AVCOM

Of Virginia Inc.

Avcom Spectrum Analyzer Protocol

Generation CSW Protocol - Revision 4
Customer Version

Avcom of Virginia – 7730 Whitepine Rd – Richmond – Virginia – 23237 USA
www.avcomofva.com – PHONE 1.804.794.2500 – FAX 1.804.794.8284

Contents

Introduction

Often customers require a custom interface for communicating with Avcom Spectrum Analyzers. This document provides a detail description of all end-user commands for Avcom analyzers that use the Generation CSW Protocol. Please see the section CSW Protocol Products for a full list of applicable Avcom products.

This document covers products both with and without an LCD. Analyzers with an LCD display have additional functionality such as saving and recalling saved waveforms, managing presets, and more. Command sets for Analyzers equipped with an LCD and front user interface are referred to as “LCD commands” or simply “LCD.”

This document is intended for end-user programmers developing their own custom user interface. This custom user interface will periodically be referred to as the “controller” in this document and the terms are interchangeable.

Hexadecimal values may be represented by either a ‘0x’ prefix as in 0xAE or with a trailing ‘h’ as in ‘AEh.’ Decimal values may be represented without any pre/postfix such as ‘174’, or with a trailing ‘d’ as in ‘174d.’

CSW Protocol Products

Starting in August 2008, a new generation of products were developed using the Avcom CSW Protocol. Below is a partial list of CSW Protocol supported products. If your product is not listed here or your product does not use the CSW Protocol, please contact Avcom of Virginia to obtain the applicable protocol document.

- All 1100B Products
- RSA-2150A Products
- All 2150B Products
- All 2500B Products
- All 2150C Products
- All 2150C Products
- The RCTV-5000

Communication Port Settings

Avcom Spectrum Analyzers may have up to three communications ports available: Ethernet, Serial (RS-232), and USB. It is important to know which Avcom Product you are using when communicating.

DB-9 Port Electrical Characteristics

Avcom Spectrum Analyzers use a standard DB-9 Female connector for serial RS-232 communications. Typically a standard straight serial cable is used to connect the analyzer to a standard computer serial (COM) port. An off-the-shelf USB-to-serial cable may also be used to connect to the analyzers serial port.

For reference, Table 1 gives the DB-9 pin out (which is standard to RS-232 DB-9) and Table 2 gives the electrical characteristics of the DB-9 connector on CSW Generation Avcom Spectrum Analyzers.

DTR and RTS are internally pulled low inside the Avcom Spectrum Analyzer.

Table 1: DB-9 Pin out

Pin	Function
2	TX
3	RX
1,4	DTR
7,8	RTS
5	GND

Table 2: DB-9 Electrical Characteristics

Parameter		MIN	TYP	MAX	Unit
RX, DTR, RTS positive input threshold voltage*	VIT+		1.7	2.4	V
RX, DTR, RTS negative input threshold voltage*	VIT-	0.8	1.2		V
TX High-level output voltage	VOH	5	7		V
TX Low-level output voltage	VOL		-7	-5	V

*DTR and RTS are internally pulled low

Ethernet

For Ethernet or LAN communication, DTR and RTS on the serial RS-232 port must both be **unasserted.** A serial cable may be connected into the analyzer during Ethernet communication as long as DTR and RTS remain unasserted. DTR and RTS are internally pulled low. If the unit also has a USB port, the USB port may need to be unplugged for Ethernet communications to work.

By default, all Avcom units are shipped with IP Address 192.168.118.242 and port 26482. The best way to change these parameters is to use the ConfigTool which is included in the Avcom GUI. To access the Avcom ConfigTool, install the Avcom GUI included with your unit and select the "Configure" menu and then choose "Ethernet Connection."

> ***NOTE:***
> In the Ethernet setup there is a baud rate field which is separate from the **Serial** communication baud rate. This Ethernet baud rate is the internal baud rate that the analyzer uses to communicate with the internal Ethernet controller.
>
> If you change the internal Ethernet baud rate or incorrectly select the wrong baud rate, the analyzer will not work until the correct baud rate is re-programmed. Please refer to
>
> Table 3 if necessary to determine correct Internal Ethernet Controller Baud Rate. If the Avcom Analyzer is part of an OEM systems integration, the analyzer most likely is an 'SBS' unit.

Table 3: Internal Ethernet Controller Baud Rate

Model	Baud Rate
All SNG, PSA, LPT, and RCTV Models	115200
All RSA models without 'CLM' or 'SBS' in title (including 1RU units)	115200
RSA Models with 'CLM' or 'SBS'	230400
BMS Model	230400

Serial

Prior to communicating with the Avcom Spectrum Analyzer through serial RS-232, the DTR and RTS lines must be properly configure. Please ensure the serial RS-232 communication device is set as follows:

- DTR must be **unasserted**
- RTS must be **asserted**
- 115200 8N1 (8 data bits, no parity, 1 stop bit, and no flow control)

> ***NOTE:***
> Do not confuse this baud rate with the internal baud rate used for configuring the Ethernet controller!

USB

Some units may come with a Universal Serial Port (USB) port. To use this port you must install the appropriate driver included on the Avcom Resource CD included with the analyzer. The USB driver is the FTDI FT232R driver which can also be found at http://www.ftdichip.com/FTDrivers.htm for any operating system. For connecting with the Avcom GUI, use the Virtual COM Port (VCP) or combined (CDM) driver. The USB setting is 115200 8N1 (8 data bits, no parity, 1 stop bit,

and no flow control). FTDI provides direct D2XX drivers as well for system integrators wishing to communicate using DLL's, however Avcom cannot provide any assistance with D2XX integration at this time.

Recommended Start Procedure

In this section the Avcom GUI's start up procedure will be explained. Depending on your programming needs portions may be omitted. This start up procedure ensures that the controlling interface obtains all identifying data from the analyzer at the beginning of each session. Figure 1 below illustrates this process.

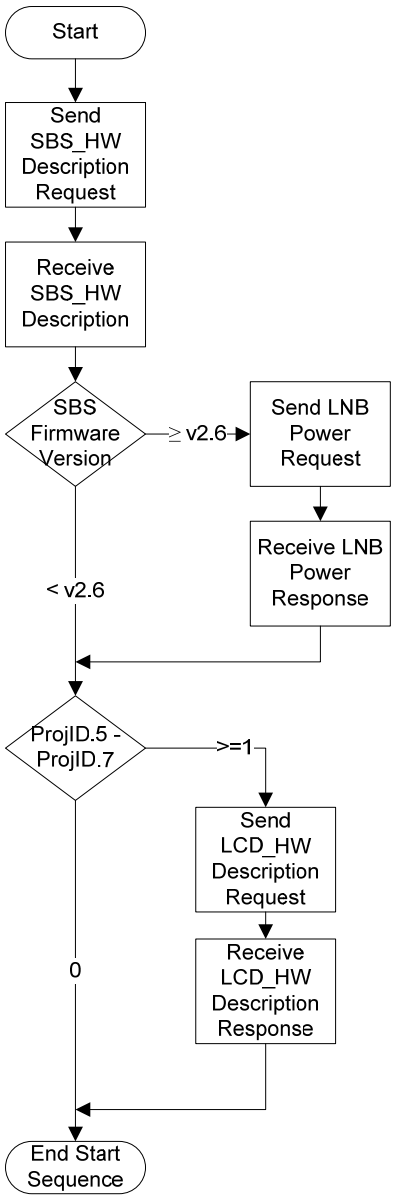

Figure 1: Startup Flow Diagram

It is recommended to first request and receive the SBS_HW Description packet. The SBS is the RF engine for this series of

products. This packet will give some critical information as to the SBS firmware version, hardware and product specifications, and current analyzer settings. The firmware version is important as later firmware may expand or modify features related to this protocol.

