

CATC SATracer™ / Trainer™ 3G

Software version 4.0

Application Notes

These Application Notes are supplemental to the printed documentation included with the CATC SATracer /Trainer 4.0

1. CATC Serial ATA product family

SATracer/Trainer 3G models (for 1.5 and 3Gbps) are supported with SATracer v4.0 software.



part #SS002AAA

2 port Analyzer model

In Nov 2003, CATC released SATracer v1.0 which supports SATA 1.5 and 3Gbps signal rate and two recording channels.



part #SS003AAA

4 Port Analyzer model

In Dec 2003, CATC released SATracer v1.01 providing 4 recording channels for true “Wide” port analysis



part #SS002APA

2 Port Analyzer w/Exerciser model

In Mar 2004, CATC released SATracer /Trainer v1.1 providing single port SATA/SATA Exerciser option in addition to software enhancements

SATracer / Trainer 1.5G Models (for 1.5Gbps only) are supported with SATracer v3.1 software and earlier. **The SATracer 4.0 software is not compatible with CATC’s legacy Serial ATA analyzers on the 2500H platform (below).**



part #SA004APA

1 port Analyzer w/Traffic Generator on UPAS 2500H

* SATracer and SATrainer 3G plugin module is not compatible with UPAS 2500H chassis (above)



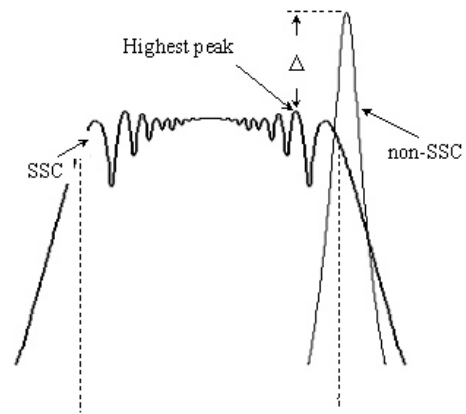
part #SA004AAA

1 port Analyzer on UPAS 2500H

* SATracer 3G plugin module is not compatible with UPAS 2500H chassis (above)

2. Spread Spectrum Clocking

SATracer can record traffic from Serial ATA devices that utilize spread spectrum clocked (SSC) signaling. SSC modulates the operating frequency of a circuit slightly to spread its radiated emissions over a range of frequencies rather than just one tone. By distributing emissions for a given frequency, SSC transmissions help devices meet FCC requirements.



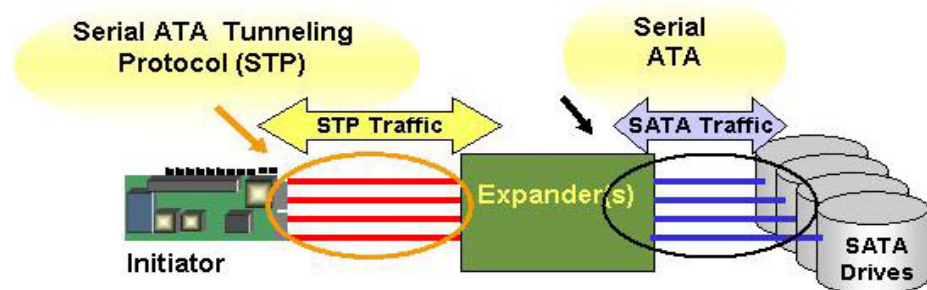
SSC transmission is optional on the transmitter (TX) side for both host and device. However, SSC is a mandatory capability for all Serial ATA receivers (RX). This requirement eliminates compatibility issues by ensuring that all devices can tolerate SSC signals when attached to a device that transmits SSC signaling.

SSC is accomplished by “down-spreading” the clock frequency using a deviation of no more than 0.5% down-spread (+0% -0.5%) □□ peak reduction

CATC’s SATrainer generator on the UPAS 10K (Pod # SS001MG) and CATC SATrainer generator on 2500H(Pod # SA004MA) allows spread spectrum transmissions to be enabled/disabled dynamically while generating traffic. This is a valuable capability for validating SSC operation for both host and device side silicon.

3. SAS and STP Support

SATracer 3G is specifically designed for Serial ATA recording and analysis. The Serial Attached SCSI (SAS) protocol allows Serial ATA devices to be attached to SAS initiators and expanders.



