Installation and Operation Manual

3rd Generation Rack-Mount RDMS™ Telemetry Receiver

Quasonix, Inc.

6025 Schumacher Park Dr.

West Chester, OH 45069

10 February 2018

Revision 3.0.5

Applies to RDMS™ System Version 14

Table of Contents

List of Figures

List of Tables

1   Introduction

1.1   Description

This document describes the installation and operation of the Quasonix 3rd Generation Rack-Mount RDMS™ Telemetry Receiver and is updated to match RDMS TM System Version 14. The RDMS™ (Receiver / DeModulator / bit Synchronizer) is designed to downconvert, demodulate, and bit synch to a variety of RF telemetry signals from flight-test aircraft. With an intuitive front-panel interface as well as an extensible web-based browser interface, and antenna-tracking outputs, the Rack-Mount RDMS™ is capable of fulfilling a variety of flight test station requirements.

The following waveform formats are supported by RDMS™:

- PCM/FM (ARTM Tier 0)
- SOQPSK-TG (ARTM Tier I)
- ARTM CPM / Multi-h CPM (ARTM Tier II)
- Legacy (PSK) suite, which includes:
    - BPSK
    - QPSK
    - Offset QPSK (OQPSK)
    - Asymmetric QPSK (AQPSK)
    - Unbalanced QPSK (UQPSK)
    - Asymmetric Unbalanced QPSK (AUQPSK)
- Digital PM
- STC
- SOQPSK/LDPC
- STC/LDPC
- OQPSK/LDPC

Of the aforementioned, RDMS™ provides true multi-symbol trellis demodulation in all three ARTM modes, PCM/FM, SOQPSK-TG, and Multi-h PCM. It also provides a clock signal, obviating the need for any outboard bit synchronizer.

Modes that support LDPC use IRIG-standard low-density parity check coding to dramatically improve link margin by up to 9 dB.

The Rack-Mount RDMS™ Telemetry Receiver is manufactured by:

Quasonix, Inc.
6025 Schumacher Park Drive
West Chester, OH 45069
CAGE code: 3CJA9

1.2   Nomenclature

The Rack-Mount RDMS™ (hereafter referred to as "RM RDMS™") is available in a plethora of variations based on the number of channels, frequency bands, demodulation methods, options, etc. The features and modes installed in each unit are identified in the model number, as depicted in Figure 1.
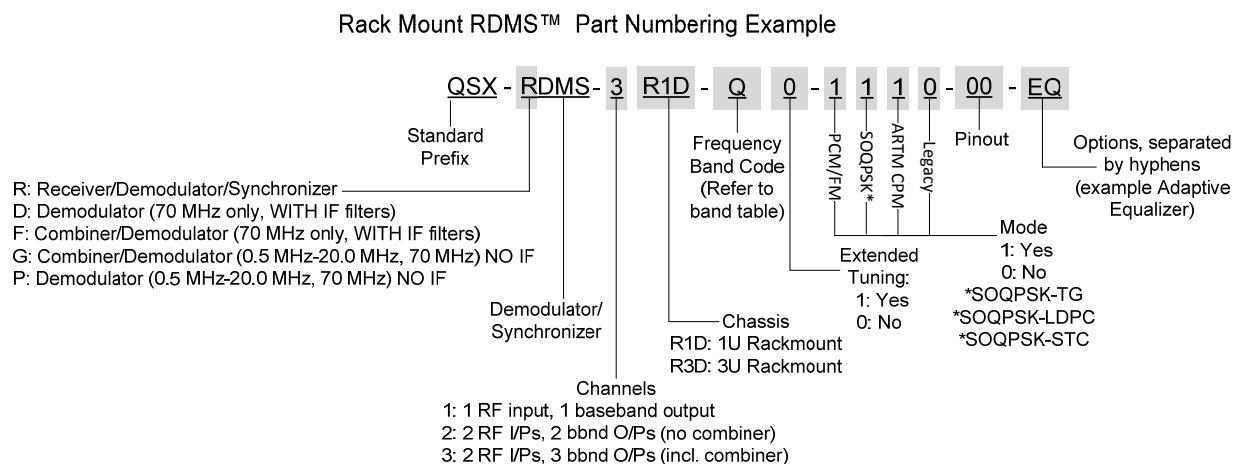
Figure 1: Rack-Mount RDMS™ Part Number Construction

Specifications are subject to change. Contact Quasonix for questions regarding your specific receiver.

1.2.1   Options

The available options are listed below. Refer to section 1.2.2 for detailed descriptions of each option. Please contact Quasonix for assistance ordering receiver options.

- 14   14 SAW filters (adds 70 kHz, 1.4, 3, 6, 14, and 28 MHz filters)
- CS   Cybersecurity
- EN   Ethernet Payload
- EQ   Adaptive Equalizer
- IP   Payload data delivered in IP format
- K7   K7 Viterbi Decoder (k=7, rate 1/2)

For example, a model QSX-RDMS-3R1D-Q0-1101-00-EQ is configured as shown in Table 1:

Table 1: Model Configuration Example

Identifiers	Description
QSX	Quasonix product
RDMS	Receiver / Demodulator / Bit Synchronizer
3	2 RF input channels, 3 baseband outputs, with combiner

Identifiers	Description
R1D	1U Rack Mount
Q	Lower L, Upper L, S, and C-band operation
0	No extended tuning
1101	Modes: Tier 0 present, Tier I present, Tier II absent, Legacy (PSK) present
00	Pinout code
EQ	Adaptive Equalizer option

1.2.2   Detailed Option Descriptions

1.2.2.1   SAW Filter Option – 14

This option adds additional SAW filters, for a total of 14. The additional filters are 70 kHz, plus 1.4, 3, 6, 14, and 28 MHz.

1.2.2.2   Cybersecurity – CS

This option is used to address customer installation security requirements. Contact Quasonix for details.

1.2.2.3   Ethernet (EVTM) Payload, Receive Only – EN

When the EN option is enabled, the RDMS will recover EVTM encoded data and convert it from Serial Streaming Telemetry back to the original Ethernet packets. Standard SST operation is not replaced, and can still be used. This hardware must be paired with an -EN enabled transmitter for proper data recovery.

1.2.2.4   Adaptive Equalizer – EQ

The Adaptive Equalizer option in the Quasonix receiver improves reception in multipath channels by using digital signal processing to compensate for the signal distortion due to multipath. This option is compatible with standard telemetry applications and installations and it works with any brand of transmitter.

Multipath fading can seriously degrade the quality of wireless telemetry data. Radio transmissions can reflect off of the airframe or other objects and arrive at the receiving antenna with different time delays, carrier phases, and relative strengths. The sum of these multiple transmission paths can produce serious distortion and signal fading resulting in poor data quality and long periods of data outage. Contrary to most situations, increasing the transmit power will not improve the link quality and may actually make the situation worse. Narrowing the beamwidth of the antenna may help eliminate some of the reflections and reduce the overall fading and distortion, but constraints on dish size and antenna tracking performance impose beamwidth limits.

Another solution is to mitigate the effects of the multipath channel by applying a filtering operation at the receiver that effectively undoes the distortion caused by the channel, thereby 'equalizing' the received signal. Since the transmitter is typically moving relative to the receiver, the RF propagation environment dynamically changes over time requiring the equalizer to 'adapt' to continually combat the perceived channel distortion. The 'adaptive equalizer' automatically calculates and applies a compensating filter to the received signal that restores its ability to be recovered by a traditional telemetry detector.

1.2.2.5   Telemetry Over IP – IP

The Telemetry Over IP (TMoIP) capability packages PCM payload data into IP packets at the receiver. The receiver provides simultaneous PCM and network outputs with separate RJ-45 connectors for network control and data output. UDP and TCP protocols are available.

A web based graphical user interface (GUI) provides end-to-end TMoIP configuration, control, and status. Network Auto-Tune capability performs automatic measurement and compensation for uncertain or varying network delay and jitter. PCM serial input channels support automatic bit rate detection and IP packet size auto-configuration.

Fully configurable network parameters include DSCP/DiffServ Quality of Service, IPv4/IPv6, MTU, link speed, etc. Security features include integrated firewall with port blocking, password-authentication and user permissions, encrypted management interface, audit logging, and support for IPv6.

Detailed operating instructions are located in section 16, Appendix H of this manual.

1.2.2.6   Viterbi Decoder (for Legacy PSK or PCM/FM Only) – K7

The K7 option (k=7, rate 1/2) enables Viterbi decoding of a convolutionally encoded data stream, which converts it back to the original (uncoded) source data stream.

Convolutional encoding adds redundant information to the transmitted data stream to help detect and correct bit errors that may occur, particularly due to predominantly Gaussian noise. Use of convolutional encoding requires a matching Viterbi decoder in the receiver to extract the source data. The decoded data rate is half the encoded data rate. The receiver has two independent decoders, one for in-phase ("I") data and one for quadrature ("Q") data. For BPSK, only a single decoder is used. Each decoder is compatible with the convolutional encoding described in the "Consultative Committee for Space Data Systems, Recommendation for Space Data System Standards, TM Synchronization and Channel Coding, CCSDS 131.0-B-1, Blue Book, September 2003, Section 3."

1.2.3 Band Configurations

Band configuration codes are listed in Table 2. Two additional band codes are described in section 1.2.3.1.

Table 2: Band Configuration Codes
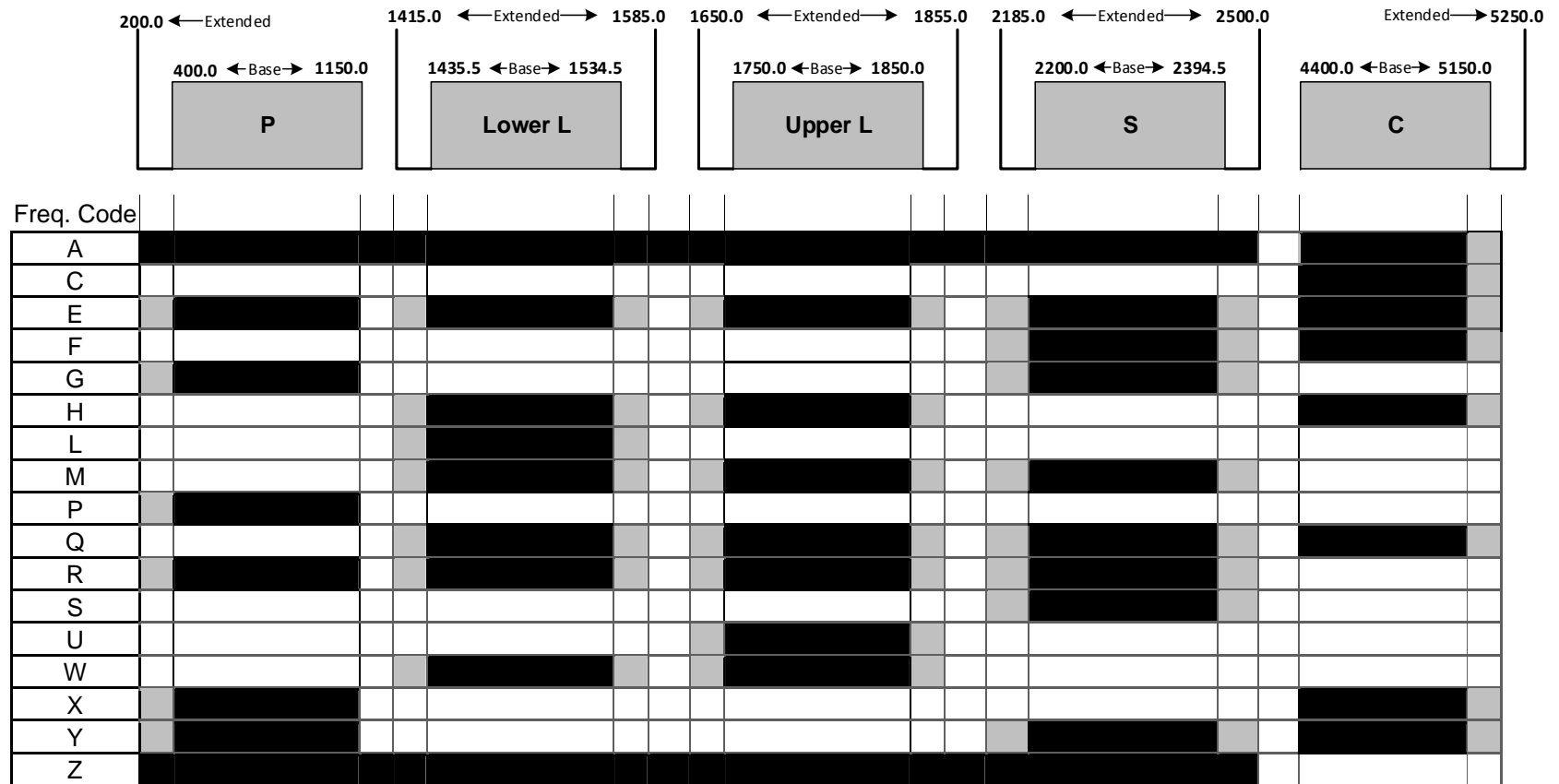
	P	Lower L	Upper L	S	C
Extended	200.0 ← Extended	1415.0 ← Extended → 1585.0	1650.0 ← Extended → 1855.0	2185.0 ← Extended → 2500.0	Extended → 5250.0
Base	400.0 ← Base → 1150.0	1435.5 ← Base → 1534.5	1750.0 ← Base → 1850.0	2200.0 ← Base → 2394.5	4400.0 ← Base → 5150.0

Freq. Code: A, C, E, F, G, H, L, M, P, Q, R, S, U, W, X, Y, Z

Legend:
- Frequency Gap
- Standard (Base) Frequency Range
- Extended Frequency Range (available by selecting Extended Tuning = 1 in part number)

1.2.3.1 Additional Band Codes

Two additional band codes are available:

- Band Code 7: 70 MHz standard range, 0.075 MHz-20 MHz, 70 MHz extended range

- Band Code T: 2025.0 MHz to 2110.0 MHz standard range

1.3 Package Contents

The contents of the box include the following:

- Rack-Mount receiver unit (1U or 3U)

- Power cord

- Ethernet cable (25 ft)

- Four (4) rubber feet with adhesive for lab bench use

A copy of the Installation and Operation manual is included with the Browser Interface software (Help option).

2   Specifications

Characteristic	Specification
Receiver Section	
Type	Dual-conversion superheterodyne
Input RF Frequency	Refer to section 1.2.3
Tuning resolution	Tunes in 62.5 kHz increments, to the 70 MHz IF output, after the 70 MHz IF output, receiver tunes in increments of less than 1 Hz
Frequency stability	1 ppm over temperature; 1 ppm per year aging
Reference oscillator	20 MHz
Noise figure	3.5 dB (typical), 5 dB (maximum)
LO phase noise, measured at 70 MHz IF output	-115 dBc/Hz @ 1 MHz offset
Maximum RF input	+20 dBm (+10 dBm for C-band)
Available gain (to 70 MHz IF output)	114 dB
Gain control	128 dB control range; User selectable: AGC or MGC (AGC freeze)
AGC time constant	Adjustable to any value from 0.1 ms to 1000 ms
First IF bandwidth	60 MHz (nominal)
IF rejection	> 90 dB
Image rejection	70 dB
RF input impedance	50 ohms
VSWR	3:1 Max; 2:1 Typical
Second IF Section	
IF frequency	70 MHz

IF output level, nominal (AGC mode)	Channel 1 and 2: 70 and 250 kHz bandwidths: -15 dBm
	                     0.5 – 4.5 MHz bandwidths: -10 dBm
	                     6 and 10 MHz bandwidths: -5 dBm
	                     14 – 40 MHz bandwidths: -15 dBm
	Combiner: -5 dBm
	Channel 1 and 2 Mod Out: -5 dBm *(3U RDMS only)*

IF output impedance	50 ohms
VSWR	2:1 Max; 1.5:1 Typical
IF bandwidths	250 kHz, 500 kHz, 1 MHz, 2 MHz, 4.5 MHz, 10 MHz, 20 MHz, 40 MHz. Automatic selection based on modulation type and data rate, with manual override. Optional: 70 kHz, 1.4 MHz, 3 MHz, 6 MHz, 14 MHz, 28 MHz
Playback Demodulator IF In, Channel 1 and 2 Section	
Input Center Frequency	75 kHz – 20 MHz, 70 MHz through any selectable SAW filter
Input Level	-30 dBm + 10 dB
Input Impedance	50 ohms, nominal

Characteristic	Specification
Demodulator Section	
Demodulator type	ARTM Tier 0 (PCM/FM), ARTM Tier I (SOQPSK-TG), ARTM Tier II (Multi-h CPM) Legacy suite: Analog FM, BPSK, QPSK, Offset QPSK (OQPSK), Asymmetric QPSK (AQPSK), Unbalanced QPSK (UQPSK), Asymmetric Unbalanced QPSK (AUQPSK), Digital PM, Space Time Coding (STC)
Bit Rates (after LDPC encoding, if applicable)	Tier 0: 24 kbps to 23 Mbps in 1 bps steps Tier I: 100 kbps to 46 Mbps in 1 bps steps Tier II: 1 Mbps to 46 Mbps in 1 bps steps STC: 5 Mbps to 22 Mbps in 1 bps steps Legacy: 25 kbps to 23 Mbps in Analog FM, 25 kbps to 23 Mbps in BPSK, 50 kbps to 46 Mbps in QPSK in 1 bps steps
Synchronization time (Average, at BER = 1e-5)	Tier 0: 250 bits, Tier I: 385 bits, Tier II: 2,800 bits
Synchronization acquisition threshold	Tier 0: -5.0 dB Eb/N0; RF Input (dBm): -115.0 (1 Mbps), -105.0 (10 Mbps) Tier I: -4.0 dB Eb/N0; RF Input (dBm): -114.0 (1 Mbps), -104.0 (10 Mbps) Tier II: -8.0 dB Eb/N0; RF Input (dBm): -118.0 (1 Mbps), -108.0 (10 Mbps)
Synchronization dropout threshold	Tier 0: -10.0 dB Eb/N0; RF Input (dBm): -120.0 (1 Mbps), -110.0 (10 Mbps) Tier I: -6.0 dB Eb/N0; RF Input (dBm): -116.0 (1 Mbps), -106.0 (10 Mbps) Tier II: -15.0 dB Eb/N0; RF Input (dBm): -125.0 (1 Mbps), -115.0 (10 Mbps)
Sensitivity (BER = 1e-5)	Tier 0: 8.6 dB Eb/N0; RF Input (dBm): -101.4 (1 Mbps), -91.4 (10 Mbps) Tier I: 11.2 dB Eb/N0; RF Input (dBm): -98.8 (1 Mbps), -88.8 (10 Mbps) Tier II: 13.0 dB Eb/N0; RF Input (dBm): -97.0 (1 Mbps), -87.0 (10 Mbps)
Bit Synchronizer Section	
Input codes	NRZ-L/M/S, BIΦ-L/M/S, RZ, DM-M/S, M2-M/S
Output codes	NRZ-L/M/S, BIΦ-L/M/S, RZ, DM-M/S, M2-M/S
Data and clock out	TTL (BNC) and RS-422
Lock detector out	TTL
Derandomizer	Standard IRIG 15-stage polynomial, selectable On/Off
Video Section	
Video out (DC to 35 MHz)	1U—Quad wideband outputs: Ch1 and Ch2; Dual wideband outputs, Combiner 3U—Quad wideband outputs: Ch1, Ch2, and Combiner
Video filter bandwidth	User programmable
Output level	1 Vp-p nominal, 4 Vp-p maximum
NTSC de-emphasis	Selectable Off/NTSC/PAL
Environmental Section	
Operating Temperature	0°C to +50°C
Non-operating Temperature	-20° C to +70° C
Operating Humidity	0 to 95% (non-condensing)
Altitude	Up to 30,000 ft. (with the no displays options)
Physical Section	
Size	1U rack-mount chassis: 18.95" wide, 1.72" tall, 14.00" rack depth, 14.74" overall depth 3U rack-mount chassis: 18.95" wide, 5.22" tall, 14.06" rack depth, 14.80" overall depth
Weight	1U: 11.4 lbs. (dual-channel) 3U: 16.0 lbs.
Power	100 to 240 VAC, 50/60 Hz

3   Installation Instructions

3.1   Mechanical

3.1.1   1U Rack-Mount

The 1U RM RDMS™ Telemetry Receiver's enclosure fits in a standard 19" rack, occupying just 1U of rack space. Mechanical layouts are provided in Figure 2 and Figure 3.
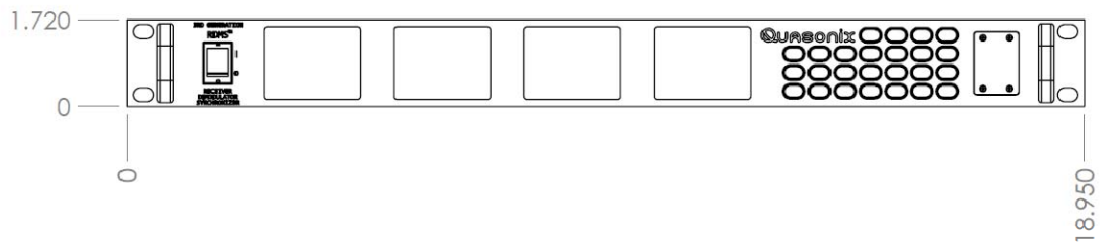
Figure 2: Mechanical Drawing – 1U Front View
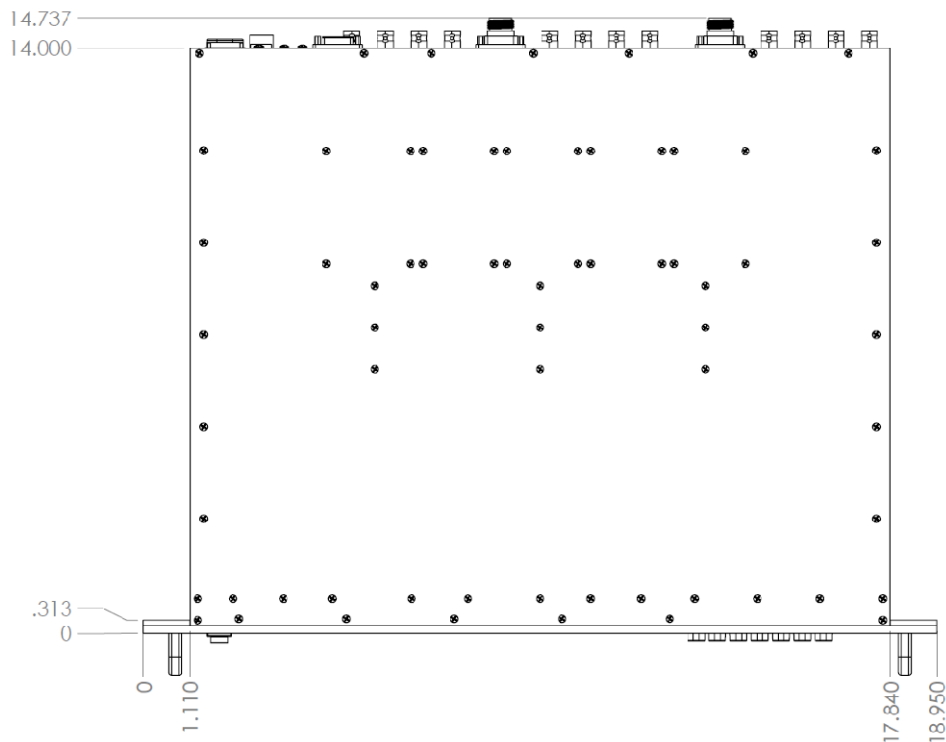
Figure 3: Mechanical Drawing – 1U Top View (Dual-channel Connectors Shown)

3.1.2   3U Touchscreen

The 3U RM RDMS™ Telemetry Receiver's enclosure fits in a standard 19" rack, occupying 3U of rack space. Mechanical layouts are provided in Figure 4 and Figure 5.
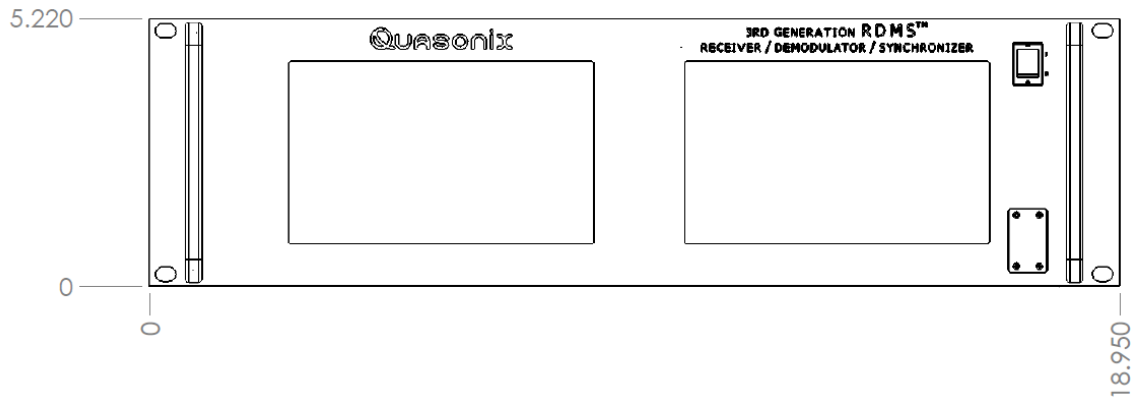
Figure 4: Mechanical Drawing – 3U Front View
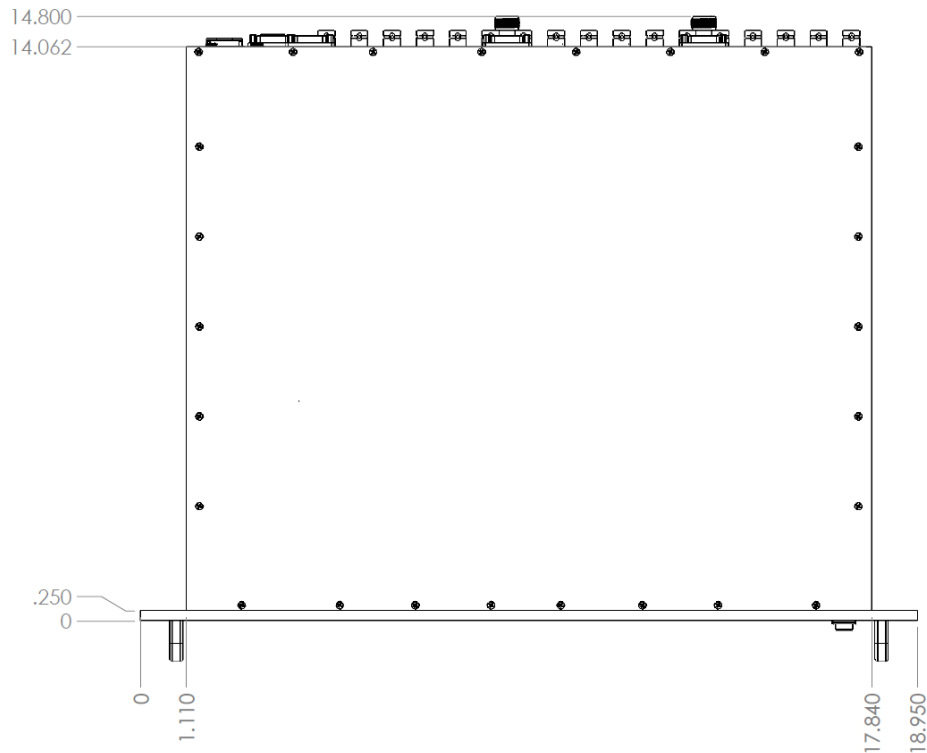
Figure 5: Mechanical Drawing – 3U Top View (Dual-channel Connectors Shown)

3.2   Thermal

The storage temperature of the RM RDMS™ unit is rated for 0°C to +70°C, while the operating temperature is rated for 0°C to +50°C. It is recommended that the unit be kept in a temperature controlled environment to minimize the risk of operating (or storing) outside the ranges specified. In particular, the four liquid crystal displays on the front panel are extremely sensitive to low temperatures.

The RM RDMS™ features cooling vents on both sides of its aluminum chassis. These vents must be kept entirely unobstructed in order to allow for maximum airflow through the system. Whenever feasible, it is helpful to leave an open rack space above and below the RM RDMS™ for additional heat dissipation.

3.3   Electrical

The RM RDMS™ is available in single- or dual- channel configurations, with all pertinent electrical connections found on the rear panel.

3.3.1   1U Rear Panel Connections

Rear panel connectors are the same for all receivers; however, in a single-channel configuration all connectors are not active.

An optional pre-detection diversity combiner is available in the dual-channel receiver configuration. Connectors for the diversity combiner are present whether the feature is ordered or not. The electrical interface connectors for all configurations are shown in Figure 6.

Figure 6: 1U Rear Panel

Functional descriptions and electrical characteristics for each clock and data connector for channel 1, channel 2, and combiner located on the rear panel are described in Table 5. The pinout for the 1U J9, an MDM-25 D-sub connector, is shown in Table 6. The pinout for the 1U J23, an MDM-25 D-sub connector, is shown in Table 7.

The ports located on the right side of the back panel are described in Table 3.

Table 3: Additional 1U Rear Panel Connectors

Name	Description
Control (J31)	MDM-25 for Factory Use Only
HDMI (J33)	Currently Factory Use Only
USB (J34)	Currently Factory Use Only
Ethernet (J35)	Enables network access
Power	Supplies AC power to the unit

3.3.2   3U Rear Panel Connections

Rear panel connectors are the same for all receivers; however, in a single-channel configuration all connectors are not active.

An optional pre-detection diversity combiner is available in the dual-channel receiver configuration. Connectors for the diversity combiner, EVTM, and TMoIP are present whether the feature is ordered or not. The electrical interface connectors for all configurations are shown in Figure 7.

Figure 7: Rear Panel

Functional descriptions and electrical characteristics for each clock and data connector for channel 1, channel 2, and combiner located on the rear panel are described in Table 5.

The ports located on the right side of the back panel are described in Table 4.

Table 4: Additional 3U Rear Panel Connectors

Name	Description	Options Required
J71	MDM-25 for Factory Use Only	-
J73	N-connector Ethernet Via Telemetry Transmitter Output	EVTM
RDMS HDMI (J74)	Currently Factory Use Only	-
J75	10 MHz Input	-
J76	10 MHz Output	-
J77	IRIG-B Time Input	TMoIP
J78	IRIG-B Time Output	TMoIP
RDMS USB (J79)	Currently Factory Use Only	-
RDMS Control (J80)	RDMS Control or TMoIP Control	-
EVTM Data (J81)	RJ-45 Ethernet via Telemetry Data	EVTM
TMOIP (J82)	RJ-45 Telemetry over IP Data Stream Out	TMoIP
TMOIP USB (J83)	Keyboard/Mouse access for TMoIP	TMoIP
TMOIP VGA (J84)	SVGA HD-15 NetAcquire Video Out	TMoIP
Power	Supplies AC power to the unit	-

Table 5: 1U and 3U Rear Panel Connector Specifications

Receiver Nomenclature	1U Channel 1 Connector Number/pin	1U Channel 2 Connector Number/pin	1U Combiner Connector Number/pin	3U Channel 1 Connector Number/pin	3U Channel 2 Connector Number/pin	3U Combiner Connector Number/pin
Clock A	J1	J15	J25	J1	J26	J51
Data A	J2	J16	J26	J2	J27	J52
Clock B	J9/14	J9/19	J9/25	J6	J31	J56
Data B	J9/15	J9/20	J9/24	J7	J32	J57
Clock C	-	-	-	J11	J36	J61
Data C	-	-	-	J12	J37	J62
Clock D	-	-	-	J16	J41	J66
Data D	-	-	-	J17	J42	J67
DAC A	J5	J19	J29	J3	J28	J53
DAC B	J6	J20	J30	J8	J33	J58
DAC C	J11	J13	-	J13	J38	J63
DAC D	J12	J14	-	J18	J43	J68
AGC OUT	J3	J17	J27	J9	J34	J59
AM OUT	J4	J18	J28	J4	J29	J54
AUX ANALOG A Out	-	-	-	J14	J39	J64
AUX ANALOG B Out	-	-	-	J19	J44	J69
IF IN	J7	J21	-	J21	J46	-
IF Out	J8	J22	J32	J24	J49	J72
70MHz Mod out	-	-	-	J22	J47	J72
Ones Detect	J9/16	J9/21	J9/23	J5	J30	J55
Demod Lock	J9/3	J9/8	J9/11	J10	J44	J60
SDI	J9/4	J9/9	J9/10	J15/1	J40/1	J65/1
RS422/Clock A_p	J23/1	J23/5	J23/9	J20/1	J45/1	J70/1
RS422/Clock A_n	J23/14	J23/18	J23/22	J20/14	J45/14	J70/14
RS422/Data A_p	J23/2	J23/6	J23/10	J20/2	J45/2	J70/2
RS422/Data A_n	J23/15	J23/19	J23/23	J20/15	J45/15	J70/15
RS422/Clock B_p	J23/3	J23/7	J23/11	J20/3	J45/3	J70/3
RS422/Clock B_n	J23/16	J23/20	J23/24	J20/16	J45/16	J70/16
RS422/Data B_p	J23/4	J23/8	J23/12	J20/4	J45/4	J70/4
RS422/Data B_n	J23/17	J23/21	J23/25	J20/17	J45/17	J70/17
RS422/Clock C_p	-	-	-	J20/5	J45/5	J70/5
RS422/Clock C_n	-	-	-	J20/18	J45/18	J70/18
RS422/Data C_p	-	-	-	J20/6	J45/6	J70/6
RS422/Data C_n	-	-	-	J20/19	J45/19	J70/19
RS422/Clock D_p	-	-	-	J20/7	J45/7	J70/7
RS422/Clock D_n	-	-	-	J20/20	J45/20	J70/20
RS422/Data D_p	-	-	-	J20/8	J45/8	J70/8
RS422/Data D_n	-	-	-	J20/21	J45/21	J70/21
Color Legend	75 Ω BNC	MDM-25	50 Ω MMCX	50 Ω BNC	DB-9	

3.3.2.1 1U Digital Output MDM-25 D-Sub Pinout-J9

The pinout for the 1U J9, an MDM-25 D-sub connector, is shown in Table 6. Pin locations are illustrated in Figure 8.

Table 6: 1U Digital Output MDM-25 D-Sub Pinout (J9)

Pin	Electrical Char.	Pin	Electrical Char.
1	GND	14	CH1 CLK B (TTL)
2	GND	15	CH1 DATA B (TTL)
3	CH1 Demod Lock (TTL)	16	CH1 Ones Detect (TTL)
4	CH1 SDI (RS-423)	17	GND
5	N/C	18	N/C
6	GND	19	CH2 CLK B (TTL)
7	DND	20	CH2 DATA B (TTL)
8	CH2 Demod Lock (TTL)	21	CH2 Ones Detect (TTL)
9	CH2 SDI (RS-423)	22	GND
10	COMB SDI (RS-423)	23	COMB Ones Detect (TTL)
11	COMB Demod Lock (TTL)	24	COMB Data B (TTL)
12	GND	25	COMB CLK B (TTL)
13	GND		

3.3.2.2 1U RS-422 Output MDM-25 D-Sub Pinout-J23

The pinout for the 1U J23, an MDM-25 D-sub connector, is shown in Table 7.

Pin locations are illustrated in Figure 8.

Table 7: 1U RS-422 MDM-25 D-Sub Pinout (J23)

Pin	Electrical Char.	Pin	Electrical Char.
1	CH1 CLK A RS-422_p	14	CH1 CLK A RS-422_n
2	CH1 DAT A RS-422_p	15	CH1 DAT A RS-422_n
3	CH1 CLK B RS-422_p	16	CH1 CLK B RS-422_n
4	CH1 DAT B RS-422_p	17	CH1 DAT B RS-422_n
5	CH2 CLK A RS-422_p	18	CH2 CLK A RS-422_n
6	CH2 DAT A RS-422_p	19	CH2 DAT A RS-422_n
7	CH2 CLK B RS-422_p	20	CH2 CLK B RS-422_n
8	CH2 DAT B RS-422_p	21	CH2 DAT B RS-422_n
9	COMB CLK A RS-422_p	22	COMB CLK A RS-422_n
10	COMB DAT A RS-422_p	23	COMB DAT A RS-422_n
11	COMB CLK B RS-422_p	24	COMB CLK B RS-422_n
12	COMB DAT B RS-422_p	25	COMB DAT B RS-422_n
13	GND		
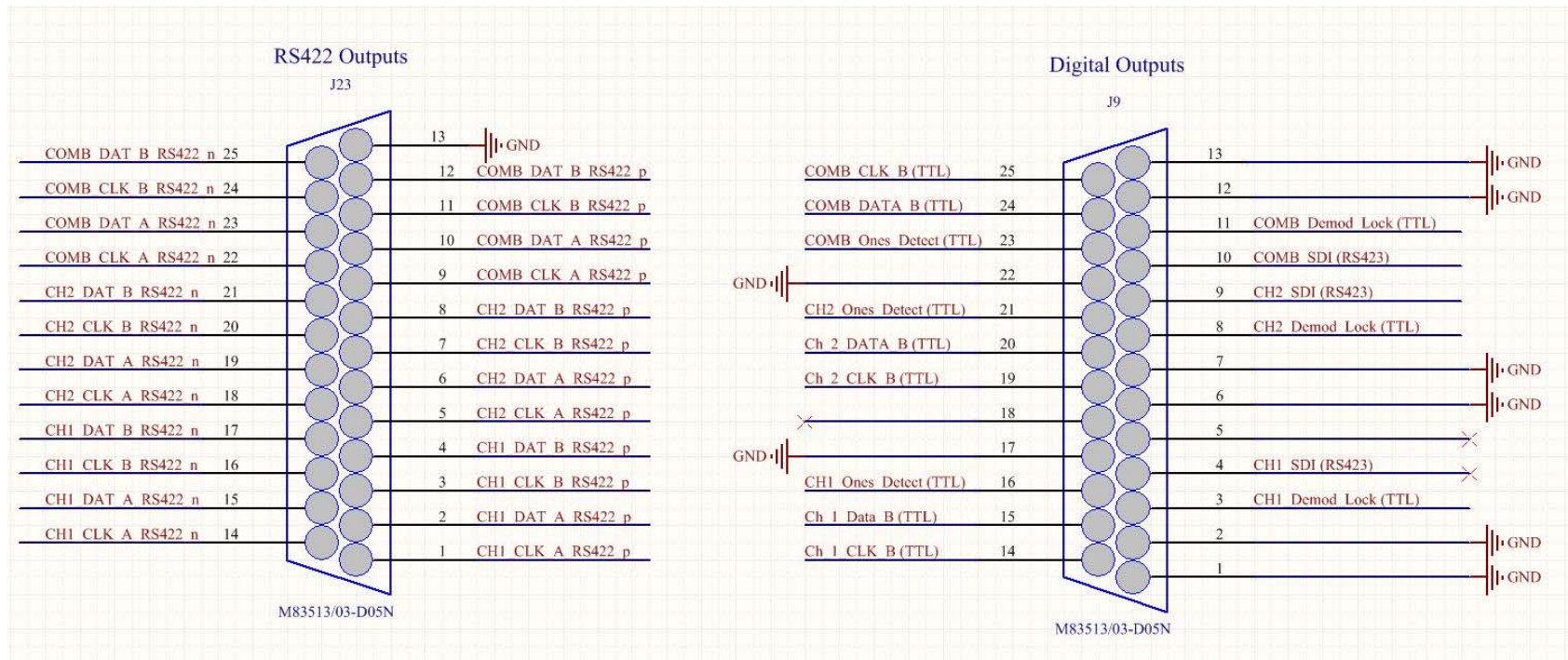
Figure 8: 1U MDM-25 D-Sub Pin Locations for J23 and J9

3.3.3   Electrical Signals

By default, the output data is valid on the falling edge of the clock, as shown in Figure 9. The polarity of the output clock may be inverted by toggling the Clock Polarity setting in either user interface. The RM RDMS™ can be operated through its front panel interface or web-based browser interface (RDMS™ Browser Interface).

Baseband Signal Timing - 0 degree clock
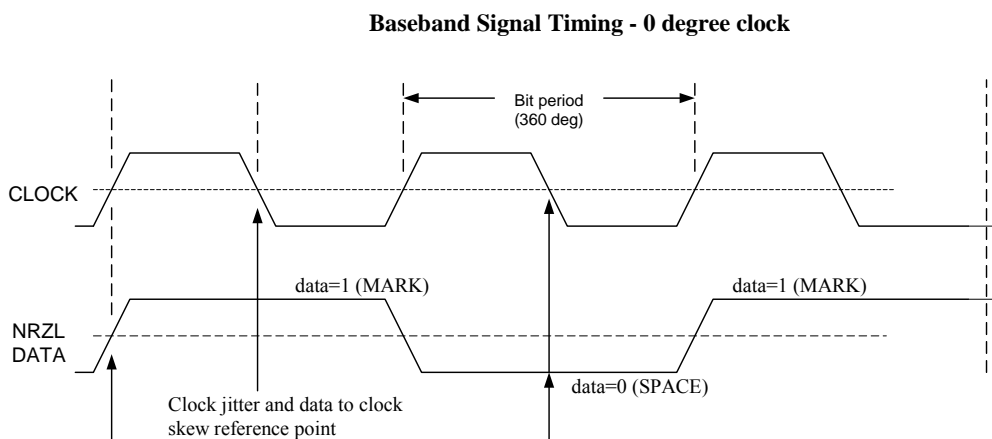
Figure 9: Baseband Signal Timing

The RF input to the receiver is a 50 ohm interface.

The RM RDMS™ also provides a 70 MHz IF output for each channel for troubleshooting purposes.

3.4   Browser Interface

The 3rd Generation Rack-Mount RDMS™ Receiver contains a built-in web server. The receiver's browser-based graphical user interface enables configuration and monitoring of one, or multiple, RDMS™ units on the user's network. While the Browser Interface works with most modern browsers, the latest version of Firefox or Chrome is recommended. Quasonix recommends running Firefox in Private mode or disabling caching to improve performance. HTML5 compatibility is required. The Browser Interface (BI) provides easy-to-read, real-time status information to the user, thus eliminating the need for direct access to the front panel.

Browser Interface is laid out intuitively with all primary control and monitoring functionality for Channel 1, Channel 2, and diversity combiner in one window.

To access the Browser Interface:

1. Plug a network cable into the RDMS™.

2. Apply power to the RDMS™.

3. Open a browser on the PC.

    The rack has an IP address assigned to it when the user sets it up. If it is static, the user must provide an IP address. If it is dynamic, the network assigns an IP address to the RDMS™. The operator needs to know this IP address. The Ethernet screen on the RDMS™ front panel displays the IP address. (Refer to section 4.6.3.1.14 for additional information about the Ethernet screen.)

4. Type the IP address into the browser as:

http://XXX.XXX.XXX.XXX

where the X's represent the IP address of the rack.

The main Browser Interface web page displays in the browser window and the user has control of the rack.

For issues that occur during installation, call Quasonix Technical Support at 513-942-1287.

4   Operating Instructions

The RM RDMS™ can be operated through its front panel interface or via the web-based browser interface (RDMS™ Browser Interface). The browser interface is capable of configuring, maintaining, and monitoring multiple receivers within a network.

4.1   Operational Priority

With two different user interfaces available—direct front panel operation and remote control—consideration must be given to one or the other to maintain device stability.

- The front panel control takes precedence over the Browser Interface unless the front panel is displaying "Please Wait".

- Changes saved from the Browser Interface are automatically updated on the front panel.

- Changes made on the front panel are automatically updated on the Browser Interface Monitor window; however, a user accessing the Configure window on the Browser Interface at the same time is notified of changes so unsaved modifications are not overwritten.

- Users may also access the RDMS remotely via Telnet

Telnet provides access to the individual receiver channel's underlying serial control interface. The serial control interface is **not** recommended for *typical* Rack-Mount Receiver usage. The Telnet interface should only be accessed by advanced users. **Contact Quasonix customer support before using the Telnet option.**

NOTE: Access to this serial control interface is provided primarily for debugging purposes. Unlike the standard front panel and browser interfaces, the serial control interface within the Telnet window is not safeguarded from accidental or improper changes to the receiver's configuration.

It is **strongly** recommended that users contact Quasonix Technical Support (Tel: 513-942-1287) prior to using the Terminal serial control interface.

Additional information about the Telnet interface is located in section 4.8.

4.2 Front-Panel Control

4.3 1U Front Panel Control

The 1U Rack-Mount Receiver's comprehensive front panel interface includes (4) 64k-color liquid crystal displays (LCDs) for displaying receiver status, configuration settings, and waveform graphics; individual function keys for the most common settings; and a complete numeric keypad for convenient parameter entry.

In a single-channel configuration, waveform graphics are displayed on the left-most LCD and receiver settings are on the second LCD from the left. A static Quasonix logo is shown on the two right-most LCDs.

In a dual-channel receiver, the two LCDs located to the right of the power switch are designated for Channel 1, while the other two LCDs are designated for Channel 2.

Figure 10: Front Panel Diagram for Dual-Channel Configuration

The front panel keypad is shown in Figure 11.

Figure 11: Front Panel Keypad

4.4 3U Front Panel Control

The 3U front panel control interface is identical to the 1U front panel control interface except that the front panel keypad is implemented as a virtual keypad on the right touchscreen of the 3U, as shown in Figure 12.
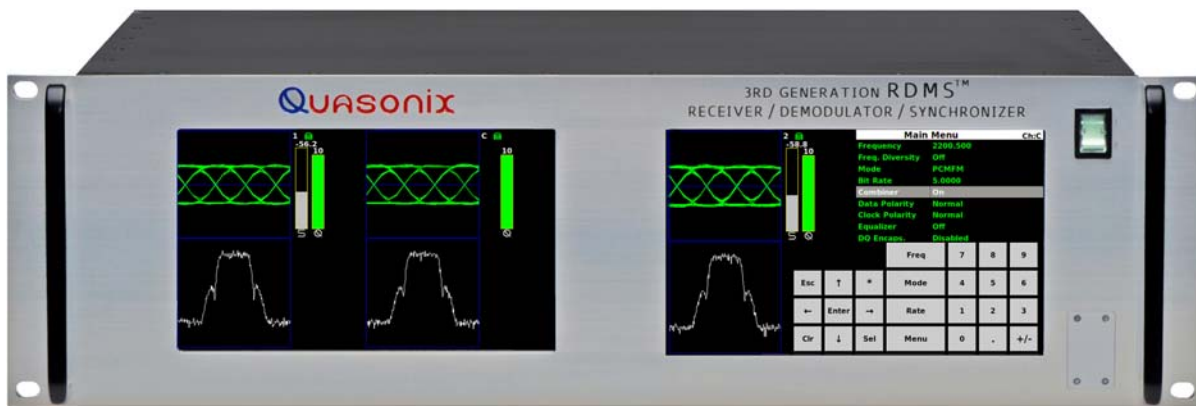
Figure 12: 3U Front Panel Graphics, DQM, Main Menu, and Virtual Keypad

4.5   Waveform Graphics

Each channel's waveform graphics display provides a real-time visual representation of the received signal's constellation, or eye pattern in the case for PCM/FM.

An example of a PCM/FM eye pattern is shown in Figure 13. An example of an SOQPSK constellation is shown in Figure 14.
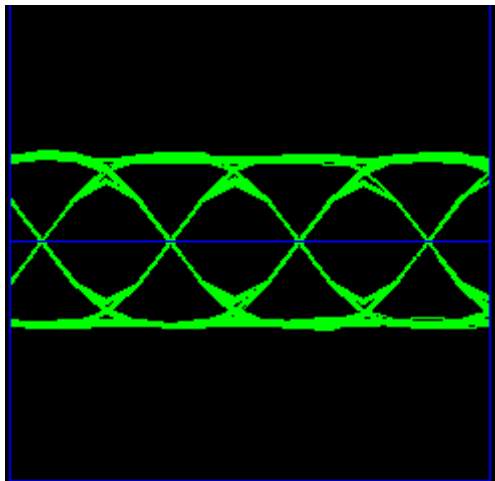
Figure 13: Example PCM/FM Eye Pattern
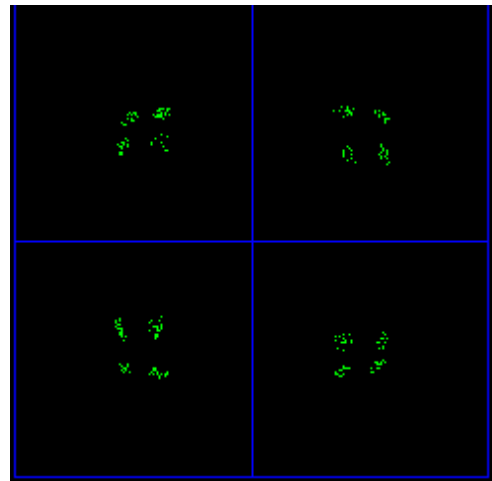
Figure 14: Example SOQPSK Constellation

In addition to the eye pattern or constellation, the waveform graphics screen displays signal strength and signal quality in vertical bar graph form, a red line AGC Zero On indicator in the Signal Strength bar, and signal lock detect through a padlock icon, as shown in Figure 15.
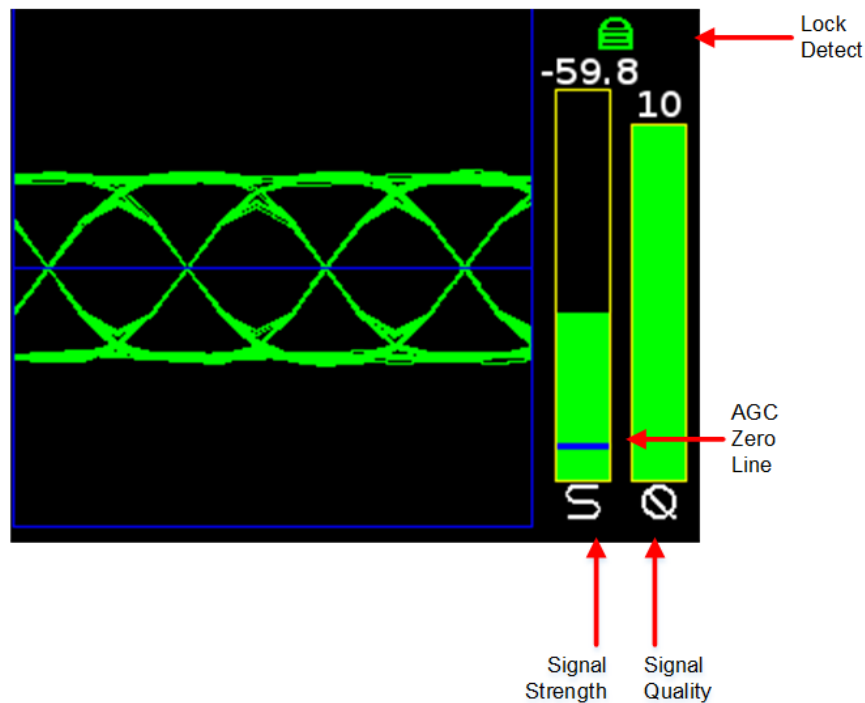
Figure 15: Waveform Graphics LCD with Locked PCM/FM Signal

The signal strength bar, the left of the two with the letter "S" below it, transitions from red at 0 dB Eb/N0 to green at 10 dB Eb/N0 and greater. The level in dBm is indicated above the bar.