> ***NOTE:***
> It is important to ensure that this protocol document is newer than your SBS firmware so all protocol features are accurately explained.

If the SBS firmware is v2.6 or later, it is recommended to request and receive

LNB Power Description Packet which will provide LNB that may apply to the analyzer. The upper two bits of the ProdID byte in the SBS_HW Description packet specify if the unit is a display or LCD unit, such as a PSA or SNG. If the analyzer is a display or LCD unit the controller should also request and receive the LCD_HW Description packet which will provide additional information and abilities of the Avcom Spectrum Analyzer.

Additionally it is important to request and receive the

LNB Power Description Packet if the SBS firmware is v3.0 or later as the

LNB Power Description packet holds information relating to the available reference level for each input.

Notes about Data Packets

The following section contains basic packet information as well as formatting information that spans across multiple packets.

Packet Header

All data packets start with a short packet header and end with an end transmission byte.

- Start Transmission Byte (STX) = 0x02
- Following two bytes specify the length (LEN) of the data packet. The length field does not include the STX and LEN fields, but does include the ETX field.
- Data including type byte
- End Transmission Byte (ETX) = 0x03

Table 4: Packet Format

	Byte 0	Byte 1	Byte 2	Byte 3 to (N + 1)	Byte (N + 4)
Field	STX=0x02	LEN (N+2)		DATA (size N)	ETX = 0x3

The first byte of the DATA field is the Packet Data Type (DTYPE) field. For many packets there is only one DTYPE byte. However some commands require two DTYPE bytes. This is particularly true for the LCD Sub-Commands (0x27) DTYPE which indicates that a second L_DTYPE byte, or sub-command, is to follow.

Packet Responses

Most packets sent to the Avcom Analyzer will yield a response packet. The Change Settings packet is one of a few that does not yield a response. However it is possible to send a Waveform Data Request packet immediately after the Change Settings packet to force a response which could be used to verify that the Change Settings request was successful.

When a packet response is expected, the controller should wait for a response before sending another command. A minimum time-out period of 250-500ms (longer if communicating over a slow internet connection) should be allowed by the controller before assuming an error has occurred. If an error is thought to of occurred, the controller should attempt to transmit the packet again. The controller may continue to retry packet transmission until data transfer is restored, allowing for adequate time-out periods between attempts.

Frequency Calculations

Center frequency (CF) and Span (SP) are represented in the CSW protocol as a four-byte or unsigned 32-bit value. To convert a frequency in megahertz's to the CSW protocol format (such as CF and SP), use equation eq(1) below where F is the frequency in the CSW protocol format. This is most frequently used in packet requests.

$$F = \text{Freqency(MHz)} * 10,000 \qquad \text{eq(1)}$$

Similarly, to convert a frequency in the CSW protocol's four-byte format to megahertz's (such as for CurCF and CurSP), use eq(2) below where F is the frequency in the CSW protocol format. This is most frequently used in packet responses.

$$\text{Freqency(MHz)} = \frac{F}{10,000} \qquad \text{eq(2)}$$

Waveform Data Points

Waveform data may be available in 8-bit or 12-bit resolutions. In both resolutions, there are 320 data points in each packet.

For 8-bit resolution, each data point is one byte. Refer to eq(3) for calculating the amplitude in dB of the 8-bit waveform data. In eq(3), dB is the amplitude, 'x' is the value in the 8-bit waveform packet, and CurRL is the current reference level value in the waveform packet.

$$dB_{\text{8-BIT}} = \frac{1}{5}x - (\text{CurRL} + 40) \qquad \text{eq(3)}$$

SBS_FM v1.X and v2.X

$$dB_{\text{8-BIT}} = \frac{1}{5}x + (\text{CurRL} - 40) \qquad \text{eq(4)}$$

SBS_FM v3.X and later

For 12-bit resolution, each data point is 12 bits, 1.5 bytes, or 3 nibbles. The data points are transmitted back-to-back so the controlling interface should 'expand' the data points. For example, if 0x20, 0xF2, 0x1E is transmitted, the first data point is 0x20F and the second is 0x21E. Refer to eq(5) for calculating the amplitude in dB of the waveform data. In eq(5), dB is the amplitude, 'x' is the value in the 12-bit waveform packet, and CurRL is the current reference level value in the waveform packet.

$$dB_{\text{12-BIT}} = \frac{1}{80}x - (\text{CurRL} + 40) \qquad \text{eq(5)}$$

SBS_FM v1.X and v2.X

$$dB_{\text{12-BIT}} = \frac{1}{80}x + (\text{CurRL} - 40) \qquad \text{eq(6)}$$

SBS_FM v3.X and later

Frequency and Span Limitations

The upper and lower values for center frequency vary based on the hardware limitations of the analyzer model. These hardware limitations may exceed the calibrated and rated range of the analyzer model. For example, an RSA-2500B is a 5-2500MHz analyzer but is capable of being tuned below 5MHz or above 2500MHz. Requesting a center frequency outside of its specified range is possible but the controller should limit the center frequency to within 5-2500MHz to keep the analyzer in its calibrated range. Undesirable results may occur attempting to tune the analyzer beyond its designated range.

The maximum span of any unit is 1300MHz but the ability to achieve the maximum span is limited in hardware. The maximum span value depends on the current center frequency. For example, if the center frequency is set to 100MHz, the maximum span will be 200MHz since the units will not tune below 0Hz. In addition, some analyzer models use multiple bands internally and maximum spans may be limited when the center frequency is set near where these bands switch (typically 1100MHz).

Any center frequency or span requested that is outside of the range of the analyzers' hardware capabilities will be rounded to the closest valid value.

The Avcom Analyzer's CF and CurCF values should always be within the analyzer's base frequency range. Any internal or external offset frequency, if present, (such as Cur_IEF or Cur_EEF) should be added to the center frequency to obtain the correct value.

Note about Reference Level (RL)

For SBS_FM versions 1.X and 2.X, the Avcom CSW protocol uses an unsigned byte to communicate reference level. For example, if the reference level was -30dB, the data that would be sent or received would be 0x1E or 30d.

In version v3.0 of the SBS Firmware Version (SBS_FM), the convention was switched to a signed byte value. Therefore, if the reference level is -30dB, the data that would be sent or received would be 0xE2 for SBS_FM ≥ v3.0.

Table 5: Reference Level Examples

Reference Level	SBS_FM < v3.0	SBS_FM ≥ v3.0
+10dB	N/A	0x0A
-10dB	0x0A	0xF6
-30dB	0x1E	0xE2
-50dB	0x32	0xCE
-70dB	0x46	0xBA

Also, if SBS_FM ≥ v3.0, the

LNB Power Description Packet holds information regarding the available reference levels for each input. The standard available reference level range is -10dB to -50dB with an add-on that will extend the range down to -70dB. In SBS_FM v3.0 the RFxFXDG fields in the

LNB Power Description Packet were introduced to identify if add-ons exist that makes adjustments to the available references available.

