

Installation and Operation Manual

3rd Generation Rack-Mount RDMS™ Telemetry Receiver



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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™ System Version 19. 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

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.

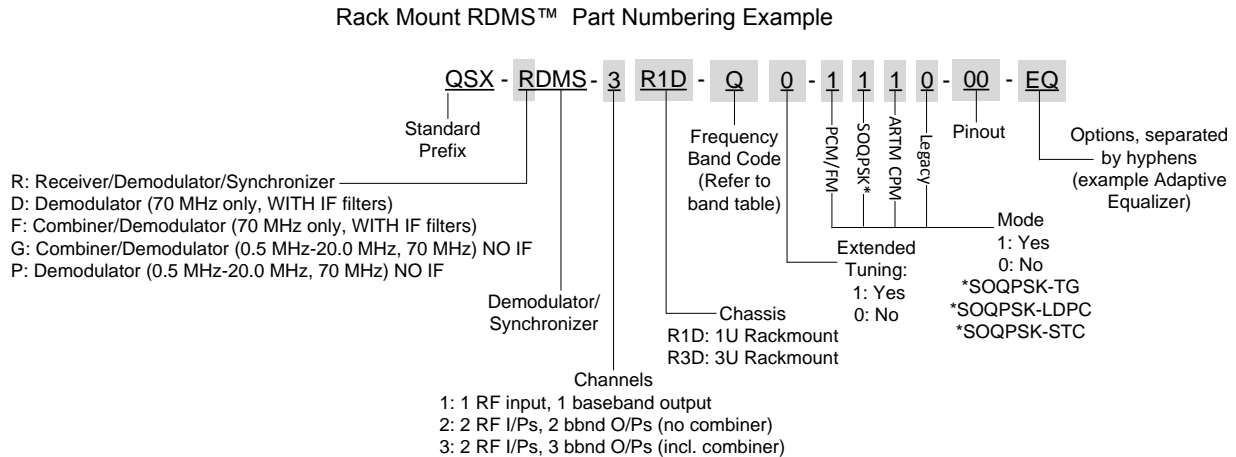


Figure 1: Rack-Mount RDMS™ Part Number Construction

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
- IP2 Payload data delivered in IP format
- 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, CS1, CS2

These options are used to address customer installation security requirements. The need for these options depends on the security requirements at the facility where the receivers will be deployed.

Contact Quasonix for additional details or for help with your particular security requirements.

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.

The EQ option is currently available for use with all modes *except* STC modes.

1.2.2.5 Telemetry Over IP – IP/IP2

The IP and IP2 options both provide TMoIP capability in the RDMS. However, the IP option is a discontinued option that was available only in the 3U RDMS. The new IP2 option replaces the IP option and is available in both the 1U and 3U RDMS. The IP option is still supported, but no longer available for purchase.

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.

A web based graphical user interface (GUI) provides end-to-end TMoIP configuration, control, and status.

Note: 3U receivers with the IP option use the IRIG-B input to provide time to the TMoIP module.

Note: All receivers (1U and 3U) with the IP2 option use the RDMS Control Ethernet connection to provide time to the TMoIP module.

Detailed operating instructions available in Appendix F and G (IP2 and IP).

1.2.2.6 Viterbi Decoder (for Legacy PSK Only) – K7

The K7 option enables Viterbi decoding of a convolutionally encoded data stream, which converts it back to the original (uncoded) source data stream.

Convolutional encoding is a form of legacy forward error correction. Like LDPC, it adds redundant information at the transmitting end of a telemetry link and then uses that redundancy to detect and correct errors at the receiving end of the link. 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-2, Section 3.”

Viterbi decoding is used to decode constraint-length (K) 7, rate 1/2, G2-inverted convolutional-encoded data.

The purpose and benefits of convolutional encoding are similar to LDPC. However, convolutional encoding requires more bandwidth than all but the lowest-rate LDPC codes, and its error-correcting performance is inferior to LDPC. Therefore, LDPC is the preferred forward error correction if possible.

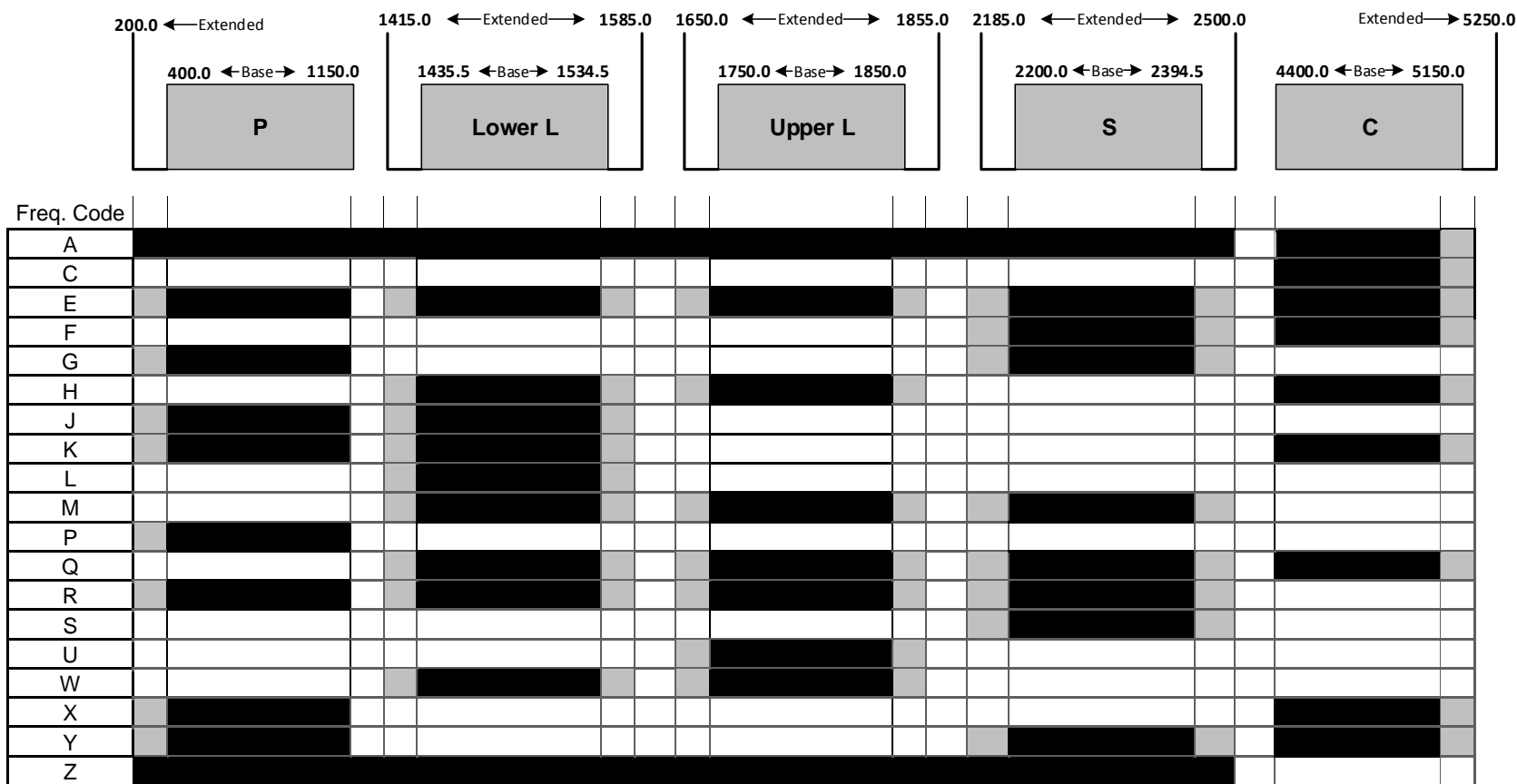
The Viterbi Decoder control requires the K7 option, and the RDMS must be set to one of the following PSK modes: BPSK, QPSK, AQPSK, AUQPSK, OQPSK, or UQPSK.

Viterbi decoding and Reed-Solomon decoding can be used together or separately.

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



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 load impedance	1 KOhm
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 \pm 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), Space Time Coding (STC); Legacy suite: Analog FM, BPSK, QPSK, Offset QPSK (OQPSK), Asymmetric QPSK (AQPSK), Unbalanced QPSK (UQPSK), Asymmetric Unbalanced QPSK (AUQPSK), Digital PM
Bit Rates (after LDPC, Viterbi, Reed-Solomon, and/or PCM 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; or input code unaltered
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.

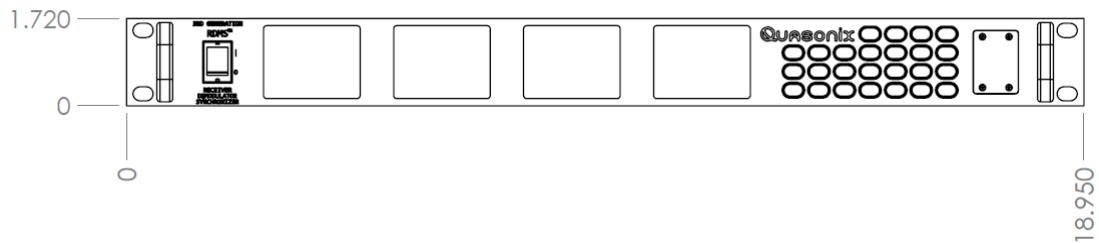


Figure 2: Mechanical Drawing – 1U Front View

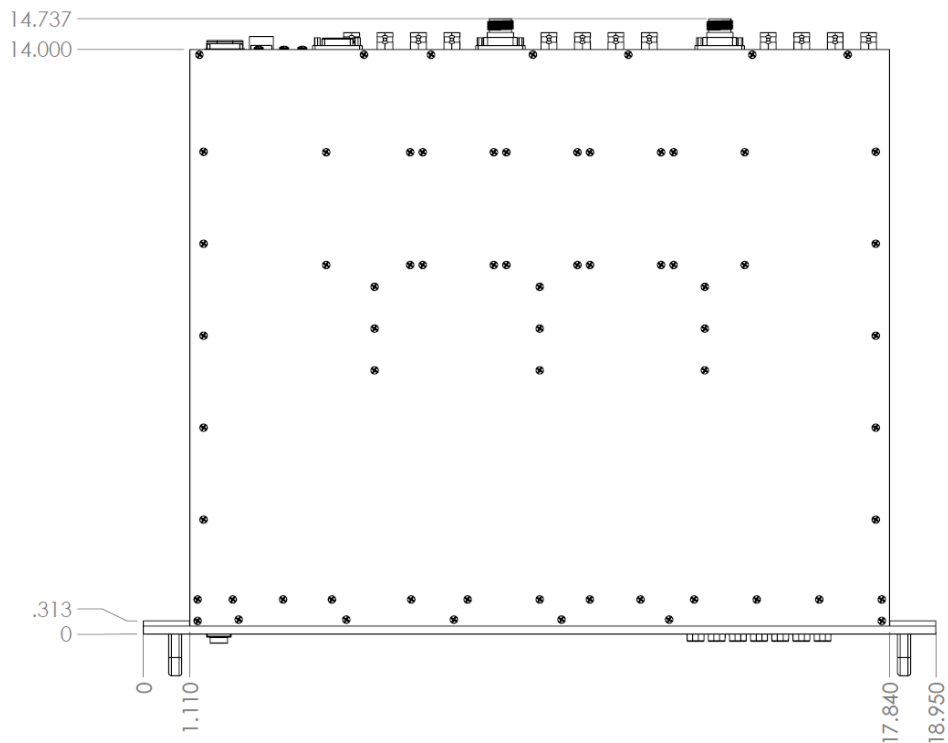


Figure 3: Mechanical Drawing – 1U Top View (Dual-channel Connectors Shown)

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.

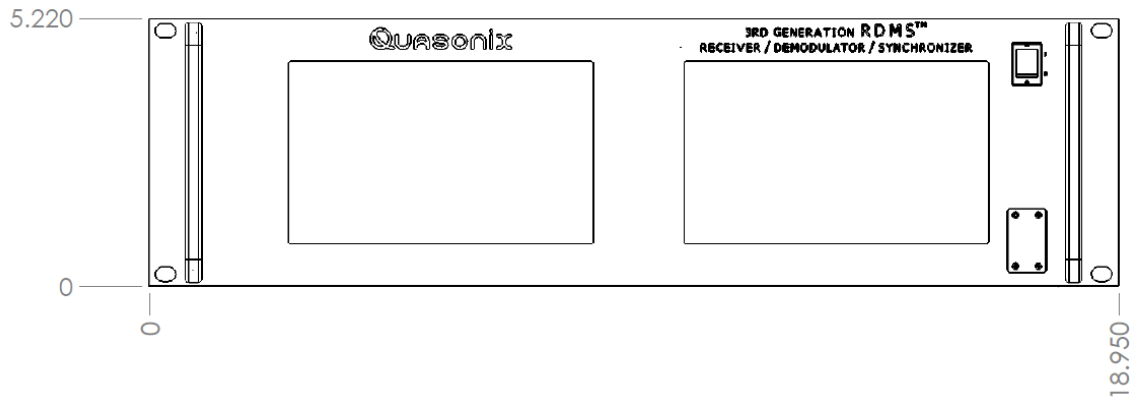


Figure 4: Mechanical Drawing – 3U Front View

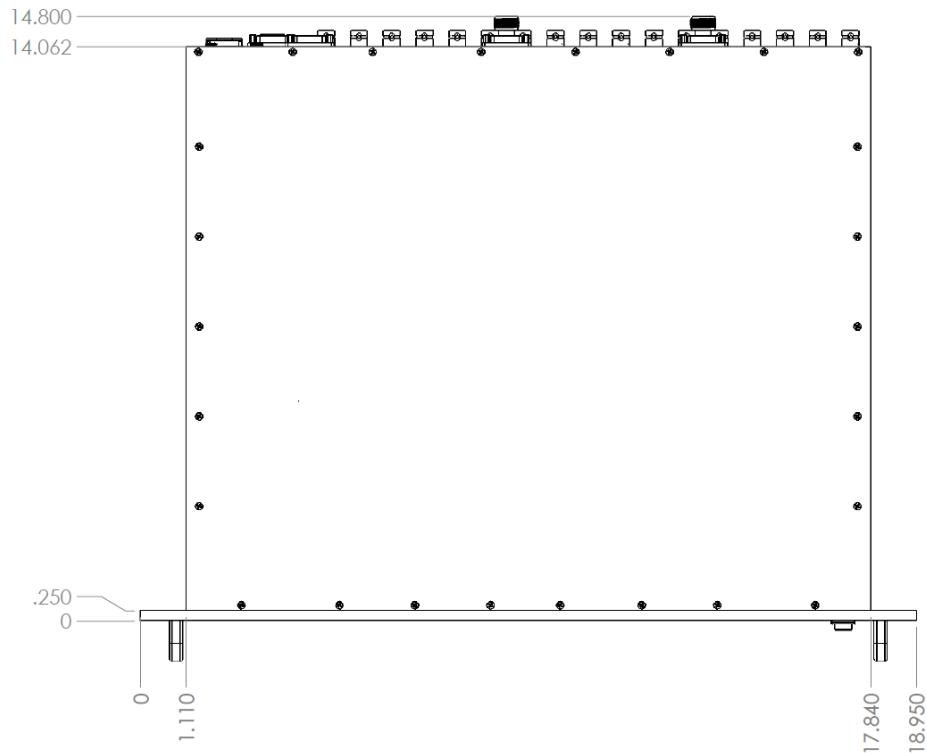


Figure 5: Mechanical Drawing – 3U Top View (Dual-channel Connectors Shown)

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 7. The pinout for the 1U J9, a male MDM-25 D-sub connector, is shown in Table 3. The pinout for the 1U J23, a male MDM-25 D-sub connector, is shown in Table 4. Numbered connector pins, as shown looking at the rear panel, are illustrated in Figure 7. Detailed internal pin wiring locations are illustrated in Figure 8.



Figure 7: 1U Rear Panel Male MDM-25 D-Sub Connector for J9 and J23, Pins Labeled

Table 3: 1U Digital Output Male 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 Sync Detect (TTL)
4	No Connection	17	GND
5	N/C	18	N/C
6	GND	19	CH2 CLK B (TTL)
7	GND	20	CH2 DATA B (TTL)
8	CH2 Demod Lock (TTL)	21	CH2 Sync Detect (TTL)
9	No Connection	22	GND
10	No Connection	23	COMB Sync Detect (TTL)
11	COMB Demod Lock (TTL)	24	COMB Data B (TTL)
12	GND	25	COMB CLK B (TTL)
13	GND		

The pinout for the 1U J23, a male MDM-25 D-sub connector, is shown in Table 4. Numbered connector pins, as shown looking at the rear panel, are illustrated in Figure 7. Internal pin wiring locations are shown in Figure 8.

Table 4: 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		

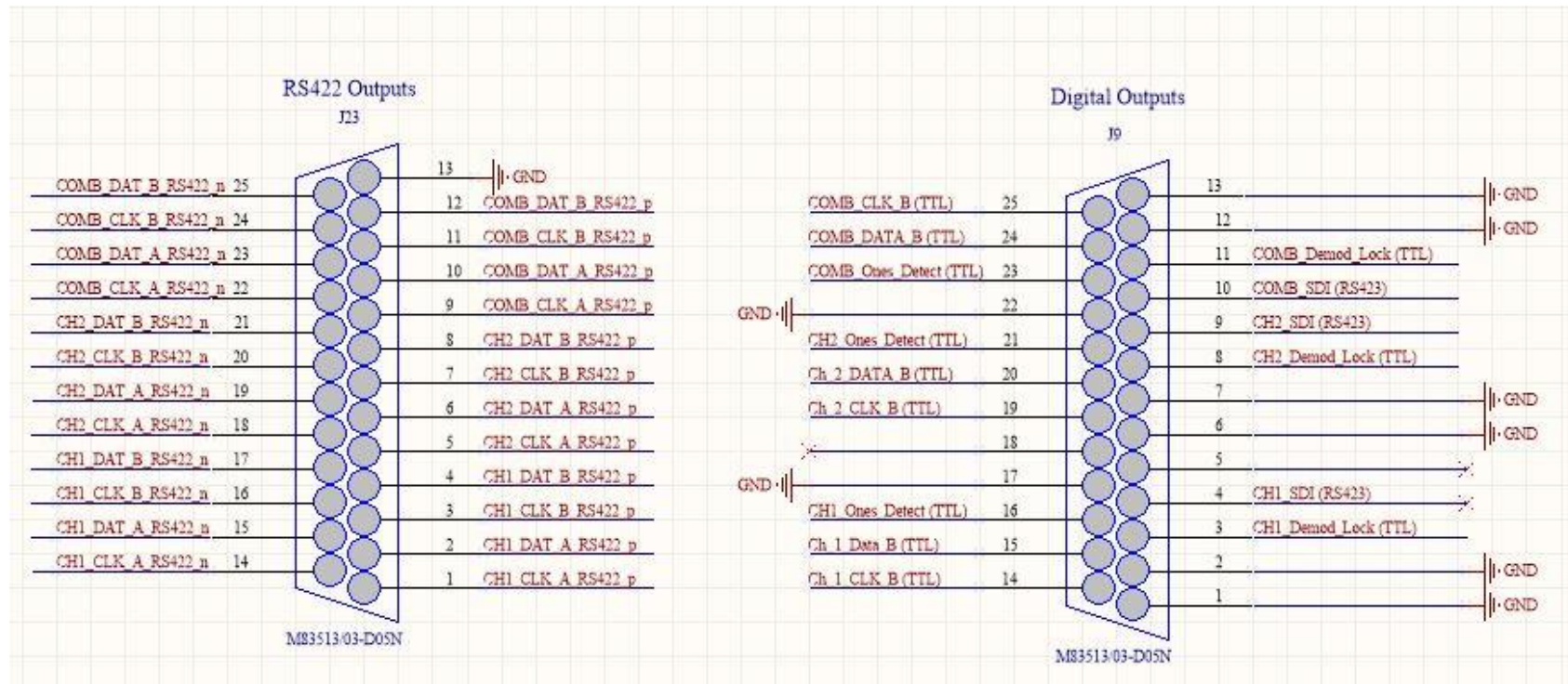


Figure 8: 1U MDM-25 D-Sub Pin Descriptions for J23 and J9, Wiring View from Inside the RDMS

The RF In ports and the ports located on the right side of the back panel are described in Table 5.

Table 5: Additional 1U Rear Panel Connectors

Name	Description
J10	Channel 1 RF In
J24	Channel 2 RF In
Control (J31)	Female MDM-25 for Status Logger Connection
HDMI (J33)	Currently Factory Use Only
USB (J34)	Currently Factory Use Only
Ethernet (J35)	Enables network access
Power	Supplies AC power to the unit



Figure 9: 1U Rear Panel Female MDM-25 D-Sub Connector for J31, Pins Labeled

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 TmIP are present whether the feature is ordered or not. The electrical interface connectors for all configurations are shown in Figure 10.



Figure 10: 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 7.

The RF In ports and the ports located on the right side of the back panel are described in Table 6.

Table 6: Additional 3U Rear Panel Connectors

Name	Description	Options Required
J23	Channel 1 RF In	-
J48	Channel 2 RF In	-
J71	MDM-25 for Status Logger Connection	-
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 (T568A) Ethernet via Telemetry Data	EVTM
TMOIP (J82)	RJ-45 (T568A) 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	-

*3U receivers with the IP option use the IRIG-B input to provide time to the TMoIP module.

All receivers (1U and 3U) with the IP2 option use the Ethernet connection, J35 for 1U, and J80 for 3U, to provide time to the TMoIP module.

Note that AQPSK mode results in two independent bit streams out of the RDMS. The I data is available on the normal clock and data outputs, but the Q data is only available on an MDM connector unless the user has a 3U receiver. Refer to Table 7 for connector/pin information for I data outputs (Clock A and Data A) and Q data outputs (Clock B and Data B).

Table 7: 1U and 3U Rear Panel Connector Specifications

	1U			3U		
	Channel 1	Channel 2	Combiner	Channel 1	Channel 2	Combiner
Receiver Nomenclature	Connector Number/pin	Connector Number/pin	Connector Number/pin	Connector Number/pin	Connector Number/pin	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
Sync Detect	J9/16	J9/21	J9/23	J5	J30	J55
Demod Lock	J9/3	J9/8	J9/11	J10	J44	J60
No Connection	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
Power on	J31/20	J31/19	J31/18	J71/20	J71/19	J71/18
TXD	J31/15	J31/17	J31/16	J71/15	J71/17	J71/16
RXD	J31/24	J31/22	J31/23	J71/24	J71/22	J71/23
TDI	J31/12	J31/6	J31/21	J71/12	J71/6	J71/21
TCK	J31/8	J31/2	J31/5	J71/8	J71/2	J71/5
TDO	J31/9	J31/3	J31/11	J71/9	J71/3	J71/11
TMS	J31/10	J31/4	J31/14	J71/10	J71/4	J71/14
3.3V	J31/13	J31/7	J31/25	J71/13	J71/7	J71/25
Color Legend	75 Ω BNC	MDM-25	50 Ω MMCK	50 Ω BNC	DB-9	

3.3.3 Electrical Signals

By default, the output data is valid on the falling edge of the clock, as shown in Figure 11. 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).

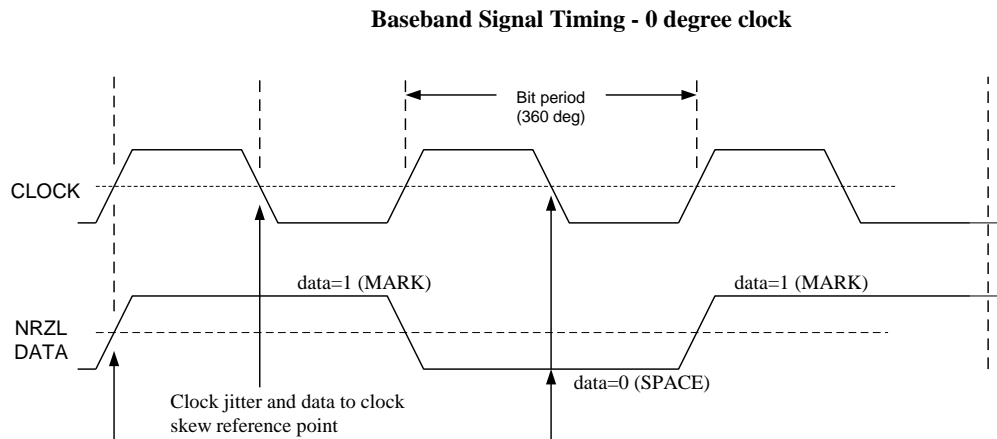


Figure 11: Baseband Signal Timing

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 4.4.2.27.2 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 the RDMS™ Access via Telnet and Serial Control Protocol Technical Guide.

4.2 Front-Panel Control

4.2.1 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 12: Front Panel Diagram for Dual-Channel Configuration

The front panel keypad is shown in Figure 13.



Figure 13: Front Panel Keypad

4.2.2 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 14.

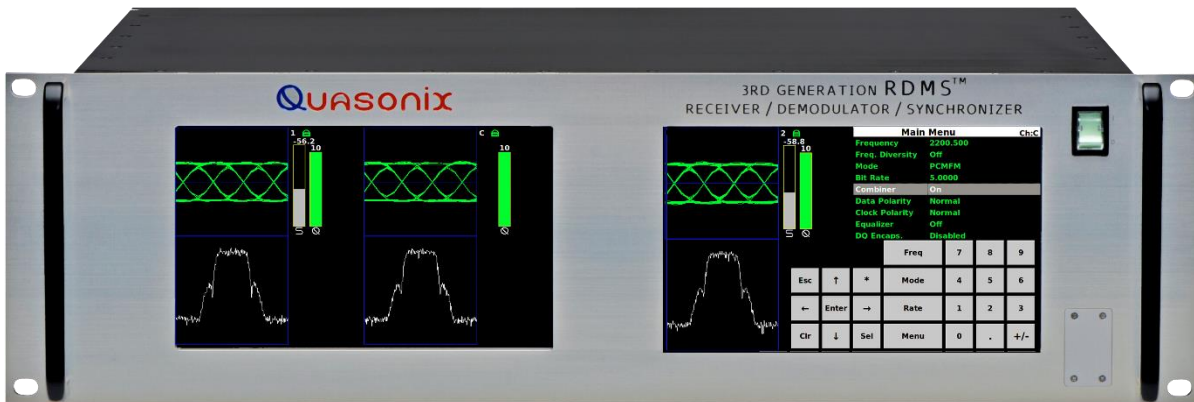


Figure 14: 3U Front Panel Graphics, DQM, Main Menu, and Virtual Keypad

4.3 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 15. An example of an SOQPSK constellation is shown in Figure 16. Additional information about waveform graphics displays, including spectrum displays, is located in section 4.4.2.28.

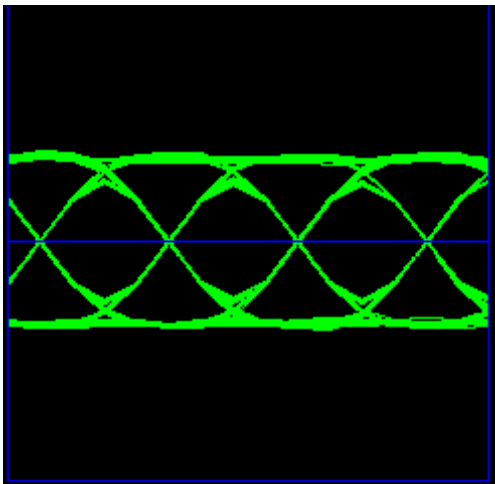


Figure 15: Example PCM/FM Eye Pattern

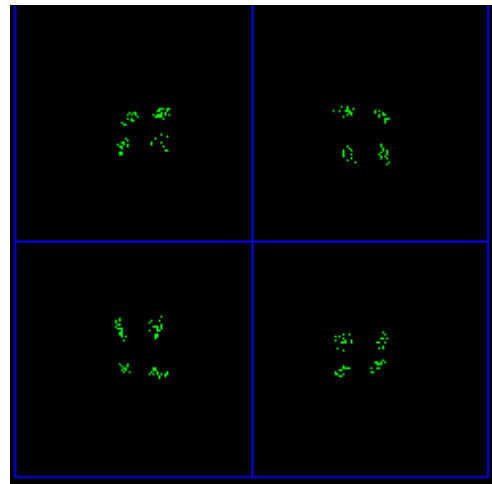


Figure 16: Example SOQPSK Constellation

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 17.

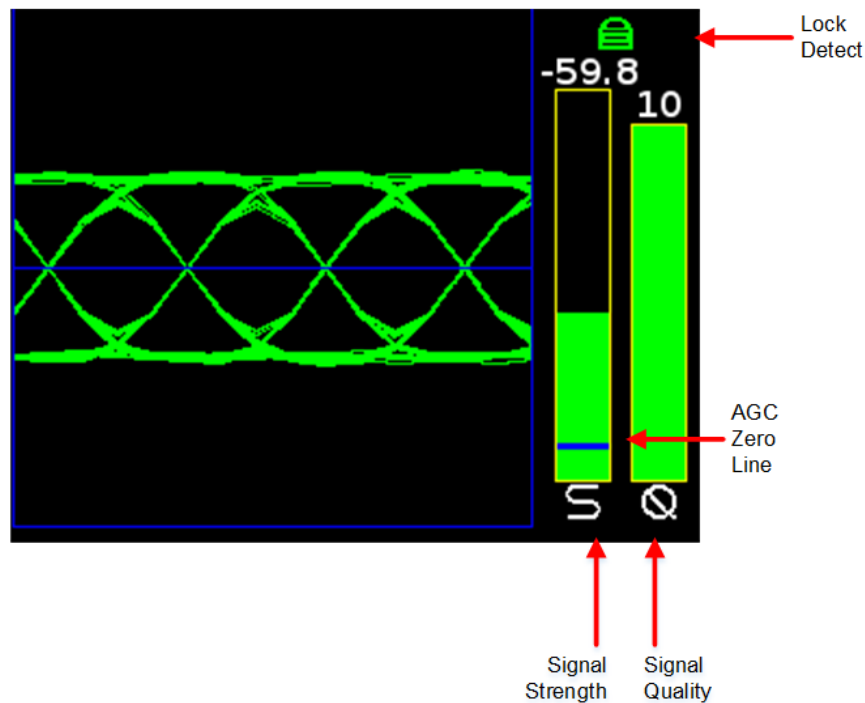


Figure 17: Waveform Graphics LCD with Locked PCM/FM Signal

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.

4.4 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 18.

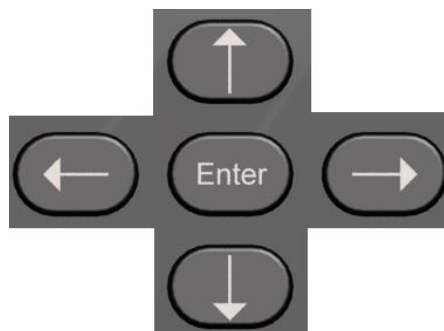


Figure 18: Front Panel Navigation Keys

4.4.1 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 19: 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 20, “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.

Main Menu		Ch:C
Frequency	1150.000	
Frequency Ch2	1150.000	
Freq. Diversity	On	
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	

Figure 20: Active Main Menu Settings LCD

The Please Wait message, shown in Figure 21, 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.

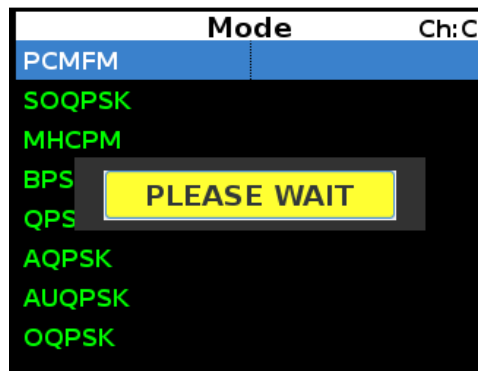


Figure 21: Mode Display with Wait Message

4.4.2 Main Menu Settings

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

- Frequency
- Frequency Diversity (Diversity Combiner On)
- Mode
- Bit Rate
- Power Ratio (UQPSK mode only)
- 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)
- HyperTrack
- AGC Menu
- AM Menu
- Options Menu
- Advanced Menu
- System Settings
- Graphics Menu
- EVTm Menu (with EN option only)

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 22. 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 redispays continuously forward or backward, depending on which arrow key is pressed.



Figure 22: 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.

4.4.2.1 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 23: Frequency Key on Front Panel

Main Menu		Ch:1
Frequency	1150.000	
Mode	SOQPSK	
Bit Rate	1.0000	
Combiner	Off	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	

Figure 24: 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.

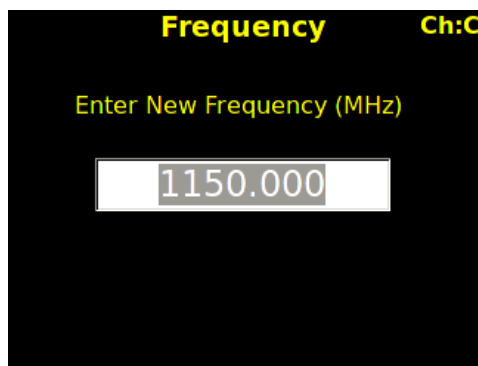


Figure 25: Frequency Entry Screen

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

- Delete the entire number by pressing the left arrow key
- Move the cursor to the end of the number by pressing the right arrow key
- 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 26: 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.

4.4.2.1.1 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.

Note, the combiner does not work for playback below 70 MHz.

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 4.4.2.12, for additional information about Modulation Scaling.

4.4.2.2 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.

Main Menu		Ch:C
Frequency	1150.000	
Frequency Ch2	1150.000	
Freq. Diversity	On	
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	

Figure 27: Main Menu, Frequency Diversity Setting

4.4.2.3 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.

Main Menu		Ch:C
Frequency	1150.000	
Frequency Ch2	1150.000	
Freq. Diversity	On	
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	

Figure 28: 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

Screen Name	Actual Name
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

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.

4.4.2.3.1 AQPSK Mode

Note that AQPSK mode results in two independent bit streams out of the RDMS. The I data is available on the normal clock and data outputs, but the Q data is only available on an MDM connector unless the user has a 3U receiver. Refer to Table 7 for connector/pin information for I data outputs (Clock A and Data A) and Q data outputs (Clock B and Data B).

Main Menu		Ch:1
Frequency	2391.000	
Mode	AQPSK	
Bit Rate	5.0000	
Bit Rate B	3.0000	
Combiner	Off	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	

Figure 29: Main Menu, Bit Rate A and B Settings

4.4.2.4 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 30: Rate Key on Front Panel

Main Menu		Ch:C
Frequency	1150.000	
Frequency Ch2	1150.000	
Freq. Diversity	On	
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	

Figure 31: 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.

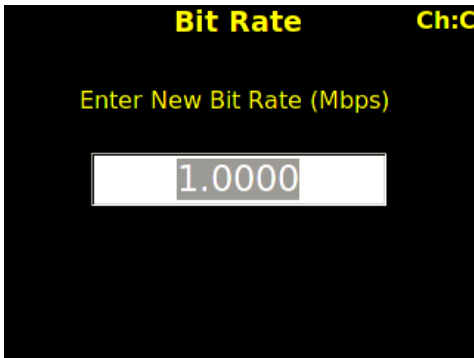


Figure 32: Bit Rate Entry Screen

For example, to set the bit rate to 10 Mbps, press the following key combination:

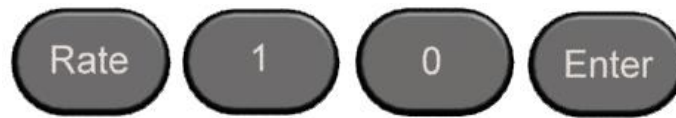


Figure 33: Example Keypad Combination for Setting Bit Rate

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.

4.4.2.5 Power Ratio (UQPSK Mode Only)

To properly distinguish the in-phase (I) component from the quadrature-phase (Q) component in a modulated UQPSK signal, the demodulator requires knowledge of the ratio of power between the two components. This degree of unbalance is specified in dB.

For example, if the I component has four (4) times the power of the Q component, the power ratio will be $10 \cdot \log_{10}(4/1) = 6$ dB. If the I component has lower power than the Q component, this setting will be negative. For example, if the I component has 1/5 the power of the Q component, the power ratio will be $10 \cdot \log_{10}(1/5) = -7$ dB.

Note that small power ratios, between -3 dB and +3 dB, may be difficult for the demodulator to reliably distinguish.

Main Menu		Ch:C
Frequency	1850.000	
Freq. Diversity	Off	
Mode	UQPSK	
Bit Rate	5.0000	
Power Ratio	0.000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	

Figure 34: Main Menu, Power Ratio Setting

Power Ratio

Ch:C

Enter A/B Ratio (dB)

0.000

Figure 35: Power Ratio Entry Screen

4.4.2.6 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.

Main Menu		Ch:C
Frequency	1150.000	
Frequency Ch2	1150.000	
Freq. Diversity	On	
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	

Figure 36: 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.

4.4.2.7 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.

Main Menu		Ch:C
Frequency	1150.000	
Frequency Ch2	1150.000	
Freq. Diversity	On	
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	

Figure 37: Main Menu, Data Setting

4.4.2.8 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.

Main Menu		Ch:C
Frequency	1150.000	
Frequency Ch2	1150.000	
Freq. Diversity	On	
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	

Figure 38: Main Menu, Clock Setting

4.4.2.9 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.

The EQ (Adaptive Equalizer) option is currently available for use with all modes *except* STC modes.

Main Menu		Ch:C
Frequency	1150.000	
Frequency Ch2	1150.000	
Freq. Diversity	On	
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	

Figure 39: Main Menu, Equalizer Setting

4.4.2.10 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 40.

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

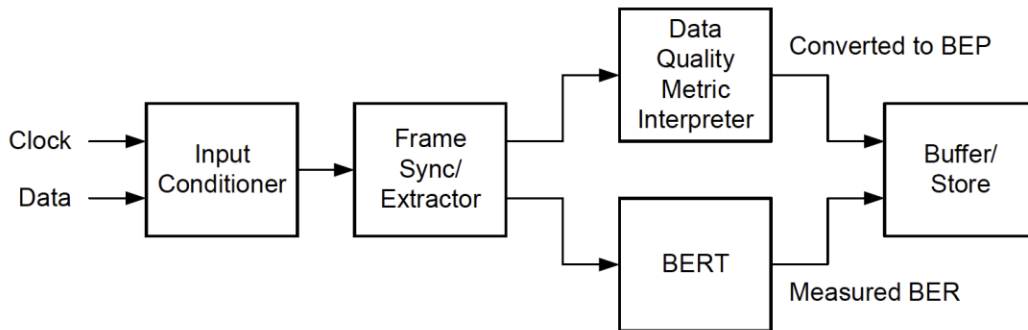


Figure 40: DQM Calibration Fixture Process

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 = $\min(\text{round}(-\log_{10}(\text{LR}) / 12 * (2^{16})), 2^{16} - 1)$
16-bit unsigned integer, ranges from 0 to 65,535
Likelihood Ratio (LR) = $\text{BEP} / (1 - \text{BEP})$
Easily reversed:
$$\text{LR} = 10^{(-12 * \text{DQM} / 2^{16})}$$
$$\text{BEP} = \text{LR} / (1 + \text{LR})$$

Q is defined as the “User’s DQM”:
$$Q = 12 * \text{DQM} / 65536$$

Represents the exponent of 10 in the LR,
which approximates the BEP
Examples:
$$Q = 3 \quad \text{BEP} = 1\text{E-}3$$
$$Q = 7 \quad \text{BEP} = 1\text{E-}7$$

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 41: DQE Format

Payload data is a user selectable length with a default of 4096 bits, unless block decoding is in use. In STC mode, the default is 3200 bits. In SOQPSK/LDPC or STC/LDPC mode, the default is the selected LDPC block size. When Reed-Solomon decoding is enabled, the default is 1024 bits.

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.

Main Menu		Ch:C
Frequency Ch2	1150.000	
Freq. Diversity	On	
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	

Figure 42: 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).

4.4.2.11 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.

Main Menu		Ch:C
Freq. Diversity	On	
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	

Figure 43: Main Menu, Derandomizer

- Off
- IRIG – Derandomizes data randomized using the IRIG 15-stage randomizer
- CCSDS – Derandomizes data randomized using the CCSDS 8-stage block synchronous randomizer, only available when an LDPC Mode is enabled (SOQPSKLDPC, or STCLDPC) or Reed-Solomon decoding is enabled



Figure 44: Derandomizer Selections, LDPC or Reed-Solomon Not Enabled

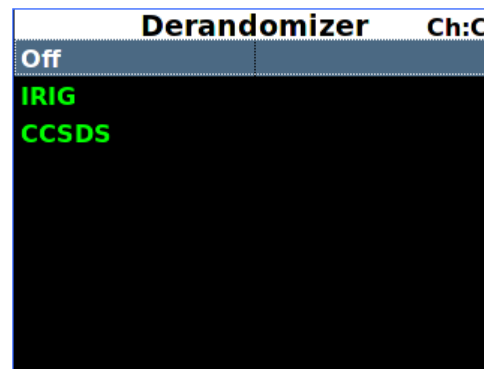


Figure 45: Derandomizer Selections, LDPC or Reed-Solomon Enabled

4.4.2.12 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.

The RDMS™ automatically adjusts demodulator bandwidth based on the selected/estimated modulation index. However, IF filter bandwidth is not automatically adjusted, even when set to automatic. It is recommended that the user manually scale the IF filter bandwidth proportional to the modulation index for modulation indexes greater than 1.0.

4.4.2.12.1 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.

Main Menu		Ch:C
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	
Mod Scaling	Track	

Figure 46: Main Menu, Modulation Scaling – Tracking

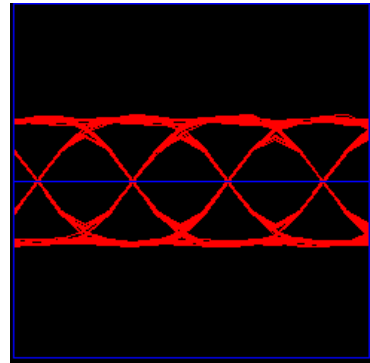


Figure 47: Red Eye Pattern Display – Tracking

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.

4.4.2.12.2 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.

Main Menu		Ch:C
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	
Mod Scaling	Hold	

Figure 48: Main Menu, Modulation Scaling – Hold

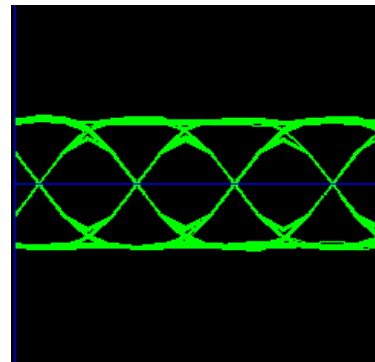


Figure 49: Green Eye Pattern Display – Hold

If Modulation Scaling is set to Hold, as shown in Figure 48, 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 4.4.2.13, Modulation Persistence.

4.4.2.12.3 Modulation Scaling – Off

The Mod Scaling Off setting is shown in Figure 50. When Modulation Scaling is set to Locked, the graphing eye pattern is displayed in GREEN, indicating the optimal modulation index is set.

Main Menu		Ch:C
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	
Mod Scaling	Off	

Figure 50: Main Menu, Modulation Scaling – Off

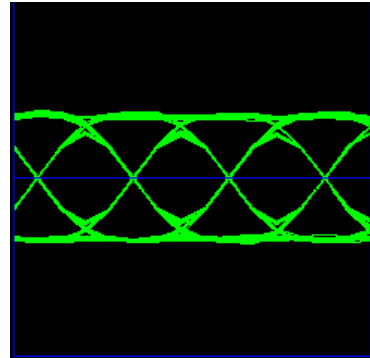


Figure 51: Green Eye Pattern Display – Off

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

4.4.2.12.4 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 53, the state is set to Armed. In Armed state, modulation scaling operates continuously.

Main Menu		Ch:C
Mode	PCMFM	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	
Mod Scaling	Acquire	

Figure 52: Main Menu, Modulation Scaling – Acquire

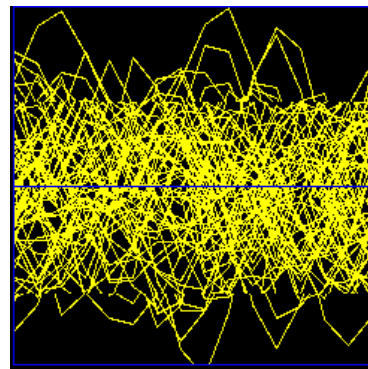


Figure 53: Yellow Eye Pattern Display – Acquire

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.

4.4.2.13 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 54.

Main Menu		Ch:C
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	
Mod Scaling	Acquire	
Mod Persist	Off	

Figure 54: 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.

Main Menu		Ch:C
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	
Mod Scaling	Acquire	
Mod Persist	On	

Figure 55: Main Menu, Modulation Persistence – On

4.4.2.14 Differential Decoding

Differential decoding is available in all PSK modes (SOQPSK and legacy BPSK, QPSK, OQPSK, AQPSK, AUQPSK, and UQPSK). Legacy modes often use differential forms of PCM encoding (e.g., NRZ-M) instead, and only one or the other form of differential encoding should be used at a time.

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.

Differential encoding results in two differentially-decoded bit errors for each received bit error. This doubling negatively impacts subsequent error-correction capability for block forward error correction. Since the Attached Sync Marker used to identify block boundaries can also be used to resolve the phase ambiguity inherent in PSK modulation, differential encoding is unnecessary for block forward error correction. Therefore, differential decoding is automatically disabled when Reed-Solomon encoding is enabled.

Main Menu		Ch:C
Mode	SOQPSK	
Bit Rate	1.0000	
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	
Diff Decoding	On	

Figure 56: Main Menu, Differential Decoding

4.4.2.15 HyperTrack™

HyperTrack™ is an all-digital antenna control protocol that offers many benefits in antenna tracking performance and system operation. These benefits are too numerous and wide-ranging to describe fully here, but they include improved tracking stability, range-based tracking bandwidth, ability to track through strong interfering signals, rejection of incidental AM (e.g., from spinning test articles), and optimal multi-receiver tracking.

Enabling HyperTrack™ switches the AM back panel output to all-digital mode. This mode requires a HyperTrack™-compatible ACU for proper operation and to take advantage of the performance improvements. Disabling HyperTrack™ switches the AM back panel output to legacy analog AM mode.

Note, in a HyperTrack™-equipped receiver, the Sync Detect digital status output is unavailable. Also, when HyperTrack™ is enabled, the Lock Detect digital status output automatically becomes a copy of the HyperTrack™ digital output data. The lock detect output defaults to fixed 0 if the HyperTrack™ back panel is present. Refer to the Digital Status Output (DSO) command in the RDMS™ Access via Telnet and Serial Control Protocol Technical Guide for additional information.

Main Menu		Ch:C
Combiner	On	
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	
Mod Scaling	Acquire	
Mod Persist	Off	
HyperTrack	Disabled	

Figure 57: Main Menu, HyperTrack

4.4.2.16 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.

Main Menu		Ch:C
Data Polarity	Normal	
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	
Mod Scaling	Acquire	
Mod Persist	Off	
HyperTrack	Disabled	
AGC Menu		

Figure 58: Main Menu, AGC Menu Selection

The AGC (Automatic Gain Control) menu, shown in Figure 59, includes the following parameters:

- Polarity (Positive/Negative)
- AGC Scale (dB/V)
- Time Constant (in ms)
- AGC Freeze
- AGC Zero Mode
- Zero AGC

4.4.2.16.1 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.

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 59: AGC Menu, Polarity Highlighted

4.4.2.16.2 AGC Scale

The AGC Scale option, shown in Figure 60, 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. The AGC output is calibrated to a load of 1 KOhm. Operation into other load impedances will result in the effective AGC scale factor being higher or lower than expected.

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 60) 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.

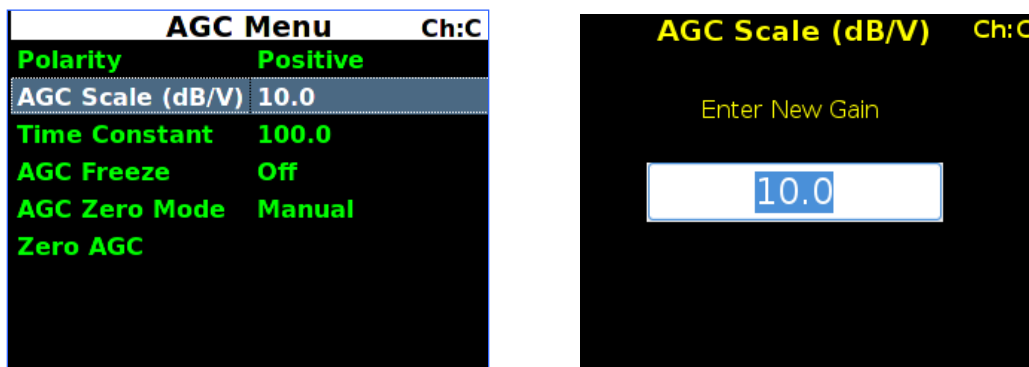


Figure 60: AGC Menu, AGC Scale Selection and Entry Screens

4.4.2.16.3 AGC Time Constant

The Time Constant option, shown in Figure 61, 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 61) 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.

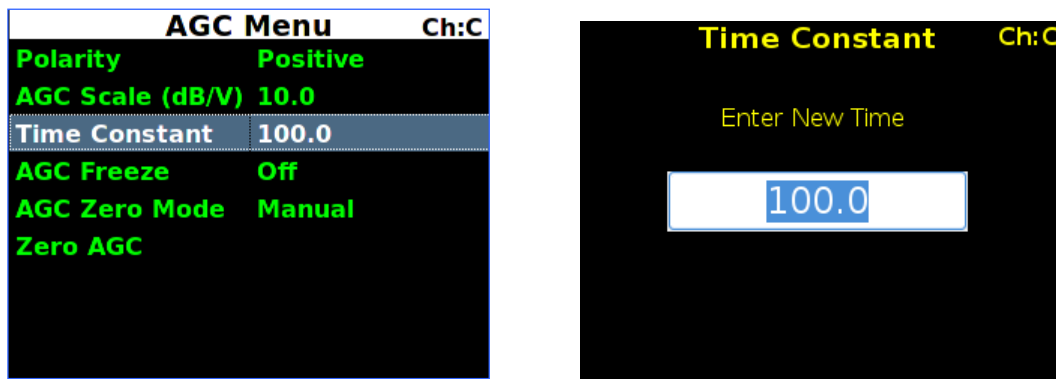


Figure 61: Time Constant Selection and Time Constant Entry Screens

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

4.4.2.16.4 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.

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 62: AGC Menu, AGC Freeze Selection

4.4.2.16.5 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 63: AGC Menu, AGC Zero Mode-Manual Highlighted

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

4.4.2.16.6 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 64.