The measurement of strength from an incoming telemetry signal by itself does not provide enough information about the integrity of the received data. Therefore, the Data Quality Metric (DQM) is displayed to the right of the signal strength bar, with "Q" below the graph. It transitions from red, being a zero (0) quality, to green, being a quality of 10. The DQM level is displayed at the top of the bar.

4.6   Navigation

The Rack-Mount Receiver's traditional hierarchical menu structure is navigated using the arrow and Enter keys on the front panel keypad, as shown in Figure 16.
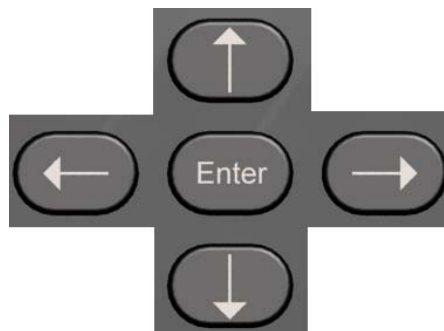
Figure 16: Front Panel Navigation Keys

4.6.1   Selecting a Receiver Channel

In a single-channel configuration all front panel keys are active for the receiver. In a dual-channel configuration, Channel 1 will be active upon start-up by default. To toggle control between the channels, press the Select Unit key on the front panel keypad.

Figure 17: Select Unit Key

The LCD dedicated to receiver settings that is under active control features a white header bar and green text. The channel number displays in the top right hand corner of the screen. In Figure 18, "CH C" designates Combiner. When the Combiner is On, the Frequency Diversity option must be set to On to see separate Frequency selections for Channel 1 and Channel 2.

Figure 18: Active Main Menu Settings LCD

The Please Wait message, shown in Figure 19, displays whenever the RDMS™ is busy—generally when processing a command for longer than one second. This usually occurs during a Mode change, Ethernet configuration, or due to configuration via the Browser Interface.
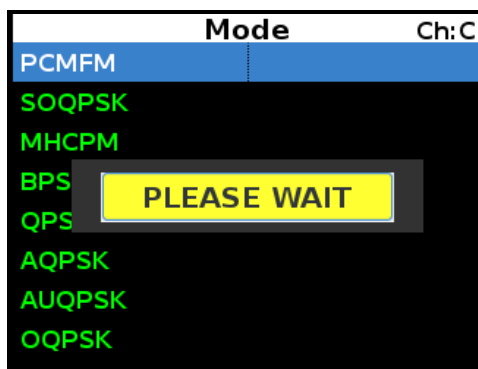
Figure 19: Mode Display with Wait Message

4.6.2   Main Menu Settings

The available options from the Main Menu screen include the following:

- Frequency

- Frequency Diversity (Diversity Combiner On)

- Mode

- Bit Rate

- Combiner

- Data Polarity

- Clock Polarity

- Equalizer

- DQ Encapsulation

- Derandomizer

- Modulation Scaling (PCM/FM mode only)

- Modulation Persistence (PCM/FM mode only)

- Differential Decoding (SOQPSK mode only)

- AGC Menu

- AM Menu

- Options Menu

- Advanced Menu

- System Settings

- Graphics Menu

NOTE: Several of the Main Menu settings are also available via direct access function keys located to the left of the numeric keypad. These include Frequency ('Freq'), Mode, and Bit Rate ('Rate'). The front panel keypad is shown in Figure 20. Depending on the number of options provided with the RDMS™, some menu items may not display when the RDMS™ is powered on. To see additional LCD menu options, use the arrow keys to scroll up or down. The complete list redisplays continuously forward or backward, depending on which arrow key is pressed.

Figure 20: Front Panel Keypad

To change a setting or access a secondary menu, use the arrow keys to navigate to the parameter. When highlighted, the Enter key prompts a secondary menu screen or a setting screen, or changes the setting itself if there are only two possible states. To back out of a sub-menu, press the Escape key, 'Esc' on the front keypad.

4.6.2.1   Frequency

There are two methods available to the user to set the receiver's frequency. The first one is to press the Freq key on the front panel keypad. The second method is to highlight the Frequency option on the Main Menu, then press the Enter key on the PC keyboard.

Figure 21: Frequency Key on Front Panel

Figure 22: Main Menu, Frequency Setting

Either method displays a frequency entry screen prompting the operator to type a frequency using the rack's front panel keypad.
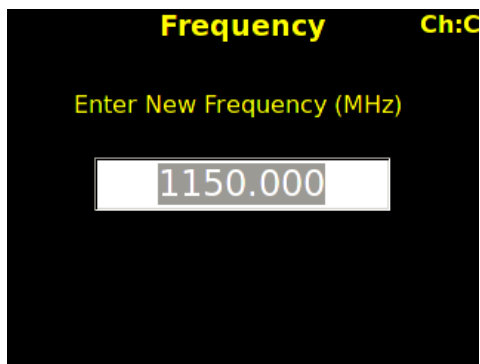
Figure 23: Frequency Entry Screen

The default frequency is highlighted. The user can use the front panel keypad to:

a. Delete the entire number by pressing the left arrow key

b. Move the cursor to the end of the number by pressing the right arrow key

c. Begin typing the desired frequency, in MHz, using the numeric keypad

For example, to set the frequency of an S-band receiver to 2250.5 MHz, press the following key combination:
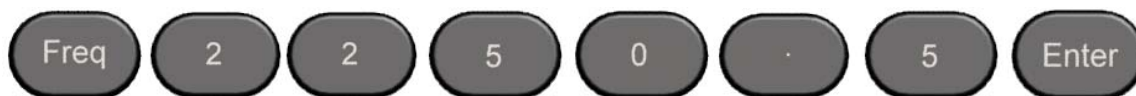
Figure 24: Example Keypad Combination for Setting Frequency

The available center frequencies are based on the band(s) and any extended options that are ordered, as shown in Table 2.

4.6.2.1.1 Playback Demodulator

The Playback Demodulator function allows the RDMS™ to demodulate signals from a previous mission recorded by an Intermediate Frequency (IF) Recorder. This approach has several possible advantages, including superior trellis demodulation capability relative to other receivers that may have been utilized for the original mission, and the ability to replay the mission multiple times with different settings to obtain the best achievable results.

When the RDMS™ Frequency is set to 75 kHz to 20 MHz, or 70 MHz with a selectable SAW filter (which is well below the standard 200.0 MHz-5250.0 MHz range), the RF downconverter is bypassed and demodulator IF input comes from the IF Input BNC instead. From this input, it is SAW filtered according to the IF Filter setting and demodulated as if it had been received by the RF front end. Accordingly, all demodulator-related settings will affect the performance of the demodulation process.

The normal gain control provided by the RF front end AGC is unavailable when using the receiver as a playback demodulator. Some IF input gain compensation is available, but the input signal must be within the range -30 dBm $\pm$ 10 dB to obtain optimal performance.

Mod scaling Acquisition mode (the default) accurately determines the modulation index of a signal in the presence of additive white Gaussian noise (AWGN). While AWGN is always present to some extent when the RF front end is in use, it may not be present when the signal comes directly from the IF input, at least until the playback signal is applied to the demodulator input.

There are a few possible approaches to ensure proper demodulation of PCM/FM signals in playback demodulation:

- If the modulation index is known to be 0.7 (e.g., the recorded source was taken from a digital transmitter), set Mod Scale to Off.

- If there is time for a manual operation after the start of playback, set Mod Scale to Off prior to playback and switch Mod Scale to Acquire after starting playback.

- If the modulation index is not 0.7 and acquisition during playback is not feasible, set Mod Scale to Tracking.

Refer to section 4.6.2.11, for additional information about Modulation Scaling.

4.6.2.2 Frequency Diversity (Available with Diversity Combiner)

The Frequency Diversity option allows the user to independently change the frequency of each channel when the diversity combiner is On.

The FreqDiversity option is toggled On or Off using the Enter key on the front panel keypad.

If there are two channels, the Combiner is set to On, and Frequency Diversity is Off, the channels are updated simultaneously and the Frequency Ch2 option does not display.

Figure 25: Main Menu, Frequency Diversity Setting

4.6.2.3 Mode

To set the mode, or modulation, press the Mode key on the front panel keypad for a display of the available choices. Use the keypad arrows to navigate to the desired mode, and then press the Enter key.

Figure 26: Main Menu, Mode Setting

Due to character limitations in the on-screen menu, some modulation names have been shortened. The following table lists the modes, as they will appear on the screen in the left column, with the generally accepted naming convention in the right column.

Table 8: Modulation Naming Convention

Screen Name	Actual Name
PCMFM	PCM/FM
SOQPSK	SOQPSK-TG
MhCPM	Multi-h CPM / ARTM CPM
BPSK	BPSK
QPSK	QPSK
AQPSK	AQPSK
AUQPSK	AUQPSK
OQPSK	OQPSK
UQPSK	UQPSK
DPM	Digital Phase Modulation
STC	Space Time Coding
SOQPSKLDPC	SOQPSK with Low Density Parity Check (LDPC) Decoder
STCLDPC	Space Time Coding with Low Density Parity Check
OQPSKLDPC	OQPSK with Low Density Parity Check

NOTE: Changing modes causes the receiver to reload the FPGA, which takes approximately twelve (12) seconds to complete. A 'Please Wait' message displays on the front panel display screen to indicate that the unit is being re-configured. The unit is temporarily unavailable during this time.

4.6.2.4   Bit Rate

There are two methods available to the user to set the receiver's bit rate. The first one is to press the Rate key on the front panel keypad. The second method is to highlight the Bit Rate option on the Main Menu, then press the Enter key on the PC keyboard.

Figure 27: Rate Key on Front Panel

Figure 28: Main Menu, Bit Rate Setting

Either method displays a bit rate dialog screen prompting the operator to enter a bit rate using the rack's front panel numeric keypad, in Mbps. A decimal point is only needed for bit rates with fidelity down into the kilobits per second range.

Figure 29: Bit Rate Entry Screen

For example, to set the bit rate to 10 Mbps, press the following key combination:
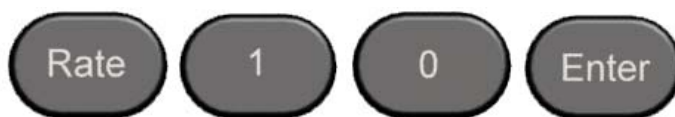
Figure 30: Example Keypad Combination for Setting Bit Rate

If an out-of-range bit rate is entered, the maximum or minimum possible rate will be set by default. For instance, if the user attempts to set the bit rate to 50 Mbps in SOQPSK-TG mode, the receiver will default back to 46 Mbps, the highest possible rate in that particular mode.

4.6.2.5   Combiner (Optional)

A pre-detection diversity combiner is available as an option for dual-channel receivers. If diversity combining is installed on the RDMS™, it can be enabled through the Main Menu > Combiner option.

Figure 31: Main Menu, Combiner Setting

When the combiner is enabled on one channel, the second channel automatically reflects this change.

Additionally, any parameter changes made by the user in one channel will automatically be made for the second channel, from which the combined signal is partially derived. The only setting that can still be changed individually when the diversity combiner is turned on is the channel frequency, which allows for frequency diversity to be implemented. To illustrate the synchronization of settings, the second channel's settings menu highlight bar will mimic the navigation path being taken by the user in the first channel.

Note: Whenever the Diversity Combiner is On, any changes made to the Frequency option (even with Frequency Diversity On enabled) causes Modulation Scaling for *both channels* to be set to the same value. However, if Mod Scaling was set to Locked when the Frequency was changed, Mod Scaling will change to Tracking.

4.6.2.6   Data Polarity

The Data option on the Main Menu is for adjusting the data polarity. The parameter options are Normal and Inverted. To change the polarity, press the Enter key when the parameter is highlighted from the Main Menu. The default is Normal.

Figure 32: Main Menu, Data Setting

4.6.2.7 Clock Polarity

The Clock option on the Main Menu is for adjusting the clock polarity. The parameter options are Normal and Inverted. To change the polarity, press the Enter key on the front panel keypad when the parameter is highlighted on the Main Menu. The default is Normal.

Figure 33: Main Menu, Clock Setting

4.6.2.8 Equalizer (Optional)

The (Adaptive) Equalizer option provides improved reception in multipath channels by reducing distortion. By enabling the equalizer, multipath fading is reduced and overall link availability is improved.

The Equalizer option is toggled On or Off using the Enter key on the front panel keypad.

Figure 34: Main Menu, Equalizer Setting

4.6.2.9 Data Quality Encapsulation (DQE)

Data Quality Encapsulation is the process of bundling data quality information along with payload data. This information is intended for use by a Best Source Selector (BSS) to optimally select correct payload data bits from amongst multiple streams of potentially errored payload data. Note that optimal performance can only be achieved if all sources of input to the BSS have independent errors; that is, related sources of data like Channel 1, Channel 2, and Combiner from a single receiver should not be presented to the BSS simultaneously.

Data quality is encoded as a Data Quality Metric (DQM). When calibrated per a standardized procedure, DQM based on bit error probability (BEP) allows DQE from multiple vendors to interoperate.

The Quasonix DQM is based on statistics developed deep inside the demodulator. Bit Error Probability (BEP) is the calculated likelihood that a bit is in error. A very low BEP can be determined from only a few bits. BEP does not require any known data and can be determined quickly and accurately from demodulator statistics. It is an unbiased quality metric, regardless of channel impairments. The DQM is calculated directly from BEP.

The basic DQM calibration fixture is described in the following steps and illustrated in Figure 35.

1. Input corrupted data (with clock)
2. Extract the frame sync word
3. Measure the BER of payload data
4. Compare DQM (converted to BEP) to measured BER and record/store on a packet by packet basis
5. Post process BEP and BER to develop score
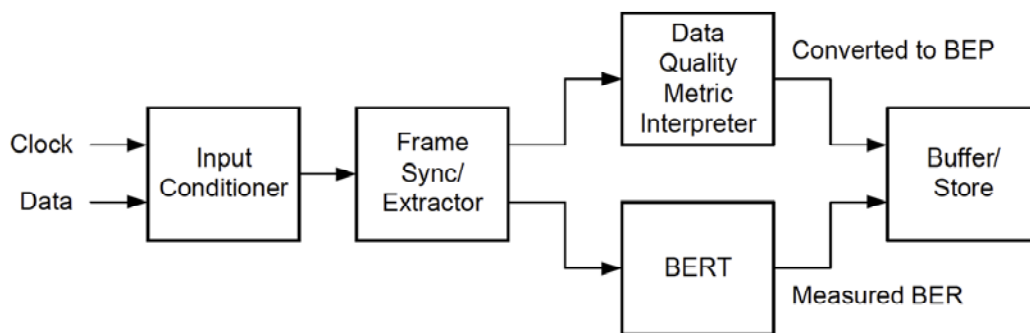
Figure 35: DQM Calibration Fixture Process

The DQE format includes a header consisting of the following:

- 16-bit sync pattern (0xFAC4)

  MSB first: 1111101011000100

- 16-bit ID word (format TBD)

- 16-bit DQM = min(round(-log10(LR) / 12 * (2^16)), 2^16 -1)

  16-bit unsigned integer, ranges from 0 to 65,535

  Likelihood Ratio (LR) = BEP / (1-BEP)

  Easily reversed:

  $$LR = 10^{(-12 * DQM / 2^{16})}$$

  $$BEP = LR / (1 + LR)$$

  Q is defined as the "User's DQM":

  $$Q = 12 * DQM / 65536$$

  Represents the exponent of 10 in the LR, which approximates the BEP

  Examples:

  Q = 3   BEP = 1E-3

  Q = 7   BEP = 1E-7

BEP	LR	DQM	Q
0.5	1.00	0	0.00
1E-01	1.11111E-01	5211	0.95
1E-02	1.01010E-02	10899	2.00
1E-03	1.00100E-03	16382	3.00
1E-04	1.00010E-04	21845	4.00
1E-05	1.00001E-05	27307	5.00
1E-06	1.00000E-06	32768	6.00
1E-07	1.00000E-07	38229	7.00
1E-08	1.00000E-08	43691	8.00
1E-09	1.00000E-09	49152	9.00
1E-10	1.00000E-10	54613	10.00
1E-11	1.00000E-11	60075	11.00
1E-12	1.00000E-12	65535	12.00

Figure 36: DQE Format

Payload data is a user selectable length with a default of 4096 bits, with the exception of STC mode, where the default is 3200 bits, and SOQPSK/LDPC or STC/LDPC mode, where the default is the selected LDPC block size.

With a payload data length of 4096 bits, the network bandwidth expansion is ~1%.

DQM accuracy is verified under various channel impairments including AWGN-static level, AWGN-dynamic level (step response), dropouts, in-band and adjacent channel interference, phase noise, timing jitter, static multipath, and dynamic multipath (similar to break frequency).

To change the DQE, press the Enter key on the front panel keypad when the parameter is highlighted on the Main Menu. The parameter options are Enable or Disable. Toggle between options to select the desired state. The default is Disabled.

Note: When DQE is enabled, normal bit error rate measurements cannot be made on the output data stream.

Figure 37: Main Menu, DQ Encapsulation

As noted above, the DQM is displayed as Signal Quality on the front panel, with a color-coded bar and a number above it (0-10).

4.6.2.10 Derandomizer

The RM RDMS™ includes a derandomizer, which can be enabled (two modes) or disabled by selecting the parameter from the Main Menu and pressing the Enter key on the front panel keypad. The default setting for the derandomizer is Off.

Figure 38: Main Menu, Derandomizer

- Off

- IRIG – Standard running mode for non-LDPC operation

- CCSDS – Only available when an LDPC Mode is enabled (SOQPSKLDPC, STCLDPC, or OQPSKLDPC)
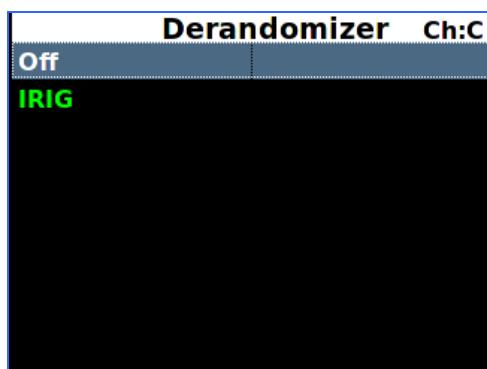
Figure 39: Derandomizer Selections, Non-LDPC
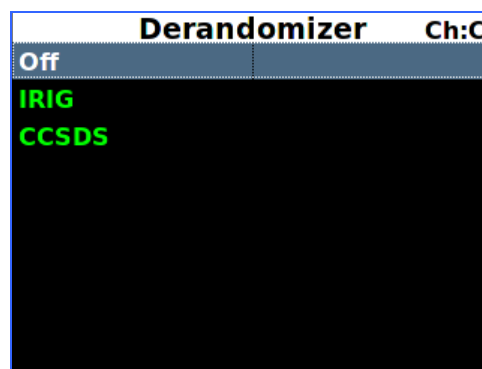
Figure 40: Derandomizer Selections, LDPC

4.6.2.11 Modulation Scaling (PCM/FM Mode Only)

Modulation Scaling is a method used to retain the maximum trellis coding gain of a non-ideal FM signal. There are four possible settings: Tracking, Hold, Off, or Acquire.

4.6.2.11.1 Modulation Scaling – Tracking

When the RDMS™ is powered on, the default setting is Acquire, unless the unit was powered off from a preset condition. If the unit was powered off from an unmodified preset setting, then the default condition of Modulation Scaling is as defined in the preset. When Tracking is set, the modulation scale index is actively being tracked.

Note: The active setting is not saved when the rack is powered off, unless the Mod Persist option was set to On.

Frequency, mode, and bit rate changes, or any changes to a preset, cause the Modulation Scaling setting to revert back to Tracking. This is because the optimal signal monitoring is no longer valid.

Note: Whenever the Diversity Combiner is On, any changes made to the Frequency option (even with Frequency Diversity On enabled) causes Modulation Scaling for both channels to be set to Tracking.
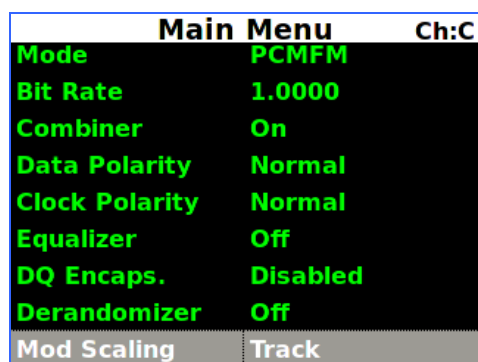
Figure 41: Main Menu, Modulation Scaling – Tracking
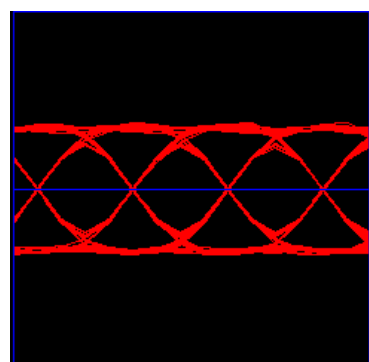
Figure 42: Red Eye Pattern Display – Tracking

The graphing eye pattern is displayed in **RED** when in Tracking mode.

If there are two channels, and the Combiner is set to On, the Modulation Scaling controls for setting the modes are linked. In Acquire or Tracking mode, the actual scaling operation functions independently in each channel.

4.6.2.11.2 Modulation Scaling – Hold

When the RDMS™ has a good lock on the target transmitter, Modulation Scaling should be set to Hold by highlighting the Mod Scaling option on the Main Menu and then pressing the Enter key on the keypad.

When Modulation Scaling is set to Hold, the graphing eye pattern is displayed in **GREEN**, indicating the optimal modulation index is set.

Figure 43: Main Menu, Modulation Scaling – Hold
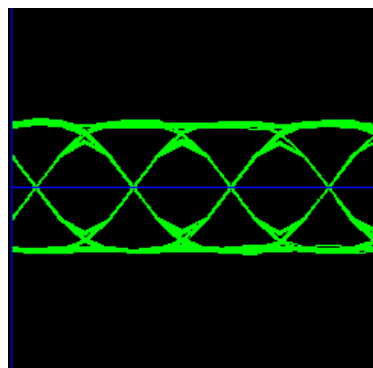
Figure 44: Green Eye Pattern Display – Hold

If Modulation Scaling is set to Hold, as shown in Figure 43, the active modulation scale index is also locked in on a particular setting. The modulation scale index number displays next to the Hold setting.

If an index number was entered manually using the Mod Scale Index option (on the Mod Scaling Menu), Modulation Scaling is simultaneously changed to Hold and reflects the Index value set via the Mod Scaling Menu.

Locked index numbers, manually or automatically selected, are lost when the Mod Scaling option is set to Tracking, Off, or Acquire. If the Locked index number is to be retained following a power-off cycle of the rack, then turn on the Mod Persist option via the Main Menu. Refer to section 4.6.2.12, Modulation Persistence.

4.6.2.11.3 Modulation Scaling – Off

The Mod Scaling Off setting is shown in Figure 45. When Modulation Scaling is set to Locked, the graphing eye pattern is displayed in **GREEN**, indicating the optimal modulation index is set.

Figure 45: Main Menu, Modulation Scaling – Off
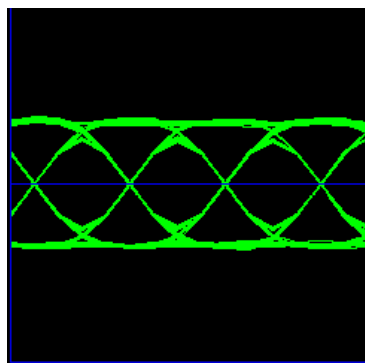
Figure 46: Green Eye Pattern Display – Off

With Mod Scaling turned Off, the Mod Index is set to the optimal 0.700. Mod Scaling should be turned off when a new generation, digitally synthesized transmitter is the source. Digitally synthesized transmitters do not have a variable deviation sensitivity adjustment, and as such are not subject to inaccurate modulation index settings

4.6.2.11.4 Modulation Scaling – Acquire

When the RDMS™ is powered on, the default setting is Acquire, unless the unit was powered off from a preset condition. Acquire mode has two states: Armed and Triggered. When Modulation Scaling is set to Acquire, in the absence of signal, the eye pattern will turn **Yellow**, as shown in Figure 48, the state is set to Armed. In Armed state, modulation scaling operates continuously.

Figure 47: Main Menu, Modulation Scaling – Acquire
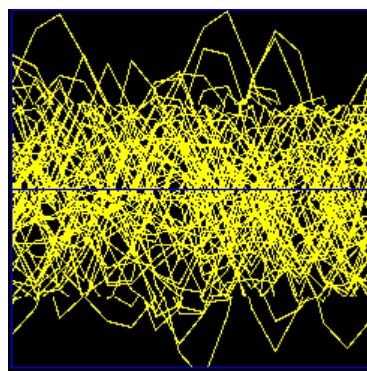
Figure 48: Yellow Eye Pattern Display – Acquire

If the receiver is locked and the delta h (the change in modulation index) has settled below the delta h threshold for the specified settling time, the state changes to Triggered, and the eye pattern will turn **Green**. In Triggered mode, the estimated h (modulation index) is monitored but the scale is not updated.

If delta h goes above the delta h threshold and settles again, the receiver is still locked, and the Eb/N0 at the settling point is higher than the last settling point, the current scaling is updated with the new estimate. There is no transition from Triggered back to Armed except for setting the mode to Acquire again.

4.6.2.12 Modulation Persistence (PCM/FM Mode Only)

The Mod Persist option allows the current state of the Mod Scaling setting to be retained following a power-off cycle of the rack. The default value is Off, as shown in Figure 49.

Figure 49: Main Menu, Modulation Persistence – Off

To retain a Locked index number, or to remain in Acquire mode, scroll to the Mod Persist option, then toggle the setting to On.

Figure 50: Main Menu, Modulation Persistence – On

4.6.2.13 Differential Decoding (SOQPSK Mode Only)

In SOQPSK-TG mode, differential encoding and decoding eliminates the phase ambiguity inherent with the received data. The differential decoder can be enabled or disabled through the Main Menu by pressing Enter when the parameter is selected. The Enter key acts as a toggle switch. Normal SOQPSK operation requires the differential decoder to be On. The default value is On.

Figure 51: Main Menu, Differential Decoding

4.6.2.14 AGC Menu

Access the Automatic Gain Control (AGC) menu from the front panel Main Menu. Select the AGC Menu, and then press the Enter key on the front panel keypad.

Figure 52: Main Menu, AGC Menu Selection

The AGC (Automatic Gain Control) menu, shown in Figure 53, includes the following parameters:

- Polarity (Positive/Negative)

- AGC Scale (dB/V)

- Time Constant (in ms)

- AGC Freeze

- AGC Zero Mode

- Zero AGC

4.6.2.14.1 AGC Polarity

The Polarity option is used to toggle the automatic gain control polarity between positive and negative.

The user may toggle the Polarity values by scrolling to the Polarity option and pressing the Enter key on the front panel keypad until the desired value, plus (+) or minus (-) sign, displays.

Figure 53: AGC Menu, Polarity Highlighted

4.6.2.14.2 AGC Scale

The AGC Scale option, shown in Figure 54, adjusts the voltage of the AGC back panel BNC output. The scale can be set in units of dB/V (decibels per volt). The higher the scale is set, the more dynamic range the AGC output can represent, but the lower its resolution will be.

For example, suppose the AGC zero point is -100 dBm. The AGC output will be 0.0 V when no input signal is applied. When a signal of -80 dBm is received (i.e., 20 dB above the zero point), then the AGC output will be 2.0 V if the scale is set to 10 dB/V and 1.0 V if the scale is set to 20 dB/V. The maximum AGC output voltage is ±5.0 V.

To change the AGC Scale value, select AGC Scale, then press the Enter key on the front panel. An entry screen (Figure 54) prompts the operator to type a new AGC Scale value, in db/V, using the rack's front panel numeric keypad. When the new value is entered, press the Enter key on the keypad.
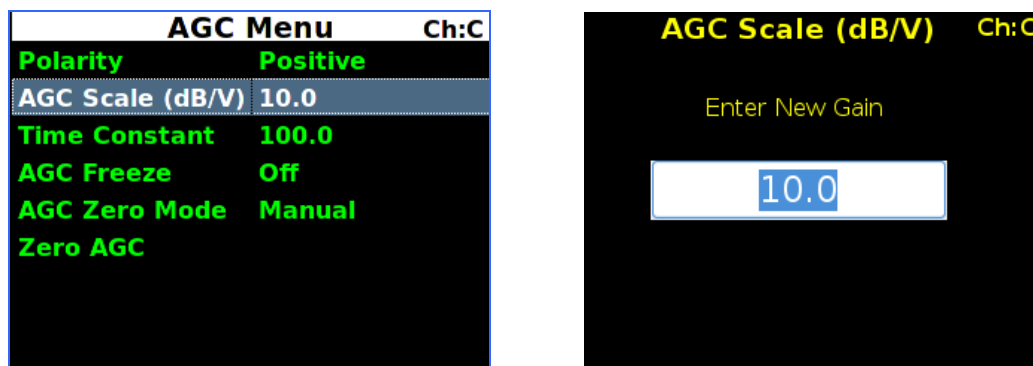
Figure 54: AGC Menu, AGC Scale Selection and Entry Screens

4.6.2.14.3 AGC Time Constant

The Time Constant option, shown in Figure 55, sets the time constant of the AGC back panel BNC output. The time constant can be set in units of ms (milliseconds). The higher the time constant, the slower the AGC output voltage will move in response to changes in input signal level.

Because the AM back panel BNC output tracks any input signal level changes that are not tracked by the AGC, the AM output will include any signal amplitude frequency content from (approximately) the inverse of the AGC time constant up to the AM bandwidth limit. For example, if the AGC time constant is set to 100 ms and the AM

bandwidth is set to 100 Hz, then the AM output will include any AM frequencies between roughly 10 Hz and 100 Hz.

To change the Time Constant value, select Time Constant, then press the Enter key on the front panel. An entry screen (Figure 55) prompts the operator to type a new Time Constant, in milliseconds, using the rack's front panel numeric keypad. When the new value is entered, press the Enter key on the keypad.
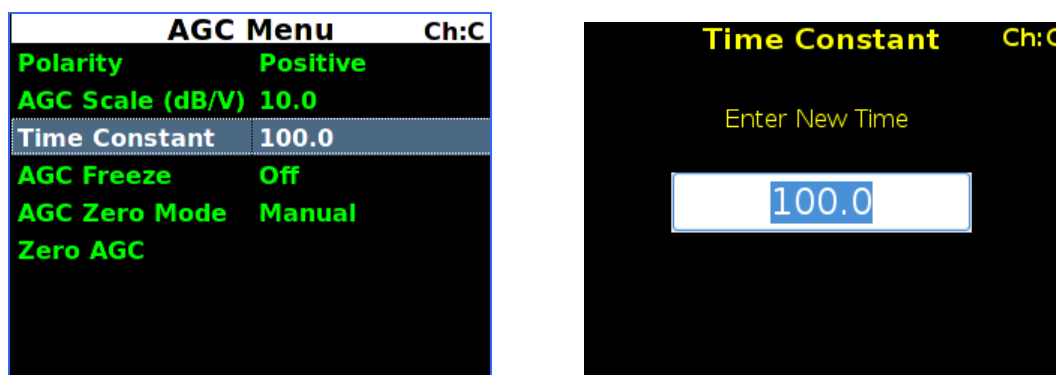
Figure 55: Time Constant Selection and Time Constant Entry Screens

Refer to Appendix B for additional details about recommended AGC/AM settings.

4.6.2.14.4 AGC Freeze

AGC Freeze disables the hardware gain compensation loop such that gain from the RF input to the IF output is fixed. The receiver front end becomes a constant gain block, which may be useful for making receiver noise figure measurements or antenna G/T measurements. Note, however, that RSSI measurement and AM/AGC outputs will continue to reflect changing input levels within a +/-16 dB window around the frozen level. Also, RSSI is calibrated to be precise enough—even varying front-end gain—that AGC Freeze is not absolutely necessary to obtain excellent noise figure or G/T readings via the RSSI measurement.

AGC Freeze can be enabled or disabled through the AGC Menu by pressing Enter when the parameter is selected. The Enter key acts as a toggle switch.
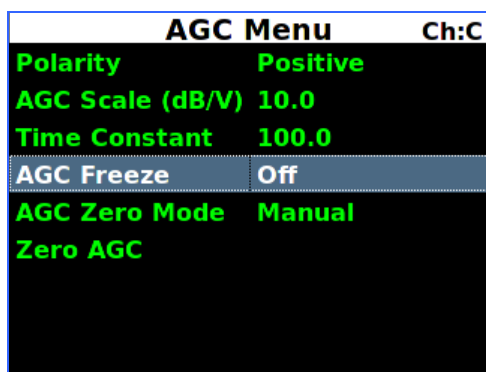
Figure 56: AGC Menu, AGC Freeze Selection

4.6.2.14.5 AGC Zero Mode

The AGC Zero Hold (On/Off) option from the 2nd Generation RDMS was replaced by AGC Zero Mode. There are three available settings, Manual, Hold, or Hold and Save.

- Manual – Means the AGC must be zeroed (set) manually after any frequency or IF bandwidth change, or after a power cycle; the IF bandwidth may change if the bit rate changes

  If AGC was already zeroed and a user scrolls through the AGC Zero Mode options, AGC zero is cleared when Manual is selected.

- Hold – Means the AGC will hold its zero level after any frequency or IF bandwidth change but must be zeroed manually after a power cycle

- Hold and Save – Means the AGC will hold its zero level after any frequency or IF bandwidth change, or after a power cycle

The user may scroll through the AGC Zero Mode values by scrolling to the AGC Zero Mode option and pressing the Enter key on the front panel keypad until the desired value displays.

AGC Menu	Ch:C
Polarity	Positive
AGC Scale (dB/V)	10.0
Time Constant	100.0
AGC Freeze	Off
AGC Zero Mode	Manual
Zero AGC	

Figure 57: AGC Menu, AGC Zero Mode-Manual Highlighted

The AGC Zero mode (manual, hold, or hold and save) remains set if a waveform mode changes.

4.6.2.14.6 Zero AGC

Zero AGC is used to set a baseline for background radio noise levels. The front panel displays provide visual indications whether the AGC is zeroed or not. If Zero AGC has not been set, the signal strength bar displays in gray and lacks the blue zero indication line, shown in Figure 58.

Signal Strength   Signal Quality
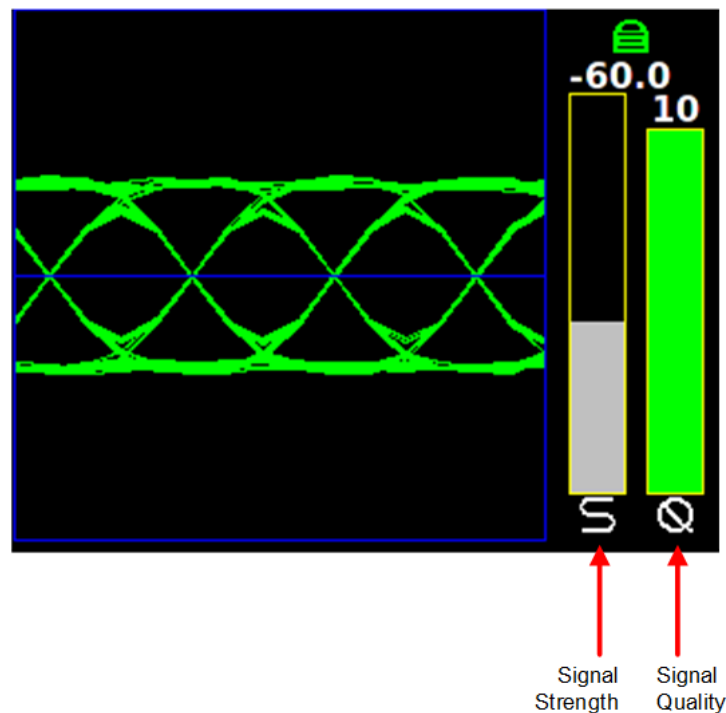
Figure 58: Waveform Graphics Before Zero AGC Set

A typical application of the Zero AGC function is explained in the following example.

1. Connect the receiver to its normal RF signal source, such as antenna, LNA, cabling, and splitters.

2. Orient the receiving antenna in a direction that is expected to yield the lowest signal level that the receiver is likely to encounter, such as a cold, dark sky.

3. Activate Zero AGC under this condition. (Scroll to Zero AGC, and then press the Enter key on the front panel, as shown in Figure 59.)

4. After the Zero AGC is set, the signal strength bar changes from gray to green (if there is a signal lock), and a blue line indicates the zero value set, as shown in Figure 60. The strength bar changes from gray to red if there is no signal lock.

Figure 59: AGC Menu, Zero AGC Highlighted
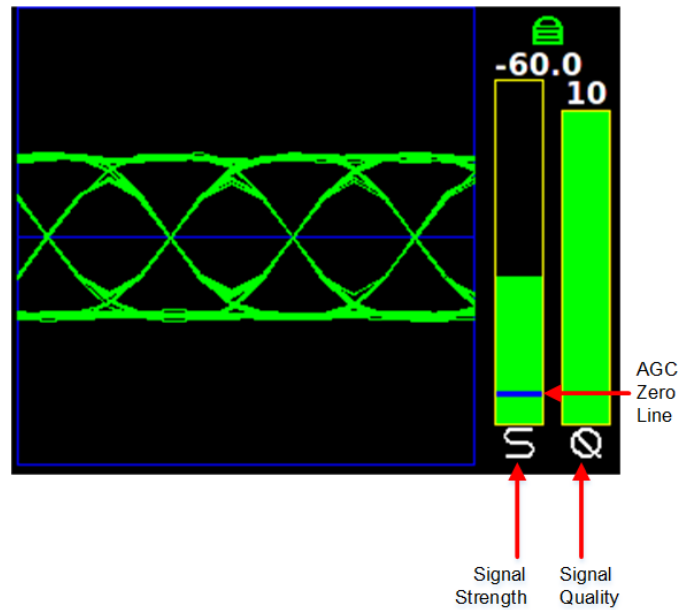
Figure 60: Waveform Graphics After AGC Zero Set

The AGC output voltage is set to zero volts DC at a time when the receiver input is at its minimum value. This process ensures that the AGC output voltage will not cross through zero volts DC under normal operation.

Note: As mentioned in section 4.6.2.14.4, AGC Zero is cleared if a user scrolls to Manual in the AGC Zero Mode options (Manual, Hold, Hold and Save).

4.6.2.15 AM Menu

Access the Amplitude Modulation (AM) menu from the front panel Main Menu. Select AM Menu, then press the Enter key on the front panel keypad.

Figure 61: Main Menu, AM Menu Selection

The AM (Amplitude Modulation) menu includes the following parameters:

- AM Bandwidth (00)

- AM Polarity (Positive/Negative)

- Scale (0.5-2.5)

- AGC Comp (Enabled / Disabled)

4.6.2.15.1 AM Bandwidth

To change the AM Bandwidth value, select the appropriate option, as shown in Figure 62, then press the Enter key on the front panel.

Figure 62: AM Menu, AM Bandwidth Highlighted	**Figure 63: AM Bandwidth Entry Screen**

An entry screen prompts the operator to enter a new AM Bandwidth using the rack's front panel numeric keypad, as shown in Figure 63. When the new value is entered, press the Enter key on the keypad.

The AM Bandwidth can be set from 5.0 to 50000.0 Hz.

4.6.2.15.2 AM Polarity

The user may toggle the AM Polarity (Figure 64) value by pressing the Enter key on the keypad until the desired value displays. Values are Positive and Negative.

Figure 64: AM Menu, AM Polarity Highlighted

4.6.2.15.3 AM Scale

To change the AM Scale value, select the Scale option on the AM Menu, as shown in Figure 65, then press the Enter key on the front panel.

Figure 65: AM Menu, Scale Highlighted   **Figure 66: AM Scale Entry Screen**

An entry screen prompts the operator to enter a new AM Scale using the rack's front panel numeric keypad, as shown in Figure 66. When the new value is entered, press the Enter key on the keypad.

The AM Scale has a range from 0.1 to 2.5. At its default setting of 1, the response is 2V p-p, into a 75 ohm load with a 50% AM.

4.6.2.15.4 AGC Comp

The user may toggle the Automatic Gain Control (AGC) Compensation state by scrolling to the AGC Comp option and pressing the Enter key on the front panel keypad until the desired value displays (Enabled or Disabled). Refer to Appendix B for more information about the AGC Comp function.

Figure 67: AM Menu, AGC Comp Highlighted

4.6.2.16 Options Menu

The Options Menu (Figure 69), which is accessed through the Main Menu (Figure 68), provides the following selections:

- Load Presets Menu

- Save Presets Menu

- Factory Default

Figure 68: Main Menu, Options Menu Selection   **Figure 69: Options Menu, Load Presets**

4.6.2.16.1 Load Presets Menu

The Load Menu allows previously stored configuration settings from the Save Presets screen, or the system default presets, to be retrieved. (The RDMS ships with predefined presets. Presets are always available even if the user has not created any custom presets. There are no "empty" preset slots.) To load saved presets, select the appropriate option, then press the Enter key on the front panel.

The Load Presets screen, shown in Figure 70, displays eight (8) slots which contain saved preset configurations. The menu displays the file name for the preset next to the load slot. These names can be modified via the Browser Interface. The file name may be truncated on the front panel display since the Browser Interface allows up to 20 characters. Use the Up and Down arrow keys to select a load slot with desired file name displayed. Pressing the Enter key loads the stored preset and configures the receiver accordingly.

Figure 70: Load Menu, Load Presets

4.6.2.16.2 Save Presets Menu

With the 3rd Generation RDMS™ there is no such thing as an empty preset. A brand new RDMS™ contains eight default presets. The Save Presets Menu allows the current settings to be saved for convenient retrieval at a later time, or for quickly switching between configurations. The Save Presets Menu, shown in Figure 71, shares the same set of presets with the Browser Interface.

The Save Presets Menu, shown in Figure 71, illustrates the eight (8) slots for saving presets. Use the Up and Down arrow keys to select a save slot. Press the 'Enter' key to save the current configuration in that slot. A wait message displays while the configuration is being saved, then the front panel redisplays the Options Menu.

Quasonix' new Browser Interface may be used to customize a preset name and description as well as select other preset parameters and advanced settings. Users of previous 2nd Generation RDMS™ receivers will find this additional flexibility an improvement over simply typing a new preset name in a front panel screen. The Browser Interface Saved Presets window, discussed in section 4.7.4, is handy for viewing complete preset descriptions. Since there is no delete presets option, this helps the user to know which presets might be overwritten.

Presets may also be exported and imported from a file saved on a connected computer. Refer to section 4.7.6.3 (Export) or section 4.7.6.4 (Import) for additional information.

Save Presets	Ch:C		Save Presets	Ch:C
Preset 1	MIssion 1		Preset 1	My Test Preset
Preset 2	Mission 2		Preset 2	Mission 2
Preset 3	Mission 3		Preset 3	Andromeda3
Preset 4	Mission 4		Preset 4	Mission 4
Preset 5	Mission 5		Preset 5	Mission 5
Preset 6	Mission 6		Preset 6	Mission 6
Preset 7	Mission 7		Preset 7	Mission 7
Preset 8	Mission 8		Preset 8	Mission 8

Figure 71: Save Menu, Save Presets – Slot 1 and Slot 3 Contain Saved Presets

4.6.2.16.3 Factory Default

The Factory Default option allows the user to reset each channel of the Rack-Mount Demodulator/Receivers to the factory default settings. Factory Default reset does not affect Ethernet settings or presets.
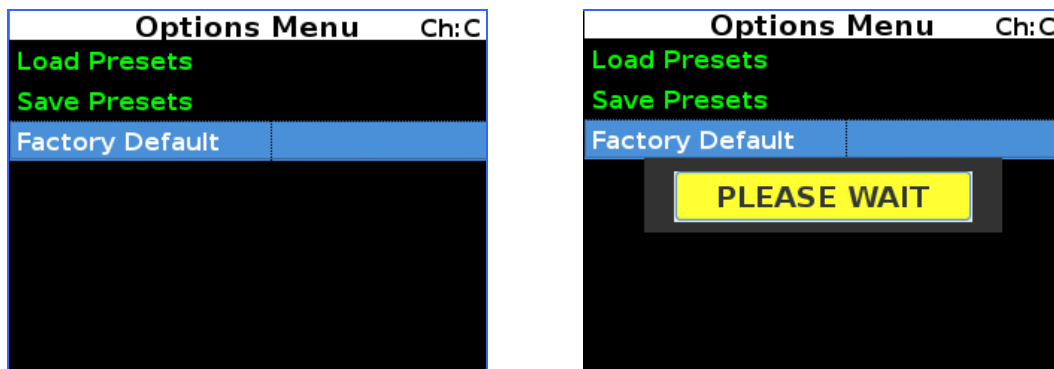
Figure 72: Options Menu, Factory Default Selection and Reset in Process

4.6.2.17 Advanced Menu

The Advanced Menu should only be accessed by advanced users. Contact Quasonix customer support before using these options.

The Advanced Menu, which is accessed via the Main Menu, as shown in Figure 73, provides access to the following options:

- Sync Bit Rate

- IF Filter

- Video DeEmphasis (PCM/FM mode only)

- Video Scale

- Phase Noise Comp (PCM/FM mode only)

- Muting Timeout

- Output Muting

- DC Antenna

- Mod Scale Index

- Best Channel Selector

- Time Aligner

- Combiner Mode

- AFC Mode

- PCM Encoding

- LDPC Mode

Figure 73: Main Menu, Advanced Menu

4.6.2.17.1 Synchronize Bit Rate

Synchronize Bit Rate sets the receiver's commanded bit rate to the value it is currently measuring on the input signal. The purpose of this process is to eliminate unintended bit rate offset error so that the receiver can make full use of its bit synchronizer tracking range, or optionally reduce its tracking range. For the receiver to have an accurate measurement, however, the input signal must be close enough to the previously commanded bit rate to be within the current bit synchronizer lock range and actually be locked.

The Sync Bit Rate option is located on the Advanced Menu, as shown in Figure 74.

Figure 74: Advanced Menu, Sync Measured Bit Rate Selection

To apply the measured bit rate, scroll to the Sync Bit Rate option to highlight it. Then press the Enter key on the front panel keypad. The displayed bit rate value will be set as the new bit rate.

Note, the measured bit rate will be set whether it is accurate or not. For proper operation, ensure that the receiver indicates it is locked (green padlock) prior to using the Sync Bit Rate function.

4.6.2.17.2 IF Filter

The receiver's integrated IF filter module, shown in Figure 75, includes eight (8) SAW filters, ranging in bandwidth from 250 kHz to 40 MHz in approximately one-octave steps. The standard eight filters are 250 kHz, 500 kHz, 1 MHz, 2 MHz, 4.5 MHz, 10 MHz, 20 MHz, and 40 MHz. These filters serve as anti-aliasing filters ahead of the A/D converter in the demodulator itself. In addition, they can provide an added measure of adjacent channel interference rejection.
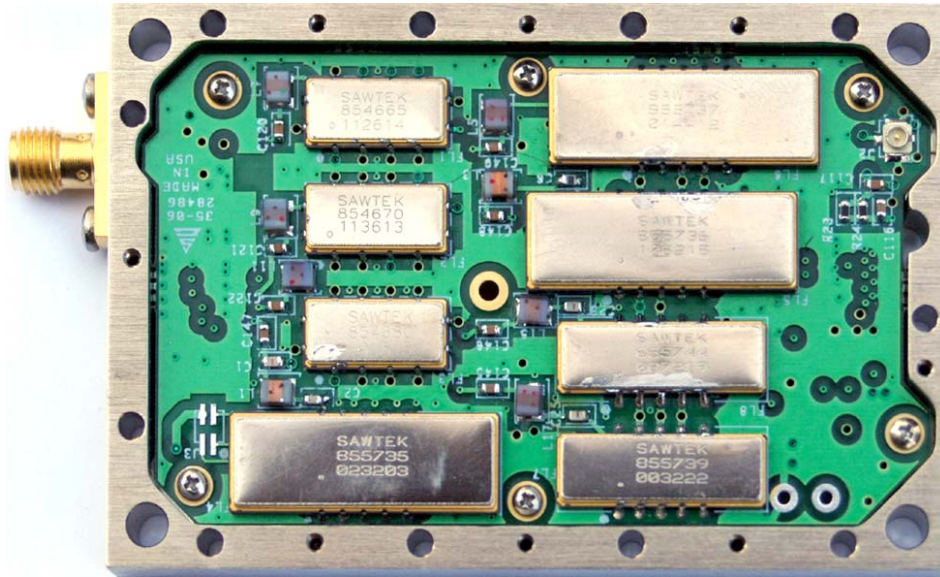
Figure 75: 70 MHz IF Module in 2" x 3" Chassis

The measured responses of the eight filters are shown in Figure 73 and Figure 74 (note the change of horizontal scale between the two figures).

