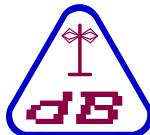


	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 1 of 54



dB Technology
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REPORT ON ELECTROMAGNETIC COMPATIBILITY TESTS

**Performed at:
TWENTY PENCE TEST SITE**

**Twenty Pence Road,
Cottenham,
Cambridge
U.K.
CB24 8PS**

on

Quatro Electronics Ltd

WDLM914HP

dated

10th December 2013

Document History

Issue	Date	Affected page(s)	Description of modifications	Revised by	Approved by
1	12/12/13		Initial release		
2	14/01/14	2	Frequency hopping changed to DSS	DB	PB
3	22/01/14	6,12,14,15,54	Added radiated measurements below 30MHz	DS	DB

Based on report template:
v090319

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	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 2 of 54

Equipment Under Test (EUT): **WDLM914HP**

Test Commissioned by: **Quatro Electronics Ltd
Quatro House
School Lane
Lytham
Lancashire
FY8 5NL**

Representative: **Tim Forrester**

Test Started: **10th September 2013**

Test Completed: **21st November 2013**

Test Engineer: **Dave Smith**

Date of Report: **10th December 2013**

Written by: Dave Smith Checked by: Derek Barlow

Signature: 

Date: 10th December 2013 Date: 12th December 2013



dB Technology can only report on the specific unit(s) tested at its site. The responsibility for extrapolating this data to a product line lies solely with the manufacturer.

Test Standards Applied

CFR 47	<i>Code of Federal Regulations: Pt 15 Subpart C - Radio Frequency Devices - Intentional Radiators</i>
---------------	---

In particular, the rules of part 15.247 for digital spread spectrum (DSS) devices were applied.

CFR 47 Class B	<i>Code of Federal Regulations: Pt 15 Subpart B- Radio Frequency Devices - Unintentional Radiators</i>
---------------------------------	--

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 3 of 54

Emissions Test Results Summary

CFR 47 - Subpart C

Test	Port	Method	Limit	PASS/FAIL	PASS	Notes
Conducted Emissions	ac power	ANSI C63.4:2003	15.207	N/A		#1
Radiated Emissions		ANSI C63.4:2003	15.209	PASS		
Occupied Bandwidth		DA 00-705	15.247 (a)(1)(i)	PASS		
Channel Separation		DA 00-705	15.247 (a)(1)	PASS		
No. of Hopping Channels		DA 00-705	15.247 (a)(1)(i)	PASS		
Time of Occupation		DA 00-705	15.247 (a)(1)(i)	PASS		
Peak Output Power		DA 00-705	15.247 (b)(2)	PASS		
Conducted Spurious	Antenna	DA 00-705	15.247 (d)	PASS		

specs_fccv100412

CFR 47 - Subpart B

Test	Port	Method	Limit	PASS/FAIL	PASS	Notes
Conducted Emissions	ac power	ANSI C63.4:2003	FCC_B	N/A		#1
Radiated Emissions		ANSI C63.4:2003	FCC_B	PASS		

specs_fccv100412

#1 Test not applicable because the radio module will only be used in battery powered products.

	Report No: R3295	FCC ID: XL8WDLM914HP	
	Issue No: 3		
	Test No: T4651	Test Report	Page: 4 of 54

Contents

1 EUT Details	6
1.1 General	6
1.2 Modifications to EUT and Peripherals	7
1.3 EUT Operating Modes	7
<i>Figure 1 General Arrangement of EUT and Peripherals</i>	8
<i>Photograph 1 Radiated Emissions</i>	9
<i>Photograph 2 Radiated Emissions</i>	9
<i>Photograph 3 Radiated Emissions</i>	10
<i>Photograph 4 Radiated Emissions</i>	10
<i>Photograph 5 Radiated Emissions</i>	11
<i>Photograph 6 Conducted Antenna</i>	11
2 Test Equipment	12
3 Test Methods	13
3.1 Radiated Emissions	13
3.2 Conducted Antenna Measurements	13
3.3 Radiated Emissions below 30MHz	14
4 Test Results	14
4.1 Radiated Emissions Results - Below 30MHz - Transmit Mode	15
4.2 Radiated Emissions Results - Below 1GHz - Transmit Mode	16
4.3 Radiated Emissions Results - Below 1GHz - Receive Mode	17
4.4 Radiated Emissions Results - Above 1GHz - Vertical	18
4.5 Radiated Emissions Results - Above 1GHz - Horizontal	19
4.6 Occupied Bandwidth	20
4.7 Carrier Frequency Separation	20
4.8 Number of Hopping Frequencies	20
4.9 Time of Occupancy	20
4.10 Peak Output Power	21
4.11 Conducted Antenna Spurious - Band Edge	21
4.12 Conducted Antenna Spurious	21
<i>PLOT 1 Radiated Emissions - Tx - 25MHz to 550MHz</i>	22
<i>PLOT 2 Radiated Emissions - Tx - 500MHz to 1GHz</i>	23
<i>PLOT 3 Radiated Emissions - Tx - 1GHz to 2GHz</i>	24
<i>PLOT 4 Radiated Emissions - Tx - 2GHz to 5GHz</i>	25
<i>PLOT 5 Radiated Emissions - Tx - 5GHz to 10GHz</i>	26
<i>PLOT 6 Radiated Emissions - Rx - 25MHz to 1GHz</i>	27
<i>PLOT 7 Radiated Emissions - Rx - 1GHz to 2GHz</i>	28
<i>PLOT 8 Radiated Emissions - Rx - 2GHz to 5GHz</i>	29
<i>PLOT 9 Radiated Emissions - Rx - 5GHz to 10GHz</i>	30
<i>PLOT 10 Conducted Antenna - 20dB Bandwidth - Low Channel</i>	31
<i>PLOT 11 Conducted Antenna - 20dB Bandwidth - Mid Channel</i>	32
<i>PLOT 12 Conducted Antenna - 20dB Bandwidth - High Channel</i>	33
<i>PLOT 13 Conducted Antenna - Channel Separation</i>	34
<i>PLOT 14 Conducted Antenna - Number of Channels - Part 1 of 2</i>	35
<i>PLOT 15 Conducted Antenna - Number of Channels - Part 2 of 2</i>	36
<i>PLOT 16 Conducted Antenna - Channel Dwell Time - Long Duration Data Sequence</i>	37
<i>PLOT 17 Conducted Antenna - Channel Dwell Time - Short Pulse Data Sequence</i>	38
<i>PLOT 18 Conducted Antenna - Channel Repetition Time - Long Data Sequence</i>	39
<i>PLOT 19 Conducted Antenna - Channel Repetition Time - Short Data Sequence</i>	40
<i>PLOT 20 Conducted Antenna - Peak Power - Low Channel</i>	41
<i>PLOT 21 Conducted Antenna - Peak Power - Mid Channel</i>	42
<i>PLOT 22 Conducted Antenna - Peak Power - High Channel</i>	43
<i>PLOT 23 Conducted Antenna - Spurious Emissions - Low Channel Band Edge</i>	44
<i>PLOT 24 Conducted Antenna - Spurious Emissions - High Channel Band Edge</i>	45
<i>PLOT 25 Conducted Antenna - Spurious Emissions - 9kHz to 1GHz - Fixed Freq.</i>	46
<i>PLOT 26 Conducted Antenna - Spurious Emissions - 850MHz to 1GHz Fixed Freq.</i>	47
<i>PLOT 27 Conducted Antenna - Spurious Emissions - 1GHz to 5GHz - Fixed Freq.</i>	48

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 5 of 54

<i>PLOT 28</i>	<i>Conducted Antenna - Spurious Emissions - 5GHz to 10GHz - Fixed Freq.</i>	49
<i>PLOT 29</i>	<i>Conducted Antenna - Spurious Emissions - 9kHz to 1GHz - Hopping</i>	50
<i>PLOT 30</i>	<i>Conducted Antenna - Spurious Emissions - 850MHz to 1GHz Hopping</i>	51
<i>PLOT 31</i>	<i>Conducted Antenna - Spurious Emissions - 1GHz to 5GHz - Hopping</i>	52
<i>PLOT 32</i>	<i>Conducted Antenna - Spurious Emissions - 5GHz to 10GHz - Hopping</i>	53
<i>PLOT 33</i>	<i>Radiated Emissions - 20MHz to 30MHz</i>	54

	Report No: R3295	FCC ID: XL8WDLM914HP	
	Issue No: 3		
Test No: T4651	Test Report		Page: 6 of 54

1 EUT Details

1.1 General

The EUT was a radio transceiver module operating in the 902MHz to 928MHz band using frequency hopping.

The module is intended to be used in a range of battery powered alarm systems. The frequency hopping is controlled by the circuitry on the main alarm control board. The system supplied for testing consisted of the radio module connected to a sample alarm control board via a ribbon cable. The alarm control board is normally battery powered, but for the purposes of these tests the battery was replaced with an external bench PSU to allow continuous transmissions to be made without draining the battery.

The unit was supplied with various test modes selected by switches. There were two basic hopping modes.

HOPPING MODE 1: Close to continuous transmission - a pulse train of a duration in the order of 375msec on each channel

HOPPING MODE 2: Short pulse operation - a pulse of a duration in the order of 6.5msec on each channel.

The system was also supplied with test modes so that transmission could be fixed to just one of three frequencies covering the bottom, top and mid point of the used frequency range. These frequencies were:

Low Channel: 909 MHz

Mid Channel: 914.2 MHz

High Channel: 919.6 MHz

Radiated measurements were performed from 20MHz to 10GHz in order to cover the lowest frequency clock of 26MHz and the 10th harmonic of the highest transmit channel.

Details of the EUT and associated peripherals used during the tests are listed below. Figure 1 shows the interconnections between the EUT and peripherals.

Item	Manufacturer	Model	Description	Serial No:	Notes
1	Quatro	WDLM914HP	EUT Module		
2	Quatro	Test Board 914	alarm control board		
3	TTI	TS3022S	Bench PSU		

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 7 of 54

1.2 Modifications to EUT and Peripherals

Details of any modifications that were required to achieve compliance are listed below. The modification numbers are referred to in the results sections as appropriate.

Mod No:	Details	Implemented for
0	Original unmodified unit.	
1	Additional switch added to alarm control board to provide additional test mode.	
2	Ferrite and common mode choke added to alarm control board DC power cable. This was to decouple the bench PSU which would not normally be part of the battery powered system.	Radiated Emissions

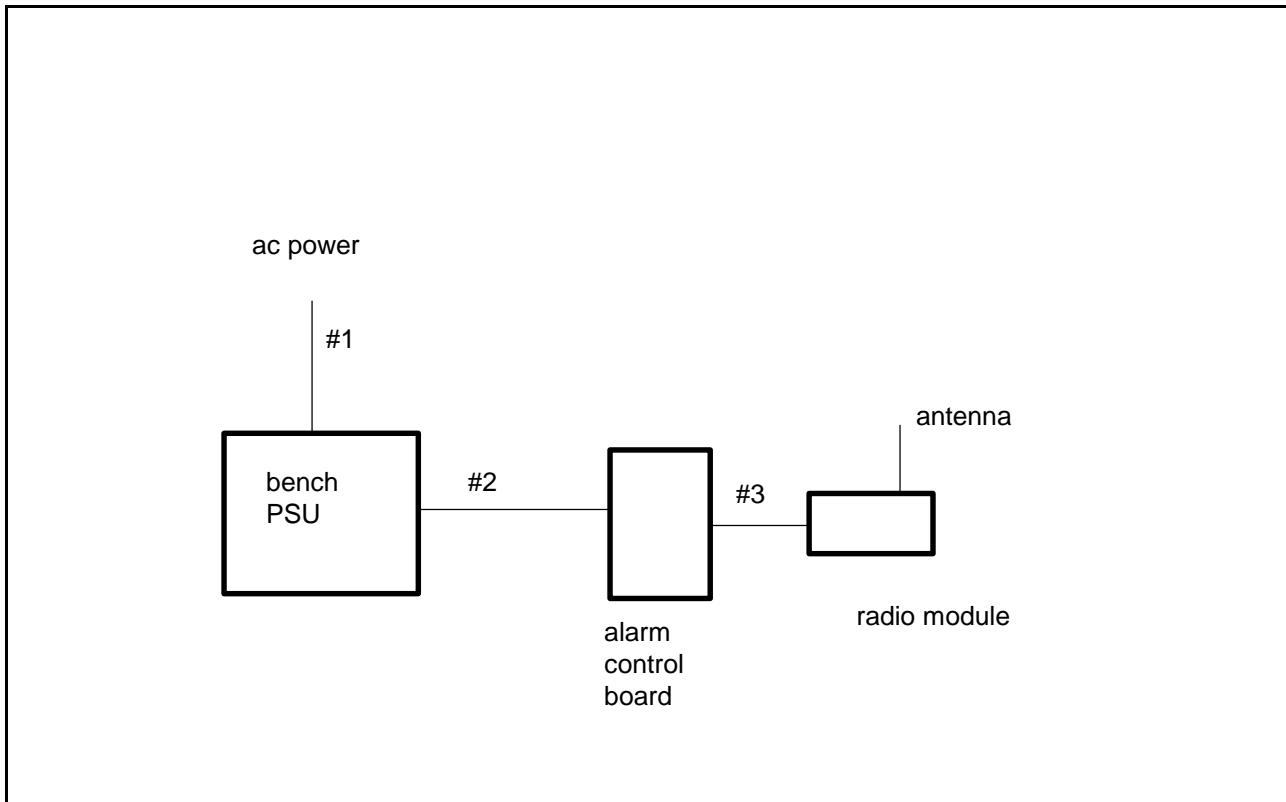
1.3 EUT Operating Modes

The EUT was tested in the following operating mode or modes. Generally, operating modes are chosen that will exercise the functions of the EUT as fully as possible and in a manner likely to produce maximum emission levels or susceptibility. Individual test result sheets reference the operating mode of the EUT.