Resolution Bandwidth (RBW)

Throughout the protocol, Table 6 illustrates the Resolution Bandwidth (RBW) Mask used to identify the current and available resolution bandwidths. The AvailRBW field in Table 11SBS_HW Description Response will mask which of RBW's are available.

Table 6: RBW Mask

SBS_FM	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
All	3MHz	1MHz	300KHz	100KHz	10KHz	3KHz	200KHz	RESERVED

LNB Power Byte

The LNB Power Byte is only valid for SBS_FM versions v1.9 and later. Refer to Table 7 for details regarding the LNB Power Byte that is used throughout the protocol.

Table 7: LNB Power Byte

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	RES	AVAIL	22KHz	RES	VSEL	EN	RES	RES
V=13V	0	1	X	0	0	1	0	0
V=18V	0	1	X	0	1	1	0	0
22KHz on	0	1	0	0	X	1	0	0
22KHz off	0	1	1	0	X	1	0	0
Disable	X	X	X	X	X	0	X	X

RES = Reserved

X = Don't Care

If the EN bit is not set, LNB Power is off and all other bits are ignored.

List of Data Types

For the direction, the 'UI' is the controller such as the user interface, and the 'SPECAN' is the Avcom Spectrum Analyzer.

Table 8: List of Data Types

DTYPE	Packet Type Description	Direction	Notes:	Reference
0x03	Waveform Data Request	UI → SPECAN		Table 24
0x04	Change Settings	UI → SPECAN		Table 22, Table 23
0x07	SBS_HW Description	UI ↔ SPECAN		Table 10, Table 11
0x08	Unknown Transmission	UI ← SPECAN	Error Detection	Table 28
0x09	8-Bit Waveform Data	UI ← SPECAN		Table 25, Table 26
0x0D	LNB Power Description	UI ↔ SPECAN	SBS_FM v2.6 and higher required	Table 18, Table 19
0x0F	12-Bit Waveform Data	UI ← SPECAN	SBS_FM v2.10 and higher required	Table 27
0x19	8-bit Import Waveform	UI → SPECAN	Only available on LCD units	Table 46
0x1F	12-bit Import Waveform	UI → SPECAN	Only available on LCD units	Table 46
0x21	Packet Acknowledgement	UI ← SPECAN	Currently only available on LCD units	Table 30
0x27	LCD Sub-Commands	UI ↔ SPECAN	Only available on LCD units	Table 9
0x60	Message Response	UI ← SPECAN	ASCII Messages	Table 29

Since the LCD Functions PTYPE indicates that a second type byte is expected, below is Table 9 for appropriate sub-commands.

Table 9: LCD Sub-Commands (0x27)

L_DTYPE	Packet Type Description	Direction	Notes:	Reference
0x19	Saved Waveform Summary	UI ↔ SPECAN		Table 49, Table 50
0x1A	Rename Saved Waveform	UI → SPECAN		Table 48
0x1B	Import Waveform	UI ↔ SPECAN	Import from LCD to controller	Table 45
0x1C	Export Waveform	UI → SPECAN	Export from controller to LCD	Table 47
0x1D	Preset Summary	UI ↔ SPECAN		Table 42, Table 43
0x1E	Rename Preset	UI → SPECAN		Table 40
0x1F	Import Preset	UI ↔ SPECAN	Import from LCD to controller	Table 37, Table 38
0x20	Export Preset	UI ↔ SPECAN	Export from controller to LCD	Table 39
0x21	Load LCD Preset	UI → SPECAN	Loads preset stored in LCD memory	Table 41
0x22	LCD_HW Description	UI ↔ SPECAN		Table 31, Table 32
0x24	Erase Presets	UI → SPECAN	Erase single or all presets	Table 44
0x25	Erase Saved Waveforms	UI → SPECAN	Erase single or all saved waveforms	Table 51
0x29	Set Date/Time	UI → SPECAN	Set date and time	Table 36

All Commands are for LCD units only

Packet Details

SBS_HW Description

The SBS_HW Description packet contains useful hardware information regarding the Avcom Analyzer. It is recommended to retrieve the SBS_HW Description packet at the beginning of the session. It may also be useful to periodically obtain the SBS_HW Description if temperature or other changing values are to be monitored.

Table 10 below is the SBS_HW Description Request packet.

Table 10: SBS_HW Description Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0003
3	1	DTYPE	Type	0x07
4	1	PADD	Padding	0x00
5	1	ETX	End	0x03

Table 11 below is the response packet for the SBS_HW Description. Some of the data is for internal engineering use and not explained in this document. Some of the data in this packet may not be pertinent to every application and may be ignored.

Table 11: SBS_HW Description Response

Byte #	Len	Field	Description	Value (or Range)
0	1	STX	Start Transmission Byte	0x02
1-2	2	LEN	Number of bytes after LEN field	0x0055
3	1	DTYPE	Identifier to type of packet	0x07
4	1	ProdID	Base Product Identification Byte	See Table 12
5-6	2	SBS_FM	SBS Firmware Version (example 0x0206 = v2.6)	MSB.LSB
7	1	STRM_M	Stream Mode (Single, Stream, OFF)	BYTE
8-11	4	CurCF	Current Center Frequency	See eq(2)
12-15	4	CurSP	Current Span	See eq(2)
16	1	CurRL	Current Reference Level	See Table 5
17	1	CurRBW	Current Resolution Bandwidth (RBW)	See Table 6
18	1	AvailRBW	Available Resolution Bandwidth (RBW)	See Table 6
19	1	CurRF	Current RF Input (10d – 15d for inputs 1 through 6)	10d – 15d
20	1	AvailRF	Available RF Inputs (10d – 15d for inputs 1 through 6)	11d – 16d
21	1	CurGain	Engineering Use Only	BYTE
22	1	OPT_BMK	Options Bitmask	See Table 15
23	1	CurCOM	Engineering Use Only	

24	1	AvailCOM	Engineering Use Only	
25-26	2	Cur_IEF	Current Internal Extender Frequency Offset (MHz)	Signed word
27-28	2	Cur_EEF	Current External Extender Frequency Offset (MHz)	Signed word
29-44	16	SN	Serial Number	ASCII
45	1	PCB-FAB	Analyzer PCB Fab (upper nibble) + Fab Rev (lower nibble)	See Table 14
46	1	Cal_Day	Day of calibration – 10d is added to byte	Day+10d
47	1	Cal_Mon	Month of calibration – 10d is added to byte	Month+10d
48-49	2	Cal_Year	calibration year – example: 0x1409 = 0x14*100d + 0x09 = 2009d	MSB*100+LSB
50	1	TEMP	Board Temperature (nom 0x80 = 0°C)	°C + 0x80
51	1	TEMPmin	Minimum Board Temperature (nom 0x80 = 0°C)	°C + 0x80
52	1	TEMPmax	Maximum Board Temperature (nom 0x80 = 0°C)	°C + 0x80
53	1	AmpCal	Engineering Only	BYTE
54	1	AvailLNB	Information regarding LNB Power options	See Table 16
55	1	CurLNB	SBS_FM ≥ v1.9: Current LNB Power Settings SBS_FM ≤ v1.8: RESERVED	See Table 7
56	1	1stRUN	ENG Only	BYTE
57	1	IsLOCK	ENG Only	BYTE
58	1	ProjID	Project ID	See Table 13
59	1	Avail70	-70dB Availability bitmask	See Table 17
60-86	27		These bytes are for engineering use only	
87	1	ETX	End Transmission Byte	0x03

Determining Product Name

A few different fields are used to determine the Avcom Analyzer model: the ProjID and ProdID bytes. The ProdID byte gives basic model information and the ProjID byte is used to identify different variations of the base models. Table 12 shows information regarding the ProdID byte.