Six additional filters are available allowing for a total of 14. The optional filters are 70 kHz, 1.4 MHz, 3 MHz, 6 MHz, 14 MHz, and 28 MHz. The measured responses of the optional filters are shown in Figure 75 and Figure 76. Contact Quasonix for information about the optional filters.
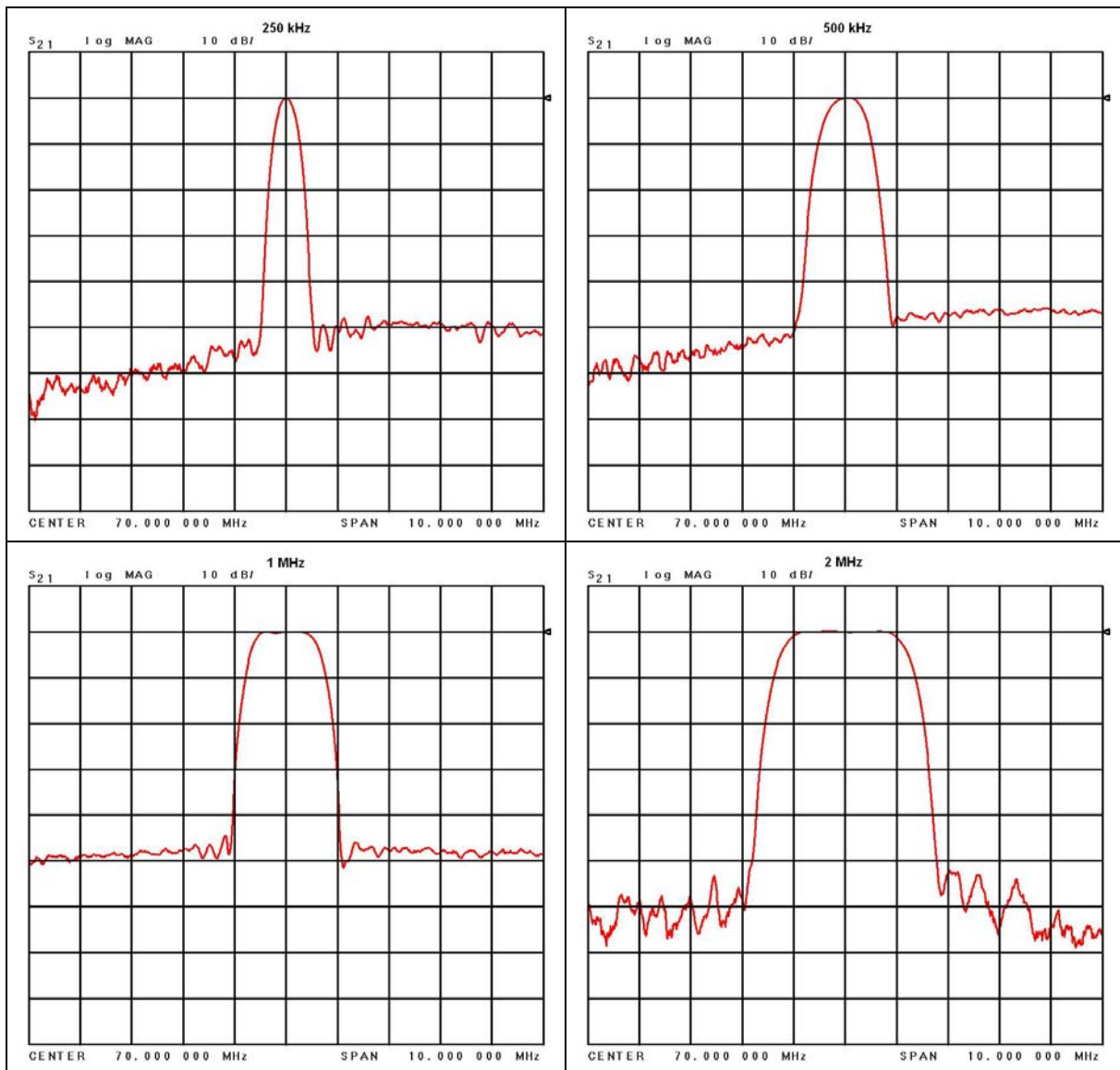
Figure 76: 70 MHz IF Module in 2" x 3" Chassis SAW Filter Responses, Narrow Group (10 MHz Span)
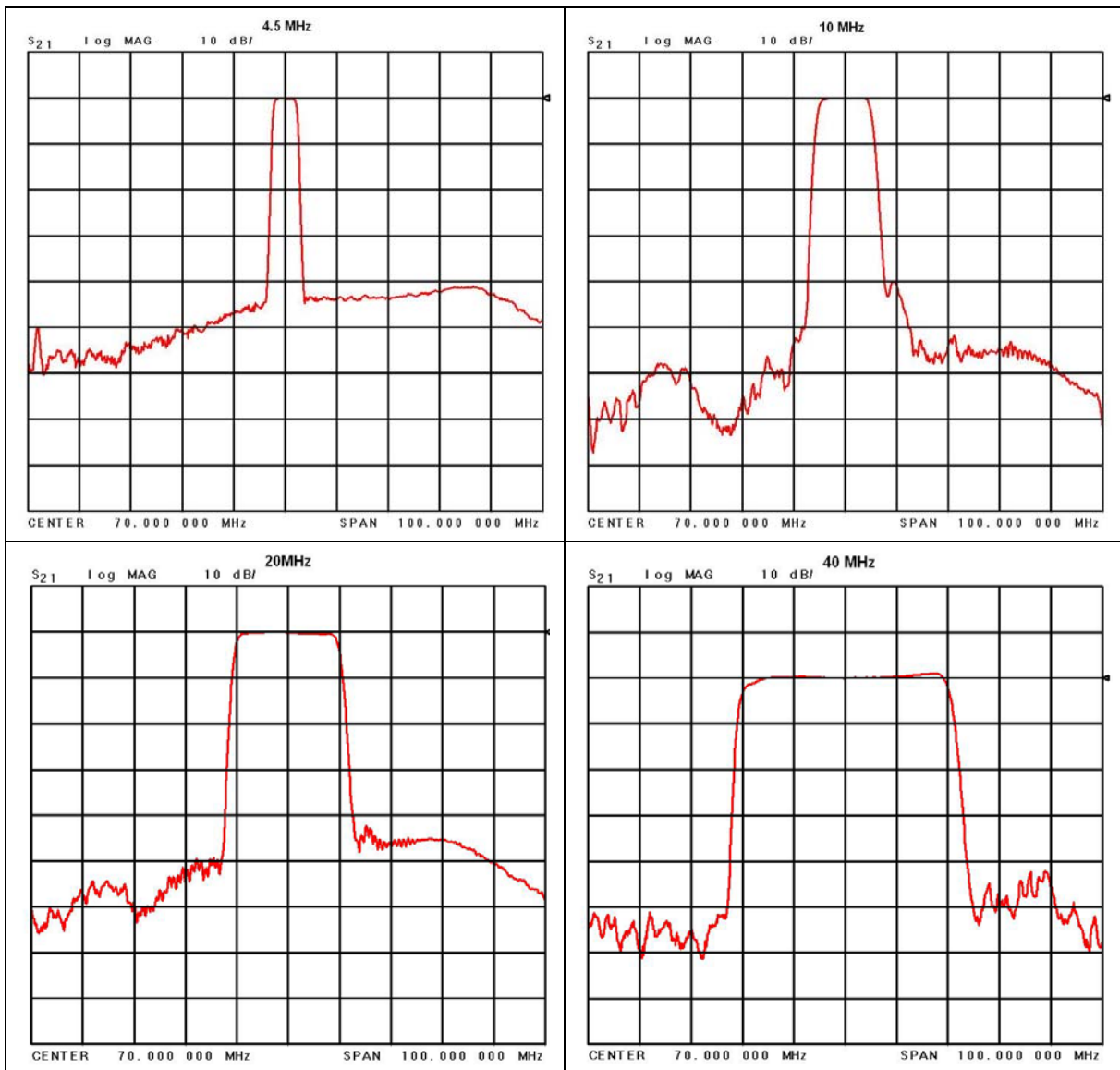
Figure 77: SAW Filter Responses, Wide Group (Plotted on 100 MHz Span)
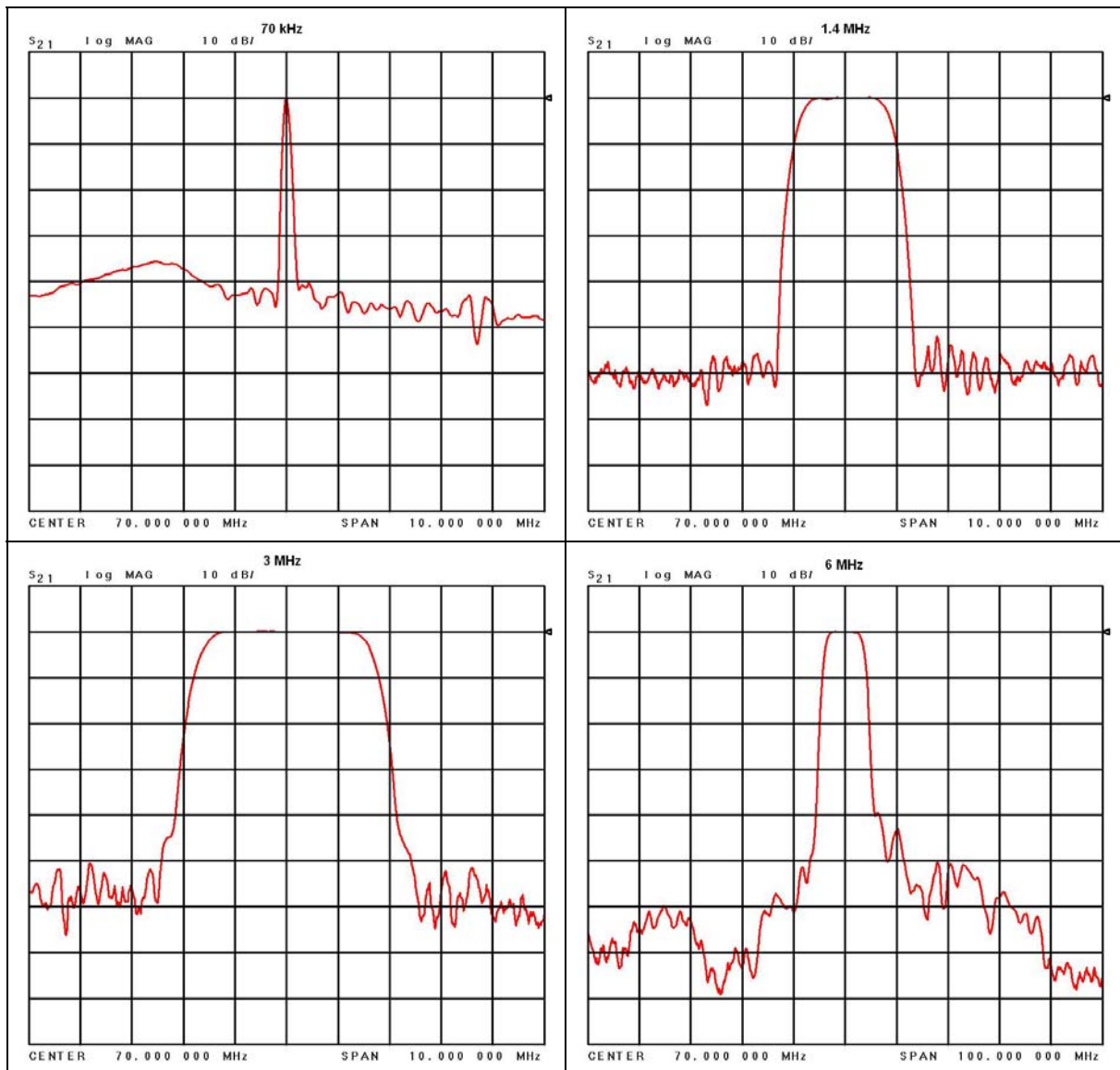
Figure 78: Optional SAW Filter Responses for 70 kHz to 6 MHz
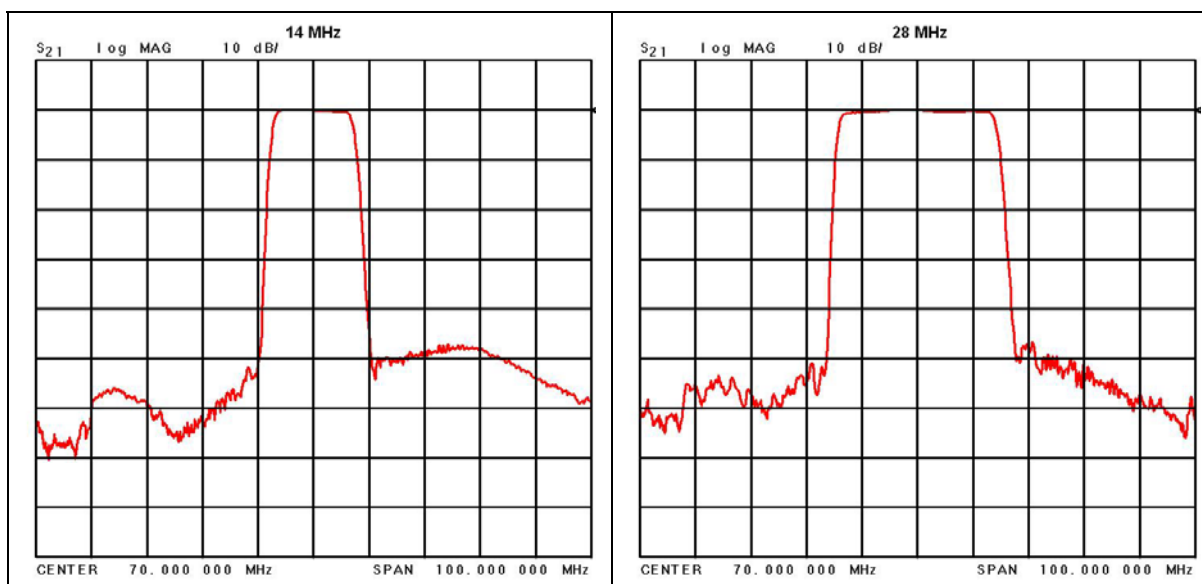
Figure 79: Optional SAW Filter Responses for 14 MHz and 28 MHz

Based on the receiver's high level of integration, the proper IF filter is automatically selected based on the current mode and bit rate settings of the demodulator. Although manual filter selection is available via the IF Filter Menu on the front panel LCD, as shown in Figure 80, **manual selection is not recommended**. In the case of a receiver with diversity combining enabled, the two channels must have the same IF filter selected for proper operation.

Figure 80: Front Panel Advanced Menu and IF Filter Menu

4.6.2.17.3 Video DeEmphasis (PCM/FM Mode Only)

The Video DeEmphasis option, shown in Figure 81, is used to set the Video DeEmphasis value to NTSC, PAL, or Off. This option should be used when a corresponding video pre-emphasis filter is used on the video transmit side.

Figure 81: Advanced Menu, Video DeEmphasis Selection

The user may toggle the Video DeEmphasis value by pressing the Enter key on the front panel keypad until the desired value displays.

4.6.2.17.4 Video Scale (PCM/FM Mode Only)

The Video Scale option sets the peak-to-peak amplitude on the video outputs. By default the video output is 1.0000 V peak-to-peak using a standard deviated NTSC video signal. This setting allows the user to compensate for a system where this is not the case.

The Video Scale option, shown in Figure 82, is used to set the video scale value.

To change the Video Scale setting, select the Video Scale option, then press the Enter key on the front panel. A dialog screen displays prompting the operator to enter a new video scale setting using the rack's front panel numeric keypad. When the new value is entered, press the Enter key on the keypad.


Figure 82: Advanced Menu, Video Scale Selection

4.6.2.17.5 Phase Noise Comp (PCM/FM Mode Only)

The Phase Noise Comp option, shown in Figure 83, is used to set the Phase Noise Compensation value to On or Off.

Figure 83: Advanced Menu, Phase Noise Compensation Selection

The user may toggle the Phase Noise Compensation value by pressing the Enter key on the front panel keypad until the desired value displays.

4.6.2.17.6 Muting Timeout

The Muting Timeout option, shown in Figure 84 is used to set a timeout value (in milliseconds). This setting is used to determine when to mute (stop sending data) when the Muting option is set to On.

Figure 84: Advanced Menu, Muting Timeout Selection

A dialog screen displays prompting the operator to enter a new Muting Timeout value (in milliseconds) using the rack's front panel numeric keypad. The valid range is 0 to 46016 milliseconds. The Muting Timeout Entry screen is shown in Figure 85. When the new value is entered, press the Enter key on the keypad.

Figure 85: Muting Timeout Entry Screen

4.6.2.17.7 Output Muting

The Output Muting option, shown in Figure 86, is used to set the muting value to On or Off. When the Output Muting option is set to On, the receiver stops sending clock and data information when the timeout value is reached. This option is beneficial to someone using a recorder with limited space. For example, if data is not locked to a valid signal or is outside the valid range, the information is muted (stopped) so the recorder is not filled with bad data.

Figure 86: Advanced Menu, Muting Selection

The user may toggle the Muting value On or Off by pressing the Enter key on the front panel keypad until the desired value displays.

4.6.2.17.8 DC Antenna

The DC Antenna option is only available when using the 5-band downconverter AND P and C bands are enabled.

The user may toggle the DC Antenna value On or Off by pressing the Enter key on the front panel keypad until the desired value displays.

- When the downconverting antenna is not available, this command displays only an assumed value.

- The downconverting antenna setting only applies to C band frequencies.

Figure 87: Advanced Menu, DC Antenna Selection

The downconverting antenna has an LO that is used to downconvert C band signals (4400 MHz – 5150 MHz) to a lower frequency range known as P band (400 MHz – 1150 MHz) using an LO frequency of 5550 MHz. This results in two issues that are addressed by the downconverting antenna control.

1. Spectral Inversion

    In a downconverting antenna, the LO is higher than the RF (high side injection) and the lower side band result is selected—the spectrum is inverted. All C to P band downconverting antennas are assumed to produce a spectrally inverted signal. The receiver automatically reinverts the signal before it is demodulated. (This is done in the downconversion to 70 MHz IF.) If an actual P band signal is received, it is NOT spectrally inverted and the automatic reinversion done by the receiver improperly causes the signal to appear inverted to the demodulator.

    The demodulator has a mechanism to invert the spectrum in the digital domain. The downconverting antenna setting determines how the spectral inversion is handled for P band signals.

2. C Band Frequency Specification Ambiguity

    It is common to tune to the C to P band downconverted signal by specifying the C band frequency. In a receiver that also has actual C band receiver capability, an ambiguity develops when a C band frequency is specified since it can be applied to either a C or P band signal. The downconverting antenna setting determines how a specified C band frequency is interpreted in a system where both C and P bands are enabled.

    If a C band frequency is specified and the downconverting antenna is *enabled*, it is assumed the signal is a C to P downconverted signal. The receiver is tuned to the P band equivalent and the automatic inversion is used. If the downconverting antenna is *disabled*, the receiver is tuned to the specified C band frequency and spectral inversion is not an issue.

    If a P band frequency is specified, it is assumed there is no downconverting antenna. If there is a downconverting antenna, it is ignored. The receiver is tuned to the actual P band frequency and the automatic spectral inversion is disabled.

4.6.2.17.9 Mod Scale Index

The Mod Scale Index option, shown in Figure 88, allows the operator to manually set the modulation scale index. This enables the receiver to operate at the optimum range of modulation desired by the user.

When modulation scale index is set, the Modulation Scaling option is simultaneously changed to Hold. The Hold notation includes the new index number that the operator has chosen.

If the held index number is to be retained following a power-off cycle of the rack, then turn on Mod Persist from the Main Menu. Refer to section 4.6.2.12, Modulation Persistence.

To change the Modulation Scale Index, select Mod Scale Index, then press the Enter key on the front panel.

A dialog screen displays prompting the operator to enter a new modulation scale index using the rack's front panel numeric keypad. The valid modulation scale index range is 0.350 to 8.000. The Index Entry screen is shown in Figure 89. When the new value is entered, press the Enter key on the keypad.

Figure 88: Advanced Menu, Mod Scale Index Selection

Figure 89: Mod Scale Index Entry

To clear any locked modulation scale index number, go to the Main Menu and toggle the Mod Scaling option back to Tracking. After Mod Scaling is set to Tracking, the modulation index follows the receiver's present estimate of the mod index.

4.6.2.17.10 Best Channel Selector

The Best Channel Selector option, shown in Figure 90, is used to set the Best Channel Selector value to On or Off. When this option is On, the combiner data output selects the best channel (1, 2, or Combiner) based on DQM.

Figure 90: Advanced Menu, Best Channel Selector

The user may toggle the Best Channel Selector value by pressing the Enter key on the front panel keypad until the desired value displays.

The Best-Channel Selector (BCS) is a revolutionary new feature, unique to the Quasonix RDMS™. Its purpose is to ensure that the back-panel data output from the Combiner is always optimal, even in rare cases where the Pre-Detection Diversity Combiner struggles relative to Channel 1 and Channel 2.

Normally, the Pre-Detection Diversity Combiner adds weighted copies of the Channel 1 and Channel 2 received signals to synthesize an improved combined signal. If the only impairment is noise (e.g., the test article is approaching maximum range), this combined signal is optimal, and provides 3 dB signal-to-noise improvement over Channel 1 and Channel 2 individually.

However, other impairments may cause the Channel 1 and Channel 2 signals to be uncombinable or to produce a suboptimal combined signal.

One simple example is frequency diversity with different multipath on Channel 1 and Channel 2. If the signal-to-noise ratio is equal on both received channels, the combined signal will be composed of half of each. This summed signal has half the amplitude of unintended reflections, but twice as many. The increased number of reflections can degrade demodulation performance, which may result in a higher bit error rate from the Combiner data output compared to the Channel 1 and Channel 2 data outputs.

The BCS solves this problem by selecting the best output data from Channel 1, Channel 2, and the Combiner on a bit-by-bit basis. The back-panel data output from the Combiner comes from the BCS whenever it is enabled, as shown in the system block diagram in Figure 91.
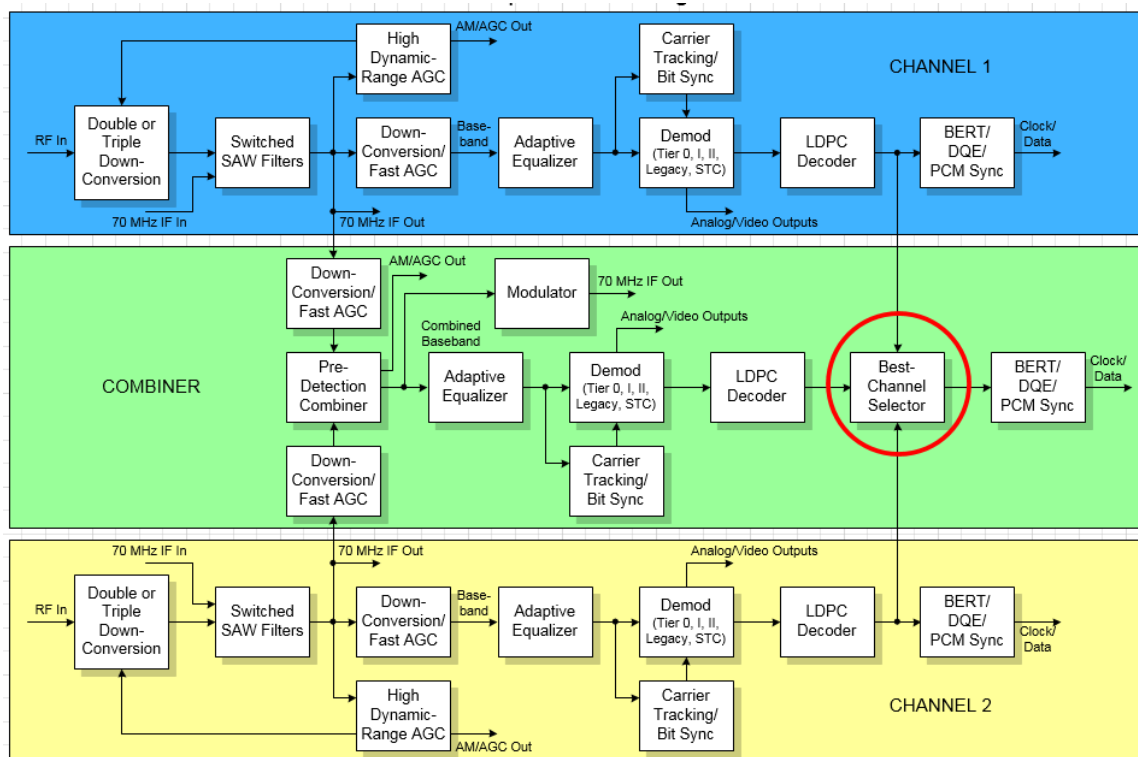
Figure 91: System Block Diagram with Best Channel Selector

This process yields optimal data output on a single connector under all conditions. The only penalty for this performance improvement is increased processing latency in the RDMS™, approximately equal to one DQE frame. Refer to section 4.6.2.9 for details about DQE.

When the BCS is disabled, the back-panel data output from the Combiner comes from the Diversity Combiner demodulator, as it traditionally has.

Another unique advantage of the BCS is that its output can be encapsulated using IRIG-standard Data Quality Encapsulation (DQE) for use by an external Best-Source Selector (BSS). This capability allows spatial diversity across a vast range with a minimal number of BSS channels and attendant bandwidth. Further, since the BCS need only accommodate relatively miniscule latency differences between its inputs, its local performance may exceed that of a BSS designed to handle several seconds of time delay between channels. Driving an external BSS with several RDMS™ BCS outputs leverages the strengths of both.

4.6.2.17.11 Time Aligner

The Time Aligner option is only available with the Combiner option enabled and set to On. The Time Aligner can be disabled or enabled. When disabled, it remains Off and does not affect the combiner.

Figure 92: Advanced Menu, Time Aligner Selection

Enabling the (combiner) time aligner, as shown in Figure 92, lets it determine when to operate (with no user intervention).

Maximal ratio combining can only achieve optimal performance if the Channel 1 and Channel 2 input signals are accurately phase- and time-aligned. Traditionally, diversity combiners have performed phase alignment only, relying on the telemetry system design to provide adequate time alignment.

However, there are cases in which time alignment cannot be easily guaranteed. Such cases include frequency diversity and spatial diversity, where the propagation of transmit and receive paths for Channel 1 and Channel 2 may be quite different through cables, equipment, and the air. As bit rates continue to increase, fixed latency differences are magnified in relation to the bit period.

The Quasonix RDMS™ Combiner can perform both phase alignment and time alignment of the Channel 1 and Channel 2 signals. The Time Aligner is capable of correcting up to ±1300 nanoseconds of time skew between channels (about a quarter mile of free-space propagation). Similar to phase alignment, time alignment is dynamic, accommodating changes in relative target antenna positions over time.

When enabled, the Time Aligner continuously measures skew between channels but remains in a "monitor" state (with no timing correction) as long as the skew remains below a predefined threshold. When the skew exceeds the threshold, the Time Aligner switches to a "run" state (with full timing correction) as long as the signal quality is sufficient for it to continue to track timing skew.

If the propagation delay between channels is well-controlled and small, the Time Aligner may be disabled to guarantee minimal timing jitter.

4.6.2.17.12 Combiner Mode

The Quasonix RDMS™ Combiner can operate in one of two modes: Maximal Ratio or Best Source.

Figure 93: Advanced Menu, Combiner Mode Selection

Maximal Ratio combining provides the best pre-detection combining possible, as long as the Channel 1 and Channel 2 input signals can be phase- and time-aligned by the Combiner. In this mode, the Combiner aligns the signals and, using an accurate measure of signal quality, generates their weighted sum. This sum contains the best of both signals plus uncorrelated noise, resulting in up to 3 dB improvement in effective SNR over each individual channel.

Best Source combining is a suboptimal method of combining, but it works for cases in which the Channel 1 and Channel 2 input signals cannot be phase- and time-aligned by the Combiner. Such cases would be rare, but one possible case might be spatial diversity over larger distances than the Combiner Time Aligner can compensate. In this mode, the Combiner continuously selects the channel with better signal quality, so there is no improvement in performance relative to the current best channel. Because Best Source combining is used when proper alignment of the two signals may not be achievable, the Time Aligner should be disabled when this Combiner Mode is selected.

Note: The Best Channel Selector (section 4.6.2.17.10) does not replace, but virtually obsoletes, the Diversity Combiner Best Source mode. In any application where phase- and time-alignment are possible, even if only occasionally, it is recommended that the Diversity Combiner Maximal Ratio mode be used in conjunction with enabling the Best-Channel Selector.

4.6.2.18 AFC Mode

AFC (Automatic Frequency Control) Mode, shown in Figure 94, compensates for frequency offset in the received signal relative to the expected carrier frequency. Demodulators for all modes in the RDMS™ contain frequency-tracking loops that can accommodate some amount of frequency offset. The amount of offset that can be tolerated depends on the mode and is generally a small percentage of the bit rate. If the input frequency offset is greater than this amount, then AFC is needed to make up the difference. Therefore, AFC is particularly applicable to lower bit rates and may be automatically overridden to Off at higher bit rates, regardless of the user specified AFC mode.

The two main sources of offset are (1) reference oscillator frequency differences between the transmitter and the receiver, and (2) Doppler shift. Reference oscillator differences are constant or very slowly time-varying. Doppler shift, by its nature, tends to be dynamic. The optimal AFC mode depends on the source and magnitude of the frequency offset. There are three possible settings: Off, Track, or Hold. In general, Quasonix recommends setting the AFC Mode to Off if possible.

The user may toggle the AFC mode by pressing the Enter key on the front panel keypad until the desired value displays.

Figure 94: Main Menu, AFC Mode Selection

Note that the AFC is automatically overridden (Off) if the demodulator can natively tolerate at least 50 kHz of frequency offset. This prevents the AFC from potentially interfering with frequency tracking if AFC is unlikely to be needed. Override may be disabled, and many other detailed AFC parameters may be controlled, via the command line interface. Refer to section 4.9.1.3 for AFC command details.

4.6.2.18.1 AFC Mode – Off

The AFC Mode Off setting is shown in Figure 95. In this mode, the AFC continuously provides zero compensation. This mode is best suited for small frequency offsets that are within the amount of frequency offset that the demodulator can natively tolerate. In general, Quasonix recommends setting the AFC Mode to Off.

Figure 95: Advanced Menu, AFC Mode – Off

4.6.2.18.2 AFC Mode – Track

When AFC Mode is set to Track, as shown in Figure 96, the AFC continuously attempts to estimate and compensate for the input frequency offset unless the input Eb/N0 falls below a predefined threshold. This mode is best suited for dynamic frequency offsets.

Figure 96: Advanced Menu, AFC Mode – Track

4.6.2.18.3 AFC Mode – Hold

When AFC Mode is set to Hold, as shown in Figure 97, the AFC holds its current compensation. This mode is best suited for static frequency offsets. It may be advantageous relative to the Acquire mode if the channel is initially "known good" but may become impaired during a mission.

Figure 97: Advanced Menu, AFC Mode – Hold

4.6.2.19 PCM Encoding

The RDMS receiver always outputs NRZ-L data. The PCM Encoding option allows user input (if different than NRZ-L) to be converted by the receiver from a specific transmitted type to NRZ-L.

The user may select the PCM Encoding value by pressing the Enter key on the front panel keypad and then selecting the appropriate value from the PCM Encoding selection screen, shown in Figure 99.

There are eleven possible settings as described below.

- NRZ-L: Non-return-to-zero, level
- NRZ-M: Non-return-to-zero, mark
- NRZ-S: Non-return-to-zero, space

- Biphase-S: Biϕ, space
- DM-M: Delay modulation (Miller code), mark
- DM-S: Delay modulation (Miller code), space

- RZ: Return-to-zero
- Biphase-L: Biϕ, level
- Biphase-M: Biϕ, mark
- M2-M: Modified delay modulation (Miller squared code), mark
- M2-S: Delay modified modulation (Miller squared code), space

Figure 98: Advanced Menu, PCM Encoding

Figure 99: PCM Encoding Selections

4.6.2.20 LDPC Mode (SOQPSKLDPC, STCLDPC, or OQPSKLDPC Modes Only)

Low-Density Parity Check (LDPC) encoding is a form of forward error correction. It works by adding redundant information at the transmitting end of a telemetry link and then using that redundancy to detect and correct errors at the receiving end of the link. Details of LDPC coding are presented in IRIG 106 Appendix R.

LDPC encoding can have many benefits. Its most common use is in range extension, where bit errors occur due to a weak received signal. LDPC can improve the point at which errors start to occur by over 9 dB. This increase in link margin is equivalent to almost tripling the operating distance of the telemetry link. Another application is error suppression—for links like compressed video that suffer major degradation due to small numbers of errored bits. LDPC has such a steep bit error rate curve that it converts the channel into essentially binary performance— perfection or highly errored. Since perfection is achieved deep into the area where occasional bit errors would normally occur, compressed video performance is greatly enhanced. Ultimately, any channel that can benefit from error reduction and has bandwidth available will likely benefit from LDPC encoding.

The IRIG standard calls out six variants of LDPC codes—all combinations of two different information block sizes (k=4096 bits and k=1024 bits) and three different code rates (r=1/2, r=2/3, and r=4/5), as shown in Figure 101. The larger block size offers better decoding performance in a static channel but may work less well in a dynamic channel with fast fading or other impairments. Lower code rates also provide better decoding performance at the cost of increased occupied bandwidth. The optimal code choice for any application may require empirical testing to determine.

LDPC decoding is only available for SOQPSK-TG and STC modulations. When in SOQPSK/LDPC, STC/LDPC, or OQPSK/LDPC mode, the appropriate code (k, r) must be selected for proper operation. Also, in these modes only, the user may select between no derandomization, standard IRIG derandomization as specified in IRIG 106 Appendix D, or CCSDS derandomization as specified in IRIG 106 Appendix R. Again, the derandomization selection must match the encoding selected at the transmitting end for proper operation.

SOQPSK/LDPC uses trellis demodulation, whereas OQPSK/LDPC uses single-symbol demodulation. Trellis bit error rate performance in pure additive noise is slightly better than single-symbol bit error rate performance, as shown in IRIG 106-17, Figures D-10 and D-11. Trellis synchronization under adverse conditions may be significantly faster than single-symbol synchronization.

LDPC encoding is intended to improve performance specifically under harsh conditions, which might have a negative effect on AFC tracking. In general, Quasonix recommends setting the AFC Mode to Off if possible. This recommendation is especially important for the best LDPC performance. Refer to section 4.6.2.18 for additional information about AFC Mode.

Figure 100: Advanced Menu, LDPC Mode   **Figure 101: LDPC Mode Selections**

Note: LDPC Mode always displays on the Advanced Menu. Selected values are NOT active unless the waveform Mode is SOQPSKLDPC, STCLDPC, or OQPSKLDPC.

4.6.3 System Settings

Access the System Settings menu from the front panel Main Menu. Select System Settings, then press the Enter key on the front panel keypad.

Figure 102: Main Menu, System Settings Selection

The System Settings menu includes the following parameters:

- System Info
- Ethernet
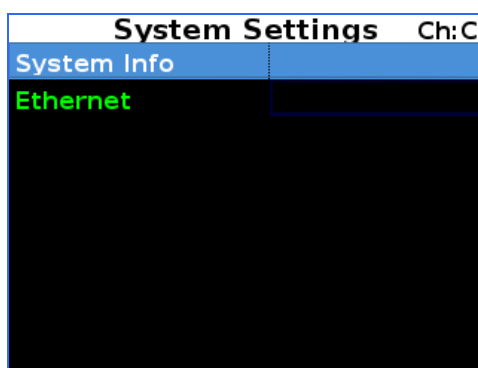
Figure 103: System Settings Menu, System Info Highlighted

4.6.3.1   System Info

The System Info screen, shown in Figure 104, is a display only screen. It provides the following information about the RDMS™.

Figure 104: System Settings Menu, System Info Displays

The System Info screens provide all of the pertinent network settings for the rack unit, including: RDMS model number, Serial Number, System Version, the FPGA version number, software version numbers, DHCP status, IP Address, IP Subnet address, MAC address, Alias, and Secure Name.

4.6.3.1.1   Model

Model describes the type of Quasonix receiver in use.

4.6.3.1.2   Serial Number

Serial number describes the Quasonix manufacturing serial number which identifies this specific RDMS™ receiver.

4.6.3.1.3   System Version

System Version describes the firmware version in use in this RDMS™ receiver.

4.6.3.1.4   FP Version

FP Version describes the FPGA version loaded in this RDMS™ receiver.

4.6.3.1.5 Ch1, Ch2, ChC Version

The Ch1, Ch2, and ChC Version numbers describe the software versions installed on each individual brick in the RDMS™ receiver.

4.6.3.1.6 DHCP

The DHCP option, when enabled, allows the rack unit to automatically receive an IP address from the local DHCP server. If DHCP is turned off, then the user must choose a valid IP address for the unit.

4.6.3.1.7 IP Address

The IP address for the rack unit will either be assigned to it automatically through the use of DHCP, or it must be entered by the user. When choosing an IP address, it is critical that the address is unique; otherwise the unit will not operate within the network properly. It is strongly recommended that the user contact their network administrator to receive a reserved address for this purpose.

4.6.3.1.8 Subnet

The subnet mask identifies the portion of the IP address used as a host identifier for the subnet in which the Quasonix rack unit participates. It is expressed in a quad-dotted decimal representation, just like the unit's IP address. The most common subnet mask is 255.255.255.0, which means that the unit's last 8-bit number (i.e. 0 through 255) uniquely identifies it within its sub-network.

4.6.3.1.9 Gateway

The Gateway address displays the Gateway network IP address.

4.6.3.1.10 MAC

The MAC (Media Access Control) is a hardware address uniquely identifying the RDMS™ receiver on the local communication network.

4.6.3.1.11 Alias

This optional parameter is used to provide an alternative name to a rack in addition to the IP Address. The default alias name is RDMS3. The Alias is set via the Browser Interface. When using the Browser Interface (refer to Section 4.7), the alias can be used to quickly identify a particular rack in the displayed list. Examples of a rack alias might be "RDMSLab1", "TestLabLevel4", or "XYZProjectRDMS".

4.6.3.1.12 System IP

The System IP address for the rack unit is assigned automatically. It will always match the IP Address *unless the RDMS is a TMoIP unit.* In a TMoIP unit, the System IP is the TMoIP address.

4.6.3.1.13 Secure Name (Currently Unavailable)

RDMS™ racks may be configured two different ways, depending on the preferred structure. A Group Identifier (ID) is used to provide a unique name for each RDMS™. In the first configuration, racks may be named based on department, such as Lab, Development, Production, Demonstration, etc. In the second configuration, racks may be named for independent users, such as Office1, B4Btest, TestX, etc.

4.6.3.1.14 Ethernet

The Ethernet screen, shown in Figure 105, is used to set the DHCP mode, the IP Address, Subnet, and Gateway address.

Figure 105: System Settings Menu, Ethernet Selection

4.6.3.1.14.1 DHCP

This is the Dynamic Host Configuration Protocol. On some networks, the DHCP assigns dynamic IP addresses to the devices on the network–in other words, it assigns a new IP address each time the user connects to the network. Some networks manage the DHCP manually.

To change the DHCP setting, press the Enter key on the keypad to toggle between On and Off.

4.6.3.1.14.2 IP Address

The IP Address must be assigned manually when DHCP is not in use on a network.

1. To assign an IP address, use the down arrow on the keypad to highlight the IP Address (Figure 106), then press the Enter key.

2. Type the IP address in the IP Address entry screen (Figure 107), then press the Enter key.

3. To exit without making a change, press the Esc key.

Figure 106: IP Address Selection

Figure 107: IP Address Entry

4.6.3.1.14.3 Subnet

The IP Subnet must be assigned manually when DHCP is not in use on a network.

1. To assign an IP subnet, use the down arrow on the keypad to highlight the IP Subnet (Figure 108), then press the Enter key.

2. Type the IP subnet in the IP Subnet entry screen (Figure 109), then press the Enter key.

3. To exit without making a change, press the Esc key.

Figure 108: IP Subnet Selection

Figure 109: IP Subnet Entry

4.6.3.1.14.4 Gateway

The Gateway address is used to set the Gateway network IP address, if required. Contact your network administrator for the correct gateway address.

1. To assign the Gateway IP address, use the down arrow on the keypad to highlight Gateway (Figure 110), then press the Enter key.

2. Type the Gateway address in the Gateway entry screen (Figure 111), then press the Enter key.

3. To exit without making a change, press the Esc key.

Figure 110: Gateway Selection

Figure 111: Gateway Entry

4.6.3.1.14.5 TMoIP Address

In an RDMS TMoIP unit, the TMoIP address displays on the Ethernet screen, as shown in Figure 112. The TMoIP address for the rack unit is assigned automatically.

Figure 112: TMoIP Address

4.6.3.2 Graphics Menu

Access the Graphics menu from the front panel Main Menu. Select Graphics Menu, then press the Enter key on the front panel keypad.

The Graphics menu includes the following parameters:

- Graph Type
- Signal Strength

4.6.3.2.1 Graph Type

There are two available graph types on the Graphics Menu, Spectrum or a pattern based on the selected mode. The user may toggle between graph types by pressing the Enter key on the front panel keypad until the desired value displays. Press the Esc key on the front panel keypad to back out of the Graphics Menu.

Figure 113: Main Menu, Graphics Menu Selection and Graphics Menu, Graph Type

Examples of the Eye Pattern (PCM/FM) (Figure 114), Constellation (SOQPSK) (Figure 115), Constellation (STC) (Figure 118 and Figure 119), and Spectrum (Figure 116 and Figure 117) are shown in the associated figures.
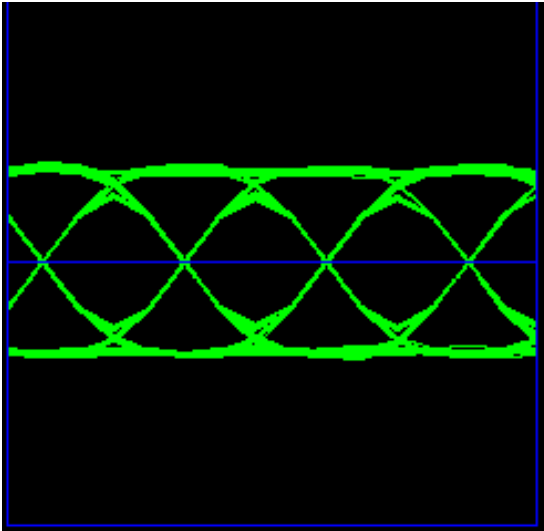
Figure 114: PCM/FM Eye Pattern
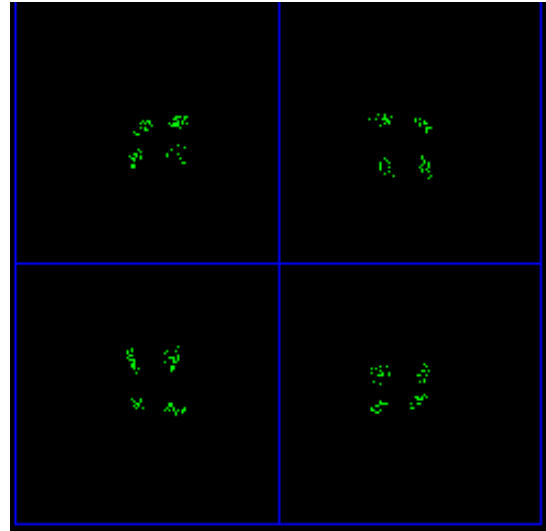
Figure 115: SOQPSK Constellation
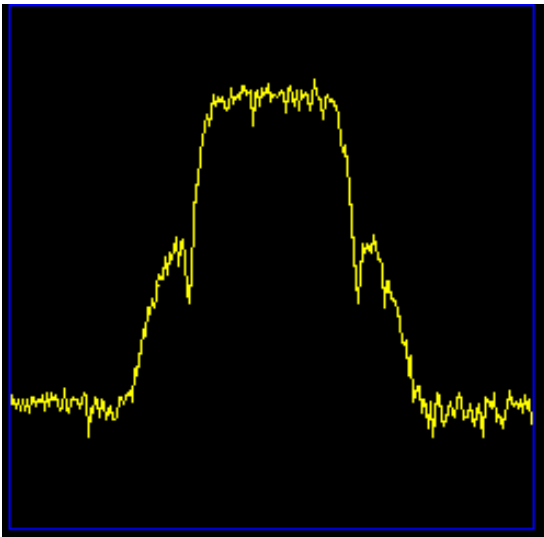
Figure 116: PCM/FM Spectrum Display
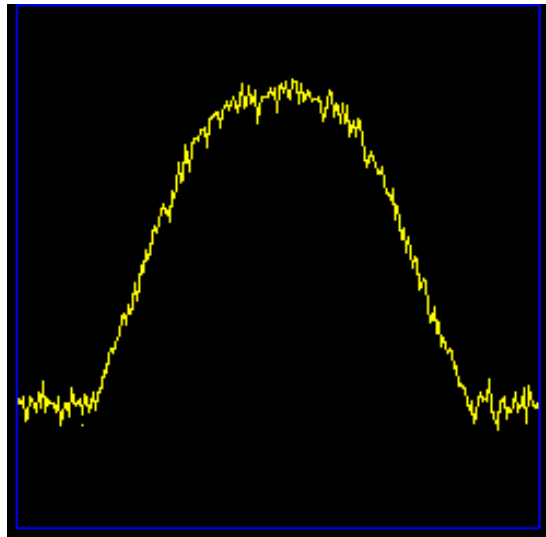
Figure 117: SOQPSK Spectrum Display

4.6.3.2.1.1 STC Constellation

In the Space-Time Coding (STC) mode of operation, the data stream is encoded into two separate signals that each contain a complete copy of the source data. These two signals are transmitted simultaneously on the same RF frequency (usually over two separate antennas) to produce a radiated over-the-air signal that eliminates antenna self-interference and improves message detectability with a similar bandwidth requirement as a conventional SOQPSK system. The trade-off for these substantial benefits is an increase in receiver processing complexity. Unlike traditional telemetry waveforms that are easy to process by looking at either the frequency or phase representation, STC consists of the sum of two unsynchronized phase modulated signals with seemingly unrelated data that must be recombined to recover the original source data.

While the spectrum display is virtually the same as the SOQPSK spectrum when the RDMS is running in STC mode, the receiver display looks quite different than the usual SOQPSK constellation, as shown in Figure 118. The individual parts of the display are labeled in Figure 119.

Since no traditional constellation exists for this mode, the RDMS displays the relative strength of each signal, the difference in time of arrival between them, and the received strength of the embedded pilot sequences. In a typical application, one of the signals is transmitted out the top antenna of a vehicle while the other signal is transmitted from the bottom. In this setup, the height of the green line above the blue graduated horizontal bar represents the relative strength of the top antenna, while the length of the green line below the bar represents the strength of the bottom. The small green square within the multicolor bar represents the time difference of arrival in increments of ¼ of a bit period with all the way to the left or right representing a full bit period. Performance is optimal in the green zone and degrades if it progresses into the yellow and red zones.

The indicators on the right side of the screen, receive signal level (dBm) and DQM, are exactly the same as in the other modes.
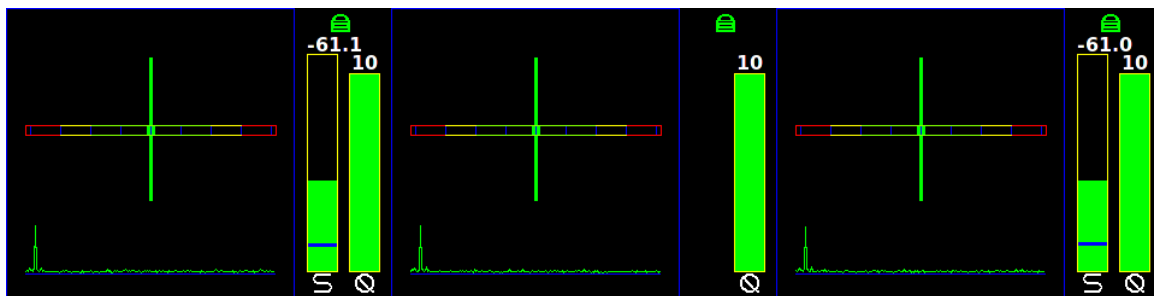
Figure 118: STC Constellation Display for Channel 1, Combiner, and Channel 2
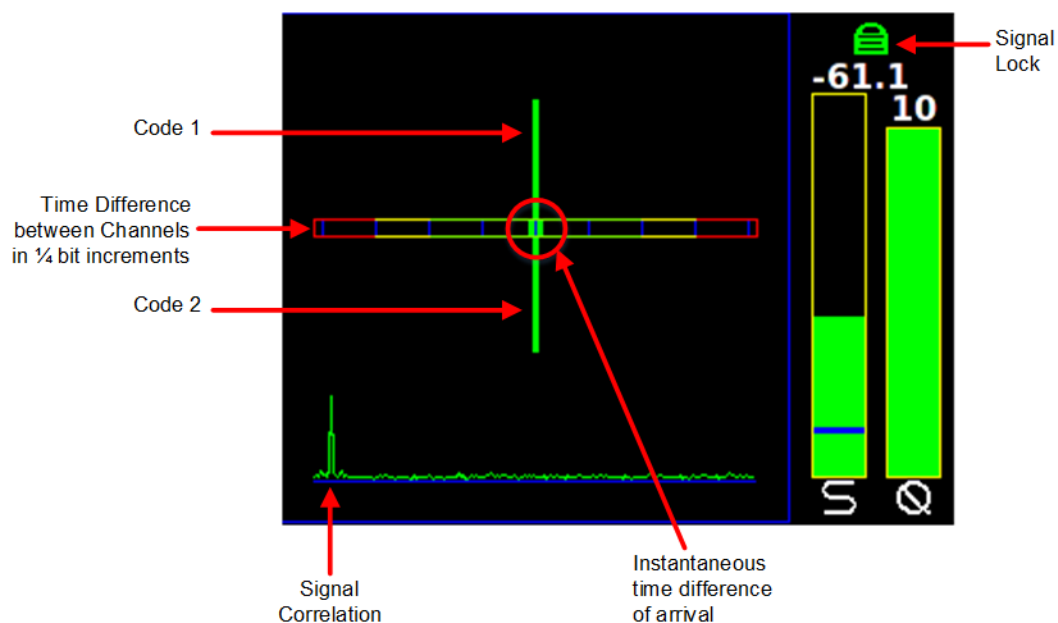
Figure 119: Labeled STC Constellation Display for Channel 1

4.6.3.2.2 Signal Strength

There are two Signal Strength options, Absolute or Relative. The user may toggle the Signal Strength value by pressing the Enter key on the front panel keypad until the desired value displays.

When Absolute is selected, the actual signal strength is displayed.

When Relative is selected, the signal strength displayed is relative to AGC Zero.