Operating Mode	Details
1	Transmit mode. Fixed frequency. Pseudo random data with normal modulation.
2	Transmit mode. Hopping Mode 1. Pseudo random data with normal modulation.
3	Transmit mode. Hopping Mode 2. Pseudo random data with normal modulation.
4	Receive mode. Fixed frequency

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 8 of 54

Figure 1 General Arrangement of EUT and Peripherals



	Description	Type	Length	Notes
#1	Mains	Unscreened	2m	
#2	DC power	Unscreened	0.6m	
#3	Ribbon cable	Unscreened	0.18m	

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 9 of 54



Photograph 1 Radiated Emissions

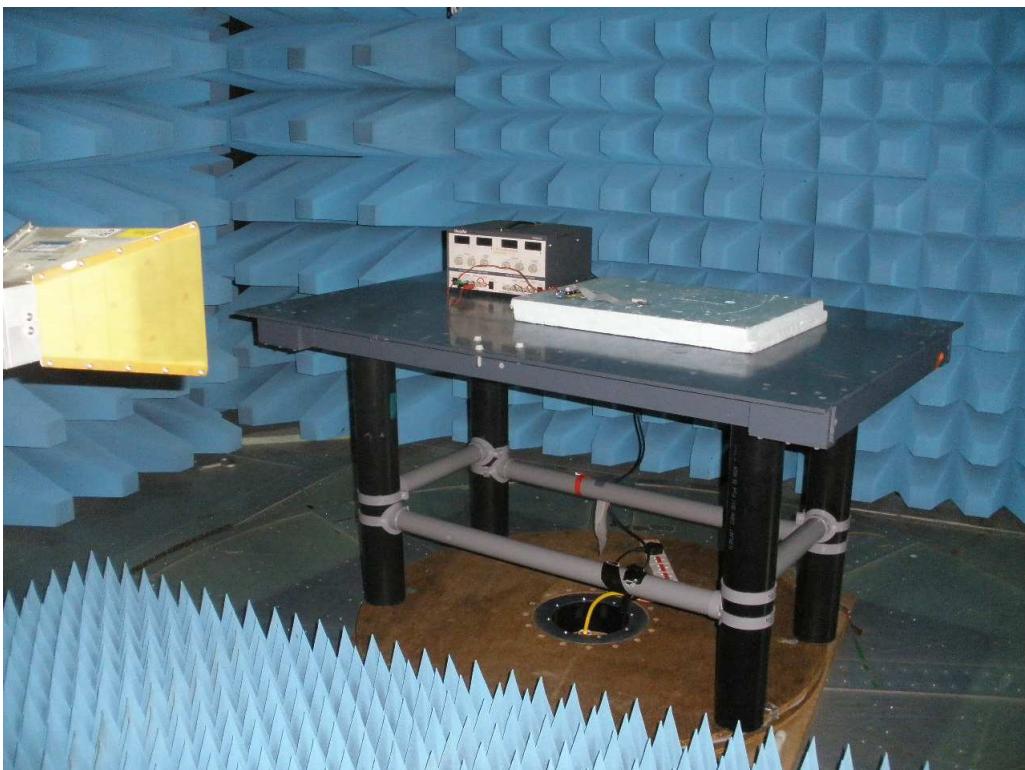


Photograph 2 Radiated Emissions

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 10 of 54

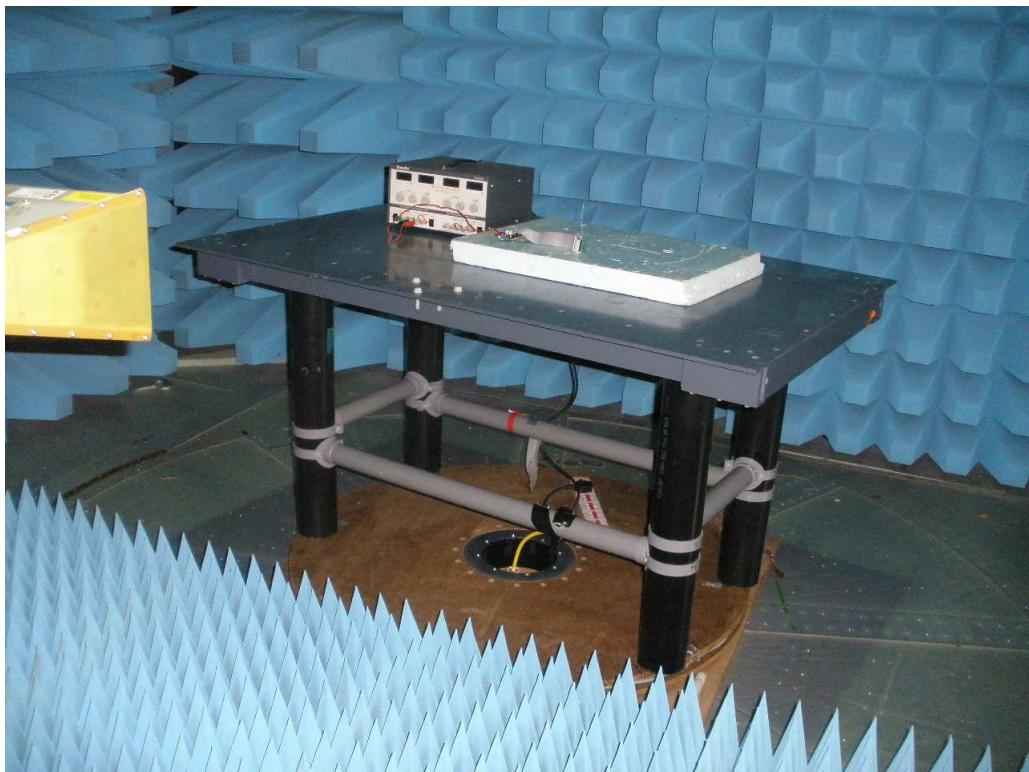


Photograph 3 Radiated Emissions

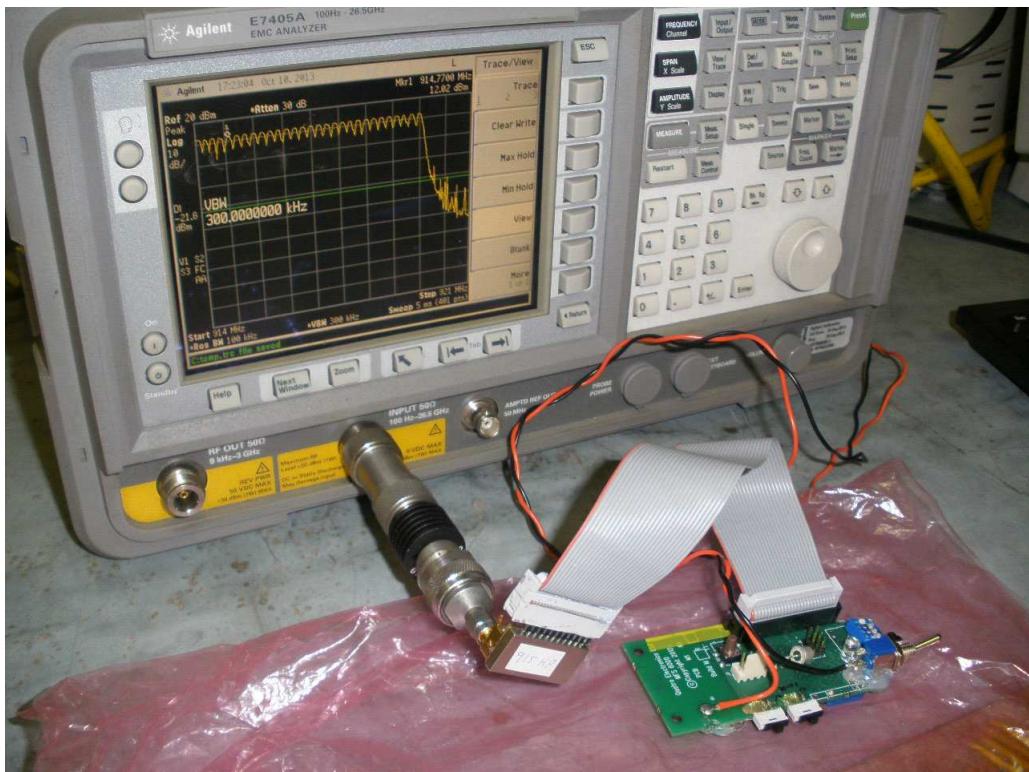


Photograph 4 Radiated Emissions

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 11 of 54



Photograph 5 Radiated Emissions



Photograph 6 Conducted Antenna

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 12 of 54

2 Test Equipment

The test equipment used during the tests was one or more of the items listed below. Individual test result sheets indicate which items were used.

Ref No:	Details	Cal Date	Cal Date	Cal Interval
A12	Chase Bilog CBL6111A	1012	30/01/2013	1 year
A24	Chase X-wing Bilog CBL6144 26MHz-3GHz	27590	28/10/2013	1 year
A8	EMCO 3115 DR Guide	6070	30/01/2013	1 year
A9	EMCO 6502 Loop	2139	10/12/2013	1 year
PRE10	LUCIX 100M-20G pre-amp	10	20/08/2013	1 year
R4	R&S ESVS10	421872	17/12/2012	1 year
R8	Agilent E7405A Spectrum Analyser	MY44212494	24/09/2013	1 year
R9	Agilent E7405A Spectrum Analyser	MY45110758	19/11/2013	1 year
RFF15	Band Pass Filter 1GHz to 2GHz	15	20/08/2013	1 year
RFF16	500MHz to 1GHz Notch Filter	FF204-3	20/08/2013	1 year
RFF17	Low Pass RF Filter 550MHz	17	20/08/2013	1 year
RFF22	High Pass Filter - 1.35GHz (10GHz) MicroTronics HPM13017	33	20/08/2013	1 year

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 13 of 54

3 Test Methods

3.1 Radiated Emissions

This section describes the general method of performing this test. The specific method used and any deviations from this general method are listed in the appropriate results section.

Initial scans are performed in a semi-anechoic screened room. Scans are performed over the frequency range specified in the test standard with the antenna both horizontally and vertically polarised. During these scans the EUT and peripherals are rotated through 360°. Bench top EUTs are placed on a non-conducting bench at a height of 0.8m above the ground plane. Floor standing EUTs are placed 0.1m above the ground plane. The results of the scans are shown in the plots included at the end of the report.

Significant emissions identified by the scans are measured on an open area test site at the appropriate test distance using the type of detector specified in the standard. Maximised readings are obtained by rotating the EUT through 360° and adjusting the height of the antenna from 1m to 4m. Measurements are made with the antenna both horizontally and vertically polarised and the results tabulated.

Tabulated results show levels based on the following calculation:

$$\text{Field Strength (dBuV)} = \text{receiver reading (dBuV)} + \text{CF (dB/m)}$$

CF is the correction factor for the antenna and cable.

For example:

If at 434.478MHz the receiver reading was 58.8dBuV and combined correction factor = 20.4 (dB/m).

$$\text{Total field strength} = 58.8 + 20.4 = 79.2 \text{dBuV/m.}$$

3.2 Conducted Antenna Measurements

This section describes the general method of performing this test. The specific method used and any deviations from this general method are listed in the appropriate results section.

The antenna port of the EUT is connected either directly, or using an appropriate attenuator, to the input of a spectrum analyser.

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 14 of 54

3.3 Radiated Emissions below 30MHz

This section describes the general method of performing this test. The specific method used and any deviations from this general method are listed in the appropriate results section.

Initial scans are performed in a semi-anechoic screened room at a distance of 3m. Scans are performed over the frequency range specified in the test standard with a loop antenna both co-axially and orthogonally orientated with respect to the EUT. During these scans the EUT and peripherals are rotated through 360°. Bench top EUTs are placed on a non-conducting bench at a height of 0.8m above the ground plane. Floor standing EUTs are placed 0.1m above the ground plane. The results of the scans are shown in the plots included at the end of the report.

Significant emissions identified by the scans are measured on an open area test site at the appropriate test distance using a CISPR16 quasi-peak receiver. Maximised readings are obtained by rotating the EUT through 360° with the antenna at a height of 1m. Measurements are made with the antenna both coaxially and orthogonally orientated with respect to the EUT and the results tabulated.

Tabulated results are obtained by adding the raw reading from the receiver (in dBuV) to the appropriate correction factors for the antenna and cables to give a reading in dBuV/m. For example:

Frequency	Receiver reading	Correction Factor	Final level
126kHz	75.8 dBuV	8.0 dB/m	83.8 dBuV/m

Final reading = 75.8 + 8.0 = 83.8 dBuV/m

4 Test Results

The following sections contain tabulated test results. Plots of various scans are included at the back of this section.