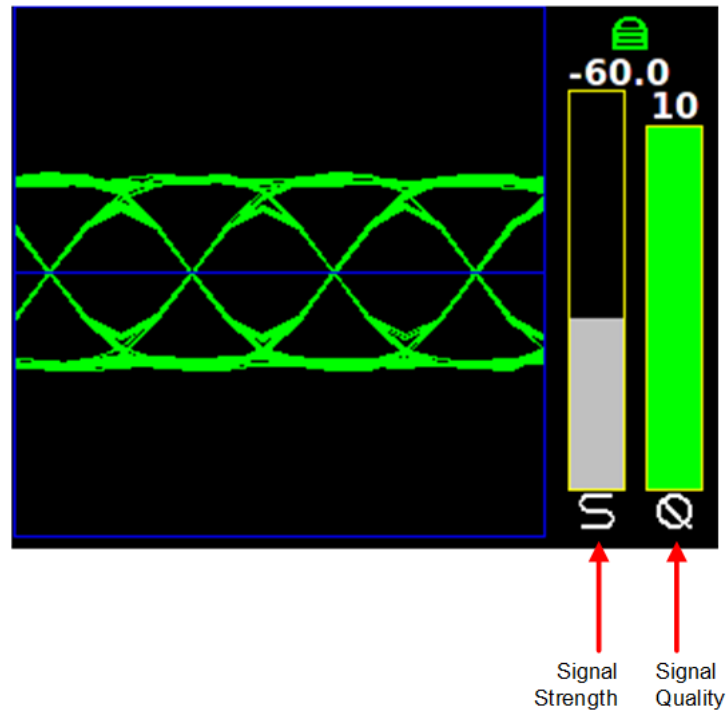


Figure 64: Waveform Graphics Before Zero AGC Set

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 65.)
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 66. The strength bar changes from gray to red if there is no signal lock.

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 65: AGC Menu, Zero AGC Highlighted

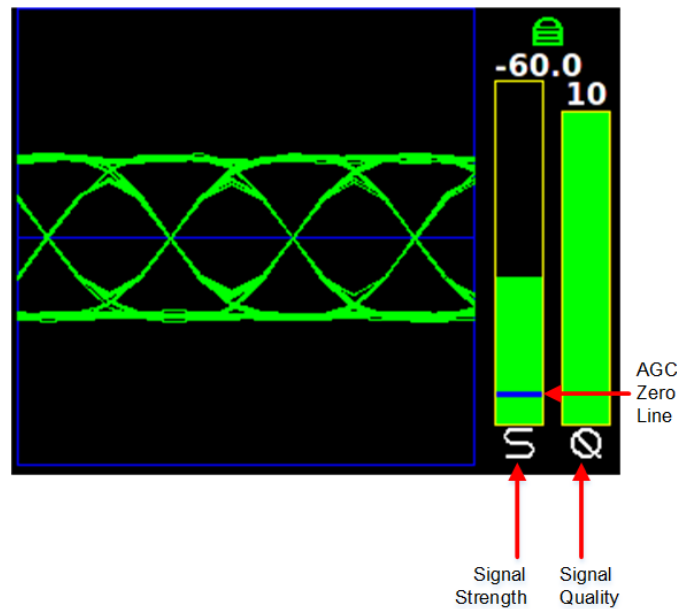


Figure 66: Waveform Graphics After AGC Zero Set

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 4.4.2.16.4, AGC Zero is cleared if a user scrolls to Manual in the AGC Zero Mode options (Manual, Hold, Hold and Save).

4.4.2.17 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.

Main Menu		Ch:C
Clock Polarity	Normal	
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	
Mod Scaling	Acquire	
Mod Persist	Off	
HyperTrack	Disabled	
AGC Menu		
AM Menu		

Figure 67: 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)

4.4.2.17.1 AM Bandwidth

To change the AM Bandwidth value, select the appropriate option, as shown in Figure 68, then press the Enter key on the front panel.

AM Menu		Ch:C
AM Bandwidth	100.0000	
AM Polarity	Positive	
Scale	1.00000	
AGC Comp	Enabled	

Figure 68: AM Menu, AM Bandwidth Highlighted

AM Bandwidth	Ch:C
Enter New Bandwidth	
<input type="text" value="100.0000"/>	

Figure 69: 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 69. 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.

4.4.2.17.2 AM Polarity

The user may toggle the AM Polarity (Figure 70) value by pressing the Enter key on the keypad until the desired value displays. Values are Positive and Negative.

AM Menu		Ch:C
AM Bandwidth	100.0000	
AM Polarity	Positive	
Scale	1.00000	
AGC Comp	Enabled	

Figure 70: AM Menu, AM Polarity Highlighted

4.4.2.17.3 AM Scale

To change the AM Scale value, select the Scale option on the AM Menu, as shown in Figure 71, then press the Enter key on the front panel.

AM Menu		Ch:C
AM Bandwidth	100.0000	
AM Polarity	Positive	
Scale	1.00000	
AGC Comp	Enabled	

Figure 71: AM Menu, Scale Highlighted

Scale	Ch:C
Enter New Scale	
<input type="text" value="1.00000"/>	

Figure 72: 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 72. When the new value is entered, press the Enter key on the keypad.

The AM Scale has a range from -128 to +128. At its default setting of 1, the response is 2V p-p, into a 50 ohm load with a 50% AM.

4.4.2.17.4 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.

AM Menu		Ch:C
AM Bandwidth	100.0000	
AM Polarity	Positive	
Scale	1.00000	
AGC Comp	Enabled	

Figure 73: AM Menu, AGC Comp Highlighted

4.4.2.18 Options Menu

The Options Menu (Figure 75), which is accessed through the Main Menu (Figure 74), provides the following selections:

- Save Receiver Settings
- Load Presets Menu
- Save Presets Menu
- Factory Default

4.4.2.18.1 Save Receiver Settings

The Save Receiver Settings option, shown in Figure 75, saves the current RDMS parameters. For example, the user may have changed a variety of parameters since the last shutdown/power up of the receiver and does not want to lose the settings in the event of a power outage. It is similar to saving a preset, but instead of saving the settings to a preset and recalling the preset, the current settings are just saved. If power is lost to the receiver, the saved settings are still set upon power up.

Main Menu		Ch:C
Equalizer	Off	
DQ Encaps.	Disabled	
Derandomizer	Off	
Mod Scaling	Acquire	
Mod Persist	Off	
HyperTrack	Disabled	
AGC Menu		
AM Menu		
Options Menu		

Figure 74: Main Menu, Options Menu Selection

Options Menu		Ch:C
Save Receiver Settings		
Load Presets		
Save Presets		
Factory Default		

Figure 75: Options Menu, Save Receiver Settings

4.4.2.18.2 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 77, 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.

Options Menu Ch:C	
Save Receiver Settings	
Load Presets	
Save Presets	
Factory Default	

Figure 76: Options Menu, Load Presets

Load Presets Ch:C	
Preset 1	Mission 1
Preset 2	Mission 2
Preset 3	Mission 3
Preset 4	Mission 4
Preset 5	Mission 5
Preset 6	Mission 6
Preset 7	Mission 7
Preset 8	Mission 8

Figure 77: Load Menu, Load Presets

4.4.2.18.3 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 78, shares the same set of presets with the Browser Interface.

The Save Presets Menu, shown in Figure 78, 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 redisplay 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 4.5.4, 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 4.5.6.3 (Export) or section 4.5.6.4 (Import) for additional information.

Save Presets		Ch:C
Preset 1	Mission 1	
Preset 2	Mission 2	
Preset 3	Mission 3	
Preset 4	Mission 4	
Preset 5	Mission 5	
Preset 6	Mission 6	
Preset 7	Mission 7	
Preset 8	Mission 8	

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

Figure 78: Save Menu, Save Presets – Slot 1 and Slot 3 Contain Saved Presets

4.4.2.18.4 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.

Options Menu		Ch:C
Save Receiver Settings		
Load Presets		
Save Presets		
Factory Default		

Options Menu		Ch:C
Save Receiver Settings		
Load Presets		
Save Presets		
Fact	PLEASE WAIT	

Figure 79: Options Menu, Factory Default Selection and Reset in Process

4.4.2.19 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 80, provides access to the following options:

- Sync Bit Rate
- IF Filter
- Phase Noise Comp (PCM/FM mode only)
- Muting Timeout
- Output Muting
- DC Antenna

- Mod Scale Index
- Best Channel Selector
- Time Aligner
- AFC Mode
- PCM Encoding
- FEC
- Video Output Menu
- Clk/Data Output Menu
- Test Utilities

Main Menu		Ch:C
DQ Encaps.	Disabled	
Derandomizer	Off	
Mod Scaling	Acquire	
Mod Persist	Off	
HyperTrack	Disabled	
AGC Menu		
AM Menu		
Options Menu		
Advanced Menu		

Figure 80: Main Menu, Advanced Menu

4.4.2.19.1 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 81.

Advanced Menu ch:C	
Sync Bit Rate	5.0000
IF Filter	10.0 MHz
Phase Noise Comp	Off
Muting Timeout	1000
Output Muting	Off
DC Antenna	Disabled
Mod Scale Index	0.700
Best Ch Selector	On
Time Aligner	Disabled

Figure 81: 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.

4.4.2.19.2 IF Filter

The receiver's integrated IF filter module, shown in Figure 82, 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.

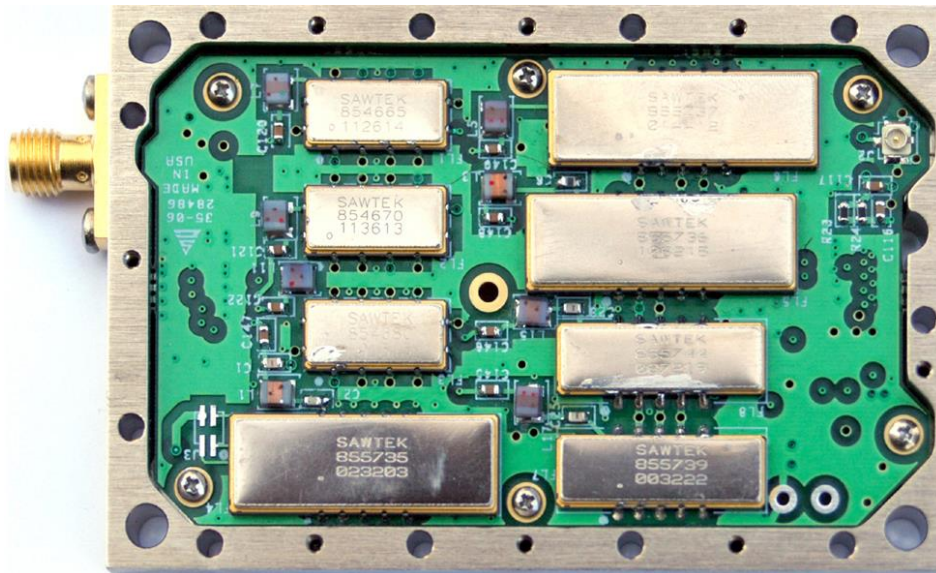


Figure 82: 70 MHz IF Module in 2" x 3" Chassis

The measured responses of the eight filters are shown in Figure 83 and Figure 84 (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 85 and Figure 86. Contact Quasonix for information about the optional filters.

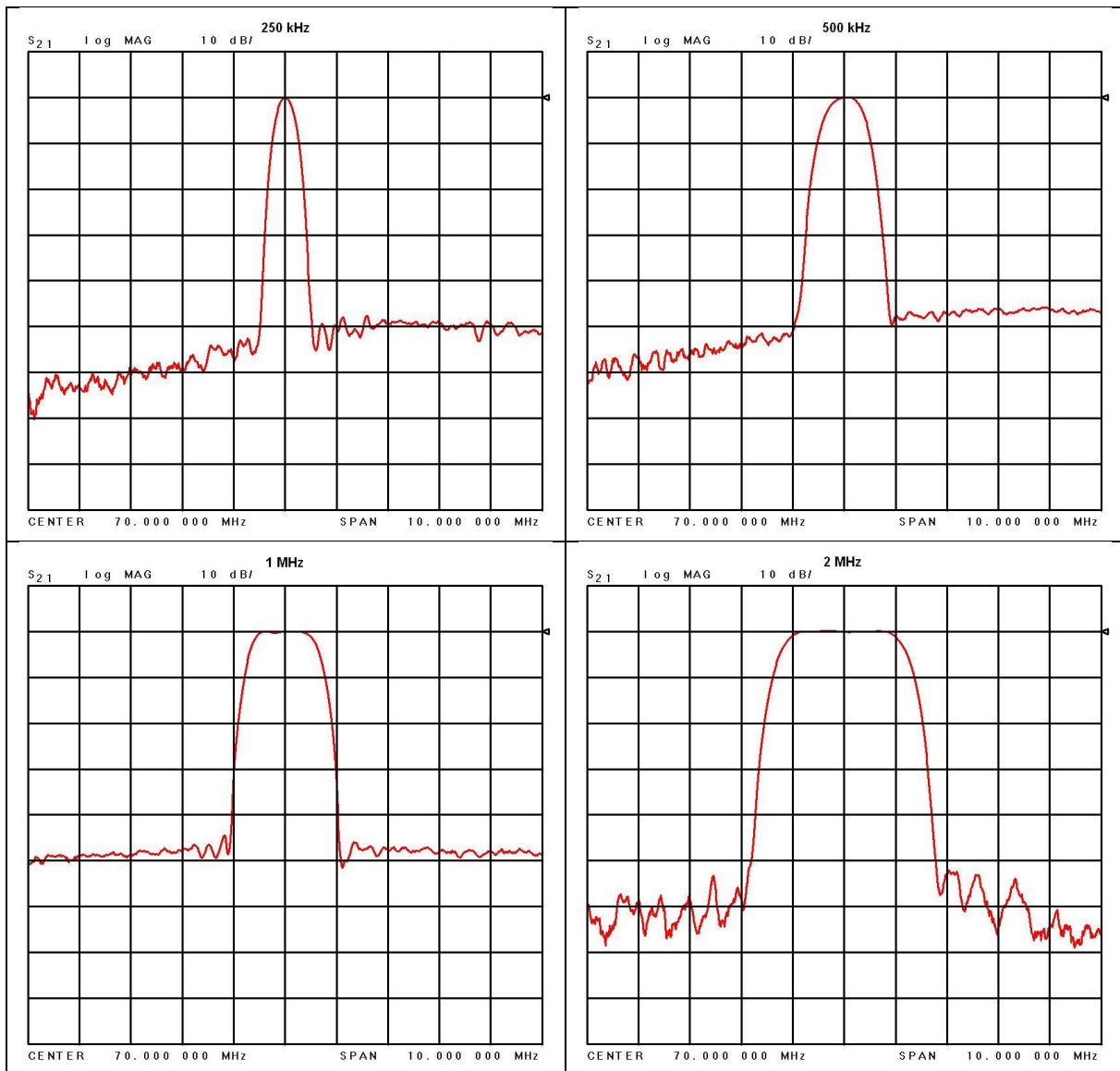


Figure 83: 70 MHz IF Module in 2" x 3" Chassis SAW Filter Responses, Narrow Group (10 MHz Span)

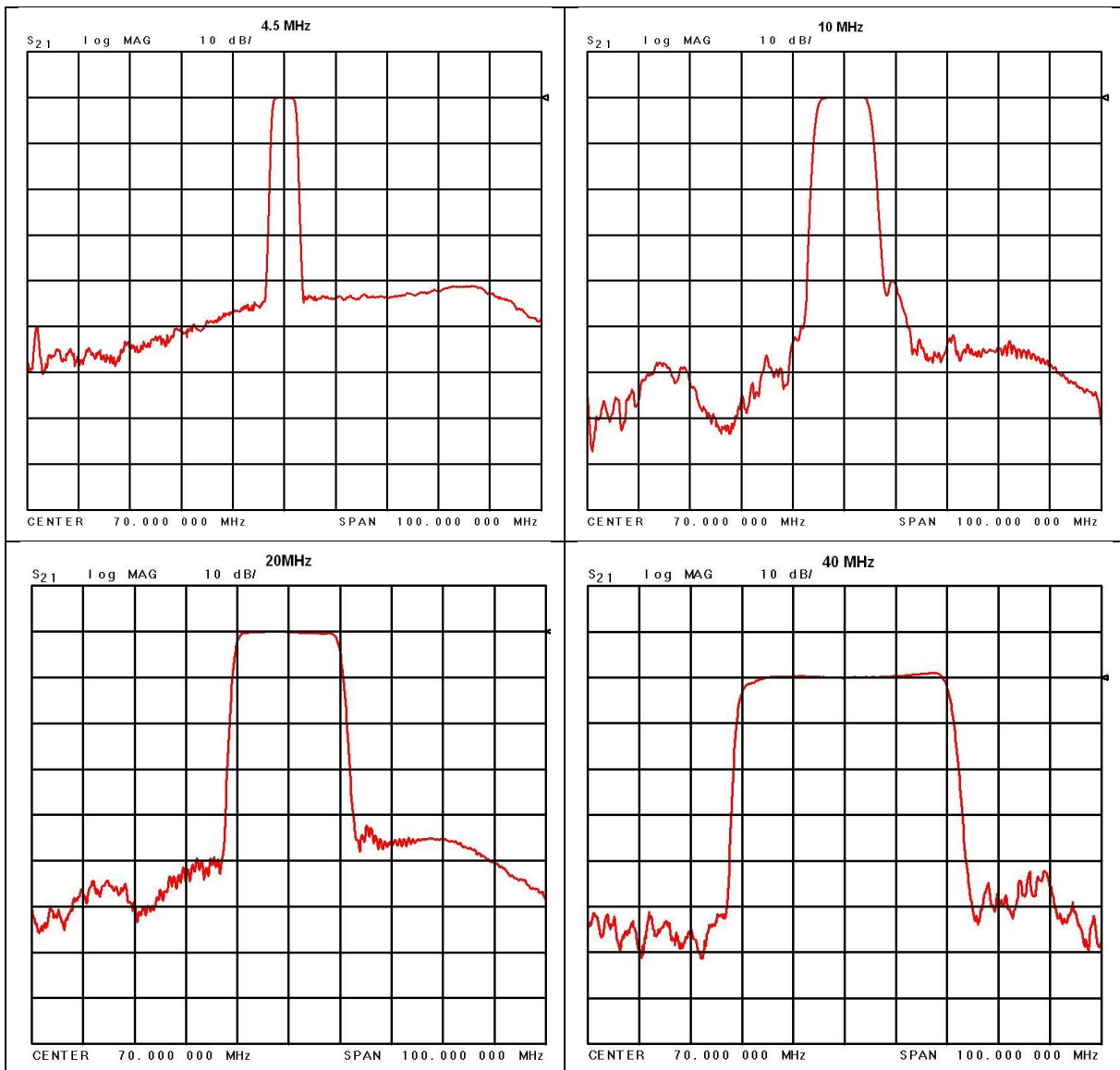


Figure 84: SAW Filter Responses, Wide Group (Plotted on 100 MHz Span)

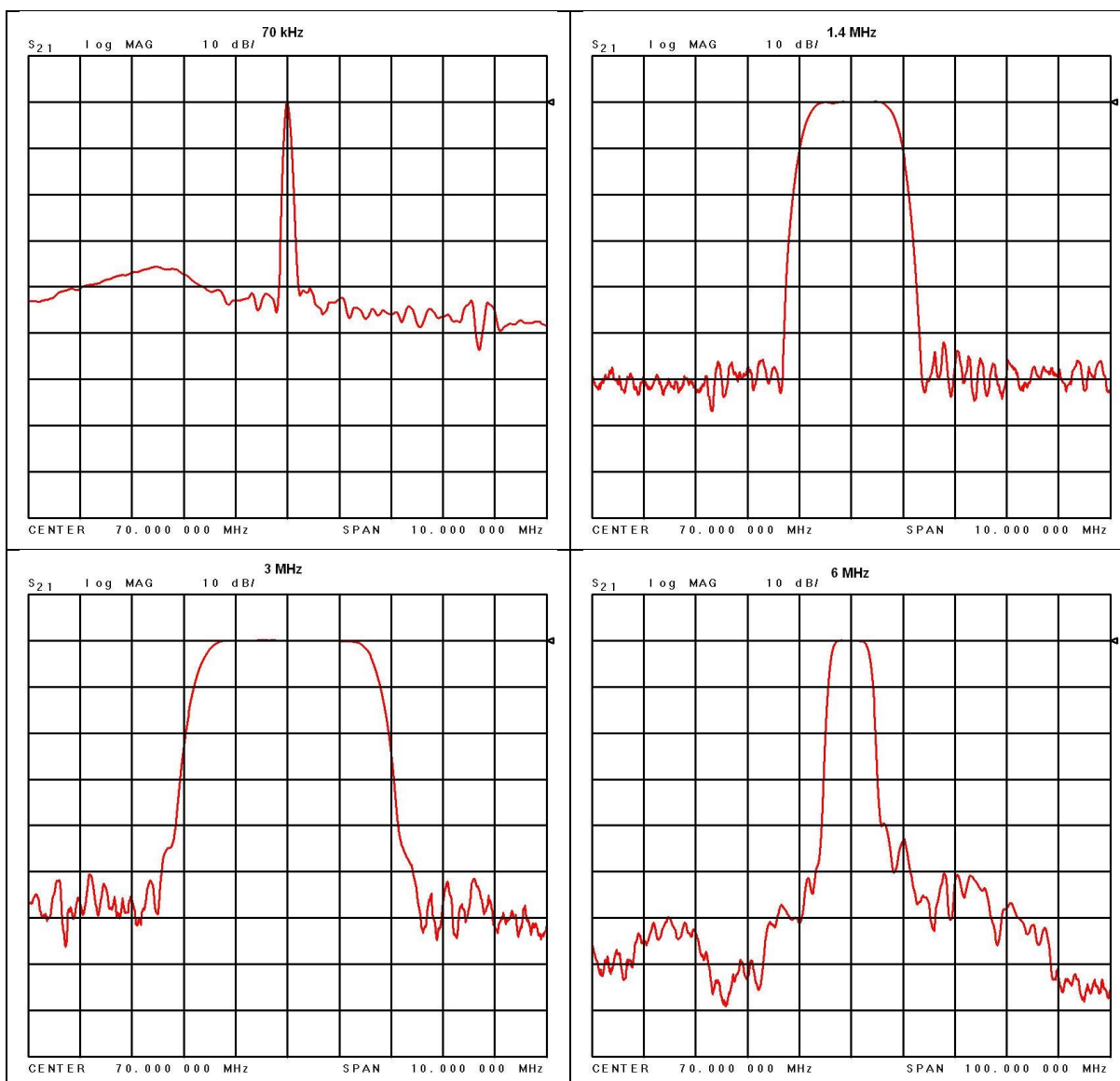


Figure 85: Optional SAW Filter Responses for 70 kHz to 6 MHz

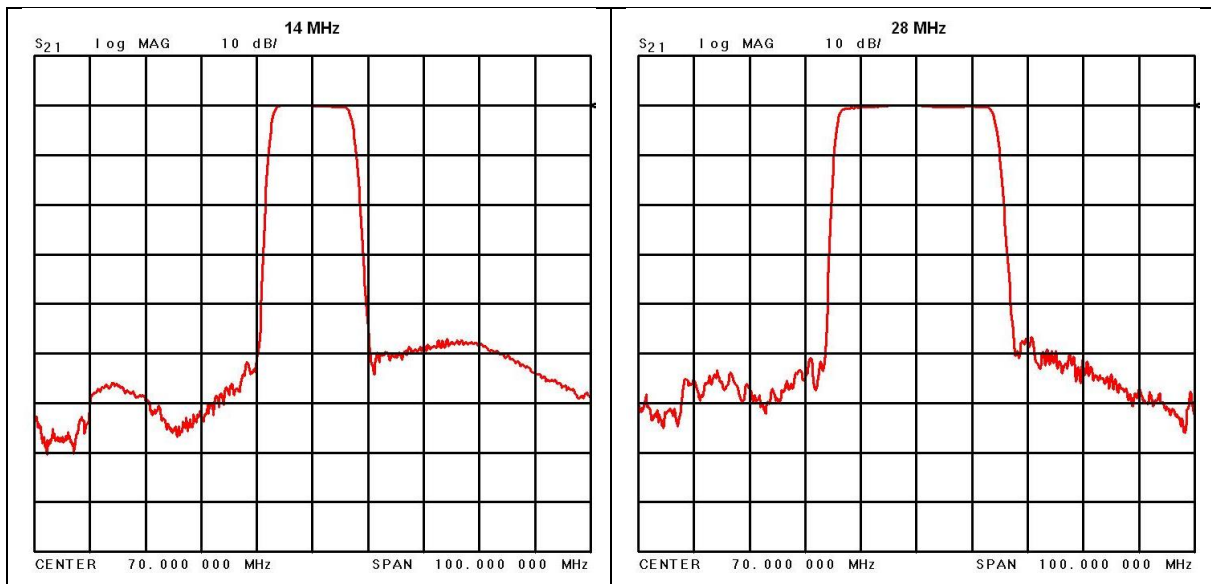


Figure 86: Optional SAW Filter Responses for 14 MHz and 28 MHz

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 87, 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.

Advanced Menu		Ch:C
Sync Bit Rate	5.0000	
IF Filter	10.0 MHz	
Phase Noise Comp	Off	
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
Mod Scale Index	0.700	
Best Ch Selector	On	
Time Aligner	Disabled	

IF Filter		Ch:C
Automatic IF Filter	Off (2.0 MHz)	
70 KHz		
250 KHz		
500KHz		
1.0 MHz		
1.4 MHz		
2.0 MHz		
3.0 MHz		
4.5 MHz		

Figure 87: Front Panel Advanced Menu and IF Filter Menu

4.4.2.19.3 Phase Noise Comp (PCM/FM Mode Only)

The Phase Noise Comp option, shown in Figure 88, is used to set the Phase Noise Compensation (PNC) value to On, Off, or Auto. When set to Auto, the RDMS continuously checks and determines which mode (with PNC or without) has a higher data quality value and automatically sets the unit to that mode. Refer to section 9, Appendix C, for detailed information about Phase Noise Compensation.

Advanced Menu		Ch:C
Sync Bit Rate	5.0000	
IF Filter	10.0 MHz	
Phase Noise Comp	Off	
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
Mod Scale Index	0.700	
Best Ch Selector	On	
Time Aligner	Disabled	

Figure 88: 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.

4.4.2.19.4 Muting Timeout

The Muting Timeout option, shown in Figure 89 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.

Advanced Menu		Ch:C
Sync Bit Rate	5.0000	
IF Filter	10.0 MHz	
Phase Noise Comp	Off	
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
Mod Scale Index	0.700	
Best Ch Selector	On	
Time Aligner	Disabled	

Figure 89: 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 90. When the new value is entered, press the Enter key on the keypad.



Figure 90: Muting Timeout Entry Screen

4.4.2.19.5 Output Muting

The Output Muting option, shown in Figure 91, 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.

Advanced Menu		Ch:C
Sync Bit Rate	5.0000	
IF Filter	10.0 MHz	
Phase Noise Comp	Off	
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
Mod Scale Index	0.700	
Best Ch Selector	On	
Time Aligner	Disabled	

Figure 91: 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.

4.4.2.19.6 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.

Advanced Menu		Ch:C
Sync Bit Rate	5.0000	
IF Filter	10.0 MHz	
Phase Noise Comp	Off	
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
Mod Scale Index	0.700	
Best Ch Selector	On	
Time Aligner	Disabled	

Figure 92: 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.

4.4.2.19.7 Mod Scale Index

The Mod Scale Index option, shown in Figure 93, 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 4.4.2.13, 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 94. When the new value is entered, press the Enter key on the keypad.

Advanced Menu Ch:C	
Sync Bit Rate	5.0000
IF Filter	10.0 MHz
Phase Noise Comp	Off
Muting Timeout	1000
Output Muting	Off
DC Antenna	Disabled
Mod Scale Index	0.700
Best Ch Selector	On
Time Aligner	Disabled

Figure 93: Advanced Menu, Mod Scale Index Selection

Mod Scale Index Ch:C
 Enter Mod Scale Index

Figure 94: 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.

4.4.2.19.8 Best Channel Selector

The Best Channel Selector option, shown in Figure 95, 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.

Advanced Menu Ch:C	
Sync Bit Rate	5.0000
IF Filter	10.0 MHz
Phase Noise Comp	Off
Muting Timeout	1000
Output Muting	Off
DC Antenna	Disabled
Mod Scale Index	0.700
Best Ch Selector	On
Time Aligner	Disabled

Figure 95: 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 96.

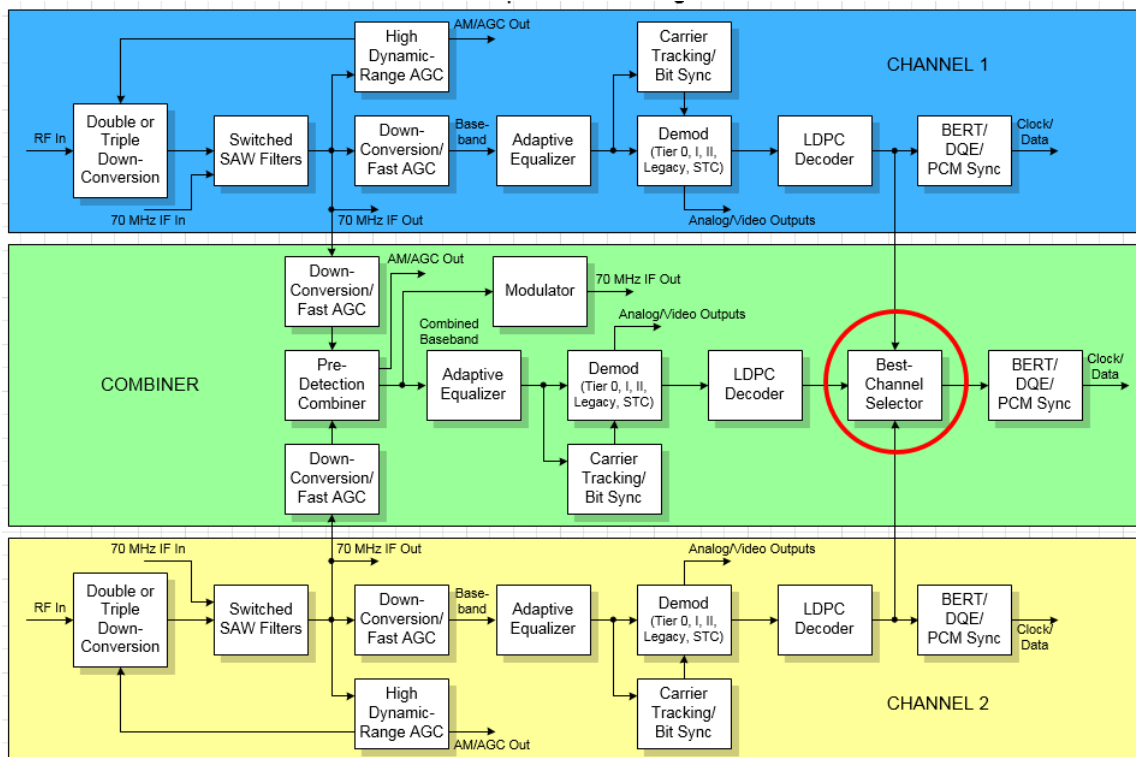


Figure 96: System Block Diagram with Best Channel Selector

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 4.4.2.10 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.

4.4.2.19.8.1 Best Channel Selector Status

Best Channel Selector status is only displayed with the Combiner option enabled and set to On. This status displays in the right-hand side of the combiner signal indicator window, to the left of the combiner Signal Quality (Q) status, as shown in Figure 97.

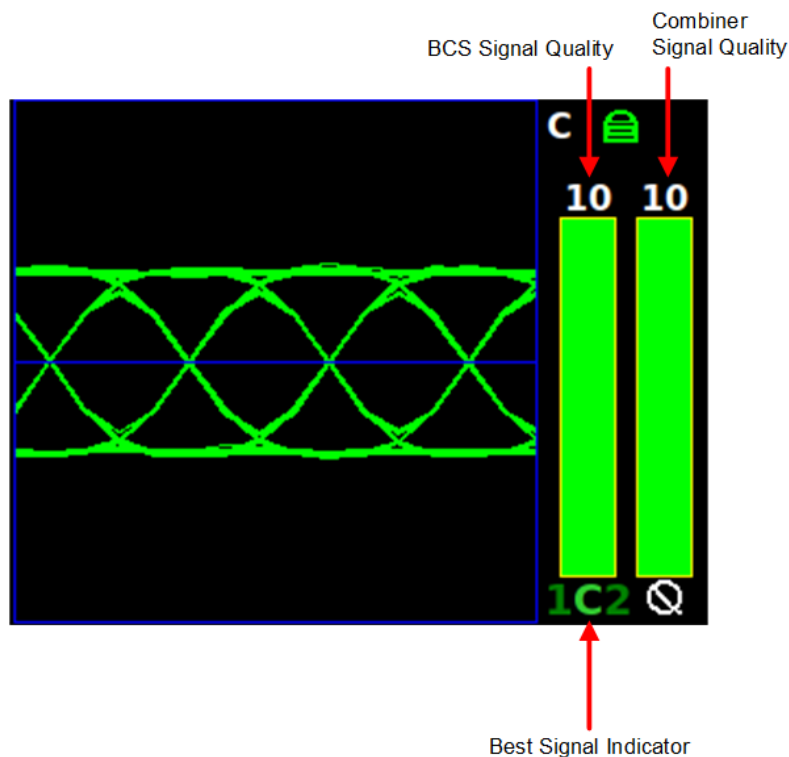


Figure 97: Best Channel Indicator Example

Two status items display for the BCS. First, BCS Signal Quality is indicated with a color-coded bar that indicates the data quality for the presently selected channel. Numerical data quality is shown above the bar. This indicator works just like the Combiner Signal Quality to the right of it. Second, BCS channel selection is shown below the BCS Signal Quality bar.

Each demodulated signal (Channel 1, Combiner, and Channel 2) is represented by a character in the BCS status display ('1', 'C', and '2' respectively). The color of each character designates the current state of that channel in the best-channel selection process:

- Bright green – Best signal; this signal has the highest data quality of all correlating signals, and its quality is directly reflected in the BCS quality bar
- Green – Good signal; this signal correlates sufficiently to the best signal to participate in best-channel selection, but its data quality is not highest
- Red – Bad signal; this signal does not correlate sufficiently to the best signal to participate in best-channel selection
- Grey – Disabled signal; the BCS is set to Off

The preceding descriptions may seem to imply a static state for each channel. In reality, channel dynamics including noise, may cause fairly rapid changes in BCS state. The BCS indicator shows a snapshot of the current status multiple times per second, but may not reflect every state transition in a highly dynamic environment. In addition, Signal Quality updates are not necessarily synchronized. Thus, as channel conditions change, there may be brief times when Combiner data quality appears to exceed BCS data quality. On average, BCS data quality will always equal, or exceed, Combiner (and Channel 1 and Channel 2) data quality.

In general, the Combiner is expected to be the best channel. However, many conditions may lead to selection of Channel 1 or Channel 2 as the best channel. One common condition is multipath. Another common—and less intuitive—condition is absence of any signal impairment. In this case, all channels have essentially “perfect” signal quality, so the BCS cannot distinguish one that is “best” and will simply stick with its current selection until something changes. Similarly, if no signal is present, the BCS may pick any channel as “best” though none are good.

When the BCS status display indicates the Combiner is the best signal, the BCS and Combiner Signal Quality bars indicate equal quality for the BCS and for the Combiner. When the BCS status display indicates Channel 1 or Channel 2 is the best signal, the BCS Signal Quality bar indicates better data quality for the BCS than for the Combiner. This difference highlights the improvement provided by the BCS relative to Combiner data alone.

Figure 98 illustrates a good signal for Channel 1 and Channel 2, with the best signal being selected from the Combiner.

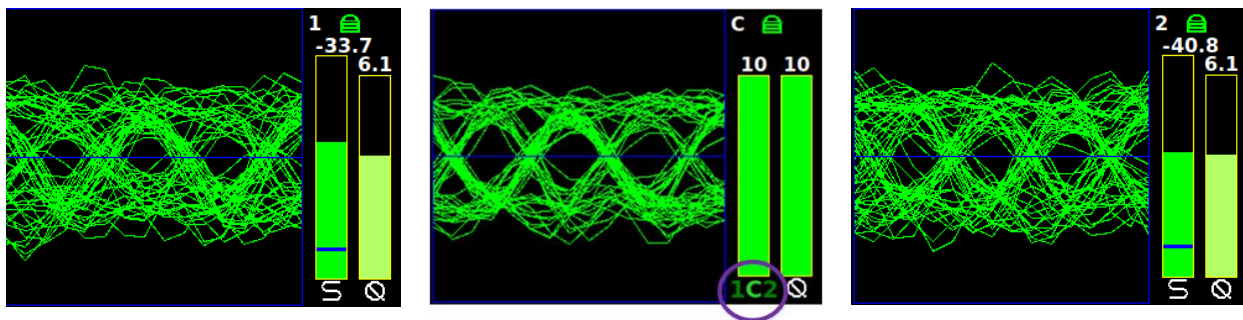


Figure 98: Best Channel Indicator-Combiner

Figure 99 illustrates a good signal for the Combiner and Channel 2, with the best signal being selected from Channel 1. This is an example of all channels being essentially “perfect.”

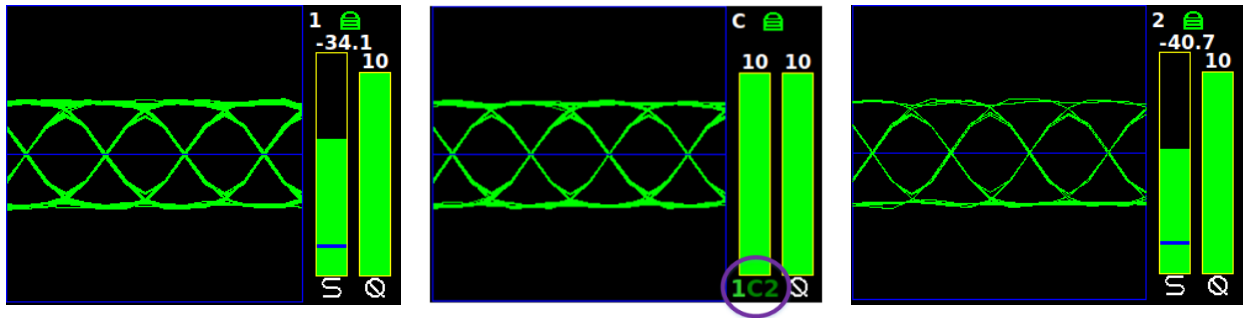


Figure 99: Best Channel Indicator-Ch 1

Figure 100 illustrates a bad signal for Channel 1, a good signal for the Combiner, with the best signal being selected from Channel 2. This can happen if one received signal is so much better than the other that the combined signal is composed of essentially 100% of the better signal and 0% of the worse signal.

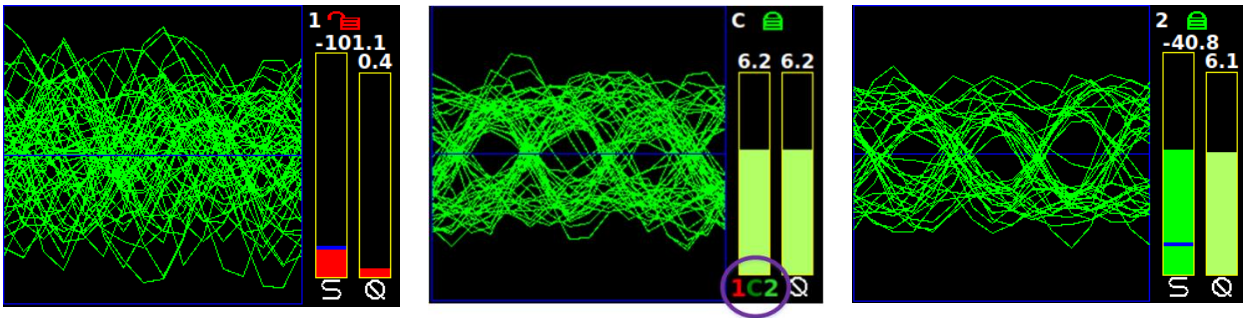


Figure 100: Best Channel Indicator-Ch 2

Figure 101 illustrates severe equalized multipath for Channel 1 and moderate equalized multipath for Channel 2. Note in this case the Combiner data quality is slightly better than Channel 1, but Channel 2 data quality is much better than the Combiner. In this case, the BCS selects Channel 2, as shown by the circled BCS selection indicator and BCS data quality of 10. Without the BCS, the Combiner output data quality would be less than 6.

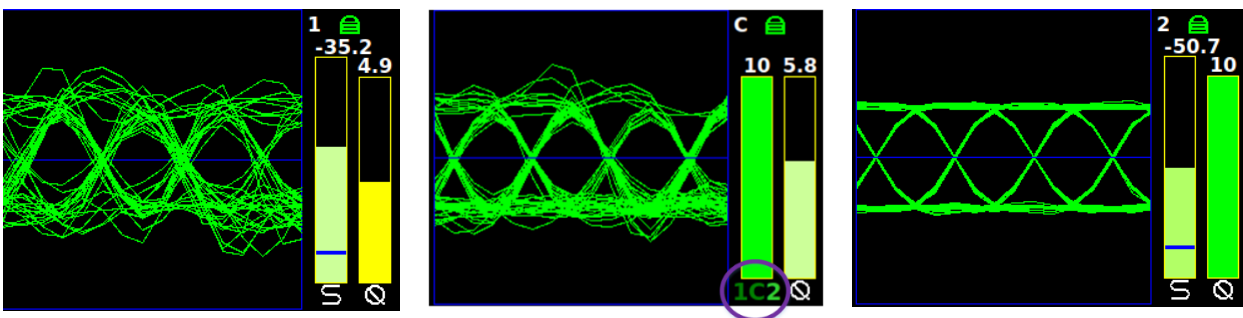


Figure 101: Best Channel Data Quality Better than Combiner Data Quality

Figure 102 illustrates BCS Off.

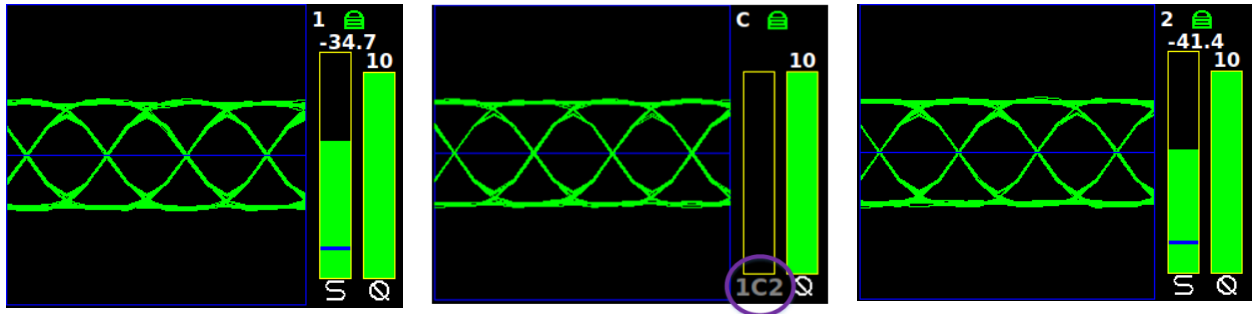


Figure 102: Best Channel Indicator Off (Grey)

4.4.2.19.9 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.

Advanced Menu		Ch:C
Sync Bit Rate	5.0000	
IF Filter	10.0 MHz	
Phase Noise Comp	Off	
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
Mod Scale Index	0.700	
Best Ch Selector	On	
Time Aligner	Disabled	

Figure 103: Advanced Menu, Time Aligner Selection

Enabling the (combiner) time aligner, as shown in Figure 103, 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.

4.4.2.20 AFC Mode

AFC (Automatic Frequency Control) Mode, shown in Figure 104, 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.

Advanced Menu ch:c	
IF Filter	20.0 MHz
Phase Noise Comp	Off
Muting Timeout	1000
Output Muting	Off
DC Antenna	Disabled
Mod Scale Index	0.699
Best Ch Selector	On
Time Aligner	Disabled
AFC Mode	Track

Figure 104: 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 the RDMS™ Access via Telnet and Serial Control Protocol Technical Guide for AFC command details.

4.4.2.20.1 AFC Mode – Off

The AFC Mode Off setting is shown in Figure 105. 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.

Advanced Menu		Ch:C
Phase Noise Comp	Off	
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
Mod Scale Index	0.700	
Best Ch Selector	On	
Time Aligner	Disabled	
Combiner Mode	Maximal Ratio	
AFC Mode	Off	

Figure 105: Advanced Menu, AFC Mode – Off

4.4.2.20.2 AFC Mode – Track

When AFC Mode is set to Track, as shown in Figure 106, 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.

Advanced Menu		Ch:C
Phase Noise Comp	Off	
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
Mod Scale Index	0.700	
Best Ch Selector	On	
Time Aligner	Disabled	
Combiner Mode	Maximal Ratio	
AFC Mode	Track	

Figure 106: Advanced Menu, AFC Mode – Track

4.4.2.20.3 AFC Mode – Hold

When AFC Mode is set to Hold, as shown in Figure 107, 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.

Advanced Menu		Ch:C
Phase Noise Comp	Off	
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
Mod Scale Index	0.700	
Best Ch Selector	On	
Time Aligner	Disabled	
Combiner Mode	Maximal Ratio	
AFC Mode	Hold	

Figure 107: Advanced Menu, AFC Mode – Hold

4.4.2.21 PCM Encoding

The PCM Encoding setting controls the RDMS receiver output PCM data format. Two primary options are available: the receiver can convert encoded data to NRZ-L, or it can preserve transmit encoding. The first option allows conversion of any of the following encoding formats to NRZ-L:

- 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

The second option allows the transmit encoding to be preserved and output from the RDMS unaltered. To accomplish this, PCM Encoding must be set to NRZ-L – regardless of the actual transmit encoding. Also, for encoding formats that use di-bits to represent each user bit (i.e., RZ, Biφ, DM, or M2), the RDMS bit rate must be set to twice the user bit rate. Note that the RDMS output clock will clock at twice the user bit rate in this configuration.

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 109.

Advanced Menu		Ch:C
Phase Noise Comp	Off	
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
Mod Scale Index	0.699	
Best Ch Selector	On	
Time Aligner	Disabled	
AFC Mode	Track	
PCM Encoding	NRZ-L	

Figure 108: Advanced Menu, PCM Encoding

PCM Encoding		Ch:C
NRZ-L		
NRZ-M		
NRZ-S		
RZ		
Biφ-L		
Biφ-M		
Biφ-S		
DM-M		
DM-S		

Figure 109: PCM Encoding Selections

4.4.2.22 FEC Menu

Forward Error Correction (FEC) may be accomplished by using Low-Density Parity Check (LDPC) encoding, in SOQPSK or STC modes, or by using convolutional encoding/Viterbi decoding, and/or Reed Solomon encoding in legacy PSK modes (BPSK, QPSK, OQPSK, AQPSK, AUQPSK, or UQPSK). All of these forms of FEC are discussed in the following sections.

Advanced Menu		Ch:1
Sync Bit Rate	0.9996	
IF Filter	2.0 MHz	
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
AFC Mode	Track	
PCM Encoding	NRZ-L	
FEC		
Video Output Menu		

Figure 110: Advanced Menu, FEC

FEC		Ch:1
LDPC Code	k=4096, r=2/3	

Figure 111: FEC Menu (LDPC Version)

4.4.2.22.1 LDPC Code (SOQPSKLDPC or STCLDPC 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 106-17 Appendix 2-D.

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 113. 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 or STC/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 106-17 Annex A-2, or CCSDS derandomization as specified in IRIG 106-17 Appendix 2-D. Again, the derandomization selection must match the encoding selected at the transmitting end for proper operation.

SOQPSK/LDPC uses trellis 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 4.4.2.20 for additional information about AFC Mode.

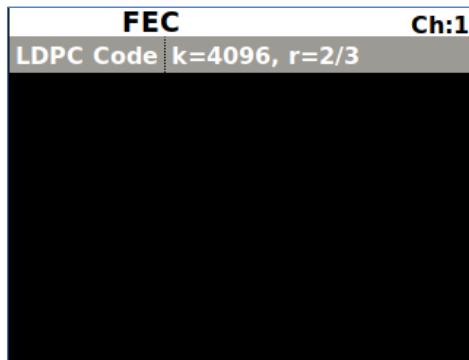


Figure 112: FEC Menu, LDPC Code

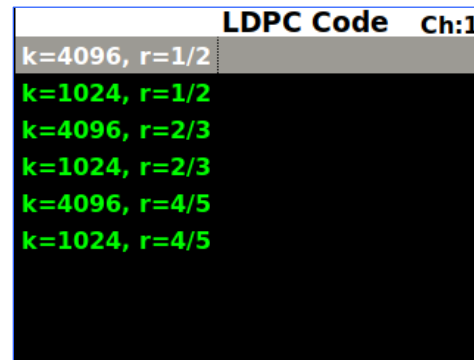


Figure 113: LDPC Code Selections

Note: LDPC Code only displays on the Advanced Menu when the waveform Mode is SOQPSKLDPC or STCLDPC.

Advanced Menu Ch:1	
Sync Bit Rate	0.9996
IF Filter	2.0 MHz
Muting Timeout	1000
Output Muting	Off
DC Antenna	Disabled
AFC Mode	Track
PCM Encoding	NRZ-L
FEC	
Video Output Menu	

Figure 114: Advanced Menu, FEC

FEC Ch:2	
Viterbi Decoder	Enabled
Conv Symbol	Disabled
R-S Decoder	Enabled
Interleave Depth	1

Figure 115: FEC Menu (PSK Version)

4.4.2.22.2 Viterbi Decoder (K7 Option Required) (Legacy PSK modes only)

Convolutional encoding is a form of legacy forward error correction. Like LDPC, it adds redundant information at the transmitting end of a telemetry link and then uses that redundancy to detect and correct errors at the receiving end of the link. Details of K=7 rate=1/2 convolutional encoding are presented in CCSDS 131.0-B-2 Section 3. Viterbi decoding is used to decode convolutional-encoded data.

The purpose and benefits of convolutional encoding are similar to LDPC. However, convolutional encoding requires more bandwidth than all but the lowest-rate LDPC codes, and its error-correcting performance is inferior to LDPC. Therefore, LDPC is the preferred forward error correction if possible.

The Viterbi Decoder control requires the K7 option, and the RDMS must be set to one of the following PSK modes: BPSK, QPSK, AQPSK, AUQPSK, OQPSK, or UQPSK.

Viterbi decoding and Reed-Solomon decoding can be used together or separately.

FEC Ch:2	
Viterbi Decoder	Enabled
Conv Symbol	Disabled
R-S Decoder	Enabled
Interleave Depth	1

Figure 116: FEC Menu, Viterbi Decoder

4.4.2.22.3 Convolutional Symbol

The Space Network Users' Guide (NASA 450-SNUG) defines two different methods for generating quadrature symbols (variants of QPSK) when using convolutional encoding.

The first method is for I and Q data streams to be independently encoded. In this method, two convolutional encoders are used, one for I data and one for Q data, as shown in Figure 117.

