

R8000 SERIES COMMUNICATIONS SYSTEM ANALYZER

AUTOTUNE USER GUIDE

Harris XL-200 Portable

Freedom Communication Technologies 2002 Synergy Blvd, Suite 200 Kilgore, Texas 75662

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TABLE OF CONTENTS

 Introduction 	າ	
2. Scope		
 Convention 	ıs	
3.1. PPM		
	lotes	
•	ed firmware	
•	ntional channel selection	
4.3. Suppor	ted models	
	00 Portable Radio Test Setup	
5.1. XL-200	Portable Test Setup	1
6. Harris XL-2	200 Portable Alignment and Test Descriptions	2
6.1. Synthes	sizer Performance Test	2
6.2. TCXO I	Frequency	3
6.3. RSSI		4
6.4. TX Pow	/er	6
6.5. Tx CTC	SS/CDCSS Modulation and Composite Deviation	7
6.6. P25 Ph	ase 1 Tx Modulation Fidelity (C4FM) Test	8
6.7. P25 Ph	ase 1 Tx Deviation (C4FM) Test	9
6.8. P25 Ph	ase 1 Rx Sensitivity (C4FM) Test	10
6.9. P25 Ph	ase 2 Rx Sensitivity (TDMA) Test	11
Basic Trouble	eshooting	12
7. Support Inf	ormation	13
7.1. Technic	cal Support	13
7.2. Sales		13
APPENDIX A.	Test Limits	A-1
APPENDIX B.	Sample Test Result Report	B-1
APPENDIX C.	Revision History	

LIST OF FIGURES

Figure 5-1.	XL-200 Po	ortable Test Se	etup Diagram	 	.1
Figure B-1.	Sample Te	est Result Rep	ort	 B	-2

LIST OF TABLES

able 6-1. Synthesizer Performance test results	2
able 6-2. Analyzer Configuration for TCXO Frequency	
able 6-3. TCXO Frequency alignment results	3
able 6-4. TCXO Frequency test results	
able 6-5. Analyzer Configuration for RSSI	
able 6-6. RSSI alignment results	
able 6-7. RSSI test results	5
able 6-8. Analyzer Configuration for TX Power	6
able 6-9. TX Power test results	
able 6-10. Analyzer Configuration for Tx CTCSS/CDCSS Modulation test	7
able 6-11. Tx CTCSS/CDCSS Modulation test results	7
able 6-12. Analyzer Configuration for P25 Phase 1 Tx Tests (C4FM)	
able 6-13. Tx P25 Phase 1 Modulation Fidelity (C4FM) results	8
able 6-14. Tx P25 Phase 1 Symbol Deviation (C4FM) results	8
able 6-15. Analyzer Configuration for P25 Phase 1 Tx Deviation (C4FM) tes	st9
able 6-16. Tx P25 Phase 1 Deviation (C4FM) test results	9
able 6-17. Analyzer Configuration for P25 Phase 1 Rx Sensitivity (C4FM) to	est10
able 6-18. P25 Phase 1 Rx Sensitivity (C4FM) test results	10
able 6-19. Analyzer Configuration for P25 Phase 2 Rx Sensitivity (TDMA) to	est11
able 6-20. P25 Phase 2 Rx Sensitivity (TDMA) test results	
able 6-21. Harris XL-200 Portable Series Troubleshooting Chart	12
able A-1 Default Harris XI -200 Portable Limits	Δ-2

1. Introduction

The Freedom Communication Technologies R8000 Series Communications System Analyzer AutoTune™ (hereafter "AutoTune") provides an automated test and alignment solution for supported two-way radios.

2. Scope

This document includes information regarding the tests and alignments performed for supported radios by AutoTune. This document is restricted to radio-specific information for Harris XL-200 Portable series radios.

Please refer to the R8000 Series Communications System Analyzer Owner's Manual (FCT-1365) for an overview and basic operating instructions for AutoTune itself.

3. Conventions

3.1. PPM

"ppm" is "parts per million". This specification is generally limited to frequency-related measurements. If the frequency units are in MHz, then the ppm specification is in Hz. For example, a 169.075 MHz frequency with a ±1.5 ppm specification is allowed to vary by 1.5 * 169.075 MHz, or about ±254 Hz.

4. Important Notes

4.1. Required firmware

Harris XL-200P series radios must be running **XLP R02D01** firmware or later for AutoTune to successfully run. **XLP R03C09** firmware or later is required for AutoTune to successfully run the RSSI align.

4.2. Conventional channel selection

The radio must have a conventional channel selected before AutoTune servicing begins. A trunked channel if selected is known to cause radio communication initialization failures.

4.3. Supported models

The following Harris XL-200 series models are supported by AutoTune:

XL-200P

5. Harris XL-200 Portable Radio Test Setup

In order to perform the test and alignment procedures, the XL-200 Portable radio must be connected to the R8000 Communications System Analyzer as shown in the figure below.



