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ADAPTIVE PROCESSING EXPERIMENT (APE) PHASE II

ROME AIR DEVELOPMENT CENTER
GRIFFISS AIR FORCE BASE, NEW YORK

MAY 1976

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ADAPTIVE PROCESSING EXPERIMENT (APE) PHASE II

Technology Service Corporation

ROME AIR DEVELOPMENT CENTER
AIR FORCE SYSTEMS COMMAND
GRIFFISS AIR FORCE BASE, NEW YORK 13441

This report has been reviewed by the RADC Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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TABLE OF CONTENTS

EVALUATION

This contractual effort was performed in support of the RADC-ESD OTH Technology Program (TPO 6). This effort represents the initial investigations into the use and expected performance of digital beamforming and adaptive beamforming techniques, both hardware and software, for OTH radar receive systems. The achievement of very low sidelobe antennas and decreased ECM vulnerability of OTH radars will depend upon the use of these techniques. The concepts, hardware, and software employed in and developed through this effort are being incorporated into RADC's Ava/Dexter experimental OTH Radar Facility.

William F. McCullough

WILLIAM F. McCULLOUGH, Capt USAF
Project Engineer

1.0 INTRODUCTION AND CONCLUSIONS

BACKGROUND

Extensive interest has developed in the last several years over the possibility of spatial filtering, whereby an antenna's aperture illumination function is adaptively controlled to produce pattern nulls in the direction of undesired interference. Implicit in the ability to adaptively control the illumination function, however, is the requirement to measure the structure of the spatial interference. This in turn necessitates a multiplicity of receivers--one for each adaptive degree of freedom in the system.

SYSTEM DEGRADATION

Many types of systematic errors (e.g., element spacing mismatch, variation in element pattern mismatch, mutual coupling, etc.) even when not known a priori, can be automatically compensated for in an adaptive beamforming network. Element-to-element receiver mismatch on the other hand imposes an inherent limitation on the achievable beam pattern sidelobe level as well as the achievable cancellation ratio against a broadband interference source. This problem becomes acute when the pulse length of the transmitted waveform approaches a small fraction of the aperture size. In such cases a point interference source has an effective spatial spread proportional to the receiver bandwidth. Both the sidelobe level and the achievable cancellation ratio against broad-band interference sources are degraded when the receiver mismatch is uncompensated. Section 3.0 quantifies this degradation as a function of the amount of receiver mismatch.

CONCLUSIONS

The receiver equalization technique employed is to solve for the set of weights in a tapped delay line transversal filter that minimizes the mean square error residue between a reference receiver's frequency response and the response of any other receiver. The conclusions of the study are as follows.

1. System Degradation - The achievable sidelobe level and the cancellation ratio against broadband interference sources may be seriously degraded by receiver mismatch.

2. Sidelobe Level - The achievable peak response to RMS sidelobe level is given by:

$$R = \frac{G}{|E|^2} \tag{1}$$

where

G = antenna gain

$|E|^2$ = normalized mean square error residue.

(Equation (1) of Section 3.0)

3. Transversal Filter Performance - The achievable improvement in $|E|^2$, the normalized mean square error residue is quantified in Section 4.0 as a function of the tap spacing and number of taps in the transversal filter.

For 16 taps spaced at $\tau = \frac{1}{2.5B}$, where (B) is the 3 dB receiver bandwidth, the improvement is over 30 dB. Indeed it was found that $|E|^2$ decreased from approximately -(30-35 dB) to -63 dB. This latter figure is also the noise floor of the calibration system as corroborated by spectral analysis.

4. Receiver Error Sources - The primary source of receiver mismatch was probably pole location errors. This is strongly suggested by the fact that the receiver transfer function has 8 complex poles (6 pole Butterworth plus 2 additional poles) and that 16 real taps reduced the error residue to negligible proportions.

2.0 TSC EFFORTS

Sections 3.0 through 6.0 of this report describe the engineering services performed by Technology Service Corporation (TSC) under Contract No. F30602-75-C-0264 to RADC, Griffiss Air Force Base, Rome, New York, in support of their Adaptive Processing Program - Phase II.

The scope of the effort consisted of three major tasks. The first task was to examine the impact of receiver passband phase and amplitude tracking errors on the performance of a radar system using digital beamforming. Secondly, we wished to develop a potential solution to the receiver tracking problem and, thirdly, it was desired to evaluate the effectiveness of the candidate solution in reducing the impact of the errors on system performance.

3.0 PERFORMANCE DEGRADATION DUE TO RECEIVER MISMATCH

BACKGROUND

There are two deleterious effects caused by receiver mismatch in a multi-channel beam forming network; sidelobe degradation and the inability to cancel point source wideband interference via spatial nulls.

3.1 Sidelobe Degradation

The most reasonable model for receiver mismatch is to assume that each receiver's frequency response is the sum of an ideal unperturbed response and a noise like error term in both phase and amplitude. This model is also obtained if one assumes that the primary reason for the mismatch is a random error in the pole locations of the filters. It will be shown that, without receiver equalization, the achievable peak response to RMS sidelobe level with <u>any</u> aperture weighting is limited to:

$$R = \geq \frac{G}{|E|^2}$$

Where:

R = Peak response to RMS sidelobe ratio

G = Antenna gain

$|E|^2$ = Normalized mean square error residue between any two receivers

Assume that (N) receivers (R_i) are used to form a beam with a set of deterministic weights (W_i), ($1 \leq i \leq N$). Then assuming that the normalized error power between any two receivers is $|E|^2$, viz:

$$|E|^2_{ik} = \frac{\int_0^\infty |R_i - R_k|^2 dx}{\int_0^\infty |R_i|^2 dx} \qquad (1)$$

Where:

R_i and R_k are the outputs of receivers (i) and (k) respectively, and the variable of integration (x), denotes frequency from a wideband interference source. (Wide bandwidth is construed to mean larger bandwidth than the receiver pass-band.)

The output of the beam forming network at any in-band frequency (x) is given by:

$$B_p = \sum_{i=1}^{N} W_i R_{i_p} = \sum_{i=1}^{N} W_i (R_i + EN_i) \tag{2}$$

Where:

R_i = Output of receiver (i) with no error

R_{i_p} = Output of error perturbed receiver (i)

N_i = Zero mean, unit variance Gaussian variable

E = Normalized RMS error defined by (1)

then for a linear array with spacing (d)

$$R_i = \exp\left[j\left(\frac{2\pi dx_i}{c}\right)\sin\theta\right] \tag{3}$$

Where:

C = Velocity of light

θ = Angle of wideband interference off of boresite

since $N_i N_k = 0$ for $i \neq k$, it follows that at all in band frequencies (x), the frequency response in voltage is given by:

$$B_p(x) = \sum_{i=1}^{N} W_i \exp\left[\frac{j2\pi dx_i}{c}\sin\theta\right] + EN_o\left(\sum_{i=1}^{N} |W_i|^2\right)^{1/2} \tag{4}$$

Where:

N_o = Zero mean unit variance Gaussian variable.

The mean response in power is given by:

$$\overline{H_p(x)} = H_c(x) + |E|^2 \sum_{i=1}^{N} |W_i|^2 \tag{5}$$

Where:

$\overline{H_p(x)}$ = Expected value of the perturbed response

$H_c(x)$ = Ideal response with no receiver mismatch

The error perturbation term is completely broadband [independent of the frequency (x)].

The achievable peak response to RMS sidelobe level is then limited by the broadband error term viz:

$$R = \frac{H_c \text{ (Boresite)}}{H_c(x) + |E|^2 \sum_{i=1}^{N} |W_i|^2} \tag{6}$$

or

$$\bar{R} = \frac{\left(\sum_{i=1}^{N} W_i\right)^2}{H_c(x) + |E|^2 \sum_{i=1}^{N} |W_i|^2} \tag{7}$$

$\left(\sum_{i=1}^{N} W_i\right)^2 / \sum_{i=1}^{N} |W_i|^2$ is the antenna gain at boresite and $H_c(x)$ may be made arbitrarily small by proper choice of the deterministic weighting function, it follows that the peak response to RMS sidelobe level is given by:

$$\bar{R} \geq \frac{G}{|E|^2} \tag{8}$$

Where:

G = Antenna gain

$|E|^2$ = Normalized error power given by (1)

3.2 Adaptive Cancellation

It is apparent that in addition to limiting the achievable sidelobe level--receiver mismatch precludes any possibility of adaptively forming a deep spatial null. Since the error term in (5) is broadband, it is impossible to spatially cancel it. (See Appendix H.)

4.0 RECEIVER MATCHING

BACKGROUND

This section derives a transversal filter to be used on a given receiver such that it "optimally" tracks a reference receiver. The criterion of optimality in this case is that the normalized mean power residue between the receivers be as small as possible for a given number of transversal filter taps and spacing.

The actual receivers used in the RADC system were 6 pole Butterworth filters. As such the computer program was organized to align both theoretically derived 6 pole Butterworth filters and the actual receivers measured by Raytheon.

4.1 Analysis

Each element of the receiving array feeds a separate amplifier and A/D converter. The digital outputs from the element channels are then combined in a digital processor which performs the functions of beamforming and pulse compression. The amplifiers in the individual array element channels must be carefully matched in order to achieve low antenna sidelobe levels over the entire frequency band. This section describes a method of matching amplifier transfer functions very accurately, utilizing a digital transversal filter in each channel.

The technique for matching the channel responses is illustrated schematically in Figure 4-1. The analog amplifier in each channel will be represented by a Butterworth filter in the following analysis. At the output of this filter, the signal $y_k(t)$ is converted to digital form, where each digital sample is a complex number retaining both amplitude and phase information. The subscript k on the variables of Figure 4-1 represents the channel number. A set of consecutive samples of each $y_k(t)$ is weighted and added as shown in Figure 4-1. The delay line, weighting multipliers, and adder in Figure 4-1 comprise a transversal filter for matching the channel response. The channel-to-channel match is achieved by selection of the set of weights, W_{kn}. The following analysis outlines a method of achieving a least-mean-square match between two channels by optimum choice of the W_{kn}.

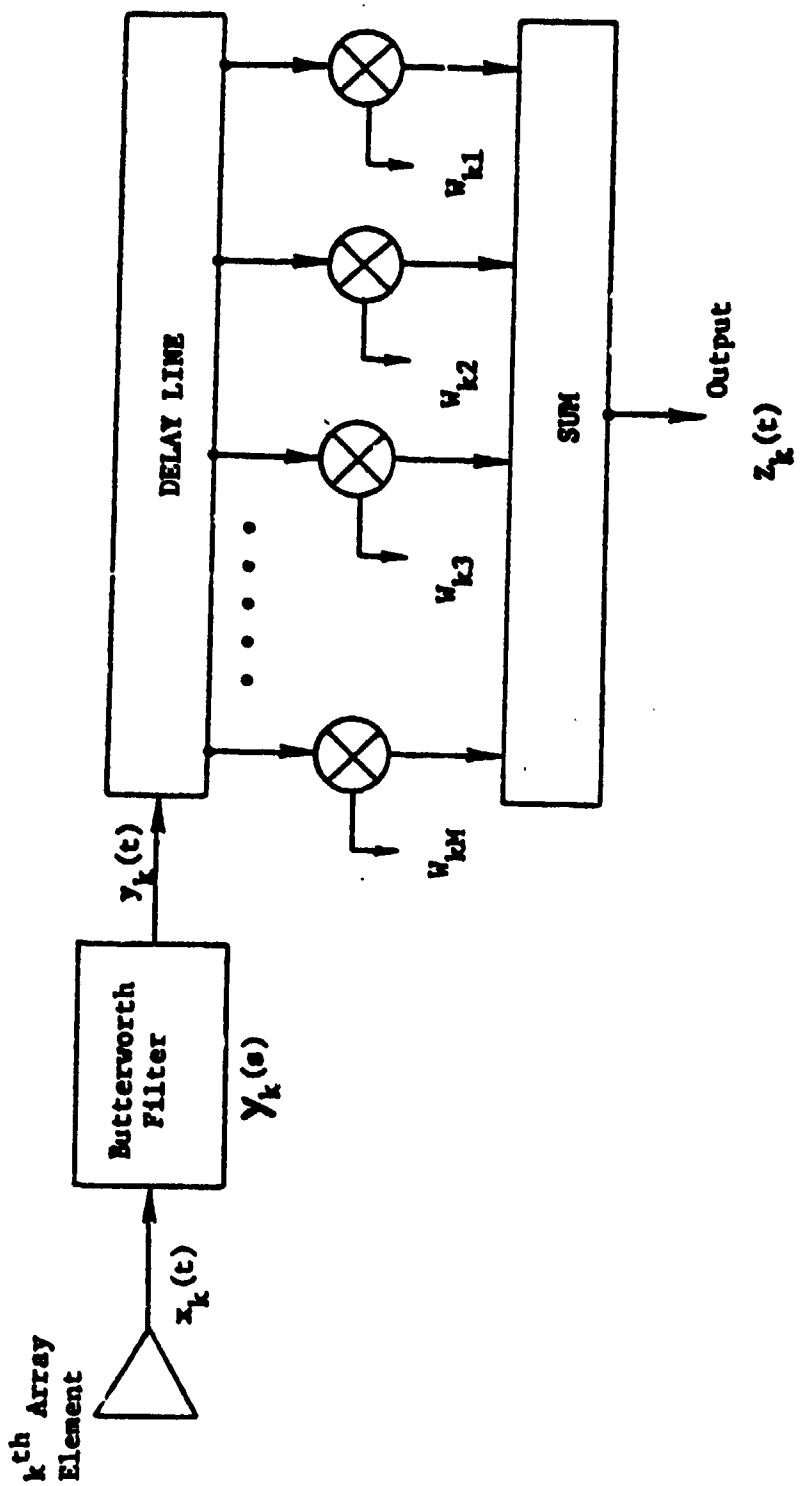

Figure 4-1. Schematic of Equalizing Circuit

In the following discussion, two channels will be considered: a reference channel (k=1), and a second channel (k=2) in which the weights are to be optimized. It is assumed that the Butterworth filter response in the reference channel is that of an ideal N-pole filter given by:

$$Y_1(s) = \left(\frac{B}{2}\right)^N \prod_{n=1}^{N} \frac{1}{(s-s_{1n})} \tag{1}$$

Where:

$s = j2\pi f$

f = frequency

$s_{1n} = n^{th}$ pole $= B/2 \exp\left\{j\pi\left(\frac{1}{2} + \frac{2n-1}{2N}\right)\right\}$

B = filter bandwidth

An alternative representation of this transfer function is

$$Y_1(s) = \sum_{n=1}^{N} \frac{A_{1n}}{(s-s_{1n})}$$

$$A_{1n} = \left(\frac{B}{2}\right)^N \prod_{\substack{j=1 \\ j\neq n}}^{N} \frac{1}{(s_{1n}-s_{1j})} \tag{2}$$

The impulse response of this filter is

$$h_1(t) = \sum_{n=1}^{N} A_{1n}\, e^{s_{in}t} \tag{3}$$

The filter in channel 2 is represented by the same expansion (Equations 1, 2, and 3), except that the poles in the second channel are in error and differ from the reference channel poles by a few percent.

The output of the transversal filter in channel k is

$$z_k(t) = \sum_{m=1}^{M} W_{km}\, y_k\,(t-m\tau) \tag{4}$$

Where:

τ = spacing between taps

M = number of taps in each delay line.

While it is convenient to represent this transversal filter by continuous functions of time (Equation 4), it should be recalled that this signal processing will be performed digitally. The transversal filter in the reference channel can be used to narrow the channel passband by weighting all taps, e.g., with Chebyschev weights to achieve low sidelobes. If all tap weights are zero except for one, the transversal filter introduces a delay but does not change the overall channel response. In the following analysis, both cases are included since tapped delay lines are assumed in both channels 1 and 2. The examples consider the case where all channel 1 taps are zero except the center tap, i.e., the case where the transversal filter in channel 2 is used to match the channel 2 response to the Butterworth filter of channel 1.

To compute optimum weights, W_{2n}, assume that the same signal is fed into channels 1 and 2. It is convenient to consider wideband white noise, n(t), as this input, although a set of signals across the receiver passband will suffice. For the input $x_k(t) = n(t)$, the Butterworth filter output is

$$\begin{aligned} y_k(t) &= \int_0^{\infty} n(t-u)h_k(u)\,du \\ &= \sum_{n=1}^{N} A_{kn} \int_0^{\infty} e^{s_{kn}u}\, n(t-u)\,du \end{aligned} \tag{5}$$

The transversal filter output in the k^{th} channel, from Equations 4 and 5, is

$$z_k(t) = \sum_{m=1}^{M} W_{km} \sum_{n=1}^{N} A_{kn} \int_0^{\infty} e^{s_{kn}u}\, n(t-u-m\tau)\,du \tag{6}$$

The weights in channel 2, W_{2n}, are selected to minimize the noise power in the difference $z_2(t)-z_1(t)$.

$$P = E\{|z_2(t)-z_1(t)|^2\} \tag{7}$$

where E denotes the expectation or average.

This expression has the following form

$$P = E\{z_2^*(t)z_2(t)-z_2^*(t)z_1(t)-z_2(t)z_1^*(t)+z_1^*(t)z_1(t)\}$$

$$= W_2^{*T}M_2W_2 - W_2^{*T}M_{12}W_1 - W_2^TM_{12}^*W_1^* + W_1^{*T}M_1W_1 \tag{8}$$

Where:

W_k = column vector of weights W_{kn}

$*$ denotes complex conjugate

T denotes transpose

M_k = covariance matrix with elements $M_k(m,n)$

$M_k(m,n) = E\{y_k^*(t-m\tau)y_k(t-n\tau)\}$

M_{12} = matrix with elements $E\{y_1^*(t-m\tau)y_2(t-n\tau)\}$

The derivation of Equation 8 can be illustrated by expanding the first term

$$E\{Z_k^*(t)Z_k(t)\} = E\left\{\sum_{m=1}^{N}\sum_{m'=1}^{N}\sum_{n=1}^{N}\sum_{n'=1}^{N}W_{km}^*W_{km'}A_{kn}^*A_{kn'}\right.$$

$$\int_0^\infty du_1\int_0^\infty du_2\, e^{(s_{kn}^*u_1+e_{km'}u_2)} \tag{9}$$

$$\left.n^*(t-u_1-m\tau)n(t-u_2-m'\tau)\right\}$$

This is a quadratic form $W_k^{*T}M_kW_k$, where the elements of M are

$$M_k(m,m') = E\left\{ \sum_{n,n'=1}^{N} A_{kn}^{*} A_{kn'} \int_0^{\infty} \int_0^{\infty} n^{*}(t-u_1-m\tau) n(t-u_2-m'\tau) \right.$$

$$\left. e^{(s_{kn}^{*} u_1 + s_{kn'} u_2)} \, du_1 du_2 \right\} \tag{10}$$

Consider a white noise process, n(t), for which

$$E\, n^{*}(t) n(t+\tau) = \delta(\tau) \tag{11}$$

The elements of the matrix M_k, from Equation 10, are

$$M_k(m,m') = \sum_{n,n'=1}^{N} A_{kn}^{*} A_{kn'} \int_0^{\infty} e^{s_{kn}^{*} u_1 + s_{kn'}(u_1 + m\tau - m'\tau)} \, du_1 \tag{12}$$

$$= - \sum_{n,n'=1}^{N} \frac{A_{kn}^{*} A_{kn'}}{(s_{kn}^{*} + s_{kn'})} e^{s_{kn'}(m-m')\tau} \quad ; \; m \geq m'$$

Note that in deriving Equation 12, both $u_1 \geq 0$ and $u_2 \geq 0$, so this equation is correct only when $m \geq m'$. When $m \leq m'$

$$M_k(m,m') = - \sum_{n,n'=1}^{N} \frac{A_{kn}^{*} A_{kn'}}{(s_{kn}^{*} + s_{kn'})} e^{s_{kn}^{*}(m'-m)\tau} \quad m \leq m' \tag{12a}$$

In performing the above integrations, note that Real $(s_{kn}) < 0$. Similar expressions can be derived for the cross-covariance matrix in Equation 8, M_{12}.

Next we select a set of weights for the transversal filter in channel 2, W_2, which minimizes the noise power in the output, $Z_2(t)-Z_1(t)$. This output power is given by Equation 8, where the covariance matrices are computed for white noise into the two filters. The set of weights, W_2, which

minimizes P of Equation 8 also provides the best least-mean-square fit of the two channel responses.

The set of weights which minimizes Equation 8 is

$$W_2 = M_2^{-1} M_{12} W_1 \tag{13}$$

For these weights, a small perturbation in the W_{2n}, denoted by the column vector δW_2, gives $\delta P = 0$.

$$\delta P = \delta W_2^{*T}(M_2 W_2 - M_{12} W_1) + (W_2^{*T} M_2 - W_1^{*T} M_{12}^{*T})\delta W_2 \tag{14}$$

$$= 0 \text{ when Equation 13 is satisfied.}$$

When the weights W_2 satisfy Equation 13, the power in the output $[Z_2(t) - Z_1(t)]$ is

$$P = W_1^{*T} M_1 W_1 - W_2^{T} M_{12}^{*} W_1^{*} \tag{15}$$

The method outlined in this section was used to match the receiver channels in the OTH receiving array. Since the filter outputs are available in digital form, the various covariance matrices in Equation 13 were computed from sample data. It has been shown[1] that, when weights are computed directly from a sample covariance matrix as suggested above, a modest number of data samples will provide an excellent estimate of the optimum weights. The number of samples in the sample covariance matrix required to achieve within 3 dB of the LMS residue is roughly $N_s = 2N$, where N_s = number of samples and N = number of taps.

Note that the expression $M_{12}W_1$ in Equation 13 can be obtained directly by cross-correlating the channel 2 tap outputs with the output $Z_1(t)$ of channel 1.

The following sections contain examples of this filter matching technique. Results show that excellent filter match can be obtained by optimizing weights on the digital transversal filters.

(1) I. S. Reed, J. D. Mallett, and L. E. Brennan, "Rapid Convergence Rate in Adaptive Arrays," to appear in IEEE Trans. AES.

4.2 Example of Filter Matching

A FORTRAN program was written to obtain quantitative estimates of the filter matching which can be achieved as a function of several parameters, viz., number of taps, tap spacing, and initial mismatch. Results have been very encouraging. One example is detailed here to show that sufficiently accurate channel matching can be achieved for the OTH receiving array to meet antenna sidelobe specifications. The program used in these studies is listed in Appendix F.

The reference filter of channel 1 is an 8-pole Butterworth filter with poles equally spaced along a circle in the left half of the s-plane. Filter 2 is obtained by displacing each of the 8 poles by a randomly generated amount from the ideal pole location of channel 1. Each s_{n2} is obtained from the corresponding s_{n1} by

$$s_{n2} = s_{n1}\,(1 + .03r) \tag{16}$$

where r is a random number uniformly distributed on the interval (-1,1) and having a uniformly distributed random phase on $(0,2\pi)$. The pole locations for the two filters are shown in Table 1. The coefficients A_{kn} for each filter were computed from Equation 2.

In this particular example, the 3 dB bandwidth of filter 1 is 100 Hz. The initial mismatch, R_o, between the two filters was computed by numerical integration.

$$R_o = \int_{-B/2}^{B/2} |Y_2(s)-Y_1(s)|^2 df \Bigg/ \int_{-B/2}^{B/2} |Y_1(s)|^2 df \tag{17}$$

In this example $R_o = .0015$. The rms phase error between the two filters, averaged over the interval (-B/2, B/2), i.e., between the 3 dB points of filter 1, was 1.27°.

The preceding equations were then used to compute an optimum set of tap weights for channel 2. The response of the channel 1 Butterworth filter was not modified by the transversal filter in this channel, i.e., all tap weights except one in channel 1 were set to zero. The resulting tap weights for the 2 channels are shown in Table 2.

Table 1. Poles of Butterworth Filters

Reference Channel 1				Channel 2			
Real		Imaginary		Real		Imaginary	
-6.128	E+02	3.081	E+02	-6.017	E+02	3.065	E+02
-1.745	E+02	2.612	E+02	-1.745	E+02	2.551	E+02
-2.612	E+02	1.745	E+02	-2.597	E+02	1.814	E+02
-3.081	E+02	6.126	E+02	-3.088	E+02	6.036	E+01
-3.081	E+02	-8.128	E+01	-3.084	E+02	-6.132	E+01
-2.612	E+02	-1.745	E+02	-2.557	E+02	-1.733	E+02
-1.745	E+02	-2.612	E+02	-1.698	E+02	-2.620	E+02
-6.128	E+01	-3.081	E+02	-6.565	E+01	-3.081	E+02

Table 2. Optimum Tap Weights

	Channel 1		Channel 2	
	Real	Imaginary	Real	Imaginary
1	0.000	0.000	.00009	-.00003
2	0.000	0.000	-.00021	.00007
3	0.000	0.000	.00038	-.00013
4	0.000	0.000	-.00064	.00021
5	0.000	0.000	.00102	-.00033
6	0.000	0.000	-.00171	.00051
7	0.000	0.000	.00335	-.00082
8	1.000	0.000	.98030	.00300
9	0.000	0.000	-.02163	-.01159
10	0.000	0.000	.00813	.00685
11	0.000	0.000	.00404	.00290
12	0.000	0.000	-.00359	-.00684
13	0.000	0.000	.00021	.00482
14	0.000	0.000	.00165	-.00105
15	0.000	0.000	-.00156	-.00096
16	0.000	0.000	.00069	.00093

The spacing between taps in this particular example was $\tau = .7/B$. Sixteen tap weights were optimized. The mismatch after optimization of the transversal filter in channel 2 was reduced by 34.2 dB. The normalized mean square residue, as in Equation 17 with $Y_k(s)$ representing the product of Butterworth and transversal filters, was reduced to 5.6×10^{-7}. The rms phase error after matching was reduced to .02°.

This example illustrates the excellent channel-to-channel match which can be achieved using digital transversal filters in each channel. The FORTRAN program can be used to explore other cases of interest.

4.3 Alignment of RADC Receivers

The equations used for obtaining the optimum weights from the measured data supplied by RADC are listed below.

Definitions

I_s^k = Output of receiver (k) measured at frequency (X_s) at output of FFT (in phase component)

Q_s^k = Same for quadrature component

τ = Tap spacing

$$\overline{w}_K = \begin{pmatrix} w_1 \\ w_2 \\ \vdots \\ w_N \end{pmatrix} = \text{Adaptive weight vector for receiver (k)}$$

$$\overline{\delta} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 0 \\ 0 \end{pmatrix} = \text{Weight vector for reference receiver (middle tap = 1)}$$

$N = 2L + 1$ = # of taps (odd)*

R = # receivers

$(1 \leq K \leq R)$ (Complex receivers)

R = 16 nominal

P = # measured frequencies

$(1 \leq s \leq P)$ P = 20 nominal

---

* For mathematical convenience only. The calculations could be carried through with an even number of taps also.

STEPS FOR ADAPTIVE PROCESSING

GIVEN	AMPLITUDE	PHASE
I_s^k	$A_s^k(I)$	$\phi_s^k(I)$
Q_s^k	$A_s^k(Q)$	$\phi_s^k(Q)$

$1 \leq k \leq 16$

$1 \leq s \leq 20$, 15-110 Hz at 5 Hz increments

1. **60 Hz Reference Alignment**

Amplitude Alignment

$$A_s^k(I)_{NEW} = A_s^k(I) \cdot \frac{A_{60\ Hz}^1(I)}{A_{60\ Hz}^k(I)} \tag{1}$$

$$A_s^k(Q)_{NEW} = A_s^k(Q) \cdot \frac{A_{60\ Hz}^1(I)}{A_{60\ Hz}^k(Q)} \tag{2}$$

Phase Alignment

$$\phi_s^k(I)_{NEW} = \phi_s^k(I) + \phi_{60\ Hz}^1(I) - \phi_{60\ Hz}^k(I) \tag{3}$$

$$\phi_s^k(Q)_{NEW} = \phi_s^k(Q) + \phi_{60\ Hz}^1(I) - \phi_{60\ Hz}^k(Q) \tag{4}$$

2. **Complex Receiver Formation**

Let

$$I_{s\ NEW}^k = \textcircled{I}_s^k$$

$$Q_{s\ NEW}^k = \textcircled{Q}_s^k$$

The outputs of the (i^{th}) tap for tap spacing (τ) is

$$\textcircled{I}_s^k (i\tau) \sim A_s^k (I)_{NEW} \cos [\phi_s^k (I)_{NEW} + 2\pi x_s (i\tau)] \tag{5}$$

$$\textcircled{Q}\,{}^{k}_{s}\,(i\tau) = A^{k}_{s}\,(Q)_{NEW}\cos\left[\phi^{k}_{s}\,(Q)_{NEW} + 2\pi x_{s}(i\tau)\right], (0 \leq i \leq 2L) \qquad (6)$$

$$\textcircled{Z}\,{}^{k}_{s}\,(i\tau) = \textcircled{I}\,{}^{k}_{s}\,(i\tau) + j\,\textcircled{Q}\,{}^{k}_{s}\,(i\tau) \qquad (7)$$

Let

$$\bar{\textcircled{Z}}\,{}^{k}_{s} = \begin{pmatrix} \textcircled{Z}\,{}^{k}_{s}\,(0) \\ \textcircled{Z}\,{}^{k}_{s}\,(\tau) \\ \vdots \\ \textcircled{Z}\,{}^{k}_{s}\,(i\tau) \end{pmatrix} \qquad (8)$$

= complex receiver output (H_k) for frequency (x_s)

ADAPTATION

Definitions:

$$\bar{w}_K = \begin{pmatrix} 1 \\ w_2 \\ w \\ \cdot \\ \cdot \\ \cdot \\ w_{2L+1} \end{pmatrix}_K = \text{Adaptive weight vector for receiver (K)}$$

$$\bar{\delta} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1_L \\ 0 \\ 0 \\ 0 \end{pmatrix} = \text{Weight vector for reference receiver (middle tap = 1)}$$

M_{kk} = Covariance matrix for receiver (K) output

M_{rr} = Covariance matrix for reference output

M_{kr} = Cross covariance matrix of receive (K) and reference

From (8)

$$M_{kk} = \sum_{s=1}^{P} \textcircled{z}_s^k \; \overline{\textcircled{z}_s^{k*}} \tag{9}$$

$$M_{rr} = \sum_{s=1}^{P} \textcircled{z}_s^r \; \overline{\textcircled{z}_s^{r*}} \tag{10}$$

$$M_{kr} = \sum_{s=1}^{P} \textcircled{z}_s^k \; \overline{\textcircled{z}_s^{r*}} \tag{11}$$

Adaptive Weight Formation

$$\overline{W}_k \text{ (opt)} = M_{kk}^{-1} M_{kr} \overline{\delta} \tag{12}$$

Mean Square Error Residue

$\textcircled{R}_k$ = Mean normalized square power residue for filter (k) after adaptation

R_k = Normalized mean square power residue before adaptation

Residue After Adaptation

$$\textcircled{R}_k = \frac{\overline{\delta}^* \left[M_{rr} - M_{kr}^{-1} M_{kk} M_{kr}^{-1} \right] \overline{\delta}}{\overline{\delta}^* M_{rr} \overline{\delta}} \tag{13}$$

Residue Prior to Adaptation

$$R_k = \frac{\sum_{s=1}^{P} \left[\overline{\textcircled{z}_s^{k*}} - \overline{\textcircled{z}_s^{r*}} \right] \left[\textcircled{z}_s^k - \textcircled{z}_s^r \right]}{\overline{\delta}^* M_{rr} \overline{\delta}} \tag{14}$$

5.0 RESULTS

5.1 RADC Receiver Data

The method described in Section 4.0 was applied to the RADC Dexter data acquisition system. This system consists of 32 homodyne receivers configured as 16 complex receivers with I&Q outputs. Each receiver output (I&Q) has its own I.F. filter with a nominal bandwidth of 15 to 110 Hz. Measurements were taken of the phase and amplitude responses of all 32 receiver channels by stepping a synthesizer across the passband of all channels simultaneously and recording the sampled outputs on magnetic tape. A 256 point FFT was then run on each channel and phase and amplitudes calculated from the outputs. The amplitude response of Receiver #1, I-channel, is shown in Figure 5-1. Using this channel as a reference, all other receiver channels were compared with it and error curves in both phase and amplitude were computed. An example of this is shown in Figure 5-2 where the phase and amplitude errors between Receiver #2, I-channel and the reference are plotted. (It should be noted that in all cases the channels were exactly matched at the 60-Hz point in the passband. This can be done with no loss in generality.) The object of the optimization is to minimize the total error power. The magnitude of the complex error vector is plotted for the above example in Figure 5-3. To get a single measure of the error magnitude, this is integrated over the bandwidth and normalized. The final measure is error power out of the reference channel for a white noise input. (It is a measure of total distortion.) For the example given, this number is -30.39 dB. In a similar manner, the normalized error was computed for all other receivers and channels using Receiver #1, I-channel, as the reference. This result is shown in Figure 5-4. If the error is averaged over all the receivers, a net mismatch can be calculated. For the data shown, this is -31.78 dB.

The achievable improvement in the error was computed by designing filters of various lengths (4, 8, 12, 16 taps) and computing the residual error remaining at the output of the filter. To illustrate this, the

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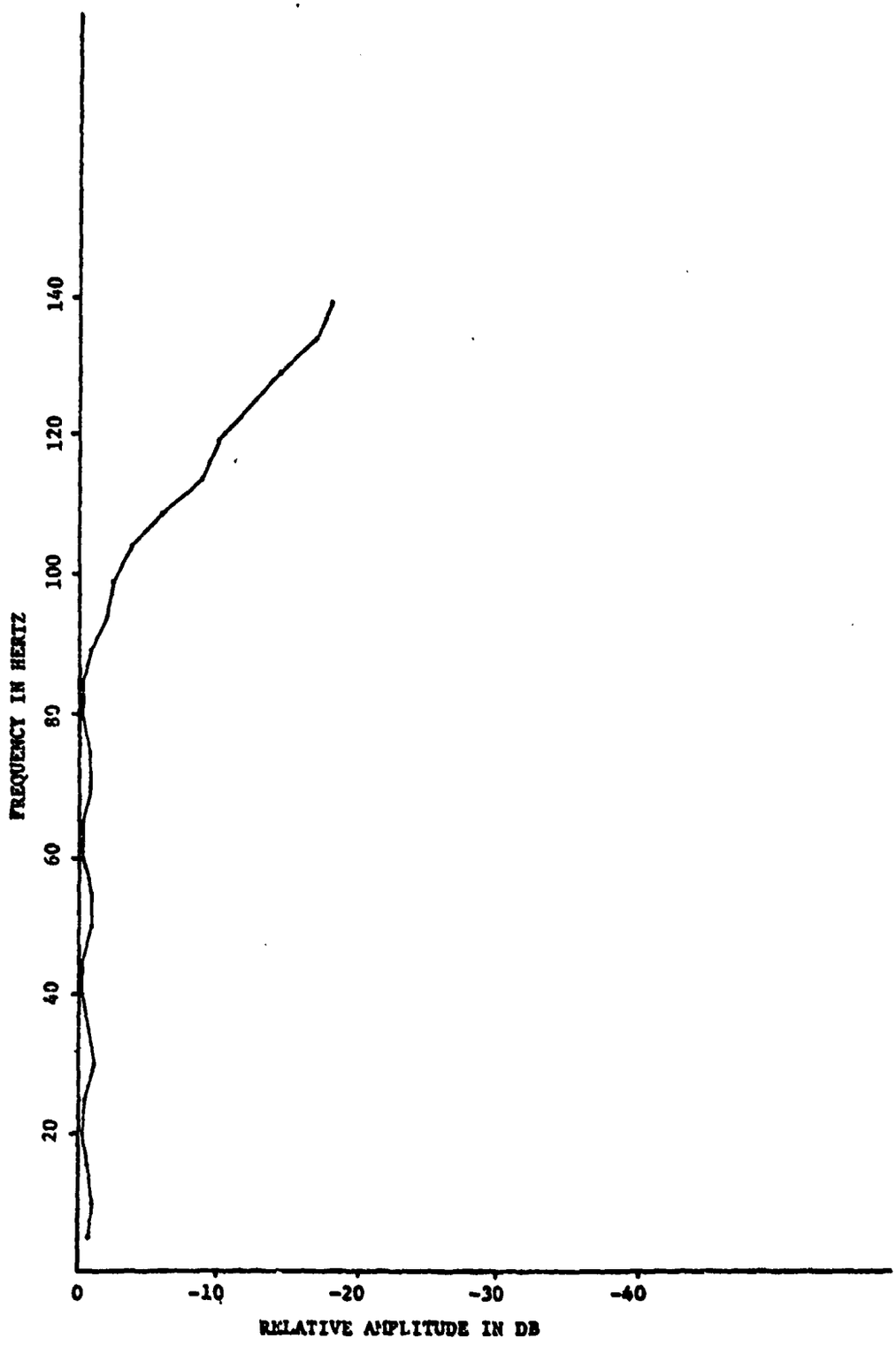


Figure 5-1. Amplitude Response of Receiver #1, I-Channel

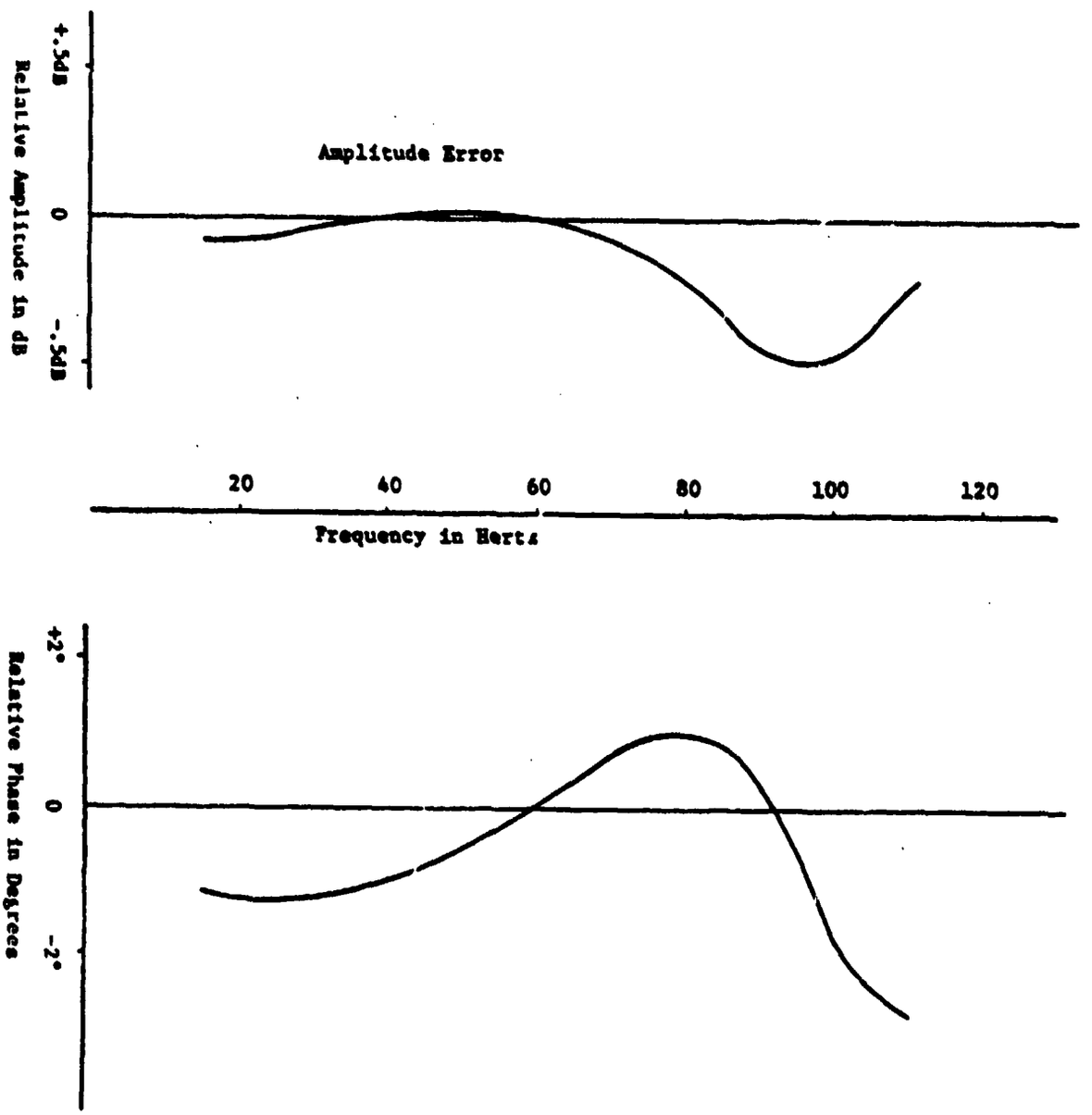


Figure 3-2. Amplitude and Phase Errors vs. Frequency for Receiver #1, I-Channel and Receiver #2, I-Channel

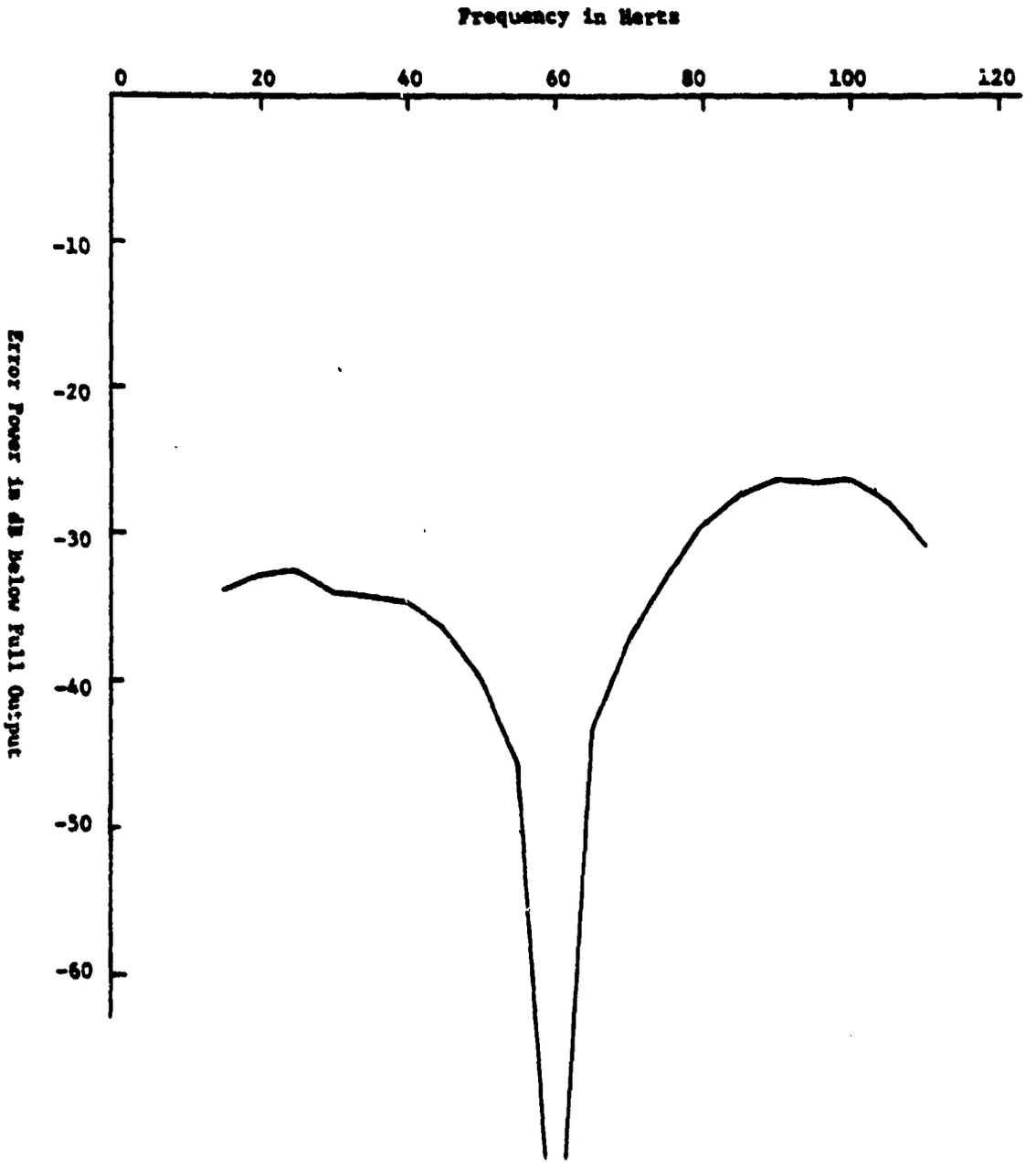


Figure 5-3. Error Power versus Frequency for Receiver #1, I-Channel vs. Receiver #2, I-Channel

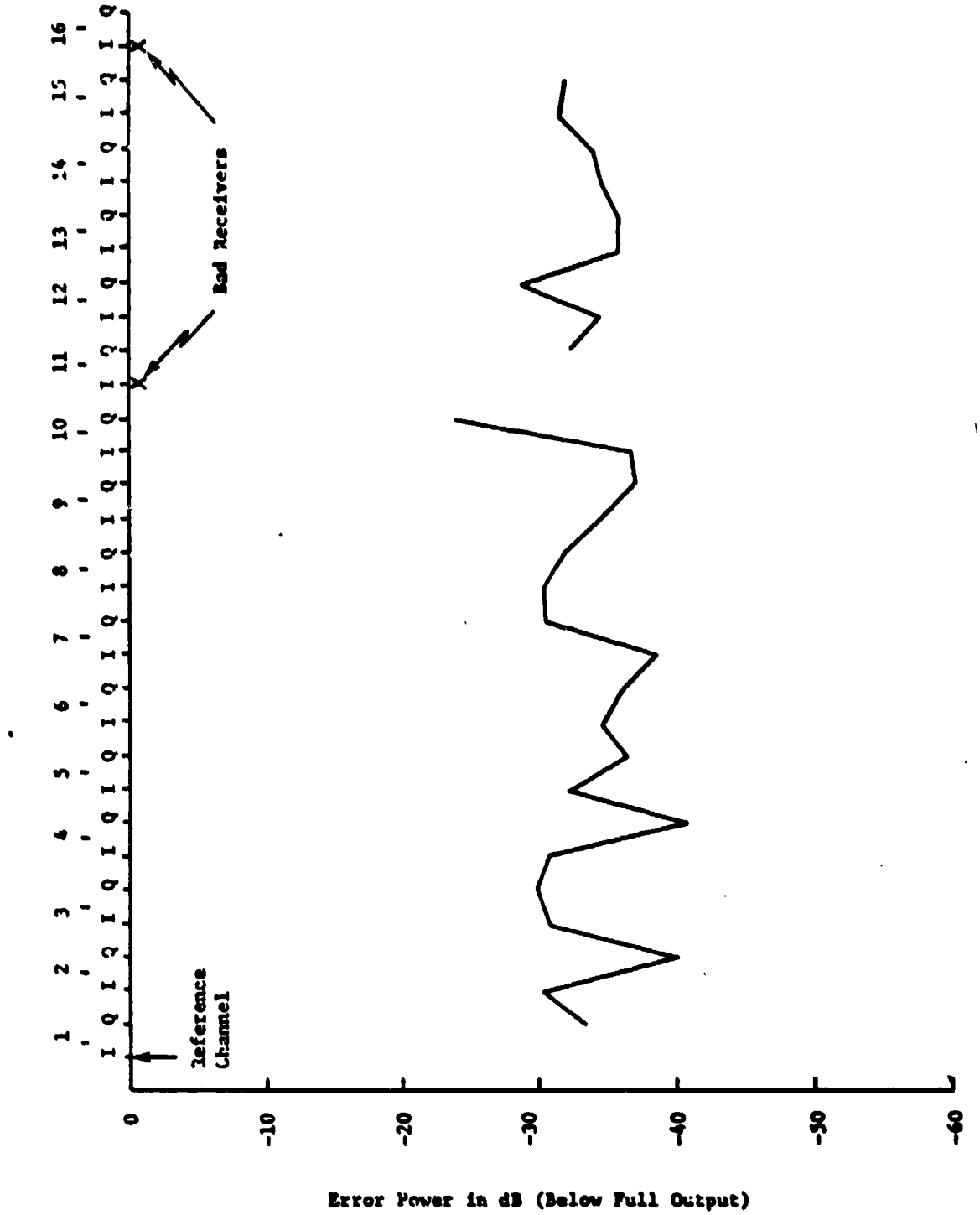


Figure 5-4. Error Power versus Receiver Channel

example of Figure 5-2 will be used. Taking Receiver #1, I-channel, as the reference and Receiver #2, I-channel as the channel to be matched to the reference, an 8-tap filter was designed. The phase and amplitude errors remaining after the filter, are shown in Figure 5-5, along with the input errors for comparison. When these numbers were converted to power and integrated over the bandpass, the results show an improvement of 7.81 dB for this example. This procedure was repeated for all receiver channels and for 4, 8, 12, and 16 tap filter designs. The residual errors obtained are shown in Figure 5-6. (Note that the results for 16 taps show a characteristic flatness around 63 dB. This is due to the signal-to-noise limit of the input data. Actual improvements for 16 taps are probably in excess of this limit.

If the data of Figure 5-6 are averaged over all receivers, the results may be plotted as a design parameter curve showing residual error versus filter length. This is done in Figure 5-7.

Finally, Appendix G shows all of the results with designed filters for all receivers and channels and for 4, 8, 12, and 16 taps.

5.2 Alternative Uses of the Transversal Filter

In considering the utility of a digital transversal filter for equalization, the possibility of its application for other purposes comes to mind. Three areas where this may offer specific gains are given here as examples.

5.2.1 Response Synthesis

The filter may be used to synthesize some desired overall frequency response. This could include

- Removal of in-band ripple caused by the analog filter response
- Steepen the roll-off characteristics of the receiver bandpass
- Tailor the receiver bandpass to approximate a Gaussian response to prevent ringing.

5.2.2 Adaptivity

The filter may service directly in a signal processor that adaptively sets the filter weights (e.g., a Griffith's algorithm).

5.2.3 Deterministic Range Patterns

The filter may be used to vary the antenna beam pattern with range in a frequency compression system in some desired deterministic fashion.

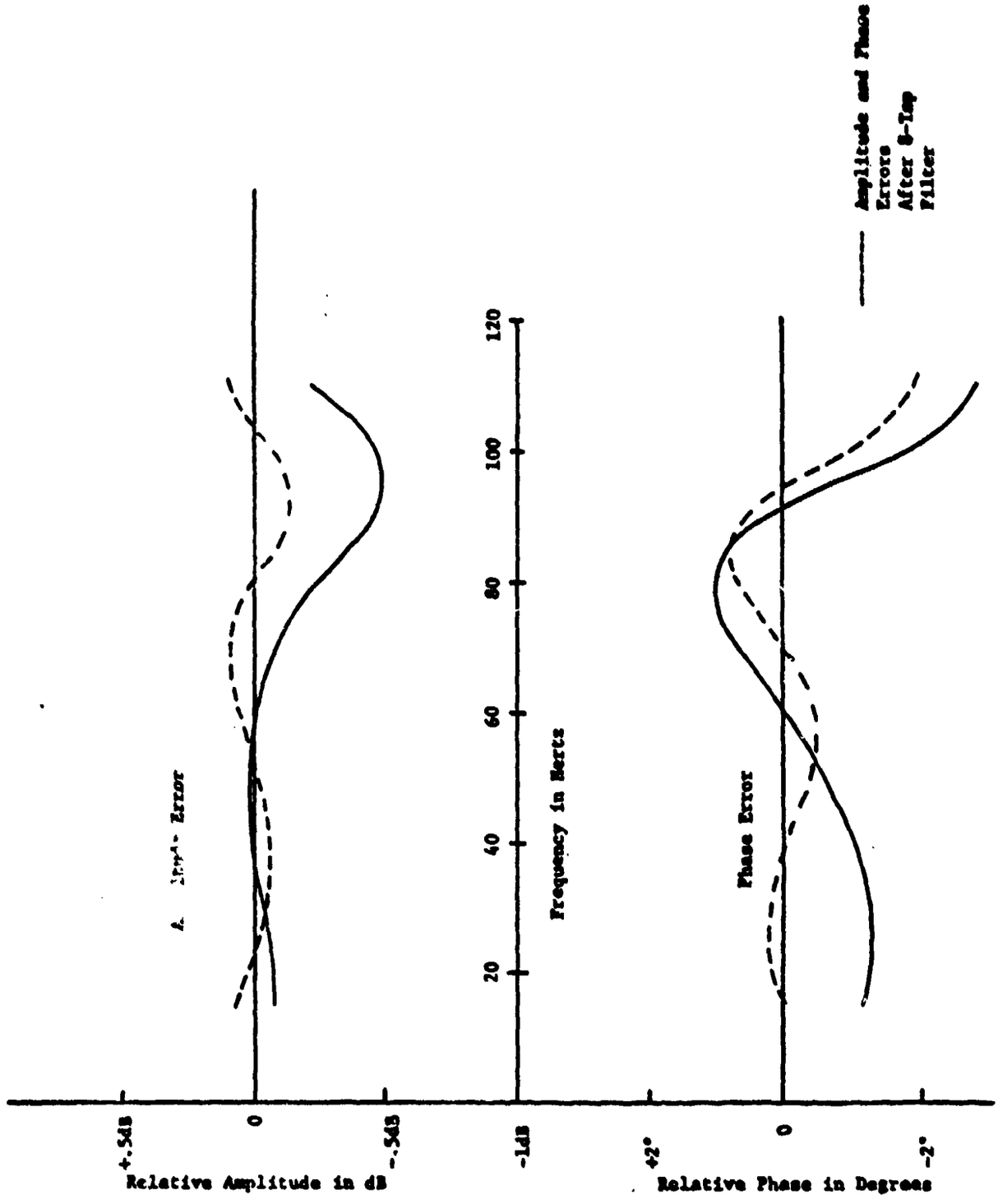


Figure 5-5. Amplitude and Phase Errors versus Frequency for Receiver #1, I-Channel and Receiver #2, I-Channel

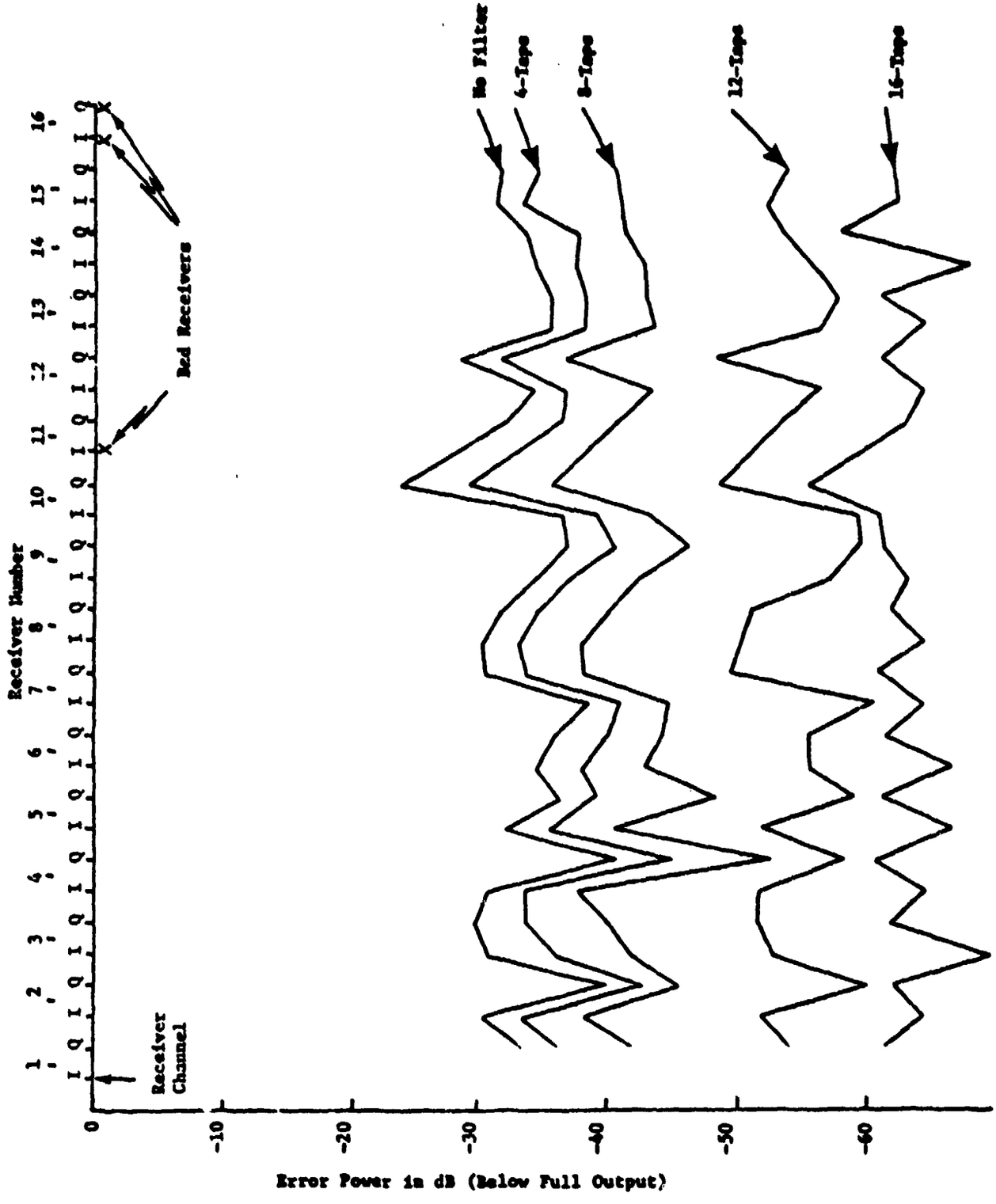


Figure 5-6. Error Power versus Receiver Channel

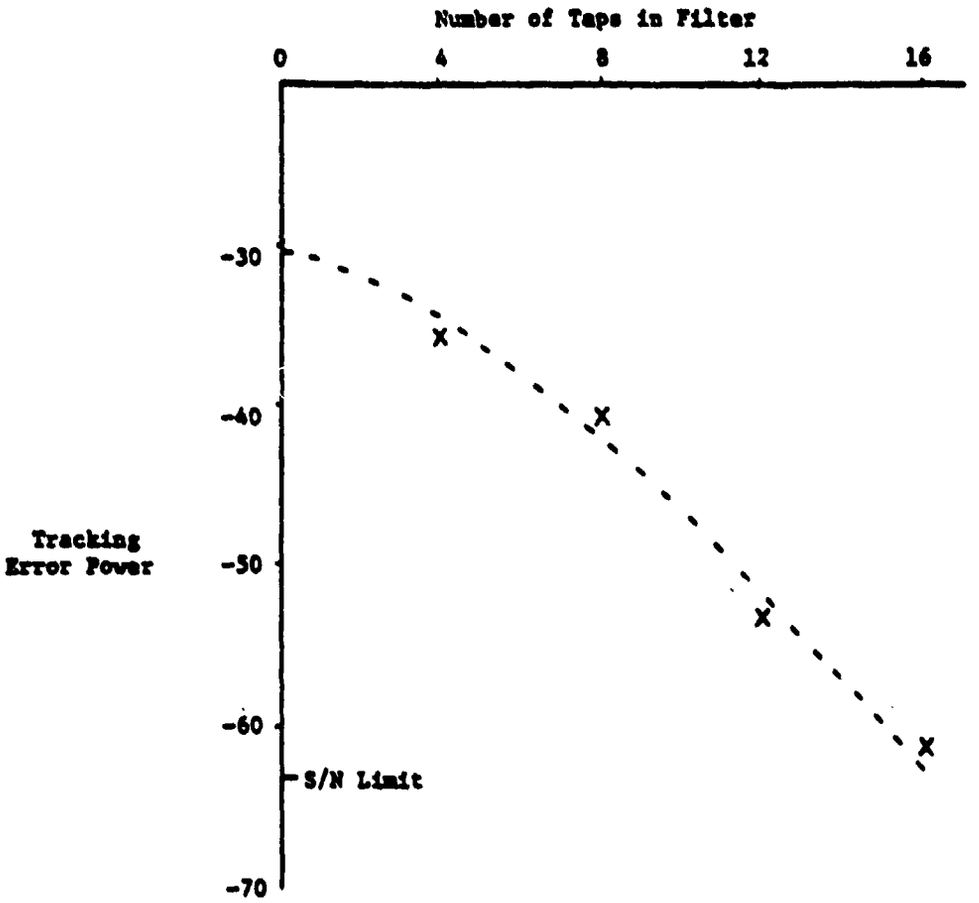


Figure 5-7. Residual Error Power versus Equalization Filter Length

6.0 RECOMMENDATIONS

The specific recommendations for work that remains to be done in the area of receiver filter tracking are:

- Use SRI's system to confirm design parameters on more conventional radar receivers.
- Demonstrate tracking improvement through increased range and spatial sidelobe control on WARF or RADC system.
- Evaluate limitations, with respect to receiver tracking, of PRS and determine impact on potential performance using adaptive technology.

7.0 RAYTHEON EFFORTS

Section 8.0 through 9.0 of this report describe the engineering services performed by Raytheon Company under subcontract to Technology Service Corporation in support of the RADC Adaptive Processing Program - Phase II. There were two primary tasks associated with this effort:

1. Adaptive Processing Software
2. Data Collection and Analysis Program

The first task was to upgrade the software package developed in the Phase I Program by adding a calibration procedure to use a near-field monopole source and by adding a Radar Processing mode. The Radar Processing Mode displays the Amplitude versus I.F. frequency for a fixed steer direction using either adaptive or conventional beamforming techniques. This mode is identified as the Radar mode because it processes the data in the manner in which an OTH radar operates. The addition of this mode will enable a determination of the capabilities of adaptive processing techniques to improve the performance of an OTH radar in the HF environment. The second task was to collect data using a 16-element array and Data Acquisition system at Dexter, New York, to: (1) provide data to checkout the software package; (2) to provide TSC with data which was required to develop and generate the equalization filters, and (3) to measure the performance of the 16-element array with OTH sources using conventional beamforming techniques.

Also included in the first task was the transfer of the off-line data processing programs developed under both Phase I and II to the Sigma-5 computer at RADC. This provides RADC with a complete in-house data processing capability. The transfer of these programs to the Sigma-5 has been successfully completed and we would like to thank the personnel at the Data Reduction Center at RADC for their cooperation in this task.

8.0 ADAPTIVE PROCESSING SOFTWARE

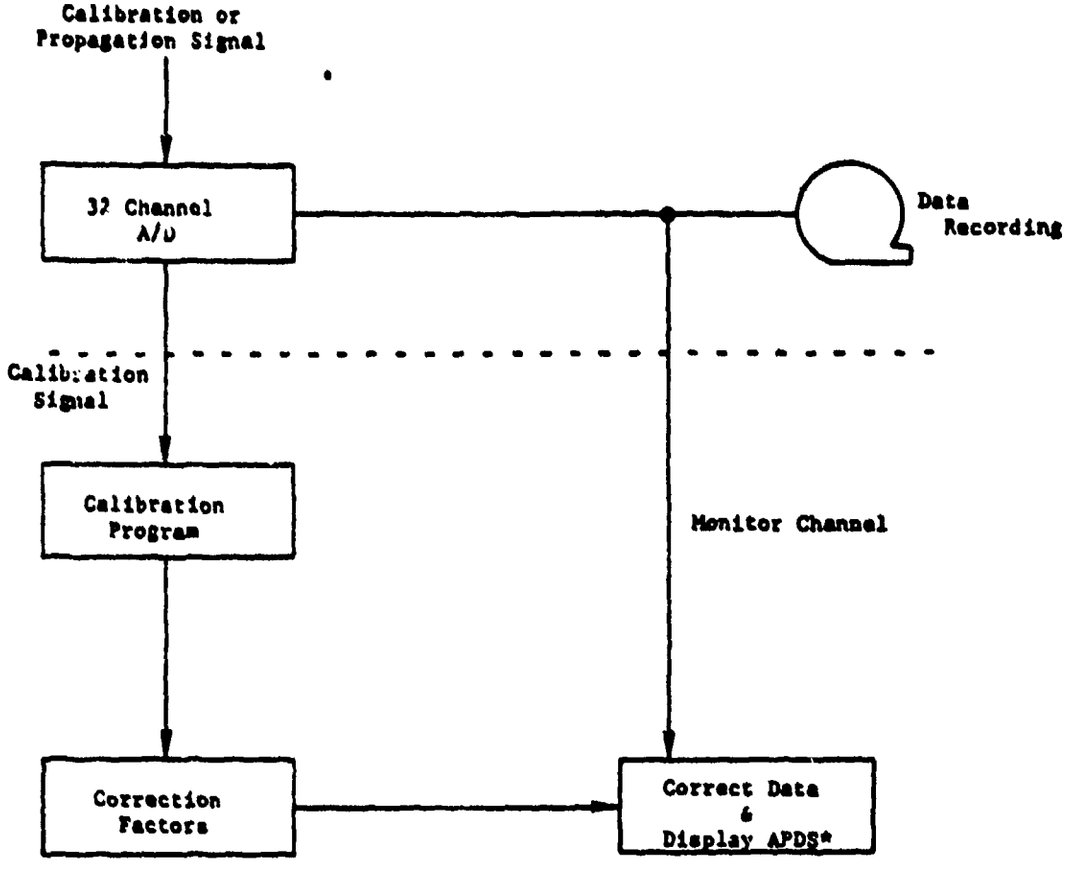
8.1 INTRODUCTION

Under the Phase I program, software was designed and implemented to process and display data collected on a temporary 16-element array at Dexter. This array was built especially for this program so that when the new 384-element planar array at Dexter was completed digital beamforming techniques developed in this program could be readily utilized on the new array. The software developed included a real-time operating system as well as an off-line data processing capability.

During the Phase II program, the off-line software was modified and augmented with additional capabilities. Before discussing the off-line software, the on-line system will be briefly described. Figure 8-1 shows a schematic block diagram of the on-line system. The output from each of the 32 receivers (I and Q receivers for each of the 16 elements) is digitized at a 250 samples/second rate. The digital data is recorded directly on 9 track/800 bpi tape in two's-complement binary format without processing. This is a very attractive feature as the data can be processed at a later date, using the off-line programs, with a variety of parameters and algorithms. The only limitation is the 200 Hz RF bandwidth and a sampling rate of 250 Hz for each receiver. In order to fully utilize this feature, calibration signals must be recorded during each data collection period. This allows a complete calibration to be implemented when the data is processed on the off-line system. During the data collection, a monitor channel is available which calibrates and displays the Angular Power Density Spectra, ADPS, for selected data.

The off-line processing software is schematically shown in Figure 8-2. The software has three major components:

1. Calibration: Uses either an internal test signal or a near-field monopole as a source to match phase and amplitude of the element ports receiver subsystems. Correction factors are generated and stored for later application to the data.



