

AUTOMOTIVE • AVIATION • TELECOM

# AUDIO BANDWIDTH TEST SYSTEMS

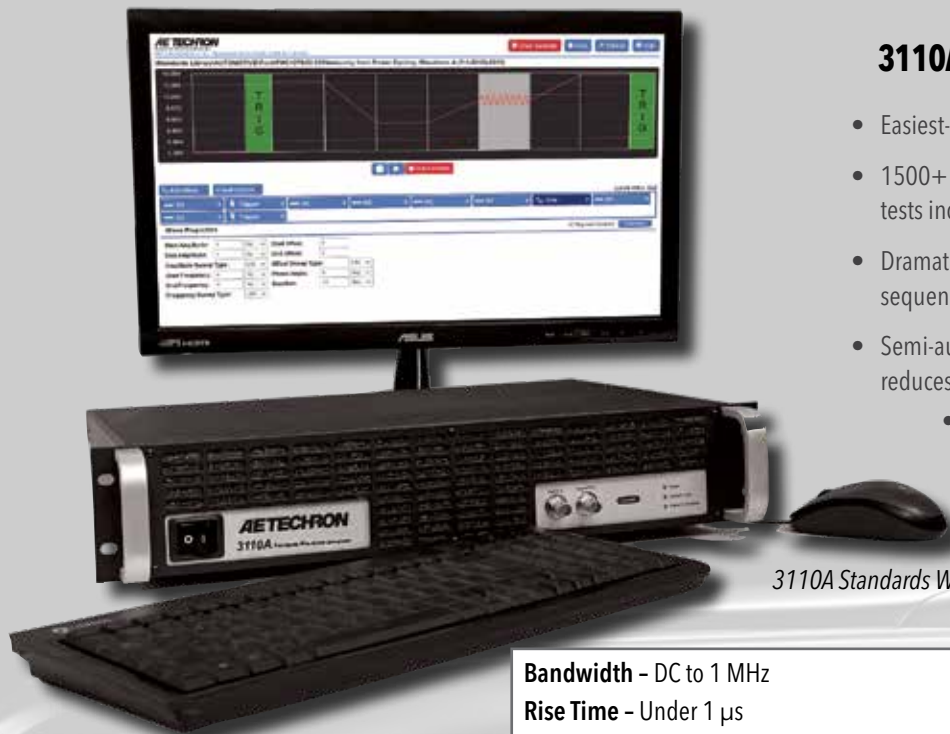
Designed to meet the rigorous requirements of EMC testing.



**AETECHRON**<sup>®</sup>

The Audio Bandwidth EMC Experts

# Automotive & Aviation Standards Waveform Generator



## 3110A Up to 1 MHz EMC Testing

- Easiest-to-use LF wave sequence generator
- 1500+ automotive and aviation standard's tests included
- Dramatically reduces test time for repetitive test sequences
- Semi-automatic calibration routine significantly reduces labor-intensive tasks (like CS101)
  - Very easy to modify included waveform sequences or create new ones



3110A Standards Waveform Generator

**Bandwidth** - DC to 1 MHz  
**Rise Time** - Under 1  $\mu$ s  
**Minimum Pulse Duration** - Under 50  $\mu$ s  
**Maximum Waveform Duration** - 144 hours

The 3110A is a simple-to-use yet powerful standards waveform generator. It has been designed to be used quickly and easily with other AE Techron products to create a wide range of powerful and intelligent EMC test solutions.

The 3110A outputs a standard analog signal that can work with any AE Techron amplifier or other LF amplifiers that you already have. It has a scalable output, so the values entered in the 3110A interface will result in your desired system output. When coupled with the AE Techron model 7228 amplifier, the 3110A can create virtually all waveforms, DC offsets, drop outs and surges needed for EMC tests with rise/fall times of 1  $\mu$ s or greater and frequencies from DC to 1 MHz.

The 3110A software is built around the simple concept of a waveform segment. Each waveform segment can have a unique waveform, (sine, square, triangle, and/or DC offset). Frequency, amplitude and DC offset can be clipped, fixed, variable or swept. Segments can be calibrated (as required in CS101) and set to continue on to the next segment or to hold for an external trigger. Individual segments can be as short as 50  $\mu$ s or as long as 144 hours.