Make certain that the radio under test is configured as described in the corresponding diagram **before** attempting to perform the indicated alignment or test. Failure to do so may result in poor radio performance and/or damage to the analyzer or radio equipment under test.

5.1. XL-200 Portable Test Setup

Refer to the diagrams below for proper test setup.

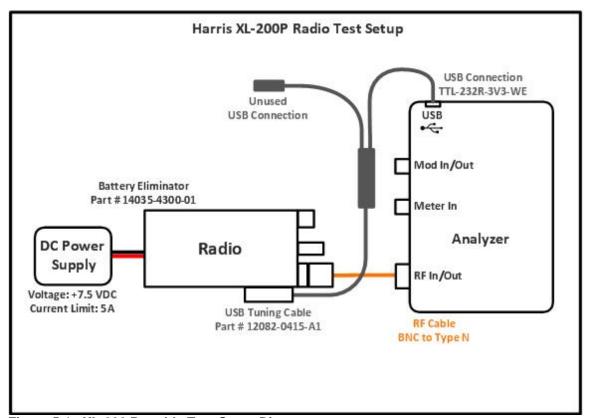


Figure 5-1. XL-200 Portable Test Setup Diagram

6. Harris XL-200 Portable Alignment and Test Descriptions

Note: Throughout this section are references to Test Frequency that are band and mode specific. A table of the frequencies used by each band may be found in the respective radio service manual.

6.1. Synthesizer Performance Test

The Synthesizer Performance test checks the lock range of the synthesizer circuits.

6.1.1. Test

The radio is set to the first Rx test frequency at the lower end of the first Rx RF Band. The user will be asked to check the radio display for an alarm message. If no alarm message is display, the synthesizer circuit is locked. All ends of the Rx RF Bands are tested. Next, the radio is set to the first Tx test frequency at the lower end of the first Tx RF Band. The radio is keyed for 2 seconds. The user will be asked to check the radio display for an alarm message. If no alarm message is display, the synthesizer circuit is locked. All ends of the Tx RF Bands are tested.

Name	Description
Result	Pass or Fail. Synthesizer circuit locked
Frequency	Test Frequency
Synth Lock	Synthesizer circuit locked

Table 6-1. Synthesizer Performance test results

6.2. TCXO Frequency

RF Control	Port	Frequency	Modulation	Output Level / Attenuation
Generate	RF IN/OUT	Test Frequency	FM	-70 dBm
Monitor	RF IN/OUT	Test Frequency	FM	30 dB

Table 6-2. Analyzer Configuration for TCXO Frequency

6.2.1. Alignment

The radio is placed into Test Mode at the first Rx Test Frequency, and the analyzer is set to generate as listed in Table 6-2. The radio is queried to tune the TCXO softpot and returns the new softpot value. The new softpot radio is written to the radio. After programming the new softpot value, the radio is set to the first Tx Test Frequency and commanded to transmit. The analyzer is set to measure as listed in Table 6-2. The frequency error is measured by the analyzer and compared to the test limits. The final results are written to the log file.

Name	Description
Result	Pass or Fail. Frequency Error within Max Limit, Min Limit.
Frequency	Test Frequency
Freq Error	Measured frequency error
Min Limit	Minimum Limit (inclusive) for frequency error alignment
Max Limit	Maximum Limit (inclusive) for frequency error alignment
Old Softpot	Radio softpot before alignment
New Softpot	Radio softpot after alignment

Table 6-3. TCXO Frequency alignment results

6.2.2. Test

The radio is placed into Test Mode at the first Tx Test Frequency and commanded to transmit. The analyzer is set to measure as listed Table 6-2. The frequency error is measured by the analyzer and compared to the test limits. This process is repeated for each Test Frequency. The final results are written to the log file.

Name	Description
Result	Pass or Fail. Frequency Error within Max Limit, Min Limit.
Frequency	Test Frequency
Freq Error	Measured frequency error
Min Limit	Minimum Limit (inclusive) for frequency error
Max Limit	Maximum Limit (inclusive) for frequency error
Softpot	Radio softpot producing the frequency error

Table 6-4. TCXO Frequency test results

6.3. **RSSI**

RF Control	Port	Frequency	Modulation	Output Level / Attenuation
Generate	RF IN/OUT	Test Freq	None	-95 dBm

Table 6-5. Analyzer Configuration for RSSI

6.3.1. Alignment

The radio is placed into Test Mode at the first Rx Test Frequency, and the analyzer is set to generate as listed in Table 6-5. The radio RSSI level is checked without a carrier signal for interference. If interference is detected, the radio Rx frequency and the analyzer frequency are changed by 75kHz until there is no interference. The analyzer RF signal is turned on. The RSSI level is measured by the radio at the RSSI softpot limits. These RSSI measurements are used to calculate the softpot value which matches the RSSI level to the output level of the analyzer, and the calculated softpot is saved to the radio. The RSSI level is measured by the radio and compared to the test limits. This process is repeated for each Test Frequency. The final results are written to the log file.