A value of zero on the front panel signal display, indicates no input signal. A value above zero indicates how strong the signal is above no input.
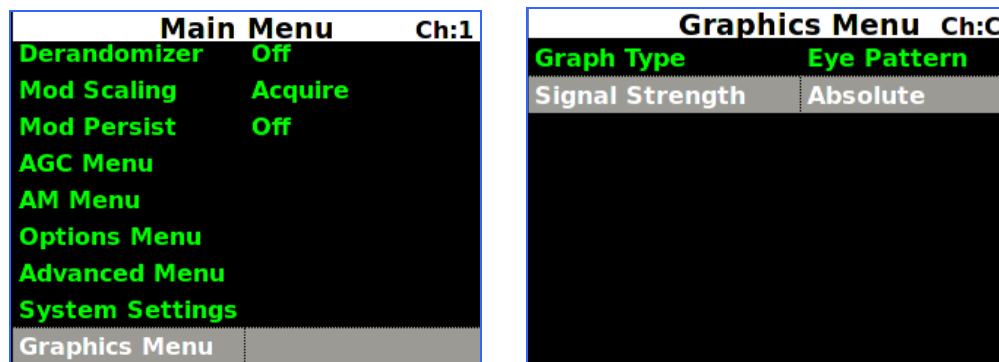
Figure 120: Main Menu, Graphics Menu Selection and Graphics Menu, Signal Strength

4.7　Browser Interface

The Browser Interface provides the user with full configuration, control, and monitoring capabilities for one or multiple rack-mount receivers. For configuration management purposes, only one browser interface can configure a receiver at a given time. However, multiple browser interfaces can monitor an individual receiver's status at once.

The browser interface's monitoring capabilities include:

- Receiver settings
- Signal strength
- Signal quality
- Signal lock detect
- Combiner link status (optional Diversity Combiner feature required)
- Constellation / eye pattern display
- Browser Interface status

The RDMS™ Browser Interface consists of a tool bar at the top of the screen, shown in Figure 121, and five selections that display a variety of parameters for each available channel. The Browser Interface defaults to the Network screen.
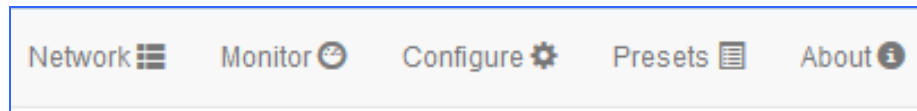
Figure 121: RDMS™ Browser Interface Header Tool Bar

4.7.1　Network Screen

The Network screen offers a quick snapshot of each rack-mount receiver, down to the channel level. The screen is comprised of a table with columns for RDMS address, Configuration Name, Channel, Frequency, Mode, Bit Rate, signal strength, signal quality, and lock-detect status (as text and as a red or green color block). The user may access a specific unit by clicking on the Configure or Monitor button for any receiver listed.

The unit to which the user is currently connected is highlighted and defaults to the top of the list.

The Network screen uses a numerical representation for signal strength and signal quality. For a complete explanation, refer to section 4.6.2.9.

Figure 122 shows four RDMS™ receivers. The Lock field is highlighted in green to indicate there is a signal lock. The first receiver is highlighted in blue to indicate it belongs to the user. Note the RDMS Address matches the address on the top browser tab and in the URL box. The additional receivers are on the same network but are in use by other users.

Figure 123 shows a closeup of the right half of the Network screen with combiners only displayed. Figure 124 shows a closeup of the left side of the Network screen with the Configure and Monitor buttons.

Figure 122: Network Screen with Multiple Receivers and Active Channels

Figure 123: Network Screen, Closeup of Left Side, Combiners Only

Figure 124: Network Screen, Closeup of Right Side

4.7.2   Monitor Screen

The Monitor screen may be accessed via the Monitor buttons on the Network screen, as described previously, or via the Monitor option on the Tool bar, as shown in Figure 125.
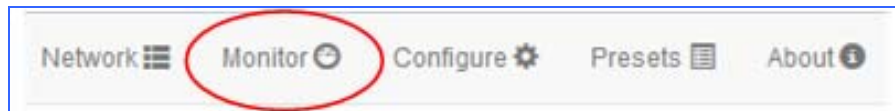
Figure 125: RDMS™ Browser Interface Tool Bar

The unit information displays in the Monitor view, as shown in Figure 126.
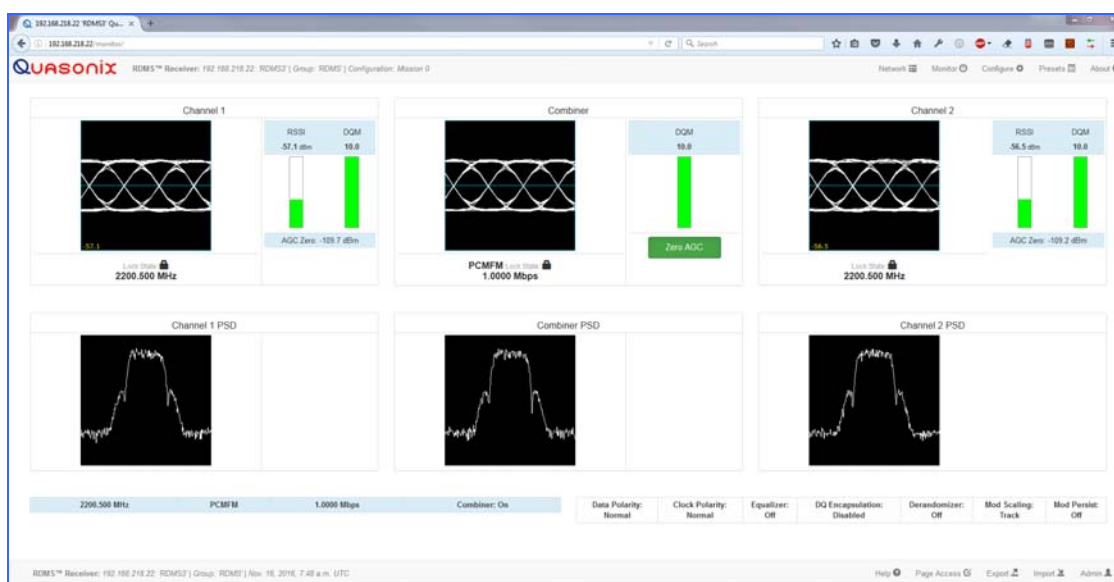
Figure 126: Browser Interface Monitor Screen

The Monitor screen provides the user with:

- Channel selection

- Basic receiver settings, such as frequency, mode, bit rate

- Signal indicators, including lock detect, signal strength, signal quality, combiner link status

- Graphical representations of the spectrum

- Zero AGC button – For user convenience, this button displays on the Monitor screen and the Configure screen

If the user is operating a single-channel receiver, only Channel 1 displays, as shown in Figure 127.
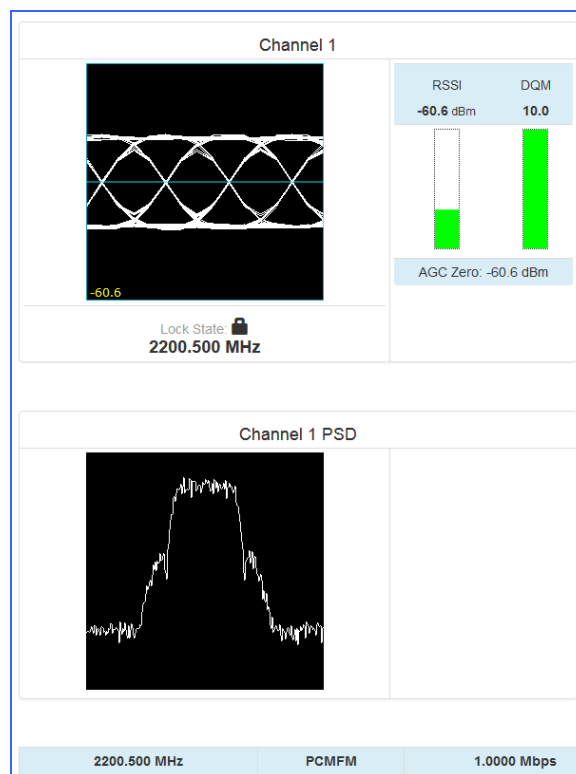
Figure 127: Monitor Screen for RDMS™ with Only One Channel Available

Additional status information, such as Frequency, Mode, and Bit Rate, is provided at the bottom of the display when the combiner is On, as shown in Figure 128, or displayed in the center of the screen between Channel 1 and Channel 2 when the combiner is Off, as shown in Figure 129.

Data Polarity:	Clock Polarity:	Equalizer:	DQ Encapsulation:	Derandomizer:	Mod Scaling:	Mod Persist:
Normal	Normal	Off	Disabled	Off	Track	Off

Figure 129: Monitor Screen Partial Status Information Block when Combiner Off

4.7.2.1 Signal Graph and Signal Indicators

The Signal Graph, shown in Figure 130, provides a separate window for monitoring the receiver's constellation or eye pattern. The graphical display, included for each channel, mimics the graphical display on the front panel of the rack-mount receiver. Depending on the modulation chosen, the monitor will either display an eye pattern for PCM/FM, or a signal constellation for the other modes.

To the right of the Signal Graph is the Signal Indicators window, also shown in Figure 130.

The Signal Indicators window includes the following indicators for each receiver channel:

- Signal Lock detection
- Signal Strength
- Data Quality Metric (DQM)
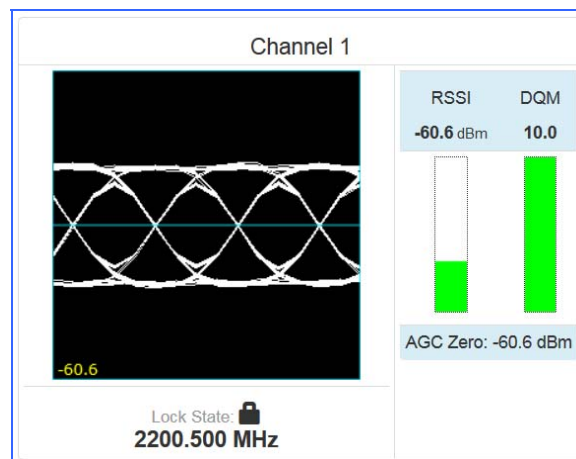
Figure 130: Signal Graph and Signal Indicators Windows

A signal lock indicator provides a visual representation of the demodulator's current lock-detect state. If the demodulator has locked onto a downconverted signal, a locked (closed) padlock displays. Conversely, if the receiver has not locked onto a signal or has recently lost lock, the indicator turns red and displays as an unlocked padlock icon.

The demodulator measures signal strength in dBm and there is no limit to what the signal strength might be. Signal strength is displayed on a dynamic bar graph and spans from -127 dBm to +50 dBm on the Browser Interface. In addition to the visual representation of signal strength, the current measurement, in dBm, is numerically displayed directly above the bar graph. When a signal of -100 dBm or higher is detected, the bar turns green to signify "good" signal strength. The Strength bar is red if the signal level is below -100 dBm.

The standard signal strength (RSSI) information is set on the Configuration screen via the Advanced > RSSI Display drop down menu (next to the Zero AGC button). Refer to section 4.7.3.10.

If "Absolute" was the RSSI Display selection, the actual signal strength is displayed.

If "Relative" was selected, the RSSI displayed is relative to AGC Zero. The following bullets apply to RSSI Relative:

- a value of zero indicates no input signal

- a value above zero indicates how strong the signal is above no input

- "*** dBm" displayed (Figure 131) indicates AGC is not zeroed and the value is invalid

- small "r" displayed next to the RSSI label indicates AGC Zero Relative was selected
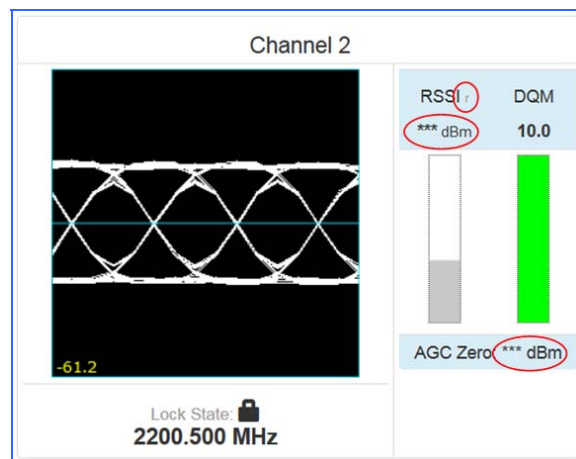
Figure 131: Signal Graph and Signal Indicators Windows, Zero AGC RSSI Display "Relative"

The Data Quality Metric (DQM) graph displays to the right of the Strength graph. The DQM range is 0 to 10, with 10 being the best possible quality.

NOTE: The integrated Quasonix demodulator can detect and establish signal lock at very low signal levels. Therefore, it is not uncommon to see a red signal strength bar indicator accompanied with a green signal lock indicator.

4.7.2.2 Spectrum Graph

Each channel display provides a real-time power spectral density (PSD) plot as it might display on a spectrum analyzer. An example is shown in Figure 132.
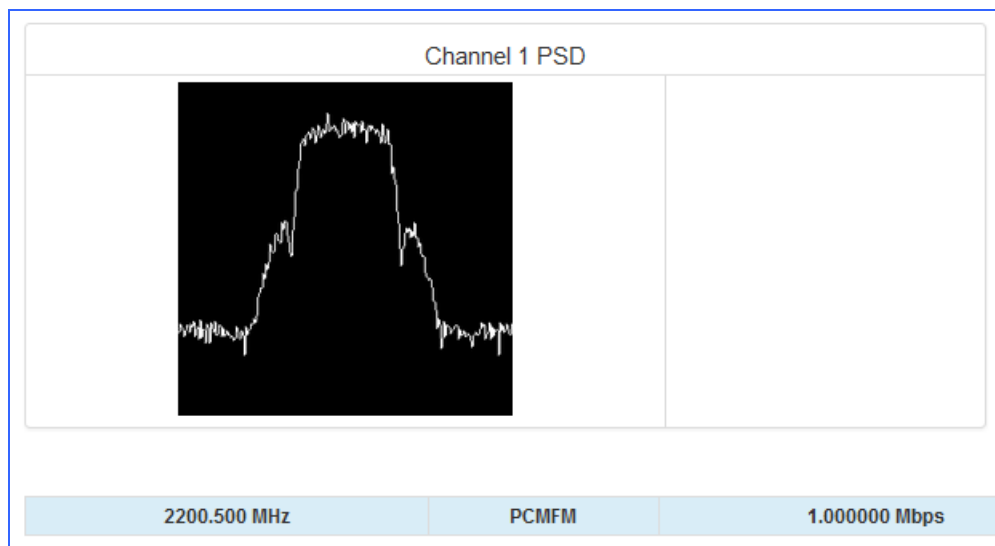
Figure 132: Power Spectral Density Plot Window

4.7.2.3 Diversity Combiner

If the optional diversity combiner is installed and enabled between two channels, then a Signal image and a DQM graph display in the area between the two channels on the Monitor. The Diversity Combiner with a signal lock (green) is shown in Figure 133.
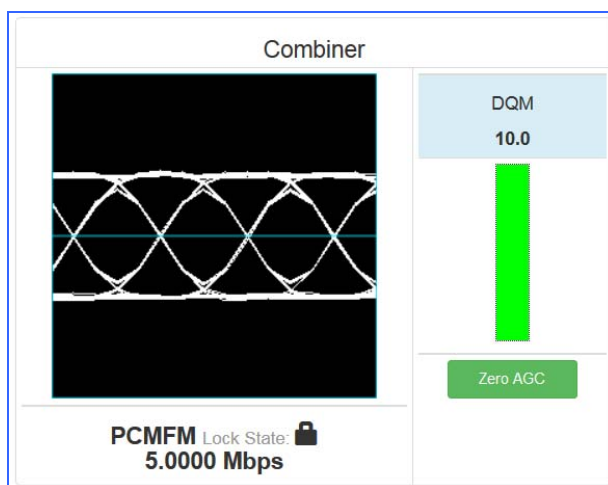
Figure 133: Diversity Combiner Link with Locked Signal

If diversity combiner is On, any changes made to one channel will be copied to the other channel so that both channels are synchronized. If diversity combiner is Off, each channel is separate and setting one channel does not copy settings to the other channel.

If the Combiner is On and Frequency Diversity On is selected, the frequency for Channel 2 may be set differently from Channel 1.

When the Combiner is On, the Zero AGC button displays under the DQM graph.

4.7.3   Configure Screen

The Configure screen may be accessed via the Configure buttons on the Network screen, as described previously, or via the Configure option on the Header Tool bar, as shown in Figure 134.

Figure 134: RDMS™ Browser Interface Header Tool Bar

4.7.3.1   Combiner (Optional)

A pre-detection diversity combiner is available as an option for dual-channel receivers.

If diversity combining is installed on the RDMS™, it can be enabled by clicking on the check box in the Combiner field, as shown in Figure 135.

Figure 135: Configure Screen, Combiner Section

When the combiner is enabled on one channel, the second channel will automatically reflect this change.

Additionally, any parameter changes made by the user in one channel will automatically be made for the second channel, from which the combined signal is partially derived. The only setting that can still be changed individually when the diversity combiner is turned on is the channel frequency, which allows for frequency diversity to be implemented. To illustrate the synchronization of settings, the second channel's settings menu highlight bar will mimic the navigation path being taken by the user in the first channel.

Note: Whenever the Diversity Combiner is On, any changes made to the Frequency option (even with Frequency Diversity On enabled) causes Modulation Scaling for *both channels* to be set to the same value. However, if Mod Scaling was set to Locked when the Frequency was changed, Mod Scaling will change to Tracking.

4.7.3.1.1 Frequency Diversity (Available with Diversity Combiner)

The Frequency Diversity option allows the user to independently change the frequency of each channel when the diversity combiner is On.

Click on the check box in the Frequency Diversity field to enable.

If there are two channels, the Combiner is set to On, and Frequency Diversity is Off, the channels are updated simultaneously.

4.7.3.2 Channel Selection and Basic Settings

The user may view channel displays and the Diversity Combiner display on the Configure screen in the Browser Interface. If the Combiner is On, only Channel 1 displays (Figure 136). Click on any field within the Configure screen to change and save settings for Channel 1, Channel 2, or both channels (Figure 137).

Figure 136: Configuration Screen with Combiner On, Channel 1 Displays

Figure 137: Configuration Screen with Combiner Off, Channel 1 and Channel 2 Display

The Configure screen includes all of the primary settings related to the receiver, including Frequency, Mode, Bit Rate, Data and Clock Polarity, Equalizer, DQ Encapsulation, and Derandomizer.

Note, Equalizer is available in all modes *except* STC and STCLDPC.

Figure 138: Configure Basic Settings Window-PCM/FM Mode

The settings can be adjusted by clicking on a check box (to enable or disable an option), clicking on a drop down menu and making a selection, or, in the case of Frequency and Bit Rate, typing the number directly or using up/down scroll arrows to select the desired value.

To save the current configuration as a preset, click on the Save as a Preset button or click on the Refresh button to refresh the settings without saving. To create or modify other presets, use the Browser Interface Presets screen.

When selecting new settings on the Browser Interface Configure screen, these settings **are not sent** to the receiver and activated **until the user clicks on the Save Presets button**. *New options are provided to the user when certain options are selected*, for example, Frequency Diversity, Time Aligner, and Diversity Combiner Mode are only available after Combiner is enabled *and saved*. Then other options may be changed *and saved*.

The Browser Interface alerts the user whenever a Save or Refresh is required. When a Save is necessary, the green Save Settings button is enlarged and a Save Changes message displays in the message area on the right side of the screen, as shown in Figure 139. Other notifications display in red text on the right side.
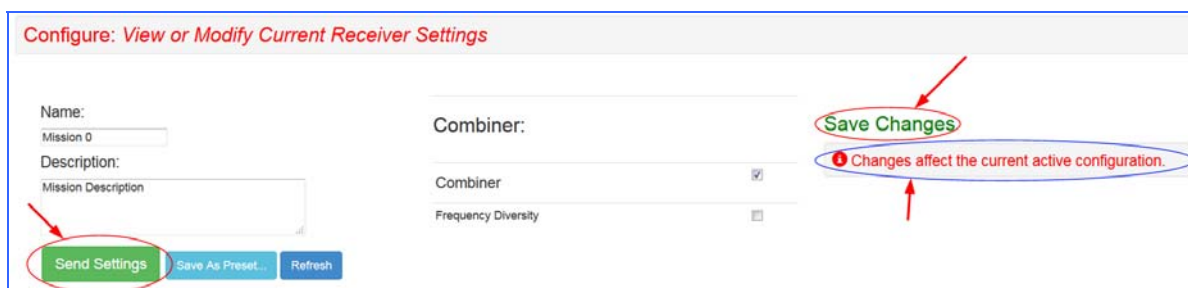
Figure 139: Configure Screen, Messages and Alerts

4.7.3.2.1 Data and Clock Polarity Settings

The Data Polarity and Clock Polarity are set by clicking on drop down arrow to display the menu, then selecting the desired option, Normal or Inverted, as shown in the Data Polarity example in Figure 140.
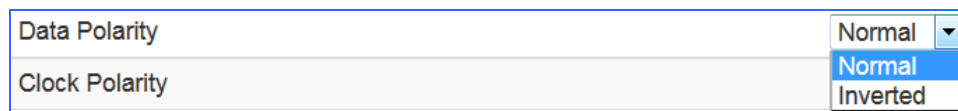
Figure 140: Settings Window, Data Polarity Selection

4.7.3.2.2 Derandomizer Settings

The Derandomizer defaults to Off. Click on the drop down arrow to display the menu, then select the desired option (Figure 141). The standard running mode for non-LDPC operation is IRIG. The CCSDS option is only available when an LDPC Mode is enabled (SOQPSKLDPC or STCLDPC).

Figure 141: Settings Window, Derandomizer Drop Down Menu

4.7.3.2.3 Differential Decoding Settings (SOQPSK Only)

The Differential Decoding option is set to On or Off by clicking on the check box (Figure 142) to enable or disable the differential decoding in SOQPSK mode. Differential Decoding defaults to enabled.

Figure 142: Configure Basic Settings Window-SOQPSK Mode

4.7.3.3 Configure Advanced Settings

The Configure screen also includes a secondary window for Advanced Settings. These include Measured Bit Rate, IF Filter, Output Muting, Muting Timeout, AFC Mode, Time Aligner, Diversity Combiner Mode, PCM Encoding, and LDPC Mode, as shown in Figure 143.

Figure 143: Advanced Settings Window

4.7.3.3.1 Measured Bit Rate Setting

Measured Bit Rate displays the receiver's bit rate on the input signal. This value may be copied and set as the specified bit rate. The purpose of this process is to eliminate unintended bit rate offset error so that the receiver can make full use of its bit synchronizer tracking range, or optionally reduce its tracking range. For the receiver to have an accurate measurement, however, the input signal must be close enough to the previously commanded bit rate to be within the current bit synchronizer lock range and actually be locked.

4.7.3.3.2 IF Filter

Based on the receiver's high level of integration, the proper IF filter is automatically selected based on the current mode and bit rate settings of the demodulator. Although manual filter selection is available through the IF Filter Menu, manual selection is not recommended. In the case of a receiver with diversity combining enabled, the two channels must have the same IF filter selected for proper operation.

The basic premise of trellis demodulation relies on the precise phase modulation of the transmitted signal. Some older analog transmitters have an inordinate amount of phase noise, reducing the effectiveness of the trellis demodulator. In Tier 0 (PCM/FM), enabling the Phase Noise Compensation option relaxes the requirements of the trellis demodulator, allowing better receive performance for transmitters with a high degree of phase noise.

When the modulation is set to PCM/FM, the Filter Settings window includes settings for IF and Phase Noise Compensation. In any other mode, only the IF Filter option is available.

Figure 144: Advanced Settings Window, IF Filter Menu

4.7.3.3.3   Output Muting

The Output Muting option sets the muting value to On or Off. When Output Muting is set to On, the receiver stops sending clock and data information when the timeout value is reached. This option is beneficial to someone using a recorder with limited space. For example, if data is not locked to a valid signal or is outside the valid range, the information is muted (stopped) so the recorder is not filled with bad data.

4.7.3.3.4   Muting Timeout

The Muting Timeout option is used to set a timeout value (in milliseconds). This setting is used to determine when to mute (stop sending data) when the Output Muting option is set to On. The valid range is 0 to 46016 milliseconds. The default value is 1000.

4.7.3.3.5   AFC Mode

The AFC (Automatic Frequency Control) Mode option, shown in Figure 145, compensates for frequency offset in the received signal relative to the expected carrier frequency. Demodulators for all modes in the RDMS™ contain frequency-tracking loops that can accommodate some amount of frequency offset. The amount of offset that can be tolerated depends on the mode and is generally a small percentage of the bit rate. If the input frequency offset is greater than this amount, then AFC is needed to make up the difference.

The two main sources of offset are (1) reference oscillator frequency differences between the transmitter and the receiver, and (2) Doppler shift. Reference oscillator differences are constant or very slowly time-varying. Doppler shift, by its nature, tends to be dynamic. The optimal AFC mode depends on the source and magnitude of the frequency offset. Valid selections are Off, Hold, and Track. In general, Quasonix recommends setting the AFC Mode to Off, if possible.

Note that the AFC is automatically overridden (Off) if the demodulator can natively tolerate at least 50 kHz of frequency offset. This prevents the AFC from potentially interfering with frequency tracking if AFC is unlikely to be needed. Override may be disabled, and many other detailed AFC parameters may be controlled, via the command line interface. Refer to section 4.9.1.3 for AFC command details.

Figure 145: Advanced Settings Window, AFC Mode Menu

4.7.3.3.5.1 AFC Mode – Track

When AFC Mode is set to Track, the AFC continuously attempts to estimate and compensate for the input frequency offset unless the input Eb/N0 falls below a predefined threshold. This mode is best suited for dynamic frequency offsets.

4.7.3.3.5.2 AFC Mode – Hold

When AFC Mode is set to Hold, the AFC holds its current compensation. This mode is best suited for static frequency offsets. It may be advantageous relative to the Acquire mode if the channel is initially "known good" but may become impaired during a mission.

4.7.3.3.5.3 AFC Mode – Off

When AFC Mode is set to Off, the AFC continuously provides zero compensation. This mode is best suited for small frequency offsets that are within the amount of frequency offset that the demodulator can natively tolerate.

4.7.3.3.6   Best Channel Selector

The Best Channel Selector option sets the Best Channel Selector value to On or Off. When this option is checked (On), the combiner data output selects the best channel (1, 2, or Combiner) based on DQM. Refer to section 4.6.2.17.10 for Best Channel Selector details.

Figure 146: Advanced Settings Window, Best Channel Selector Checked

4.7.3.3.7   Time Aligner

The Time Aligner option is only available with the Combiner option enabled and set to On. The Time Aligner can be disabled or enabled. When disabled, it remains Off and does not affect the combiner.

Clicking on the check box to enable the (combiner) time aligner, as shown in Figure 147, lets it determine when to operate (with no user intervention).

Figure 147: Advanced Settings Window, Time Aligner Selection Checked

Maximal ratio combining can only achieve optimal performance if the Channel 1 and Channel 2 input signals are accurately phase- and time-aligned. Traditionally, diversity combiners have performed phase alignment only, relying on the telemetry system design to provide adequate time alignment.

However, there are cases in which time alignment cannot be easily guaranteed. Such cases include frequency diversity and spatial diversity, where the propagation of transmit and receive paths for Channel 1 and Channel 2 may be quite different through cables, equipment, and the air. As bit rates continue to increase, fixed latency differences are magnified in relation to the bit period.

The Quasonix RDMS™ Combiner can perform both phase alignment and time alignment of the Channel 1 and Channel 2 signals. The Time Aligner is capable of correcting up to ±1300 nanoseconds of time skew between channels (about a quarter mile of free-space propagation). Similar to phase alignment, time alignment is dynamic, accommodating changes in relative target antenna positions over time.

When enabled, the Time Aligner continuously measures skew between channels but remains in a "monitor" state (with no timing correction) as long as the skew remains below a predefined threshold. When the skew exceeds the threshold, the Time Aligner switches to a "run" state (with full timing correction) as long as the signal quality is sufficient for it to continue to track timing skew.

If the propagation delay between channels is well-controlled and small, the Time Aligner may be disabled to guarantee minimal timing jitter.

4.7.3.4   Diversity Combiner Mode

The Quasonix RDMS™ Combiner can operate in one of two modes, Maximal Ratio or Best Source, as shown in Figure 148. Click on the drop down arrow to display the menu, then select the desired option.
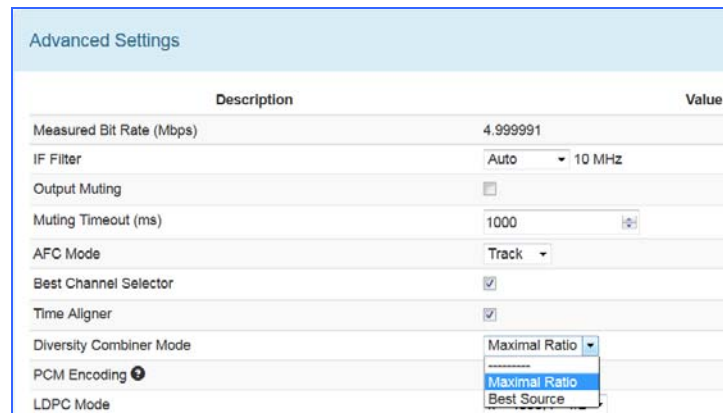
Figure 148: Advanced Settings Window, Diversity Combiner Mode Drop Down Menu

Maximal Ratio combining provides the best pre-detection combining possible, as long as the Channel 1 and Channel 2 input signals can be phase- and time-aligned by the Combiner. In this mode, the Combiner aligns the signals and, using an accurate measure of signal quality, generates their weighted sum. This sum contains the best of both signals plus uncorrelated noise, resulting in up to 3 dB improvement in effective SNR over each individual channel.

Best Source combining is a suboptimal method of combining, but it works for cases in which the Channel 1 and Channel 2 input signals cannot be phase- and time-aligned by the Combiner. Such cases would be rare, but one possible case might be spatial diversity over larger distances than the Combiner Time Aligner can compensate. In this mode, the Combiner continuously selects the channel with better signal quality, so there is no improvement in performance relative to the current best channel. Because Best Source combining is used when proper alignment of the two signals may not be achievable, the Time Aligner should be disabled when this Combiner Mode is selected.

Note: The Best Channel Selector (section 4.6.2.17.10) does not replace, but virtually obsoletes, the Diversity Combiner Best Source mode. In any application where phase- and time-alignment are possible, even if only occasionally, it is recommended that the Diversity Combiner Maximal Ratio mode be used in conjunction with enabling the Best-Channel Selector.

4.7.3.5   PCM Encoding

The RDMS receiver always outputs NRZ-L data. The PCM Encoding option allows user input (if different than NRZ-L) to be converted by the receiver from a specific transmitted type to NRZ-L. Select the desired encoding format from the drop down menu, as shown in Figure 149.

Available PCM encoding options are:

- NRZ-L: Non-return-to-zero, level
- NRZ-M: Non-return-to-zero, mark
- NRZ-S: Non-return-to-zero, space
- RZ: Return-to-zero
- Biphase-L: Biϕ, level
- Biphase-M: Biϕ, mark

- Biphase-S: Biϕ, space
- DM-M: Delay modulation (Miller code), mark
- DM-S: Delay modulation (Miller code), space
- M2-M: Modified delay modulation (Miller squared code), mark
- M2-S: Delay modified modulation (Miller squared code), space

Figure 149: Advanced Settings Window, PCM Encoding Drop Down Menu

4.7.3.6   LDPC Mode (SOQPSKLDPC, STCLDPC, or OQPSKLDPC Modes Only)

Low-Density Parity Check (LDPC) encoding is a form of forward error correction. It works by adding redundant information at the transmitting end of a telemetry link and then using that redundancy to detect and correct errors at the receiving end of the link. Details of LDPC coding are presented in IRIG 106 Appendix R.

LDPC encoding can have many benefits. Its most common use is in range extension, where bit errors occur due to a weak received signal. LDPC can improve the point at which errors start to occur by over 9 dB. This increase in link margin is equivalent to almost tripling the operating distance of the telemetry link. Another application is error suppression—for links like compressed video that suffer major degradation due to small numbers of errored bits. LDPC has such a steep bit error rate curve that it converts the channel into essentially binary performance— perfection or highly errored. Since perfection is achieved deep into the area where occasional bit errors would normally occur, compressed video performance is greatly enhanced. Ultimately, any channel that can benefit from error reduction and has bandwidth available will likely benefit from LDPC encoding.

The IRIG standard calls out six variants of LDPC codes—all combinations of two different information block sizes (k=4096 bits and k=1024 bits) and three different code rates (r=1/2, r=2/3, and r=4/5), as shown in Figure 101. The larger block size offers better decoding performance in a static channel but may work less well in a dynamic channel with fast fading or other impairments. Lower code rates also provide better decoding performance at the cost of increased occupied bandwidth. The optimal code choice for any application may require empirical testing to determine.

LDPC decoding is only available for SOQPSK-TG, STC, and OQPSKLDPC modulations. When in SOQPSK/LDPC, STC/LDPC, or OQPSKLDPC mode, the appropriate code (k, r) must be selected for proper operation. Also, in these modes only, the user may select between no derandomization, standard IRIG derandomization as specified in IRIG 106 Appendix D, or CCSDS derandomization as specified in IRIG 106

Appendix R. Again, the derandomization selection must match the encoding selected at the transmitting end for proper operation.

SOQPSK/LDPC uses trellis demodulation, whereas OQPSK/LDPC uses single-symbol demodulation. Trellis bit error rate performance in pure additive noise is slightly better than single-symbol bit error rate performance, as shown in IRIG 106-17, Figures D-10 and D-11. Trellis synchronization under adverse conditions may be significantly faster than single-symbol synchronization.

LDPC encoding is intended to improve performance specifically under harsh conditions, which might have a negative effect on AFC tracking. In general, Quasonix recommends setting the AFC Mode to Off if possible. This recommendation is especially important for the best LDPC performance. Refer to section 4.7.3.3.5 for more information about AFC Mode.

Select the desired encoding format from the drop down menu, as shown in Figure 150.

Available LDPC Mode options are:

---------- (none)	k = 4096, r = 1/2	k = 1024, r = 2/3
	k = 1024, r = 1/2	k = 4096, r = 4/5
	k = 4096, r 2/3	k = 1024, r = 4/5
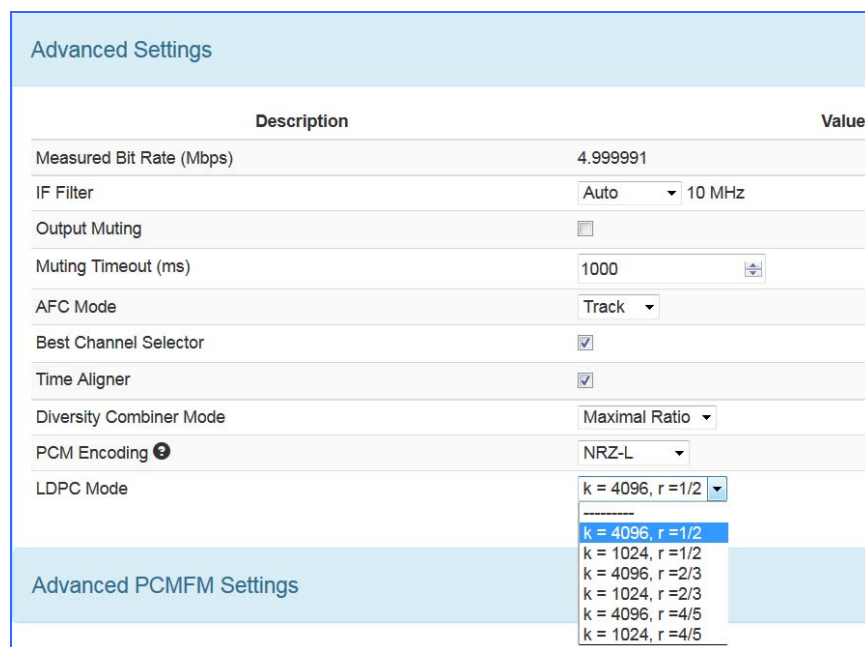
Figure 150: Advanced Settings Window, LDPC Mode Drop Down Menu

Note: LDPC Mode always displays on the Advanced Settings Menu. Selected values are NOT active unless the waveform Mode is SOQPSKLDPC, STCLDPC, or OQPSKLDPC.

4.7.3.7   Advanced PCM/FM Settings

The Advanced PCM/FM Settings window is shown in Figure 151. When the modulation is set to PCM/FM, the Scale Settings window includes settings for modulation scaling and video scaling indexes. In any other mode, the Scale Settings are not available.

Figure 151: Advanced PCMFM Settings Window

4.7.3.7.1   Modulation Index Scaling Mode

The Modulation Index Scaling Mode option allows the operator to manually set the modulation scale index. This enables the receiver to operate at the optimum range of modulation desired by the user. The valid modulation scaling *index* range is 0.350 to 8.000.

Modulation Index Scaling Mode contains four settings: Track, Hold, Off, and Acquire. Modulation Scaling is a method used to retain the maximum trellis-coding gain of a non-ideal FM signal. For additional functional details, refer to section 4.6.2.11 Modulation Scaling in the front panel section.

Figure 152: Advanced PCMFM Settings Window, Modulation Index Scaling Mode Menu

4.7.3.7.2 Modulation Persistence

Modulation Persistence allows the current state of the Modulation Scaling setting to be retained following a power-off cycle. The default value is Off (not checked), as shown in Figure 153.

Figure 153: Advanced PCMFM Settings Window, Modulation Persistence Not Checked

When modulation scale index is set, the Modulation Scaling option on the Configure screen is simultaneously changed to Hold. The Hold notation includes the new index number that the operator has chosen.

If the held index number is to be retained following a power-off cycle of the rack, then turn on Modulation Persistence by checking the Modulation Persistence box on the Advanced PCMFM Settings screen. Save the current setup profile using the Save Presets option. Refer to section 4.7.4.1.

When the RDMS™ is powered on, the default setting is Acquire, unless the unit was powered off from a preset condition. If the unit was powered off from an unmodified preset setting, then the default condition of Modulation Scaling is as defined in the preset. When Tracking is set, the modulation scale index is actively being tracked.

Note: The active setting is not saved when the rack is powered off, unless the Modulation Persistence option was set to On.

If there are two channels, and the Combiner is set to On, the Modulation Scaling is NOT linked. Modulation Scaling for channel one and channel two functions independently.

When the RDMS™ has a good lock on the target transmitter, Modulation Scaling should be set to Hold.

When Modulation Scaling is set to Hold or Off, the graphs display in green. This indicates the optimal Modulation Index is set.

Mod Scaling should be turned off when a new generation, digitally synthesized transmitter is the source. Digitally synthesized transmitters do not have a variable deviation sensitivity adjustment, and as such are not subject to inaccurate modulation index settings

When Modulation Scaling is set to Acquire, the graphs display in yellow.

Acquire mode has two states: Armed and Triggered. When Modulation Scaling is set to Acquire, the state is set to Armed. In Armed state, modulation scaling operates continuously.

If the receiver is locked and the delta h (the change in modulation index) has settled below the delta h threshold for the specified settling time, the state changes to Triggered and the eye pattern turns green. In Triggered mode, the estimated h (modulation index) is monitored but the scale is not updated.

If delta h goes above the delta h threshold and settles again, the receiver is still locked, and the Eb/N0 at the settling point is higher than the last settling point, the current scaling is updated with the new estimate.

There is no transition from Triggered back to Armed except for setting the mode to Acquire again.

4.7.3.7.3   Mod Scale Index

The Mod Scale Index option allows the operator to manually set the modulation scale index. This enables the receiver to operate at the optimum range of modulation desired by the user.

When modulation scale index is set via the front panel of the receiver, the Modulation Scaling option is simultaneously changed to Hold. The Hold notation includes the new index number that the operator has chosen.

To change the Modulation Scale Index in the *Browser*, ensure that the Modulation Index Scaling Mode is set to Hold. If it isn't, the Modulation Scale Index field is set to *read only*, as shown in Figure 154. Use the steps in section 4.7.3.7.1 to set and save the scaling mode. When the scaling mode is saved as Hold, the Mod Scale Index field changes to an editable field, as shown in Figure 155. Type the desired scale index in the field or use the up/down scroll arrows to change the value. The valid modulation scale index range is 0.350 to 8.000.

If the held index number is to be retained following a power-off cycle of the rack, then turn on Mod Persist from the Main Menu. Refer to section 4.6.2.12, Modulation Persistence.

Figure 154: Advanced PCMFM Settings Window, Modulation Scale Index Current Value, Read Only

Figure 155: Mod Index Scaling Mode/Hold, Modulation Scale Index with Edit Field

To clear any held modulation scale index number, go to the Main Menu and toggle the Mod Scaling option back to Tracking. After Mod Scaling is set to Tracking, the modulation index follows the receiver's present estimate of the mod index.

4.7.3.7.4   Video DeEmphasis

The Video DeEmphasis option is used to set the Video DeEmphasis value to Off, NTSC, or PAL. This option should be used when a corresponding video pre-emphasis filter is used on the video transmit side.
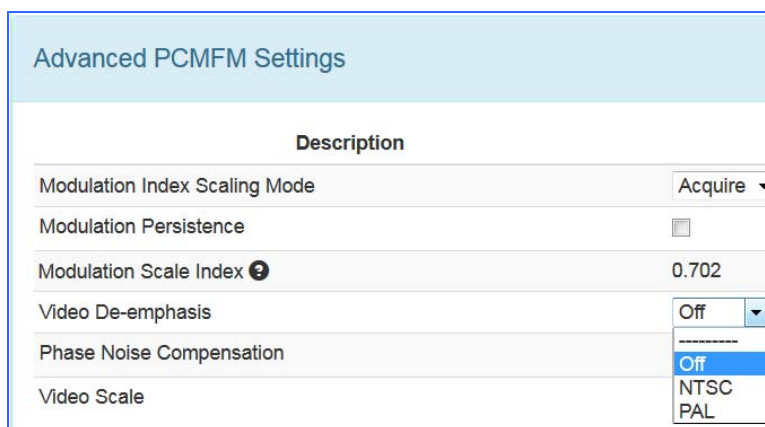
Figure 156: Advanced PCMFM Settings Window, Video DeEmphasis

4.7.3.7.5   Phase Noise Compensation

The Phase Noise Compensation (PNC) option is used to set the Phase Noise Compensation value to On or Off. Refer to Appendix C in section 11 for detailed information about PNC.

4.7.3.7.6   Video Scale

The Video Scale option sets the peak-to-peak amplitude on the video outputs. By default the video output is 1 V peak-to-peak using a standard deviated NTSC video signal. This setting allows the user to compensate for a system where this is not the case. The valid range is -128 to +128.

4.7.3.8   System Antenna Control Settings

The System Antenna Control window, shown in Figure 157, includes the following AGC (Automatic Gain Control) parameters:

- AGC Polarity (Positive/Negative)

- AGC Scale (in dB/V)

- AGC Time Constant (in ms)

- AGC Freeze

- AGC Zero Mode

- D/C Antenna

Figure 157: System Antenna Control Window

4.7.3.8.1 AGC Polarity

The AGC Polarity option is used to set the automatic gain control polarity. Click on the drop down menu to select Positive or Negative, as shown in Figure 158.

Figure 158: System Antenna Control Window, AGC Polarity Selection

4.7.3.8.2 AGC Scale

The AGC Scale option adjusts the voltage of the AGC back panel BNC output. The scale can be set in units of dB/V (decibels per volt). The higher the scale is set, the more dynamic range the AGC output can represent, but the lower its resolution will be. Refer to AGC Scale on the front panel, section 4.6.2.14.2, for an example.

4.7.3.8.3 AGC Time Constant

The Time Constant option sets the time constant of the AGC back panel BNC output. The time constant can be set in units of ms (milliseconds). The higher the time constant, the slower the AGC output voltage will move in response to changes in input signal level.

Because the AM back panel BNC output tracks any input signal level changes that are not tracked by the AGC, the AM output will include any signal amplitude frequency content from (approximately) the inverse of the AGC time constant up to the AM bandwidth limit. For example, if the AGC time constant is set to 100 ms and the AM bandwidth is set to 100 Hz, then the AM output will include any AM frequencies between roughly 10 Hz and 100 Hz.

4.7.3.8.4 AGC Freeze

The AGC Freeze option disables the hardware gain compensation loop such that gain from the RF input to the IF output is fixed. The receiver front end becomes a constant gain block, which may be useful for making receiver noise figure measurements or antenna G/T measurements. Note, however, that RSSI measurement and AM/AGC outputs will continue to reflect changing input levels within a +/-16 dB window around the frozen level. Also, RSSI is calibrated to be precise enough—even varying front-end gain—that AGC Freeze is not absolutely necessary to obtain excellent noise figure or G/T readings via the RSSI measurement.

Click on the drop down menu to select On or Off, as shown in Figure 159.

Figure 159: System Antenna Control Window, AGC Freeze Selection

4.7.3.8.5 AGC Zero Mode

The AGC Zero Mode option is shown in Figure 160. The AGC Zero Hold (On/Off) option from the 2nd Generation RDMS was replaced by AGC Zero Mode. There are three available settings, Manual, Hold, or Hold and Save.

- Manual – Means the AGC must be zeroed manually after any frequency or IF bandwidth change, or after a power cycle

- Hold – Means the AGC holds its zero level after any frequency or IF bandwidth change but must be zeroed manually after a power cycle

- Hold and Save – Means the AGC holds its zero level after any frequency or IF bandwidth change, or after a power cycle

The AGC Zero mode (manual, hold, or hold and save) remains set if a waveform mode changes.

Figure 160: System Antenna Control Window, AGC Zero Hold Drop Down Menu

4.7.3.8.6 Downconvert Antenna

The DC Antenna option is only available when using the 5-band downconverter AND P and C band are enabled.

- When the downconverting antenna is not available, this command displays only an assumed value.

- The downconverting antenna setting only applies to C band frequencies.

- Click on the box in the DC Antenna field to check the box and enable the option, as shown in Figure 161.

Figure 161: System Antenna Control Window, D/C Antenna Selection Checked

The downconverting antenna has an LO that is used to downconvert C band signals (4400 MHz – 5150 MHz) to a lower frequency range known as P band (400 MHz – 1150 MHz) using an LO frequency of 5550 MHz. This results in two issues that are addressed by the downconverting antenna control.

1. Spectral Inversion

    In a downconverting antenna, the LO is higher than the RF (high side injection) and the lower side band result is selected—the spectrum is inverted. All C to P band downconverting antennas are

assumed to produce a spectrally inverted signal. The receiver automatically reinverts the signal before it is demodulated. (This is done in the downconversion to 70 MHz IF.) If an actual P band signal is received, it is NOT spectrally inverted and the automatic reinversion done by the receiver improperly causes the signal to appear inverted to the demodulator.

The demodulator has a mechanism to invert the spectrum in the digital domain. The downconverting antenna setting determines how the spectral inversion is handled for P band signals.

2. C Band Frequency Specification Ambiguity

It is common to tune to the C to P band downconverted signal by specifying the C band frequency. In a receiver that also has actual C band receiver capability, an ambiguity develops when a C band frequency is specified since it can be applied to either a C or P band signal. The downconverting antenna setting determines how a specified C band frequency is interpreted in a system where both C and P bands are enabled.

If a C band frequency is specified and the downconverting antenna is *enabled*, it is assumed the signal is a C to P downconverted signal. The receiver is tuned to the P band equivalent and the automatic inversion is used. If the downconverting antenna is *disabled*, the receiver is tuned to the specified C band frequency and spectral inversion is not an issue.

If a P band frequency is specified, it is assumed there is no downconverting antenna. The receiver is tuned to the actual P band frequency and the automatic spectral inversion is disabled.

4.7.3.9   Interfaces Window

The Interfaces Setup window, shown in Figure 162, includes the following parameters:

- AM Bandwidth (Hz)

- AM Polarity (Positive/Negative)

- AM Scale (0.05-2.5)

- AGC Compensate

Figure 162: Interfaces Window

4.7.3.9.1   AM Bandwidth

To change the AM Bandwidth value, type the desired value or use the up/down arrows to scroll to the appropriate value. The AM Bandwidth can be set from 5.00 to 50000.00 Hz.

4.7.3.9.2 AM Polarity

AM Polarity is set by clicking on the drop down menu to select the desired value, Positive or Negative, as shown in Figure 163.

Figure 163: Interfaces Window, AM Polarity Drop Down Menu Selections

4.7.3.9.3 AM Scale

To change the AM Scale value, type the desired value or use the up/down arrows to scroll to the appropriate value. The AM Scale has a range from -128 to +128. At its default setting of 1, the response is 2V p-p, into a 75 ohm load with a 50% AM.

4.7.3.9.4 AGC Compensate

The user may enable AGC Compensation by clicking on the check box. Refer to Appendix B for more information about the AGC Compensation function.

4.7.3.10 Zero AGC Button

Automatic Gain Control (AGC) may be set to zero (0) by clicking on the green Zero AGC button in the Advanced section, shown in Figure 164. One or two buttons are available depending on the number of channels and the combiner mode.

Figure 164: Advanced Buttons, Zero AGC Button, Separate Channels or Combiner Active

Zero AGC is used to set a baseline for background radio noise levels. A typical application of the AGC Zero function is explained in the following example.

    a.   Connect the receiver to its normal RF signal source, such as antenna, LNA, cabling, and splitters.

b. Orient the receiving antenna in a direction that is expected to yield the lowest signal level that the receiver is likely to encounter.

c. Activate AGC Zero under this condition by clicking on the Zero AGC button.

The AGC output voltage is set to zero volts DC at a time when the receiver input is at its minimum value. This process ensures that the AGC output voltage will not cross through zero volts DC under normal operation.