* APDS - Angular Power Density Spectra

Figure 8-1. On-Line Data Recording System

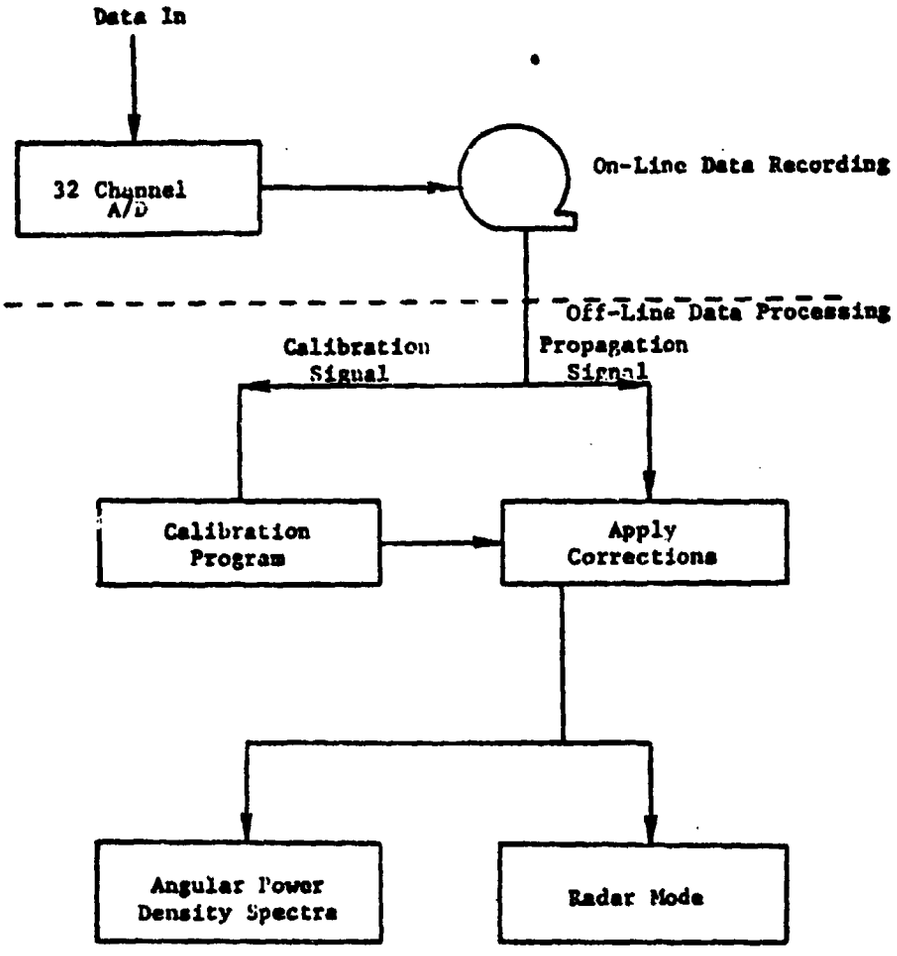


Figure 8-2. Off-Line Data Processing

2. Angular Power Density Spectra (APDS): Generates the APDS using either adaptive or conventional (FFT) beamforming techniques.

3. Radar Mode: Generates amplitude versus frequency at fixed steer directions using either adaptive or conventional beamforming techniques.

Appendices A-E contain listings of the programs that comprise the off-line processing software. The programs and their nomenclature by which they are identified are listed in Table 8-1. These programs are currently operational on the Sigma-5 at RADC.

Table 8-1. Off-Line Adaptive Processing Software Programs

Appendix A:	Calibration - MCALT
Appendix B:	Conventional Angular Power Density Spectra - CONVT
Appendix C:	Adaptive Angular Power Density Spectra -ADAPT
Appendix D:	Radar Processing with Conventional Techniques - RCONVT
Appendix E:	Radar Processing with Adaptive Techniques - RADAPT

8.2 Calibration (MCALT)

The 32 receivers in the Data Acquisition System were designed and measured to track within $\pm$ one percent in phase and $\pm$ one percent in amplitude with each other. Calibration procedures were implemented to remove systematic phase and amplitude errors introduced by the antenna and receiver subsystem, i.e., to maintain orthogonality between corresponding I and Q channels and amplitude and phase match between elements. Two calibration signals are available. One is an internal test signal which feeds an identical phase and amplitude reference signal into each of the 32 receivers. This will remove systematic errors in the receiver subsystem but not the antenna subsystem. A monopole located 600 m in front of the 16-element array can be used to calibrate the antenna subsystem as well as the receiver subsystem. The monopole, however, presents a spherical wavefront to the antenna and for it to provide a plane wave source, the calibration program was modified to remove the spherical nature of the signal wavefront from the reference monopole. Figure 8-3 is a block diagram of

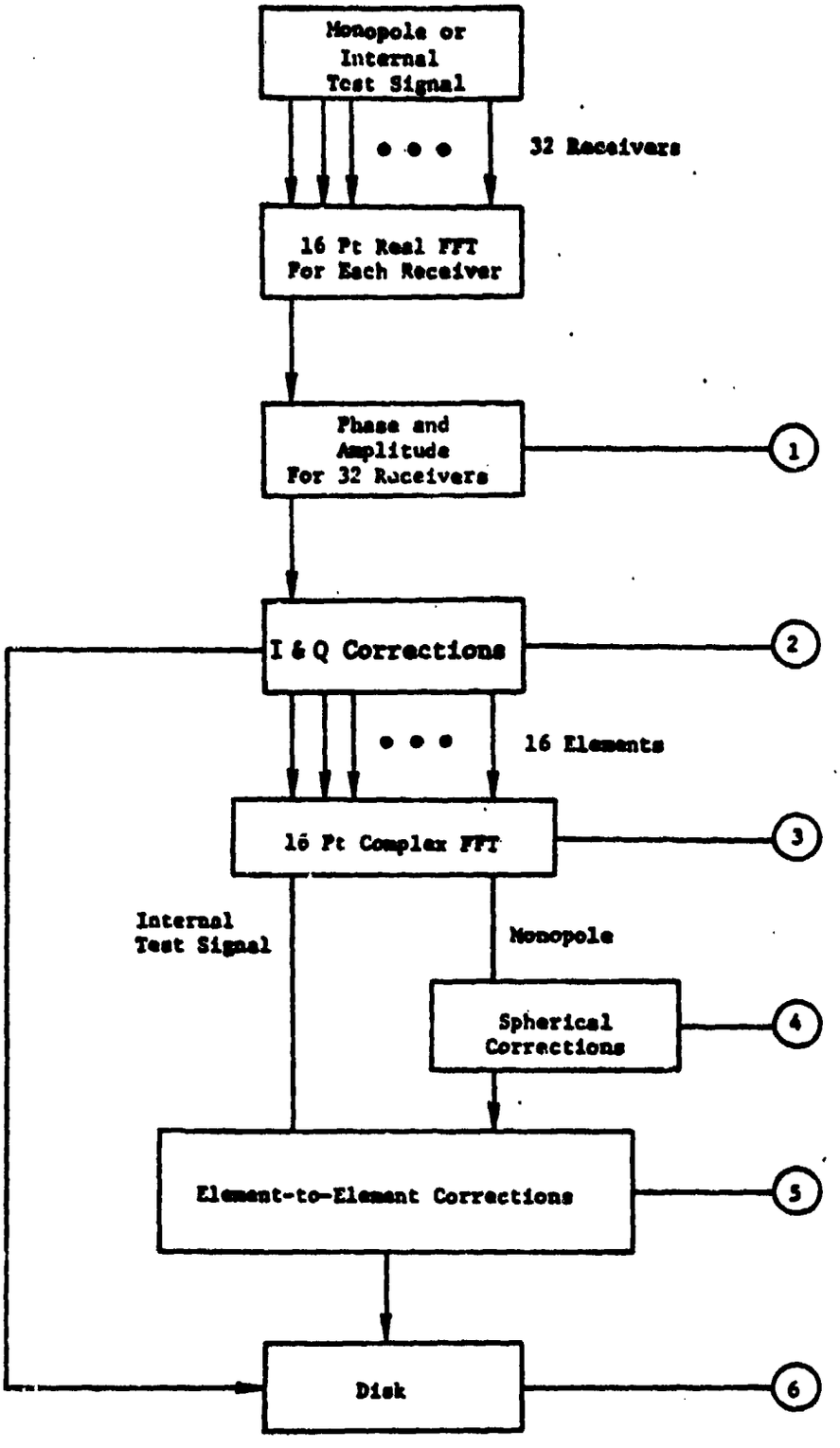


Figure 8-3. Calibration Procedures

the calibration procedure. The numbered points indicate where calibration data is displayed and hard copies available. The calibration program requires as input the time in hours, minutes, and seconds to specify the data on the tape to be used for calibration. In addition, the number of data sets (LTIMES) used in averaging the correction factors is specified. Each data set is 16 time samples or 0.064 s. The calibration source is also specified as Internal or Monopole. If the monopole source is used, the operating frequency in MHz of the monopole is also specified.

A 16 pt real FFT is performed to determine the phase and amplitude of the calibration tone for each of the 32 receivers. A single frequency tone is used for calibrating the receivers. This procedure matches the 32 receivers at only one point in the 100 Hz filter bandwidth. A digital equalization filter technique has been developed by TSC (Section 5.0 of this report) to correct for variations between receivers across the bandwidth of each filter. At this point, (1) and (2) in Figure 8-3, correction factors are generated which produce orthogonal and equal amplitude I and Q channels. The I channel of each receiver pair is left unchanged and the phase and amplitude of the Q channel is adjusted. The receivers are numbered 1 to 32 with the odd numbers being the I channels and the corresponding Q channel the next even number. A 16 pt complex FFT is applied to each port of the receive subsystem on the same data set used to obtain the I and Q corrections after the corrections are applied. This determines the phase and amplitude of each element of the array, (3) in Figure 8-3. Up to this point, there is no difference between the procedures for the monopole or internal test signal. The different procedure for each will be described separately below.

8.2.1 Internal Calibration Signal

The internal calibration signal is injected into the 32 receivers with equal phase and amplitude. This corresponds to a plane wave at boresight. For a plane wave at boresight, the response at all the elements must be of equal phase and amplitude. Defining the signal at each element as $S_n = A_n e^{i\phi}n$ the correction factor for element n is $Z_n = \Delta A_n e^{i\Delta\phi}n$ where $\Delta A_n = A_1/A_n$ and $\Delta\phi_n = \phi_1 - \phi_n$. Multiplying S_n by Z_n we get $A_1 e^{i\phi_1}$ for all n.

These correction factors, Z_n, insure that all the elements have the same phase and amplitude response for a plane wave at boresight; see (5) in Figure 8-3. The correction factors for each I-Q pair and element matching are stored on the disk. These corrections are then applied to data before the Angular Power Density Spectra or the radar maps are generated.

8.2.2 Monopole Calibration

A monopole was located in front of the 16-element array. Figure 8-4 shows the position of the monopole with respect to the 16-element array. The distances from the monopole to the front posts of the 1st and 16th element were surveyed.* A spherical wavefront from the monopole is also shown with the distance between the wavefront and each element shown in the Table. Before the systematic phase and amplitude corrections between elements can be determined, a factor has to be applied to the spherical wavefront to make it appear as a plane wave. A correction factor based on a spherical calibration signal would distort the measurement of a plane wave source.

The signal measured at the n^{th} element is $A_n e^{i\phi}n$. In order to make the spherical wave look like a plane wave, the monopole signal is phase retarded at each element by $\delta\phi_n = 2\pi d_{ns}/\lambda$ where d_{ns} is the distance between the wave front and the n^{th} element. The element-to-element correction factor for the monopole source is $Z_n = \Delta A_n e^{i\Delta\phi}n$ where $\Delta A_n = A_1/A_n$ and $\Delta\phi_n = \phi_1 - (\phi_n - \delta\phi_n)$. With this correction factor both the antenna and receiver subsystems are calibrated as in paragraph 8.2.1.

Figure 8-5 shows a conventional APDS for the OTH signal from WWV at 10 MHz using calibration factors obtained from the monopole with and without spherical corrections. Correcting for the spherical wavefront of the monopole signal improves the angular resolution of the conventional (FFT) APDS.

8.3 ANGULAR POWER DENSITY SPECTRA

The angular power density spectra (APDS) of the received energy is determined using either conventional or adaptive beamforming techniques. Figure 8-6 shows a block diagram of the APDS software for both the adaptive and conventional techniques.

---

* The elements were 220 foot long single-wire Beverage elements with a spacing of 18.288 m. The element phase centers were chosen to be approximately 2/3 of the length of the element back from the front posts.

Calculated d_{n_s}, Meters	
Elt	d_{n_s} Meters
1, 16	0.0
2, 15	4.033
3, 14	7.512
4, 13	10.427
5, 12	12.770
6, 11	14.534
7, 10	15.713
8, 9	16.303

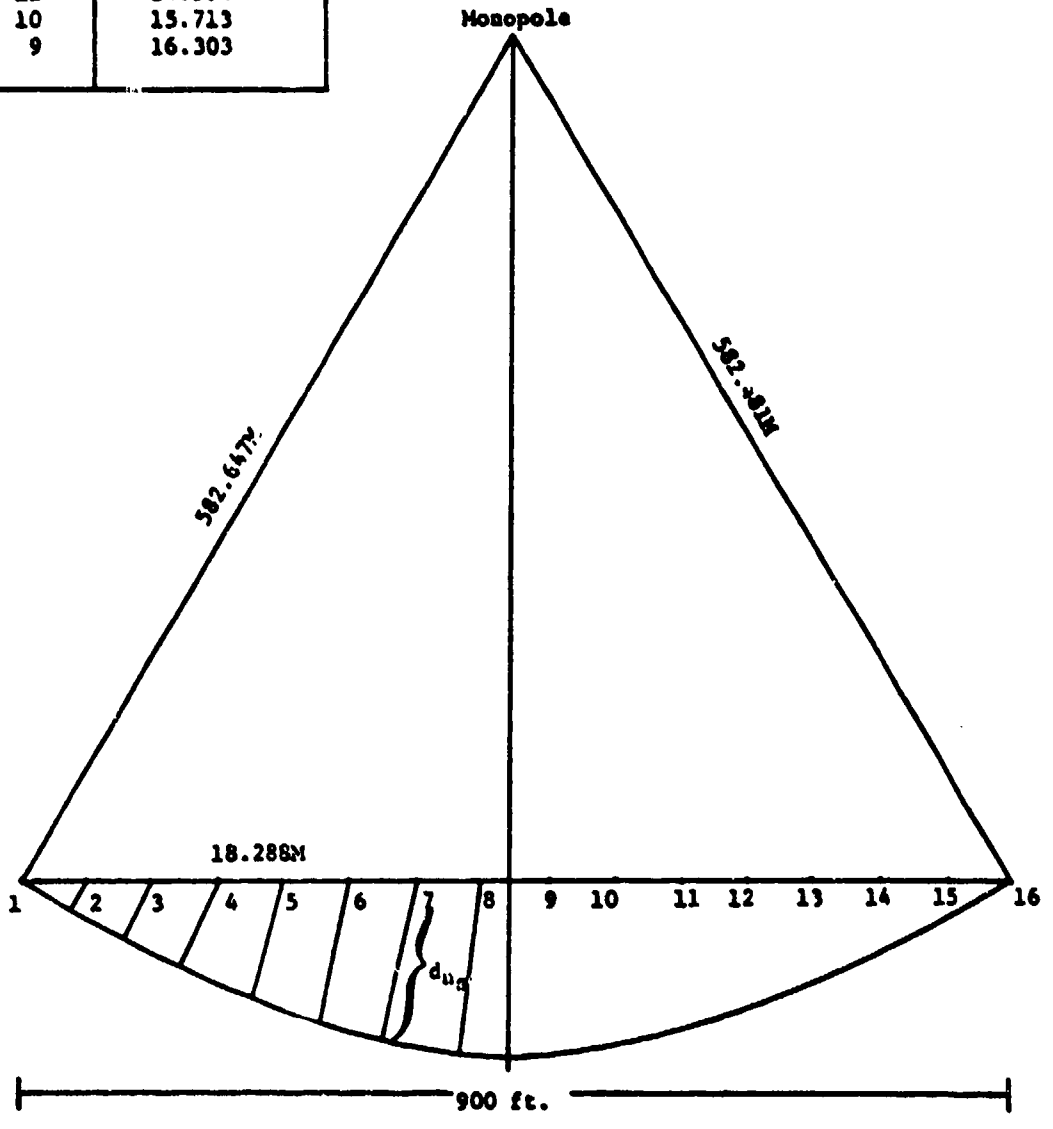


Figure 8-4. Location of Monopole with Respect to 16-Element Array

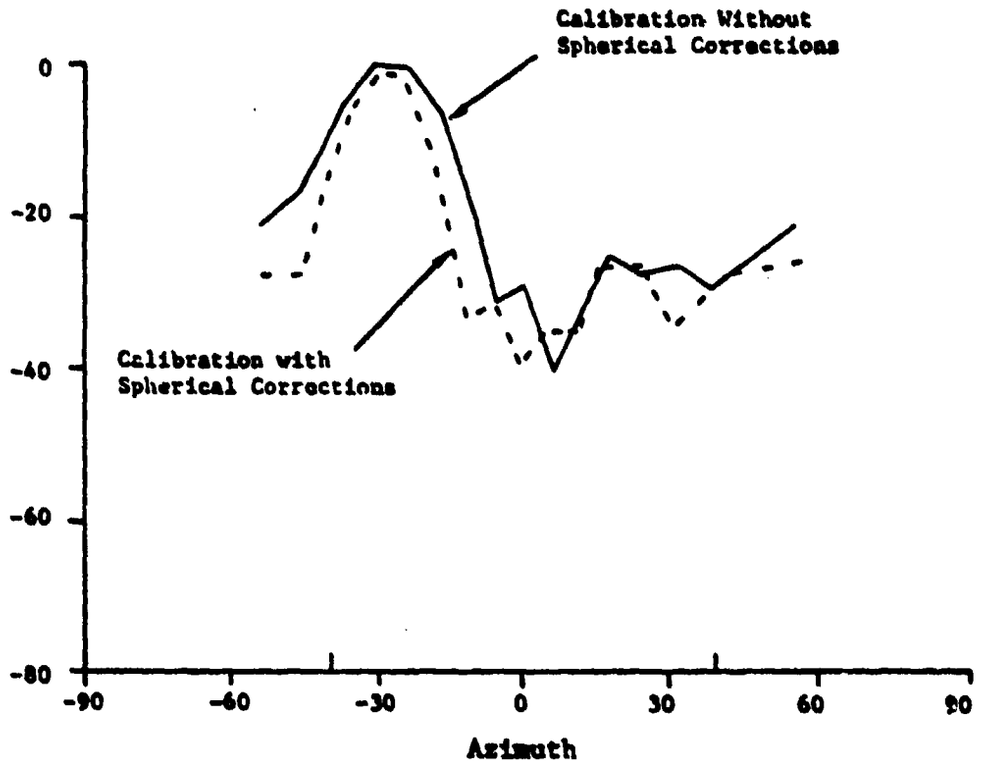


Figure 8-5. Conventional APDS of WWV Using Monopole Calibrations with and Without Spherical Corrections

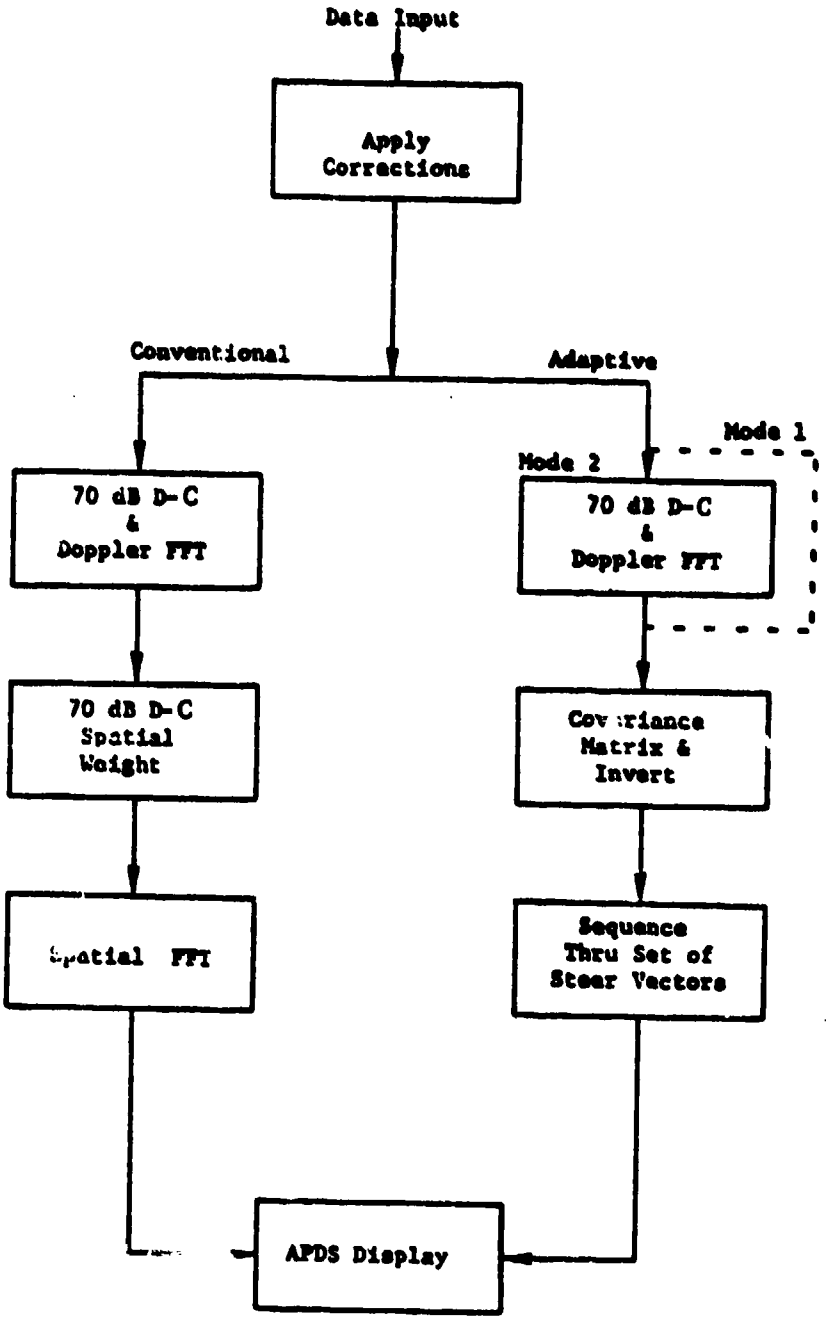


Figure 8-6. Processing Required to Produce Conventional and Adaptive Angular Power Density Spectra

8.3.1 Conventional APDS (CONVT)

The conventional APDS is generated by the program CONVT. The input data is the time (hours, minutes, seconds) and the operating frequency. After the corrections are applied to the data, 16 time samples from each element are time-weighted with a 70 dB Dolph-Chebyshev (D-C) weighting function and a 16 pt complex FFT for each element is performed. This gives an effective 64 ms coherent integration period. For Element #1, the Doppler bin, where the peak signal occurs, is identified. The phase and amplitude for this Doppler bin is determined for the 16 elements. The 16 phase and amplitudes for this doppler bin are then spatially FFT'd using a 70 dB D-C weighting function. The 16 amplitude outputs from the spatial FFT form the APDS when plotted against the azimuths of the 16 FFT beam outputs.

Conventional (FFT) beamforming with a 16 pt spatial FFT provides 16 independent beam positions. The direction of the beams in sine (i.e. μ) space is defined by $\mu_n = \pm M/2 = n\lambda/Md$ where M is the number of elements, n is an integer from 0 to $\pm$ M/2, and θ_n is the azimuth of the n^{th} beam measured from boresight. The angle at which the FFT formed APDS will begin to repeat is when $n = \pm M/2$ or $\mu = \pm 1/2\ \lambda/d$. For $\lambda = 2d$ this occurs at $\pm$ 90° in angle space, and for $\lambda < 2d$ the azimuthal angle coverage of the APDS is reduced. An FFT APDS beam position at the far right ($n = M/2$) is the same as the beam position on the far left of boresight. For successive values of $n = 0,1,2,\ldots,M/2$, the beam positions are equally spaced in sine space up to the point where the FFT APDS begins to repeat. The same is true on the left of boresight. The output of the FFT APDS is 17-beam positions (two-beam positions are identical for $n = M/2$) equally spaced in sine space. Figure 8-5 shows the APDS for an OTH source (WWV) at 10 MHz. The source occurs at approximately 30° to the right of boresight. For APDS maps presented in this report, a negative beam position angle is to the right of boresight. The antenna boresight was 240°T and 30° to the right of boresight on the APDS corresponds to an azimuth of 270°T. The calculated direction to WWV from Dexter is 271.3°T. At 10 MHz and for an element spacing of 18.288 m the APDS covers azimuths $\pm$ 55° from boresight. The 17 data points at the output of the spatial FFT are formed within this $\pm$ 55° region. Also the points are equally spaced. Finally the maximum

steer $\theta_{s_{max}}$ for an array with no grating lobes in visible space is specified by the condition

$$\theta_{s_{max}} = \pm \sin^{-1} (\lambda/d - 1)$$

This maximum steer is indicated on the display by two vertical ticks on the horizontal axis which for a frequency of 10 MHz occur at $\pm$ 39.8°.

8.3.2 Adaptive APDS (ADAPT)

The input parameters for the adaptive APDS program are time (hours, minutes, seconds), mode (1 = normal, 2 = spectral preprocessing of data), operating frequency, element configuration, and NGROUP. NGROUP is the number of sample groups used to generate the covariance matrix. Each sample group contains 16 complex time samples per array element. In the normal mode an NGROUP of 2 is usually selected. The normal mode indicates that the covariance matrix is determined for the entire filter bandwidth. In the preprocessing mode, a 16 pt complex FFT is performed on each element output and the peak signal is resolved in frequency. The covariance matrix is generated for a specific frequency cell in the filter bandwidth. (For a 16 pt FFT in mode 2, an NGROUP of 32 is required.

This report cannot discuss in detail the algorithms used in producing the adaptive APDS maps. A brief discussion will follow so that the computer programs in Appendix D can be followed. At a specified look direction the output of the beamformer is $y = W^*X$ where X is an N element complex column vector which represents the output of the N element array. W^* is the transpose conjugate of the weighting function for a specific look direction. For conventional beamforming $W^* = V^*$ where V is the unit vector in a specified steer direction. For adaptive beamforming it has been shown that the set of weights that optimize the SNR for a given look direction is:

$$W = \frac{F^{-1} V}{(V^* F^{-1} V)/M)}$$

where F^{-1} is the inverse of the covariance matrix F, M is the number of elements, and $(V^* F^{-1} V)/M$ is a normalization factor. The power density in a given look direction is defined as yy^*. Using the definition of $y = W^* X$ we can show that:

$$yy^* = W^* XX^* W$$

$$= \frac{V^* F^{-1*} XX^* F^{-1} V}{\frac{(V^* F^{-1} V)}{M} \frac{(V^* F^{-1} V)}{M}}$$

Since $XX^* \triangleq F$, $F^* = F$, and $(F^{-1})^* = F^{-1}$

$$yy^* = V^* F^{-1} FF^{-1} V \quad = M^2 \frac{V^* F^{-1} V}{(V^* F^{-1} V)^2}$$

$$\therefore \quad yy^* = \frac{M^2}{V^* F^{-1} V}$$

This defines the power density for a given look direction. The APDS is obtained by calculating $1/(V^* F^{-1} V)$ for 65 look directions equally spaced in sine space from -1 to +1. The APDS for WWV at 10 MHz using Adaptive weights as generated by the adaptive algorithm described above is illustrated in Figure 8-7.

8.4 Radar Processing

An HF/OTH radar detects targets after range / Doppler processing. Evaluation of convontional and adaptive beamforming techniques for OTH radars requires processing of the data in a radar detection mode. For this reason, the off-line adaptive processing software has been augmented with a radar processing mode. This mode displays amplitude versus frequency for a fixed steer direction. The beamforming weights can be generated with either conventional weights or adaptively calculated. Figure 8-8 is a block diagram of the radar processing mode. The data is represented by an N element column vector X. The beamformer multiples this column vector by a weighting function row vector determined either adaptively or conventionally. The output of the beamformer is a time series of the complex scalar y. This time series is weighted and FFT'd. The output is the amplitude versus frequency for a selected azimuth. In the current program, the size of the FFT varies from 16 to 256 complex points which for a sample rate of 250 complex samples/second represents a coherent integration time which varies from 0.064 to 1.024 seconds.

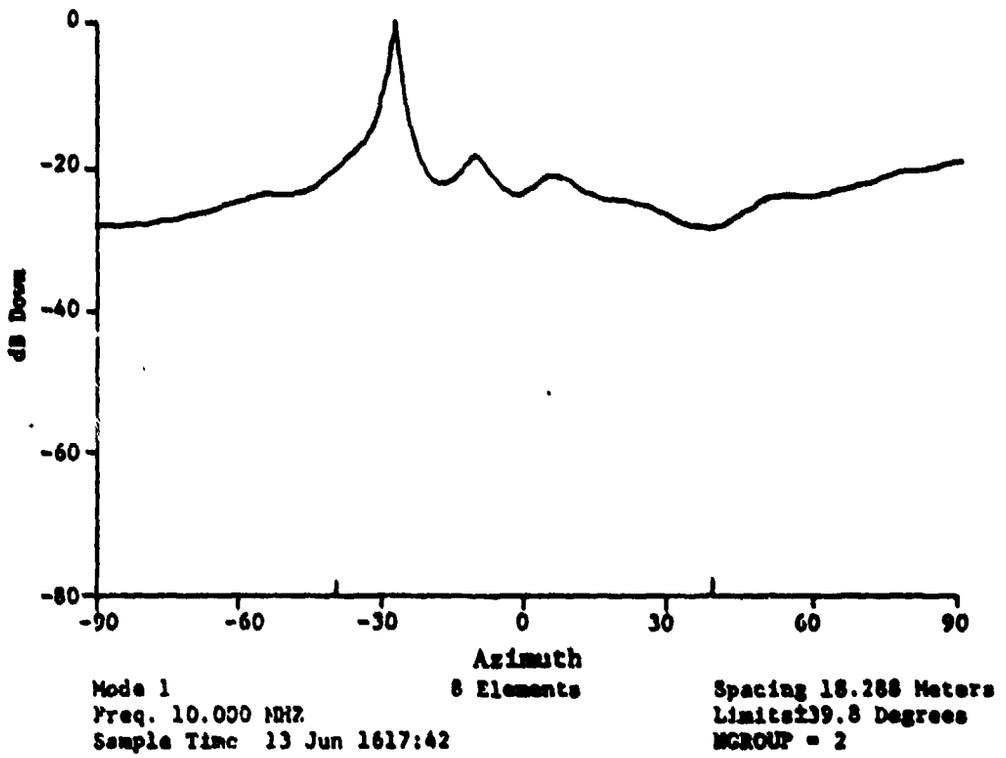


Figure 8-7. Example of Angular Power Density Spectra Using Adaptive Weights

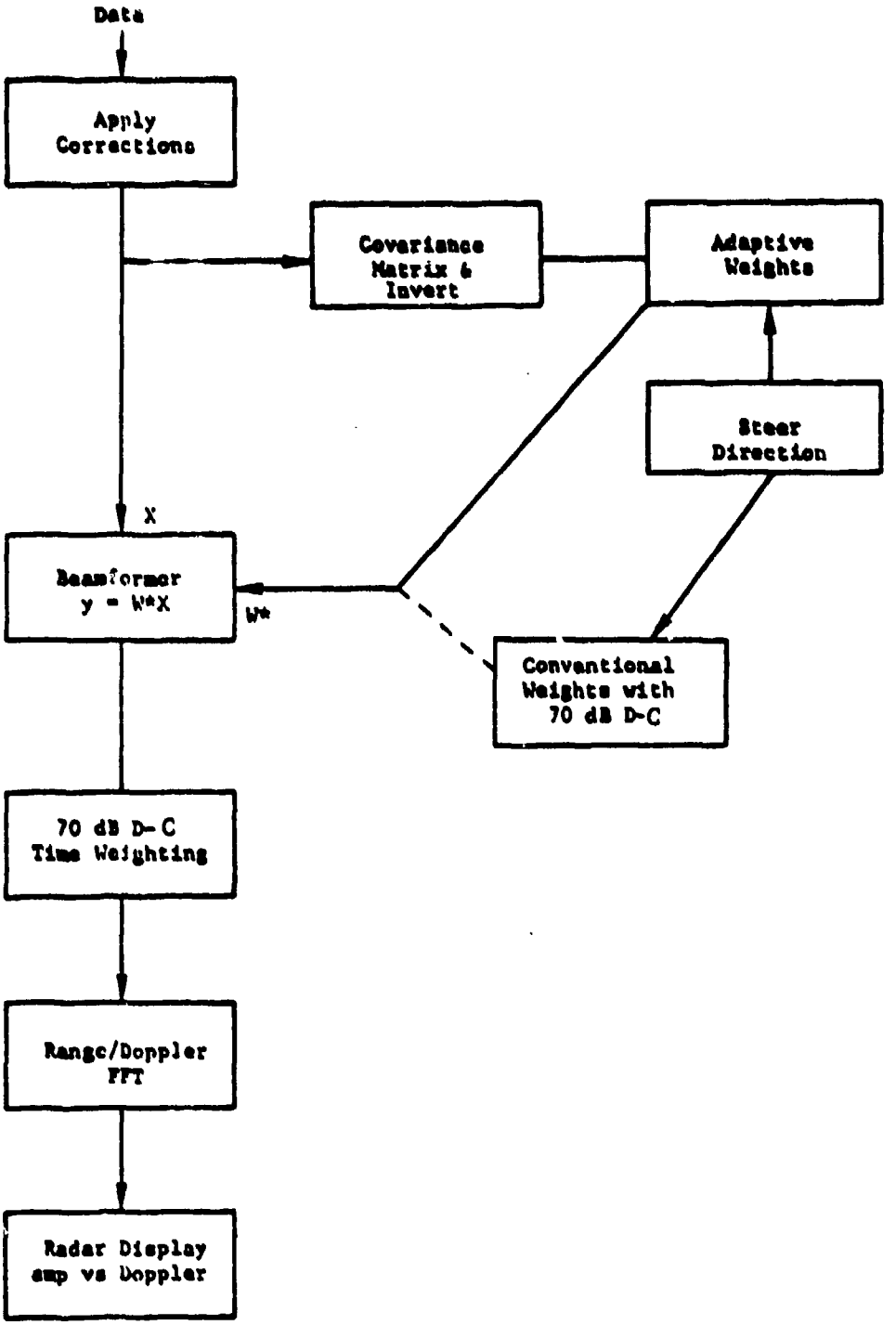


Figure 8-8. Block Diagram of Radar Processing for Adaptive and Conventional Beamforming

8.4.1 Conventional Beamforming (RCONVT)

The steer direction specified determines the steer vector V. For conventional beamforming W = V. In addition, a 70 dB D-C spatial weighting function is applied across the 16-element array. The program can easily be generalized to apply different spatial weightings if required. In addition, the number of elements can be variable and from 1 to N elements can be used. This is done by weighting with 0 those elements which are not desired. Depending on the desired frequency resolution, a time series of complex scalars, y, are obtained from the output of the beamformer. A 70 dB D-C time window, which is specified by the size of the FFT, is applied to the data. The amplitude output of the resultant FFT is displayed. Figure 8-9 shows the output of the radar mode with a 256 pt FFT for a 50 Hz test tone at boresight. The horizontal axis shows both the FFT cell number and its associated frequency cell in the 250 Hz band as determined by the sampling rate. In addition to the sample time and the steer direction (relative to boresight) the peak signal is shown. The data when plotted is scaled so that the peak signal occurs at 0 dB. The value of the peak signal can be used to compare signal levels at the same FFT cell for different steer directions. This assumes that the same data set is used to produce the radar maps at the selected steers.

Figure 8-10 shows the output of the radar processing mode at 0° and -27.95° for WWV signals at 10 MHz. The signal from WWV at the 0° steer is 39.1 dB below the signal at the -27.9° steer. The conventional APDS for this time period (see Figure 5) is in agreement as it shows a slightly less than 40 dB sidelobe level at 0° when compared to the peak of the APDS.

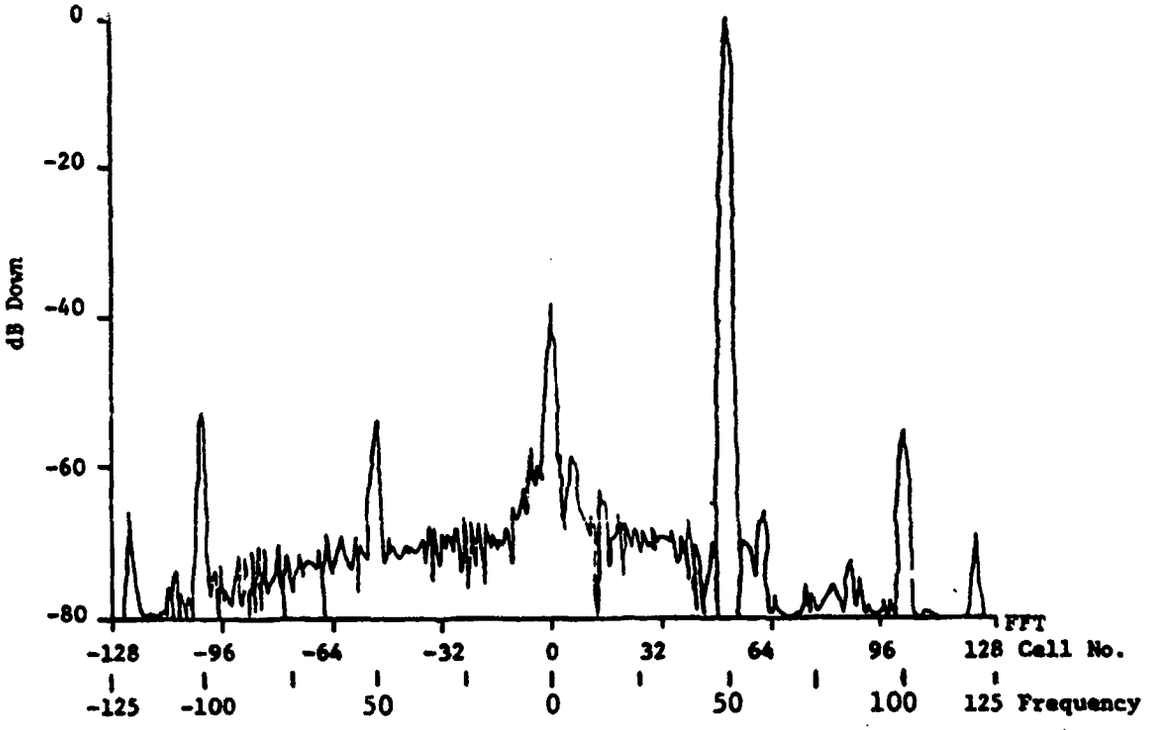
8.4.2 Adaptive Beamforming (RADAPT)

For the radar mode using adaptive weights, data is read in, stored onto the disk, and added to the covariance matrix, as in ADAPT. The matrix is then inverted and the weights in a given look direction are

$$W = F^{-1}V/((V*F^{-1}V)/M)$$

and the output of the beamformer is

$$y = W^{*} X.$$



Sample Time 13 Jun 1614:30 Steer = .000, Peak = 83.819 dB
Using Conventional Weights

Figure 8-9. Radar Map with Conventional Weights of a 50 Hz Test Tone at Boresight

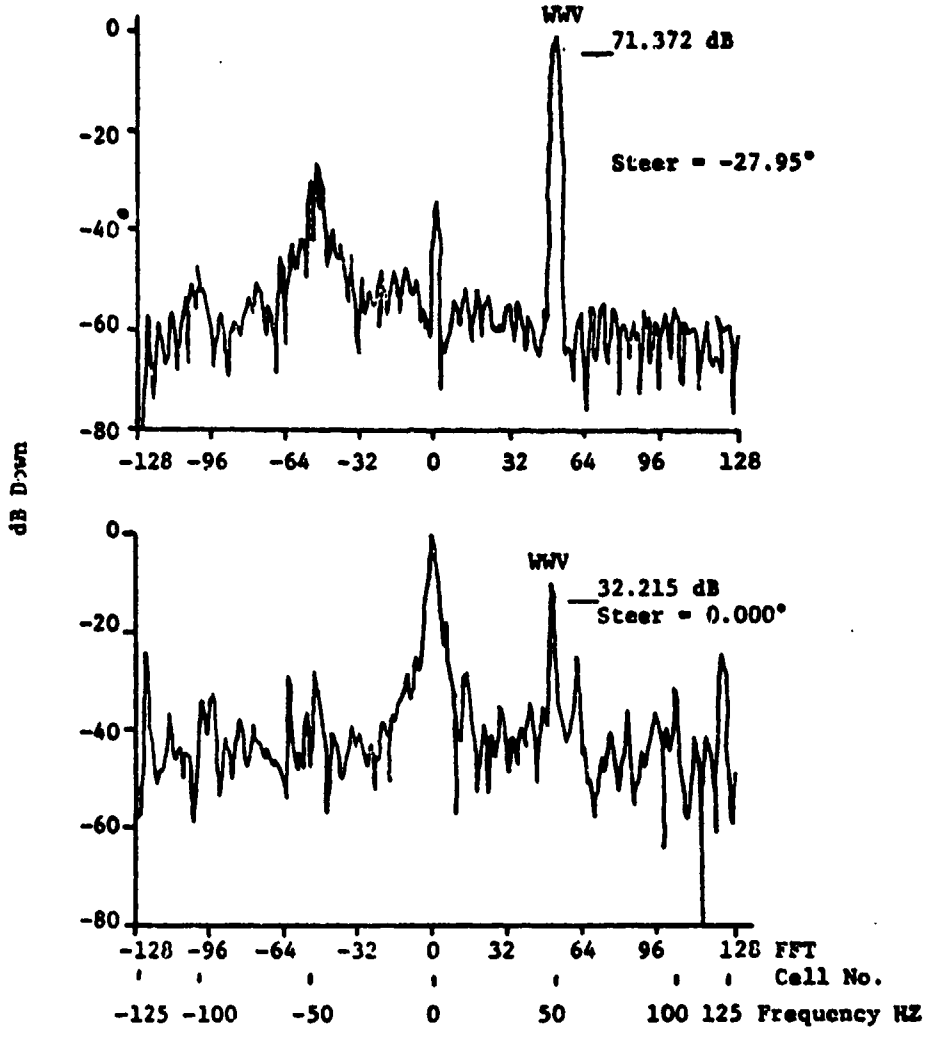


Figure 8-10. Conventional Radar Map of 10 MHz WWV Signal at 0° and -27.95° Steer

As for the conventional mode, a time series of 'y' is obtained and time windowed with a 70 dB D-C weights prior to the FFT. The weights can be generated for any look direction by the appropriate selection of the steer vector. In order to expedite the generation of radar maps using adaptive weights, the inverse of the covariance matrix is determined for a set of data and may be used for several azimuths without regenerating the covariance matrix.

The number of samples used to generate the covariance matrix is specified by NGROUP. In the adaptive radar mode, the number of time samples used is the doppler/range FFT size. The NGROUP required is specified by 2^4 x NGROUP = FFT size. For example, a 256 point FFT requires an NGROUP of 16. The covariance matrix is a 16 x 16 matrix (for 16-element array) which is formed by the expectation value of $\overline{x_i\ x_j}$. x_1 is the complex signal at the i^{th} element and i and j are running indices representing the 16 elements. For an NGROUP of 16, 256 values of x_i are used to determine the expectation value of $\overline{x_i\ x_j}$. This approach ensures that the weights generated from a given data set are used on the same data set to generate the adaptive radar mode. The approach described above although specified at a 16-element array can be generalized to any number of elements. Figure 8-11 shows an adaptive radar map of WWV at 10 MHz using adaptive weights for an 8-element array. Indicated on the figure is the element configuration utilized.

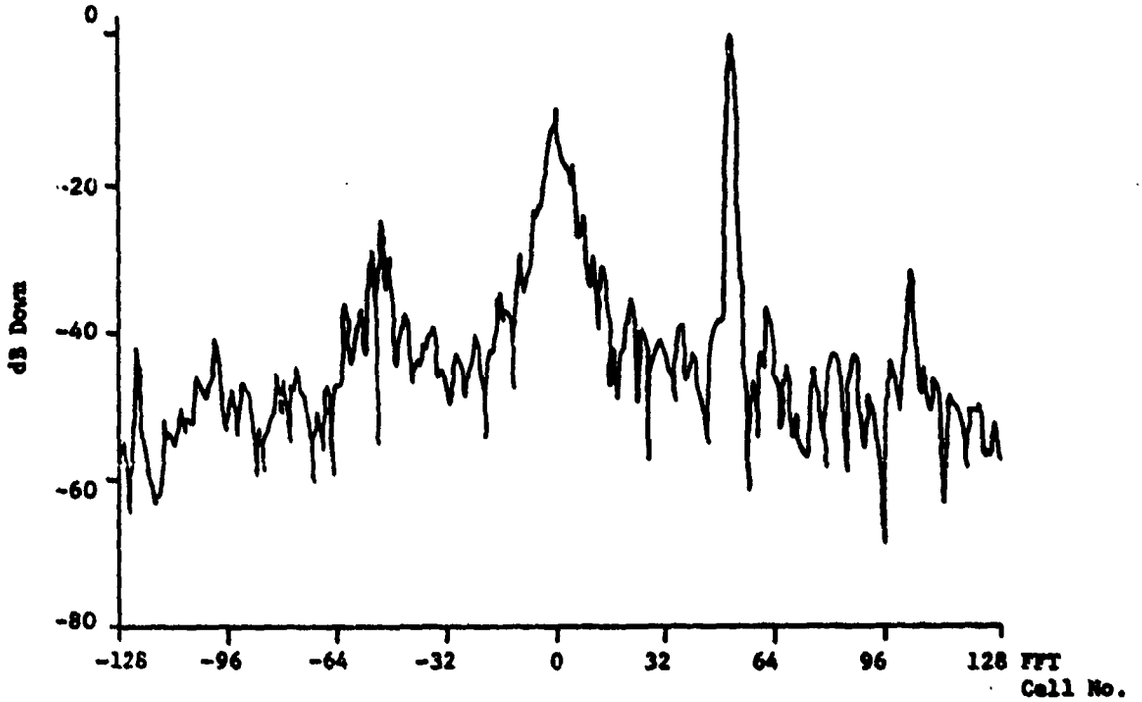


Figure 8-11. Adaptive Radar Map of a 10 MHz WWV Signal at -28.7° Steer

9.0 EXPERIMENTAL PROGRAM

A limited experimental program was undertaken during this phase of the Adaptive Processing Program. The objective of the program was to:

1. Provide data necessary for implementation of Equalization Filter by TSC.
2. To provide data to check-out off-line adaptive processing software described in section two of this report.
3. To measure sidelobe levels with OTH sources achievable with the 16-element array using conventional beamforming.

Table 9-1 lists the data collected during the Phase II Adaptive Processing Program. The data for the equalization filter consisted of the output of the 32 receivers for CW Test Tones from 5 to 150 Hz in 5 Hz frequency increments. The data for each CW Test Tone was time weighted (with 70 dB D-C weighting) and processed with a 512 point real FFT. The phase and amplitude of the test tone for each receiver was determined and referenced to Receiver 1. The results were forwarded to TSC for use in the construction of the digital equalization filter.

The WWV data was used to verify operation of the off-line software. This has been discussed in detail in Section 8.0 of this report. The data was also used to determine sidelobe levels achievable with the 16-element array for the OTH source. Figure 8-5 of this report illustrated a typical angular power density spectra of WWV which shows a 40 dB sidelobe response. Finally, two controlled CW sources (SRI and UI) were explored to determine performance of Adaptive and Conventional Processing in the presence of two sources. Unfortunately, transmitter difficulties at the University of Illinois prevented the observation of the two controlled CW sources.

Table 9-1. Data Collected During Phase II Adatpive Processing Program

Date	Time	Comments
14 June 1975	1528:20 - 1544Z	Filter Equalisation Data
14 June 1975	1611:30 - 1634Z	WWV at 10 MHz
28 August 1975	2336:30 - 2355Z	WWV at 10 MHz
29 August 1975	0011 - 0027Z	SRI(1) & UI(2): CW at 7.8 MHz
29 August 1975	0030:52 - 004:40Z	SRI & UI CW at 9:835 MHz
29 August 1975	0105:30 - 0121:15Z	SRI & UI: CW at 7:800 MHz
29 August 1975	0135:30 - 0149:30Z	SRI & UI: CW at 9:835 MHz

(1) SRI: Stanford Research Institute - CW Transmitter at Los Lunas, New Mexico

(2) UI: University of Illinois - CW Transmitter in Champagne, Illinois

LIST OF APPENDICES

APPENDIX A
CALIBRATION PROGRAM

```
C      PROGRAM MCALT                                                    0000
C                                                                       0000
C                                                                       0000
C    THIS PROGRAM IS CALLED MCALT                                       0000
C    READS RAW CALIBRATION TONE SAMPLES FROM FIELD TAPE                 0000
C    AND GENERATES CORRECTION FACTORS.  SOURCE MAY EITHER               0000
C    BE INTERNAL OR EXTERNAL(MONOPOLE)                                  0000
C    READS TAPE  =  512 DATA WORDS + 11 PARAMETER WORDS = 523 WORDS.    0000
C                                                                       0000
C     9 SEPTEMBER 1975  1600   WITH CORRECTED MONOPOLE CORRECTIONS      0001
C                                                                       0001
      REAL ISAMPL,IQCORA,COS,CABS,CORA(16),ELPH(16)                     0001
      INTEGER CTIME,STIME,IDB(6)                                        0001
      COMPLEX ZCORR(16),ZSAMPL,ZCORR1,ZTEMP(16),ZZCORR(16),ZTEMP1,ZTEMP2 0001
C                                                                       0001
      DIMENSION IQCORA(16),DELPH(16),PHIOUT(16),YPOINT(16),OUTBUF(64),  0001
     *WBUF(523),DOLPH(16),XAM(16),XPH(16),IR(8),IV(6)                   0001
      DIMENSION DIST(8),SPHCOR(16)                                      0001
C                                                                       0001
      COMMON IBUF1(262),IBUF2(262),INBUF(523),ISAMPL(32),QSAMPL(32),    0002
     * AM(32),PH(32),CTIME(6),STIME(6)                                  0002
C                                                                       0002
      EQUIVALENCE(INBUF(1),WBUF(1))                                     0002
      EQUIVALENCE (OUTBUF(1),IQCORA(1)),(OUTBUF(17),DELPH(1)),          0002
     * (OUTBUF(33),ZCORR(1)),(PHIOUT(1),YPOINT(1))                      0002
C                                                                       0002
      DATA(DOLPH(I),I=1,16)/0.01266,0.05237,0.13904,0.28431,0.48131,    0002
     * 0.69921,0.889,1.0,1.0,0.889,0.69921,0.48131,0.28431,0.13904,     0002
     * 0.05237,0.01266/                                                 0002
      DATA (IR(I),I=1,8)/ZA0A0,ZA0A0,ZA0C3,ZCAC1,ZCECE,ZC5CC,ZA0CE,     0003
     * ZCFAE/                                                           0003
      DATA (IV(I),I=1,6)/ZA0A0,ZA0A0,ZA0A0,ZA0D6,ZCFCC,ZD4D3/           0003
      DATA (IDB(I),I=1,6)/ZA0A0,ZA0A0,ZA0C4,ZC2A0,ZC4CF,ZD7CE/          0003
      DATA (DIST(I),I=1,8)/0.0,4.033,7.512,10.427,                      0003
     1 12.770,14.534,15.713,16.303/                                     0003
      DATA IDUM,ICOLON,RAD,IFIRST,NSAMP,NCHAN/ZA0A0,ZBAA0,57.29578,     0003
     *0,512,32/                                                       0003
C                                                                       0003
      TAN(DUMMY)=SIN(DUMMY)/COS(DUMMY)                                  0003
C                                                                       0004
    1 CONTINUE                                                          0004
      DO 3 I=1,16                                                       0004
      CORA(I)=0.0                                                       0004
      ELPH(I)=0.0                                                       0004
    3 ZZCORR(I)=CMPLX(0.0,0.0)                                          0004
      CALL BURST                                                        0004
C                                                                       0004
C    LTIMES = NUMBER OF TIMES WANT TO AVERAGE THE CORRECTION FACTORS     0004
C                                                                       0004
      WRITE(13,111)                                                     0005
  111 FORMAT('TIME HR,MIN,SEC; LTIMES(3A2,I5)')                         0005
      READ(13,112) IHR,IMIN,ISEC,LTIMES                                 0005
  112 FORMAT(3A2,I5)                                                    0005
      WRITE(13,105)                                                     0005
  105 FORMAT('SOURCE?  0=INTERNAL  1=MONOPOLE (I1)')                    0005
      READ(13,106)ISOURC                                                0005
  106 FORMAT(I1)                                                        0005
      IF(ISOURC.EQ.0)GO TO 1101                                         0005
C                                                                       0005
C    MONOPOLE TEST TONE SOURCE                                          0006
C    COMPUTE PHASE DISTANCES                                            0006
```

```
C                                                                       00062
      WRITE(13,107)                                                     00063
  107 FORMAT('INPUT OPERATING FREQUENCY (F6.3)')                        00064
      READ(13,108)FREQ                                                  00065
  108 FORMAT(F6.3)                                                      00066
      XLAMDA=299.7925/FREQ                                              00067
      DO 50 I=1,8                                                       00068
      SPHCOR(I)=6.28318*DIST(I)/XLAMDA                                  00069
   50 SPHCOR(17-I)=SPHCOR(I)                                            00070
1101  IFILE=+1                                                          00071
      CALL RDTAPE(IFILE)                                                00072
      CALL TMASCI(CTIME)                                                00073
      IF(CTIME(4).NE.IHR.OR.CTIME(5).NE.IMIN.OR.CTIME(6).NE.            00074
     1   ISEC) GO TO 1101                                               00075
      DO 6800 LT=1,LTIMES                                               00076
C                                                                       00077
C   OUTPUT LT COUNT ON THE RIB       SET RIB TO 71                      00078
C                                                                       00079
      CALL RIBOUT(LT)                                                   00080
C                                                                       00081
C   READ A RECORD                                                       00082
C                                                                       00083
      IF(LT.EQ.1) GO TO 1105                                            00084
      IFILE=+1                                                          00085
      CALL RDTAPE(IFILE)                                                00086
      CALL TMASCI(CTIME)                                                00087
1105  DO 16 I=1,NSAMP                                                   00088
   16 WBUF(I)=FLOAT(INBUF(I))                                           00089
C                                                                       00090
C   PERFORM 16 PT. DFT ON EACH RECEIVER                                 00091
C                                                                       00092
      DO 6700 ICORR=1,2                                                 00093
      DO 6699 IEL=1,16                                                  00094
      ICONST=2*IEL-1                                                    00095
      IF(ICORR.EQ.1)GO TO 4                                             00096
      ANGLR=(90.0-DELPH(IEL))/RAD                                       00097
      COSANG=COS(ANGLR)                                                 00098
      TANANG=TAN(ANGLR)                                                 00099
    4 CONTINUE                                                          00100
      DO 69 I=1,16                                                      00101
      IRXWD=ICONST+32*(I-1)                                             00102
      I2=2*I                                                            00103
      I2M=I2-1                                                          00104
      ISAMPL(I2M)=WBUF(IRXWD)                                           00105
      ISAMPL(I2)=0.0                                                    00106
      QSAMPL(I2M)=WBUF(IRXWD+1)                                         00107
      QSAMPL(I2)=0.0                                                    00108
      IF(ICORR.EQ.1)GO TO 69                                            00109
      QSAMPL(I2M)=QSAMPL(I2M)*IQCORA(IEL)/COSANG-ISAMPL(I2M)*TANANG     00110
   69 CONTINUE                                                          00111
C                                                                       00112
C   THE ISAMPL ARRAY NOW CONTAINS 16 SAMPLES (IMAGINARY PART SET = 0.0) 00113
C   FOR A DFT ON THE I-CHANNEL                                          00114
C   SAME FOR THE QSAMPL ARRAY                                           00115
C                                                                       00116
C   WINDOW PRIOR TO FFT                                                 00117
C                                                                       00118
      DO 691 I=1,16                                                     00119
      I2=2*I                                                            00120
      ZSAMPL=CMPLX(ISAMPL(I2-1),ISAMPL(I2))*CMPLX(DOLPH(I),0.0)         00121
      ISAMPL(I2-1)=REAL(ZSAMPL)                                         00122
      ISAMPL(I2)=AIMAG(ZSAMPL)                                          00123
```

```
      ZSAMPL=CMPLX(QSAMPL(I2-1),QSAMPL(I2))*CMPLX(DOLPH(I),0.0)                00124
      QSAMPL(I2-1)=REAL(ZSAMPL)                                                00125
  691 QSAMPL(I2)=AIMAG(ZSAMPL)                                                 00126
C                                                                              00127
C   NOW PERFORM A DFT ON THE I-CHANNEL, THEN THE Q-CHANNEL                     00128
C                                                                              00129
      CALL FORT(4,-1,ISAMPL,IFERR)                                             00130
      CALL FORT(4,-1,QSAMPL,IFERR)                                             00131
C                                                                              00132
C   THE ISAMPL ARRAY NOW CONTAINS 16 COMPLEX (32 TOTAL)SPECTRAL VALUES         00133
C   FOR ONE I-CHANNEL RECEIVER                                                 00134
C   SAME FOR THE QSAMPL ARRAY                                                  00135
C   NOW GET SPECTRA - AMPLITUDE AND PHASE VS. FREQUENCY                        00136
C                                                                              00137
      DO 66 JCHANL=1,2                                                         00138
      DO 68 I=1,16                                                             00139
      I2=2*I-1                                                                 00140
      IF(JCHANL.EQ.2)GO TO 681                                                 00141
      CALL AMPHAS(ISAMPL(I2),ISAMPL(I2+1),XAM(I),XPH(I))                       00142
      GO TO 68                                                                 00143
  681 CALL AMPHAS(QSAMPL(I2),QSAMPL(I2+1),XAM(I),XPH(I))                       00144
   68 CONTINUE                                                                 00145
C                                                                              00146
C   FIND MAXIMUM AMPLITUDE - THIS IS THE CAL TONE                              00147
C   SKIP XAM(1) = D.C.        DO ONLY THE FIRST HALF NUMBER OF PTS             00148
C   DUE TO THIS BEING A REAL FFT                                               00149
C                                                                              00150
      NPTS=9                                                                   00151
      KOUNT=2                                                                  00152
      CALL FNDMAX(XAM,NPTS,KOUNT)                                              00153
      IF(JCHANL.EQ.2)GO TO 665                                                 00154
      AM(ICONST)=XAM(KOUNT)/3276.7                                             00155
      PH(ICONST)=XPH(KOUNT)                                                    00156
      GO TO 66                                                                 00157
665   AM(ICONST+1)=XAM(KOUNT)/3276.7                                           00158
      PH(ICONST+1)=XPH(KOUNT)                                                  00159
   66 CONTINUE                                                                 00160
 6699 CONTINUE                                                                 00161
C                                                                              00162
C   AM ARRAY CONTAINS AMPLITUDE VALUES(VOLTS) FOR ALL RECEIVERS, 1-32 IN       00163
C   ORDER I(1), Q(1), I(2), Q(2) ... I(16), Q(16)                              00164
C   PH ARRAY CONTAINS PHASE VALUES(DEGREES) FOR ALL RECEIVERS IN THE           00165
C   SAME ORDER                                                                 00166
C   NOW PLOT AMPLITUDES                                                        00167
C                                                                              00168
  500 CALL SSWTCH(2,IUP)                                                       00169
      IF(IUP.EQ.1)GO TO 500                                                    00170
      CALL BURST                                                               00171
      WRITE(13,100)(CTIME(I),I=1,5),ICOLON,CTIME(6),LT                         00172
  100 FORMAT(22X,'CORRECTION TIME  ',3A2,3X,2A2,A1,A2,11X,I3)                  00173
      CALL TKWAIT                                                              00174
      CALL TKPLOT(0,0,0)                                                       00175
      XSTART=3.6                                                               00176
      YSTART=3.3                                                               00177
      CALL AXIS(XSTART,YSTART,IR,-16,6.0,0.0,1.001,5.001)                      00178
      CALL AXIS(XSTART,YSTART,IV,+12,2.0,90.0,0.001,1.001)                     00179
      DO 70 I=1,32                                                             00180
      X=FLOAT(I-1)*0.2+XSTART                                                  00181
      Y=AM(I)/1.3+YSTART                                                       00182
      IF(I.GT.1)GO TO 699                                                      00183
      CALL PLOT(X,Y,3)                                                         00184
      GO TO 70                                                                 00185
```

```
  699 CALL PLOT(X,Y,2)                                                    00186
   70 CONTINUE                                                            00187
C                                                                         00188
C    PRINT OUT PHASE VALUES - A I'S ABOVE A Q'S                           00189
C                                                                         00190
      DO 72 JPAIR=1,16                                                    00191
      J=2*JPAIR                                                           00192
      IF(ICORR.EQ.2)GO TO 719                                             00193
      IQCORA(JPAIR)=AM(J-1)/AM(J)                                         00194
      DELPH(JPAIR)=ABS(PH(J-1)-PH(J))                                     00195
      IF(DELPH(JPAIR).GE.180.)DELPH(JPAIR)=360.0-DELPH(JPAIR)             00196
      PHIOUT(JPAIR)=DELPH(JPAIR)                                          00197
      CORA(JPAIR)=CORA(JPAIR)+IQCORA(JPAIR)                               00198
      ELPH(JPAIR)=ELPH(JPAIR)+DELPH(JPAIR)                                00199
      GO TO 72                                                            00200
  719 PHIOUT(JPAIR)=ABS(PH(J-1)-PH(J))                                    00201
      IF(PHIOUT(JPAIR).GE.180.)PHIOUT(JPAIR)=360.0-PHIOUT(JPAIR)          00202
   72 CONTINUE                                                            00203
      CALL PLOT(0.0,2,2,-1)                                               00204
      WRITE(13,101) (PH(I),I=1,16,2),(PH(I),I=2,16,2),(PHIOUT(I),I=1,8),  00205
     * (PH(I),I=17,32,2),(PH(I),I=18,32,2),(PHIOUT(I),I=9,16)             00206
  101 FORMAT(23X,21HRECEIVER PHASE ANGLES,2(//2X,2H I,8F8.1,/2X,2H Q,     00207
     * 8F8.1,/1X,3HDIF,8F8.1))                                           00208
 6700 CONTINUE                                                            00209
C                                                                         00210
C    FINISHED I-Q CORRECTIONS  NOW FIND ELEMENT-ELEMENT CORRECTIONS       00211
C                                                                         00212
C    DO A COMPLEX DFT ON EACH ELEMENT                                     00213
C                                                                         00214
      DO 6800 ICORR=1,2                                                   00215
      ZCORR1=ZCORR(1)                                                     00216
      DO 5000 IEL=1,16                                                    00217
      ANGLR=(90.-DELPH(IEL))/RAD                                          00218
      COSANG=COS(ANGLR)                                                   00219
      TANANG=TAN(ANGLR)                                                   00220
      IF(ICORR.NE.2)GO TO 5102                                            00221
      ZCORR(IEL)=ZCORR1/ZCORR(IEL)                                        00222
      ZZCORR(IEL)=ZZCORR(IEL)+ZCORR(IEL)                                  00223
 5102 ICONST=2*IEL-1                                                      00224
      DO 5100 I=1,16                                                      00225
      IRXWD=ICONST+32*(I-1)                                               00226
      I2=2*I                                                              00227
      I2M=I2-1                                                            00228
      ISAMPL(I2M)=WBUF(IRXWD)                                             00229
      ISAMPL(I2)=WBUF(IRXWD+1)*IQCORA(IEL)/COSANG-ISAMPL(I2M)*TANANG      00230
C                                                                         00231
C    WINDOW PRIOR TO FFT                                                  00232
C                                                                         00233
      ZSAMPL=CMPLX(ISAMPL(I2M),ISAMPL(I2))*CMPLX(DOLPH(I),0.0)            00234
      IF(ICORR.EQ.2)ZSAMPL=ZSAMPL*ZCORR(IEL)                              00235
      ISAMPL(I2M)=REAL(ZSAMPL)                                            00236
 5100 ISAMPL(I2)=AIMAG(ZSAMPL)                                            00237
      CALL FORT(4,-1,ISAMPL,IFERR)                                        00238
C                                                                         00239
C    GET AMP AND PHASE OF CAL TONE                                        00240
C                                                                         00241
      DO 5101 I=1,16                                                      00242
      I2=2*I-1                                                            00243
 5101 CALL AMPHAS(ISAMPL(I2),ISAMPL(I2+1),XAM(I),XPH(I))                  00244
      NPTS=16                                                             00245
      KOUNT=2                                                             00246
      CALL FNDMAX(XAM,NPTS,KOUNT)                                         00247
```

```
      KOUNT2=2*KOUNT                                                    00248
      ZTEMP(IEL)=CMPLX(ISAMPL(KOUNT2-1),ISAMPL(KOUNT2))                 00249
      IF(ICORR.GT.1)GO TO 4999                                          00250
      ZCORR(IEL)=ZTEMP(IEL)                                             00251
 4999 AM(IEL)=XAM(KOUNT)/3276.7                                         00252
 5000 PH(IEL)=XPH(KOUNT)                                                00253
C                                                                       00254
C    PRINT OUT 16 ELEMENT AMPLITUDES AND PHASES                         00255
C                                                                       00256
  501 CALL SSWTCH(2,IUP)                                                00257
      IF(IUP.EQ.1)GO TO 501                                             00258
      CALL PLTE2E                                                       00259
      IF(ICORR.GT.1.OR.ISOURC.NE.1)GO TO 6799                           00260
CJ                                                                      00261
C    COMPUTE AND PLOT MONOPOLE CORRECTIONS                              00262
C                                                                       00263
      DO 6798 I=1,16                                                    00264
      PH(I)=PH(I)+SPHCOR(I)*RAD                                         00265
      IF(PH(I).GT.360) PH(I)=PH(I)-360.                                 00266
 6798 CONTINUE                                                          00267
      CALL SPHCOM(ZCORR,SPHCOR)                                         00268
 5002 CALL SSWTCH(2,IUP)                                                00269
      IF(IUP.EQ.1)GO TO 5002                                            00270
      CALL PLTE2E                                                       00271
      CALL PLOT(0.0,2.6,-1)                                             00272
      WRITE(13,115)                                                     00273
  115 FORMAT(/6X,'WITH MONOPOLE CORRECTIONS')                           00274
 6799 CONTINUE                                                          00275
 6800 CONTINUE                                                          00276
C                                                                       00277
C    NOW AVERAGE CORRECTION FACTORS OVER LTIMES AND                     00278
C    SAVE LATEST CORRECTION FACTORS ON DISC                             00279
C                                                                       00280
      FLTLT=LTIMES                                                      00281
      DO 6810 I=1,16                                                    00282
      IQCORA(I)=CORA(I)/FLTLT                                           00283
      DELPH(I)=FLPH(I)/FLTLT                                            00284
      ZTEMP1=REAL(ZZCORR(I))/FLTLT                                      00285
      ZTEMP2=AIMAG(ZZCORR(I))/FLTLT                                     00286
 6810 ZCORR(I)=CMPLX(ZTEMP1,ZTEMP2)                                     00287
      ISECT=1                                                           00288
      CALL DSKOUT(OUTBUF,ISECT,64)                                      00289
C                                                                       00290
C    TASK COMPLETE  NOW CHECK SS2   IF UP,WAIT   IF DOWN COMPUTE       00291
C    A NEW SET OF CALIBRATION CORRECTION FACTORS                        00292
C                                                                       00293
  502 CALL SSWTCH(2,IUP)                                                00294
      IF(IUP.EQ.1)GO TO 502                                             00295
      CALL BURST                                                        00296
      WRITE(13,6811)IQCORA,DELPH,ZCORR                                  00297
 6811 FORMAT(///2(/1X,8F9.4),/2(/1X,8F9.3),//2(/1X,4(2F7.4,4X)))        00298
  503 CALL SSWTCH(2,IUP)                                                00299
      IF(IUP.EQ.1)GO TO 503                                             00300
      GO TO 1                                                           00301
C                                                                       00302
$MCALT    EQU   F.MAIN    NAME THE PROGRAM MCALT                        00303
$         ENTRY  MCALT                                                  00304
$         LIBR   MCALT                                                  00305
      END                                                               00306
```

```
      SUBROUTINE SPHCOM(Z,SPHCOR)                                       00308
S         LIBR  SPHCOM                                                  00309
      COMPLEX Z(16)                                                     00310
      REAL CABS,COS                                                     00311
      DIMENSION SPHCOR(16)                                              00312
      COMMON IDUM(1047),DUM(96),PH(32),IDUM1(12)                        00313
      DO 1 I=1,16                                                       00314
      Q1=CABS(Z(I))                                                     00315
      Q3=PH(I)/57.29578                                                 00316
      Q4=Q1*COS(Q3)                                                     00317
      Q5=Q1*SIN(Q3)                                                     00318
    1 Z(I)=CMPLX(Q4,Q5)                                                 00319
      RETURN                                                            00320
      END                                                               00321
```

```
      SUBROUTINE RDTAPE(IFILE)                                          00323
S        NTRY  RDTAPE                                                   00324
S        LIBR  RDTAPE                                                   00325
C                                                                       00326
C   TAPE READ ROUTINE FOR CORRECTION FACTORS GENERATION ONLY USING      00327
C   PROGRAM CALT                                                        00328
C                                                                       00329
      COMMON IBUF1(262),IBUF2(262),INBUF(523)                           00330
      DATA ICOLON/ZAA00/                                                00331
    5 NWORDS=523                                                        00332
      IUNIT=9                                                           00333
      IEOF=0                                                            00334
   10 CALL INP7(INBUF,NWORDS,IUNIT,IFILE,NWR)                           00335
      IF(IFILE)1,2,3                                                    00336
C   PARITY ERROR ON TAPE                                                00337
    1 WRITE(3,100)NWR                                                   00338
  100 FORMAT(/5X,'TAPE PARITY',I5,'WORDS READ')                         00339
      GO TO 10                                                          00340
C   END OF FILE CONDITION                                               00341
    3 WRITE(3,101)                                                      00342
  101 FORMAT(/5X,'TAPE EOF')                                            00343
      IEOF=IEOF+1                                                       00344
      IF(IEOF.GE.2)STOP                                                 00345
      GO TO 10                                                          00346
C   NORMAL READ                                                         00347
    2 IF(NWR.EQ.10)GO TO 4                                              00348
      IF(NWR.NE.523)WRITE(3,102)NWR                                     00349
  102 FORMAT(//15X,23HRECORD LENGTH INCORRECT,I5,11H WORDS READ)        00350
      CALL TIMOVE(INBUF(513))                                           00351
      RETURN                                                            00352
    4 WRITE(13,104)(INBUF(I),I=1,6),ICOLON,INBUF(7)                     00353
  104 FORMAT(//2X,A2,3X,3A2,3X,2A2,A1,A2)                               00354
      IFILE=+1                                                          00355
      GO TO 5                                                           00356
      END                                                               00357
```

```
      SUBROUTINE RIBDOT(K)                                              00359
S        NTRY  RIBDOT                                                   00360
S        LIBR  RIBDOT                                                   00361
      I=K                                                               00362
 1111 CONTINUE                                                          00363
S        D     R.MACH,0                                                00364
S        LDW   I              FETCH NUMBER OF TIMES THRU LOOP           00365
S        DOT   7,1                                                      00366
S        SMB   R.EXEC                                                   00367
S        JSX   R.EXEC                                                   00368
      RETURN                                                            00369
      END                                                               00370
```

```
      SUBROUTINE PLTE2E                                                 00372
S        NTRY  PLTE2E                                                   00373
S        LIBR  PLTE2E                                                   00374
C                                                                       00375
C                                                                       00376
C   SUBROUTINE PLTE2E PLOTS AMPLITUDE AND PRINTS OUT PHASES AND         00377
C   DIFFERENCES FOR 16 ELEMENTS                                         00378
C                                                                       00379
      REAL PHIOUT(16),DIFRAD(16),DIFVLT(16),TOTERR(16)                  00380
      INTEGER CTIME,STIME,IV(6),IE(7)                                   00381
      COMMON IDUMMY(1111),AM(32),PH(32),CTIME(6),STIME(6)               00382
      DATA RAD,ICOLON/57.29578,ZBAA0/                                   00383
      DATA (IV(I),I=1,6)/ZA0A0,ZA0A0,ZA0A0,ZA0D6,ZCFCC,ZD4D3/           00384
      DATA (IE(I),I=1,7)/ZA0A0,ZA0C5,ZCCC5,ZCDC5,ZCED4,ZA0CE,ZCFAE/     00385
      CALL BURST                                                        00386
      WRITE(13,100)(CTIME(I),I=1,5),ICOLON,CTIME(6)                     00387
  100 FORMAT(22X,'CORRECTION TIME  ',3A2,3X,2A2,A1,A2)                  00388
      CALL TKWAIT                                                       00389
      CALL TKPLOT(0,0,0)                                                00390
      XSTART=2.                                                         00391
      YSTART=3.3                                                        00392
      CALL AXIS(XSTART,YSTART,IE,-14,3.0,0.0,1.0,5.0)                   00393
      CALL AXIS(XSTART,YSTART,IV,+12,2.0,90.0,0.001,1.0)                00394
      DO 5002 I=1,16                                                    00395
      X=FLOAT(I-1)*0.2+XSTART                                           00396
      Y=AM(I)/1.9+YSTART                                                00397
      IF(I.GT.1)GO TO 5001                                              00398
      CALL PLOT(X,Y,3)                                                  00399
      GO TO 5002                                                        00400
 5001 CALL PLOT(X,Y,2)                                                  00401
 5002 CONTINUE                                                          00402
      DO 5003 I=1,16                                                    00403
      PHIOUT(I)=PH(I)-PH(1)                                             00404
      IF(PHIOUT(I).LT.-180.0)PHIOUT(I)=PHIOUT(I)+180.0                  00405
      IF(PHIOUT(I).GT.180.0)PHIOUT(I)=PHIOUT(I)-180.0                   00406
      DIFRAD(I)=PHIOUT(I)/RAD                                           00407
      DIFVLT(I)=1.0-(AM(I)/AM(1))                                       00408
 5003 TOTERR(I)=SQRT(DIFRAD(I)**2+DIFVLT(I)**2)                         00409
      CALL PLOT(0.0,2.6,-1)                                             00410
      WRITE(13,1)AM(1),PH(1),(PH(I),I=1,8),(PHIOUT(I),I=1,8),           00411
     *(DIFRAD(I),I=1,8),(DIFVLT(I),I=1,8),(TOTERR(I),I=1,8),            00412
     *(PH(I),I=9,16),(PHIOUT(I),I=9,16),(DIFRAD(I),I=9,16),(DIFVLT(I),  00413
     *I=9,16),(TOTERR(I),I=9,16)                                        00414
    1 FORMAT(6X,'ELEMENT PHASE AND AMPLITUDES',5X,'ELEMENT 1  AMP',F7.2, 00415
      * /50X,3HPHS,F7.2,2(//1X,6HPHASE ,8F8.2,/3X,4HDIF ,8F8.4,/,7HERRPHS 00416
      * ,8F8.4,/7HERRVLT ,8F8.4,/7HTOTERR ,8F8.4))                       00417
      RETURN                                                            00418
      END                                                               00419
```

```
      SUBROUTINE AMPHAS(X,Y,A,P)                                        00421
S         NTRY  AMPHAS                                                  00422
S         LIBR  AMPHAS                                                  00423
      RAD=57.29578                                                      00424
      A=SQRT(X*X+Y*Y)                                                   00425
      P=0.0                                                             00426
      IF(Y.EQ.0.0)RETURN                                                00427
      IF(X.LT.0.0)GO TO 67                                              00428
      P=ATAN(Y/X)*RAD                                                   00429
      IF(Y.LT.0.0)P=360.0+P                                             00430
      RETURN                                                            00431
   67 P=180.0+ATAN(Y/X)*RAD                                             00432
      RETURN                                                            00433
      END                                                               00434
```

```
      SUBROUTINE FNDMAX(XAM,NPTS,KOUNT)                                 00436
S        NTRY  FNDMAX                                                   00437
S        LIBR  FNDMAX                                                   00438
      DIMENSION XAM(16)                                                 00439
      K=KOUNT+1                                                         00440
      PMAX=XAM(KOUNT)                                                   00441
      DO 1 I=K,NPTS                                                     00442
      IF(XAM(I).LT.PMAX)GO TO 1                                         00443
      PMAX=XAM(I)                                                       00444
      KOUNT=I                                                           00445
    1 CONTINUE                                                          00446
      RETURN                                                            00447
                                                                        00448
```