	Report No: R3295	FCC ID: XL8WDLM914HP	Page: 15 of 54
	Issue No: 3	Test No: T4651	

4.1 Radiated Emissions Results - Below 30MHz - Transmit Mode

Factor Set 1: A9_HI_V_13A CBL015_11A --

Factor Set 2: - - -

Factor Set 3: - - -

Test Equipment: R9 A9

Radiated Emissions

Company: Quatro Electronics Ltd							Product: WDLM914HP						
Date: 22/01/2014							Test Eng: Dave Smith						
Ports:													
Test: ANSI C63.4:2003 using limits of							15.209						
Ports:													
Test: using limits of													
Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB/m	Corr'n Factor dB	Total Level dBuV/m	Limit FCC_B dBuV/m	Margin FCC_B dB	Notes
33	TMD	2	3	1	26.000	F	21.6	7.3		28.9	69.5	40.6	
33	TMD	2	3	1	26.000	E	21.4	7.3		28.7	69.5	40.9	
Results Minimum Margin PASS/FAIL										40.6 dB			
Notes	Comments and Observations												
	Results of scans shown in plot 33. Measured with 9kHz RBW/ 30kHz VBW peak detector. F = loop antenna face on with EUT. E = loop antenna edge on with EUT. Limits extrapolated to 3m using 40dB/decade. TMD = transmitting on mid channel.												

	Report No: R3295	FCC ID: XL8WDLM914HP	Page: 16 of 54
	Issue No: 3		
Test No: T4651	Test Report		

4.2 Radiated Emissions Results - Below 1GHz - Transmit Mode

Factor Set 1: A12_FS_13B - - CBL015_11A	1 m cable
Factor Set 2: - - -	
Factor Set 3: - - -	
Test Equipment: R4 A12 A24 R8 RFF16 RFF17	

Radiated Emissions

Company: Quatro Electronics Ltd	Product: WDLM914HP																
Date: 21/11/2013	Test Eng: Dave Smith																
Ports:																	
Test: ANSI C63.4:2003 using limits of 15.209																	
Ports:																	
Test: using limits of																	
Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB/m	Corr'n Factor dB	Total Level dBuV/m	Limit 15.209 dBuV/m	Margin 15.209 dB	Notes				
1	THi	2	3	1	30.250	V	7.2	19.9		27.1	40.0	12.9					
1	THi	2	3	1	30.250	H	4.5	19.9		24.4	40.0	15.6					
1	THi	2	3	1	33.400	V	7.9	17.6		25.5	40.0	14.5					
1	THi	2	3	1	33.400	H	5.0	17.6		22.6	40.0	17.4					
1	THi	2	3	1	37.300	V	5.7	15.0		20.7	40.0	19.3					
1	THi	2	3	1	37.300	H	6.0	15.0		21.0	40.0	19.0					
1	THi	2	3	1	133.700	V	-3.8	13.0		9.2	43.5	34.3					
1	THi	2	3	1	133.700	H	2.2	13.0		15.2	43.5	28.3					
1	THi	2	3	1	141.100	V	-3.2	12.9		9.7	43.5	33.8					
1	THi	2	3	1	141.100	H	-0.2	12.9		12.7	43.5	30.8					
2	THi	2	3	1	385.900	V	-2.8	19.0		16.2	46.0	29.8					
2	THi	2	3	1	385.900	H	-2.8	19.0		16.2	46.0	29.8					
2	THi	2	3	1	960.000	V	6.6	30.8		37.4	46.0	8.7	#1				
2	THi	2	3	1	960.000	H	-0.9	30.8		29.9	46.0	16.2					
Results		Minimum Margin PASS/FAIL				8.7	dB										
Notes	Comments and Observations																
THi	Results of scans are shown in plots 1 and 2. Measurements made with 120kHz QP detector. Maximum reading for unit standing upright and laying flat. Transmitting on high channel. Prescans showed emissions did not differ significantly between the three channels.																
#1	Including contribution from ambient signal. Limits only actually apply in restricted bands.																
Key:	qp - quasi-peak, av - average, pk - peak																

	Report No: R3295	FCC ID: XL8WDLM914HP	Page: 17 of 54
	Issue No: 3		
Test No: T4651	Test Report		

4.3 Radiated Emissions Results - Below 1GHz - Receive Mode

Factor Set 1: A12_FS_13B - - CBL015_11A	1 m cable
Factor Set 2: - - -	
Factor Set 3: - - -	
Test Equipment: R4 A12 A24 R8	

Radiated Emissions

Company: Quatro Electronics Ltd Product: WDLM914HP Date: 21/11/2013 Test Eng: Dave Smith													
Ports:													
Test: ANSI C63.4:2003 using limits of FCC B													
Ports:													
Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB/m	Corr'n Factor dB	Total Level dBuV/m	Limit FCC_B dBuV/m	Margin FCC_B dB	Notes
6	RHi	2	3	1	33.770	V	7.0	17.3		24.3	40.0	15.7	
6	RHi	2	3	1	33.770	H	4.5	17.3		21.8	40.0	18.2	
6	RHi	2	3	1	44.500	V	8.1	10.6		18.7	40.0	21.3	
6	RHi	2	3	1	44.500	H	4.9	10.6		15.5	40.0	24.5	
6	RHi	2	3	1	133.700	V	-2.0	13.0		11.0	43.5	32.5	
6	RHi	2	3	1	133.700	H	4.2	13.0		17.2	43.5	26.3	
6	RHi	2	3	1	141.100	V	-3.3	12.9		9.6	43.5	33.9	
6	RHi	2	3	1	141.100	H	4.1	12.9		17.0	43.5	26.5	
6	RHi	2	3	1	408.100	V	-2.8	19.9		17.1	46.0	28.9	
6	RHi	2	3	1	408.100	H	-2.8	19.9		17.1	46.0	28.9	
6	RHi	2	3	1	878.100	V	-2.7	28.7		26.0	46.0	20.0	
6	RHi	2	3	1	878.100	H	-2.7	28.7		26.0	46.0	20.0	
Results Minimum Margin PASS/FAIL										15.7 dB			
Notes		Comments and Observations											
RHi		Results of scans are shown in plot 6. Measurements made with 120kHz QP detector. Maximum reading for unit standing upright and laying flat. Receiving on high channel. Prescans showed emissions did not differ significantly between the three channels.											

	Report No: R3295	FCC ID: XL8WDLM914HP	
	Issue No: 3		
Test No: T4651	Test Report		Page: 18 of 54

4.4 Radiated Emissions Results - Above 1GHz - Vertical

Factor Set 1: A8_3m_12B PRE10_12A RFF22_12A CBL050_11A	1 m cable
Factor Set 2: - - -	
Factor Set 3: - - -	
Test Equipment: R8 A8 PRE10 RFF22 RFF15	

Radiated Emissions

Company: Quatro Electronics Ltd Product: WDLM914HP Date: 10/09/2013 Test Eng: Peter Barlow															
Ports:															
Test: ANSI C63.4:2003 using limits of 15.209															
Ports:															
Test: using limits of															
Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Det. Type	Rec. Level dBuV	Corr'n Factor dB	Total Level dBuV/m	Limit 15.209 dBuV/m	Margin 15.209 dB	Notes		
4	Lo	0	1.5	1	2726.000	V	pk	55.8	-6.9	48.9	80.0	31.1	Upright		
4	Lo	0	1.5	1	2726.000	V	av	53.6	-6.9	46.7	60.0	13.4	Upright		
4	Mid	0	1.5	1	2742.000	V	pk	55.4	-6.9	48.5	80.0	31.5	Upright		
4	Mid	0	1.5	1	2742.000	V	av	53.3	-6.9	46.5	60.0	13.6	Upright		
4	Hi	0	1.5	1	2757.000	V	pk	55.5	-6.8	48.7	80.0	31.3	Upright		
4	Hi	0	1.5	1	2757.000	V	av	53.5	-6.8	46.6	60.0	13.4	Upright		
4	Lo	0	1.5	1	3635.000	V	pk	58.2	-4.1	54.0	80.0	26.0	Flat		
4	Lo	0	1.5	1	3635.000	V	av	56.5	-4.1	52.3	60.0	7.7	Flat		
4	Mid	0	1.5	1	3656.000	V	pk	56.4	-4.0	52.4	80.0	27.6	Flat		
4	Mid	0	1.5	1	3656.000	V	av	54.6	-4.0	50.6	60.0	9.4	Flat		
4	Hi	0	1.5	1	3676.000	V	pk	58.1	-3.8	54.3	80.0	25.8	Flat		
4	Hi	0	1.5	1	3676.000	V	av	56.6	-3.8	52.7	60.0	7.3	Flat		
Results								Minimum Margin PASS/FAIL		7.3	dB				
Notes Comments and Observations															
Lo Mid Hi	Results of scans are shown in plots 3 to 5 and 7 to 9. The plots showed no significant emissions in receive mode. The highest emissions identified in transmit mode were maximised with a 1MHz RBW peak detector and linear average detector. The results are tabulated above.														
	Transmitting on low channel Transmitting on mid channel Transmitting on high channel														
	Maximised for height and rotation. EUT measured upright and flat with vertical and horizontal measuring antenna. Highest reading recorded above.														

	Report No: R3295	FCC ID: XL8WDLM914HP	
	Issue No: 3		
Test No: T4651	Test Report		Page: 19 of 54

4.5 Radiated Emissions Results - Above 1GHz - Horizontal

Factor Set 1: A8_3m_12B PRE10_12A RFF22_12A CBL050_11A	1 m cable
Factor Set 2: - - -	
Factor Set 3: - - -	
Test Equipment: R8 A8 PRE10 RFF22 RFF15	

Radiated Emissions

Company: Quatro Electronics Ltd Product: WDLM914HP Date: 10/09/2013 Test Eng: Peter Barlow															
Ports:															
Test: ANSI C63.4:2003 using limits of 15.209															
Ports:															
Test: using limits of															
Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Det. Type	Rec. Level dBuV	Corr'n Factor dB	Total Level dBuV/m	Limit 15.209 dBuV/m	Margin 15.209 dB	Notes		
4	Lo	0	1.5	1	2726.000	H	pk	59.0	-6.9	52.1	80.0	27.9	Upright		
4	Lo	0	1.5	1	2726.000	H	av	57.6	-6.9	50.7	60.0	9.3	Upright		
4	Mid	0	1.5	1	2742.000	H	pk	59.1	-6.9	52.2	80.0	27.8	Upright		
4	Mid	0	1.5	1	2742.000	H	av	57.8	-6.9	50.9	60.0	9.1	Upright		
4	Hi	0	1.5	1	2757.000	H	pk	59.5	-6.8	52.7	80.0	27.3	Upright		
4	Hi	0	1.5	1	2757.000	H	av	58.2	-6.8	51.3	60.0	8.7	Upright		
4	Lo	0	1.5	1	3635.000	H	pk	58.1	-4.1	53.9	80.0	26.1	Flat		
4	Lo	0	1.5	1	3635.000	H	av	56.5	-4.1	52.3	60.0	7.7	Flat		
4	Mid	0	1.5	1	3656.000	H	pk	56.4	-4.0	52.4	80.0	27.6	Flat		
4	Mid	0	1.5	1	3656.000	H	av	54.6	-4.0	50.6	60.0	9.4	Flat		
4	Hi	0	1.5	1	3676.000	H	pk	58.1	-3.8	54.3	80.0	25.7	Flat		
4	Hi	0	1.5	1	3676.000	H	av	56.6	-3.8	52.8	60.0	7.2	Flat		
Results								Minimum Margin PASS/FAIL		7.2	dB				
Notes Comments and Observations															
Lo Mid Hi	Results of scans are shown in plots 3 to 5 and 7 to 9. The plots showed no significant emissions in receive mode. The highest emissions identified in transmit mode were maximised with a 1MHz RBW peak detector and linear average detector. The results are tabulated above.														
	Transmitting on low channel Transmitting on mid channel Transmitting on high channel														
	Maximised for height and rotation. EUT measured upright and flat with vertical and horizontal measuring antenna. Highest reading recorded above.														

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 20 of 54

4.6 Occupied Bandwidth

The spectrum analyser results for occupied bandwidth are shown in plots 10 to 12. The 20dB occupied bandwidth measurements were as follows:

Low channel: 77.5 kHz

Mid Channel: 78 kHz

High Channel: 77.6 kHz

According to 15.247 (a)(1)(i) the bandwidth must not exceed 500kHz and therefore the EUT is compliant.

PASS

4.7 Carrier Frequency Separation

The spectrum analyser results for channel separation are shown in plot 13. The channel separation was measured as 200kHz.

According to 15.247 (a)(1) the channel separation must exceed the occupied bandwidth (and must not be lower than 25kHz). Since the maximum occupied bandwidth measured was 77.8kHz, and the channel separation was measured at 200kHz, the EUT is compliant.

PASS

4.8 Number of Hopping Frequencies

The spectrum analyser results for number of hopping frequencies are shown in plots 14 and 15. The number of hopping channels was measured as 54.

According to 15.247 (a)(1)(i), if the occupied bandwidth is less than 250kHz, the number of hopping frequencies must exceed 50. The EUT is compliant.

PASS

4.9 Time of Occupancy

The spectrum analyser results for time of occupancy are shown in plots 16 to 19.

Plot 16 shows that in HOPPING MODE 1 the dwell time is 374.8 msec.

Plot 17 shows that for HOPPING MODE 2 the dwell time is 6.502msec.

Plot 18 shows that in HOPPING MODE 1 the time between channel repetition is 20.25 seconds.