To confirm AGC Zero, view the Monitor screen RSSI bar graph. If AGC is not zero, the graph is grey and there is no AGC Zero value displayed, as shown in Figure 165. When AGC is zero, the bar graph is not grey and the AGC Zero value is displayed, as shown in Figure 166.
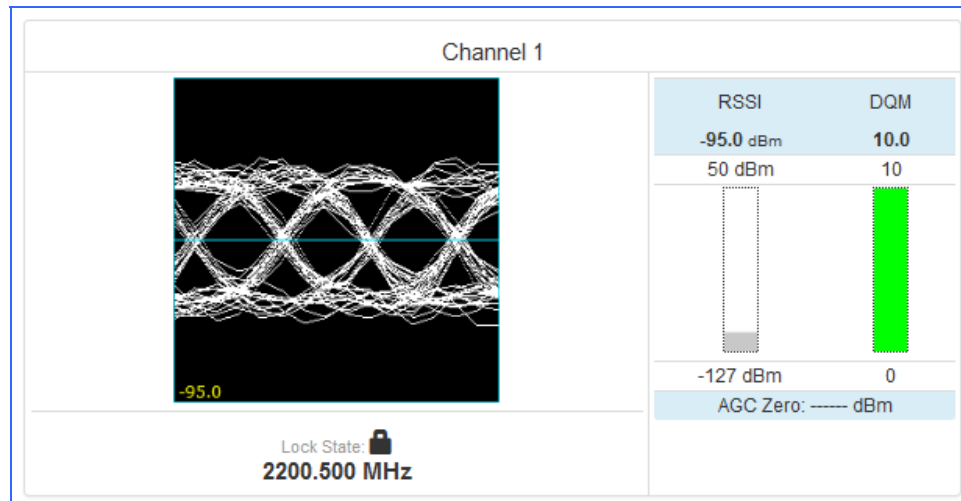
Figure 165: Monitor Screen, RSSI Grey – AGC Not Zero
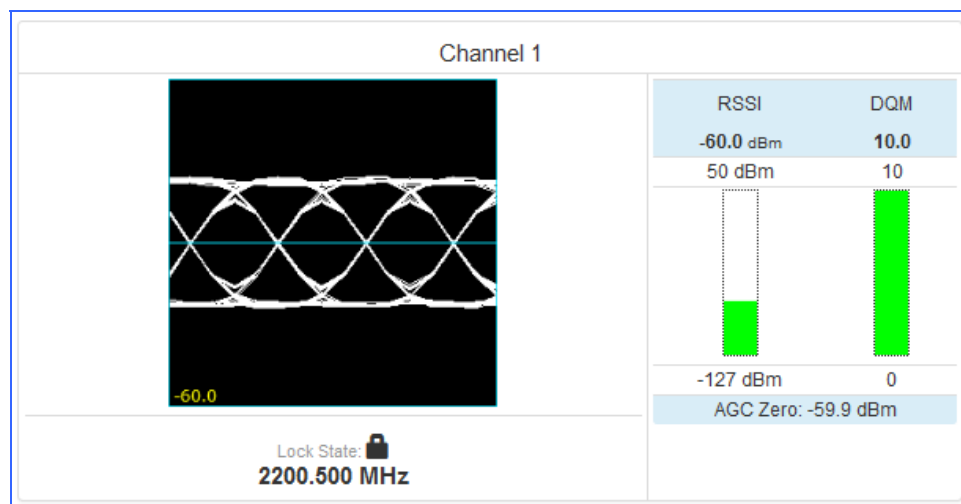
Figure 166: Monitor Screen, RSSI Not Grey – AGC Zero Value Displayed

4.7.3.10.1 RSSI Display

The RSSI display has two modes depending on the option selected in the RSSI Display drop down menu, shown in Figure 164.

If "Absolute" was the RSSI Display selection for the channel, the actual signal strength is displayed.

If "Relative" was selected, the RSSI displayed is relative to AGC Zero. The following bullets apply to RSSI Relative:

- a value of zero indicates no input signal

- a value above zero indicates how strong the signal is above no input

- "*** dBm" displayed (Figure 131) indicates AGC is not zeroed and the value is invalid

- small "r" displayed next to the RSSI label indicates AGC Zero Relative was selected
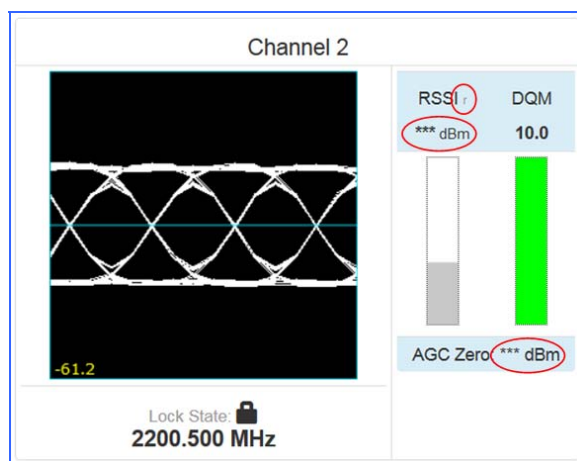
Figure 167: Signal Graph and Signal Indicators Windows, Zero AGC RSSI Display "Relative"

4.7.3.11 Reset to Factory Defaults Button

The Reset to Factory Defaults button, shown in Figure 168, sends a command to reset the RDMS hardware to factory default settings. During the process, the Browser Interface is temporarily unavailable.

Figure 168: Advanced Buttons, Reset to Factory Defaults Button

4.7.3.12 Shutdown Hardware Button

The Shutdown Hardware button, shown in Figure 169, sends a command to prepare the RDMS hardware for the removal of power. All current receiver settings are saved to ensure the subsequent startup restores the receiver's state. *Remote access is disabled when this action is performed.* There is no remote command to restart the hardware. Power must be removed and reapplied.

If the user intends to immediately restart the RDMS, it is important to wait until the indication that the unit is offline is received. This takes about 30 seconds, and is typically indicated by an "Unable to connect" message in the browser.

To restart the RDMS, perform the following action, depending on your installation:

- Cycle the power switch on the front panel of the RDMS receiver

- Remove AC power, then reapply using a remotely controllable power source, such as a network controlled power strip

Figure 169: Advanced Buttons, Shutdown Hardware Button

4.7.4 Presets

The Presets functionality is accessed via the Presets option on the Tool bar, as shown in Figure 170.
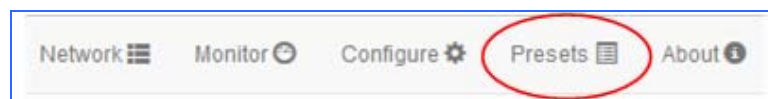
Figure 170: Presets Option on Tool Bar

4.7.4.1 Save Presets

Accessed from the Presets option in the Tool Bar, Saved Presets screen, shown in Figure 171, allows the user to save and load settings stored on the RDMS™ receiver. Closeups of the right and left side of the Presets screen are shown in Figure 172 and Figure 173.
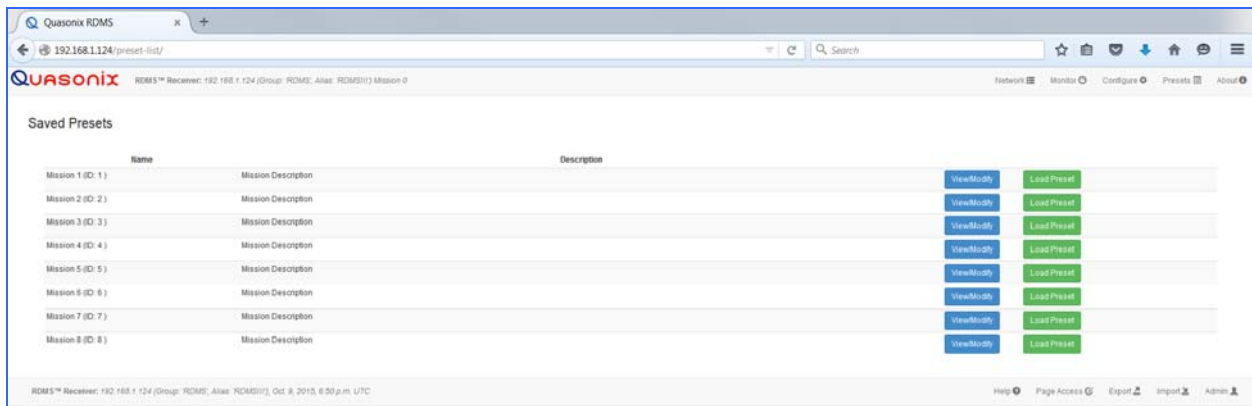
Figure 171: Presets Screen
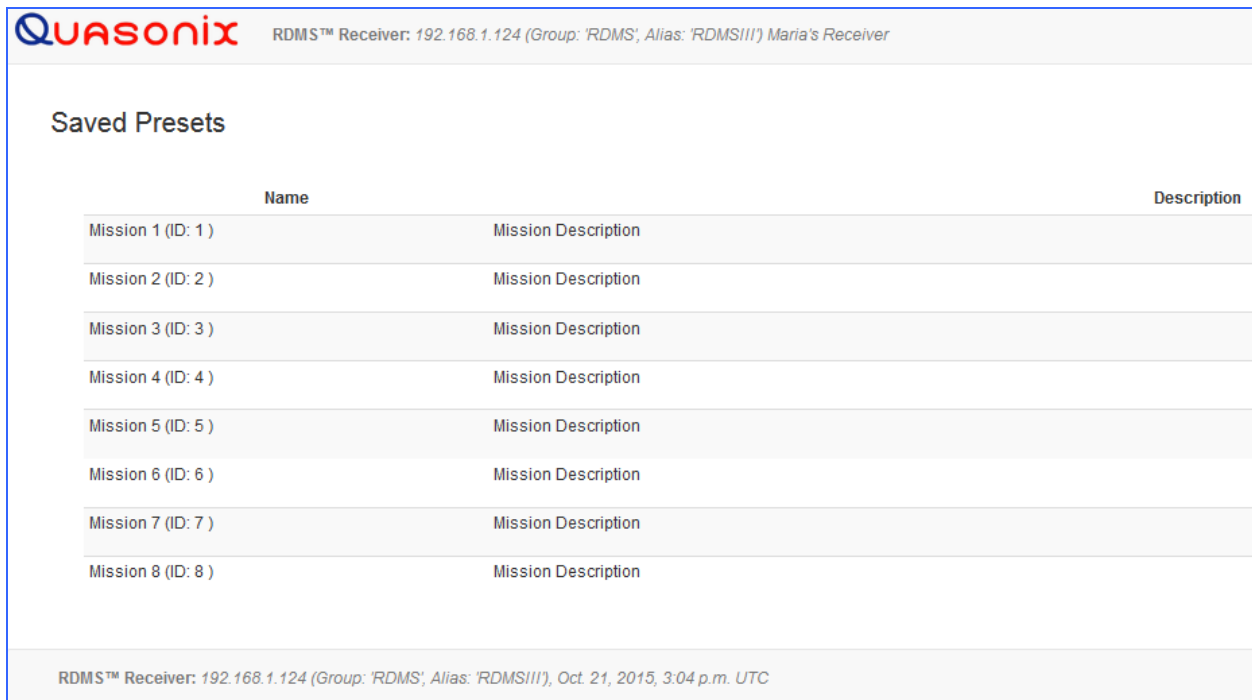
Figure 172: Presets Screen, Closeup of Left Side
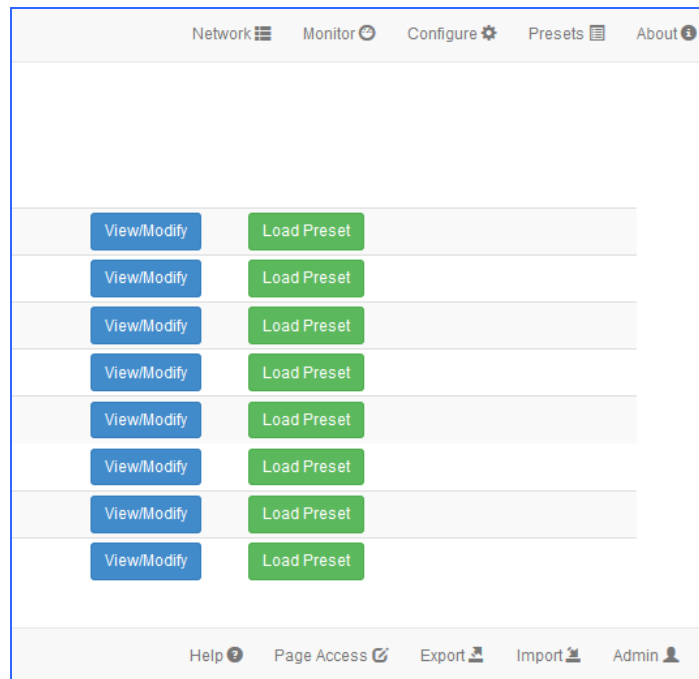
Figure 173: Presets Screen, Closeup of Right Side

The Saved Presets screen contains a list of eight (8) saved setup files. Files are accessed by clicking on the View/Modify button next to the desired preset.

When the user clicks on a View/Modify button, the Preset: View or Modify Preset screen opens, as shown in Figure 174. The contents and layout of this screen is similar to the Configure screen.
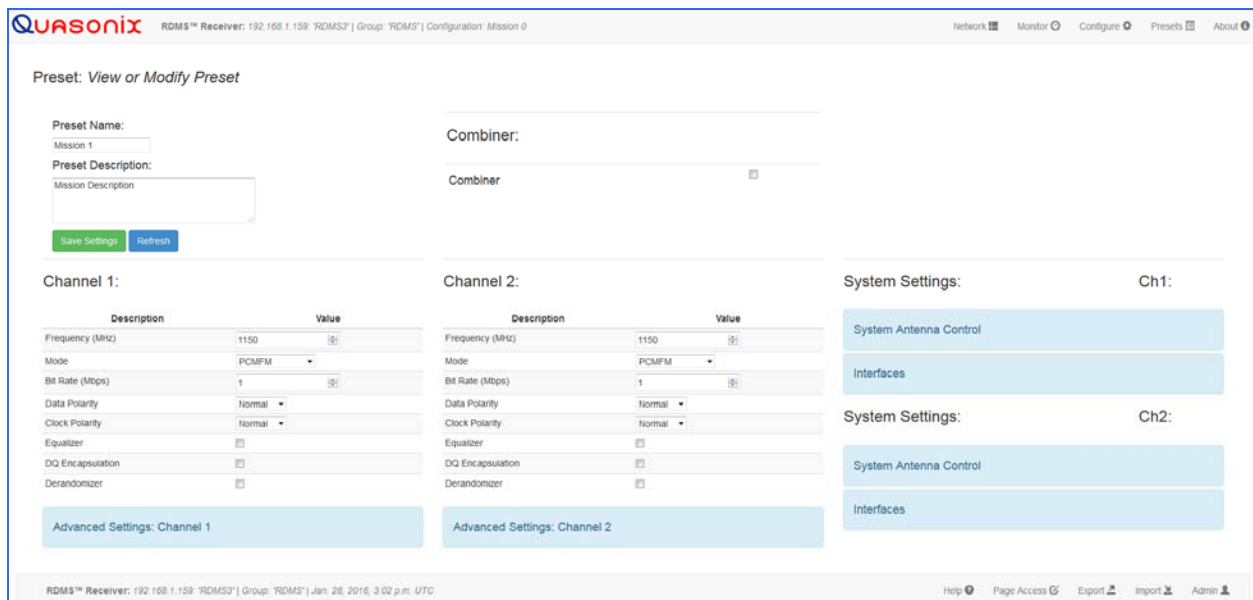
Figure 174: Preset: View or Modify Preset Screen

Type a name for the new preset file along with the desired description in the Preset Name and Preset Description fields as shown in Figure 175. Changing the name and description are not required but customizing them provides immediate recognition for the user. It also helps to eliminate confusion when changing an existing preset.

Preset names are limited to 20 alphanumeric characters, dots, dashes, and spaces. Longer preset names display in the Browser Interface, but may be truncated on the front panel of the RDMS™ when the preset file name exceeds 14 or 15 characters. This does not affect preset functionality.

Figure 175: Preset: View or Modify Preset Screen, Preset Name and Description Fields

The settings can be configured by clicking on a check box (to enable or disable an option), clicking on a drop down menu and making a selection, or, in the case of Frequency and Bit Rate, typing the number directly or using up/down scroll arrows to select the desired value. *New options are provided to the user when certain options are selected*, for example, Frequency Diversity, Time Aligner, and Diversity Combiner Mode are only available after Combiner is enabled *and saved*.

If all of the settings are configured as desired, click on the green Save Settings button. If the configuration must be modified, select or deselect settings until the desired configuration is achieved. Then click on the Save Settings button.

To save the current configuration as a preset, click on the Save as a Preset button in the Browser Interface *Configure screen*.

A "successfully saved" message displays in the Message bar, as shown in Figure 176.

Figure 176: Preset: View or Modify Preset Screen, Information Successfully Saved Message

When the user clicks on the Presets option in the Menu bar, the Saved Presets screen displays clearly showing the new preset, as shown in Figure 177.

Figure 177: Saved Presets Screen with New Preset Added

4.7.4.2 Load Presets

Loading a preset configuration is a quick way to set up an RDMS™ with specific settings. The RDMS™ has eight (8) default configurations pre-loaded and ready to use on the receiver. As shown in the previous section, the user may set up and save other configurations for later reuse.

To load a preset, click on the Presets option on the Tool bar, as shown in Figure 178.
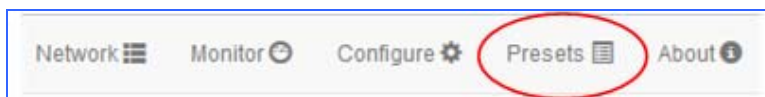
Figure 178: Presets Option on Tool Bar

When the Saved Presets screen displays (Figure 179), click on the green Load Preset button on the line containing the desired preset.
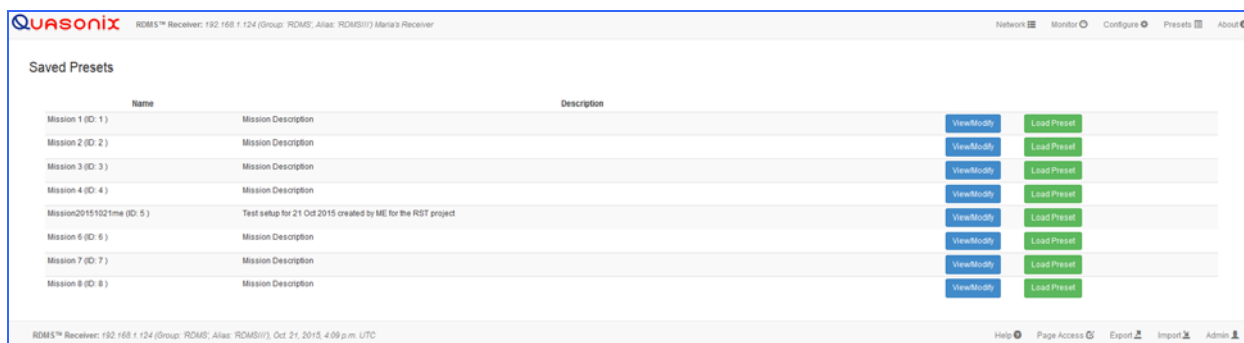
Figure 179: Presets Screen

While the preset is loading, the front panel on the receiver displays a wait message, as shown in Figure 180. The preset is finished loading when the wait message no longer displays.
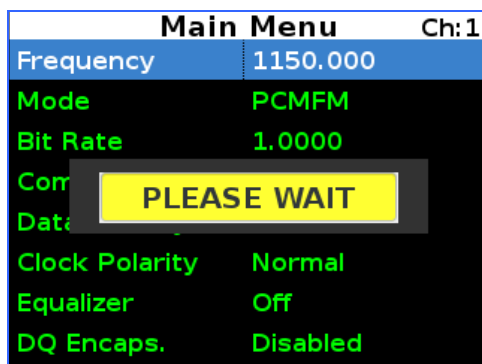
Figure 180: Loading Preset Please Wait Message on Front Panel

4.7.5   About

To access the System Information screen, click on the About option on the Tool bar, as shown in Figure 181.
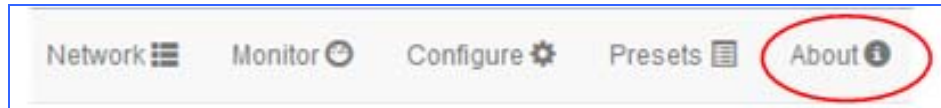
Figure 181: About Option on Tool Bar

In addition to displaying the system information, this screen is also used to add a Rack Alias, if desired. Type a new name into the Rack Alias field, as shown in Figure 183, then click on the Rename button.
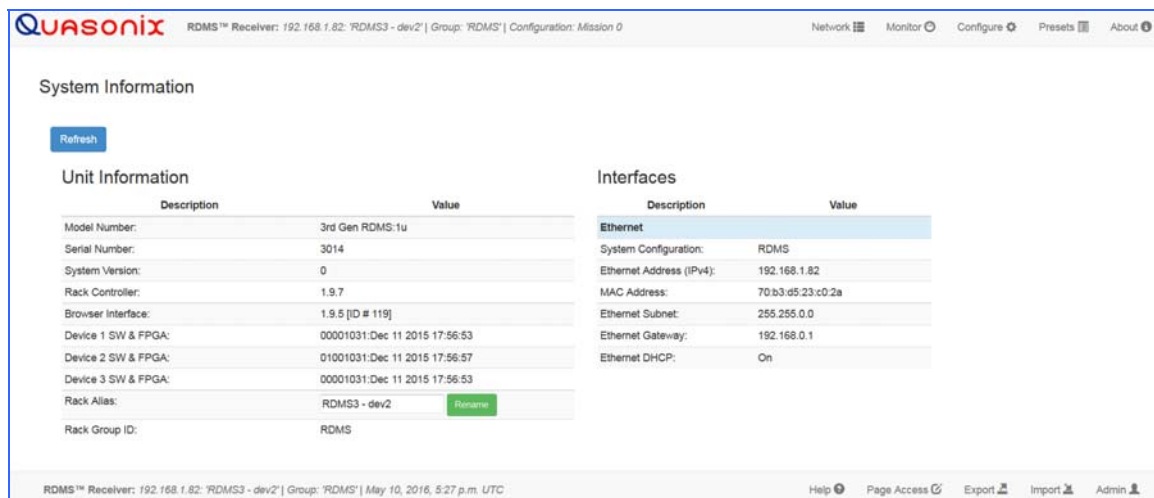
Figure 182: System Information Screen

Figure 183: System Information Screen, Rack Alias Field

4.7.6 Footer Tool Bar

The Footer Tool bar, shown in Figure 184, provides access to additional Browser Interface functionality.
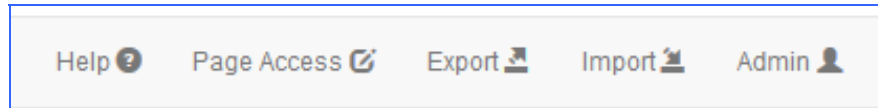
Figure 184: Browser Interface Footer Tool Bar

4.7.6.1 Help

The Help option on the Footer Tool bar, provides a link to the Rack-Mount RDMS Installation and Operation manual as well as contact information for Quasonix. The Help screen is shown in Figure 185.
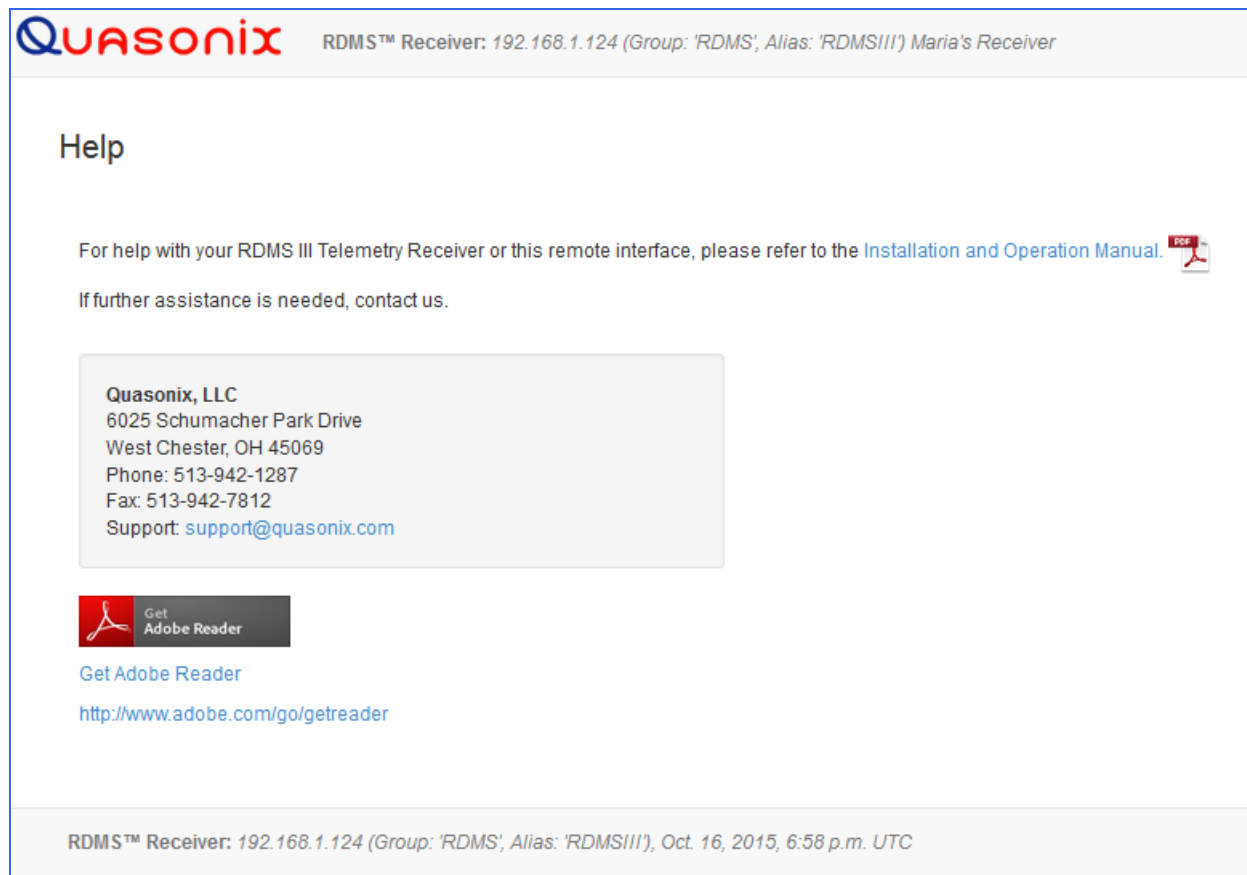
Figure 185: Help Screen

4.7.6.2 Page Access

The Page Access Management screen, shown in Figure 186, provides user feedback and control regarding configuration via multiple browser sessions that may be occurring on the receiver. As noted earlier, the 3rd

Generation RDMS receiver uses a built-in web server to provide monitoring and control. Multiple users may access the receiver. To minimize configuration or control conflicts, the Browser Interface alerts users of potential conflicts. Users may choose to override controls to provide access to specific pages.

Figure 186: Page Access Management Screen

The closeup images in Figure 187 and Figure 188 show the pages (screens) being accessed, their status, the controlling IP Address for the RDMS receiver, the time when control was acquired, and the length of time the user has been in control.

Figure 187: Page Access Management-Closeup of Left Side

Figure 188: Page Access Management-Closeup of Right Side

Users trying to access one of the browser screens, such as Configure, that was recently visited by another computer receive a Page Access Error message, as shown in Figure 189. The message provides a link to the Page Access Management screen so the user may review and release control as needed.
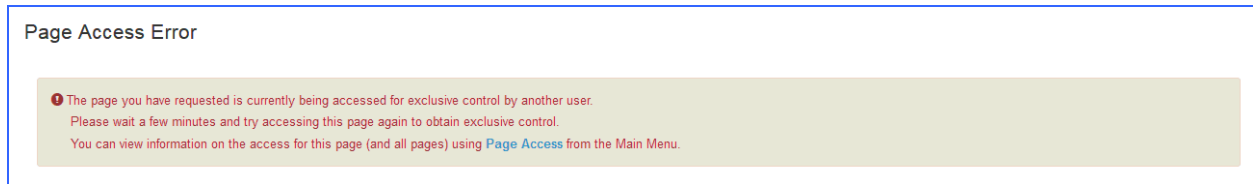
Figure 189: Page Access Error Message

4.7.6.3 Export

Export Configuration, shown in Figure 190, and Import Configuration provide a way for users to save and retrieve RDMS receiver settings and information. This functionality may be useful to provide a record of settings used during test missions, as a way to quickly switch between receiver setups, or as a way to backup the receiver settings. The files are saved locally, based on the browser's default settings, often the Downloads folder. These files may be moved or renamed as needed. Note, modifying the contents of the files is not recommended.

While in the Export Page, the user is able to select Current Receiver Settings, Saved Presets, and System Information by clicking on the check box associated with each option.

The Export Configuration button activates the download of the selected items into a single JSON type file that may be imported and read by the same, or other, RDMS Receivers.
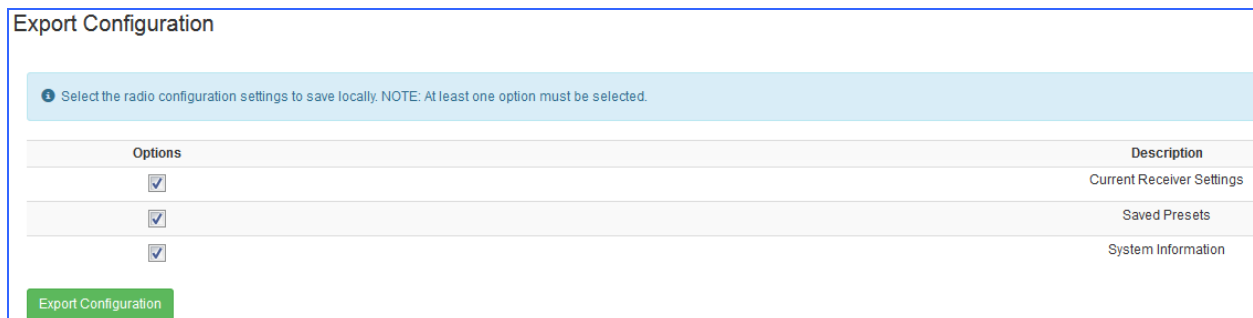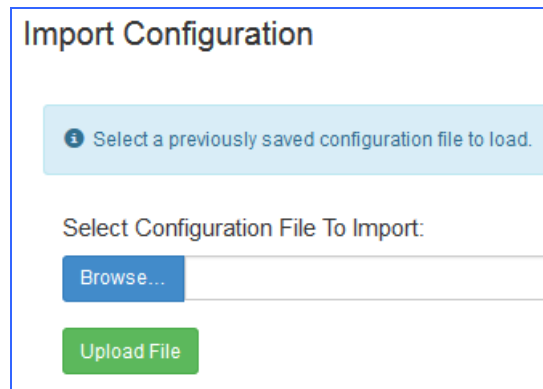
Figure 190: Export Configuration Screen

4.7.6.4 Import

The Import Configuration screen, shown in Figure 191, is used to import files that were previously exported (as described in the previous section).
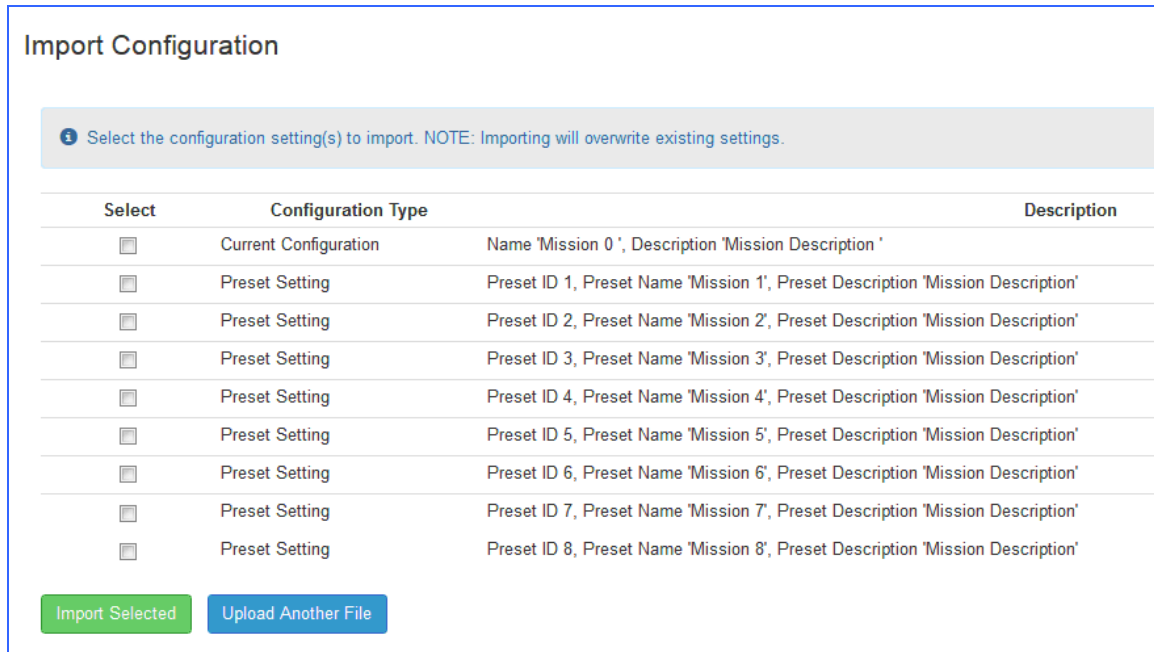
Figure 191: Import Configuration Screen

1. Click on the Browse button to open a File Upload window on the desktop.

2. Click on the Upload File button.

After the import file is selected, the Import Configuration screen allows the selection of specific items to be immediately copied to the current device, as shown in Figure 192.

Note that any settings on the receiver in the selected areas will be overwritten. This includes the Current Configuration.

Figure 192: Import Configuration Selection Window

4.7.6.5   Admin (Quasonix Factory Use Only)

The Admin link on the footer tool bar is used for Quasonix factory use only.

Figure 193: Quasonix RDMS Administration Window

4.8   Access via Telnet

Telnet provides access to the individual receiver channel's underlying serial control interface. The serial control interface is not recommended for typical Rack-Mount Receiver usage. The Telnet interface should only be accessed by advanced users. **Contact Quasonix customer support before using these options.**

NOTE: Access to this serial control interface is provided primarily for debugging purposes. Unlike the standard front panel and browser interfaces, the serial control interface within the Telnet screen is not safeguarded from accidental or improper changes to the receiver's configuration.

It is **strongly** recommended that users contact Quasonix Technical Support (Tel: 513-942-1287) prior to using the Terminal serial control interface.

1. In a command window, type: **telnet open {IP address of the receiver to connect to} 8888.**

2. Press the Enter key on the keyboard.

Figure 194: Telnet Into Terminal

The next screen (Figure 195) shows the RDMS channel subscribed to by Telnet.

Method 1-Use the Subscribed Channel

3. At this point, the user may ignore the instructions on the screen and press the Enter key again.
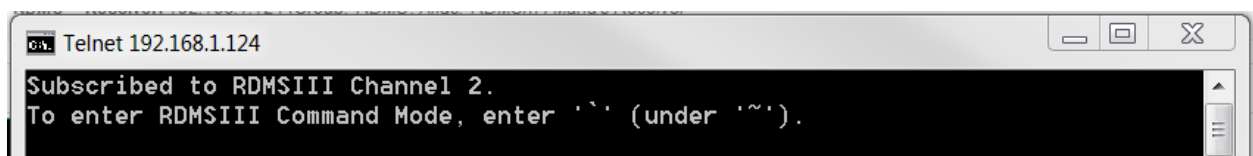
Figure 195: Channel Subscribed

The command prompt for the mode in the subscribed channel displays immediately, as shown in Figure 196. This is a portal to the receiver's serial control interface and allows the user to communicate to the individual receiver "brick" using its basic command protocol.
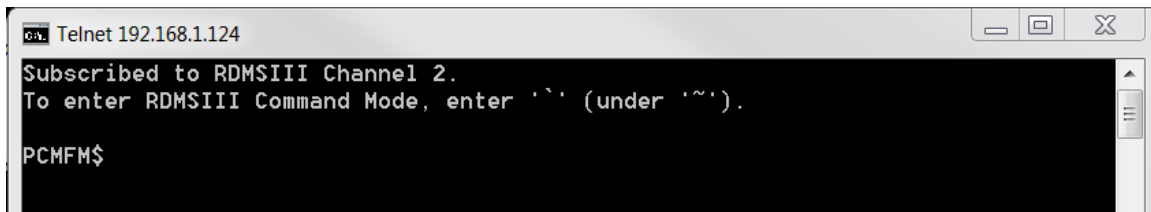
Figure 196: Connected to Channel 2 in PCM/FM Mode

Method 2-Unsubscribe and use a different channel

Look at the second Telnet screen again (Figure 197).

1. Follow the on-screen instruction and press the ` key. This is the very first key on the left side of the keyboard under the tilde (~).
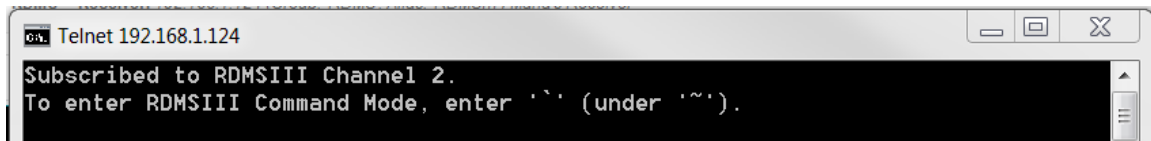
Figure 197: Channel Subscribed-Method 2

The RDMSIII Telnet Command Menu is shown in Figure 198.
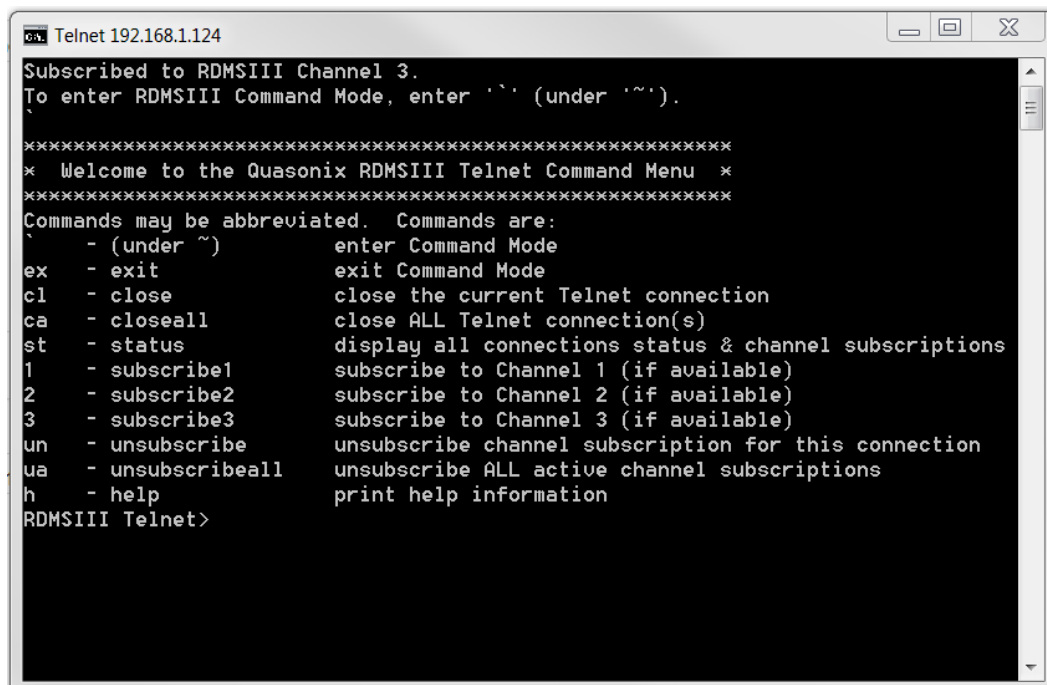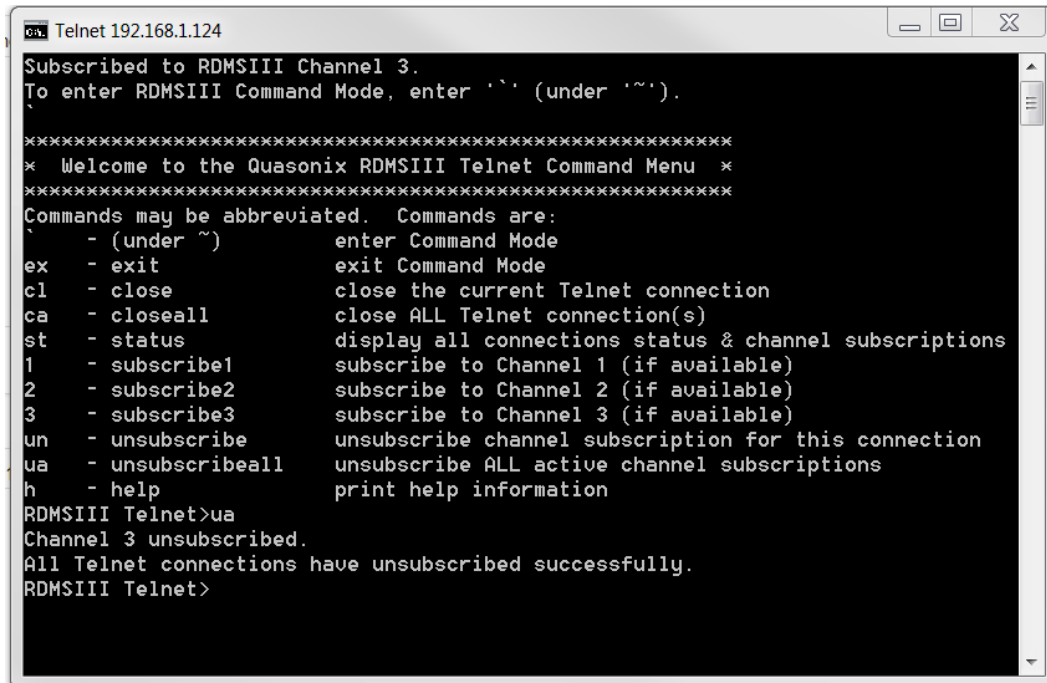
Figure 198: RDMSIII Telnet Command Menu
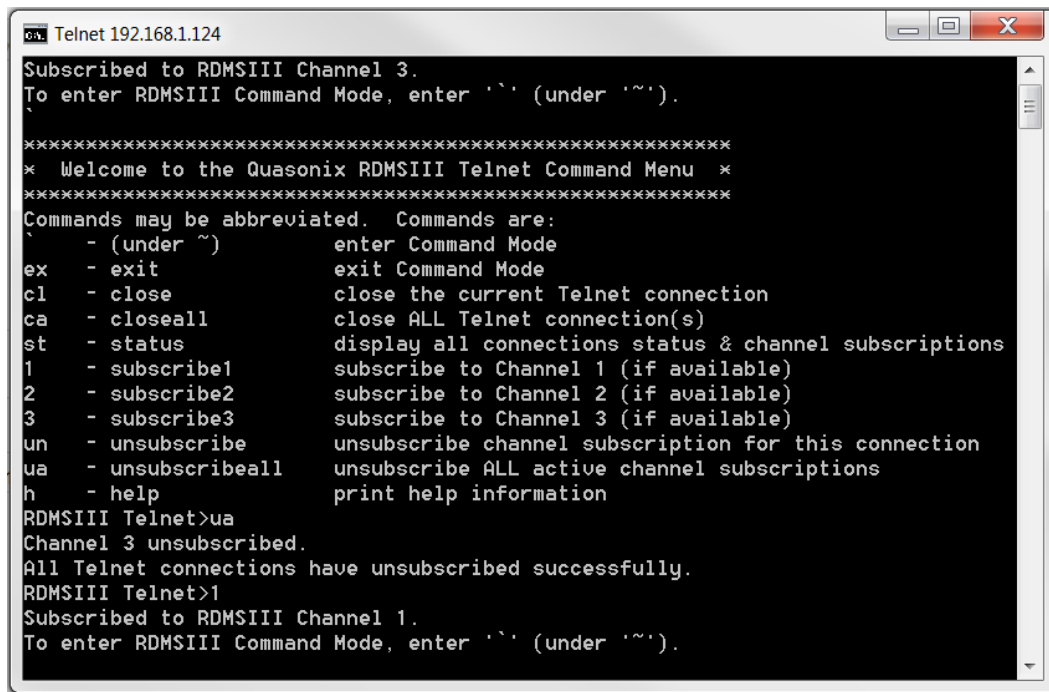
The command menu is used to unsubscribe from connections and reconnect to a specific channel. Figure 199 shows all connections being unsubscribed.


```
Telnet 192.168.1.124                                          ─  □   ✕

Subscribed to RDMSIII Channel 3.
To enter RDMSIII Command Mode, enter '`' (under '~').
`
××××××××××××××××××××××××××××××××××××××××××××××××××××
×   Welcome to the Quasonix RDMSIII Telnet Command Menu   ×
××××××××××××××××××××××××××××××××××××××××××××××××××××
Commands may be abbreviated.  Commands are:
`    - (under ~)           enter Command Mode
ex   - exit                exit Command Mode
cl   - close               close the current Telnet connection
ca   - closeall            close ALL Telnet connection(s)
st   - status              display all connections status & channel subscriptions
1    - subscribe1          subscribe to Channel 1 (if available)
2    - subscribe2          subscribe to Channel 2 (if available)
3    - subscribe3          subscribe to Channel 3 (if available)
un   - unsubscribe         unsubscribe channel subscription for this connection
ua   - unsubscribeall      unsubscribe ALL active channel subscriptions
h    - help                print help information
RDMSIII Telnet>ua
Channel 3 unsubscribed.
All Telnet connections have unsubscribed successfully.
RDMSIII Telnet>
```

Figure 199: RDMSIII Telnet Command Menu-Unsubscribe All Channels

In Figure 200, the user typed a 1 to subscribe (connect) to channel 1. At this point, the user may press the Enter key to continue, as described in Method 1.

```
Telnet 192.168.1.124
Subscribed to RDMSIII Channel 3.
To enter RDMSIII Command Mode, enter '`' (under '~').
`

****************************************************************
*   Welcome to the Quasonix RDMSIII Telnet Command Menu   *
****************************************************************
Commands may be abbreviated.  Commands are:
`     - (under ~)          enter Command Mode
ex    - exit              exit Command Mode
cl    - close             close the current Telnet connection
ca    - closeall          close ALL Telnet connection(s)
st    - status            display all connections status & channel subscriptions
1     - subscribe1        subscribe to Channel 1 (if available)
2     - subscribe2        subscribe to Channel 2 (if available)
3     - subscribe3        subscribe to Channel 3 (if available)
un    - unsubscribe       unsubscribe channel subscription for this connection
ua    - unsubscribeall    unsubscribe ALL active channel subscriptions
h     - help              print help information
RDMSIII Telnet>ua
Channel 3 unsubscribed.
All Telnet connections have unsubscribed successfully.
RDMSIII Telnet>1
Subscribed to RDMSIII Channel 1.
To enter RDMSIII Command Mode, enter '`' (under '~').
```

Figure 200: RDMSIII Telnet Command Menu-Subscribe to a Specific Channel

All Quasonix serial commands are alphabetic characters, followed by 0, 1, or 2 arguments. If the command is issued with arguments, there must be a space after the alphabetic characters. The commands are not case sensitive.

All commands generate a response of one or more lines. The length of the response depends on the verbosity level (set by the VL command – this is an advanced command). The last response line is always the currently selected mode (PCMFM, SOQPSK, CPM, or PSK), followed by the character "+" or ">", depending on the version of the firmware. This prompt signifies that the RDMS™ is ready to accept new characters.

A complete list of available serial commands can be found in section 4.9 or by typing HA.

4.9   Tier 0 (PCM/FM), Tier I (SOQPSK-TG), and Tier II (MULTI-H CPM) Commands

The following table describes all receiver user commands. Listed are the command code, name, description of the command, whether specific options must be ordered or the command is standard on all receivers, and whether the command is restricted to specific waveform modes.

Multiple commands may be typed on a command line if they are separated by a semicolon ";". There is a limit of 256 characters per command line, including semicolons. Commands with no parameters request status only.

Refer to command HA in section 4.9.1.25 for specific help in reading the command sets.

Refer to section 4.9.1 for additional command set detail and examples. Complete information is also available in the command Help.

For example:

PCM/FM>FR 2200.5; BR 6.000; AGC

results in the following:

Frequency set to 2200.5 MHz

Bit Rate set to 6.000 Mbps

and status for all AGC parameters are displayed as:

AGC control enabled

AGC control mode RF

AGC automatic mode select enabled

AGC zero mode Auto

AGC zeroed at -110.22 dBm (13.38 dB attenuation)

AGC auto zero hold threshold 0.000 dB

AGC auto zero time constant 0.250 seconds

AGC loop total power 13.375 dB

Bulk attenuator AGC control enabled, switched out

Ctrl Y repeats the command sequence without having to retype the commands.