The power of the system occurs when waveform segments are linked to create test sequences. These test sequences can be of any length and can be run as a single sequence, looped, or

looped with multiple variables changing within the test sequence (as required in multiple Toyota and GM standards). Finally, multiple sequences can be combined to create a single customized extended test.

An extensive library of 1500+ tests for many automotive, aviation and industry Standards makes it possible for the 3110A to save time from day one. And, for customers that require over-testing or testing for products that have no predefined standard, tests from the Standards Library can be easily modified and saved for later use.

The 3110A delivers extensive capabilities for LF EMC testing with very short training-time requirements. Plus, it makes it easy to automate repetitive and labor-intensive tasks, making the 3110A a very efficient and cost-effective solution for LF EMC testing.

## LF Tests from the following Standards are included in the 3110A Standards Library

Airbus ABD0100.1.8.1 Issue C (2008-07)	Chrysler CS-11979 (2010-04-13)	Honda 7794Z-SAAA-000 (28.12.2004)	Mitsubishi ES X82115 Rev C (2009-03)
Airbus ABD0100.1.8 Issue E (2005-04)	Claas CN 05 0215 (2004-12)	Hyundai ES 39110-00 (5-8-2012)	Nissan 28400 NDS 02, 03
Airbus AMD-24 Issue C (2005-03)	Cummins 14269 (06201-028)	Hyundai ES 95400-10 (2007-11-14)	Nissan 28401 NDS 02 Rev.4 (2008-08)
ANSI ASAE EP455	Cummins 14387 (102020-119)	Hyundai ES 96100-02 (2006-11-16)	SAE J1113-2, -11
Audi I EE-32 (2006-06)	DAF BSL-003 (1998-12)	Hyundai ES 96200-00 (2008-07-03)	SAE J2139 SEP2005
BMW GS 95003-2 (2010-01)	DAF BSL-006 (2009-04)	ISO 7637-2:2011( E )	SAE J2628 JUL2007
BMW GS 95003-3 (2010-01)	Daimler Chrysler DC-10842 (2003-12)	ISO 16750-2:2012 ( E )	Toyota TSC3500G Rev 8 (May 2005)
BMW GS 95024-2-1 (2010-01)	Daimler Chrysler PF-9326 Change D	JASO D001-94 (1994)	Toyota TSC3590G Rev 7 (June 2001)
BMW GS 95024-2-2 (2011-01)	DO160G (2012-12)	Mazda MES PW 67600 (1995-17)	Toyota TSC7021G Rev.2 (2007-06)
Boeing D6-16050-5 Issue C (2006-09)	Fiat 9-90110 Issue 13 (2007-03)	MIL STD 461F (2007-12)	VW 80000 (2009-10)
Case New Holland ENS0310 (12-2-2010)	Ford CS-209.1 (2-11-2010)	MIL-HDBK-704-8 (9 April 2004)	VW 80101 (2009-03)
Chrysler CS-11809 (2009-05-29)	GMW 3172 H (July 2010)	Mitsubishi ES-X82010 Rev Q (2007-01)	

**Disclaimer:** Although AE Techron has made substantial effort to ensure the accuracy of the Standards' test files (SWG files), which are included with the 3110A unit, no warranty, expressed or implied, is made regarding accuracy, adequacy, completeness, legality, reliability or usefulness of the information provided. It is the responsibility of the user to ensure the accuracy and applicability of these test files for their intended purposes.



# DC + AC Amplifiers / Battery Simulators

7114 / 7118 / 7136

Exceptional  
Versatility  
& Value



7114 and 7136 power amplifiers



Durable, economical, and very portable. An integrated handle makes it easy to carry the 7114/7118 amplifier from bench to bench.

	7114*	7118*	7136*
<b>Maximum Output:</b>	400 VA	425VA	900 VA
<b>Small Signal (8V p-p)</b>	400 kHz	400 kHz	400 kHz
<b>For High-Power Applications to</b>	50 kHz	50 kHz	50 kHz
<b>Output Voltage</b>	$\pm 92 V_p$ or $\pm 42 V_p$	$\pm 148 V_p$ or $\pm 92 V_p$	$\pm 300 V_p$ or $\pm 150 V_p$
<b>DC Power</b>	15A at 13.5 VDC	9A at 48 VDC	5A from 13.5-48 VDC
<b>40 ms Pulse</b>	25 A <sub>p</sub> (0.5Ω)	24 A <sub>p</sub> (2Ω)	25 A <sub>p</sub> (4Ω)
<b>Slew Rate</b>	50 V/μs	75 V/μs	165 V/μs
<b>Output Impedance</b>	10 mΩ in series with 0.95 μH	10 mΩ in series with 0.95 μH	10 mΩ in series with 0.95 μH