Plot 19 shows that in HOPPING MODE 2 the time between channel repetition is 20.25 seconds.

According to 15.247 (a)(1)(i), if the occupied bandwidth is less than 250kHz, the average time of occupancy must not be more than 400msec in a 20 second period.

PASS

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 21 of 54

4.10 Peak Output Power

The spectrum analyser results for peak output power are shown in plots 20 to 22. The measured results were as follows:

Low channel: 21.68 dBm

Mid Channel: 22.09 dBm

High Channel: 22.06 dBm

According to 15.247 (b)(2) the limit is 1 watt (30dBm) for systems employing at least 50 hopping channels.

PASS

4.11 Conducted Antenna Spurious - Band Edge

The spectrum analyser results for conducted antenna band edge spurious are shown in plots 23 and 24. The measured results are comfortably below the -20dBc limit of 15.247 (d).

(Note: the band edges do not coincide with restricted bands and therefore radiated measurements were not performed at the band edges).

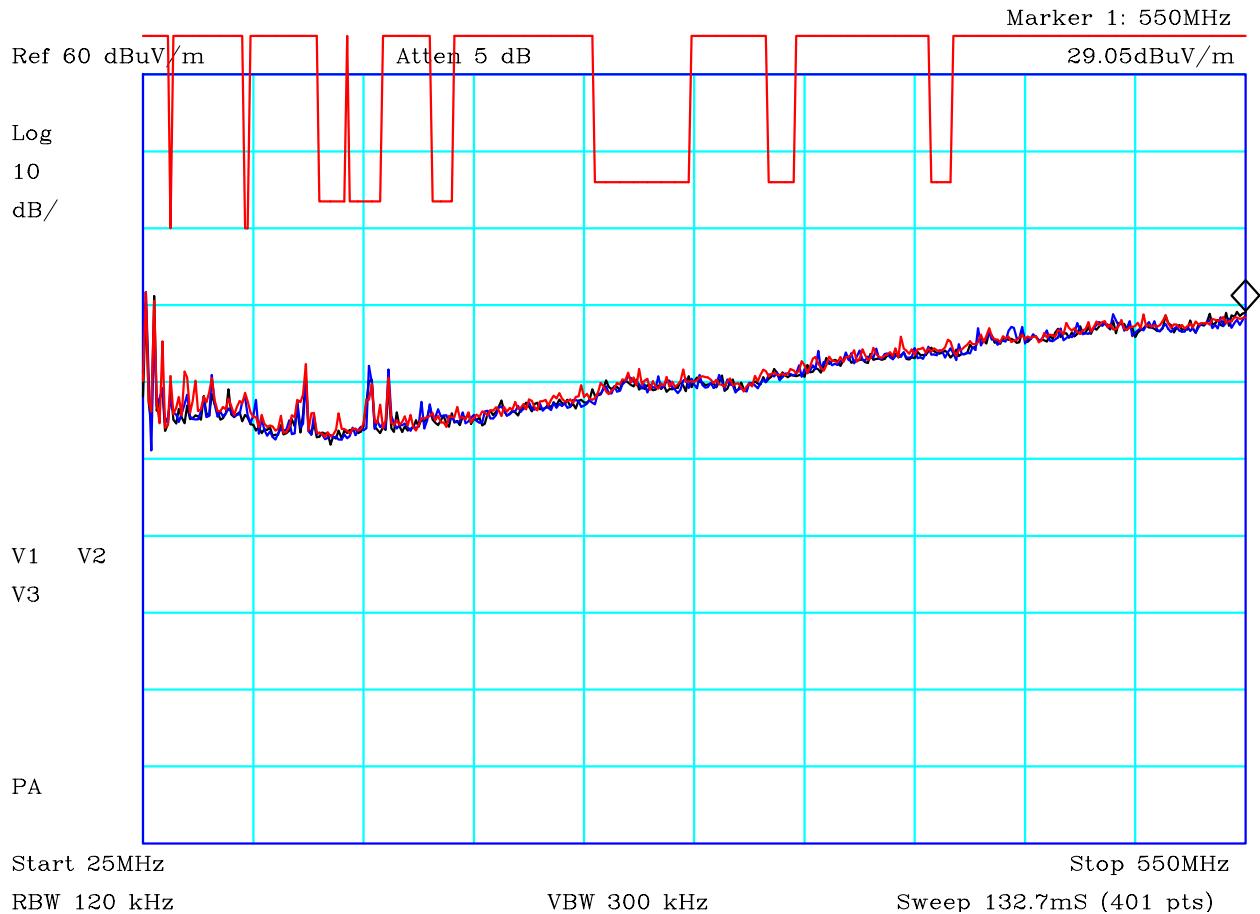
PASS

4.12 Conducted Antenna Spurious

The spectrum analyser results for conducted antenna spurious are shown in plots 25 to 32. The measured results are more than 20dB below the -20dBc limit of 15.247 (d).

PASS

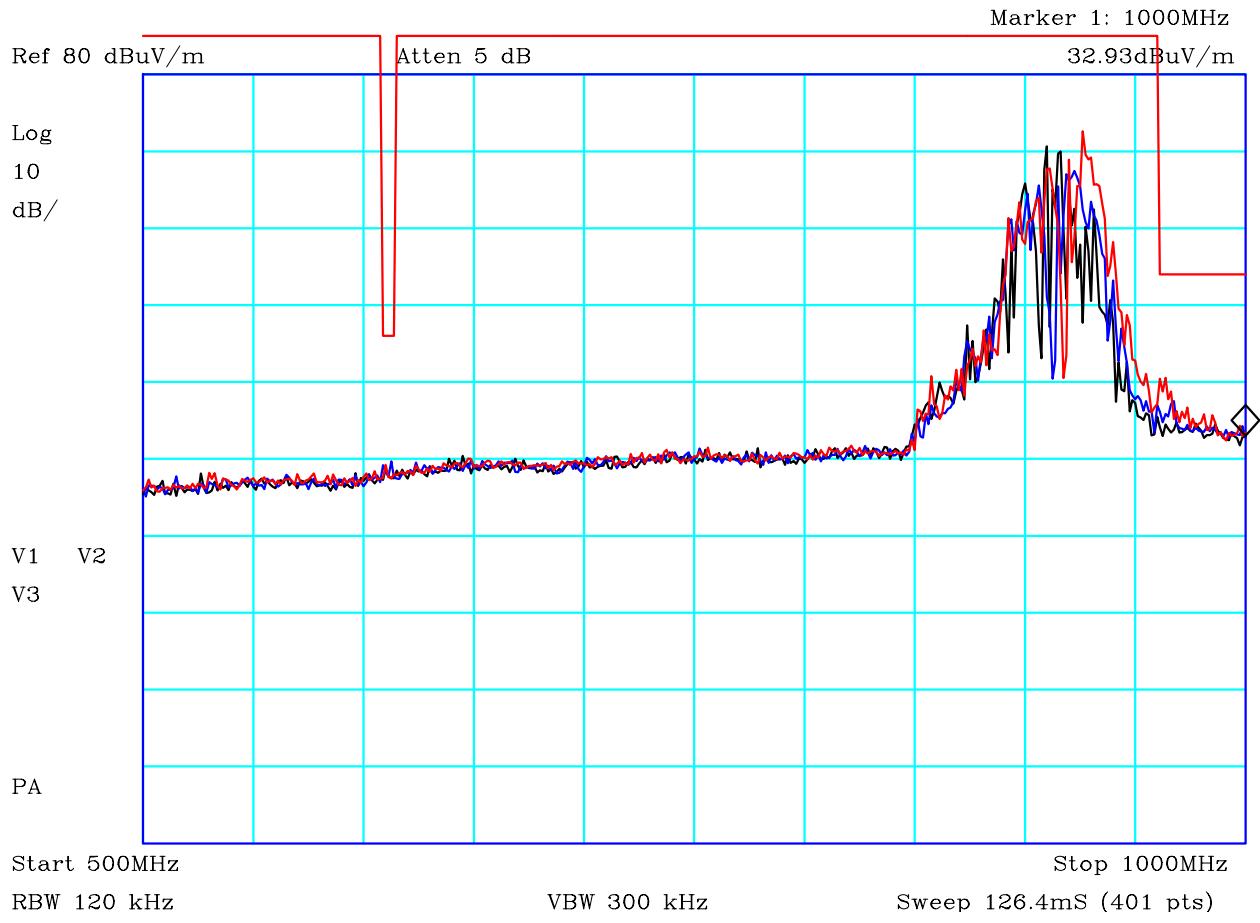
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 22 of 54



PLOT 1 Radiated Emissions - Tx - 25MHz to 550MHz

Company:	Quattro	Product:	Frequency Hopping Module
Date:	20/11/2013	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 3m	Limit2:	
Limit3:		Limit4:	
Black: 909 MHz Carrier. Blue: 914 MHz Carrier. Red: 919 MHz Carrier. Antenna fitted. Upright and on side. Canned modules.			
Facility:	Anech_2	Height	1.1,1.5,1.9m
Distance	3m	Polarisation	V+H
Angle	0-360	File:	H3A20806
		Mode:	1
		Modification State:	2
		Analyser:	R8

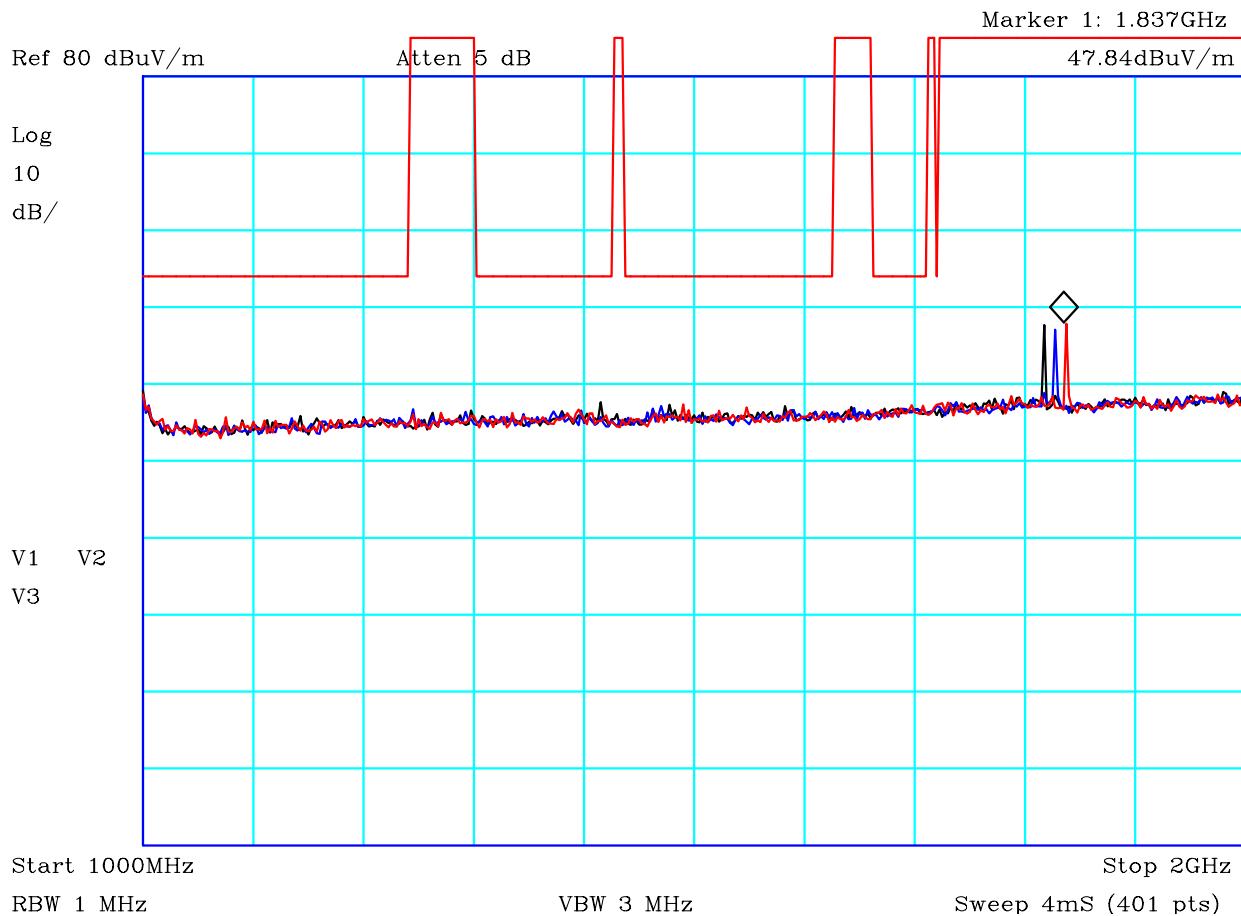
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 23 of 54



PLOT 2 Radiated Emissions - Tx - 500MHz to 1GHz

Company:	Quattro	Product:	Frequency Hopping Module
Date:	20/11/2013	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 3m	Limit2:	
Limit3:		Limit4:	
<p>Black: 909 MHz Carrier. Blue: 914 MHz Carrier. Red: 919 MHz Carrier. Antenna fitted. Upright and on side. Canned modules. Carrier filtered out with notch filter.</p>			
Facility:	Anech_2	Height	1.5m
Distance	3m	Polarisation	V+H
Angle	0-360	File:	H3A207F1
Mode:	1	Modification State:	2
Analyser:	R8		