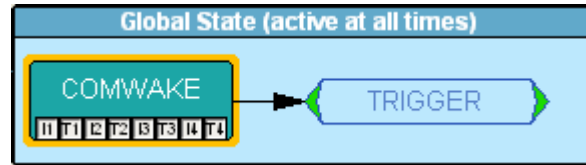
SATracer will record SATA traffic only – The SASTracer software option is required to capture SAS traffic including STP protocol

When using SATA hard disk devices attached to SAS expanders, SATracer 3G will record and display the Serial ATA protocol traffic between the Serial ATA targets and the SAS expander. SATA traffic transmitted between the SAS Initiator and the SAS Expander is considered STP protocol. SATracer 3G users must purchase the SAS software upgrade option to record and display STP or SAS protocol.

4. Recording OOB

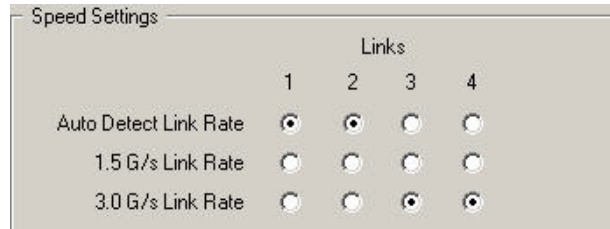
SATracer supports recording the OOB sequence. Some users may encounter difficulties recording OOB if using early prototype host devices that do not have bootable BIOS. In this environment, the OOB sequence will only occur after Windows boots and the initiator port driver loads. This makes OOB difficult to capture using snapshot recording. To ensure capture of OOB handshaking when testing environments where OOB exchange is unpredictable, follow these steps:

- a) Use the Event trigger and select COMWAKE as the trigger condition as displayed below. (OOB is a series of ALIGN bursts. Do not filter ALIGN primitives if you're interested in capturing the OOB ALIGN sequence).



5. Speed Negotiation for Serial ATA

SATracer 3G supports Auto Detect link rate between two SATA PHYs. Use the Auto Detect Link Rate option in the Recording Options dialog to allow the SATA link under analysis to automatically negotiate to the highest Serial ATA transfer speed supported.



6. Link Tracker

LinkTracker is CATC's chronological display of DWORD traffic. This time-synchronized table format shows multilane traffic and can toggle between displaying Packet fields, 10B HEX, scrambled, unscrambled DWORDs and Summary which decodes the field name along with the actual DWORD Values.

The screenshot shows the Link Tracker interface with a table of traffic data. The table has columns for Time, I1, T1, I2, and T2. A packet at time 00.124.623.333 is highlighted. A detailed view of this packet is shown below the table:

Text Decoding	Features	Command	C	R	R	Reserved(0)	Port	FIS Type
Value	DA	35	1	0	0	0	0	27
Scrambled Value	AA	F6	E7					18
Symbols	D10.5	D22.7	D07.7					D24.0

7. Frame Tracker™

SATracer 3G now offers a condensed view of traffic organized sequentially with each channel displayed in a separate column. The Frame Tracker provides a higher level view of events by showing SATA FIS along with a summary of the SATA primitives transmitted on the line. The Frame Tracker display and can be synchronized to CATC's Link Tracker display allowing easy drill down to byte-level detail.

Time	Frame #	SATA 3G HOST 0	SATA Port Multiplier T0
00.144 385 895	6194		SATA RCV, Primitives:10421
00.144 525 280	6199	P:2, FIS H>D, CMD WRITE DMA	
00.144 525 500	6200		SATA RCV, Primitives:330
00.144 530 757	6205		P:3, FIS DMA Activ
00.144 530 935	6206	SATA RCV, Primitives:85	
00.144 532 080	6209	P:3, FIS Data, Bytes:8192	
00.144 532 315	6210		SATA RCV, Primitives:10293
00.144 670 335	6215		P:0, FIS DMA Activ
00.144 670 522	6216	SATA RCV, Primitives:87	
00.144 671 700	6219	P:0, FIS Data, Bytes:8192	
00.144 671 937	6220		SATA RCV, Primitives:10044
00.144 806 595	6225		P:2, FIS DMA Activ
00.144 806 777	6226	SATA RCV, Primitives:85	
00.144 807 925	6229	P:2, FIS Data, Bytes:8192	
00.144 808 152	6230		SATA RCV, Primitives:10431
00.144 948 000	6237		P:3, FIS DMA Activ
00.144 948 197	6238	SATA RCV, Primitives:87	
00.144 949 367	6241	P:3, FIS Data, Bytes:8192	
00.144 949 605	6243		SATA RCV, Primitives:9986
00.145 083 660	6248		P:0, FIS DMA Activ
00.145 083 850	6251	SATA RCV, Primitives:85	
00.145 085 000	6254	P:0, FIS Data, Bytes:8192	
00.145 085 222	6255		SATA RCV, Primitives:10353
00.145 224 220	6260		P:2, FIS DMA Activ
00.145 224 400	6261	SATA RCV, Primitives:85	
00.145 225 550	6264	P:2, FIS Data, Bytes:8192	