AE Techron's **7100-series** amplifiers are 4-quadrant, AC and DC amplifiers that provide exceptional versatility and value. Compact size, user configurability, DC-Max™ topology, and AE Techron toughness make the 7100-series amplifiers the ideal lab partners for automotive conducted immunity testing, PSRR testing, or any application where more voltage or current is needed than is available from the signal source.

## 7114 Features

- 15A DC and capable of reproducing 250 kHz ripple or <4 μs dropout/pulses
- User-variable DC offset:  $\pm 20V$  or  $\pm 45V$
- User-adjustable current limit: 1A to 25A
- Variable gain: 0 to 10
- Compact 9.5-inch width, 2U height; weighs only 20 lbs.

## 7118 Features

- Up to 425 watts RMS power output
- Capable of reproducing 150 kHz ripple or <4 μs dropout/pulses
- User-variable DC offset:  $\pm 20V$  or  $\pm 45V$
- User-adjustable current limit: 1A to 25A
- Variable gain: 0 to 20
- Compact 9.5-inch width, 2U height; weighs only 20 lbs.

## 7136 Features

- 180V<sub>RMS</sub> at 5 amps; 200V<sub>RMS</sub> capable
- Precision, user-variable DC offset:  $\pm 2V$  or  $\pm 20V$
- User-adjustable current limit: 1A to 25A
- Variable gain: 0 to 40
- Compact 2U height; weighs only 40 lbs.

**AE Techron Tough:** Protection from over-temperature, over-current, over/under supply voltages; will drive capacitive and inductive loads.

\*NOTE: These models do not carry the CE mark.



## Amplifiers for Conducted &



7224 and 7226 amplifiers

### 7224 / 7226 Robust & Versatile

- DC (0 Hz) to 400 kHz (7224); DC (0 Hz) to 600 kHz (7226)
- 75V/ $\mu$ s rise time (7224); 90V/ $\mu$ s rise time (7226)
- 0 to 30V DC, 0 up to 60 Ap, or 0 to 110 VRMS modes
- Signal Integrity: <1 mV noise floor; <0.1% THD
- Maximum Power Output: 900 watts
- Controlled-voltage and controlled-current modes
- Like models can be combined in Series or Parallel systems for increased voltage or current
- Rugged Design - Output protected from open circuit, shorting, back EMF; amplifier protected from over temperature, under/over voltage and over current

	7224
AC Power at 20 kHz	900 watts RMS
Small Signal (8V p-p)	400 kHz
For High-Power Applications to	100 kHz
DC Power	16A at 13.5V DC
40 ms Pulse (0.5 $\Omega$ )	50 Ap
Slew Rate	75 V/ $\mu$ s
Output Voltage	$\pm$ 150 Vp
Output Impedance	5.3 m $\Omega$ in series with 0.95 $\mu$ H

**7220-series amplifiers**, when used with a signal generator such as the AE Techron 3110A, can simultaneously produce both the DC voltage needed to drive the DUT and the high-frequency (AC ripple) conducted interference waveform required in cranking tests found in Standards like FMC1278. They can also be used to perform surge and dropout



## DC Amplifiers / Battery Simulators



### 7796HC / 7794 / 7796 Modular Power

- Up to 5000 watts RMS power output
- Small signal response up to 250 kHz
- Controlled-voltage and controlled-current modes
- Output protected from open circuit, shorting, back EMF; amplifier protected from over temperature, under/over voltage and over current
- Can be used alone or combined with like models in Series or Parallel systems for up to 400 ARMS or 300 VRMS continuous output



# Radiated Immunity Testing

7226	7228
900 watts RMS	1000 watts RMS
600 kHz	1 MHz
150 kHz	200 kHz +
16A at 13.5V DC	16A at 13.5V DC
50 Ap	60 Ap
90 V/μs	100 V/μs
±150 Vp	±150 Vp
5.3 mΩ in series with 0.95 μH	5.3 mΩ in series with 0.95 μH