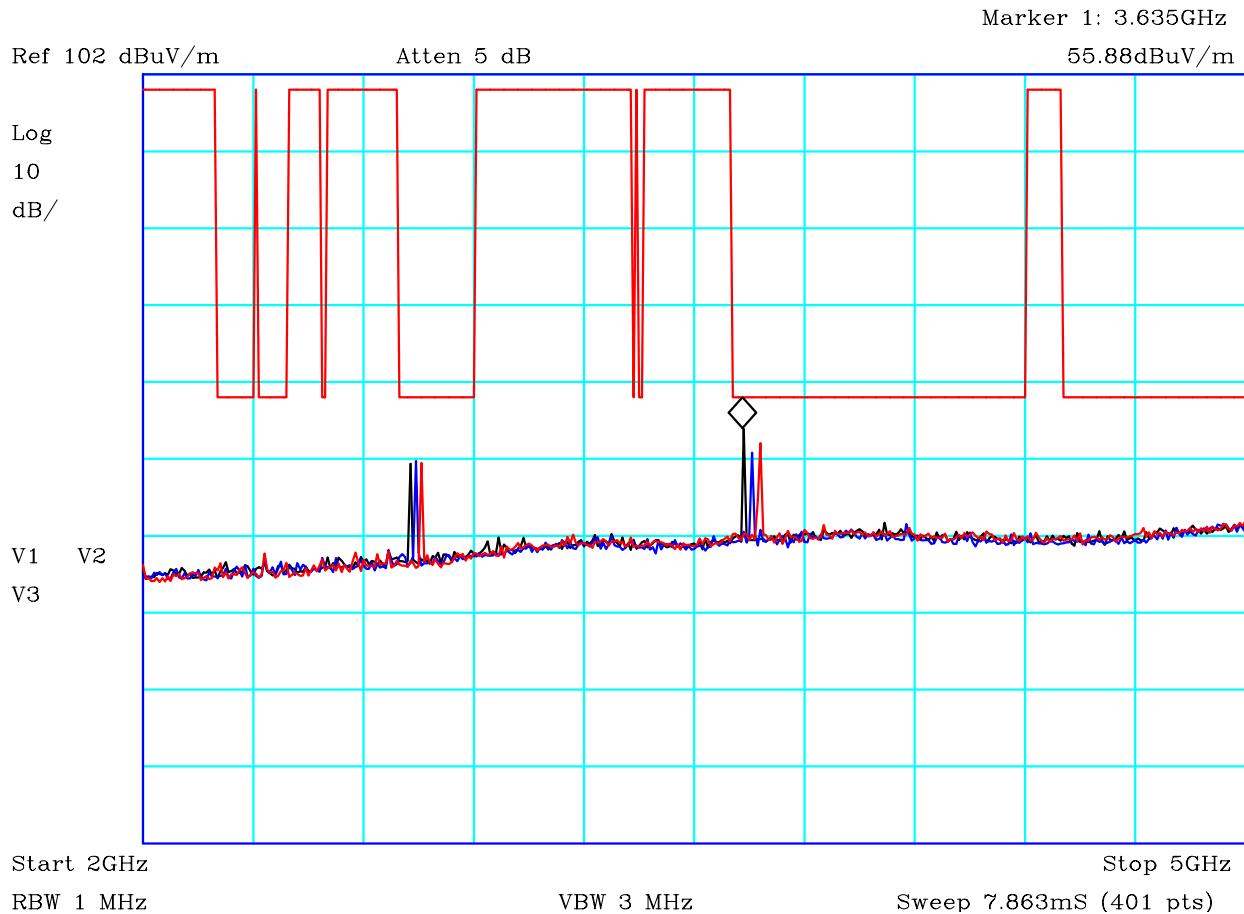
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 24 of 54



PLOT 3 Radiated Emissions - Tx - 1GHz to 2GHz

Company:	Quattro	Product:	Frequency Hopping Module HP
Date:	10/09/2013	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 3m	Limit2:	
Limit3:		Limit4:	
Black: 909 MHz Carrier. Blue: 914 MHz Carrier. Red: 919 MHz Carrier. Antenna fitted. Upright and on side. Canned modules.			
Facility:	Anech_2	Height	1.1m,1.5m,1.9m
Distance	3m	Polarisation	V+H
Angle	0-360	File:	H3810803
		Mode:	1
		Modification State:	0
		Analyser:	R8

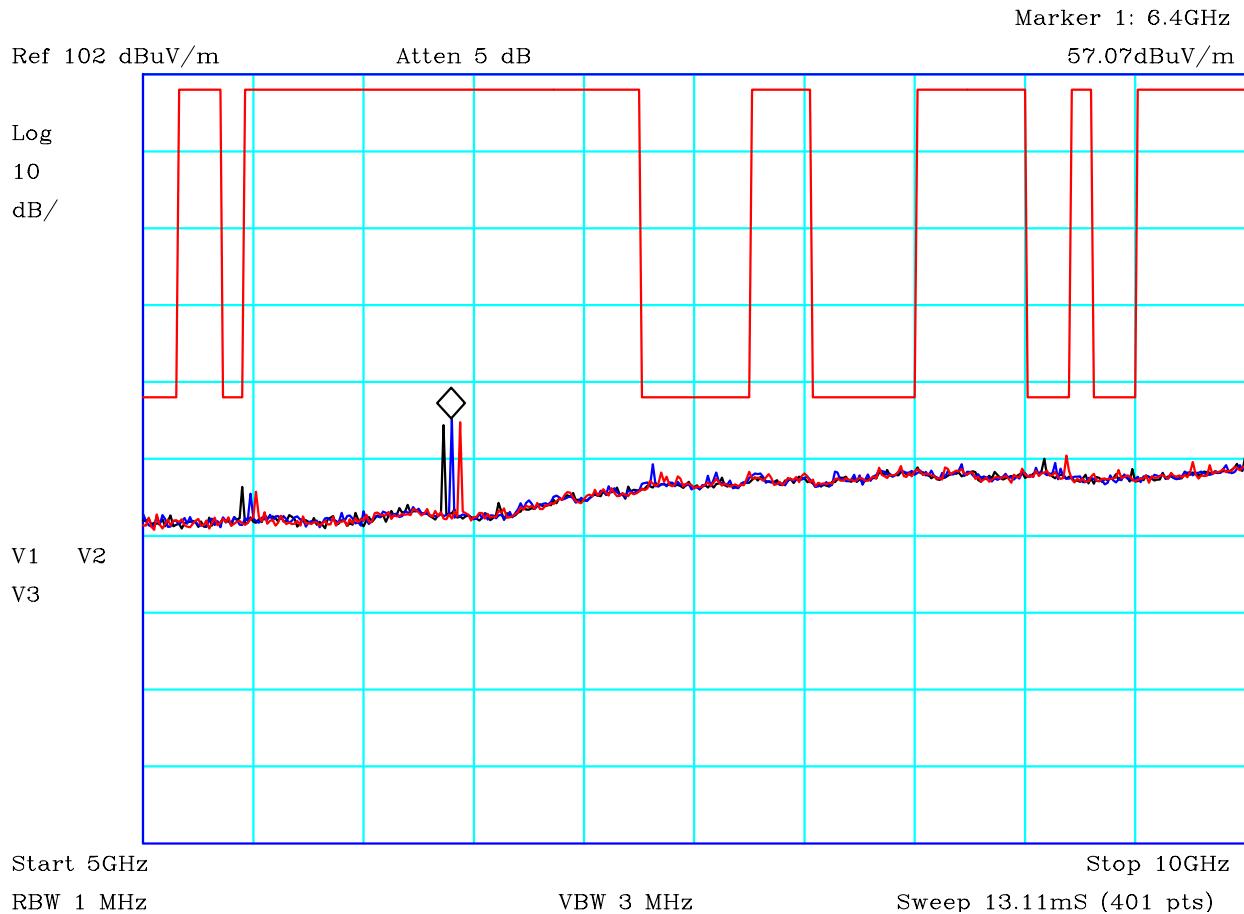
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 25 of 54



PLOT 4 Radiated Emissions - Tx - 2GHz to 5GHz

Company:	Quattro	Product:	Frequency Hopping Module HP
Date:	10/09/2013	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands@1.5m	Limit2:	
Limit3:		Limit4:	
Black: 909 MHz Carrier. Blue: 914 MHz Carrier. Red: 919 MHz Carrier. Antenna fitted. Upright and on side. Canned modules.			
Facility:	Anech_2	Height	1.1m,1.5m,1.9m
Distance	1.5m	Polarisation	V+H
Angle	0-360	File:	H38104B6
		Mode:	1
		Modification State:	0
		Analyser:	R8

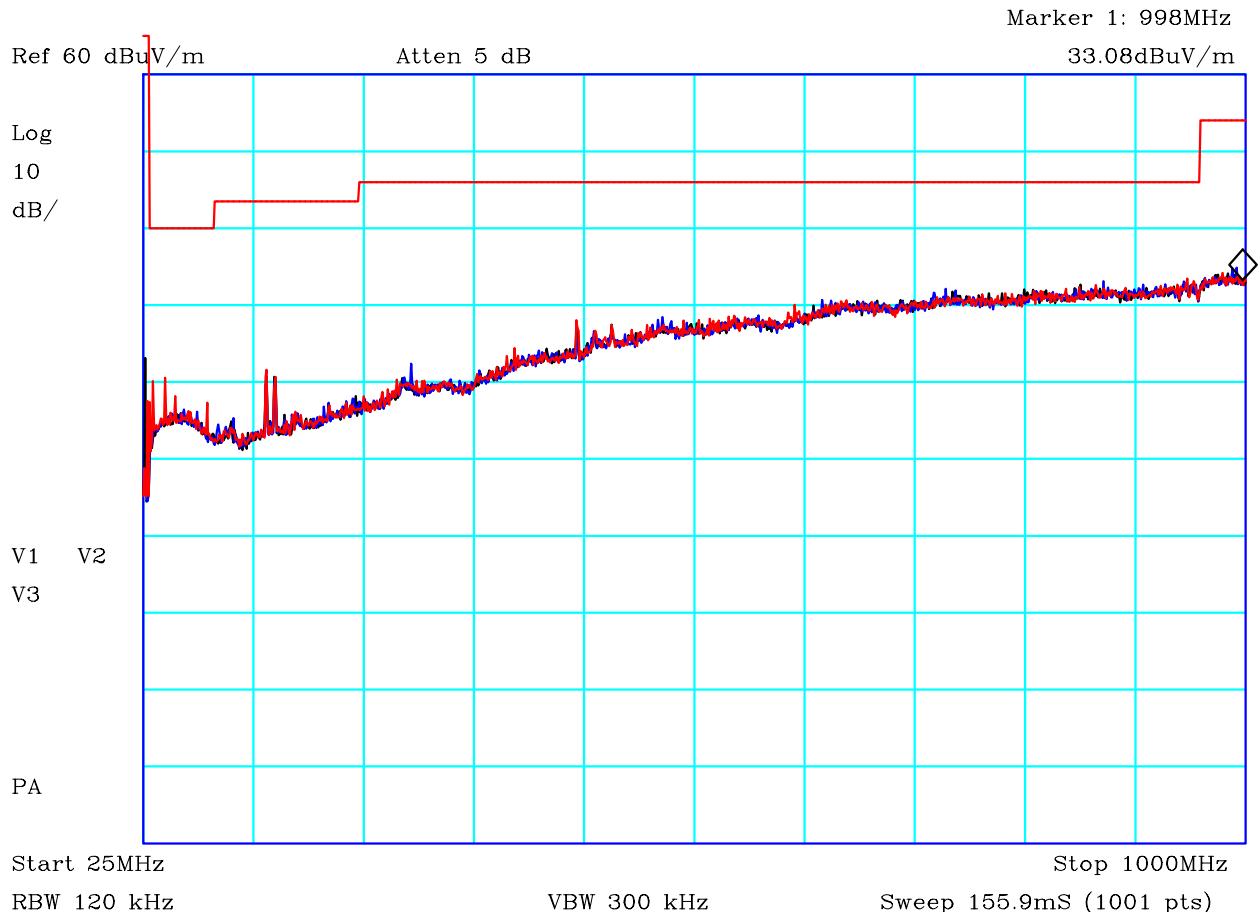
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 26 of 54



PLOT 5 Radiated Emissions - Tx - 5GHz to 10GHz

Company:	Quattro	Product:	Frequency Hopping Module HP
Date:	10/09/2013	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands@1.5m	Limit2:	
Limit3:		Limit4:	
Black: 909 MHz Carrier. Blue: 914 MHz Carrier. Red: 919 MHz Carrier. Antenna fitted. Upright and on side. Canned modules.			
Facility:	Anech_2	Height	1.1m,1.5m,1.9m
Distance	1.5m	Polarisation	V+H
Angle	0-360	File:	H38104E2
		Mode:	1
		Modification State:	0
		Analyser:	R8