Table 12: ProdID byte

ProdID Byte	Model(s)
0x3A	2150
0x4A	1100
0x5A	2500 or 5000

In order to obtain more information regarding the analyzer the ProjID byte must also be considered. The ProjID byte is described in Table 13 separated into two parts. Bits 6 and 7 are used to determine if the analyzer is an SNG or PSA. Bits 0 through 5 are special projects codes.

Table 13: ProjID Byte

	Bits 7, 6, 5	Bits 4, 3, 2, 1, 0	Data Value
SNG	010	XXXXX	
PSA	100	XXXXX	
RSA with Advanced API	001	XXXXX	
Default	000	00000	0x00
RCTV-5000	000	00001	0x01
RESERVED	000	00010	0x02
RSA-2300	XXX	00011	0x03
RESERVED	111	11111	0xFF

X = Don't Care

If the spectrum analyzer is an RSA with Advanced API as Table 13 identifies, then all LCD commands apply. Also, the user interface should obtain the LCD_HW Description packet to obtain additional firmware and capabilities information relating to the API.

There is not a precise method for determining between BMS, LPT, SAE, SBS and the base RSA model since the difference is in the mechanical form factor. The hardware capabilities are identical for these units.

PCB-FAB

The PCB-FAB field gives physical hardware information regarding the analyzer. Table 14 is the look-up table for the PCB-FAB byte and lists certain hardware capabilities for that unit.

Table 14: PCB-FAB Byte

PCB-FAB Byte	PCB-FAB Name	Dynamic Graphing Range
0x0B, 0x1B, or 0x42	FAB-09D02-B	40dB
0x0C, 0x1C, or 0x43	FAB-09D02-C	40dB
0x1D	FAB-09D02-D	40dB
0x1E	FAB-09D02-E	40dB
0x1F	FAB-09D02-F	40dB
0x2A	FAB-08H01-A	40dB
0x2B	FAB-08H01-B	50dB
0x2C	FAB-08H01-C	50dB
0x2D	FAB-08H01-D	50dB
0x2E	FAB-08H01-E	50dB
0x3A	FAB-09D09-A	50dB
0x3B	FAB-09D09-B	50dB
0x3C	FAB-09D09-C	50dB
0x3D	FAB-09D09-D	50dB
0x3E	FAB-09D09-E	50dB
0x5A	FAB-10C01-A	50dB
0x5B	FAB-10C01-B	50dB
0x5C	FAB-10C01-C	50dB
0x5D	FAB-10C01-D	50dB
0x5E	FAB-10C01-E	50dB

Other Bitmasks

The options bitmask (OPT_BMK) in Table 15 is used to tell the controlling interface if certain options are available on the Avcom Analyzer. For the 60dB range, this means that 20dB of amplitude range is available above the current reference level value. The splitter bit is for Avcom internal use.

Table 15: Options Bitmask

SBS_FM	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
All	0	0	0	0	0	60dB Range	RESERVED	Splitter

The AvailLNB byte gives details about LNB options that may be available on the Avcom Analyzer. Table 16 below shows the bitmasks of the AvailLNB byte. For SBS_FM v1.8 and lower, LNB is not available. For SBS_FM between v1.9 and v2.5 LNB Power is available only on one input and its availability is determined by bit0: 0x01 if LNB is available and 0x00 if LNB is not available. For SBS_FM v2.6 and greater, bit0 designates if LNB is available on any inputs, and bits 1-6 designate if that input has LNB power available.

It is recommended to fetch the

LNB Power Description Packet if the unit has LNB power on it or if the controller does not know. If more than one input has LNB power, the

LNB Power Description Packet should be obtained to determine the current state of all RF inputs with LNB power.

Table 16: AvailLNB Bitmask

SBS_FM	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
≤ v1.8	RESERVED							
≥ v1.9, ≤ v2.5	0	0	0	0	0	0	0	LNB Avail
≥ v2.6	0	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1	LNB Avail

For inputs: 0=disabled, 1=enabled

The Avail70 is used to specify if any inputs are capable of achieving -70dB reference level. Table 17 below shows the bitmasks of the Avail70 byte. For SBS_FM v2.13 and lower, Avail70 byte is not available. For SBS_FM v2.6 and greater, bit7 is always '1' and bits 0-5 designate if inputs 1-6 has -70dB reference level available respectfully.

Table 17: Avail70 Bitmask

SBS_FM	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
≤ v2.13	RESERVED							
≥ v2.14	1	X	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1

For inputs: 0=disabled, 1=enabled

LNB Power Description

The

LNB Power Description Packet contains hardware capabilities regarding LNB power options for the Avcom Analyzer. This packet applies for SBS_FM ≥ v2.6 and is applicable when the Avcom Analyzer is equipped with LNB power options.

Table 18:

LNB Power Description Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0002
3	1	DTYPE	Type	0x0D
4	1	ETX	End	0x03

Table 19:

LNB Power Description Response

Byte #	Len	Field	Description	Value (or Range)
0	1	STX	Start Transmission Byte	0x02
1-2	2	LEN	Number of bytes after LEN field	0x002D
3	1	DTYPE	Identifier to type of packet	0x0D
4	1	LNB_LOM	RF LO Offset Mask	See Table 20
5	1	LNB_PM	LNB Power Mask	See Table 21
6	1	LNB_RFP	Eng Only	
7-8	2	RF1OFF1	Input 1, Offset 1; 13V/22kHz OFF (in MHz)	Signed Word
9-10	2	RF1OFF2	Input 1, Offset 2; 18V/22kHz ON (in MHz)	Signed Word
11-12	2	RF2OFF1	Input 2, Offset 1; 13V/22kHz OFF (in MHz)	Signed Word
13-14	2	RF2OFF2	Input 2, Offset 2; 18V/22kHz ON (in MHz)	Signed Word
15-16	2	RF3OFF1	Input 3, Offset 1; 13V/22kHz OFF (in MHz)	Signed Word
17-18	2	RF3OFF2	Input 3, Offset 2; 18V/22kHz ON (in MHz)	Signed Word
19-20	2	RF4OFF1	Input 4, Offset 1; 13V/22kHz OFF (in MHz)	Signed Word
21-22	2	RF4OFF2	Input 4, Offset 2; 18V/22kHz ON (in MHz)	Signed Word
23-24	2	RF5OFF1	Input 5, Offset 1; 13V/22kHz OFF (in MHz)	Signed Word
25-26	2	RF5OFF2	Input 5, Offset 2; 18V/22kHz ON (in MHz)	Signed Word
27-28	2	RF6OFF1	Input 6, Offset 1; 13V/22kHz OFF (in MHz)	Signed Word
29-30	2	RF6OFF2	Input 6, Offset 2; 18V/22kHz ON (in MHz)	Signed Word
31	1	RF1LNB	Input 1 LNB Power state	See Table 7
32	1	RF2LNB	Input 2 LNB Power state	See Table 7
33	1	RF3LNB	Input 3 LNB Power state	See Table 7
34	1	RF4LNB	Input 4 LNB Power state	See Table 7
35	1	RF5LNB	Input 5 LNB Power state	See Table 7
36	1	RF6LNB	Input 6 LNB Power state	See Table 7
37	1	RF1FXDG	Input 1 Fixed Gain (Available RL Adjustment) SBS_FM > v3.0 (NOTE 1)	Signed Byte
38	1	RF2FXDG	Input 2 Fixed Gain (Available RL Adjustment) (NOTE 1)	Signed Byte
39	1	RF3FXDG	Input 3 Fixed Gain (Available RL Adjustment) (NOTE 1)	Signed Byte
40	1	RF4FXDG	Input 4 Fixed Gain (Available RL Adjustment) (NOTE 1)	Signed Byte
41	1	RF5FXDG	Input 5 Fixed Gain (Available RL Adjustment) (NOTE 1)	Signed Byte
42	1	RF6FXDG	Input 6 Fixed Gain (Available RL Adjustment) (NOTE 1)	Signed Byte
43-46	4	RESERVED	Reserved	
47	1	ETX	End Transmission Byte	0x03

NOTE 1: SBS_FM ≥ v3.0 only. Bytes are reserved for SBS_FM < v3.0

The RF LO Offset Mask Byte in Table 20 is used to determine if the analyzer will always use the low band offset or if it will use the LNB Power Mask Byte in Table 21 to determine when to use the low band offset.

For SBS_FM v3.0 or later, The Input Fixed Gain fields specify if a fixed gain/attenuation block is installed on that particular input. This fixed gain/attenuation block will affect the available reference levels available on that particular input. For example, on a normal input without a fixed gain block attached, a valid reference level range is -10dB to -50dB. If a Fixed Gain/Attenuation value is 0xEC (or -20d) then that means a 20dB attenuator is attached and therefore the available reference level becomes +10dB to -30dB for that particular input..

Table 20: RF LO Offset Mask Byte

SBS_FM	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
All	1	X	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1

For inputs: 0=LNB Power Mask Byte determines offset, 1=always use low band offset

X = Don't Care

Table 21: LNB Power Mask Byte

SBS_FM	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
All	1	X	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1

For inputs: 0=use 22KHz selection to select band, 1=use voltage to select band

X = Don't Care

Change Settings

Two different Change Settings packets exist and the SBS_FM determines which one to use. For SBS_FM versions v1.9 and later, use Table 22 below.

Table 22: Change Settings Packet (SBS_FM ≥ v1.9)

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0010
3	1	DTYPE	Type	0x04
4-7	4	CF	Center Frequency	See eq(1)
8-11	4	SP	Span	See eq(1)
12	1	RL	Reference Level (Note 1)	See Table 5
13	1	RBW	Resolution Bandwidth (Note 2)	See Table 6
14	1	RF	RF Input (10d – 15d for inputs 1 through 6)	10d-15d
15	1	LNB	LNB Power	See Table 7
16-17	2	RESERVED	Reserved	
18	1	ETX	End Transmission Byte	0x03

NOTE 1: Please refer to SBS_HW Description Response[59] to verify -70dB capabilities before selecting RL > 50

NOTE 2: One and only one bit should be set

For SBS_FM versions v1.8 and earlier, use Table 23 below.

Table 23: Change Settings Packet (SBS_FM ≤ v1.8)

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x000D
3	1	DTYPE	Type	0x04
4-7	4	CF	Center Frequency	See eq(1)
8-11	4	SP	Span	See eq(1)
12	1	RL	Reference Level (Note 1)	10d-50d
13	1	RBW	Resolution Bandwidth (Note 2)	See Table 6
14	1	RF	RF Input (10d – 15d for inputs 1 through 6)	10d-15d
15	1	ETX	End Transmission Byte	0x03

NOTE 1: Please refer to SBS_HW Description Response[59] and verify -70dB capabilities before selecting RL > 50
NOTE 2: One and only one bit should be set

> ***NOTE:***
> The Change Settings packet does not elicit a response. To force a response packet it is possible to send a Waveform Data Request packet immediately after this packet to force a response and verify Change Settings execution. Sending these two packets back to back does not negatively affect the Avcom analyzer.

Waveform Data

Waveform data is sent to the controller only after a request is made. To request a waveform, send the Waveform Data Request Packet in Table 24.

Waveform Data Request

Depending on SBS_FM (SBS Firmware Version), 8-bit and 12-bit data from the Avcom Analyzers is supported. 12-bit data is available only for Avcom Analyzers with a SBS_FM v2.10 and later.

Table 24: Waveform Data Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0003
3	1	DTYPE	Type	0x03
4	320	WAVET	Waveform Type: 0x03: Request 8-bit resolution waveform (NOTE 1) 0x05: Request 12-bit resolution waveform (NOTE 2)	0x03 or 0x05
5	1	ETX	End	0x03

NOTE 1: Refer to Table 25 for SBS_FM ≥ v1.9 and Table 26 for SBS_FM ≤ v1.8
NOTE 2: Refer to Table 27 and only available for SBS_FM ≥ v2.10

8-Bit Waveform Data

If an 8-bit waveform is requested, the Avcom analyzer will respond with either Table 25 or Table 26 depending on the SBS_FM value.

Table 25: 8-bit Waveform Data (SBS_FM ≥ v1.9)

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0155
3	1	DTYPE	Type	0x09
4-323	320	DATA8	8-bit waveform data	See eq(3), eq(4)
324	1	ProdID	Base Product Identification Byte	See Table 12
325-328	4	CurCF	Current Center Frequency	See eq(2)
329-332	4	CurSP	Current Span	See eq(2)
333	1	CurRL	Current Reference Level	See Table 5
334	1	CurRBW	Current Resolution Bandwidth (RBW)	See Table 6
335	1	CurRF	Current RF Input (10d – 15d for inputs 1 through 6)	10d – 15d
336-337	2	Cur_IEF	Current Internal Extender Frequency Offset (MHz)	Signed word
338-339	2	Cur_EEF	Current External Extender Frequency Offset (MHz)	Signed word
340	1	CurLNB	SBS_FM ≥ v1.9: Current LNB Power Settings	See Table 7
341-342	2	RESERVED	Reserved	
343	1	ETX	End	0x03

Table 26: 8-bit Waveform Data (SBS_FM ≤ v1.8)

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0152
3	1	DTYPE	Type	0x09
4-323	320	DATA8	8-bit waveform data	See eq(3)
324	1	ProdID	Base Product Identification Byte	See Table 12
325-328	4	CurCF	Current Center Frequency	See eq(2)
329-332	4	CurSP	Current Span	See eq(2)
333	1	CurRL	Current Reference Level	10d – 70d
334	1	CurRBW	Current Resolution Bandwidth (RBW)	See Table 6
335	1	CurRF	Current RF Input (10d – 15d for inputs 1 through 6)	10d – 15d
336-337	2	Cur_IEF	Current Internal Extender Frequency Offset (MHz)	Signed word
338-339	2	Cur_EEF	Current External Extender Frequency Offset (MHz)	Signed word
340	1	ETX	End	0x03

The internal offsets, if present, should be added to the current center frequency (CurCF) to obtain the correct center frequency.