APPENDIX B
CONVENTIONAL ANGULAR POWER DENSITY SPECTRA

```
C      PROGRAM CONVT                                                    00001
C                                                                       00002
C                                                                       00003
C     THIS PROGRAM IS CALLED 'CONVT'                                    00004
C     RETRIEVES CORRECTION FACTORS FROM DISK (PREVIOUSLY GENERATED BY   00005
C     PROGRAM 'MCALT'), READS DATA AND APPLIES SAID CORRECTION          00006
C     FACTORS, COMPUTES AND PLOTS CONVENTIONAL MAPS ON THE TEKTRONIX    00007
C     CRT USING DATA COLLECTED ON THE                                   00008
C     16 ELEMENT ARRAY AT RADC,  DEXTER, NEW YORK.                      00009
C     READS TAPE INPUT ONLY                                             00010
C                                                                       00011
C     4 SEPTEMBER 1975 WITH KOUNT FIX AND SPC=18.288                    00012
C                                                                       00013
      REAL ISAMPL(32),IQCORA(16),DELPH(16),BUF(64),COSANG(16),          00014
     * TANANG(16),XAM(16),XPH(16)                                       00015
      REAL COS,AM(16),PH(16),YPOINT(17)                                 00016
      REAL XPOINT(17)                                                   00017
      INTEGER CTIME(6),WBUF(523),IAZ(6),IDR(6)                          00018
      INTEGER KNTST(16),KNTCNT(16)                                      00019
      COMPLEX ZCORR(16),ZTEMP(16),DOLPH(16),ZSAMPL                      00020
C                                                                       00021
      COMMON IBUF1(262),IBUF2(262),INBUF(523)                           00022
      EQUIVALENCE (INBUF(1),WBUF(1))                                    00023
C                                                                       00024
      EQUIVALENCE (BUF(1),IQCORA(1)),(BUF(17),DELPH(1)),                00025
     * (BUF(33),ZCORR(1))                                               00026
C                                                                       00027
      DATA (DOLPH(I),I=1,16)/(0.01266,0.0),(0.05237,0.0),(0.13904,0.0),  00028
     * (0.28431,0.0),(0.48131,0.0),(0.69921,0.0),(0.889,0.0),(1.0,0.0),  00029
     * (1.0,0.0),(0.889,0.0),(0.69921,0.0),(0.48131,0.0),(0.28431,0.0),  00030
     * (0.13904,0.0),(0.05237,0.0),(0.01266,0.0)/                        00031
      DATA(IAZ(I),I=1,6)/ZA0A0,ZA0A0,ZC1DA,ZC9CD,ZD5D4,ZC8A0/           00032
      DATA(IDR(I),I=1,6)/ZA0A0,ZA0A0,ZA0C4,ZC2A0,ZC4CF,ZD7CF/           00033
      DATA PI,RAD,NSAMP,NCHAN,ICOLON/3.14159,57.29578,512,32,Z8A40/     00034
      DATA IDUM/ZA0A0/                                                  00035
C                                                                       00036
      TAN(DUMMY)=SIN(DUMMY)/COS(DUMMY)                                  00037

      ARSIN(DUMMY)=ATAN(DUMMY/SQRT(1.0-DUMMY**2))                       00038

C                                                                       00039
C    RETRIEVE CORRECTION FACTORS FROM DISK                              00040
C    COMPUTE ELEMENTAL PHASE ANGLE CORRECTIONS                          00041
C                                                                       00042
      ISECT=1                                                           00043
      CALL DSKIN(BUF,ISECT,64)                                          00044
      DO 91 IEL=1,16                                                    00045
      ANGLR=(90.0-DELPH(IEL))/RAD                                       00046
      COSANG(IEL)=COS(ANGLR)                                            00047
   91 TANANG(IEL)=TAN(ANGLR)                                            00048
C                                                                       00049
C    INPUT DESIRED TIME AND SEARCH TAPE FOR IT                          00050
C                                                                       00051
    1 CALL BURST                                                        00052
      WRITE(13,100)                                                     00053
100   FORMAT('INPUT DESIRED TIME--HR,MIN,SEC;  FREQ (3A2,F7.3)')        00054
      READ(13,101) IHR,IMIN,ISEC,FREQ                                   00055
101   FORMAT(3A2,F7.3)                                                  00056
      UMAX=300./(FREQ*2.*18.288)                                        00057
      WRITE(13,20057)                                                   00058
20057  FORMAT('  SPACING=18.288 M')                                     00059
      WRITE(13,20058) UMAX                                              00060
```

```
      IF(XU.LT.0.) XU=0.                                                00061
      IF(XU.GT.1.) XU=1.                                                00062
      XANGL=ARSIN(XU)*RAD                                               00063
      XUL=3.5-XANGL/30.                                                 00064
      XUR=3.5+XANGL/30.                                                 00065
      XPOINT(9)=3.5                                                     00066
      DO 1010 IP=1,8                                                    00067
      UTHET=FLOAT(IP)*UMAX/8.                                           00068
      THIN=3.                                                           00069
      IF(UTHET.LT.1.) THIN=RAD*ARSIN(UTHET)/30.                         00070
      XPOINT(IP+9)=3.5+THIN                                             00071
      IPP=9-IP                                                          00072
      XPOINT(IPP)=3.5-THIN                                              00073
1010  CONTINUE                                                          00074
   10 IFILE=+1                                                          00075
   11 CALL RDTAPE(IFILE)                                                00076
      CALL TMASCI(CTIME)                                                00077
      IF(CTIME(4).NE.IHR.OR.CTIME(5).NE.IMIN.OR.                        00078
     1  CTIME(6).NE.ISEC)   GO TO 10                                    00079
      GO TO 15                                                          00080
    2 IFILE=+1                                                          00081
      CALL RDTAPE(IFILE)                                                00082
      CALL TMASCI(CTIME)                                                00083
   15 DO 16 I=1,NSAMP                                                   00084
   16 WBUF(I)=FLOAT(INBUF(I))                                           00085
C                                                                       00086
C    APPLY ALL CORRECTION FACTORS TO NEW SAMPLES, ADD WEIGHTS AND       00087
C    DO A COMPLEX FFT                                                   00088
C    WINDOW PRIOR TO FFT                                                00089
C                                                                       00090
      DO 5995 I=1,16                                                    00091
5995  KNTCNT(I)=0                                                       00092
      DO 6000 IEL=1,16                                                  00093
      ANGLR=(90.0-DELPH(IEL))/RAD                                       00094
      COSANG=COS(ANGLR)                                                 00095
      TANANG=TAN(ANGLR)                                                 00096
      ICONST=2*IEL-1                                                    00097
      DO 6001 I=1,16                                                    00098
      IRXWD=ICONST+32*(I-1)                                             00099
      I2=2*I                                                            00100
      I2M=I2-1                                                          00101
      ISAMPL(I2M)=WBUF(IRXWD)                                           00102
      ISAMPL(I2)=WBUF(IRXWD+1)*TOCORA(IEL)/COSANG-ISAMPL(I2M)*TANANG    00103
      ZSAMPL=CMPLX(ISAMPL(I2M),ISAMPL(I2))*ZCORR(IEL)*DOLPH(I)          00104
      ISAMPL(I2M)=REAL(ZSAMPL)                                          00105
 6001 ISAMPL(I2)=AIMAG(ZSAMPL)                                          00106
      CALL FORT(4,-1,ISAMPL,IFERR)                                      00107
      DO 40 I=1,16                                                      00108
      I2=2*I-1                                                          00109
   40 CALL AMPHAS(ISAMPL(I2),ISAMPL(I2+1),XAM(I),XPH(I))                00110
      NPTS=16                                                           00111
      KOUNT=2                                                           00112
      CALL FNDMAX(XAM,NPTS,KOUNT)                                       00113
      KOUNT2=2*KOUNT                                                    00114
      KNTCNT(KOUNT)=KNTCNT(KOUNT)+1                                     00115
      KNTST(IEL)=KOUNT                                                  00116
 6000 ZTEMP(IEL)=CMPLX(ISAMPL(KOUNT2-1),ISAMPL(KOUNT2))                 00117
      KMAX=2                                                            00118
      DO 6003 I=3,16                                                    00119
      IF(KNTCNT(I).LT.KNTCNT(KMAX)) GO TO 6003                          00120
      KMAX=I                                                            00121
 6003 CONTINUE                                                          00122
```

```
      KOUNT=KMAX                                                        00123
      KOUNT2=KOUNT*2                                                    00124
      DO 6005 IEL=1,16                                                  00125
      IF(KNTST(IEL).EQ.KOUNT) GO TO 6005                                00126
      ANGLR=(90.0-DELPH(IEL))/RAD                                       00127
      COSANG=COS(ANGLR)                                                 00128
      TANANG=TAN(ANGLR)                                                 00129
      ICONST=2*IEL-1                                                    00130
      DO 6201 I=1,16                                                    00131
      IRXWD=ICONST+32*(I-1)                                             00132
      I2=2*I                                                            00133
      I2M=I2-1                                                          00134
      ISAMPL(I2M)=WBUF(IRXWD)                                           00135
      ISAMPL(I2)=WBUF(IRXWD+1)*IQCORR(IEL)/COSANG-ISAMPL(I2M)*TANANG    00136
      ZSAMPL=CMPLX(ISAMPL(I2M),ISAMPL(I2))*ZCORR(IEL)*DOLPH(I)          00137
      ISAMPL(I2M)=REAL(ZSAMPL)                                          00138
      ISAMPL(I2)=AIMAG(ZSAMPL)                                          00139
 6201 CALL FORT(4,-1,ISAMPL,IFERR)                                      00140
      ZTEMP(IEL)=CMPLX(ISAMPL(KOUNT2-1),ISAMPL(KOUNT2))                 00141
 6005 CONTINUE                                                          00142
C                                                                       00143
C    APPLY 70DB D-T WINDOW AND FFT ACROSS THE 16 ELEMENTS               00144
C                                                                       00145
      DO 31 I=1,16                                                      00146
      ZTEMP(I)=ZTEMP(I)*DOLPH(I)                                        00147
      I2=2*I                                                            00148
      ISAMPL(I2-1)=REAL(ZTEMP(I))                                       00149
   31 ISAMPL(I2)=AIMAG(ZTEMP(I))                                        00150
      CALL FORT(4,-1,ISAMPL,IFERR)                                      00151
      DO 32 I=1,16                                                      00152
      I2=2*I-1                                                          00153
   32 CALL AMPHAS(ISAMPL(I2),ISAMPL(I2+1),XAM(I),XPH(I))                00154
      NPTS=16                                                           00155
      KOUNT=1                                                           00156
C                                                                       00157
C    FIND PEAK AND PLOT CONVENTIONAL MAP                                00158
C                                                                       00159
      CALL FNDMAX(XAM,NPTS,KOUNT)                                       00160
      PEAK=XAM(KOUNT)                                                   00161
      PKLG=20.0*ALOG10(PEAK)                                            00162
      DO 300 I=1,16                                                     00163
      IF(XAM(I).LT.1.0E-20)XAM(I)=1.0E-20                               00164
  300 XAM(I)=PKLG-20.0*ALOG10(XAM(I))                                   00165
  502 CALL SSWTCH(2,IUP)                                                00166
      IF(IUP.EQ.1)GO TO 502                                             00167
      CALL BURST                                                        00168
      CALL TKPLOT(0,0,0)                                                00169
      YSTART=1.4                                                        00170
      CALL AXIS(.5,YSTART,IAZ,-11,6.0,0.0,-90.,30.001)                  00171
      CALL AXIS(.5,YSTART,IDB,+12,4.0,90.0,-80.0,20.001)                00172
      DO 35 I=1,8                                                       00173
   35 YPOINT(I)=XAM(I+8)                                                00174
      DO 36 I=9,17                                                      00175
   36 YPOINT(I)=XAM(I-8)                                                00176
      DO 33 I=1,17                                                      00177
      X=XPOINT(I)                                                       00178
      Y=(YSTART+4.0)-(YPOINT(I)/20.0)                                   00179
      IF(Y.LT.YSTART)Y=YSTART                                           00180
      IF(I.GT.1)GO TO 34                                                00181
      CALL PLOT(X,Y,3)                                                  00182
      GO TO 33                                                          00183
   34 CALL PLOT(X,Y,2)                                                  00184
```

```
   33 CONTINUE                                                                  00185
      CALL PLOT(XUR,YSTART+.1,3)                                                00186
      CALL PLOT(XUR,YSTART,2)                                                   00187
      CALL PLOT(XUL,YSTART+.1,3)                                                00188
      CALL PLOT(XUL,YSTART,2)                                                   00189
      CALL PLOT(0.0,0.5,-1)                                                     00190
      WRITE(13,102)(CTIME(I),I=1,5),ICOLON,CTIME(6),KMAX                        00191
102   FORMAT(9X,'SAMPLE TIME',3X,3A2,3X,2A2,A1,A2,9X,'KMAX=',I2)                00192
      CALL TKWAIT                                                               00193
C                                                                               00194
C    SS2 UP = WAIT                                                              00195
C                                                                               00196
  600 CALL SSWTCH(2,IUP)                                                        00197
      IF(IUP.EQ.1)GO TO 600                                                     00198
C    SS1 DOWN=CONTINUE PROCESSING          UP=INPUT NEW TIME                    00199
C    SS1 UP=CONTINUE PROCESSING                                                 00200
C                                                                               00201
      CALL SSWTCH(1,IUP)                                                        00202
      IF(IUP.EQ.1)GO TO 1                                                       00203
      GO TO 2                                                                   00204
SCONVT    EQU   F.MAIN          NAME THE PROGRAM CONVT                        00205
S         ENTRY CONVT                                                         00206
S        LIBR   CONVT                                                         00207
      END                                                                       00208
```

```
      SUBROUTINE RDTAPE(IFILE)                                          00210
$        ENTRY  RDTAPE                                                  00211
$        LIBR   RDTAPE                                                  00212
C                                                                       00213
C    TAPE READ ROUTINE FOR CORRECTION FACTORS GENERATION ONLY USING     00214
C    PROGRAM CALT                                                       00215
C                                                                       00216
      COMMON IBUF1(262),IBUF2(262),INBUF(523)                           00217
      DATA ICOLON/ZBAAA/                                                00218
    5 NWORDS=523                                                        00219
      IUNIT=9                                                           00220
      IEOF=0                                                            00221
   10 CALL INP7(INBUF,NWORDS,IUNIT,IFILE,NWR)                           00222
      IF(IFILE)1,2,3                                                    00223
C    PARITY ERROR ON TAPE                                               00224
    1 WRITE(3,100)NWR                                                   00225
  100 FORMAT(/5X,'TAPE PARITY',I5,'WORDS READ')                         00226
      GO TO 10                                                          00227
C    END OF FILE CONDITION                                              00228
    3 WRITE(3,101)                                                      00229
  101 FORMAT(/5X,'TAPE EOF')                                            00230
      IEOF=IEOF+1                                                       00231
      IF(IEOF.GE.2)STOP                                                 00232
      GO TO 10                                                          00233
C    NORMAL READ                                                        00234
    2 IF(NWR.EQ.10)GO TO 4                                              00235
      IF(NWR.NE.523)WRITE(3,102)NWR                                     00236
  102 FORMAT(//15X,23HRECORD LENGTH INCORRECT,I5,11H WORDS READ)        00237
      CALL TIMOVE(INBUF(513))                                           00238
      RETURN                                                            00239
    4 WRITE(13,104)(INBUF(I),I=1,6),ICOLON,INBUF(7)                     00240
  104 FORMAT(//2X,A2,3X,3A2,3X,2A2,A1,A2)                               00241
      IFILE=+1                                                          00242
      GO TO 5                                                           00243
                                                                        00244
```

APPENDIX C
ADAPTIVE ANGULAR POWER DENSITY SPECTRA

```
      PROGRAM ADAPT                                                     00001
C                                                                       00002
C                                                                       00003
C                                                                       00004
C     THIS PROGRAM IS CALLED  'ADAPT'                                   00005
C     IT GENERATES AND PLOTS A ONE-DIMENSIONAL ADAPTIVE MAP USING THE   00006
C     16 ELEMENT ARRAY AT RADC,  DEXTER, NEW YORK.                      00007
C     READS TAPE INPUT ONLY                                             00008
C                                                                       00009
C     25 AUGUST 1975        1030                                        00010
C                                                                       00011
      REAL IQCORA(16),DELPH(16),BUF(64),SAMPL(32),COSANG(16),TANANG(16) 00012
      REAL AM(16),COS                                                   00013
      INTEGER IAZ(11),IDR(6),STIME(6),DUM(523)                          00014
      COMPLEX ZCORR(16),ZSAMPL,DOLPH(16)                                00015
C                                                                       00016
      COMMON IBUF1(262),IBUF2(262),INBUF(523),DRROW(65),MELEM,DUMD(32), 00017
     * AL(272),TOL,VS(32),WT(32),REPI,REPQ,AMP,POSD,ITHET,SPEL,MA(64),  00018
     * BL(272)                                                          00019
C                                                                       00020
      EQUIVALENCE (INBUF(1),DUM(1))                                     00021
      EQUIVALENCE (BUF(1),IQCORA(1)),(BUF(17),DELPH(1)),                00022
     * (BUF(33),ZCORR(1)),(DRROW(1),SAMPL(1)),(DRROW(33),COSANG(1)),    00023
     * (DRROW(49),TANANG(1))                                            00024
C                                                                       00025
      DATA (DOLPH(I),I=1,16)/(0.01266,0.0),(0.05237,0.0),(0.13904,0.0), 00026
     * (0.28431,0.0),(0.48131,0.0),(0.69921,0.0),(0.889,0.0),(1.0,0.0), 00027
     * (1.0,0.0),(0.889,0.0),(0.69921,0.0),(0.48131,0.0),(0.28431,0.0), 00028
     * (0.13904,0.0),(0.05237,0.0),(0.01266,0.0)/                       00029
      DATA(IAZ(I),I=1,11)/7A0A3,7A0A0,7C1DA,7C9CD,7D5D4,7C8A0,7A0A0,    00030
     * 7A0D5,7A0D3,7D0C1,7C3C5/                                         00031
      DATA(IDR(I),I=1,6)/7A0A0,7A0A0,7A0C4,7C2A0,7C4CF,7D7CF/           00032
      DATA PI,RAD,NSAMP,NCHAN,ICOLON/3.14159,57.29578,512,32,7B4A0/     00033
      DATA IDUM/7A0A3/                                                  00034
C                                                                       00035
      ARSIN(DUMMY)=ATAN2(DUMMY,SQRT(1.0-DUMMY**2))                      00036
      TAN(DUMMY)=SIN(DUMMY)/COS(DUMMY)                                  00037
C                                                                       00038
      TOL=1.1E-06                                                       00039
    1 CONTINUE                                                          00040
      DO 22 I=1,272                                                     00041
      AL(I)=0.0                                                         00042
   22 BL(I)=0.0                                                         00043
      IDSPLA=0                                                          00044
C                                                                       00045
C     CHECK SSW  -  IF UP USE FORMER PARAMETERS                         00046
C                                                                       00047
      CALL SSWTCH(0,IUP)                                                00048
      IF(IUP.EQ.1)GO TO 166                                             00049
      CALL BURST                                                        00050
      WRITE(13,4)                                                       00051
    4 FORMAT(37HMODE?  FREQ?  EL. SPACING? (I2,2F7.3))                  00052
      READ(13,44)MODE,FREQ,SPACE                                        00053
   44 FORMAT(I2,2F7.3)                                                  00054
      IF(MODE.LE.0)GO TO 2                                              00055
      XLAMDA=300.0/FREQ                                                 00056
      SSPL=SPACE/XLAMDA*2.0*PI                                          00057
      SPEL=SSPL                                                         00058
      XK=SSPL/PI                                                        00059
      XU=2.0/XK-1.0                                                     00060
      IF(XU.LE.0.0)GO TO 97
```

```
      IF(XU.GT.1.0)XU=1.0                                              00061
      XANGL=ARSIN(XU)*RAD                                              00062
      GO TO 98                                                         00063
   97 XANGL=90.0                                                       00064
   98 CONTINUE                                                         00065
111   WRITE(13,6)                                                      00066
6     FORMAT(' TIME HR,MIN,SEC; NO OF ELEMENT  (3A2,I3)')              00067
      READ(13,113) IHR,IMIN,ISEC,MELEM                                 00068
113   FORMAT(3A2,I3)                                                   00069
      IF(MELEM.GT.16)GO TO 111                                         00070
  112 WRITE(13,8)                                                      00071
8     FORMAT(16HCONFIGURATION  X)                                      00072
      READ(13,9)(MA(I),I=1,16)                                         00073
9     FORMAT(16I1)                                                     00074
      DO 701 I=17,64                                                   00075
701   MA(I)=0                                                          00076
      ISUM=0                                                           00077
      DO 71 I=1,64                                                     00078
   71 ISUM=ISUM+MA(I)                                                  00079
      IF(ISUM.EQ.MELEM)GO TO 711                                       00080
      WRITE(13,72)MA                                                   00081
   72 FORMAT(64I1,/20X,19HCONFIGURATION ERROR)                         00082
      GO TO 112                                                        00083
  711 WRITE(13,10)                                                     00084
   10 FORMAT('NGROUP? (I5)')                                           00085
      READ(13,11)NGROUP                                                00086
   11 FORMAT(I5)                                                       00087
      MELEM2=2*MELEM                                                   00088
1167  IFILE=1                                                          00089
      CALL ROTP(IFILE)                                                 00090
      CALL TMASCI(STIME)                                               00091
      IF(STIME(4).NE.IHR.OR.STIME(5).NE.IMIN.OR.STIME(6)               00092
     1 .NE.ISEC) GO TO 1167                                            00093
      IFIRST=0                                                         00094
C                                                                      00095
C   RETRIEVE CORRECTION FACTORS FROM DISK                              00096
C   COMPUTE ELEMENTAL PHASE ANGLE CORRECTIONS                          00097
C                                                                      00098
  166 ISECT=1                                                          00099
      CALL DSKIN(BUF,ISECT,64)                                         00100
      DO 91 IEL=1,16                                                   00101
      ANGLR=(90.0-DELPH(IEL))/RAD                                      00102
      COSANG(IEL)=COS(ANGLR)                                           00103
   91 TANANG(IEL)=TAN(ANGLR)                                           00104
      IF(MODE.EQ.2)GO TO 5999                                          00105
C                                                                      00106
C   APPLY CORRECTION FACTORS                                           00107
C                                                                      00108
      DO 93 N=1,NGROUP                                                 00109
      CALL RIBOOT(N)                                                   00110
      IF(IFIRST.EQ.0) GO TO 1168                                       00111
      IFILE=+1                                                         00112
      CALL ROTP(IFILE)                                                 00113
      CALL TMASCI(STIME)                                               00114
1168  IFIRST=1                                                         00115
      DO 93 NPULSE=1,16                                                00116
      INORD=32*(NPULSE-1)                                              00117
      DO 912 IEL=1,MELEM                                               00118
      I2=2*IEL                                                         00119
      IDNUM=I2+INORD                                                   00120
      SAMPL(I2-1)=FLOAT(DUM(IDNUM-1))                                  00121
      SAMPL(I2)=FLOAT(DUM(IDNUM))*IRCORA(IEL)/COSANG(IEL)-SAMPL(I2-1)  00122
```

```
     1 *TANANG(IEL)                                                     00123
       ZSAMPL=CMPLX(SAMPL(I2-1),SAMPL(I2))*ZCORR(IEL)                   00124
       SAMPL(I2-1)=REAL(ZSAMPL)                                         00125
   912 SAMPL(I2)=AIMAG(ZSAMPL)                                          00126
       DO 931 K=1,MELEM2                                                00127
   931 DUMD(K)=SAMPL(K)                                                 00128
C                                                                       00129
C    GENERATE THE COVARIANCE MATRIX                                     00130
C                                                                       00131
    93 CALL ADCRMT                                                      00132
       GO TO 6010                                                       00133
C                                                                       00134
C                              MODE 2                                   00135
C    GET SAMPLES FOR EACH I-Q PAIR, CORRECT, AND APPLY WINDOW           00136
C                                                                       00137
 5909 DO 930 N=1,NGROUP                                                 00138
       IFILE=+1                                                         00139
       CALL RDTP(IFILE)                                                 00140
       CALL TMASCI(STIME)                                               00141
       DO 6000 IEL=1,MELEM                                              00142
       ICONST=2*IEL-1                                                   00143
       DO 6001 J=1,16                                                   00144
       JR=ICONST+32*(J-1)                                               00145
       J2=2*J                                                           00146
       SAMPL(J2-1)=FLOAT(DUM(JR))                                       00147
       SAMPL(J2)=FLOAT(DUM(JR+1))*IQCORA(IEL)/COSANG(IEL)-SAMPL(J2-1)   00148
      . *TANANG(IEL)                                                    00149
       ZSAMPL=CMPLX(SAMPL(J2-1),SAMPL(J2))*ZCORR(IEL)*DOLPH(J)          00150
       SAMPL(J2-1)=REAL(ZSAMPL)                                         00151
 6001 SAMPL(J2)=AIMAG(ZSAMPL)                                           00152
C                                                                       00153
C    DO COMPLEX FFT  -  DISPLAY THE FIRST SPECTRUM                      00154
C                                                                       00155
       CALL FORT(4,-1,SAMPL,IFERR)                                      00156
       DO 6002 J=1,16                                                   00157
       J2=2*J                                                           00158
       CALL AMP[illegible](SAMPL(J2-1),SAMPL(J2),AM(J),PH)              00159
 6002 AM(J)=AM(J)/3276.7                                                00160
       IF(IDSPLA.GE.1)GO TO 6008                                        00161
       IDSPLA=1                                                         00162
       CALL TKPLOT(0,0,0)                                               00163
  503 CALL [illegible]NTCH(2,IUP)                                       00164
       IF(IUP.EQ.1)GO TO 503                                            00165
       CALL BURST                                                       00166
       XSTART=1.5                                                       00167
       YSTART=2.5                                                       00168
       CALL AXIS(XSTART,YSTART,IDUM,-2,4.0,0.0,0.01,4.0)                00169
       CALL AXIS(XSTART,YSTART,IDUM,+2,3.0,90.0,0.01,4.0)               00170
       DO 6003 I=1,16                                                   00171
       X=FLOAT(I)/4.0+XSTART                                            00172
       Y=AM(I)/4.0+YSTART                                               00173
       IF(I.GT.1)GO TO 6004                                             00174
       CALL PLOT(X,Y,3)                                                 00175
       GO TO 6003                                                       00176
 6004 CALL PLOT(X,Y,2)                                                  00177
 6003 CONTINUE                                                          00178
C                                                                       00179
C    NOW CHOOSE DESIRED CELL                                            00180
C                                                                       00181
       CALL PLOT(4.0,1.0,-1)                                            00182
       WRITE(13,223)AM                                                  00183
  223 FORMAT(8E7.1)                                                     00184
```

```
      WRITE(13,202)                                                    00185
  202 FORMAT(/'INPUT CELL NO. (I2)')                                   00186
      READ(13,113)ICELL                                                00187
      JCELL=2*ICELL-1                                                  00188
 6008 DUMD(ICONST)=SAMPL(JCELL)                                        00189
      DUMD(ICONST+1)=SAMPL(JCELL+1)                                    00190
 6000 CONTINUE                                                         00191
C                                                                      00192
C   GENERATE COVARIANCE MATRIX                                         00193
C                                                                      00194
  930 CALL ADCRMT                                                      00195
 6010 CONTINUE                                                         00196
C                                                                      00197
C                                                                      00198
C                                                                      00199
C   INVERT THE COVARIANCE MATRIX                                       00200
C                                                                      00201
      DO 94 I=1,272                                                    00202
   94 BL(I)=AL(I)                                                      00203
      CALL CHLKYA                                                      00204
      CALL INVTL                                                       00205
      CALL HINVL                                                       00206
C                                                                      00207
C   CHECK GOODNESS                                                     00208
C                                                                      00209
      CALL MULHM                                                       00210
      CALL PRPKE                                                       00211
      AMP=1.0                                                          00212
C                                                                      00213
C                                                                      00214
C                                                                      00215
C   64 STEERS + BORESITE = 65 TOTAL LOOKS                              00216
C                                                                      00217
C   DO ALL STEERS EXECPT BORESITE.  BEGIN AT U=-1 AND STEP ALONG       00218
C   TOWARDS BORESITE.  FOR EACH -AZIMUTH DO A +AZIMUTH BY SETTING      00219
C   IMAGINARY PART OF STEER VECTOR VS TO A - VALUE AND CONTINUE.       00220
C                                                                      00221
      UINCR=2.0/64.0                                                   00222
      USTART=-1.0                                                      00223
      DO 75 I=1,32                                                     00224
      CALL RIBBOT(I)                                                   00225
      FI=FLOAT(I-1)                                                    00226
      UTHET=USTART+(FI*UINCR)                                          00227
      CALL SGEN3                                                       00228
      DO 96 K=1,MELEM2                                                 00229
   96 VS(K)=DUMD(K)                                                    00230
      CALL HXV                                                         00231
      CALL VSRXN                                                       00232
      DBPOW(I)=1.0/REPI                                                00233
C                                                                      00234
C   DO + SIDE OF AZIMUTH                                               00235
C                                                                      00236
      DO 64 K=1,MELEM                                                  00237
   64 VS(2*K)=-VS(2*K)                                                 00238
      CALL HXV                                                         00239
      CALL VSRXN                                                       00240
      ISUB=66-I                                                        00241
   75 DBPOW(ISUB)=1.0/REPI                                             00242
C                                                                      00243
C   FINISHED ALL STEERS.  NOW DO BORESITE                              00244
C                                                                      00245
      DO 65 K=1,MELEM                                                  00246
```

```
      K2=2*K                                                            00247
      VS(K2-1)=1.0                                                      00248
   65 VS(K2)=0.0                                                        00249
      CALL MXV                                                          00250
      CALL VSRXA                                                        00251
      DBPOW(33)=1.2/REPI                                                00252
      PEAK=DBPOW(1)                                                     00253
      DO 133 I=2,65                                                     00254
      IF(DBPOW(I).GT.PEAK)PEAK=DBPOW(I)                                 00255
  133 CONTINUE                                                          00256
      PKLG=10.0*ALOG10(PEAK)                                            00257
      DO 134 I=1,65                                                     00258
      IF(DBPOW(I).LT.1.0E-20)DBPOW(I)=1.0E-20                           00259
  134 DBPOW(I)=PKLG-10.0*ALOG10(DBPOW(I))                               00260
      WRITE(13,221)DBPOW                                                00261
  221 FORMAT(/,'DB POWER',22(/8F9.1))                                   00262
C                                                                       00263
C   PLOT THE ADAPTIVE AAP                                               00264
C                                                                       00265
  500 CALL SSWTCH(2,IUP)                                                00266
      IF(IUP.EQ.1)GO TO 500                                             00267
      CALL BKRST                                                        00268
      CALL PLOT(0.0,0.0,3)                                              00269
      XSTART=0.5                                                        00270
      YSTART=1.4                                                        00271
      CALL AXIS(XSTART,YSTART,TAZ,-11,6.0,0.0,-90.0,30.001)             00272
      CALL AXIS(XSTART,YSTART,TDB,+12,4.0,90.0,-80.0,20.001)            00273
      DO 135 I=1,65                                                     00274
      XX=FLOAT(I-33)/32.                                                00275
      X=3.5+SIGN(3.0,XX)                                                00276
      IF(ABS(XX).LT.1.) X=3.5+ARSIN(XX)*RAD/30.                         00277
      Y=(YSTART+4.0)-(DBPOW(I)/20.0)                                    00278
      IF(Y.LT.YSTART)Y=YSTART                                           00279
      IF(I.GT.1)GO TO 1041                                              00280
      CALL PLOT(X,Y,3)                                                  00281
      GO TO 135                                                         00282
 1041 CALL PLOT(X,Y,2)                                                  00283
  135 CONTINUE                                                          00284
      XMOV=XANGL/30.                                                    00285
      XMID=XSTART+3.0                                                   00286
      XULEFT=XMID-XMOV                                                  00287
      XURITE=XMID+XMOV                                                  00288
      CALL PLOT(XULEFT,YSTART+3.1,3)                                    00289
      CALL PLOT(XULEFT,YSTART,2)                                        00290
      CALL PLOT(XURITE,YSTART+3.1,3)                                    00291
      CALL PLOT(XURITE,YSTART,2)                                        00292
      CALL PLOT(3.0,0.8,-1)                                             00293
      WRITE(13,102)MODE,MELEM,SPACE,FREQ,XANGL,(STIME(I),I=1,5),ICOLON, 00294
     * STIME(6),NGROUP                                                  00295
  102 FORMAT(12X,4HMODE,I2,5X,I2,9H ELEMENTS,5X,7HSPACING,F7.3,         00296
     * 7H METERS,/12X,4HFREQ,F7.3,4H MHZ,12X,6HLIMITS,F5.1,8H DEGREES,  00297
     * /12X,13HSAMPLE TIME  ,3A2,3X,2A2,A1,A2,5X,'NGROUP=',I4)          00298
  501 CALL SSWTCH(2,IUP)                                                00299
      IF(IUP.EQ.1)GO TO 501                                             00300
      GO TO 1                                                           00301
    2 STOP                                                              00302
$ADAPT   EQU   F.MAIN         NAMES THE PROGRAM ADAPT                   00303
$        ENTRY ADAPT                                                    00304
$        LIBR  ADAPT                                                    00305
      END                                                               00306
```

```
      SUBROUTINE RDTP(IFILE)                                            00308
$        ENTRY  RDTP                                                    00309
$        LIBR  RDTP                                                     00310
      COMMON IBUF1(262),IBUF2(262),INBUF(523),DBPOW(65),MELEM,          00311
     * DUMD(32),AL(272),TOL,VS(32),WT(32),RFPI,REPQ,AMP,PDSD,           00312
     * UTHET,SPEL,MA(64),BL(272)                                        00313
      DATA ICOLON/ZBAA0/                                                00314
    5 NWORDS=523                                                        00315
      IUNIT=9                                                           00316
      IEOF=0                                                            00317
   10 CALL INP7(INBUF,NWORDS,IUNIT,IFILE,NWR)                           00318
      IF(IFILE)1,2,3                                                    00319
C   PARITY ERROR ON TAPE                                                00320
    1 WRITE(13,100)NWR                                                  00321
  100 FORMAT(/5X,'TAPE PARITY',I5,'WORDS READ')                         00322
      GO TO 10                                                          00323
C   END OF FILE CONDITION                                               00324
    3 WRITE(13,101)                                                     00325
  101 FORMAT(/5X,'TAPE EOF')                                            00326
      IEOF=IEOF+1                                                       00327
      IF(IEOF.GE.2)STOP                                                 00328
      GO TO 10                                                          00329
C   NORMAL READ                                                         00330
    2 IF(NWR.EQ.10)GO TO 4                                              00331
      IF(NWR.NE.523)WRITE(3,102)NWR                                     00332
  102 FORMAT(//15X,23HRECORD LENGTH INCORRECT,I5,11H WORDS READ)        00333
      CALL TIMOVE(INBUF(513))                                           00334
      RETURN                                                            00335
    4 CONTINUE                                                          00336
      WRITE(13,104)(INBUF(I),I=1,6),ICOLON,INBUF(7)                     00337
  104 FORMAT(//2X,A2,3X,3A2,3X,2A2,A1,A2)                               00338
      IFILE=+1                                                          00339
      GO TO 5                                                           00340
                                                                        00341
```

APPENDIX D

RADAR PROCESSING WITH CONVENTIONAL BEAMFORMING

```
C      PROGRAM RCONVT                                                    00001
C                                                                        00002
C                                                                        00003
C    THIS PROGRAM IS CALLED 'RCONVT'                                     00004
C    RETRIEVES CORRECTION FACTORS FROM DISK (PREVIOUSLY GENERATED BY     00005
C    PROGRAM 'MCALT'), READS DATA AND APPLIES SAID CORRECTION            00006
C    FACTORS, COMPUTES AND PLOTS CONVENTIONAL DOPPLER SPECTRA ON THE TEK. 00007
C    CRT USING DATA COLLECTED ON THE                                     00008
C    16 ELEMENT ARRAY AT RADC,  DEXTER, NEW YORK.                        00009
C    READS TAPE INPUT ONLY                                               00010
C                                                                        00011
C      17 SEPTEMBER 1975       1500                                      00012
C                                                                        00013
       REAL ISAMPL(32),IQCORA(16),DELPH(15),BUF(64),COSANG(16),          00014
      * TANANG(16),XAM(16),XPH(16)                                       00015
      *,FFTD(512)                                                        00016
       COMMON IBUF1(262),IBUF2(262),INBUF(523),DBPOW(65),MELEM,DUMD(32), 00017
      * AL(272),TOL,VS(32),WT(32),REPI,REPQ,AMP,POSD,UTHFT,SPEL,MA(64),  00018
      * BL(272)                                                          00019
       INTEGER CTIME(6),WBUF(523),IZ(6),IDB(6)                           00020
       COMPLEX ZCORR(16),ZTEMP(16),DOLPH(16),ZSAMPL                      00021
      *  ,STWT(16)                                                       00022
C                                                                        00023
       REAL COS,AM(16),PH(16),YPOINT(16)                                 00024
       REAL DLPTIM(248)                                                  00025
       INTEGER IPT(5)                                                    00026
       EQUIVALENCE (INBUF(1),WBUF(1))                                    00027
C                                                                        00028
       EQUIVALENCE (BUF(1),IQCORA(1)),(BUF(17),DELPH(1)),                00029
      * (BUF(33),ZCORR(1))                                               00030
C                                                                        00031
       DATA (DOLPH(I),I=1,16)/(0.01266,0.0),(0.05237,0.0),(0.13004,0.0), 00032
      * (0.28431,0.0),(0.48131,0.0),(0.69921,0.0),(0.889,0.0),(1.0,0.0), 00033
      * (1.0,0.0),(0.889,0.0),(0.69921,0.0),(0.48131,0.0),(0.28431,0.0), 00034
      * (0.13004,0.0),(0.05237,0.0),(0.01266,0.0)/                       00035
       DATA (IZ(I),I=1,6)/ZA0A0,ZA0A0,ZA0C1,ZDAC9,ZCDD5,ZD4CB/           00036
       DATA(IDB(I),I=1,6)/ZA0A0,ZA0A0,ZA0C4,ZC2A0,ZC4CF,ZD7CE/           00037
       DATA PI,RAD,NSAMP,NCHAN,ICOLON/3.14159,57.29578,512,32,Z8AA0/     00038
       DATA IDUM/ZA0A0/                                                  00039
       DATA IPT/0,8,24,56,120/                                           00040
       DATA NTP/0/                                                       00041
C                                                                        00042
       TAN(DUMMY)=SIN(DUMMY)/COS(DUMMY)                                  00043
       ARSIN(DUMMY)=ATAN(DUMMY/SQRT(1.-DUMMY**2))                        00044
C                                                                        00045
COMPUTE DOLPH WEIGHTS                                                    00046
       DO 911 M=4,8                                                      00047
       II=IPT(M-3)+1                                                     00048
       N=2**M                                                            00049
       CALL RIBDOT(N)                                                    00050
911    CALL DLPH(DLPTIM(II),N,70.,,INDO)                                 00051
C    RETRIEVE CORRECTION FACTORS FROM DISK                               00052
C    COMPUTE ELEMENTAL PHASE ANGLE CORRECTIONS                           00053
C                                                                        00054
       ISECT=1                                                           00055
       CALL DSKIN(BUF,ISECT,64)                                          00056
       DO 91 IEL=1,16                                                    00057
       ANGLR=(90.-DELPH(IEL))/RAD                                        00058
       COSANG(IEL)=COS(ANGLR)                                            00059
    91 TANANG(IEL)=TAN(ANGLR)                                            00060
```

```
C                                                                       00061
C    INPUT DESIRED TIME AND SEARCH TAPE FOR IT                          00062
C                                                                       00063
     1 CALL BURST                                                       00064
C                                                                       00065
C    CHECK SS0  -  IF UP USE FORMER PARAMETERS                          00066
C                                                                       00067
       CALL SSWTCH(0,IUP)                                               00068
       IF(IUP.EQ.1) GO TO 711                                           00069
       WRITE(13,4)                                                      00070
4      FORMAT(' INPUT FREQ (F7.3)')                                     00071
       READ(13,44) FREQ                                                 00072
44     FORMAT(F7.3)                                                     00073
       SPACE=18.288                                                     00074
       XLAMDA=300.0/FREQ                                                00075
       SSPL=SPACE/XLAMDA*2.0*PI                                         00076
       SPEL=SSPL                                                        00077
       XK=SSPL/PI                                                       00078
       XU=2.0/XK-1.0                                                    00079
       IF(XU.LE.0.0)GO TO 97                                            00080
       IF(XU.GT.1.0)XU=1.0                                              00081
       XANGL=ARSIN(XU)*RAD                                              00082
       GO TO 98                                                         00083
   97  XANGL=0.0                                                        00084
   98  CONTINUE                                                         00085
       MELEM=16                                                         00086
       DO 71 I=1,16                                                     00087
71     MA(I)=1                                                          00088
       DO 72 I=17,64                                                    00089
72     MA(I)=0                                                          00090
       ISUM=16                                                          00091
711    MELEM2=2*MELEM                                                   00092
       WRITE(13,100)                                                    00093
100    FORMAT('INPUT DESIRED TIME HR,MIN,SEC(3A2)')                     00094
       READ(13,101)IHR,IMIN,ISEC                                        00095
101    FORMAT(3A2)                                                      00096
       WRITE(13,1111)                                                   00097
1111   FORMAT(' INPUT LOG BASE 2 OF NTIMES, STEER(I1,F7.3)')            00098
       READ(13,1112) MTIMES,STEER                                       00099
1112   FORMAT(I1,F7.3)                                                  00100
       UTHET=SIN(STEER/RAD)                                             00101
       POSD=UTHET                                                       00102
       NTIMES=2**MTIMES                                                 00103
       CALL SGEN3                                                       00104
       NNT=NTIMES/16                                                    00105
       DO 1113 K=1,MELEM                                                00106
       K2=2*K                                                           00107
1113   STWT(K)=CMPLX(DUMD(K2-1),-DUMD(K2))                              00108
   10  IFILE=+1                                                         00109
   11  CALL RDTAPE(IFILE)                                               00110
       CALL TMASCI(CTIME)                                               00111
       IF(CTIME(4).NE.IHR.OR.CTIME(5).NE.IMIN.OR.CTIME(6).NE.           00112
      1 ISEC) GO TO 10                                                  00113
1120   DO 6000 ITIMES=1,NNT                                             00114
       CALL RIBOOT(ITIMES)                                              00115
       IF(ITIMES.EQ.1) GO TO 15                                         00116
       CALL RDTAPE(IFILE)                                               00117
       CALL TMASCI(CTIME)                                               00118
   15  DO 16 I=1,NSAMP                                                 00119
   16  XBUF(I)=FLOAT(INBUF(I))                                          00120
C                                                                       00121
C    APPLY ALL CORRECTION FACTORS TO NEW SAMPLES, ADD WEIGHTS AND       00122
```

```
C     STEER AND STORE                                                    00123
C                                                                        00124
      ITT=(ITIMES-1)*32                                                  00125
      DO 5995 IE=1,32                                                    00126
      II=IE+ITT                                                          00127
5995  FFTD(II)=0.                                                        00128
      DO 6000 IEL=1,16                                                   00129
      ICONST=2*IEL-1                                                     00130
      DO 6001 I=1,16                                                     00131
      IRXWD=ICONST+32*(I-1)                                              00132
      I2=2*I                                                             00133
      I2M=I2-1                                                           00134
      ISAMPL(I2M)=WBUF(IRXWD)                                            00135
      ISAMPL(I2)=WBUF(IRXWD+1)*TQCORA(IEL)/COSANG(IEL)-                  00136
     1 ISAMPL(I2M)*TANANG(IEL)                                           00137
      ZSAMPL=CMPLX(ISAMPL(I2M),ISAMPL(I2))*ZCORR(IEL)*DOLPH(IEL)         00138
     1  *STWT(IEL)                                                       00139
      II=I2+ITT                                                          00140
      FFTD(II-1)=REAL(ZSAMPL)+FFTD(II-1)                                 00141
6001  FFTD(II)=AIMAG(ZSAMPL)+FFTD(II)                                    00142
6000  CONTINUE                                                           00143
C  IF DESIRED, TIME SERIES MAY BE WRITTEN ON TAPE HERE                   00144
C                                                                        00145
C    MULTIPLY BY DOLPH WEIGHTS                                           00146
      IP=IPT(MTIMES-3)                                                   00147
      DO 6005 I=1,NTIMES                                                 00148
      I2=2*I                                                             00149
      II=I+IP                                                            00150
      IF(I2.GT.NTIMES) II=NTIMES+1-I+IP                                  00151
      FFTD(I2-1)=FFTD(I2-1)*DLPTIM(II)                                   00152
6005  FFTD(I2)=FFTD(I2)*DLPTIM(II)                                       00153
C                                                                        00154
C     TAKE FFT AND PLOT SPECTRUM                                         00155
      CALL FORT2(MTIMES,-1,FFTD,IERRR)                                   00156
  502 CALL SSWTCH(2,IUP)                                                 00157
      IF(IUP.EQ.1)GO TO 502                                              00158
      CALL BURST                                                         00159
      CALL TKPLOT(0,0,0)                                                 00160
      YSTART=1.4                                                         00161
      XSTART=.5                                                          00162
      CALL AXIS(XSTART,YSTART,IDB,12,4.0,90.0,-80.0,20.001)              00163
      CALL PLOT(XSTART,YSTART-.07,3)                                     00164
      DO 5021 I=1,8                                                      00165
      CALL PLOT(XSTART,YSTART,2)                                         00166
      XSTART=XSTART+.75                                                  00167
      CALL PLOT(XSTART,YSTART,2)                                         00168
      CALL PLOT(XSTART,YSTART-.07,2)                                     00169
5021  CONTINUE                                                           00170
      NSTR=NTIMES/2                                                      00171
      NSTP=NSTR/4                                                        00172
      XSTART=XSTART-.1                                                   00173
      YSTART=1.2                                                         00174
      DO 5022 I=1,9                                                      00175
      FN=NSTR+.1*ISIGN(1,NSTR)                                           00176
      CALL NUMBER(XSTART,YSTART,.1,FN,0.,-1)                             00177
      NSTR=NSTR-NSTP                                                     00178
5022  XSTART=XSTART-.75                                                  00179
      XSTART=.5                                                          00180
      YSTART=1.4                                                         00181
      NP2=NTIMES/2                                                       00182
      SCN=6./FLOAT(NTIMES)                                               00183
      PEAK=0.                                                            00184
```

```
      DO 5023 I=1,NTIMES                                                00185
      J=2*I                                                             00186
      FFTD(I)=FFTD(J-1)**2+FFTD(J)**2                                   00187
5023  PEAK=AMAX1(PEAK,FFTD(I))                                          00188
      SHFT=YSTART+4.-ALOG10(PEAK)*.5                                    00189
      DBMIN=PEAK*1.E-8                                                  00190
      IPEN=3                                                            00191
      X=XSTART                                                          00192
      DO 5024 I=1,NP2                                                   00193
      J=I+NP2                                                           00194
      Y=YSTART                                                          00195
      IF(FFTD(J).GT.DBMIN) Y=SHFT+ALOG10(FFTD(J))*.5                    00196
      CALL PLOT(X,Y,IPEN)                                               00197
      X=X+SCN                                                           00198
5024  IPEN=2                                                            00199
      NP2=NP2+1                                                         00200
      DO 5025 I=1,NP2                                                   00201
      Y=YSTART                                                          00202
      IF(FFTD(I).GT.DBMIN) Y=SHFT+ALOG10(FFTD(I))*.5                    00203
      CALL PLOT(X,Y,2)                                                  00204
5025  X=X+SCN                                                           00205
      CALL PLOT(0.,.5,-1)                                               00206
      PKDB=10.*ALOG10(PEAK)                                             00207
      WRITE(13,102) (CTIME(I),I=1,5),ICOLON,CTIME(6),STEER,PKDB         00208
102   FORMAT(5X,'SAMPLE TIME  ',3A2,2X,2A2,A1,A2,3X,'STEER=',F7.3,      00209
     1 ', PEAK=',F7.3,' DB'/19X,'USING CONVENTIONAL WEIGHTS')           00210
      CALL TKWAIT                                                       00211
C                                                                       00212
C    SS2 UP = WAIT                                                      00213
C                                                                       00214
  600 CALL SSWTCH(2,IUP)                                                00215
      IF(IUP.EQ.1)GO TO 600                                             00216
C    SS1 DOWN=CONTINUE PROCESSING        UP=INPUT NEW TIME              00217
C    SS1 UP=CONTINUE PROCESSING                                         00218
C                                                                       00219
      CALL SSWTCH(1,IUP)                                                00220
      IF(IUP.EQ.1)GO TO 1                                               00221
      IFILE=1                                                           00222
      CALL RDTAPE(IFILE)                                                00223
      CALL TMASCT(CTIME)                                                00224
      GO TO 1120                                                        00225
SRCONVT     EQU   F.MAIN                                              00226
S           ENTRY RCONVT                                              00227
S           LIBR  RCONVT                                              00228
      END                                                               00229
```

```
      SUBROUTINE FORT2(M,IFS,A,IFERR)                                   00231
$       LIBR   FORT2                                                    00232
      DIMENSION A(512),S(128),K(16)                                     00233
      EQUIVALENCE (K(15),K1),(K(14),K2),(K(13),K3),(K(12),K4)           00234
      EQUIVALENCE (K(11),K5),(K(10),K6),(K( 9),K7),(K( 8),K8)           00235
      EQUIVALENCE (K( 7),K9 ),(K( 6),K10),(K( 5),K11),(K( 4),K12)       00236
      EQUIVALENCE (K( 3),K13),(K( 2),K14),(K( 1),K15)                   00237
      DATA NP/0/                                                        00238
      IF(M)2,2,3                                                        00239
    3 IF(M-15) 5,5,2                                                    00240
    2 IFERR=1                                                           00241
    1 RETURN                                                            00242
    5 IFERR=0                                                           00243
      N=2**M                                                            00244
   10 IF( N-NP )20,20,12                                                00245
   12 IFERR=1                                                           00246
      GO TO 200                                                         00247
   20 K(1)=2*N                                                          00248
      N2 = K(1)                                                         00249
      DO 22 L=2,M                                                       00250
   22 K(L)=K(L-1)/2                                                     00251
      DO 24 L=M,14                                                      00252
   24 K(L+1)=2                                                          00253
      IJ=2                                                              00254
      J3 = 2                                                            00255
      DO 30 J4=J3,K4,K3                                                 00256
      DO 30 J5=J4,K5,K4                                                 00257
      DO 30 J6=J5,K6,K5                                                 00258
      DO 30 J7=J6,K7,K6                                                 00259
      DO 30 J8=J7,K8,K7                                                 00260
      DO 30 J9=J9,K9,K8                                                 00261
      DO 30 J10=J9,K10,K9                                               00262
      DO 30 J11=J10,K11,K10                                             00263
      DO 30 J12=J11,K12,K11                                             00264
      DO 30 J13=J12,K13,K12                                             00265
      J14=J13                                                           00266
   26 JI=J14                                                            00267
   27 IF(IJ-JI)28,29,29                                                 00268
   28 T=A(IJ-1 )                                                        00269
      A(IJ-1)=A(JI-1)                                                   00270
      A(JI-1)=T                                                         00271
      T=A(IJ)                                                           00272
      A(IJ)=A(JI)                                                       00273
      A(JI)=T                                                           00274
   29 IJ=IJ+2                                                           00275
      JI=JI+K14                                                         00276
      IF(JI.LE.K15) GO TO 27                                            00277
      J14=J14+K13                                                       00278
      IF(J14.LE.K14) GO TO 26                                           00279
   30 CONTINUE                                                          00280
      IF(IFS)32,2,36                                                    00281
   32 FN=N                                                              00282
      DO 34 I=1,N                                                       00283
      A(2*I-1) = A(2*I-1)/FN                                            00284
   34 A(2*I)=-A(2*I)/FN                                                 00285
   36 DO 40 I=1,N,2                                                     00286
      T = A(2*I-1)                                                      00287
      A(2*I-1) =T + A(2*I+1)                                            00288
      A(2*I+1)=T-A(2*I+1)                                               00289
      T=A(2*I)                                                          00290
      A(2*I) = T + A(2*I+2)                                             00291
      A(2*I+2)= T - A(2*I+2)                                            00292
```

```
      IF(M-1) 2,1 ,50                                                   00293
   50 LEXP1=2                                                           00294
      LEXP=4                                                            00295
      NPL= 2**MT                                                        00296
   60 DO 130 L=2,M                                                      00297
      DO 80 I=2,N2,LEXP                                                 00298
      I1=I + LEXP1                                                      00299
      I2=I1+ LEXP1                                                      00300
      I3 =I2+LEXP1                                                      00301
      T=A(I-1)                                                          00302
      A(I-1) = T +A(I2-1)                                               00303
      A(I2-1) = T-A(I2-1)                                               00304
      T =A(I)                                                           00305
      A(I) = T+A(I2)                                                    00306
      A(I2) = T-A(I2)                                                   00307
      T= -A(I3)                                                         00308
      TI = A(I3-1)                                                      00309
      A(I3-1) =A(I1-1) - T                                              00310
      A(I3   ) = A(I1 )   - TI                                          00311
      A(I1-1) = A(I1-1) +T                                              00312
   80 A(I1)   = A(I1   ) +TI                                            00313
      IF(L-2) 120,120,90                                                00314
   90 KLAST=N2-LEXP                                                     00315
      JJ=NPL                                                            00316
      DO 110 J=4,LEXP1,2                                                00317
      NPJJ=NT-JJ                                                        00318
      UR=S(NPJJ)                                                        00319
      UI=S(JJ)                                                          00320
      ILAST=J+KLAST                                                     00321
      DO 100 I= J,ILAST,LEXP                                            00322
      I1=I+LEXP1                                                        00323
      I2=I1+LEXP1                                                       00324
      I3=I2+LEXP1                                                       00325
      T=A(I2-1)*UR-A(I2)*UI                                             00326
      TI=A(I2-1)*UI+A(I2)*UR                                            00327
      A(I2-1)=A(I-1)-T                                                  00328
      A(I2 )=A(I   ) - TI                                               00329
      A(I-1) =A(I-1)+T                                                  00330
      A(I)   =A(I)+TI                                                   00331
      T=-A(I3-1)*UI-A(I3)*UR                                            00332
      TI=A(I3-1)*UR-A(I3)*UI                                            00333
      A(I3-1)=A(I1-1)-T                                                 00334
      A(I3)   =A(I1  )-TI                                               00335
      A(I1-1)=A(I1-1)+T                                                 00336
  100 A(I1)  =A(I1)   +TI                                               00337
  110 JJ=JJ+NPL                                                         00338
  120 LEXP1=2*LEXP1                                                     00339
      LEXP = 2*LEXP                                                     00340
      NPL = NPL/2                                                       00341
  130 CONTINUE                                                          00342
  140 IF(IFS)145,2,1                                                    00343
  145 DO 150 I=1,N                                                      00344
  150 A(2*I) =-A(2*I)                                                   00345
  160 GO TO 1                                                           00346
  200 NP=N                                                              00347
      MP=M                                                              00348
      NT=N/4                                                            00349
      MT=M-2                                                            00350
      IF(MT)260,260,205                                                 00351
  205 THETA=.785398163A                                                 00352
  210 JSTEP = NT                                                        00353
      JDIF = NT/2                                                       00354
```

```
      S(JDIF) = SIN(THETA)                                              00355
      IF (MT-2)260,220,220                                              00356
  220 DO 250 L=2,MT                                                     00357
      THETA = THETA/2.                                                  00358
      JSTEP2 = JSTEP                                                    00359
      JSTEP = JDIF                                                      00360
      JDIF = JDIF/2                                                     00361
      S(JDIF)=SIN(THETA)                                                00362
      JC1=NT-JDIF                                                       00363
      S(JC1)=COS(THETA)                                                 00364
      JLAST=NT-JSTEP2                                                   00365
      IF(JLAST-JSTEP)250,230,230                                        00366
  230 DO 240 J=JSTEP,JLAST,JSTEP                                        00367
      JC=NT-J                                                           00368
      JD=J+JDIF                                                         00369
  240 S(JD)=S(J)*S(JC1)+S(JDIF)*S(JC)                                   00370
  250 CONTINUE                                                          00371
  260 IF(IFS)20,1,20                                                    00372
      END                                                               00373
```

```
      SUBROUTINE DLPH(WT,N,SLL,INDQ)                                    00375
      $   LIBR   DLPH                                                   00376
      DIMENSION WT(256)                                                 00377
      IF(N.EQ.1)  GO TO 310                                             00378
C     N IS FULL WINDOW SIZE, EVEN OR ODD                                00379
C     COMPUTES HALF WINDOW, EVEN OR ODD                                 00380
C     N IS INTEGER,  SLL IS REAL                                        00381
C     IF INDQ IS SET TO 1  POSSIBLE OVERFLOW                            00382
C      RESULTS NOT NEC. VALID                                           00383
      FN = FLOAT(N)                                                     00384
      S = 10.**(SLL/20.)                                                00385
      VAR1 = ALOG(S+SQRT(S**2-1.))                                      00386
      AA=EXP(2.*VAR1/(FN-1.))                                           00387
      A=((AA-1.)/(AA+1.))**2                                            00388
      WT(1) = 1.                                                        00389
      N2 = (N+1)/2                                                      00390
      INDQ=0                                                            00391
      DO 300 K = 2,N2                                                   00392
      FK = FLOAT(K)                                                     00393
      B = 0.0                                                           00394
      K1 = K-1                                                          00395
      CD=1.                                                             00396
      DO 280 J = 1,K1                                                   00397
      FJ = FLOAT(J)                                                     00398
      IF(J.NE.1) CD=CD*((FK-FJ)/(FJ+1.))                                00399
      CD=CD*A*((FN-FK+1.+FJ)/FJ)                                        00400
      IF(CD.GT.1.E35) GO TO 285                                         00401
  280 B=B+CD                                                            00402
      GO TO 290                                                         00403
  285 INDQ=1                                                            00404
  290 WT(K) = (FN-1.0)*B/(FN-FK)                                        00405
  300 CONTINUE                                                          00406
      DO 315 K = 1,N2                                                   00407
  315 WT(K) = WT(K)/WT(N2)                                              00408
      RETURN                                                            00409
  310 WT(1)=1.                                                          00410
      RETURN                                                            00411
      END                                                               00412
```