Name	Description	
Result	Pass or Fail. RSSI within Max Limit, Min Limit.	
Frequency	Test Frequency	
Old Softpot	Radio softpot before alignment	
New Softpot	Radio softpot after alignment	
RSSI	Measured frequency error	
Min Limit	Minimum Limit (inclusive) for RSSI alignment	
Max Limit	Maximum Limit (inclusive) for RSSI alignment	

Table 6-6. RSSI alignment results

6.3.2. Test

The radio is placed into Test Mode at a Rx Test Frequency, and the analyzer is set to generate as listed Table 6-5. The radio RSSI level is check without a carrier signal for interference. If interference is detected, the rest of the test is skipped, and results are written to the log file. The analyzer RF signal is turned on. The RSSI level is measured by the radio and compared to the test limits. This process is repeated for each Test Frequency. The final results are written to the log file.

Harris XL-200 Portable Series AutoTune™ User Guide

Name	Description
Result	Pass or Fail. Frequency Error within Max Limit, Min Limit.
Frequency	Test Frequency
RSSI Intrf	Measured RSSI level to check for interference with no RF
	signal
RSSI	Measured RSSI level
Min Limit	Minimum Limit (inclusive) for RSSI
Max Limit	Maximum Limit (inclusive) for RSSI
Softpot	Radio softpot producing the RSSI

Table 6-7. RSSI test results

6.4. TX Power

RF Control	Port	Frequency	Modulation	Attenuation
Monitor	RF IN/OUT	Test Frequency	FM	40 dB

Table 6-8. Analyzer Configuration for TX Power

6.4.1. Test

The radio is commanded to transmit. Beginning at the first Tx Test Frequency, the output level is measured at each TX Test Frequency, for Low and High Power, and compared to the test limits. The final results are written to the log file.

Name	Description
Result	Pass or Fail. Power Out within Max Limit, Min Limit
Frequency	Test Frequency
Power Out	Measured radio output level
Min Limit	Minimum Limit (inclusive) for Power Out
Max Limit	Maximum Limit (inclusive) for Power Out

Table 6-9. TX Power test results

6.5. Tx CTCSS/CDCSS Modulation and Composite Deviation

The Tx CTCSS/CDCSS Modulation test measures the radio's CTCSS or CDCSS deviation levels and tone or code accuracy for each test frequency.

RF Control	Port	Frequency	Modulation	Attenuation	Dev Avg
Monitor	RF IN/OUT	Test Frequency	FM	30 dB	+/-Peak / 2

Table 6-10. Analyzer Configuration for Tx CTCSS/CDCSS Modulation test

6.5.1. Test

For each test frequency and bandwidth (Wide, Narrow, NPSPAC) supported, the radio transmits CTCSS tones and CDCSS codes at rated deviation levels. The ±Peak / 2-averaged deviations of these individual tones/codes and the composite levels are measured with the analyzer for CTCSS tone or CDCSS code accuracy. The test results are written to the log file.

Name	Description
Result	Pass or Fail. CTCSS or CDCSS deviation levels are within
	limits, and CTCSS tone/CDCSS code is accurate.
Frequency	Test Frequency
CTCSS Dev	Measured CTCSS or CDCSS deviation level
Min Dev	Minimum CTCSS or CDCSS deviation level (inclusive)
Max Dev	Maximum CTCSS or CDCSS deviation level (inclusive)
Meas Tone Meas Code	Measured CTCSS tone frequency or CDCSS code

Table 6-11. Tx CTCSS/CDCSS Modulation test results

6.6. P25 Phase 1 Tx Tests (C4FM)

The Tx P25 Phase 1 Tx Tests (C4FM) measures the radio's P25 Phase 1 C4FM modulation fidelity level and symbol deviation at multiply test frequencies with a random pattern.

RF Control	Port	Frequency	Modulation	Attenuation	Dev Avg
Monitor	RF IN/OUT	Test Frequency	C4FM	30 dB	Peak Avg

Table 6-12. Analyzer Configuration for P25 Phase 1 Tx Tests (C4FM)

6.6.1. Test

The radio is set to a digital channel at low power at the first Tx Test Frequency and commanded to transmit a random deviation pattern. The modulation fidelity and symbol deviation of this tone is measured with the analyzer. This process is repeated for each Test Frequency. The test results are written to the log file.