12-Bit Waveform Data

If the Avcom analyzer supports 12-bit data and a 12-bit waveform is requested, the analyzer will respond with the packet described in Table 27.

Table 27: 12-bit Waveform Data (SBS_FM ≥ v2.10)

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x01F5
3	1	DTYPE	Type	0x0F
4-483	480	DATA12	12-bit waveform data	See eq(5), eq(6)
484	1	ProdID	Base Product Identification Byte	See Table 12
485-488	4	CurCF	Current Center Frequency	See eq(2)
489-492	4	CurSP	Current Span	See eq(2)
493	1	CurRL	Current Reference Level	See Table 5
494	1	CurRBW	Current Resolution Bandwidth (RBW)	See Table 6
495	1	CurRF	Current RF Input (10d – 15d for inputs 1 through 6)	10d – 15d
496-497	2	Cur_IEF	Current Internal Extender Frequency Offset (MHz)	Signed word
498-499	2	Cur_EEF	Current External Extender Frequency Offset (MHz)	Signed word
500	1	CurLNB	SBS_FM ≥ v1.9: Current LNB Power Settings	See Table 7
501-502	2	RESERVED	Reserved	
503	1	ETX	End	0x03

The internal offsets, if present, should be added to the current center frequency (CurCF) to obtain the correct center frequency.

Message Commands

The following are commands relating to messages between the user interface and the Avcom Analyzers. Some may be used to report errors; others may be used to coordinate specific tasks.

Unknown Transmission

The Unknown Transmission Response packet in Table 28 is used to notify the user interface that the Avcom Analyzer successfully received a packet, but the packet appears to be either an invalid DTYPE, in the wrong format, or another transmission occurred and as a result cannot be correctly processed.

Table 28: Unknown Transmission Response

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0003
3	1	DTYPE	Type	0x08
4	1	RxDTYPE	DTYPE Requested by Controller	
5	1	ETX	End	0x03

Message Response

The Message Response packet in Table 29 is used for the Avcom Analyzer to deliver human-readable messages in ASCII to the user interface. Often this packet is used for acknowledging certain commands where the confirmation is meant to be given to a user in human-readable ASCII. This packet is always a received from the Avcom Analyzer

Table 29: Message Response

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	N+2
3	1	DTYPE	Type	0x60
4-(N+3)	N	MESG	Message (NOTE 1)	ASCII
N+4	1	ETX	End	0x03

Note 1: MESG limited to 25 characters for compatibility with Avcom GUI

List of Packets for LCD Display Units

The follow packets are valid only for Avcom units with an LCD Display, namely the SNG and PSA models. Units without an LCD interface may skip this section.

Packet Acknowledgement

Often the Packet Acknowledgement packet in Table 30: is used by the Avcom Analyzer to acknowledge that a packet was received correctly. In some cases the packet acknowledgment is used to confirm a task is executed and/or if errors were encounter. The packet is always a response from the Avcom Analyzer. This command differs from the Message Response packet in that its response is typically used for error processing and is not in human-readable ASCII.

Currently this packet is only implemented for LCD commands.

Table 30: Packet Acknowledgement

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	N + 2
3	1	DTYPE	Type	0x21
4	1	ACK	Packet type being acknowledged	
5	1	ACK_L	Sub-Packet Type being acknowledged (Note 1)	
6-(N+4)	N	ACKMESG	Optional success/error codes (Note 2)	
N+6	1	ETX	End	0x03

Note 1: ACK_L Byte ONLY exists when ACK byte is 0x27. In other cases ACK_L is omitted which effects the byte size.

Note 2: ACKMESG Byte(s) are optional and may not exist. Refer to the transmitting packet details to determine if additional information is expected to be included.

LCD_HW Description

The LCD_HW Description packets contain hardware information regarding the LCD interface portion of the Avcom Analyzer such as PCB revisions, firmware version, and applicable project codes. As information in this packet may determine functionality of the unit, it is recommended to retrieve this packet once the controlling interface determines that the unit is an LCD model (such as through the ProjID byte in the SBS_HW Description Response packet).

Table 31: LCD_HW Description Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0003
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x22
5	1	ETX	End	0x03

The response is show in Table 32.

Table 32: LCD_HW Description Response

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0033
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x22
5-6	2	LCD_FM	LCD Firmware Version (example 0x0103 = v1.3)	MSB.LSB
7	1	L_MBHW	LCD's Motherboard PCB	See Table 33
8	1	L_FPHW	LCD's Front Panel PCB	See Table 34
9	1	L_FGHW	Fuel Guage PCB	See Table 35
10	1	RESERVED	Future HW Tracking (NOTE 1)	
11-12	2	LCD_Proj	LCD Firmware Project ID (NOTE 2)	
13	1	MFG_M	Manufactured Month of Year – starts at Jan = 10d	10d – 21d
14	1	MFG_D	Manufactured Day of Month + 10d (example:15th is 25d)	10d – 41d
15-16	2	MGF_Y	Manufactured Year – Starts at 1900 (example: year 2009 is 0x6D)	0x6D – 0x96
17-32	15	LCD_SN	LCD Identifying Number (NOTE 1)	
33-52	20	RESERVED	Reserved	
53	1	ETX	End	0x03

NOTE 1: Note in use, may be reallocated in future

NOTE 2: LCD Project variations currently do not exist

Table 33 below outlines the LCD's motherboard PCB revision information. This is currently for informational purposes.

Table 33: L_MBHW Byte

	Bits 7, 6, 5, 4	Bits 3, 2, 1, 0	Data Value
FAB-09E02	1h	Xh	1Xh
Rev A	Xh	1h	X1h
Rev B	Xh	2h	X2h or XBh

X = Don't Care

Table 34 below outlines the LCD's front panel PCB revision information. This is currently for informational purposes.

Table 34: L_FPHW Byte

	Bits 7, 6, 5, 4	Bits 3, 2, 1, 0	Data Value
FAB-09E01	1h	Xh	1Xh
Rev A	Xh	1h	X1h
Rev B	Xh	2h	X2h
Rev C	Xh	3h	X3h
Rev D	Xh	4h	X4h

X = Don't Care

Table 34 below outlines the Fuel Gauge's PCB revision information.

Table 35: L_FGHW Byte

	Bits 7, 6, 5, 4	Bits 3, 2, 1, 0	Data Value
FAB-10I01	1h	Xh	1Xh
Rev A	Xh	1h	X1h
Rev B	Xh	2h	X2h
Rev C	Xh	3h	X3h
Rev D	Xh	4h	X4h

X = Don't Care

Currently there are no variations in the protocol regarding L_FGHW and L_MBHW.