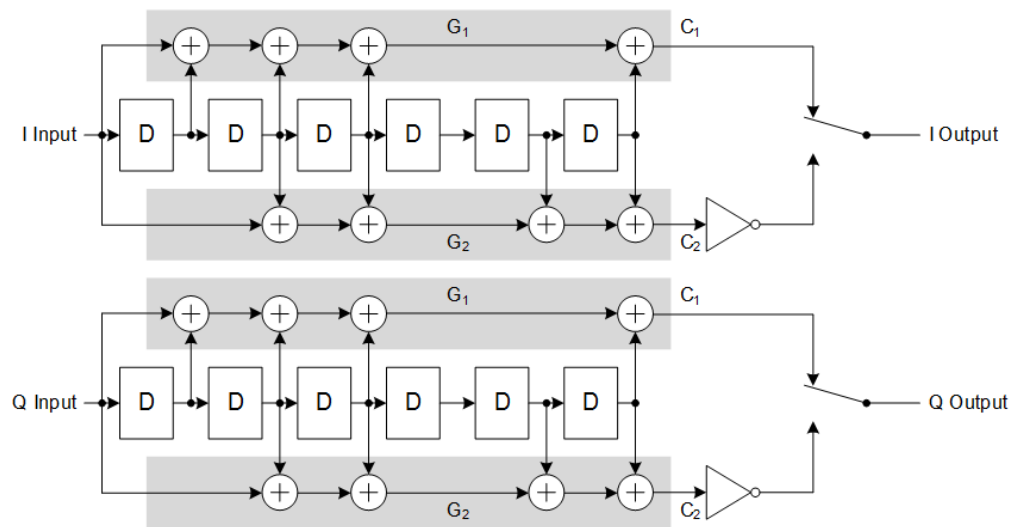


Figure 117: I and Q Data Streams Independently Encoded

The appropriate decoder for this method is selected by setting Convolutional Symbol to Disabled, as shown in Figure 118. In older releases without the Convolutional Symbol control, this was the only method supported.

FEC		Ch:2
Viterbi Decoder	Enabled	
Conv Symbol	Disabled	
R-S Decoder	Enabled	
Interleave Depth	1	

Figure 118: FEC Menu, Conv Symbol

The second method is for I and Q data to be created from the G1 and G2 generators, respectively, of a single convolutional encoder. In this method, only one convolutional encoder is used for both the I and Q data.

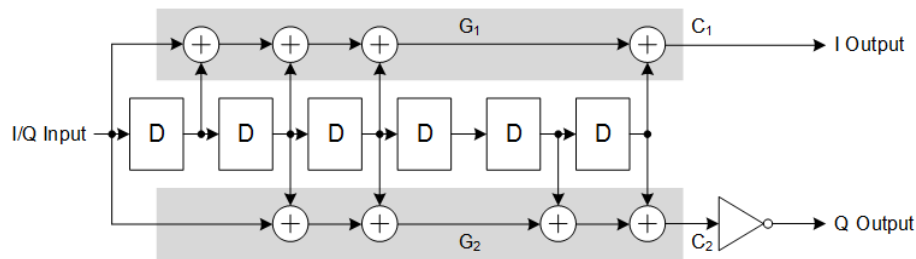


Figure 119: I and Q Data from Single Convolutional Encoder

The appropriate decoder for this method is selected by setting Convolutional Symbol to Enabled.

4.4.2.22.4 Reed-Solomon Decoder (K7 Option Required) (Legacy PSK modes only)

Reed-Solomon encoding is another form of legacy forward error correction. Like LDPC, it is a block code that adds redundant information at the transmitting end of a telemetry link and then uses that redundancy to detect and correct errors at the receiving end of the link. Unlike LDPC, however, encoding/decoding occurs on 8-bit symbols, and errors are detected and corrected on a symbol-by-symbol basis, regardless of the number of bits in error within a symbol. This characteristic makes Reed-Solomon encoding suitable for correcting burst errors. Details of Reed-Solomon encoding are presented in CCSDS 131.0-B-2 Section 4. The specific variant of Reed-Solomon decoder implemented is the (255, 223) code.

While Reed-Solomon encoding can be used by itself, it is a far less powerful code than LDPC. Its primary use is as a second code to correct burst errors that arise in the Viterbi decoder. The concatenation of Reed-Solomon encoding and convolutional encoding results in far better performance than either code by itself.

The Reed-Solomon control requires the K7 option, and the RDMS must be set to one of the following PSK modes: BPSK, QPSK, AQPSK, AUQPSK, OQPSK, or UQPSK. The RDMS has only one Reed-Solomon decoder. Therefore, in AQPSK and AUQPSK modes, only the 'A' data will be decoded when Reed-Solomon decoding is enabled; 'B' data will be output without decoding.

Reed-Solomon decoding and Viterbi decoding can be used together or separately.

The Reed-Solomon decoder is selected by setting R-S Decoder to Enabled, as shown in Figure 120.

FEC		Ch:2
Viterbi Decoder	Enabled	
Conv Symbol	Disabled	
R-S Decoder	Enabled	
Interleave Depth 1		

Figure 120: FEC Menu, R-S Decoder

4.4.2.22.5 Interleave Depth (K7 Option Required) (Legacy PSK modes only)

The burst error correction capability of the Reed-Solomon decoder can be extended by interleaving N code blocks, which spreads burst errors out in the decoder. Valid interleave depths range from N = 1 (no interleaving) to N = 8.

To change the Interleave Depth, select Interleave Depth from the FEC screen, as shown in Figure 121, then press the Enter key on the front panel.

A dialog screen displays prompting the operator to enter a new depth using the rack's front panel numeric keypad. The valid Interleave Depth range is 1 to 8. The Index Entry screen is shown in Figure 122. When the new value is entered, press the Enter key on the keypad.

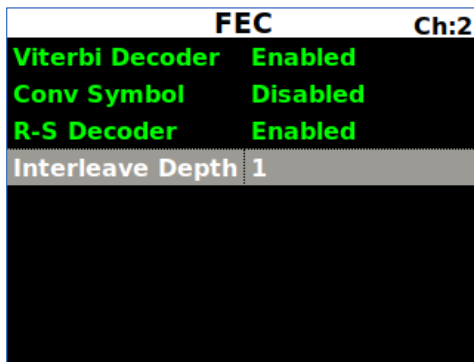


Figure 121: FEC Menu (PSK Version)

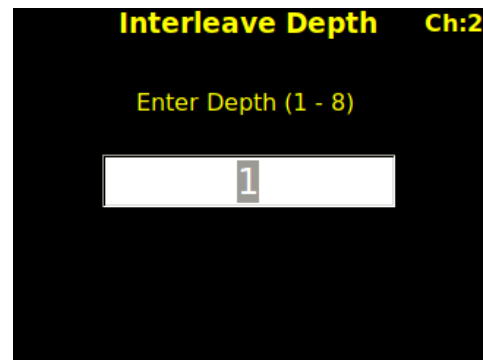


Figure 122: FEC Menu, Interleave Depth

4.4.2.23 Video Output Menu

The Video Output Menu, which is accessed via the Advanced Menu, as shown in Figure 123, provides access to the following options:

- Channel A Output
- Channel B Output
- Channel A Scale
- Channel B Scale
- Tape Out Freq (MHz)
- FM De-emphasis (PCM/FM mode only)

Advanced Menu		Ch:C
Muting Timeout	1000	
Output Muting	Off	
DC Antenna	Disabled	
Mod Scale Index	0.699	
Best Ch Selector	On	
Time Aligner	Disabled	
AFC Mode	Track	
PCM Encoding	NRZ-L	
Video Output Menu		

Figure 123: Advanced Menu, Video Output Menu

4.4.2.23.1 Channel A Output

The Channel A Output option, shown in Figure 124, selects what signal appears on the I/Video A output: Normal, Tape Out, or Carrier Only. The Normal output depends on the selected Mode, as shown in Table 9.

Table 9: Normal (Default) Video Output Signals

Mode	I/Video A	Q/Video B
PCM/FM	Eye Pattern	Unused (0 Volts)
SOQPSK, SOQPSK/LDPC	Noncoherent I/Q Baseband	Noncoherent I/Q Baseband
MHCPM	Noncoherent I/Q Baseband	Noncoherent I/Q Baseband
BPSK	I Baseband	Unused
QPSK, OQPSK, AQPSK, UQPSK, AUQPSK	I Baseband	Q Baseband
DPM	I Baseband	Unused

Tape Out outputs the Pre-D signal, and Carrier Only outputs an unmodulated carrier; either of these will be output at the carrier frequency selected by Tape Out Freq (MHz).

Video Output Menu		Ch:C
Channel A Output	Normal	
Channel B Output	Normal	
Channel A Scale	1.0000	
Channel B Scale	1.0000	
Tape Out Freq (MHz)	2.1000	
FM De-emphasis	Off	

Channel A Output		Ch:C
Normal		
Tape Out		
Carrier Only		

Figure 124: Video Output Menu, Channel A Output Selection

4.4.2.23.2 Channel B Output

The Channel B Output option, shown in Figure 125, selects what signal appears on the Q/Video B output: Normal, Tape Out, or Carrier Only. The Normal output depends on the selected Mode, as shown in Table 9. Tape Out outputs the Pre-D signal, and Carrier Only outputs an unmodulated carrier; either of these will be output at the carrier frequency selected by Tape Out Freq (MHz).

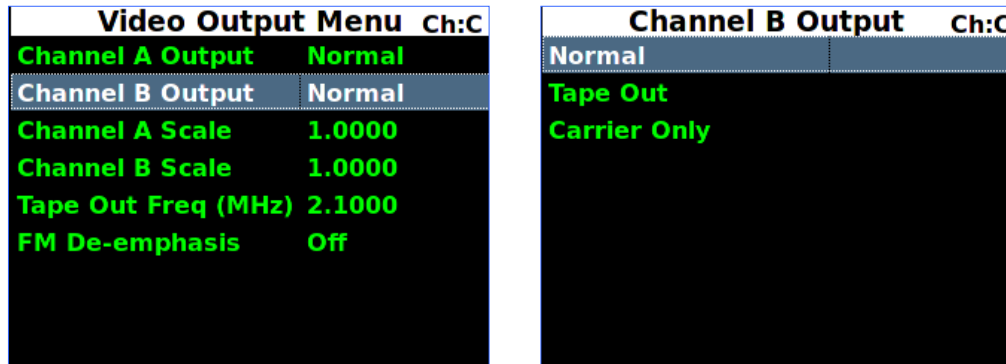


Figure 125: Video Output Menu, Channel B Output Selection

4.4.2.23.3 Channel A Scale

The Channel A Scale option, shown in Figure 126, adjusts the peak-to-peak amplitude on the I/Video A output. 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.

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

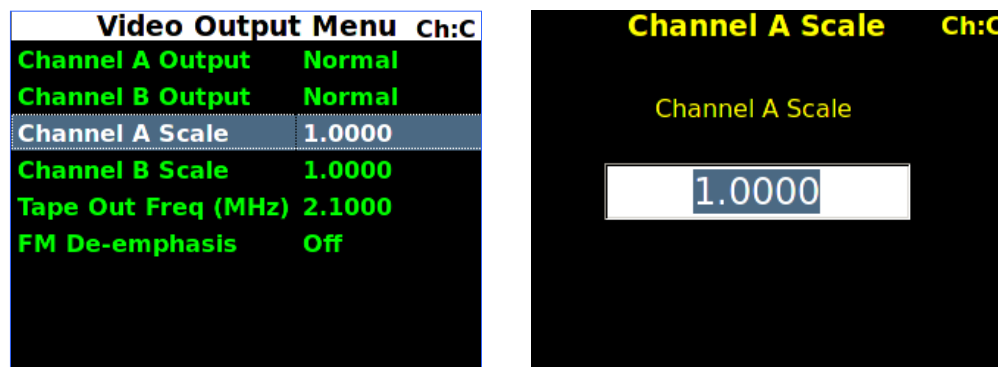


Figure 126: Video Output Menu, Channel A Scale Selection

4.4.2.23.4 Channel B Scale

The Channel B Scale option, shown in Figure 127, adjusts the peak-to-peak amplitude on the Q/Video B output. 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.

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

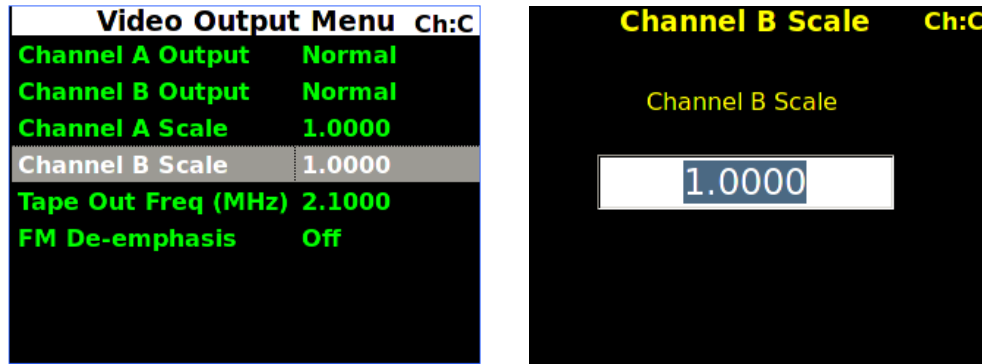


Figure 127: Video Output Menu, Channel B Scale Selection

4.4.2.23.5 Tape Out Frequency

The Tape Out Frequency option, shown in Figure 128, sets the carrier frequency for any video output that is set to Tape Output or Carrier Only. The frequency may be selected from a standard set of values. Alternatively, any frequency up to 46.666 MHz may be entered as a custom frequency. Note, however, that frequencies above 30 MHz will experience filter roll-off and may not be useful.

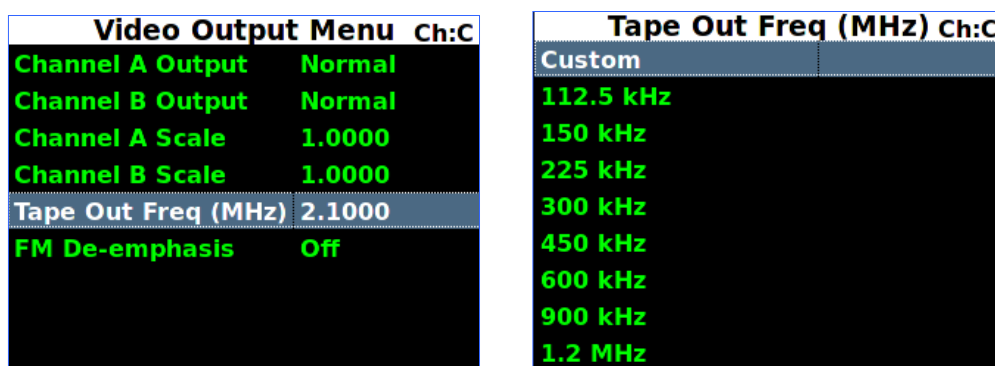


Figure 128: Video Output Menu, Tape Out Frequency Selection

4.4.2.23.6 FM De-emphasis (PCM/FM Mode Only)

The FM De-emphasis option, shown in Figure 129, is used to set the FM De-emphasis 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.

Video Output Menu Ch:C	
Channel A Output	Normal
Channel B Output	Normal
Channel A Scale	1.0000
Channel B Scale	1.0000
Tape Out Freq (MHz)	2.1000
FM De-emphasis	Off

Figure 129: Video Output Menu, FM De-emphasis Selection

The user may toggle the FM De-emphasis value by pressing the Enter key on the front panel keypad until the desired value displays.

4.4.2.24 Clk/Data Output Menu (1U Receiver)

The Clk/Data Output Menu, which is accessed via the Advanced Menu, as shown in Figure 130, provides access to the following options:

- Channel A Output
- Channel B Output

Advanced Menu Ch:C	
Output Muting	Off
DC Antenna	Disabled
Mod Scale Index	0.699
Best Ch Selector	On
Time Aligner	Disabled
AFC Mode	Track
PCM Encoding	NRZ-L
Video Output Menu	
Clk/Data Output Menu	

Figure 130: Advanced Menu, Clk/Data Output Menu

4.4.2.24.1 Channel A Output

The Channel A Output options, shown in Figure 131, select what signals appear on the Channel A clock/data outputs: DQE, No DQE, or Test Data.

- DQE – Selecting DQE enables encapsulation of data on Channel A; if DQE is enabled in the Main Menu, the output is encapsulated, otherwise it will not
- No DQE – Selecting No DQE bypasses data quality encapsulation
- Test Data – Selecting Test Data causes the output of the Data Generator to display on Channel A clock and data

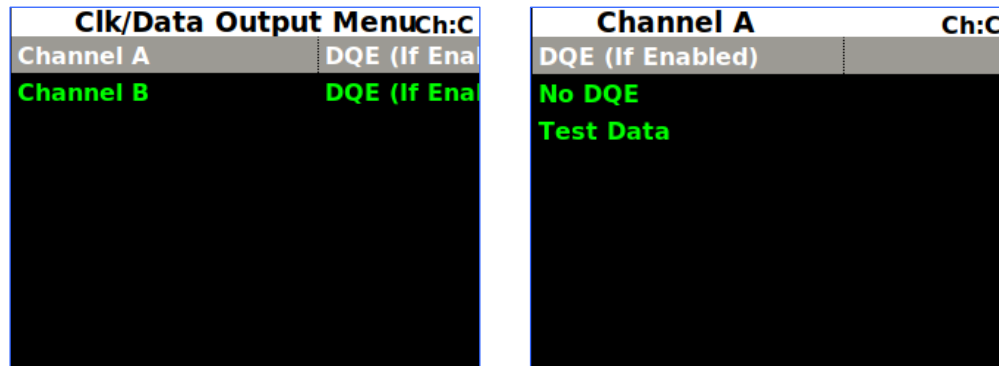


Figure 131: Clk/Data Output Menu, Channel A Output Selection

4.4.2.24.2 Channel B Output

The Channel B Output options, shown in Figure 131, select what signals appear on the Channel B clock/data outputs: DQE, No DQE, or Test Data.

- DQE – Selecting DQE enables encapsulation of data on Channel B; if DQE is enabled in the Main Menu, the output is encapsulated, otherwise it is not
- No DQE – Selecting No DQE bypasses data quality encapsulation
- Test Data – Selecting Test Data causes the output of the Data Generator to display on Channel B clock and data

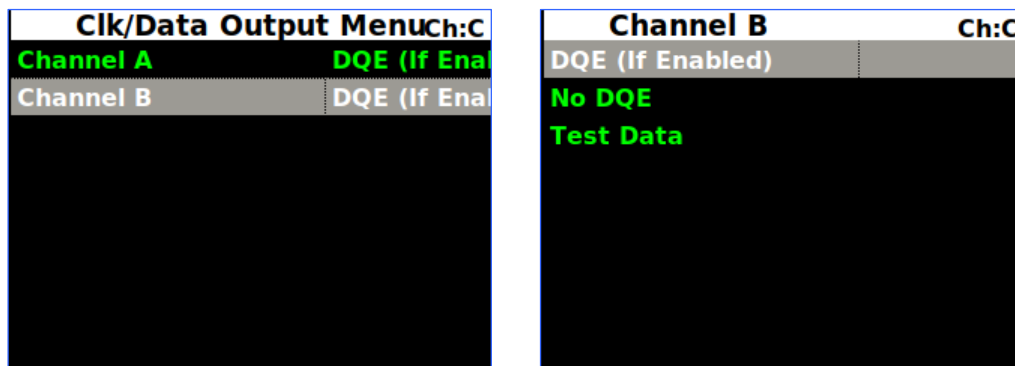


Figure 132: Clk/Data Output Menu, Channel B Output Selection

4.4.2.25 Clk/Data Output Menu (3U Receiver)

The Clk/Data Output Menu, as shown in Figure 133, provides access to four channels in a 3U receiver:

- Channel A Output
- Channel B Output
- Channel C Output
- Channel D Output

Clock and data output for the additional 3U channels functions the same as the channel selections in a 1U receiver.

Clk/Data Output M		Ch:1
Channel A	DQE (If Enabled)	
Channel B	DQE (If Enabled)	
Channel C	DQE (If Enabled)	
Channel D	No DQE	

Figure 133: Clk/Data Output Menu, Four Channel Parameters

4.4.2.26 Test Utilities

The Test Utilities selections, accessed via the Advanced Menu, as shown in Figure 134, provide access to the following options:

- Noise Generator
- Data Generator
- BERT

Advanced Menu Ch:C		Test Utilities Ch:C	
Output Muting	Off	Noise Generator	
DC Antenna	Disabled	Data Generator	
Best Ch Selector	On	BERT	
Time Aligner	Disabled		
AFC Mode	Track		
PCM Encoding	NRZ-L		
Video Output Menu			
Clk/Data Output Menu			
Test Utilities			

Figure 134: Advanced Menu, Test Utilities

4.4.2.26.1 Noise Generator

The Noise Generator, shown in Figure 135, optionally sums AWGN (Additive White Gaussian Noise) with the received signal to achieve the desired E_b/N_0 . Since the bit error rate of an ideally modulated signal at any given E_b/N_0 is known and should be readily reproducible, the Noise Generator may be used to verify transmitter or receiver RF integrity. Two parameters are available: Test Noise and Noise Level.

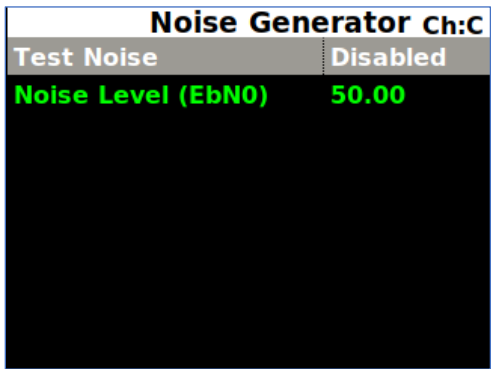


Figure 135: Noise Generator, Test Noise

- Test Noise – Enables or disables the AWGN generator
- Noise Level -Sets the noise level to use in the test in dB E_b/N_0 , as shown in Figure 136

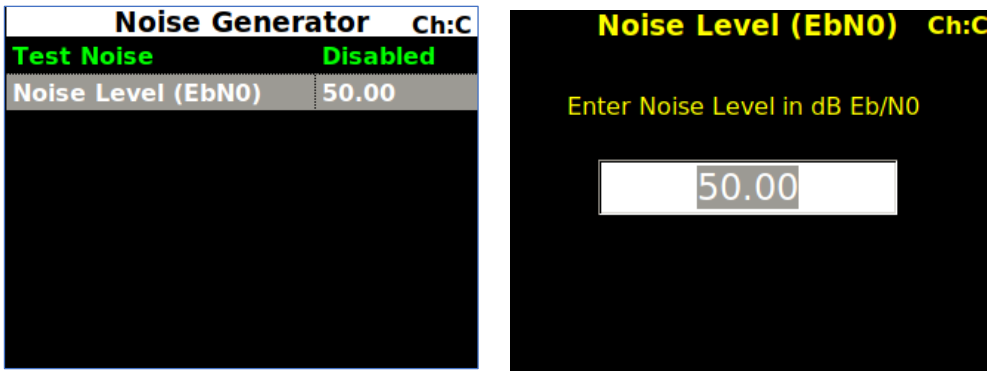


Figure 136: Noise Generator, Noise Level Selection

4.4.2.26.2 Data Generator

The Data Generator option, shown in Figure 137, allows the user to generate data patterns at a settable data rate. This data may be used as known source data for system testing, including transmitter or receiver RF integrity verification. Optionally, the user may invert data, or add randomization. The available parameters are Test Data, Data Rate, Pattern, Inversion, and Randomization.

- Test Data – Enable or disable test data generation

Test Utilities	Ch:C
Noise Generator	
Data Generator	
BERT	

Data Generator	Ch:C
Test Data	Disabled
Data Rate (Mbps)	1.0000
Pattern	PN15
Inversion	Normal
Randomization	Disabled

Figure 137: Data Generator, Test Data

- Data rate in Mbps – Typing a number in this field sets the data rate in Mbps

Data Generator	Ch:C
Test Data	Disabled
Data Rate (Mbps)	1.0000
Pattern	PN15
Inversion	Normal
Randomization	Disabled

Figure 138: Data Generator, Data Rate

- Pattern – Sets the data pattern produced by the data generator; This may be a fixed pattern or a pseudorandom pattern that repeats based on the chosen pattern/sequence (a shorter pattern looks more regular, a longer pattern looks more random)
 - PN6 – Pseudorandom pattern 2^6-1 bits in length
 - PN9 – Pseudorandom pattern 2^9-1 bits in length
 - PN11 – Pseudorandom pattern $2^{11}-1$ bits in length
 - PN15 – Pseudorandom pattern $2^{15}-1$ bits in length
 - PN17 – Pseudorandom pattern $2^{17}-1$ bits in length
 - PN20 – Pseudorandom pattern $2^{20}-1$ bits in length
 - PN23 – Pseudorandom pattern $2^{23}-1$ bits in length
 - PN31 – Pseudorandom pattern $2^{31}-1$ bits in length
 - User Defined

Data Generator		Ch:C
Test Data	Disabled	
Data Rate (Mbps)	1.0000	
Pattern	PN15	
Inversion	Normal	
Randomization	Disabled	

Pattern		Ch:C
PN6		
PN9		
PN11		
PN15		
PN17		
PN20		
PN23		
PN31		
User Defined		

Figure 139: Data Generator, Test Pattern Selection

- User Defined – A unique binary pattern, between 2 and 32 bits, specified by the person running the test; only available when Pattern is “User Defined”

User Defined		Ch:C
Enter Pattern (2 - 32 bits)		
1011		

Data Generator		Ch:C
Test Data	Disabled	
Data Rate (Mbps)	1.0000	
Pattern	1011	
Inversion	Normal	
Randomization	Disabled	

Figure 140: Data Generator, User Defined Test Pattern Selection

- Inversion – Set to Normal or Inverted; when Inverted the data stream is inverted; useful for patterns that are defined as inverted by certain standards, or to compensate for an inversion elsewhere in the system

Data Generator		Ch:C
Test Data	Disabled	
Data Rate (Mbps)	1.0000	
Pattern	PN15	
Inversion	Normal	
Randomization	Disabled	

Figure 141: Data Generator, Inversion

- Randomization – Enable or disable IRIG 106 15-bit randomization; *not recommended for PN15 data*, due to potential conflict between the sequence generator and the randomizer, both of which are based on the same generator polynomial

Data Generator		Ch:C
Test Data	Disabled	
Data Rate (Mbps)	1.0000	
Pattern	PN15	
Inversion	Normal	
Randomization	Disabled	

Figure 142: Data Generator, Randomization

4.4.2.26.3 BERT

The Bit Error Rate Tester (BERT) option, shown in Figure 143, allows the user to measure system performance. It does this by comparing received data to a specified data pattern and counting the ratio of errored bits to total received bits. This may be useful for various forms of system testing, including transmitter or receiver RF integrity verification. The available settings are:

- Measurement
- (Re)Start BERT
- Pattern
- Type
- Time Limit (s)
- Bit Limit
- Error Limit
- Gating
- Restart on Resync

Note that BERT status is not available via the front panel interface, but it can be monitored via the Browser interface or the API.

Test Utilities		Ch:C
Noise Generator		
Data Generator		
BERT		

Figure 143: Test Utilities, BERT

- Measurement – Enables or disables Bit Error Rate (BER) measurement

BERT		Ch:C
Measurement	Enabled	
(Re)Start BERT	Running	
Pattern	PN15	
Type	Continuous	
Time Limit (s)	0	
Bit Limit	0	
Error Limit	0	
Gating	Repeat	
Restart on Resync	Disabled	

Figure 144: BERT, Measurement

- (Re)Start BERT – Starts (or restarts) the (BER) test measurement with an error count and total bit count of zero; indicates whether a measurement is currently running or stopped, as shown in Figure 145

BERT		Ch:C
Measurement	Enabled	
(Re)Start BERT	Running	
Pattern	PN15	
Type	Continuous	
Time Limit (s)	0	
Bit Limit	0	
Error Limit	0	
Gating	Repeat	
Restart on Resync	Disabled	

BERT		Ch:C
Measurement	Disabled	
(Re)Start BERT	Stopped	
Pattern	PN15	
Type	Continuous	
Time Limit (s)	0	
Bit Limit	0	
Error Limit	0	
Gating	Repeat	
Restart on Resync	Disabled	

Figure 145: BERT, (Re)Start BERT

- Pattern – Sets the data pattern used by the bit error rate test; This may be a fixed pattern or a pseudorandom pattern that repeats based on the chosen pattern/sequence (a shorter pattern looks more regular, a longer pattern looks more random)
 - PN6 – Pseudorandom pattern 2^6-1 bits in length
 - PN9 – Pseudorandom pattern 2^9-1 bits in length
 - PN11 – Pseudorandom pattern $2^{11}-1$ bits in length
 - PN15 – Pseudorandom pattern $2^{15}-1$ bits in length
 - PN17 – Pseudorandom pattern $2^{17}-1$ bits in length
 - PN20 – Pseudorandom pattern $2^{20}-1$ bits in length
 - PN23 – Pseudorandom pattern $2^{23}-1$ bits in length
 - PN31 – Pseudorandom pattern $2^{31}-1$ bits in length
 - User Defined

BERT		Ch:C
Measurement	Disabled	
(Re)Start BERT	Stopped	
Pattern	PN15	
Type	Continuous	
Time Limit (s)	0	
Bit Limit	0	
Error Limit	0	
Gating	Repeat	
Restart on Resync	Disabled	

Pattern		Ch:C
PN6		
PN9		
PN11		
PN15		
PN17		
PN20		
PN23		
PN31		
User Defined		

Figure 146: BERT, Pattern Selection

- User Defined – A unique binary pattern, between 2 and 32 bits, specified by the person running the test; only available when Pattern is “User Defined”

User Defined		Ch:C
Enter Pattern (2 - 32 bits)		
1011		

BERT		Ch:C
Measurement	Disabled	
(Re)Start BERT	Stopped	
Pattern	1011	
Type	Continuous	
Time Limit (s)	0	
Bit Limit	0	
Error Limit	0	
Gating	Repeat	
Restart on Resync	Disabled	

Figure 147: BERT, User Defined Test Pattern Selection, and Pattern Changed

- Type – Selects the BERT measurement type—Continuous or Limited, as shown in Figure 148; Limited tests automatically complete when the selected time limit, total bit limit, or errored bit limit is reached

BERT Ch:C		BERT Ch:C	
Measurement	Disabled	Measurement	Disabled
(Re)Start BERT	Stopped	(Re)Start BERT	Stopped
Pattern	PN15	Pattern	PN15
Type	Continuous	Type	Limit
Time Limit (s)	0	Time Limit (s)	5
Bit Limit	0	Bit Limit	0
Error Limit	0	Error Limit	0
Gating	Repeat	Gating	Repeat
Restart on Resync	Disabled	Restart on Resync	Disabled

Figure 148: BERT, Type-Continuous or Limit

- Time Limit (s) – (in seconds) – Sets a specific time limit for the BER measurement; the measurement completes when the time limit has elapsed

BERT Ch:C		Time Limit (s) Ch:C	
Measurement	Disabled	Enter Time (s)	
(Re)Start BERT	Stopped	5	
Pattern	PN15		
Type	Continuous		
Time Limit (s)	0		
Bit Limit	0		
Error Limit	0		
Gating	Repeat		
Restart on Resync	Disabled		

Figure 149: BERT, Time Limit (s)

- Bit Limit – Sets a specific number of total received bits, as shown in Figure 150; the measurement completes when the selected number of bits has been received

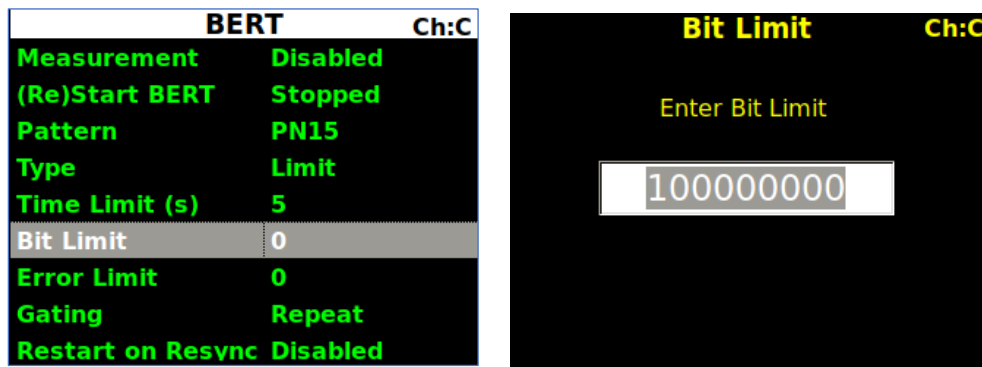


Figure 150: BERT, Bit Limit

- Error Limit – (Bits) – Sets a specific number of bit errors; the test completes when the selected number of errored bits has been received

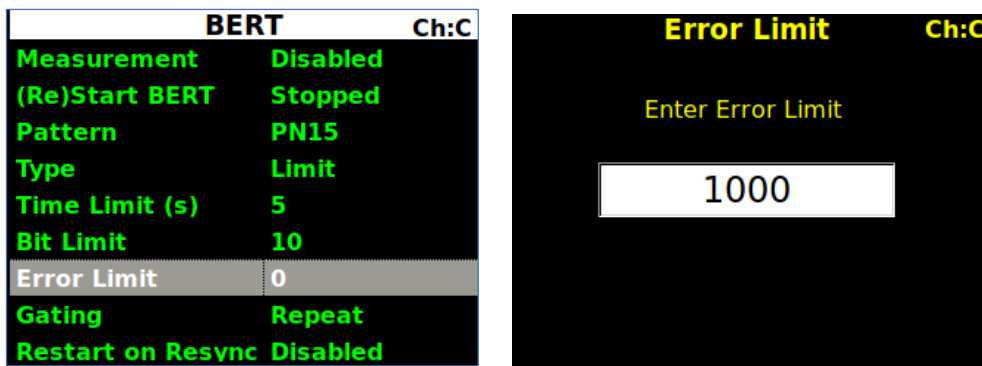


Figure 151: BERT, Error Limit

- Gating –Selects the action that occurs when the current measurement completes; this can be to stop, or to run a new measurement, as shown in Figure 152
 - Single – Runs the BER measurement one time based on programmed limits
 - Repeat – Runs the BER measurement until it reaches programmed limits, then repeats the measurement

BERT		Ch:C
Measurement	Disabled	
(Re)Start BERT	Stopped	
Pattern	PN15	
Type	Limit	
Time Limit (s)	5	
Bit Limit	0	
Error Limit	1000	
Gating	Repeat	
Restart on Resync	Disabled	

BERT		Ch:C
Measurement	Disabled	
(Re)Start BERT	Stopped	
Pattern	PN15	
Type	Limit	
Time Limit (s)	5	
Bit Limit	0	
Error Limit	1000	
Gating	Single	
Restart on Resync	Disabled	

Figure 152: BERT, Gating

- Restart on Resync – When enabled, automatically clears the bit count and errored bit count to zero whenever the BERT loses pattern sync; this effectively restarts any measurement that may be inaccurate due to BERT synchronization loss

BERT		Ch:C
Measurement	Disabled	
(Re)Start BERT	Stopped	
Pattern	PN15	
Type	Limit	
Time Limit (s)	5	
Bit Limit	0	
Error Limit	1000	
Gating	Single	
Restart on Resync	Disabled	

Figure 153: BERT, Restart on Resync

4.4.2.27 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.

Main Menu		Ch:C
Derandomizer	Off	
Mod Scaling	Acquire	
Mod Persist	Off	
HyperTrack	Disabled	
AGC Menu		
AM Menu		
Options Menu		
Advanced Menu		
System Settings		

Figure 154: Main Menu, System Settings Selection

The System Settings menu includes the following parameters:

- System Info
- Ethernet
- Web Server
- Fan Control
- System Update

System Settings		Ch:C
System Info		
Ethernet		
Web Server		
Fan Control		
System Update		

Figure 155: System Settings Menu, System Info Highlighted

4.4.2.27.1 System Info

The System Info screen, shown in Figure 156, is a display only screen. It provides the following information about the RDMS™.

System Info Ch:2		System Info Ch:2	
Model	3rd Gen RDMS: 1U	System Version	18rc1
Serial Number	3044	DHCP	Off
System Version	18rc1	IP Address	192.168.0.250
DHCP	Off	Subnet	255.255.0.0
IP Address	192.168.0.250	Gateway	192.168.0.1
Subnet	255.255.0.0	MAC	70:b3:d5:23:c0:42
Gateway	192.168.0.1	Alias	RDMS3--Maria's Te
MAC	70:b3:d5:23:c0:42	System IP	192.168.0.250
Alias	RDMS3--Maria's Te	SD Card	Samsung

Figure 156: System Info Menu

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.

4.4.2.27.1.1 Model

Model describes the type of Quasonix receiver in use.

4.4.2.27.1.2 Serial Number

Serial number describes the Quasonix manufacturing serial number which identifies this specific RDMS™ receiver. The Serial Number screen provides the serial number for the Channel 1, Channel 2, and Combiner bricks inside the receiver.

System Info Ch:2		Serial Number Ch:2	
Model	3rd Gen RDMS: 1U	Ch1 SN	2280
Serial Number	3044	Ch2 SN	2093
System Version	18rc1	Combiner SN	2028
DHCP	Off		
IP Address	192.168.0.250		
Subnet	255.255.0.0		
Gateway	192.168.0.1		
MAC	70:b3:d5:23:c0:42		
Alias	RDMS3--Maria's Te		

Figure 157: System Info Menu, Serial Number Displays

4.4.2.27.1.3 System Version

System Version describes the software/firmware release installed in this RDMS™ receiver.

System Info Ch:2		System Version Ch:2	
Model	3rd Gen RDMS: 1U	FP	1.18.5
Serial Number	3044	Browser	1.18.5
System Version	18rc1	Ch1 App	1.18.3.10
DHCP	Off	Ch1 FPGA	0100105F
IP Address	192.168.0.250	Ch2 App	1.18.3.10
Subnet	255.255.0.0	Ch2 FPGA	0100105F
Gateway	192.168.0.1	Comb App	1.18.3.49
MAC	70:b3:d5:23:c0:42	Comb FPGA	0000105F
Alias	RDMS3--Maria's Te		

Figure 158: System Info Menu, System Version Displays

4.4.2.27.1.3.1 FP

FP describes the Front Panel software version installed in this RDMS™ receiver.

4.4.2.27.1.3.2 Browser

Browser describes the Browser Interface version installed on this RDMS™ receiver.

4.4.2.27.1.3.3 Ch1 App and Ch1 FPGA

Ch1 App and Ch1 FPGA describe the firmware versions installed on Channel 1 in the RDMS™ receiver.

4.4.2.27.1.3.4 Ch2 App and Ch2 FPGA

Ch2 App and Ch2 FPGA describe the firmware versions installed on Channel 2 in the RDMS™ receiver.

4.4.2.27.1.3.5 Comb App and Comb FPGA

Comb App and Comb FPGA describe the firmware versions installed on the Combiner 1 in the RDMS™ receiver.

4.4.2.27.1.4 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.

4.4.2.27.1.5 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.

4.4.2.27.1.6 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.

4.4.2.27.1.7 Gateway

The Gateway address displays the Gateway network IP address. This is the address of the router that allows the RDMS to access networks outside of the network defined by the IP Address and Subnet (the local subnet). The Gateway address must be an address on this network. For example, if the IP Address is 192.168.100.1 and the

Subnet is 255.255.255.0, the Gateway could be anything in the 192.168.100.X network. If no Gateway is needed (all access to the RDMS comes from the same network it is on), the Gateway can safely be set to 0.0.0.0.

4.4.2.27.1.8 MAC

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

4.4.2.27.1.9 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 4.5), 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”.

4.4.2.27.1.10 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.

4.4.2.27.1.11 SD Card

The SD Card parameter provides information about the internal SD card. It includes the Manufacturer of the card, Manufacturer ID (in hexadecimal), Name of the card (may not have one), Original Equipment Manufacturer (OEM) ID (in hex), Hardware Revision number (in hex), Firmware Revision number (in hex), Serial Number (in hex), and the Date of manufacture as month/year (MM/YYYY).

System Info		Ch:2
System Version	18rc1	
DHCP	Off	
IP Address	192.168.0.250	
Subnet	255.255.0.0	
Gateway	192.168.0.1	
MAC	70:b3:d5:23:c0:42	
Alias	RDMS3--Maria's Te	
System IP	192.168.0.250	
SD Card	Samsung	

SD Card		Ch:2
Manufacturer	Samsung	
Manufacturer ID	0x00001b	
Name	00000	
OEM ID	0x534d	
HW Rev	0x1	
FW Rev	0x0	
Serial Number	0xf492066e	
Date	08/2014	

Figure 159: System Info Menu, SD Card Displays

4.4.2.27.2 Ethernet

The Ethernet screen, shown in Figure 160, is used to set the DHCP mode, the IP Address, Subnet, and Gateway address.

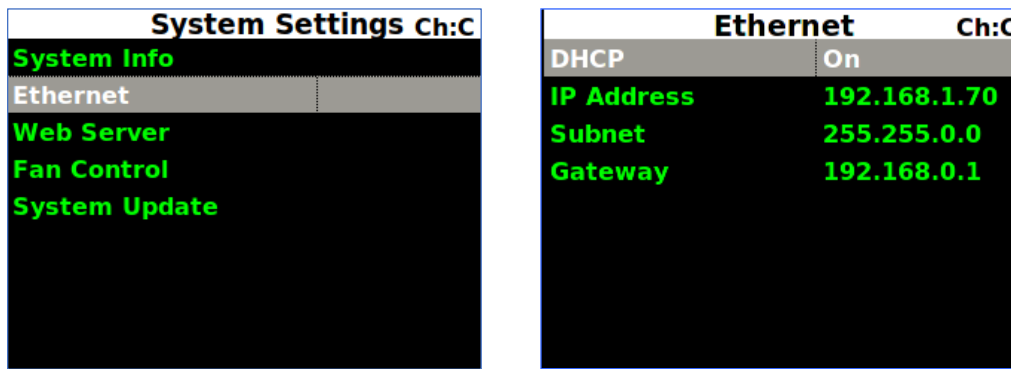


Figure 160: System Settings Menu, Ethernet Selection

4.4.2.27.2.1 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.

4.4.2.27.2.2 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 161), then press the Enter key.
2. Type the IP address in the IP Address entry screen (Figure 162), then press the Enter key.
3. To exit without making a change, press the Esc key.

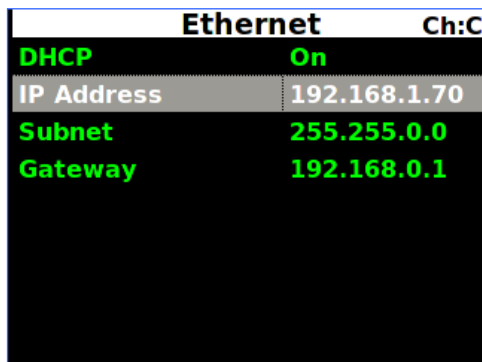


Figure 161: IP Address Selection

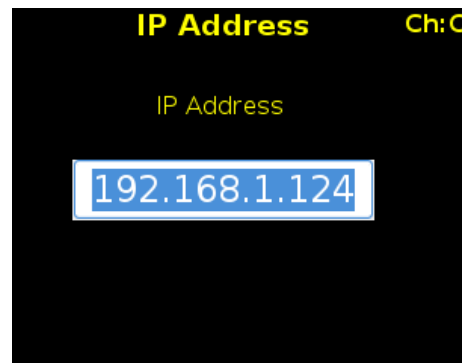


Figure 162: IP Address Entry

4.4.2.27.2.3 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 163), then press the Enter key.

2. Type the IP subnet in the IP Subnet entry screen (Figure 164), then press the Enter key.
3. To exit without making a change, press the Esc key.

Ethernet		Ch:C
DHCP	On	
IP Address	192.168.1.70	
Subnet	255.255.0.0	
Gateway	192.168.0.1	

Figure 163: IP Subnet Selection

IP Subnet Ch:C

IP Subnet

255.255.0.0

Figure 164: IP Subnet Entry

4.4.2.27.2.4 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 165), then press the Enter key.
2. Type the Gateway address in the Gateway entry screen (Figure 166), then press the Enter key.
3. To exit without making a change, press the Esc key.

Ethernet		Ch:C
DHCP	On	
IP Address	192.168.1.70	
Subnet	255.255.0.0	
Gateway	192.168.0.1	

Figure 165: Gateway Selection

Gateway Ch:C

Gateway

192.168.0.1

Figure 166: Gateway Entry

4.4.2.27.2.5 TMoIP Address

In an RDMS TMoIP unit, the TMoIP address displays on the Ethernet screen, as shown in Figure 167.

In units with the IP option, the TMoIP address for the rack unit is assigned automatically.

In units with the IP2 option, the user enters the desired TMoIP Address. It must be on the same subnet as the IP Address. It must also not conflict with any of the configured TMoIP channels' IP Addresses. The TMoIP address is used to access the browser interface for the TMoIP system.

Ethernet		Ch:C
DHCP	On	
IP Address	192.168.1.70	
Subnet	255.255.0.0	
Gateway	192.168.0.1	
TMoIP Address	192.168.1.172	

Figure 167: TMoIP Address

4.4.2.27.3 Web Server

The Web Server screen, shown in Figure 168, is used to set the HTTPS server parameter On or Off. This parameter may only be set from the front panel of the receiver. The current setting is displayed with the Ethernet parameters on the System Information window and is accessed via the About screen in the Browser Interface.

Note: When turning HTTPS On or Off, the web server must restart and may take up to one (1) minute to accept connections from a web browser.

HTTPS is a widely-used secure communication extension to HTTP that uses Transport Layer Security (TLS) to encrypt all communications between the client and server. It also enables authentication of the accessed website via a system of verified and trusted certificates. Enabling HTTPS on the RDMS ensures that the connection is being made to an authentic RDMS, and that all communications between the web browser and RDMS are secure.

System Settings	Ch:C
System Info	
Ethernet	
Web Server	
Fan Control	
System Update	

Web Server	Ch:C
HTTPS	Off

Figure 168: System Settings Menu, Web Server

Connection to the RDMS HTTPS server requires a Quasonix Root Authority certificate, obtained from Quasonix. This certificate is generated by Quasonix, and it is used to verify the server certificates presented by the RDMS upon

HTTPS connection with a web browser. The Quasonix Root Authority certificate must be imported into the browser prior to making an HTTPS connection to the RDMS. If a connection is made without importing the certificate, the user could see one of the following security/privacy errors from the browser:

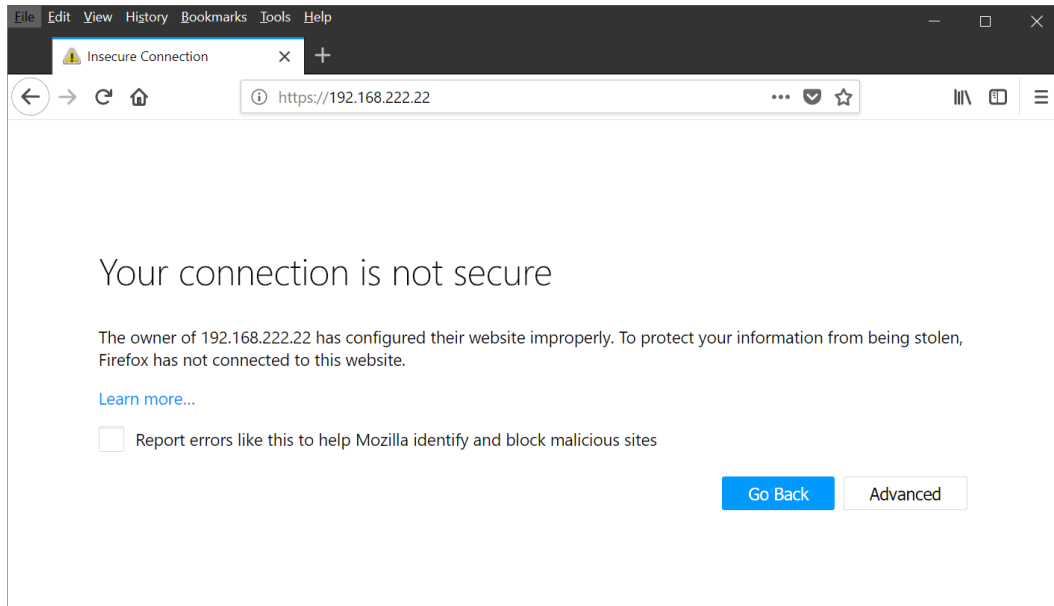


Figure 169: Firefox HTTPS Connection Without Quasonix Certificate Imported

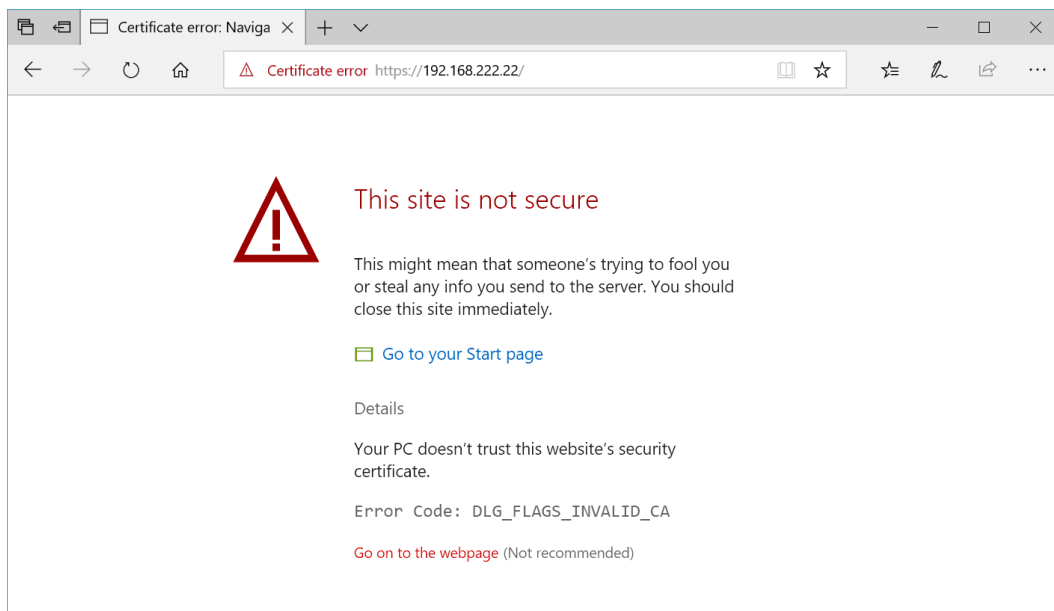


Figure 170: Edge HTTPS Connection Without Quasonix Certificate Imported

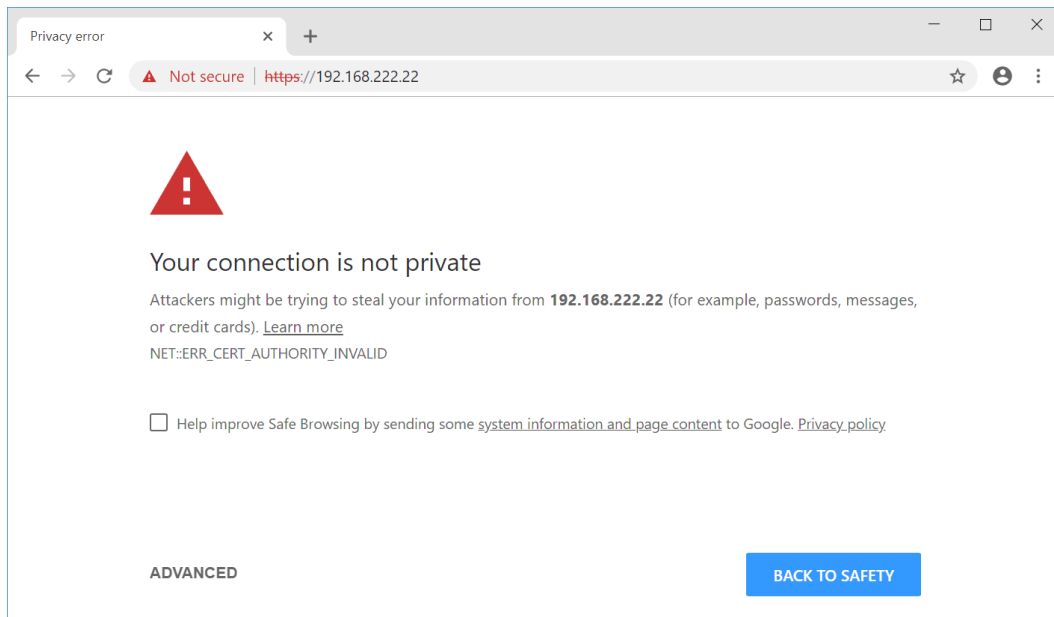


Figure 171: Chrome HTTPS Connection Without Quasonix Certificate Imported

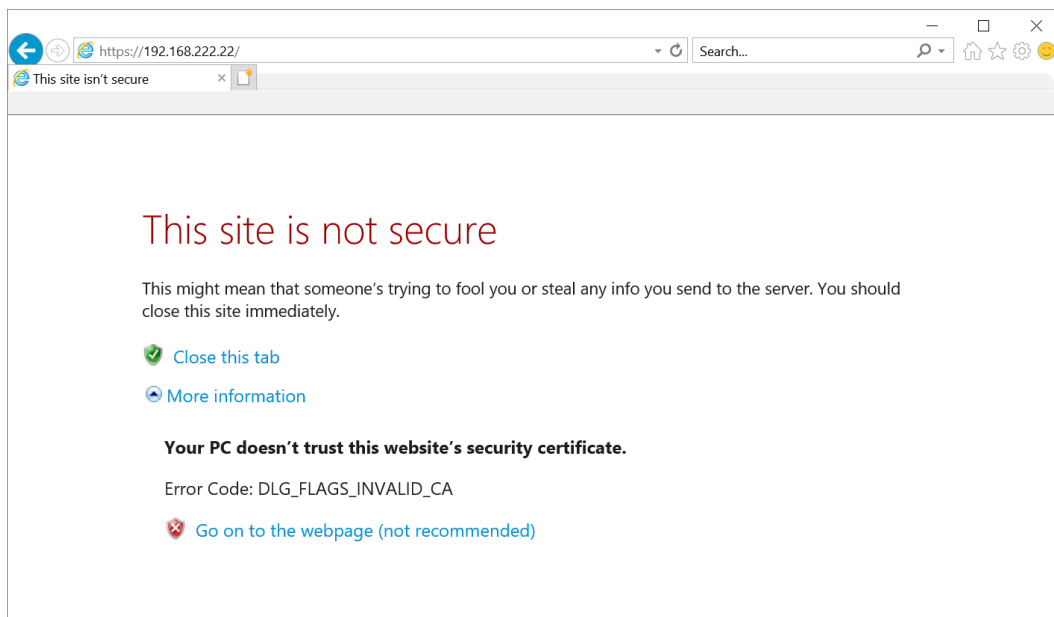


Figure 172: Internet Explorer HTTPS Connection Without Quasonix Certificate Imported

In order to instruct the browser to ‘trust’ the certificate provided by the RDMS, the user must import the Quasonix Root Authority certificate. Instructions for importing the certificate into the browser vary by application and are located in section 17, Appendix J.