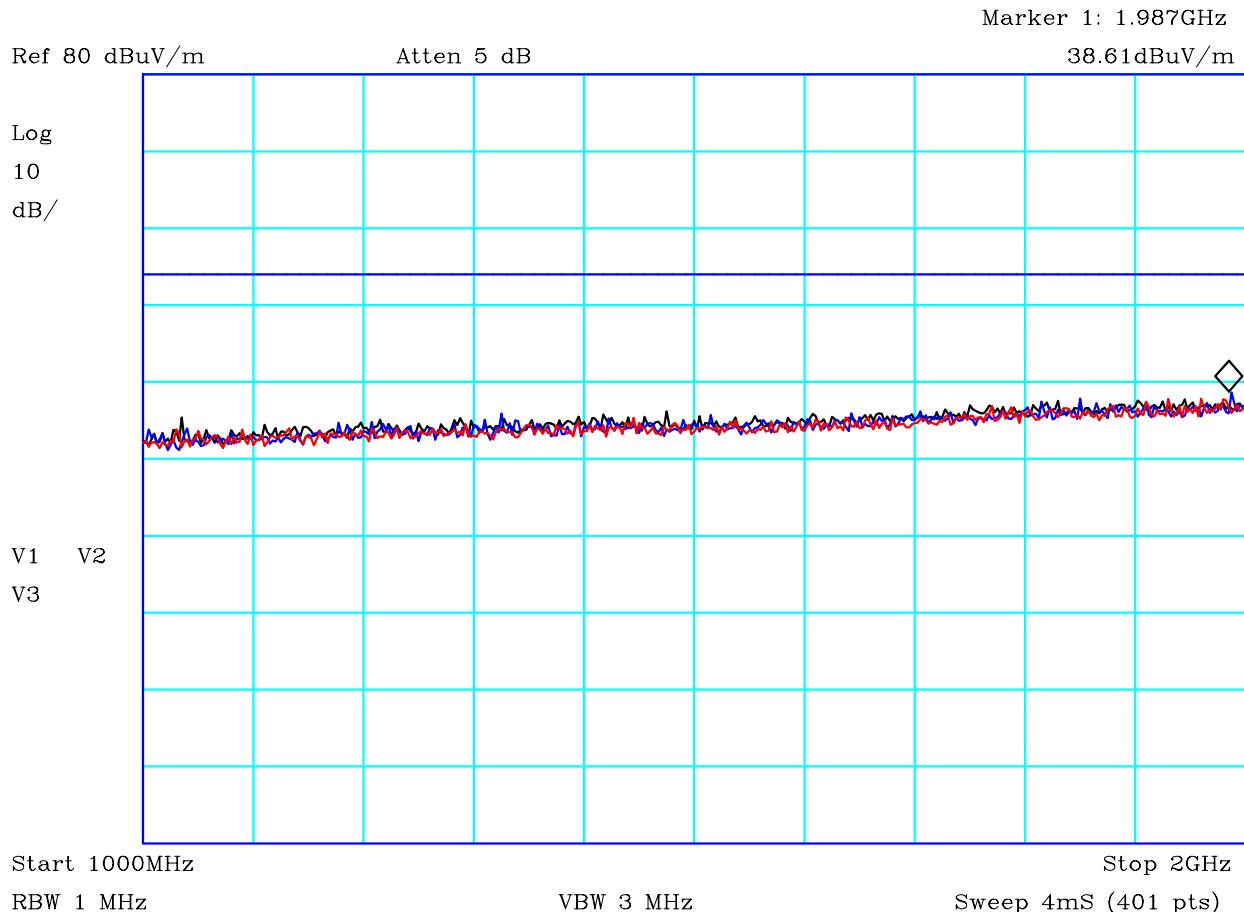
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 27 of 54



PLOT 6 Radiated Emissions - Rx - 25MHz to 1GHz

Company:	Quattro	Product:	Frequency Hopping Module
Date:	20/11/2013	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC(B)@3m	Limit2:	
Limit3:		Limit4:	
Black: 909 MHz Carrier. Blue: 914 MHz Carrier. Red: 919 MHz Carrier. Antenna fitted. Upright and on side. Canned modules. Rx mode			
Facility:	Anech_2	Height	1.5m
Distance	3m	Polarisation	V+H
Angle	0-360	File:	H3A213EB
		Mode:	4
		Modification State:	2
		Analyser:	R8

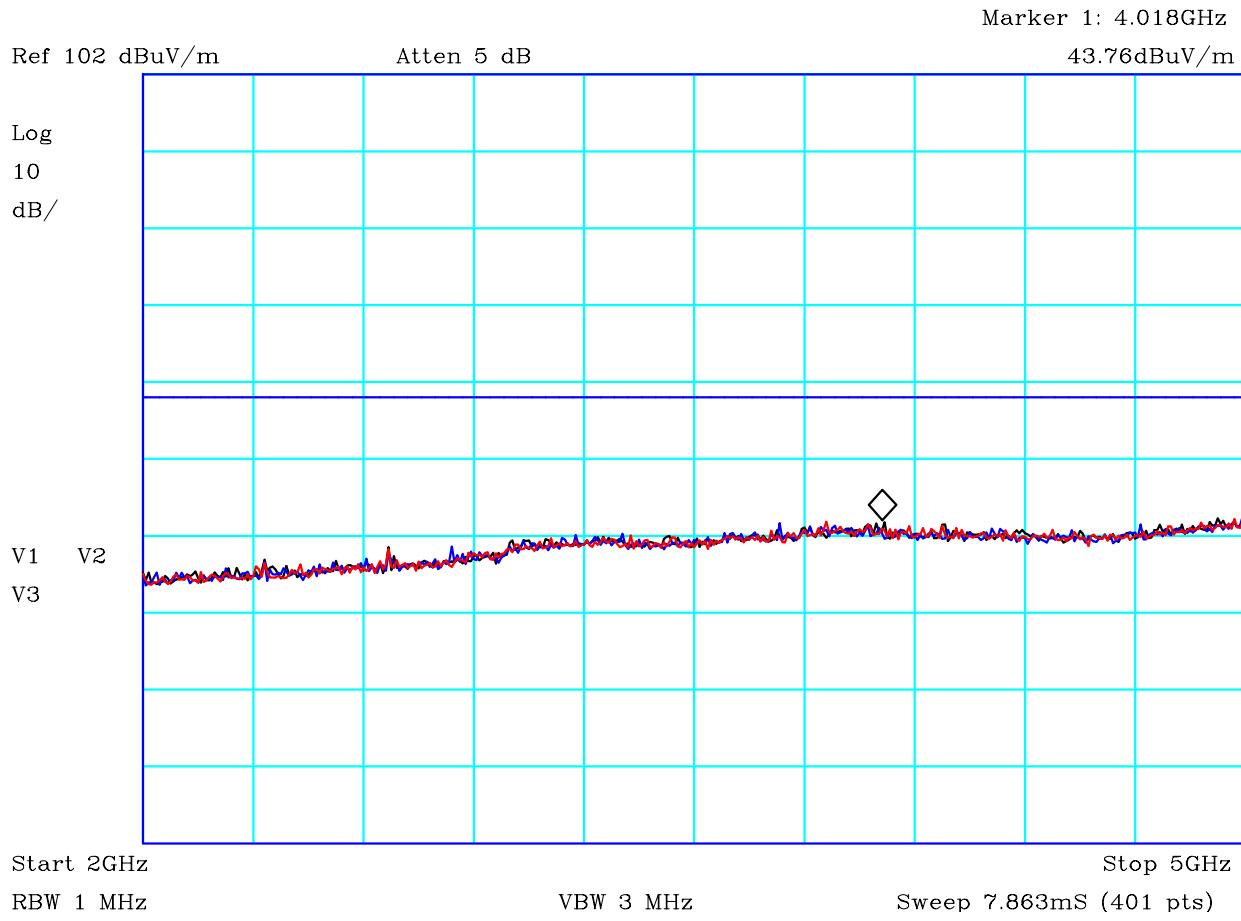
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 28 of 54



PLOT 7 Radiated Emissions - Rx - 1GHz to 2GHz

Company:	Quattro	Product:	Frequency Hopping Module HP
Date:	10/09/2013	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(BLU)	FCC(B)@3m	Limit2:	
Limit3:		Limit4:	
Black: 909 MHz Carrier. Blue: 914 MHz Carrier. Red: 919 MHz Carrier. Antenna fitted. Upright and on side. Canned modules.			
Facility:	Anech_2	Height	1.1m,1.5m,1.9m
Distance	3m	Polarisation	V+H
Angle	0-360	File:	H38107AE
		Mode:	4
		Modification State:	0
		Analyser:	R8

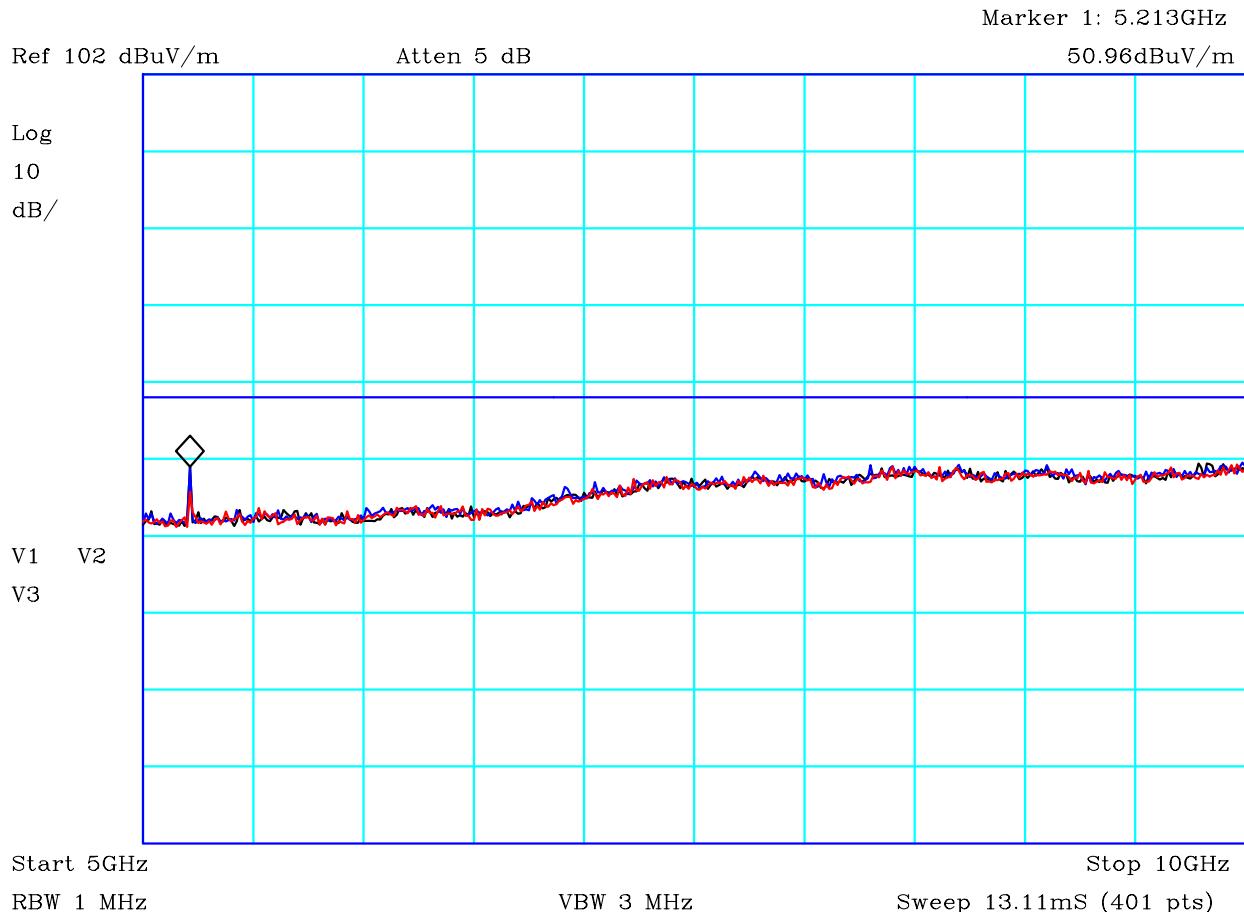
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 29 of 54



PLOT 8 Radiated Emissions - Rx - 2GHz to 5GHz

Company:	Quattro	Product:	Frequency Hopping Module HP
Date:	10/09/2013	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(BLU)	FCC(B)@1.5m	Limit2:	
Limit3:		Limit4:	
Black: 909 MHz Carrier. Blue: 914 MHz Carrier. Red: 919 MHz Carrier. Antenna fitted. Upright and on side. Canned modules.			
Facility:	Anech_2	Height	1.1m,1.5m,1.9m
Distance	1.5m	Polarisation	V+H
Angle	0-360	File:	H381075C
		Mode:	4
		Modification State:	0
		Analyser:	R8