APPENDIX E
RADAR PROCESSING WITH ADAPTIVE BEAMFORMING

```
C       PROGRAM RADAPT                                                          00001
C                                                                               00002
C                                                                               00003
C     THIS PROGRAM IS CALLED 'RADAPT'  IT GENERATES ADAPTIVE WEIGHTS            00004
C     AND APPLIES THEM TO GENERATE DOPPLER SPECTRA,USING DATA FROM THE          00005
C     16 ELEMENT ARRAY AT RADC,  DEXTER, NEW YORK.                              00006
C     READS TAPE INPUT ONLY                                                     00007
C                                                                               00008
C      23 SEPTEMBER 1975        1500                                            00009
C                                                                               00010
       REAL IQCORA(16),DELPH(16),BUF(64),SAMPL(32),COSANG(16),TANANG(16)        00011
       REAL AM(16),COS                                                          00012
       INTEGER IAZ(11),IDB(6),STIME(6),DUM(523)                                 00013
       COMPLEX ZCORR(16),ZSAMPL,DOLPH(16)                                       00014
       COMPLEX STAT(16)                                                         00015
       INTEGER WBUF(523),CTIME(6)                                               00016
       REAL FFTD(512),ISAMPL(32)                                                00017
       DIMENSION DLPTIM(248),IPT(5)                                             00018
C                                                                               00019
       COMMON IBUF1(262),IBUF2(262),INBUF(523),DBPOW(65),MELEM,DUMD(32),        00020
      * AL(272),TOL,VS(32),WT(32),REPI,REPD,AMP,POSD,UTHET,SPEL,MA(64),         00021
      * BL(272)                                                                 00022
C                                                                               00023
       EQUIVALENCE (INBUF(1),DUM(1),WBUF(1)),(CTIME(1),STIME(1))                00024
       EQUIVALENCE (BUF(1),IQCORA(1)),(BUF(17),DELPH(1)),                       00025
      * (BUF(33),ZCORR(1)),(DBPOW(1),SAMPL(1)),(DBPOW(33),COSANG(1)),           00026
      * (DBPOW(49),TANANG(1))                                                   00027
C                                                                               00028
       DATA (DOLPH(I),I=1,16)/(0.01266,0.0),(0.03237,0.0),(0.13904,0.0),        00029
      * (0.28431,0.0),(0.48131,0.0),(0.69921,0.0),(0.889,0.0),(1.0,0.0),        00030
      * (1.0,0.0),(0.889,0.0),(0.69921,0.0),(0.48131,0.0),(0.28431,0.0),        00031
      * (0.13904,0.0),(0.03237,0.0),(0.01266,0.0)/                              00032
       DATA(IAZ(I),I=1,11)/7A0A0,7A0A0,7C1DA,7C9CD,7D5D4,7CBA0,7A0A0,           00033
      * 7A0D5,7A0D3,7D0C1,7C3C5/                                                00034
       DATA(IDB(I),I=1,6)/7A0A0,7A0A0,7A0C4,7C2A0,7C4CF,7D7CE/                  00035
       DATA PI,RAD,NSAMP,NCHAN,ICOLON/3.14159,57.29578,512,32,7BAA0/            00036
       DATA IDUM/7A0A0/                                                         00037
       DATA NTP/0/                                                              00038
       DATA IPT/0,9,24,56,120/                                                  00039
C                                                                               00040
       ARSIN(DUMMY)=ATAN2(DUMMY,SQRT(1.0-DUMMY**2))                             00041

       TAN(DUMMY)=SIN(DUMMY)/COS(DUMMY)                                         00042

C                                                                               00043
       DO 911 M=4,9                                                             00044
       II=IPT(M-3)+1                                                            00045
       N=2**M                                                                   00046
       CALL RIBDOT(N)                                                           00047
911    CALL DLPH(DLPTIM(II),N,70.,INDO)                                         00048
       TOL=1.0E-06                                                              00049
       ISECT=1                                                                  00050
       CALL DSKIN(BUF,ISECT,64)                                                 00051
       DO 91 IEL=1,16                                                           00052
       ANGLR=(90.-DELPH(IEL))/RAD                                               00053
       COSANG(IEL)=COS(ANGLR)                                                   00054
91      TANANG(IEL)=TAN(ANGLR)                                                  00055
1      DO 20 I=1,272                                                            00056
       AL(I)=0.0                                                                00057
20     BL(I)=0.0                                                                00058
       IDSPLA=0                                                                 00059
C                                                                               00060
```

```
      CALL BURST                                                        00061
      WRITE(13,4)                                                       00062
4     FORMAT('FREQ?(F7.3)')                                             00063
      READ(13,44) FREQ                                                  00064
44    FORMAT(F7.3)                                                      00065
      SPACE=18.288                                                      00066
      XLAMDA=300.0/FREQ                                                 00067
      SSPL=SPACE/XLAMDA*2.0*PI                                          00068
      SPEL=SSPL                                                         00069
      XK=SSPL/PI                                                        00070
      XU=2.0/XK-1.0                                                     00071
      IF(XU.LE.0.0)GO TO 97                                             00072
      IF(XU.GT.1.0)XU=1.0                                               00073
      XANGL=ARSIN(XU)*RAD                                               00074
      GO TO 98                                                          00075
   97 XANGL=0.0                                                         00076
   98 CONTINUE                                                          00077
111   WRITE(13,6)                                                       00078
6     FORMAT(' TIME HR,MIN,SEC; NO OF ELEMENT  (3A2,I3)')               00079
      READ(13,113) IHR,IMIN,ISEC,MELEM                                  00080
113   FORMAT(3A2,I3)                                                    00081
      IF(MELEM.GT.16)GO TO 111                                          00082
  112 WRITE(13,8)                                                       00083
8     FORMAT(16HCONFIGURATION  X)                                       00084
      READ(13,9)(MA(I),I=1,16)                                          00085
9     FORMAT(16I1)                                                      00086
      DO 701 I=17,64                                                    00087
701   MA(I)=0                                                           00088
      ISUM=0                                                            00089
      DO 71 I=1,64                                                      00090
   71 ISUM=ISUM+MA(I)                                                   00091
      IF(ISUM.EQ.MELEM)GO TO 711                                        00092
      WRITE(13,72)MA                                                    00093
   72 FORMAT(64I1,/20X,19HCONFIGURATION ERROR)                          00094
      GO TO 112                                                         00095
  711 WRITE(13,10)                                                      00096
10    FORMAT(' NGROUP,LOG BASE 2 OF NTIMES,STEER? (2I2,F7.3)')          00097
      READ(13,11) NGROUP,MTIMES,STEER                                   00098
11    FORMAT(2I2,F7.3)                                                  00099
      NTIMES=2**MTIMES                                                  00100
      NGROUP=MIN0(NGROUP,NTIMES/16)                                     00101
      MELEM2=2*MELEM                                                    00102
1167  IFILE=1                                                           00103
      CALL RDTP(IFILE)                                                  00104
      CALL TMASCI(STIME)                                                00105
      IF(STIME(4).NE.IHR.OR.STIME(5).NE.IMIN.OR.STIME(6)                00106
     1 .NE.ISEC) GO TO 1167                                             00107
      IFIRST=0                                                          00108
C                                                                       00109
166   CONTINUE                                                          00110
C                                                                       00111
C                                                                       00112
C    APPLY CORRECTION FACTORS                                           00113
C                                                                       00114
      ISECT=10                                                          00115
      DO 93 N=1,NGROUP                                                  00116
      CALL RIADDT(N)                                                    00117
      IF(IFIRST.EQ.0) GO TO 1168                                        00118
      IFILE=+1                                                          00119
      CALL RDTP(IFILE)                                                  00120
      CALL TMASCI(STIME)                                                00121
1168  IFIRST=1                                                          00122
```

```
      CALL DSKOUT(DUM,ISECT,523)                                                00123
      DO 93 NPULSE=1,16                                                         00124
      IWORD=32*(NPULSE-1)                                                       00125
      DO 912 IEL=1,MELEM                                                        00126
      I2=2*IEL                                                                  00127
      IDNUM=I2+IWORD                                                            00128
      SAMPL(I2-1)=FLOAT(DUM(IDNUM-1))                                           00129
      SAMPL(I2)=FLOAT(DUM(IDNUM))*IQCORA(IEL)/COSANG(IEL)-SAMPL(I2-1)           00130
     1 *TANANG(IEL)                                                             00131
      ZSAMPL=CMPLX(SAMPL(I2-1),SAMPL(I2))*ZCORR(IEL)                            00132
      SAMPL(I2-1)=REAL(ZSAMPL)                                                  00133
  912 SAMPL(I2)=AIMAG(ZSAMPL)                                                   00134
      DO 931 K=1,MELEM2                                                         00135
  931 DUMD(K)=SAMPL(K)                                                          00136
C                                                                               00137
C   GENERATE THE COVARIANCE MATRIX                                              00138
C                                                                               00139
   93 CALL ADCRMT                                                               00140
C                                                                               00141
C                                                                               00142
C                                                                               00143
C   INVERT THE COVARIANCE MATRIX                                                00144
C                                                                               00145
      DO 94 I=1,272                                                             00146
   94 BL(I)=AL(I)                                                               00147
      CALL CHLKYA                                                               00148
      CALL INVTL                                                                00149
      CALL HINVL                                                                00150
C                                                                               00151
C   CHECK GOODNESS                                                              00152
C                                                                               00153
      CALL MULHM                                                                00154
      CALL PRPKE                                                                00155
20156 AMP=1.0                                                                   00156
      UTHET=SIN(STEER/RAD)                                                      00157
      POSD=UTHET                                                                00158
      CALL SGEN3                                                                00159
      DO 9666 K=1,MELEM2                                                        00160
9666  VS(K)=DUMD(K)                                                             00161
      CALL HXV                                                                  00162
      CALL VSRXW                                                                00163
      MT=0                                                                      00164
      DO 96 K=1,15                                                              00165
      IF(MA(K).EQ.1) GO TO 996                                                  00166
      STWT(K)=(0.,0.)                                                           00167
      GO TO 96                                                                  00168
 996  MT=MT+1                                                                   00169
      K2=2*MT                                                                   00170
      STWT(K)=CMPLX(WT(K2-1)/REPI,-WT(K2)/REPI)                                 00171
 96   CONTINUE                                                                  00172
      WRITE(13,997) STWT                                                        00173
 997  FORMAT(/(4E15.7))                                                         00174
      NNT=NTIMES/16                                                             00175
      ISECT=10                                                                  00176
 1120 DO 6000 ITIMES=1,NNT                                                      00177
      CALL RIBDOT(ITIMES)                                                       00178
      IF(ITIMES.GT.NGROUP) GO TO 20213                                          00179
      CALL DSKIN(INBUF,ISECT,523)                                               00180
      GO TO 20214                                                               00181
20213 IFILE=1                                                                   00182
      CALL RDTP(IFILE)                                                          00183
      CALL SMASGI(ITIME)                                                        00184
```

```
C                                                                       00185
C    APPLY ALL CORRECTION FACTORS TO NEW SAMPLES, ADD WEIGHTS AND       00186
C     STEER AND STORE                                                   00187
C                                                                       00188
C                                                                       00189
      ITT=(ITIMES-1)*32                                                 00190
      DO 5995 IE=1,32                                                   00191
      II=IE+ITT                                                         00192
5995  FFTD(II)=0.                                                       00193
      DO 6000 IEL=1,16                                                  00194
      ICONST=2*IEL-1                                                    00195
      DO 6001 I=1,16                                                    00196
      IRXWD=ICONST+32*(I-1)                                             00197
      I2=2*I                                                            00198
      I2M=I2-1                                                          00199
      ISAMPL(I2M)=NBUF(IRXWD)                                           00200
      ISAMPL(I2)=NBUF(IRXWD+1)*IQCORA(IEL)/COSANG(IEL)-                 00201
     1 ISAMPL(I2M)*TANANG(IEL)                                          00202
      ZSAMPL=CMPLX(ISAMPL(I2M),ISAMPL(I2))*ZCORR(IEL)*STNT(IEL)         00203
      II=I2+ITT                                                         00204
      FFTD(II-1)=REAL(ZSAMPL)+FFTD(II-1)                                00205
6001  FFTD(II)=AIMAG(ZSAMPL)+FFTD(II)                                   00206
6000  CONTINUE                                                          00207
C  IF DESIRED, TIME SERIES MAY BE WRITTEN ON TAPE HERE                  00208
C                                                                       00209
C     MULTIPLY TIME SERIES BY DOLPH WEIGHTS                             00210
      IP=IPT(MTIMES-3)                                                  00211
      DO 6005  I=1,NTIMES                                               00212
      I2=2*I                                                            00213
      II=I+IP                                                           00214
      IF(I2.GT.NTIMES) II=NTIMES+1-I+IP                                 00215
      FFTD(I2-1)=FFTD(I2-1)*DLPTIM(II)                                  00216
6005  FFTD(I2)=FFTD(I2)*DLPTIM(II)                                      00217
C                                                                       00218
C     TAKE FFT AND PLOT SPECTRUM                                        00219
      CALL FORT2(MTIMES,-1,FFTD,IFRRR)                                  00220
  502 CALL SSWTCH(2,IUP)                                                00221
      IF(IUP.EQ.1)GO TO 502                                             00222
      CALL BURST                                                        00223
      CALL TKPLOT(0,0,0)                                                00224
      YSTART=1.4                                                        00225
      XSTART=.5                                                         00226
      CALL AXIS(XSTART,YSTART,IDB,12,4.0,90.0,-80.0,20.001)             00227
      CALL PLOT(XSTART,YSTART-.07,3)                                    00228
      DO 5021 I=1,8                                                     00229
      CALL PLOT(XSTART,YSTART,2)                                        00230
      XSTART=XSTART+.75                                                 00231
      CALL PLOT(XSTART,YSTART,2)                                        00232
      CALL PLOT(XSTART,YSTART-.07,2)                                    00233
5021  CONTINUE                                                          00234
      NSTR=NTIMES/2                                                     00235
      NSTP=NSTR/4                                                       00236
      XSTART=XSTART-.1                                                  00237
      YSTART=1.2                                                        00238
      DO 5022 I=1,9                                                     00239
      FN=NSTR+.1*ISIGN(1,NSTR)                                          00240
      CALL NUMBER(XSTART,YSTART,.1,FN,0.,-1)                            00241
      NSTR=NSTR-NSTP                                                    00242
5022  XSTART=XSTART-.75                                                 00243
      XSTART=.5                                                         00244
      YSTART=1.4                                                        00245
      NP2=NTIMES/2                                                      00246
      SCN=6./FLOAT(NTIMES)
```

```
      PEAK=0.                                                          00247
      DO 5023 I=1,NTIMES                                               00248
      J=2*I                                                            00249
      FFTD(I)=FFTD(J-1)**2+FFTD(J)**2                                  00250
5023  PEAK=AMAX1(PEAK,FFTD(I))                                         00251
      SHFT=YSTART+4.-ALOG10(PEAK)*.5                                   00252
      DBMIN=1.E-8*PEAK                                                 00253
      IPEN=3                                                           00254
      X=XSTART                                                         00255
      DO 5024 I=1,NP2                                                  00256
      J=I+NP2                                                          00257
      Y=YSTART                                                         00258
      IF(FFTD(J).GT.DBMIN) Y=SHFT+ALOG10(FFTD(J))*.5                   00259
      CALL PLOT(X,Y,IPEN)                                              00260
      X=X+SCN                                                          00261
5024  IPEN=2                                                           00262
      NP2=NP2+1                                                        00263
      DO 5025 I=1,NP2                                                  00264
      Y=YSTART                                                         00265
      IF(FFTD(I).GT.DBMIN) Y=SHFT+ALOG10(FFTD(I))*.5                   00266
      CALL PLOT(X,Y,2)                                                 00267
5025  X=X+SCN                                                          00268
      CALL PLOT(0.,.5,-1)                                              00269
      PKDB=10.*ALOG10(PEAK)                                            00270
      WRITE(13,102)(CTIME(I),I=1,5),ICOLON,CTIME(6),STEER,PKDB         00271
     1 ,(MA(I),I=1,16)                                                 00272
102   FORMAT(5X,'SAMPLE TIME    ',3A2,2X,2A2,A1,A2,3X,'STEER=',         00273
     1 F7.3,', PEAK=',F7.3,' DB'/5X,'USING ADAPTIVE WEIGHTS      '    00274
     2 '  CONFIGURATION=',16I1)                                       00275
      CALL TKWAIT                                                      00276
C                                                                      00277
C    SS2 UP = WAIT                                                     00278
C                                                                      00279
  600 CALL SSWTCH(2,IUP)                                               00280
      IF(IUP.EQ.1)GO TO 600                                            00281
C    SS3 DOWN=GO ON,   UP= CHANGE ONLY STEER                           00282
C                                                                      00283
      CALL SSWTCH(3,IUP)                                               00284
      IF(IUP.NE.1) GO TO 630                                           00285
      CALL BURST                                                       00286
      WRITE(13,610)                                                    00287
610   FORMAT('STEER=?   (F7.3)')                                       00288
      READ(13,620) STEER                                               00289
620   FORMAT(F7.3)                                                     00290
      GO TO 20156                                                      00291
630   CONTINUE                                                         00292
C    SS1 DOWN=CONTINUE PROCESSING        UP=INPUT NEW TIME             00293
C    SS1 UP=CONTINUE PROCESSING                                        00294
C                                                                      00295
      CALL SSWTCH(1,IUP)                                               00296
      IF(IUP.EQ.1)GO TO 1                                              00297
      GO TO 166                                                        00298
SRADAPT   EQU   F,MAIN                                                 00299
S         NTRY  RADAPT                                                 00300
S         LIBR  RADAPT                                                 00301
      END                                                              00302
```

APPENDIX F

EQUALIZATION FILTER DESIGN PROGRAM

```
*
      PROGRAM FILTRN
      CALL FILTRIM
      END
      SUBROUTINE FILTRTM
*     NP=NUMBER OF POLES
*     NT=NUMBER OF TAPS
*     A(J,N)=N-TH COEFFICIENT IN J-TH BUTTERWORTH FILTER
*     SP(J,N)=N-TH POLE IN J-TH BUTTERWORTH FILTER
*     B=BANDWIDTH OF BUTTERWORTH FILTERS
*     TAU=TAP SPACING IN DELAY LINE
*     W(J,N)=N-TH TAP WEIGHT IN J-TH DELAY LINE
*     N1=COMPLEX REF CHANNEL
*     N2=CHANNEL TO BE MATCHED
*     NF=NUMBER OF FREQS
*     NS=NUMBER OF NORMALIZATION FREQ
*     IR=0 USES POLES
*     IR=1 INPUTS MEASURED FREQ
*     IS=1=1 AMP PER CHANNEL
*     IS=2=2 AMP PER CHANNEL
      COMPLEX A(2,10),SP(2,10),W(2,20),CP,C(20,20),C1(20,20),C2(20,20)
      COMPLEX XX,YY,SV(20),D(20,20)
      COMPLEX B1(101),B2(101),P(20),SS(101)
      COMPLEX CA,CB,CC,CD
      COMPLEX CPT
      COMMON/A/B1,B2,IXT,II,SS,IR,FY,CPT,IS
      DIMENSION FY(101)
      NAMELIST/INPUT/NP,NT,B,TAU,IT,IS,N1,N3,NF,NS,IR,IDUMP,N4
1     READ INPUT
      IF(NT.EQ.0) GO TO 900
      DO 100 N2=N3,N4,1
      II=2*NF
   15 FORMAT(2I5,2F10.4)
      PI=4.*ATAN(1.)
      RAD=PI/180.
      CP=CMPLX(0.,PI)
      CPT=2.*CP*TAU
      WRITE(6,78)
   78 FORMAT(1H1,//*      PROGRAM FOR EVALUATING FILTER MATCH*)
      WRITE(6,79)
   79 FORMAT(1X,/*          FILTER COEFFICIENTS *)
      B=2.*PI*B
      IXT=0
*     SELECT TAP WEIGHTS FOR REFERENCE FILTER
*
      DO 50 J=1,NT
      W(1,J)=1.
      IF(J.NE.NT/2) W(1,J)=0.
   50 CONTINUE
      IF(IR.EQ.1) CALL DATA(N1,N2,NS,NF,JF,RAD)
      IF(IR.EQ.1) GO TO 500
*
*     COMPUTE POLE LOCATIONS FOR BUTTERWORTH FILTERS
*
      UUU=RANF(3.)
      DO 10 N=1,NP
      SP(1,N)=B/2.*CEXP(CP*(.5+(2.*N-1)/2./NP))
      Y=RANF(0.)
      YY=CEXP(2.*CP*Y)
      X=RANF(0.)
   10 SP(2,N)=SP(1,N)*(1.+.06*YY*(X-.5))
*
      COMPUTE COEFFICIENTS OF BUTTERWORTH FILTERS
```

```
      DO 20 K=1,2
      DO 20 N=1,NP
      A(K,N)=1.
      DO 30 J=1,NP
      IF(J.EQ.N) GO TO 30
      A(K,N)=A(K,N)*1./(SP(K,N)-SP(K,J))
   30 CONTINUE
   20 A(K,N)=A(K,N)*(B/2.)**NP
*
*     PRINT PARAMETERS OF FILTERS
*
      DO 40 N=1,NP
   40 WRITE(6,41) SP(1,N),SP(2,N),A(1,N),A(2,N)
   41 FORMAT(8E15.6)
      WRITE(6,89) B,TAU
   89 FORMAT(///*  BANDWIDTH=*,F10.2,*    TIME DELAY=*,F10.4///)
*
*
*     COMPUTE COVARIANCE MATRIX OF TAP OUTPUTS
*
      DO 60 K=1,NT
      DO 60 L=1,NT
      C(K,L)=0.
      C1(K,L)=0.
      C2(K,L)=0.
      DO 61 M=1,NP
      DO 61 N=1,NP
      XX=CONJG(A(2,M))*A(2,N)/(CONJG(SP(2,M))+SP(2,N))
      YY=SP(2,N)*(K-L)
      IF(K.LT.L) YY=CONJG(SP(2,M))*(L-K)
      C(K,L)=C(K,L)+XX*CEXP(YY*TAU)
      XX=CONJG(A(2,M))*A(1,N)/(CONJG(SP(2,M))+SP(1,N))
      YY=SP(1,N)*(K-L)
      IF(K.LT.L) YY=CONJG(SP(2,M))*(L-K)
      C1(K,L)=C1(K,L)+XX*CEXP(YY*TAU)
      XX=CONJG(A(1,M))*A(1,N)/(CONJG(SP(1,M))+SP(1,N))
      YY=SP(1,N)*(K-L)
      IF(K.LT.L) YY=CONJG(SP(1,M))*(L-K)
      C2(K,L)=C2(K,L)+XX*CEXP(YY*TAU)
   61 CONTINUE
      D(K,L)=C(K,L)
   60 CONTINUE
      PRINT 200,((C(K,L),L=1,NT),K=1,NT)
      PRINT 200,((C1(K,L),L=1,NT),K=1,NT)
      PRINT 200,((C2(K,L),L=1,NT),K=1,NT)
  101  CONTINUE
*
*     INVERT COVARIANCE MATRIX M
*
      CALL MATINV(C,NT)
*
*    COMPUTE STEERING VECTOR
*
      DO 70 M=1,NT
      SV(M)=0.
      DO 71 N=1,NT
   71 SV(M)=SV(M)+C1(M,N)*W(1,N)
   70 CONTINUE
*
*     COMPUTE LMS TAP WEIGHTS
*
```

```
      DO 80 M=1,NT
      W(2,M)=0.
      DO 81 N=1,NT
   81 W(2,M)=W(2,M)+C(M,N)*SV(N)
   80 CONTINUE
*
*     PRINT THE FILTER WEIGHTS
*
      DO 82 J=1,NT
   82 WRITE(6,83) J,W(1,J),W(2,J)
   83 FORMAT(I5,4F15.5)
      WRITE(6,84)
   84 FORMAT(1X,//)
*
*     COMPUTE POWER IN OUTPUT
*
      YY=0.
      XX=0.
      DO 90 M=1,NT
      DO 90 N=1,NT
      XX=XX+CONJG(W(1,M))*C2(M,N)*W(1,N)
      XX=XX-W(2,M)*CONJG(C1(M,N)*W(1,N))
       YY=YY-CONJG(W(2,M))*C1(M,N)*W(1,N)
      YY=YY+CONJG(W(2,M))*D(M,N)*W(2,N)
   90 CONTINUE
      YY=YY+XX
      POUT=CABS(XX)
      PREF=CABS(YY)
*
*     PRINT FILTER RESPONSE
*
      E=H/2./PI
      CALL        FILFL1(SP,A,W,NP,NT,E,TAU,CP,NF,N1,N2)
*
  300 CONTINUE
*     COMPUT COVAR MAT USING FREQ
*
      IF(IXT.GE.1) GO TO 100
      IXT=IXT+1
      II=IM/2+1
      DO 62 K=1,NT
      DO 62 L=K,NT
      CA=CB=CC=CD=0.
      YY=CPI*(K-L)
      DO 63 I=1,II
      XX=CEXP(YY*FY(I))
      CA=CA+XX*CONJG(B2(I))*B2(I)
      CB=CB+XX*CONJG(B2(I))*B1(I)
      CC=CC+XX*CONJG(B1(I))*B1(I)
      CD=CD+CONJG(XX)*CONJG(B2(I))*B1(I)
   63 CONTINUE
      C(K,L)=CA
      D(K,L)=CA
      C1(K,L)=CB
      C2(K,L)=CC
      IF(K.EQ.L) GO TO 64
      C (L,K)=CONJG(CA)
      D(L,K)=C(L,K)
      C1(L,K)=CD
      C2(L,K)=CONJG(CC)
   64 CONTINUE
   62 CONTINUE
```

```
201   FORMAT(1X,2I2,10E11.3)
      IF(IDUMP.EQ.0) GO TO 101
      PRINT 200,(A1(I),I=1,II)
      PRINT 200,(A2(I),I=1,II)
      PRINT 200,((C(K,L),L=1,NT),K=1,NT)
      PRINT 200,((C1(K,L),L=1,NT),K=1,NT)
      PRINT 200,((C2(K,L),L=1,NT),K=1,NT)
200   FORMAT(1X, 8F11.3)
      GO TO 101
100   CONTINUE
      GO TO 1
900   CONTINUE
      RETURN
      END
      SUBROUTINE DATA(N1,N2,NS,NF,JF,RAD)
C     READ AND SELECT DATA
C     NC(1),NC(3) ARE ICOMP OF REC CHANNELS
C     NC(2),NC(4) ARE QCOMP OF REC CHANNELS
C     N1,N2 DESIGNATE REF AND OTHER CH
C     NF=NUMBER OF FREQS
C     NS=SELECTED NORMALIZATION FREQ
      DIMENSION NC(4),DA(8,10),A(4,30),P(4,30),C(4,2)
      COMPLEX A1(101),A2(101)
      COMPLEX SS(101)
      COMMON/A/A1,A2,II,SS,IR,FY,CPT,IS
      COMPLEX CC
      COMPLEX CPT
      DIMENSION FY(101),FX(101)
C
      REWIND 9
      JI=IS*2
      JF=8
      NC(1)=N1*2-1
      NC(2)=N1*2
      NC(3)=N2*2-1
      NC(4)=N2*2
      IF(IS.EQ.1) NC(2)=N2
      IF(IS.EQ.1) NC(1)=N1
      DO 1 M=1,NF
      DO 2 K=1,JF
2     READ(9,8) KK,F,(DA(K,J),J=1,JF)
      AC=DA(1,1)
      PC=DA(5,1)
      FX(M)=F
      J2=JF/2
      DO 3 I=1,JI
      N=(NC(I)-1)/JF+1
      JJ=MOD(NC(I)-1,JF)+1
      A(I,M)=DA(N    ,JJ)
      P(I,M)=DA(N+J2,JJ)
      IF(N.EQ.1.AND.JJ.EQ.1) GO TO 7
      A(I,M)=A(I,M)+AC
      P(I,M)=P(I,M)+PC
7     CONTINUE
3     CONTINUE
1     CONTINUE
      DO 30 I=1,NF
      FY(I)=-FX(NF+1-I)
30    FY(NF+I)=FX(I)
      DO 6 I=1,JI
      C(I,1)=A(I,NS)
6     C(I,2)=P(I,NS)
```

```
C
      DO 4 J=1,NF
      DO 5 I=1,J1
      A(I,J)=A(I,J)+C(I,1)
      P(I,J)=P(I,J)+C(I,2)
      IF(II.EQ.2)P(I,J)=P(I,J)+90.
 5    CONTINUE
 20   FORMAT(/)
 4    CONTINUE
      PRINT 20
      DO 10 M=1,NF
      DO 10 N=1,2
      AMP=10.**(A(N,M)/20.)
      AI=AMP                *COS(P(N,M)*RAD)
      L=N+1
      IF(IB.EQ.2) AQ=10.**(A(L,M)/20.)*COS(P(L,M)*RAD)
      IF(IB.EQ.1) AQ=AMP*SIN(P(N,M)*RAD)
      IF(N.EQ.2) GO TO 11
      CC=CMPLX(AI,AQ)
      R1(NF+1-M)=CONJG(CC)
      R1(NF+M)=CC
      GO TO 10
 11   CONTINUE
      CC=CMPLX(AI,AQ)
      R2(NF+1-M)=CONJG(CC)
      R2(NF+M)=CC
 10     CONTINUE
 8    FORMAT(I1,F5.0,8F9.4)
 9    FORMAT(1X,8F9.4)
 21   FORMAT(1X,8E12.5)
      RETURN
      END
      SUBROUTINE FILPLT(SP,A,N,NP,NT,B,TAU,CP,NF,N1,N2)
*     B1=BUTTERWORTH FILTER, REFERENCE CHANNEL 1
*     B2=BUTTERWORTH FILTER,CHANNEL 2
*     C1=OVERALL CHANNEL 1 RESPONSE
*     C2=OVERALL CHANNEL 2 RESPONSE
      DIMENSION FY(101)
      COMMON/A/B1,B2,IXT,II,SS,IR,FY,CPT,IS
      COMPLEX CPT
      COMPLEX A(2,10),SP(2,10),N(2,20),B1(101),B2(101),C1(101),C2(101)
      COMPLEX SS(101)
      COMPLEX CP,S
      COMPLEX FRESP
      COMPLEX AAA
      R1=R2=R3=R4=RP1=RP2=0.
      AMPTOT1=AMPTOT2=0.
      III=II-1
      PRINT 900,N1,N2,NT
900   FORMAT(*  CORRECTION FILTER FOR RECEIVERS *,I2,* AND *,
     1I2,* WITH *,I2,* TAPS *)
      PRINT 901,TAU
901   FORMAT(*  FOR A TAP SPACING OF *,F9.4,* SECS. *)
      PRINT 902
902   FORMAT(* FREQ      PHASE        AMPLITUDE        TOTAL       FILTER
     1FILTER  *)
      PRINT 903
903   FORMAT(*           ERROR          ERROR          MS ERROR      PHASE
     1 AMPL.  *)
      PRINT 904
904   FORMAT(* (HZ)    (DEGREES)         (DB)         (DB POWER)  (DEGREES)
     1  (DB)  *)
```

```
905   FORMAT(*      BEFORE AFTER  BEFORE AFTER  BEFORE AFTER *)
      PRINT 905
      DO 10 K=1,II
      IF(IR.EQ.1) GO TO 1
      FREQ=A+2.*B*(K-1)/III
      FY(K)=FREQ
      A=2.*CP*FREQ
      S=S(K)=S
      B1(K)=B2(K)=0.
      DO 11 N=1,NP
      B1(K)=B1(K)+A(1,N)/(S-SP(1,N))
      B2(K)=B2(K)+A(2,N)/(S-SP(2,N))
   11 CONTINUE
      GO TO 2
 1    CONTINUE
      FREQ=FY(K)
 2    CONTINUE
      IF(FREQ.LE.0.) GO TO 10
      C1(K)=C2(K)=0.
      DO 12 N=1,NT
      C1(K)=C1(K)+CEXP(-CPT*FREQ*N)*W(1,N)
      C2(K)=C2(K)+CEXP(-CPT*FREQ*N)*W(2,N)
   12 CONTINUE
      C1(K)=C1(K)*B1(K)
      C2(K)=C2(K)*B2(K)
      R1=R1+CABS(B1(K)-B2(K))**2
      R2=R2+CABS(C1(K)-C2(K))**2
      R3=R3+CABS(B1(K))**2
      R4=R4+CABS(C1(K))**2
      A1=CABS(B1(K))
      A2=CABS(B2(K))
      AMPTOT1=(A2/A1-1.)**2+AMPTOT1
      A3=CABS(C1(K))
      A4=CABS(C2(K))
      AMPTOT2=(A4/A3-1.)**2+AMPTOT2
      P1=REAL(B1(K))
      IF(P1.EQ.0.)P1=1000000.
      P1=ATAN2(AIMAG(B1(K)),P1)
      P2=REAL(B2(K))
      IF(P2.EQ.0.)P2=1000000.
      P2=ATAN2(AIMAG(B2(K)),P2)
      P3=REAL(C1(K))
      IF(P3.EQ.0.)P3=1000000.
      P3=ATAN2(AIMAG(C1(K)),P3)
      P4=REAL(C2(K))
      IF(P4.EQ.0.)P4=1000000.
      P4=ATAN2(AIMAG(C2(K)),P4)
      B5=B/2.
      IF(FREQ.LT.-B5 .OR.FREQ.GT.B5 ) GO TO 30
      RP1=RP1+(P1-P2)**2
      RP2=RP2+(P3-P4)**2
   30 CONTINUE
      ADB1=20.*ALOG10(A2/A1)
      ADB2=20.*ALOG10(A4/A3)
      APH1=(P2-P1)*57.2958
      APH2=(P4-P3)*57.2958
      ATOT1=CABS(B2(K)-B1(K))
      IF(ATOT1.LE.1.E-10) ATOT1=1.E-10
      ATOT1=20.*ALOG10(ATOT1)
      ATOT2=CABS(C2(K)-C1(K))
      IF(ATOT2.LE.1.E-10) ATOT2=1.E-10
      ATOT2=20.*ALOG10(ATOT2)
```

```
      FRESP=0.
      EE=ALOG(10.)
      DO 950 KK=1,NT
      PI=3.14159265
      AA=-1.*FLOAT(KK-1)*2.*PI*FREQ*TAU
      AAA=CMPLX(COS(AA),SIN(AA))
950   FRESP=W(2,KK)*AAA+FRESP
      WT=2.*PI*FREQ*TAU
      FILPH=APH2-APH1
      FILAMP=CABS(FRESP)
      IF(FILAMP.LE.1.E-10) FILAMP=1.E-10
      FILAMP=20.*ALOG10(FILAMP)
      PRINT 906,FREQ,APH1,APH2,ADB1,ADB2,ATOT1,ATOT2,FILPH,FILAMP
906   FORMAT(1X,F5.1,6F7.2,2F9.2)
10    CONTINUE
      AMPTOT1=20.*ALOG10(SQRT(AMPTOT1/FLOAT(NF))+1.)
      AMPTOT2=20.*ALOG10(SQRT(AMPTOT2/FLOAT(NF))+1.)
      RA1=10.*ALOG10(R1/R3)
      RA2=10.*ALOG10(R2/R4)
      RP1=180./PI*SQRT(RP1/FLOAT(NF))
      RP2=180./PI*SQRT(RP2/FLOAT(NF))
      RRR=RA1-RA2
      PRINT 907,RP1,RP2,AMPTOT1,AMPTOT2,RA1,RA2
907   FORMAT(* TOTAL*,6F7.2)
      PRINT 908,RRR
908   FORMAT(* NET REDUCTION OF MISMATCH ERROR= *,F7.2,*DB.*)
      RETURN
      END
```

APPENDIX G
EQUALIZATION FILTER DESIGN RESULTS

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00460	-.00000
2	1.00000	0.00000	1.01249	.00000
3	0.00000	0.00000	-.00462	.00000
4	0.00000	0.00000	-.00394	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 2 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.48	-.33	-.13	-.12	-35.40	-36.76	.15	.01
20.0	-.68	-.49	-.13	-.11	-34.29	-36.44	.19	.02
25.0	-.79	-.58	-.12	-.08	-34.45	-37.47	.21	.04
30.0	-.86	-.64	-.11	-.06	-35.02	-38.61	.22	.05
35.0	-.89	-.67	-.09	-.02	-35.12	-38.90	.22	.07
40.0	-.81	-.60	-.07	.02	-35.89	-39.32	.20	.08
45.0	-.68	-.51	-.05	.05	-37.76	-39.43	.17	.10
50.0	-.63	-.50	-.02	.09	-39.62	-37.97	.13	.12
55.0	-.34	-.25	-.02	.11	-44.81	-37.76	.08	.13
60.0	0.00	.03	0.00	.14	-200.00	-35.74	.03	.14
65.0	.30	.27	-.01	.14	-45.32	-35.43	-.03	.15
70.0	.60	.52	-.04	.12	-39.44	-35.93	-.08	.16
75.0	.88	.75	-.07	.09	-35.73	-36.13	-.13	.16
80.0	1.16	.99	-.14	.03	-31.66	-35.00	-.17	.17
85.0	1.15	.95	-.22	-.05	-29.88	-35.04	-.20	.17
90.0	.91	.69	-.30	-.13	-29.28	-35.11	-.22	.17
95.0	.29	.07	-.33	-.17	-30.16	-36.18	-.22	.17
100.0	-.27	-.48	-.33	-.16	-30.73	-36.06	-.21	.17
105.0	-.81	-.99	-.26	-.10	-33.26	-37.29	-.19	.16
110.0	-.96	-1.11	-.17	-.01	-37.68	-40.05	-.15	.16
TOTAL	.45	.33	.16	.10	-33.32	-36.09		

NET REDUCTION OF MISMATCH ERROR= 2.77DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00973	.00000
2	1.00000	0.00000	1.01715	-.00000
3	0.00000	0.00000	-.01540	.00000
4	0.00000	0.00000	-.00162	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 3 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.10	-.92	-.07	-.13	-33.90	-33.37	.18	-.06
20.0	-1.19	-.96	-.07	-.12	-32.90	-33.26	.24	-.05
25.0	-1.28	-1.00	-.06	-.09	-32.75	-34.01	.28	-.03
30.0	-1.22	-.90	-.04	-.05	-34.11	-36.35	.32	-.01
35.0	-1.15	-.81	-.02	-.01	-34.27	-37.36	.34	.01
40.0	-1.01	-.66	-.01	.03	-34.98	-38.42	.36	.04
45.0	-.84	-.48	.00	.07	-36.69	-38.88	.36	.06
50.0	-.61	-.25	.01	.10	-40.14	-38.66	.36	.09
55.0	-.31	.04	.01	.13	-45.75	-37.07	.35	.12
60.0	0.00	.33	0.00	.15	-200.00	-34.82	.33	.15
65.0	.36	.67	-.03	.15	-43.09	-33.59	.31	.17
70.0	.70	.98	-.07	.13	-37.03	-33.39	.28	.20
75.0	.90	1.23	-.15	.08	-33.02	-33.17	.25	.22
80.0	1.07	1.29	-.24	.00	-29.46	-32.86	.22	.25
85.0	.85	1.03	-.35	-.09	-27.32	-33.66	.18	.27
90.0	.26	.42	-.46	-.17	-26.46	-34.39	.15	.29
95.0	-.69	-.57	-.50	-.20	-26.65	-33.99	.13	.30
100.0	-1.77	-1.68	-.47	-.16	-26.48	-31.53	.10	.32
105.0	-2.51	-2.43	-.36	-.04	-28.08	-30.96	.08	.33
110.0	-2.81	-2.76	-.23	.11	-31.01	-31.83	.05	.34
TOTAL	1.24	1.17	.23	.11	-30.39	-33.33		

NET REDUCTION OF MISMATCH ERROR= 2.94DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00244	-.00000
2	1.00000	0.00000	1.00468	.00000
3	0.00000	0.00000	-.00517	.00000
4	0.00000	0.00000	-.00142	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 4 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.28	-.17	.01	-.02	-46.41	-48.14	.11	-.03
20.0	-.36	-.22	-.00	-.02	-43.86	-46.44	.14	-.02
25.0	-.41	-.24	-.00	-.02	-43.01	-46.76	.17	-.02
30.0	-.43	-.24	-.01	-.02	-43.24	-47.35	.19	-.01
35.0	-.44	-.24	-.01	-.01	-42.67	-47.89	.20	.00
40.0	-.38	-.17	-.01	.01	-43.55	-50.22	.21	.01
45.0	-.30	-.10	-.01	.02	-45.58	-52.31	.20	.02
50.0	-.35	-.15	.00	.03	-45.08	-47.68	.20	.03
55.0	-.17	.02	-.00	.03	-51.19	-46.45	.18	.04
60.0	0.00	.17	0.00	.05	-200.00	-43.99	.17	.05
65.0	.13	.28	-.02	.04	-50.67	-43.32	.14	.06
70.0	.23	.35	-.04	.03	-45.22	-43.71	.12	.06
75.0	.28	.37	-.06	.01	-42.27	-44.05	.10	.07
80.0	.35	.42	-.10	-.02	-37.81	-42.06	.08	.08
85.0	.22	.27	-.13	-.05	-36.30	-42.74	.06	.08
90.0	-.04	-.00	-.16	-.07	-35.63	-42.38	.04	.08
95.0	-.49	-.46	-.14	-.06	-36.42	-41.47	.03	.09
100.0	-.73	-.71	-.11	-.02	-37.24	-40.14	.01	.09
105.0	-.93	-.92	-.04	.05	-39.05	-38.81	.01	.09
110.0	-.83	-.83	.04	.13	-42.26	-39.47	.00	.09
TOTAL	.43	.40	.07	.04	-40.03	-42.81		

NET REDUCTION OF MISMATCH ERROR= 2.78DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.01663	-.00000
2	1.00000	0.00000	1.01125	-.00000
3	0.00000	0.00000	-.02052	.00000
4	0.00000	0.00000	-.00335	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 5 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.06	-.85	.14	-.09	-32.38	-35.28	.22	-.23
20.0	-1.14	-.87	.12	-.08	-32.07	-34.89	.28	-.20
25.0	-1.13	-.81	.11	-.06	-32.61	-36.00	.32	-.17
30.0	-1.03	-.68	.10	-.04	-34.24	-38.72	.35	-.14
35.0	-.92	-.55	.09	-.02	-34.87	-40.60	.37	-.10
40.0	-.77	-.41	.07	.01	-35.89	-42.76	.36	-.06
45.0	-.61	-.25	.06	.04	-38.01	-44.04	.35	-.02
50.0	-.46	-.14	.04	.06	-41.24	-42.88	.32	.02
55.0	-.21	.08	.02	.09	-47.41	-40.41	.29	.06
60.0	0.00	.20	0.00	.11	-200.00	-37.74	.24	.11
65.0	.25	.45	-.04	.11	-44.46	-36.45	.20	.15
70.0	.49	.63	-.08	.10	-38.52	-36.22	.15	.18
75.0	.73	.82	-.14	.08	-34.49	-35.90	.10	.22
80.0	.80	.86	-.22	.03	-30.86	-36.11	.05	.25
85.0	.74	.76	-.31	-.03	-28.46	-37.17	.01	.28
90.0	.43	.41	-.40	-.10	-27.39	-37.99	-.02	.30
95.0	-.20	-.23	-.47	-.14	-27.36	-37.24	-.04	.32
100.0	-.98	-1.03	-.49	-.14	-27.05	-34.48	-.05	.34
105.0	-1.81	-1.69	-.45	-.09	-28.33	-33.67	-.05	.36
110.0	-2.01	-2.06	-.38	-.01	-31.01	-34.70	-.05	.37
TOTAL	.92	.84	.24	.08	-50.98	-36.17		

NET REDUCTION OF MISMATCH ERROR= 5.19DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.01461	.00000
2	1.00000	0.00000	1.01480	-.00000
3	0.00000	0.00000	-.02009	.00000
4	0.00000	0.00000	-.00493	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 6 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.67	-1.36	.04	-.14	-30.81	-31.16	.32	-.18
20.0	-1.59	-1.20	.04	-.12	-30.83	-32.00	.40	-.16
25.0	-1.48	-1.02	.04	-.09	-31.63	-33.92	.46	-.13
30.0	-1.37	-.87	.03	-.06	-33.13	-36.43	.50	-.09
35.0	-1.24	-.72	.04	-.02	-33.47	-38.31	.52	-.06
40.0	-1.04	-.52	.04	.02	-34.53	-40.47	.52	-.01
45.0	-.80	-.30	.03	.06	-36.81	-41.27	.50	.03
50.0	-.69	-.23	.03	.10	-38.75	-38.91	.46	.07
55.0	-.34	.07	.01	.12	-44.86	-37.38	.41	.11
60.0	0.00	.34	0.00	.15	-200.00	-34.64	.34	.15
65.0	.32	.59	-.04	.15	-42.93	-33.81	.27	.19
70.0	.60	.80	-.09	.13	-37.13	-34.14	.20	.22
75.0	.83	.96	-.15	.10	-33.45	-34.37	.13	.25
80.0	1.06	1.12	-.25	.03	-29.37	-35.91	.06	.28
85.0	.96	.97	-.35	-.05	-27.22	-34.87	.01	.30
90.0	.59	.56	-.46	-.14	-26.22	-35.29	-.03	.32
95.0	-.23	-.30	-.53	-.19	-26.35	-34.90	-.06	.34
100.0	-1.02	-1.10	-.54	-.19	-26.22	-33.03	-.08	.35
105.0	-1.86	-1.94	-.48	-.12	-27.63	-32.35	-.08	.36
110.0	-2.23	-2.30	-.39	-.02	-30.58	-33.73	-.07	.37
TOTAL	1.15	1.02	.25	.11	-29.91	-33.86		

NET REDUCTION OF MISMATCH ERROR= 3.95DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.01011	.00000
2	1.00000	0.00000	1.01651	-.00000
3	0.00000	0.00000	-.01496	-.00000
4	0.00000	0.00000	-.00078	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 7 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.86	-.72	-.05	-.11	-36.34	-35.30	.13	-.06
20.0	-.90	-.81	-.05	-.10	-34.75	-34.72	.17	-.05
25.0	-1.06	-.85	-.04	-.08	-34.49	-35.37	.21	-.03
30.0	-1.02	-.78	-.03	-.05	-35.70	-37.56	.24	-.02
35.0	-.90	-.74	-.02	-.01	-35.55	-38.17	.26	.01
40.0	-.91	-.63	-.01	.02	-35.95	-38.93	.27	.03
45.0	-.74	-.46	-.00	.05	-37.80	-39.86	.28	.05
50.0	-.55	-.26	.01	.09	-41.05	-39.78	.29	.08
55.0	-.29	-.00	.01	.11	-46.51	-38.13	.29	.11
60.0	0.00	.28	0.00	.14	-200.00	-35.67	.28	.14
65.0	.34	.61	-.03	.14	-43.54	-34.34	.27	.16
70.0	.67	.92	-.07	.12	-37.31	-34.03	.25	.19
75.0	.90	1.22	-.14	.07	-33.14	-33.36	.23	.21
80.0	1.04	1.25	-.24	.00	-29.71	-33.14	.21	.24
85.0	.79	.98	-.35	-.09	-27.52	-33.94	.19	.26
90.0	.20	.37	-.44	-.16	-26.69	-34.70	.16	.28
95.0	-.77	-.63	-.49	-.19	-26.83	-34.14	.14	.30
100.0	-1.81	-1.69	-.45	-.13	-26.78	-31.77	.12	.31
105.0	-2.60	-2.51	-.33	-.01	-28.24	-30.72	.09	.32
110.0	-2.86	-2.79	-.19	.14	-31.17	-31.53	.07	.33
TOTAL	1.20	1.15	.21	.10	-30.83	-33.84		

NET REDUCTION OF MISMATCH ERROR= 3.01DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00425	-.00000
2	1.00000	0.00000	1.00118	-.00000
3	0.00000	0.00000	.00356	.00000
4	0.00000	0.00000	-.00536	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 8 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.59	-.37	-.10	-.06	-36.68	-41.00	.22	.04
20.0	-.55	-.27	-.09	-.04	-37.01	-43.09	.28	.04
25.0	-.53	-.21	-.08	-.03	-38.00	-46.50	.31	.05
30.0	-.56	-.22	-.08	-.02	-38.53	-47.73	.33	.06
35.0	-.52	-.19	-.06	.00	-39.21	-50.00	.33	.06
40.0	-.43	-.12	-.05	.02	-40.53	-50.59	.31	.07
45.0	-.34	-.07	-.04	.03	-42.71	-48.80	.27	.07
50.0	-.37	-.15	-.02	.05	-44.04	-45.03	.22	.07
55.0	-.18	-.03	-.02	.05	-49.22	-45.43	.15	.07
60.0	0.00	.08	0.00	.06	-200.00	-42.95	.08	.06
65.0	.15	.15	-.00	.05	-51.70	-44.21	.00	.05
70.0	.25	.17	-.01	.03	-47.54	-46.83	-.07	.04
75.0	.33	.19	-.01	.02	-45.18	-49.14	-.14	.03
80.0	.43	.23	-.03	-.02	-41.69	-46.99	-.20	.01
85.0	.42	.18	-.03	-.04	-41.53	-45.18	-.25	-.01
90.0	.36	.09	-.04	-.06	-43.07	-43.64	-.27	-.02
95.0	.18	-.11	-.01	-.05	-51.75	-46.28	-.28	-.04
100.0	.24	-.03	.03	-.03	-47.29	-51.75	-.27	-.06
105.0	.27	.03	.08	.01	-43.15	-64.76	-.24	-.07
110.0	.56	.36	.13	.04	-40.88	-48.00	-.20	-.09
TOTAL	.40	.19	.06	.04	-40.79	-45.16		

NET REDUCTION OF MISMATCH ERROR= 4.36DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.01175	-.00000
2	1.00000	0.00000	1.01390	.00000
3	0.00000	0.00000	-.01246	-.00000
4	0.00000	0.00000	-.00240	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 9 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.56	-.44	-.01	-.10	-40.41	-37.55	.11	-.09
20.0	-.76	-.61	-.02	-.09	-37.42	-36.24	.14	-.07
25.0	-.86	-.69	-.02	-.08	-36.59	-36.06	.16	-.06
30.0	-.83	-.67	-.02	-.05	-37.52	-38.53	.17	-.03
35.0	-.81	-.65	-.01	-.02	-37.33	-39.16	.17	-.01
40.0	-.74	-.58	-.01	.01	-37.68	-39.72	.16	.02
45.0	-.63	-.48	-.00	.04	-39.30	-40.18	.14	.04
50.0	-.48	-.36	.00	.08	-42.23	-40.07	.12	.07
55.0	-.24	-.15	.00	.10	-48.18	-38.69	.09	.10
60.0	0.00	.06	0.00	.13	-200.00	-36.00	.06	.13
65.0	.32	.34	-.02	.15	-44.55	-35.49	.02	.15
70.0	.64	.65	-.06	.12	-38.33	-35.56	-.01	.18
75.0	.90	.95	-.11	.09	-34.05	-34.63	-.04	.20
80.0	1.13	1.06	-.19	.03	-30.56	-34.34	-.07	.22
85.0	1.07	.99	-.29	-.05	-28.48	-34.79	-.09	.24
90.0	.70	.60	-.38	-.13	-27.65	-35.60	-.10	.25
95.0	-.00	-.11	-.44	-.17	-27.87	-35.82	-.11	.27
100.0	-.84	-.94	-.44	-.16	-27.91	-34.35	-.10	.28
105.0	-1.52	-1.61	-.38	-.09	-29.58	-34.06	-.09	.29
110.0	-1.86	-1.93	-.29	.01	-32.66	-35.25	-.08	.30
TOTAL	.87	.83	.20	.10	-32.04	-35.55		

NET REDUCTION OF MISMATCH ERROR= 3.51DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00004	-.00000
2	1.00000	0.00000	1.00670	.00000
3	0.00000	0.00000	.00143	-.00000
4	0.00000	0.00000	-.00595	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 10 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.60	-.40	-.15	-.10	-34.87	-37.58	.20	.03
20.0	-.65	-.41	-.13	-.08	-34.62	-38.33	.25	.04
25.0	-.67	-.39	-.11	-.06	-35.39	-40.50	.28	.05
30.0	-.71	-.43	-.11	-.04	-36.02	-41.82	.28	.06
35.0	-.71	-.44	-.09	-.01	-36.34	-42.55	.27	.08
40.0	-.62	-.38	-.07	.02	-37.42	-43.04	.24	.09
45.0	-.50	-.31	-.05	.04	-39.57	-42.81	.19	.10
50.0	-.40	-.37	-.03	.07	-41.44	-40.13	.12	.10
55.0	-.24	-.19	-.02	.09	-46.85	-40.16	.05	.11
60.0	0.00	-.04	0.00	.11	-200.00	-37.92	-.04	.11
65.0	.23	.11	-.00	.10	-47.72	-38.2[illegible]	-.12	.11
70.0	.46	.26	-.01	.09	-42.21	-39.4[illegible]	-.20	.10
75.0	.68	.41	-.03	.07	-38.85	-39.98	-.27	.10
80.0	.94	.50	-.06	.02	-34.86	-39.19	-.33	.09
85.0	1.00	.62	-.10	-.03	-33.55	-38.82	-.37	.07
90.0	.94	.54	-.15	-.09	-33.31	-37.92	-.39	.06
95.0	.61	.22	-.16	-.12	-35.19	-38.94	-.39	.05
100.0	.42	.05	-.16	-.12	-36.51	-39.17	-.37	.03
105.0	.15	-.18	-.11	-.09	-41.17	-42.62	-.33	.02
110.0	.19	-.07	-.06	-.05	-48.46	-50.72	-.26	.01
TOTAL	.60	.36	.09	.08	-36.43	-39.15		

NET REDUCTION OF MISMATCH ERROR= 2.72DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00847	-.00000
2	1.00000	0.00000	1.00978	.00000
3	0.00000	0.00000	-.00959	-.00000
4	0.00000	0.00000	-.00226	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 11 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.46	-.55	.00	-.07	-42.51	-40.32	.11	-.08
20.0	-.61	-.47	-.00	-.07	-39.37	-38.87	.14	-.06
25.0	-.68	-.52	-.01	-.06	-38.54	-39.13	.16	-.05
30.0	-.67	-.50	-.01	-.04	-39.45	-41.14	.17	-.03
35.0	-.67	-.49	-.00	-.01	-39.00	-41.55	.18	-.01
40.0	-.71	-.49	-.00	.01	-39.45	-42.21	.17	.01
45.0	-.51	-.35	.00	.03	-41.10	-42.81	.16	.03
50.0	-.37	-.24	.00	.06	-44.44	-42.93	.13	.05
55.0	-.19	-.08	.00	.08	-50.08	-41.59	.11	.07
60.0	0.00	.08	0.00	.09	-200.00	-39.19	.08	.09
65.0	.24	.30	-.02	.10	-46.22	-38.13	.05	.11
70.0	.50	.51	-.04	.09	-40.52	-37.78	.01	.13
75.0	.77	.75	-.09	.06	-36.24	-37.06	-.02	.15
80.0	.83	.79	-.14	.02	-33.08	-37.00	-.04	.16
85.0	.74	.67	-.22	-.04	-31.06	-37.88	-.06	.18
90.0	.44	.36	-.28	-.10	-30.28	-38.50	-.08	.19
95.0	-.11	-.19	-.32	-.13	-30.57	-38.41	-.08	.20
100.0	-.72	-.80	-.31	-.11	-30.70	-36.72	-.08	.20
105.0	-1.15	-1.22	-.26	-.05	-32.65	-36.71	-.08	.21
110.0	-1.30	-1.37	-.18	.03	-36.13	-38.14	-.06	.21
TOTAL	.66	.62	.15	.07	-34.64	-38.19		

NET REDUCTION OF MISMATCH ERROR 3.5508.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00805	-.00000
2	1.00000	0.00000	1.00808	.00000
3	0.00000	0.00000	-.00742	-.00000
4	0.00000	0.00000	-.00306	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 12 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.18	-.07	.03	-.05	-47.15	-45.55	.11	-.07
20.0	-.36	-.25	.01	-.05	-43.66	-42.98	.13	-.06
25.0	-.45	-.31	.00	-.04	-42.11	-42.82	.15	-.05
30.0	-.51	-.36	-.01	-.04	-41.68	-42.85	.15	-.03
35.0	-.53	-.38	-.01	-.02	-41.05	-43.34	.15	-.01
40.0	-.47	-.34	-.01	-.00	-41.51	-44.40	.13	.01
45.0	-.40	-.30	-.01	.02	-42.90	-45.13	.10	.03
50.0	-.46	-.39	-.01	.04	-42.53	-42.08	.07	.05
55.0	-.22	-.19	-.01	.06	-48.74	-42.90	.03	.07
60.0	0.00	-.01	0.00	.09	-200.00	-39.87	-.01	.09
65.0	.21	.15	-.01	.09	-47.98	-39.38	-.06	.10
70.0	.42	.33	-.04	.08	-41.82	-39.65	-.10	.12
75.0	.50	.40	-.07	.06	-38.38	-39.79	-.13	.13
80.0	.42	.66	-.12	.02	-33.86	-38.55	-.16	.14
85.0	.84	.65	-.18	-.03	-31.92	-38.48	-.18	.15
90.0	.63	.44	-.24	-.08	-31.19	-38.86	-.20	.16
95.0	.15	-.04	-.27	-.11	-31.88	-39.77	-.20	.16
100.0	-.23	-.41	-.27	-.10	-32.39	-39.54	-.18	.17
105.0	-.63	-.73	-.22	-.05	-34.75	-40.06	-.16	.17
110.0	-.78	-.89	-.15	.02	-39.08	-41.86	-.13	.17
TOTAL	.50	.44	.13	.06	-36.11	-40.20		

NET REDUCTION OF MISMATCH ERRORS 4.09DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00260	.00000
2	1.00000	0.00000	1.00515	-.00000
3	0.00000	0.00000	-.00604	-.00000
4	0.00000	0.00000	-.00136	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 13 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.40	-.36	-.00	-.03	-41.62	-42.79	.13	-.03
20.0	-.54	-.38	-.00	-.03	-40.36	-42.57	.16	-.03
25.0	-.54	-.35	-.00	-.02	-40.51	-43.42	.19	-.02
30.0	-.51	-.30	-.00	-.01	-41.77	-45.99	.21	-.01
35.0	-.40	-.25	-.00	-.00	-41.82	-47.26	.23	-.00
40.0	-.42	-.20	-.00	.01	-42.37	-48.84	.24	.01
45.0	-.36	-.11	.00	.02	-40.30	-49.65	.24	.02
50.0	-.26	-.02	.00	.03	-47.81	-49.37	.23	.03
55.0	-.13	.09	.00	.04	-53.61	-46.02	.22	.04
60.0	0.00	.20	0.00	.05	-200.00	-43.16	.20	.05
65.0	.16	.30	-.01	.05	-49.99	-41.74	.18	.06
70.0	.20	.45	-.03	.04	-44.36	-41.54	.16	.07
75.0	.29	.43	-.07	.01	-41.42	-42.84	.14	.08
80.0	.38	.49	-.10	-.02	-37.19	-40.91	.12	.08
85.0	.29	.32	-.15	-.06	-35.22	-41.31	.09	.09
90.0	-.12	-.05	-.18	-.08	-34.60	-41.31	.07	.09
95.0	-.57	-.52	-.17	-.07	-35.11	-40.20	.06	.10
100.0	-.96	-.92	-.12	-.02	-34.42	-37.92	.04	.10
105.0	-1.19	-1.16	-.05	.06	-36.95	-36.95	.03	.10
110.0	-1.09	-1.07	.03	.14	-40.06	-37.92	.02	.11
TOTAL	.55	.51	.07	.05	-38.62	-41.03		

NET REDUCTION OF MISMATCH ERRORS = 2.420B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.01159	.00000
2	1.00000	0.00000	1.01921	-.00000
3	0.00000	0.00000	-.01458	.00000
4	0.00000	0.00000	-.00029	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 14 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.28	-.21	-.08	-.12	-40.11	-36.95	.07	-.05
20.0	-.66	-.56	-.08	-.11	-36.65	-35.77	.10	-.03
25.0	-.87	-.75	-.07	-.08	-35.49	-35.85	.12	-.02
30.0	-1.01	-.88	-.06	-.06	-35.25	-36.31	.13	.00
35.0	-1.04	-.89	-.04	-.02	-34.97	-36.51	.15	.02
40.0	-.94	-.78	-.03	.02	-35.55	-37.20	.16	.05
45.0	-.78	-.61	-.02	.06	-37.33	-38.10	.17	.07
50.0	-.70	-.53	.00	.10	-38.97	-37.30	.17	.10
55.0	-.36	-.19	-.00	.12	-44.59	-37.19	.17	.13
60.0	0.00	.17	0.00	.15	-200.00	-34.84	.17	.15
65.0	.36	.52	-.03	.15	-42.92	-33.98	.17	.18
70.0	.68	.84	-.08	.13	-37.16	-33.90	.16	.21
75.0	.96	1.11	-.14	.09	-33.23	-33.64	.15	.24
80.0	1.18	1.32	-.24	.02	-29.17	-32.63	.14	.26
85.0	1.04	1.16	-.35	-.07	-27.06	-33.14	.13	.29
90.0	.55	.66	-.47	-.16	-26.08	-33.84	.11	.31
95.0	-.41	-.31	-.55	-.20	-26.33	-34.40	.10	.33
100.0	-1.33	-1.25	-.52	-.17	-26.32	-32.85	.08	.34
105.0	-2.21	-2.15	-.43	-.07	-27.84	-31.91	.07	.36
110.0	-2.56	-2.51	-.30	.07	-30.94	-32.79	.05	.37
TOTAL	1.08	1.05	.24	.11	-30.48	-33.89		

NET REDUCTION OF MISMATCH ERROR= 3.42DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00945	.00000
2	1.00000	0.00000	1.01944	-.00000
3	0.00000	0.00000	-.01134	-.00000
4	0.00000	0.00000	-.00195	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 15 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.53	-.41	-.14	-.15	-34.80	-34.67	.12	-.01
20.0	-.86	-.72	-.14	-.14	-33.15	-33.90	.15	.00
25.0	-1.06	-.89	-.12	-.10	-32.80	-34.24	.17	.02
30.0	-1.13	-.95	-.10	-.06	-33.69	-35.70	.19	.04
35.0	-1.13	-.94	-.08	-.02	-33.74	-36.04	.19	.06
40.0	-1.05	-.86	-.05	.03	-34.23	-36.21	.19	.08
45.0	-.89	-.71	-.03	.07	-36.05	-36.54	.18	.10
50.0	-.67	-.50	-.01	.11	-39.37	-36.73	.17	.13
55.0	-.35	-.20	-.00	.15	-44.94	-35.68	.15	.15
60.0	0.00	.12	0.00	.17	-200.00	-33.90	.12	.17
65.0	.41	.51	-.02	.17	-42.33	-33.09	.09	.19
70.0	.83	.90	-.06	.15	-36.27	-32.98	.06	.22
75.0	1.25	1.28	-.13	.10	-32.18	-32.41	.04	.24
80.0	1.39	1.41	-.23	.02	-28.92	-32.03	.01	.25
85.0	1.26	1.25	-.35	-.08	-26.90	-32.49	-.01	.27
90.0	.77	.74	-.46	-.18	-26.16	-33.12	-.03	.28
95.0	-.15	-.18	-.52	-.22	-26.52	-33.61	-.04	.29
100.0	-1.18	-1.22	-.50	-.20	-26.66	-32.40	-.04	.30
105.0	-2.01	-2.05	-.41	-.10	-28.36	-32.12	-.04	.31
110.0	-2.34	-2.37	-.28	.04	-31.59	-33.41	-.04	.32
TOTAL	1.11	1.07	.24	.13	-30.25	-33.12		

NET REDUCTION OF MISMATCH ERROR= 2.88DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00784	.00000
2	1.00000	0.00000	1.01637	.00000
3	0.00000	0.00000	-.00818	-.00000
4	0.00000	0.00000	-.00263	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 16 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.45	-.54	-.13	-.13	-35.85	-36.07	.11	-.00
20.0	-.60	-.56	-.12	-.12	-34.50	-35.59	.14	.01
25.0	-.83	-.68	-.11	-.09	-34.46	-36.32	.15	.02
30.0	-.91	-.75	-.10	-.06	-34.91	-37.32	.16	.04
35.0	-.93	-.77	-.08	-.02	-35.00	-37.66	.16	.06
40.0	-.86	-.71	-.06	.02	-35.58	-37.96	.15	.08
45.0	-.72	-.59	-.04	.06	-37.51	-38.40	.13	.10
50.0	-.67	-.56	-.02	.10	-39.28	-37.20	.11	.12
55.0	-.34	-.27	-.01	.12	-44.84	-37.03	.07	.14
60.0	0.00	.04	0.00	.15	-200.00	-34.90	.04	.15
65.0	.33	.33	-.02	.15	-44.17	-34.43	.00	.17
70.0	.68	.64	-.05	.14	-38.11	-34.61	-.04	.19
75.0	.97	.90	-.10	.10	-34.48	-34.58	-.07	.20
80.0	1.26	1.16	-.18	.03	-30.42	-33.58	-.10	.21
85.0	1.26	1.14	-.27	-.05	-28.38	-35.60	-.12	.22
90.0	.93	.60	-.37	-.14	-27.58	-34.08	-.13	.23
95.0	.18	.05	-.43	-.19	-28.05	-34.90	-.13	.24
100.0	-.56	-.69	-.43	-.19	-28.23	-34.30	-.13	.24
105.0	-1.30	-1.42	-.37	-.12	-30.09	-34.57	-.11	.25
110.0	-1.64	-1.73	-.26	-.01	-33.55	-36.19	-.09	.25
TOTAL	.87	.82	.21	.11	-31.77	-34.74		

NET REDUCTION OF MISMATCH ERROR= 2.970B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00450	.00000
2	1.00000	0.00000	1.00924	.00000
3	0.00000	0.00000	-.00732	.00000
4	0.00000	0.00000	-.00393	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 17 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.16	-.95	-.06	-.10	-33.71	-34.35	.21	-.04
20.0	-1.05	-.78	-.05	-.08	-34.16	-35.55	.27	-.03
25.0	-.96	-.65	-.05	-.06	-35.17	-37.62	.31	-.01
30.0	-.88	-.55	-.04	-.04	-36.72	-40.47	.34	.00
35.0	-.81	-.46	-.03	-.01	-37.17	-42.20	.34	.02
40.0	-.70	-.37	-.02	.02	-37.98	-43.47	.34	.04
45.0	-.58	-.26	-.01	.04	-39.88	-43.28	.32	.06
50.0	-.42	-.14	-.01	.07	-43.35	-42.35	.28	.08
55.0	-.22	.02	-.00	.09	-49.00	-40.10	.24	.09
60.0	0.00	.19	0.00	.11	-200.00	-37.83	.19	.11
65.0	.26	.39	-.01	.11	-46.37	-36.99	.15	.12
70.0	.52	.59	-.04	.09	-40.44	-37.02	.07	.13
75.0	.79	.81	-.08	.06	-36.24	-36.67	.02	.14
80.0	.83	.60	-.14	.01	-33.38	-36.98	-.03	.14
85.0	.73	.65	-.21	-.06	-31.41	-37.44	-.07	.15
90.0	.38	.28	-.27	-.12	-30.83	-37.61	-.10	.15
95.0	-.21	-.32	-.29	-.14	-31.45	-37.40	-.11	.15
100.0	-.83	-.95	-.26	-.11	-31.91	-35.94	-.12	.15
105.0	-1.27	-1.38	-.18	-.03	-33.97	-35.82	-.11	.15
110.0	-1.34	-1.43	-.09	.06	-37.77	-37.48	-.09	.15
TOTAL	.78	.71	.13	.08	-34.46	-36.98		