Name	Description	
Result	Pass or Fail. Modulation fidelity is between Min Limit and Male	
Frequency	Test Frequency	
Meas Mod Fidelity	Measured P25 Phase 1 C4FM modulation fidelity	
Min Mod Fidelity	Minimum passable modulation fidelity level	
Max Mod Fidelity	Maximum passable modulation fidelity level	

Table 6-13. Tx P25 Phase 1 Modulation Fidelity (C4FM) results

Name	Description
Result	Pass or Fail. Symbol deviation is between Min Limit and Max Limit.
Frequency	Test Frequency
Meas Sym Deviation	Measured P25 Phase 1 C4FM symbol deviation
Min Sym Deviation	Minimum symbol deviation fidelity level
Max Sym Deviation	Maximum symbol deviation fidelity level

Table 6-14. Tx P25 Phase 1 Symbol Deviation (C4FM) results

6.7. P25 Phase 1 Tx Deviation (C4FM) Test

The Tx P25 Phase 1 Tx Deviation (C4FM) test measures the radio's P25 Phase 1 C4FM deviation level at specific test frequencies for both High and Low Patterns.

RF Control	Port	Frequency	Modulation	Attenuation	Dev Avg
Monitor	RF IN/OUT	Test Frequency	C4FM	30 dB	Peak Avg

Table 6-15. Analyzer Configuration for P25 Phase 1 Tx Deviation (C4FM) test

6.7.1. Test

The radio is set to a digital channel at low power at the first Tx Test Frequency and commanded to transmit a pattern. The Peak-averaged deviation of this tone is measured with the analyzer. This process is repeated for each Test Frequency and High and Low patterns. The test results are written to the log file.

Name	Description
Result	Pass or Fail. Deviation is between Min Limit and Max Limit.
Frequency	Test Frequency
Meas Dev	Measured P25 Phase 1 C4FM deviation
Min Dev	Minimum passable deviation level
Max Dev	Maximum passable deviation level

Table 6-16. Tx P25 Phase 1 Deviation (C4FM) test results

6.8. P25 Phase 1 Rx Sensitivity (C4FM) Test

The P25 Phase 1 Rx Sensitivity (C4FM) test measures the radio's P25 Phase 1 C4FM sensitivity level at several Rx test frequencies.

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Frequency	C4FM	-117 dBm

Table 6-17. Analyzer Configuration for P25 Phase 1 Rx Sensitivity (C4FM) test

6.8.1. Test

The analyzer is setup by applying the Modulation signal in Table 6-17 to the radio. The radio is set to a digital zone and the first Rx test frequency. The radio's reported C4FM BER level is measured and compared against the test limits. This process is repeated for each Test Frequency. The final results are written to the log file.

Name	Description
Result	Pass or Fail. BER level within Max Limit
Frequency	Test Frequency
BER	Radio Bit Error Rate (BER) level
Max Limit	Maximum Limit (inclusive) for Bit Error Rate (BER)
Min Limit	Minimum Limit (exclusive) for Bit Error Rate (BER)

Table 6-18. P25 Phase 1 Rx Sensitivity (C4FM) test results

6.9. P25 Phase 2 Rx Sensitivity (TDMA) Test

The P25 Phase 2 Rx Sensitivity (TDMA) test measures the radio's P25 Phase 2 TDMA sensitivity level at several Rx test frequencies.

RF Control	Port	Frequency	Modulation	Output Level
Generate	RF IN/OUT	Test Frequency	TDMA	-117 dBm

Table 6-19. Analyzer Configuration for P25 Phase 2 Rx Sensitivity (TDMA) test

6.9.1. Test

The analyzer is setup by applying the Modulation signal in Table 6-19 to the radio. The radio is set to a digital zone at the first RX Test Frequency. The radio's reported TDMA BER level is measured and compared against the test limits. This process is repeated for each Test Frequency. The final results are written to the log file.

Name	Description
Result	Pass or Fail. BER level within Max Limit
Frequency	Test Frequency
BER	Radio Bit Error Rate (BER) level
Max Limit	Maximum Limit (inclusive) for Bit Error Rate (BER)
Min Limit	Minimum Limit (exclusive) for Bit Error Rate (BER)

Table 6-20. P25 Phase 2 Rx Sensitivity (TDMA) test results

Basic Troubleshooting

Symptom	Possible Cause	Possible Solution
Analyzer consistently fails to communicate with radio	Radio on a trunking channel	 Change radio channel to a conventional channel. Trunking channel mode can prevent AutoTune from placing radio into test mode.
Analyzer consistently fails to communicate with radio and radio display softkeys are blank.	 Current mission plan corrupted while setting mission plan to test mode. 	 Boot radio into "Wifi programming mode" by pressing the PTT and Bottom Side Button and powering up the radio. Wait 5 seconds. Connect the radio to RPM and re-flash or overwrite the radio personality.
Analyzer occasionally fails to communicate with radio	USB hub in use	USB hubs are known to occasionally prevent or drop radio communication. Connect the radio programming cable directly to an analyzer USB port.
Tx Power test power output levels are lower than expected.	Cable Sweep not enabled	Enable Settings > System Settings > Cable Sweep > Cable Sweep. Change cable attenuation values to correspond with the RF cable in use. For example, if 0.5 dB of loss expected at 100 MHz and 1.5 dB of loss is expected at 1 GHz, enter "-0.5 dB" as the 100 MHz loss value and - "1.5 dB" as the 1 GHz loss value. Cable losses are entered as negative values.