Set Date/Time

The Date and time can be set by sending the packet. The Avcom analyzer will respond with an Acknowledgement Packet (Table 30). The response includes an error byte. Upon no errors, it shall return 0x00. All other values indicate an error has occurred.

Table 36: Set Date/Time Packet

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0009
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x29
5	1	TIME_S	Time: Seconds – Seconds + 10d	10d – 69d
6	1	TIME_M	Time: Minutes – Minutes + 10d	10d – 69d
7	1	TIME_H	Time Hours – Hours + 10d (example: 12 O'clock is 24d)	10d – 33d
8	1	TIME_D	Time: Day of Month – Day of month +10d (example: 15th is 25d)	11d – 41d
9	1	TIME_MO	Time: Month of Year – Starts at Jan=10d	10d – 21d
10	1	TIME_YR	Time: Year – Starts at 1900 (example: year 2009 is 0x6D)	0x6D – 0x96
11	1	ETX	End	0x03

Manage Presets

The following packets are used to manage presets stored in the LCD Avcom Analyzer.

The LLO_OFF or LO Offset field used in the preset data packets is separate to LNB settings described in the

LNB Power Description packet. Avcom Analyzers with an LCD interface has its own LO Offset that users may turn on or off through the LCD user interface and the LLO_OFF is associated with this value. If no LO Offset is wanted inside the preset, set LLO_OFFSET to zero.

Import Preset

This sequence will import settings from a preset saved on the Avcom Analyzer to the controller. The controller should first request Table 37 and expect to receive Table 38.

Table 37: Import Preset Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0004
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x1F
5	1	PRES	Preset Slot Number	1d – 10d
6	1	ETX	End	0x03

Table 38: Import Preset Response

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0023
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x1F
5	1	PRES	Preset Slot Number	1d – 10d
6-9	4	CF	Center Frequency	See eq(2)
10-13	4	SP	Span	See eq(2)
14	1	RL	Reference Level	See Table 5
15	1	RBW	Resolution Bandwidth	See Table 6
16	1	RF	RF Input (10d – 15d for inputs 1 through 6)	10d-15d
17	1	LNB	LNB Power	See Table 7
18-19	2	RESERVED	Reserved	
20-21	2	LLO_OFF	LO Offset	Signed Word
22-36	15	PRES_N	Preset Name (NOTE 1)	ASCII
37	1	ETX	End	0x03

NOTE 1: All extra bytes will be padded with NULL characters. If no name exists, field will be all NULL (0x00)

Export Preset

This command will export a preset from the controlling interface to the Avcom Analyzer. The Avcom analyzer will respond with an Acknowledgement Packet (Table 30). The response includes an error byte. Upon no errors, it shall return 0x00. All other values indicate an error has occurred.

Table 39: Export Preset Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0023
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x20
5	1	PRES	Preset Number	1d – 10d
6-9	4	CF	Center Frequency	See eq(1)
10-13	4	SP	Span	See eq(1)
14	1	RL	Reference Level (Note 1)	See Table 5–
15	1	RBW	Resolution Bandwidth	See Table 6
16	1	RF	RF Input (10d – 15d for inputs 1 through 6)	10d-15d
17	1	LNB	LNB Power	See Table 7
18-19	2	RESERVED	Reserved	
20-21	2	LO_OFF	LO Offset	Signed Word
22-36	15	PRES_N	Preset Name (NOTE 2)	ASCII
37	1	ETX	End	0x03

NOTE 1: Please refer to SBS_HW Description Response[59] to verify -70dB capabilities before selecting RL > 50
NOTE 2: All extra bytes **must** be padded with NULL (0x00) characters. If no name, fill with all NULL.

Rename Preset

This command will rename a preset without modifying any other attribute. The Avcom analyzer will respond with an Acknowledgement Packet (Table 30). The response includes an error byte. Upon no errors, it shall return 0x00. All other values indicate an error has occurred.

Table 40: Rename Preset Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0013
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x1E
5	1	PRES	Preset Number	1d – 10d
6-20	15	PRES_N	Preset Name (NOTE 1)	ASCII
21	1	ETX	End	0x03

NOTE 1: All extra bytes must be padded with NULL (0x00) characters. To remove the name, fill with all NULL.

Load LCD Preset

This command will remotely tell the Avcom Analyzer to change its settings to a preset stored within the unit. The Avcom analyzer will respond with an Acknowledgement Packet (Table 30). The response includes an error byte. Upon no errors, it shall return 0x00. All other values indicate an error has occurred.

Table 41: Load LCD Preset Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x004
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x21
5	1	PRES	Preset Number	1d – 10d
6	1	ETX	End	0x03

Note 1: All extra bytes must be padded with NULL (0x00) characters.

Preset Summary

This command will retrieve basic preset information that will indicate if a given preset slot is empty or not, and if the preset exists it will indicate if the preset has a name assigned to it or not.

Table 42: Preset Summary Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0003
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x1D
5	1	ETX	End	0x03

Table 43: Preset Summary Response

Byte #	Len	Field	Description		Value (or range)
0	1	STX	Start of Packet		0x02
1-2	2	LEN	Length		0x000D
3	1	L_SUB	Type		0x27
4	1	L_DTYPE	LCD Sub-Command Data Type		0x1D
5-14	1	PRES_S	Preset Summary	0x00 = Preset is empty 0x01 = Preset exists and has no name 0x02 = Preset exists and has name	0x00 – 0x02
15	15	ETX	End		0x03

PRES_S is an array of size 10, each byte representing one preset slot

Erase Presets

The following command will delete a single preset or all presets. The Avcom analyzer will respond with an Acknowledgement Packet (Table 30). The response includes an error byte. Upon no errors, it shall return 0x00. All other values indicate an error has occurred.

Table 44: Erase Presets Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x004
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x24
5	1	PRES	Preset Number (Note 1)	1d – 10d, 0xFF
6	1	ETX	End	0x03

Note 1: To erase all presets, PRES byte should be 0xFF.

Manage Saved Waveforms

The following packets are used to manage Saved Waveforms stored in the Avcom Analyzer. For saved waveforms, any LO Offset applied during a save in the LCD Avcom Analyzer will be added to the center frequency (CurCF) field.

Import Waveform

This sequence will import settings from a Saved Waveform saved on the Avcom Analyzer to the controller. The controller should first request Table 45 and expect to receive Table 46.

Table 45: Import Waveform Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0004
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x1B
5	1	PRES	Saved Waveform Number	1d – 50d
6	1	ETX	End	0x03

If the saved waveform was stored in 8-bit mode, then the response will give waveform data in 8-bit format. Similarly, if the waveform was saved in 12-bit mode, the response will give the waveform data in 12-bit mode. This affects the number of bytes in the packet. The DTYPE byte will determine if the data is 8-bit or 12-bit. At byte offset 4, the data is identical to the data (excluding STX, LEN, DTYPE and ETX bytes) that is in a normal 8-bit or 12-bit waveform.