NET REDUCTION OF MISMATCH ERROR= 2.52DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00444	-.00000
2	1.00000	0.00000	1.00393	-.00000
3	0.00000	0.00000	-.00960	.00000
4	0.00000	0.00000	-.00321	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 18 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.11	-.87	.05	-.05	-34.07	-36.15	.24	-.10
20.0	-.96	-.66	.05	-.04	-34.86	-38.20	.30	-.09
25.0	-.81	-.46	.05	-.02	-36.33	-41.60	.35	-.07
30.0	-.74	-.35	.04	-.02	-38.11	-44.58	.39	-.06
35.0	-.64	-.23	.04	-.00	-38.84	-48.45	.41	-.04
40.0	-.49	-.07	.03	.01	-40.53	-53.86	.42	-.02
45.0	-.35	.06	.02	.02	-43.46	-50.61	.41	.00
50.0	-.34	.04	.02	.04	-44.39	-46.92	.39	.02
55.0	-.13	.22	.01	.04	-52.75	-44.44	.36	.04
60.0	0.00	.32	0.00	.05	-200.00	-41.57	.32	.05
65.0	.13	.40	-.03	.04	-48.55	-41.28	.27	.07
70.0	.22	.44	-.05	.03	-43.28	-42.03	.22	.08
75.0	.25	.42	-.08	.01	-40.41	-43.13	.17	.09
80.0	.26	.38	-.13	-.02	-36.36	-42.86	.12	.10
85.0	.11	.20	-.16	-.05	-34.72	-43.76	.08	.11
90.0	-.17	-.12	-.19	-.07	-34.05	-42.50	.05	.12
95.0	-.61	-.59	-.18	-.06	-34.67	-40.14	.02	.12
100.0	-.78	-.78	-.15	-.02	-35.46	-39.26	-.00	.12
105.0	-1.02	-1.03	-.09	.04	-37.33	-38.16	-.01	.13
110.0	-.93	-.94	-.02	.10	-41.51	-39.64	-.02	.13
TOTAL	.61	.52	.09	.04	-37.00	-40.66		

NET REDUCTION OF MISMATCH ERROR= 3.66DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00330	.00000
2	1.00000	0.00000	1.00663	-.00000
3	0.00000	0.00000	-.00667	-.00000
4	0.00000	0.00000	-.00231	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 19 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.61	-.45	-.02	-.06	-39.52	-40.19	.16	-.04
20.0	-.62	-.41	-.02	-.05	-39.00	-40.59	.21	-.03
25.0	-.63	-.39	-.02	-.04	-39.07	-42.02	.24	-.02
30.0	-.59	-.33	-.01	-.02	-40.49	-45.17	.26	-.01
35.0	-.60	-.32	-.01	-.00	-39.97	-45.41	.28	.01
40.0	-.53	-.25	.00	.02	-40.57	-46.04	.28	.02
45.0	-.45	-.17	.00	.04	-42.17	-45.46	.28	.03
50.0	-.37	-.11	.01	.05	-44.35	-44.32	.26	.05
55.0	-.16	.07	.01	.07	-51.05	-42.64	.24	.06
60.0	0.00	.21	0.00	.07	-200.00	-40.85	.21	.07
65.0	.19	.37	-.02	.06	-47.46	-40.42	.17	.08
70.0	.36	.50	-.05	.04	-41.74	-40.54	.14	.09
75.0	.50	.60	-.09	.01	-37.90	-40.10	.10	.10
80.0	.53	.60	-.14	-.04	-34.45	-38.85	.07	.11
85.0	.33	.37	-.20	-.09	-32.63	-38.57	.04	.11
90.0	-.01	.01	-.22	-.11	-32.61	-38.95	.02	.12
95.0	-.53	-.53	-.20	-.08	-34.06	-39.56	-.00	.12
100.0	-1.07	-1.09	-.14	-.02	-34.44	-36.57	-.01	.12
105.0	-1.21	-1.22	-.04	.08	-36.91	-36.08	-.02	.12
110.0	-1.12	-1.14	.04	.16	-39.71	-36.97	-.02	.12
TOTAL	.61	.57	.09	.07	-36.87	-39.35		

NET REDUCTION OF MISMATCH ERROR= 2.48DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.03350	.00000
2	1.00000	0.00000	1.01509	-.00000
3	0.00000	0.00000	-.05313	-.00000
4	0.00000	0.00000	-.00963	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 20 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-4.06	-3.21	.46	-.19	-21.07	-24.79	.85	-.65
20.0	-3.57	-2.49	.45	-.15	-21.51	-26.59	1.08	-.59
25.0	-3.11	-1.85	.43	-.09	-22.55	-29.50	1.26	-.52
30.0	-2.62	-1.23	.39	-.04	-24.55	-33.98	1.39	-.43
35.0	-2.20	-.73	.35	.01	-25.35	-38.20	1.46	-.34
40.0	-1.60	-.20	.30	.06	-26.68	-41.95	1.49	-.24
45.0	-1.23	.23	.23	.10	-29.22	-38.37	1.47	-.13
50.0	-.78	.62	.17	.14	-33.20	-35.06	1.40	-.03
55.0	-.38	.91	.09	.16	-39.04	-32.92	1.30	.07
60.0	0.00	1.17	0.00	.17	-200.00	-30.96	1.17	.17
65.0	.39	1.41	-.12	.14	-36.36	-30.53	1.02	.26
70.0	.61	1.48	-.25	.09	-30.87	-31.50	.87	.34
75.0	.67	1.38	-.39	.03	-27.40	-32.83	.71	.42
80.0	.67	1.23	-.55	-.06	-23.94	-32.84	.56	.49
85.0	.23	.65	-.70	-.15	-22.08	-33.71	.42	.55
90.0	-.59	-.29	-.82	-.21	-21.54	-32.62	.30	.60
95.0	-1.88	-1.67	-.85	-.20	-21.94	-30.48	.20	.65
100.0	-3.12	-2.99	-.79	-.11	-22.02	-27.62	.13	.69
105.0	-4.15	-4.08	-.65	.06	-23.50	-26.42	.07	.72
110.0	-4.66	-4.62	-.50	.24	-26.11	-27.07	.03	.74
TOTAL	2.34	2.03	.46	.13	-23.84	-29.43		

NET REDUCTION OF MISMATCH ERROR= 5.59DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.26440	.00000
2	1.00000	0.00000	.04154	-.00000
3	0.00000	0.00000	-.03503	.00000
4	0.00000	0.00000	-.00171	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 21 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	217.46	-119.10	-.35	-11.47	5.11	.98	-336.56	-11.11
20.0	66.77	97.53	-.86	-11.83	.56	.67	30.76	-10.96
25.0	38.46	76.19	-.57	-11.37	-3.93	-.31	37.74	-10.80
30.0	-20.62	23.75	-.09	-10.73	-9.80	-3.41	44.37	-10.64
35.0	-69.11	341.56	-.36	-10.87	.52	-3.09	410.67	-10.50
40.0	-87.96	-31.27	-.83	-11.22	2.51	-2.13	56.69	-10.39
45.0	-237.62	184.85	-.69	-11.01	4.48	2.09	422.47	-10.31
50.0	244.41	-47.51	.33	-9.96	4.00	-2.46	-291.92	-10.29
55.0	-65.37	8.21	.03	-10.28	.11	-3.69	73.58	-10.31
60.0	0.00	79.03	0.00	-10.38	-200.00	-.10	79.03	-10.38
65.0	-265.36	179.15	-.62	-11.14	3.09	2.16	444.51	-10.52
70.0	215.25	-54.67	.08	-10.62	5.17	-1.74	-269.92	-10.71
75.0	-40.[illegible]	55.04	-.04	-10.99	-3.73	-1.79	95.83	-10.95
80.0	-68.35	33.48	-.59	-11.65	.84	-1.84	101.83	-11.26
85.	94.05	-57.78	-.63	-12.24	5.76	-.86	-251.83	-11.61
90.	84.85	-69.90	.20	-11.81	5.46	-1.16	114.95	-12.01
95.0	-27.76	94.50	.92	-11.52	-7.49	-1.32	122.26	-12.44
100.0	68.34	61.66	1.89	-11.00	-.03	-3.05	130.20	-12.89
105.0	-254.65	-115.80	3.48	-9.85	2.50	-2.13	138.85	-13.33
110.0	-196.00	312.25	5.23	-8.50	3.14	-7.78	508.25	-13.73
TOTAL 15	5.56	134.46	1.79	4.69	2.91	-.36		

NET REDUCTION OF MISMATCH ERROR= 3.2708.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.01203	-.00000
2	1.00000	0.00000	1.01202	.00000
3	0.00000	0.00000	-.01648	-.00000
4	0.00000	0.00000	-.00202	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 22 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.86	-.68	.05	-.08	-36.12	-36.66	.18	-.13
20.0	-.95	-.72	.04	-.07	-35.10	-36.23	.22	-.12
25.0	-.95	-.69	.04	-.06	-35.33	-37.44	.26	-.10
30.0	-.92	-.63	.03	-.05	-36.54	-39.13	.29	-.07
35.0	-.80	-.58	.03	-.02	-36.39	-40.21	.31	-.04
40.0	-.75	-.43	.03	.01	-37.32	-42.24	.32	-.02
45.0	-.60	-.28	.02	.04	-39.45	-43.79	.32	.02
50.0	-.55	-.24	.02	.07	-40.82	-41.62	.31	.05
55.0	-.26	.03	.01	.09	-47.20	-40.66	.29	.08
60.0	0.00	.27	0.00	.11	-200.00	-37.29	.27	.11
65.0	.24	.49	-.03	.11	-44.49	-36.32	.24	.14
70.0	.48	.68	-.08	.09	-38.78	-36.37	.20	.17
75.0	.65	.82	-.13	.06	-35.03	-36.41	.17	.20
80.0	.80	.93	-.22	.01	-30.92	-35.64	.14	.22
85.0	.64	.75	-.30	-.05	-28.85	-36.73	.11	.25
90.0	.25	.33	-.39	-.12	-27.83	-37.20	.08	.27
95.0	-.52	-.46	-.43	-.14	-28.04	-36.67	.06	.28
100.0	-1.19	-1.15	-.41	-.11	-28.05	-34.61	.04	.30
105.0	-1.86	-1.84	-.35	-.03	-29.50	-33.36	.02	.31
110.0	-2.09	-2.08	-.25	.07	-32.65	-34.35	.01	.32
TOTAL	.92	.86	.20	.08	-32.02	-36.25		

NET REDUCTION OF MISMATCH ERRORS 4.23DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00097	-.00000
2	1.00000	0.00000	1.01083	.00000
3	0.00000	0.00000	.00007	-.00000
4	0.00000	0.00000	-.00437	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 25 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.47	-.32	-.18	-.12	-33.53	-36.99	.15	.06
20.0	-.64	-.46	-.17	-.10	-32.92	-36.83	.18	.07
25.0	-.74	-.54	-.15	-.08	-33.35	-37.86	.20	.08
30.0	-.78	-.58	-.13	-.05	-34.70	-39.74	.21	.09
35.0	-.80	-.60	-.11	-.01	-35.02	-39.95	.20	.10
40.0	-.74	-.56	-.08	.02	-35.83	-39.84	.17	.11
45.0	-.63	-.50	-.06	.06	-37.86	-39.38	.14	.11
50.0	-.48	-.39	-.04	.09	-41.32	-39.13	.09	.12
55.0	-.25	-.22	-.02	.11	-46.91	-38.04	.03	.13
60.0	0.00	-.03	0.00	.13	-200.00	-36.41	-.03	.13
65.0	.31	.22	-.00	.13	-45.18	-36.25	-.09	.13
70.0	.64	.49	-.02	.11	-39.36	-36.62	-.15	.13
75.0	.99	.79	-.05	.07	-35.35	-36.37	-.20	.13
80.0	1.11	.87	-.10	.02	-32.84	-36.19	-.24	.12
85.0	1.10	.82	-.17	-.05	-31.27	-36.01	-.27	.11
90.0	.85	.57	-.23	-.12	-31.20	-36.05	-.29	.11
95.0	.37	.08	-.25	-.15	-32.50	-36.89	-.29	.10
100.0	-.17	-.44	-.22	-.14	-33.98	-37.40	-.27	.09
105.0	-.54	-.78	-.16	-.08	-37.43	-39.37	-.24	.08
110.0	-.56	-.75	-.07	.00	-43.79	-43.46	-.19	.07
TOTAL	.67	.55	.13	.09	-34.38	-36.91		

NET REDUCTION OF MISMATCH ERROR= 2.5408.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.01339	-.00000
2	1.00000	0.00000	1.02273	.00000
3	0.00000	0.00000	-.01609	-.00000
4	0.00000	0.00000	-.00264	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 24 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.89	-.73	-.12	-.17	-34.10	-32.87	.16	-.06
20.0	-1.13	-.92	-.11	-.15	-32.48	-32.41	.20	-.04
25.0	-1.26	-1.02	-.10	-.12	-32.25	-33.16	.24	-.02
30.0	-1.31	-1.06	-.09	-.08	-32.83	-34.53	.26	.01
35.0	-1.31	-1.04	-.07	-.03	-32.76	-35.06	.27	.04
40.0	-1.10	-.93	-.05	.02	-33.30	-35.64	.27	.07
45.0	-1.00	-.74	-.03	.07	-35.09	-36.23	.25	.10
50.0	-.88	-.64	-.01	.13	-37.04	-35.30	.23	.14
55.0	-.86	-.26	-.00	.16	-42.45	-34.70	.20	.17
60.0	0.00	.17	0.00	.20	-200.00	-32.51	.17	.20
65.0	.43	.56	-.03	.21	-41.79	-31.62	.13	.23
70.0	.90	1.00	-.08	.19	-35.35	-31.58	.09	.26
75.0	1.27	1.33	-.13	.14	-31.58	-31.58	.06	.29
80.0	1.61	1.63	-.27	.04	-27.50	-30.67	.02	.32
85.0	1.54	1.54	-.41	-.07	-25.34	-30.92	-.01	.34
90.0	.99	.96	-.56	-.20	-24.48	-31.67	-.03	.36
95.0	-.13	-.17	-.64	-.27	-24.73	-32.12	-.04	.37
100.0	-1.25	-1.30	-.64	-.25	-24.74	-30.94	-.05	.39
105.0	-2.32	-2.37	-.55	-.15	-24.31	-30.59	-.05	.40
110.0	-2.86	-2.91	-.41	.00	-29.31	-31.71	-.04	.41
TOTAL	1.31	1.25	.30	.15	-28.67	-31.78		

NET REDUCTION OF MISMATCH ERROR = 3.11DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00193	-.00000
2	1.00000	0.00000	1.00880	.00000
3	0.00000	0.00000	.00019	-.00000
4	0.00000	0.00000	-.00412	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 25 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.22	-.10	-.13	-.09	-36.76	-39.84	.12	.04
20.0	-.41	-.27	-.13	-.08	-35.75	-39.43	.14	.04
25.0	-.54	-.40	-.12	-.07	-35.66	-39.85	.15	.05
30.0	-.58	-.43	-.10	-.04	-36.96	-41.89	.15	.06
35.0	-.64	-.50	-.09	-.02	-36.87	-41.45	.14	.07
40.0	-.61	-.50	-.07	.01	-37.44	-41.07	.11	.08
45.0	-.53	-.46	-.05	.04	-39.27	-40.57	.07	.09
50.0	-.42	-.39	-.03	.07	-42.45	-40.40	.02	.10
55.0	-.29	-.26	-.01	.09	-48.08	-39.29	-.03	.11
60.0	0.00	-.09	0.00	.11	-200.00	-37.80	-.09	.11
65.0	.29	.14	-.00	.11	-46.01	-37.57	-.15	.11
70.0	.58	.38	-.01	.10	-40.26	-37.99	-.20	.11
75.0	.92	.66	-.04	.07	-36.17	-37.59	-.25	.11
80.0	1.06	.77	-.09	.02	-33.51	-37.17	-.29	.11
85.0	1.05	.74	-.14	-.04	-32.08	-37.02	-.31	.10
90.0	.85	.53	-.20	-.11	-32.01	-36.95	-.32	.09
95.0	.42	.10	-.22	-.14	-33.46	-37.94	-.32	.08
100.0	-.06	-.35	-.20	-.12	-35.19	-38.73	-.29	.08
105.0	-.38	-.64	-.13	-.06	-39.13	-41.10	-.26	.07
110.0	-.37	-.57	-.05	.01	-46.83	-45.76	-.20	.06
TOTAL	.58	.46	.11	.08	-35.82	-38.35		

NET REDUCTION OF MISMATCH ERROR= 2.54DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00070	.00000
2	1.00000	0.00000	1.00939	-.00000
3	0.00000	0.00000	-.00169	.00000
4	0.00000	0.00000	-.00259	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 20 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.65	-.51	-.15	-.09	-33.89	-37.44	.14	.06
20.0	-.66	-.49	-.14	-.07	-34.02	-38.30	.18	.07
25.0	-.65	-.45	-.12	-.05	-34.98	-40.26	.21	.07
30.0	-.70	-.48	-.11	-.04	-35.76	-41.30	.22	.08
35.0	-.70	-.47	-.09	-.01	-36.36	-42.06	.23	.08
40.0	-.63	-.41	-.07	.02	-37.34	-42.46	.23	.09
45.0	-.51	-.30	-.05	.04	-39.57	-42.84	.21	.09
50.0	-.47	-.28	-.02	.07	-41.93	-40.90	.19	.10
55.0	-.25	-.08	-.02	.09	-47.20	-40.62	.16	.10
60.0	0.00	.13	0.00	.10	-200.00	-38.32	.13	.10
65.0	.24	.33	-.01	.10	-47.23	-38.01	.09	.10
70.0	.43	.49	-.03	.08	-42.31	-38.63	.05	.10
75.0	.64	.66	-.05	.05	-38.58	-38.42	.02	.10
80.0	.77	.76	-.10	-.01	-34.80	-37.43	-.01	.10
85.0	.68	.64	-.15	-.06	-33.41	-37.57	-.04	.09
90.0	.37	.31	-.20	-.11	-33.06	-37.62	-.06	.09
95.0	-.23	-.30	-.20	-.12	-34.37	-38.45	-.07	.08
100.0	-.62	-.70	-.18	-.09	-35.47	-38.29	-.07	.08
105.0	-1.01	-1.08	-.08	-.01	-37.60	-38.00	-.07	.07
110.0	-1.00	-1.06	.02	.09	-40.92	-39.31	-.06	.07
TOTAL	.61	.56	.11	.07	-35.89	-38.32		

NET REDUCTION OF MISMATCH ERRORS 2.4206.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00756	-.00000
2	1.00000	0.00000	1.00960	.00000
3	0.00000	0.00000	-.00802	-.00000
4	0.00000	0.00000	-.00349	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 27 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.62	-.46	-.02	-.09	-39.37	-38.11	.15	-.06
20.0	-.73	-.54	-.03	-.08	-37.55	-37.63	.19	-.05
25.0	-.78	-.57	-.03	-.06	-37.16	-38.37	.21	-.03
30.0	-.76	-.54	-.02	-.04	-38.17	-40.49	.23	-.02
35.0	-.73	-.50	-.02	-.01	-38.18	-41.35	.23	.00
40.0	-.65	-.[illegible]	-.01	.01	-38.73	-42.05	.21	.02
45.0	-.58	-.36	-.01	.04	-40.49	-42.23	.19	.05
50.0	-.40	-.24	-.00	.06	-43.91	-42.12	.15	.07
55.0	-.20	-.09	.00	.09	-49.50	-40.25	.11	.09
60.0	0.00	.06	0.00	.10	-200.00	-38.31	.06	.10
65.0	.20	.30	-.01	.11	-45.63	-37.53	.01	.12
70.0	.54	.51	-.04	.10	-40.13	-37.36	-.04	.14
75.0	.83	.75	-.08	.07	-35.88	-36.86	-.08	.15
80.0	.93	.81	-.14	.02	-32.81	-36.73	-.12	.16
85.0	.86	.71	-.21	-.04	-30.99	-37.53	-.15	.17
90.0	.58	.42	-.28	-.11	-30.24	-37.61	-.16	.17
95.0	.05	-.12	-.31	-.13	-30.83	-37.96	-.17	.18
100.0	-.55	-.71	-.30	-.12	-31.25	-36.88	-.16	.18
105.0	-1.01	-1.16	-.24	-.06	-33.31	-36.49	-.15	.18
110.0	-1.14	-1.26	-.16	.03	-37.27	-38.88	-.12	.18
TOTAL	.68	.01	.14	.08	-34.58	-37.70		

NET REDUCTION OF MISMATCH ERROR= 3.1308.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.01004	-.00000
2	1.00000	0.00000	1.01224	.00000
3	0.00000	0.00000	-.01141	-.00000
4	0.00000	0.00000	-.00051	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 28 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.47	-.43	.01	-.06	-41.82	-40.24	.04	-.07
20.0	-.35	-.30	.02	-.04	-43.76	-42.86	.05	-.06
25.0	-.47	-.40	-.01	-.05	-41.77	-40.59	.06	-.05
30.0	-.60	-.52	-.02	-.05	-40.26	-40.11	.07	-.03
35.0	-.59	-.51	-.01	-.03	-40.11	-40.99	.08	-.01
40.0	-.45	-.37	.00	.01	-42.02	-43.62	.08	.01
45.0	-.40	-.32	-.00	.03	-43.14	-44.03	.08	.03
50.0	-.37	-.29	.00	.05	-44.42	-42.69	.08	.05
55.0	-.18	-.10	-.00	.07	-50.64	-41.90	.08	.07
60.0	0.00	.08	0.00	.10	-200.00	-38.95	.08	.10
65.0	.26	.33	-.03	.09	-44.96	-38.43	.08	.12
70.0	.50	.57	-.06	.08	-39.74	-37.59	.07	.14
75.0	.70	.76	-.10	.06	-36.03	-37.01	.06	.16
80.0	.76	.82	-.13	.00	-32.12	-36.78	.06	.19
85.0	.63	.68	-.26	-.05	-29.99	-37.39	.05	.20
90.0	.25	.29	-.33	-.11	-29.07	-37.92	.04	.22
95.0	-.45	-.42	-.37	-.13	-29.31	-37.54	.04	.24
100.0	-.84	-.81	-.34	-.09	-29.90	-37.39	.03	.25
105.0	-1.51	-1.49	-.27	-.01	-31.44	-35.26	.02	.26
110.0	-1.80	-1.78	-.19	.09	-34.28	-35.49	.02	.27
TOTAL	.71	.70	.17	.07	-33.84	-37.94		

NET REDUCTION OF MISMATCH ERROR= 4.09DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00426	.00000
2	1.00000	0.00000	1.01586	-.00000
3	0.00000	0.00000	-.00161	.00000
4	0.00000	0.00000	-.00542	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 29 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.59	-.43	-.23	-.17	-31.41	-33.86	.16	.06
20.0	-.81	-.62	-.21	-.15	-30.90	-33.89	.19	.07
25.0	-.93	-.73	-.19	-.11	-31.32	-34.93	.20	.08
30.0	-1.00	-.79	-.17	-.07	-32.66	-36.81	.20	.10
35.0	-1.03	-.84	-.14	-.02	-32.91	-36.91	.19	.11
40.0	-.96	-.81	-.10	.03	-33.72	-36.77	.15	.13
45.0	-.82	-.72	-.07	.07	-35.76	-36.42	.10	.14
50.0	-.73	-.70	-.04	.12	-37.99	-35.57	.04	.16
55.0	-.33	-.36	-.02	.15	-44.95	-35.04	-.03	.17
60.0	0.00	-.11	0.00	.18	-200.00	-33.57	-.11	.18
65.0	.43	.25	-.00	.19	-42.36	-33.12	-.19	.19
70.0	.91	.66	-.02	.17	-36.33	-33.39	-.26	.19
75.0	1.24	.92	-.07	.12	-33.67	-33.85	-.32	.19
80.0	1.63	1.26	-.14	.05	-29.70	-32.73	-.37	.19
85.0	1.68	1.28	-.23	-.05	-27.98	-32.61	-.40	.18
90.0	1.41	.99	-.33	-.16	-27.66	-32.80	-.41	.18
95.0	.77	.36	-.39	-.22	-28.47	-33.40	-.41	.17
100.0	.03	-.35	-.39	-.23	-29.25	-33.61	-.38	.16
105.0	-.64	-.97	-.33	-.17	-31.80	-35.30	-.33	.16
110.0	-.91	-1.17	-.23	-.08	-36.22	-38.87	-.26	.15
TOTAL	.95	.79	.20	.14	-31.24	-33.69		

NET REDUCTION OF MISMATCH ERROR= 2.45DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00926	.00000
2	1.00000	0.00000	1.01366	.00000
3	0.00000	0.00000	-.01169	-.00000
4	0.00000	0.00000	-.00528	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 30 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.02	-.76	-.05	-.14	-34.82	-34.06	.26	-.08
20.0	-1.13	-.80	-.05	-.12	-33.66	-34.19	.32	-.07
25.0	-1.14	-.77	-.04	-.09	-33.87	-35.71	.37	-.04
30.0	-1.18	-.78	-.04	-.06	-34.35	-37.24	.40	-.02
35.0	-1.19	-.72	-.03	-.01	-34.46	-38.34	.40	.01
40.0	-.99	-.60	-.01	.03	-35.18	-39.20	.39	.04
45.0	-.78	-.43	-.01	.06	-37.32	-39.61	.36	.07
50.0	-.65	-.35	.01	.11	-39.55	-37.96	.31	.10
55.0	-.34	-.10	.00	.13	-45.07	-37.10	.24	.13
60.0	0.00	.17	0.00	.15	-200.00	-34.97	.17	.15
65.0	.36	.46	-.03	.15	-42.99	-34.51	.10	.17
70.0	.67	.69	-.07	.12	-37.47	-35.01	.02	.19
75.0	.97	.92	-.13	.08	-33.63	-35.12	-.04	.21
80.0	1.18	1.07	-.21	.01	-29.90	-34.44	-.10	.22
85.0	1.11	.96	-.30	-.07	-28.00	-34.50	-.15	.23
90.0	.75	.56	-.39	-.15	-27.40	-34.66	-.18	.24
95.0	-.00	-.20	-.42	-.18	-28.23	-35.09	-.20	.25
100.0	-.65	-.85	-.40	-.15	-28.83	-35.02	-.20	.25
105.0	-1.30	-1.48	-.32	-.07	-31.00	-34.93	-.18	.25
110.0	-1.51	-1.66	-.21	.04	-34.81	-36.42	-.15	.25
TOTAL	.93	.82	.19	.11	-31.70	-34.95		

NET REDUCTION OF MISMATCH ERROR= 3.25DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.24821	.00000
2	1.00000	0.00000	.04488	-.00000
3	0.00000	0.00000	-.02846	.00000
4	0.00000	0.00000	.00537	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 31 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	218.54	-120.26	.19	-11.13	5.36	1.06	-338.80	-11.33
20.0	67.16	95.34	-.20	-11.49	.91	.62	28.18	-11.29
25.0	39.64	74.72	.01	-11.23	-3.43	-.38	35.08	-11.24
30.0	-18.64	23.22	.75	-10.44	-9.96	-3.53	41.86	-11.19
35.0	-66.71	341.78	.26	-10.87	.56	-3.09	408.50	-11.13
40.0	-87.24	-32.27	-.13	-11.21	2.[illegible]	-2.09	54.97	-11.08
45.0	-238.85	182.41	.00	-11.03	4.[illegible]	2.09	421.26	-11.03
50.0	244.41	-48.24	.61	-10.39	4.15	-2.35	-292.64	-11.00
55.0	-65.42	7.85	.56	-10.44	.40	-3.63	73.28	-11.00
60.0	0.00	79.04	0.00	-11.04	-200.00	-.12	79.04	-11.04
65.0	-265.22	179.46	-.01	-11.13	3.39	2.17	444.68	-11.12
70.0	215.34	-54.39	.52	-10.73	5.39	-1.75	-269.73	-11.25
75.0	-40.46	55.41	.60	-10.85	-3.44	-1.79	95.87	-11.45
80.0	-67.53	34.04	-.03	-11.74	1.01	-1.84	101.57	-11.71
85.0	194.21	-58.29	-.17	-12.21	5.99	-.84	-252.51	-12.04
90.0	-184.19	-70.42	.69	-11.75	5.71	-1.14	113.77	-12.44
95.0	-27.51	93.05	1.81	-11.10	-6.56	-1.33	120.56	-12.91
100.0	-68.10	59.94	2.16	-11.27	.12	-3.12	128.04	-13.43
105.0	-254.87	-118.45	3.69	-10.30	2.63	-2.12	136.42	-13.98
110.0	-194.80	311.05	5.84	-8.63	3.58	-7.67	505.85	-14.52
TOTAL	156.55	134.21	2.03	4.69	3.16	-.36		

NET REDUCTION OF MISMATCH ERROR= 3.52DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00970	.00000
2	1.00000	0.00000	1.02030	-.00000
3	0.00000	0.00000	-.00922	.00000
4	0.00000	0.00000	-.00280	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 32 WITH 4 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.58	-.48	-.16	-.16	-33.77	-34.35	.10	.01
20.0	-.80	-.66	-.16	-.14	-32.75	-33.99	.12	.02
25.0	-.92	-.79	-.14	-.11	-32.89	-34.79	.14	.04
30.0	-1.05	-.91	-.13	-.08	-33.29	-35.59	.14	.05
35.0	-1.06	-.93	-.11	-.03	-33.49	-36.03	.14	.08
40.0	-.98	-.86	-.08	.02	-34.17	-36.39	.12	.10
45.0	-.83	-.74	-.06	.06	-35.97	-36.70	.10	.12
50.0	-.75	-.68	-.03	.11	-38.13	-35.70	.07	.14
55.0	-.39	-.36	-.02	.15	-43.58	-35.22	.03	.17
60.0	0.00	-.01	0.00	.19	-200.00	-33.19	-.01	.19
65.0	.44	.39	-.01	.19	-42.05	-32.52	-.05	.21
70.0	.86	.78	-.05	.18	-36.35	-32.62	-.08	.23
75.0	1.26	1.15	-.11	.13	-32.54	-32.46	-.12	.24
80.0	1.62	1.47	-.21	.05	-28.57	-31.49	-.14	.26
85.0	1.60	1.44	-.33	-.06	-26.56	-31.59	-.16	.27
90.0	1.19	1.02	-.46	-.18	-25.76	-32.01	-.17	.28
95.0	.23	.06	-.54	-.25	-26.22	-32.84	-.17	.29
100.0	-.74	-.90	-.54	-.24	-26.45	-32.25	-.16	.30
105.0	-1.70	-1.85	-.45	-.15	-28.21	-32.35	-.14	.30
110.0	-2.13	-2.24	-.32	-.02	-31.56	-33.96	-.12	.31
TOTAL	1.00	1.04	.25	.14	-29.97	-32.82		

NET REDUCTION OF MISMATCH ERROR= 2.85DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00353	-.00000
2	0.00000	0.00000	.01487	.00000
3	0.00000	0.00000	-.00659	-.00000
4	1.00000	0.00000	1.02045	.00000
5	0.00000	0.00000	-.00678	.00000
6	0.00000	0.00000	.00226	.00000
7	0.00000	0.00000	-.00263	-.00000
8	0.00000	0.00000	.00255	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 2 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.48	.14	-.13	.05	-35.40	-44.63	.63	.18
20.0	-.68	.11	-.13	.02	-34.29	-51.55	.79	.15
25.0	-.70	.11	-.12	-.01	-34.45	-54.16	.90	.11
30.0	-.86	.08	-.11	-.03	-35.02	-48.37	.95	.08
35.0	-.89	.03	-.09	-.04	-35.12	-47.40	.92	.05
40.0	-.81	.01	-.07	-.04	-35.89	-47.38	.81	.03
45.0	-.68	-.05	-.05	-.03	-37.76	-49.85	.63	.02
50.0	-.63	-.25	-.02	-.00	-39.62	-48.02	.39	.02
55.0	-.34	-.23	-.02	.01	-44.81	-47.99	.11	.03
60.0	0.00	-.17	0.00	.04	-200.00	-44.80	-.17	.04
65.0	.30	-.13	-.01	.05	-45.32	-44.27	-.43	.06
70.0	.60	-.02	-.04	.05	-39.44	-45.88	-.62	.08
75.0	.88	.15	-.07	.03	-35.73	-47.33	-.73	.11
80.0	1.16	.40	-.14	-.00	-31.66	-42.92	-.76	.14
85.0	1.15	.45	-.22	-.05	-29.88	-40.41	-.70	.17
90.0	.91	.32	-.30	-.09	-29.26	-39.46	-.59	.21
95.0	.29	-.15	-.33	-.08	-30.16	-41.99	-.44	.25
100.0	-.27	-.55	-.33	-.03	-30.73	-42.03	-.28	.30
105.0	-.81	-.96	-.26	.08	-33.26	-37.85	-.15	.34
110.0	-.96	-1.01	-.17	.21	-37.68	-36.09	-.05	.38
TOTAL	.45	.05	.16	.07	-33.32	-42.14		

NET REDUCTION OF MISMATCH ERROR= 8.820B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.01086	.00000
2	0.00000	0.00000	.01378	-.00000
3	0.00000	0.00000	-.00972	.00000
4	1.00000	0.00000	1.02477	-.00000
5	0.00000	0.00000	-.01712	.00000
6	0.00000	0.00000	.00598	-.00000
7	0.00000	0.00000	-.00612	.00000
8	0.00000	0.00000	.00427	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 3 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.10	-.02	-.07	.07	-33.90	-41.64	1.08	.14
20.0	-1.19	.13	-.07	.02	-32.96	-49.25	1.32	.09
25.0	-1.28	.17	-.06	-.02	-32.75	-49.40	1.45	.04
30.0	-1.22	.24	-.04	-.05	-34.11	-44.33	1.46	-.00
35.0	-1.15	.18	-.02	-.06	-34.27	-43.11	1.33	-.03
40.0	-1.01	.06	-.01	-.06	-34.98	-43.58	1.08	-.05
45.0	-.84	-.11	.00	-.04	-36.69	-46.50	.73	-.04
50.0	-.61	-.28	.01	-.01	-40.14	-46.78	.33	-.02
55.0	-.31	-.38	.01	.03	-45.75	-43.29	-.07	.02
60.0	0.00	-.41	0.00	.06	-200.00	-40.09	-.41	.06
65.0	.36	-.28	-.03	.08	-43.09	-39.86	-.64	.10
70.0	.70	-.02	-.07	.07	-37.03	-41.90	-.72	.15
75.0	.99	.24	-.15	.05	-33.02	-42.66	-.65	.19
80.0	1.07	.64	-.24	-.01	-29.46	-38.90	-.43	.23
85.0	.85	.74	-.35	-.07	-27.32	-36.13	-.11	.28
90.0	.26	.52	-.46	-.13	-26.46	-35.95	.26	.33
95.0	-.69	-.09	-.50	-.12	-26.65	-38.84	.60	.38
100.0	-1.77	-.92	-.47	-.04	-26.48	-37.66	.85	.43
105.0	-2.51	-1.54	-.36	.12	-28.08	-33.91	.96	.48
110.0	-2.81	-1.89	-.23	.30	-31.01	-32.10	.92	.53
TOTAL	1.24	.66	.23	.09	-30.39	-38.20		

NET REDUCTION OF MISMATCH ERRORS 7.81DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00479	-.00000
2	0.00000	0.00000	.00188	-.00000
3	0.00000	0.00000	-.00117	-.00000
4	1.00000	0.00000	1.00570	-.00000
5	0.00000	0.00008	-.00458	.00000
6	0.00000	0.00000	-.00001	-.00000
7	0.00000	0.00000	-.00115	.00000
8	0.00000	0.00000	.00120	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 4 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.88	.10	.01	.03	-46.41	-47.41	.38	.03
20.0	-.36	.10	-.00	.01	-43.86	-52.86	.46	.01
25.0	-.41	.09	-.00	-.00	-43.01	-55.35	.50	-.00
30.0	-.43	.07	-.01	-.03	-43.24	-50.47	.50	-.02
35.0	-.44	.01	-.01	-.03	-42.67	-49.86	.45	-.02
40.0	-.38	-.02	-.01	-.03	-43.53	-49.92	.36	-.02
45.0	-.30	-.06	-.01	-.02	-45.58	-52.08	.24	-.01
50.0	-.35	-.23	.00	-.00	-45.08	-48.59	.12	-.00
55.0	-.17	-.17	-.00	.01	-51.19	-50.24	-.01	.02
60.0	0.00	-.11	0.00	.03	-200.00	-47.15	-.1	.03
65.0	.13	-.04	-.02	.04	-50.67	-47.29	-.17	.05
70.0	.23	.05	-.04	.03	-45.22	-49.10	-.18	.07
75.0	.28	.13	-.06	.02	-42.27	-49.83	-.14	.08
80.0	.25	.9	-.10	-.01	-37.81	-45.69	-.06	.09
85.0	.22	.27	-.13	-.03	-36.30	-44.09	.06	.09
90.0	.04	.14	-.16	-.06	-35.63	-43.34	.18	.10
95.0	-.40	-.19	-.14	-.05	-36.42	-45.53	.29	.10
100.0	-.73	-.36	-.11	-.01	-37.24	-46.09	.37	.10
105.0	-.93	-.53	-.04	.06	-39.05	-42.48	.40	.10
110.0	-.83	-.46	.04	.13	-42.26	-41.17	.37	.09
TOTAL	.43	.22	.07	.04	-40.03	-45.86		

NET REDUCTION OF MISMATCH ERROR= 5.83DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00566	.00000
2	0.00000	0.00000	.01135	-.00000
3	0.00000	0.00000	-.01863	-.00000
4	1.00000	0.00000	1.01762	-.00000
5	0.00000	0.00000	-.02358	.00000
6	0.00000	0.00000	.00277	-.00000
7	0.00000	0.00000	-.00641	.00000
8	0.00000	0.00000	.00249	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 5 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.06	-.13	.14	.04	-32.38	-45.88	.93	-.10
20.0	-1.14	-.02	.12	.01	-32.07	-57.80	1.13	-.11
25.0	-1.13	.09	.11	-.01	-32.61	-54.26	1.22	-.12
30.0	-1.03	.19	.10	-.02	-34.24	-48.29	1.21	-.12
35.0	-.92	.18	.09	-.03	-34.87	-46.68	1.10	-.12
40.0	-.77	.11	.07	-.03	-35.89	-48.06	.89	-.10
45.0	-.61	.00	.06	-.02	-38.01	-53.40	.61	-.08
50.0	-.46	-.17	.04	-.00	-41.24	-50.97	.29	-.05
55.0	-.21	-.24	.02	.01	-47.41	-47.56	-.03	-.01
60.0	0.00	-.30	0.00	.03	-200.00	-43.94	-.30	.03
65.0	.25	-.24	-.04	.04	-44.46	-44.16	-.49	.07
70.0	.49	-.09	-.08	.04	-38.52	-46.85	-.58	.12
75.0	.73	.17	-.14	.03	-34.49	-47.53	-.55	.17
80.0	.80	.38	-.22	.00	-30.86	-43.52	-.43	.22
85.0	.74	.52	-.31	-.04	-28.46	-39.89	-.22	.27
90.0	.43	.44	-.40	-.07	-27.39	-39.53	.01	.33
95.0	-.20	.05	-.47	-.08	-27.36	-43.02	.24	.39
100.0	-.98	-.86	-.49	-.03	-27.05	-41.78	.42	.46
105.0	-1.64	-1.13	-.45	.07	-28.34	-36.99	.51	.52
110.0	-2.01	-1.51	-.38	.19	-31.01	-35.07	.50	.57
TOTAL	.92	.49	.24	.06	-30.98	-41.85		

NET REDUCTION OF MISMATCH ERRORS 10.87DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0,00000	0,00000	,00800	,00000
2	0,00000	0,00000	,01542	-,00000
3	0,00000	0,00000	-,01667	,00000
4	1,00000	0,00000	1,02207	-,00000
5	0,00000	0,00000	-,02326	,00000
6	0,00000	0,00000	,00250	-,00000
7	0,00000	0,00000	-,00706	,00000
8	0,00000	0,00000	,00208	-,00000

CORRECTION FILTER FOR RECEIVERS 1 AND 6 WITH 8 TAPS
FOR A TAP SPACING OF ,0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15,0	-1,67	-,36	,04	,04	-30,81	-42,35	1,31	-,00
20,0	-1,59	-,03	,04	,02	-30,83	-54,32	1,57	-,03
25,0	-1,48	,20	,04	-,00	-31,63	-48,97	1,69	-,05
30,0	-1,37	,29	,03	-,03	-33,13	-45,08	1,66	-,06
35,0	-1,24	,25	,04	-,03	-33,47	-45,11	1,49	-,07
40,0	-1,04	,16	,04	-,03	-34,53	-46,39	1,20	-,07
45,0	-,80	,02	,03	-,03	-36,81	-50,12	,82	-,06
50,0	-,69	-,29	,03	-,00	-38,75	-46,68	,40	-,04
55,0	-,34	-,34	,01	,01	-44,86	-44,85	-,00	-,00
60,0	0,00	-,35	0,00	,04	-200,00	-42,48	-,35	,04
65,0	,32	-,27	-,04	,05	-42,93	-42,88	-,59	,09
70,0	,60	-,10	-,09	,05	-37,13	-45,60	-,70	,14
75,0	,83	,15	-,15	,04	-33,45	-46,52	-,68	,19
80,0	1,06	,51	-,25	-,00	-29,37	-40,89	-,54	,25
85,0	,96	,64	-,35	-,04	-27,22	-38,20	-,32	,31
90,0	,59	,53	-,46	-,09	-26,22	-37,93	-,06	,37
95,0	-,23	-,04	-,53	-,09	-26,35	-41,49	,19	,44
100,0	-1,02	-,64	-,54	-,04	-26,22	-40,60	,39	,50
105,0	-1,86	-1,36	-,48	,08	-27,63	-35,38	,49	,56
110,0	-2,23	-1,73	-,39	,22	-30,58	-33,70	,50	,61
TOTAL	1,15	,59	,25	,07	-29,91	-40,15		

NET REDUCTION OF MISMATCH ERROR= 10,24DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.01023	-.00000
2	0.00000	0.00000	.01179	-.00000
3	0.00000	0.00000	-.00984	.00000
4	1.00000	0.00000	1.02328	-.00000
5	0.00000	0.00000	-.01642	-.00000
6	0.00000	0.00000	.00622	-.00000
7	0.00000	0.00000	-.00571	.00000
8	0.00000	0.00000	.00460	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 7 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.85	.06	-.05	.08	-36.34	-41.14	.91	.12
20.0	-.99	.13	-.05	.03	-34.75	-43.55	1.12	.07
25.0	-1.06	.18	-.04	-.02	-34.49	-48.50	1.24	.02
30.0	-1.02	.23	-.03	-.05	-35.70	-44.32	1.25	-.02
35.0	-.99	.15	-.02	-.06	-35.55	-42.64	1.15	-.04
40.0	-.91	.02	-.01	-.06	-35.95	-43.06	.93	-.05
45.0	-.74	-.12	-.00	-.04	-37.80	-46.01	.62	-.04
50.0	-.55	-.29	.01	-.01	-41.05	-46.49	.26	-.01
55.0	-.29	-.29	.01	.03	-46.51	-43.03	-.10	.02
60.0	0.00	-.41	0.00	.06	-200.00	-39.71	-.41	.06
65.0	.34	-.28	-.03	.08	-43.54	-39.45	-.62	.11
70.0	.67	-.02	-.07	.08	-37.31	-41.64	-.69	.15
75.0	.99	.38	-.14	.05	-33.14	-41.84	-.60	.19
80.0	1.04	.66	-.24	-.01	-29.71	-38.69	-.38	.23
85.0	.79	.74	-.35	-.08	-27.52	-35.94	-.06	.27
90.0	.20	.51	-.44	-.13	-26.69	-35.72	.31	.31
95.0	-.77	-.12	-.49	-.13	-26.83	-38.36	.65	.36
100.0	-1.81	-.91	-.45	-.04	-26.78	-37.82	.90	.41
105.0	-2.60	-1.59	-.33	.12	-28.24	-33.59	1.01	.46
110.0	-2.86	-1.90	-.19	.31	-31.17	-31.92	.95	.50
TOTAL	1.20	.67	.21	.10	-30.83	-37.94		

NET REDUCTION OF MISMATCH ERRORS 7.11DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00296	-.00000
2	0.00000	0.00000	.00381	-.00000
3	0.00000	0.00000	.00513	-.00000
4	1.00000	0.00000	1.00211	-.00000
5	0.00000	0.00000	.00451	.00000
6	0.00000	0.00000	-.00482	-.00000
7	0.00000	0.00000	.00109	.00000
8	0.00000	0.00000	-.00130	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 8 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.59	-.07	-.10	.01	-36.68	-56.69	.52	.10
20.0	-.55	.06	-.09	.01	-37.01	-58.70	.60	.09
25.0	-.51	.11	-.08	.00	-38.00	-54.42	.63	.08
30.0	-.56	.05	-.08	-.01	-38.53	-58.33	.60	.07
35.0	-.52	.01	-.06	-.01	-39.21	-60.29	.53	.05
40.0	-.47	.00	-.05	-.01	-40.53	-59.27	.43	.04
45.0	-.34	-.03	-.04	-.01	-42.71	-57.49	.31	.03
50.0	-.37	-.18	-.02	-.00	-44.04	-50.93	.19	.02
55.0	-.18	-.11	-.02	-.00	-49.22	-55.20	.08	.02
60.0	0.00	-.03	0.00	.01	-200.00	-55.11	-.03	.01
65.0	.15	.03	-.00	.01	-51.70	-55.49	-.11	.02
70.0	.25	.06	-.01	.01	-47.54	-55.11	-.19	.02
75.0	.31	.08	-.01	.01	-45.18	-54.13	-.25	.02
80.0	.41	.13	-.03	-.00	-41.69	-52.84	-.30	.02
85.0	.42	.08	-.03	-.01	-41.53	-53.74	-.35	.02
90.0	.34	-.01	-.04	-.03	-43.07	-50.54	-.38	.01
95.0	.18	-.22	-.01	-.02	-51.75	-49.12	-.40	-.01
100.0	.24	-.15	.03	-.00	-47.29	-53.84	-.39	-.03
105.0	.27	-.09	.08	.02	-43.15	-53.56	-.36	-.06
110.0	.56	.25	.13	.04	-40.88	-49.19	-.31	-.08
TOTAL	.40	.11	.06	.02	-40.79	-52.91		

NET REDUCTION OF MISMATCH ERRORS 12.12DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00442	-.00000
2	0.00000	0.00000	.01390	.00000
3	0.00000	0.00000	-.01404	-.00000
4	1.00000	0.00000	1.02158	.00000
5	0.00000	0.00000	-.01545	-.00000
6	0.00000	0.00000	.00454	-.00000
7	0.00000	0.00000	-.00473	-.00000
8	0.00000	0.00000	.00309	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 9 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.56	.11	-.01	.06	-40.61	-45.36	.60	.07
20.0	-.75	.07	-.02	.02	-37.42	-52.92	.82	.04
25.0	-.85	.09	-.02	-.01	-36.59	-53.27	.93	.01
30.0	-.83	.14	-.02	-.04	-37.52	-47.22	.97	-.02
35.0	-.91	.11	-.01	-.04	-37.33	-45.64	.92	-.03
40.0	-.74	.04	-.01	-.04	-37.68	-46.17	.79	-.04
45.0	-.63	-.06	-.00	-.03	-39.30	-49.75	.57	-.03
50.0	-.48	-.20	.00	-.01	-42.23	-49.87	.29	-.01
55.0	-.24	-.26	.00	.02	-48.18	-46.48	-.02	.02
60.0	0.00	-.31	0.00	.04	-200.00	-42.53	-.31	.04
65.0	.32	-.23	-.02	.06	-44.55	-42.20	-.55	.08
70.0	.64	-.06	-.06	.05	-38.33	-44.57	-.70	.11
75.0	.90	.26	-.11	.04	-34.05	-44.78	-.74	.14
80.0	1.13	.47	-.19	-.00	-30.66	-41.70	-.66	.18
85.0	1.07	.57	-.29	-.05	-28.48	-38.47	-.50	.23
90.0	.70	.42	-.38	-.10	-27.65	-38.09	-.28	.28
95.0	-.00	-.05	-.44	-.10	-27.87	-40.73	-.05	.34
100.0	-.84	-.69	-.44	-.03	-27.91	-40.16	.15	.41
105.0	-1.52	-1.23	-.38	.09	-29.56	-35.88	.29	.47
110.0	-1.85	-1.53	-.29	.24	-32.66	-33.96	.33	.53
TOTAL	.87	.52	.20	.07	-32.04	-40.39		

NET REDUCTION OF MISMATCH ERROR= 8.35DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00129	-.00000
2	0.00000	0.00000	.01143	.00000
3	0.00000	0.00000	-.00154	-.00000
4	1.00000	0.00000	1.01172	.00000
5	0.00000	0.00000	.00015	-.00000
6	0.00000	0.00000	-.00224	.00000
7	0.00000	0.00000	-.00037	-.00000
8	0.00000	0.00000	.00009	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 10 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.60	-.03	-.13	.02	-34.87	-54.40	.57	.15
20.0	-.66	.04	-.13	.01	-34.62	-56.70	.69	.13
25.0	-.67	.10	-.11	.00	-35.39	-55.12	.77	.11
30.0	-.71	.07	-.11	-.02	-36.02	-54.18	.78	.09
35.0	-.71	.03	-.09	-.02	-36.34	-54.63	.74	.07
40.0	-.62	.02	-.07	-.02	-37.42	-54.81	.64	.05
45.0	-.50	-.00	-.05	-.02	-39.57	-55.12	.49	.04
50.0	-.40	-.18	-.03	-.00	-41.44	-50.95	.32	.03
55.0	-.24	-.12	-.02	-.00	-44.85	-54.03	.12	.02
60.0	0.00	-.09	0.00	.02	-200.00	-50.72	-.09	.02
65.0	.23	-.06	-.00	.02	-47.72	-51.29	-.29	.03
70.0	.46	-.01	-.01	.02	-42.21	-53.02	-.47	.03
75.0	.68	.07	-.03	.02	-38.85	-51.68	-.61	.05
80.0	.94	.22	-.06	.00	-34.86	-48.18	-.71	.06
85.0	1.00	.22	-.10	-.02	-33.55	-47.06	-.78	.08
90.0	.94	.15	-.15	-.05	-33.31	-45.38	-.79	.10
95.0	.61	-.15	-.16	-.04	-35.19	-46.97	-.76	.12
100.0	.42	-.27	-.16	-.02	-36.51	-47.86	-.70	.14
105.0	.18	-.45	-.11	.04	-41.17	-44.28	-.60	.15
110.0	.10	-.28	-.06	.11	-48.48	-43.14	-.47	.17
TOTAL	.60	.17	.09	.03	-36.43	-48.39		

NET REDUCTION OF MISMATCH ERROR= 11.96DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00413	-.00000
2	0.00000	0.00000	.00952	.00000
3	0.00000	0.00000	-.00960	-.00000
4	1.00000	0.00000	1.01499	.00000
5	0.00000	0.00000	-.01133	-.00000
6	0.00000	0.00000	.00259	.00000
7	0.00000	0.00000	-.00345	-.00000
8	0.00000	0.00000	.00267	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 11 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.44	.10	.00	.05	-42.51	-45.19	.55	.04
20.0	-.61	.07	-.00	.01	-39.37	-53.91	.68	.02
25.0	-.68	.08	-.01	-.01	-38.54	-53.95	.76	-.00
30.0	-.67	.11	-.01	-.03	-39.43	-49.40	.78	-.02
35.0	-.67	.07	-.00	-.04	-39.06	-47.87	.74	-.03
40.0	-.61	.01	-.00	-.03	-39.43	-48.20	.62	-.03
45.0	-.51	-.07	.00	-.02	-41.10	-51.35	.44	-.02
50.0	-.37	-.15	.00	-.00	-44.44	-51.99	.22	-.01
55.0	-.19	-.21	.00	.02	-50.08	-48.36	-.02	.01
60.0	0.00	-.24	0.00	.04	-200.00	-44.63	-.24	.04
65.0	.26	-.16	-.02	.04	-46.22	-44.77	-.41	.06
70.0	.50	-.02	-.04	.04	-40.52	-46.39	-.51	.09
75.0	.77	.23	-.09	.03	-36.24	-46.29	-.53	.11
80.0	.83	.37	-.14	-.00	-33.08	-43.78	-.47	.14
85.0	.74	.40	-.22	-.04	-31.06	-41.16	-.33	.17
90.0	.44	.24	-.28	-.08	-30.28	-40.61	-.16	.21
95.0	-.11	-.08	-.32	-.07	-30.57	-43.02	.03	.25
100.0	-.72	-.54	-.31	-.02	-30.70	-42.32	.18	.29
105.0	-1.15	-.87	-.26	.07	-32.65	-38.67	.27	.33
110.0	-1.30	-1.00	-.18	.19	-36.13	-36.87	.30	.37
TOTAL	.66	.57	.15	.06	-34.64	-42.89		

NET REDUCTION OF MISMATCH ERROR= 8.24DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00117	-.00000
2	0.00000	0.00000	.00845	.00000
3	0.00000	0.00000	-.00976	-.00000
4	1.00000	0.00000	1.01256	.00000
5	0.00000	0.00000	-.00927	-.00000
6	0.00000	0.00000	.00077	.00000
7	0.00000	0.00000	-.00209	-.00000
8	0.00000	0.00000	.00187	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 12 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.18	.17	.03	.04	-47.15	-45.47	.35	.01
20.0	-.36	.09	.01	.01	-43.66	-53.72	.45	.00
25.0	-.45	.06	.00	-.01	-42.11	-57.28	.52	-.01
30.0	-.51	.04	-.01	-.03	-41.68	-50.09	.55	-.02
35.0	-.53	.02	-.01	-.03	-41.05	-49.22	.54	-.02
40.0	-.47	.01	-.01	-.03	-41.51	-49.53	.48	-.02
45.0	-.40	-.03	-.01	-.02	-42.90	-52.21	.37	-.01
50.0	-.46	-.24	-.01	-.00	-42.53	-48.28	.22	.00
55.0	-.22	-.16	-.01	.01	-48.74	-50.71	.05	.02
60.0	0.00	-.13	0.00	.04	-200.00	-46.43	-.13	.04
65.0	.21	-.09	-.01	.04	-47.98	-46.36	-.29	.05
70.0	.42	.01	-.04	.04	-41.82	-48.33	-.42	.07
75.0	.59	.10	-.07	.03	-38.38	-49.75	-.49	.09
80.0	.82	.31	-.12	-.01	-33.86	-45.13	-.51	.12
85.0	.84	.36	-.18	-.04	-31.92	-42.39	-.47	.14
90.0	.63	.24	-.24	-.07	-31.19	-41.73	-.39	.18
95.0	.15	-.14	-.27	-.06	-31.88	-44.01	-.29	.21
100.0	-.23	-.42	-.27	-.02	-32.39	-44.48	-.19	.25
105.0	-.63	-.73	-.22	.06	-34.75	-40.21	-.10	.29
110.0	-.76	-.79	-.15	.17	-39.08	-38.20	-.03	.32
TOTAL	.50	.30	.13	.05	-36.11	-44.23		

NET REDUCTION OF MISMATCH ERROR= 8.120B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00650	.00000
2	0.00000	0.00000	.00219	.00000
3	0.00000	0.00000	-.00104	.00000
4	1.00000	0.00000	1.00630	.00000
5	0.00000	0.00000	-.00538	-.00000
6	0.00000	0.00000	.00031	-.00000
7	0.00000	0.00000	-.00189	-.00000
8	0.00000	0.00000	.00116	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 13 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL Nb ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.49	.03	-.00	.04	-41.62	-47.91	.52	.04
20.0	-.54	.08	-.00	.01	-40.36	-53.71	.62	.02
25.0	-.54	.11	-.00	-.01	-40.51	-53.32	.66	-.00
30.0	-.51	.12	-.00	-.02	-41.77	-50.55	.63	-.02
35.0	-.49	.06	-.00	-.03	-41.82	-49.18	.55	-.03
40.0	-.43	-.01	-.00	-.03	-42.37	-49.22	.42	-.03
45.0	-.35	-.09	.00	-.02	-44.30	-51.30	.26	-.02
50.0	-.25	-.17	.00	-.01	-47.81	-51.16	.09	-.01
55.0	-.13	-.19	.00	.01	-53.61	-49.17	-.07	.01
60.0	0.00	-.18	0.00	.03	-200.00	-46.19	-.16	.03
65.0	.16	-.08	-.01	.04	-49.99	-46.18	-.24	.05
70.0	.29	.05	-.03	.04	-44.38	-47.38	-.24	.07
75.0	.29	.13	-.07	.02	-41.42	-49.79	-.16	.09
80.0	.38	.34	-.10	-.01	-37.19	-44.46	-.04	.10
85.0	.22	.34	-.15	-.04	-35.22	-42.39	.12	.11
90.0	-.12	.16	-.18	-.07	-34.60	-42.61	.28	.11
95.0	-.57	-.14	-.17	-.06	-35.11	-44.85	.43	.11
100.0	-.96	-.44	-.12	-.01	-35.42	-44.29	.52	.11
105.0	-1.19	-.64	-.05	.06	-36.95	-41.10	.55	.11
110.0	-1.09	-.58	.03	.14	-40.06	-40.12	.50	.11
TOTAL	.55	.26	.07	.25	-38.62	-44.68		

NET REDUCTION OF MISMATCH ERROR= 6.27DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00685	.00000
2	0.00000	0.00000	.01559	-.00000
3	0.00000	0.00000	-.01317	.00000
4	1.00000	0.00000	1.02813	-.00000
5	0.00000	0.00000	-.01725	.00000
6	0.00000	0.00000	.00808	-.00000
7	0.00000	0.00000	-.00484	.00000
8	0.00000	0.00000	.00565	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 14 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.28	.37	-.08	.08	-40.11	-39.18	.65	.16
20.0	-.66	.19	-.08	.03	-36.65	-47.06	.84	.10
25.0	-.87	.12	-.07	-.02	-35.49	-51.27	.99	.05
30.0	-1.01	.05	-.06	-.06	-35.25	-44.46	1.06	.01
35.0	-1.04	.01	-.04	-.07	-34.97	-42.92	1.05	-.02
40.0	-.94	-.01	-.03	-.06	-35.55	-43.20	.92	-.03
45.0	-.78	-.08	-.02	-.04	-37.33	-46.40	.70	-.02
50.0	-.70	-.31	.00	-.00	-38.97	-46.01	.39	-.00
55.0	-.36	-.32	-.00	.03	-44.59	-44.42	.04	.03
60.0	0.00	-.29	0.00	.07	-200.00	-40.61	-.29	.07
65.0	.36	-.19	-.03	.08	-42.92	-40.31	-.55	.11
70.0	.68	-.03	-.08	.07	-37.16	-42.17	-.70	.15
75.0	.96	.24	-.14	.04	-33.23	-44.07	-.72	.19
80.0	1.18	.59	-.24	-.01	-29.17	-39.55	-.59	.23
85.0	1.04	.89	-.35	-.07	-27.06	-36.51	-.35	.28
90.0	.55	.52	-.47	-.13	-26.08	-35.72	-.04	.34
95.0	-.41	-.13	-.53	-.12	-26.33	-39.67	.27	.40
100.0	-1.33	-.80	-.52	-.04	-26.32	-38.76	.53	.47
105.0	-2.21	-1.55	-.43	.12	-27.84	-33.84	.67	.55
110.0	-2.56	-1.89	-.30	.32	-30.94	-31.83	.67	.61
TOTAL	1.08	.64	.24	.10	-30.48	-38.20		

NET REDUCTION OF MISMATCH ERROR= 7.720B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00731	-.00000
2	0.00000	0.00000	.01842	.00000
3	0.00000	0.00000	-.01151	.00000
4	1.00000	0.00000	1.02952	.00000
5	0.00000	0.00000	-.01422	-.00000
6	0.00000	0.00000	.00716	-.00000
7	0.00000	0.00000	-.00482	-.00000
8	0.00000	0.00000	.00533	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 15 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.53	.27	-.14	.08	-34.80	-39.96	.81	.22
20.0	-.86	.16	-.14	.03	-35.15	-47.75	1.02	.16
25.0	-1.06	.12	-.12	-.02	-32.80	-50.32	1.18	.10
30.0	-1.13	.11	-.10	-.05	-33.69	-45.35	1.25	.05
35.0	-1.13	.08	-.08	-.06	-33.74	-43.08	1.21	.01
40.0	-1.05	-.01	-.05	-.06	-34.23	-43.24	1.05	-.01
45.0	-.89	-.11	-.03	-.04	-36.05	-46.48	.78	-.01
50.0	-.67	-.25	-.01	-.01	-39.37	-47.93	.42	.01
55.0	-.35	-.32	-.00	.03	-44.94	-44.25	.02	.03
60.0	0.00	-.36	0.00	.06	-200.00	-40.38	-.36	.06
65.0	.41	-.25	-.02	.08	-42.33	-39.97	-.67	.10
70.0	.83	-.02	-.06	.07	-36.27	-41.94	-.86	.14
75.0	1.25	.35	-.13	.05	-32.18	-42.48	-.90	.18
80.0	1.30	.60	-.23	-.01	-28.92	-39.51	-.80	.22
85.0	1.26	.68	-.35	-.08	-26.90	-36.47	-.57	.27
90.0	.77	.49	-.46	-.13	-26.16	-35.84	-.27	.33
95.0	-.15	-.11	-.52	-.13	-26.52	-38.46	.04	.39
100.0	-1.18	-.87	-.50	-.04	-26.66	-38.15	.31	.46
105.0	-2.01	-1.53	-.41	.12	-28.36	-33.67	.48	.53
110.0	-2.34	-1.82	-.28	.31	-31.59	-32.00	.52	.60
TOTAL	1.11	.64	.24	.10	-30.25	-38.22		

NET REDUCTION OF MISMATCH ERROR= 7.97DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00380	.00000
2	0.00000	0.00000	.01701	-.00000
3	0.00000	0.00000	-.01053	.00000
4	1.00000	0.00000	1.02540	-.00000
5	0.00000	0.00000	-.01167	-.00000
6	0.00000	0.00000	.00510	.00000
7	0.00000	0.00000	-.00365	-.00000
8	0.00000	0.00000	.00388	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 16 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.45	.18	-.13	.06	-35.85	-42.91	.63	.19
20.0	-.43	.11	-.12	.02	-34.50	-50.32	.81	.14
25.0	-.83	.11	-.11	-.01	-34.46	-53.55	.94	.10
30.0	-.91	.09	-.10	-.04	-34.91	-46.79	1.00	.06
35.0	-.93	.05	-.08	-.05	-35.00	-45.61	.99	.03
40.0	-.86	.01	-.06	-.05	-35.56	-45.67	.88	.02
45.0	-.72	-.04	-.04	-.03	-37.51	-48.82	.68	.01
50.0	-.67	-.27	-.02	-.00	-39.26	-47.40	.40	.02
55.0	-.34	-.26	-.01	.02	-44.84	-46.75	.08	.03
60.0	0.00	-.24	0.00	.05	-200.00	-42.92	-.24	.05
65.0	.33	-.18	-.02	.06	-44.17	-42.61	-.51	.07
70.0	.68	-.03	-.05	.05	-38.11	-44.60	-.71	.10
75.0	.97	.16	-.10	.04	-34.48	-46.21	-.81	.14
80.0	1.26	.46	-.16	-.01	-30.42	-41.76	-.80	.17
85.0	1.24	.58	-.27	-.05	-28.38	-38.48	-.68	.22
90.0	.93	.43	-.37	-.10	-27.58	-37.76	-.50	.27
95.0	.18	-.10	-.43	-.10	-28.03	-40.42	-.28	.33
100.0	-.56	-.65	-.43	-.04	-28.23	-40.53	-.08	.40
105.0	-1.30	-1.23	-.37	.09	-30.09	-35.84	.07	.46
110.0	-1.64	-1.49	-.26	.26	-33.53	-35.74	.15	.52
TOTAL	.87	.51	.21	.08	-31.77	-40.30		

NET REDUCTION OF MISMATCH ERROR= 8.53DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00691	.00000
2	0.00000	0.00000	.00944	-.00000
3	0.00000	0.00000	-.00454	.00000
4	1.00000	0.00000	1.01382	-.00000
5	0.00000	0.00000	-.00827	.00000
6	0.00000	0.00000	.00039	.00000
7	0.00000	0.00000	-.00372	.00000
8	0.00000	0.00000	.00119	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 17 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.16	-.25	-.06	.04	-35.74	-44.57	.91	.09
20.0	-1.06	.03	-.05	.01	-34.16	-55.17	1.08	.07
25.0	-.96	.19	-.05	-.01	-35.17	-49.45	1.15	.04
30.0	-.88	.24	-.04	-.02	-36.72	-47.08	1.12	.02
35.0	-.81	.19	-.03	-.03	-37.17	-46.67	.99	.00
40.0	-.70	.08	-.02	-.03	-37.98	-48.09	.78	-.01
45.0	-.58	-.07	-.01	-.02	-39.88	-50.57	.51	-.01
50.0	-.42	-.21	-.01	-.01	-43.35	-49.19	.21	-.00
55.0	-.22	-.28	-.00	.01	-49.00	-46.37	-.07	.01
60.0	0.00	-.30	0.00	.03	-200.00	-43.70	-.30	.03
65.0	.26	-.20	-.01	.04	-46.37	-44.08	-.46	.06
70.0	.52	-.02	-.04	.05	-40.44	-46.03	-.54	.08
75.0	.79	.27	-.08	.03	-36.24	-45.18	-.52	.11
80.0	.83	.41	-.14	.00	-33.38	-42.84	-.42	.14
85.0	.73	.47	-.21	-.04	-31.41	-40.52	-.26	.16
90.0	.38	.30	-.27	-.08	-30.85	-40.20	-.08	.19
95.0	-.21	-.10	-.29	-.08	-31.45	-42.71	.10	.21
100.0	-.83	-.59	-.26	-.02	-31.91	-41.65	.24	.23
105.0	-1.27	-.95	-.18	.07	-33.97	-38.13	.32	.25
110.0	-1.34	-1.00	-.09	.18	-37.77	-36.92	.33	.27
TOTAL	.78	.40	.13	.06	-34.46	-42.30		

NET REDUCTION OF MISMATCH ERROR= 7.84DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00717	-.00000
2	0.00000	0.00000	.00208	.00000
3	0.00000	0.00000	-.00280	-.00000
4	1.00000	0.00000	1.00464	.00000
5	0.00000	0.00000	-.00893	.00000
6	0.00000	0.00000	-.00200	-.00000
7	0.00000	0.00000	-.00269	.00000
8	0.00000	0.00000	-.00039	-.00000