Table 6-21. Harris XL-200 Portable Series Troubleshooting Chart

7. Support Information

7.1. Technical Support

Telephone/Fax: 903.985.8999 Email: service@freedomcte.com Web: http://freedomcte.com/support/

7.2. Sales

Telephone/Fax: 903.985.8999 Email: sales@freedomcte.com Web: http://freedomcte.com/sales/

APPENDIX A. Test Limits

The factory limits contain the default limits as defined by the radio manufacturer and generally should not be modified. However, if extenuating circumstances cause a need to modify the limits this is accommodated by AutoTune. Refer to the R8000 Series Communications System Analyzer Owner's Manual (FCT-1365) for modification instructions.

The following tables list the default test limits for Harris XL-200 Portable radio model supported by AutoTune.

Section	Test Name	Limit	Default Value
6.2	TCXO Frequency	Reference Oscillator Align	Min = -0.05 ppm
		-	Max = 0.05 ppm
		Reference Oscillator Test	Min = -0.4 ppm
			Max = 0.4 ppm
6.3	RSSI	RSSI Align	Min = -3.0 dBm
			Max = 3.0 dBm
		RSSI Test	Min = -3.0 dBm
			Max = 3.0 dBm
		RSSI Level	Max = -95 dBm
		RSSI Interference Threshold	Max = -115 dBm
6.4	TX Power (Test)	TX Power Test VHF Low	Min = 0.7 W
			Max = 1.3 W
		TX Power Test UHF Low	Min = 0.70 W
			Max = 1.3 W
		TX Power Test 700MHz Low	Min = 0.2 W
			Max = 0.8 W
		TX Power Test 800MHz Low	Min = 0.2 W
		TV Dower Took V/III Link	Max = 0.8 W Min = 5.6 W
		TX Power Test VHF High	
		TX Power Test UHF High	Max = 7.6 W Min = 4.7 W
		1X Power Test OHF High	Max = 6.3 W
		TX Power Test 700MHz High	Min = 2.2 W
		1X 1 GWC1 1GGC 7 GGIVII 12 1 light	Max = 3.2 W
		TX Power Test 800MHz High	Min = 2.8 W
		.,g	Max = 3.8 W
6.5	Tx CTCSS/CDCSS	Tx CTCSS/CDCSS Modulation	Min = 0.5 kHz
	Modulation and	Deviation Wide	Max = 1.0 kHz
	Composite Deviation	Tx CTCSS/CDCSS Modulation	Min = 0.315 kHz
		Deviation Narrow	Max = 0.465 kHz
		Tx CTCSS/CDCSS Modulation	Min = 0.4 kHz
		Deviation NPSPAC	Max = 0.8 kHz
6.6	P25 Phase1 Tx Tests	P25 Phase1 Tx Modulation	Min = 0.0 %
	C4FM	Fidelity C4FM	Max = 0.5 %
		P25 Phase1 Tx Symbol Deviation	Min = 1.620 kHz
		C4FM	Max = 1.980 kHz
6.7	P25 Phase2 Tx	P25 Phase1 Tx Modulation C4FM	Min = 2.544 kHz
	Modulation TDMA	High Pattern	Max = 3.110 kHz
		P25 Phase1 Tx Modulation C4FM	Min = 0.849 kHz
		Low Pattern	Max = 1.037 kHz
6.8	P25 Phase1 Rx	P25 Phase1 Rx Sensitivity C4FM	Min = 0 %
	Sensitivity (C4FM)		Max = 5 %
6.9	P25 Phase2 Rx	P25 Phase2 Rx Sensitivity TDMA	Min = 0 %
	Sensitivity (TDMA)		Max = 5 %

Table A-1. Default Harris XL-200 Portable Limits

APPENDIX B. Sample Test Result Report

Note: Results shown below are representative of actual results. Actual results and report format may vary.