7228 amplifier

## 7228 Up to 1 MHz

- DC (0 Hz) to 1 MHz
- 100 V/μs rise time
- 0 to 30V DC, 0 up to 60 Ap, or 0 to 110 VRMS modes
- Signal Integrity: <1 mV noise floor; <0.1% THD
- Maximum Power Output: 1000 watts
- Can be combined in series or parallel systems for increased voltage or current
- Rugged Design – Output protected from open circuit, shorting, back EMF; amplifier protected from over temperature, under/over voltage and over current

tests found in many automotive Standards, like GMW3172-07, ISO 7637-2, and SAE J1113/2.

When used with T-Series coupling transformers, 7220-series amplifiers are ideal for the low-voltage conducted or radiated immunity tests needed for Aviation industry standards like DO 160 (Section 18 and 19), MIL STD 461/462 (CS101 and RS101),

Airbus and Boeing audio bandwidth electrical and magnetic tests.

The **7224** amplifier offers reliable, cost-effective performance for DC–400 kHz EMC testing.

The **7226** amplifier offers all of the reliability and durability of the 7224, but offers up to 2X the long-term power above 40 kHz.

The **7228** offers up to 4X the long-term power of the 7224 above 100 kHz, and a small-signal response to 1 MHz. It also features ultra-low DC drift and offset, adjustable current limits, and convenient configuration control (including controlled-voltage or controlled-current operation) via external switches.

**7796HC/7794/7796** power amplifiers offer great power and flexibility. The series consists of three models. Each model can be used as a free-standing gain block or combined in multiples to achieve high voltage (300 VRMS at 50 ARMS) or high current (up to 300A at 13.5V DC continuously).

A single **7796HC** makes a very good choice for 13.5V DC-based power susceptibility test standards for high current draw (up to 85A) EUTs.\*

The **7794** was designed with a very low output impedance; a single 7794 is able to produce up to 106A continuous at 28V DC, making it an excellent battery substitute for transient immunity testing. It is also capable of producing the 80V surges required for DO-160G section 16.6.2.4 abnormal surge testing and is well suited for ISO 7637 pulse 2b and 4 testing.

The **7796**, when run in controlled-current mode, is a perfect choice to drive medium to large diameter Helmholtz coils and radiators like those specified in Ford FMC1278 (RI140, RI150).

\*The 7796HC is only available in 208V AC source; 400V version not available.

AE Techron precision amplifiers are used in difficult, high-reliability applications around the world – everything from controlling plasma in a reactor to driving the motors that aim telescopes on mountain tops.



The Eas Asian Observatory's James Clerk Maxwell Telescope, Hilo, Hawaii, uses AE Techron amplifiers.  
Courtesy William Montgomerie, photographer.

	7796HC*	7794	7796
<b>AC Power at 20 kHz</b>	2500 watts RMS	5000 watts RMS	5000 watts RMS
<b>Maximum Output</b>	35 VRMS, 71 ARMS (0.5-ohm load)	50 VRMS, 100 ARMS (0.5-ohm load)	100 VRMS, 50 ARMS (2-ohm load)
<b>DC Power</b>	85A at 13.5V DC; 70A at 28V DC	60A at 13.5V DC; 106A at 28V DC	30A at 28V DC (13.5V DC not recommended)
<b>Output Voltage</b>	±80 Vp	±100 Vp	±180 Vp



# Low-Frequency Test Systems

AE Techron's **DSR Series** systems provide complete, single-box solutions for immunity testing. They include a simple-to-use yet powerful standards

waveform generator matched with an industry leading power supply technology and come with an extensive library of tests for many automotive, aviation and industry standards.

has power in reserve; each model provides continuous DC power as rated, and is able to provide 4X rated power for in-rush testing up to 200 ms, as is required in DO 160 Section 16.

All models of the DSR Series are 4-quadrant, allowing them to source and sink current. The DSR Series

**All DSR test systems include LF tests from a wide variety of Standards, including:**

- Airbus ABD0100.1.8.1 Issue C (2008-07)
- Boeing D6-16050-5 Issue C (2006-09)
- DO160G (2012-12)
- ISO 16750-2:2012 (E)
- Ford FMC1278
- MIL 461F (2007-12)
- GMW 3172 H (July 2010)
- SAE J1113-2, -11
- ISO 7637-2:2011(E)
- and many more.