CORRECTION FILTER FOR RECEIVERS [illegible] AND 18 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.11	-.28	.05	.02	-34.07	-45.73	.83	-.04
20.0	-.96	-.00	.05	.01	-34.86	-59.57	.96	-.04
25.0	-.81	.18	.05	.00	-36.33	-50.35	.99	-.05
30.0	-.74	.18	.04	-.02	-38.11	-49.67	.92	-.05
35.0	-.64	.13	.04	-.02	-38.84	-50.78	.77	-.06
40.0	-.49	.08	.03	-.02	-40.53	-52.17	.57	-.05
45.0	-.35	-.02	.02	-.02	-43.46	-54.48	.34	-.04
50.0	-.34	-.22	.02	-.00	-44.39	-48.85	.12	-.02
55.0	-.13	-.19	.01	.00	-52.75	-49.88	-.06	-.00
60.0	0.00	-.18	0.00	.02	-200.00	-47.77	-.18	.02
65.0	.13	-.10	-.03	.02	-48.55	-49.67	-.23	.05
70.0	.22	.02	-.05	.02	-43.28	-51.90	-.20	.08
75.0	.25	.13	-.08	.02	-40.41	-50.19	-.11	.10
80.0	.26	.28	-.13	-.00	-36.38	-46.21	.02	.12
85.0	.11	.28	-.16	-.02	-34.72	-44.87	.17	.13
90.0	-.17	.15	-.19	-.04	-34.05	-45.41	.32	.14
95.0	-.61	-.17	-.18	-.03	-34.67	-47.79	.43	.14
100.0	-.78	-.28	-.15	-.01	-35.46	-48.02	.50	.14
105.0	-1.02	-.51	-.09	.04	-37.33	-43.46	.51	.13
110.0	-.93	-.48	-.02	.09	-41.51	-43.08	.45	.12
TOTAL	.61	.23	.09	.03	-37.00	-46.95		

NET REDUCTION OF MISMATCH ERRORS 9.95DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00802	.00000
2	0.00000	0.00000	.00313	-.00000
3	0.00000	0.00000	-.00087	.00000
4	1.00000	0.00000	1.00799	-.00000
5	0.00000	0.00000	-.00519	.00000
6	0.00000	0.00000	-.00046	-.00000
7	0.00000	0.00000	-.00088	.00000
8	0.00000	0.00000	.00122	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 19 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.61	.01	-.02	.05	-39.52	-45.52	.62	.06
20.0	-.62	.12	-.02	.01	-39.00	-51.41	.74	.04
25.0	-.63	.15	-.02	-.01	-39.07	-50.87	.78	.01
30.0	-.59	.17	-.01	-.03	-40.49	-48.04	.76	-.02
35.0	-.60	.07	-.01	-.04	-39.97	-46.73	.67	-.03
40.0	-.53	-.02	.00	-.04	-40.57	-47.45	.52	-.04
45.0	-.45	-.12	.00	-.02	-42.17	-49.02	.33	-.03
50.0	-.37	-.25	.01	-.01	-44.35	-47.83	.12	-.01
55.0	-.16	-.23	.01	.02	-51.05	-47.34	-.06	.01
60.0	0.00	-.21	0.00	.04	-200.00	-44.37	-.21	.04
65.0	.19	-.10	-.02	.05	-47.46	-44.47	-.29	.07
70.0	.36	.05	-.05	.05	-41.74	-45.73	-.31	.10
75.0	.50	.25	-.09	.03	-37.80	-46.04	-.25	.12
80.0	.53	.40	-.14	-.01	-34.45	-42.88	-.13	.13
85.0	.33	.36	-.20	-.05	-32.63	-40.89	.03	.14
90.0	-.01	.19	-.22	-.08	-32.61	-40.85	.21	.14
95.0	-.53	-.17	-.20	-.06	-34.06	-44.20	.36	.14
100.0	-1.07	-.60	-.14	-.01	-34.44	-41.66	.47	.13
105.0	-1.21	-.70	-.04	.08	-36.91	-39.78	.51	.12
110.0	-1.12	-.65	.04	.15	-39.71	-39.45	.48	.11
TOTAL	.61	.31	.09	.05	-36.87	-43.24		

NET REDUCTION OF MISMATCH ERROR= 6.3708.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.02558	-.00000
2	0.00000	0.00000	.00701	.00000
3	0.00000	0.00000	-.02897	.00000
4	1.00000	0.00000	1.01877	-.00000
5	0.00000	0.00000	-.05229	-.00000
6	0.00000	0.00000	-.00330	-.00000
7	0.00000	0.00000	-.01178	.00000
8	0.00000	0.00000	-.00019	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 20 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-4.06	-1.08	.46	.05	-21.07	-34.43	2.98	-.42
20.0	-3.57	-.11	.45	.02	-21.51	-50.06	3.46	-.43
25.0	-3.11	.45	.43	-.00	-22.55	-42.16	3.56	-.43
30.0	-2.62	.70	.39	-.03	-24.55	-38.73	3.31	-.42
35.0	-2.20	.56	.35	-.05	-25.35	-39.40	2.76	-.40
40.0	-1.69	.31	.30	-.05	-26.68	-41.98	2.00	-.35
45.0	-1.23	-.07	.23	-.04	-29.22	-45.81	1.16	-.28
50.0	-.78	-.42	.17	-.01	-33.20	-43.25	.36	-.18
55.0	-.38	-.67	.09	.02	-39.04	-39.02	-.29	-.06
60.0	0.00	-.69	0.00	.06	-200.00	-36.98	-.69	.06
65.0	.39	-.44	-.12	.08	-36.36	-38.61	-.82	.19
70.0	.61	-.07	-.25	.07	-30.87	-41.83	-.68	.32
75.0	.67	.36	-.39	.05	-27.40	-42.03	-.31	.44
80.0	.67	.89	-.55	-.01	-23.94	-36.08	.22	.54
85.0	.23	1.04	-.70	-.08	-22.08	-33.87	.81	.63
90.0	-.50	.78	-.82	-.13	-21.54	-34.65	1.37	.69
95.0	-1.88	-.06	-.85	-.12	-21.94	-39.18	1.81	.73
100.0	-3.12	-1.05	-.79	-.04	-22.02	-36.65	2.07	.75
105.0	-4.15	-2.07	-.65	.11	-23.50	-31.83	2.08	.76
110.0	-4.66	-2.81	-.50	.27	-26.11	-30.43	1.84	.76
TOTAL	2.34	.99	.46	.09	-23.84	-35.98		

NET REDUCTION OF MISMATCH ERROR= 12.14DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.09515	.00000
2	0.00000	0.00000	-.06125	-.00000
3	0.00000	0.00000	.23299	.00000
4	1.00000	0.00000	.01362	-.00000
5	0.00000	0.00000	-.05957	.00000
6	0.00000	0.00000	-.02749	-.00000
7	0.00000	0.00000	-.00908	.00000
8	0.00000	0.00000	-.03857	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 21 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	217.45	-107.04	-.35	-22.53	5.11	-.05	-324.50	-22.17
20.0	66.77	92.42	-.86	-17.82	.56	.25	25.66	-16.96
25.0	38.46	61.47	-.57	-14.28	-3.93	-.76	23.02	-13.71
30.0	-20.62	3.10	-.09	-11.75	-9.80	-3.43	23.72	-11.66
35.0	-69.11	-42.10	-.30	-10.80	.52	-2.24	27.01	-10.43
40.0	-87.96	-55.09	-.83	-10.61	2.51	-1.20	32.87	-9.78
45.0	-237.62	165.76	-.69	-10.16	4.48	2.23	401.38	-9.47
50.0	244.41	-63.41	.33	-8.92	4.00	-1.66	-307.82	-9.25
55.0	-65.37	-1.32	.03	-8.91	.11	-4.43	64.05	-8.94
60.0	0.00	75.36	0.00	-8.52	-200.00	-.22	75.36	-8.52
65.0	-265.36	-180.32	-.62	-8.76	3.09	2.74	85.04	-8.14
70.0	215.24	-51.83	.08	-7.69	5.17	-2.25	-267.08	-7.47
75.0	-40.79	58.70	-.04	-8.20	-3.73	-1.84	99.49	-8.16
80.0	-68.35	37.20	-.59	-9.59	.84	-2.30	105.55	-8.79
85.0	194.05	-53.36	-.63	-10.53	5.76	-1.21	-247.91	-9.90
90.0	-184.85	-64.44	.20	-11.23	5.46	-1.42	120.41	-11.43
95.0	-27.76	-255.77	.92	-12.27	-7.49	-1.06	-228.01	-13.19
100.0	-68.34	78.97	1.89	-12.00	-.03	-2.31	147.31	-14.69
105.0	-254.65	266.73	3.48	-11.91	2.50	-3.22	523.38	-15.39
110.0	-196.00	-20.84	5.25	-10.11	3.14	-8.70	175.16	-15.34
TOTAL	156.56	113.25	1.79	-4.70	2.91	-.41		

NET REDUCTION OF MISMATCH ERRORS 3.32DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00706	-.00000
2	0.00000	0.00000	.00964	.00000
3	0.00000	0.00000	-.01258	-.00000
4	1.00000	0.00000	1.01802	.00000
5	0.00000	0.00000	-.01820	-.00000
6	0.00000	0.00000	.00342	.00000
7	0.00000	0.00000	-.00511	-.00000
8	0.00000	0.00000	.00287	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 22 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.84	-.03	.05	.05	-36.12	-44.66	.83	.00
20.0	-.95	.06	.04	.02	-35.10	-52.63	1.01	-.03
25.0	-.95	.15	.04	-.01	-35.33	-51.05	1.10	-.05
30.0	-.92	.18	.03	-.04	-36.54	-46.05	1.10	-.07
35.0	-.80	.11	.03	-.04	-36.39	-45.83	1.00	-.07
40.0	-.75	.06	.03	-.04	-37.32	-46.34	.81	-.07
45.0	-.60	-.04	.02	-.03	-39.45	-49.65	.56	-.05
50.0	-.55	-.28	.02	-.00	-40.82	-46.81	.26	-.02
55.0	-.24	-.29	.01	.02	-47.20	-45.85	-.03	.01
60.0	0.00	-.28	0.00	.05	-200.00	-42.66	-.28	.05
65.0	.26	-.19	-.03	.05	-44.49	-43.00	-.44	.09
70.0	.48	-.03	-.08	.05	-38.78	-45.20	-.51	.13
75.0	.65	.19	-.13	.03	-35.03	-46.44	-.46	.17
80.0	.80	.48	-.22	-.01	-30.92	-41.30	-.31	.21
85.0	.64	.55	-.30	-.05	-28.85	-38.87	-.09	.25
90.0	.25	.42	-.39	-.09	-27.83	-38.38	.17	.29
95.0	-.52	-.11	-.43	-.09	-28.04	-41.62	.41	.34
100.0	-1.10	-.60	-.41	-.03	-28.05	-41.30	.58	.38
105.0	-1.84	-1.20	-.35	.08	-29.50	-36.24	.67	.43
110.0	-2.09	-1.46	-.25	.22	-32.63	-34.53	.65	.47
TOTAL	.92	.50	.20	.07	-32.02	-40.81		

NET REDUCTION OF MISMATCH ERROR= 8.79DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00365	-.00000
2	0.00000	0.00000	.01342	.00000
3	0.00000	0.00000	-.00218	-.00000
4	1.00000	0.00000	1.01728	.00000
5	0.00000	0.00000	-.00130	-.00000
6	0.00000	0.00000	.00094	.00000
7	0.00000	0.00000	-.00127	-.00000
8	0.00000	0.00000	.00196	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 25 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (Db)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.47	.13	-.18	.04	-33.53	-45.40	.60	.22
20.0	-.64	.10	-.17	.01	-32.92	-52.18	.74	.18
25.0	-.74	.10	-.15	-.01	-33.35	-53.83	.84	.14
30.0	-.78	.09	-.13	-.03	-34.70	-50.39	.87	.11
35.0	-.80	.04	-.11	-.03	-35.02	-48.29	.83	.07
40.0	-.74	-.02	-.08	-.03	-35.83	-47.95	.72	.05
45.0	-.63	-.09	-.05	-.02	-37.86	-50.22	.54	.03
50.0	-.48	-.17	-.04	-.01	-41.32	-51.02	.31	.03
55.0	-.25	-.20	-.02	.01	-46.91	-48.86	.05	.03
60.0	0.00	-.21	0.00	.04	-200.00	-45.00	-.21	.04
65.0	.31	-.13	-.04	.05	-45.18	-44.85	-.44	.05
70.0	.64	.02	-.02	.05	-39.36	-46.05	-.62	.06
75.0	.90	.26	-.05	.03	-35.35	-45.75	-.73	.08
80.0	1.11	.34	-.10	-.00	-32.84	-44.34	-.77	.10
85.0	1.10	.37	-.17	-.05	-31.27	-41.57	-.73	.12
90.0	.85	.22	-.23	-.08	-31.20	-40.77	-.64	.15
95.0	.37	-.14	-.25	-.08	-32.50	-42.71	-.51	.17
100.0	-.17	-.50	-.22	-.02	-33.98	-42.42	-.37	.20
105.0	-.54	-.78	-.16	.07	-37.43	-39.34	-.24	.23
110.0	-.54	-.69	-.07	.19	-43.79	-37.85	-.14	.26
TOTAL	.67	.31	.15	.06	-34.36	-43.26		

NET REDUCTION OF MISMATCH ERROR= 8.880B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00710	-.00000
2	0.00000	0.00000	.02218	.00000
3	0.00000	0.00000	-.01683	-.00000
4	1.00000	0.00000	1.03497	.00000
5	0.00000	0.00000	-.02054	-.00000
6	0.00000	0.00000	.00820	.00000
7	0.00000	0.00000	-.00671	-.00000
8	0.00000	0.00000	.00561	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 24 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.89	.11	-.12	.08	-34.10	-40.54	1.00	.20
20.0	-1.13	.13	-.11	.03	-32.48	-47.89	1.26	.14
25.0	-1.24	.18	-.10	-.02	-32.25	-48.93	1.44	.08
30.0	-1.31	.20	-.09	-.06	-32.85	-43.53	1.51	.04
35.0	-1.31	.14	-.07	-.07	-32.76	-42.19	1.45	.00
40.0	-1.19	.06	-.05	-.06	-33.30	-42.69	1.25	-.01
45.0	-1.00	-.07	-.03	-.04	-35.09	-45.83	.93	-.01
50.0	-.88	-.36	-.01	-.00	-37.04	-44.70	.51	.00
55.0	-.46	-.41	-.00	.03	-42.45	-42.80	.06	.03
60.0	0.00	-.38	0.00	.07	-200.00	-39.72	-.38	.07
65.0	.43	-.30	-.03	.08	-41.79	-39.08	-.74	.11
70.0	.90	-.05	-.08	.08	-35.35	-41.21	-.96	.16
75.0	1.27	.26	-.15	.05	-31.58	-42.98	-1.01	.21
80.0	1.61	.70	-.27	-.01	-27.50	-38.11	-.91	.27
85.0	1.54	.88	-.41	-.08	-25.34	-34.87	-.67	.33
90.0	.90	.64	-.56	-.15	-24.48	-34.52	-.34	.41
95.0	-.13	-.13	-.64	-.14	-24.73	-37.32	-.00	.50
100.0	-1.25	-.96	-.64	-.05	-24.74	-37.15	.28	.59
105.0	-2.32	-1.85	-.55	.13	-26.31	-32.39	.47	.68
110.0	-2.86	-2.34	-.41	.36	-29.31	-30.34	.52	.77
TOTAL	1.31	.78	.30	.11	-28.67	-36.94		

NET REDUCTION OF MISMATCH ERROR= 8.26DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00207	-.00000
2	0.00000	0.00000	.01147	.00000
3	0.00000	0.00000	-.00330	-.00000
4	1.00000	0.00000	1.01440	.00000
5	0.00000	0.00000	-.00119	-.00000
6	0.00000	0.00000	.00045	.00000
7	0.00000	0.00000	-.00081	-.00000
8	0.00000	0.00000	.00196	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 25 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.22	.20	-.13	.04	-36.76	-44.77	.42	.17
20.0	-.41	.12	-.13	.01	-55.75	-51.75	.53	.14
25.0	-.56	.06	-.12	-.01	-35.66	-56.41	.61	.11
30.0	-.58	.07	-.10	-.02	-36.96	-51.06	.65	.08
35.0	-.64	.01	-.09	-.03	-36.87	-48.78	.64	.06
40.0	-.61	-.03	-.07	-.03	-37.44	-48.40	.57	.04
45.0	-.53	-.09	-.05	-.02	-39.27	-50.72	.44	.03
50.0	-.42	-.15	-.03	-.01	-42.45	-51 77	.26	.03
55.0	-.22	.17	-.01	.01	-48.08	-4' 15	.05	.03
60.0	0.00	-.18	0.00	.03	-200.00	-46.00	-.18	.03
65.0	.29	-.10	-.00	.04	-46.01	-45.52	-.39	.04
70.0	.58	.02	-.01	.04	-40.22	-46.71	-.56	.05
75.0	.92	.23	-.04	.03	-36.17	-46.40	-.68	.07
80.0	1.06	.32	-.09	-.00	-33.51	-44.96	-.74	.08
85.0	1.05	.32	-.14	-.04	-32.08	-42.47	-.73	.10
90.0	.85	.19	-.20	-.08	-32.01	-41.35	-.67	.12
95.0	.42	-.14	-.22	-.07	-33.46	-43.19	-.56	.15
100.0	-.06	-.50	-.20	-.02	-35.19	-43.10	-.44	.18
105.0	-.38	-.70	-.13	.07	-39.13	-40.16	-.32	.20
110.0	-.37	-.58	-.05	.18	-46.83	-38.62	-.21	.23
TOTAL	.58	.28	.11	.05	-35.82	-43.92		

NET REDUCTION OF MISMATCH ERROR= 8.10DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00593	.00000
2	0.00000	0.00000	.00856	.00000
3	0.00000	0.00000	.00122	.00000
4	1.00000	0.00000	1.01343	-.00000
5	0.00000	0.00000	-.00137	.00000
6	0.00000	0.00000	.00113	.00000
7	0.00000	0.00000	-.00150	.00000
8	0.00000	0.00000	.00156	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 26 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.65	-.02	-.15	.04	-33.89	-47.21	.63	.19
20.0	-.66	.10	-.14	.02	-34.02	-51.49	.76	.16
25.0	-.65	.18	-.12	-.00	-34.98	-50.15	.83	.12
30.0	-.70	.13	-.11	-.03	-35.76	-48.27	.83	.08
35.0	-.70	.06	-.09	-.04	-36.36	-47.92	.77	.05
40.0	-.63	-.00	-.07	-.03	-37.34	-48.07	.63	.03
45.0	-.51	-.07	-.05	-.03	-39.57	-49.65	.44	.02
50.0	-.47	-.25	-.02	-.00	-41.93	-48.00	.23	.02
55.0	-.25	-.24	-.02	.01	-47.20	-47.67	.00	.03
60.0	0.00	-.19	0.00	.04	-200.00	-44.98	-.19	.04
65.0	.24	-.10	-.01	.05	-47.23	-45.07	-.34	.05
70.0	.43	.00	-.03	.04	-42.31	-46.42	-.43	.07
75.0	.64	.20	-.05	.03	-38.58	-46.41	-.44	.08
80.0	.77	.39	-.10	-.01	-34.80	-43.19	-.38	.10
85.0	.68	.40	-.15	-.04	-33.41	-41.20	-.27	.11
90.0	.37	.24	-.20	-.08	-33.06	-40.50	-.13	.12
95.0	-.23	-.21	-.20	-.07	-34.37	-42.81	.02	.13
100.0	-.62	-.48	-.16	-.02	-35.47	-43.30	.14	.14
105.0	-1.01	-.80	-.08	.07	-37.60	-39.24	.21	.15
110.0	-1.00	-.76	.02	.18	-40.92	-37.88	.23	.16
TOTAL	.61	.33	.11	.06	-35.89	-45.14		

NET REDUCTION OF MISMATCH ERROR= 7.25DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00430	-.00000
2	0.00000	0.00000	.01063	.00000
3	0.00000	0.00000	-.00853	-.00000
4	1.00000	0.00000	1.01508	.00000
5	0.00000	0.00000	-.00973	-.00000
6	0.00000	0.00000	.00143	.00000
7	0.00000	0.00000	-.00316	-.00000
8	0.00000	0.00000	.00213	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 27 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.62	.03	-.02	.04	-39.37	-46.55	.65	.07
20.0	-.73	.06	-.03	.01	-37.55	-54.16	.79	.04
25.0	-.78	.09	-.03	-.01	-37.16	-54.09	.87	.02
30.0	-.76	.12	-.02	-.02	-38.17	-49.75	.89	-.00
35.0	-.73	.09	-.02	-.03	-38.18	-47.96	.82	-.01
40.0	-.65	.03	-.01	-.03	-38.73	-48.50	.68	-.02
45.0	-.54	-.06	-.01	-.02	-40.49	-51.46	.48	-.02
50.0	-.40	-.16	-.00	-.01	-43.91	-51.57	.24	-.00
55.0	-.20	-.22	.00	.01	-49.50	-48.11	-.02	.01
60.0	0.00	-.25	0.00	.03	-200.00	-44.63	-.25	.03
65.0	.29	-.16	-.01	.04	-45.63	-44.74	-.44	.06
70.0	.51	-.02	-.04	.04	-40.13	-46.38	-.57	.08
75.0	.83	.23	-.08	.03	-35.86	-46.28	-.60	.11
80.0	.93	.37	-.14	-.00	-32.81	-43.70	-.56	.14
85.0	.86	.41	-.21	-.04	-30.89	-41.16	-.45	.17
90.0	.58	.29	-.28	-.08	-30.24	-40.51	-.30	.20
95.0	.05	-.08	-.31	-.07	-30.83	-43.11	-.13	.24
100.0	-.55	-.53	-.30	-.02	-31.25	-42.45	.02	.28
105.0	-1.01	-.89	-.24	.07	-33.31	-38.63	.12	.31
110.0	-1.14	-.97	-.16	.19	-37.27	-36.97	.17	.34
TOTAL	.68	.37	.14	.06	-34.58	-42.95		

NET REDUCTION OF MISMATCH ERROR= 8.37DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00484	-.00000
2	0.00000	0.00000	.00798	-.00000
3	0.00000	0.00000	-.01059	-.00000
4	1.00000	0.00000	1.01674	.00000
5	0.00000	0.00000	-.01277	-.00000
6	0.00000	0.00000	.00412	.00000
7	0.00000	0.00000	-.00342	-.00000
8	0.00000	0.00000	.00277	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 28 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.47	-.01	.01	.05	-41.82	-44.76	.46	.04
20.0	-.35	.23	.02	.03	-43.76	-45.33	.57	.01
25.0	-.47	.17	-.01	-.02	-41.77	-48.71	.64	-.01
30.0	-.60	.06	-.02	-.05	-40.26	-45.73	.65	-.03
35.0	-.59	.02	-.01	-.05	-40.11	-45.09	.60	-.04
40.0	-.45	.04	.00	-.03	-42.02	-48.39	.49	-.04
45.0	-.40	-.04	-.00	-.03	-43.14	-49.60	.32	-.02
50.0	-.37	-.25	.00	-.00	-44.42	-47.84	.12	-.00
55.0	-.18	-.27	-.00	.02	-50.64	-46.28	-.09	.02
60.0	0.00	-.27	0.00	.05	-200.00	-42.59	-.27	.05
65.0	.26	-.15	-.03	.05	-44.96	-44.00	-.40	.08
70.0	.50	.03	-.06	.05	-39.74	-44.93	-.46	.11
75.0	.70	.26	-.10	.04	-36.03	-44.66	-.43	.14
80.0	.76	.44	-.18	-.01	-32.12	-42.13	-.32	.17
85.0	.63	.48	-.26	-.05	-29.99	-39.55	-.15	.20
90.0	.25	.29	-.33	-.09	-29.07	-39.14	.05	.24
95.0	-.45	-.21	-.37	-.09	-29.31	-41.27	.24	.28
100.0	-.84	-.45	-.34	-.02	-29.90	-43.96	.39	.32
105.0	-1.51	-1.04	-.27	.09	-31.44	-37.12	.47	.36
110.0	-1.80	-1.34	-.19	.21	-34.28	-35.16	.46	.40
TOTAL	.71	.45	.17	.07	-33.84	-41.29		

NET REDUCTION OF MISMATCH ERROR= 7.45DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00252	.00000
2	0.00000	0.00000	.02128	-.00000
3	0.00000	0.00000	-.00779	.00000
4	1.00000	0.00000	1.02655	-.00000
5	0.00000	0.00000	-.00505	.00000
6	0.00000	0.00000	.00308	-.00000
7	0.00000	0.00000	-.00251	.00000
8	0.00000	0.00000	.00320	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 29 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.59	.12	-.23	.05	-31.41	-44.14	.71	.28
20.0	-.81	.10	-.21	.02	-30.90	-51.41	.90	.23
25.0	-.93	.11	-.19	-.01	-31.32	-52.81	1.04	.18
30.0	-1.00	.12	-.17	-.03	-32.66	-48.54	1.11	.14
35.0	-1.03	.07	-.14	-.04	-32.91	-46.51	1.10	.09
40.0	-.96	.02	-.10	-.04	-33.72	-46.55	.98	.06
45.0	-.85	-.05	-.07	-.03	-35.76	-49.68	.77	.04
50.0	-.73	-.27	-.04	-.01	-37.99	-47.14	.47	.03
55.0	-.33	-.22	-.02	.02	-44.95	-48.10	.11	.03
60.0	0.00	-.26	0.00	.04	-200.00	-43.68	-.26	.04
65.0	.43	-.18	-.00	.05	-42.38	-43.05	-.61	.05
70.0	.91	.01	-.02	.05	-36.33	-44.57	-.90	.08
75.0	1.24	.15	-.07	.04	-33.37	-46.42	-1.09	.10
80.0	1.63	.45	-.14	.00	-29.70	-41.96	-1.18	.14
85.0	1.68	.53	-.23	-.05	-27.98	-39.09	-1.16	.18
90.0	1.41	.36	-.33	-.10	-27.66	-38.45	-1.05	.23
95.0	.77	-.11	-.39	-.10	-28.47	-40.41	-.87	.29
100.0	.03	-.65	-.39	-.04	-29.25	-40.57	-.67	.36
105.0	-.64	-1.12	-.33	.09	-31.80	-36.54	-.48	.42
110.0	-.91	-1.22	-.23	.25	-36.22	-34.60	-.31	.48
TOTAL	.95	.45	.20	.08	-31.24	-40.92		

NET REDUCTION OF MISMATCH ERROR= 9.6800.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00707	-.00000
2	0.00000	0.00000	.01445	-.00000
3	0.00000	0.00000	-.01015	.00000
4	1.00000	0.00000	1.02079	.00000
5	0.00000	0.00000	-.01324	-.00000
6	0.00000	0.00000	.00101	.00000
7	0.00000	0.00000	-.00340	-.00000
8	0.00000	0.00000	.00221	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 30 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MB ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.02	-.02	-.05	.05	-34.82	-44.64	1.00	.11
20.0	-1.13	.08	-.05	.02	-33.66	-51.46	1.21	.07
25.0	-1.14	.19	-.04	-.01	-33.87	-49.35	1.33	.03
30.0	-1.18	.15	-.04	-.04	-34.35	-46.91	1.34	.00
35.0	-1.12	.11	-.03	-.04	-34.46	-45.87	1.23	-.02
40.0	-.99	.03	-.01	-.04	-35.18	-46.15	1.02	-.03
45.0	-.78	-.05	-.01	-.03	-37.32	-48.51	.73	-.03
50.0	-.65	-.26	.01	-.00	-39.55	-47.41	.39	-.01
55.0	-.34	-.30	.00	.02	-45.07	-45.60	.04	.01
60.0	0.00	-.28	0.00	.05	-200.00	-42.67	-.28	.05
65.0	.36	-.18	-.03	.06	-42.99	-42.81	-.53	.08
70.0	.67	-.02	-.07	.05	-37.47	-44.48	-.69	.12
75.0	.97	.23	-.13	.04	-33.63	-45.21	-.74	.17
80.0	1.18	.49	-.21	-.01	-29.90	-41.30	-.69	.21
85.0	1.11	.56	-.30	-.05	-28.00	-38.60	-.55	.25
90.0	.75	.38	-.39	-.10	-27.40	-38.08	-.37	.29
95.0	-.00	-.17	-.42	-.09	-28.23	-41.06	-.16	.53
100.0	-.65	-.64	-.40	-.03	-28.83	-40.93	.02	.37
105.0	-1.30	-1.16	-.32	.09	-31.00	-36.33	.14	.41
110.0	-1.51	-1.32	-.21	.23	-34.81	-34.75	.20	.44
TOTAL	.93	.48	.19	.07	-31.70	-40.71		

NET REDUCTION OF MISMATCH ERROR= 9.01DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.08933	.00000
2	0.00000	0.00000	-.06177	-.00000
3	0.00000	0.00000	.22002	.00000
4	1.00000	0.00000	.01635	-.00000
5	0.00000	0.00000	-.05308	.00000
6	0.00000	0.00000	-.02242	-.00000
7	0.00000	0.00000	-.00558	.00000
8	0.00000	0.00000	-.04001	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 31 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	218.54	-111.90	.19	-22.04	5.36	.01	-330.45	-22.23
20.0	67.16	88.87	-.20	-17.36	.91	.19	21.71	-17.16
25.0	39.64	59.34	.01	-14.01	-3.43	-.84	19.70	-14.02
30.0	-18.64	2.04	.75	-11.31	-9.96	-3.59	20.67	-12.06
35.0	-66.71	-42.54	.26	-10.67	.56	-2.25	24.17	-10.93
40.0	-87.24	-56.89	-.13	-10.50	2.78	-1.13	30.36	-10.37
45.0	-238.85	160.59	.00	-10.13	4.76	2.21	399.44	-10.14
50.0	244.41	-64.57	.01	-9.33	4.15	-1.57	-308.98	-9.95
55.0	-65.42	-1.78	.56	-9.03	.40	-4.36	63.65	-9.60
60.0	0.00	75.37	0.00	-9.08	-200.00	-.24	75.37	-9.08
65.0	-265.22	-180.21	-.01	-8.61	3.39	2.78	85.01	-8.60
70.0	215.34	-52.11	.52	-7.84	5.39	-2.24	-267.45	-8.36
75.0	-40.46	58.18	.40	-7.92	-3.44	-1.90	98.63	-8.52
80.0	-67.53	36.60	-.03	-9.18	1.01	-2.39	104.14	-9.15
85.0	194.21	-55.63	-.17	-10.46	5.99	-1.13	-249.84	-10.29
90.0	-184.19	-66.06	.69	-11.23	5.71	-1.35	118.13	-11.92
95.0	-27.51	-257.63	1.81	-12.00	-6.56	-1.09	-230.12	-13.81
100.0	-68.10	78.17	2.16	-13.24	.12	-2.34	146.27	-15.41
105.0	-254.87	266.88	3.69	-12.33	2.63	-3.25	523.75	-16.02
110.0	-194.80	-18.66	5.89	-9.88	3.56	-8.86	176.13	-15.76
TOTAL	156.55	115.39	2.03	4.69	3.16	-.41		

NET REDUCTION OF MISMATCH ERROR= 3.57DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00424	.00000
2	0.00000	0.00000	.02115	-.00000
3	0.00000	0.00000	-.01340	.00000
4	1.00000	0.00000	1.03171	-.00000
5	0.00000	0.00000	-.01343	.00000
6	0.00000	0.00000	.00690	-.00000
7	0.00000	0.00000	-.00491	.00000
8	0.00000	0.00000	.00488	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 32 WITH 8 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.58	.15	-.16	.07	-33.77	-41.48	.73	.23
20.0	-.80	.14	-.16	.03	-32.75	-48.32	.94	.18
25.0	-.92	.17	-.14	-.01	-32.89	-49.63	1.10	.13
30.0	-1.05	.12	-.13	-.05	-33.29	-45.11	1.17	.08
35.0	-1.06	.09	-.11	-.06	-33.49	-43.54	1.15	.05
40.0	-.98	.04	-.08	-.06	-34.17	-43.72	1.02	.03
45.0	-.83	-.06	-.06	-.04	-35.97	-46.61	.77	.02
50.0	-.75	-.31	-.03	-.01	-38.13	-45.98	.44	.02
55.0	-.39	-.34	-.02	.02	-43.58	-44.34	.05	.04
60.0	0.00	-.34	0.00	.06	-200.00	-40.69	-.34	.06
65.0	.44	-.24	-.01	.07	-42.05	-40.43	-.68	.09
70.0	.86	-.06	-.05	.07	-36.35	-42.19	-.92	.12
75.0	1.24	.23	-.11	.05	-32.54	-43.72	-1.03	.16
80.0	1.62	.61	-.21	-.01	-28.57	-39.37	-1.01	.20
85.0	1.60	.74	-.33	-.07	-26.56	-36.26	-.86	.26
90.0	1.19	.56	-.46	-.13	-25.76	-35.49	-.63	.33
95.0	.23	-.13	-.54	-.13	-26.22	-38.19	-.36	.41
100.0	-.74	-.84	-.54	-.05	-26.43	-38.29	-.11	.49
105.0	-1.70	-1.62	-.45	.12	-28.21	-33.51	.08	.57
110.0	-2.13	-1.94	-.32	.33	-31.56	-31.55	.18	.65
TOTAL	1.09	.67	.25	.10		-38.08		

NET REDUCTION OF MISMATCH ERROR= 11DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00518	-.00000
2	0.00000	0.00000	-.00870	.00000
3	0.00000	0.00000	.00816	-.00000
4	0.00000	0.00000	.00914	.00000
5	0.00000	0.00000	-.00193	-.00000
6	1.00000	0.00000	1.01555	.00000
7	0.00000	0.00000	-.00339	-.00000
8	0.00000	0.00000	-.00113	.00000
9	0.00000	0.00000	-.00033	-.00000
10	0.00000	0.00000	.00070	.00000
11	0.00000	0.00000	-.00004	-.00000
12	0.00000	0.00000	.00064	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 2 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.48	.10	-.13	.01	-35.40	-52.58	.58	.15
20.0	-.68	.02	-.13	-.01	-34.29	-61.27	.70	.12
25.0	-.79	-.03	-.12	-.01	-34.45	-58.11	.77	.11
30.0	-.86	-.06	-.11	-.01	-35.02	-54.81	.80	.09
35.0	-.89	-.08	-.09	.00	-35.12	-57.77	.81	.09
40.0	-.81	-.01	-.07	.01	-35.89	-57.88	.80	.08
45.0	-.68	.06	-.05	.01	-37.76	-55.24	.74	.06
50.0	-.63	-.02	-.02	.01	-39.62	-58.38	.61	.03
55.0	-.34	.06	-.02	-.01	-44.81	-57.82	.40	.01
60.0	0.00	.08	0.00	-.01	-200.00	-55.12	.08	-.01
65.0	.30	-.00	-.01	-.02	-45.32	-54.77	-.30	-.00
70.0	.60	-.10	-.04	-.01	-39.44	-54.27	-.70	.03
75.0	.88	-.14	-.07	.01	-35.73	-51.77	-1.02	.08
80.0	1.16	-.00	-.14	.02	-31.66	-54.31	-1.16	.16
85.0	1.15	.07	-.22	.02	-29.88	-53.10	-1.08	.23
90.0	.91	.14	-.30	-.01	-29.28	-52.11	-.77	.29
95.0	.29	-.00	-.33	-.02	-30.16	-54.78	-.29	.31
100.0	-.27	-.03	-.33	-.02	-30.73	-54.30	.24	.31
105.0	-.81	-.13	-.26	.00	-33.26	-56.06	.68	.27
110.0	-.96	-.06	-.17	.03	-37.68	-53.47	.90	.20
TOTAL	.45	.03	.16	.01	-33.32	-54.12		

NET REDUCTION OF MISMATCH ERROR= 20.81DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00879	.00000
2	0.00000	0.00000	-.01345	-.00000
3	0.00000	0.00000	.01853	.00000
4	0.00000	0.00000	.00490	-.00000
5	0.00000	0.00000	-.00268	.00000
6	1.00000	0.00000	1.01733	-.00000
7	0.00000	0.00000	-.01225	.00000
8	0.00000	0.00000	.00095	-.00000
9	0.00000	0.00000	-.00370	.00000
10	0.00000	0.00000	.00165	-.00000
11	0.00000	0.00000	-.00131	.00000
12	0.00000	0.00000	.00078	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 3 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.10	.05	-.07	.02	-33.90	-51.62	1.15	.09
20.0	-1.19	.08	-.07	-.01	-32.96	-54.70	1.27	.06
25.0	-1.28	-.02	-.06	-.02	-32.75	-53.03	1.26	.04
30.0	-1.22	-.04	-.04	-.01	-34.11	-55.65	1.17	.03
35.0	-1.15	-.09	-.02	.00	-34.27	-56.36	1.06	.03
40.0	-1.01	-.06	-.01	.01	-34.98	-54.14	.95	.02
45.0	-.84	-.00	.00	.02	-36.69	-53.33	.84	.02
50.0	-.61	.08	.01	.01	-40.14	-55.25	.69	.00
55.0	-.31	.13	.01	-.01	-45.75	-53.11	.44	-.01
60.0	0.00	.07	0.00	-.02	-200.00	-52.37	.07	-.02
65.0	.36	-.02	-.03	-.02	-43.09	-52.68	-.38	.01
70.0	.70	-.12	-.07	-.01	-37.03	-53.11	-.83	.07
75.0	.90	-.13	-.15	.01	-33.02	-51.63	-1.12	.16
80.0	1.07	-.06	-.24	.02	-29.46	-50.32	-1.13	.27
85.0	.85	.07	-.35	.02	-27.32	-52.59	-.78	.37
90.0	.26	.18	-.46	-.01	-26.46	-50.22	-.09	.44
95.0	-.69	.12	-.50	-.03	-26.65	-50.13	.81	.47
100.0	-1.77	-.06	-.47	-.02	-26.48	-52.38	1.71	.45
105.0	-2.51	-.14	-.36	.01	-28.08	-55.26	2.37	.37
110.0	-2.81	-.24	-.23	.04	-31.01	-49.97	2.57	.27
TOTAL	1.24	.10	.23	.02	-30.39	-51.82		

NET REDUCTION OF MISMATCH ERROR= 21.43DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00279	-.00000
2	0.00000	0.00000	-.00609	-.00000
3	0.00000	0.00000	.00767	-.00000
4	0.00000	0.00000	-.00214	-.00000
5	0.00000	0.00000	.00170	-.00000
6	1.00000	0.00000	1.00208	-.00000
7	0.00000	0.00000	-.00243	.00000
8	0.00000	0.00000	-.00271	-.00000
9	0.00000	0.00000	.00013	.00000
10	0.00000	0.00000	-.00048	-.00000
11	0.00000	0.00000	.00020	.00000
12	0.00000	0.00000	-.00002	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 4 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.28	.04	.01	.00	-46.41	-61.17	.32	-.00
20.0	-.36	.01	-.00	-.00	-43.86	-70.25	.37	-.00
25.0	-.41	-.02	-.00	-.00	-43.01	-64.60	.39	-.00
30.0	-.43	-.03	-.01	-.01	-43.24	-60.43	.40	.00
35.0	-.44	-.04	-.01	.00	-42.67	-63.11	.40	.01
40.0	-.38	.01	-.01	.00	-43.55	-65.32	.39	.01
45.0	-.30	.06	-.01	.00	-45.58	-59.38	.36	.01
50.0	-.35	-.05	.00	.01	-45.08	-60.30	.30	.00
55.0	-.17	.02	-.00	-.01	-51.19	-63.14	.19	-.00
60.0	0.00	.04	0.00	-.00	-200.00	-63.62	.04	-.00
65.0	.13	.00	-.02	-.01	-50.67	-63.55	-.13	.01
70.0	.23	-.05	-.04	-.00	-45.22	-60.35	-.28	.03
75.0	.28	-.08	-.06	.01	-42.27	-56.72	-.35	.07
80.0	.35	.03	-.10	.00	-37.81	-62.93	-.32	.10
85.0	.22	.05	-.13	.01	-36.30	-58.17	-.16	.13
90.0	-.04	.06	-.16	-.01	-35.63	-58.36	.10	.15
95.0	-.40	-.08	-.14	-.00	-36.42	-58.54	.41	.14
100.0	-.73	-.03	-.11	-.00	-37.24	-65.86	.70	.10
105.0	-.93	-.04	-.04	.00	-39.05	-65.34	.89	.04
110.0	-.83	.09	.04	.01	-42.26	-61.23	.92	-.03
TOTAL	.43	.05	.07	.00	-40.03	-60.55		

NET REDUCTION OF MISMATCH ERROR= 20.520B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00637	.00000
2	0.00000	0.00000	-.00771	-.00000
3	0.00000	0.00000	.01064	.00000
4	0.00000	0.00000	.00628	-.00000
5	0.00000	0.00000	-.01424	.00000
6	1.00000	0.00000	1.01359	-.00000
7	0.00000	0.00000	-.02073	.00000
8	0.00000	0.00000	.00036	-.00000
9	0.00000	0.00000	-.00531	.00000
10	0.00000	0.00000	.00155	-.00000
11	0.00000	0.00000	-.00179	.00000
12	0.00000	0.00000	.00077	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 5 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.06	.03	.14	.02	-32.38	-55.80	1.09	-.12
20.0	-1.14	.04	.12	-.01	-32.07	-58.54	1.18	-.13
25.0	-1.13	.01	.11	-.02	-32.61	-54.77	1.14	-.13
30.0	-1.03	-.02	.10	-.01	-34.24	-58.96	1.01	-.11
35.0	-.92	-.06	.09	.00	-34.87	-60.01	.86	-.09
40.0	-.77	-.06	.07	.01	-35.89	-55.76	.71	-.06
45.0	-.61	-.01	.06	.02	-38.01	-55.05	.60	-.04
50.0	-.46	.02	.04	.01	-41.24	-60.57	.48	-.03
55.0	-.21	.11	.02	-.00	-47.41	-54.97	.32	-.03
60.0	0.00	.08	0.00	-.01	-200.00	-54.05	.08	-.01
65.0	.25	.01	-.04	-.02	-44.46	-54.02	-.24	.02
70.0	.49	-.09	-.08	-.01	-38.52	-55.56	-.57	.07
75.0	.73	-.11	-.14	.01	-34.49	-53.83	-.83	.15
80.0	.86	-.10	-.22	.02	-30.86	-50.73	-.90	.24
85.0	.74	.03	-.31	.02	-28.46	-54.61	-.72	.32
90.0	.43	.16	-.40	-.01	-27.39	-51.52	-.27	.40
95.0	-.20	.16	-.47	-.02	-27.36	-50.19	.35	.45
100.0	-.98	.02	-.49	-.02	-27.05	-53.44	1.00	.46
105.0	-1.64	-.15	-.45	.00	-28.34	-54.97	1.49	.45
110.0	-2.01	-.35	-.38	.04	-31.01	-48.06	1.66	.42
TOTAL	.92	.11	.24	.02	-30.98	-52.90		

NET REDUCTION OF MISMATCH ERROR= 21.91DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00815	.00000
2	0.00000	0.00000	-.00959	-.00000
3	0.00000	0.00000	.01426	.00000
4	0.00000	0.00000	.00903	-.00000
5	0.00000	0.00000	-.01114	.00000
6	1.00000	0.00000	1.01769	-.00000
7	0.00000	0.00000	-.01966	.00000
8	0.00000	0.00000	-.00078	-.00000
9	0.00000	0.00000	-.00552	.00000
10	0.00000	0.00000	.00056	-.00000
11	0.00000	0.00000	-.00211	.00000
12	0.00000	0.00000	.00029	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 6 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.67	-.10	.04	.01	-30.81	-52.97	1.57	-.03
20.0	-1.59	.08	.06	-.00	-30.83	-56.00	1.68	-.05
25.0	-1.48	.10	.04	-.01	-31.65	-53.57	1.58	-.05
30.0	-1.37	.01	.03	-.02	-33.13	-55.49	1.38	-.05
35.0	-1.24	-.10	.04	-.00	-33.47	-55.52	1.14	-.04
40.0	-1.04	-.09	.04	.01	-34.55	-53.94	.95	-.03
45.0	-.80	-.00	.03	.01	-36.81	-57.20	.80	-.02
50.0	-.60	-.03	.03	.01	-38.75	-57.07	.66	-.02
55.0	-.34	.11	.01	-.01	-44.86	-54.35	.45	-.02
60.0	0.00	.14	0.00	-.01	-200.00	-51.56	.14	-.01
65.0	.32	.05	-.04	-.02	-42.93	-53.26	-.27	.02
70.0	.60	-.11	-.09	-.01	-37.13	-53.15	-.71	.08
75.0	.83	-.20	-.15	.01	-33.45	-49.06	-1.04	.16
80.0	1.06	-.08	-.25	.02	-29.37	-51.89	-1.13	.27
85.0	.96	.05	-.35	.02	-27.22	-52.72	-.92	.37
90.0	.59	.20	-.46	-.01	-26.22	-49.61	-.39	.45
95.0	-.23	.10	-.53	-.02	-26.35	-51.76	.34	.50
100.0	-1.03	.07	-.54	-.02	-26.22	-52.40	1.09	.51
105.0	-1.86	-.20	-.48	.00	-27.63	-52.82	1.66	.48
110.0	-2.23	-.36	-.39	.04	-30.58	-47.93	1.87	.43
TOTAL	1.15	.14	.25	.02	-29.91	-51.73		

NET REDUCTION OF MISMATCH ERRORS 21.85DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00878	-.00000
2	0.00000	0.00000	-.01407	-.00000
3	0.00000	0.00000	.01808	.00000
4	0.00000	0.00000	.00257	-.00000
5	0.00000	0.00000	-.00258	.00000
6	1.00000	0.00000	1.01552	-.00000
7	0.00000	0.00000	-.01135	-.00000
8	0.00000	0.00000	.00093	-.00000
9	0.00000	0.00000	-.00312	-.00000
10	0.00000	0.00000	.00180	-.00000
11	0.00000	0.00000	-.00110	-.00000
12	0.00000	0.00000	.00089	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 7 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (FOR POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.85	.08	-.05	.02	-36.54	-50.87	.93	.07
20.0	-.90	.05	-.05	-.01	-34.75	-57.10	1.03	.04
25.0	-1.06	-.02	-.04	-.02	-34.49	-52.20	1.03	.02
30.0	-1.02	-.08	-.03	-.01	-35.70	-56.72	.98	.02
35.0	-.90	-.09	-.02	.00	-35.55	-56.42	.90	.02
40.0	-.91	-.07	-.01	.01	-35.95	-53.68	.83	.03
45.0	-.74	.02	-.00	.02	-37.80	-52.97	.76	.02
50.0	-.56	.08	.01	.01	-41.05	-55.02	.63	.00
55.0	-.20	.13	.01	-.01	-46.51	-53.31	.41	-.01
60.0	0.00	.07	0.00	-.02	-200.00	-52.88	.07	-.02
65.0	.34	-.03	-.03	-.02	-43.54	-52.40	-.37	.01
70.0	.67	-.13	-.07	-.01	-37.31	-52.37	-.80	.06
75.0	.90	-.10	-.14	.01	-33.14	-52.98	-1.09	.16
80.0	1.04	-.05	-.24	.03	-29.71	-49.94	-1.09	.26
85.0	.76	.06	-.35	.02	-27.52	-53.22	-.73	.36
90.0	.20	.17	-.44	-.01	-26.69	-50.63	-.03	.43
95.0	-.77	.10	-.49	-.03	-26.83	-49.95	.87	.45
100.0	-1.81	-.03	-.45	-.02	-28.78	-53.70	1.78	.42
105.0	-2.60	-.16	-.33	.01	-28.24	-53.94	2.44	.34
110.0	-2.84	-.22	-.19	.04	-31.17	-50.54	2.64	.23
TOTAL	1.20	.10	.21	.02	-30.85	-51.90		

NET REDUCTION OF MISMATCH ERROR= 21.0800.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00104	-.00000
2	0.00000	0.00000	-.00245	-.00000
3	0.00000	0.00000	.00418	-.00000
4	0.00000	0.00000	.00188	-.00000
5	0.00000	0.00000	.00649	-.00000
6	1.00000	0.00000	1.00014	-.00000
7	0.00000	0.00000	.00574	.00000
8	0.00000	0.00000	-.00658	-.00000
9	0.00000	0.00000	.00207	.00000
10	0.00000	0.00000	-.00269	-.00000
11	0.00000	0.00000	.00075	.00000
12	0.00000	0.00000	-.00101	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 8 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.59	-.07	-.10	-.01	-36.68	-57.88	.52	.09
20.0	-.55	.03	-.09	.00	-37.01	-65.21	.57	.09
25.0	-.53	.04	-.08	.01	-38.00	-58.13	.57	.09
30.0	-.56	-.02	-.08	-.00	-38.55	-69.35	.54	.07
35.0	-.52	-.03	-.06	-.00	-39.21	-67.37	.49	.06
40.0	-.43	.02	-.05	-.00	-40.53	-68.56	.45	.05
45.0	-.30	.05	-.04	-.01	-42.71	-59.79	.39	.03
50.0	-.37	-.07	-.02	.00	-44.04	-58.87	.30	.02
55.0	-.18	-.01	-.02	-.00	-49.22	-68.86	.17	.01
60.0	0.00	.02	0.00	.01	-200.00	-60.31	.02	.01
65.0	.15	.01	-.00	.00	-51.70	-72.82	-.14	.01
70.0	.25	-.02	-.01	-.00	-47.54	-67.92	-.27	.01
75.0	.33	-.03	-.01	.00	-45.18	-65.93	-.36	.01
80.0	.43	.04	-.03	-.01	-41.69	-60.60	-.39	.02
85.0	.42	.05	-.03	-.00	-41.55	-61.38	-.38	.03
90.0	.36	.02	-.04	-.01	-43.07	-65.58	-.35	.03
95.0	.18	-.14	-.01	.01	-51.75	-55.54	-.32	.01
100.0	.24	-.05	.05	.01	-47.29	-59.46	-.30	-.02
105.0	.27	-.01	.08	.00	-43.15	-70.89	-.28	-.08
110.0	.56	.31	.13	-.02	-40.98	-50.66	-.25	-.14
TOTAL	.40	.08	.06	.01	-40.79	-58.51		

NET REDUCTION OF MISMATCH ERROR= 17.72DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00673	-.00000
2	0.00000	0.00000	-.01018	.00000
3	0.00000	0.00000	.01033	-.00000
4	0.00000	0.00000	.00726	.00000
5	0.00000	0.00000	-.00858	-.00000
6	1.00000	0.00000	1.01609	.00000
7	0.00000	0.00000	-.01171	-.00000
8	0.00000	0.00000	.00097	.00000
9	0.00000	0.00000	-.00290	-.00000
10	0.00000	0.00000	.00147	-.00000
11	0.00000	0.00000	-.00099	-.00000
12	0.00000	0.00000	.00102	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 4 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.55	.13	-.01	.02	-40.61	-49.71	.68	.03
20.0	-.75	.02	-.02	-.01	-57.42	-56.26	.77	.01
25.0	-.85	-.05	-.02	-.02	-36.59	-52.66	.79	.00
30.0	-.83	-.05	-.02	-.01	-37.52	-55.49	.78	.00
35.0	-.81	-.07	-.01	.00	-37.35	-58.47	.74	.01
40.0	-.74	-.04	-.01	.01	-37.68	-54.99	.70	.02
45.0	-.63	.02	-.00	.02	-39.30	-53.39	.65	.02
50.0	-.48	.06	.00	.01	-42.23	-57.10	.54	.01
55.0	-.24	.12	.00	-.00	-48.18	-54.17	.35	-.01
60.0	0.00	.05	0.00	-.02	-200.00	-53.70	.05	-.02
65.0	.32	-.03	-.02	-.02	-44.55	-52.97	-.34	-.00
70.0	.60	-.12	-.06	-.01	-38.35	-53.17	-.76	.05
75.0	.99	-.09	-.11	.01	-34.05	-54.34	-1.08	.12
80.0	1.13	-.06	-.19	.02	-30.66	-50.44	-1.19	.21
85.0	1.07	.06	-.24	.02	-28.48	-52.90	-1.02	.30
90.0	.70	.15	-.38	-.01	-27.65	-51.82	-.55	.37
95.0	-.00	.11	-.44	-.03	-27.87	-50.14	.11	.41
100.0	-.84	-.02	-.44	-.03	-27.91	-52.80	.82	.42
105.0	-1.52	-.14	-.38	.01	-29.56	-55.22	1.37	.38
110.0	-1.85	-.25	-.29	.04	-32.66	-49.26	1.60	.53
TOTAL	.87	.10	.20	.02	-32.04	-52.17		

NET REDUCTION OF MISMATCH ERROR= 20.13DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00286	-.00000
2	0.00000	0.00000	-.00419	.00000
3	0.00000	0.00000	.00385	-.00000
4	0.00000	0.00000	.00846	.00000
5	0.00000	0.00000	.00102	-.00000
6	1.00000	0.00000	1.00905	.00000
7	0.00000	0.00000	.00214	-.00000
8	0.00000	0.00000	-.00425	.00000
9	0.00000	0.00000	.00090	-.00000
10	0.00000	0.00000	-.00120	.00000
11	0.00000	0.00000	.00031	-.00000
12	0.00000	0.00000	-.00029	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 10 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.60	-.00	-.13	.00	-34.87	-69.58	.60	.14
20.0	-.65	.02	-.13	-.00	-34.62	-67.99	.68	.12
25.0	-.67	.03	-.11	.00	-35.39	-65.40	.70	.11
30.0	-.71	-.03	-.11	-.01	-36.02	-60.18	.68	.10
35.0	-.71	-.06	-.09	-.00	-36.34	-59.95	.65	.09
40.0	-.62	-.01	-.07	.00	-37.42	-65.73	.61	.07
45.0	-.50	.05	-.05	.00	-39.57	-60.29	.55	.06
50.0	-.40	-.05	-.03	.01	-41.44	-59.39	.44	.04
55.0	-.24	.04	-.02	-.01	-46.85	-61.04	.28	.02
60.0	0.00	.05	0.00	.00	-200.00	-61.14	.05	.00
65.0	.23	.00	-.00	-.01	-47.72	-61.96	-.23	-.00
70.0	.46	-.06	-.01	-.01	-42.21	-57.61	-.52	.01
75.0	.68	-.09	-.03	.01	-38.85	-56.26	-.76	.03
80.0	.94	.02	-.06	.00	-34.86	-63.66	-.92	.07
85.0	1.00	.05	-.10	.01	-33.55	-57.33	-.95	.11
90.0	.94	.08	-.15	-.01	-33.31	-56.95	-.86	.14
95.0	.61	-.06	-.16	-.01	-35.19	-59.46	-.68	.16
100.0	.42	-.03	-.16	-.01	-36.51	-61.65	-.45	.15
105.0	.15	-.09	-.11	.00	-41.17	-59.63	-.23	.12
110.0	.19	.12	-.06	.01	-48.48	-57.77	-.07	.07
TOTAL	.60	.06	.09	.01	-36.45	-59.31		

NET REDUCTION OF MISMATCH ERROR= 22.87DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00481	-.00000
2	0.00000	0.00000	-.00796	.00000
3	0.00000	0.00000	.00850	-.00000
4	0.00000	0.00000	.00428	.00000
5	0.00000	0.00000	-.00546	-.00000
6	1.00000	0.00000	1.01052	.00000
7	0.00000	0.00000	-.00841	-.00000
8	0.00000	0.00000	-.00048	.00000
9	0.00000	0.00000	-.00191	-.00000
10	0.00000	0.00000	.00101	.00000
11	0.00000	0.00000	-.00044	-.00000
12	0.00000	0.00000	.00046	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 11 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.40	.10	.00	.01	-42.51	-52.59	.54	.01
20.0	-.61	.01	-.00	-.01	-39.37	-62.58	.62	-.00
25.0	-.68	-.04	-.01	-.01	-38.54	-55.12	.64	-.01
30.0	-.67	-.04	-.01	-.01	-39.43	-59.65	.63	-.00
35.0	-.67	-.06	-.00	.00	-39.06	-60.33	.61	.01
40.0	-.61	-.03	-.00	.01	-39.43	-58.71	.58	.01
45.0	-.51	.02	.00	.01	-41.10	-56.74	.53	.01
50.0	-.37	.06	.00	.01	-44.44	-58.54	.43	.00
55.0	-.19	.08	.00	-.00	-50.08	-57.58	.27	-.01
60.0	0.00	.02	0.00	-.01	-200.00	-58.21	.02	-.01
65.0	.26	-.03	-.02	-.01	-46.22	-55.37	-.28	.00
70.0	.50	-.09	-.04	-.00	-40.52	-56.05	-.59	.04
75.0	.77	-.04	-.09	.01	-36.24	-59.27	-.81	.09
80.0	.83	-.03	-.14	.02	-33.08	-54.30	-.86	.16
85.0	.70	.04	-.22	.01	-31.06	-56.76	-.70	.23
90.0	.44	.10	-.28	-.01	-30.26	-54.96	-.34	.28
95.0	-.11	.05	-.32	-.02	-30.57	-54.29	.16	.30
100.0	-.72	-.05	-.31	-.02	-30.70	-55.99	.67	.30
105.0	-1.15	-.09	-.26	.01	-32.65	-59.20	1.06	.26
110.0	-1.30	-.10	-.18	.03	-36.13	-54.82	1.21	.21
TOTAL	.66	.06	.15	.01	-34.54	-55.74		

NET REDUCTION OF MISMATCH ERROR= 21.0906.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00381	-.00000
2	0.00000	0.00000	-.00687	.00000
3	0.00000	0.00000	.00484	-.00000
4	0.00000	0.00000	.00398	.00000
5	0.00000	0.00000	-.00620	-.00000
6	1.00000	0.00000	1.00872	.00000
7	0.00000	0.00000	-.00669	-.00000
8	0.00000	0.00000	-.00168	.00000
9	0.00000	0.00000	-.00066	-.00000
10	0.00000	0.00000	.00042	.00000
11	0.00000	0.00000	-.00002	-.00000
12	0.00000	0.00000	.00055	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 12 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.18	.11	.03	.01	-47.15	-52.61	.29	-.02
20.0	-.36	-.00	.01	-.01	-43.66	-63.36	.36	-.02
25.0	-.45	-.04	.00	-.01	-42.11	-58.42	.41	-.01
30.0	-.51	-.07	-.01	-.01	-41.68	-55.72	.45	.00
35.0	-.53	-.05	-.01	.00	-41.05	-61.33	.48	.01
40.0	-.47	.02	-.01	.01	-41.51	-58.81	.49	.02
45.0	-.40	.07	-.01	.01	-42.90	-55.99	.47	.02
50.0	-.46	-.06	-.01	.01	-42.53	-58.01	.41	.01
55.0	-.22	.06	-.01	-.01	-48.74	-58.28	.27	.00
60.0	0.00	.06	0.00	-.00	-200.00	-58.36	.06	-.00
65.0	.21	-.00	-.01	-.01	-47.98	-57.04	-.21	.00
70.0	.42	-.07	-.04	-.01	-41.82	-57.12	-.49	.03
75.0	.59	-.13	-.07	.01	-38.38	-52.85	-.72	.08
80.0	.82	-.00	-.12	.01	-33.86	-57.58	-.82	.13
85.0	.84	.07	-.16	.01	-31.92	-55.86	-.76	.19
90.0	.63	.10	-.24	-.01	-31.19	-55.06	-.53	.24
95.0	.15	-.02	-.27	-.02	-31.88	-56.37	-.18	.26
100.0	-.23	-.01	-.27	-.02	-32.39	-57.16	.22	.25
105.0	-.63	-.09	-.22	.00	-34.75	-59.73	.54	.22
110.0	-.76	-.06	-.15	.03	-39.08	-55.09	.70	.18
TOTAL	.50	.06	.13	.01	-36.11	-55.73		

NET REDUCTION OF MISMATCH ERROR= 19.63DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00365	.00000
2	0.00000	0.00000	-.00662	-.00000
3	0.00000	0.00000	.00971	.00000
4	0.00000	0.00000	-.00262	.00000
5	0.00000	0.00000	.00228	.00000
6	1.00000	0.00000	1.00239	-.00000
7	0.00000	0.00000	-.00294	-.00000
8	0.00000	0.00000	-.00256	-.00000
9	0.00000	0.00000	-.00049	-.00000
10	0.00000	0.00000	-.00058	-.00000
11	0.00000	0.00000	-.00004	-.00000
12	0.00000	0.00000	-.00004	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 13 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.40	.02	-.00	.01	-41.62	-62.70	.51	.01
20.0	-.54	.01	-.00	-.00	-40.36	-69.30	.55	.00
25.0	-.54	.00	-.00	-.01	-40.51	-62.70	.54	-.00
30.0	-.51	-.01	-.00	-.00	-41.77	-68.10	.50	.00
35.0	-.46	-.03	-.00	.00	-41.82	-65.58	.46	.00
40.0	-.43	-.03	-.00	.00	-42.37	-63.04	.41	.01
45.0	-.35	.01	.00	.01	-44.30	-62.15	.36	.00
50.0	-.25	.03	.00	.00	-47.81	-66.26	.28	-.00
55.0	-.13	.04	.00	-.00	-53.61	-62.39	.17	-.00
60.0	0.00	.01	0.00	-.00	-200.00	-65.44	.01	-.00
65.0	.16	-.01	-.01	-.01	-49.99	-63.30	-.16	.01
70.0	.29	-.03	-.03	-.00	-44.38	-64.78	-.32	.03
75.0	.29	-.10	-.07	.00	-41.42	-54.97	-.40	.07
80.0	.38	.03	-.10	.01	-37.19	-59.60	-.35	.11
85.0	.22	.07	-.15	.00	-35.22	-57.96	-.16	.15
90.0	-.12	.04	-.18	-.01	-34.60	-60.33	.16	.17
95.0	-.57	-.02	-.17	-.01	-35.11	-61.56	.55	.16
100.0	-.96	-.06	-.12	-.00	-35.42	-61.83	.91	.12
105.0	-1.19	-.05	-.05	.01	-36.95	-63.12	1.14	.05
110.0	-1.09	.09	.03	.00	-40.06	-61.80	1.17	-.03
TOTAL	.55	.04	.07	.00	-38.62	-60.90		

NET REDUCTION OF MISMATCH ERROR= 22.290B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00756	.00000
2	0.00000	0.00000	-.01357	-.00000
3	0.00000	0.00000	.01418	.00000
4	0.00000	0.00000	.00698	-.00000
5	0.00000	0.00000	-.00632	.00000
6	1.00000	0.00000	1.02101	-.00000
7	0.00000	0.00000	-.01245	.00000
8	0.00000	0.00000	.00341	-.00000
9	0.00000	0.00000	-.00239	.00000
10	0.00000	0.00000	.00345	-.00000
11	0.00000	0.00000	-.00058	.00000
12	0.00000	0.00000	.00196	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 14 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.28	.22	-.08	.03	-40.11	-46.29	.51	.10
20.0	-.66	.01	-.08	-.01	-36.65	-57.16	.66	.07
25.0	-.87	-.08	-.07	-.02	-35.49	-50.90	.79	.04
30.0	-1.01	-.13	-.06	-.02	-35.25	-50.09	.89	.04
35.0	-1.04	-.10	-.04	.00	-34.97	-55.40	.93	.05
40.0	-.94	-.09	-.03	.02	-35.55	-52.79	.93	.05
45.0	-.78	.09	-.02	.02	-37.33	-50.55	.86	.04
50.0	-.70	.01	.00	.02	-38.97	-54.73	.72	.02
55.0	-.36	.10	-.00	-.01	-44.59	-54.13	.46	-.01
60.0	0.00	.09	0.00	-.02	-200.00	-51.53	.09	-.02
65.0	.36	-.01	-.03	-.03	-42.92	-50.12	-.36	.00
70.0	.68	-.14	-.08	-.01	-37.16	-51.52	-.82	.06
75.0	.96	-.18	-.14	.02	-33.23	-49.02	-1.14	.16
80.0	1.18	-.04	-.24	.03	-29.17	-49.13	-1.21	.27
85.0	1.04	.09	-.35	.03	-27.06	-49.57	-.95	.38
90.0	.55	.20	-.47	-.01	-26.08	-48.92	-.35	.46
95.0	-.41	.07	-.53	-.03	-26.33	-49.37	.48	.49
100.0	-1.33	.02	-.52	-.03	-26.32	-50.06	1.35	.48
105.0	-2.21	-.20	-.43	.01	-27.84	-52.53	2.01	.43
110.0	-2.56	-.30	-.30	.06	-30.94	-46.94	2.26	.36
TOTAL	1.08	.13	.24	.02	-30.48	-49.60		

NET REDUCTION OF MISMATCH ERROR= 19.13DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00800	-.00000
2	0.00000	0.00000	-.01362	-.00000
3	0.00000	0.00000	.01482	-.00000
4	0.00000	0.00000	.00960	.00000
5	0.00000	0.00000	-.00429	.00000
6	1.00000	0.00000	1.02218	-.00000
7	0.00000	0.00000	-.00928	-.00000
8	0.00000	0.00000	.00224	-.00000
9	0.00000	0.00000	-.00225	-.00000
10	0.00000	0.00000	.00268	-.00000
11	0.00000	0.00000	-.00064	-.00000
12	0.00000	0.00000	.00150	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 15 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.53	.19	-.14	.03	-34.80	-47.06	.73	.17
20.0	-.86	.02	-.14	-.01	-33.15	-57.49	.88	.13
25.0	-1.06	-.08	-.12	-.03	-32.80	-50.01	.98	.10
30.0	-1.13	-.10	-.10	-.02	-33.69	-52.59	1.04	.08
35.0	-1.13	-.09	-.08	.00	-33.74	-56.82	1.05	.08
40.0	-1.05	-.04	-.05	.02	-34.23	-53.53	1.02	.07
45.0	-.89	.04	-.03	.02	-36.05	-51.13	.93	.05
50.0	-.67	.09	-.01	.01	-39.37	-53.96	.76	.02
55.0	-.35	.12	-.00	-.01	-44.94	-55.38	.47	-.01
60.0	0.00	.05	0.00	-.02	-200.00	-52.12	.05	-.02
65.0	.41	-.05	-.02	-.02	-42.35	-50.45	-.46	-.00
70.0	.83	-.14	-.06	-.01	-36.27	-51.77	-.97	.05
75.0	1.25	-.10	-.13	.02	-32.18	-52.61	-1.35	.15
80.0	1.59	-.05	-.23	.03	-28.92	-48.72	-1.44	.26
85.0	1.26	.07	-.35	.02	-26.90	-51.39	-1.19	.37
90.0	.77	.18	-.46	-.01	-26.16	-49.80	-.58	.45
95.0	-.15	.11	-.52	-.04	-26.52	-48.75	.26	.48
100.0	-1.18	-.04	-.50	-.03	-26.66	-51.30	1.14	.47
105.0	-2.01	-.18	-.41	.01	-28.36	-53.24	1.83	.42
110.0	-2.34	-.24	-.26	.05	-31.59	-48.49	2.10	.34
TOTAL	1.11	.12	.24	.02	-30.25	-50.34		