After the Quasonix Root Authority certificate has been imported into the browser, the browser will indicate a secure connection to the RDMS, as seen in Figure 173 through Figure 176. Connect to the HTTPS Browser Interface by entering “https://” followed by the IP address of the RDMS (for example, https://192.168.222.22). When the connection is made, you may operate the interface just as you would with the standard HTTP interface. The browser indicates a secure connection by displaying a padlock image in the address bar.

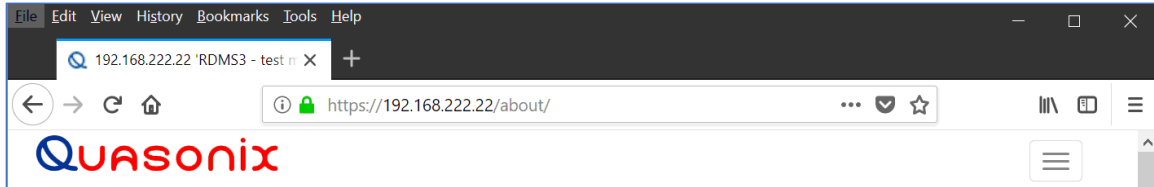


Figure 173: Firefox Secure HTTPS Connection

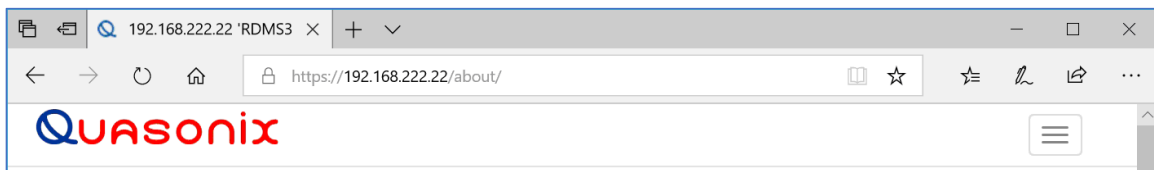


Figure 174: Edge Secure HTTPS Connection

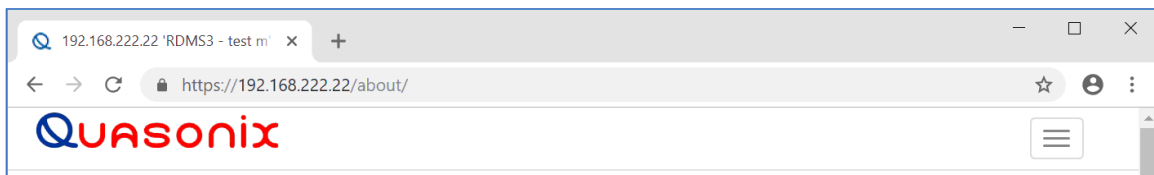


Figure 175: Chrome Secure HTTPS Connection

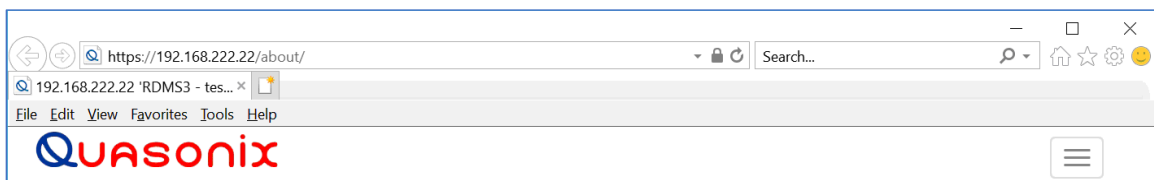


Figure 176: Internet Explorer Secure HTTPS Connection

4.4.2.27.3.1 Web Server Differences with CS1 Option

With the CS1 Cybersecurity option, two items are added to the Web Server screen: User Certificate and HSTS. When User Certificate is turned On, the RDMS web server utilizes an HTTPS Certificate provided by the user instead of a certificate generated internally by the RDMS. A User Certificate provides the user more control over the creation and signing of the certificate, which may be required in some installations. The HSTS setting stands for HTTP Strict Transport Security and is a web security policy that allows the RDMS web server to declare that web browsers should connect to it using only HTTPS connections.

4.4.2.27.3.1.1 User Certificate

In order to use a user-provided certificate, the following general steps must be performed:

1. Create directory structure for use with OpenSSL
2. (Optionally) Create a Certificate Authority and Key
3. Create a server certificate and private key that will be utilized by the RDMS web server.
4. Present the server certificate to your signing authority to have it signed.
5. Upload the certificate and private key to the RDMS via the 'admin' user account.
6. Enable the User Certificate setting on the Web Server screen.
7. Upload your Certificate Authority certificate to your web browser.

In these instructions, Quasonix recommends the use of OpenSSL v1.1.1d or newer. Other tools and methods are available to create certificates and keys, but only OpenSSL is officially supported to work with this User Certificate feature. Additionally, keep in mind that this is merely one configuration that will work. OpenSSL is a complex tool with many configurations and capabilities.

4.4.2.27.3.1.1.1 Create Directory Structure

In order to use OpenSSL for key and certificate creation, a directory structure must be set up. Create a main directory to use with OpenSSL (the example below uses `rdms_server_cert`), and create the following subdirectories: `certs`, `crl`, `csr`, `newcerts`, and `private`. In the main directory, create an empty file named `index.txt` and a file named `serial` with contents '1000'. Finally, create a file called `openssl.cnf` with the following contents. Some entries need to be changed to reflect your setup and are highlighted in the file listing.

```
# OpenSSL root CA configuration file.

[ ca ]
# `man ca`
default_ca = CA_default

[ CA_default ]
# Directory and file locations.
Dir                = /home/jm/rdms_cert_inst
certs              = $dir/certs
crl_dir            = $dir/crl
new_certs_dir      = $dir/newcerts
database           = $dir/index.txt
serial             = $dir/serial
RANDFILE           = $dir/private/.rand

# The root key and root certificate.
Private_key        = $dir/private/ca.key.pem
certificate         = $dir/certs/ca.cert.pem

# For certificate revocation lists.
```

```

Crlnumber          = $dir/crlnumber
crl                 = $dir/crl/ca.crl.pem
crl_extensions     = crl_ext
default_crl_days   = 30

# SHA-1 is deprecated, so use SHA-2 instead.
Default_md         = sha256

name_opt           = ca_default
cert_opt           = ca_default
default_days       = 375
preserve           = no
policy             = policy_def

[ policy_def ]
countryName        = optional
stateOrProvinceName = optional
organizationName   = optional
organizationalUnitName = optional
commonName         = supplied
emailAddress       = optional

[ req ]
# Options for the `req` tool (`man req`).
default_bits       = 2048
distinguished_name = req_distinguished_name
string_mask        = utf8only

# SHA-1 is deprecated, so use SHA-2 instead.
Default_md         = sha256

# Extension to add when the -x509 option is used.
X509_extensions    = v3_ca

[ req_distinguished_name ]
# See <https://en.wikipedia.org/wiki/Certificate\_signing\_request>.
countryName        = Country Name (2 letter code)
stateOrProvinceName = State or Province Name
localityName       = Locality Name
0.organizationName = Organization Name
organizationalUnitName = Organizational Unit Name
commonName         = Common Name
emailAddress       = Email Address

[ v3_ca ]
# Extensions for a typical CA (`man x509v3_config`).
subjectKeyIdentifier = hash
authorityKeyIdentifier = keyid:always,issuer
basicConstraints = critical, CA:true
keyUsage = critical, digitalSignature, cRLSign, keyCertSign

[ server_cert ]
# Extensions for server certificates (`man x509v3_config`).
basicConstraints = CA:FALSE
nsCertType = server
nsComment = "OpenSSL Generated Server Certificate"
subjectKeyIdentifier = hash
authorityKeyIdentifier = keyid,issuer:always
keyUsage = critical, digitalSignature, keyEncipherment
extendedKeyUsage = serverAuth
subjectAltName = @alternate_names

```



```
[ crt_ext ]
# Extension for CRLs (`man x509v3_config`).
authorityKeyIdentifier=keyid:always

[ ocsf ]
# Extension for OCSF signing certificates (`man ocsf`).
basicConstraints = CA:FALSE
subjectKeyIdentifier = hash
authorityKeyIdentifier = keyid,issuer
keyUsage = critical, digitalSignature
extendedKeyUsage = critical, OCSPSigning
[ alternate_names ]
# Provide all IP and DNS names used by this server
# IP.1 = x.x.x.x
# DNS.1 = rdms1.xxx
IP.1 = 10.1.1.18
DNS.1 = mytestrdms.q
```

Change the following entries to match your setup:

- ‘dir’ – should indicate the path to your main directory
- ‘default_days’ – change to the number of days you want the certificate to be valid
- ‘IP.1’ – set to the IP address of the RDMS
- ‘DNS.1’ (.2, .3, etc.) – set to the DNS name(S) you’ve given this RDMS in your DNS server

4.4.2.27.3.1.1.2 Create a Certificate Authority (CA) and Key (Optional)

If you do not already have a Certificate Authority that will sign your server certificate, you must create one. This only needs to be done once if you are signing multiple server certificates. Change directory to the directory you created above and perform these steps:

1. Generate CA Key
 - a. `openssl genrsa -aes256 -out private/ca.key.pem 4096`
 - b. When prompted, provide a passphrase that you will use when signing server certificates
2. Generate CA Certificate
 - a. `openssl req -config openssl.cnf -key private/ca.key.pem -new -x509 -days 7300 -sha256 -extensions v3_ca -out certs/ca.cert.pem`
 - b. When prompted, provide the passphrase created in the previous step.
 - c. Provide Country Name, State or Province Name, Locality, Org Name, Org Unit Name, Common Name, and Email Address for the Certificate Authority. Common Name is required.

4.4.2.27.3.1.1.3 Create Server Certificate and Private Key

Next, generate the server certificate and key that will be uploaded to the RDMS and used by it when connections are made to the browser interface over HTTPS.

1. Generate RDMS Server Key
 - a. `openssl genrsa -out private/rdms1.key.pem 2048`
2. Generate RDMS Server Certificate Signing Request (CSR)
 - a. `openssl req -config openssl.cnf -key private/rdms1.key.pem -new -sha256 -out csr/rdms1.csr.pem`

- b. When prompted, provide the Country, State, Locality, Organization, Organizational Unit, Common Name, and Email Address for the RDMS Server Certificate. Common Name is required and must be either the DNS name of the server or its IP address.

4.4.2.27.3.1.1.4 Sign Server Certificate

If you have created a Certificate Authority above, use it to sign the server certificate. Otherwise, present your CSR to your authority to create a signed certificate for the RDMS.

1. Create a Signed Server Certificate
 - a. `openssl ca -config openssl.cnf -extensions server_cert -days 375 -notext -md sha256 -in csr/rdms1.csr.pem -out certs/rdms1.cert.pem`
 - b. Enter the CA password created above
 - c. The contents of the newly signed certificate are displayed.
 - d. When prompted, answer 'y' to two questions "Sign the certificate?" and "1 out of 1 certificate requests certified, commit?"

4.4.2.27.3.1.1.5 Upload Certificate and Private Key to RDMS

4.4.2.27.3.1.1.5.1 Admin User

A user named 'admin' is provided to allow for uploading of the certificate and private key to the RDMS. This user has very restricted capability and is limited to uploading files and changing its password.

The default password for the user 'admin' is QRSAAtMC3L53HXLgtx.

The password should be changed by the user, but understand that there is currently no way to reset or retrieve the password if it is forgotten. Be sure to record the password in some fashion and keep it protected.

In order to change the admin password, first ssh to the RDMS server using

- `ssh admin@IP`
where IP is the IP address of the RDMS

When connected, use the following command to change the password:

- `passwd`
When prompted, provide the current password, then the desired new password.

Type 'exit' to exit the ssh session.

4.4.2.27.3.1.1.5.2 Uploading Files to RDMS

In order to upload the Server Certificate and Private Key, use the scp utility.

First change the certificate file name (certs/rdms1.cert.pem above) to user.cert.pem and the key file name (private/rdms1.key.pem above) to user.key.pem. Note that the file names cannot be changed via the scp utility and only one file can be sent at a time. 'IP' is the IP address of the RDMS.

1. `scp certs/user.cert.pem admin@IP:~/`
2. `scp private/user.key.pem admin@IP:~/`

4.4.2.27.3.1.1.5.3 Enable User Certificate

After the certificate and key files have been uploaded to the RDMS, they must be latched into place and utilized by the server.

On the Web Server screen, set User Certificate to ‘On’. If it is already ‘On’, turn it ‘Off’ and back ‘On’ again. This setting restarts the web server, so it may take up to one minute in order to affect the change.

4.4.2.27.3.1.6 Configure Browser to use your Certificate Authority Certificate

Follow the directions in Appendix I – Import Quasonix Root Authority Certificate, but use the Certificate Authority you created above, instead of the Quasonix Root Authority.

4.4.2.27.3.1.2 HSTS

HTTP Strict Transport Security (HSTS) can be enabled through the Web Server menu on units with the CS1 part number. When enabled, the RDMS responds to HTTPS connection attempts with a ‘Strict Transport Security’ header that notifies the connecting Browser that all attempts to connect to this RDMS should be by HTTPS. Thus, after receiving this header, a Browser always requests the HTTPS site even if the URL is entered with HTTP.

Note that HSTS is only specified to work with URLs given with names, not IP addresses. If the RDMS is addressed via an IP address, HSTS will not take affect. This also means that you need a DNS server to provide the name to IP address translation for Browsers using a name. This name must also be included in the User Certificate that you’ve generated for the RDMS (refer to section 4.4.2.27.3.1.1).

If HSTS is used on an RDMS, and HTTPS is subsequently turned off on the RDMS, it may be impossible to access the RDMS via a Browser that has previously received the HSTS header (because it will always ask for the HTTPS site). If this occurs, you can use a Browser that has not received the HSTS header, or manually remove the HSTS information from the Browser (this varies by Browser and is not covered here).

4.4.2.27.4 Fan Control

The Fan Control screen, shown in Figure 177, is used to alter the fan speed on the receiver. When Dynamic is set to On, the fan speed adjusts up or down depending on the temperature of the internal bricks or rack controller board. When it is Off, the fans run in the default mode.

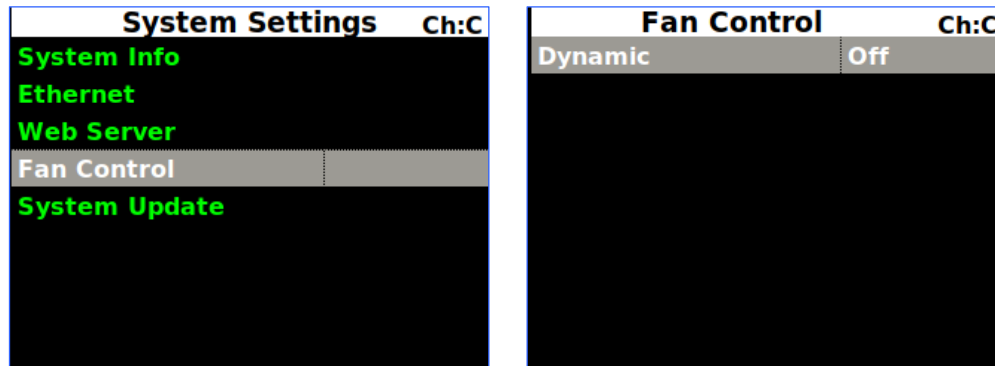


Figure 177: System Settings Menu, Fan Control

4.4.2.27.5 System Update (RDMS Local Update)

The RDMS now supports a firmware update using local USB media. This feature relies on an encrypted and signed firmware update file provided by Quasonix upon release of all versions after R15.

Note: The R15 update is a ‘gatekeeper’ release and must be performed prior to updating to R16 or beyond. If required, please contact Quasonix to request an R15 update card.

To perform a local update:

1. Obtain a firmware update file from Quasonix.
2. Transfer the update file to the root directory of a USB thumb drive, then plug the drive into the RDMS via the back port, or via the front port with an adapter.
 - The USB drive must be 32 GB, or smaller, and must be formatted as FAT32 (Windows) or Ext4 (Linux).
 - The update file must NOT be renamed, and must be the only update file on the USB drive.
3. Access the System Update screen, as shown in Figure 178. Press the Enter key.
4. Select Perform Local Update, then press the Enter key.

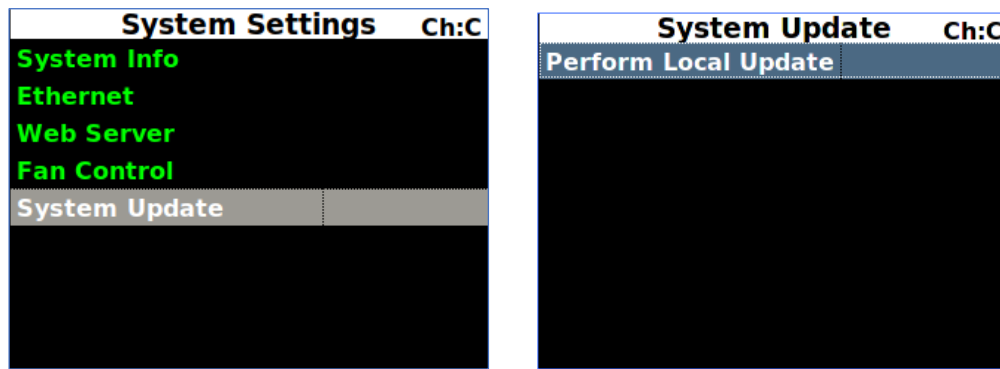


Figure 178: System Update, Perform Local Update Selection

After pressing Enter, the front panel displays the Perform Local Update screen, as shown in Figure 180.

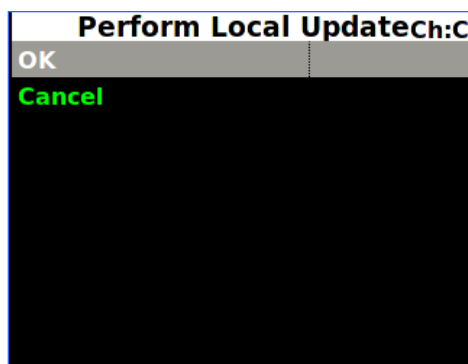


Figure 179: Perform Local Update Screen

5. Select OK, then press Enter to start the update.

The front panel displays the RDMS3 Local Update screen, as shown in Figure 180.

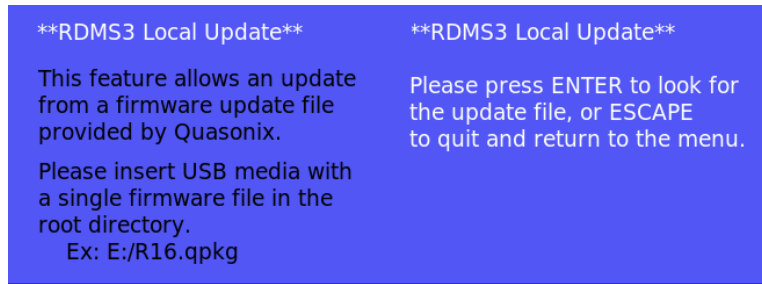


Figure 180: RDMS3 Local Update Screen

6. Press Enter to search the USB drive for the update file.
7. If a proper update file is found, the name of the file displays on the front panel along with additional instructions, as shown in Figure 181.

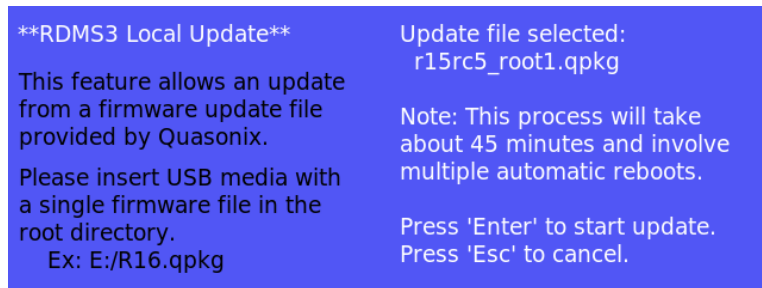


Figure 181: RDMS3 Local Update Screen, Update File Selected

8. Press Enter to start the update. The RDMS copies the update file from the USB drive and begins the update.
 - Do not power off the RDMS during the update.
 - During the update, a status displays, as shown in Figure 182.
 - The RDMS will reboot twice during the update.
 - After the first reboot, the front panel displays are automatically updated first. This update may cause the screens to be blank for several minutes while they are being updated.

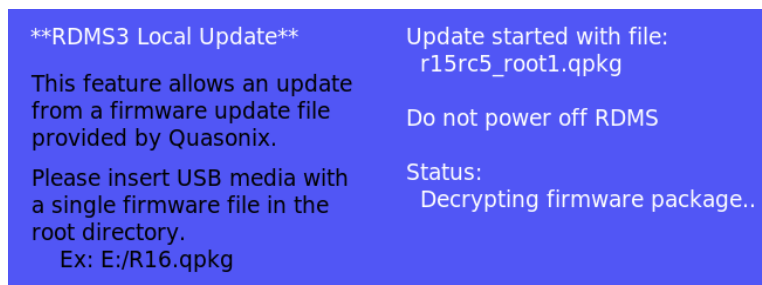


Figure 182: RDMS3 Local Update Screen, Update Status

Upon completion of the update, the RDMS returns to normal operating mode and all parameters are reset to system defaults.

9. Navigate to the System Settings screen, then select, as shown in Figure 183, to verify that the System Version matches the firmware update version.

System Settings Ch:C		System Info Ch:C	
System Info		Model	3rd Gen RDMS: 1
Ethernet		Serial Number	3044
Web Server		System Version	15rc3
Fan Control		FP Version	1.15.7
System Update		Ch1 Version	0000104E:Oct 25
		Ch2 Version	0000104E:Oct 25
		ChC Version	0000104E:Oct 25
		DHCP	On
		IP Address	192.168.3.22

Figure 183: System Settings, System Info

4.4.2.28 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

4.4.2.28.1 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.

Main Menu Ch:C		Graphics Menu Ch:C	
Mod Scaling	Acquire	Graph Type	Eye Pattern
Mod Persist	Off	Signal Strength	Absolute
HyperTrack	Disabled		
AGC Menu			
AM Menu			
Options Menu			
Advanced Menu			
System Settings			
Graphics Menu			

Figure 184: Main Menu, Graphics Menu Selection and Graphics Menu, Graph Type

Examples of the Eye Pattern (PCM/FM) (Figure 185), Constellation (SOQPSK) (Figure 186), Constellation (STC) (Figure 191 and Figure 192), and Spectrum (Figure 187 and Figure 188) are shown in the associated figures.

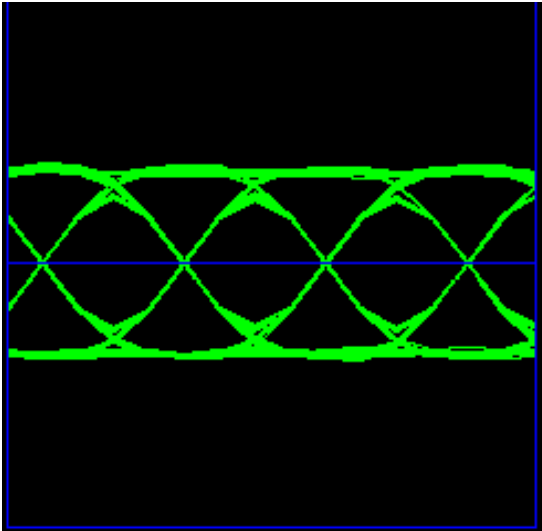


Figure 185: PCM/FM Eye Pattern

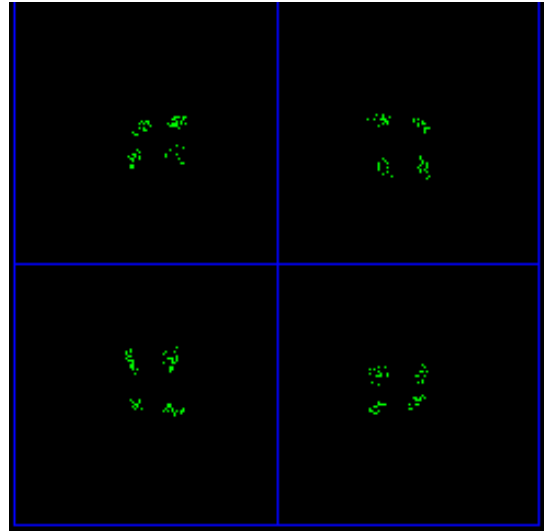


Figure 186: SOQPSK Constellation

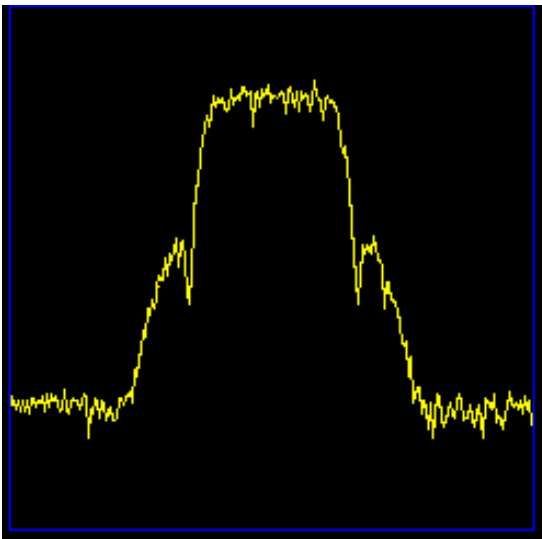


Figure 187: PCM/FM Spectrum Display

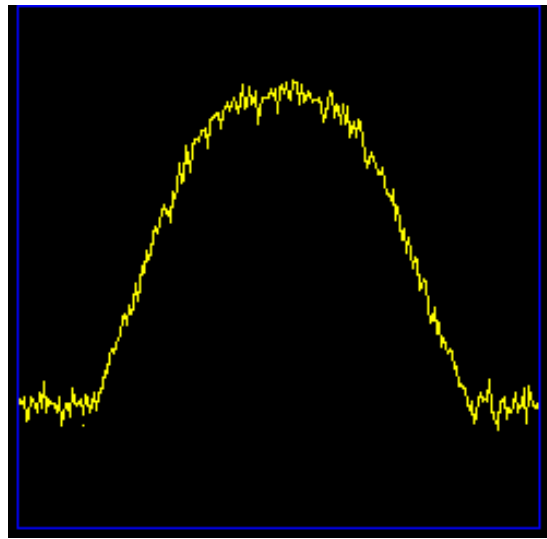


Figure 188: SOQPSK Spectrum Display

4.4.2.28.1.1 Multi-h CPM (MHCPM)

The “constellation” for MHCPM, shown in Figure 189, is synthetic in nature. The waveform is really just a 4-ary FSK signal with very narrow tone spacing and a smooth pulse shape that produces a very compact spectrum. To achieve the detection efficiency comparable to single symbol PCM/FM or SOQPSK, the frequencies of the tones

periodically change to extend the length over which phase trajectory of different data sequences can rejoin. This increases the minimum distance, thereby improving the Eb/No performance.

Since the MHCPM waveform is heavily filtered, there is no traditional “eye” opening that can be viewed with an oscilloscope. Therefore, a synthetic two point constellation display is produced from the output of the trellis detector that is required to demodulate and recover the data. The trellis detector effectively computes the correlation between the received signal and all possible phase trajectories that could have been generated by the transmitter. For each data symbol, the one with the largest correlation is declared to be the winner, and two data bits are produced. The “constellation” display is created by multiplying the correlation value (real and imaginary) by the sign of the individual data bit (+1 for 1, -1 for 0). This produces a “BPSK”-like constellation with two ideal dots at 0 degrees ($x = 1, y=0$), or 180 degrees ($x = -1, y=0$). It behaves like a BPSK constellation in the sense that dots farther apart on the x axis indicate a better signal, the dot spread relates to SNR, and dots that tilt to the left or right show phase rotation.

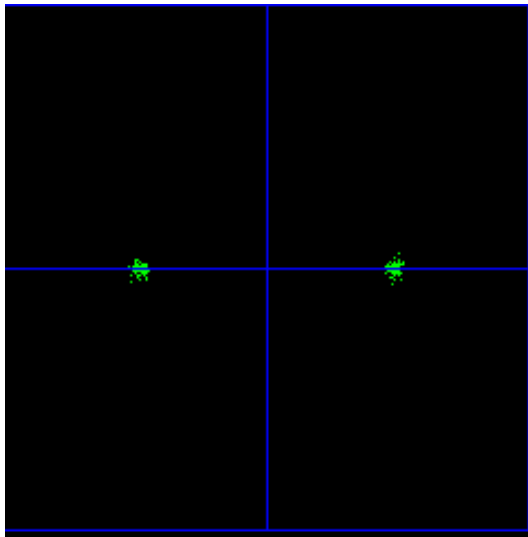


Figure 189: MHCPM Constellation

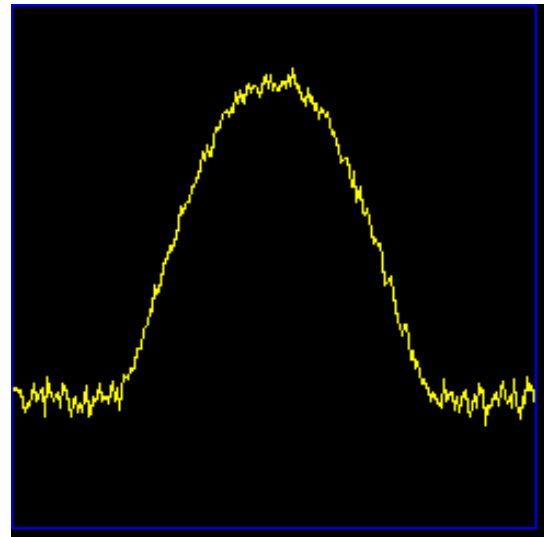


Figure 190: MHCPM Spectrum Display

4.4.2.28.1.2 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 191. The individual parts of the display are labeled in Figure 192.

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 $\frac{1}{4}$ 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.

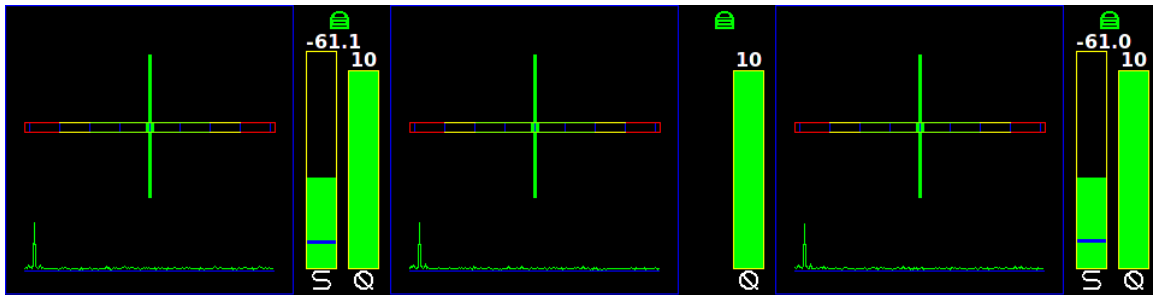


Figure 191: STC Constellation Display for Channel 1, Combiner, and Channel 2

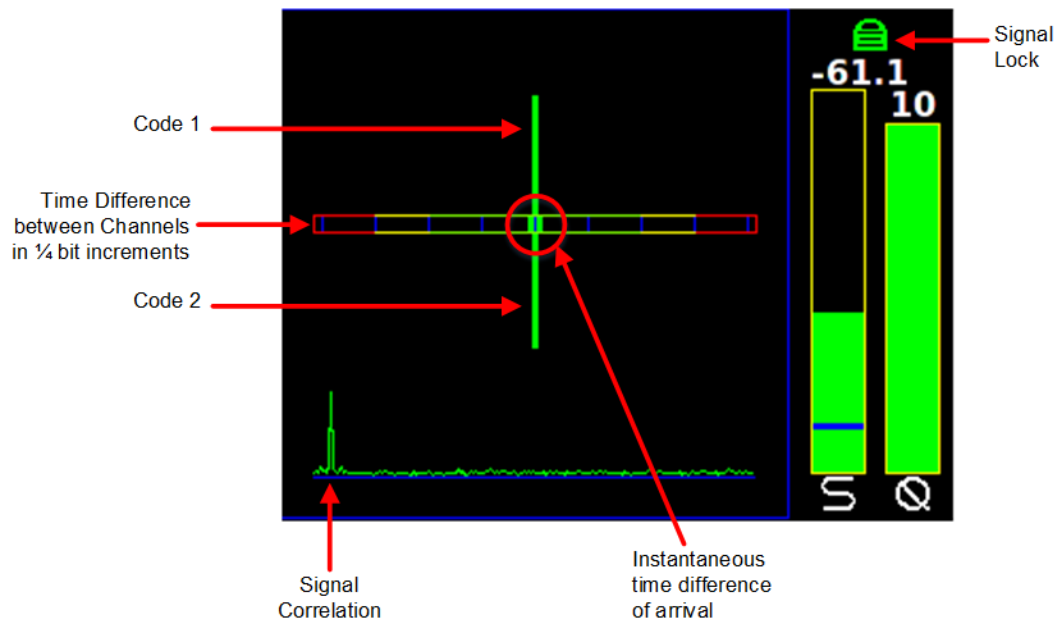


Figure 192: Labeled STC Constellation Display for Channel 1

4.4.2.28.2 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.

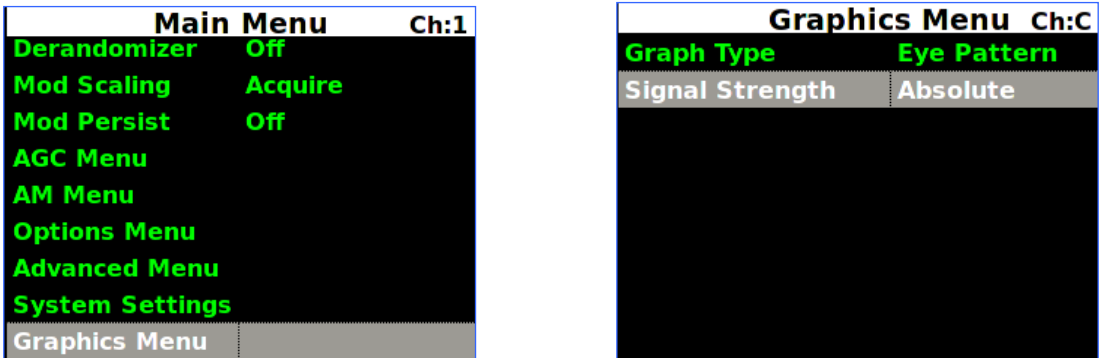


Figure 193: Main Menu, Graphics Menu Selection and Graphics Menu, Signal Strength

4.4.2.29 EVTM Menu

The EVTM Menu is only available with the EN option. Refer to Appendix 18 – RDMS with -EN Option for details.

4.5 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 194, and five selections that display a variety of parameters for each available channel. The Browser Interface defaults to the Network screen.

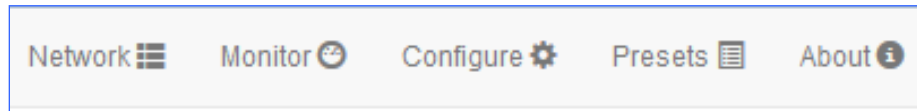


Figure 194: RDMS™ Browser Interface Header Tool Bar

4.5.1 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 4.4.2.10.

Figure 195 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 196 shows a closeup of the right half of the Network screen with combiners only displayed. Figure 197 shows a closeup of the left side of the Network screen with the Configure and Monitor buttons.

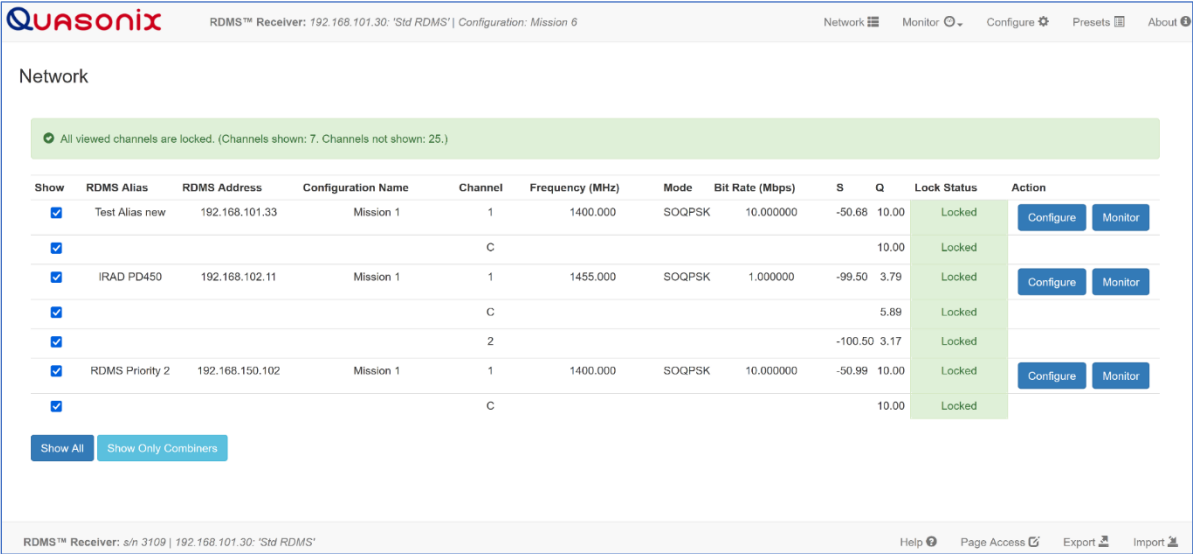


Figure 195: Network Screen with Multiple Receivers and Active Channels

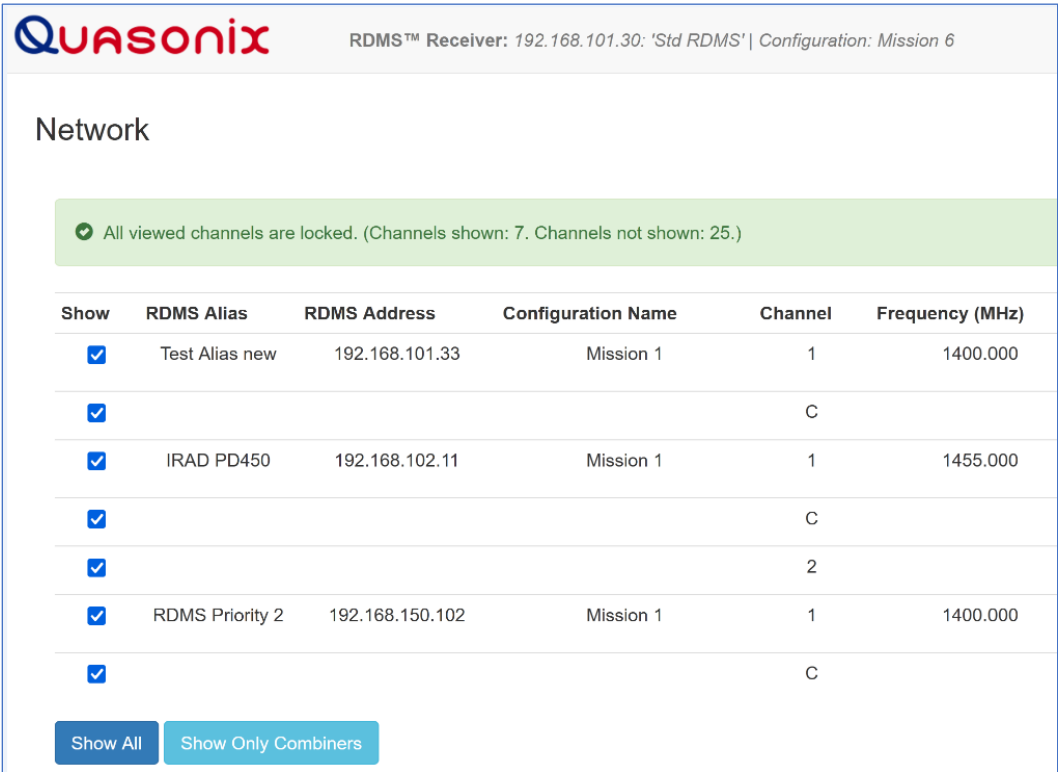


Figure 196: Network Screen, Closeup of Left Side, Combiners Only

NetworkMonitorConfigurePresetsAbout

Mode	Bit Rate (Mbps)	S	Q	Lock Status	Action
SOQPSK	10.000000	-50.68	10.00	Locked	ConfigureMonitor
			10.00	Locked	
SOQPSK	1.000000	-99.50	3.79	Locked	ConfigureMonitor
			5.89	Locked	
		-100.50	3.17	Locked	
SOQPSK	10.000000	-50.99	10.00	Locked	ConfigureMonitor
			10.00	Locked	

Figure 197: Network Screen, Closeup of Right Side

4.5.2 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 198.

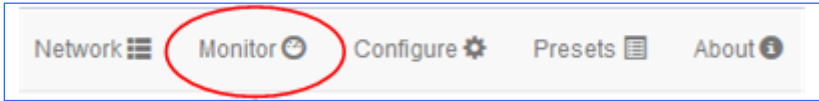


Figure 198: RDMS™ Browser Interface Tool Bar

The unit information displays in the Monitor view, as shown in Figure 199.

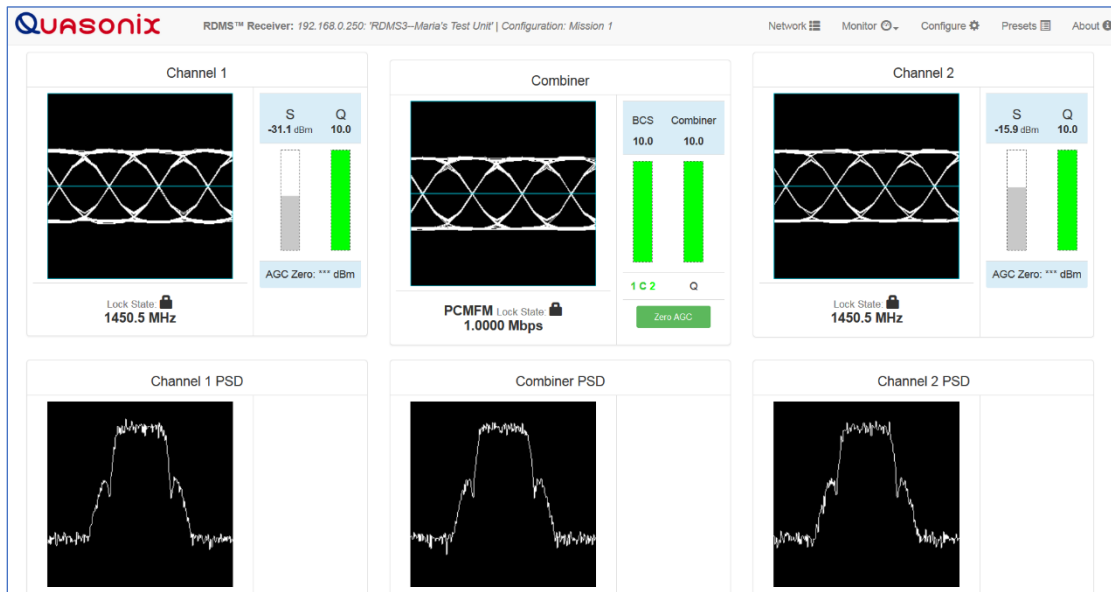


Figure 199: Browser Interface Monitor Screen

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, best channel, 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 200.

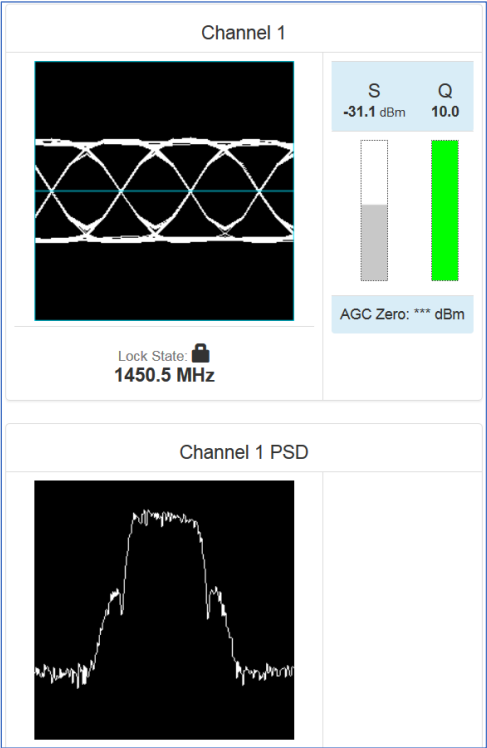


Figure 200: Monitor Screen for RDMS™ with Only One Channel Available

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 201, or displayed in the center of the screen between Channel 1 and Channel 2 when the combiner is Off, as shown in Figure 202.

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

Figure 201: Monitor Screen Partial Status Information Block when Combiner On

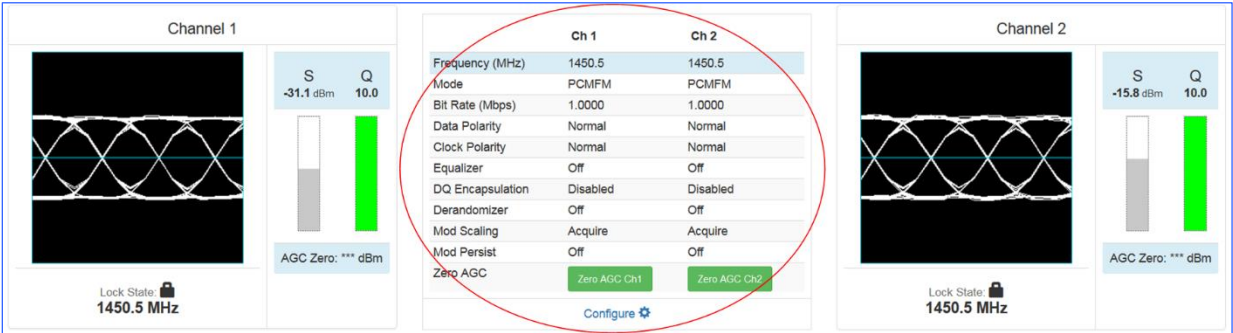


Figure 202: Monitor Screen Partial Status Information Block when Combiner Off

4.5.2.1 Signal Graph and Signal Indicators

The Signal Graph, shown in Figure 203, 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 203.

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

- Signal Lock detection
- Signal Strength
- Data Quality Metric (DQM)

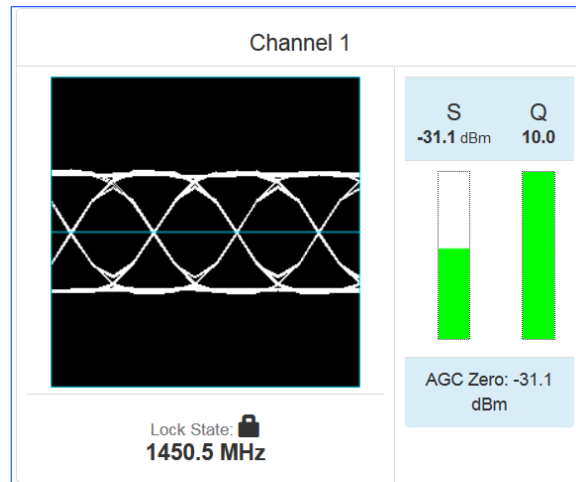


Figure 203: Signal Graph and Signal Indicators Windows

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 4.5.3.9.