Test Result Report								
Model # Serial	: Harris XL-2 #: A4030000321	00 Portable	Date 0pe	========= e/Time: rator ID:	======================================	7/11/2017 2: 10 PM		
Info: F	Info: FLASH Version: R03D09							
TCXO Fr	equency Align							
Resul t	Frequency	Freq Error	Min Limit	Max Limit	Old Softpot	New Softpot		
Pass	136. 0000 MHz	- 2 Hz	-7 Hz	7 Hz	463	461		
	equency Test							
Result	Frequency	Freq Error	Min Limit	Max Limit	Softpot			
Pass	136. 0000 MHz	-1 Hz	-54 Hz	54 Hz	461			
Pass Pass	174.0000 MHz 378.0000 MHz	-2 Hz -9 Hz	-70 Hz -151 Hz	70 Hz 151 Hz	461 461			
Pass Pass	522.0000 MHz 776.0000 MHz	-14 Hz -27 Hz	-209 Hz -310 Hz	209 Hz 310 Hz	461 461			
Pass Pass	136. 0000 MHz 174. 0000 MHz 378. 0000 MHz 522. 0000 MHz 776. 0000 MHz 798. 0000 MHz 816. 0000 MHz 861. 0000 MHz	- 26 Hz - 27 Hz	-319 Hz -326 Hz	70 HZ 151 Hz 209 Hz 310 Hz 319 Hz 326 Hz 344 Hz	461 461			
		-24 Hz	-344 Hz	344 Hz	461			
RSSI Al	ign ====	01.1.0.0	N C C	, poor		10 T		
Result	Frequency 136, 0000 MHz 139, 8000 MHz 143, 6000 MHz 143, 6000 MHz 151, 2000 MHz 155, 0000 MHz 155, 0000 MHz 162, 6000 MHz 170, 2000 MHz 171, 2000 MHz	Old Softpot	New Soft	oot RSSI	Max Limit	Min Limit		
Pass Pass	136. 0000 MHz 139. 8000 MHz	175 175	175 175	0. 0 dBm 0. 0 dBm	3.0 dBm 3.0 dBm	- 3. 0 dBm - 3. 0 dBm		
Pass Pass	143.6000 MHz 147.7000 MHz	175 175	175 175	0. 0 dBm 0. 0 dBm	3.0 dBm 3.0 dBm	-3.0 dBm -3.0 dBm		
Pass Pass	151. 2000 MHz 155. 0000 MHz	175 175	175 175	0.0 dBm 0.0 dBm	3.0 dBm 3.0 dBm	-3.0 dBm -3.0 dBm		
Pass Pass	158. 8000 MHz 162. 6000 MHz	175 175	175 175	0.0 dBm 0.0 dBm	3.0 dBm 3.0 dBm	- 3. 0 dBm - 3. 0 dBm		
Pass Pass	166. 4000 MHz 170. 2000 MHz	175 175	175 175	0.0 dBm 0.0 dBm	3.0 dBm 3.0 dBm	- 3. 0 dBm - 3. 0 dBm		
Pass Pass	174. 0000 MHz 378. 0000 MHz	174 173	175 173	0.0 dBm 0.0 dBm	3.0 dBm 3.0 dBm	- 3. 0 dBm - 3. 0 dBm		
Pass Pass	394.0000 MHz 408.0000 MHz	173 174	173 174	0.0 dBm 0.0 dBm	3.0 dBm 3.0 dBm	- 3. 0 dBm - 3. 0 dBm		
Pass Pass	422. 0000 MHz 436. 0000 MHz	174 174	174 174	0. 0 dBm 0. 0 dBm	3.0 dBm 3.0 dBm	- 3. 0 dBm - 3. 0 dBm		
Pass Pass	450.0000 MHz 464.0000 MHz	174 173	175 175 175 175 175 175 175 175 175 173 173 174 174 174 174 174 173 173 173 173 173 173 173 173 173 173	0. 0 dBm 1. 0 dBm	3. 0 dBm 3. 0 dBm	- 3. 0 dBm - 3. 0 dBm		