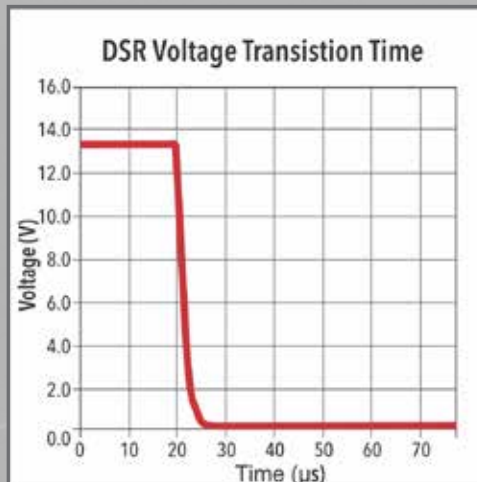
See the complete test list at [aetechron.com](http://aetechron.com).



**DSR 75 Series**  
High-Current  
Dropout, Surge, Ripple Simulator  
& AC/DC Voltage Source

- $\pm 80V$  DC supply for 12V to 48V systems; meets 80V surge requirements
- 3  $\mu s$  rise time exceeds surge and dropout slew rate requirements
- 3 m $\Omega$  DC source impedance; outperforms ISO 7637-2 requirements
- Includes 1500+ routines for testing to EMC Standards
- Models from 75A to 300A continuous output current available
- Three-phase, 208V AC; 400V AC version not available

DSR systems are faster than the 10  $\mu s$  transition time specified in Ford FMC1278: CI260 (Immunity to Voltage Dropout).

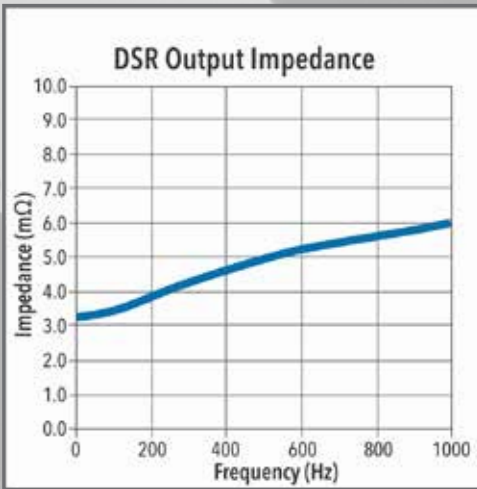


	DSR 75-75	DSR 75-150
<b>Output Current (continuous)</b>	85A at 13.5VDC 70A at 28VDC	170A at 13.5VDC 140A at 28VDC
<b>Peak Current (200 ms)</b>	110A	220A
<b>Full Signal Bandwidth (-3 dB)</b>	DC - 150 kHz	DC - 150 kHz
<b>Small Signal Bandwidth (20 Vp-p)</b>	DC - 250 kHz	DC - 250 kHz
<b>Supply Voltage</b>	Three-phase, 208V	Three-phase, 208V

## DSR 100 Series

### Dropout, Surge, Ripple Simulator & AC/DC Voltage Source

- $\pm 80V$  DC supply for 12V to 48V systems; meets 80V surge requirements
- Sine up to 300 kHz allows reproduction of DC ripple tests for all major standards
- 3  $\mu s$  rise time exceeds surge and dropout slew rate requirements
- 3 m $\Omega$  DC source impedance; outperforms ISO 7637-2 requirements
- Includes 1500+ routines for testing to EMC Standards
- Models from 15A to 200A continuous output current available



DSR systems out-perform the 10 m $\Omega$  ISO 7637-2 requirements.

### CHOOSE YOUR SYSTEM

**DSR 75** test systems are your “**automobile specialists.**” They are capable of the 10  $\mu s$  pulse required by Ford standards and provide maximum current for 13.5V DC automotive EMC testing.

**DSR 100** test systems are your “**switch hitters.**” They can produce the 10  $\mu s$  pulse required in automotive EMC testing and meet the 80V surge requirements for aviation EMC testing.