NET REDUCTION OF MISMATCH ERROR= 20.10DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00650	-.00000
2	0.00000	0.00000	-.01042	-.00000
3	0.00000	0.00000	.00974	.00000
4	0.00000	0.00000	.01025	-.00000
5	0.00000	0.00000	-.00494	.00000
6	1.00000	0.00000	1.01980	-.00000
7	0.00000	0.00000	-.00733	-.00000
8	0.00000	0.00000	.00141	.00000
9	0.00000	0.00000	-.00161	-.00000
10	0.00000	0.00000	.00208	.00000
11	0.00000	0.00000	-.00050	-.00000
12	0.00000	0.00000	.00125	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 16 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.45	.14	-.13	.02	-35.85	-49.83	.59	.15
20.0	-.69	.02	-.12	-.01	-34.50	-54.65	.71	.12
25.0	-.83	-.04	-.11	-.02	-34.46	-54.43	.79	.09
30.0	-.91	-.08	-.10	-.02	-34.91	-52.53	.84	.08
35.0	-.93	-.08	-.08	.00	-35.00	-57.14	.85	.08
40.0	-.86	-.03	-.06	.01	-35.58	-55.28	.84	.08
45.0	-.72	.06	-.04	.02	-37.51	-52.78	.78	.06
50.0	-.67	-.01	-.02	.01	-39.28	-56.17	.66	.03
55.0	-.34	.09	-.01	-.01	-44.84	-55.12	.43	.00
60.0	0.00	.10	0.00	-.01	-200.00	-55.14	.10	-.01
65.0	.33	-.00	-.02	-.02	-44.17	-51.91	-.34	-.00
70.0	.68	-.11	-.05	-.01	-38.11	-53.03	-.79	.04
75.0	.97	-.18	-.10	.01	-34.48	-49.82	-1.15	.11
80.0	1.26	-.05	-.18	.02	-30.42	-50.92	-1.30	.20
85.0	1.26	.09	-.27	.02	-28.38	-50.47	-1.17	.29
90.0	.93	.17	-.37	-.01	-27.58	-50.48	-.75	.37
95.0	.18	.06	-.43	-.03	-28.03	-50.85	-.12	.40
100.0	-.56	.01	-.45	-.03	-28.23	-51.37	.57	.40
105.0	-1.30	-.17	-.37	.00	-30.09	-54.00	1.13	.37
110.0	-1.64	-.25	-.26	.05	-33.53	-48.35	1.39	.32
TOTAL	.87	.11	.21	.02	-31.77	-51.42		

NET REDUCTION OF MISMATCH ERROR= 19.6606.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00612	.00000
2	0.00000	0.00000	-.00816	.00000
3	0.00000	0.00000	.01185	.00000
4	0.00000	0.00000	.00374	-.00000
5	0.00000	0.00000	.00009	.00000
6	1.00000	0.00000	1.00888	-.00000
7	0.00000	0.00000	-.00499	.00000
8	0.00000	0.00000	-.00316	.00000
9	0.00000	0.00000	-.00196	.00000
10	0.00000	0.00000	-.00094	.00000
11	0.00000	0.00000	-.00081	.00000
12	0.00000	0.00000	-.00050	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 17 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.16	-.09	-.06	.01	-33.74	-55.57	1.07	.06
20.0	-1.05	.07	-.05	-.00	-34.16	-58.20	1.12	.05
25.0	-.96	.07	-.05	-.01	-35.17	-56.64	1.04	.04
30.0	-.88	.00	-.04	-.01	-36.72	-64.58	.89	.03
35.0	-.81	-.06	-.03	-.00	-37.17	-59.37	.74	.03
40.0	-.70	-.07	-.02	.00	-37.96	-57.42	.65	.03
45.0	-.58	-.02	-.01	.01	-39.88	-60.24	.56	.02
50.0	-.42	.04	-.01	.00	-43.35	-62.10	.46	.01
55.0	-.22	.09	-.00	-.00	-49.00	-56.78	.31	.00
60.0	0.00	.05	0.00	-.00	-200.00	-59.19	.05	-.00
65.0	.26	-.01	-.01	-.01	-46.37	-59.06	-.27	.00
70.0	.52	-.08	-.04	-.00	-40.44	-56.77	-.60	.03
75.0	.79	-.05	-.08	.00	-36.24	-61.08	-.83	.08
80.0	.83	-.05	-.14	.01	-33.38	-55.47	-.88	.15
85.0	.73	.04	-.21	.01	-31.41	-56.59	-.69	.21
90.0	.38	.10	-.27	-.01	-30.83	-55.00	-.28	.26
95.0	-.21	.05	-.29	-.01	-31.45	-57.26	.25	.28
100.0	-.83	-.05	-.26	-.01	-31.91	-60.92	.78	.25
105.0	-1.27	-.10	-.18	.01	-33.97	-58.19	1.18	.19
110.0	-1.34	-.03	-.09	.01	-37.77	-62.86	1.31	.10
TOTAL	.78	.06	.13	.01	-54.46	-57.43		

NET REDUCTION OF MISMATCH ERROR= 22.97DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00350	-.00000
2	0.00000	0.00000	-.00457	.00000
3	0.00000	0.00000	.00988	.00000
4	0.00000	0.00000	-.00130	.00000
5	0.00000	0.00000	-.00026	-.00000
6	1.00000	0.00000	1.00160	-.00000
7	0.00000	0.00000	-.00715	.00000
8	0.00000	0.00000	-.00429	-.00000
9	0.00000	0.00000	-.00176	.00000
10	0.00000	0.00000	-.00188	-.00000
11	0.00000	0.00000	-.00066	.00000
12	0.00000	0.00000	-.00084	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 18 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.11	-.13	.05	-.00	-34.07	-52.95	.98	-.06
20.0	-.96	.05	.05	.00	-30.86	-60.62	1.01	-.05
25.0	-.81	.10	.05	.00	-36.33	-54.66	.91	-.05
30.0	-.74	.01	.04	-.00	-38.11	-66.24	.75	-.04
35.0	-.64	-.05	.04	-.00	-38.84	-61.68	.59	-.04
40.0	-.49	-.03	.03	-.00	-40.53	-65.16	.46	-.03
45.0	-.35	.01	.02	-.00	-43.46	-69.21	.36	-.03
50.0	-.34	-.06	.02	.00	-44.39	-59.43	.28	-.02
55.0	-.13	.05	.01	-.00	-52.75	-61.72	.18	-.01
60.0	0.00	.04	0.00	.00	-200.00	-60.83	.04	.00
65.0	.13	.02	-.03	-.00	-48.55	-67.78	-.11	.02
70.0	.22	-.03	-.05	-.00	-43.28	-64.17	-.25	.05
75.0	.25	-.06	-.08	.00	-40.41	-58.63	-.31	.09
80.0	.26	.00	-.13	-.00	-36.38	-79.52	-.26	.12
85.0	.11	.04	-.16	.00	-34.72	-62.91	-.07	.16
90.0	-.17	.04	-.19	-.01	-34.05	-60.83	.21	.18
95.0	-.61	-.08	-.18	.00	-34.67	-58.97	.55	.18
100.0	-.78	.03	-.15	.00	-35.46	-67.66	.81	.15
105.0	-1.02	-.04	-.09	.00	-37.33	-65.14	.98	.09
110.0	-.93	.05	-.02	-.01	-41.51	-64.65	.98	.02
TOTAL	.61	.06	.09	.00	-37.00	-59.61		

NET REDUCTION OF MISMATCH ERROR= 22.60DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00405	-.00000
2	0.00000	0.00000	-.00917	-.00000
3	0.00000	0.00000	.01190	.00000
4	0.00000	0.00000	-.00229	-.00000
5	0.00000	0.00000	.00288	.00000
6	1.00000	0.00000	1.00315	-.00000
7	0.00000	0.00000	-.00247	.00000
8	0.00000	0.00000	-.00404	-.00000
9	0.00000	0.00000	.00063	.00000
10	0.00000	0.00000	-.00101	-.00000
11	0.00000	0.00000	-.00023	.00000
12	0.00000	0.00000	-.00019	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 19 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.61	-.02	-.02	.01	-39.52	-63.15	.60	.02
20.0	-.62	.03	-.02	-.00	-39.00	-63.02	.65	.02
25.0	-.63	.01	-.02	-.00	-39.07	-65.70	.64	.01
30.0	-.59	.01	-.01	-.00	-40.49	-74.69	.60	.01
35.0	-.60	-.05	-.01	-.00	-39.97	-62.40	.55	.01
40.0	-.53	-.02	.00	.00	-40.57	-63.50	.51	.00
45.0	-.45	.01	.00	.00	-42.17	-65.98	.46	-.00
50.0	-.37	-.00	.01	.00	-44.35	-82.36	.37	-.01
55.0	-.16	.06	.01	-.00	-51.05	-59.39	.23	-.01
60.0	0.00	.02	0.00	-.00	-200.00	-64.57	.02	-.00
65.0	.19	-.02	-.02	-.01	-47.46	-62.15	-.21	.02
70.0	.36	-.06	-.05	.00	-41.74	-59.58	-.43	.05
75.0	.50	-.04	-.09	.01	-37.80	-59.85	-.54	.10
80.0	.53	.03	-.14	.01	-34.45	-58.79	-.50	.15
85.0	.33	.04	-.20	-.00	-32.63	-62.57	-.29	.19
90.0	-.01	.06	-.22	-.01	-32.61	-56.58	.07	.21
95.0	-.53	-.01	-.20	-.00	-34.06	-69.14	.51	.19
100.0	-1.07	-.14	-.14	.00	-34.44	-54.19	.93	.14
105.0	-1.21	.01	-.04	.01	-36.91	-59.04	1.21	.05
110.0	-1.12	.15	.04	-.01	-39.71	-56.22	1.27	-.05
TOTAL	.61	.06	.09	.01	-36.87	-59.67		

NET REDUCTION OF MISMATCH ERROR= 22.79DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.01346	.00000
2	0.00000	0.00000	-.01485	-.00000
3	0.00000	0.00000	.03562	.00000
4	0.00000	0.00000	-.00304	.00000
5	0.00000	0.00000	-.02064	.00000
6	1.00000	0.00000	1.01060	-.00000
7	0.00000	0.00000	-.04708	-.00000
8	0.00000	0.00000	-.00855	-.00000
9	0.00000	0.00000	-.00986	.00000
10	0.00000	0.00000	-.00247	-.00000
11	0.00000	0.00000	-.00469	-.00000
12	0.00000	0.00000	-.00055	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 20 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-4.06	-.44	.46	.01	-21.07	-42.62	3.65	-.46
20.0	-3.57	.20	.45	-.00	-21.51	-49.04	3.76	-.45
25.0	-3.11	.29	.43	-.00	-22.55	-46.01	3.40	-.43
30.0	-2.62	.14	.39	-.01	-24.55	-52.34	2.75	-.40
35.0	-2.20	-.14	.35	.00	-25.35	-52.75	2.06	-.35
40.0	-1.69	-.20	.30	.01	-26.68	-48.82	1.49	-.29
45.0	-1.23	-.14	.23	.01	-29.22	-52.11	1.09	-.23
50.0	-.78	.04	.17	.01	-33.20	-61.34	.81	-.16
55.0	-.38	.15	.09	-.01	-39.04	-51.95	.53	-.09
60.0	0.00	.17	0.00	-.00	-200.00	-50.48	.17	-.00
65.0	.39	.10	-.12	-.01	-36.36	-52.54	-.28	.11
70.0	.61	-.10	-.25	-.01	-30.87	-54.97	-.71	.24
75.0	.67	-.26	-.39	.01	-27.40	-46.94	-.94	.40
80.0	.67	-.12	-.55	.01	-23.94	-51.37	-.79	.57
85.0	.23	.04	-.70	.01	-22.08	-58.22	-.19	.71
90.0	-.50	.22	-.82	-.01	-21.54	-48.58	.81	.81
95.0	-1.88	.16	-.85	-.01	-21.94	-51.65	2.03	.83
100.0	-3.12	.09	-.79	-.01	-22.02	-57.51	3.20	.79
105.0	-4.15	-.15	-.65	.01	-23.50	-53.84	4.00	.67
110.0	-4.66	-.53	-.50	.00	-26.11	-46.57	4.13	.50
TOTAL	2.34	.22	.46	.01	-23.84	-48.80		

NET REDUCTION OF MISMATCH ERROR= 24.96DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.30852	-.00000
2	0.00000	0.00000	-.17582	.00000
3	0.00000	0.00000	-.22721	-.00000
4	0.00000	0.00000	-.22615	.00000
5	0.00000	0.00000	.11007	-.00000
6	1.00000	0.00000	-.17456	.00000
7	0.00000	0.00000	-.16856	-.00000
8	0.00000	0.00000	-.22111	.00000
9	0.00000	0.00000	-.08914	-.00000
10	0.00000	0.00000	-.21837	.00000
11	0.00000	0.00000	.02582	-.00000
12	0.00000	0.00000	-.28801	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 21 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	217.45	47.61	-.35	-7.28	5.11	-2.45	-169.85	-6.93
20.0	66.77	33.39	-.86	-13.41	.56	-1.49	-33.38	-12.55
25.0	38.46	26.94	-.57	-5.24	-3.93	-4.96	-11.52	-4.67
30.0	-20.62	-20.78	-.09	-4.10	-9.80	-7.36	-.16	-4.01
35.0	-69.11	-44.83	-.36	-6.52	.52	-2.97	24.27	-6.16
40.0	-87.96	-21.20	-.83	-7.48	2.51	-4.03	66.76	-6.66
45.0	-237.62	-146.11	-.69	-5.48	4.48	5.30	91.51	-4.79
50.0	244.41	-18.83	.33	-4.59	4.00	-7.26	-263.24	-4.72
55.0	-65.37	-336.23	.03	-7.44	.11	-4.52	-270.87	-7.46
60.0	0.00	57.07	0.00	-12.88	-200.00	-.94	57.07	-12.88
65.0	-265.36	94.93	-.02	-15.19	3.09	.29	360.28	-14.57
70.0	215.25	201.51	.08	-16.54	5.17	.69	-13.74	-16.42
75.0	-40.79	38.78	-.04	-18.63	-3.73	-1.38	79.56	-18.59
80.0	-68.35	38.86	-.59	-8.38	.84	-2.48	107.21	-7.78
85.0	194.05	301.84	-.63	-4.01	5.76	-1.24	107.79	-3.38
90.0	-184.85	-79.10	.20	-2.20	5.46	.51	105.75	-2.40
95.0	-27.76	76.70	.92	-3.78	-7.49	-1.28	104.46	-4.70
100.0	-68.34	-310.96	1.89	-11.90	-.03	-3.51	-242.63	-13.79
105.0	-254.65	-8.26	3.48	-7.12	2.50	-8.46	246.39	-10.60
110.0	-196.00	52.24	5.23	1.45	3.14	-6.03	248.24	-3.78
TOTAL	156.56	141.49	1.79	4.03	2.91	-1.13		

NET REDUCTION OF MISMATCH ERROR= 4.050B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00647	-.00000
2	0.00000	0.00000	-.00980	.00000
3	0.00000	0.00000	.01266	-.00000
4	0.00000	0.00000	.00322	.00000
5	0.00000	0.00000	-.00745	-.00000
6	1.00000	0.00000	1.01266	.00000
7	0.00000	0.00000	-.01472	-.00000
8	0.00000	0.00000	-.00013	.00000
9	0.00000	0.00000	-.00345	-.00000
10	0.00000	0.00000	.00108	.00000
11	0.00000	0.00000	-.00116	-.00000
12	0.00000	0.00000	.00068	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 22 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DL)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.86	.03	.05	.01	-36.12	-55.38	.89	-.04
20.0	-.95	.03	.04	-.01	-35.10	-60.97	.98	-.05
25.0	-.95	.02	.04	-.01	-35.33	-58.44	.97	-.05
30.0	-.92	-.03	.03	-.02	-36.54	-55.30	.89	-.04
35.0	-.89	-.09	.03	.00	-36.39	-56.91	.80	-.03
40.0	-.75	-.04	.03	.01	-37.32	-56.64	.72	-.02
45.0	-.60	.04	.02	.01	-39.45	-55.94	.63	-.01
50.0	-.55	-.02	.02	.01	-40.82	-58.31	.52	-.01
55.0	-.26	.09	.01	-.01	-47.20	-55.71	.35	-.01
60.0	0.00	.09	0.00	-.01	-200.00	-54.71	.09	-.01
65.0	.26	.02	-.03	-.02	-44.49	-54.35	-.24	.02
70.0	.48	-.10	-.08	-.01	-38.78	-54.68	-.57	.07
75.0	.65	-.15	-.13	.01	-35.03	-51.08	-.80	.14
80.0	.80	-.03	-.22	.02	-30.92	-53.84	-.83	.23
85.0	.64	.05	-.30	.02	-28.85	-53.53	-.59	.32
90.0	.25	.15	-.39	-.01	-27.83	-51.55	-.10	.38
95.0	-.52	.04	-.43	-.02	-28.04	-54.05	.56	.41
100.0	-1.19	.04	-.41	-.02	-28.05	-54.90	1.23	.39
105.0	-1.86	-.15	-.35	.00	-29.50	-55.23	1.72	.35
110.0	-2.09	-.23	-.25	.03	-32.63	-50.87	1.86	.28
TOTAL	.92	.09	.20	.01	-32.02	-53.80		

NET REDUCTION OF MISMATCH ERROR= 21.79DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00448	-.00000
2	0.00000	0.00000	-.00794	.00000
3	0.00000	0.00000	.00791	-.00000
4	0.00000	0.00000	.00809	.00000
5	0.00000	0.00000	.00203	-.00000
6	1.00000	0.00000	1.01259	.00000
7	0.00000	0.00000	.00186	-.00000
8	0.00000	0.00000	-.00248	.00000
9	0.00000	0.00000	.00062	-.00000
10	0.00000	0.00000	-.00009	.00000
11	0.00000	0.00000	.00028	-.00000
12	0.00000	0.00000	.00012	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 23 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.47	.09	-.18	.01	-33.53	-54.02	.56	.19
20.0	-.64	.01	-.17	-.01	-32.92	-63.45	.65	.16
25.0	-.74	-.03	-.15	-.01	-33.35	-57.51	.71	.14
30.0	-.78	-.05	-.13	-.01	-34.70	-59.50	.73	.13
35.0	-.80	-.06	-.11	.00	-35.02	-60.23	.74	.11
40.0	-.74	-.02	-.08	.01	-35.83	-61.20	.72	.09
45.0	-.63	.03	-.06	.01	-37.86	-57.69	.66	.07
50.0	-.48	.06	-.04	.00	-41.32	-59.58	.54	.04
55.0	-.25	.07	-.02	-.00	-46.91	-58.69	.32	.01
60.0	0.00	.01	0.00	-.01	-200.00	-62.14	.01	-.01
65.0	.31	-.04	-.00	-.01	-45.16	-56.12	-.36	-.01
70.0	.64	-.08	-.02	-.00	-39.36	-56.57	-.73	.01
75.0	.99	-.02	-.05	.01	-35.35	-64.01	-1.01	.06
80.0	1.11	-.01	-.10	.02	-32.84	-54.87	-1.13	.12
85.0	1.10	.05	-.17	.01	-31.27	-57.14	-1.04	.18
90.0	.85	.09	-.25	-.01	-31.20	-55.82	-.77	.22
95.0	.37	.01	-.25	-.02	-32.50	-56.49	-.36	.23
100.0	-.17	-.09	-.22	-.01	-33.98	-56.62	.09	.21
105.0	-.54	-.09	-.16	.01	-37.43	-58.86	.45	.16
110.0	-.56	.09	-.07	.02	-43.79	-57.24	.64	.09
TOTAL	.67	.06	.13	.01	-34.38	-56.98		

NET REDUCTION OF MISMATCH ERROR= 22.6000.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.01010	-.00000
2	0.00000	0.00000	-.01531	.00000
3	0.00000	0.00000	.01614	-.00000
4	0.00000	0.00000	.01215	.00000
5	0.00000	0.00000	-.00856	-.00000
6	1.00000	0.00000	1.02678	.00000
7	0.00000	0.00000	-.01485	-.00000
8	0.00000	0.00000	.00286	.00000
9	0.00000	0.00000	-.00390	-.00000
10	0.00000	0.00000	.00310	.00000
11	0.00000	0.00000	-.00136	-.00000
12	0.00000	0.00000	.00166	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 24 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES) BEFORE	PHASE ERROR (DEGREES) AFTER	AMPLITUDE ERROR (DB) BEFORE	AMPLITUDE ERROR (DB) AFTER	TOTAL MS ERROR (DB POWER) BEFORE	TOTAL MS ERROR (DB POWER) AFTER	FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
15.0	-.89	.13	-.12	.03	-34.10	-48.18	1.02	.14
20.0	-1.13	.05	-.11	-.01	-32.48	-56.00	1.17	.10
25.0	-1.26	-.02	-.10	-.02	-32.25	-51.06	1.23	.08
30.0	-1.31	-.08	-.09	-.03	-32.83	-50.64	1.23	.07
35.0	-1.31	-.12	-.07	.00	-32.76	-53.91	1.19	.07
40.0	-1.19	-.06	-.05	.02	-33.30	-51.45	1.13	.07
45.0	-1.00	.05	-.03	.03	-35.09	-50.30	1.05	.06
50.0	-.88	.02	-.01	.02	-37.04	-53.75	.89	.03
55.0	-.46	.14	-.00	-.01	-42.43	-51.95	.60	-.01
60.0	0.00	.15	0.00	-.02	-200.00	-48.75	.15	-.02
65.0	.43	-.01	-.03	-.03	-41.79	-49.43	-.44	-.00
70.0	.90	-.15	-.08	-.01	-35.35	-50.61	-1.05	.06
75.0	1.27	-.26	-.15	.02	-31.58	-46.59	-1.53	.17
80.0	1.61	-.08	-.27	.03	-27.50	-47.64	-1.69	.31
85.0	1.54	.12	-.41	.03	-25.34	-48.00	-1.42	.44
90.0	.99	.25	-.56	-.01	-24.48	-47.38	-.74	.54
95.0	-.13	.11	-.64	-.04	-24.75	-47.52	.24	.60
100.0	-1.25	.02	-.64	-.04	-24.74	-48.76	1.27	.60
105.0	-2.32	-.23	-.55	.01	-26.31	-51.15	2.09	.55
110.0	-2.86	-.44	-.41	.07	-29.31	-44.98	2.42	.47
TOTAL	1.31	.16	.30	.03	-28.67	-48.48		

NET REDUCTION OF MISMATCH ERRORS 19.81DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00388	-.00000
2	0.00000	0.00000	-.00740	.00000
3	0.00000	0.00000	.00596	-.00000
4	0.00000	0.00000	.00654	.00000
5	0.00000	0.00000	.00058	-.00000
6	1.00000	0.00000	1.01003	.00000
7	0.00000	0.00000	.00178	-.00000
8	0.00000	0.00000	-.00275	.00000
9	0.00000	0.00000	.00102	-.00000
10	0.00000	0.00000	.00003	.00000
11	0.00000	0.00000	.00050	-.00000
12	0.00000	0.00000	.00019	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 25 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.22	.12	-.13	.01	-36.76	-52.35	.34	.14
20.0	-.41	.01	-.13	-.01	-35.75	-63.93	.42	.12
25.0	-.56	-.07	-.12	-.01	-35.66	-55.16	.49	.11
30.0	-.58	-.04	-.10	-.01	-36.96	-60.58	.54	.10
35.0	-.64	-.05	-.09	.00	-36.87	-61.04	.58	.09
40.0	-.61	-.01	-.07	.01	-37.44	-61.46	.60	.08
45.0	-.53	.04	-.05	.01	-39.27	-57.28	.57	.06
50.0	-.42	.06	-.03	.00	-42.45	-60.11	.47	.04
55.0	-.22	.06	-.01	-.00	-48.08	-59.78	.28	.01
60.0	0.00	.01	0.00	-.01	-200.00	-61.34	.01	-.01
65.0	.29	-.05	-.00	-.01	-46.01	-56.36	-.33	-.01
70.0	.58	-.08	-.01	-.01	-40.22	-56.45	-.67	.01
75.0	.92	-.02	-.04	.01	-36.17	-62.55	-.93	.05
80.0	1.06	.00	-.09	.01	-33.51	-55.58	-1.06	.10
85.0	1.05	.05	-.14	.01	-32.08	-57.12	-1.00	.15
90.0	.85	.08	-.20	-.01	-32.01	-56.28	-.77	.19
95.0	.42	-.00	-.22	-.02	-33.46	-56.78	-.42	.20
100.0	-.06	-.09	-.20	-.01	-35.19	-56.36	-.03	.19
105.0	-.38	-.09	-.13	.01	-39.13	-59.40	.30	.14
110.0	-.37	.11	-.05	.02	-46.83	-56.41	.48	.07
TOTAL	.58	.06	.11	.01	-35.82	-56.72		

NET REDUCTION OF MISMATCH ERRORS 20.91DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00472	.00000
2	0.00000	0.00000	-.00801	.00000
3	0.00000	0.00000	.01022	.00000
4	0.00000	0.00000	.00314	.00000
5	0.00000	0.00000	.00542	.00000
6	1.00000	0.00000	1.00864	.00000
7	0.00000	0.00000	.00174	.00000
8	0.00000	0.00000	-.00239	.00000
9	0.00000	0.00000	.00032	.00000
10	0.00000	0.00000	-.00060	.00000
11	0.00000	0.00000	.00003	.00000
12	0.00000	0.00000	-.00014	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 26 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.65	-.02	-.15	.01	-33.89	-63.62	.63	.16
20.0	-.66	.04	-.14	-.00	-34.02	-63.82	.70	.14
25.0	-.65	.05	-.12	-.00	-34.98	-61.40	.70	.12
30.0	-.70	-.03	-.11	-.01	-35.76	-57.70	.67	.10
35.0	-.70	-.07	-.09	-.00	-36.36	-59.02	.63	.09
40.0	-.63	-.03	-.07	.01	-37.34	-60.64	.60	.07
45.0	-.51	.04	-.05	.01	-39.57	-60.52	.55	.06
50.0	-.47	-.01	-.02	.01	-41.93	-60.89	.46	.03
55.0	-.25	.05	-.02	-.00	-47.20	-59.73	.30	.01
60.0	0.00	.06	0.00	-.00	-200.00	-59.53	.06	-.00
65.0	.24	.00	-.01	-.01	-47.23	-58.70	-.24	-.00
70.0	.43	-.09	-.03	-.01	-42.31	-55.44	-.53	.02
75.0	.64	-.09	-.05	.01	-38.58	-55.25	-.73	.06
80.0	.77	.01	-.10	.01	-34.80	-60.14	-.76	.11
85.0	.68	.07	-.15	.01	-33.41	-55.94	-.61	.16
90.0	.37	.09	-.20	-.01	-33.06	-54.98	-.27	.19
95.0	-.23	-.07	-.20	-.01	-34.37	-57.93	.16	.19
100.0	-.62	-.02	-.16	-.01	-35.47	-63.04	.60	.16
105.0	-1.01	-.08	-.08	.01	-37.60	-59.61	.93	.09
110.0	-1.00	.05	.02	.01	-40.92	-62.04	1.05	-.01
TOTAL	.61	.06	.11	.01	-35.89	-58.02		

NET REDUCTION OF MISMATCH ERROR 22.1208.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00511	-.00000
2	0.00000	0.00000	-.00781	.00000
3	0.00000	0.00000	.00879	-.00000
4	0.00000	0.00000	.00541	.00000
5	0.00000	0.00000	-.00427	-.00000
6	1.00000	0.00000	1.01062	.00000
7	0.00000	0.00000	-.00670	-.00000
8	0.00000	0.00000	-.00165	.00000
9	0.00000	0.00000	-.00154	-.00000
10	0.00000	0.00000	.00043	.00000
11	0.00000	0.00000	-.00043	-.00000
12	0.00000	0.00000	.00030	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 27 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.62	.06	-.02	.01	-39.37	-55.03	.68	.04
20.0	-.73	.03	-.03	-.01	-37.55	-62.19	.75	.02
25.0	-.78	-.02	-.05	-.01	-37.16	-56.85	.76	.02
30.0	-.76	-.04	-.02	-.01	-38.17	-59.76	.72	.02
35.0	-.73	-.06	-.02	.00	-38.18	-60.64	.67	.02
40.0	-.65	-.03	-.01	.01	-38.73	-58.87	.62	.02
45.0	-.54	.01	-.01	.01	-40.49	-57.12	.56	.02
50.0	-.40	.06	-.00	.00	-43.91	-59.52	.45	.01
55.0	-.20	.08	.00	-.00	-49.50	-57.95	.28	-.00
60.0	0.00	.02	0.00	-.01	-200.00	-58.46	.02	-.01
65.0	.29	-.02	-.01	-.01	-45.63	-56.65	-.30	.00
70.0	.54	-.09	-.04	-.01	-40.13	-55.96	-.63	.03
75.0	.83	-.04	-.08	.01	-35.88	-59.80	-.88	.09
80.0	.93	-.03	-.14	.02	-32.81	-54.42	-.96	.15
85.0	.84	.04	-.21	.01	-30.84	-57.18	-.82	.22
90.0	.58	.10	-.28	-.01	-30.24	-54.71	-.48	.27
95.0	.05	.05	-.31	-.02	-30.83	-55.32	.00	.29
100.0	-.55	-.04	-.30	-.01	-31.25	-57.49	.51	.29
105.0	-1.01	-.10	-.24	.00	-33.31	-58.20	.91	.24
110.0	-1.14	-.07	-.16	.03	-37.27	-55.66	1.07	.18
TOTAL	.68	.06	.14	.01	-34.56	-56.45		

NET REDUCTION OF MISMATCH ERROR= 21.870B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00533	-.00000
2	0.00000	0.00000	-.00977	-.00000
3	0.00000	0.00000	.00986	-.00000
4	0.00000	0.00000	.00157	-.00000
5	0.00000	0.00000	-.00586	-.00000
6	1.00000	0.00000	1.01123	.00000
7	0.00000	0.00000	-.00946	-.00000
8	0.00000	0.00000	.00027	.00000
9	0.00000	0.00000	-.00173	-.00000
10	0.00000	0.00000	.00062	-.00000
11	0.00000	0.00000	-.00061	-.00000
12	0.00000	0.00000	.00042	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 28 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.47	-.03	.01	.01	-41.82	-60.26	.44	-.00
20.0	-.35	.13	.02	.01	-43.76	-51.92	.48	-.01
25.0	-.47	.02	-.01	-.02	-41.77	-54.81	.49	-.01
30.0	-.60	-.12	-.02	-.02	-40.26	-51.01	.48	.00
35.0	-.59	-.12	-.01	-.00	-40.11	-53.98	.47	.01
40.0	-.45	.01	.00	.02	-42.02	-52.85	.46	.02
45.0	-.40	.05	-.00	.01	-43.14	-55.91	.45	.01
50.0	-.37	.02	.00	.01	-44.42	-62.20	.39	.00
55.0	-.18	.08	-.00	-.01	-50.64	-56.66	.26	-.01
60.0	0.00	.03	0.00	-.01	-200.00	-60.05	.03	-.01
65.0	.26	-.01	-.03	-.02	-44.96	-52.89	-.27	.01
70.0	.50	-.07	-.06	-.00	-39.74	-57.75	-.57	.05
75.0	.70	-.07	-.10	.02	-36.03	-53.70	-.77	.12
80.0	.76	-.03	-.18	.02	-32.12	-54.79	-.79	.20
85.0	.63	.05	-.26	.01	-29.99	-55.82	-.58	.27
90.0	.25	.09	-.33	-.01	-29.07	-54.52	-.15	.32
95.0	-.45	-.04	-.37	-.02	-29.31	-53.74	.41	.35
100.0	-.84	.14	-.34	-.01	-29.90	-53.48	.98	.33
105.0	-1.51	-.11	-.27	.01	-31.44	-56.80	1.40	.28
110.0	-1.80	-.27	-.19	.02	-34.28	-51.19	1.52	.21
TOTAL	.71	.10	.17	.01	-33.84	-53.69		

NET REDUCTION OF MISMATCH ERROR= 19.8508.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00640	.00000
2	0.00000	0.00000	-.00984	-.00000
3	0.00000	0.00000	.00830	.00000
4	0.00000	0.00000	.01068	-.00000
5	0.00000	0.00000	-.00223	.00000
6	1.00000	0.00000	1.02094	-.00000
7	0.00000	0.00000	-.00099	.00000
8	0.00000	0.00000	-.00080	-.00000
9	0.00000	0.00000	-.00021	.00000
10	0.00000	0.00000	.00109	-.00000
11	0.00000	0.00000	-.00007	.00000
12	0.00000	0.00000	.00060	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 29 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.50	.12	-.23	.02	-31.41	-50.81	.70	.25
20.0	-.81	.02	-.21	-.01	-30.90	-60.61	.83	.21
25.0	-.93	-.03	-.19	-.02	-31.32	-53.46	.90	.18
30.0	-1.00	-.04	-.17	-.01	-32.66	-55.76	.93	.15
35.0	-1.03	-.04	-.14	-.00	-32.91	-57.02	.94	.14
40.0	-.96	-.03	-.10	.01	-33.72	-56.47	.93	.12
45.0	-.82	.05	-.07	.02	-35.76	-53.10	.87	.09
50.0	-.73	-.01	-.04	.01	-37.99	-60.16	.75	.05
55.0	-.33	.13	-.02	-.00	-44.95	-55.28	.46	.01
60.0	0.00	.04	0.00	-.01	-200.00	-54.40	.06	-.01
65.0	.43	-.02	-.00	-.02	-42.38	-55.23	-.45	-.02
70.0	.91	-.07	-.02	-.01	-36.33	-55.90	-.99	.01
75.0	1.24	-.14	-.07	.01	-33.37	-50.05	-1.43	.08
80.0	1.63	-.02	-.11	.02	-29.70	-51.03	-1.65	.16
85.0	1.68	.09	-.23	.02	-27.98	-51.99	-1.60	.25
90.0	1.41	.15	-.33	-.01	-27.66	-51.78	-1.26	.33
95.0	.77	.07	-.39	-.03	-28.47	-51.06	-.70	.37
100.0	.03	-.04	-.39	-.02	-29.23	-52.91	-.07	.37
105.0	-.64	-.17	-.33	.00	-31.80	-55.99	.47	.33
110.0	-.91	-.12	-.23	.04	-36.22	-50.90	.79	.27
TOTAL	.95	.09	.20	.02	-31.24	-52.42		

NET REDUCTION OF MISMATCH ERROR= 21.1800.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00658	-.00000
2	0.00000	0.00000	-.01016	-.00000
3	0.00000	0.00000	.01289	-.00000
4	0.00000	0.00000	.00769	-.00000
5	0.00000	0.00000	-.00471	.00000
6	1.00000	0.00000	1.01505	.00000
7	0.00000	0.00000	-.00940	-.00000
8	0.00000	0.00000	-.00293	.00000
9	0.00000	0.00000	-.00137	-.00000
10	0.00000	0.00000	.00007	.00000
11	0.00000	0.00000	-.00068	-.00000
12	0.00000	0.00000	.00046	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 30 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.02	.02	-.05	.01	-34.82	-55.91	1.04	.07
20.0	-1.13	.04	-.05	-.01	-33.66	-60.44	1.16	.05
25.0	-1.14	.04	-.04	-.01	-33.87	-56.72	1.18	.03
30.0	-1.18	-.06	-.04	-.01	-34.35	-55.48	1.13	.03
35.0	-1.12	-.09	-.05	.00	-34.46	-56.81	1.04	.03
40.0	-.90	-.05	-.01	.01	-35.18	-56.49	.94	.02
45.0	-.78	.04	-.01	.01	-37.32	-56.69	.83	.02
50.0	-.65	.01	.01	.01	-39.55	-57.87	.67	.00
55.0	-.34	.08	.00	-.01	-45.07	-56.59	.42	-.01
60.0	0.00	.07	0.00	-.01	-200.00	-55.47	.07	-.01
65.0	.36	.01	-.03	-.02	-42.99	-54.46	-.35	.01
70.0	.67	-.11	-.07	-.01	-37.47	-54.01	-.78	.06
75.0	.97	-.13	-.13	.01	-33.63	-52.17	-1.10	.14
80.0	1.18	-.03	-.21	.02	-29.90	-53.47	-1.21	.23
85.0	1.11	.08	-.30	.01	-28.00	-53.40	-1.04	.32
90.0	.75	.14	-.39	-.01	-27.40	-51.54	-.60	.38
95.0	-.00	.00	-.42	-.02	-28.25	-55.05	.01	.40
100.0	-.65	.00	-.40	-.02	-28.83	-57.10	.66	.38
105.0	-1.30	-.13	-.32	.01	-31.00	-55.86	1.17	.32
110.0	-1.51	-.13	-.21	.03	-34.81	-53.94	1.38	.24
TOTAL	.93	.08	.19	.01	-31.70	-54.33		

NET REDUCTION OF MISMATCH ERRORS 22.6300.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.28582	-.00000
2	0.00000	0.00000	-.17060	.00000
3	0.00000	0.00000	-.21258	-.00 [illegible]
4	0.00000	0.00000	-.21714	.00[illegible]
5	0.00000	0.00000	.10214	-.00000
6	1.00000	0.00000	-.16284	.00000
7	0.00000	0.00000	-.15594	-.00000
8	0.00000	0.00000	-.20606	.00000
9	0.00000	0.00000	-.08053	-.00000
10	0.00000	0.00000	-.21014	.00000
11	0.00000	0.00000	.02116	-.00000
12	0.00000	0.00000	-.26648	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 31 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	218.54	49.26	.19	-7.22	5.36	-2.53	-169.28	-7.41
20.0	67.16	32.53	-.20	-13.14	.91	-1.56	-34.63	-12.44
25.0	39.64	27.37	.01	-5.12	-3.43	-4.98	-12.27	-5.12
30.0	-18.64	-19.83	.75	-3.69	-9.96	-7.88	-1.19	-4.44
35.0	-66.71	-44.46	.20	-0.36	.56	-3.04	22.25	-6.62
40.0	-87.24	-22.47	-.13	-7.51	2.78	-3.94	64.77	-7.39
45.0	-238.86	-147.94	.00	-5.55	4.76	3.31	90.91	-5.55
50.0	244.41	-18.67	.61	-4.80	4.15	-6.92	-263.08	-5.41
55.0	-65.42	-335.34	.56	-7.51	.40	-4.42	-269.91	-8.08
60.0	0.00	59.86	0.00	-13.53	-200.00	-.79	59.86	-13.53
65.0	-265.22	97.09	-.01	-15.59	5.39	.34	362.91	-15.57
70.0	215.34	204.58	.52	-16.80	5.39	.61	-10.76	-17.32
75.0	-40.46	37.78	.60	-18.10	-3.44	-1.44	78.23	-18.70
80.0	-67.53	38.07	-.03	-8.44	1.01	-2.51	105.60	-8.41
85.0	194.21	300.76	-.17	-4.24	5.99	-1.14	106.54	-4.07
90.0	-184.10	-79.57	.69	-2.40	5.71	.49	104.61	-3.09
95.0	-27.51	75.77	1.81	-3.58	-6.56	-1.31	103.28	-5.39
100.0	-68.10	-312.44	2.16	-12.32	.12	-3.51	-244.33	-14.49
105.0	-254.87	-9.14	3.69	-7.63	2.63	-8.07	245.73	-11.32
110.0	-194.80	52.44	5.89	1.46	5.58	-6.00	247.23	-4.43
TOTAL	156.55	141.69	2.03	4.05	3.16	-1.12		

NET REDUCTION OF MISMATCH ERROR= 4.28DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00874	.00000
2	0.00000	0.00000	-.01343	-.00000
3	0.00000	0.00000	.01211	.00000
4	0.00000	0.00000	.01235	-.00000
5	0.00000	0.00000	-.00606	.00000
6	1.00000	0.00000	1.02447	-.00000
7	0.00000	0.00000	-.00828	.00000
8	0.00000	0.00000	.00213	-.00000
9	0.00000	0.00000	-.00225	.00000
10	0.00000	0.00000	.00257	-.00000
11	0.00000	0.00000	-.00079	.00000
12	0.00000	0.00000	.00148	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 32 WITH 12 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.58	.13	-.16	.03	-33.77	-48.78	.72	.19
20.0	-.80	.04	-.16	-.01	-32.75	-57.55	.84	.15
25.0	-.92	-.01	-.14	-.02	-32.89	-52.12	.91	.12
30.0	-1.05	-.11	-.13	-.02	-34.29	-50.41	.94	.11
35.0	-1.06	-.11	-.11	.00	-33.44	-54.43	.95	.11
40.0	-.98	-.04	-.08	.02	-34.17	-52.81	.94	.10
45.0	-.83	.06	-.06	.02	-35.97	-51.14	.89	.08
50.0	-.75	.02	-.03	.02	-38.13	-54.46	.77	.05
55.0	-.30	.13	-.02	-.01	-43.58	-52.98	.52	.01
60.0	0.00	.11	0.00	-.02	200.00	-51.03	.11	-.02
65.0	.44	.01	-.01	-.03	-42.05	-49.86	-.43	-.01
70.0	.86	-.15	-.05	-.01	-36.35	-50.76	-1.01	.04
75.0	1.24	-.21	-.11	.02	-32.54	-48.08	-1.48	.13
80.0	1.62	-.06	-.21	.03	-28.57	-48.66	-1.67	.24
85.0	1.60	.10	-.33	.03	-26.56	-48.88	-1.50	.36
90.0	1.19	.23	-.46	-.01	-25.76	-47.99	-.96	.45
95.0	.23	.09	-.54	-.04	-24.22	-48.50	-.14	.50
100.0	-.74	.01	-.54	-.04	-26.43	-49.73	.74	.50
105.0	-1.70	-.23	-.45	.01	-28.21	-51.29	1.47	.46
110.0	-2.13	-.32	-.32	.06	-31.56	-46.54	1.81	.39
TOTAL	1.09	.14	.25	.03	-29.97	-49.44		

NET REDUCTION IN MISMATCH ERRORS 19.4700.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00057	-.00000
2	0.00000	0.00000	-.00256	.00000
3	0.00000	0.00000	.00604	-.00000
4	0.00000	0.00000	-.01069	.00000
5	0.00000	0.00000	.00423	-.00000
6	0.00000	0.00000	.00678	.00000
7	0.00000	0.00000	-.00089	-.00000
8	1.00100	0.00000	1.01328	.00000
9	0.00000	0.00000	-.00247	-.00000
10	0.00000	0.00000	-.00313	.00000
11	0.00000	0.00000	.00041	-.00000
12	0.00000	0.00000	-.00065	.00000
13	0.00000	0.00000	.00043	-.00000
14	0.00000	0.00000	-.00023	.00000
15	0.00000	0.00000	.00024	-.00000
16	0.00000	0.00000	-.00013	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 2 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.48	.02	-.15	-.00	-35.40	-69.49	.50	.13
20.0	-.68	-.02	-.13	-.00	-34.29	-68.58	.66	.13
25.0	-.79	-.01	-.12	.00	-34.45	-66.28	.79	.12
30.0	-.88	.01	-.11	-.00	-35.02	-66.81	.87	.11
35.0	-.80	-.01	-.09	.00	-35.12	-77.93	.88	.09
40.0	-.81	.02	-.07	.00	-35.89	-67.64	.83	.07
45.0	-.68	.03	-.05	-.00	-37.70	-64.81	.71	.05
50.0	-.63	-.09	-.02	.00	-39.62	-56.41	.54	.03
55.0	-.34	-.01	-.02	-.00	-44.81	-66.72	.32	.01
60.0	0.00	.05	0.00	.00	-200.00	-59.37	.05	.00
65.0	.30	.03	-.01	-.00	-45.52	-64.28	-.27	.01
70.0	.50	-.02	-.04	-.00	-39.44	-65.28	-.62	.03
75.0	.88	-.07	-.07	.00	-35.75	-58.40	-.95	.08
80.0	1.16	.01	-.14	.00	-31.66	-71.93	-1.15	.14
85.0	1.15	.02	-.22	.00	-29.48	-64.90	-1.13	.22
90.0	.91	.06	-.30	-.01	-29.26	-58.70	-.85	.29
95.0	.29	-.07	-.33	-.00	-30.16	-60.50	-.35	.33
100.0	-.27	-.02	-.33	.00	-30.75	-70.32	.25	.33
105.0	-.81	-.03	-.26	.01	-33.20	-65.18	.77	.27
110.0	-.98	.11	-.17	-.01	-37.68	-59.54	1.07	.16
TOTAL	.45	.01	.16	.00	-33.52	-61.80		

NET REDUCTION OF MISMATCH ERROR= 28.48DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00037	-.00000
2	0.00000	0.00000	-.00256	.00000
3	0.00000	0.00000	.00604	-.00000
4	0.00000	0.00000	-.01089	.00000
5	0.00000	0.00000	.00923	-.00000
6	0.00000	0.00000	.00678	.00000
7	0.00000	0.00000	-.00089	-.00000
8	1.00000	0.00000	1.01328	.00000
9	0.00000	0.00000	-.00247	-.00000
10	0.00000	0.00000	-.00313	.00000
11	0.00000	0.00000	.00041	-.00000
12	0.00000	0.00000	-.00085	.00000
13	0.00000	0.00000	.00043	-.00000
14	0.00000	0.00000	-.00023	.00000
15	0.00000	0.00000	.00024	-.00000
16	0.00000	0.00000	-.00013	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 2 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.48	.02	-.13	-.00	-35.40	-69.49	.50	.13
20.0	-.68	-.02	-.13	-.00	-34.29	-68.58	.66	.13
25.0	-.79	-.01	-.12	.00	-34.45	-66.26	.79	.12
30.0	-.86	.01	-.11	-.00	-35.02	-66.81	.87	.11
35.0	-.89	-.01	-.09	.00	-35.12	-77.93	.88	.09
40.0	-.81	.02	-.07	.00	-35.89	-67.64	.83	.07
45.0	-.68	.03	-.05	-.00	-37.76	-64.81	.71	.05
50.0	-.63	-.09	-.02	.00	-39.62	-56.41	.54	.03
55.0	-.34	-.01	-.02	-.00	-44.81	-66.72	.32	.01
60.0	0.00	.05	0.00	.00	-200.00	-59.37	.05	.00
65.0	.30	.03	-.01	-.00	-45.32	-64.28	-.27	.01
70.0	.60	-.02	-.04	-.00	-39.44	-65.28	-.62	.03
75.0	.88	-.07	-.07	.00	-35.75	-58.40	-.95	.08
80.0	1.16	.01	-.14	.00	-31.66	-71.93	-1.15	.14
85.0	1.15	.02	-.22	.00	-29.88	-64.90	-1.13	.22
90.0	.91	.06	-.30	-.01	-29.28	-58.70	-.85	.29
95.0	.29	-.07	-.33	-.00	-30.16	-60.50	-.35	.33
100.0	-.27	-.07	-.33	.00	-30.73	-70.32	.25	.33
105.0	-.81	-.05	-.26	.01	-33.26	-65.18	.77	.27
110.0	-.96	.11	-.17	-.01	-37.68	-59.54	1.07	.16
TOTAL	.45	.01	.16	.00	-33.32	-61.80		

NET REDUCTION OF MISMATCH ERROR= 28.48DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00061	.00000
2	0.00000	0.00000	-.00357	-.00000
3	0.00000	0.00000	.00993	.00000
4	0.00000	0.00000	-.01650	-.00000
5	0.00000	0.00000	.01978	.00000
6	0.00000	0.00000	.00165	-.00000
7	0.00000	0.00000	-.00158	.00000
8	1.00000	0.00000	1.01424	-.00000
9	0.00000	0.00000	-.01159	.00000
10	0.00000	0.00000	-.00173	-.00000
11	0.00000	0.00000	-.00313	.00000
12	0.00000	0.00000	-.00040	-.00000
13	0.00000	0.00000	-.00111	.00000
14	0.00000	0.00000	-.00035	-.00000
15	0.00000	0.00000	-.00027	.00000
16	0.00000	0.00000	-.00024	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 5 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.10	-.02	-.07	-.00	-33.90	-69.55	1.08	.07
20.0	-1.19	.03	-.07	-.00	-32.96	-65.73	1.22	.07
25.0	-1.28	-.02	-.06	.00	-32.75	-66.40	1.26	.06
30.0	-1.22	.02	-.04	-.00	-34.11	-71.62	1.23	.04
35.0	-1.15	-.00	-.02	-.00	-34.27	-79.68	1.15	.02
40.0	-1.01	.00	-.01	-.00	-34.98	-71.18	1.02	.01
45.0	-.84	-.01	.00	.00	-36.69	-73.71	.83	-.00
50.0	-.61	-.01	.01	.00	-40.14	-68.93	.60	-.01
55.0	-.31	.01	.01	.00	-45.75	-72.03	.32	-.01
60.0	0.00	.01	0.00	.00	-200.00	-79.17	.01	.00
65.0	.36	.01	-.03	-.00	-43.09	-69.17	-.35	.02
70.0	.70	-.01	-.07	-.00	-37.05	-68.41	-.71	.07
75.0	.99	-.01	-.15	.00	-33.02	-71.47	-1.00	.15
80.0	1.07	-.01	-.24	.00	-29.46	-65.72	-1.08	.25
85.0	.85	.01	-.35	.00	-27.32	-69.23	-.84	.36
90.0	.26	.04	-.46	-.01	-26.46	-60.27	-.23	.45
95.0	-.69	-.01	-.50	-.00	-26.65	-67.15	.69	.49
100.0	-1.77	-.08	-.47	.00	-26.46	-59.37	1.70	.47
105.0	-2.51	.02	-.36	.01	-28.08	-59.94	2.53	.38
110.0	-2.81	.07	-.23	-.01	-31.01	-60.43	2.88	.22
TOTAL	1.24	.03	.25	.00	-30.39	-64.59		

NET REDUCTION OF MISMATCH ERROR= 34.20DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00019	-.00000
2	0.00000	0.00000	-.00072	-.00000
3	0.00000	0.00000	.00283	-.00000
4	0.00000	0.00000	-.00671	-.00000
5	0.00000	0.00000	.00779	-.00000
6	0.00000	0.00000	-.00287	-.00000
7	0.00000	0.00000	.00186	-.00000
8	1.00000	0.00000	1.00134	-.00000
9	0.00000	0.00000	-.00226	-.00000
10	0.00000	0.00000	-.00340	-.00000
11	0.00000	0.00000	.00031	-.00000
12	0.00000	0.00000	-.00107	-.00000
13	0.00000	0.00000	.00038	.00000
14	0.00000	0.00000	-.00042	-.00000
15	0.00000	0.00000	.00021	.00000
16	0.00000	0.00000	-.00017	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 4 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.28	.00	.01	-.00	-46.41	-76.74	.28	-.01
20.0	-.36	-.01	-.00	.00	-43.86	-78.61	.36	.00
25.0	-.41	.00	-.00	.00	-43.01	-67.42	.41	.00
30.0	-.43	.00	-.01	-.00	-43.24	-66.25	.43	.01
35.0	-.44	-.01	-.01	-.00	-42.67	-73.29	.43	.01
40.0	-.38	.02	-.01	.00	-43.53	-71.29	.39	.01
45.0	-.30	.04	-.01	-.00	-45.58	-64.25	.34	.00
50.0	-.35	-.09	.00	.00	-45.08	-56.88	.26	.00
55.0	-.17	-.00	-.00	-.00	-51.19	-68.06	.17	.00
60.0	0.00	.04	0.00	.00	-200.00	-61.64	.04	.00
65.0	.13	.03	-.02	-.00	-50.67	-64.78	-.10	.01
70.0	.23	-.02	-.04	-.00	-45.22	-65.46	-.25	.03
75.0	.28	-.07	-.06	.00	-42.27	-58.26	-.34	.06
80.0	.35	.01	-.10	.00	-37.81	-71.87	-.33	.10
85.0	.29	.03	-.13	.00	-36.30	-64.32	-.19	.13
90.0	-.04	.04	-.16	-.01	-35.63	-59.78	.09	.15
95.0	-.40	-.07	-.14	.00	-36.42	-59.99	.42	.14
100.0	-.73	-.01	-.11	.00	-37.24	-72.54	.72	.11
105.0	-.93	-.02	-.04	.01	-39.05	-66.20	.90	.04
110.0	-.83	.09	.04	-.01	-42.26	-61.29	.92	-.04
TOTAL	.43	.04	.07	.00	-40.03	-62.56		

NET REDUCTION OF MISMATCH ERROR= 22.5308.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00109	-.00000
2	0.00000	0.00000	-.00301	-.00000
3	0.00000	0.00000	.00776	.00000
4	0.00000	0.00000	-.01023	-.00000
5	0.00000	0.00000	.01208	.00000
6	0.00000	0.00000	.00369	-.00000
7	0.00000	0.00000	-.01301	.00000
8	1.00000	0.00000	1.01122	-.00000
9	0.00000	0.00000	-.01981	.00000
10	0.00000	0.00000	-.00159	-.00000
11	0.00000	0.00000	-.00477	.00000
12	0.00000	0.00000	.00017	-.00000
13	0.00000	0.00000	-.00170	.00000
14	0.00000	0.00000	.00016	-.00000
15	0.00000	0.00000	-.00050	.00000
16	0.00000	0.00000	.00010	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 5 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.06	-.00	.14	.00	-32.38	-75.99	1.06	-.14
20.0	-1.14	.01	.12	-.00	-32.07	-70.33	1.15	-.12
25.0	-1.13	-.01	.11	-.00	-32.61	-75.38	1.12	-.11
30.0	-1.03	.00	.10	.00	-34.24	-72.93	1.03	-.10
35.0	-.92	-.00	.09	.00	-34.87	-76.82	.91	-.09
40.0	-.77	.00	.07	-.00	-35.89	-75.71	.78	-.07
45.0	-.61	.01	.06	-.00	-38.01	-72.39	.62	-.06
50.0	-.46	-.03	.04	-.00	-41.24	-67.57	.43	-.04
55.0	-.21	.01	.02	.00	-47.41	-72.50	.23	-.02
60.0	0.00	-.00	0.00	.00	-200.00	-69.28	-.00	.00
65.0	.25	.00	-.04	-.00	-44.46	-78.12	-.25	.03
70.0	.49	-.00	-.08	-.00	-38.52	-69.57	-.49	.08
75.0	.73	.02	-.14	-.00	-34.49	-70.61	-.71	.14
80.0	.80	-.02	-.22	.00	-30.86	-68.48	-.82	.22
85.0	.74	-.00	-.31	.00	-28.46	-70.77	-.75	.31
90.0	.43	.02	-.40	-.00	-27.39	-67.24	-.41	.40
95.0	-.20	.00	-.47	-.00	-27.36	-74.10	.20	.47
100.0	-.98	-.03	-.49	.00	-27.05	-69.35	.96	.49
105.0	-1.64	.01	-.45	.01	-28.34	-67.68	1.65	.45
110.0	-2.01	.01	-.38	-.00	-31.01	-71.72	2.02	.38
TOTAL	.92	.01	.24	.00	-30.98	-70.09		

NET REDUCTION OF MISMATCH ERROR= 39.11DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00177	.00000
2	0.00000	0.00000	-.00318	-.00000
3	0.00000	0.00000	.01002	.00000
4	0.00000	0.00000	-.01222	-.00000
5	0.00000	0.00000	.01618	.00000
6	0.00000	0.00000	.00604	-.00000
7	0.00000	0.00000	-.00947	.00000
8	1.00000	0.00000	1.01488	-.00000
9	0.00000	0.00000	-.01838	.00000
10	0.00000	0.00000	-.00319	-.00000
11	0.00000	0.00000	-.00472	.00000
12	0.00000	0.00000	-.00124	-.00000
13	0.00000	0.00000	-.00191	.00000
14	0.00000	0.00000	-.00067	-.00000
15	0.00000	0.00000	-.00065	.00000
16	0.00000	0.00000	-.00039	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 6 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.67	-.05	.04	-.00	-30.81	-61.28	1.62	-.04
20.0	-1.89	.05	.04	.00	-30.83	-61.49	1.64	-.04
25.0	-1.48	.03	.04	.00	-31.63	-63.49	1.51	-.04
30.0	-1.37	-.03	.03	-.01	-33.13	-62.52	1.34	-.04
35.0	-1.24	-.05	.04	-.00	-33.47	-61.77	1.20	-.04
40.0	-1.04	.01	.04	.00	-34.55	-70.94	1.05	-.04
45.0	-.80	.06	.03	-.00	-36.81	-59.04	.87	-.03
50.0	-.60	-.06	.03	.00	-38.75	-59.09	.62	-.03
55.0	-.34	-.01	.01	-.00	-44.86	-68.42	.33	-.02
60.0	0.00	.02	0.00	.00	-200.00	-66.37	.02	.00
65.0	.32	.02	-.04	-.00	-42.93	-66.73	-.30	.04
70.0	.60	-.01	-.09	-.00	-37.13	-65.83	-.61	.09
75.0	.83	-.05	-.15	.00	-33.45	-61.12	-.88	.16
80.0	1.06	.02	-.25	.00	-29.37	-67.67	-1.03	.25
85.0	.96	.01	-.35	.00	-27.22	-67.65	-.95	.35
90.0	.50	.04	-.46	-.01	-26.22	-60.58	-.55	.45
95.0	-.23	-.07	-.53	-.00	-26.35	-59.45	.16	.53
100.0	-1.02	.02	-.54	.00	-26.22	-68.51	1.04	.54
105.0	-1.86	-.01	-.48	.01	-27.63	-63.22	1.84	.49
110.0	-2.23	.03	-.39	-.01	-30.58	-63.76	2.26	.38
TOTAL	1.15	.04	.25	.00	-29.91	-62.03		

NET REDUCTION OF MISMATCH ERROR= 32.1208.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00047	-.00000
2	0.00000	0.00000	-.00352	-.00000
3	0.00000	0.00000	.00981	-.00000
4	0.00000	0.00000	-.01703	-.00000
5	0.00000	0.00000	.01924.	-.00000
6	0.00000	0.00000	-.00056	-.00000
7	0.00000	0.00000	-.00156	.00000
8	1.00000	0.00000	1.01255	-.00000
9	0.00000	0.00000	-.01054	-.00000
10	0.00000	0.00000	-.00164	-.00000
11	0.00000	0.00000	-.00258	-.00000
12	0.00000	0.00000	-.00015	-.00000
13	0.00000	0.00000	-.00088	-.00000
14	0.00000	0.00000	-.00016	-.00000
15	0.00000	0.00000	-.00019	-.00000
16	0.00000	0.00000	-.00012	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 7 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.85	-.00	-.05	-.00	-36.34	-84.42	.85	.05
20.0	-.90	-.00	-.05	-.00	-34.75	-88.85	.98	.05
25.0	-1.06	-.01	-.04	.00	-34.49	-75.97	1.05	.04
30.0	-1.09	.03	-.03	.00	-35.70	-65.68	1.05	.03
35.0	-.99	-.00	-.02	-.00	-35.55	-75.19	.99	.02
40.0	-.91	-.02	-.01	-.00	-35.95	-67.89	.89	.01
45.0	-.74	-.00	-.00	.00	-37.80	-81.53	.74	.00
50.0	-.55	-.00	.01	.00	-41.05	-71.96	.55	-.00
55.0	-.29	.02	.01	.00	-46.51	-70.19	.30	-.01
60.0	0.00	.01	0.00	.00	-200.00	-73.06	.01	.00
65.0	.34	.00	-.03	-.00	-43.54	-69.99	-.34	.02
70.0	.67	-.03	-.07	-.00	-37.31	-63.54	-.70	.07
75.0	.99	.01	-.14	.00	-33.14	-71.33	-.98	.14
80.0	1.04	-.01	-.24	.01	-29.71	-63.63	-1.05	.24
85.0	.79	.00	-.35	.00	-27.52	-72.44	-.79	.35
90.0	.20	.04	-.44	-.01	-26.69	-60.95	-.16	.44
95.0	-.71	-.02	-.49	-.01	-26.83	-63.35	.75	.48
100.0	-1.81	-.04	-.45	.00	-26.78	-63.00	1.76	.45
105.0	-2.60	-.01	-.33	.01	-28.24	-60.22	2.59	.34
110.0	-2.86	.07	-.19	-.01	-31.17	-59.75	2.93	.18
TOTAL	1.20	.02	.21	.01	-30.83	-64.85		

NET REDUCTION OF MISMATCH ERRORS 34.02DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00036	-.00000
2	0.00000	0.00000	.00066	-.00000
3	0.00000	0.00000	.00068	.00000
4	0.00000	0.00000	-.00206	-.00000
5	0.00000	0.00000	.00385	.00000
6	0.00000	0.00000	.00214	-.00000
7	0.00000	0.00000	.00626	.00000
8	1.00000	0.00000	1.00025	-.00000
9	0.00000	0.00000	.00562	.00000
10	0.00000	0.00000	-.00662	-.00000
11	0.00000	0.00000	.00208	.00000
12	0.00000	0.00000	-.00289	-.00000
13	0.00000	0.00000	.00068	.00000
14	0.00000	0.00000	-.00133	-.00000
15	0.00000	0.00000	.00028	.00000
16	0.00000	0.00000	-.00057	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 8 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.50	-.04	-.10	-.00	-56.68	-62.91	.55	.09
20.0	-.55	.03	-.09	.00	-57.01	-64.08	.58	.09
25.0	-.53	.03	-.08	.01	-58.00	-61.90	.56	.08
30.0	-.56	-.03	-.08	-.01	-58.53	-61.25	.52	.07
35.0	-.52	-.03	-.06	-.00	-59.21	-64.67	.49	.06
40.0	-.43	.02	-.05	.00	-60.53	-70.01	.45	.05
45.0	-.34	.05	-.04	.00	-62.71	-62.00	.38	.04
50.0	-.37	-.07	-.02	.01	-64.04	-57.34	.29	.03
55.0	-.18	-.01	-.02	-.00	-69.22	-67.07	.18	.01
60.0	0.00	.04	0.00	.00	-200.00	-63.52	.04	.00
65.0	.15	.03	-.00	-.00	-51.70	-62.60	-.12	-.00
70.0	.25	-.02	-.01	-.00	-47.54	-66.80	-.27	.01
75.0	.33	-.06	-.01	.01	-45.18	-58.42	-.39	.02
80.0	.43	.00	-.03	.00	-41.69	-74.77	-.43	.03
85.0	.42	.03	-.05	.00	-41.53	-64.52	-.39	.03
90.0	.36	.06	-.04	-.01	-43.07	-57.66	-.31	.03
95.0	.18	-.07	-.01	.00	-51.75	-59.95	-.25	.01
100.0	.24	-.01	.03	.00	-47.29	-66.98	-.26	-.03
105.0	.27	-.06	.08	.01	-43.15	-61.39	-.33	-.07
110.0	.56	.15	.13	-.01	-40.88	-56.97	-.41	-.14
TOTAL	.40	.05	.06	.00	-40.79	-60.83		

NET REDUCTION OF MISMATCH ERRORS 20.0400.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00051	-.00000
2	0.00000	0.00000	-.00338	.00000
3	0.00000	0.00000	.00785	-.00000
4	0.00000	0.00000	-.01298	.00000
5	0.00000	0.00000	.01162	-.00000
6	0.00000	0.00000	.00432	.00000
7	0.00000	0.00000	-.00740	-.00000
8	1.00000	0.00000	1.01355	.00000
9	0.00000	0.00000	-.01074	-.00000
10	0.00000	0.00000	-.00136	.00000
11	0.00000	0.00000	-.00221	-.00000
12	0.00000	0.00000	.00025	.00000
13	0.00000	0.00000	-.00065	-.00000
14	0.00000	0.00000	.00016	-.00000
15	0.00000	0.00000	-.00002	-.00000
16	0.00000	0.00000	.00012	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 9 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.56	.03	-.01	.00	-40.61	-66.60	.57	.01
20.0	-.75	-.02	-.02	-.00	-37.42	-65.54	.73	.02
25.0	-.85	-.02	-.02	.00	-36.59	-68.62	.83	.02
30.0	-.83	.03	-.02	.00	-37.52	-66.91	.86	.02
35.0	-.81	.01	-.01	.00	-37.33	-71.54	.83	.01
40.0	-.74	-.00	-.01	-.00	-37.68	-77.18	.74	.01
45.0	-.63	-.01	-.00	-.00	-39.30	-75.97	.62	-.00
50.0	-.48	-.02	.00	-.00	-42.23	-67.97	.46	-.00
55.0	-.24	.02	.00	.00	-48.18	-68.03	.26	-.00
60.0	0.00	.01	0.00	.00	-200.00	-70.37	.01	.00
65.0	.32	.01	-.02	-.00	-44.55	-78.45	-.31	.02
70.0	.64	-.02	-.06	-.00	-38.33	-64.53	-.66	.05
75.0	.99	.02	-.11	-.00	-34.05	-71.54	-.98	.11
80.0	1.13	-.02	-.19	.00	-30.66	-66.46	-1.15	.19
85.0	1.07	.01	-.29	.00	-28.46	-69.16	-1.07	.29
90.0	.70	.03	-.38	-.00	-27.65	-64.93	-.67	.38
95.0	-.00	-.00	-.44	-.00	-27.87	-67.66	-.00	.44
100.0	-.84	-.04	-.44	.00	-27.91	-65.61	.80	.44
105.0	-1.52	.00	-.38	.01	-29.58	-64.83	1.52	.39
110.0	-1.85	.04	-.29	-.01	-32.66	-65.28	1.89	.28
TOTAL	.87	.02	.20	.00	-32.04	-66.82		

NET REDUCTION OF MISMATCH ERRORS 34.780B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00024	-.00000
2	0.00000	0.00000	-.00098	.00000
3	0.00000	0.00000	.00331	-.00000
4	0.00000	0.00000	-.00517	.00000
5	0.00000	0.00000	.00446	-.00000
6	0.00000	0.00000	.00750	.00000
7	0.00000	0.00000	.00167	-.00000
8	1.00000	0.00000	1.00785	.00000
9	0.00000	0.00000	.00278	-.00000
10	0.00000	0.00000	-.00539	.00000
11	0.00000	0.00000	.00148	-.00000
12	0.00000	0.00000	-.00219	.00000
13	0.00000	0.00000	.00076	-.00000
14	0.00000	0.00000	-.00049	.00000
15	0.00000	0.00000	.00035	-.00000
16	0.00000	0.00000	-.00046	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 10 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.60	-.01	-.13	-.00	-34.87	-70.37	.59	.13
20.0	-.65	.00	-.13	.00	-34.62	-75.69	.66	.13
25.0	-.67	.02	-.11	.01	-35.39	-63.03	.69	.12
30.0	-.71	-.01	-.11	-.01	-36.02	-63.34	.70	.10
35.0	-.71	-.03	-.09	-.00	-36.34	-65.89	.68	.09
40.0	-.62	.01	-.07	.00	-37.42	-70.16	.64	.07
45.0	-.50	.05	-.05	-.00	-39.57	-61.64	.54	.05
50.0	-.40	-.08	-.03	.01	-41.44	-56.82	.41	.03
55.0	-.24	.00	-.02	-.01	-46.85	-64.50	.24	.02
60.0	0.00	.03	0.00	.00	-200.00	-62.63	.03	.00
65.0	.23	.03	-.00	-.00	-47.72	-65.07	-.21	.00
70.0	.46	-.02	-.01	-.00	-42.21	-65.30	-.48	.01
75.0	.68	-.06	-.03	.01	-38.85	-58.79	-.74	.03
80.0	.94	.01	-.06	.00	-34.86	-72.89	-.92	.06
85.0	1.00	.02	-.10	.00	-33.55	-67.03	-.98	.10
90.0	.94	.05	-.15	-.01	-33.31	-58.65	-.89	.14
95.0	.61	-.06	-.16	-.00	-35.19	-61.03	-.68	.16
100.0	.42	-.00	-.16	.00	-36.51	-71.01	-.43	.16
105.0	.15	-.06	-.11	.01	-41.17	-61.12	-.21	.12
110.0	.19	.13	-.06	-.01	-48.48	-58.01	-.06	.05
TOTAL	.60	.05	.09	.00	-36.45	-61.59		