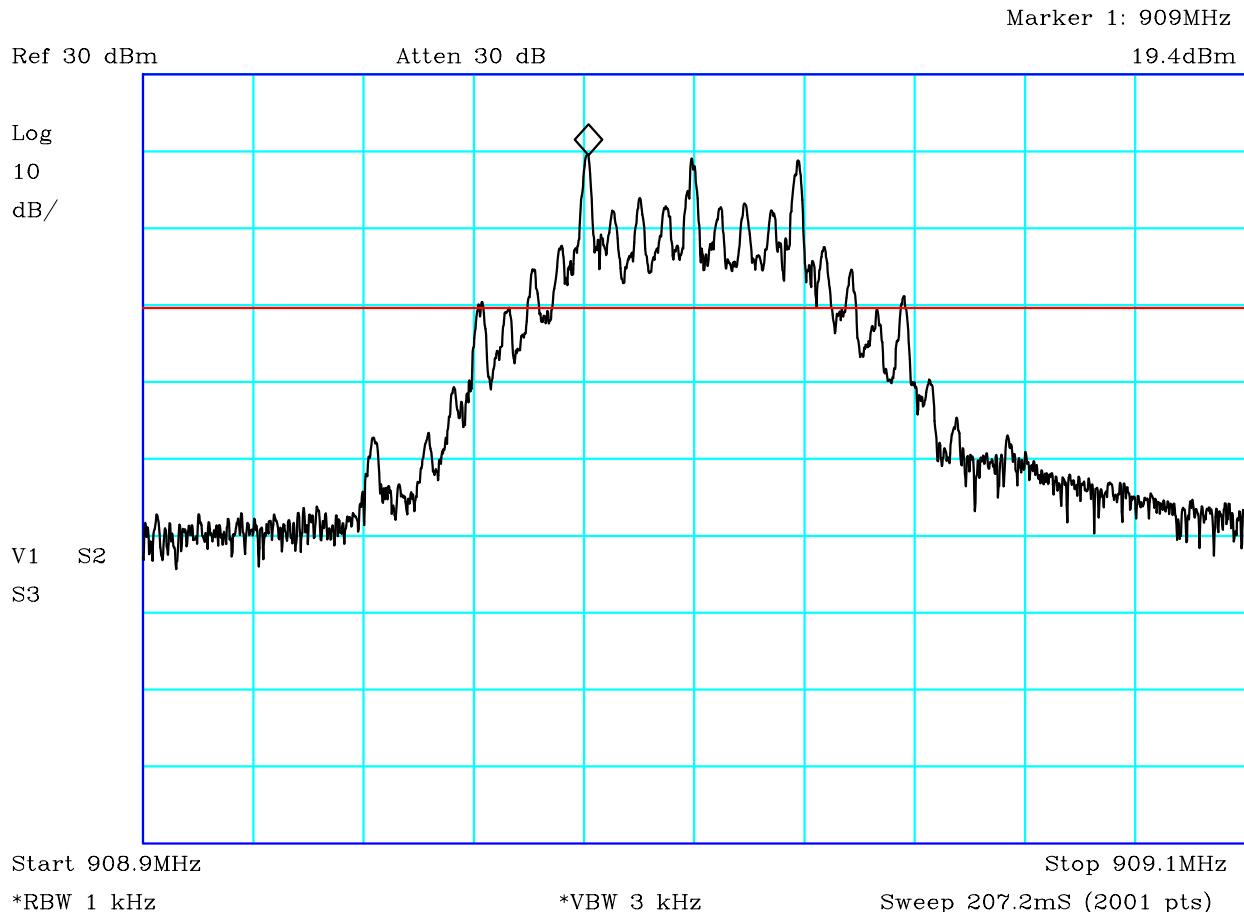
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 30 of 54



PLOT 9 Radiated Emissions - Rx - 5GHz to 10GHz

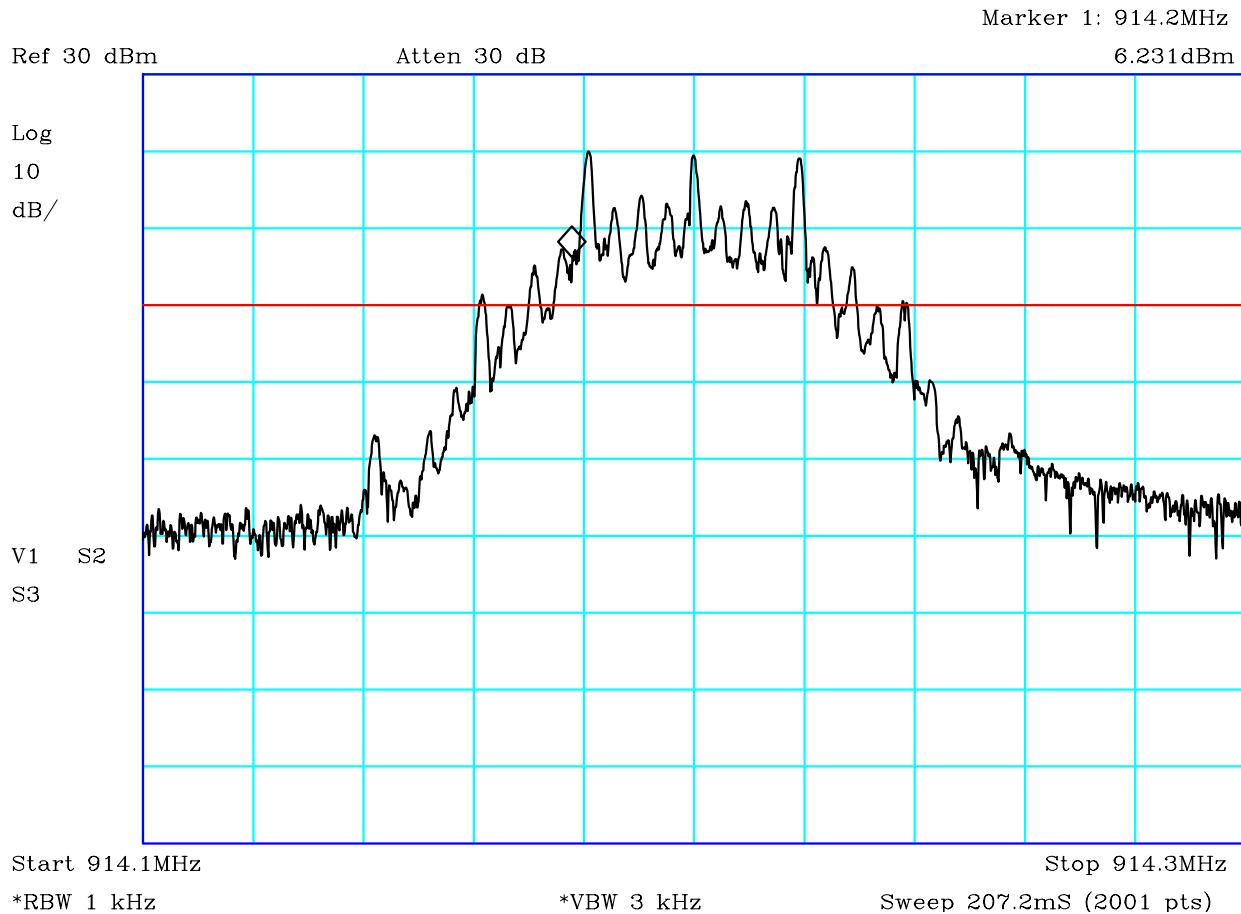
Company:	Quattro	Product:	Frequency Hopping Module HP
Date:	10/09/2013	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(BLU)	FCC(B)@1.5m	Limit2:	
Limit3:		Limit4:	
Black: 909 MHz Carrier. Blue: 914 MHz Carrier. Red: 919 MHz Carrier. Antenna fitted. Upright and on side. Canned modules.			
Facility:	Anech_2	Height	1.1m,1.5m,1.9m
Distance	1.5m	Polarisation	V+H
Angle	0-360	File:	H381077D
		Mode:	4
		Modification State:	0
		Analyser:	R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 31 of 54



PLOT 10 Conducted Antenna - 20dB Bandwidth - Low Channel

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:	Limit2:
Limit3:	Limit4:
20dB bandwidth = 77.5kHz Continuous modulation - Low Channel.	
Facility:	Mode: 1
	Modification State: 1
File: H3910749	Analyser: R8



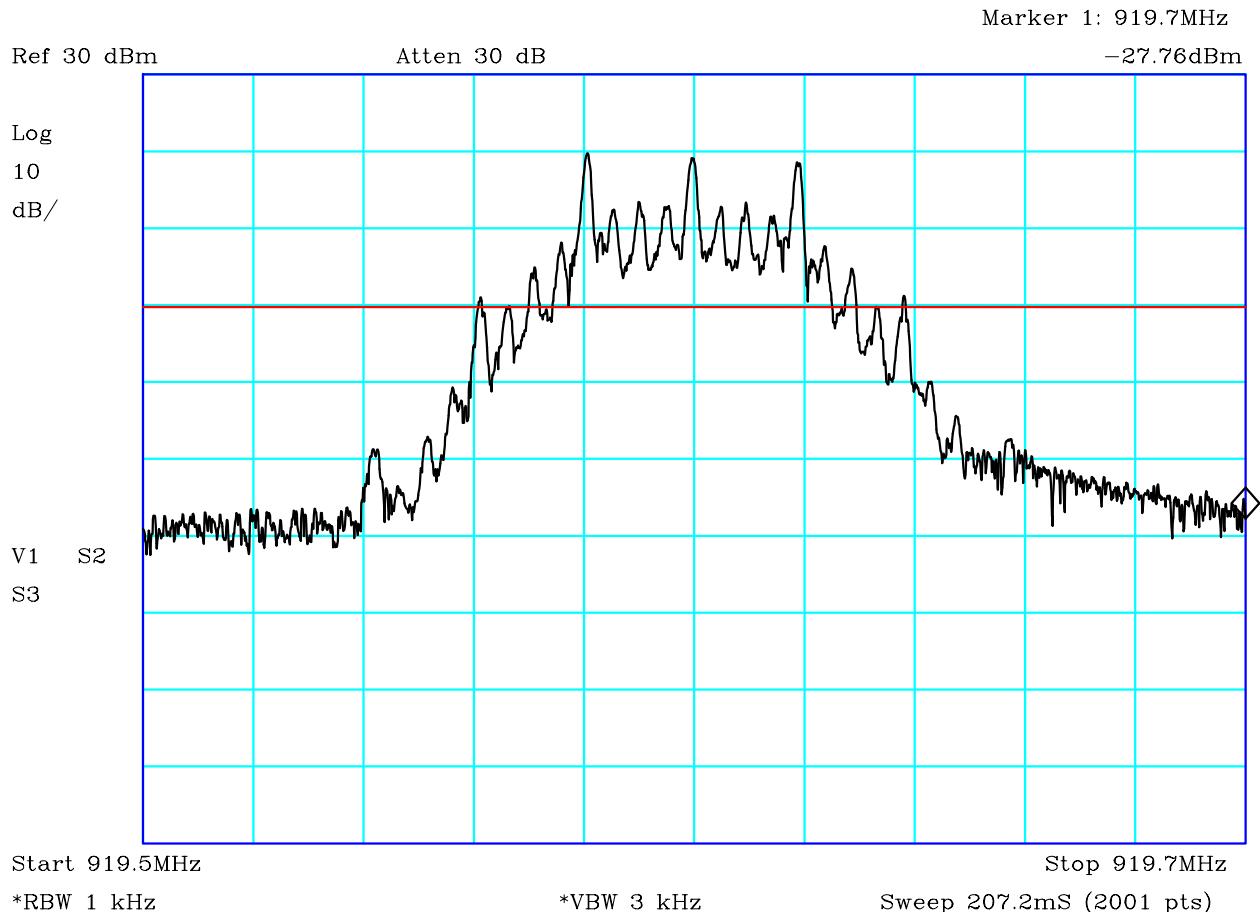
PLOT 11 Conducted Antenna - 20dB Bandwidth - Mid Channel

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:	Limit2:
Limit3:	Limit4:

20dB bandwidth = 78kHz
Continuous modulation - Mid Channel.

Facility:	Mode: 1
	Modification State: 1
File: H391073D	Analyser: R8

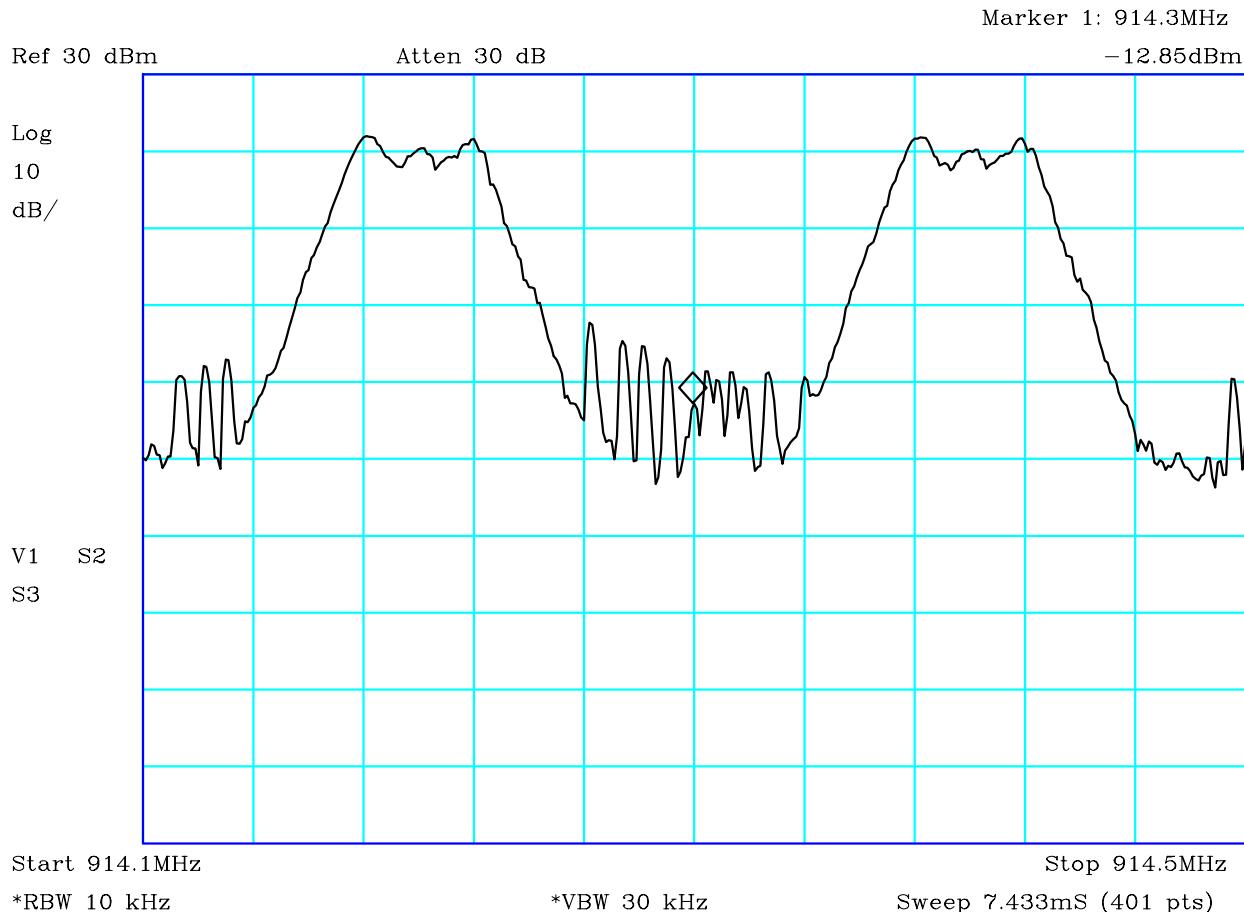
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 33 of 54