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 204) indicates AGC is not zeroed and the value is invalid
- Small “r” displayed next to the Signal label indicates AGC Zero Relative was selected

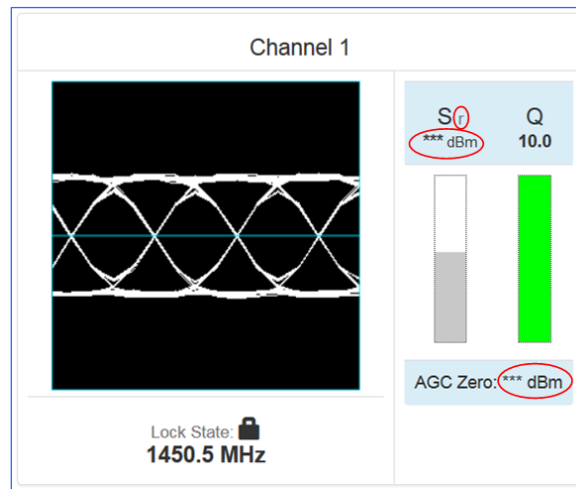


Figure 204: Signal Graph and Signal Indicators Windows, Zero AGC Signal Display “Relative”

The Data Quality Metric (Q) graph displays to the right of the Signal 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.

4.5.2.2 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 205.

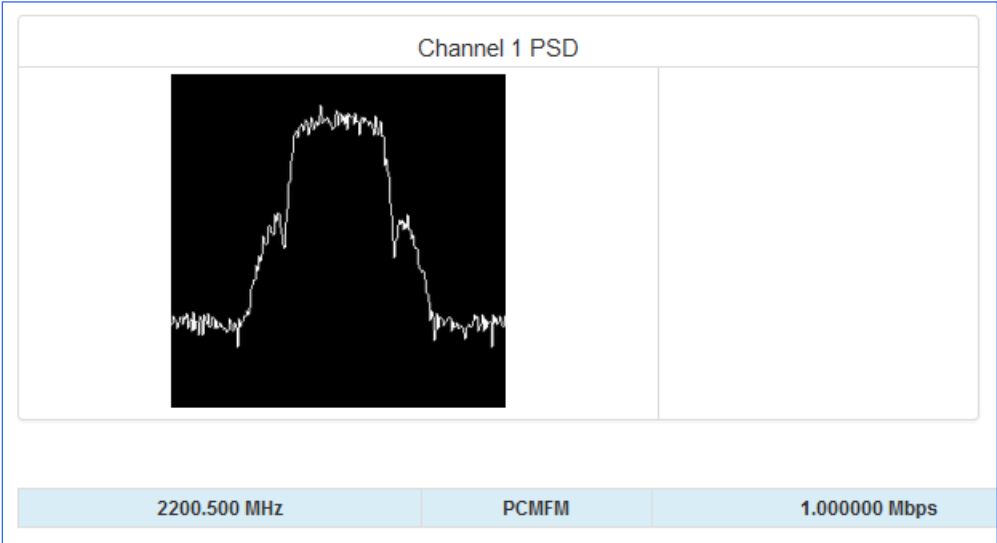


Figure 205: Power Spectral Density Plot Window

4.5.2.3 Diversity Combiner

If the optional diversity combiner is installed and enabled between two channels, then a Best Channel Source 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 206.

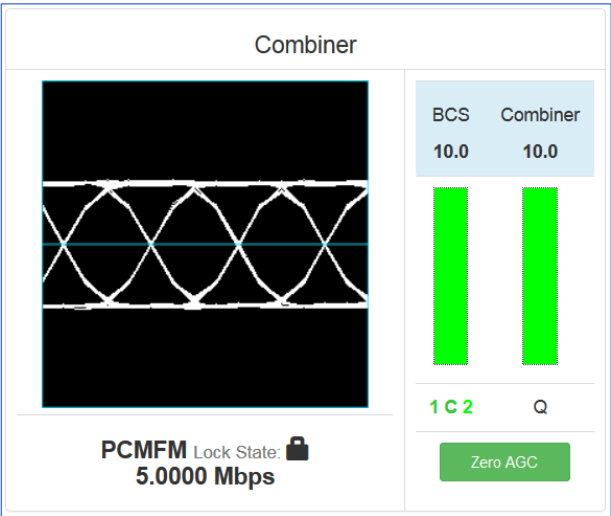


Figure 206: Diversity Combiner Link with Locked Signal

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.

Best Channel Selector (BCS) status is only displayed with the Combiner option enabled and set to On. This status displays at the bottom of the combiner signal indicator window. Refer to front panel section 4.4.2.19.8.1 for detailed information and examples of the BCS display.

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

4.5.2.4 Monitor Selective Display Options

The down arrow next to the Monitor option on the Menu Bar, shown in Figure 207, enables selection of specific items to monitor while reducing bandwidth requirements. The user may view:

- Full Monitor screen
- Eye pattern or Constellation only
- PSD (spectrum display) only
- Combiner display only

Examples of each display type are shown in the following figures.

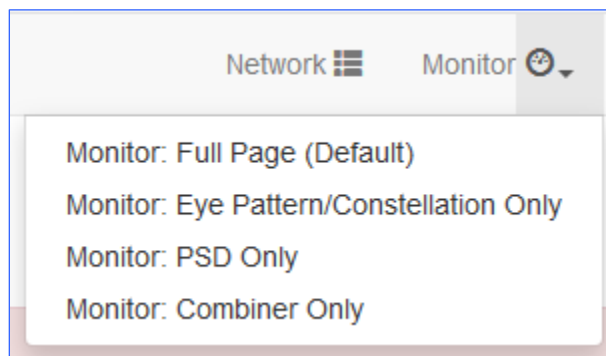


Figure 207: Monitor Display Menu

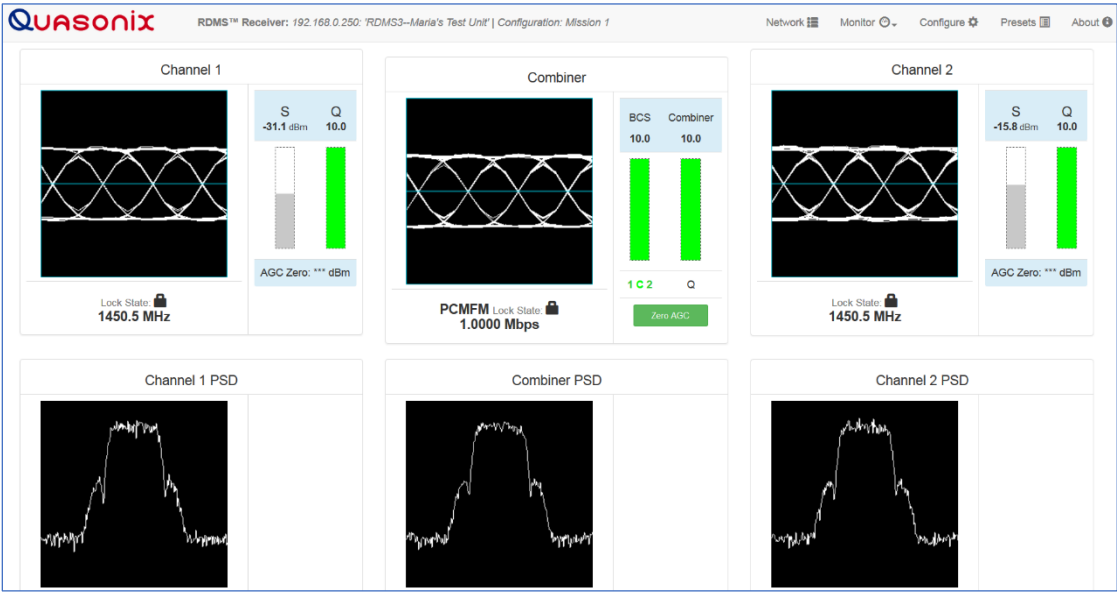


Figure 208: Monitor Full Display (Default)

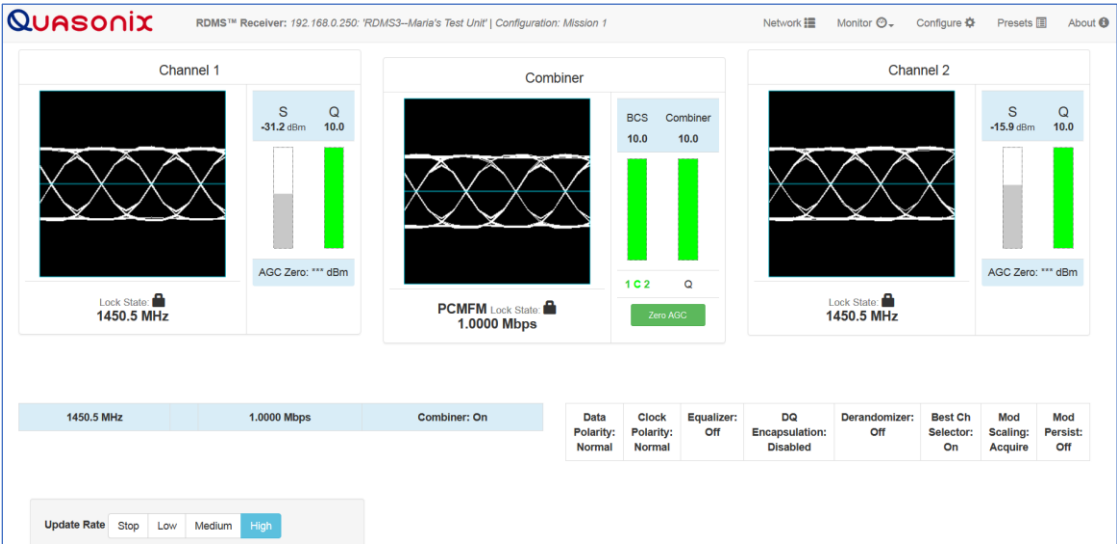


Figure 209: Monitor Eye Pattern/Constellation Display Only



Figure 210: Monitor PSD (Spectrum) Only

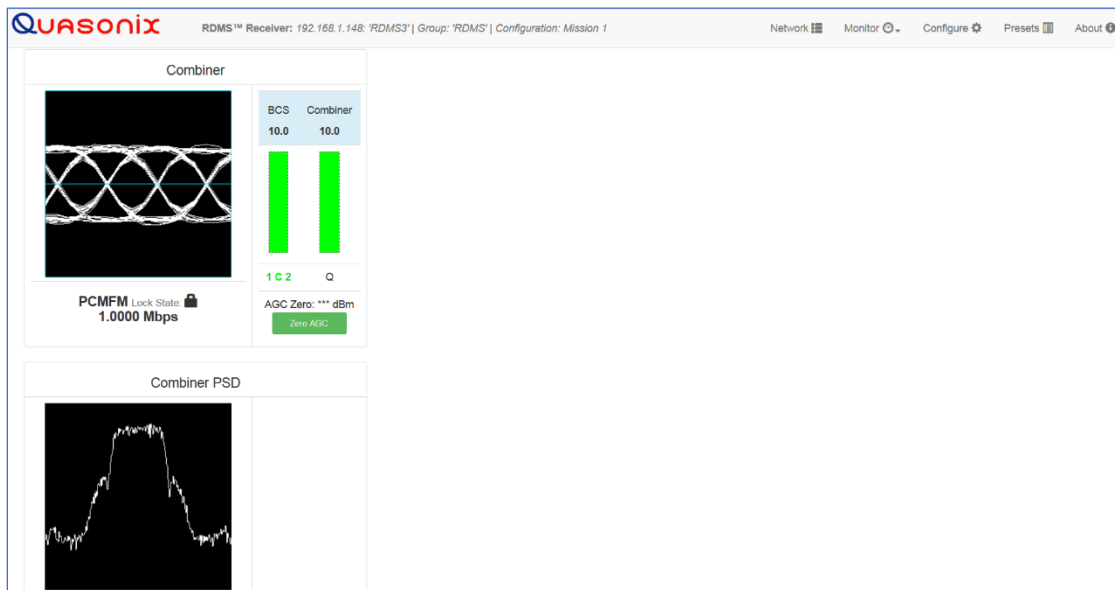


Figure 211: Monitor Combiner Display Only

4.5.2.5 Client Level Update Rate

Users may override the receiver level update rate temporarily. The Update Rate buttons at the bottom of the Monitor screen are used to change in increments between low, medium, and high. The user may press the Stop button to temporarily pause the screen transmission. This has the effect of taking a snapshot in time (freezing the page) and is useful to more closely evaluate details, such as a spectrum curve. Network bandwidth usage is roughly halved as you progress through each setting from High to Low. High is the as-shipped default setting. The receiver continues normal operation if the Monitor screen is temporarily stopped.

Navigation away from the screen and back does not change the setting, however, a refresh or reload of the screen automatically resets the frame rate to the default. For information about setting the default update rate, refer to Monitor Page Default Update Rate on the About screen, section 4.5.5.1.

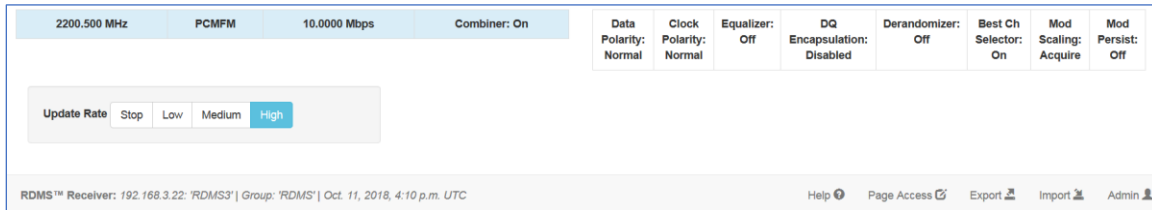


Figure 212: Monitor Update Rate Adjustment

4.5.3 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 213.

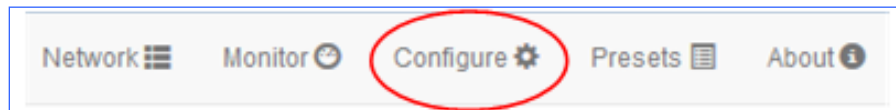


Figure 213: RDMS™ Browser Interface Header Tool Bar

All changes to configuration parameters are highlighted in green until the Send Settings or Refresh buttons are activated. This is a visual reminder that something has changed.

4.5.3.1 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 214.

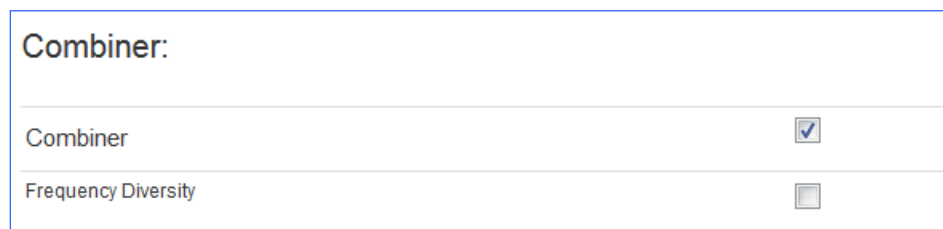


Figure 214: Configure Screen, Combiner Section

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.

4.5.3.1.1 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.

4.5.3.2 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 215). Click on any field within the Configure screen to change and save settings for Channel 1, Channel 2, or both channels (Figure 216).

QUASONIX RDMS™ Receiver: 192.168.1.148: RDMS3 | Group: RDMS | Configuration: Mission 1

Network Monitor Configure Presets About

Configure: View or Modify Current Receiver Settings

Mission 1

Mission Description

Send Settings Save As Preset... Refresh

Combiner:

Combiner ☒

Frequency Diversity ☐

Changes affect the current active configuration.

Description	Value
Frequency (MHz)	1150
Mode	PCMF
Bit Rate (Mbps)	1
Data Polarity	Normal
Clock Polarity	Normal
Equalizer	<input checked="" type="checkbox"/>
DQ Encapsulation	<input checked="" type="checkbox"/>
Derandomizer	Off

Advanced Settings

System Settings:

Antenna Controls

Clock/Data Output Controls

Test Utilities

Advanced:

Zero AGC ☒ RSSI Display: Absolute

Reset to Factory Defaults

Shutdown Hardware

Reboot System

Figure 215: Configuration Screen with Combiner On, Channel 1 Displays

Name: Maria 1
Description: Mission Description
 Send Settings Save As Preset... Refresh

Combiner: Combiner ☐

Channel 1:

Description	Value
Frequency (MHz)	2200.5
Mode	PCMF
Bit Rate (Mbps)	10
Data Polarity	Normal
Clock Polarity	Normal
Equalizer	<input type="checkbox"/>
DQ Encapsulation	<input type="checkbox"/>
Derandomizer	Off

Advanced Settings: Channel 1

Channel 2:

Description	Value
Frequency (MHz)	2200.5
Mode	PCMF
Bit Rate (Mbps)	10
Data Polarity	Normal
Clock Polarity	Normal
Equalizer	<input type="checkbox"/>
DQ Encapsulation	<input type="checkbox"/>
Derandomizer	Off

Advanced Settings: Channel 2

System Settings: Ch1:

- Antenna Controls
- Clock/Data Output Controls
- Test Utilities

System Settings: Ch2:

- Antenna Controls
- Output Controls
- Test Utilities

Advanced:

Changes affect the current active configuration.

Figure 216: 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. The Power Ratio control is available for UQPSK mode only. A selection box displays below the Bit Rate option in UQPSK mode. Refer to section 4.4.2.5 for specific information about Power Ratio. The AQPSK mode uses two bit rates, as shown in Figure 218. Refer to section 4.4.2.3.1 for specific information about AQPSK bit rates.

Note: The Equalizer is currently available for use with all modes *except* STC mode.

QUASONIX RDMS™ Receiver: 192.168.1.159: "RDMS3" | Group: "RDMS" | Configuration: Mission 0

Configure: View or Modify Current Receiver Settings

Name: Mission 0
Description: Mission Description
 Send Settings Save As Preset... Refresh

Combiner: Combiner ☒
 Frequency Diversity ☐

Description	Value
Frequency (MHz)	2200.5
Mode	PCMF
Bit Rate (Mbps)	1
Data Polarity	Normal
Clock Polarity	Normal
Equalizer	<input type="checkbox"/>
DQ Encapsulation	<input type="checkbox"/>
Derandomizer	Off

Figure 217: Configure Basic Settings Window-PCM/FM Mode

Channel 1:	
Description	Value
Frequency (MHz)	2247
Mode	AQPSK
Bit Rate (Mbps)	5
Bit Rate B (Mbps)	0.5
Data Polarity	Normal

Figure 218: Configure Basic Settings Window-AQPSK Mode, Two Bit Rates

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 and Time Aligner 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 Send Settings button changes color (from green to gold), and a Save Changes message displays in the message area on the right side of the screen, as shown in Figure 219. Other notifications display in red text on the right side.

Configure: View or Modify Current Receiver Settings

Name: Maria 1

Description: Mission Description

Send Settings Save As Preset Refresh

Combiner:

Combiner ☒

Frequency Diversity ☐

Save Changes

Changes affect the current active configuration.

Figure 219: Configure Screen, Messages and Alerts

4.5.3.2.1 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 220.

Data Polarity	Normal
Clock Polarity	Normal
	Inverted

Figure 220: Settings Window, Data Polarity Selection

4.5.3.2.2 Derandomizer Settings

The Derandomizer defaults to Off. Click on the drop down arrow to display the menu, then select the desired option (Figure 221). The standard running mode for non-LDPC, non-Reed-Solomon operation is IRIG. The CCSDS option is only available when an LDPC Mode is enabled (SOQPSKLDPC or STCLDPC) or when Reed-Solomon decoding is enabled.

- IRIG – Derandomizes data randomized using the IRIG 15-stage randomizer
- CCSDS – Derandomizes data randomized using the CCSDS 8-stage block synchronous randomizer

Description	Value
Frequency (MHz)	2200.5
Mode	STC
Bit Rate (Mbps)	5
Data Polarity	Normal
Clock Polarity	Normal
DQ Encapsulation	<input type="checkbox"/>
Derandomizer	Off

Advanced Settings

Derandomizer dropdown menu options: Off, IRIG, CCSDS

Figure 221: Settings Window, Derandomizer Drop Down Menu

4.5.3.2.3 Differential Decoding Settings

The Differential Decoding option is set to On or Off by clicking on the check box (Figure 222) to enable or disable the differential decoding. Differential Decoding defaults to enabled.

Differential decoding is available in all PSK modes (SOQPSK and legacy BPSK, QPSK, OQPSK, AQPSK, AUQPSK, and UQPSK). Legacy modes often use differential forms of PCM encoding (e.g., NRZ-M) instead, and only one or the other form of differential encoding should be used at a time.

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.

Differential encoding results in two differentially-decoded bit errors for each received bit error. This doubling negatively impacts subsequent error-correction capability for block forward error correction. Since the Attached Sync Marker used to identify block boundaries can also be used to resolve the phase ambiguity inherent in PSK modulation, differential encoding is unnecessary for block forward error correction. Therefore, differential decoding is automatically disabled when Reed-Solomon encoding is enabled.

Send Settings
Save As Preset...
Refresh

Description	Value
Frequency (MHz)	2200.5
Mode	SOQPSK
Bit Rate (Mbps)	1
Data Polarity	Normal
Clock Polarity	Normal
Equalizer	<input type="checkbox"/>
DQ Encapsulation	<input type="checkbox"/>
Derandomizer	Off
Differential Decoding	<input checked="" type="checkbox"/>

Figure 222: Configure Basic Settings Window-SOQPSK Mode

4.5.3.3 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, Best Channel Selector, Time Aligner, and PCM Encoding, as shown in Figure 223. Additionally, the Advanced Settings window shows Video Output parameters, Channel A and Channel B Output, Channel A and Channel B Scale, Tape Output Frequency, and FM De-emphasis (when in PCM/FM mode).

Advanced Settings

Measured Bit Rate (Mbps)	0.999688
IF Filter	Auto 2.0 MHz
Output Muting	<input type="checkbox"/>
Muting Timeout (ms)	1000
AFC Mode	Track
Best Channel Selector	<input checked="" type="checkbox"/>
Time Aligner	<input type="checkbox"/>
PCM Encoding ⓘ	NRZ-L
Channel A Video Output	Normal
Channel B Video Output	Normal
Channel A Video Scale	1
Channel B Video Scale	1
Tape Output Frequency (MHz)	2.1

Figure 223: Advanced Settings Window

4.5.3.3.1 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.

4.5.3.3.2 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.

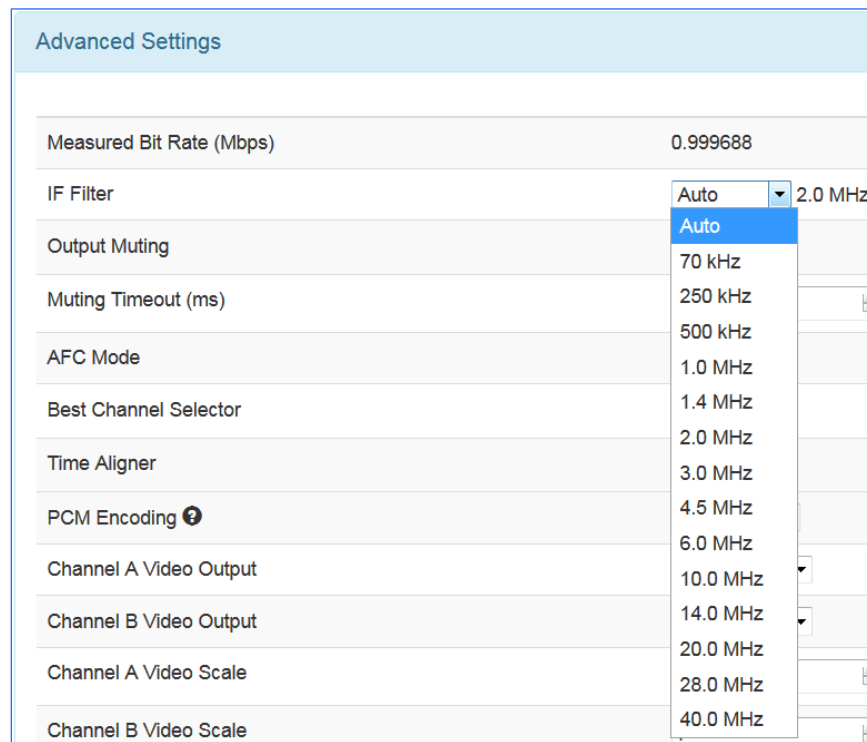


Figure 224: Advanced Settings Window, IF Filter Menu

4.5.3.3.3 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.

4.5.3.3.4 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.

4.5.3.3.5 AFC Mode

The AFC (Automatic Frequency Control) Mode option, shown in Figure 225, 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 the RDMS™ Access via Telnet and Serial Control Protocol Technical Guide for AFC command details.

Advanced Settings	
Description	Value
Measured Bit Rate (Mbps)	4.999991
IF Filter	Auto 10 MHz
Output Muting	<input type="checkbox"/>
Muting Timeout (ms)	1000
AFC Mode	Track
Best Channel Selector	Track
Time Aligner	Hold

Figure 225: Advanced Settings Window, AFC Mode Menu

4.5.3.3.5.1 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.

4.5.3.3.5.2 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.

4.5.3.3.5.3 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.

4.5.3.3.6 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 4.4.2.19.8 for Best Channel Selector details.

Advanced Settings	
Description	Value
Measured Bit Rate (Mbps)	4.999991
IF Filter	Auto 10 MHz
Output Muting	<input type="checkbox"/>
Muting Timeout (ms)	1000
AFC Mode	Track
Best Channel Selector	<input checked="" type="checkbox"/>
Time Aligner	<input checked="" type="checkbox"/>

Figure 226: Advanced Settings Window, Best Channel Selector Checked

4.5.3.3.7 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 227, lets it determine when to operate (with no user intervention).

Advanced Settings	
Description	Value
Measured Bit Rate (Mbps)	4.999991
IF Filter	Auto 10 MHz
Output Muting	<input type="checkbox"/>
Muting Timeout (ms)	1000
AFC Mode	Track
Best Channel Selector	<input checked="" type="checkbox"/>
Time Aligner	<input checked="" type="checkbox"/>

Figure 227: 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.

4.5.3.3.8 PCM Encoding

The PCM Encoding setting controls the RDMS receiver output PCM data format. Two primary options are available: the receiver can convert encoded data to NRZ-L, or it can preserve transmit encoding.

Note: When using TMoIP with the IP2 option, NRZ-L must be used.

The first option allows conversion of any of the following encoding formats to NRZ-L:

- 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
- Biphas-L: Biφ, level
- Biphas-M: Biφ, mark
- Biphas-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

The second option allows the transmit encoding to be preserved and output from the RDMS unaltered. To accomplish this, PCM Encoding must be set to NRZ-L – regardless of the actual transmit encoding. Also, for encoding formats that use di-bits to represent each user bit (i.e., RZ, Biφ, DM, or M2), the RDMS bit rate must be set to twice the user bit rate. Note that the RDMS output clock will clock at twice the user bit rate in this configuration.

Select the desired encoding format from the drop down menu, as shown in Figure 228.

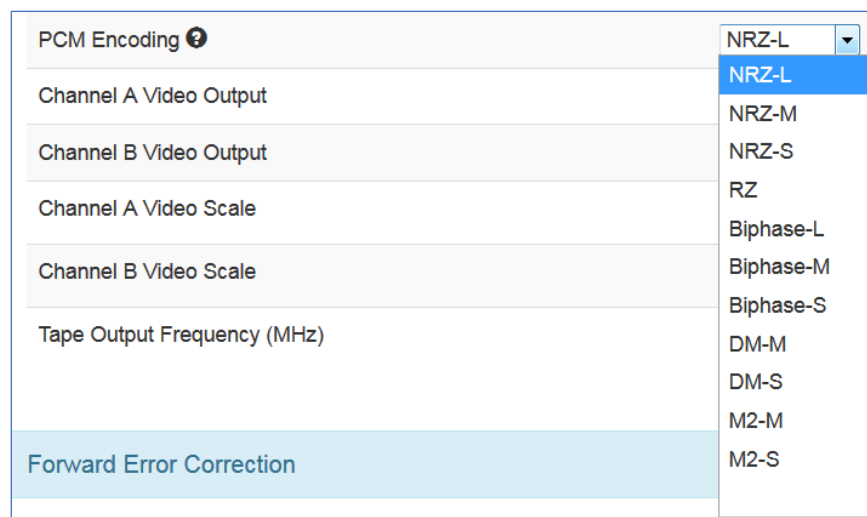


Figure 228: Advanced Settings Window, PCM Encoding Drop Down Menu

4.5.3.3.9 Channel A Video Output

The Channel A Video Output option, shown in Figure 229, selects what signal appears on the I/Video A output: Normal, Tape Out, or Carrier Only. The Normal output depends on the selected Mode, as shown in Table 10. Tape Out outputs the Pre-D signal, and Carrier Only outputs an unmodulated carrier; either of these will be output at the carrier frequency selected by Tape Out Freq (MHz).

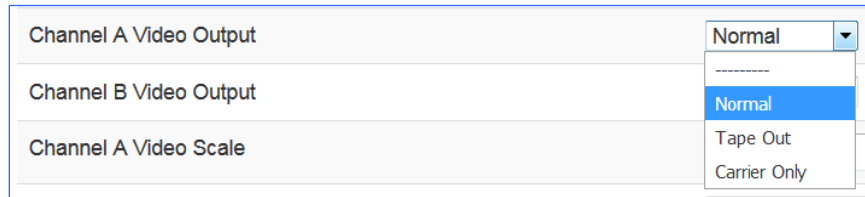


Figure 229: Advanced Settings Window, Channel A Video Output Drop Down Menu

Table 10: Normal (Default) Video Output Signals

Mode	I/Video A	Q/Video B
PCM/FM	Eye Pattern	Unused (0 Volts)
SOQPSK, SOQPSK/LDPC	Noncoherent I/Q Baseband	Noncoherent I/Q Baseband
MHCPM	Noncoherent I/Q Baseband	Noncoherent I/Q Baseband
BPSK	I Baseband	Unused
QPSK, OQPSK, AQPSK, UQPSK, AUQPSK	I Baseband	Q Baseband
DPM	I Baseband	Unused

4.5.3.3.10 Channel B Video Output

The Channel B Video Output option, shown in Figure 230, selects what signal appears on the Q/Video B output: Normal, Tape Out, or Carrier Only. The Normal output depends on the selected Mode, as shown in Table 10. Tape Out outputs the Pre-D signal, and Carrier Only outputs an unmodulated carrier; either of these will be output at the carrier frequency selected by Tape Out Freq (MHz).

Channel B Video Output	Normal
Channel A Video Scale	Normal
Channel B Video Scale	Tape Out
	Carrier Only

Figure 230: Advanced Settings Window, Channel B Video Output Drop Down Menu

4.5.3.3.11 Channel A Video Scale

The Channel A Video Scale option, shown in Figure 231, adjusts the peak-to-peak amplitude on the I/Video A output. 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.

Channel A Video Scale	1
Channel B Video Scale	1

Figure 231: Advanced Settings Window, Channel A Video Scale

4.5.3.3.12 Channel B Video Scale

The Channel B Video Scale option, shown in Figure 232, adjusts the peak-to-peak amplitude on the Q/Video B output. 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.

Channel A Video Scale	1
Channel B Video Scale	1

Figure 232: Advanced Settings Window, Channel B Video Scale

4.5.3.3.13 Tape Output Frequency

The Tape Out Frequency option, shown in Figure 233, sets the carrier frequency for any video output that is set to Tape Output or Carrier Only. The frequency may be selected from a standard set of values. Alternatively, any frequency up to 46.666 MHz may be entered as a custom frequency. Note, however, that frequencies above 30 MHz will experience filter roll-off and may not be useful.

Tape Output Frequency (MHz)	2.1
-----------------------------	-----

Figure 233: Advanced Settings Window, Tape Output Frequency

4.5.3.3.14 FM De-emphasis (PCM/FM Mode Only)

The FM De-emphasis option, shown in Figure 234, is used to set the FM De-emphasis 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.

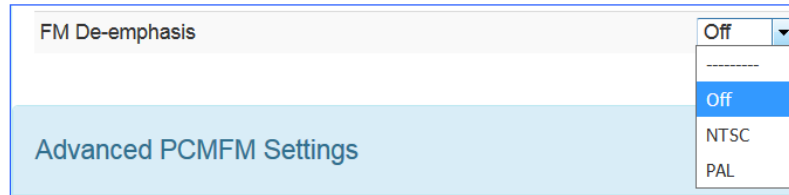


Figure 234: Advanced Settings Window, FM De-emphasis

4.5.3.4 Forward Error Correction

Forward Error Correction (FEC) may be accomplished by using Low-Density Parity Check (LDPC) encoding, in SOQPSK or STC modes, as shown in Figure 235 and in Figure 236, or by using a convolutional encoding/Viterbi decoding, and/or Reed-Solomon encoding in legacy PSK modes (BPSK, QPSK, OQPSK, AQPSK, AUQPSK, or UQPSK), as shown in Figure 237.

All of these forms of FEC are discussed in detail in the associated front panel sections: LDPC in section 4.4.2.22.1, Viterbi Decoder in section 4.4.2.22.2, Convolutional Symbol in section 4.4.2.22.3, Reed-Solomon Decoder in section 4.4.2.22.4, and Interleave Depth in section 4.4.2.22.5.

LDPC Code always displays in the Forward Error Correction window when the waveform Mode is SOQPSKLDPC or STCLDPC.

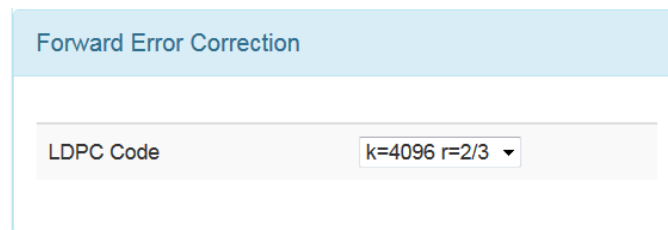


Figure 235: Forward Error Correction Window when in SOQPSKLDPC or SOQPSKSTC Mode

Select the desired encoding format from the drop down menu, as shown in Figure 236.

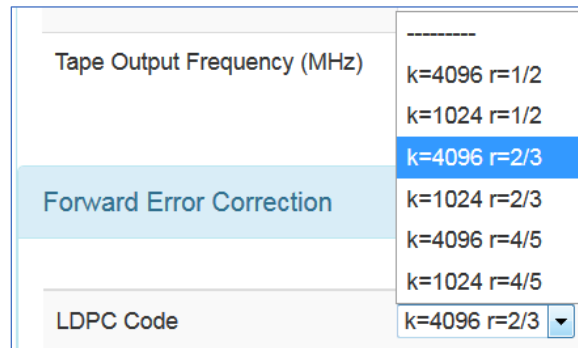


Figure 236: Forward Error Correction Window, LDPC Mode Drop Down Menu

The Viterbi decoder and Reed-Solomon decoder can be disabled or enabled by clicking on the appropriate check box while a legacy PSK mode is selected (BPSK, QPSK, OQPSK, AQPSK, AUQPSK, or UQPSK). Likewise, the Convolutional Symbol setting for Viterbi decoding can be disabled or enabled by clicking on its check box.

Interleave depth for Reed-Solomon decoding may be changed by typing in the desired number, or by using the up/down arrows to scroll to the desired setting.

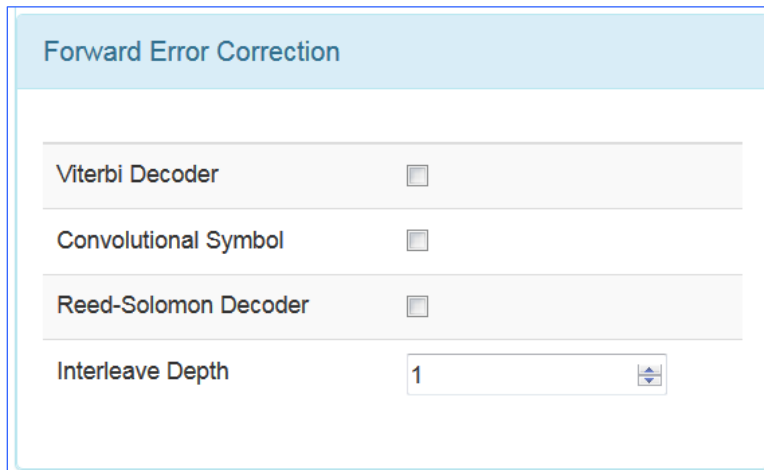


Figure 237: Forward Error Correction Window when in a PSK Mode

4.5.3.5 Advanced PCM/FM Settings

The Advanced PCM/FM Settings window is shown in Figure 238. When the modulation is set to PCM/FM, the Scale Settings window includes settings for modulation scaling indexes. In any other mode, the Scale Settings are not available.

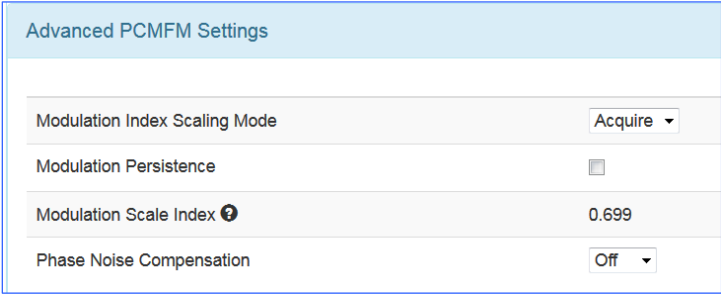


Figure 238: Advanced PCMFm Settings Window

4.5.3.5.1 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 4.4.2.12 Modulation Scaling in the front panel section.

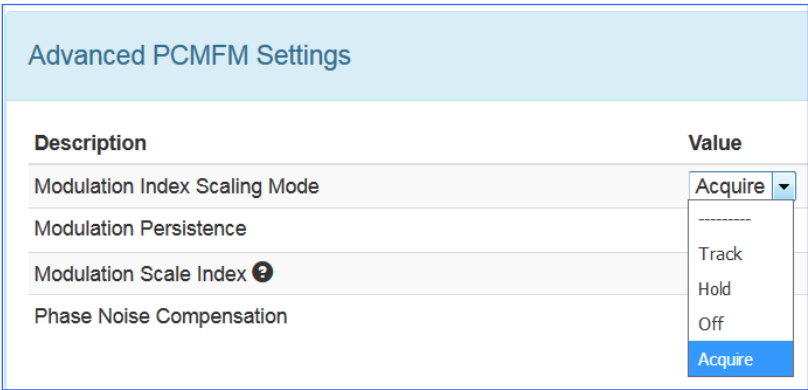


Figure 239: Advanced PCMFm Settings Window, Modulation Index Scaling Mode Menu

4.5.3.5.2 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 240.

Advanced PCMFm Settings	
Modulation Index Scaling Mode	Acquire ▼
Modulation Persistence	<input type="checkbox"/>
Modulation Scale Index ⓘ	0.699
Phase Noise Compensation	Off ▼

Figure 240: 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 4.5.4.1.

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.

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

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.

4.5.3.5.3 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 241. Use the steps in section 4.5.3.5.1 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 242. 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 4.4.2.13, Modulation Persistence.

Advanced PCMFm Settings

Modulation Index Scaling Mode	Acquire
Modulation Persistence	<input type="checkbox"/>
Modulation Scale Index ?	0.699
Phase Noise Compensation	Off

Figure 241: Advanced PCMF Settings Window, Modulation Scale Index Current Value, Read Only

Advanced PCMF Settings	
Description	Value
Modulation Index Scaling Mode	Hold
Modulation Persistence	<input type="checkbox"/>
Modulation Scale Index	0.486084

Figure 242: 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.

4.5.3.5.4 Phase Noise Compensation

The Phase Noise Compensation (PNC) option is used to set the Phase Noise Compensation value to On, Off, or Auto. Refer to Appendix C in section 9 for detailed information about PNC.

Phase Noise Compensation

Off

Off

On

Auto

Figure 243: Advanced PCMFM Settings Window, Phase Noise Compensation Drop Down Menu

4.5.3.6 System Settings

The System Settings window, shown in Figure 244, includes the following settings:

- Antenna Controls
- Clock/Data Output Controls
- Test Utilities

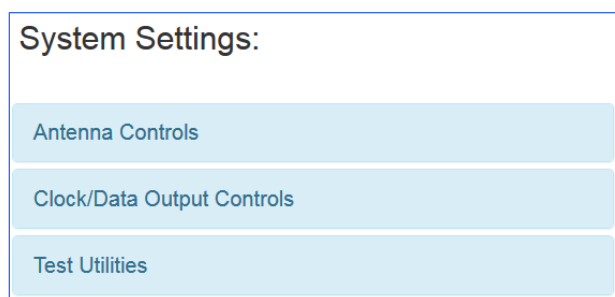


Figure 244: System Settings Window

4.5.3.6.1 Antenna Controls

The Antenna Controls section contains the following parameters for AGC (Automatic Gain Control) and AM, as shown in Figure 245.

- HyperTrack
- AGC Polarity (Positive/Negative)
- AGC Scale (in dB/V)
- AGC Time Constant (in ms)
- AGC Freeze
- AGC Zero Mode
- AGC Compensate
- AM Bandwidth (Hz)
- AM Polarity (Positive/Negative)
- AM Scale (-128 to +128)
- D/C Antenna

System Settings:

Antenna Controls

HyperTrack	Disabled ▾
AGC Polarity	Positive ▾
AGC Scale (dB/V)	10 <input type="text"/>
AGC Time Constant (ms)	100 <input type="text"/>
AGC Freeze	Off ▾
AGC Zero Mode	Manual ▾
AGC Compensate	<input type="checkbox"/>
AM Bandwidth (Hz)	100 <input type="text"/>
AM Polarity	Positive ▾
AM Scale	1 <input type="text"/>
D/C Antenna	<input type="checkbox"/>

Figure 245: System Settings, Antenna Controls

4.5.3.6.2 HyperTrack

HyperTrack™ is an all-digital antenna control protocol that offers many benefits in antenna tracking performance and system operation. These benefits are too numerous and wide-ranging to describe fully here, but they include improved tracking stability, range-based tracking bandwidth, ability to track through strong interfering signals, rejection of incidental AM (e.g., from spinning test articles), and optimal multi-receiver tracking.

Enabling HyperTrack™ switches the AM back panel output to all-digital mode. This mode requires a HyperTrack™-compatible ACU for proper operation and to take advantage of the performance improvements. Disabling HyperTrack™ switches the AM back panel output to legacy analog AM mode.

Note, in a HyperTrack™-equipped receiver, the Sync Detect digital status output is unavailable. Also, when HyperTrack™ is enabled, the Lock Detect digital status output automatically becomes a copy of the HyperTrack™ digital output data. The lock detect output defaults to fixed 0 if the HyperTrack™ back panel is present. Refer to the Digital Status Output (DSO) command in the RDMS™ Access via Telnet and Serial Control Protocol Technical Guide for additional information.

Click on the drop down menu to select Enabled or Disabled, as shown in Figure 246.

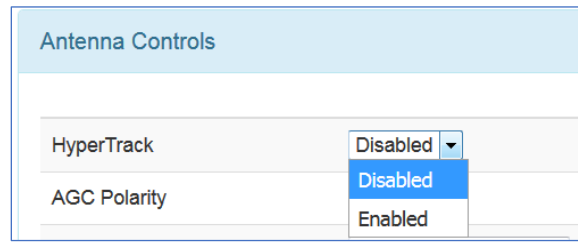


Figure 246: Antenna Controls Window, HyperTrack Selection

4.5.3.6.3 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 247.

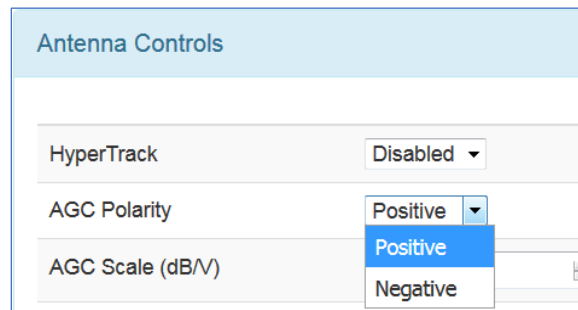


Figure 247: Antenna Controls Window, AGC Polarity Selection

4.5.3.6.4 AGC Scale

The AGC Scale option, shown in Figure 248, 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. The AGC output is calibrated to a load of 1 KOhm. Operation into other load impedances will result in the effective AGC scale factor being higher or lower than expected. Refer to AGC Scale on the front panel, section 4.4.2.16.2, for an example.

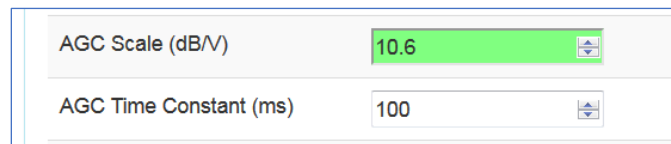


Figure 248: Antenna Controls Window, AGC Scale Selection

4.5.3.6.5 AGC Time Constant

The Time Constant option, shown in Figure 249, 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.

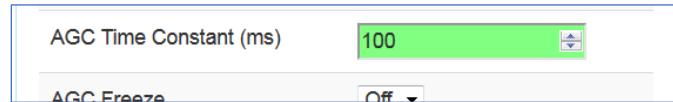


Figure 249: Antenna Controls Window, AGC Time Constant Selection

4.5.3.6.6 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 250.

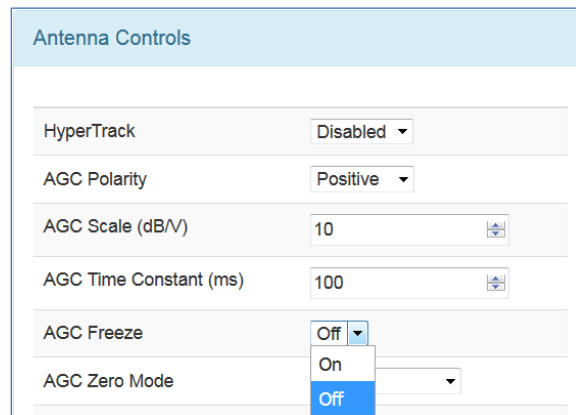


Figure 250: Antenna Controls Window, AGC Freeze Selection

4.5.3.6.7 AGC Zero Mode

The AGC Zero Mode option is shown in Figure 251. 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.

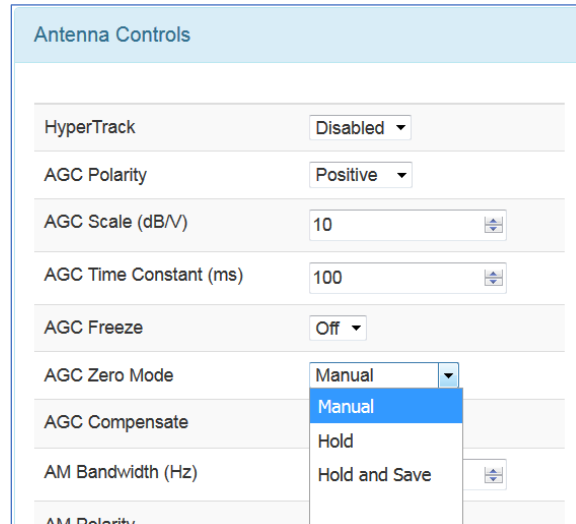


Figure 251: Antenna Controls Window, AGC Zero Hold Drop Down Menu

4.5.3.6.8 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.

4.5.3.6.9 AM Bandwidth

To change the AM Bandwidth value, type the desired value or use the up/down arrows to scroll to the appropriate value, as shown in Figure 252. The AM Bandwidth can be set from 5.00 to 50000.00 Hz.

4.5.3.6.10 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 252.

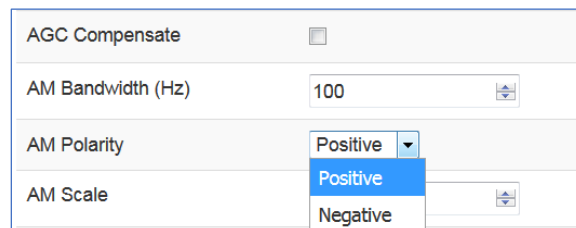


Figure 252: Antenna Controls Window, AM Polarity Drop Down Menu Selections

4.5.3.6.11 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 50 ohm load with a 50% AM.

4.5.3.6.12 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 253.


AM Scale	1	
D/C Antenna	<input checked="" type="checkbox"/>	

Figure 253: Antenna Controls 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.

4.5.3.7 Clock/Data Output Controls

The Clock/Data Output Controls section contains parameters for clock and data output for Channel A and Channel B, as shown in Figure 254. Units with the IP2 option also provide a selection for TMoIP.

Figure 254: Output Controls Window

The Channel A Output options, shown in Figure 255, select what signals appear on the Channel A clock/data outputs: DQE, No DQE, or Test Data.

- DQE – Selecting DQE enables encapsulation of data on Channel A; if DQE is enabled in the Main Menu, the output is encapsulated, otherwise it will not
- No DQE – Selecting No DQE bypasses data quality encapsulation
- Test Data – Selecting Test Data causes the output of the Data Generator to display on Channel A clock and data

Figure 255: Output Controls, Clock/Data Output Channel A

The Channel B Output options, shown in Figure 256, select what signals appear on the Channel B clock/data outputs: DQE, No DQE, or Test Data.

- DQE – Selecting DQE enables encapsulation of data on Channel B; if DQE is enabled in the Main Menu, the output is encapsulated, otherwise it is not
- No DQE – Selecting No DQE bypasses data quality encapsulation

- Test Data – Selecting Test Data causes the output of the Data Generator to display on Channel B clock and data

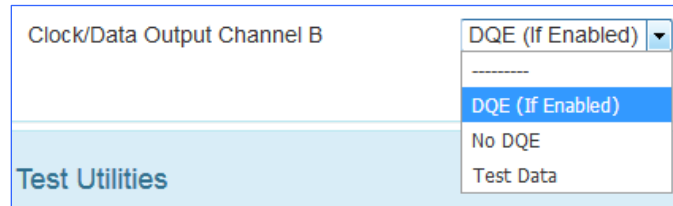


Figure 256: Output Controls, Clock/Data Output Channel B

The TMoIP options (IP2 only), shown in Figure 257, select what data is sent to the TMoIP module for packetization: DQE, No DQE, or Test Data.

- DQE – Selecting DQE sends encapsulated data to the TMoIP module; if DQE is enabled in the Main Menu, the output is encapsulated, otherwise it is not
- No DQE – Selecting No DQE bypasses data quality encapsulation
- Test Data – Selecting Test Data causes the output of the Data Generator to be sent to the TMoIP module

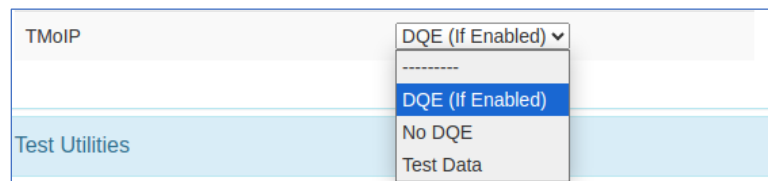


Figure 257: Output Controls, TMoIP

4.5.3.8 Clock/Data Output Controls (3U Receiver)

The Clock/Data Output Controls section, as shown in Figure 258, provides access to four channels in a 3U receiver:

- Channel A Output
- Channel B Output
- Channel C Output
- Channel D Output

Clock and data output for the additional 3U channels functions the same as the channel selections in a 1U receiver.