NET REDUCTION OF MISMATCH ERRORS 25.15DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00011	-.00000
2	0.00000	0.00000	-.00221	.00000
3	0.00000	0.00000	.00539	-.00000
4	0.00000	0.00000	-.00980	.00000
5	0.00000	0.00000	.00922	-.00000
6	0.00000	0.00000	.00231	.00000
7	0.00000	0.00000	-.00477	-.00000
8	1.00000	0.00000	1.00863	.00000
9	0.00000	0.00000	-.00782	-.00000
10	0.00000	0.00000	-.00212	.00000
11	0.00000	0.00000	-.00145	-.00000
12	0.00000	0.00000	-.00025	.00000
13	0.00000	0.00000	-.00016	-.00000
14	0.00000	0.00000	-.00023	.00000
15	0.00000	0.00000	.00013	-.00000
16	0.00000	0.00000	-.00003	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 11 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.44	.02	.00	.00	-42.51	-70.09	.46	-.00
20.0	-.61	-.02	-.00	-.00	-39.37	-68.31	.59	.00
25.0	-.68	-.01	-.01	-.00	-36.54	-73.96	.67	.01
30.0	-.67	.03	-.01	.00	-33.43	-66.51	.70	.01
35.0	-.67	.01	-.00	.00	-29.06	-79.71	.67	.00
40.0	-.61	-.01	-.00	-.00	-39.43	-73.99	.60	-.00
45.0	-.51	-.01	.00	-.00	-41.10	-74.17	.50	-.00
50.0	-.37	-.01	.00	.00	-44.44	-79.70	.37	-.00
55.0	-.19	.02	.00	.00	-50.08	-70.99	.21	-.00
60.0	0.00	.00	0.00	.00	-200.00	-73.07	.00	.00
65.0	.26	.01	-.02	-.00	-40.22	-70.35	-.25	.01
70.0	.50	-.02	-.04	-.00	-40.52	-67.62	-.52	.04
75.0	.77	.02	-.09	.00	-36.24	-70.82	-.75	.09
80.0	.83	-.01	-.14	.00	-33.08	-68.41	-.85	.15
85.0	.74	-.00	-.22	.00	-31.00	-73.52	-.74	.22
90.0	.44	.03	-.28	-.00	-30.28	-64.09	-.41	.28
95.0	-.11	.00	-.32	-.00	-30.57	-70.30	.11	.32
100.0	-.72	-.04	-.31	.00	-30.70	-64.65	.68	.31
105.0	-1.15	-.00	-.26	.01	-32.65	-65.48	1.14	.26
110.0	-1.30	.05	-.18	-.01	-36.13	-64.36	1.35	.17
TOTAL	.66	.02	.15	.00	-34.64	-67.93		

NET REDUCTION OF MISMATCH ERRORS 33.29DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00016	-.00000
2	0.00000	0.00000	-.00194	.00000
3	0.00000	0.00000	.00440	-.00000
4	0.00000	0.00000	-.00848	.00000
5	0.00000	0.00000	.00560	-.00000
6	0.00000	0.00000	.00226	.00000
7	0.00000	0.00000	-.00545	-.00000
8	1.00000	0.00000	1.00708	.00000
9	0.00000	0.00000	-.00602	-.00000
10	0.00000	0.00000	-.00330	.00000
11	0.00000	0.00000	-.00011	-.00000
12	0.00000	0.00000	-.00065	.00000
13	0.00000	0.00000	.00034	-.00000
14	0.00000	0.00000	-.00002	.00000
15	0.00000	0.00000	.00024	-.00000
16	0.00000	0.00000	.00004	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 12 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.18	.03	.03	.00	-47.15	-64.96	.21	-.03
20.0	-.36	-.03	.01	-.00	-43.60	-65.20	.33	-.01
25.0	-.45	-.01	.00	.00	-42.11	-68.65	.44	-.00
30.0	-.51	-.00	-.01	-.00	-41.68	-68.99	.51	.01
35.0	-.53	.00	-.01	.00	-41.05	-74.85	.53	.01
40.0	-.47	.03	-.01	.00	-41.51	-65.20	.50	.01
45.0	-.40	.03	-.01	-.00	-42.90	-63.94	.44	.01
50.0	-.46	-.12	-.01	.00	-42.53	-54.40	.35	.01
55.0	-.22	.01	-.01	-.00	-48.74	-66.53	.22	.01
60.0	0.00	.05	0.00	.01	-200.00	-59.33	.05	.01
65.0	.21	.03	-.01	-.00	-47.98	-65.25	-.18	.01
70.0	.42	-.01	-.04	-.00	-41.82	-66.32	-.43	.03
75.0	.59	-.08	-.07	.00	-38.38	-57.64	-.67	.07
80.0	.82	.01	-.12	-.00	-33.86	-75.38	-.81	.12
85.0	.84	.04	-.14	.00	-31.92	-61.61	-.80	.18
90.0	.63	.04	-.24	-.00	-31.19	-61.99	-.59	.24
95.0	.14	-.07	-.27	-.00	-31.88	-60.32	-.22	.27
100.0	-.23	-.01	-.27	.00	-32.39	-76.72	.22	.27
105.0	-.63	-.02	-.22	.00	-34.75	-70.20	.61	.23
110.0	-.76	.07	-.15	-.00	-39.08	-63.96	.83	.15
TOTAL	.50	.04	.13	.00	-36.11	-61.04		

NET REDUCTION OF MISMATCH ERRORS 25.53DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00018	.00000
2	0.00000	0.00000	-.00091	.00000
3	0.00000	0.00000	.00366	.00000
4	0.00000	0.00000	-.00746	.00000
5	0.00000	0.00000	.00976	.00000
6	0.00000	0.00000	-.00321	.00000
7	0.00000	0.00000	.00234	.00000
8	1.00000	0.00000	1.00138	.00000
9	0.00000	0.00000	-.00269	-.00000
10	0.00000	0.00000	-.00351	.00000
11	0.00000	0.00000	-.00044	-.00000
12	0.00000	0.00000	-.00140	.00000
13	0.00000	0.00000	.00000	-.00000
14	0.00000	0.00000	-.00001	.00000
15	0.00000	0.00000	.00001	-.00000
16	0.00000	0.00000	-.00037	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 13 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.40	-.00	-.00	-.00	-41.62	-72.22	.49	-.00
20.0	-.54	-.00	-.00	.00	-40.36	-69.40	.54	.01
25.0	-.54	.00	-.00	.00	-40.51	-78.11	.54	.01
30.0	-.51	.01	-.00	-.00	-41.77	-72.81	.53	.00
35.0	-.49	.00	-.00	-.00	-41.82	-70.28	.49	.00
40.0	-.43	-.01	-.00	-.00	-42.37	-75.60	.43	-.00
45.0	-.35	-.01	.00	.00	-44.30	-68.45	.34	.00
50.0	-.25	-.01	.00	.00	-47.81	-76.10	.25	.00
55.0	-.13	.01	.00	.00	-53.61	-70.35	.13	-.00
60.0	0.00	.01	0.00	-.00	-200.00	-79.83	.01	-.00
65.0	.16	.02	-.01	-.00	-49.99	-65.50	-.14	.01
70.0	.20	.01	-.03	-.00	-44.38	-72.44	-.28	.03
75.0	.29	-.08	-.07	.00	-41.42	-57.45	-.37	.07
80.0	.38	.02	-.10	.00	-37.19	-64.53	-.36	.11
85.0	.22	.04	-.15	.00	-35.22	-63.54	-.19	.15
90.0	-.12	.01	-.18	-.01	-34.60	-62.80	.14	.17
95.0	-.57	-.02	-.17	-.00	-35.11	-66.37	.55	.16
100.0	-.96	-.04	-.12	.01	-35.42	-63.18	.93	.13
105.0	-1.19	-.02	-.05	.01	-36.95	-64.53	1.17	.05
110.0	-1.09	.10	.03	-.01	-40.06	-59.59	1.18	-.04
TOTAL	.58	.03	.07	.00	-38.62	-64.38		

NET REDUCTION OF MISMATCH ERROR= 25.77DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00054	.00000
2	0.00000	0.00000	-.00456	-.00000
3	0.00000	0.00000	.00900	.00000
4	0.00000	0.00000	-.01711	-.00000
5	0.00000	0.00000	.01507	.00000
6	0.00000	0.00000	.00333	-.00000
7	0.00000	0.00000	-.00474	.00000
8	1.00000	0.00000	1.01704	-.00000
9	0.00000	0.00000	-.01110	.00000
10	0.00000	0.00000	.00059	-.00000
11	0.00000	0.00000	-.00137	.00000
12	0.00000	0.00000	.00141	-.00000
13	0.00000	0.00000	-.00001	.00000
14	0.00000	0.00000	.00103	-.00000
15	0.00000	0.00000	.00020	.00000
16	0.00000	0.00000	.00045	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 14 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.28	.05	-.08	.00	-40.11	-61.08	.33	.08
20.0	-.64	-.05	-.08	-.00	-36.65	-60.01	.61	.07
25.0	-.87	-.01	-.07	.00	-35.49	-68.58	.86	.07
30.0	-1.01	.01	-.06	-.00	-35.25	-71.59	1.02	.06
35.0	-1.04	.01	-.04	.00	-34.97	-67.68	1.05	.05
40.0	-.94	.03	-.03	.00	-35.55	-66.36	.96	.03
45.0	-.78	.03	-.02	-.00	-37.33	-63.67	.80	.01
50.0	-.70	-.10	.00	.00	-38.97	-55.71	.60	.00
55.0	-.36	-.01	-.00	-.00	-44.59	-68.50	.35	-.00
60.0	0.00	.05	0.00	.01	-200.00	-58.82	.05	.01
65.0	.36	.04	-.03	-.00	-42.92	-62.35	-.31	.03
70.0	.68	-.03	-.08	-.00	-37.16	-65.48	-.70	.07
75.0	.96	-.07	-.14	.00	-33.25	-59.07	-1.03	.14
80.0	1.18	.01	-.24	.00	-29.17	-77.31	-1.17	.24
85.0	1.04	.02	-.35	.01	-27.00	-61.55	-1.01	.36
90.0	.55	.06	-.47	-.01	-26.08	-59.14	-.50	.46
95.0	-.41	-.07	-.53	-.00	-26.33	-59.66	.34	.52
100.0	-1.33	-.01	-.52	.00	-26.32	-80.32	1.32	.52
105.0	-2.2	-.02	-.43	.01	-27.84	-64.97	2.19	.43
110.0	-2.56	.07	-.30	-.01	-30.94	-65.03	2.63	.29
TOTAL	1.08	.05	.24	.00	-30.48	-61.16		

NET REDUCTION OF MISMATCH ERRORS 30.69DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00052	-.00000
2	0.00000	0.00000	-.00413	-.00000
3	0.00000	0.00000	.00917	-.00000
4	0.00000	0.00000	-.01702	-.00000
5	0.00000	0.00000	.01663	-.00000
6	0.00000	0.00000	.00605	-.00000
7	0.00000	0.00000	-.00297	-.00000
8	1.00000	0.00000	1.01885	-.00000
9	0.00000	0.00000	-.00815	-.00000
10	0.00000	0.00000	-.00059	-.00000
11	0.00000	0.00000	-.00140	-.00000
12	0.00000	0.00000	.00077	-.00000
13	0.00000	0.00000	-.00016	-.00000
14	0.00000	0.00000	.00045	-.00000
15	0.00000	0.00000	.00017	-.00000
16	0.00000	0.00000	.00022	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 15 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB PHASE)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.52	.04	-.14	.00	-34.80	-44.55	.57	.14
20.0	-.86	-.04	-.14	-.00	-33.15	-43.37	.83	.14
25.0	-1.06	-.02	-.12	-.00	-32.80	-70.13	1.04	.12
30.0	-1.13	.02	-.10	.00	-33.69	-46.61	1.16	.10
35.0	-1.13	.03	-.08	.00	-33.74	-47.16	1.16	.08
40.0	-1.05	-.00	-.05	-.00	-34.25	-72.98	1.05	.05
45.0	-.80	-.02	-.03	-.00	-36.05	-69.76	.87	.03
50.0	-.67	-.02	-.01	-.00	-39.37	-68.94	.64	.01
55.0	-.36	.02	-.00	.00	-44.94	-49.93	.36	.00
60.0	0.00	.02	0.00	.00	-200.00	-46.28	.02	.00
65.0	.41	.01	-.02	-.00	-42.33	-71.33	-.41	.02
70.0	.83	-.02	-.06	-.00	-36.27	-65.87	-.86	.06
75.0	1.26	.01	-.13	-.00	-32.16	-76.49	-1.24	.13
80.0	1.30	-.02	-.23	.00	-29.92	-64.92	-1.41	.23
85.0	1.24	.00	-.35	.00	-26.90	-67.97	-1.26	.35
90.0	.77	.05	-.46	-.01	-26.16	-60.32	-.72	.45
95.0	-.15	-.01	-.52	-.01	-26.52	-65.79	.14	.51
100.0	-1.18	-.05	-.50	.00	-26.66	-62.76	1.13	.50
105.0	-2.01	-.02	-.41	.01	-26.36	-62.70	1.99	.42
110.0	-2.34	.08	-.28	-.01	-31.59	-60.84	2.42	.27
TOTAL	1.11	.03	.24	.00	-30.25	-64.53		

NET REDUCTION OF MISMATCH ERRORS 34.2800.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00082	.00000
2	0.00000	0.00000	-.00360	-.00000
3	0.00000	0.00000	.00794	.00000
4	0.00000	0.00000	-.01345	-.00000
5	0.00000	0.00000	.01143	.00000
6	0.00000	0.00000	.00709	-.00000
7	0.00000	0.00000	-.00335	.00000
8	1.00000	0.00000	1.01684	-.00000
9	0.00000	0.00000	-.00597	-.00000
10	0.00000	0.00000	-.00111	-.00000
11	0.00000	0.00000	-.00057	-.00000
12	0.00000	0.00000	.00022	-.00000
13	0.00000	0.00000	.00008	-.00000
14	0.00000	0.00000	.00032	-.00000
15	0.00000	0.00000	.00016	-.00000
16	0.00000	0.00000	.00014	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 16 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.45	.03	-.13	.00	-35.85	-65.43	.48	.13
20.0	-.69	-.03	-.12	-.00	-34.50	-64.61	.67	.12
25.0	-.83	-.01	-.11	.00	-34.46	-67.70	.82	.11
30.0	-.91	.00	-.10	-.00	-34.91	-68.50	.92	.10
35.0	-.93	.00	-.08	.00	-35.00	-70.78	.94	.08
40.0	-.86	.02	-.06	.00	-35.58	-69.94	.88	.06
45.0	-.72	.04	-.04	-.00	-37.5[illegible]	-63.47	.75	.04
50.0	-.67	-.10	-.02	.00	-39.28	-56.24	.57	.02
55.0	-.34	-.01	-.01	-.00	-44.84	-67.07	.34	.01
60.0	0.00	.04	0.00	.01	-200.00	-59.70	.04	.01
65.0	.33	.03	-.02	-.00	-44.17	-65.54	-.31	.02
70.0	.68	-.01	-.05	-.00	-38.11	-65.49	-.69	.04
75.0	.97	-.07	-.10	.00	-34.48	-58.99	-1.04	.10
80.0	1.26	.00	-.18	.00	-30.42	-97.28	-1.26	.18
85.0	1.26	.03	-.27	.00	-28.38	-61.82	-1.23	.28
90.0	.93	.05	-.37	-.00	-27.58	-60.92	-.88	.37
95.0	.18	-.06	-.43	-.00	-28.03	-60.62	-.25	.43
100.0	-.56	-.01	-.43	.00	-28.23	-75.07	.55	.44
105.0	-1.30	-.01	-.37	.01	-30.09	-65.90	1.29	.37
110.0	-1.64	.07	-.26	-.01	-33.53	-63.40	1.71	.26
TOTAL	.87	.04	.21	.00	-31.77	-62.28		

NET REDUCTION OF MISMATCH ERROR= 30.5108.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00057	.00000
2	0.00000	0.00000	-.00156	.00000
3	0.00000	0.00000	.00676	.00000
4	0.00000	0.00000	-.00965	.00000
5	0.00000	0.00000	.01254	.00000
6	0.00000	0.00000	.00205	.00000
7	0.00000	0.00000	.00069	.00000
8	1.00000	0.00000	1.00718	.00000
9	0.00000	0.00000	-.00452	.00000
10	0.00000	0.00000	-.00471	.00000
11	0.00000	0.00000	-.00166	.00000
12	0.00000	0.00000	-.00223	.00000
13	0.00000	0.00000	-.00071	.00000
14	0.00000	0.00000	-.00136	.00000
15	0.00000	0.00000	-.00025	.00000
16	0.00000	0.00000	-.00064	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 17 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.16	-.05	-.06	-.00	-33.74	-60.21	1.11	.05
20.0	-1.05	.04	-.05	.00	-34.16	-61.39	1.10	.06
25.0	-.96	.03	-.05	.00	-35.17	-64.84	.99	.05
30.0	-.88	-.01	-.04	-.00	-36.72	-70.95	.87	.04
35.0	-.81	-.03	-.03	-.00	-37.17	-64.11	.78	.03
40.0	-.70	-.01	-.02	-.00	-37.98	-72.84	.69	.02
45.0	-.58	.01	-.01	.00	-39.88	-68.86	.59	.02
50.0	-.42	.01	-.01	.00	-43.35	-70.04	.43	.01
55.0	-.22	.02	-.00	.00	-49.00	-70.81	.23	.00
60.0	0.00	-.00	0.00	-.00	-200.00	-81.17	-.00	-.00
65.0	.26	-.01	-.01	-.00	-46.37	-65.19	-.27	.01
70.0	.52	-.02	-.04	-.00	-40.44	-68.48	-.54	.04
75.0	.79	.05	-.08	.00	-36.24	-65.33	-.76	.08
80.0	.83	-.02	-.14	.01	-33.38	-61.96	-.85	.14
85.0	.73	.01	-.21	.00	-31.41	-75.28	-.72	.21
90.0	.38	.03	-.27	-.01	-30.85	-59.98	-.35	.26
95.0	-.21	-.01	-.29	-.00	-31.45	-67.07	.20	.28
100.0	-.83	-.04	-.26	.01	-31.91	-61.85	.79	.26
105.0	-1.27	-.02	-.18	.01	-33.97	-61.25	1.25	.19
110.0	-1.34	.09	-.09	-.01	-37.77	-58.82	1.43	.07
TOTAL	.78	.03	.13	.01	-34.46	-63.20		

NET REDUCTION OF MISMATCH ERROR= 28.7508.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00037	.00000
2	0.00000	0.00000	-.00013	-.00000
3	0.00000	0.00000	.00371	.00000
4	0.00000	0.00000	-.00496	.00000
5	0.00000	0.00000	.01007	.00000
6	0.00000	0.00000	-.00171	.00000
7	0.00000	0.00000	-.00010	.00000
8	1.00000	0.00000	1.00113	-.00000
9	0.00000	0.00000	-.00705	.00000
10	0.00000	0.00000	-.00479	-.00000
11	0.00000	0.00000	-.00171	.00000
12	0.00000	0.00000	-.00238	-.00000
13	0.00000	0.00000	-.00068	.00000
14	0.00000	0.00000	-.00127	-.00000
15	0.00000	0.00000	-.00021	.00000
16	0.00000	0.00000	-.00060	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 18 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.11	-.06	.05	-.00	-34.07	-59.11	1.05	-.06
20.0	-.96	.05	.05	.00	-34.86	-60.70	1.00	-.05
25.0	-.81	.05	.05	.00	-36.33	-59.88	.86	-.05
30.0	-.74	-.04	.04	-.01	-38.11	-60.82	.71	-.04
35.0	-.64	-.05	.04	-.00	-38.84	-61.19	.59	-.04
40.0	-.49	.01	.03	.00	-40.53	-76.69	.50	-.03
45.0	-.35	.05	.02	.00	-43.46	-60.96	.40	-.02
50.0	-.34	-.06	.02	.01	-44.39	-59.03	.29	-.02
55.0	-.13	.02	.01	-.00	-52.75	-67.00	.15	-.01
60.0	0.00	.01	0.00	.00	-200.00	-74.09	.01	.00
65.0	.13	.01	-.03	-.01	-48.55	-64.63	-.12	.02
70.0	.22	-.01	-.05	-.00	-43.28	-69.54	-.23	.05
75.0	.25	-.04	-.08	.01	-40.41	-59.68	-.28	.09
80.0	.26	.01	-.13	.00	-36.38	-70.74	-.24	.13
85.0	.11	.03	-.16	.00	-34.72	-65.90	-.08	.16
95.0	-.61	-.09	-.18	.00	-34.67	-58.29	.52	.18
100.0	-.78	.04	-.15	.00	-35.46	-64.35	.82	.15
105.0	-1.02	-.03	-.09	.01	-37.33	-64.31	.99	.10
110.0	-.93	.06	-.02	-.01	-41.51	-62.58	.98	.01
TOTAL	.61	.04	.09	.00	-37.00	-61.31		

NET REDUCTION OF MISMATCH ERROR= 24.30DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00048	.00000
2	0.00000	0.00000	-.00054	-.00000
3	0.00000	0.00000	.00369	.00000
4	0.00000	0.00000	-.00869	-.00000
5	0.00000	0.00000	.01150	.00000
6	0.00000	0.00000	-.00295	-.00000
7	0.00000	0.00000	.00247	.00000
8	1.00000	0.00000	1.00243	-.00000
9	0.00000	0.00000	-.00286	.00000
10	0.00000	0.00000	-.00475	-.00000
11	0.00000	0.00000	.00029	.00000
12	0.00000	0.00000	-.00165	-.00000
13	0.00000	0.00000	-.00046	.00000
14	0.00000	0.00000	-.00069	-.00000
15	0.00000	0.00000	-.00020	.00000
16	0.00000	0.00000	-.00045	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 19 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.61	-.03	-.02	-.00	-39.52	-65.73	.59	.01
20.0	-.62	.02	-.02	.00	-39.00	-67.88	.64	.02
25.0	-.63	.00	-.02	.00	-39.07	-68.54	.64	.02
30.0	-.59	.02	-.01	-.00	-40.49	-68.63	.62	.01
35.0	-.60	-.02	-.01	-.01	-39.97	-62.71	.58	.00
40.0	-.53	-.00	.00	-.00	-40.57	-74.93	.53	-.00
45.0	-.45	.00	.00	.00	-42.17	-70.93	.45	-.00
50.0	-.37	-.03	.01	.00	-44.35	-63.30	.34	-.00
55.0	-.16	.03	.01	.00	-51.05	-64.21	.20	-.00
60.0	0.00	.02	0.00	-.00	-200.00	-68.94	.02	-.00
65.0	.19	.00	-.02	-.01	-47.46	-61	-.19	.02
70.0	.36	-.03	-.05	-.00	-41.74	-6_	-.39	.05
75.0	.50	-.05	-.09	.00	-37.80	-63.09	-.53	.10
80.0	.59	.01	-.14	.01	-34.45	-59.91	-.52	.15
85.0	.33	.01	-.20	-.00	-32.63	-70.36	-.32	.19
90.0	-.01	.05	-.22	-.01	-32.61	-57.84	.06	.21
95.0	-.53	.00	-.20	-.00	-34.06	-73.69	.53	.20
100.0	-1.07	-.11	-.14	.00	-34.44	-55.86	.96	.14
105.0	-1.21	.02	-.04	.01	-36.91	-58.86	1.22	.05
110.0	-1.12	.12	.04	-.02	-39.71	-56.68	1.24	-.06
TOTAL	.61	.04	.09	.01	-36.87	-61.32		

NET REDUCTION OF MISMATCH ERROR= 24.45DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00245	.00000
2	0.00000	0.00000	-.00262	.00000
3	0.00000	0.00000	.01525	.00000
4	0.00000	0.00000	-.01731	.00000
5	0.00000	0.00000	.03704	-.00000
6	0.00000	0.00000	-.00568	.00000
7	0.00000	0.00000	-.01972	.00000
8	1.00000	0.00000	1.00811	.00000
9	0.00000	0.00000	-.04674	-.00000
10	0.00000	0.00000	-.01071	.00000
11	0.00000	0.00000	-.01012	.00000
12	0.00000	0.00000	-.00410	.00000
13	0.00000	0.00000	-.00555	-.00000
14	0.00000	0.00000	-.00145	.00000
15	0.00000	0.00000	-.00220	-.00000
16	0.00000	0.00000	-.00141	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 20 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-4.06	-.18	.46	-.01	-21.07	-50.24	3.88	-.47
20.0	-3.57	.16	.45	.01	-21.51	-50.44	3.73	-.44
25.0	-3.11	.07	.43	.01	-22.55	-56.32	3.18	-.42
30.0	-2.62	-.04	.39	-.01	-24.55	-58.75	2.57	-.39
35.0	-2.20	-.12	.35	-.01	-25.35	-53.25	2.08	-.35
40.0	-1.66	-.01	.30	.00	-26.66	-75.80	1.68	-.30
45.0	-1.23	.05	.23	.00	-29.22	-60.04	1.29	-.23
50.0	-.78	.06	.17	.01	-33.20	-57.78	.84	-.16
55.0	-.38	-.01	.09	-.00	-39.04	-73.14	.37	-.09
60.0	0.00	-.05	0.00	.00	-200.00	-61.19	-.05	.00
65.0	.39	.01	-.12	-.01	-36.36	-59.40	-.38	.11
70.0	.61	.01	-.25	-.00	-30.87	-67.30	-.60	.25
75.0	.67	-.04	-.39	.01	-27.40	-58.14	-.71	.40
80.0	.67	.05	-.55	.01	-23.94	-58.60	-.62	.56
85.0	.23	.01	-.70	.00	-22.08	-73.22	-.22	.70
90.0	-.59	.01	-.82	-.01	-21.54	-56.00	.60	.80
95.0	-1.88	-.08	-.85	-.01	-21.94	-57.41	1.79	.84
100.0	-3.12	.01	-.79	.01	-22.02	-61.68	3.12	.80
105.0	-4.15	.07	-.65	.02	-23.50	-54.50	4.21	.67
110.0	-4.66	-.03	-.50	-.03	-26.11	-55.97	4.63	.47
TOTAL	2.34	.07	.46	.01	-23.84	-55.72		

NET REDUCTION OF MISMATCH ERRORS = 31.86DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.06656	-.00000
2	0.00000	0.00000	-.44161	.00000
3	0.00000	0.00000	-.30999	-.00000
4	0.00000	0.00000	-.53044	.00000
5	0.00000	0.00000	-.24234	.00000
6	0.00000	0.00000	-.63814	.00000
7	0.00000	0.00000	.08258	.00000
8	1.00000	0.00000	-.61676	.00000
9	0.00000	0.00000	-.21480	.00000
10	0.00000	0.00000	-.64348	.00000
11	0.00000	0.00000	-.14090	.00000
12	0.00000	0.00000	-.58114	.00000
13	0.00000	0.00000	-.03589	.00000
14	0.00000	0.00000	-.56564	.00000
15	0.00000	0.00000	-.12638	.00000
16	0.00000	0.00000	-.21027	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 21 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	217.45	35.79	-.35	-1.29	5.11	-4.89	-181.67	-.94
20.0	66.77	36.91	-.86	-5.67	.56	-3.45	-29.85	-4.81
25.0	38.46	19.73	-.57	.01	-3.93	-9.36	-18.73	.58
30.0	-20.62	-23.44	-.09	-2.16	-9.80	-8.35	-2.83	-2.08
35.0	-69.11	-9.83	-.36	-6.13	.52	-6.08	59.28	-5.77
40.0	-87.96	-347.70	-.85	-2.93	2.51	-9.36	-259.74	-2.10
45.0	-237.62	-129.65	-.59	-2.88	4.46	3.80	107.97	-2.19
50.0	244.41	-12.68	.33	-7.30	4.00	-5.34	-257.09	-7.63
55.0	-65.37	-44.95	.03	-16.80	.11	-1.36	15.42	-16.83
60.0	0.00	-18.81	0.00	-9.63	-200.00	-3.15	-18.81	-9.63
65.0	-265.36	99.36	-.62	-9.76	3.09	.87	364.72	-9.13
70.0	215.25	-91.28	.08	-8.50	5.17	.16	-306.53	-8.59
75.0	-40.79	-306.69	-.04	-5.92	-3.73	-2.44	-265.91	-5.88
80.0	-68.35	51.36	-.59	-4.46	.84	-2.03	119.71	-5.87
85.0	194.06	-32.89	-.65	-4.10	5.76	-4.55	-226.94	-3.48
90.0	-184.85	305.76	.20	-5.56	5.46	-2.45	490.61	-5.76
95.0	-27.76	65.25	.92	-9.95	-7.49	-2.67	91.00	-10.87
100.0	-68.34	318.67	1.89	-8.79	-.03	-4.47	387.01	-10.68
105.0	-254.65	64.21	3.48	-13.42	2.50	-4.19	318.86	-16.90
110.0	-196.00	10.89	5.23	2.39	3.14	-14.11	206.89	-2.84
TOTAL	156.56	152.26	1.79	3.04	2.91	-1.91		

NET REDUCTION OF MISMATCH ERROR = 4.82DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00082	-.00000
2	0.00000	0.00000	-.00267	.00000
3	0.00000	0.00000	.00761	-.00000
4	0.00000	0.00000	-.01206	.00000
5	0.00000	0.00000	.01390	-.00000
6	0.00000	0.00000	.00084	.00000
7	0.00000	0.00000	-.00636	-.00000
8	1.00000	0.00000	1.01043	.00000
9	0.00000	0.00000	-.01365	-.00000
10	0.00000	0.00000	-.00202	.00000
11	0.00000	0.00000	-.00287	-.00000
12	0.00000	0.00000	-.00032	.00000
13	0.00000	0.00000	-.00094	-.00000
14	0.00000	0.00000	-.00004	.00000
15	0.00000	0.00000	-.00024	-.00000
16	0.00000	0.00000	-.00005	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 22 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.86	-.00	.05	-.00	-36.12	-83.83	.85	-.05
20.0	-.95	-.00	.04	-.00	-35.10	-80.38	.94	-.04
25.0	-.95	.01	.04	.00	-35.33	-65.77	.96	-.04
30.0	-.92	.00	.03	-.01	-36.54	-65.24	.92	-.03
35.0	-.89	-.03	.03	.00	-36.39	-66.60	.86	-.03
40.0	-.75	.01	.03	.00	-37.32	-72.29	.77	-.03
45.0	-.60	.04	.02	-.00	-39.45	-62.29	.64	-.02
50.0	-.55	-.08	.02	.00	-40.82	-58.01	.47	-.02
55.0	-.26	.00	.01	-.00	-47.20	-66.88	.27	-.01
60.0	0.00	.03	0.00	.00	-200.00	-62.69	.03	.00
65.0	.26	.02	-.03	-.00	-44.49	-65.74	-.23	.03
70.0	.48	-.02	-.08	-.00	-38.78	-65.81	-.49	.07
75.0	.65	-.05	-.13	.00	-35.03	-60.65	-.70	.14
80.0	.80	.02	-.22	.00	-30.92	-68.31	-.77	.22
85.0	.64	.01	-.30	.00	-28.85	-64.97	-.63	.30
90.0	.25	.04	-.39	-.01	-27.83	-60.29	-.21	.38
95.0	-.52	-.07	-.43	-.00	-28.04	-59.44	.45	.42
100.0	-1.19	.02	-.41	.00	-28.05	-69.70	1.20	.42
105.0	-1.86	-.02	-.35	.01	-29.50	-66.10	1.85	.35
110.0	-2.09	.05	-.25	-.01	-32.65	-64.65	2.14	.24
TOTAL	.92	.03	.20	.00	-32.02	-63.09		

NET REDUCTION OF MISMATCH ERRORS 31.07DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00020	-.00000
2	0.00000	0.00000	-.00176	.00000
3	0.00000	0.00000	.00475	-.00000
4	0.00000	0.00000	-.00946	.00000
5	0.00000	0.00000	.00836	-.00000
6	0.00000	0.00000	.00637	.00000
7	0.00000	0.00000	.00251	-.00000
8	1.00000	0.00000	1.01088	.00000
9	0.00000	0.00000	.00234	-.00000
10	0.00000	0.00000	-.00403	.00000
11	0.00000	0.00000	.00106	-.00000
12	0.00000	0.00000	-.00136	.00000
13	0.00000	0.00000	.00065	-.00000
14	0.00000	0.00000	-.00068	.00000
15	0.00000	0.00000	.00036	-.00000
16	0.00000	0.00000	-.00026	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 23 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.47	.01	-.18	-.00	-33.53	-74.77	.48	.18
20.0	-.64	-.02	-.17	.00	-32.92	-70.78	.62	.17
25.0	-.74	-.00	-.15	.00	-33.35	-78.08	.74	.15
30.0	-.78	02	-.13	.00	-34.70	-71.09	.80	.13
35.0	-.80	.00	-.11	-.00	-35.02	-75.97	.80	.11
40.0	-.74	00	-.08	-.00	-35.83	-74.52	.74	.08
45.0	-.63	-.01	-.06	.00	-37.86	-72.63	.62	.06
50.0	-.48	-.01	-.04	.00	-41.32	-72.62	.47	.04
55.0	-.25	.01	-.02	.00	-46.91	-72.87	.27	.02
60.0	0.00	.01	0.00	.00	-200.00	-69.87	.01	.00
65.0	.31	.00	-.00	-.00	-45.18	-67.72	-.31	-.00
70.0	.64	-.02	-.02	-.00	-39.36	-67.54	-.66	.02
75.0	.90	.02	-.05	.00	-35.35	-71.58	-.97	.05
80.0	1.11	-.03	-.10	.01	-32.84	-61.57	-1.14	.11
85.0	1.10	.01	-.17	.00	-31.27	-75.34	-1.09	.17
90.0	.85	.05	-.23	-.01	-31.20	-60.27	-.81	.22
95.0	.37	.00	-.25	-.00	-32.50	-68.21	-.37	.25
100.0	-.17	-.06	-.22	.00	-33.98	-60.88	.11	.23
105.0	-.54	-.05	-.16	.01	-37.43	-62.47	.50	.16
110.0	-.56	.13	-.07	-.01	-43.79	-58.00	.69	.06
TOTAL	.67	.04	.13	.00	-34.38	-64.74		

NET REDUCTION OF MISMATCH ERRORS 30.37DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00133	-.00000
2	0.00000	0.00000	-.00520	.00000
3	0.00000	0.00000	.01223	-.00000
4	0.00000	0.00000	-.01971	.00000
5	0.00000	0.00000	.01851	-.00000
6	0.00000	0.00000	.00757	.00000
7	0.00000	0.00000	-.00641	-.00000
8	1.00000	0.00000	1.02251	.00000
9	0.00000	0.00000	-.01308	-.00000
10	0.00000	0.00000	-.00076	.00000
11	0.00000	0.00000	-.00264	-.00000
12	0.00000	0.00000	.00043	.00000
13	0.00000	0.00000	-.00078	-.00000
14	0.00000	0.00000	.00053	.00000
15	0.00000	0.00000	-.00016	-.00000
16	0.00000	0.00000	.00008	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 24 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.89	.02	-.12	.00	-34.10	-70.19	.91	.12
20.0	-1.13	-.02	-.11	-.00	-32.48	-69.25	1.11	.11
25.0	-1.26	-.01	-.10	.00	-32.25	-68.15	1.25	.10
30.0	-1.31	.00	-.09	-.00	-32.83	-69.60	1.32	.09
35.0	-1.31	-.00	-.07	.00	-32.76	-77.26	1.31	.07
40.0	-1.19	.02	-.05	.00	-33.30	-69.71	1.21	.05
45.0	-1.00	.04	-.03	-.00	-35.09	-63.11	1.04	.03
50.0	-.88	-.10	-.01	.00	-37.04	-56.15	.78	.01
55.0	-.46	-.01	-.00	-.00	-42.43	-69.22	.45	.00
60.0	0.00	.05	0.00	.00	-200.00	-59.31	.05	.00
65.0	.43	.02	-.03	-.00	-41.79	-67.49	-.41	.02
70.0	.90	-.00	-.08	-.01	-35.35	-64.88	-.91	.07
75.0	1.27	-.08	-.15	.00	-31.56	-57.14	-1.35	.16
80.0	1.61	.01	-.27	.00	-27.50	-74.50	-1.60	.28
85.0	1.54	.05	-.41	.01	-25.34	-59.56	-1.50	.42
90.0	.99	.05	-.56	-.01	-24.48	-59.49	-.94	.55
95.0	-.13	-.09	-.64	-.00	-24.73	-57.45	.04	.64
100.0	-1.25	-.01	-.64	.00	-24.74	-72.08	1.23	.64
105.0	-2.32	.00	-.55	.01	-26.31	-61.46	2.32	.56
110.0	-2.86	.06	-.41	-.01	-29.31	-61.73	2.92	.40
TOTAL	1.31	.04	.30	.00	-28.67	-61.27		

NET REDUCTION OF MISMATCH ERROR= 32.59DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	-.00055	-.00000
2	0.00000	0.00000	-.00169	.00000
3	0.00000	0.00000	.00406	-.00000
4	0.00000	0.00000	-.00883	.00000
5	0.00000	0.00000	.00632	-.00000
6	0.00000	0.00000	.00493	.00000
7	0.00000	0.00000	.00101	-.00000
8	1.00000	0.00000	1.00843	.00000
9	0.00000	0.00000	.00223	-.00000
10	0.00000	0.00000	-.00421	.00000
11	0.00000	0.00000	.00146	-.00000
12	0.00000	0.00000	-.00117	.00000
13	0.00000	0.00000	.00090	-.00000
14	0.00000	0.00000	-.00055	.00000
15	0.00000	0.00000	.00047	-.00000
16	0.00000	0.00000	-.00018	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 25 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.29	.02	-.13	-.00	-36.76	-68.32	.24	.13
20.0	-.41	-.02	-.13	.00	-35.75	-68.65	.39	.13
25.0	-.56	-.03	-.12	.00	-35.66	-66.96	.53	.12
30.0	-.58	.04	-.10	.00	-36.96	-64.05	.62	.10
35.0	-.64	.01	-.09	-.00	-36.87	-73.58	.65	.09
40.0	-.61	-.00	-.07	-.00	-37.44	-75.09	.61	.07
45.0	-.53	-.02	-.05	.00	-39.27	-70.51	.52	.05
50.0	-.42	-.02	-.03	-.00	-42.45	-70.05	.40	.03
55.0	-.29	.01	-.01	.00	-48.08	-71.21	.24	.02
60.0	0.00	.02	0.00	.00	-200.00	-69.20	.02	.00
65.0	.29	.01	-.00	-.00	-46.01	-68.62	-.28	-.00
70.0	.58	-.03	-.01	-.00	-40.22	-65.83	-.61	.01
75.0	.92	.00	-.04	.00	-36.17	-79.39	-.91	.04
80.0	1.06	-.02	-.09	.00	-33.51	-63.95	-1.08	.09
85.0	1.05	.01	-.14	.00	-32.08	-73.62	-1.05	.15
90.0	.85	.05	-.20	-.01	-32.01	-60.13	-.81	.19
95.0	.42	.00	-.22	-.00	-33.46	-69.06	-.42	.22
100.0	-.06	-.06	-.20	.00	-35.19	-60.85	.00	.20
105.0	-.38	-.05	-.13	.01	-39.13	-62.56	.33	.14
110.0	-.37	.13	-.05	-.01	-46.85	-57.77	.50	.05
TOTAL	.58	.04	.11	.00	-35.82	-64.31		

NET REDUCTION OF MISMATCH ERROR= 28.4906.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00020	.00000
2	0.00000	0.00000	-.00136	.00000
3	0.00000	0.00000	.00514	.00000
4	0.00000	0.00000	-.00927	.00000
5	0.00000	0.00000	.01075	.00000
6	0.00000	0.00000	.00169	.00000
7	0.00000	0.00000	.00594	.00000
8	1.00000	0.00000	1.00718	.00000
9	0.00000	0.00000	.00262	.00000
10	0.00000	0.00000	-.00375	.00000
11	0.00000	0.00000	.00072	.00000
12	0.00000	0.00000	-.00174	.00000
13	0.00000	0.00000	.00030	.00000
14	0.00000	0.00000	-.00041	.00000
15	0.00000	0.00000	.00012	.00000
16	0.00000	0.00000	-.00046	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 26 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.65	-.03	-.15	-.00	-33.89	-64.16	.62	.15
20.0	-.66	.01	-.14	.00	-34.02	-67.07	.68	.14
25.0	-.65	.04	-.12	.01	-34.98	-61.16	.69	.13
30.0	-.70	-.02	-.11	-.01	-35.76	-61.77	.69	.11
35.0	-.70	-.03	-.09	-.00	-36.36	-65.96	.67	.09
40.0	-.63	-.00	-.07	.00	-37.34	-82.18	.63	.07
45.0	-.51	.04	-.05	.00	-39.57	-63.65	.55	.05
50.0	-.47	-.05	-.02	.01	-41.93	-59.23	.42	.03
55.0	-.25	.00	-.02	-.00	-47.20	-69.36	.25	.01
60.0	0.00	.03	0.00	.00	-200.00	-64.78	.03	.00
65.0	.20	.03	-.01	-.00	-47.23	-62.76	-.22	.00
70.0	.43	-.04	-.03	-.00	-42.31	-62.50	-.47	.02
75.0	.64	-.04	-.05	.01	-38.58	-59.05	-.68	.06
80.0	.77	.01	-.10	.00	-34.80	-69.61	-.76	.11
85.0	.68	.03	-.15	.00	-33.41	-64.03	-.64	.16
90.0	.37	.05	-.20	-.01	-33.06	-57.58	-.32	.19
95.0	-.23	-.09	-.20	-.00	-34.37	-58.16	.14	.20
100.0	-.62	.00	-.16	.00	-35.47	-66.93	.62	.17
105.0	-1.01	-.03	-.08	.01	-37.60	-61.73	.98	.09
110.0	-1.00	.10	.02	-.01	-40.92	-58.05	1.10	-.03
TOTAL	.61	.04	.11	.01	-35.89	-61.34		

NET REDUCTION OF MISMATCH ERRORS 25.4506.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00020	-.00000
2	0.00000	0.00000	-.00207	.00000
3	0.00000	0.00000	.00570	-.00000
4	0.00000	0.00000	-.00958	.00000
5	0.00000	0.00000	.00952	-.00000
6	0.00000	0.00000	.00350	.00000
7	0.00000	0.00000	-.00359	-.00000
8	1.00000	0.00000	1.00879	.00000
9	0.00000	0.00000	-.00611	-.00000
10	0.00000	0.00000	-.00326	.00000
11	0.00000	0.00000	-.00108	-.00000
12	0.00000	0.00000	-.00082	.00000
13	0.00000	0.00000	-.00016	-.00000
14	0.00000	0.00000	-.00042	.00000
15	0.00000	0.00000	.00008	-.00000
16	0.00000	0.00000	-.00013	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 27 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
(HZ)	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.62	.00	-.02	-.00	-39.37	-86.11	.62	.02
20.0	-.73	-.00	-.03	.00	-37.55	-84.57	.72	.03
25.0	-.78	-.00	-.03	.00	-37.16	-81.15	.78	.03
30.0	-.76	.01	-.02	.00	-38.17	-73.47	.78	.02
35.0	-.73	.00	-.02	-.00	-38.18	-78.10	.73	.02
40.0	-.65	-.00	-.01	-.00	-38.73	-77.59	.65	.01
45.0	-.54	-.01	-.01	.00	-40.49	-75.14	.54	.01
50.0	-.40	-.00	-.00	-.00	-43.91	-82.74	.39	.00
55.0	-.20	.01	.00	.00	-49.50	-70.69	.22	-.00
60.0	0.00	-.00	0.00	.00	-200.00	-79.38	-.00	.00
65.0	.29	.01	-.01	-.00	-45.63	-69.90	-.27	.01
70.0	.54	-.02	-.04	-.00	-40.13	-66.85	-.57	.04
75.0	.83	.02	-.08	.00	-35.86	-71.59	-.82	.08
80.0	.93	-.01	-.14	.00	-32.81	-66.46	-.94	.14
85.0	.84	-.00	-.21	.00	-30.89	-74.65	-.86	.21
90.0	.58	.03	-.28	-.01	-30.24	-62.26	-.55	.27
95.0	.05	-.00	-.31	-.00	-30.83	-72.84	-.05	.31
100.0	-.56	-.03	-.30	.00	-31.25	-65.08	.52	.30
105.0	-1.01	-.02	-.24	.01	-33.31	-66.57	.99	.25
110.0	-1.18	.07	-.16	-.01	-37.27	-62.52	1.21	.15
TOTAL	.68	.02	.14	.00	-34.58	-68.18		

NET REDUCTION OF MISMATCH ERROR= 33.600B.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00036	-.00000
2	0.00000	0.00000	-.00242	-.00000
3	0.00000	0.00000	.00603	-.00000
4	0.00000	0.00000	-.01152	-.00000
5	0.00000	0.00000	.01061	-.00000
6	0.00000	0.00000	-.00020	-.00000
7	0.00000	0.00000	-.00521	-.00000
8	1.00000	0.00000	1.00964	-.00000
9	0.00000	0.00000	-.00898	-.00000
10	0.00000	0.00000	-.00102	.00000
11	0.00000	0.00000	-.00145	-.00000
12	0.00000	0.00000	-.00026	-.00000
13	0.00000	0.00000	-.00056	-.00000
14	0.00000	0.00000	.00009	-.00000
15	0.00000	0.00000	-.00021	-.00000
16	0.00000	0.00000	.00032	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 28 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (MZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.47	-.11	.01	-.01	-41.82	-54.10	.36	-.02
20.0	-.35	.11	.02	.01	-43.76	-52.46	.46	-.00
25.0	-.47	.05	-.01	-.00	-41.77	-61.51	.51	.01
30.0	-.60	-.07	-.02	-.01	-40.26	-57.06	.53	.01
35.0	-.59	-.07	-.01	-.00	-40.11	-58.66	.52	.01
40.0	-.45	.04	.00	.01	-42.02	-58.47	.49	.01
45.0	-.40	.03	-.00	-.00	-43.14	-64.14	.43	-.00
50.0	-.37	-.03	.00	-.00	-44.42	-66.53	.35	-.00
55.0	-.18	.02	-.00	-.00	-50.64	-67.33	.20	-.00
60.0	0.00	-.01	0.00	.01	-200.00	-62.85	-.01	.01
65.0	.26	-.00	-.03	-.01	-44.96	-62.47	-.26	.02
70.0	.50	-.02	-.06	-.00	-39.74	-68.93	-.51	.06
75.0	.70	-.00	-.10	.01	-36.05	-64.02	-.70	.11
80.0	.76	.01	-.18	.00	-32.12	-73.18	-.75	.18
85.0	.63	.03	-.26	.00	-29.99	-64.98	-.60	.26
90.0	.25	.01	-.33	-.01	-29.07	-64.16	-.24	.33
95.0	-.45	-.13	-.37	-.00	-29.31	-54.23	.32	.36
100.0	-.88	.11	-.34	.01	-29.90	-55.74	.95	.35
105.0	-1.51	-.01	-.27	.01	-31.44	-64.68	1.50	.28
110.0	-1.80	-.04	-.19	-.01	-34.28	-63.07	1.76	.18
TOTAL	.71	.06	.17	.01	-33.44	-58.27		

NET REDUCTION OF MISMATCH ERROR= 24.4300.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00056	.00000
2	0.00000	0.00000	-.00325	-.00000
3	0.00000	0.00000	.00753	.00000
4	0.00000	0.00000	-.01202	-.00000
5	0.00000	0.00000	.00967	.00000
6	0.00000	0.00000	.01172	-.00000
7	0.00000	0.00000	-.00093	.00000
8	1.00000	0.00000	1.01812	-.00000
9	0.00000	0.00000	.00014	.00000
10	0.00000	0.00000	-.00325	-.00000
11	0.00000	0.00000	.00067	.00000
12	0.00000	0.00000	-.00080	-.00000
13	0.00000	0.00000	.00046	.00000
14	0.00000	0.00000	-.00043	-.00000
15	0.00000	0.00000	.00019	.00000
16	0.00000	0.00000	-.00010	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 29 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.50	.02	-.23	.00	-31.41	-67.87	.61	.23
20.0	-.81	-.02	-.21	-.00	-30.90	-68.18	.78	.21
25.0	-.93	-.01	-.19	.00	-31.32	-72.96	.92	.19
30.0	-1.00	.01	-.17	.00	-32.66	-72.08	1.01	.17
35.0	-1.03	.00	-.14	-.00	-32.91	-88.25	1.03	.14
40.0	-.96	.02	-.10	-.00	-33.72	-70.55	.97	.10
45.0	-.82	.02	-.07	.00	-35.76	-67.59	.84	.07
50.0	-.73	-.09	-.04	-.00	-37.99	-56.35	.64	.04
55.0	-.33	.04	-.02	.00	-44.95	-64.43	.36	.02
60.0	0.00	.01	0.00	.00	-200.00	-70.20	.01	.00
65.0	.43	.02	-.00	-.00	-42.38	-69.19	-.42	-.00
70.0	.91	.02	-.02	-.00	-36.33	-64.98	-.89	.02
75.0	1.24	-.09	-.07	-.00	-33.37	-57.02	-1.33	.07
80.0	1.63	.01	-.14	.00	-29.70	-66.59	-1.62	.14
85.0	1.68	.03	-.23	.00	-27.98	-65.09	-1.66	.24
90.0	1.41	.04	-.33	-.00	-27.66	-62.04	-1.37	.33
95.0	.77	-.03	-.39	-.00	-28.47	-64.72	-.79	.39
100.0	.03	-.04	-.39	.00	-29.25	-65.59	-.07	.40
105.0	-.64	-.04	-.33	.01	-31.80	-62.83	.61	.34
110.0	-.91	.12	-.23	-.01	-36.22	-58.79	1.03	.22
TOTAL	.95	.05	.20	.00	-31.24	-62.48		

NET REDUCTION OF MISMATCH ERRORS 31.24DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00053	-.00000
2	0.00000	0.00000	-.00254	.00000
3	0.00000	0.00000	.00748	-.00000
4	0.00000	0.00000	-.01237	.00000
5	0.00000	0.00000	.01389	-.00000
6	0.00000	0.00000	.00532	.00000
7	0.00000	0.00000	-.00381	-.00000
8	1.00000	0.00000	1.01278	.00000
9	0.00000	0.00000	-.00866	-.00000
10	0.00000	0.00000	-.00493	.00000
11	0.00000	0.00000	-.00086	-.00000
12	0.00000	0.00000	-.00147	.00000
13	0.00000	0.00000	-.00045	-.00000
14	0.00000	0.00000	-.00042	.00000
15	0.00000	0.00000	-.00012	-.00000
16	0.00000	0.00000	-.00026	.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 30 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-1.02	-.02	-.05	-.00	-34.82	-68.49	1.00	.05
20.0	-1.13	.00	-.05	.00	-33.66	-77.99	1.13	.05
25.0	-1.14	.04	-.04	.00	-33.87	-62.18	1.17	.05
30.0	-1.18	-.02	-.04	-.00	-34.35	-65.59	1.16	.04
35.0	-1.12	-.02	-.03	-.00	-34.46	-67.98	1.10	.02
40.0	-.99	.00	-.01	-.00	-35.18	-87.19	.99	.01
45.0	-.78	.04	-.01	-.00	-37.32	-63.14	.82	.01
50.0	-.65	-.05	.01	.01	-39.55	-59.85	.60	-.00
55.0	-.34	-.01	.00	-.00	-45.07	-71.18	.34	-.00
60.0	0.00	.02	0.00	.00	-200.00	-66.18	.02	.00
65.0	.36	.03	-.03	-.00	-42.99	-63.02	-.33	.02
70.0	.67	-.03	-.07	-.00	-37.47	-64.28	-.70	.07
75.0	.97	-.04	-.13	.00	-33.63	-61.74	-1.01	.13
80.0	1.18	.00	-.21	.00	-29.90	-68.01	-1.17	.22
85.0	1.11	.03	-.30	.00	-28.00	-63.63	-1.08	.31
90.0	.75	.04	-.39	-.01	-27.40	-57.67	-.70	.38
95.0	-.00	-.08	-.42	-.00	-28.25	-58.71	-.08	.42
100.0	-.65	.00	-.40	.01	-28.83	-66.60	.65	.41
105.0	-1.30	-.02	-.32	.01	-31.00	-62.87	1.28	.33
110.0	-1.51	.08	-.21	-.01	-34.81	-60.24	1.59	.20
TOTAL	.93	.04	.19	.00	-31.70	-62.37		

NET REDUCTION OF MISMATCH ERROR= 30.67DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.07472	-.00000
2	0.00000	0.00000	-.40668	.00000
3	0.00000	0.00000	-.27651	-.00000
4	0.00000	0.00000	-.49417	.00000
5	0.00000	0.00000	-.21496	-.00000
6	0.00000	0.00000	-.59706	.00000
7	0.00000	0.00000	.08371	-.00000
8	1.00000	0.00000	-.56636	.00000
9	0.00000	0.00000	-.18847	-.00000
10	0.00000	0.00000	-.59286	.00000
11	0.00000	0.00000	-.12385	-.00000
12	0.00000	0.00000	-.54377	.00000
13	0.00000	0.00000	-.02685	-.00000
14	0.00000	0.00000	-.52292	-.00000
15	0.00000	0.00000	-.11162	.00000
16	0.00000	0.00000	-.19456	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 31 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	218.54	36.42	.19	-1.43	5.36	-4.7	-182.12	-1.62
20.0	67.16	36.32	-.20	-5.60	.91	-3.47	-30.83	-5.59
25.0	39.64	20.04	.01	-.08	-3.43	-9.27	-19.61	-.09
30.0	-18.64	-22.89	.75	-1.85	-9.96	-8.68	-4.25	-2.60
35.0	-66.71	-11.13	.26	-6.19	.56	-5.96	55.58	-6.45
40.0	-87.24	-348.90	-.13	-3.09	2.78	-9.32	-261.70	-2.96
45.0	-238.85	-131.88	.00	-3.00	4.76	3.83	106.97	-3.00
50.0	244.41	-12.44	.61	-7.83	4.15	-5.03	-256.85	-8.44
55.0	-65.42	-52.80	.56	-17.70	.40	-1.23	12.63	-18.26
60.0	0.00	-21.11	0.00	-10.41	-200.00	-2.77	-21.11	-10.41
65.0	-265.22	98.11	-.01	-9.79	3.39	.82	363.34	-9.78
70.0	215.34	-92.57	.52	-8.61	5.39	.21	-307.91	-9.13
75.0	-40.46	-307.74	.60	-5.85	-3.44	-2.54	-267.29	-6.45
80.0	-67.53	51.13	-.05	-4.48	1.01	-2.06	118.67	-4.44
85.0	194.21	-33.49	-.17	-4.23	5.99	-4.41	-227.71	-4.07
90.0	-184.19	305.57	.69	-5.72	5.71	-2.42	489.76	-6.42
95.0	-27.51	60.52	1.81	-9.68	-6.56	-2.83	88.02	-11.49
100.0	-68.10	317.20	2.16	-8.56	.12	-4.43	385.31	-10.73
105.0	-254.87	70.52	3.69	-13.21	2.65	-5.99	325.39	-16.90
110.0	-194.80	11.12	5.89	2.34	3.58	-14.20	205.92	-3.55
TOTAL	156.55	152.58	2.03	3.67	3.16	-1.87		

NET REDUCTION OF MISMATCH ERROR= 5.03DB.

PROGRAM FOR EVALUATING FILTER MATCH

FILTER COEFFICIENTS

1	0.00000	0.00000	.00108	.00000
2	0.00000	0.00000	-.00464	-.00000
3	0.00000	0.00000	.01058	.00000
4	0.00000	0.00000	-.01755	-.00000
5	0.00000	0.00000	.01423	.00000
6	0.00000	0.00000	.00825	-.00000
7	0.00000	0.00000	-.00411	.00000
8	1.00000	0.00000	1.02062	-.00000
9	0.00000	0.00000	-.00663	.00000
10	0.00000	0.00000	-.00116	-.00000
11	0.00000	0.00000	-.00102	.00000
12	0.00000	0.00000	.00012	-.00000
13	0.00000	0.00000	-.00014	.00000
14	0.00000	0.00000	.00024	-.00000
15	0.00000	0.00000	.00007	.00000
16	0.00000	0.00000	.00007	-.00000

CORRECTION FILTER FOR RECEIVERS 1 AND 32 WITH 16 TAPS
FOR A TAP SPACING OF .0040 SECS.

FREQ (HZ)	PHASE ERROR (DEGREES)		AMPLITUDE ERROR (DB)		TOTAL MS ERROR (DB POWER)		FILTER PHASE (DEGREES)	FILTER AMPL. (DB)
	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER		
15.0	-.58	.02	-.16	.00	-33.77	-71.69	.60	.16
20.0	-.80	-.02	-.16	-.00	-32.75	-68.23	.78	.16
25.0	-.92	.01	-.14	.00	-32.89	-67.99	.94	.15
30.0	-1.05	-.02	-.13	-.00	-33.29	-66.45	1.03	.13
35.0	-1.06	-.00	-.11	.00	-33.49	-74.05	1.06	.11
40.0	-.98	.02	-.08	.00	-34.17	-67.25	1.00	.08
45.0	-.83	.03	-.06	-.00	-35.97	-63.56	.87	.06
50.0	-.75	-.09	-.03	.00	-38.13	-56.87	.66	.03
55.0	-.39	-.01	-.02	-.00	-43.58	-70.27	.38	.01
60.0	0.00	.03	0.00	.01	-200.00	-61.35	.03	.01
65.0	.44	.04	-.01	-.00	-42.05	-62.12	-.40	.01
70.0	.86	-.02	-.05	-.01	-36.35	-64.11	-.88	.05
75.0	1.26	-.07	-.11	.00	-32.54	-58.93	-1.33	.11
80.0	1.62	.00	-.21	.00	-28.57	-75.86	-1.61	.21
85.0	1.60	.03	-.33	.01	-26.56	-61.65	-1.58	.34
90.0	1.19	.06	-.46	-.01	-25.76	-58.09	-1.13	.45
95.0	.23	-.08	-.54	-.00	-26.22	-58.83	-.31	.53
100.0	-.74	-.01	-.54	.00	-26.43	-70.52	.72	.54
105.0	-1.70	-.03	-.45	.01	-28.21	-61.88	1.67	.46
110.0	-2.13	.09	-.32	-.01	-31.56	-59.93	2.22	.31
TOTAL	1.09	.04	.25	.00	-29.97	-61.62		

NET REDUCTION OF MISMATCH ERROR= 31.65DB.

APPENDIX H

ADAPTIVE PROCESSING WIDE BANDWIDTH CONSIDERATIONS

APPENDIX H
WIDE BANDWIDTH CONSIDERATIONS

H.1 Background

The ability of a wide bandwidth system to successfully cancel strong spatial interference sources is examined. It is heuristically reasonable that a conventional sidelobe canceller approach will have seriously degraded performance since zero's of the pattern, at a given frequency, will be displaced for other frequency components within the receiver passband.

Conclusions

- Successful Adaptation

An adaptive receiving array can successfully reject broadband interference from both point sources such as RFI and spatially extended sources such as auroral return.

- Frequency-Spatial Equivalence

A point source in a broadband system is mathematically equivalent to a spatially extended narrowband source, where the equivalent spatial distribution depends upon the receiver passband characteristics.

- Additional Degrees of Freedom for Adaptation

Since a broadband system senses broadband interference as an equivalent narrowband spatially extended source, more than one adaptive degree of freedom must be dedicated to such a source for successful spatial nulling. The number of degrees of freedom that must be utilized depends upon the bandwidth and strength of the source, the passband characteristics of the receiver, the length of the receiving array and the angle off boresite of the source.

- Worst Case Design - Point Source

The worst case occurs when the equivalent spatial spread of a wideband-noise like signal is maximized. This occurs in a PRS-like system when the full aperture is used at low frequency and the instantaneous receiver bandwidth is 100 KHz. In such a case, a maximum of two zero's, and hence two adaptive degrees of freedom are required to assure cancellation of a source spatially spread by $\Delta\theta_{max} = 2.6°$.

● Aurora

Spatially spread aurora can be modeled as a large number of spatially contiguous point scatterers. As such, the effect of 100 KHz bandwidth operation is to effectively further spread each edge of the aurora by $\Delta\theta_{max}/2 = 1.3°$. As such, the performance is degraded very little over what is achievable when operating with a lower bandwidth.

H.2 Analysis

Consider an N-element line array. Let the array lie along x-axis of (x,y, z) coordinate system and the position of the k^{th} element of array be $\bar{a}_k = kd\bar{i}$, where $\bar{i}$ denotes a unit vector along x-axis, and (d) is the element spacing.

The incoming interfering signal has the discrete spectral representation

$$e(t) = \Sigma A_m e^{2\pi i f_m t} \qquad (1)$$

where A_n denotes the complex amplitude of the m^{th} spectral component. If this signal is transmitted from position

$$\bar{r} = x_o\bar{i} + y_o\bar{j} + f_o\bar{k} ,$$

then the signal at the k^{th} element is $e(t - \tau_k)$ where τ_k is the time to transmit a radio wave from $\bar{r}$ to $\bar{a}_k$. Evidently

$$\tau_T = \frac{1}{c}\sqrt{(\bar{r} - \bar{a}_k)\cdot(\bar{r} - \bar{a}_k)}$$

$$= \frac{r}{c}\sqrt{1 - \frac{1}{r^2}[2(\bar{a}_k \cdot \bar{r}) - (\bar{a}_k \cdot \bar{a}_k)]} \qquad (2)$$

$$\approx \frac{1}{c}(r) - \frac{1}{cr}(\bar{a}_k \cdot \bar{r})$$

is the far field approximation, where $(\bar{a}_k \cdot \bar{r})$ denotes the scalar product of position vectors $\bar{a}_k$ and $\bar{r}$ is,

$$(\bar{a}_k \cdot \bar{r}) = Kd\ r \sin\theta_o \qquad (3)$$

where θ_o is azimuth from boresite (the y-axis direction). Combining (1), (2) and (3), the signal at the k^{th} element is approximately

$$s(t - \tau_k) = \Sigma A_m e^{j2\pi i f_m (t-\tau_k)}$$

$$= \Sigma A_m e^{j2\pi i f_m (t - \frac{r}{c} + kd \sin \theta_o)}$$

$$= \Sigma A_m e^{j2\pi i f_m (t' + kd \sin \theta_o)}$$

where $t' = t - r/c$, the "retarded" time. Replacing t' by t, the interference arriving at the k^{th} element from direction θ_o in the far field is

$$S_k(t) = \Sigma A_m e^{j2\pi i f_m (t + kd \sin \theta_o)} \qquad (4)$$

In the limit spectral representation (4) can be shown to be equivalent to spectral representation

$$S_k(t) = \int_o^\infty e^{j2\pi i f (t + kd \sin \theta_o)} d\alpha(t) \qquad (5)$$

with $\alpha(t)$, a stochastic process of orthogonal increments with the properties

$$E\bar{\alpha}(t') \alpha(t) = G(t) \delta(t'-t) dt$$

$$E\alpha(t') \alpha(t) = 0$$

where E is expected value operator, $\delta(t)$ is the Dirac delta function, and $G(f)$ is the one-sided power spectrum. If the spectrum of the interference is band limited to interval $-w/2 + f_o < f < w/2 + f_o$ where f_o is the center frequency and w is bandwidth, then the spectral representation in the form of (5) reduces to

$$S_k(t) = \int_{-w/2 + f_o}^{w/2 + f_o} e^{2\pi i f(t + kd \sin \theta_o)} dd(f)$$

$$= e^{2\pi i f_o t} \int_{-w/2}^{w/2} e^{2\pi i f(t + kd \sin \theta_o)} d(f + f_o) \quad (6)$$

by a simple change of variable. If one expands $e^{2\pi i f t}$ as a Fourier series on the interval $-w/2 < + < w/2$, i.e.

$$e^{2\pi i f t} = \sum_{n=-\infty}^{\infty} e^{2\pi i n/w} \left[\frac{\sin \pi w (t - n/w)}{\pi w (t - n/w)} \right]$$

Then (6) is equivalent to the well known sampling theorem

$$S_k(t) = \sum_{n=-\infty}^{\infty} S_k(n/w) \left[\frac{\sin \pi w (t - n/w)}{\pi w (t - n/w)} \right] \quad (7)$$

This theorem shows that the sampling interval for the complex signal at the k^{th} antenna element need be no less than

$$T = 1/w$$

Now at each sampling time, i.e., $t_n = n/w$ for some n, an antenna beam is the sampled data filter

$$\mu = \sum_{i=1}^{k} \bar{w}_k x_t \quad (9)$$

where x_k is the signal at the k^{th} antenna element at time $t_n = n/w$ and $\bar{w}_k$ are the antenna weights. If the interference in direction θ_o were a single sine wave of frequency f_o, then by (4), the interference part of x_k would be

$$S_k(n/w) = A\, e^{2\pi i f_o(n/w + kd \sin \theta_o)} \tag{10}$$

for k = 1, 2, ... N. In order to reduce the magnitude of interference (10) in the antenna (9) one must choose the weights w_k in (9) so that a zero of the pattern tends to cancel interference (10), i.e., so that

$$A \sum_{i=1}^{n} w_k\, e^{2\pi i f_o\, kd \sin \theta_o}$$

is small, and have at the same time a main beam which still points in the desired direction.

If the interference is broad band, by (4)

$$S_k\ (n/w) = \sum A_m\, e^{2\pi i (f_m\, n/w + kd \sin \theta_o)}$$

$$= \sum B_m\, e^{2\pi i f_m\, kd \sin \theta_o} \tag{11}$$

where B_m are the complex numbers

$$B_m = A_m\, e^{2\pi i f_m (n/w)}$$

Evidently the component of (11), related to frequency f_m, can be referenced to the center frequency f_o as follows

$$S_k(n/w) = \sum B_m e^{2\pi i f_m\, kd \sin \theta_o}$$

$$= \sum B_m\, e^{2\pi i f_o (f_m/f_o)\, kd \sin \theta_o}$$

$$= \sum B_m\, e^{2\pi i f_o\, kd \sin \theta_o (m)} \tag{12}$$

This suggests a possible replacement of the frequency dependence f_m by an angular dependence defined by

$$\sin \theta_o(m) = \left(\frac{f_m}{f_o}\right) \sin \theta_o$$

$$= \left(\frac{f_o + (f_m - f_o)}{f_o}\right) \sin \theta_o$$

$$= \sin \theta_o + \left(\frac{f_m - f_o}{f_o}\right) \sin \theta_o \qquad (13)$$

If one lets $\theta_o(m) = \theta_o + \Delta\theta_m$ and assumes $((f-f_o)/f_o)$ is small, then by Taylor's expansion

$$\sin (\theta_o + \Delta\theta_m) = \sin \theta_o + (\cos \theta_o)\, \Delta\theta_m$$

$$+ \text{higher order terms.}$$

Form this one can see by (13) that

$$\Delta\theta_m = \left(\frac{f_m - f_o}{f_o}\right) \tan \theta_o$$

Substituting in (12) yields

$$S_k(n/w) = \sum B_m\, e^{2\pi i f_o kd \sin \left[\theta_o + \frac{(f_m - f_o)}{f_o} \tan \theta_o\right]} \qquad (14)$$

This is the desired mapping of the frequency components of the interference into an equivalent angular interference pattern coming in directions

$$\theta_o(m) = \theta_o + \left|(f_m - f_o)/f_o\right| \tan \theta_o \qquad (15)$$

corresponding to the frequency f_m.

In order to minimize interference in the form of (14), one must place, by adaptivity or otherwise, a set of antenna nulls over the angular region

occupied by the directions $\theta_o(m)$, given in (15). The angular extent of this region about θ_o is bounded by

$$\Delta\theta = \max_m |\theta_o(m) - \theta_o|$$

$$= \max_m \frac{(f_m - f_o)}{f_o} \tan \theta_o$$

$$= \frac{\Delta f}{f_o} \tan \theta_o$$

If f_o is at the center of the interference band of bandwidth w, then

$$\underline{\Delta\theta = (w/2f_o)\tan \theta_o} \qquad (16)$$

This is the angular extent of the interference when mapped from frequency into the angular domain by (14).