Table 46: Import Waveform Response

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02

1-2	2	LEN	Length:	For 8-bit For 12-bit	0x01AF 0x024F
3	1	DTYPE	Type:	For 8-bit For 12-bit	0x19 0x1F
4-342 **4-502**	339 499		Normal 8-bit waveform Packet or Normal 12-bit waveform Packet		See Table 25 See Table 27
343 **503**	1	SWAV	Saved Waveform Location Number		1d – 50d
344 **504**	1	TIME_S	Time: Seconds – Seconds + 10d		10d – 69d
345 **505**	1	TIME_M	Time: Minutes – Minutes + 10d		10d – 69d
346 **506**	1	TIME_H	Time Hours – Hours + 10d (example: 12 O'clock is 24d)		10d – 33d
347 **507**	1	TIME_D	Time: Day of Month – Day of month +10d (example: 15th is 25d)		11d – 41d
348 **508**	1	TIME_MO	Time: Month of Year – Starts at Jan=10d		10d – 21d
349 **509**	1	TIME_YR	Time: Year – Starts at 1900 (example: year 2009 is 0x6D)		0x6d – 0x96
350-351 **510-511**	2	SBS_FM	SBS Firmware Version (example 0x0206 = v2.6)		MSB.LSB
352 **512**	1	PCB-FAB	Analyzer PCB Fab		See Table 14
353 **513**	1	ProjID	Project ID		See Table 13
354-355 **514-515**	2	LCD_FM	LCD Firmware Version (example 0x0103 = v1.3)		MSB.LSB
356 **516**	1	L_MBHW	LCD's Motherboard PCB		See Table 33
357 **517**	1	L_FPHW	LCD's Front Panel PCB		See Table 34
358-359 **518-519**	2	RESERVED	Reserved		
560-561 **520-521**	2	LCD_Proj	Current RF Input (10d – 15d for inputs 1 through 6)		10d – 15d
362-377 **522-537**	16	SN	Serial Number		ASCII
378-392 **538-552**	15	SWAV_N	Preset Name (NOTE 1)		ASCII
393-432 **553-592**	40	RESERVED	Reserved		
433 **593**	1	ETX	End		0x03

Note 1: All extra bytes will be padded with NULL characters. If no name exists, field will be all NULL (0x00)

Export Waveform

This command will export a Saved Waveform from the controlling interface to the Avcom Analyzer. The Avcom analyzer will respond with an Acknowledgement Packet (Table 30). The response includes an error byte. Upon no errors, it shall return 0x00. All other values indicate an error has occurred. At byte offset 7, the data is identical to the data (excluding STX, LEN, DTYPE and ETX bytes) that is in a normal 8-bit or 12-bit waveform.

Table 47: Export Waveform Request

Byte #	Len	Field	Description		Value (or range)
0	1	STX	Start of Packet		0x02
1-2	2	LEN	Length	For 8-bit For 12-bit	0x01B1 0x0251
3	1	L_SUB	Type		0x27
4	1	L_DTYPE	LCD Sub-Command Data Type		0x1C
5	1	SWAV	Saved Waveform Number		1d – 50d
6	1	SWAV_RE	Waveform Resolution: 8 bit (0x09) or 12bit (0x0F)		0x09, 0x0F
7-345 **7-505**	4	339 499	Normal 8-bit waveform Packet or Normal 12-bit waveform Packet		See Table 25 See Table 27
346 **506**	1	TIME_S	Time: Seconds – Seconds + 10d		10d – 69d
347 **507**	1	TIME_M	Time: Minutes – Minutes + 10d		10d – 69d
348 **508**	1	TIME_H	Time Hours – Hours + 10d (example: 12 O'clock is 24d)		10d – 33d
349 **509**	1	TIME_D	Time: Day of Month – Day of month +10d (example: 15th is 25d)		11d – 41d
350 **510**	1	TIME_MO	Time: Month of Year – Starts at Jan=10d		10d – 21d
351 **511**	1	TIME_YR	Time: Year – Starts at 1900 (example: year 2009 is 0x6D)		0x6d – 0x96
352-353 **512-513**	2	SBS_FM	SBS Firmware Version (example 0x0206 = v2.6)		MSB.LSB
354 **514**	1	PCB-FAB	Analyzer PCB Fab		See Table 14
355 **515**	1	ProjID	Project ID		See Table 13
356-357 **516-517**	2	LCD_FM	LCD Firmware Version (example 0x0103 = v1.3)		MSB.LSB
358 **518**	1	L_MBHW	LCD's Motherboard PCB		See Table 33
359 **519**	1	L_FPHW	LCD's Front Panel PCB		See Table 34
360-361 **520-521**	2	RESERVED	Reserved		
362-363 **522-523**	2	LCD_Proj	Current RF Input (10d – 15d for inputs 1 through 6)		10d – 15d
364-379 **524-539**	16	SN	Serial Number		ASCII
380-394 **540-554**	15	SWAV_N	Preset Name (NOTE 1)		ASCII
395-434 **555-594**	40	RESERVED	Reserved		

435 595	1	ETX	End	0x03

Note 1: All extra bytes must be padded with NULL (0x00) characters. If no name, field should be all NULL.

Rename Saved Waveform

This command will rename a Saved Waveform without modifying any other attribute. The Avcom analyzer will respond with an Acknowledgement Packet (Table 30). The response includes an error byte. Upon no errors, it shall return 0x00. All other values indicate an error has occurred.

Table 48: Rename Saved Waveform Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0013
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x1A
5	1	SWAV	Saved Waveform Number	1d – 50d
6-20	15	SWAV_N	Saved Waveform Name (NOTE 1)	ASCII
21	1	ETX	End	0x03

Note 1: All extra bytes must be padded with NULL (0x00) characters. To remove a name fill field with all NULL.

Saved Waveform Summary

This command will retrieve basic Saved Waveform information that will indicate if a given Saved Waveform slot is empty or not, and if the Saved Waveform exists it will indicate if the Saved Waveform has a name assigned to it or not.

Table 49: Saved Waveform Summary Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x0003
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x19
5	1	ETX	End	0x03

Table 50: Saved Waveform Summary Response

Byte #	Len	Field	Description		Value (or range)
0	1	STX	Start of Packet		0x02
1-2	2	LEN	Length		0x0035
3	1	L_SUB	Type		0x27
4	1	L_DTYPE	LCD Sub-Command Data Type		0x19
5-54	1	SWAV_S	Waveform Summary	0x00 = Slot is empty 0x01 = Slot exists and has no name 0x02 = Slot exists and has name	0x00 – 0x02
55	15	ETX	End		0x03

SWAV_S is an array of size 50, each byte representing one saved waveform slot

Erase Saved Waveforms

The following command will delete a single Saved Waveform or all Saved Waveforms. The Avcom analyzer will respond with an Acknowledgement Packet (Table 30). The response includes an error byte. Upon no errors, it shall return 0x00. All other values indicate an error has occurred.

Table 51: Erase Saved Waveforms Request

Byte #	Len	Field	Description	Value (or range)
0	1	STX	Start of Packet	0x02
1-2	2	LEN	Length	0x004
3	1	L_SUB	Type	0x27
4	1	L_DTYPE	LCD Sub-Command Data Type	0x25
5	1	SWAV	Saved Waveform Number (Note 1)	1d – 50d, 0xFF
6	1	ETX	End	03

Note 1: To erase all Saved Waveforms, set SWAV byte to 0xFF.

Appendix A: List of Tables