The 3U also has a TMoIP control for IP2. It behaves the same as on the 1U but looks like Figure 258.

Clock/Data Output Controls

Clock/Data Output Channel A	DQE (If Enabled) ▼
Clock/Data Output Channel B	DQE (If Enabled) ▼
Clock/Data Output Channel C (TMOIP)	DQE (If Enabled) ▼
Clock/Data Output Channel D	DQE (If Enabled) ▼

Figure 258: Clock/Data Output Controls, Clock/Data Output Channels for 3U Receivers

4.5.3.9 Test Utilities

The Test Utilities selections, accessed via the Advanced Menu, as shown in Figure 259, provide access to the following options:

- Noise Generator
- Data Generator
- BERT

System Settings:

Antenna Controls

Clock/Data Output Controls

Test Utilities

Noise Generator

Test Noise Disabled

Noise Level (Eb/N0) 50

Data Generator

Test Data Disabled

Data Rate (Mbps) 0.999995

Pattern PN15

Inversion Normal

Randomization Disabled

BERT See Test Utilities Page

Figure 259: System Settings, Test Utilities

4.5.3.9.1 Noise Generator

The Noise Generator selection, shown in Figure 260, optionally sums AWGN (Additive White Gaussian Noise) with the received signal to achieve the desired E_b/N_0 . Since the bit error rate of an ideally modulated signal at any given E_b/N_0 is known and should be readily reproducible, the Noise Generator may be used to verify transmitter or receiver RF integrity. Two parameters are available: Test Noise and Noise Level.

- Test Noise – Enables or disables the AWGN generator, as shown in Figure 260

Test Utilities

Noise Generator

Test Noise Disabled

Noise Level (Eb/N0)

Figure 260: Test Utilities, Noise Generator-Test Noise Drop Down Menu

- Noise Level -Sets the noise level to use in the test in dB E_b/N_0 , as shown in Figure 261

Test Utilities

Noise Generator

Test Noise

Disabled

Noise Level (Eb/N0)

50

Figure 261: Test Utilities, Noise Generator-Noise Level Selection

4.5.3.9.2 Data Generator

The Data Generator option, shown in Figure 262, allows the user to generate data patterns at a settable data rate. This data may be used as known source data for system testing, including transmitter or receiver RF integrity verification. Optionally, the user may invert data, or add randomization. The available parameters are Test Data, Data Rate, Pattern, Inversion, and Randomization.

Data Generator

Test Data

Disabled

Data Rate (Mbps)

0.999995

Pattern

PN15

Inversion

Normal

Randomization

Disabled

Figure 262: Test Utilities, Data Generator

- Test Data – Enable or disable test data generation, as shown in Figure 263

Data Generator

Test Data

Disabled

Disabled

Enabled

Data Rate (Mbps)

Figure 263: Data Generator, Test Data Drop Down Menu

- Data rate in Mbps – Typing a number in this field sets the data rate in Mbps, as shown in Figure 264

Figure 264: Data Generator, Data Rate Selection

- Pattern – Sets the data pattern produced by the data generator, as shown in Figure 265; This may be a fixed pattern or a pseudorandom pattern that repeats based on the chosen pattern/sequence (a shorter pattern looks more regular, a longer pattern looks more random)
 - PN6 – Pseudorandom pattern 2^6-1 bits in length
 - PN9 – Pseudorandom pattern 2^9-1 bits in length
 - PN11 – Pseudorandom pattern $2^{11}-1$ bits in length
 - PN15 – Pseudorandom pattern $2^{15}-1$ bits in length
 - PN17 – Pseudorandom pattern $2^{17}-1$ bits in length
 - PN20 – Pseudorandom pattern $2^{20}-1$ bits in length
 - PN23 – Pseudorandom pattern $2^{23}-1$ bits in length
 - PN31 – Pseudorandom pattern $2^{31}-1$ bits in length
 - User defined
 - User Defined – A unique binary pattern, between 2 and 32 bits, specified by the person running the test; only available when Pattern is “User Defined”

Figure 265: Data Generator, Pattern Selection

- Inversion – Set to Normal or Inverted, as shown in Figure 266; when Inverted the data stream is inverted; useful for patterns that are defined as inverted by certain standards, or to compensate for an inversion elsewhere in the system

Figure 266: Data Generator, Inversion Drop Down Menu

- Randomization – Enable or disable IRIG 106 15-bit randomization, as shown in Figure 267; *not recommended for PN15 data*, due to potential conflict between the sequence generator and the randomizer, both of which are based on the same generator polynomial

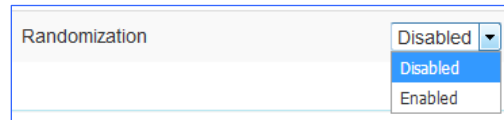


Figure 267: Data Generator, Randomization Drop Down Menu

4.5.3.9.3 BERT

The Bit Error Rate Tester (BERT) option, shown in Figure 268, allows the user to measure system performance. It does this by comparing received data to a specified data pattern and counting the ratio of errored bits to total received bits. The Browser provides the ability to set BERT parameters and access BERT status information.

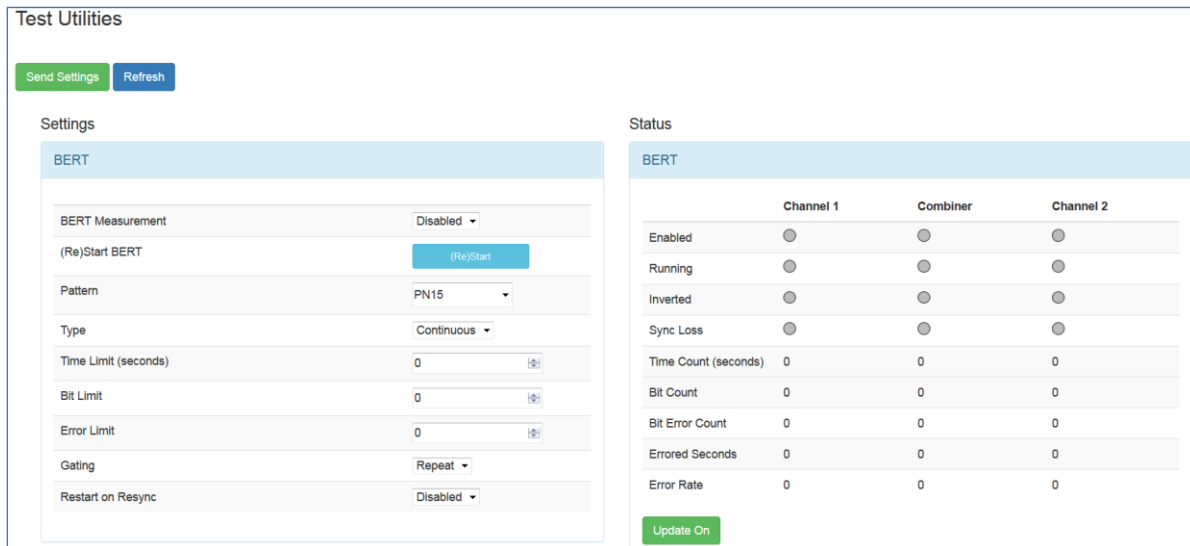


Figure 268: Test Utilities, BERT

4.5.3.9.3.1 BERT Settings

Refer to front panel section 4.4.2.26.3 for detailed information about BERT Settings.

4.5.3.9.3.2 BERT Measurement Status

BERT Status is only available via the Test Utilities screen in the Browser. The Status information, shown in Figure 269, displays measurements for Channel 1, Channel 2, and the Combiner (if enabled) when a BER test is running.

Status			
BERT			
	Channel 1	Combiner	Channel 2
Enabled	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Running	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inverted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sync Loss	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Time Count (seconds)	0	0	0
Bit Count	0	0	0
Bit Error Count	0	0	0
Errored Seconds	0	0	0
Error Rate	0	0	0
<input type="button" value="Update On"/>			

Figure 269: Test Utilities, BERT Status

Colored indicators are always grey when inactive, or an associated color during a test. The status display continually updates for the duration of a BER test.

- Enabled – Green when enabled
- Running – Green when running
- Inverted – Yellow if inverted
- Sync Loss – Red when sync loss occurs
- Time Count (seconds) – Time in seconds since starting or restarting the current BER test
- Bit Count – Number of bits passed during BER test
- Bit Error Count – Number of errored bits
- Errored Seconds – Number of seconds during the test in which errors occurred
- Error Rate – Bit error rate in scientific notation
- Update On/Off button – Freezes the state of the Status window for easy viewing, but the test continues to run as prescribed in the BERT Settings (limited or continuous)

An example of the Status screen when a BER test is running is shown in Figure 270.

Status			
BERT			
	Channel 1	Combiner	Channel 2
Enabled	●	●	●
Running	●	●	●
Inverted	●	●	●
Sync Loss	●	●	●
Time Count (seconds)	355.44	355.592	355.459
Bit Count	3554392684	3555918105	3554587858
Bit Error Count	1775939634	1776701693	1776036931
Errored Seconds	355	355	355
Error Rate	4.996e-1	4.996e-1	4.996e-1
Update Off			

Figure 270: Test Utilities, Status During BER Test

4.5.3.10 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 271. One or two buttons are available depending on the number of channels and the combiner mode.

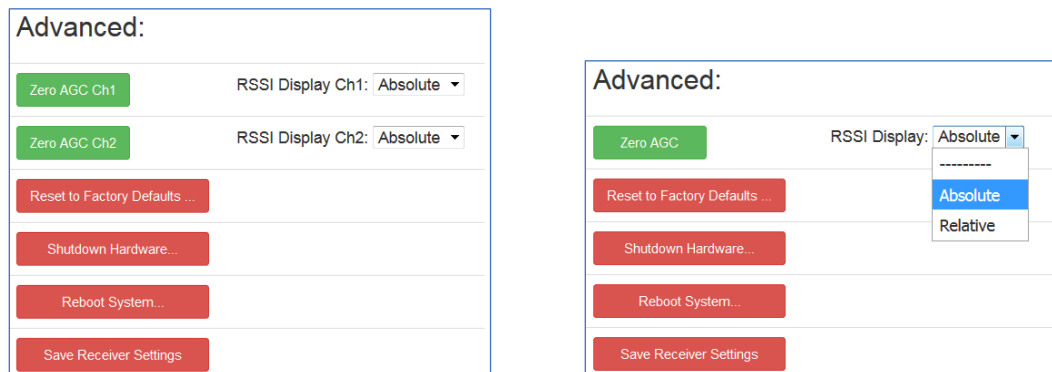


Figure 271: Advanced Buttons, Zero AGC Button, Separate Channels or Combiner Active

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 Signal Strength bar graph. If AGC is not zero, the graph is grey and there is no AGC Zero value displayed, as shown in Figure 272. When AGC is zero, the bar graph is not grey and the AGC Zero value is displayed, as shown in Figure 273.

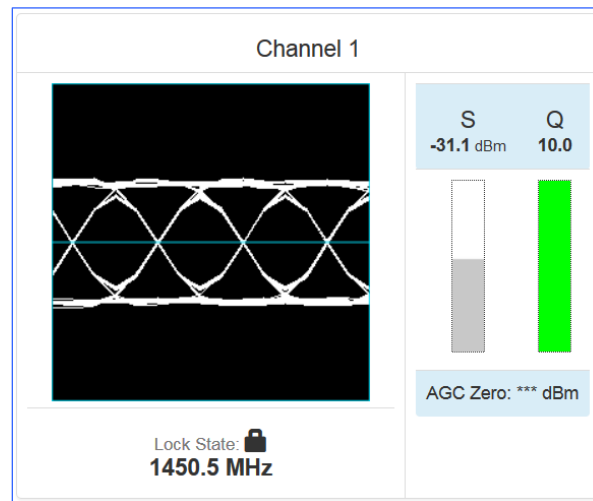


Figure 272: Monitor Screen, Signal Strength Grey – AGC Not Zero

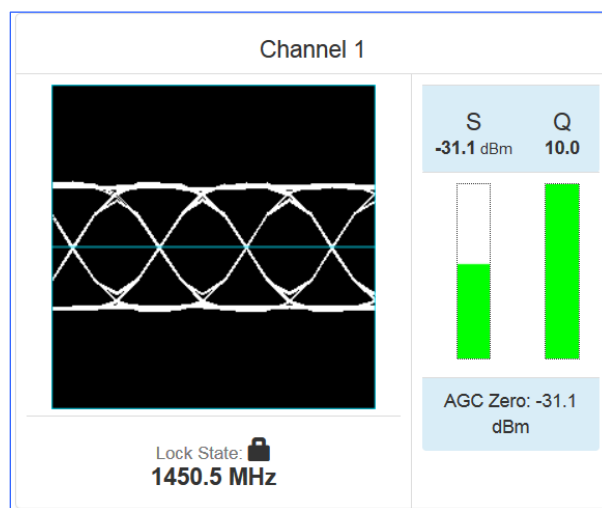


Figure 273: Monitor Screen, Signal Strength Not Grey – AGC Zero Value Displayed

4.5.3.10.1 Signal Strength Display

The Signal Strength display has two modes depending on the option selected in the RSSI Display drop down menu, shown in Figure 271.

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

If “Relative” was selected, the signal strength 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 204) indicates AGC is not zeroed and the value is invalid
- A small “r” displayed next to the Signal Strength (S) label indicates AGC Zero Relative was selected

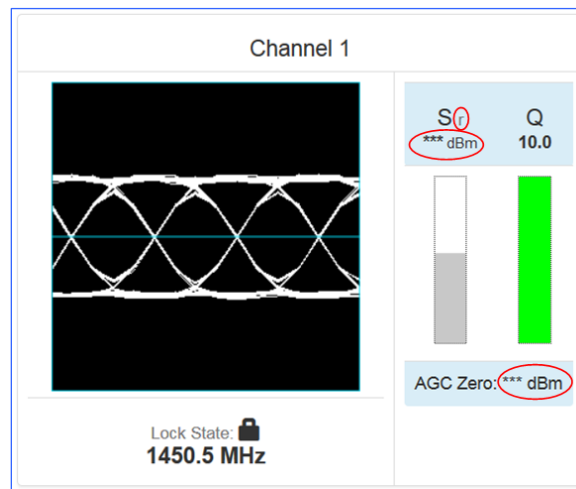


Figure 274: Signal Graph and Signal Indicators Windows, Zero AGC RSSI Display “Relative”

4.5.3.11 Reset to Factory Defaults Button

The Reset to Factory Defaults button, shown in Figure 275, sends a command to reset the RDMS hardware to factory default settings. During the process, the Browser Interface is temporarily unavailable.

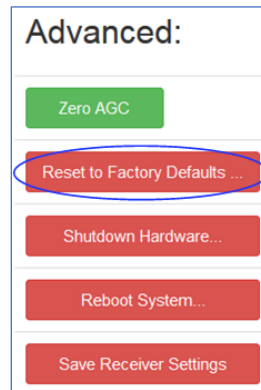


Figure 275: Advanced Buttons, Reset to Factory Defaults Button

4.5.3.12 Shutdown Hardware Button

The Shutdown Hardware button, shown in Figure 276, 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

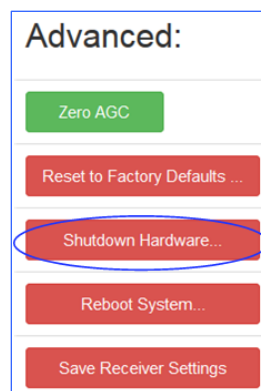


Figure 276: Advanced Buttons, Shutdown Hardware Button

4.5.3.13 Reboot System Button

The Reboot System button, shown in Figure 277, enables a remote user to perform a shutdown/power up on a receiver.

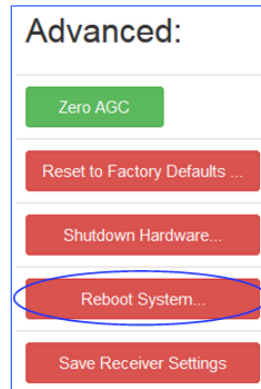


Figure 277: Advanced Buttons, Reboot System Button

4.5.3.14 Save Receiver Settings Button

The Save Receiver Settings button, shown in Figure 278, saves the current RDMS parameters. For example, the user may have changed a variety of parameters since the last shutdown/power up of the receiver and does not want to lose the settings in the event of a power outage. It is similar to saving a preset, but instead of saving the settings to a preset and recalling the preset, the current settings are just saved. If power is lost to the receiver, the saved settings are still set upon power up.

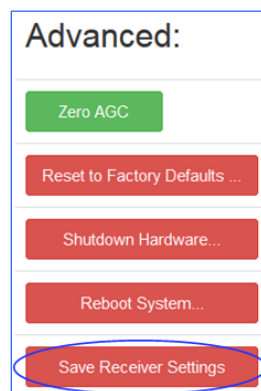


Figure 278: Advanced Buttons, Save Receiver Settings Button

4.5.4 Presets

The Presets functionality is accessed via the Presets option on the Tool bar, as shown in Figure 279.

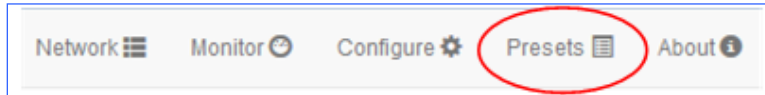


Figure 279: Presets Option on Tool Bar

4.5.4.1 Save Presets

Accessed from the Presets option in the Tool Bar, Saved Presets screen, shown in Figure 280, 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 281 and Figure 282.

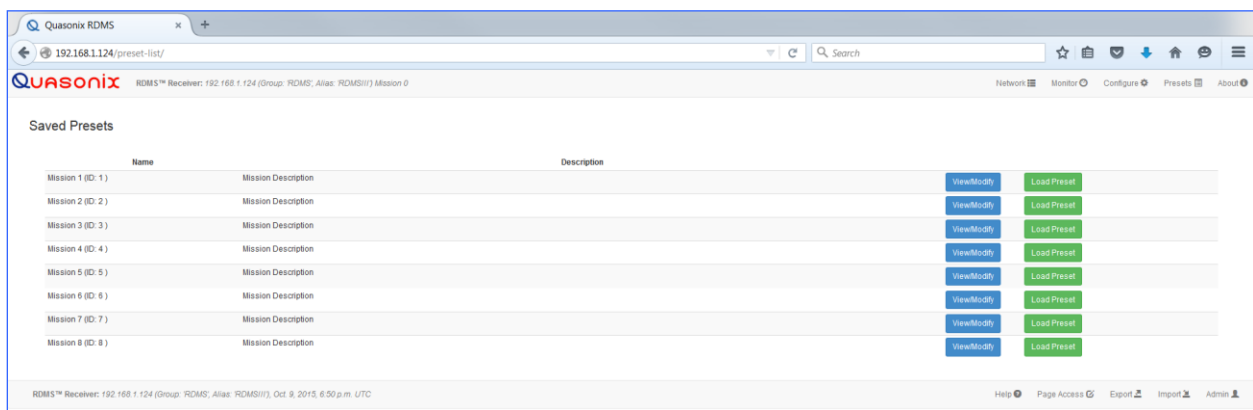


Figure 280: Presets Screen

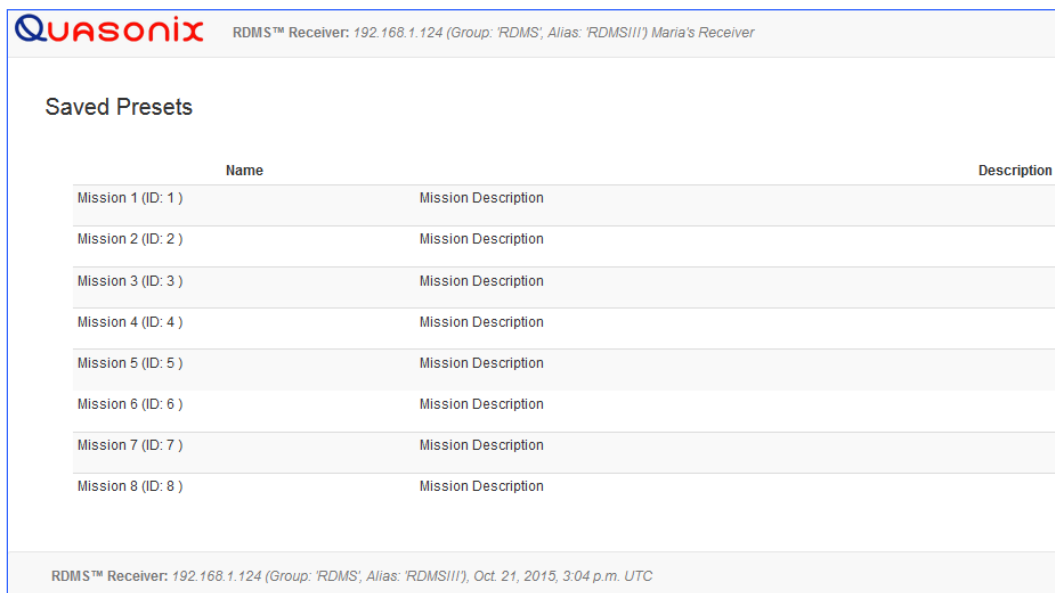


Figure 281: Presets Screen, Closeup of Left Side

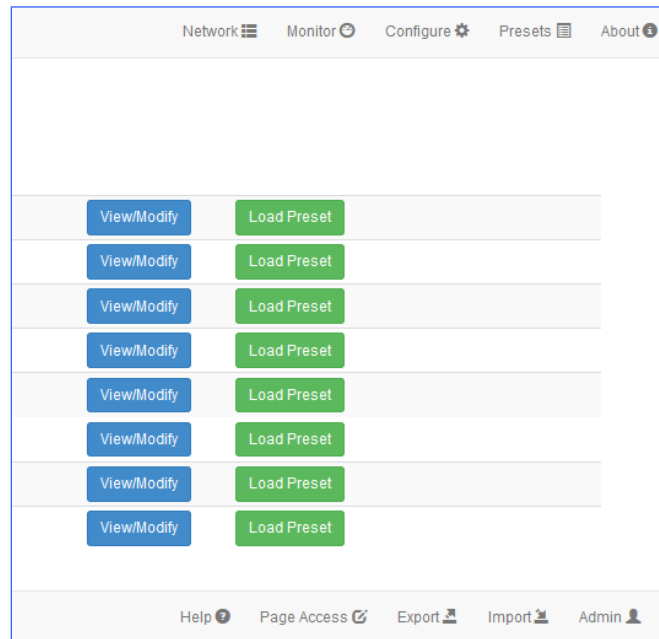


Figure 282: Presets Screen, Closeup of Right Side

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 283. The contents and layout of this screen is similar to the Configure screen.

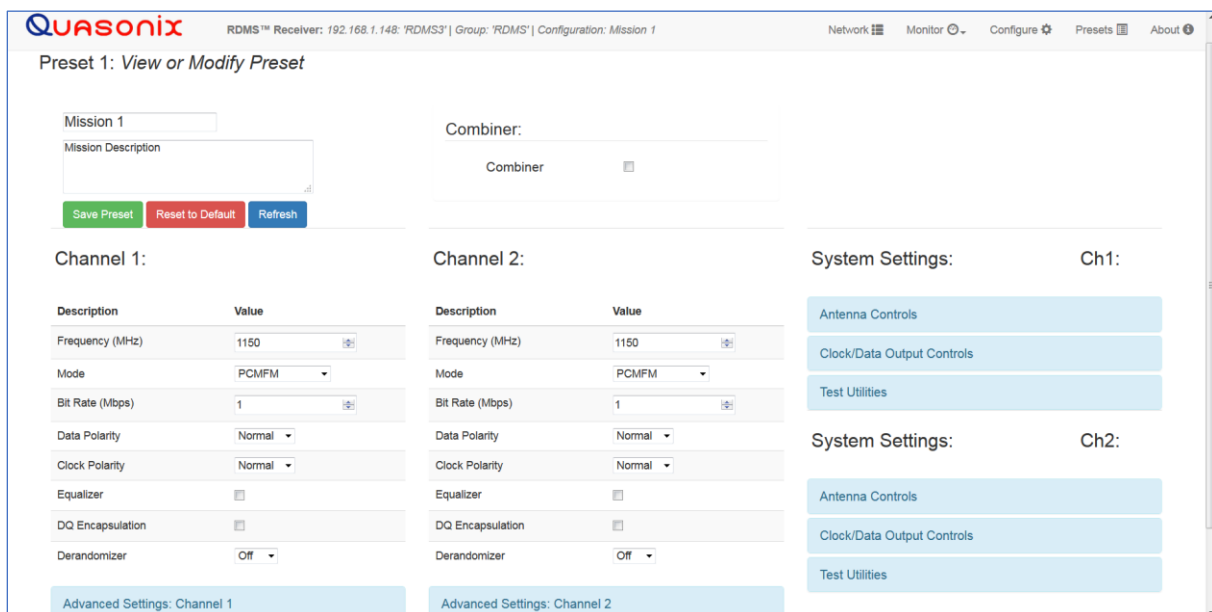


Figure 283: Preset: View or Modify Preset Screen

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 284. 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 284: 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 and Time Aligner 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, or click on the Refresh button to erase the changes and redisplay the original settings. 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 285.

QUASONIX

RDMS™ Receiver: 192.168.1.1

Preset: View or Modify Preset

✔ The information you entered was successfully saved.

Preset Name:

Mission20151021me

Preset Description:

Test setup for 21 Oct 2015 created by ME for the RST project

Save Settings

Refresh

Figure 285: 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 286.

QUASONIX

RDMS™ Receiver: 192.168.1.124 (Group: 'RDMS', Alias: 'RDMSIII') Maria's Receiver

Saved Presets

Name	
Mission 1 (ID: 1)	Mission Description
Mission 2 (ID: 2)	Mission Description
Mission 3 (ID: 3)	Mission Description
Mission 4 (ID: 4)	Mission Description
Mission20151021me (ID: 5)	Test setup for 21 Oct 2015 created by ME for the RST project
Mission 6 (ID: 6)	Mission Description
Mission 7 (ID: 7)	Mission Description
Mission 8 (ID: 8)	Mission Description

RDMS™ Receiver: 192.168.1.124 (Group: 'RDMS', Alias: 'RDMSIII'), Oct. 21, 2015, 4:09 p.m. UTC

Figure 286: Saved Presets Screen with New Preset Added

To clear the preset and revert to the default settings for that preset, click on the Reset to Default button. The preset name field now displays “Default” to indicate the change took place. This is shown in Figure 287.



Figure 287: Preset: View or Modify Preset Screen, Preset Name Set to Default

4.5.4.2 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 288.

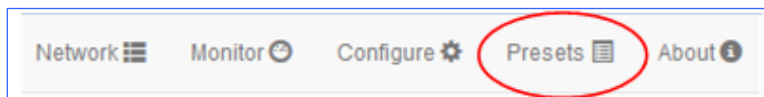


Figure 288: Presets Option on Tool Bar

When the Saved Presets screen displays (Figure 289), click on the green Load Preset button on the line containing the desired preset.

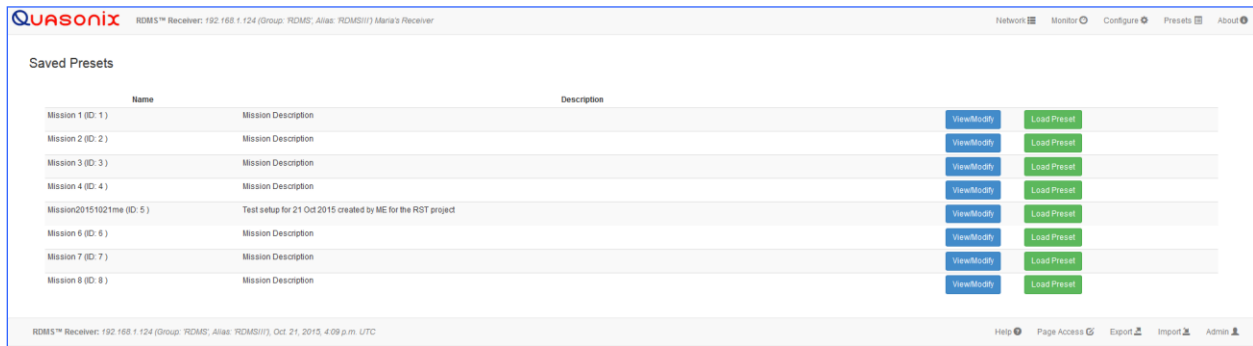


Figure 289: Presets Screen

While the preset is loading, the front panel on the receiver displays a wait message, as shown in Figure 290. The preset is finished loading when the wait message no longer displays.

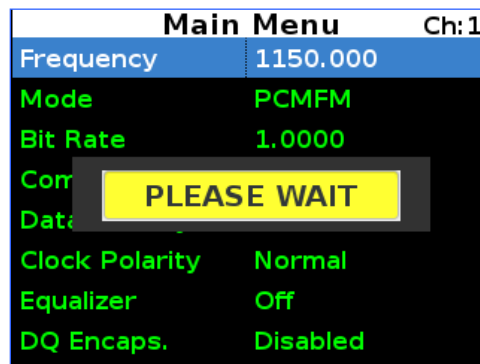


Figure 290: Loading Preset Please Wait Message on Front Panel

4.5.5 About

To access the System Information screen, click on the About option on the Tool bar, as shown in Figure 291.

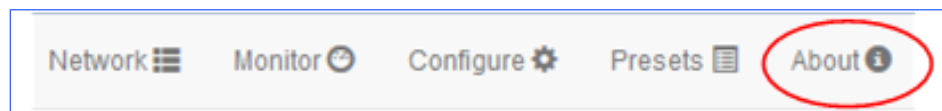


Figure 291: About Option on Tool Bar

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 292, then click on the Rename button.

System Information

[Refresh](#)

Unit Information

Description	Value
Rack Alias:	RDMS3--Maria's Test Unit Rename
Model Number:	3rd Gen RDMS: 1U1u
Serial Number:	3044
Part Number:	3rd Gen RDMS
System Configuration:	RDMS
System Version: Firmware Update Page	18rc1
Monitor Page Default Update Rate:	High Update Rate Update

Additional:

Interfaces

Description	Value
Ethernet	
Ethernet Address (IPv4):	192.168.0.250
MAC Address:	70:b3:d5:23:c0:42
Ethernet Subnet:	255.255.0.0
Ethernet Gateway:	192.168.0.1
Ethernet DHCP:	Off
HTTPS:	Off

RDMS™ Receiver: s/n 3044 | 192.168.0.250: 'RDMS3--Maria's Test Unit' | Group: 'RDMS' | Aug. 14, 2020, 4:50 a.m. UTC

[Help](#) [Page Access](#) [Export](#) [Import](#)

Figure 292: System Information Screen

Additional:	
Description	Value
FP Version:	1.18.5
Browser Interface:	1.18.5
Ch1 App:	1.18.3.10
Ch1 FPGA:	0100105F
Ch2 App:	1.18.3.10
Ch2 FPGA:	0100105F
Combiner App:	1.18.3.49
Combiner FPGA:	0000105F
SD Card: ?	Samsung

Figure 293: System Information Screen, Additional Information

SD Card information displays when the user clicks on the ?, as shown in Figure 294. It provides details about the SD card in the unit that is useful for Quasonix if a receiver update is necessary.

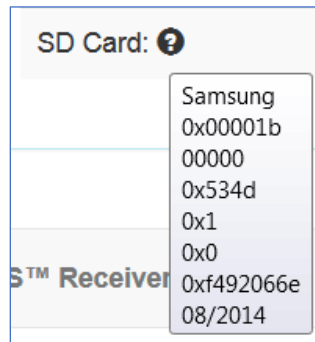


Figure 294: System Information Screen, SD Card Information

4.5.5.1 Monitor Page Default Update Rate

The default receiver level update rate is set by a user from the About screen, Monitor Page Default Update Rate parameter, as shown in Figure 295. The drop down menu provides four update rate settings for all clients connected to the receiver. They are High, Medium, Low, and No Automatic Updates. This provides user control of the required bandwidth for client consumption.

If a rate selection is made, click on the Update button to save the change. A message displays to remind the user to manually restart the receiver. A system restart is required for the rate change to take effect.

Resetting to Factory Defaults does not affect this setting. Network bandwidth usage is roughly halved as you progress through each setting from High to Low. High Update Rate is the as-shipped default setting.

A user may change the frame reset rate temporarily at the client level. For more information, refer to the Monitor screen, Client Level Frame Rate explanation in section 4.5.2.5.

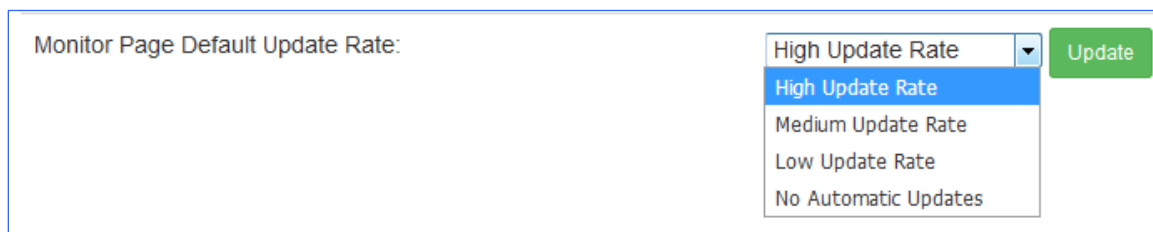


Figure 295: System Information Screen, Monitor Page Default Update Rate Field

4.5.5.2 Interfaces

The Interfaces side of the System Information screen displays the current Ethernet settings. They are read only.

IP2 includes the TMoIP Address, as shown in Figure 296.

Interfaces	
Description	Value
Ethernet	
TMoIP Address:	192.168.160.92
Ethernet Address (IPv4):	192.168.160.91
MAC Address:	70:b3:d5:23:c6:ed
Ethernet Subnet:	255.255.0.0
Ethernet Gateway:	192.168.0.1
Ethernet DHCP:	Off
HTTPS:	On

Figure 296: System Information Screen, Interface Information

4.5.6 Footer Tool Bar

The Footer Tool bar, shown in Figure 297, provides access to additional Browser Interface functionality.



Figure 297: Browser Interface Footer Tool Bar

4.5.6.1 Help

The Help option on the Footer Tool bar, provides a link to the Rack-Mount RDMS Installation and Operation manual, an RDMS API User Guide, as well as contact information for Quasonix. The Help screen is shown in Figure 298.

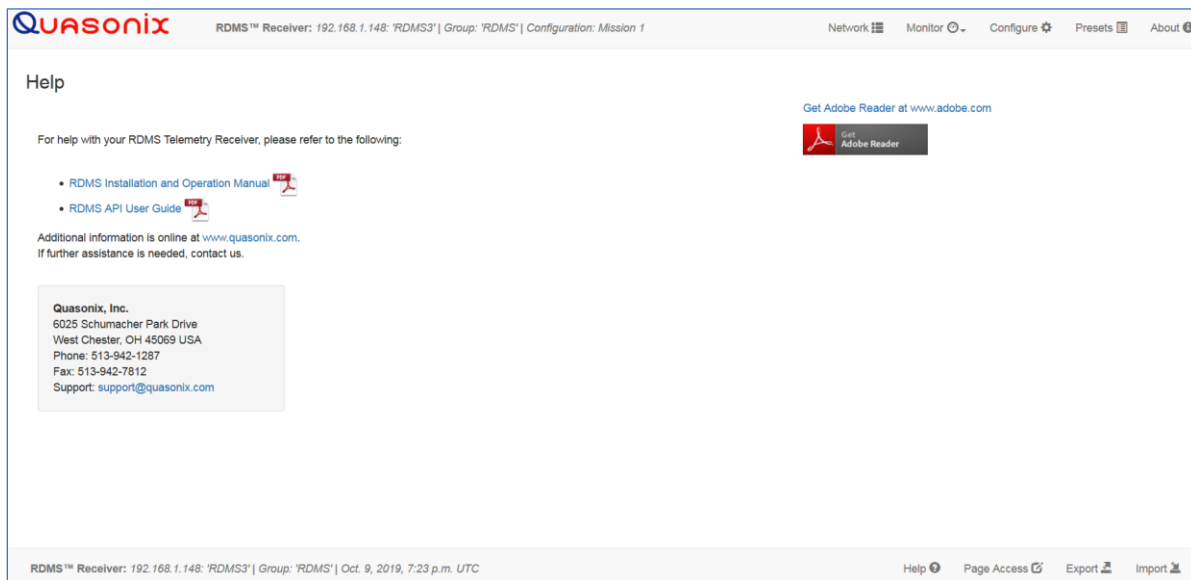


Figure 298: Help Screen

4.5.6.2 Page Access

The Page Access Management screen, shown in Figure 299, 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.

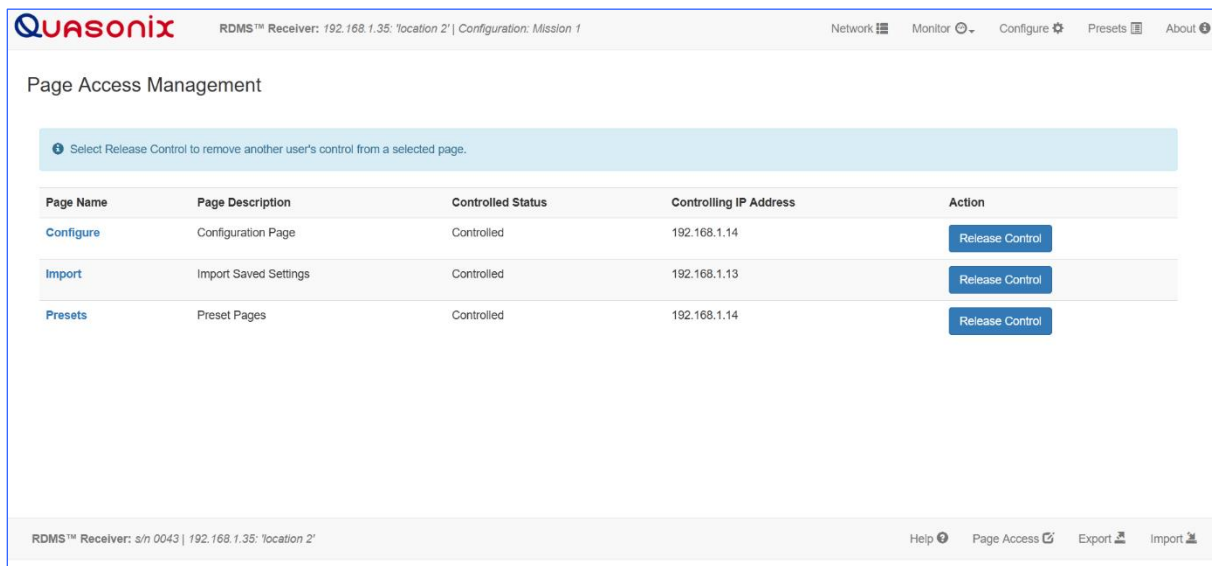


Figure 299: Page Access Management Screen

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 300. The message provides a link to the Page Access Management screen so the user may review and release control as needed.

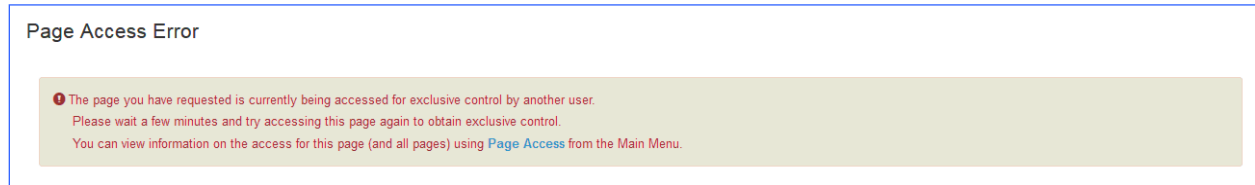


Figure 300: Page Access Error Message

4.5.6.3 Export

Export Configuration, shown in Figure 301, 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.

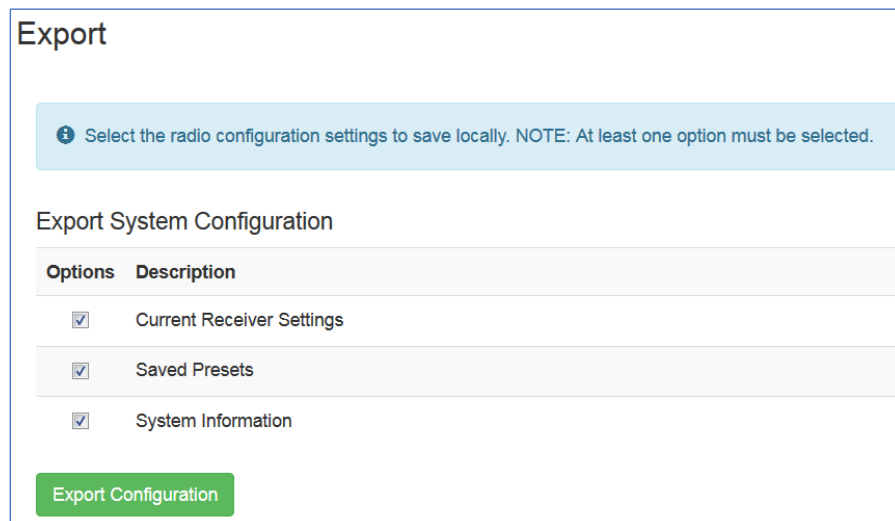


Figure 301: Export Configuration Screen

4.5.6.4 Import

The Import Configuration screen, shown in Figure 302, is used to import files that were previously exported (as described in the previous section).

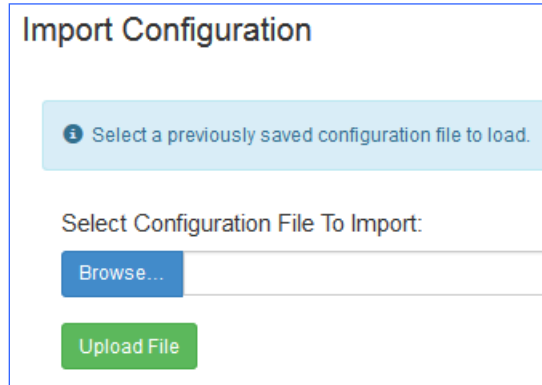


Figure 302: Import Configuration Screen

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 303.

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

Import Configuration

Select the configuration setting(s) to import. NOTE: Importing will overwrite existing settings.

Select	Configuration Type	Description
<input type="checkbox"/>	Current Configuration	Name 'Mission 0 ', Description 'Mission Description '
<input type="checkbox"/>	Preset Setting	Preset ID 1, Preset Name 'Mission 1', Preset Description 'Mission Description'
<input type="checkbox"/>	Preset Setting	Preset ID 2, Preset Name 'Mission 2', Preset Description 'Mission Description'
<input type="checkbox"/>	Preset Setting	Preset ID 3, Preset Name 'Mission 3', Preset Description 'Mission Description'
<input type="checkbox"/>	Preset Setting	Preset ID 4, Preset Name 'Mission 4', Preset Description 'Mission Description'
<input type="checkbox"/>	Preset Setting	Preset ID 5, Preset Name 'Mission 5', Preset Description 'Mission Description'
<input type="checkbox"/>	Preset Setting	Preset ID 6, Preset Name 'Mission 6', Preset Description 'Mission Description'
<input type="checkbox"/>	Preset Setting	Preset ID 7, Preset Name 'Mission 7', Preset Description 'Mission Description'
<input type="checkbox"/>	Preset Setting	Preset ID 8, Preset Name 'Mission 8', Preset Description 'Mission Description'

Import Selected

Upload Another File

Figure 303: Import Configuration Selection Window

4.6 Performance Specifications

4.7 Power

The rack-mount receiver requires 100 to 240 VAC, 50/60 Hz power.

4.8 RF Frequency Error

By default, the RDMS™ is capable of acquiring a signal with a frequency error of up to ± 100 kHz.

4.9 Bit Error Rate

The RDMS™ meets the following BER limits, when tested with a signal source, which complies with IRIG 106-17.

Table 11: 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.

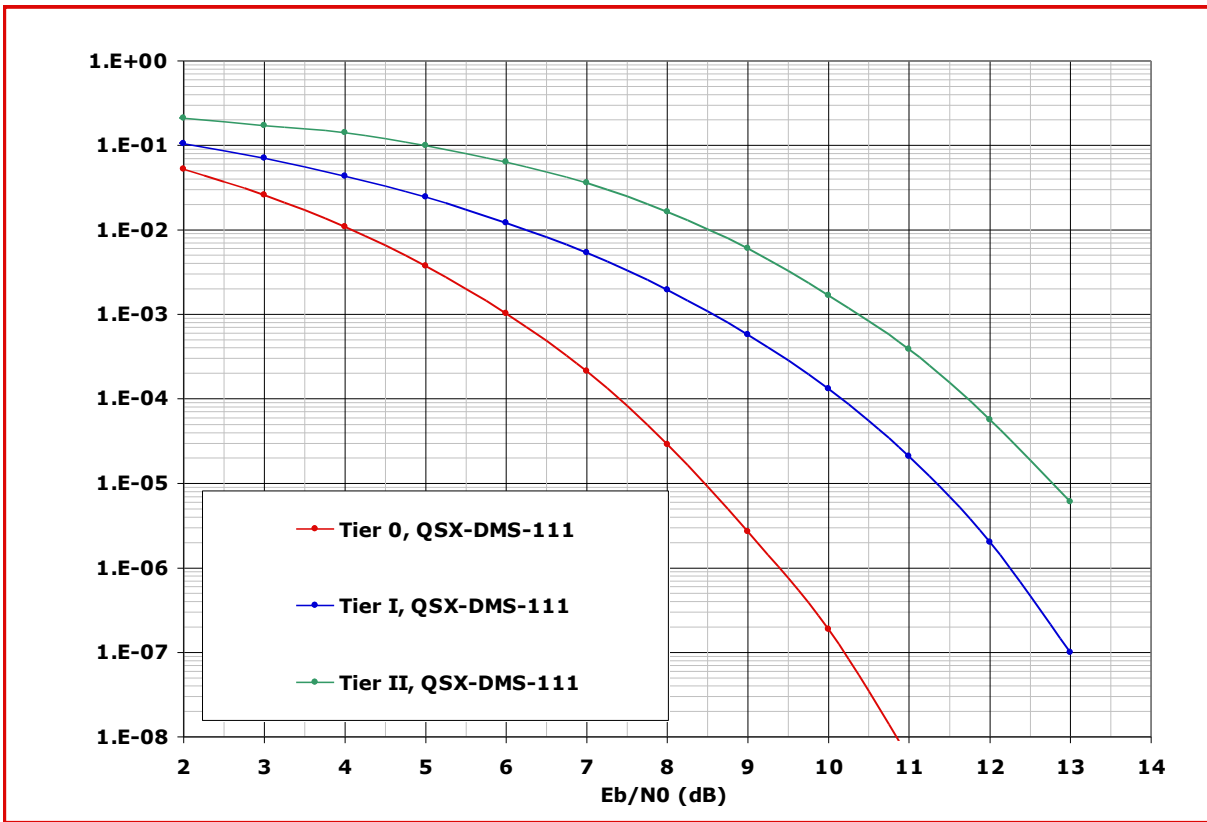


Figure 304: BER Performance for Tier 0, I, and II

4.10 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 305.

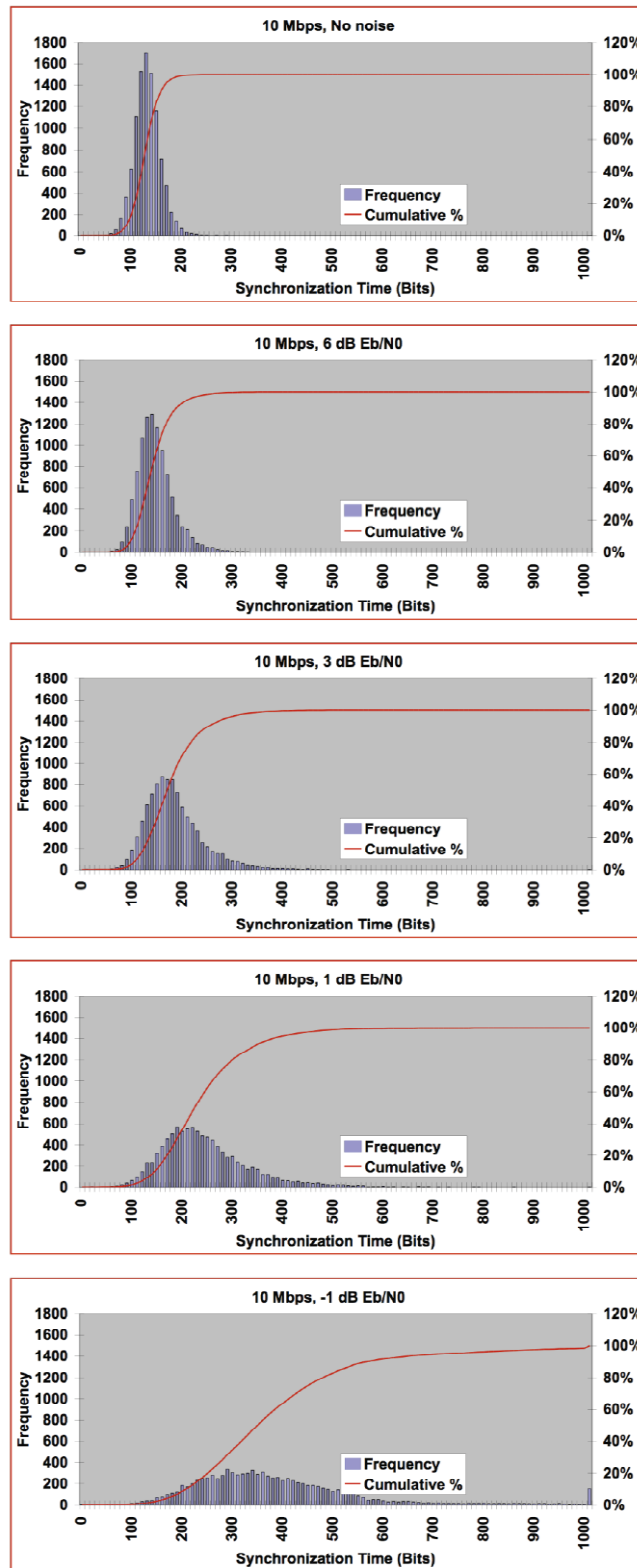
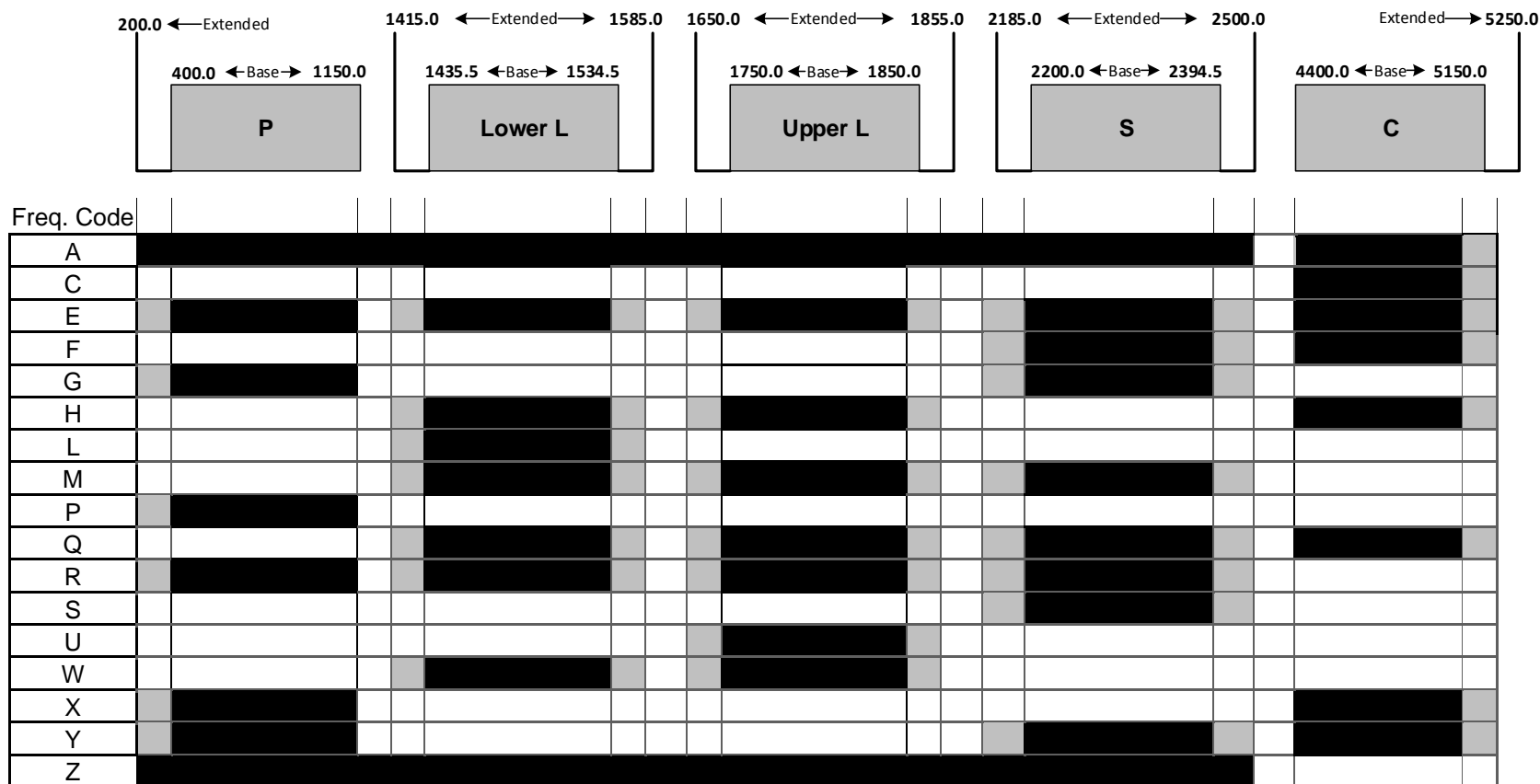


Figure 305: Synchronization Time at Various Signal-to-Noise Ratios

4.11 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 12: Band Configuration Codes



Legend:

Frequency Gap

Standard (Base) Frequency Range

Extended Frequency Range (available by selecting Extended Tuning = 1 in part number)

4.11.1 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

5 Maintenance Instructions

The Rack-Mount receiver requires no regular maintenance, and there are no user-serviceable parts inside.