Pass Pass	478.0000 MHz 492.0000 MHz	173 173	173 173	0. 0 dBm 0. 0 dBm	3. 0 dBm 3. 0 dBm	- 3. 0 dBm - 3. 0 dBm		
Pass Pass	506.0000 MHz 522.0000 MHz	173 172	173 172	- 1. 0 dB	m 3.0 dBm	- 3. 0 dBm		
Pass	768. 0000 MHz	172	172	0. 0 dBm	3. 0 dBm	- 3. 0 dBm		
Pass	771. 2000 MHz	171	171	0. 0 dBm	3. 0 dBm	- 3. 0 dBm		
Pass	774. 4000 MHz	170	171 171	0. 0 dBm	3. 0 dBm	- 3. 0 dBm		
Pass Pass	851. 0000 MHz 852. 9000 MHz	169 169	169 169	0. 0 dBm	3. 0 dBm	- 3. 0 dBm		
Pass Pass	856. 7000 MHz 861. 0000 MHz	171 168	171 168	0. 0 dBm	3.0 dBm	- 3. 0 dBm		
	er Test - Low F		100	0.0 0.0	Max Limit 3.0 dBm	0. 0 dbm		
======	Frequency	=====	Min Limit					
Pass				1. 30 W				
Pass Pass	136. 0000 MHz 174. 0000 MHz 378. 0000 MHz	1. 09 W 1. 01 W	0. 70 W 0. 70 W	1. 30 W 1. 30 W				
Pass	522.0000 MHz	1. 03 W 0. 47 W	0. 70 W	1. 30 W 0. 80 W				
Pass	798, 0000 MHz	0. 46 W 0. 49 W	0. 20 W	0.80 W				
	816. 0000 MHz 861. 0000 MHz		0. 20 W	0. 80 W 0. 80 W				
======		=====						
	Frequency	Power Out						
Pass Pass	136. 0000 MHz 174. 0000 MHz 378. 0000 MHz 522. 0000 MHz 776. 0000 MHz 798. 0000 MHz	6. 49 W 6. 54 W	5. 60 W 5. 60 W	7. 60 W 7. 60 W 6. 30 W				
Pass Pass	378. 0000 MHz 522. 0000 MHz	4. 97 W 5. 03 W	4. 70 W 4. 70 W	6. 30 W				
Pass Pass	776. 0000 MHz 798. 0000 MHz	2.50 W 2.47 W	4. 70 W 2. 20 W 2. 20 W 2. 80 W 2. 80 W	3. 20 W 3. 20 W				
1 033	816.0000 MHz 861.0000 MHz		£. 60 W	3. 80 W 3. 80 W				
Tx CTCS	S (156.7 Hz) M	Modulation Wi	de					
	Frequency			Max Limit				
Pass	174. 0000 MHz 816. 0000 MHz 861. 0000 MHz	0. 677 kHz	0. 5 kHz	1. 0 kHz	156. 8 Hz 156. 7 Hz			
Pass Pass	861. 0000 MHz	0.677 kHz	0.5 kHz	1.0 kHz 1.0 kHz	156. 7 Hz 156. 8 Hz			
Tx CDCSS (627) Modulation Wide								
Resul t	Frequency	CDCSS Dev			Meas Code			
Pass Pass Pass	174.0000 MHz 816.0000 MHz 861.0000 MHz	0. 629 kHz 0. 637 kHz 0. 624 kHz	0.5 kHz 0.5 kHz 0.5 kHz	1.0 kHz 1.0 kHz	627 627 627			
	S (156. 7 Hz) M	fodul ation Na	arrow					
Resul t	Frequency	CTCSS Dev	Min Limit	Max Limit	Meas Tone			
Pass	174. 0000 MHz	0. 383 kHz	0. 315 kHz	0. 465 kHz	156. 7 Hz			
Pass Pass	174. 0000 MHz 522. 0000 MHz 776. 0000 MHz 798. 0000 MHz	0. 383 kHz 0. 383 kHz	0. 315 kHz 0. 315 kHz	0. 465 kHz 0. 465 kHz	156. 8 Hz 156. 7 Hz			
Pass			U. 315 KHZ	U. 465 KHZ	156. 8 HZ			
======	S (627) Modul a		= Man I toute	Mou. I t t +-	Mana Co-1-			
kesul t	Frequency	CDC22 Dev	MIT LIMIT	metX LIMIT	meas code			