Table 9: Standard and Optional User Commands

Mnemonic	Name	Description	Option (s) Required	Mode Restriction
?	Help Message	Displays abbreviated list of available Help commands	Standard	None
ACU	Antenna Control Unit	Report or set antenna control unit automatic gain control (AGC) settings	Standard	None
AEQ	Adaptive Equalizer	Report equalizer status and control adaptive equalizer settings	EQ	None
AFC	Automatic Frequency Control	Report or set a variety of automatic frequency control parameters	Standard	None
AHM	Analog High Speed Mixer	Displays and controls high speed (video) output mixer settings	Standard	None
AHO	Analog High Speed Output (Tape Output)	Displays and controls high speed (video) output settings	Standard	None
ALM	Analog Low Speed Mixer	Displays and controls low speed (video) output mixer settings	Standard	None
ALO	Analog Low Speed Output	Displays and controls low speed (ACU) output settings	Standard	None
AL	Lock Status Command	Reports system lock status	Standard	None
BCS	Best Channel Selector	Displays and controls best channel selector settings	Standard	None
BER	Bit Error Rate	For Bit Error Rate commands and information, refer to Appendix A, Bit Error Rate Testing	Standard	None
BR	Bit Rate	Report or set baseband bit rate	Standard	For Asynch PSK (legacy) modes, BR A and BR B must be specified separately
CLH	Command Line History	Reports last 25 commands issued	Standard	None

Mnemonic	Name	Description	Option (s) Required	Mode Restriction
CMB	Combiner Control	Displays and controls combiner settings	Standard	None
CP	Clock Polarity	Report or set clock polarity inversion state	Standard	For Asynch PSK (legacy) modes, CP A and CP B must be specified separately
DA	Downconverting Antenna	Displays and controls receiver C band to P band downconverting antenna	P band enabled receiver	None
DD	Differential Decoding	Enable or disable differential decoding	Standard	SOQPSK
DHI	High Speed Digital Input	Displays and controls high speed digital input settings	Standard	None
DHO	High Speed Digital Output	Displays and controls high speed digital output settings	Standard	None
DLI	Low Speed Digital Input	Displays and controls low speed digital input settings	Standard	None
DLO	Low Speed Digital Output	Displays and controls low speed digital output settings	Standard	None
DOM	Digital Output Muting	Control shut down of clock and data outputs	Standard	None
DP	Data Polarity	Report or set data polarity inversion state	Standard	For Asynch PSK (legacy) modes, DP A and DP B must be specified separately
DQ	Data Quality Encapsulation and Metrics	Display and control data quality encapsulation and DQ metrics	Standard	ARTM modes
DR	Derandomizer State	Report or set the derandomizer state	Standard	None
DSO	Digital Status Output	Control the source, polarity, and override states	Standard	None
FEC	Forward Error Correction Mode	Report FEC status for enabled modes	-K7	Legacy PSK or PCM/FM

Mnemonic	Name	Description	Option (s) Required	Mode Restriction
FL	Force Lock Indication	Diagnostic tool to force the system to indicate locked or unlocked	Standard	None
FM	FM Demodulator Settings	Display and control FM demodulator settings	Standard	PCM/FM
FPD	Front Panel Display Status	Display data sent to the rack used to keep the front panel displays updated	Standard	None
FR	Frequency	Report or set receiver center frequency	Standard	None
HA	Advanced Help Command	Displays Help commands not frequently used or with more complex construction than the basic two character Help commands	Standard	None
IF	IF Filter Control	Display and control IF filter settings	Standard	None
LDPC	Low Density Parity Check	Display and control Forward Error Correction settings	Standard	SOQPSKLDPC or STCLDPC
MI	Modulation Index	Report or Set Modulation Index Tracking or Acquire	Standard	PCM/FM
MO	Modulation	Report or set modulation setting	Standard	Limited to modes installed
OCM	Output Clock Measurement	Displays measured output clock frequency	Standard	None
PDC	PCM Decoding	Controls digital decoding such as NRZ-L, NRZ-M, and bi-phase	Standard	None
PER	Parameters Erase	Erases the stored parameter set for the current mode; Upon power cycle, resets current operating parameter set to factory default values	Standard	None
PERA	All Parameters Erase	Reset all modes to factory default values	Standard	None
PL	Input Power Level	Reports or sets the current input power level setting	Standard	None
PLD	Parameters Load	Loads the stored parameter set into the current operating parameter set	Standard	None

Mnemonic	Name	Description	Option (s) Required	Mode Restriction
PNC	Phase Noise Compensation	Report or set phase noise compensation state	Standard	PCM/FM
PRS	Reset Defaults	Restores factory default parameters for the unit Default is currently the lowest number modulation supported by the transmitter with the selected band and frequency limits	Standard	None
PSV	Parameters Save	Writes the current operating parameter set into a (previously erased) stored parameter set	Standard	None
RFD	Reset Defaults	Reset all parameters to factory default values Erases all parameter data Resets to default Mode	Standard	None
QT	Query Temperature	Report the temperature in degrees Celsius	Standard	None
SDI	Signal Degradation Information	Sets signal degradation information enable or disable parameters	Standard	SOQPSK
SI	Spectrum Inversion	Accounts for downconverting antenna spectral inversion	Standard	None
SN	Show Serial Number	Report the serial number for the unit	Standard	None
SV	Save Parameters	Saves the current parameters in non-volatile memory, including frequency, modulation, bit rate, data polarity, clock polarity, AGC state, verbosity level, etc.	Standard	None
SYS	System Status Tracking	Displays the system status of the receiver	Standard	None
TOD	Time of Day	Sets the current calendar date and time of day	Standard	None
UP	Show Options	Displays the current hardware configuration and options on the receiver	Standard	None

Mnemonic	Name	Description	Option (s) Required	Mode Restriction
VE	Version	Report the current Firmware (software) version information for the receiver; displays the current application, FPGA, and adaptive equalizer versions	Standard	None

4.9.1 Additional Command Set Details

4.9.1.1 Antenna Control Unit – ACU

The ACU command displays and controls the antenna control unit settings.

ACU [M <m>|C <e>|O <s>]

> M <m> - Sets antenna control mode to <m>
>
> > where: <m> - Control mode
> >
> > > M – AGC time constant and AM bandwidth set manually
> > >
> > > S – AGC time constant and AM bandwidth set based on antenna scan
>
> C <e> - Sets AGC compensated AM enable to <e>
>
> > where: <e> - Enable
> >
> > > 0 – Disabled
> > >
> > > 1 – Enabled
>
> O <s> - Sets antenna control output to <s>
>
> > where: <s> - Signal source
> >
> > > 0 – Channel 0
> > >
> > > 1 – Channel 1
> > >
> > > C – Combiner

ACU [S [T <t>|R <r>]] – Antenna scan settings

> T <t> - Sets antenna mode scan type to <t>
>
> > where: <t> - Scan type
> >
> > > C – Conical scan
> > >
> > > E – E-scan
>
> R <r> - Sets antenna mode scan rate to <r>, 10.00 to 50.00 Hz

ACU [AM [<p>|S <s>|B <b>]] – Antenna control unit AM settings

    <p> - Sets AM output polarity to <p>

        where: <p> - Polarity

            {0|+} – Normal

            {1|-} – Inverted

    S <s> - Sets AM output scale to <s>, -128.0 to 128.0

    B <b> - Sets manual mode AM detector bandwidth to <b>, 5.00 to 50000.00 Hz

ACU [AGC [<p>|S <s>|T <n>]] – Antenna control unit AGC settings

    <p> - Sets AGC output polarity to <p>

        where: <p> - Polarity

            {0|+} – Normal

            {1|-} – Inverted

    S <s> - Sets AGC output scale to <s>, 1.0 to 50.0 dB/V

    T <n> - Sets manual mode AGC time constant to <n>, 0.1 to 1000.0 ms

Examples:

ACU   Report ACU related status
       PCMFM$acu
       ACU mode manual
       AGC compensated AM on
       Antenna scan type conical
       Antenna scan rate 30.0 Hz
       Manual AM bandwidth 100.0 Hz
       Manual AGC time constant 100.0 ms
       AM output polarity +
       AGC output polarity +
       AGC output scale 10.0 dB/V
       AM scale 1.0

ACU AGC 0   Set polarity to Normal
ACU AGC 1   Set polarity to Inverted
ACU AGC S 42.0   Set AGC output scale to 42.0 dB/V
            Valid range is 1.0 to 50.0 dB/V
ACU AGC T 222.0   Set manual mode AGC time constant to 222.0 ms
            Valid range is 0.1 to 1000.0 ms

4.9.1.2 Adaptive Equalizer Control – AEQ

The AEQ command displays and controls adaptive equalizer settings.

AEQ [<e>| H {E|Q}|HE<t>|HQ <t>|HD <t>]

        <e> - Sets adaptive equalizer enable to <e>

            where: <e> - Enable

                    0 – Disabled

                    1 – Enabled

        H E – Sets equalizer hold reference to Eb/N0

        H Q – Sets equalizer hold reference to DQM BEP

        HD <t> - Sets EQ hold/run delay <t>, 10 to 60000 ms or 0 is Off

        HE <t> - Sets EQ hold below Eb/N0 <t>, -20.000 to 30.000 dB or -100.000 is Off

        HQ <t> - Sets EQ hold below DQM BEP <t>, 1.00042e-12 to 0.5 or 1.0 is Off

AEQ [M <c>|D <d>|S <s>|R {<e>|S <s>}|C {<e>|R <r>}]

        M <c> - Sets EQ Mu <c>, -0.125 to 0.124996

        D <d> - Sets EQ error filter delta to <d>, -0.500 to 0.499985

        S <s> - Sets EQ input scale to <s>, 0.000244 to 15.999756

        R <e> - Sets auto reset enable to <e>

            <e> - Sets adaptive equalizer enable to <e>

                where: <e> - Enable

                      0 – Disabled

                      1 – Enabled

        R S <s> - Sets auto reset speed to <r>

            where: <s> - Speed

                  F – Fast

                  S – Slow

        C <e> - Sets power centering enable to <e>

            <e> - Sets adaptive equalizer enable to <e>

                where: <e> - Enable

                      0 – Disabled

                      1 – Enabled

C R <r> - Sets power centering rate to <r>, 0 to 65535

AEQ [N {C <c>|L <l>}]

N C <c> - Sets added noise coefficient to <c>, 0.000015 to 0.999985

N L <l> - Sets added noise limit to <l>, 0.000015 to 0.999985

AEQ [P {T <t>|S <s>}]

P T <t> - Sets power check target to <t>, 0.000244 to 15.999756

P S <s> - Sets power check scale to <s>, 0.000244 to 15.999756; default is 0.0

AEQ [SC {C <c>|D <d>}]

SC C <t> - Sets symbol check count to <c>, 0 to 16777215

SC D <s> - Sets symbol check delta to <d>, 0 to 16777215

AEQ TAPS [C|CC|CP|G][F[<w>]] – Display equalizer tap values

C – Display using CSV format

CC – Display complex values using CSV format

CP – Display polar values using CSV format

G – Display as graphic only

F[<w>] – Display taps in frequency domain of width <w>, 2 to 64

AEQ BINS [C] – Display equalizer bin values

C – Display using CSV format

Examples:

AEQ   Report equalizer status

    PCMFM$aeq

    Adaptive equalizer disabled

    Filter Mu 0.000122

    Center power 0.250 Total power 0.250 (0.000 dB)

    Error magnitude 0.000244

    Added noise 0.000000

    EQ Eb/N0 auto hold enabled below 10.000 dB Eb/N0

    EQ DQM auto hold enabled below 1.000e-02

    EQ auto hold reference DQM (and held)

AEQ 0 Disable adaptive equalizer

AEQ 1 Enable adaptive equalizer

AEQ H x   Set equalizer hold below Eb/N0 to a value between -20.000 and 30.000 dB;

        -100.000 sets equalizer hold to Off

AEQ T 0   Disable equalizer information tracking display

AEQ T 1   Enable equalizer information tracking display

4.9.1.3   Automatic Frequency Control – AFC

The Automatic Frequency Control command reports or sets various AFC parameters.

AFC [M <m>|H <t>|C {A|<c>}|L <m>|T {L|H} <t>|R <e>] or AFC SYS <d>

     M <m> - Sets AFC mode to <m>

         where: <m> - mode

             O – Off

             H – Hold

             T – Track

     H <t> - Sets AFC hold below Eb/N0 <t>, -20.000 to 30.000 dB or -100.000 is off

     C A – Sets AFC coefficient to be automatically set based on bit rate

     C <c> - Sets AFC coefficient to <c>, 0.0003511 to 46.018 seconds

     L <m> - Sets AFC correction limit to <m>, 0.000006 to 46.666661 MHz

     T L <t> - Sets AFC power detect low threshold to <m>, 0.000000 to 0.999985

     T H <t> - Sets AFC power detect high threshold to <m>, 1.000015 to 65536.000000

     O <e> - Sets AFC data path override enable to <e>

         where: <e> - enable

             0 – Disabled

             1 – Enabled

     SYS <d> - Sets the AFC status tracking display mode to <d>

     where: <d> - display mode

         D – Detected

         C – Compensated

     The Sys d setting is used to change whether detected or compensated offset is displayed in the SYS output.

AFC C – Sets the automatic frequency control coefficient

Examples:

AFC C A   Set AFC coefficient to be automatically set based on bit rate

AFC C 0.00001   Set AFC coefficient to 0.00001 seconds (ten times slower tracking than default)

                     Valid range is 4.389e-05 to 5.752 seconds

AFC H – Sets the automatic frequency control hold threshold below Eb/N0

Example:

AFC H 6.000   Set AFC to automatically hold tracking below 6.000 dB E_b/N_0

Valid range is -20.000 dB to 30.000 dB; -100.000 dB is Off

AFC L – Sets the automatic frequency control correction limit

Example:

AFC L 42.123456   Set AFC correction limit to 42.123456 MHz

Valid range is 0.000006 to 46.666661 MHz

AFC M – Sets the automatic frequency control mode

Examples:

AFC M O   Set AFC to Off

AFC M H   Set AFC to Hold

AFC M T   Set AFC to Track

AFC M A   Set AFC to Auto

AFC P <p> – Sets the automatic frequency control hold period

Example:

AFC P 5007   Set AFC hold period to 5007 μs

Valid range is 0.000 to 4294967296.000 μs; initialized value is 5000 μs

AFC T – Sets the automatic frequency control power detect threshold

Example:

AF T 0.0000   Set AFC to power detect threshold to 0.000

Valid range is 0.000 to 1.000

Example:

AFC

AFC auto operation mode Off

AFC tracking auto hold below 6.00000 dB Eb/N0

Compensated frequency offset -0.004606 MHz

Detected frequency offset -0.004718 MHz

Duty cycle   0.08 %

Auto AFC bandwidth is enabled

AFC coefficient 0.03573 seconds

AFC limit 0.50000 MHz

AFC power threshold 0.000

4.9.1.4   Automatic Gain Control – AGC

The Automatic Gain Control command reports and sets a variety of AGC parameters. Additional AGC commands are described in separate subsections 4.9.1.4.1 through 4.9.1.4.7.

AGC [-V] – Shows advanced AGC status

AGC [<e>] – Sets the AGC enable to <e>

>>>> where: <e> - Enable

>>>>> 0 – Disabled

>>>>> 1 – Enabled

Example:

AGC (shows total actual power attenuation readings)

>> AGC control enabled

>> AGC control mode RF

>> AGC automatic mode select enabled

>> AGC zero mode Manual

>> AGC zeroed at -60.36 dBm (60.38 dB attenuation)

>> AGC auto zero hold threshold 0.000 dB SNR

>> AGC auto raising zero time constant 0.250 seconds

>> AGC auto lowering zero time constant 0.250 seconds

>> AGC loop total attenuation 60.062 dB

>> Bulk attenuator AGC control enabled, switched out CMFM$agc

>> AGC control enabled

>> AGC control mode RF

>> AGC automatic mode select enabled

>> AGC zero mode Manual

>> AGC zeroed at -60.36 dBm (60.38 dB attenuation)

>> AGC auto zero hold threshold 0.000 dB SNR

>> AGC auto raising zero time constant 0.250 seconds

>> AGC auto lowering zero time constant 0.250 seconds

>> AGC loop total attenuation 60.062 dB

>> Bulk attenuator AGC control enabled, switched out

4.9.1.4.1   Automatic Gain Control Bulk Attenuation – AGC BA

The **AGC BA x** command sets the bulk attenuation parameters. The bulk attenuator has three modes In, Out, and Auto. Setting the bulk attenuator to In or Out removes the bulk attenuator from AGC control and forces it In or Out, respectively. Setting it to Auto allows the AGC mode to control it.

There are no hard value limits for the switch in/out threshold at input power due to variances in other parameters such as gain, calibration, and temperature. It will clip to a minimum or maximum value and report that setting.

The bulk attenuation switch out threshold is forced to match the switch in threshold when the AGC is in IF mode. This is to prevent the AGC from attempting to switch the bulk attenuator while using a path that doesn't have a bulk attenuator.

AGC [BA [<e>|V <a>|D <t>|{I|O <t> [A]}]] – AGC bulk attenuation settings

   <e> - Sets bulk attenuation control enable to <e>

     where: <e> - Enable

       0 – Disabled, switched out

       1 – Enabled, switched in

       A – AGC control enabled

   V <a> - Attenuation value to <a>, 0.0000 to 511.9375 dB

   D <t> - Switch out threshold delta attenuation <t>, -255.5 to -0.0 dB

   I|O <t> - Switch In|Out threshold at input power <t>, in dBm

   I|O <t> A – Switch In|Out threshold at attenuation <t>, 0.0 to 255.5 dB

Examples:

AGC BA 1	Bulk attenuator AGC control enabled, switched in
AGC BA V 17.000	Set attenuation value to 17.000 dB
	Valid range 0.0000 to 511.9375 dB
AGC BA D 33.3	Set switch out threshold delta attenuation to -33.3 dB
	Valid range -255.5 to -0.0 dB
AGC BA I x	Set switch in threshold at input power to x dBm
AGC BA O x	Set switch out threshold at input power to x dBm

4.9.1.4.2 Automatic Gain Control Data Settings – AGC DATA

The AGC DATA command is used to set the AGC table attenuation value for a specific attenuator along with an attenuation or data operation value. Parameter values are explained below.

AGC DATA [<p> <a> = <v>|<o>] – AGC data settings

   <p> <a> = <v> - Set AGC table attenuation <p>, attenuator <a> to attenuation <v> dB

     where:

       <p> - 0.0 to 255.5 dB

       <a> - Attenuator A, B, C, D, E

       <v> - Attenuation 0.0 to 31.5 dB or 'MIN' or 'MAX'

       <o> - Data operation

         LOAD – Load data

         ERASE – Erase data

SAVE – Save data

Example:

AGC DATA 2.2 E MIN   Set AGC table attenuation to 2.2 dB for attenuator E with attenuation of minimum

4.9.1.4.3   Automatic Gain Control Mode – AGC M

The **AGC M** command sets the automatic gain control loop mode.

AGC [M <m>] – Sets the AGC loop mode to <m>

where: <m> - AGC control mode

A – Automatically select mode based on source

R – Use RF attenuators

I – Use IF attenuators

Setting the AGC Mode to Auto automatically sets the AGC mode to RF/IF based on IF input path (which is based on the receiver frequency).

Setting the AGC Mode to RF forces control of the RF attenuators and (if the bulk attenuator is set to Auto) the bulk attenuator under AGC control.

Setting the AGC mode to IF forces control of the IF attenuators under AGC control and disables AGC control of the bulk attenuator. This also forces AGC Zero to Auto because when playing back recorded signals, such as demod/playback-demod, the noise floor changes as the AGC in the original recording holds the signal power steady and allows the noise floor to move. The dynamic range of the AGC closely matches the dynamic range of the auto zero.

Examples:

AGC M A   Automatically select mode based on source
AGC M R   Set AGC control mode to use RF attenuators
AGC M I   Set AGC control mode to use IF attenuators

4.9.1.4.4   Automatic Gain Control Loop Parameter – AGC L

The AGC L command sets AGC loop parameters.

AGC [L {P <t>|S <t>|A <t>|D <d>|C <d>|T <d>}] – Set AGC loop parameter

P <t> - Sets period to <t>, 0.000 to 5.464 us

S <t> - Sets sample time to <t>, 0.000 to 2.732 us

A <t> - Sets averaging sample time to <t>, 0.002 to 2100.897 ms

D <d> - Sets deadband to <d>, 0.0000 to 15.9375 dB

C <t> - Sets time constant to <t>, 0.100 to 1000.000 ms

T <d> - Sets power target to <d>, -100.0 to 13.0 dBm

Examples:

AGC L P 0.567   Set AGC loop period to 0.567 µs

	Valid range is 0.000 to 5.464 µs
AGC L S 1.987	Set AGC sample time to 0.567 µs
	Valid range is 0.000 to 2.732 µs
AGC L A 42.000	Set AGC averaging sample time to 42.000 ms
	Valid range is 0.002 to 2100.897 ms
AGC L D 0.0010	Set AGC deadband to 0.0010 dB
	Valid range is 0.0000 to 15.9375 dB
AGC L C 25.000	Set AGC time constant to 25.000 ms
	Valid range is 0.100 to 1000.000 ms
AGC L T -70.0	Set AGC power target to -70.0
	Valid range is -100.0 to 13.0 dBm

4.9.1.4.5   Automatic Gain Control Attenuator Look Up Table – AGC LUT

The **AGC LUT** command displays or rebuilds the attenuator look up table.

AGC LUT [<p>|R] – AGC attenuator Look Up Table

>   <p> - Show AGC LUT <p> attenuation

>   R – Rebuild AGC LUT

Examples:

AGC LUT 111.5	Display AGC look up table 111.5 attenuation
	Valid range is 0.0 to 255.5 dB
AGC LUT R	Rebuild AGC look up table

4.9.1.4.6   Automatic Gain Control Auto Zero – AGC AZ

The **AGC AZ** command enables or disables AGC auto zero and sets hold threshold or time constants.

AGC [AZ [TR <c>|TL <c>]]

>   TR <c> - Sets the AGC DSP auto zero raising time constant to <c>, 0.050 to 100.000 seconds

>   TL <c> - Sets the AGC DSP auto zero lowering time constant to <c>, 0.050 to 100.000 seconds

Examples:

AGC AZ 0	Disable AGC auto zero
AGC AZ 1	Enable AGC auto zero
AGC AZ TR 0.100	Set AGC DSP auto zero raising time constant to 0.100 seconds
	Valid range 0.050 seconds to 100.000 seconds

4.9.1.4.7   Automatic Gain Control Zero – AGC Z

The **AGC Z** command sets the AGC Zero operating mode and the value at which zero can be set.

AGC [Z [M <m>]] – Sets the AGC zero mode to <m>

>   where: <m> - AGC zero mode

>   A – Auto: Automatically set AGC zero level

M – Manual: Manually set AGC zero level, reset on frequency or IF bandwidth change, reset on power cycle

H – Hold: Manually set AGC zero level, NO reset on frequency or IF bandwidth change, reset on power cycle

S – Hold and Save: Manually set AGC zero level, NO reset on frequency or IF bandwidth change, NO reset on power cycle

The AGC Zero mode (manual, hold, or hold and save) remains set if a waveform mode changes.

AGC [Z [<p>|Z|R]]

    <p> - Sets the AGC output zero to <p> in dBm

    Z – Sets the AGC output zero to current

    R – Resets the AGC output zero to nominal

Examples:

AGC Z A	Automatically set AGC zero level
AGC Z M m	Manually set AGC zero level, reset on frequency, or IF bandwidth change; Reset on power cycle
AGC Z H	Manually set AGC zero level, NO reset on frequency or IF bandwidth change; Reset on power cycle
AGC Z S	Manually set AGC zero level, NO reset on frequency or IF bandwidth change; NO reset on power cycle
AGC Z 2	Set AGC output zero to 2 dBm
AGC Z R	Reset AGC output zero to nominal
AGC Z Z	Set AGC output zero to current

4.9.1.5 High Speed Output Mixer Settings – AHM

The AHM command displays and controls high speed (video) output mixer settings.

AHM [<f>|<c> [<e>]] – Sets high speed (video) mixer parameters

    <f> - Sets mixer frequency for ALL channels to <f>, -46.6667 to 46.6667 MHz

    <c> <e> - Sets channel <c> mixer enable to <e>

        where:

            <c> - Channel to set enable

                A – Channel DAC A

                B – Channel DAC B

                C – Channel DAC C

                D – Channel DAC D

            <e> - Enable

0 – Disabled

1 – Enabled

Examples:

AHM

> high speed (video) mixer at 0.0000 MHz
>> Channel DAC A mixer disabled
>> Channel DAC B mixer disabled
>> Channel DAC C mixer disabled
>> Channel DAC D mixer disabled

AHM x	Sets mixer frequency for all channels in MHz
	Valid range is -46.6667 to 46.6667 MHz
AHM c x	Sets a specific channel (c) mixer to enabled or disabled
	Valid channel mixer values are A, B, C, or D
For example:	AHM B 1 sets channel DAC B to Enabled
	AHM D 0 sets channel DAC D to Disabled.

4.9.1.6 High/Low Speed Outputs

The receiver has four generic high speed (video) analog outputs, four generic low speed analog outputs, and four generic clock/data paired digital outputs. While there are signals that are normally found on these outputs, there is also a list of other sources that can be connected.

A receiver channel is conceptually divided into two basic parts. One is the common 'platform' and the other is the 'demodulator'. The 'platform' is common to all telemetry modulations schemes. The demodulator is specific to the telemetry modulations scheme.

Some commands operate at the platform level, some at the demodulator level, and some at specific configurations of the demodulator. This is why the Help displays in this manner:

System Commands

H ? for help on help

ACU Antenna control unit	ADC ADC register
UP Unit Parameters	VE Version

Demodulator/Receiver Commands

AEQ Adaptive equalizer	DLS Data path lock status

PCMFM Commands

FM FM demodulator	MI Modulation index scale

Some of these sources are part of the 'platform' and some of these sources are specific to the demodulator in use.

The commands AHO, ALO, DHO, and DLO are the source control commands for the platform.

These commands control source, (for analog outputs, scale, offset,) and polarity.

- AHO – Analog High-Speed Outputs
- ALO – Analog Low-Speed Outputs
- DHO – Digital High Speed Outputs
- DLO – Digital Low Speed Outputs

4.9.1.6.1   Analog High Speed Output – AHO

The AHO command displays and controls the high speed (video) output settings. Refer to section 13 (Appendix E) for tape output configuration instructions.

Parameter values are explained below.

$$\text{AHO} \quad [\text{<c>} \quad [\text{<s>|<p>|S <s>|O <o>}] \quad |E \quad \text{<e>}]$$

where:

<c> is the channel to set; Valid entries are:

- A – Channel DAC A
- B – Channel DAC B
- C – Channel DAC C
- D – Channel DAC D

    <s> sets the channel source to one of the options below (if desired):

    - IF0 – Physical channel 0 IF input
    - IF1 – Physical channel 1 IF input
    - P0I – Physical channel 0 downconverted baseband I only
    - P0Q – Physical channel 0 downconverted baseband Q only
    - P0T – Physical channel 0 tape output source (needs mixer)
    - P1I – Physical channel 1 downconverted baseband I only
    - P1Q – Physical channel 1 downconverted baseband Q only
    - P1T – Physical channel 1 tape output source (needs mixer)
    - CMBI – Combiner baseband I only
    - CMBQ – Combiner baseband Q only
    - CMBT – Combiner tape output source (needs mixer)
    - DP0 – Data path high-speed signal 0
    - DP1 – Data path high-speed signal 1
    - DP2 – Data path high-speed signal 2
    - DP3 – Data path high-speed signal 3
    - F0 – Fixed value 0

- F1 – Fixed value 1

OR

<p> sets the channel polarity to one of the values below:

- {0|+} – Active high (normal)
- {1|-} – Active low (inverted)

OR

S <s> sets the channel scale to a value between -128.0000 and 127.9961

OR

O <o> sets the channel offset to a value between -1.0000 and 0.9995

E <e> sets the channel enable to enabled or disabled

- 0 – Disabled
- 1 – Enabled

Example:

AHO   Displays current high speed (video) output status settings (enabled/disabled and output frequency)

    high speed (video) Channel DAC A

        Source Data path high-speed signal 0

        Scale   - 1.0000

        Offset - 0.0000

        Polarity – High (+)

    high speed (video) Channel DAC B

        Source Data path high-speed signal 1

        Scale   - 1.0000

        Offset - 0.0000

        Polarity – High (+)

    high speed (video) Channel DAC C

        Source Physical channel 0 downconverted baseband I only

        Scale   - 1.0000

        Offset - 0.0000

        Polarity – High (+)

    high speed (video) Channel DAC D

        Source Physical channel 0 downconverted baseband Q only

        Scale   - 1.0000

        Offset - 0.0000

Polarity – High (**+**)

70 MHz modulator disabled

AHO B P1T	Sets the channel to Channel DAC B with Physical channel 1 tape output source; (Needs mixer)
AHO D S -42.0000	Sets the channel to Channel DAC D with a channel scale of -42.0000
AHO C O 0.1234	Sets the channel to Channel DAC C with a channel offset of 0.1234
AHO A E 1	Sets the channel to Channel DAC A and enables the channel

AHO M – Sets the 70 MHz modulator output to enable or disable

Examples:

AHO M 0   Disabled

AHO M 1   Enabled

AHO –V ? – Shows extended Help for the AHO command

4.9.1.6.2   Analog Low Speed Output – ALO

The ALO command displays and controls the low speed (ACU) output settings.

Parameter values are explained below.

$$ALO \quad [<c> \quad [<s>|<p>|S <s>|O <o>] \quad |E \quad <e>]$$

where:

<c> is the channel to set; Valid entries are:

- A – Channel A (AM)

- B – Channel B (Aux Analog A Out)

- C – Channel C (AGC)

- D – Channel D (Aux Analog B Out)

  <s> sets the channel source to one of the options below (if desired):

  - AM – Demodulated AM

  - AGC – AGC output

  - CMBW – Combiner weight

  - DP0 – Data path low-speed source 0

  - DP1 – Data path low-speed source 1

  - DP2 – Data path low-speed source 2

  - DP3 – Data path low-speed source 3

  - DQDEC – DQ decode

  - DQDP – DQ datapath

- DQOUT – DQ output

- DS0 – DSP SNR 0

- DS1 – DSP SNR 1

- EA0 – External AGC 0

- EA1 – External AGC 1

- F0 – Fixed value 0

- F1 – Fixed value 1

- IA0 – Internal AGC 0

- IA1 – Internal AGC 1

OR

<p> sets the channel polarity to one of the values below:

- {0|+} – Active high (normal)

- {1|-} – Active low (inverted)

OR

S <s> sets the channel scale to a value between -128.0000 and 127.9961

OR

O <o> sets the channel offset to a value between -1.0000 and 0.9995

E <e> sets the channel enable to enabled or disabled

- 0 – Disabled

- 1 – Enabled

Examples:

ALO C AGC	Sets the channel to Channel C (AGC) with AGC output
ALO D 1	Sets the channel to Channel D (Aux Analog B Out) with polarity active low (inverted)
ALO A S 98.6543	Sets the channel to Channel A (Demodulated AM) with channel scale set to 98.6543
ALO B E 0	Sets the channel to Channel B and disables the channel

ALO –V ? – Shows extended Help for the AHO command

Example:

ALO   Displays current low speed (ACU) output status settings (enabled/disabled and output frequency) low speed (ACU) Channel A (AM)

Source Demodulated AM

Scale   -   1.0000

Offset   -   0.0000

Polarity – High (**+**)

low speed (ACU) Channel B (Aux Analog A Out)

Source Fixed value 0

Scale   -   1.0000

Offset   -   0.0000

Polarity – High (**+**)

low speed (ACU) Channel C (AGC)

Source AGC output

Scale   -   1.0000

Offset   -   0.0000

Polarity – High (**+**)

low speed (ACU) Channel D (Aux Analog B Out)

Source Fixed value 0

Scale   -   1.0000

Offset   -   0.0000

Polarity – High (**+**)

4.9.1.6.3   Digital High Speed Input – DHI

DHI displays and controls high speed digital input settings.

DHI [<c> <s>] – Sets channel <c> to source <s>

where:

<c> - Input channel

NC – Not Connected

<s> - Signal source

F0 – Fixed 0

F1 – Fixed 1

GC – Generator Clock

GD – Generator Data

TH5 – Top Hat 5

TH7 – Top Hat 7

DHI [<s> <p>] – Sets source <s> polarity to <p>

where:

<s> - Input source

TH5 – Top Hat 5

TH7 – Top Hat 7

<p> - Input polarity

{0|+} – Active high (normal)

{1|-} – Active low (inverted)

4.9.1.6.4   High Speed Digital Output - DHO

DHO displays and controls high speed digital output settings.

DHO [<c> <s>] - Sets channel <c> to source <s>

where:

<c> - Output channel

AC - Channel A Clock

AD - Channel A Data

BC - Channel B Clock

BD - Channel B Data

CC - Channel C Clock

CD - Channel C Data

DC - Channel D Clock

DD - Channel D Data

TH1 - Top Hat 1

TH2 - Top Hat 2

<s> - Signal source

F0 - Fixed 0

F1 - Fixed 1

GC - Generator Clock

GD - Generator Data

AC - Clock A

AD - Data A

BC - Clock B

BD - Data B

DP0 - Datapath 0

DP1 - Datapath 1

DP2 - Datapath 2

DP3 - Datapath 3

DP4 - Datapath 4

DP5 - Datapath 5

DP6 - Datapath 6

DP7 - Datapath 7

DHO [<c> <p>] - Sets channel <c> polarity to <p>

where:

<c> - Output channel

AC - Channel A Clock

AD - Channel A Data

BC - Channel B Clock

BD - Channel B Data

CC - Channel C Clock

CD - Channel C Data

DC - Channel D Clock

DD - Channel D Data

TH1 - Top Hat 1

TH2 - Top Hat 2

<p> - Output polarity

{0|+} - Active high (normal)

{1|-} - Active low (inverted)

4.9.1.6.5 Low Speed Digital Input – DLI

DLI displays and controls low speed digital input settings.

DLI [<c> <s>] – Sets channel <c> to source <s>

where:

<c> - Input channel

UR0 – UART Rx 0

UR1 – UART Rx 1

<s> - Signal source

F0 – Fixed 0

F1 – Fixed 1

URX – UART Rx

TH8 – Top Hat 8

TH9 – Top Hat 9

TH10 – Top Hat 10

TH11 – Top Hat 11

TH12 – Top Hat 12

TH14 – Top Hat 14

TH18 – Top Hat 18

TH20 – Top Hat 20

TH21 – Top Hat 21

DLI [<s> <p>] – Sets source <s> polarity to <p>

where:

<s> - Input source

URX – UART Rx

TH8 – Top Hat 8

TH9 – Top Hat 9

TH10 – Top Hat 10

TH11 – Top Hat 11

TH12 – Top Hat 12

TH14 – Top Hat 14

TH18 – Top Hat 18

TH20 – Top Hat 20

TH21 – Top Hat 21

<p> - Input polarity

{0|+} – Active high (normal)

{1|-} – Active low (inverted)

4.9.1.6.6 Low Speed Digital Output – DLO

DLO displays and controls low speed digital output settings.

DLO [<c> <s>] - Sets channel <c> to source <s>

    where:

        <c> - Output channel

            UTX - UART Tx

            TH3 - Top Hat 3

            TH4 - Top Hat 4

            TH6 - Top Hat 6

            TH13 - Top Hat 13

            TH15 - Top Hat 15

            TH16 - Top Hat 16

            TH17 - Top Hat 17

            TH19 - Top Hat 19

            TH22 - Top Hat 22

        <s> - Signal source

            F0 - Fixed 0

            F1 - Fixed 1

            UT0 - UART Tx 0

            UT1 - UART Tx 1

            DP0 - Datapath 0

            DP1 - Datapath 1

            DP2 - Datapath 2

            DP3 - Datapath 3

            DP4 - Datapath 4

            DP5 - Datapath 5

            DP6 - Datapath 6

            DP7 - Datapath 7

DLO [<c> <p>] - Sets channel <c> polarity to <p>

    where:

<c> - Output channel

UTX - UART Tx

TH3 - Top Hat 3

TH4 - Top Hat 4

TH6 - Top Hat 6

TH13 - Top Hat 13

TH15 - Top Hat 15

TH16 - Top Hat 16

TH17 - Top Hat 17

TH19 - Top Hat 19

TH22 - Top Hat 22

<p> - Output polarity

{0|+} - Active high (normal)

{1|-} - Active low (inverted)

4.9.1.7 Low Speed Mixer Control – ALM

The ALM command displays and controls low speed (ACU) output mixer settings

ALM [<f>|<c> [<e>]] – Sets low speed (ACU) mixer parameters

<f> - Sets mixer frequency for ALL channels to <f>, -100.0000 to 100.0000 kHz

<c> <e> - Sets channel <c> mixer enable to <e>

where:

<c> - Channel to set enable

A – Channel A (AM)

B – Channel B (Aux Analog A Out)

C – Channel C (AGC)

D – Channel D (Aux Analog B Out)

<e> - Enable

0 – Disabled

1 – Enabled

Examples:

ALM x   Sets mixer frequency for all channels in MHz

Valid range is -46.6667 to 46.6667 MHz

ALM c x   Sets a specific channel (c) mixer to enabled or disabled

Valid channel mixer values are A, B, C, or D

For example: ALM B 1 sets channel DAC B to Enabled

ALM D 0 sets channel DAC D to Disabled.

ALM

low speed (ACU) mixer at 0.0000 kHz

Channel A (AM) mixer disabled

Channel B (Aux Analog A Out) mixer disabled

Channel C (AGC) mixer disabled

Channel D (Aux Analog B Out) mixer disabled

4.9.1.8   Lock Status Command – AL

The Lock Status command reports the system lock status.

Example:

AL

System Lock is active

4.9.1.9   Best Channel Selector – BCS

The BCS command displays and controls the best channel selector settings.

BCS [<e>] - Enables best channel selection

where: <e> - Enable

0 – Disabled (Off)

1 – Enabled (On)

BCS [T <t>] - Sets best channel selector threshold <t>, 0 to 255

BCS [PH <n>] - Sets best channel selector pin hold delay 2^<n>, 0 to 15 cycles

BCS [S <s> <e>] - Sets best channel selector source <s> enable to <e>

where:

<s> - Sources

CH0 - Channel 0

CH1 - Channel 1

INT - Internal

<e> - Enable

0 - Disabled

1 – Enabled

Example:

PCMFM$bcs

BCS enabled

BCS threshold 192

BCS pin hold delay 2^2 cycles

System status display elements:

BCS   -   - Best channel selector

4.9.1.10 Bit Rate – BR

The Bit Rate command sets or reports the baseband bit rate. The value reported by this command is shown on the front panel Advanced Menu, Sync Bit Rate option and on the Browser Interface in the Advanced Settings, Sync Bit Rate field.

BR [<r>|M|SM]

> <r> - Set bit rate to <r>, 0.0240 to 23.0000 Mbps
>
> M – Show measured bit rate
>
> SM – Set bit rate to measured bit rate

BR M – Show the current measured bit rate

> BR M   Display measured bit rate in Mbps

BR SM – Set the bit rate to the measured bit rate

> BR SM Set the bit rate to the measured bit rate in Mbps

Examples:

BR   Report the bit rate setting

Bit rate: 1.000000 Mb/s

BR 5   Set bit rate to 5 Mbps

BR 0.6 Set bit rate to 600 Kbps

> Valid range is 0.0080 to 23.0000 Mbps

4.9.1.11 Combiner Control – CMB

The Combiner Control command displays and controls combiner settings.

CMB [<e>|M <m>|W <s>|]

> <e> - Sets combiner enable to <e>
>
> > where: <e> - Enable
> >
> > > 0 – Disabled
> > >
> > > 1 – Enabled

M <m> - Sets combiner operation mode to <m>

    where: <m> - Operation Mode

        M – Maximal Ratio

        B – Best Source

W <w> - Sets combiner weighting source to <s>

    where: <s> - Weighting Source

        SNR – Ultra-Dynamic – Signal to Noise Ratio

        DQ – Ultra-Precision – Data Quality

CMB [A <e>|H <t>|B <b>]

A <e> - Sets combiner time aligner enable to <e>

    where: <e> - Enable

        0 – Disabled

        1 – Enabled

A H <t> - Sets aligner hold below Eb/N0 <t>, -20.000 to 30.000 dB or -100.000 is off

A B <b> - Sets aligner with timing offset above <b>, 0.010 to 1.000 bits

CMB A P <p> – Sets the aligner hold period to <p>

Example:

CMB A P 5007 Set CMB aligner hold period to 5007 µs

        Valid range is 0.000 to 4294967296.000 µs; initialized value is 5000 µs

CMB [BSS <h>] – Sets combiner BSS mode hysteresis <h>, 0.000 to 48.131

CMB [B <s>|MB <b>|L <f>>|Z <v>]

B <s> - Sets combiner bit rate to bandwidth scale to <s>, 0.001000 to 10.000000

MB <b> - Sets combiner maximum bandwidth to <b>, 0.000001 to 10.000000

L <f> - Sets combiner frequency error limit to <f>, .00000002173 to 23.3333 of bit rate

Z <v> - Sets combiner loop zeta to <v>, 0.001 to 10.000

CMB [BI <t>|BO <t>] – Sets combiner maximal ratio to BSS in/out thresholds

>   BI <t> - Sets combiner maximal ratio mode to BSS hold mode threshold to <t>

>   BO <t> - Sets combiner maximum BSS hold mode to ratio mode threshold to <t>

Examples:

CMB BI x   Set combiner BSS in to value

CMB BO x   Set combiner BSS out to value

>   Value range -24.065 to 24.065

CMB [HI <t>|HO <t>] - Set combiner hold in/out thresholds

>   HI <t> - Sets combiner hold in to <t>, -24.065 to 24.065

>   HO <t> - Sets combiner hold out to <t>, -24.065 to 24.065

Examples:

CMB HI x   Set combiner hold in to value

CMB HO x   Set combiner hold out to value

>   Value range -24.065 to 24.065

Examples:

CMB

>   System configured for Physical input 0
>   Combiner frequency error -0.024177 MHz
>   Combiner error limit 0.06250 of bitrate
>   Combiner zeta 1.000
>   Hold in threshold 5.936 dB
>   Hold out threshold 0.000 dB
>   BSS in threshold 11.761 dB
>   BSS out threshold 8.936 dB
>   Aligner off
>   Average aligner time shift 0.00 ns (0.000 bits)
>   Aligner hold threshold 0.000 dB
>   Aligner max offset 0.333 bits

CMB 0   Set combiner Disabled

CMB 1   Set combiner Enabled

4.9.1.12 Clock Polarity – CP

The Clock Polarity command displays and controls clock output polarity.

CP [<p>] – Sets clock component output polarity

>   <p> - Set clock polarity to <p>

where:

<p> - Polarity

{0|+} – Active high (normal)

{1|-} – Active low (inverted)

Examples:

CP   Report the clock source state

Clock polarity active High (**+**)

CP 0   Set clock inversion Off

CP 1   Set clock inversion On

4.9.1.13 Downconverting Antenna – DA

The Downconverting Antenna command displays and controls receiver C band to P band downconverting antenna

DA [<e>] – Sets the C band downconverting antenna enable to <e>

where: <e> - Enable

0 – Disabled (C band tunes directly)

1 – Enabled (C band tunes to downconverted P band)

Examples:

DA

Downconverting antenna is disabled

DA 0   Set downconvert antenna state to Off (Disabled); C band tunes directly

DA 1   Set downconvert antenna state to On (Enabled); C band tunes to downconverted P band

**Downconverting antenna control only available when using a 5-band downconverter AND P and C bands are enabled.

4.9.1.14 Differential Decoding – DD

The Differential Decoding command displays and controls differential decoder settings (SOQPSK mode only). Differential Decoding for DPM defaults to Disabled (Off).

DD <e> - Sets the differential decoder enable to <e>

where: <e> - Enable

0 – Disabled

1 – Enabled

Example:

DD

differential decoder disabled

4.9.1.15 Digital Output Muting – DOM

The Digital Output Muting command displays and controls lock detect controlled output settings.

DOM [<e>|T <t>|C <e>|D <e>]

> <e> - Sets the output muting enable to <e>
>
> > where: <e> - Enable
> >
> > > 0 – Disabled
> > >
> > > 1 – Enabled
>
> T <t> - Sets the output muting unlock timeout to <t>, 0 to 46016 ms
>
> C <e> - Sets clock output muting on unlock to <e>
>
> > where: <e> - Enable
> >
> > > 0 – Disabled
> > >
> > > 1 – Enabled
>
> D <e> - Sets data output muting on unlock to <e>
>
> > where: <e> - Enable
> >
> > > 0 – Disabled
> > >
> > > 1 – Enabled

Example:
DOM

> Output muting timeout 1000
> Output muting clock enable 0
> Output muting data enable 0

4.9.1.16 Data Polarity – DP

The DP command displays and controls data output polarity.

DP [<p>] – Sets data component output polarity

> <p> - Set data polarity to <p>
>
> > where: <p> - Polarity
> >
> > > {0|+} – Active high (normal)
> > >
> > > {1|-} – Active low (inverted)

Examples:
DP

Data polarity active High (**+**)

DP 0   Set data polarity to NOT inverted (Off)

DP 1   Set data polarity to inverted (On)

4.9.1.17 Data Quality Encapsulation – DQ

The Data Quality command displays and controls data quality settings.

DQ [<e>|B <b>]

> **[<e>]** - Enables data quality encapsulation
>
>> where: <e> - Enable
>>
>>> 0 - Disabled
>>>
>>> 1 - Enabled
>
> **[B <b>]** - Sets data quality encapsulation block size to <b>, 1 to 16384

DQ [RAW <t> <e>] - Sets data quality raw metric enable for table <t> to <e>

> where: <t> - Table
>
>> DP - datapath LUT
>>
>> DEC - decode LUT
>>
>> OUT - output LUT
>
> where: <e> - Enable
>
>> 0 - Disabled
>>
>> 1 - Enabled

DQ LUT <t> [<p>[= <v>]] - Show/set data quality LUT value(s) for table <t>

> where: <t> - Table
>
>> DP - datapath LUT
>>
>> DEC - decode LUT
>>
>> OUT - output LUT
>
> where:
>
> <p> - Data quality LUT index <p>, 0 to 255
>
> <v> - Data quality LUT value <v>, 0.0000 to 0.999985

DQ [M <e> [<r>]] - Sets data quality encapsulation dump enable to <e> at rate <r>

      where: <e> - Enable

               0 - Disabled

               1 - Enabled

           <r> - Display rate <r>, 1 to 60000 ms

Example:

PCMFM$dq

Data quality encapsulation disabled

Data quality encapsulation block size 4096 bits

Average datapath BEP 1.005e-12

Average decode BEP 1.005e-12

Average output BEP 1.140e-12

DQ datapath bit count: 3253769216   error count: 2.70774440e+07   BEP: 8.322e-03

DQ decode bit count: 1725284352   error count: 2.58360140e+07   BEP: 1.497e-02

DQ output bit count: 1725284352   error count: 2.09354580e+07   BEP: 1.213e-02

DQ decode raw disabled

DQ datapath raw disabled

System status display elements:

  DQ DP   -   - Average datapath DQ

  DQ DEC -   - Average decode DQ

  DQ OUT - Normal Wide CSV - Average output DQ

  DQ DPC -   - DQ datapath counts

  DQ DECC -   - DQ decode counts

  DQ OUTC -   - DQ output counts

4.9.1.18 Derandomizer State – DR

The DR command displays and controls derandomizer settings.

DR [M <m>] – Sets the derandomizer mode to <m>

      where: <m> - Derandomizer mode

          N – None

          I – IRIG

          C – CCSDS (Only valid with LDPC)

Examples:

DR

      Derandomizer none

DR M I

Derandomizer IRIG

4.9.1.19 Digital Status Output – DSO

There are two generic discrete digital outputs that are normally lock status and sync detect (used for synchronization time testing) but also have other potential sources. The Digital Status Output command controls the source, polarity, and override states.

DSO [<c> [<s>|<p>|M <m>]]

> <c> <s> - Sets channel <c> source to <s>
>
>> where:
>>
>>> <c> - Channel
>>>
>>>> L – Lock detect output
>>>>
>>>> S – Sync detect output
>>>
>>> <s> - Signal source
>>>
>>>> LD – Lock detect
>>>>
>>>> SD – Sync detect
>>>>
>>>> PL – PCM frame lock
>>>>
>>>> PS – PCM sub-frame valid
>
> <c> <p> - Sets channel <c> polarity to <p>
>
>> where: <p> - Output polarity
>>
>>> {0|+} – Active high (normal)
>>>
>>> {1|-} – Active low (inverted)
>
> M <m> - Sets channel <c> output mode to <m>
>
>> where: <m> - Output mode
>>
>>> 0 – Allows normal output
>>>
>>> 1 – Forces output to 1 (active)
>>>
>>> -1 – Forces output to 0 (inactive)

Example:
DSO

> Lock detect output = Lock detect active High (+) normal operation
> Sync detect output = Sync detect active High (+) normal operation

4.9.1.20 Forward Error Correction – FEC

Forward Error Correction requires the K7 option in the serial number.

The FEC command displays and controls Forward Error Correction settings.

FEC [M <m>|S <m> <s>]

      M <m> - Sets FEC mode to <m>

            where: <m> - Mode

                  N – None

                  L – LDPC Block decode

                  V – Viterbi K = 7 Rate

      S <m> <s> - Sets soft decision scale for mode <m> to <s>

            where: <m> - Mode

                  N – None

                  L – LDPC Block decode

                  V – Viterbi K = 7 Rate

            where: <s> is a value between -32.000 and 31.984

FEC M – Sets the FEC mode for all enabled modes

Examples:
FEC M N   Set FEC mode to None
FEC M V   Set FEC mode to Viterbi K=7 Rate=1/2

Examples:
FEC
      FEC mode None

4.9.1.21 Force Lock Indication – FL

The FL command displays and controls lock forcing settings.

FL [<l>] – Sets lock state to <l>

      where: <l> - Lock state

            0 – Normal operation

            1 – Forced active

            -1 – Forced inactive

Examples:
FL
      Lock is normal
      System lock is active

Datapath lock is active

FL 0   Force lock to Normal

FL 1   Force lock to On

FL -1   Force lock to Off

4.9.1.22 FM Demodulator Settings – FM

The FM command displays and controls FM demodulator settings.

Parameter values are explained below.

<div align="center">

FM   [<p>|S <s>|B <b>|D <m>]

</div>

where:

<p> sets the channel polarity to one of the values below:

- {0|+} – Active high (normal)

- {1|-} – Active low (inverted)

OR
S <s> sets the FM output scale to a value between -128.0 and 128.0

OR
B <b> sets the FM detector bandwidth to a value between 0.02 MHz and 46.00 MHz

The FM detector bandwidth cannot be less than current bit rate bandwidth. Refer to section 4.9.1.22.1 for additional details about the FM B x command.

OR
D <m> sets the NTSC Video deemphasis filter mode to one of three values

- 0 – Off

- N – NTSC

- P – PAL

Example:

FM

FM output polarity +

FM demodulator bandwidth 1.4 MHz

FM output scale 1.0

Video de-emphasis filter Off

4.9.1.22.1 FM Video Bandwidth Control – FM B

The FM B x command adjusts the I/Q (video) output bandwidth with PCM/FM in mind. Setting the FM (video) bandwidth wider than it would normally be set by the bit rate (this would be 1.1 to 1.4 wider than the bit rate) configures the system to allow a higher bandwidth on the output while allowing normal PCM/FM demodulation on the lower frequency PCM/FM.

- The video bandwidth can never be set narrower than the required bandwidth for the specified bit rate. (The FM bandwidth cannot be less than the bandwidth required to process the bit rate being used.)

- The IF filter selection, if set to FS A, is wide enough to accommodate the wider FM (video) bandwidth.

- This configuration only operates properly in Phase Noise Compensation mode (PN 1).

- Modulation Index tracking must be turned OFF as it is incompatible with modulations like PCM/FM/FM.

- The video bandwidth must be set AFTER the bit rate has been set.

- Setting the bit rate sets the video bandwidth compatible with the bit rate.

4.9.1.23 Front Panel Display Status – FPD

The Front Panel Display status command displays the data that is sent to the rack used to keep the front panel displays updated.