6 Product Warranty

The Rack-Mount receiver carries a standard parts and labor warranty of one (1) year from the date of delivery.

6.1 Quasonix Limited Warranty Statement

This Limited Warranty Statement (this “Limited Warranty”) applies to all hardware and software products and internal components of such products (the “Products”) sold by Quasonix, or its representatives, authorized resellers, or country distributors (collectively referred to herein as “Quasonix”). EXCEPT AS EXPRESSLY SET FORTH IN THIS LIMITED WARRANTY, QUASONIX MAKES NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO ANY PRODUCTS SOLD BY IT. Quasonix expressly disclaims all warranties and conditions not stated in this limited warranty. There are no warranties which extend beyond the description on the face hereof. Capitalized terms not otherwise defined herein shall have the meaning set forth in those certain General Terms and Conditions of Sale for Standard Product, as amended from time to time.

Quasonix warrants to customer that for one (1) year from the date of shipment of the Products by Quasonix (the “Warranty Period”), such Products purchased from Quasonix or its authorized affiliate will materially conform to the specifications set forth in the applicable Quasonix Specifications, if any, and are free from defects in materials and workmanship under normal use during the Warranty Period. As used herein, “normal use” means the intended use of the Products for which it was designed by Quasonix.

This Limited Warranty extends only to the original purchaser of the Products and is not transferable to anyone who obtains ownership of the Products from the original purchaser.

Quasonix’s software, whether incorporated into the Products or sold separately, is warranted solely to the extent that problems or “bugs” are found in the software and affect the functional operation of the Products. At no time shall requests for changes in the software architecture or visual esthetics be considered a warranty item.

The Products are manufactured using new materials only. Replacement parts may be new or equivalent to new. Replacement parts are warranted to be free from defects in material or workmanship for thirty (30) days or for the remainder of the Warranty Period of the Products in which they are installed, whichever is longer.

During the Warranty Period, Quasonix will repair or replace the defective Products. All components or hardware products removed from the Products under this Limited Warranty become the property of Quasonix. All warranties are limited to the repair or replacement of the Products.

In no event shall Quasonix be liable for any special, consequential, incidental or indirect damages of any kind, including, without limitation, loss of profits, loss of data, “down-time,” loss of use or damage to other equipment, or personal injury or death, whether or not Quasonix has been advised of the possibility of such loss.

Notwithstanding anything to the contrary herein, Quasonix’s entire liability hereunder from any cause whatsoever and regardless of the form of action shall be limited to the amount actually received by Quasonix.

Quasonix shall not be liable for a breach of the warranty set forth in this Limited Warranty unless: (i) the customer gives written notice of the defect, reasonably described, to Quasonix’s Contracts Administrator within thirty (30) days of the time when customer discovers or ought to have discovered the defect and obtains a Return Materials Authorizations (“RMA”) number; (ii) Quasonix is given a reasonable opportunity after receiving the notice to examine such Products and customer (if requested to do so by Quasonix) returns such Products to Quasonix’s facility in Moorpark, CA, unless otherwise approved by Quasonix; and (iii) Quasonix reasonably verifies customer’s claim that the Products are defective.

Subject to the foregoing, with respect to any such Products during the Warranty Period, Quasonix shall, in its sole discretion, either: (i) repair or replace such Products (or the defective part) or (ii) credit or refund the price of such

Products at the pro rata contract rate provided that, if Quasonix so requests, customer shall, at Quasonix's expense, return such Products to Quasonix.

The customer is responsible for all costs associated with packaging and shipping of the defective Products to Quasonix's facility and clearly marking or affixing the given RMA number on the shipping label. Quasonix is not responsible for any loss or damage during shipment to Quasonix's facility. Following repair or replacement of covered Products, Quasonix will assume responsibility for the costs associated with the return of the material to the customer to an address provided by the customer. Notwithstanding the foregoing, items returned to Quasonix's facility and found to be operational or otherwise not covered by this Limited Warranty shall be returned to the customer at the customer's expense.

This Limited Warranty does not apply to expendable parts, such as cables, lamps, fuses, connectors, etc. This Limited Warranty does not extend to any Products which have been damaged or rendered defective (a) as a result of accident, misuse, abuse, or external causes; (b) by operation outside the usage parameters stated in the user documentation that shipped with the Products; (c) as a result of a failure to follow the instructions in the Operations & Maintenance Manual (d) by the use of parts not manufactured or sold by Quasonix; or (e) by modification or service by anyone other than (i) Quasonix, (ii) an Quasonix authorized service provider, or (iii) your own installation of end-user replaceable Quasonix or Quasonix approved parts if available for the Products in the servicing country.

THE TERMS OF THE WARRANTIES CONTAINED HEREIN DO NOT IN ANY WAY EXTEND TO ANY PRODUCT OR PART THEREOF OR SOFTWARE MATERIALS WHICH WERE NOT MANUFACTURED BY SELLER OR PREPARED BY SELLER OR ANY OF ITS AFFILIATES.

These terms and conditions constitute the complete and exclusive warranty agreement between the customer and Quasonix regarding the Products purchased. This Limited Warranty is applicable in all countries and may be enforced in any country where Quasonix or its authorized affiliates offer warranty service subject to the terms and conditions set forth in this Limited Warranty.

These terms and conditions supersede any prior agreements or representations (including representations made in Quasonix sales literature or advice given to the customer by Quasonix or an agent or employee of Quasonix) that may have been made in connection with the purchase of the Products. No change to the conditions of this Limited Warranty is valid unless it is made in writing and signed by an authorized representative of Quasonix.

6.1.1 Extended Warranties

Extended warranties or extra coverage are available upon request. Please contact Quasonix for details and pricing.

THE REMEDIES SET FORTH IN THIS LIMITED WARRANTY STATEMENT SHALL BE THE BUYER'S SOLE AND EXCLUSIVE REMEDY AND SELLER'S ENTIRE LIABILITY FOR ANY BREACH OF THE LIMITED WARRANTY SET FORTH HEREIN.

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7 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 the Quasonix representative determines that the product issue must be addressed at Quasonix, a returned materials authorization (RMA) number will be provided for return shipment.

Authorized return shipments must be addressed in the following manner:

**Quasonix, Inc.
ATTN: Repair, RMA #
6025 Schumacher Park Drive
West Chester, OH 45069**

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.

8 Appendix A – Recommended AM and AGC Settings for ACU Interfaces

8.1 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.

8.2 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

8.3 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 8.2). Table 13 describes recommended settings based on these parameters:

Table 13: 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 13, 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 13.

9 Appendix B – Phase Noise Compensation

9.1 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 306, shows all of the possible paths the phase trajectory can take over a period of seven bits. Figure 307 shows the two unique paths, based on whether the second bit is a 1 or 0.

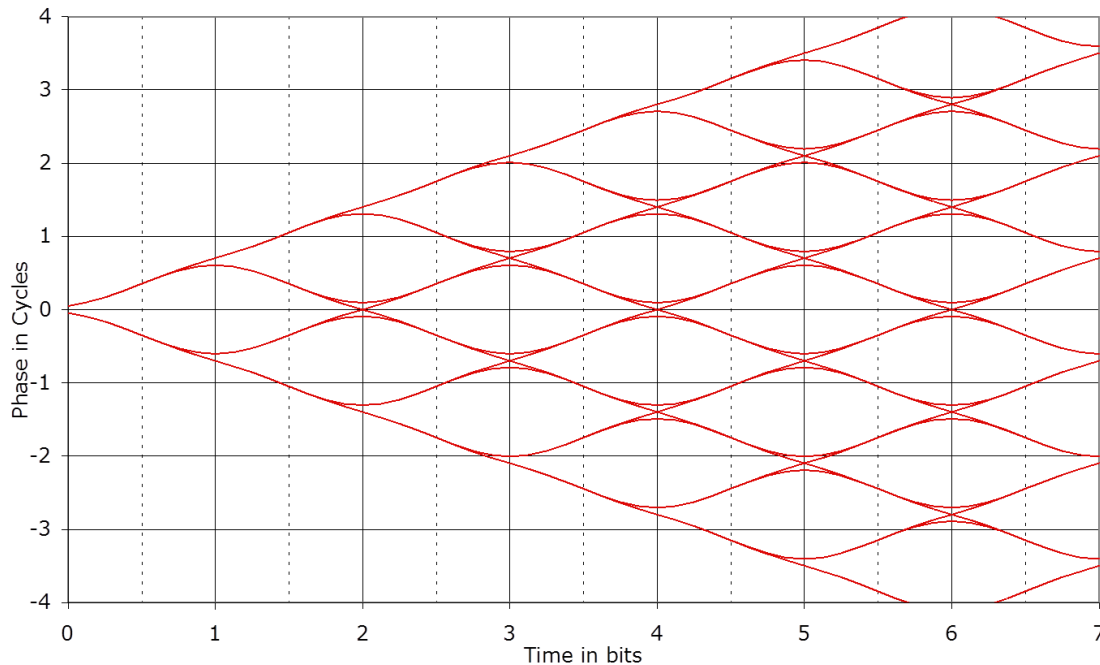


Figure 306: Ideal PCM/FM Phase Tree ($h = 0.7$)

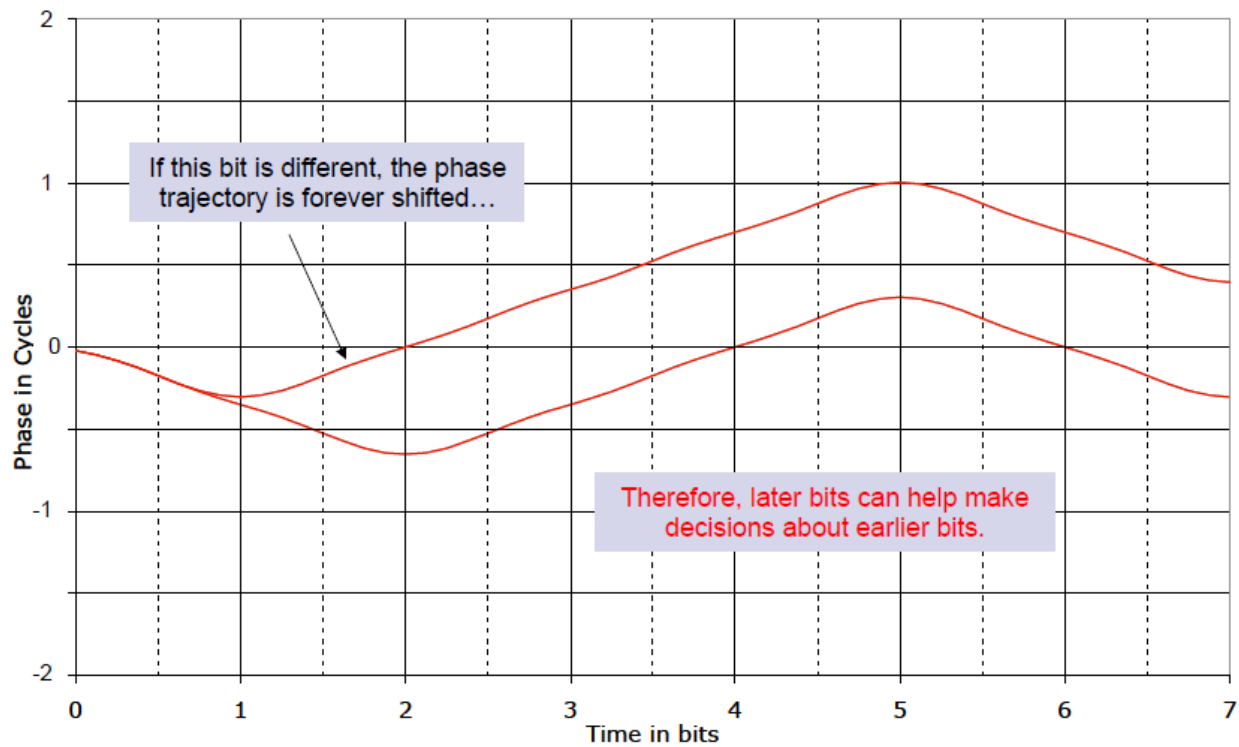


Figure 307: Phase Trajectory Never Forgets

9.1.1 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.

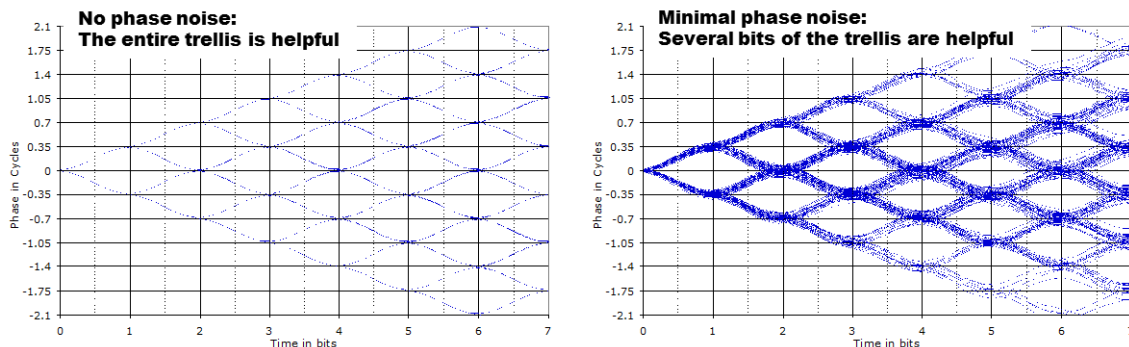


Figure 308: Trellis Detection Gain with Zero to Minimum Phase Noise

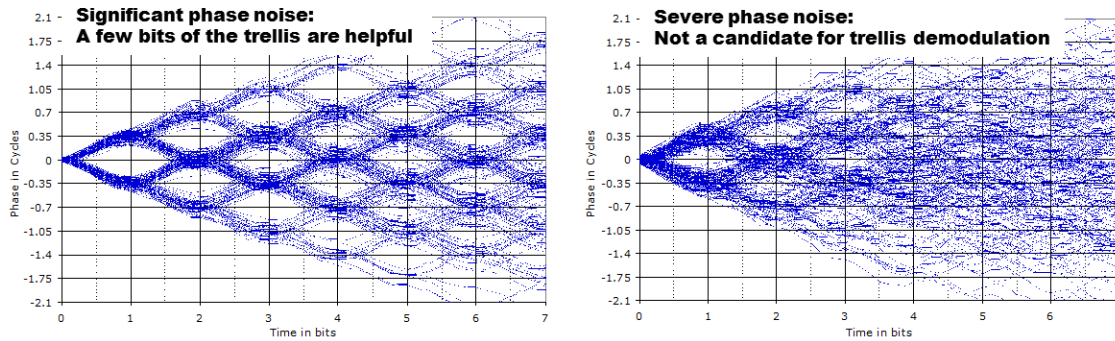


Figure 309: Trellis Detection Gain with Significant to Severe Phase Noise

9.2 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.

9.3 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.

9.4 When to Use PNC

There is no bullet-proof test for whether PNC is needed, but DQM is pretty close. The PNC Auto setting uses DQM from both trellis and single-symbol demodulation to select which is providing better results for the present input signal. The primary downside to PNC Auto is that there is time delay switching between PNC On and PNC Off. Therefore, PNC Auto is ideal for cases where it is not obvious if PNC is needed, but it may not be suitable for cases where phase noise is rapidly variable. Enable PNC Auto or PNC On if:

- The demodulator is struggling to lock, even with good Signal to Noise Ratio (SNR). ("Good" SNR means the signal strength bar with properly zeroed AGC is green.)
- The eye pattern NEVER looks "clean," as in Figure 310
- Symptoms get worse when the transmitter is under vibration
- Symptoms get worse at low bit rates

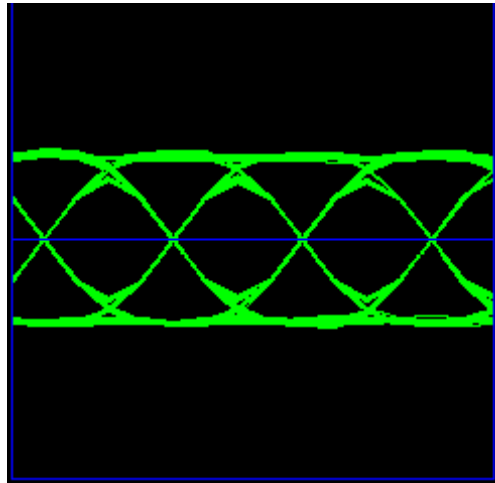


Figure 310: "Clean" Eye Pattern

9.5 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 Auto or On:

- Microwave Innovations
- Emhiser
- Southern California Microwave
- L3 (analog transmitters)

10 Appendix C - PCM Framer/Deframer Function

Quasonix RDMS™ receivers recognize PCM frames as defined by IRIG 106-17 Chapter 4 and Appendix 4-A. 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.

10.1 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:

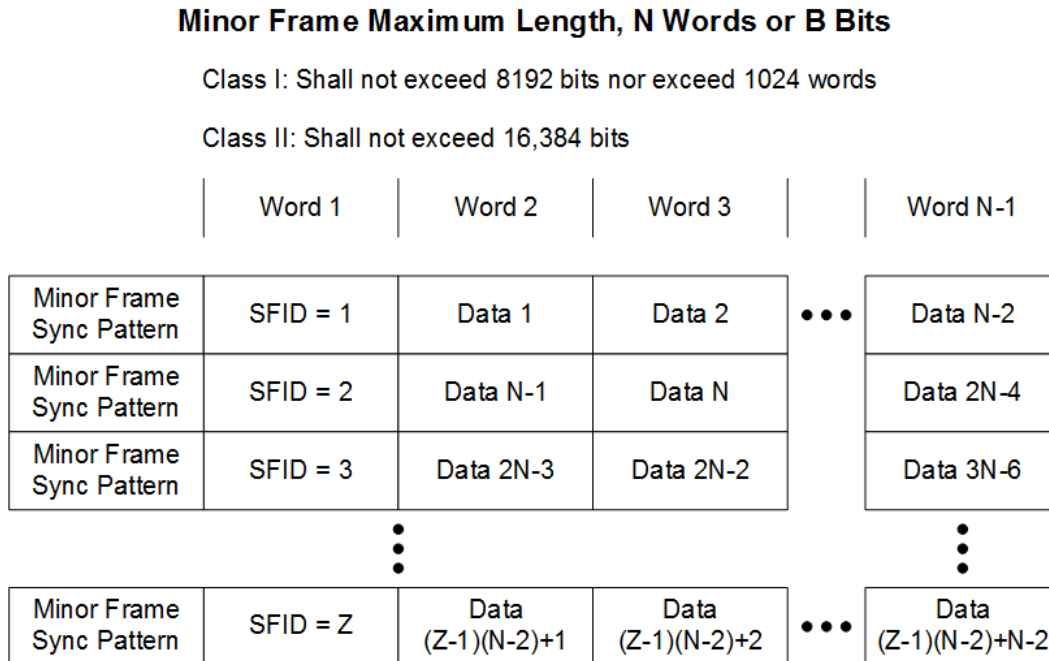


Figure 311: Frame Format with SFID Insertion Enabled

*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.

10.2 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 pattern detect
- LOCK_THRESH – Number of valid sync pattern detects required to declare PCM frame lock
- SEARCH_THRESH – Number of invalid sync pattern 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 311, 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 frame 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 SYNC_DETECT back-panel outputs.

11 Appendix D – How to Configure Tape Output

The method for configuring Tape Output has been updated. Refer to section 4.4.2.22 Video Output Menu for front panel control and section 4.5.3.3.9 Channel A Output, etc., for Browser Interface control.

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.

11.1 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 11.3 for 3U connectors). Connectors are listed in Table 14 and locations are illustrated in Figure 6.

Table 14: 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 312: 1U Rear Panel