### DSR “R” Series

“Ready” for increased power

- Anticipate and budget for future increased power requirements
- Add up to three additional amplifier modules into the original cabinet
- Just a small, nominal sur-charge for Ready models

DSR 100-50 R100



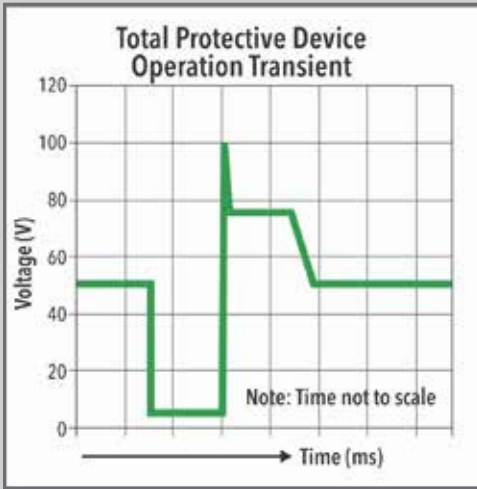
DSR 75-225	DSR 75-300	DSR 100-15	DSR 100-50	DSR 100-100	DSR 100-150	DSR 100-200
255A at 13.5VDC 210A at 28VDC	340A at 13.5VDC 280A at 28VDC	16A at 13.5VDC 20A at 28VDC	60A at 13.5VDC 106A at 28VDC	120A at 13.5VDC 212A at 28VDC	180A at 13.5VDC 318A at 28VDC	240A at 13.5VDC 424A at 28VDC
330A	440A	50A	200A	400A	600A	800A
DC - 150 kHz	DC - 150 kHz	DC - 200 kHz	DC - 150 kHz	DC - 150 kHz	DC - 150 kHz	DC - 150 kHz
DC - 250 kHz	DC - 250 kHz	DC - 300 kHz	DC - 250 kHz	DC - 250 kHz	DC - 250 kHz	DC - 250 kHz
Three-phase, 208V	Three-phase, 208V	Single-phase, 120V or 230V	Three-phase, 208V or 400V	Three-phase, 208V or 400V	Three-phase, 208V or 400V	Three-phase, 208V or 400V



# Telecom Test Systems

## 4301

### Transient Voltage Test System



The 4301 can output transient voltages of 50-100V in less than 2 $\mu$ S, or 5-100V in less than 5 $\mu$ S (shown). It can reproduce either the combined waveform/ single measurement or the multiple waveform/ multiple measurement methods described in the ATIS standard.

- For GR-1089 Section 10 and ATIS-0600315.2007 testing
- Slew rates up to 60 V/ $\mu$ sec
- Up to 240 ADC at +50 VDC or -50 VDC
- Can provide pulses of up to 800 amps at voltages of up to  $\pm$ 100V
- Models from 60A to 240A continuous output current available

AE Techron's **4301 Series** have been specially designed for EMC testing of network telecommunications equipment and are the best systems available for producing the waveforms required for transient voltage measurements as described in GR-1089 Section 10 and ATIS-0600315.2007. They are designed to work with a standard arbitrary waveform generator or signal source that can be triggered.

Available in 208V or 400V AC supply.

4301-180

4301-240



4301-60

4301-120

4301 systems shown with optional Fluke arbitrary waveform generator.

## Transformers

### T1000

#### AF Magnetic Field Susceptibility Transformer

- Up to 100 A<sub>RMS</sub>
- 350 Hz to 35 kHz
- Turns ratio 10:1 step-down
- Exceeds DO 160 Section 19 and Boeing D6-16050-5 Section 7.2 requirements

### T2000

#### LF Conducted Susceptibility Transformer

- Audio power up to 200 watts
- Secondary saturation, 40Ap
- Turns ratio, 2:1 step down
- 10 Hz to 250 kHz bandwidth
- Exceeds DO 160 Section 18 requirements

### T3700

#### AF Electric Field Susceptibility Transformer

- Up to 3,700 V<sub>RMS</sub> output potential
- Turns ratio of 1:37 step up
- 250 Hz to 35 kHz bandwidth
- Withstand tested to 5,000 VDC
- Exceeds DO 160 Section 19 and Boeing D6-16050-5 requirements

**Protection** – Circuit Breaker/ Fuse to protect from damage

**Design** – Modern toroidal design gives wider bandwidth, lower weight and a contemporary look

**Integration** – Specifically designed to work in conjunction with AE Techron 7220 Series amplifiers



T-Series Coupling Transformers