FPD [<e>]

        <e> - Sets front panel data update enable to <e>

                where: <e> - Enable

                        0 – Disabled

                        1 – Enabled

Example:

FPD

        Front panel data update enabled at 50 ms update rate

        Version 4

        Signal strength -60.547 dB

        Signal quality 27.235 db Eb/N0

        System lock active

        AGC is zeroed

        AGC zeroed at -60.109 dBm

        Gain calibration is valid

        Demod temperature 43 C

        DQE BEP 0.999985 (1.000e-12)

        Privilege dictionary is invalid

        PCMFM

                Version 1

                MI scaling mode acquire

                MI scaling state triggered

                MI scaling acquire trigger 27.573 Eb/N0 dBm

                Modulation H 0.701

4.9.1.24 Frequency – FR

The FR command displays and controls receiver frequency.

FR [<f>] – Sets receiver to <f> in MHz

> where: <f> - Receiver frequency
>
> > P band: 200.0 to 1150.0 MHz
> >
> > CT band: 1150.0 to 2500.0 MHz
> >
> > C band: 4400.0 to 5250.0 MHz
> >
> > 70 MHz band: 70.0 to 70.0 MHz
> >
> > Playback band: 0.1 to 20.0 MHz

Examples:

FR	Rx frequency 2200.500000 MHz
FR 2200.5	Set modulation to 2200.5 MHz

4.9.1.25 Help Command – H

H – Displays a list of basic Help commands

H ? – Displays "Help on Help"

Commas ',' indicate one or more of the following parameters are allowed:

> If multiple parameters are specified they must be in the order in the list.

For example, **BER [M [<s>,?[ ]** - BER command followed by optional command control parameter 'M'. If the 'M' command control parameter is used, it is optionally followed by one or more parameters from the list **<s>, '?'**.

4.9.1.26 Advanced Help Command – HA

HA [-v] – Displays extended help for each command, if available

HA [<s>] – Searches help for <s> and displays it

> Help on Help...

- Commands are tiered according to their degree of complexity/frequency of use into basic, advanced, or extended
- Basic command help can be accessed by 'H' or '?'
- Detailed help on any command is accessed by following the command with '?' such as <command> ?

Help/Command conventions:

- All commands are entered followed by 0 or more parameters.
- Each parameter is separated by one or more spaces.
- Each parameter may be either a value parameter to the command or a command control parameter that specifies the operation of the command.

<command> <parameter 1> <parameter 2> ...

- In general, a command with no parameters will display the commands associated status.

Detailed help displays follow a common convention:

- Upper case parameters indicate command control parameters that must be entered as specified:

BR M – BR command followed by the command control parameter 'M'

- Angle brackets '<' and '>' indicate value parameters. A value parameter is a variable parameter to a command. A value parameter may be either a numeric or text value, or an additional command control parameter:

FR <f> - FR command followed by the value parameter <f>

- Square brackets '[' and ']' indicate optional parameters:

MO [<m>] – MO command followed by optional value parameter <m>

- Vertical bars '|' indicate a choice of parameters:

AGC [M <m>|<e>]

AGC command followed by optional M control parameter followed by the <m> value parameter OR AGC command followed by just the <e> value parameter.

- Braces '{' and '}' indicate a required value:

DDT [P {<s>|<p>}]

DDT command followed by optional command control parameter 'P'. If the 'P' command control parameter is used it is followed by a required <s> OR <p> value parameter.

A complex example:

AGC BA [<e>|V <a>|I|O <t> [A]]

The AGC command followed by the BA command control parameter, followed by one of:

<e> value parameter

OR

the V command parameter followed by the <a> value parameter

OR

the I or O command parameter followed by the <t> value parameter followed by an optional A command parameter

4.9.1.27 IF Filter Control – IF

The IF filter control command displays and controls the filter selections.

IF filters may be set to automatic based on the bit rate or the second IF filter may be set to a value based on a filter index.

IF [A|<s>|F <f>] – Sets IF filter control

A – Sets IF filter selections to automatic based on bit-rate

<s> - Sets second IF filter to <s>

where: <s> - Filter index

The **IF A** command sets the IF filter selections to automatic based on bit rate.

IF x sets the second IF filter to one of the filter index values listed below:

• 0 – 70 kHz	• 5 – 2.0 MHz	• 10 – 14.0 MHz
• 1 – 250 kHz	• 6 – 3.0 MHz	• 11 – 20.0 MHz
• 2 – 500 kHz	• 7 – 4.5 MHz	• 12 – 28.0 MHz
• 3 – 1.0 MHz	• 8 – 6.0 MHz	• 13 – 40.0 MHz
• 4 – 1.4 MHz	• 9 – 10.0 MHz	• 14 – OPEN

IF F x sets the first IF filter to one of the filter index values below:

- 0 – 12.0 MHz
- 1 – bypassed

Examples:

IF

Auto IF filter select enabled
First IF filter (0) 12.0 MHz
Second IF filter (5) 2.0 MHz

IF F 0   Sets the first IF filter to 12.0 MHz
IF 9   Sets the second IF filter to 10.0 MHz

4.9.1.28 Low Density Parity Check – LDPC

The LDPC command displays and controls Forward Error Correction settings.

LDPC [M <m>|A <t>|I <s>]

M <m> - Sets LDPC mode to <m>. LDPC mode is stored and transferred if the (waveform) Mode changes.

where: <m> - LDPC Mode

4k1 – 4k Rate 1/2

1k1 – 1k Rate 1/2

4k2 – 4k Rate 2/3

1k2 – 1k Rate 2/3

4k4 – 4k Rate 4/5

1k4 – 1k Rate 4/5

A <t> - Sets ASM threshold to <t>, 0 to 65535. This is not a stored parameter.

I <s> - Sets half iteration scale to <s>, 0.100 to 1.000

Examples:

LDPC

LDPC mode 4k Rate 2/3
LDPC decode ASM threshold 192
LDPC decode half iteration scale 0.900

LDPC A 42   LDPC decode ASM threshold 42

LDPC I .567   LDPC decode half iteration scale 0.567

4.9.1.29 Modulation Index – MI

The MI command displays and controls modulation index scale settings.

MI [<s>|M <m>|TH <h>|THE <e>|AD <d>|AS <s>|P <e>]

<s> - Sets modulation index scale to <s>, 0.350 to 8.000, this forces the mode to hold at the specified value

M <m> - Sets modulation index scale mode to <m>

where: <m> - Mode

O – Off (sets scale 1.0 for nominal deviation of 0.70)

H – Hold

A – Acquire

T – Tracking

TH <h> - Sets tracking-mode hold below Eb/N0 of <h>, -20.000 to 30.000

THE <e> - Sets tracking-mode hold below Eb/N0 enable to <e>

where: <e> - Enable

0 – Disabled

1 – Enabled

AD <d> - Sets acquire mode minimum delta H to <d>, 0.000 to 8.000

AS <s> - Sets acquire mode settling time to <s>, 20 to 10000 ms with a 10 ms resolution

P <e> - Sets the modulation index scale parameter (mode and H value) persistence to <e>

where: <e> - Enable

0 – Disabled

1 – Enabled

MI [TS {M <i>|T <i>|H <i>}]

> M <i> - Sets modulation index trellis maximum index to <i>, 0.000 to 8.000
>
> T <i> - Sets modulation index trellis target index to <i>, 0.000 to 8.000
>
> H <i> - Sets modulation index trellis hysteresis to <i>, 0.000 to 8.000

Examples:

MI

> Modulation index scaling mode acquire (Triggered at 27.57 Eb/N0)
>
> Modulation index 0.701, estimated index 0.701
>
> Tracking mode hold threshold 10.000 Eb/N0
>
> Tracking mode hold enabled
>
> Acquire mode delta H 0.005
>
> Acquire mode settle time 500 ms
>
> Operation persistence disabled

MI x	Sets mod index scale to a value between 0.350 and 8.000 and forces mode to hold at specified value
MI O	Disable Mod Index Tracking (Set to h=0.7)
MI A	Acquire mode enable
MI A D	Sets the maximum delta h (indicates a change in h defaults to 0.005)
MI A S	Sets the delta h settling time defaults to 500 ms
MI H	Hold Mod Index Tracking at current position
MI I	Sets Trellis Index
MI T	Tracking mode enable
MI T H x	Sets the Tracking Hold threshold below Eb/N0 (x)
	Valid range is -20.000 to 30.000

4.9.1.30 Modulation – MO

The MO command displays and controls mode settings.

MO [<m>] – Sets the demodulation mode to <m>

> where: <m> - Mode
>
>> {0|PCMFM} – Pulse Code Modulation/Frequency Modulation
>>
>> {1|SOQPSK} – Shaped Offset Quadrature Phase Shift Keying
>>
>> {2|MhCPM} – Multi-h Continuous Phase Modulation
>>
>> {3|BPSK} – Bi-Phase Phase Shift Keying
>>
>> {4|QPSK} – Quadrature Phase Shift Keying

{5|AQPSK} – Asymmetrical Quadrature Phase Shift Keying

{6|AUQPSK} – Asymmetrical/Unbalanced Quadrature Phase Shift Keying

{7|OQPSK} – Offset Quadrature Phase Shift Keying

{8|UQPSK} – Unbalanced Quadrature Phase Shift Keying

{9|DPM} – Digital Phase Modulation

{11|STC} – Space Time Coding

{12|SOQPSK/LDPC} – Shaped Offset Quadrature Phase Shift Keying With LDPC

{13|STC/LDPC} – Space Time Coding With LDPC

{17|OQPSK/LDPC} – Offset Quadrature Phase Shift Keying With LDPC

Examples:
MO

      Mode PCMFM – Pulse Code Modulation/Frequency Modulation
      MO 0   Set modulation to PCM/FM
      MO 1   Set modulation to SOQPSK-TG
      MO 2   Set modulation to Multi-h CPM
      MO 3   Set modulation to BPSK
      MO 4   Set modulation to QPSK
      MO 5   Set modulation to AQPSK
      MO 6   Set modulation to AUQPSK
      MO 7   Set modulation to OQPSK
      MO 8   Set modulation to UQPSK
      MO 9   Set modulation to Digital PM (DPM)
      MO 10 Set modulation to Analog FM
      MO 11 Set modulation to Space Time Coding (STC)
      MO 12 Set modulation to SOQPSK/LDPC
      MO 13 Set modulation to STC/LDPC
      MO 17 Set modulation to OQPSK/LDPC

4.9.1.31 Output Clock Measurement – OCM

The Output Clock Measurement command displays measured output clock frequency. Most of the time this is the same as the commanded bit rate but, depending on encoding/decoding and other factors, this may or may not be the commanded bit rate.

OCM – Shows measured clock rate

Example:
OCM

Component A measured datapath rate 0.999998 – commanded 0.999998

Component B measured datapath rate 0.000000 – commanded 0.000000

4.9.1.32 PCM Decoding – PDC

The PCM Decoding command displays and controls PCM digital decoder settings.

PDC [<t>] – Sets the PCM decoding to <t>

where: <t> - Decoding

NRZL – Non-return-to-zero, level

NRZM – Non-return-to-zero, mark

NRZS – Non-return-to-zero, space

RZ – Return-to-zero

BIPL – Bi-phase, level

BIPM – Bi-phase, mark

BIPS – Bi-phase, space

DMM – Delay modulation (Miller code), mark

DMS – Delay modulation (Miller code), space

M2M – Modified delay modulation (Miller squared code), mark

M2S – Delay modified modulation (Miller squared code), space

Example:

PDC

PCM decode NRZL – Non-return-to-zero, level

4.9.1.33 Receiver Channel Parameters

Six of the listed commands, PER, PERA, PLD, PRS, PSV, and RFD operate within the following constraints.

There are two forms the receiver channel parameters take. One is the current operating parameter set that controls the operation of the receiver brick and the other is the stored parameter set.

The current operating parameters are volatile in nature in that when the power is removed, the parameters are lost. The stored parameters are saved in FLASH memory in the receiver brick. When the receiver brick is turned on, the stored parameters are loaded into the current operating parameter set.

Parameters in the current operating parameter set can be changed without affecting the stored parameter set. When the receiver brick is powered down, current operating parameters go away and when powered on, the stored parameter set becomes the current operating parameter set.

4.9.1.33.1 Parameters Erase – PER

The Parameters Erase command erases the stored parameter set for the current mode. It has no impact on the current operating parameter set. If the receiver brick is power cycled, the current operating parameter set is set to defaults.

Example:

PER

       Erasing parameter data... ok

4.9.1.33.2 All Parameters Erase – PERA

The Parameters Erase command erases the stored parameter set for all modes. It has no impact on the current operating parameter set. When the receiver brick is power cycled, all operating parameters set are set to defaults.

Example:

PERA

       Erasing parameter data... ok

4.9.1.33.3 Parameter Load – PLD

The Parameter Load command loads the stored parameter set into the current operating parameter set.

Example:

PLD

       Loading parameter data... ok

4.9.1.33.4 Parameter Reset – PRS

The Parameter Reset command resets the current operating parameter set to the defaults. This does not affect the stored parameter set.

Example:

PRS

       Initializing parameter data... ok

4.9.1.33.5 Parameters Save – PSV

The Parameters Save command writes the current operating parameter set into a (previously erased) stored parameter set.

Example:

PSV

       Saving parameter data... ok

4.9.1.33.6 RF Path Attenuation – RFA

RFA [<p>] – Sets RF path attenuation to <p>

       where: <p>

              MIN

              MAX

              0.0 to 126.0 dB using AGC table

4.9.1.33.7 Reset to Factory Defaults – RFD

The Reset to Factory Defaults command erases the stored parameter set for ALL modes then resets the current operating parameter set to the defaults including mode (it changes to the default mode).

Example:

RFD

>WARNING: ALL CONFIGURATION PARAMETER DATA IS ABOUT TO BE ERASED!!
>
>THIS CANNOT BE UNDONE!!
>
>Enter "YES" to continue!$
>
>Aborted

4.9.1.34 Power Level – PL

The PL command reports or sets the current input power level setting.

PL [<e>[-h][<f>][<r>] - Sets power level tracking display enable to <e> in format <f> at rate <r>

>where:
>
>> <e> - Enable
>>
>>> 0 – Disabled
>>>
>>> 1 – Enabled
>>
>> <f> - Format (last used, if not specified)
>>
>>> N – Normal
>>>
>>> C – CSV
>>
>> <r> - Sets display rate to <r>
>>
>>> Valid range is 100 to 60000 ms (500 ms if not specified)
>>
>> Options:
>>
>>> -h – Do not display header

PL [HEAD <f>] – Shows system status header in format <f>

>where:
>
>> <f> - Format (last used, if not specified)
>>
>>> N – Normal
>>>
>>> C – CSV

Examples:

PL

>Input dBm Atten dB Signal dBm   Adj dBm   Eb/N0 dB Saturation
>
>60.48   59.750   -3.43   13.03   27.30   0
>
>Power leveling automatic
>
>Power leveling active
>
>Power level target power 13.00 dB
>
>Power level scale   0.00 dB

Power level measurement signal + noise

Power level filtering enabled

PL 0   Set the current power level information tracking display to Off

PL 1   Set the current power level information tracking display to On

PL C A – Sets power level automatic control mode

Examples:

PL C A 0   Set the power level automatic control mode to Software

PL C A 1   Set the power level automatic control mode to Hardware

PL F – Sets the average and adjusted power level filter coefficient

Example:

PL F 5   Set the power level filter coefficient to 5

            Valid range is 1 to 16

PL M – Sets the power level measurement type

Examples:

PL M 0   Set the power level measurement type to Total Power

PL M 1   Set the power level measurement type to Signal Power

PL S – Sets the power level scale value

Example:

PL S 2.517   Set the power level scale value to 2.517

              Valid range is 0.000 to 7.996

4.9.1.35 Phase Noise Compensation – PNC

The PNC command reports or sets the phase noise compensation state.

Examples:

PNC

        Phase noise compensation off

PNC 0 Set phase noise compensation to Off

PNC 1 Set phase noise compensation to On

4.9.1.36 Query Temperature – QT

The Query Temperature command reports the temperature in degrees Celsius.

Example:

QT

        FPGA temperature: 41.0 C (85 C Max)

        Demod temperature: 43.0 C (85 C Max)

4.9.1.37 Signal Degradation Information – SDI

The Signal Degradation Information command sets and displays a variety of signal degradation information settings.

SDI [<e>|T <e>|S <s>|P <p>|L <l>|IT <t>|ET <t>]

>>> <e> - Sets the SDI enable to <e>

>>>> where: <e> - Enable

>>>>> 0 – Disabled

>>>>> 1 – Enabled

>>> T <e> - Sets the SDI tracking display enable to <e>

>>>> where: <e> - Enable

>>>>> 0 – Disabled

>>>>> 1 – Enabled

>>> S <s> - Sets the SDI data source to <s>

>>>> where: <s> - Data source

>>>>> P0 – Physical input 0

>>>>> P1 – Physical input 1

>>>>> CMB – Combiner

>>> P <p> - Sets source polarity to <p>

>>>> where: <p> - Polarity

>>>>> {0|+} – Active high (normal)

>>>>> {1|-} – Active low (inverted)

>>> L <l> - Sets lock state to <l>

>>>> where: <l> - Lock state

>>>>> 0 – Normal operation

>>>>> 1 – Forced active

>>>>> -1 – Forced inactive

>>> I <t> - Sets internal threshold to <t>, 0 to 65535, or A for automatic

>>> E <t> - Sets external threshold to <t>, 0 to 65535, or A for automatic

Examples:

SDI

>> SDI enabled

>> SDI datasource Physical input 0

Lock is normal

SDI lock is inactive

Polarity – High (+)

SDI internal threshold automatically set to 32768

SDI external threshold automatically set to 403

SDI 0   Disable SDI

SDI 1   Enable SDI

SDI E – Sets signal degradation information external threshold

Examples:

SDI E A   Set SDI external threshold to automatic

SDI I 1943   Set SDI external threshold to 1943

                 Valid range 0 to 65535

SDI I – Sets signal degradation information internal threshold

Examples:

SDI I A   Set SDI internal threshold to automatic

SDI I 4242   Set SDI internal threshold to 4242

                 Valid range 0 to 65535

SDI L – Sets signal degradation information lock state

Examples:

SDI L 0   Set SDI lock state to normal operation

SDI L 1   Set SDI lock state to forced active

SDI L -1   Set SDI lock state to forced inactive

SDI P – Sets signal degradation information source polarity

Examples:

SDI P 0   Set SDI source polarity to active high (normal)

                 Valid active high 0 or +

SDI P 1   Set SDI source polarity to active low (inverted)

                 Valid active low 1 or –

SDI S – Sets signal degradation information source

Examples:

SDI S P0   Set SDI data source to Physical Input 0

SDI S P1   Set SDI data source to Physical Input 1

SDI S CMB   Set SDI data source to Combiner

SDI T – Sets signal degradation information tracking display enable or disable parameters

Examples:

SDI T 0   Disable SDI tracking display

SDI T 1   Enable SDI tracking display

4.9.1.38 Spectrum Inversion – SI

The SI command displays and controls receiver spectrum inversion.

SI [<e>]

>   where: <e> - Enable

>>   0 – Disabled

>>   1 – Enabled

Example:

SI

>   Spectrum inversion is disabled

4.9.1.39 Show Serial Number – SN

The SN command displays the part number and serial number for the connected RDMS™.

Example:

SN

>   Part Number: QSX-RDMS-3R1D-A1-1311-00-14-K7-EQ

>   Customer Model: CHANNEL 1

>   Serial Number: 2091

>   Hardware Rev:

4.9.1.40 Save Parameters – SV

The Save Parameters command erases the stored parameter set and writes the current operating parameter set into the stored parameter set in a single command.

Example:

SV

>   Saving parameter data... ok

4.9.1.41 System Status Tracking – SYS

The SYS command displays system status and allows specification of the format: Normal (narrow), Wide (verbose), and CSV (Comma Separated Values). If "-h" is added to the command string, the header will not be displayed.

SYS [<e> [-h] [<f>] [<r>]] – Sets system status tracking display enable to <e> in format <f> at rate <r>. If not specified, Format and Rate will be the last one used, or the default if it was never specified.

>   where:

<e> - Enable

0 – Disabled

1 – Enabled

<f> - Format (last used, if not specified) Each item/parameter in the SYS display is optional within each display format.

N – Normal

W – Wide

C – CSV

<r> - Display rate <r>, 100 to 60000 ms (500 ms if not specified)

Options:

-h – Do not display header (This command suppresses header emission. This has to be specified with each command.)

SYS [HEAD [<f>|ELE [<f>]]

[HEAD <f>] – Shows the system status header in format <f>

[ELE [<f>]] – Shows the system status elements (items/parameters) for format <f>

where:

<f> - Format

N – Normal

W – Wide

C – CSV

SYS [<c>[<s>] <f> <e>] – Sets the system status element (item/parameter) <c> [<s>] display in format <f> to <e>

where:

<c> [<s>] - (Command <c> and subcommand <s>)

BEOL – Beginning/End of line marker

List of optional items/parameters that can be displayed.

Parameter	Description
TOD ST	System time
TOD DT	Date/Time of day (can be set with the TOD Command)

Parameter	Description
PL INP	Receiver input power
PL ATT	Input attenuation
PL SL	Demod signal level
PL ADJ	Adjusted signal level
PL EB	Signal Eb/N0
AFC DET	Detected AFC offset
AFC CMP	Compensated AFC offset
AFC S	AFC state
AGC EXT	External AGC zero
BR	Current bitrate
AL	Demod locked
DQ OUT	Average DQM in DQE
DQ DP	Average datapath DQM
PDF	PCM deframe
MI	Modulation index and mode

where:

    <f> - Format (last used, if not specified)

        N - Normal

        W - Wide

        C - CSV

        A - All above

    <e> - Enable

        0 - Disabled

        1 - Enabled

SYS [ALL <f> <e>] – Sets all system status elements (items/parameters) in style <f> to <e>

    where:

    <f> - Format (last used, if not specified)

        N - Normal

W - Wide

C - CSV

A - All above

<e> - Enabled in

DEF - Default

0 - Disabled

1 - Enabled

Examples:
SYS 1
STC$sys 1

Input dBm	Eb/N0 dB	AFC DET kHz	BR Mb/s L	Avg DQE
-61.13	4.42	-10.959~	4.999991 !	1.023e-12
-61.07	4.43	-11.015~	4.999991 !	1.016e-12
-61.13	4.43	-11.032~	4.999991 !	1.013e-12
-61.13	4.42	-11.137~	4.999991 !	1.013e-12

4.9.1.42 Time of Day – TOD

The Time of Day command displays and sets the current calendar date and time of day values. This is primarily used to add a hard reference to the BERT (BER command) output. It is volatile and *must be reset after every power cycle or mode change*.

TOD [[mm/dd/yyyy] [hh:mm[:ss]]

where:

mm – Month 1 – 12

dd – Day of month 1 – 31

yyyy – Year

hh – Hour 0 – 23

mm – Minutes 0 – 59

ss – Seconds 0 = 59

Examples:
TOD

10/16/2015 14:34:06

Friday, October 16, 2015 02:34:06 PM

TOD 10/16/2015 14:34:00

4.9.1.43 Show Options – UP

The Show Options command displays unit parameter settings.

Example:

UP

>Part Number: QSX-RDMS-3R1D-A1-1311-00-14-K7-EQ
>
>Customer Model: CHANNEL 1
>
>Serial Number: 2091
>
>Hardware Rev:
>
>Revisions options: None
>
>Configured as receiver with IF SAW filters
>
>1 channel
>
>Housing is rack mount, IF input, TTL output
>
>Enabled extended bands:
>
>>P band: 200.0 to 1150.0 MHz
>>
>>CT band: 1150.0 to 2500.0 MHz
>>
>>C band: 4400.0 to 5250.0 MHz
>>
>>70 MHz band: 70.0 to 70.0 MHz
>>
>>Playback band: 0.1 to 20.0 MHz
>
>Enabled modes:
>
>>PSK
>>
>>MHCPM
>>
>>SOQPSK
>>
>>STC
>>
>>PCMFM
>
>Pin out:
>
>>00 – Standard
>
>Options:
>
>>EQ – Adaptive Equalizer
>>
>>14 – 14 SAW Filters
>>
>>K7 – Viterbi decode (k = 7 rate = 1/2)

4.9.1.44 Version – VE

The Version command displays the current application, FPGA, and adaptive equalizer versions.

Example:

VE

>PCMFM App Rev: 1.0.7.137 Sep 18 2015 13:49:13
>
>PCMFM FPGA Rev: 0000102A   Sep 9 2015 19:19:51
>
>AEQ Rev: 1.0.5   Sep 9 2015 19:13:52

4.9.1.45 Viterbi Forget Factor – VFF

The Viterbi Forget Factor command reports or sets the Viterbi forget factor, on a scale from 0.01 – 0.99.

VFF [F <f>]

> F <f> - Sets trellis forget factor to <f>, 0.000 to 1.000

Examples:

VFF

> Trellis run length 241.078, increment 14.952
>
> Trellis forget factor 0.800

VF 0.04   Set the Viterbi forget factor to 0.04

VF 0.62   Set the Viterbi forget factor to 0.62

VF V   Show current trellis index (where applicable)

5 Performance Specifications

5.1 Power

The rack-mount receiver requires 100 to 240 VAC, 50/60 Hz power.

5.2 RF Frequency Error

By default, the RDMS™ is capable of acquiring a signal with a frequency error of up to ±100 kHz.

5.3 Bit Error Rate

The RDMS™ meets the following BER limits, when tested with a signal source, which complies with IRIG 106-05.

Table 10: RDMS™ BER Specifications

BER	Maximum E_b/N_0 (dB)		
	PCM/FM, Tier 0	**SOQPSK-TG, Tier I**	**Multi-h CPM, Tier II**
10^{-3}	7.5	9.5	11.0
10^{-4}	9.0	11.5	12.5
10^{-5}	10.0	13.0	13.5
10^{-6}	11.0	14.5	14.5

Typical BER performance, plotted in Figure 48, is significantly superior to that tabulated above.
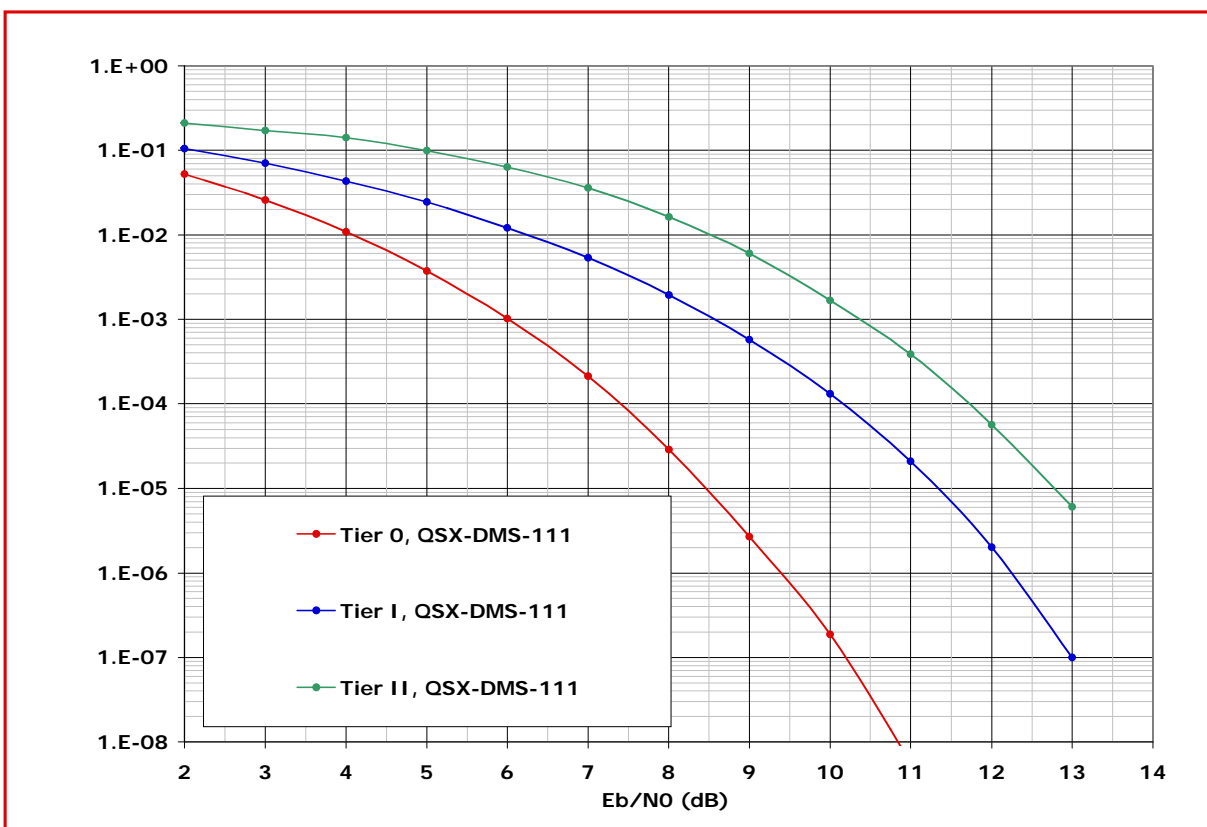
Figure 201: BER Performance for Tier 0, I, and II

5.4   Synchronization

The RDMS™ offers very fast, reliable acquisition, even at very low signal to noise ratio. Synchronization time is a function of modulation type and IF frequency error. Typical SOQPSK results (from 10,000 synchronization trials) are shown in Figure 202.
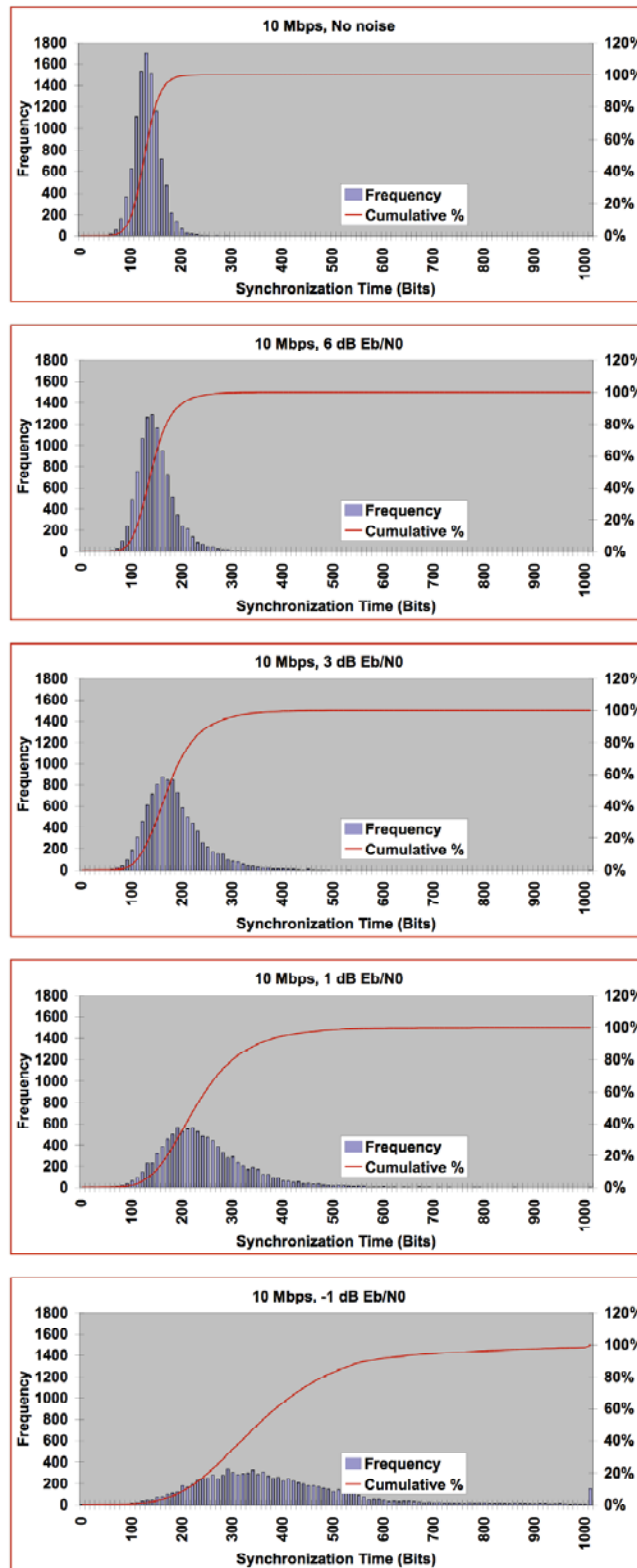
Figure 202: Synchronization Time at Various Signal-to-Noise Ratios

5.5 RF Input

Available band configurations are shown in Table 2. Two additional band codes are described in section 1.2.3.1. The input impedance is 50 ohms.

Table 11: Band Configuration Codes
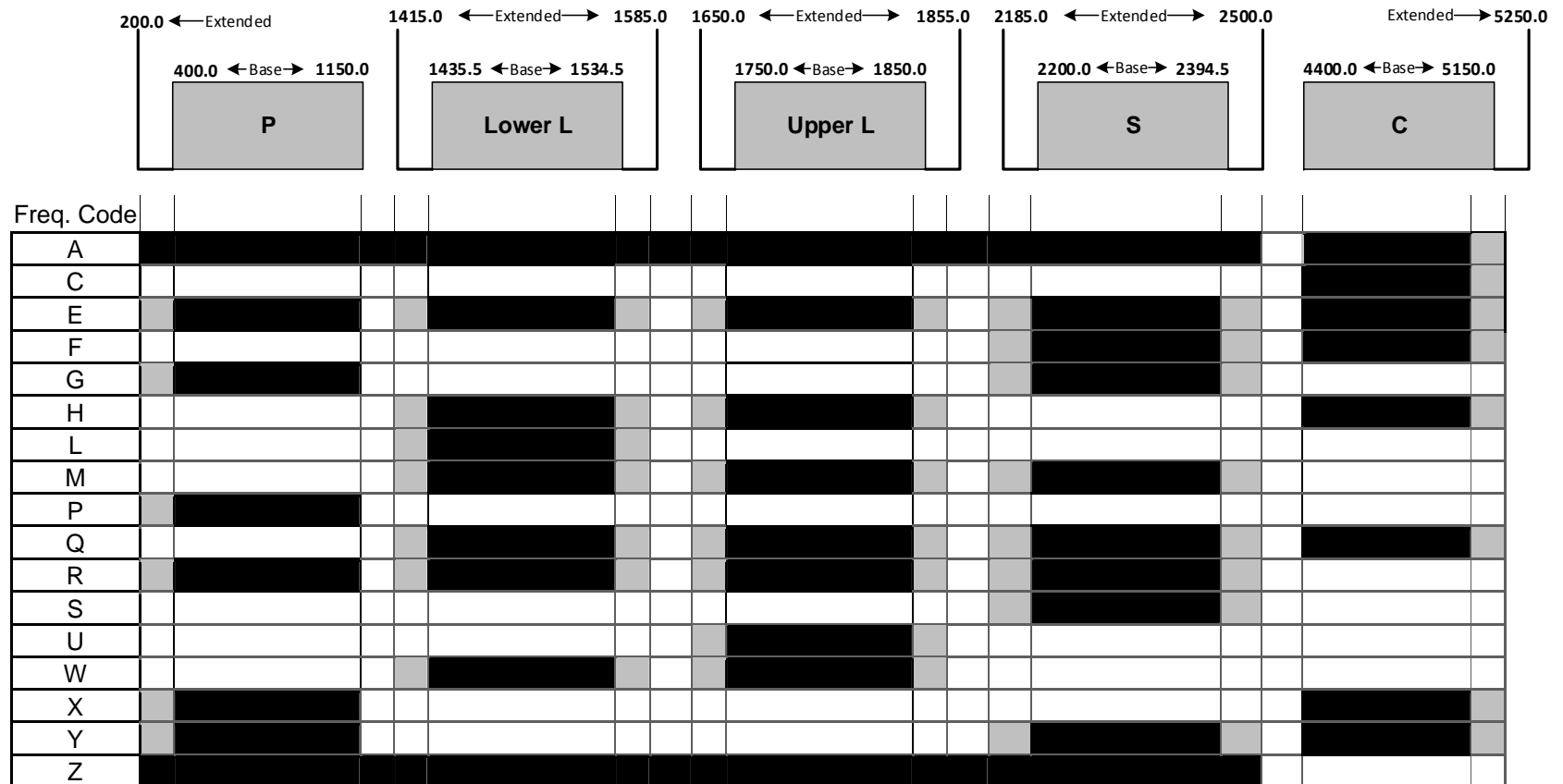
Band	Extended range	Base range
P	200.0 ← Extended	400.0 ← Base → 1150.0
Lower L	1415.0 ← Extended → 1585.0	1435.5 ← Base → 1534.5
Upper L	1650.0 ← Extended → 1855.0	1750.0 ← Base → 1850.0
S	2185.0 ← Extended → 2500.0	2200.0 ← Base → 2394.5
C	Extended → 5250.0	4400.0 ← Base → 5150.0

Freq. Code: A, C, E, F, G, H, L, M, P, Q, R, S, U, W, X, Y, Z

Legend:
- ☐ Frequency Gap
- ■ Standard (Base) Frequency Range
- ▨ Extended Frequency Range (available by selecting Extended Tuning = 1 in part number)

5.5.1 Additional Band Codes

Two additional band codes are available:

- Band Code 7: Through the IF Input: 70 MHz through SAW filters, 0.075 MHz-20 MHz, 70 MHz

- Band Code T: 2025.0 MHz to 2110.0 MHz standard range

6   Maintenance Instructions

The Rack-Mount receiver requires no regular maintenance. Please consult the factory for any maintenance, upgrade, or repair requirements.

7   Product Warranty

The RM RDMS™ carries a standard parts and labor warranty of two (2) years from the date of delivery.

8   Technical Support and RMA Requests

In the event of a product issue, customers should contact Quasonix via phone (1-513-942-1287) or e-mail (support@quasonix.com) to seek technical support. If Quasonix determines that the product issue must be addressed at the factory, a returned materials authorization (RMA) number will be provided for return shipment.

Authorized return shipments must be addressed in the following manner:

<div align="center">

Quasonix, Inc.
ATTN: Repair, RMA #
6025 Schumacher Park Drive
West Chester, OH 45069

</div>

To ensure that your shipment is processed most efficiently, please include the following information with your product return:

- Ship To – Company name, address, zip code, and internal mail-drop, if applicable

- Attention/Contact person – Name, Title, Department, Phone number, email address

- Purchase Order Number – If applicable

- RMA Number – provided by the Quasonix representative

Please note that Quasonix reserves the right to refuse shipments that arrive without RMA numbers.

9   Appendix A – Bit Error Rate Testing

There is a separate BERT for each data path in the receiver (0 main channel, 1 combiner channel). By default all commands are targeted to the current "tracking channel", 0 or 1.

The results of the test can be displayed using the BER command with no parameters or a continuous display can be produced using BER D 1. BER D 0 turns off the continuous display.

Table 12: Bit Error Rate Serial Commands

Mnemonic	Name	Description
BER ?	Bit Error Rate Help	Provides help for using the bit error rate commands
BER	Bit Error Rate Status	Report bit error rate status Examples: BER 　　　　Measurement disabled 　　　　Sequence is PN15 　　　　Continuous measurement 　　　　Gating repeat 　　　　Error interval seconds 　　　　BERT display tracking Normal at 0 ms
BER (was D)	Bit Error Rate Output Display	Set the bit error output display to a specific style and display rate BER [<e>[-h] [<f>] [<r>]] – Sets bit error tracking display enable to <e> in format <f> at rate <r> 　　where: 　　　　<e> - Enable 　　　　　　0 – Disabled 　　　　　　1 – Enabled 　　　　<f> - Format (last used, if not specified) 　　　　　　N – Normal 　　　　　　W – Wide 　　　　　　C – CSV (Comma Separated Values) 　　　　<r> - Display rate <r>, 100 to 60000 ms (500 ms if not specified) 　　　　-h – Do not display header

Mnemonic	Name	Description
BER DQ	Set AGV DQ	Sets average DQ for output (OUT) or datapath (DP) display enable to <e> BER [DQ {OUT|DP} <e>] 　　　　where: <e> - Enable 　　　　　　　0 - Disabled 　　　　　　　1 - Enabled
BER G n	Set Bit Error Measurement Gating	Sets bit error measurement gating The test can be configured to make a single measurement or, when a time limit, bit count, or error count is set, automatically repeat the test. BER [G <n>] 　Sets bit error measurement gating to <n> 　　　　where <n> - Measurement gating 　　　　　　　S – Single 　　　　　　　R – Repeat Examples: BER G S　　Set gating to Single BER G R　　Set gating to Repeat
BER HEAD <f>	BER Header	BER [HEAD <f>] Shows system status header in format <f> where 　　　　<f> - Format 　　　　　　N – Normal 　　　　　　W – Wide 　　　　　　C – CSV
BER I	BER Interval	BER [I <i>] Sets bit error interval to <i> where 　　　　<i> - Error Interval 　　　　　　S – Seconds 　　　　　　D – Desciseconds

Mnemonic	Name	Description
BER M	BERT Measurement Status	Display current BERT measurement status in a specific style BER [M <s>[-h]|?] where <s> - Style N - Normal W - Wide C - CSV Options: -h - Do not display header Examples: BER M ? Display style help BER M N N indicates Normal BER M W W indicates Wide BER M CSV CSV indicates Comma Separated Values
BER P n	Set Bit Error Test Pattern	Set bit error test pattern BER [P {<n>|<p>}] P indicates a preset or fixed pattern length where 'n' is one of: PN6, PN9, PN11, PN15, PN17, PN20, PN23, PN31 or 'p' is a fixed pattern length of 2 to 32 bits (fixed pattern lengths are automatically determined and leading zeros are significant) Examples: BER P PN9 Set test pattern to preset PN9 BER P 13 Set test pattern to a fixed pattern length of 13 bits
BER RR n	Set Restart Measurement	Set restart measurements on resync enable BER [RR <e>] where 'e' is Enable 0 = Disable 1 = Enable

Mnemonic	Name	Description

BER T n	Set Bit Error Measurement Type	Sets bit error measurement type
		
		The test type can be configured to run continuously or stop when either a time limit, bit count, or error count has been reached. The error count limit guarantees a minimum number of errors.
		
		BER [T <t>]
		
		T indicates type
		
		      where 'n' is one of the following:
		
		      C = Sets to Continuous (clears limits)
		
		      T x = Sets BERT time limit
		
		            where 'x' is between 0.000 and 4294967.500 seconds
		
		      B x = Sets bit limit
		
		            where 'x' is between 1 and 2.81475E+14 bits
		
		      E x = Sets error limit
		
		            where 'x' is between 1 to 2.81475E+14 errors
		
		Bit count and error count limits are mutually exclusive--either parameter may be combined with time limit
		
		Examples:
		
		BER T C Set bit error measurement type to Continuous
		BER T 2.333 Set BERT time limit to 2.333 seconds
		BER T B 1 Set bit limit to 1 bit
		BER T E 0.5 Set error limit to 0.5 errors

BER R	Measurement Enable	Starts or Restarts bit error measurement If a time limit, bit count, or error count limit is set and the limit has been reached (enabled but not running) the BERT is restarted. Example: BER R Enter command to Start or Restart bit error measurement, current tracking channel
BER S	Measurement Disable	Stops bit error measurement Example: BER S Enter command to Stop bit error measurement current tracking channel

The following example illustrates how to display a bit error register. Note the details below.

- A column header is displayed every ten rows.

- The 'E' column indicates the BERT is enabled by displaying a pound sign '#'. If the BERT is not enabled, this column is blank.

- The 'R' column indicates the BERT is actually running and making a measurement by displaying a '!'. If the BERT is not running, this column is blank.

- The BERT can be enabled, but not running, in the case of a time, bit, or error count limit.

- An asterisk '*' after the error rate column indicates that the data is inverted. If the display is continuous and a time, bit, or error limit is set with repeating gating, the display shows the end of the test by displaying '>>>' in the first three columns.

The following shows an example display with a five (5) second repeating test.

PCMFM$**ber t t 5**

Time limit 5 seconds

PCMFM$**ber r**

Measurement enabled, running

PCMFM$**ber d n**

Measurement enabled, running

Sequence is PN15

Time limit 5 seconds

Gating repeat

Error interval seconds

BERT display tracking Normal at 0 ms

PCMFM$

```
E R        Time       Bits     Errors Delta Err* Error Rate*  Seconds   Eb/N0 L
! *    00:00:02.600 2.5933e+07 1.2836e+07 1.2836e+07* 4.950e-01        2    -45.15
! !    00:00:03.100 3.0919e+07 1.5516e+07 2.6804e+06* 5.018e-01        3    -43.43
! !    00:00:03.600 3.5904e+07 1.8197e+07 2.6813e+06* 5.068e-01        3    -44.11
! !    00:00:04.100 4.0889e+07 2.0737e+07 2.5398e+06* 5.072e-01        4    -44.64
! !    00:00:04.600 4.5875e+07 2.3443e+07 2.7062e+06* 5.110e-01        4    -31.84
```

9.1 Test Noise Commands

Digitally generated Additive White Gaussian Noise (AWGN) can be injected in the demodulator for test purposes. This noise can exhaust most or all of the demodulator's error-free signal processing margin so that small imperfections in the received signal will be visible as an increase in the bit error rate.

The noise level is calibrated relative to an extremely accurate measurement of the input signal level. This measurement will be most accurate when the received signal has a high signal-to-noise ratio. Therefore, input signal levels above -70 dBm are generally recommended. Due to the available dynamic range of the demodulator signal processing path and the faithful representation of the AWGN, noise samples may be clipped, especially at or below 0 dB Eb/N0.

Note that the noise is injected following downconversion to baseband but before demodulation. Therefore, the noise will affect demodulator output signals, including video outputs and the front panel display (eye diagram or constellation), but it will not change measurements of the input signal (signal strength and signal quality).

The AWGN command, described in Table 13, displays and controls Additive White Gaussian Noise settings.

Table 13: Test Noise Commands

Mnemonic	Name	Description
AWGN ?	Test Noise Help	Provides help for using the test noise commands
AWGN	Test Noise Status	Report test noise status of current tracking channel Example: AWGN 　　　AWGN disabled 　　　AWGN power 50.00 dB E_b/N_0
AWGN <e>	Enable/Disable Test Noise	Turns the test noise output Enabled or Disabled AWGN <e> <e> - Sets AWGN enable to <e> 　　　If 'e' is 0, test noise is Off/Disabled 　　　If 'e' is 1, test noise is On/Enabled Example: AWGN 1 　　　AWGN enabled
AWGN [P <p>]	Set Test Noise Level	Sets the test noise power level in dB E_b/N_0 Range for p is -10.00 dB E_b/N_0 to +50.00 dB E_b/N_0 Example: AWGN P 42.00 　　　AWGN power 42.00 dB E_b/N_0

10 Appendix B – Recommended AM and AGC Settings for ACU Interfaces

10.1 AM and AGC

In a typical flight test scenario, Automatic Gain Control (AGC) tracks out slow variations in received signal strength. Ideally, the net received signal has constant signal strength except for higher-frequency amplitude modulation (AM) induced by the antenna tracking mechanism. If the antenna system uses conical scan, sinusoidal AM is induced by physical motion of the antenna feed. If the antenna system uses e-scan, square-wave AM is induced by switching between antenna elements.

The receiver demodulates the AM on the received signal and provides it to the antenna control unit (ACU). From the magnitude and phase of this AM signal, the ACU detects and corrects pointing error.

10.2 AM AGC Compensation

In some systems, vehicle rotation or other dynamics can induce additional undesired low-frequency AM. If the frequency of this undesired AM is close enough to the scan rate, the AGC will not track it out. Worse, inherent lag in the AGC may result in severe distortion of the desired AM.

AGC Compensation adjusts the AM output to neutralize these effects. This allows the AGC to fully track out undesired AM at frequencies just below the antenna scan rate. However, the compensation adds a large amount of delay to the AM output, proportional to the AGC time constant. This delay may make antenna tracking difficult or impossible. Therefore, AGC Compensation should only be enabled when:

- The antenna tracking system experiences degradation due to undesired AM at roughly 1/20 to 1/2 the antenna scan rate

- The added compensation delay on the AM signal does not cause the antenna tracking loop to become unstable; this can only be verified on a case-by-case basis

10.3 Recommended Settings

Recommended AM and AGC settings depend on three primary parameters: antenna scan type (conical or e-scan), antenna scan rate, and whether the system is subject to undesired low-frequency AM (refer to section 10.2). Table 14 describes recommended settings based on these parameters:

Table 14: Recommended AM/AGC Settings

Antenna Scan Type	Undesired Low Frequency AM?	AGC Time Constant (ms, 0.1 to 1000)	AM Bandwidth (Hz, 5 to 50,000)	AGC Compensation
Conical scan	No	1000 / ScanRate	5 * ScanRate	OFF
Conical scan	Yes	850 / ScanRate	5 * ScanRate	ON
E-scan	No	1000 / ScanRate	10 * ScanRate	OFF
E-scan	Yes	850 / ScanRate	10 * ScanRate	ON

In Table 14, ScanRate is the antenna scan rate in Hz.

For example, suppose a conical scan system with no undesired low-frequency AM has a scan rate of 30 Hz. This system has a recommended AGC Time Constant of 1000 / 30 = 33.3 ms, and an AM Bandwidth of 5 * 30 = 150 Hz, with AGC Compensation OFF.

The AGC Time Constant should *never* be set lower than recommended. Setting the AGC Time Constant higher is unlikely to affect performance, though it may degrade performance if vehicle dynamics cause relatively rapid changes in received signal strength.

The AM Bandwidth may be set lower to reduce noise on the AM signal, or higher to reduce delay on the AM signal. At the recommended settings, AM phase delay is approximately 30 degrees for typical conical scan and e-scan scan rates.

If AGC Compensation is enabled, the AGC Time Constant and AM Bandwidth should both be set only as indicated in Table 14.