8. ATAPI Command Decoding

The ATA Packet command is specifically for ATAPI devices. The purpose of the ATA Packet command is to deliver a packet of data to the device which defines the function that the device is to perform. This structure of the data within the packet is termed the Command Descriptor Block Packet (CDBP).

Packet commands are issued the same way normal ATA commands are; by initializing the Task File Registers, setting the Drive Selection Bit and writing the Command byte into the Command Register. The majority of the ATA Packet commands implemented by ATAPI devices are concerned with configuring the device. SATracer will decode these commands using the Packet Command code (A0h) and the associated command register and status fields within the CATC Trace.

Command #	Time Stamp	Delta	ATA Command	Port	ATA Protocol	ATAPI Cmd	RelAddr	FUA	DPO(0)	LUN			
136	9.895 04376	89.162 ms	PACKET	0x00	PACKET	READ (10)	0	0	0x0	0x0			
	LBA	Transfer Length	Link	Flag	NACA	Vendor Specific	In	OVL	DMA	Tag	Byte count low	Byte count high	
	0x7301	0x10	0	0	0	0x0	0	0	0x00	0x00	0x80		
	DEV	REL	I/O	C/D	Tag	DEV	BSY	DRDY	DF	SERV	DRQ	CHK	
	0	0	0	0	0x00	0	0	0	1	0	1	0	0
Command #	Time Stamp	Delta	ATA Command	Port	ATA Protocol	ATAPI Cmd	In	Out					
137	9.983 35714	7.341 ms	PACKET	0x00	PACKET	TEST UNIT READY	In	Out					

9. Cascading Multiple Analyzers:

Now users can “Cascade” up to 4 SATracers analyzers using the BNC connectors to synchronize traffic to a single clock reference. Engineers testing large SATA-based RAID systems may benefit from the ability to aggregate multiple standalone analyzers for high port count applications.



10. Multiprotocol Analysis (MPA)

Like cascading, MPA allows users to combine standalone analyzers together to capture high speed traffic across different communication protocols. CATC’s SAS, SATA and Fibre Channel analyzers can be configured to cross-trigger, capture and display traffic from heterogeneous protocols - all synchronized to a common clock. Support for synchronizing with CATC’s PCI Express analyzer will be available in Q4-2004.

The screenshot displays the CATC Multi-Protocol Analyzer software interface. The top section shows a menu bar (File, Setup, Devices, Record, Report, Search, View, Window, Help) and a toolbar. Below the toolbar, there are two main data panels. The left panel shows a table of traffic items with columns: Exchange, Originator, Responder, OX_ID, RX_ID, and FCP SCSI. The right panel shows a table of ATA Commands with columns: PROT, Command, Port, and LBA Addr. Below these panels are two Link Tracker windows. The left Link Tracker window shows Frame # 18952 with a table of packet details including Time, Packet #, and various fields like SDF3, FCP_CMN, CS_CTL, FCP-2, SEQ_ID, DF_CTL, SEQ_CNT, OX_ID, RX_ID, Parameter, LUN(Hi), LUN(Lo), CMD RefN, RES, S, TskMgmtFL, Add CD, WRITE(10), Logical Block Addr, Logical Block Addr, Transfer Le, CONTROL, FCP_DL, CRC, and EOF. The right Link Tracker window shows Frame # 128710 with a table of packet details including Time, Packet #, and various fields like SATA_XXXX, SATA_SOF, Features, Dev/Head, Features(exp), Control, Reserved, CRC, SATA_EOF, SATA_WTRM, and SATA_CONT. Two yellow callouts with arrows point to the 'FC Traffic' and 'SATA Traffic' labels in the interface.

The Multiprotocol Analyzer provides a unified parent application in which CATC’s SATracer and FCTracer can record and display traffic from two or more UPAS analyzers synchronized to single reference clock