Harris XL-200 Portable Series AutoTune™ User Guide

Pass	174. 0000 MHz	0. 348 kHz	0. 315 kHz	2 0. 465 kHz	627		
Pass	522.0000 MHz	0. 354 kHz	0. 315 kHz	z. 0.465 kHz	627		
Pass Pass	776.0000 MHz 798.0000 MHz	0. 352 kHz 0. 350 kHz	0. 315 kHz 0. 315 kHz	2 0.465 kHz 2 0.465 kHz	627 627		
Tw. CTCS							
Tx CTCSS (156.7 Hz) Modulation NPSPAC							
Result	Frequency	CTCSS Dev	Min Limit	Max Limit	Meas Tone		
Pass	816.0000 MHz 861.0000 MHz	0.535 kHz	0.4 kHz	0.8 kHz	156. 7 Hz		
Pass	861.0000 MHz	0.535 kHz	0.4 kHz	0.8 kHz	156. 8 Hz		
P25 Pha	ise 1 Tx Modula	tion Fideli	ty C4FM				
Resul t	Frequency	Mod Fideli	ty Max Li	mi t			
Pass	136. 0000 MHz	0. 422 %	5. 000				
Pass	174. 0000 MHz 378. 0000 MHz 522. 0000 MHz	0.438 %	5 000	%			
Pass Pass	378.0000 MHz	0. 549 % 0. 580 %	5. 000 5. 000	%			
Pass	776.0000 MHz	0.706 %	5. 000	%			
Pass Pass	776. 0000 MHz 798. 0000 MHz 816. 0000 MHz	0.639 % 0.641 %	5. 000 5. 000	%			
Pass	861.0000 MHz	0.665 %	5. 000	%			
P25 Pha	se 1 Tx Symbol	Devi at i on	C4FM				
====== Resul t	Frequency			t Max Limit			
Pass Pass	136.0000 MHz 174.0000 MHz	1. 823 kHz 1. 821 kHz	1. 620 kl 1. 620 kl	Iz 1.980 kHz Iz 1.980 kHz			
Pass	378.0000 MHz 522.0000 MHz	1. 822 kHz 1. 823 kHz	1. 620 kł	łz 1.980 kHz			
Pass Pass	776, 0000 MHz	1. 824 kHz	1. 620 kl 1. 620 kl	Iz. 1.980 kHz			
Pass Pass	798.0000 MHz 816.0000 MHz	1. 823 kHz 1. 822 kHz	1. 620 kl 1. 620 kl	Iz 1.980 kHz			
Pass Pass	861.0000 MHz	1. 822 KHZ 1. 821 kHz	1. 620 ki 1. 620 ki	iz 1.980 kHz Iz 1.980 kHz			
P25 Pha	se 1 Tx Deviat	ion C4FM Hi	gh Pattern	1			
			·=======	==			
Result	Frequency	Meas Dev	Min Dev	Max Dev			
Pass Pass	136.0000 MHz	2. 880 kHz 2. 871 kHz	2. 544 kHz	2 3. 110 kHz			
Pass Pass	174. 0000 MHz 378. 0000 MHz	2. 876 kHz	2. 544 kHz 2. 544 kHz	z 3. 110 kHz			
Pass Pass	378. 0000 MHz 522. 0000 MHz 776. 0000 MHz	2. 878 kHz 2. 873 kHz	2. 544 kHz 2. 544 kHz	z 3. 110 kHz			
Pass	798.0000 MHz	2.878 kHz	2. 544 kHz 2. 544 kHz	2 3.110 kHz			
Pass Pass	816. 0000 MHz 861. 0000 MHz	2. 880 kHz 2. 879 kHz	2. 544 kHz 2. 544 kHz	2 3.110 kHz 2 3.110 kHz			
				0.110 1			
	se 1 Tx Deviat			=			
Result	Frequency	Meas Dev	Min Dev	Max Dev			
Pass	136.0000 MHz	0.963 kHz	0.849 kHz				
Pass Pass	174.0000 MHz	0.964 kHz	0. 849 kHz 0. 849 kHz	z 1.037 kHz z 1.037 kHz			
Pass	174. 0000 MHz 378. 0000 MHz 522. 0000 MHz	0. 970 kHz 0. 971 kHz	0.849 kHz	z 1.037 kHz			
Pass Pass	776. 0000 MHz 798. 0000 MHz	0.974 kHz	0. 849 kHz 0. 849 kHz	2 1.037 kHz 2 1.037 kHz			
Pass	816.0000 MHz	0. 974 kHz 0. 972 kHz 0. 970 kHz	0.849 kHz	z 1.037 kHz			
Pass	861.0000 MHz	0. 974 kHz	0. 849 kHz	z 1.037 kHz			
P25 Rx	Sensitivity BE	R (C4FM)					
Resul t	Frequency	BER N	an Limit	Max Limit			
Pass		0 631 % 0	0.0 %	5. 1 %			
Pass	136.0000 MHz 174.0000 MHz	0.609 %). 0 %). 0 %	5.1 %			
Pass Pass	378. 0000 MHz 522. 0000 MHz	0. 935 % C 1. 261 % C). 0 %). 0 %	5. 1 % 5. 1 %			
Pass	768.0000 MHz	1.421 % 0	0.0 %	5.1 %			
Pass Pass	776. 0000 MHz 851. 0000 MHz	1. 805 % C 2. 327 % C). 0 %). 0 %	5. 1 % 5. 1 %			
Pass	861.0000 MHz	3. 125 % 0	0.0 %	5.1 %			
P25 Pha	se2 Rx Sensiti	vity (TDMA)					
Resul t	Frequency		= Ain Limit	Max Limit			
Pass Pass	136.0000 MHz 174.0000 MHz	0.026 % 0). 0 %). 0 %	5. 1 % 5. 1 %			
Pass	174. 0000 MHz 378. 0000 MHz	0. 206 % 0	0.0 %	5.1 %			
Pass Pass	522.0000 MHz 768.0000 MHz	0. 376 % 0 0. 342 % 0). 0 %). 0 %	5. 1 % 5. 1 %			
Pass	776.0000 MHz	0.650 % 0	0.0 %	5.1 %			
Pass Pass	851.0000 MHz 861.0000 MHz	1. 157 % C 1. 720 % C). 0 %). 0 %	5. 1 % 5. 1 %			
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Figure B-1. Sample Test Result Report

APPENDIX C. Revision History

A – Original Release	M. Hammer	W.Black	12/17/17	0160
Revision – Change	Requested By	Approved By	Rel. Date	ECO#