11   Appendix C – Phase Noise Compensation

11.1 Trellis Demodulation Basics

Legacy Single-Symbol Detection:

- Uses basic Limiter-Discriminator operation
- Frequency in this bit above nominal → data = 1
- Frequency in this bit below nominal → data = 0
- Makes no use of adjacent symbols for error correction

Trellis Detection:

- Uses the phase tree for data detection
- Uses adjacent symbols to help decide on "iffy" bits
- Improves BER performance by 3.5 to 5.0 dB

The Phase Tree shown in Figure 203, shows all of the possible paths the phase trajectory can take over a period of seven bits. Figure 204 shows the two unique paths, based on whether the second bit is a 1 or 0.
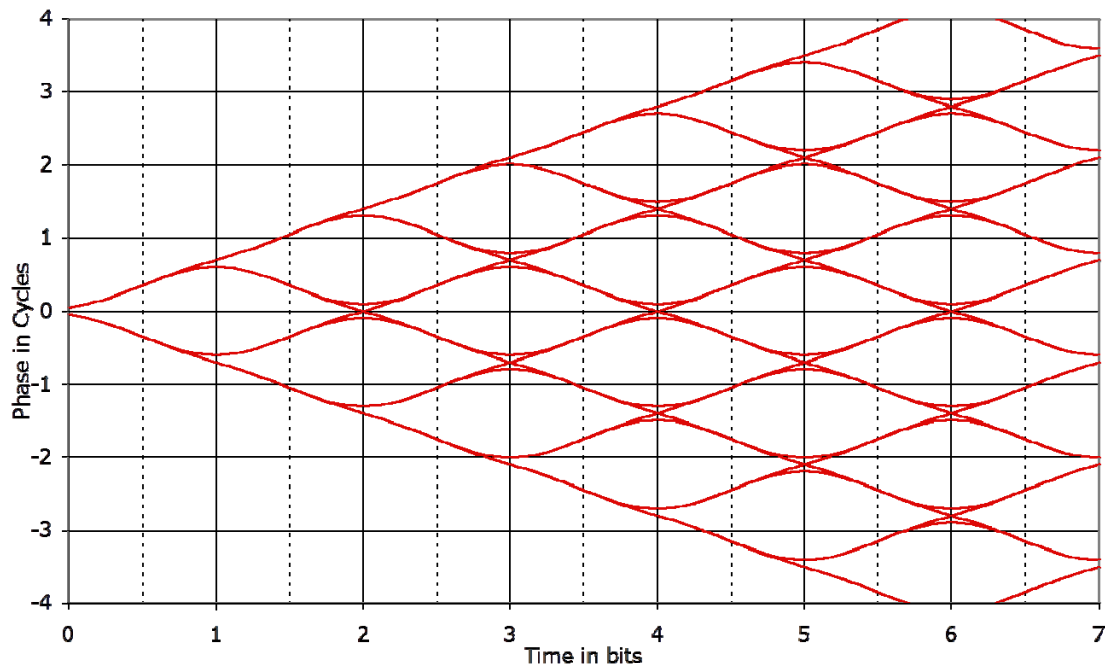
Figure 203: Ideal PCM/FM Phase Tree (h = 0.7)
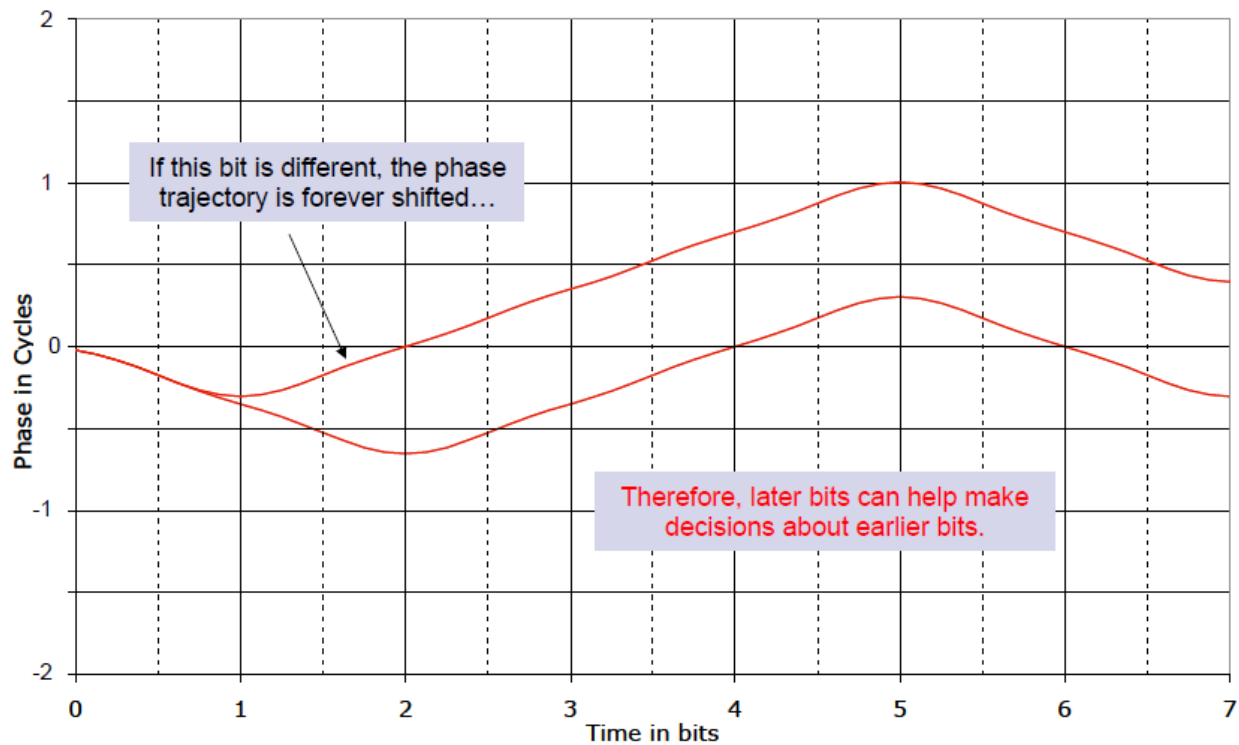
Figure 204: Phase Trajectory Never Forgets

11.1.1 Trellis Demodulation Summary

The basic premise of trellis demodulation is that the signal from the transmitter follows a known path through the phase tree. When the demodulator knows this, it can use a sequence of several symbols to help make better decisions about each individual bit. This process improves BER performance by about 3.5 to 5 dB over conventional FM detection. However, this assumes that the transmitter is really following the "known" and "correct" phase tree, and this assumption is NOT always true.

High phase noise can reduce the trellis detection gain because phase noise corrupts the tree. The following figures illustrate the differences in trellis detection gain depending on the amount of phase noise introduced.

Figure 205: Trellis Detection Gain with Zero to Minimum Phase Noise

Figure 206: Trellis Detection Gain with Significant to Severe Phase Noise

11.2 Phase Noise Impact

Trellis demodulation is based on the assumption that the signal is following a predictable path through the trellis. If this is not true (due to high phase noise), then a trellis demodulator cannot provide the expected performance gain.

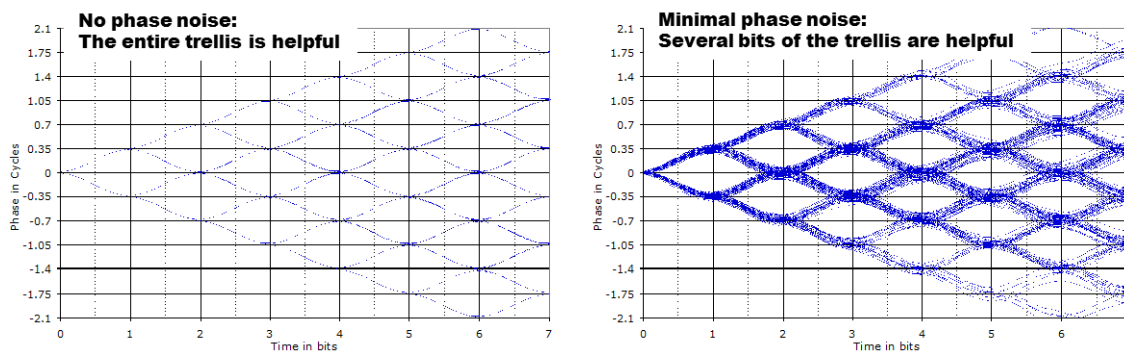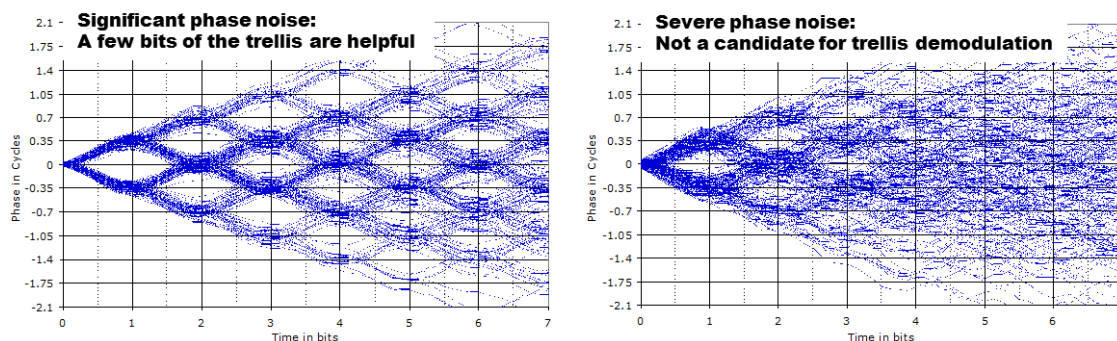- Many legacy analog transmitters (a simple modulated VCO) have high phase noise.

- Vibration often further increases phase noise.

- Phase noise is generally more damaging at low bit rates.

- Phase Noise Compensation (PNC) gives back some of the trellis detection gain, by shortening the trellis observation span.

11.3 Clock Jitter Impact

Many older PCM encoders are susceptible to large inaccuracies in clock rate or have clock stability issues, especially under harsh vibration conditions. While the RDMS is capable of tracking static clock rate errors as large as 1000 ppM, excessive jitter causes the integrated bit sync to lose lock. Enabling the PNC mode opens the tracking loop bandwidth to accommodate for these issues. This increase in bandwidth does have a tradeoff. A wider tracking range allows the RDMS to deal with the additional jitter, but it may also increase synchronization times slightly, and slightly increase the minimum SNR at which the RDMS declares lock.

11.4 When to Use PNC

There is no bullet-proof test for whether PNC is needed, but there are good indicators. Turn on PNC if:

- The demodulator is struggling to lock, even with good Signal to Noise Ratio (SNR). ("Good" SNR means the Quality bar is above one-quarter height.)

- The eye pattern NEVER looks "clean," as in Figure 207

- Symptoms get worse when the transmitter is under vibration

- Symptoms get worse at low bit rates
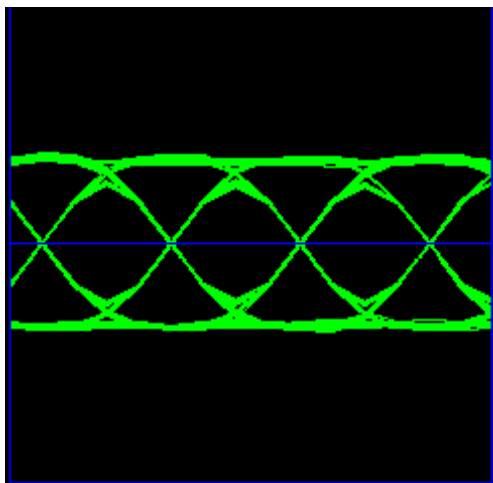
Figure 207: "Clean" Eye Pattern

11.5 Know Your Transmitter

If you know the brand and type of transmitter, these tips can help determine when to use PNC.

If your transmitter was manufactured by these companies, PNC should be OFF:

- Quasonix – guaranteed
- Nova Engineering – highly likely
- L3 – probably, but digital transmitters only

If the transmitter was manufactured by the companies below, PNC should be ON:

- Microwave Innovations
- Emhiser
- Southern California Microwave
- L3 (analog transmitters)

12   Appendix D - PCM Framer/Deframer Function

Quasonix RDMS™ receivers recognize PCM frames as defined by IRIG 106 Chapter 4 and Appendix C. The receiver can provide basic processing of a large subset of possible frame configurations, including sync word detection, subframe ID checking, and data extraction from the frame structure (without decommutation). Within the receiver, this functionality is referred to as the PCM Deframer.

To facilitate testing the PCM Deframer, Quasonix Receiver Analyzers can generate PCM frames using external (user) data or internal test patterns for the frame payload. Within the Receiver Analyzer, this functionality is referred to as the PCM Framer.

This note describes the detailed capabilities of the PCM Framer and Deframer.

12.1 PCM Framer

The PCM Framer supports fixed-length PCM frame generation with the following parameters:

- Major frame length up to 256 minor frames

- Minor frame length up to 16,384 bits

- Minor frame sync pattern 16 to 33 bits (user-selectable pattern and length)

- Optional subframe ID (SFID) insertion (word 1 position only)

The resulting PCM frame format appears as:

Minor Frame Maximum Length, N Words or B Bits

Class I: Shall not exceed 8192 bits nor exceed 1024 words

Class II: Shall not exceed 16,384 bits

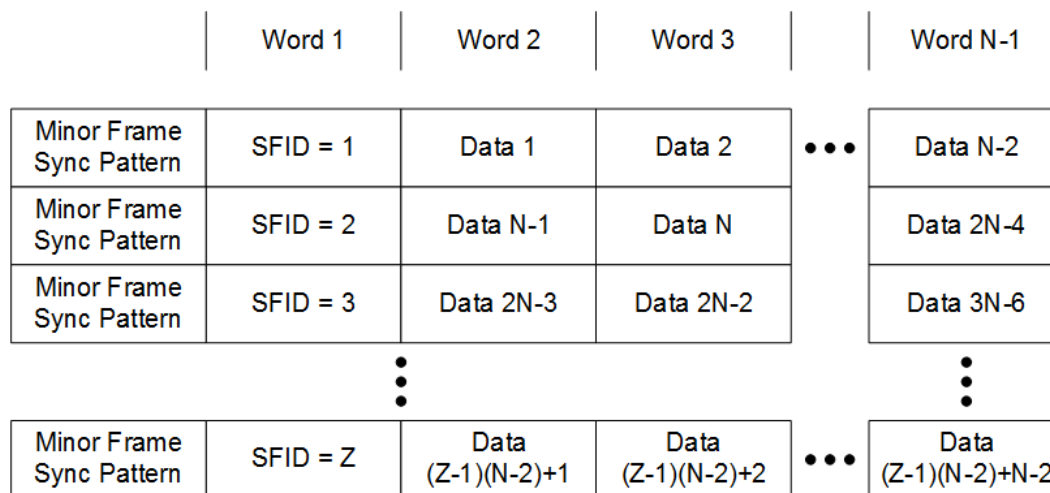|	Word 1	Word 2	Word 3		Word N-1
Minor Frame Sync Pattern	SFID = 1	Data 1	Data 2	•••	Data N-2
Minor Frame Sync Pattern	SFID = 2	Data N-1	Data N		Data 2N-4
Minor Frame Sync Pattern	SFID = 3	Data 2N-3	Data 2N-2		Data 3N-6
Minor Frame Sync Pattern	SFID = Z	Data (Z-1)(N-2)+1	Data (Z-1)(N-2)+2	•••	Data (Z-1)(N-2)+N-2

Figure 208: Frame Format with SFID Insertion Enabled

*Major Frame Length = Minor Frame Maximum Length multiplied by Z

The PCM Framer uses serial streaming data, either from an external source or an internal pattern generator, to fill the data portion of the frame. There is no mechanism to align specific sets of serial bits to Data words, and there is no mechanism to align specific data words to a given position within the frame format. Therefore, the PCM Framer cannot generate frames with data parameters suitable for decommutation. It can, however, be used to test frame synchronization and link quality via SFID verification. Further, if the serial streaming data is a known pattern, the data can be monitored by a BERT at the receiving end after data extraction.

12.2 PCM Deframer

The PCM Deframer supports **fixed-length** PCM frame recognition with the following parameters:

- Major frame length up to 256 minor frames
- Minor frame length up to 16,384 bits
- Minor frame sync pattern 16 to 33 bits (user-selectable pattern and length)
- Optional subframe ID (SFID) checking (word 1 position only)

Acquisition of PCM frame lock takes place according to the process recommended by RCC 119 Section 4.6. There are four settable parameters that are used to configure acquisition and re-acquisition:

- CORR_APERTURE – Number of bits, early or late, that the sync pattern may appear relative to other detected sync patterns and still be detected
- CORR_THRESH – Number of bits of the sync pattern that must match to declare sync detect
- LOCK_THRESH – Number of valid sync detects required to declare PCM frame lock
- SEARCH_THRESH – Number of invalid sync detects required to declare loss of PCM frame lock (once locked)

The PCM Deframer acquires frame lock using the following states:

- Search – Detect sync pattern if correlation of any set of bits exceeds CORR_THRESH
- Check – Declare PCM frame lock if valid sync pattern appears LOCK_THRESH consecutive times
- Lock – Maintain PCM frame lock until invalid sync pattern appears SEARCH_THRESH consecutive times

SFID checking occurs whenever PCM frame lock is detected. The SFID is expected to be located in the first word after the sync pattern, as shown in Figure 208, and it is considered valid if it is one greater than the previous SFID, or if it is 1 and the previous SFID was Z (the major frame length).

The PCM Deframer cannot be programmed to perform decommutation. It can, however, optionally strip the sync pattern and SFID (if present) to leave only the frame data. If the fame data is a known pattern, it can be monitored by a BERT to measure link performance.

The RDMS™ receiver can output PCM frame lock and/or SFID valid indications on the DEMOD_LOCK and/or ONES_DETECT back-panel outputs. Refer to the RDMS™ data sheet for more information about these outputs.

13   Appendix E – How to Configure Tape Output

This appendix is also available on the Quasonix web site as a stand alone document: How to Configure the Tape Output on a 3rd Generation Rack-Mount RDMS Telemetry Receiver.

This appendix assumes the use of Windows 7 with access via Telnet.

Access via Telnet is described in section 4.8 of this manual.

Contact your local administrator when using other versions of Windows or non-Windows platforms.

13.1 Overview

The Tape Output feature uses the I/Video A or the Q/Video B outputs on the 1U rack mount receiver (refer to section 13.3 for 3U connectors). Connectors are listed in Table 15 and locations are illustrated in Figure 6.

Table 15: 1U Tape Output Connectors

Output	Connector
I/Video A Channel 1	J5
Q/Video B Channel 1	J6
I/Video A Channel 2	J19
Q/Video B Channel 2	J20
I/Video A Channel Combiner	J29
Q/Video B Channel Combiner	J30

These connectors ordinarily provide the baseband video outputs. If they are used to drive a bit-sync, that functionality may not be available when using Tape Out.

For PCM/FM, only I/Video A is used for baseband video, leaving Q/Video B available for Tape Out. In any QPSK mode (that requires both I and Q baseband outputs), using Tape Out is mutually exclusive.

This is not a persistent configuration. Changing modes or power cycling the unit causes the Video outputs to revert to their normal, baseband outputs.

Figure 209: 1U Rear Panel

13.2 Commands

After connecting to Channel 1, Channel 2, or Channel 3 (the combiner), the command prompt displays. The following commands configure the Tape Out on Q/Video B. Anything past the '#' is a comment, and can be discarded.

```
aho b p0t;  # Routes Physical channel 0 tape output source to Q/Video B

ahm x.x;    # Sets the tape out mixer to x.x MHz

ahm b 1;    # Enables the tape out mixer on Q/Video B output
```

The following commands configure the Tape Out on I/Video A.

```
aho a p0t;  # Routes Physical channel 0 tape output source to I/Video A
ahm x.x;    # Sets the tape out mixer to x.x MHz

ahm a 1;    # Enables the tape out mixer on I/Video A output
```

In both cases, the x.x MHz is in the range of 0.075 to 20.0 MHz. Frequencies outside of that range result in unpredictable behavior.

Example:

To configure Q/Video B out for 5.1 MHz center frequency:

```
Aho b p0t
ahm 5.1
ahm b 1
```

To configure I/Video A out for 2.8 MHz center frequency:

```
aho a p0t
ahm 2.8
ahm a 1
```

13.2.1 Notes

This is not a persistent configuration. Changing modes or power cycling the unit cause the Video outputs to revert to their normal, baseband outputs.

While the Tape Out can be configured simultaneously on I/Video A and Q/Video B, they cannot have independent frequencies. The frequency specified by 'ahm x.x' will be used for BOTH.

13.3 3U Connectors

The Tape Output feature on the 3U Receiver uses the I/Video A, Q/Video B, Video C, and Video D outputs. The 3U connectors are listed in Table 16 and locations are illustrated in Figure 210.

Table 16: 3U Tape Output Connectors

Output	Connector
I/Video A Channel 1	J3
Q/Video B Channel 1	J8
Video C Channel 1	J13
Video D Channel 1	J18
I/Video A Channel 2	J28
Q/Video B Channel 2	J33
Video C Channel 2	J38
Video D Channel 2	J43
I/Video A Channel Combiner	J53
Q/Video B Channel Combiner	J58
Video C Combiner	J63
Video D Combiner	J68

Figure 210: 3U Rear Panel

13.4 Troubleshooting

If you are still having difficulties at this point, contact Quasonix technical support.

Quasonix Technical Support
(1-513-942-1287) or email (support@quasonix.com)

When calling technical support, it will speed things up if you have the following information handy:

- Model number   ***Note that this is different from the customer part number.***

- Serial number

- Software Version

It is also helpful if you can call from a phone in your lab so our tech support people can actually walk you through setting, checking, and controlling your receiver.

14 Appendix F – Factory Reset Values

When a reset command is activated, the frequency defaults to the lowest valid frequency for the lowest authorized band on the unit. The reset priority is:

1. PCM/FM
2. SOQPSK
3. Multi-h CPM
4. QPSK

Reset values for each mode are listed in the following tables.

The default Frequency is 2200.000 MHz.

Table 17: PCM/FM Factory Reset Values

Parameter	Reset State	Parameter	Reset State
Bit Rate	1	Phase Noise Compensation	Off
Combiner (if available)	Off	Muting Timeout	1000
Clock Polarity	Normal	Output Muting	Off
Data Polarity	Normal	Downconvert Antenna	Disabled
Equalizer (if available)	Off	AGC Polarity	+ (Positive)
DQ Encapsulation (if available)	Disabled	AGC Scale	10
Derandomizer	Disabled	AGC Time Constant	100
Differential Decoder	N/A	AGC Zero Mode	Manual
Modulation Scaling	Acquire	AM Bandwidth	100
Modulation Persist	Off	AM Polarity	Normal
IF Filter	Auto	AM Scale	1
Video De-emphasis	Off	AGC Compensation	Enabled

Table 18: SOQPSK Factory Reset Values

Parameter	Reset State
Bit Rate	1
Modulation Scaling	N/A
Clock Polarity	Normal
Data Polarity	Normal
Derandomizer	Disabled
Differential Decoder	Enabled
IF Filter	Auto
Downconvert Antenna	Disabled
AGC Zero Mode	Manual
Convolutional Decoder	N/A
Lock Output Polarity	Active High
NRZ Encoding	N/A
Output Control	Default
Output Muting	Disabled
Phase Noise Compensation	Disabled
Tape Output	Disabled

Table 19: Multi-h CPM Factory Reset Values

Parameter	Reset State
Bit Rate	1
Modulation Scaling	N/A
Clock Polarity	Normal
Data Polarity	Normal
Derandomizer	Disabled
Differential Decoder	N/A
IF Filter	Auto
Downconvert Antenna	Disabled
AGC Zero Mode	Manual
Convolutional Decoder	N/A
Lock Output Polarity	Active High
NRZ Encoding	N/A
Output Control	Default
Output Muting	Disabled
Phase Noise Compensation	Disabled
Tape Output	Disabled

Table 20: QPSK Factory Reset Values

Parameter	Reset State
Bit Rate	1
Modulation Scaling	N/A
Clock Polarity	Normal
Data Polarity	Normal
Derandomizer	Disabled
Differential Decoder	N/A
IF Filter	Auto
Downconvert Antenna	Disabled
AGC Zero Mode	Manual
Convolutional Decoder	Disabled
Lock Output Polarity	Active High
NRZ Encoding	NRZ-L
Output Control	Default
Output Muting	Disabled
Phase Noise Compensation	Disabled
Tape Output	Disabled

15   Appendix G – Special Considerations for International Applications

Because formatting standards may differ by region or country, Windows software may set defaults for your PC to values not expected by the RDMS™ software. Changing these settings, as described in this section, should resolve regional connectivity issues.

15.1 IP Address Separator

An incorrect IP address separator results in the RDMS™ Browser Interface being unable to connect to the PC. Any separator other than a period (**.**) is unrecognizable by the RDMS™ software. Some regions use a comma (**,**) instead of a period to separate the fractional part of decimal numbers. For example:

123,456,789

instead of

123.456.789

Typically, changing the Regional Settings option for the list separator on the PC from a comma to a period will resolve the problem.

To change the settings on a Windows 7 machine:

5.   Access the Control Panel from the Start Menu. The Start Menu is usually the first icon on the bottom of the PC screen--a circle with four windows in it. Click on Control Panel.
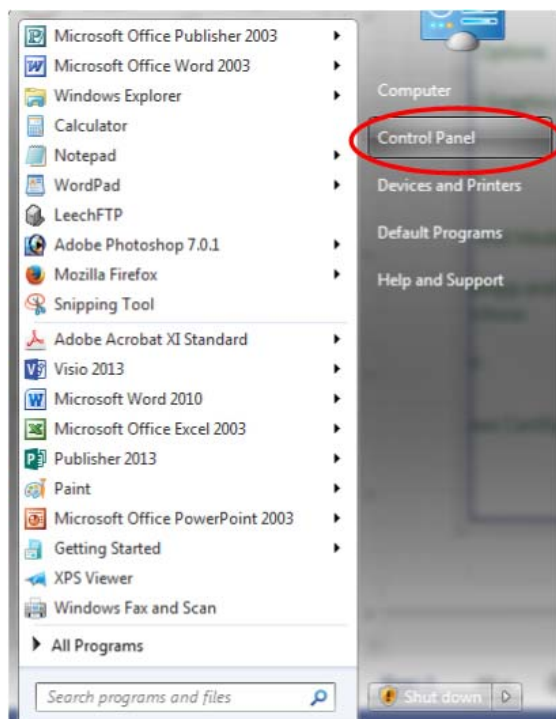
Figure 211: Start Menu - Control Panel

6. When the Computer Settings window displays, click on the Region and Language selection (labeled 2 in Figure 212). This causes the Region and Language window to display (labeled 3 in Figure 212).
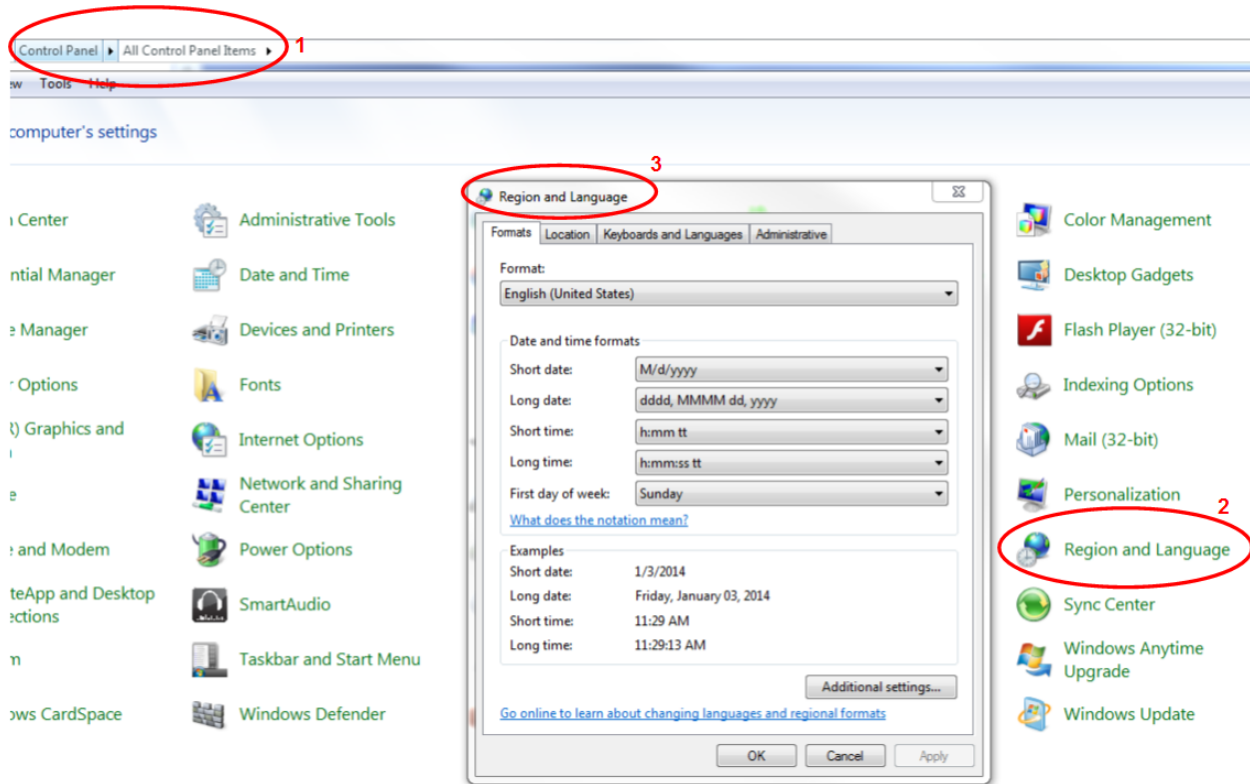
Figure 212: Region and Language Selection

7. In the Region and Language window, click on the Additional Settings button. The Customize Format window displays (shown in Figure 213).
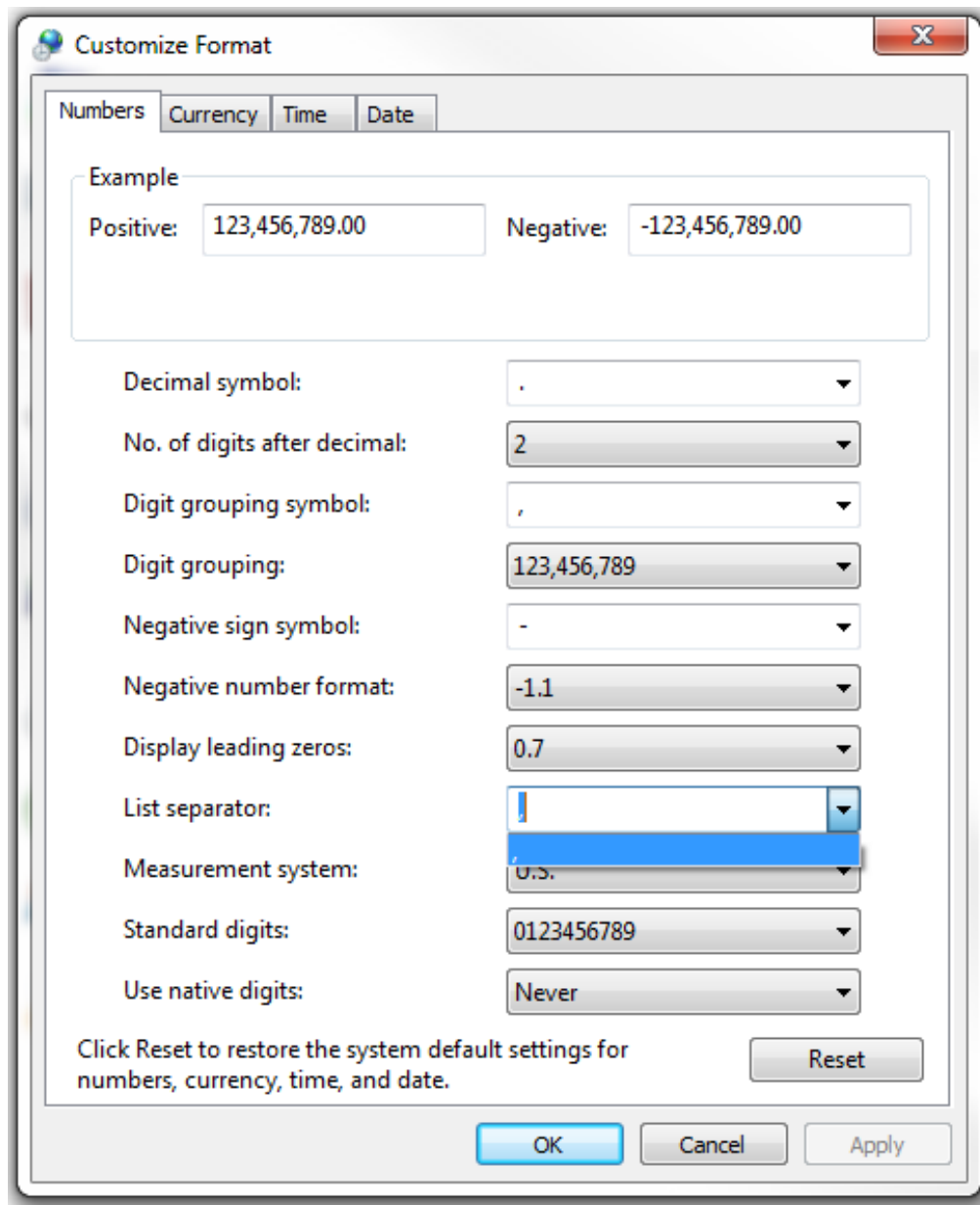
Figure 213: Customize Format Window

8. Use the down arrow in the List Separator column to change the comma to a period. Click on the OK button to complete the change and close the window.

9. Click on the OK button in the Region and Languages window to close the window. The separator in the IP list should now be the period (**.**).

16 Appendix H - RDMS with -IP Option

16.1 Overview

This appendix describes how to operate a 3U Rack-Mount RDMS^{TM} Telemetry Receiver with the -IP (TMoIP) option (Telemetry over IP).

The Browser-based graphical user interface (GUI) provides RDMS and TMoIP configuration, control, and status. PCM serial input channels support automatic bit rate detection and IP packet size auto-configuration.

For detailed operational information refer to the documents in Table 21.

Table 21: Reference Documents

Document Name	Document Number
Quasonix 3rd Generation Rack-Mount RDMS^{TM} Telemetry Receiver Installation and Operation Manual (this document)	N/A
NetAcquire® Telemetry over IP (TMoIP) Option Users Manual	NA-MAN-021
NetAcquire® Server for RDMS Users Manual	NA-MAN-058
NetAcquire® Serial I/O Option Users Manual	NA-MAN-003
NetAcquire® IRIG Option Users Manual	NA-MAN-023

16.2 Hardware

The 3U Rack-Mount RDMS back panel provides connectors used specifically with the -IP (TMoIP) option. The full back panel is shown in Figure 214. An enlarged view of the right side with TMoIP connectors is shown in Figure 215.

Figure 214: 3rd Generation RDMS 3U Back Panel Connectors

Figure 215: 3rd Generation RDMS 3U Back Panel Connectors-Right Side

The ports used specifically for TMoIP operation are described in Table 22. EVTM ports are NOT enabled when using TMoIP.

Table 22: 3U Rack-Mount RDMS TMoIP Ports

Port Name	Purpose	Port Type	Connector
RDMS Control	Browser control network interface	Ethernet (RJ-45)	J80
TMOIP	Data stream out	Ethernet (RJ-45)	J82
IRIG-B IN	IRIG-B Time Input	BNC	J77
IRIG-B OUT	IRIG-B Time Output	BNC	J78
TMOIP USB	Keyboard or mouse, if desired	USB	J83
TMOIP VGA	NetAcquire video out to monitor, if desired	SVGA HD-15	J84

16.3 Set Up TMoIP IP Address

The TMoIP enabled receiver must be accessed directly via a web browser. Refer to the front panel Main Menu > System Settings selection to determine the IP address of the RDMS Control Ethernet interface (J80).

1. Open a browser on the connected PC.

2. Type the IP address for the TMoIP enabled receiver into the browser, then press Enter on the keyboard.

   If the screen in Figure 216 displays, click on the Set Address button.
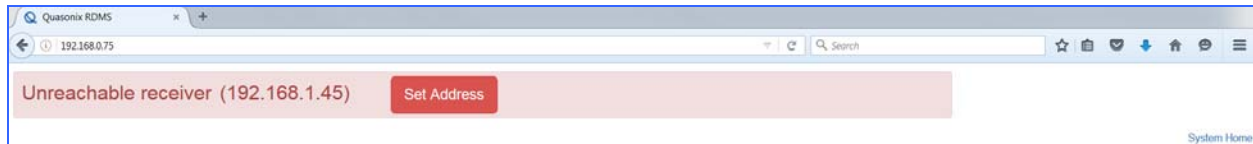
Figure 216: Browser Window with an Incorrect IP Address

When the Receiver Addressing window displays (Figure 217), type the correct IP address in the Receiver IP Address field, then click on the OK button. The IP address requested is located on the front panel Main Menu > System Settings screen.

Figure 217: Receiver Addressing Window

When the correct IP address is entered, the Browser Interface screen displays. *The NetAcquire TMoIP option requires a web browser with Java enabled.*

16.4 Browser Interface

The Browser Interface provides the user with full configuration, control, and monitoring capabilities for one or multiple rack-mount receivers. For configuration management purposes, only one browser interface can configure a receiver at a given time. However, multiple browser interfaces can monitor an individual receiver's status at once.

The RDMS™ Browser Interface consists of a tool bar at the top of the screen, shown in Figure 121, with six selections that display a variety of parameters for each available channel. The Browser Interface defaults to the Network screen.
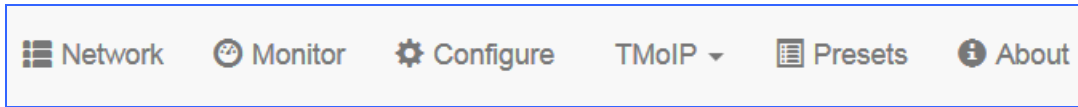
Figure 218: Browser Interface Header Tool Bar for RDMS™ with TMoIP Option

The RDMS Network, Monitor, Configure, Presets, and About screens are described in section 4.7 of this manual. The TMoIP functionality is accessed via the TMoIP tab, as shown in Figure 219. Detailed information about each TMoIP screen is found in the NetAcquire® Telemetry over IP (TMoIP) Option Users Manual.
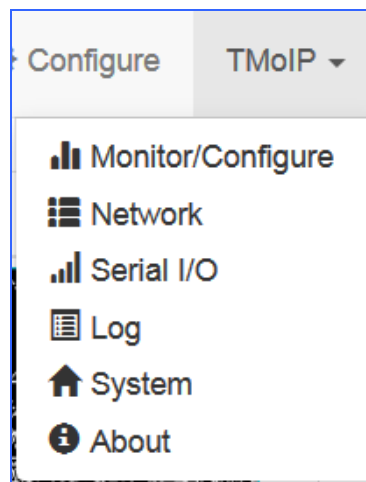

Figure 219: RDMS™ Browser Interface Header Tool Bar, TMoIP Tab

16.4.1 TMoIP Monitor/Configure Screen

The TMoIP Monitor/Configure screen, shown in Figure 122, is the primary operator interface for the TMoIP status and configuration.

Figure 220: TMoIP Monitor/Configure Screen

In addition to providing status, a key capability of the TMoIP Monitor/Configure screen is selecting the parameters of TMoIP network output packets. Configuration is accomplished by scrolling to the row of the desired Local (TMoIP) Channel, then clicking on the Local Endpoint field, as shown in Figure 221. Associated configuration and control information displays in the right side pane.
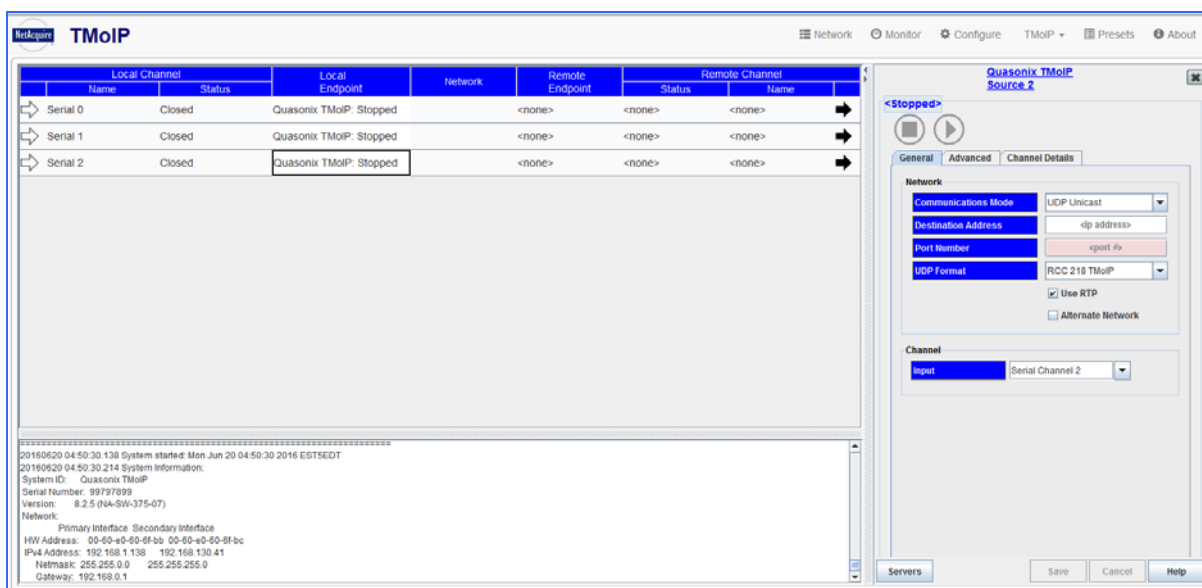
Figure 221: TMoIP Monitor/Configure Screen with TMoIP Channel Selected

16.4.2   TMoIP Network Screen

The TMoIP Network screen, shown in Figure 222, configures the TMoIP network interfaces. The last interface listed in the left pane, Net 2, is not used.
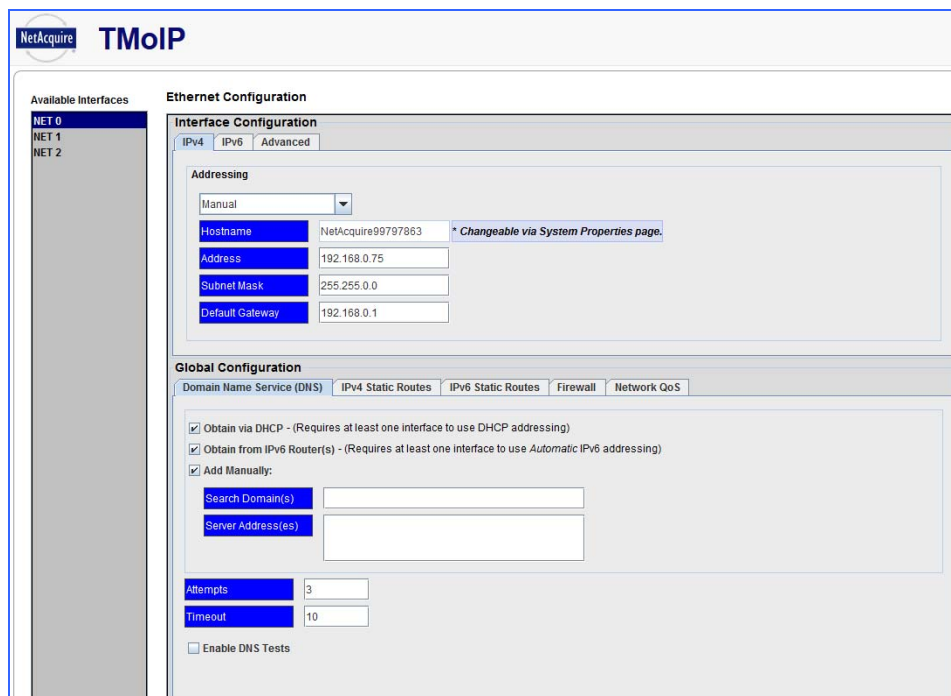
Figure 222: TMoIP Network Screen

16.4.3 TMoIP Serial I/O Screen

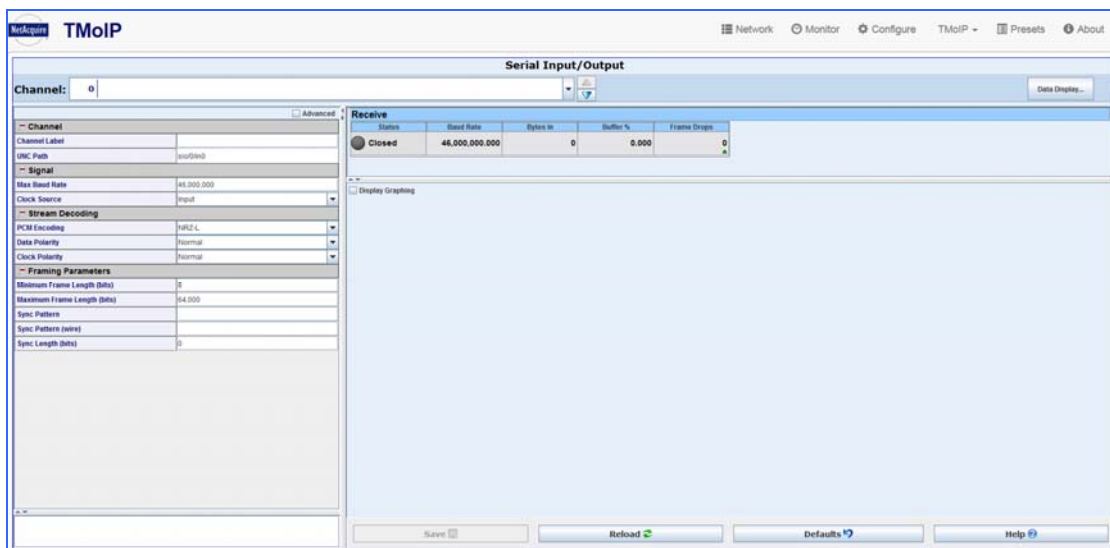The TMoIP Serial I/O screen, shown in Figure 223, updates status and configures serial input channels for TMoIP.

Figure 223: TMoIP Serial I/O Screen

16.4.4 TMoIP Log Screen

The TMoIP Log screen, shown in Figure 224, displays NetAquire server message log entries.
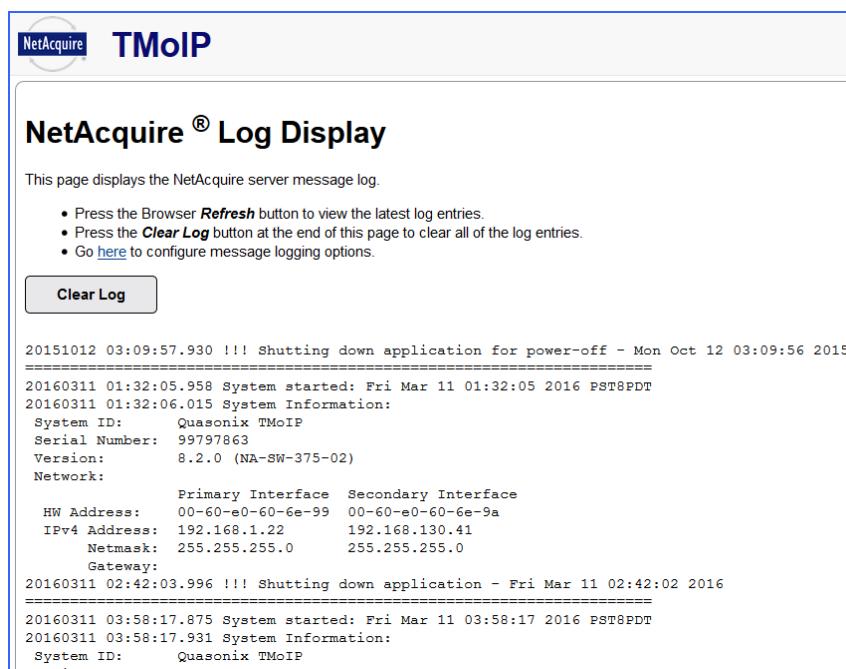
Figure 224: TMoIP Log Screen

16.4.5 TMoIP System Screen

The TMoIP System screen is shown in Figure 225. It provides links to a variety of configuration and status screens. The default view contains basic links used by most operators but additional links may be displayed by clicking on the Advanced View check box.

Figure 225: TMoIP System Screen, Basic

16.4.6 TMoIP About Screen

The TMoIP About screen, shown in Figure 226, provides NetAcquire® server status information, such as host resources, network interface, and server task status.

Figure 226: TMoIP About Window

Detailed information about each TMoIP screen is found in the NetAcquire® Telemetry over IP (TMoIP) Option Users Manual (NA-MAN-021).

17 Appendix I – Acronym List

Acronym	Description
AGC	Automatic Gain Control
AM	Amplitude Modulation
AQPSK	Variant of Quadrature Phase Shift Keying
ARTM	Advanced Range Telemetry
AUQPSK	Variant of Quadrature Phase Shift Keying
BEP	Bit Error Probability
BER	Bit Error Rate
BNC	Bayonet Neill-Concelman Connector (RF Connector)
BPSK	Binary Phase Shift Keying
CCSDS	Consultative Committee for Space Data Systems (coding standard)
CD	Compact Disk
CPM	Continuous Phase Modulation
DB-9	D-subminiature 9 pin Serial Connector
DC	Diversity Combiner
DHCP	Dynamic Host Configuration Protocol
DPM	Digital Phase Modulation
DQE	Data Quality Encapsulation
DQM	Data Quality Metric
FPGA	Field Programmable Gate Array
IF	Intermediate Frequency
IP	Internet Protocol
kbps	Kilobits per second
KHz	Kilohertz
LCD	Liquid Crystal Display
LDPC	Low Density Parity Check
mbps	Megabits per second
MCX	Snap on subminiature connector
MHCPM	multi-h Continuous Phase Modulation

Acronym	Description
MHz	Megahertz
N	(connector type) Threaded RF connector
OQPSK	Offset Quadrature Phase Shift Keying
PCMFM	Pulse Code Modulation/Frequency Modulation
PM	Phase Modulation
PSK	Phase Shift Keying
QPSK	Offset Quadrature Phase Shift Keying
RDMS	Receiver DeModulator Synchronizer
RF	Radio Frequency
RJ-45	Ethernet Connection Jack
RM	Rack-Mount
RS-232	Recommended Standard 232 (Serial Communications)
SAW	Sawtooth Wave
SDI	System Degradation Indication
SNR	Signal to Noise Ratio
SOQPSK	Shaped Offset Quadrature Phase Shift Keying
SOQPSK-TG	Shaped Offset Quadrature Phase Shift Keying –Telemetry Group
STC	Space-Time Coding
TRL	Tracking Loop
TTL	Transistor Transistor Logic
UDP	User Datagram Protocol
UQPSK	Unbalanced Quadrature Phase Shift Keying
USB	Universal Serial Bus
VAC	Voltage Alternating Current
WAN	Wide Area Network