11.2 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
```

11.2.1 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.

11.3 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 15 and locations are illustrated in Figure 313.

Table 15: 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 313: 3U Rear Panel

11.4 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.

12 Appendix E – 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 16: PCM/FM Factory Reset Values

Parameter	Reset State
Bit Rate	1
Combiner (if available)	Off
Clock Polarity	Normal
Data Polarity	Normal
Equalizer (if available)	Off
DQ Encapsulation (if available)	Disabled
Derandomizer	Disabled
Differential Decoder	N/A
Modulation Scaling	Acquire
Modulation Persist	Off
IF Filter	Auto
Video De-emphasis	Off

Parameter	Reset State
Phase Noise Compensation	Off
Muting Timeout	1000
Output Muting	Off
Downconvert Antenna	Disabled
AGC Polarity	+ (Positive)
AGC Scale	10
AGC Time Constant	100
AGC Zero Mode	Manual
AM Bandwidth	100
AM Polarity	Normal
AM Scale	1
AGC Compensation	Enabled

Table 17: 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 18: 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 19: 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

14 Appendix F – RDMS with IP2 Option

14.1 Overview

This appendix describes how to operate a Rack-Mount RDMS™ Telemetry Receiver with the IP2 (TMoIP) option (Telemetry over IP).

The Browser-based graphical user interface (GUI) provides RDMS and TMoIP configuration, control, and status.

For detailed operational information, refer to the documents in Table 20: Reference Documents.

Table 20: Reference Documents

Document Name
Quasonix 3 rd Generation Rack-Mount RDMS™ Telemetry Receiver Installation and Operation Manual (this document)
TMOIP Operation Manual - https://www.quasonix.com/files/tmoip-processor-manual.pdf

14.2 Hardware

The 1U and 3U Rack-Mount RDMS back panel provides connectors used specifically with the IP2 (TMoIP) option. The full back panel is shown in Figure 314. An enlarged view of the right side with TMoIP connectors is shown in Figure 315.



Figure 314: 3rd Generation RDMS 3U with IP2 Option, Back Panel Connectors



Figure 315: 3rd Generation RDMS 3U with IP2 Option, Back Panel Connectors-Right Side

The ports used specifically for TMOIP operation are described in Table 21. EVTM ports are NOT enabled when using TMOIP.

Table 21: 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	UNUSED for TMOIP	BNC	J77
IRIG-B OUT	UNUSED for TMOIP	BNC	J78



Figure 316: 3rd Generation RDMS 1U with IP2 Option, Back Panel Connectors-Right Side

Note: On the 1U, J35/CTRL is the equivalent of the 3U J80, and J36 TMoIP is the equivalent of 3U J82.

14.3 Set Up TMoIP Address

The RDMS with IP2 option has two configuration IP addresses: one for the RDMS and one for the embedded TMoIP Processor. Prior to using the TMoIP features, the TMoIP Address must be set via the front panel Main Menu > System Settings > Ethernet > TMoIP Address. Be sure to set this IP address to be on the same subnet as the IP Address, because these interfaces are on the same network and internally connect to the same connector on the back of the RDMS (J35 on 1U and J80 on 3U).

Note: The TMoIP Address must be set so that it does not conflict with the TMoIP channel addresses (accessible via the TMoIP browser interface).

Ethernet		Ch:1
DHCP	Off	
IP Address	192.168.160.91	
Subnet	255.255.0.0	
Gateway	192.168.0.1	
TMoIP Address	192.168.160.92	

Figure 317: Main Menu, System Settings, Ethernet Selection

The TMoIP enabled RDMS 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/J35).

1. Open a browser on the connected PC.
2. Type the IP address for the TMoIP -enabled receiver RDMS into the browser, then press Enter on the keyboard.

14.4 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 318, with six selections that display a variety of parameters for each available channel. The Browser Interface defaults to the Monitor screen.



Figure 318: Browser Interface Header Tool Bar for RDMS™ with TMoIP IP2 Option

The RDMS Network, Monitor, Configure, Presets, and About screens are described in section 4.5 of this manual. The TMoIP functionality is accessed via the TMoIP Control link, which opens a new tab and takes the user to the TMoIP Configure System Screen. Detailed information about each TMoIP screen is found in the TMoIP Processor Manual, specifically section 4.2.

14.4.1 TMoIP Configure System

The TMoIP Monitor/Configure System screen, shown in Figure 319, is the primary operator interface for the TMoIP status and configuration.

Figure 319: TMoIP Configure System Screen

The TMoIP Configure System screen, along with the other screens linked in the header menu, give the user complete control and status for the embedded TMoIP module. This browser-based user interface is described in detail in the TMoIP Processor Manual, specifically in section 4.2.

15 Appendix G - RDMS with IP Option

15.1 Overview

This appendix describes how to operate a 3U Rack-Mount RDMS™ Telemetry Receiver with the IP (TMoIP) option (Telemetry over IP). **While this option has been replaced by the IP2 option, customers having 3U receivers with the IP option are still supported by Quasonix.**

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 22.

Table 22: Reference Documents

Document Name	Document Number
Quasonix 3 rd Generation Rack-Mount RDMS™ 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

15.2 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 320. An enlarged view of the right side with TMoIP connectors is shown in Figure 321.



Figure 320: 3rd Generation RDMS 3U with IP Option, Back Panel Connectors



Figure 321: 3rd Generation RDMS 3U with IP Option, Back Panel Connectors-Right Side

The ports used specifically for TMOIP operation are described in Table 23. EVTM ports are NOT enabled when using TMOIP.

Table 23: 3U Rack-Mount RDMS with IP Option, 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

15.3 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 322 displays, click on the Set Address button.

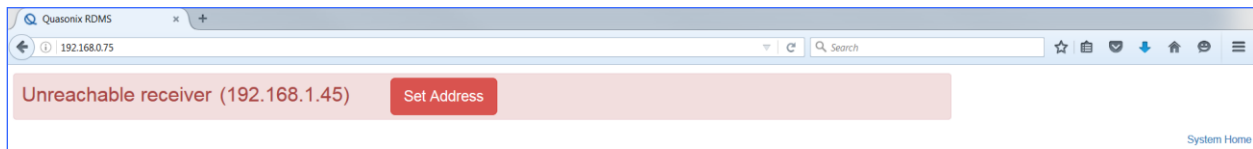


Figure 322: Browser Window with an Incorrect IP Address

3. When the Receiver Addressing window displays (Figure 323), 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 323: 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.*

15.4 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 194, with six selections that display a variety of parameters for each available channel. The Browser Interface defaults to the Network screen.

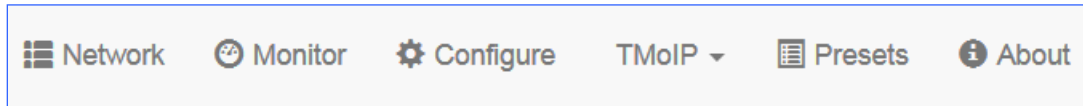


Figure 324: Browser Interface Header Tool Bar for RDMS™ with TMoIP Option

The RDMS Network, Monitor, Configure, Presets, and About screens are described in section 4.5 of this manual. The TMoIP functionality is accessed via the TMoIP tab, as shown in Figure 325. Detailed information about each TMoIP screen is found in the NetAcquire® Telemetry over IP (TMoIP) Option Users Manual.

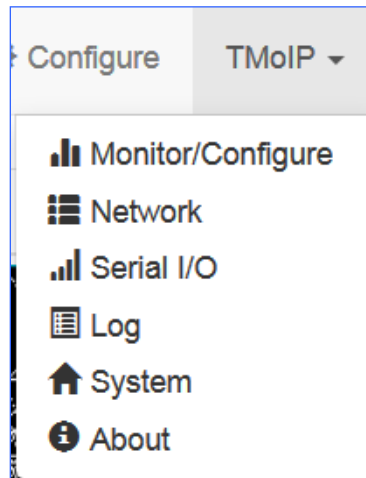


Figure 325: RDMS™ Browser Interface Header Tool Bar, TMoIP Tab

15.4.1 TMoIP Monitor/Configure Screen

The TMoIP Monitor/Configure screen, shown in Figure 195, is the primary operator interface for the TMoIP status and configuration.

Local Channel		Status	Local Endpoint	Network	Remote Endpoint	Remote Channel	
Name						Status	Name
Serial 0	Closed		Quasonix TMoIP: Stopped		<none>	<none>	
Serial 1	Closed		Quasonix TMoIP: Stopped		<none>	<none>	
Serial 2	Closed		Quasonix TMoIP: Stopped		<none>	<none>	

Figure 326: 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 327. Associated configuration and control information displays in the right side pane.

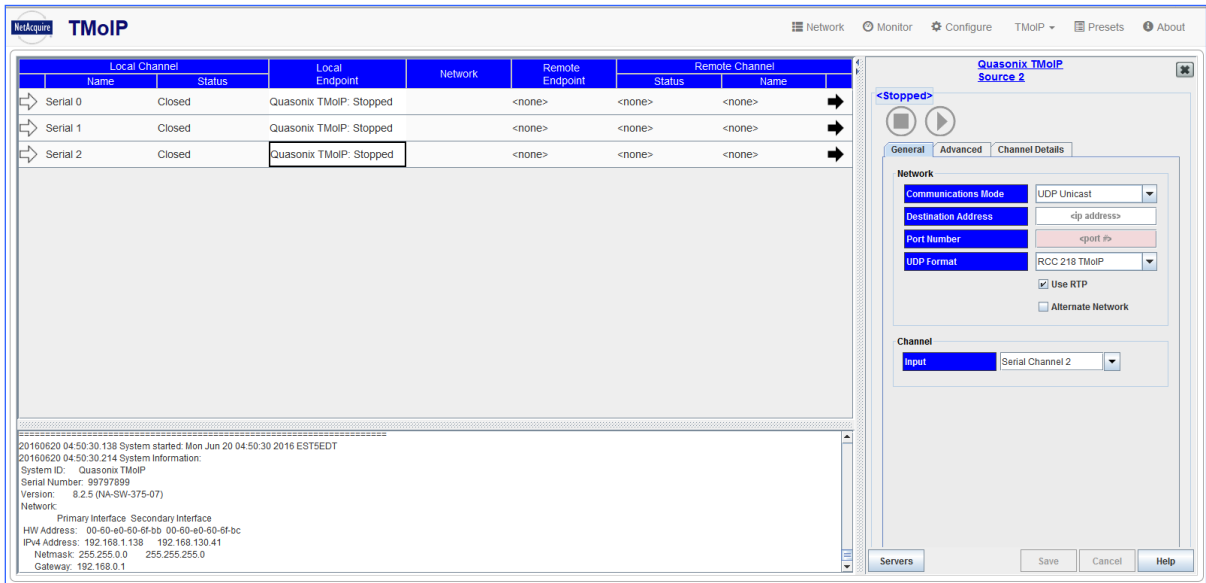


Figure 327: TMOIP Monitor/Configure Screen with TMOIP Channel Selected

15.4.2 TMOIP Network Screen

The TMOIP Network screen, shown in Figure 328, configures the TMOIP network interfaces. The last interface listed in the left pane, Net 2, is not used.

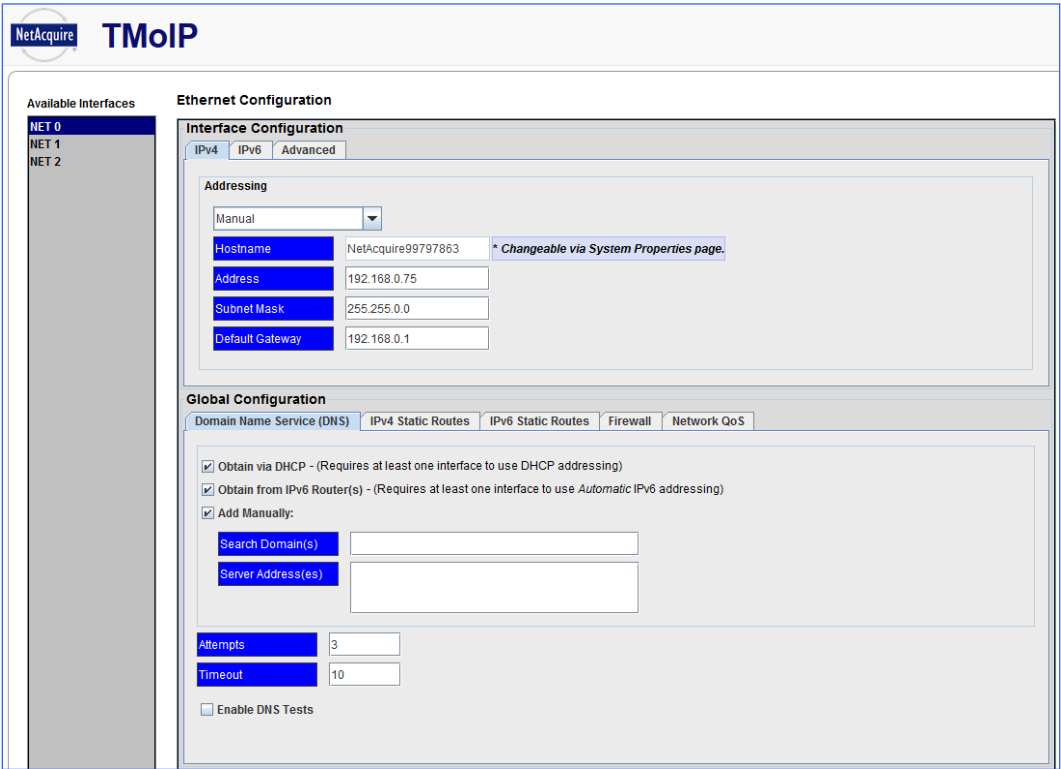


Figure 328: TMOIP Network Screen

15.4.3 TMOIP Serial I/O Screen

The TMOIP Serial I/O screen, shown in Figure 329, updates status and configures serial input channels for TMOIP.

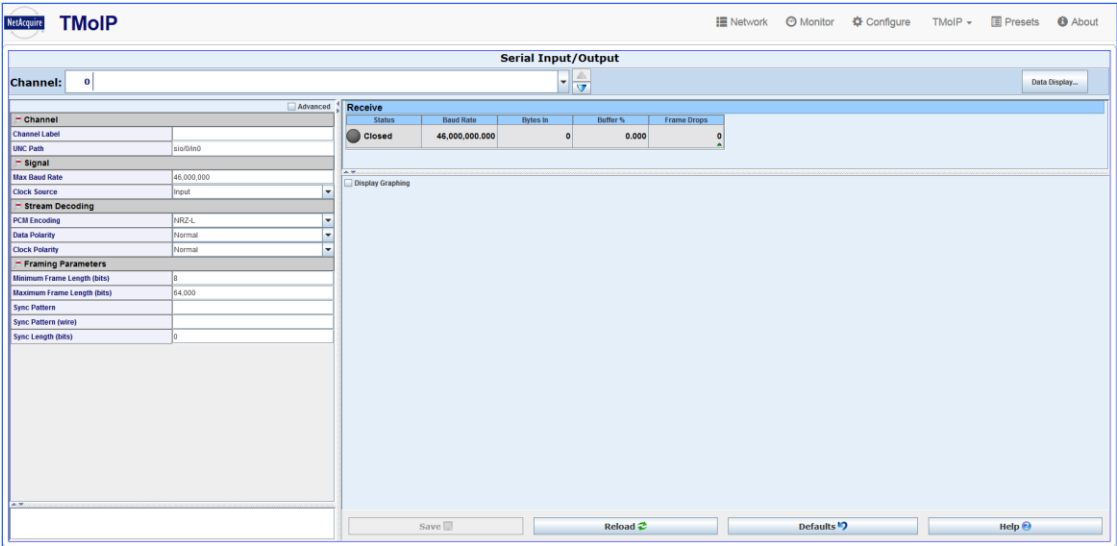


Figure 329: TMOIP Serial I/O Screen

15.4.4 TMoIP Log Screen

The TMoIP Log screen, shown in Figure 330, displays NetAcquire server message log entries.

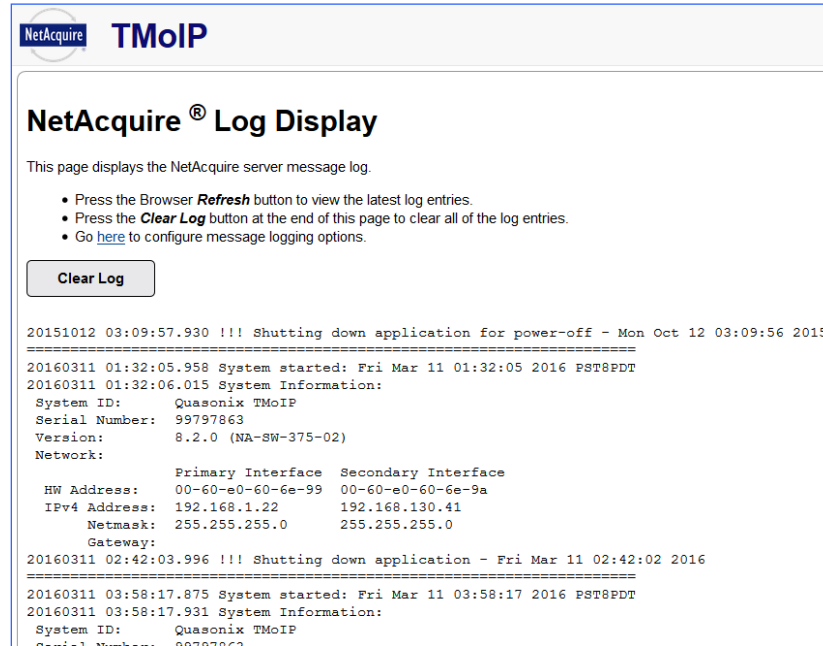


Figure 330: TMoIP Log Screen

15.4.5 TMoIP System Screen

The TMoIP System screen is shown in Figure 331. 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.

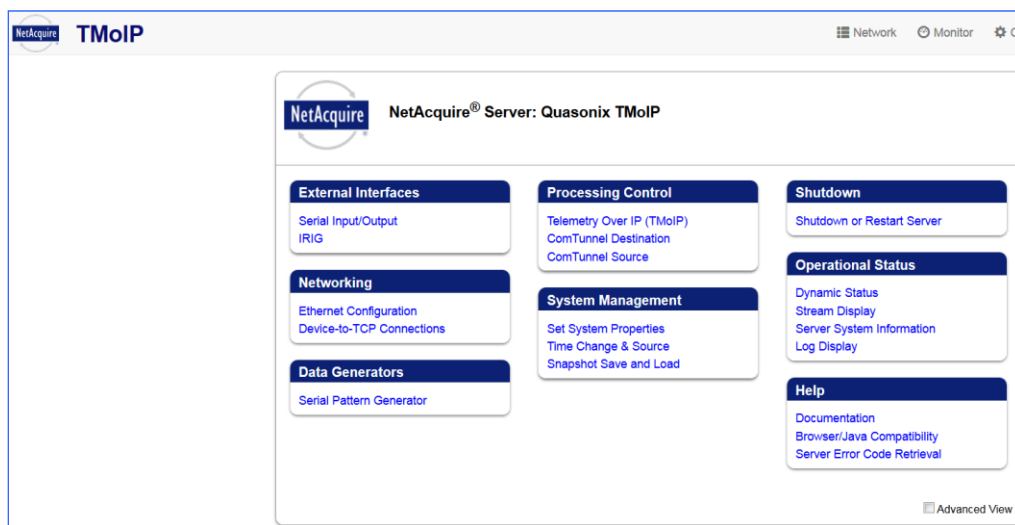
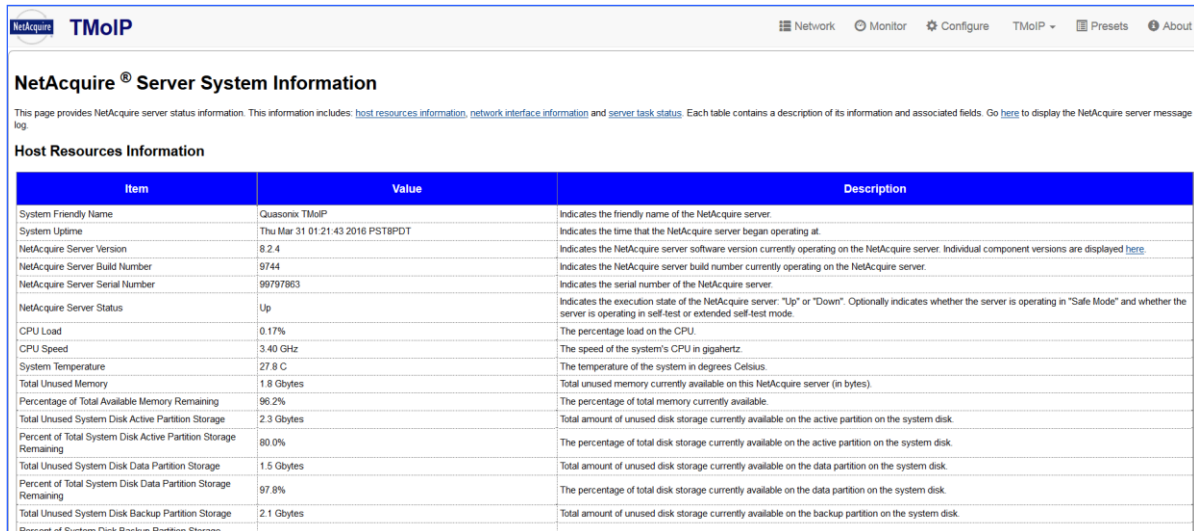


Figure 331: TMoIP System Screen, Basic

15.4.6 TMOIP About Screen

The TMOIP About screen, shown in Figure 332, provides NetAcquire® server status information, such as host resources, network interface, and server task status.



The screenshot shows the 'NetAcquire TMOIP' interface. At the top, there's a navigation bar with links: Network, Monitor, Configure, TMOIP (selected), Presets, and About. Below this is the title 'NetAcquire® Server System Information'. A paragraph explains that the page provides server status information, including host resources, network interface, and server task status, and provides a link to the message log. The main content is a table titled 'Host Resources Information' with three columns: Item, Value, and Description. The table lists various system metrics such as System Friendly Name, System Uptime, NetAcquire Server Version, NetAcquire Server Build Number, NetAcquire Server Serial Number, NetAcquire Server Status, CPU Load, CPU Speed, System Temperature, Total Unused Memory, Percentage of Total Available Memory Remaining, Total Unused System Disk Active Partition Storage, Percent of Total System Disk Active Partition Storage Remaining, Total Unused System Disk Data Partition Storage, Percent of Total System Disk Data Partition Storage Remaining, Total Unused System Disk Backup Partition Storage, and Percent of System Disk Backup Partition Storage.

Item	Value	Description
System Friendly Name	Quasonix TMOIP	Indicates the friendly name of the NetAcquire server.
System Uptime	Thu Mar 31 01:21:43 2016 PST8PDT	Indicates the time that the NetAcquire server began operating at.
NetAcquire Server Version	8.2.4	Indicates the NetAcquire server software version currently operating on the NetAcquire server. Individual component versions are displayed here .
NetAcquire Server Build Number	9744	Indicates the NetAcquire server build number currently operating on the NetAcquire server.
NetAcquire Server Serial Number	99797863	Indicates the serial number of the NetAcquire server.
NetAcquire Server Status	Up	Indicates the execution state of the NetAcquire server: "Up" or "Down". Optionally indicates whether the server is operating in "Safe Mode" and whether the server is operating in self-test or extended self-test mode.
CPU Load	0.17%	The percentage load on the CPU.
CPU Speed	3.40 GHz	The speed of the system's CPU in gigahertz.
System Temperature	27.8 C	The temperature of the system in degrees Celsius.
Total Unused Memory	1.8 Gbytes	Total unused memory currently available on this NetAcquire server (in bytes).
Percentage of Total Available Memory Remaining	96.2%	The percentage of total memory currently available.
Total Unused System Disk Active Partition Storage	2.3 Gbytes	Total amount of unused disk storage currently available on the active partition on the system disk.
Percent of Total System Disk Active Partition Storage Remaining	80.0%	The percentage of total disk storage currently available on the active partition on the system disk.
Total Unused System Disk Data Partition Storage	1.5 Gbytes	Total amount of unused disk storage currently available on the data partition on the system disk.
Percent of Total System Disk Data Partition Storage Remaining	97.8%	The percentage of total disk storage currently available on the data partition on the system disk.
Total Unused System Disk Backup Partition Storage	2.1 Gbytes	Total amount of unused disk storage currently available on the backup partition on the system disk.
Percent of System Disk Backup Partition Storage		

Figure 332: TMOIP About Window

Detailed information about each TMOIP screen is found in the NetAcquire® Telemetry over IP (TMOIP) Option Users Manual (NA-MAN-021).

16 Appendix H – RDMS Recovery Mode

Recovery Mode is a new feature added in R15 that serves as a fallback position for system recovery in case of an unforeseen failure that prevents the RDMS from booting or updating.

When the RDMS detects the appropriate boot failure conditions, it automatically boots into Recovery Mode to allow the user an opportunity to restore the unit to normal operation. This system is installed during an SD Card Update, but is not modified by any other type of update, thereby ensuring its reliability in case of unforeseen failure.

When the RDMS enters recovery mode, a Recovery App is displayed on the front panel, as shown in Figure 333, and any accesses via the Browser Interface are forwarded to a Recovery Page, as shown in Figure 334.

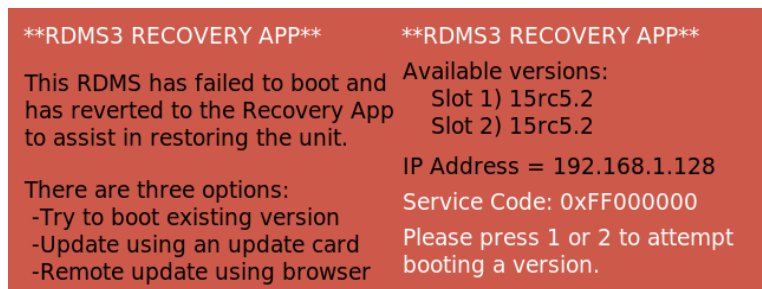


Figure 333: RDMS3 Recovery Application Front Panel Screen

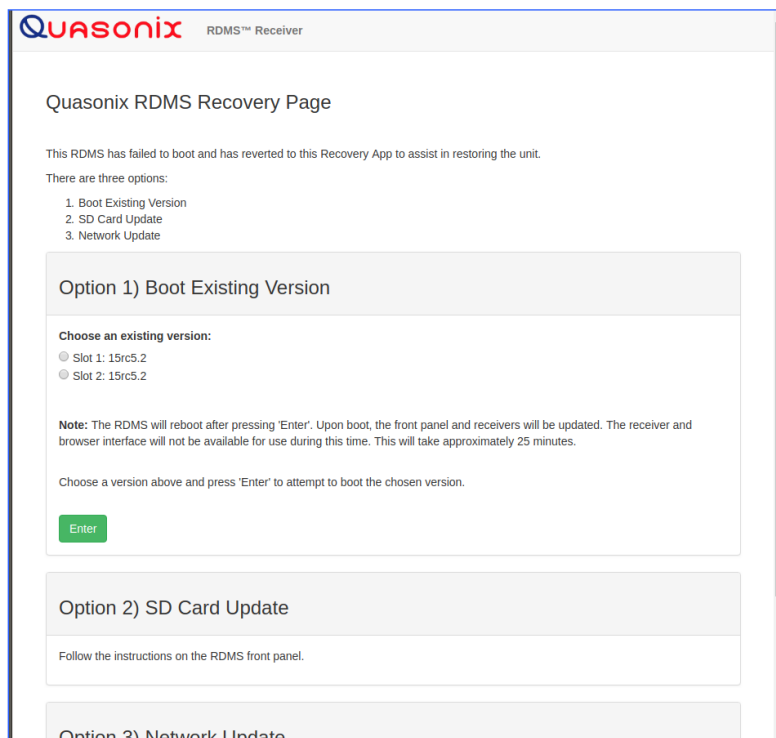


Figure 334: Browser Interface Recovery Screen

In Recovery Mode, the RDMS uses the same addressing method (static or dynamic) that it was last configured with to obtain an IP address. If it was configured with a static address, the RDMS will still be addressable via this static address. If it was configured with DHCP, it is likely, though not guaranteed, that it will have the same IP address that it last had; though this will depend on the DHCP server being utilized on the network. The IP address is not configurable in Recovery Mode, but is displayed on the front panel.

While the system cannot be used operationally in this mode, there are three options for resuming normal operation:

1. Boot Existing Version
2. SD Card Update
3. Network Update

16.1 Option 1 - Boot Existing Version

The first, and most straightforward, method to recover operation is by attempting to boot an existing version that is stored on the RDMS. In order to provide redundancy, the RDMS retains up to two versions of firmware on the device. If one version fails to boot, it is possible to retry booting into that version again, or to fall back to a previous version.

When this option is chosen, the RDMS reboots and boots from the version selected, then it will update the front panel and receivers, in order to match the selected version.

This option is possible through either the front panel or through the browser interface. Only one interface or the other should be utilized.

Front Panel Recovery Boot

The available versions for a recovery boot are displayed on the front panel, as shown in Figure 335.

1. Select a version by pressing the number 1 or 2 on the front panel keypad.

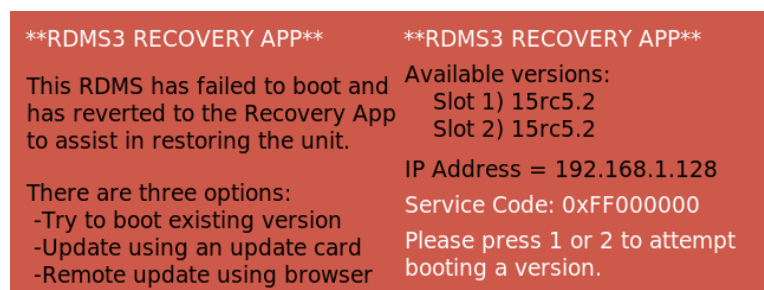


Figure 335: RDMS3 Recovery Application Front Panel, Available Versions

2. Press Enter to confirm and begin the reboot process, as shown in Figure 336.

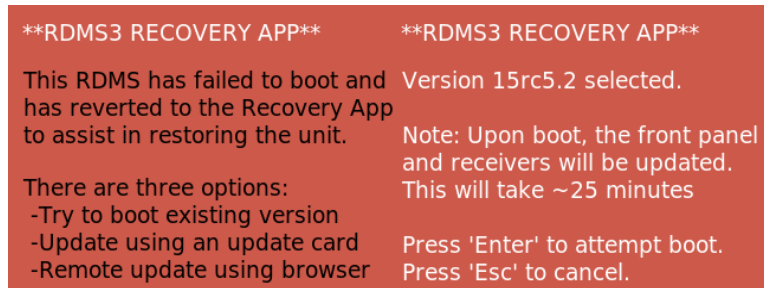


Figure 336: RDMS3 Recovery Application Front Panel, Version Selected

Browser Interface Recovery Boot

The available versions for a browser interface recovery boot are shown in Figure 337.

1. Choose an existing version by clicking on one of the selection buttons in front of the version name.
2. Click on the Enter button to confirm and begin the reboot process.

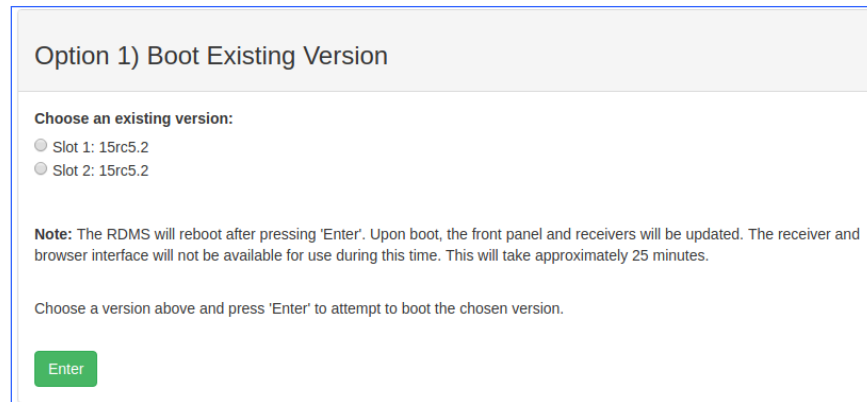


Figure 337: Browser Interface Recovery Screen, Boot Existing Version

After the RDMS begins to reboot, the recovery process takes about 25 minutes, if no errors are encountered. The browser interface or the front panel may be used to track the progress of the reboot and update. If additional problems occur, the RDMS returns to Recovery Mode after three attempts.

16.2 Option 2 - SD Card Update

If the RDMS cannot be recovered through the use of Option 1, the next best option is to use the SD Card Update process. This method uses an update card, provided by Quasonix, to perform a fresh install of the system firmware. Instructions for how to perform this type of update are included with the update card.

16.3 Option 3 - Network Update

If the RDMS is not physically accessible, or an update card is not available, the Network Update is the final method available for recovering normal operation.

When the RDMS is accessed via a browser directed to its IP address, the Recovery Mode page displays, as shown previously in Figure 334.

This method uses a firmware update file, provided by Quasonix, in conjunction with the Browser Interface. Instructions for how to perform this type of update are included with the update file. The Update Page can be accessed via the link on the Browser Interface Recovery screen under the Option 3 title, as shown in Figure 338.

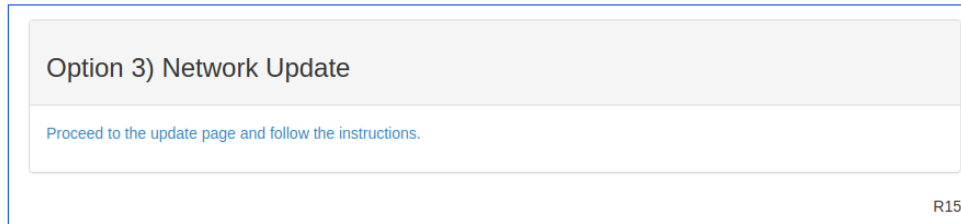


Figure 338: Browser Interface Recovery Screen, Network Update

17 Appendix I – Import Quasonix Root Authority Certificate

In order to instruct the web browser to ‘trust’ the TLS certificate presented by the RDMS during an HTTPS Browser Interface connection, the Quasonix Root Authority Certificate must be imported into the browser or operating system’s Certificate Store. The instructions for this vary by browser and are presented below.

17.1 Firefox

When using the Firefox browser in Windows, the certificate must be imported through the Settings menu.

1. Click on the Settings button in the upper right-hand corner of the browser.
2. Select Options. The Options tab displays, as shown in Figure 339.
3. Select Privacy & Security menu item.
4. Click on the View Certificates... button to view the Certificate Manager, as shown in Figure 340.

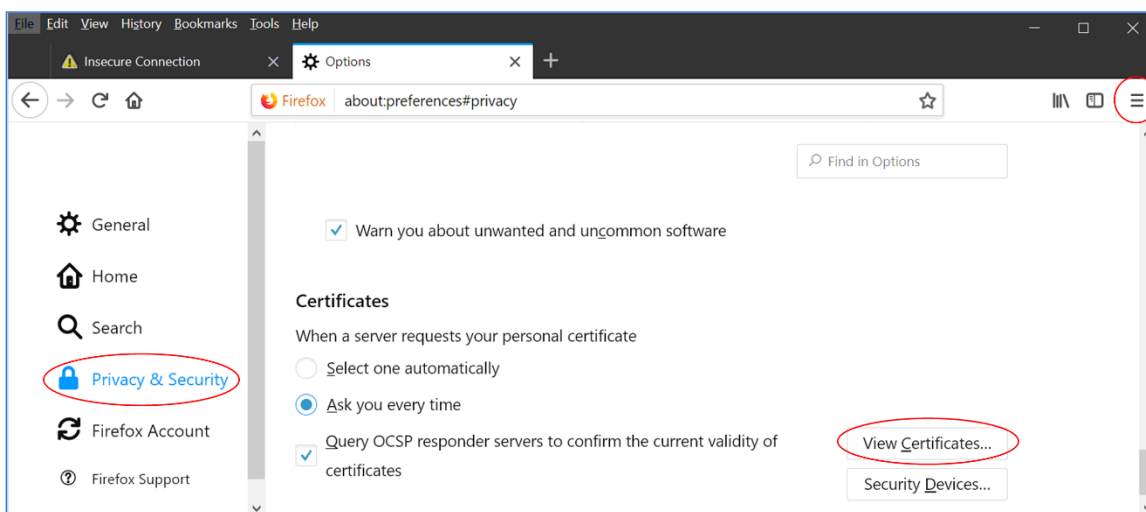


Figure 339: Firefox Options Interface

5. Select the Authorities tab.

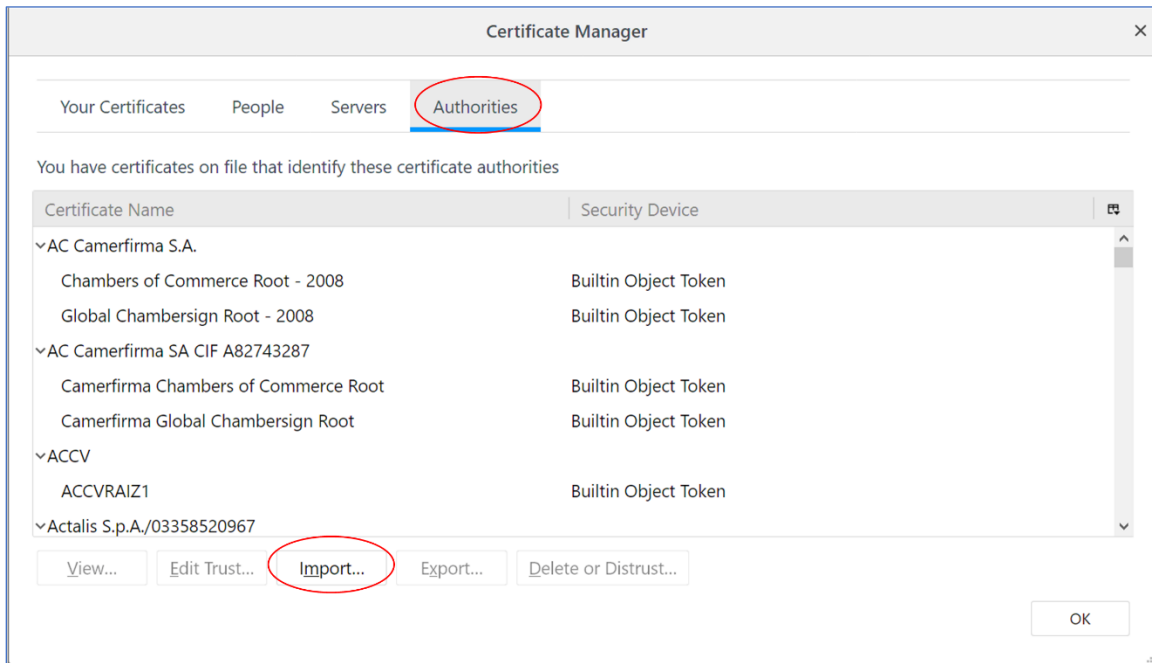


Figure 340: Firefox Certificate Manager

6. Click on the Import... button. A File Browser displays. Select the Quasonix Root Authority file obtained from Quasonix, then click on the Open button.
7. The Downloading Certificate window displays, as shown in Figure 341.

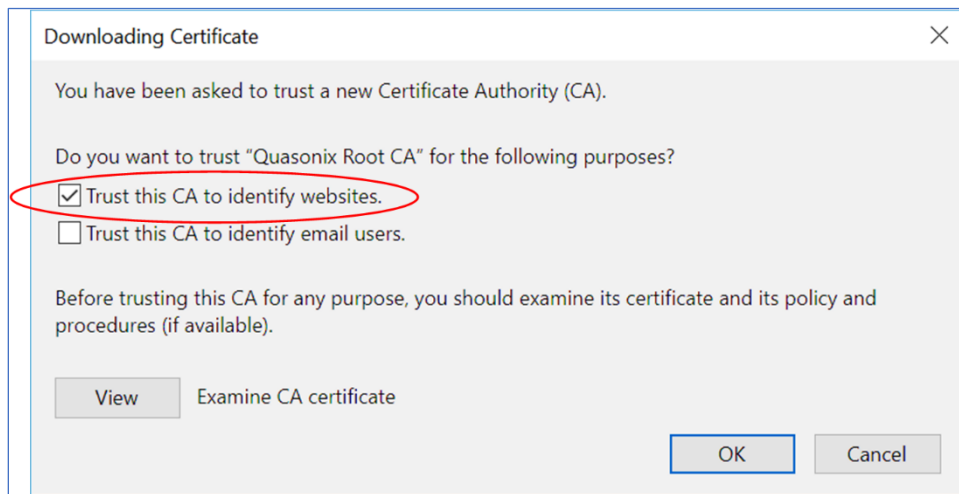


Figure 341: Firefox Downloading Certificate Window

8. Click on the View button to examine the certificate. It should match the one shown in Figure 342.
9. Check the box for Trust this CA to identify websites, then click on the OK button. The certificate has now been imported.

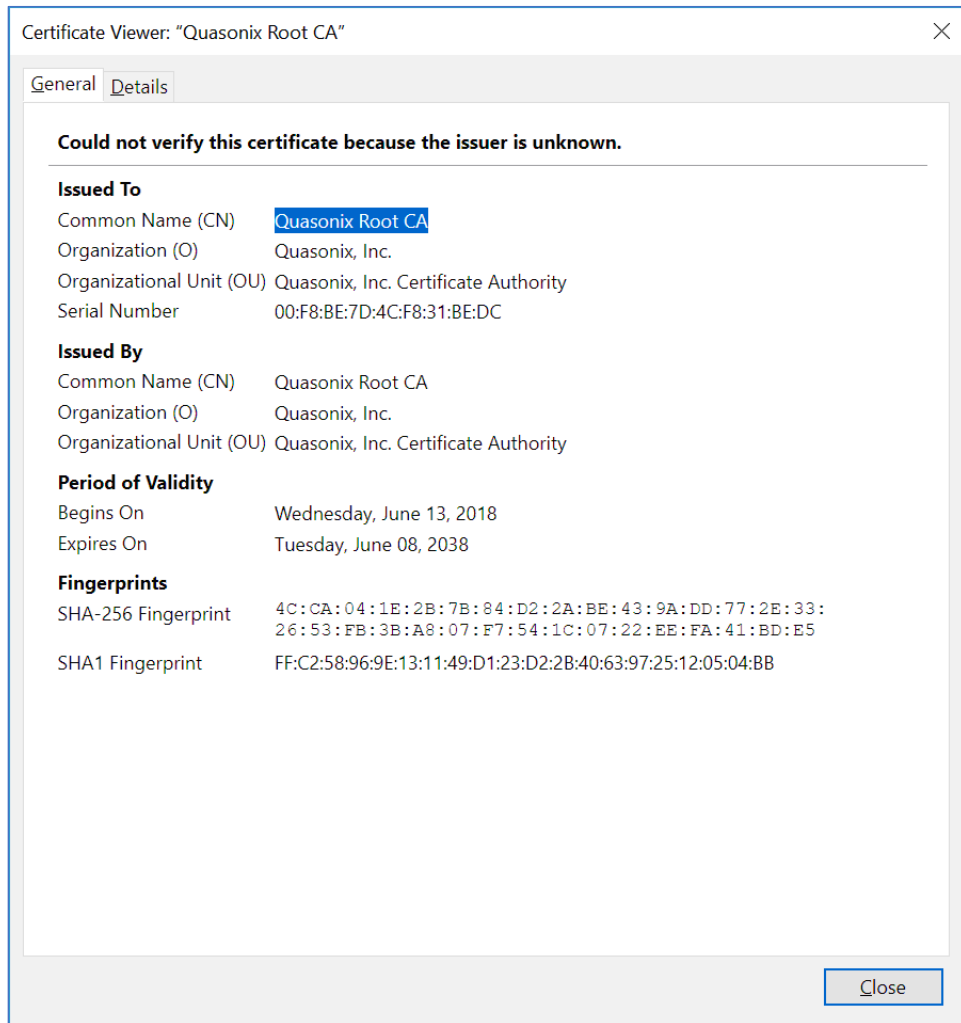


Figure 342: Firefox Certificate Viewer-Quasonix Root CA

10. Scroll through the Certificate Names in the Authorities tab of the Certificate Manager to ensure "Quasonix, Inc." is in the list, as shown in Figure 343.

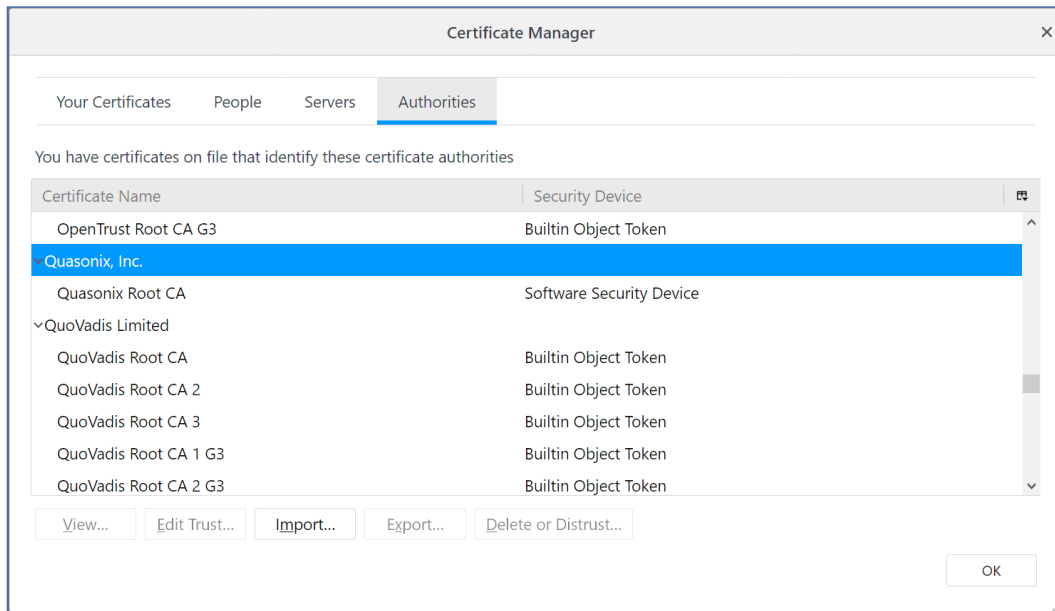


Figure 343: Firefox Certificate Manager with Quasonix Root CA Added

11. Using Firefox, browse to https://RDMS_IP, where RDMS_IP is the IP address of the RDMS.

17.2 Edge, Internet Explorer, and Chrome

To add a certificate to Edge, Internet Explorer, and Chrome, use the Windows Certificate Browser tool. After a certificate has been added to the system, it is available for use in Edge, Internet Explorer, and Chrome.

1. In Windows, click on the Start Menu, type Internet Options, then press the Enter key to open the Internet Properties screen, as shown in Figure 344.
2. Click on the Content tab.

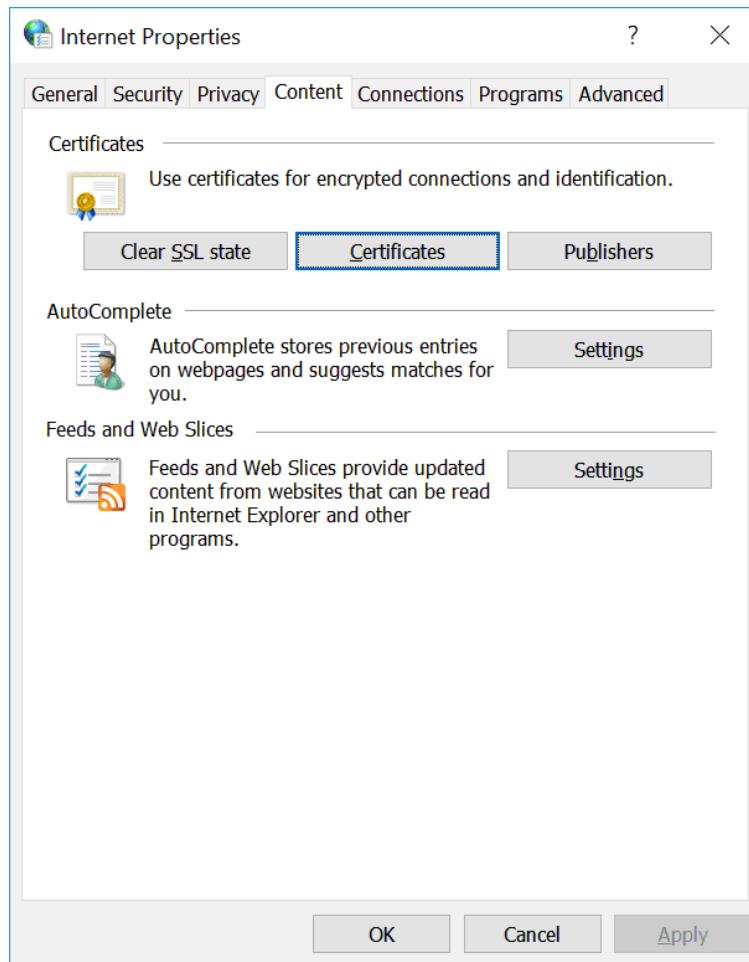


Figure 344: Internet Properties, Content Tab

3. Click on the Certificates button. The Certificates screen displays. Click on the Trusted Root Certification Authorities tab, as shown in Figure 345.

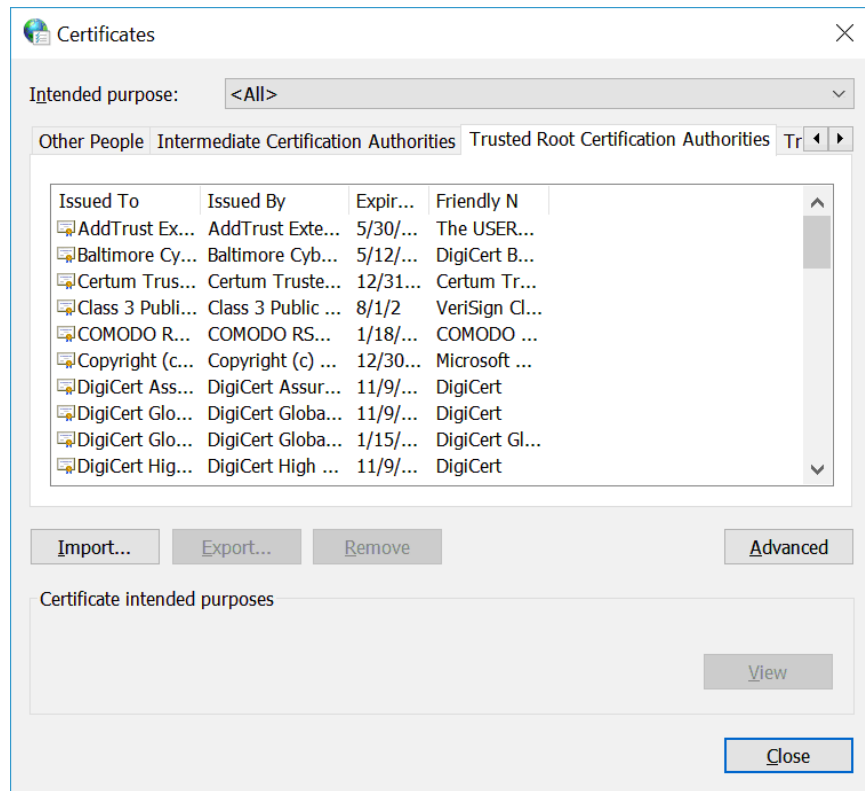


Figure 345: Certificates Screen

- Click on the Import... button to start the Certificate Import Wizard. The Wizard is shown in Figure 346.

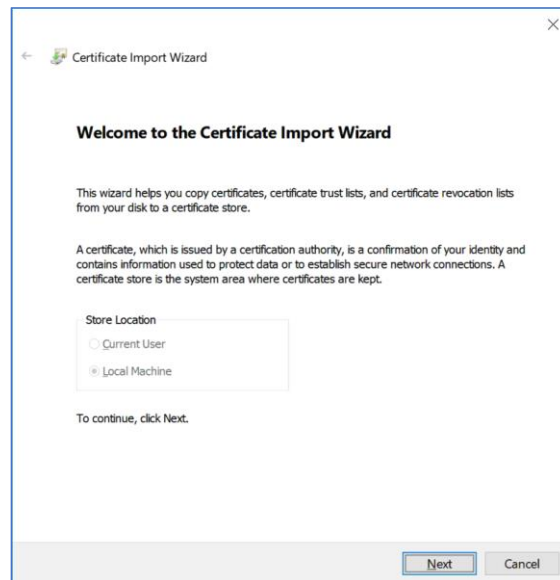


Figure 346: Windows Certificate Import Wizard

5. Click on the Next button. Click on the Browse button under File to Import.
6. Select the Quasonix Root Authority file obtained from Quasonix. Click on the Next button.

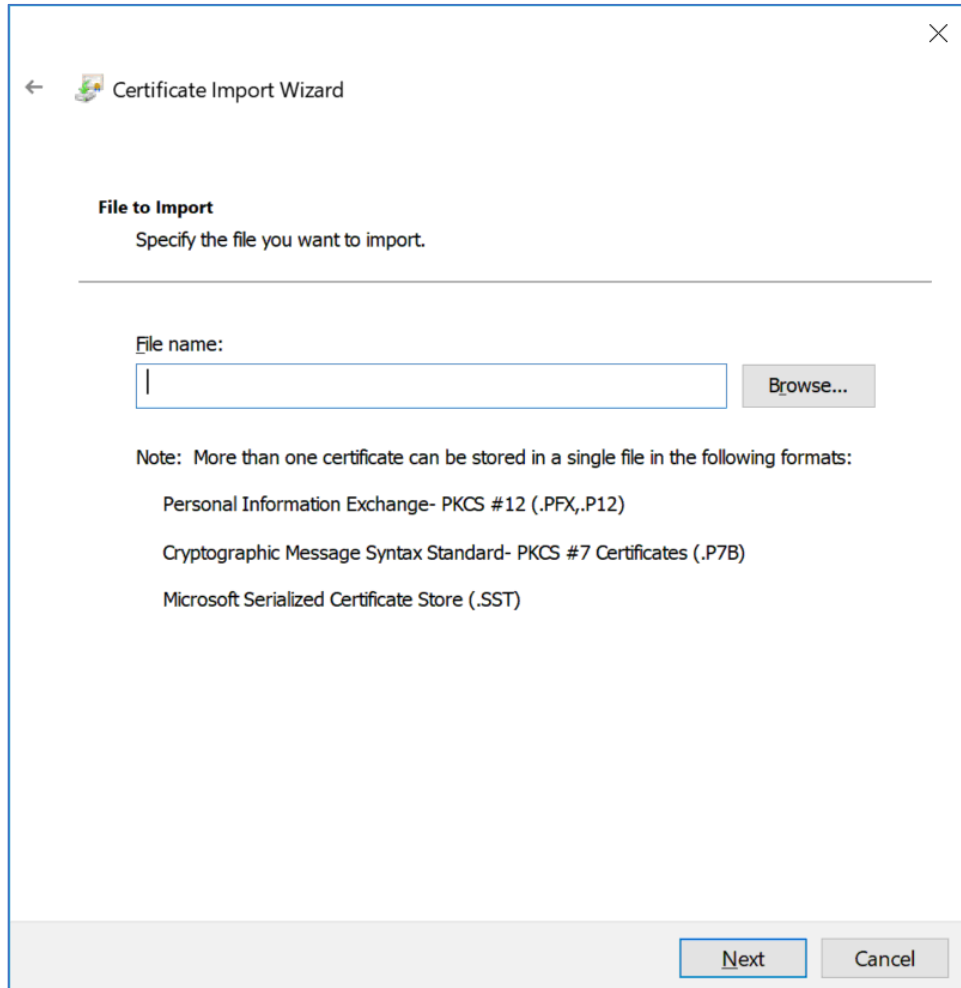


Figure 347: Windows Certificate Import Wizard-Browse

7. Select “Place all certificates in the following store.”
8. Click on the Browse button, then select “Trusted Root Certification Authorities.” When the Certificate Store parameter completes, click on the Next button. The Certificate Store screen is shown in Figure 348.

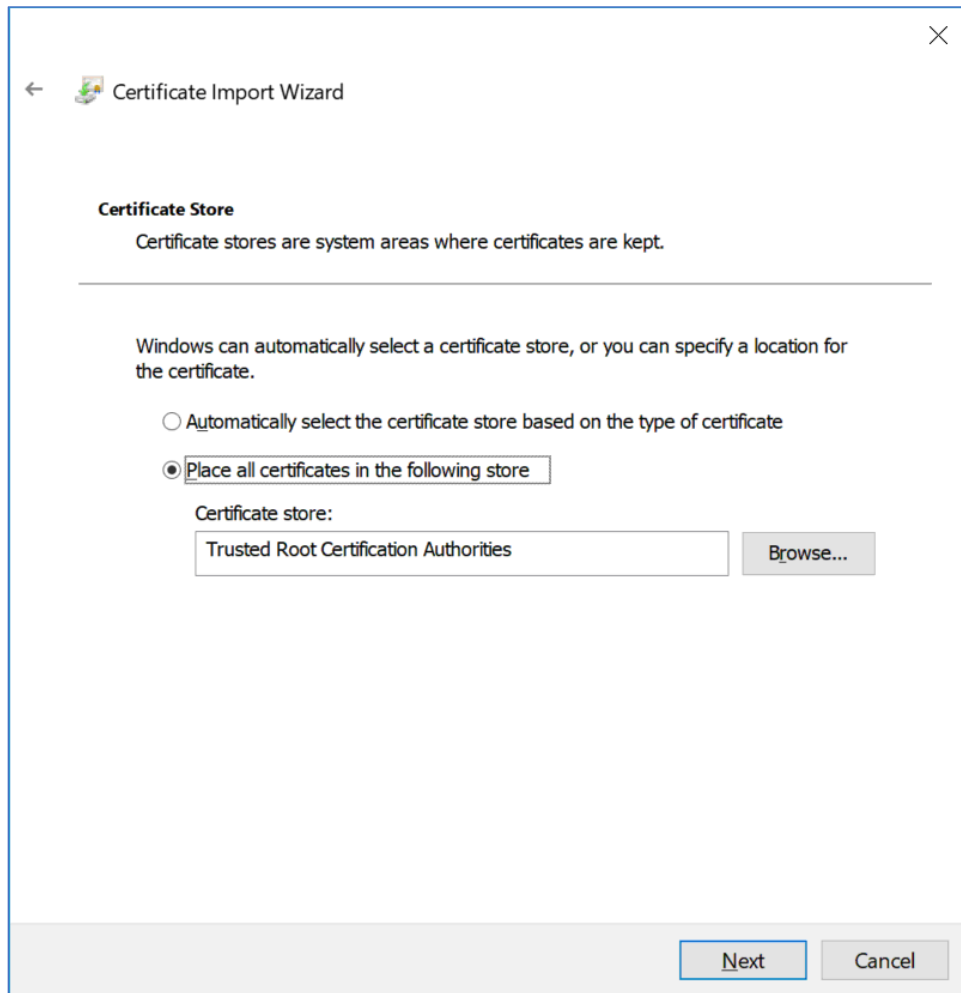


Figure 348: Windows Certificate Import Wizard-Choose Certificate Store

9. Click on the Finish button. A message displays “The import was successful.” Click on the OK button.
10. View the list of Certificates under Trusted Root Certification Authorities, and verify that Quasonix Root CA is listed, as shown in Figure 349.

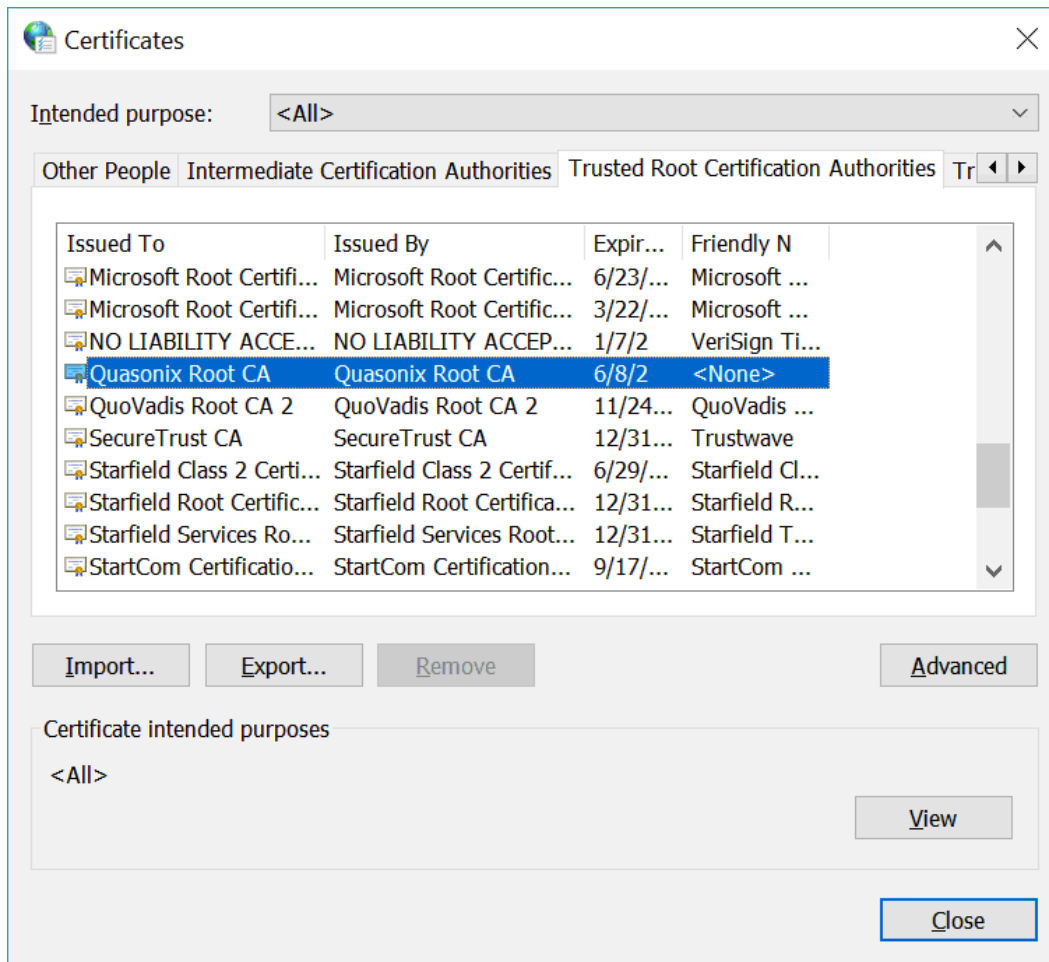


Figure 349: Certificates, Quasonix Certificate Imported

11. Using Edge, Internet Explorer, or Chrome, browse to https://RDMS_IP, where RDMS_IP is the IP address of the RDMS.

18 Appendix J – RDMS with EN Option

18.1 Overview

This appendix describes how to operate a 3U Rack-Mount RDMS™ Telemetry Receiver with the EN (EVTM) option (Ethernet via Telemetry). The RDMS recovers EVTVM encoded data and converts it from serial streaming clock and data back to the original Ethernet packets.

EVTVM encoding and decoding is required at both ends of a link for operation. The 3U three channel transceiver can support bidirectional data from a single piece of hardware.

The following diagrams describe the differences between a standard three channel 3U RDMS receiver, the same receiver with the EN option, and the three channel transceiver with the EN option.

Figure 350 illustrates the standard 3U three channel receiver configuration.

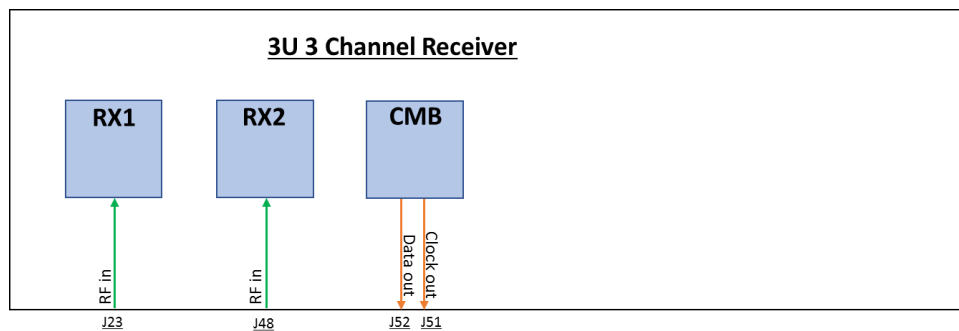


Figure 350: 3rd Generation RDMS 3U Three Channel Receiver

When the EN option is added to the standard 3U three channel receiver, the it can receive EVTVM downlink data, as shown in Figure 351. There is no EVTVM uplink. No additional configuration is necessary.

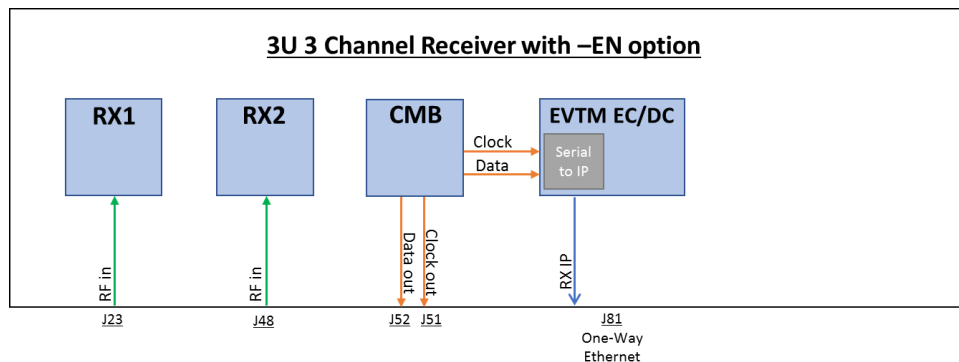


Figure 351: 3rd Generation RDMS 3U Three Channel Receiver with the EN Option

Adding the transmitter option along with the EN option creates a 3U three channel transceiver, as shown in Figure 352, which provides bi-directional EVTM and the ability to configure basic embedded transmitter settings.

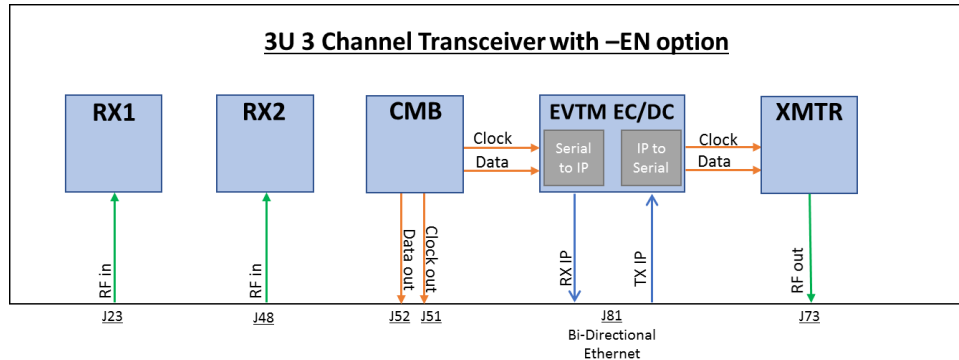


Figure 352: 3rd Generation RDMS 3U Three Channel Transceiver with the EN Option

The receiver's browser-based graphical user interface (GUI) and the 3U front panel provide RDMS and EVTM configuration, control, and status.

18.2 Hardware

The 3U Rack-Mount RDMS back panel provides connectors used specifically with the EN (EVTM) option. The full back panel is shown in Figure 353. An enlarged view of the right side with EVTM connectors is shown in Figure 354.



Figure 353: 3rd Generation RDMS 3U Back Panel Connectors



Figure 354: 3rd Generation RDMS 3U Back Panel Connectors-Right Side

The ports used specifically for EVTM operation are described in Table 23. TMOIP ports are NOT enabled when using EVTM.

Table 24: 3U Rack-Mount RDMS EVTM Ports

Port Name	Purpose	Port Type	Connector
EVTM Tx	Ethernet Via Telemetry Transmitter Output	N-connector	J73
EVTM Data	Ethernet via Telemetry Data	Ethernet (RJ-45) (T568A)	J81
RDMS Control	Browser Control Network Interface for EVTM units with an installed transmitter	Ethernet (RJ-45)	*J80

*Receivers with the EN option only (no installed transmitter) do not require configuration through the J80 connection.

18.3 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 355, with six selections that display a variety of parameters for each available channel. The Browser Interface defaults to the Network screen.

The RDMS Network, Monitor, Configure, Presets, and About screens are described in section 4.5 of this manual. The EVTm functionality is accessed via the EVTm icon, and is described in this section.

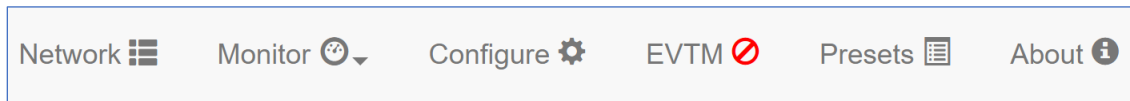


Figure 355: Browser Interface Header Tool Bar for RDMS™ with EVTm Option

18.3.1 EVTm Embedded Transmitter Settings

When the user clicks on the EVTm icon, the EVTm: View or Modify Embedded Transmitter Settings screen displays, as shown in Figure 356.

Name	Value
Frequency (MHz)	990.995
Mode	SOQPSK
Bitrate (Mbps)	44.995
Randomizer	Off
LDPC	On
Power Level	13
RF	On

Figure 356: EVTm Embedded Transmitter Settings

EVTm transmitter settings may be changed as follows.

A new transmitter frequency may be typed into the Frequency field, or the user may scroll to the desired frequency using the up/down arrow buttons. Any valid frequency may be selected. The field turns green when a change is made, as shown in Figure 357.

As with other Browser Interface changes, click on the Send Settings button to save the new frequency. This may be done after all of the parameters are set.

EVTM: View or Modify Embedded Transmitter Settings

Send Settings

Refresh

Name	Value
Frequency (MHz)	2200

Figure 357: EVTM Embedded Transmitter Settings, Frequency Selection

Change the Mode by using the drop down menu to see the available mode list. Highlight the desired mode, as shown in Figure 358.

Mode	SOQPSK
Bitrate (Mbps)	PCMFM
Randomizer	SOQPSK
LDPC	MHCPM
Power Level	BPSK
RF	QPSK
	Carrier Only
	OQPSK
	UQPSK

Figure 358: EVTM Embedded Transmitter Settings, Mode Drop Down Menu

To change the bit rate, type the new rate (in Mbps) into the Bitrate field, or by scroll to the desired bit rate using the up/down arrow buttons, as shown in Figure 359.

Name	Value
Frequency (MHz)	990.995
Mode	SOQPSK
Bitrate (Mbps)	45

Figure 359: EVTM Embedded Transmitter Settings, Bit Rate Selection

Turn the randomizer or LDPC (low density parity check) On or Off by clicking the down arrow next to the parameter and then highlighting the required setting, as shown in Figure 360 and Figure 361.

Randomizer	Off
LDPC	On
	Off

Figure 360: EVTM Embedded Transmitter Settings, Randomizer Drop Down Menu

LDPC	On
Power Level	On
	Off

Figure 361: EVTM Embedded Transmitter Settings, LDPC Drop Down Menu

A power value between 0.0 and 31.5 may be typed into the Power Level field, or selected by scrolling to the desired power level using the up/down arrow buttons, as shown in Figure 362.

LDPC	On
Power Level	13.5
RF	On

Figure 362: EVTM Embedded Transmitter Settings, Power Level Selection

Turn the RF On or Off by clicking the down arrow and then highlighting the required setting, as shown in Figure 363.

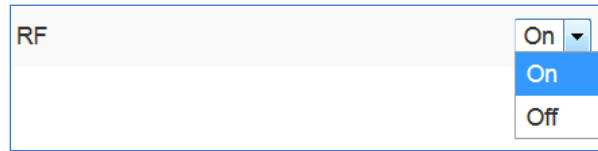


Figure 363: EVTM Embedded Transmitter Settings, RF Drop Down Menu

18.3.2 EVTM Status

The EVTM icon on the Menu bar also provides EVTM status information. When the actual RF state is On, and the EVTM transmitter output is On, a check mark displays in a green circle, as shown in Figure 364.



Figure 364: EVTM Status Icon, Green Check Mark—Actual RF On, EVTM Transmitter Output On

When the actual RF state is Off, and the EVTM transmitter output is On, an X displays in a yellow circle, as shown in Figure 365.

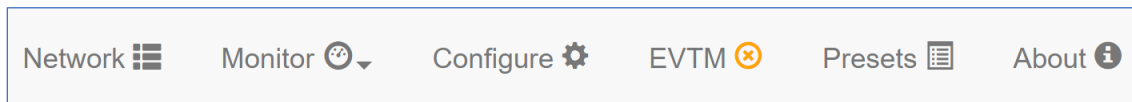


Figure 365: EVTM Status Icon, Yellow X—Actual RF Off, EVTM Transmitter Output On

When the actual RF state is Off and the EVTM transmitter output is Off, a slash in a red circle displays, as shown in Figure 366.



Figure 366: EVTM Status Icon, Red Slash—Actual RF Off, EVTM Transmitter Output Off

18.4 Front Panel Control

EVTM embedded transmitter settings can also be accessed from the 3U front panel.

18.4.1 EVTM Menu

Access the EVTM menu from the front panel Main Menu, as shown in Figure 367. Select EVTM, then press the Enter key on the front panel keypad.

Main Menu		Ch:C
Mod Persist	Off	
HyperTrack	Disabled	
AGC Menu		
AM Menu		
Options Menu		
Advanced Menu		
System Settings		
Graphics Menu		
EVTM		

Figure 367: EVTM Embedded Transmitter Settings

The EVTM menu, shown in Figure 368, includes the following parameters for controlling the embedded transmitter:

- RF
- Tx Frequency
- Tx Mode
- EN Bitrate
- Randomizer
- LDPC
- VP

EVTM		Ch:C
RF	Off	
Tx Frequency	2350.0	
Tx Mode	SOQPSK	
EN Bitrate	1.000	
Randomizer	On	
LDPC	Off	
VP	0.0	

Figure 368: EVTM Menu

- RF - Select the RF option, as shown in Figure 369. The user may toggle between RF On or Off 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 EVTM Menu.

EVTM		Ch:C
RF	On	
Tx Frequency	2350.0	
Tx Mode	SOQPSK	
EN Bitrate	1.000	
Randomizer	On	
LDPC	Off	
VP	0.0	

Figure 369: EVTM Embedded Transmitter RF Option

- Tx Frequency - Scroll to the Tx Frequency option to set the embedded transmitter frequency. Click on Tx Frequency to display the selection screen, as shown in Figure 370. Any valid frequency may be entered in MHz, then press the Enter key on the front panel keypad.

Tx Frequency

Ch:C

Tx Frequency

2350.0

Figure 370: EVTM Embedded Transmitter Tx Frequency Selection

- Tx Mode - Scroll to the Tx Mode option to select the embedded transmitter mode. Click on Tx Mode to display the selection screen, as shown in Figure 371. Scroll to the desired mode, then press the Enter key on the front panel keypad.

Tx Mode		Ch:C
PCMFM		
SOQPSK		
MHCPM		
BPSK		
QPSK		
Carrier Only		
OQPSK		
UQPSK		

Figure 371: EVTM Embedded Transmitter Tx Mode Selection

- EN Bitrate - Scroll to the EN Bitrate option to select the embedded transmitter bit rate. Click on EN Bitrate to display the selection screen, as shown in Figure 372. Type the new bit rate, in Mbps, then press the Enter key on the front panel keypad.

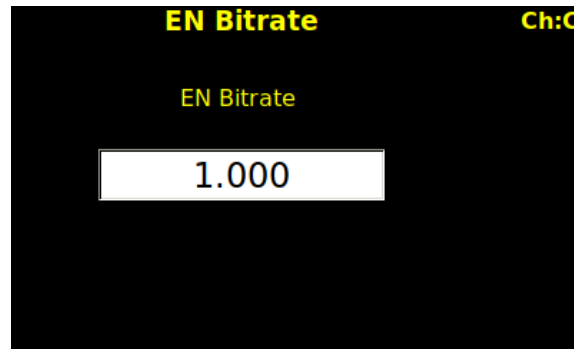


Figure 372: EVTM Embedded Transmitter EN Bit Rate Selection

- Randomizer - Select the Randomizer option. The user may toggle between Randomizer On or Off 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 EVTM Menu.
- LDPC - Select the LDPC (Low Density Parity Check) option. The user may toggle between LDPC On or Off 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 EVTM Menu.
- VP - Scroll to the VP option to select the embedded transmitter power level. Click on VP to display the selection screen, as shown in Figure 373. A power value between 0.0 and 31.5 may be typed into the VP field, then press the Enter key on the front panel keypad.

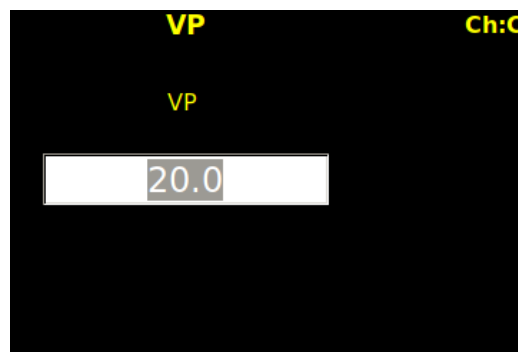


Figure 373: EVTM Embedded Transmitter Variable Power Selection

18.4.2 Front Panel EVTM Status

EVTM status information displays next to the combiner spectrum on the 3U front panel. When the actual RF state is On, and the EVTM transmitter output is On, a green square displays, as shown in Figure 374.

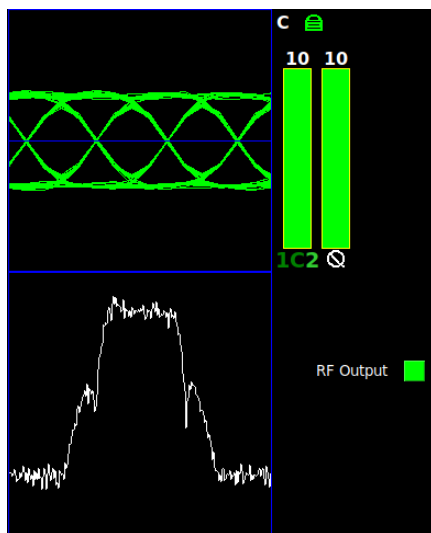


Figure 374: EVTM Status, Green Square—Actual RF Output On, EVTM Transmitter Output On

When the actual RF state is Off and the EVTM transmitter output is Off, a red square displays, as shown in Figure 375.

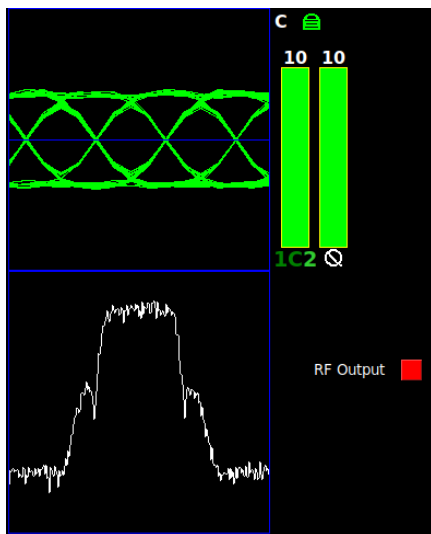


Figure 375: EVTM Status, Red Square—Actual RF Off, EVTM Transmitter Output Off

If you have questions or would like additional information about EVTM, contact Quasonix.

19 Appendix K – 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
EVTM	Ethernet Via Telemetry
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

Acronym	Description
MHCPM	multi-h Continuous Phase Modulation
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	Surface Acoustic 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