PLOT 12 Conducted Antenna - 20dB Bandwidth - High Channel

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:	Limit2:
Limit3:	Limit4:
20dB bandwidth = 77.6kHz Continuous modulation - High Channel.	
Facility:	Mode: 1
	Modification State: 1
File: H3910768	Analyser: R8

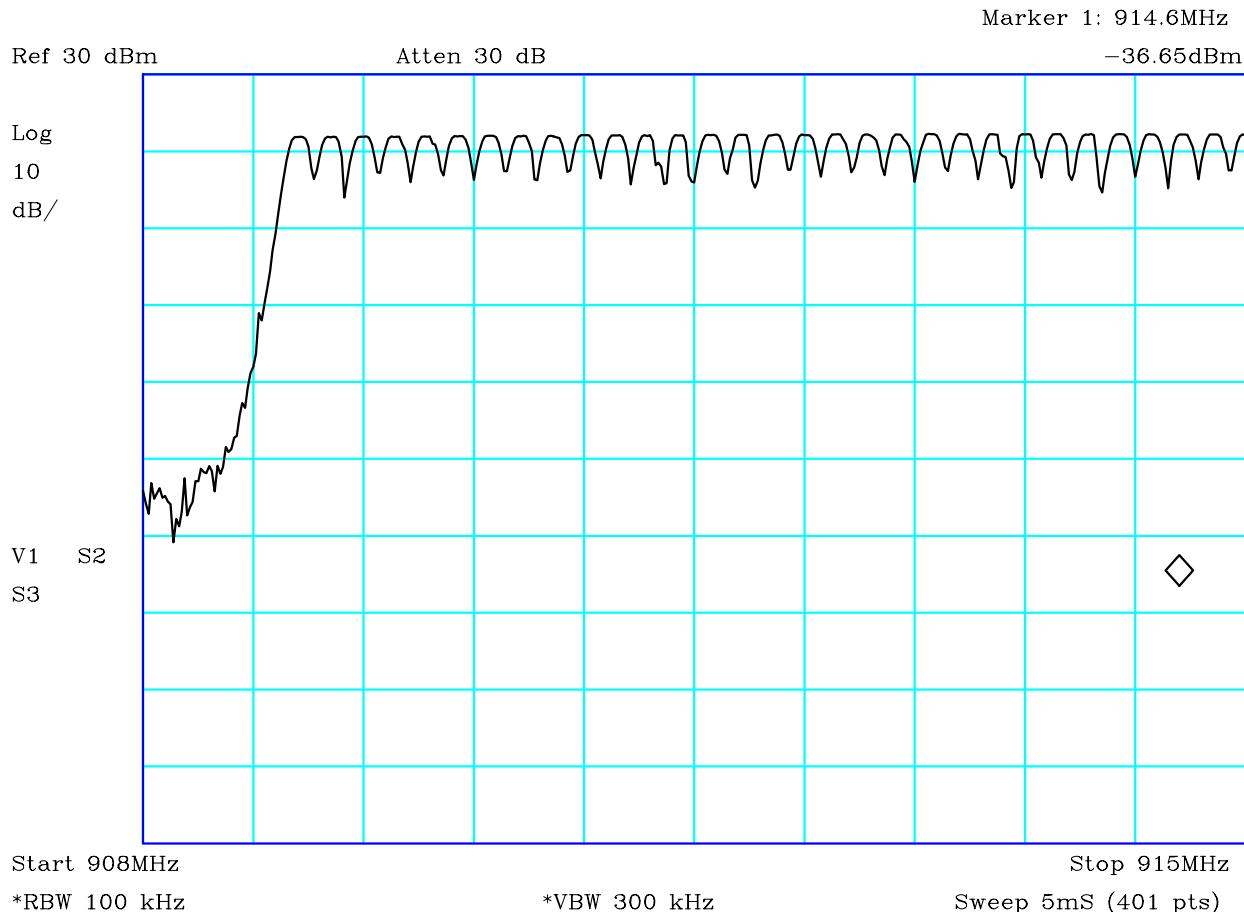
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 34 of 54



PLOT 13 Conducted Antenna - Channel Separation

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:	Limit2:
Limit3:	Limit4:
Channel Separation = 200kHz Continuous hopping mode.	
Facility:	Mode: 2
	Modification State: 1
File: H39106B6	Analyser: R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 35 of 54



CF1:10dB_PAD

PLOT 14 Conducted Antenna - Number of Channels - Part 1 of 2

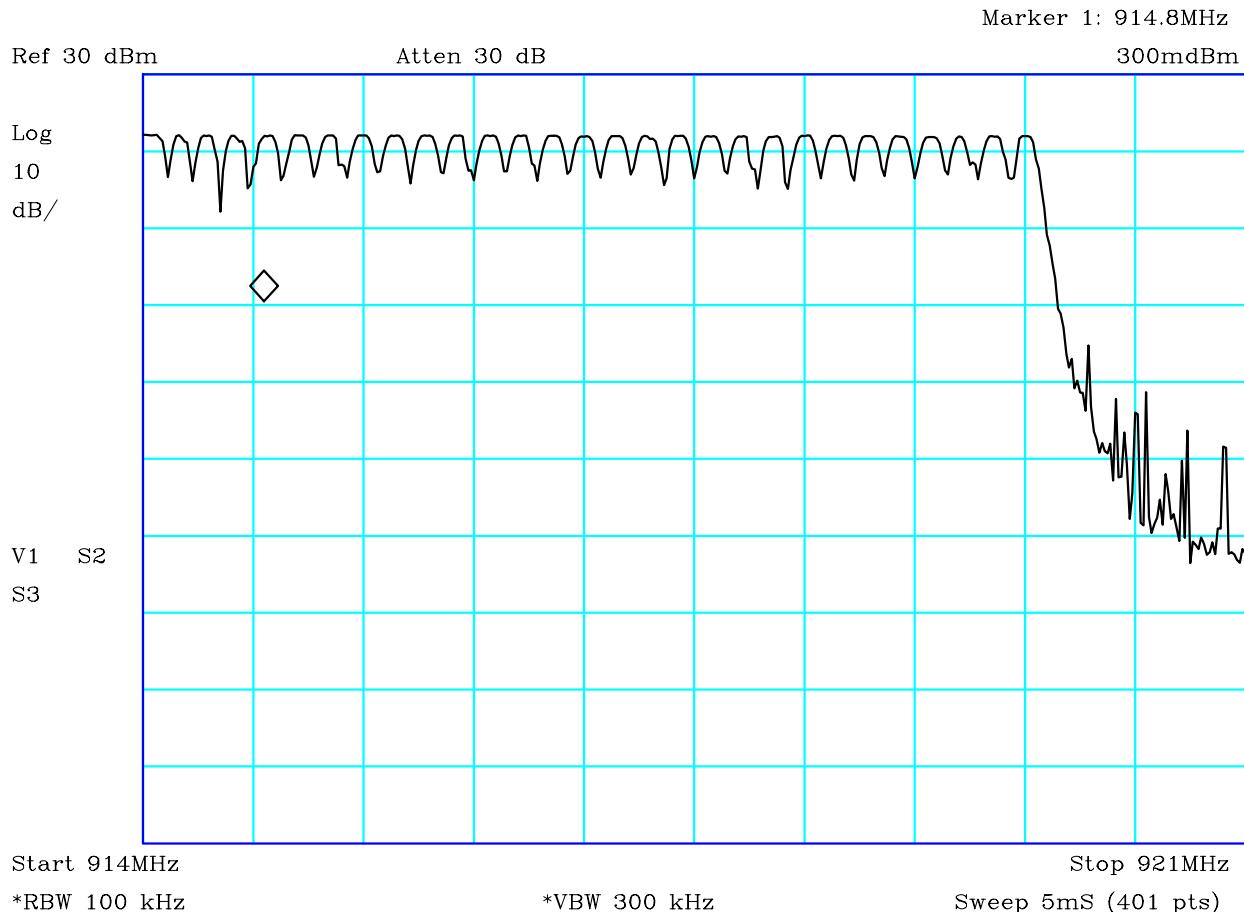
Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:	Limit2:
Limit3:	Limit4:

29 channels between 908.997MHz and 914.615MHz

Continuous hopping mode.

Facility:	Mode: 2
	Modification State: 1
File: H3910825	Analyser: R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 36 of 54

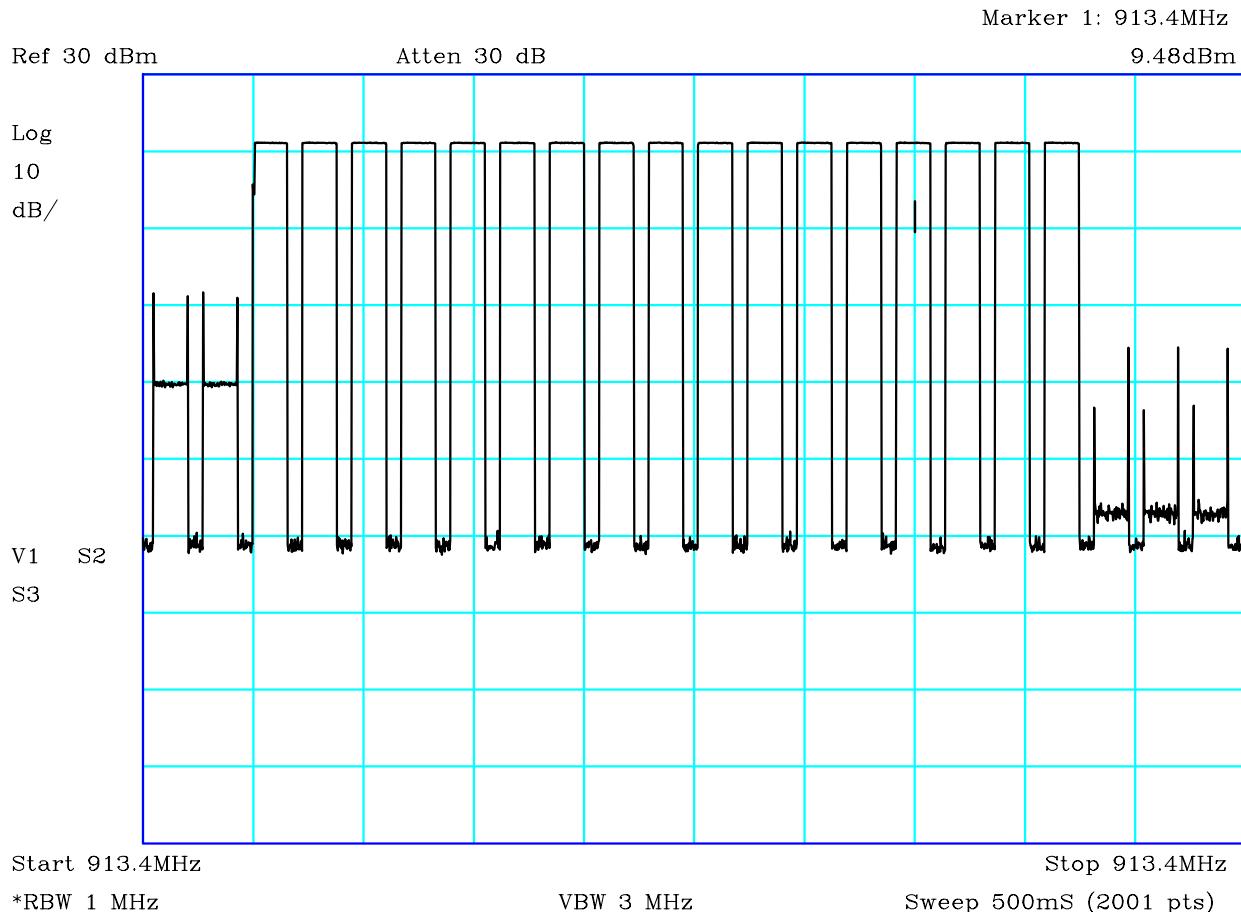


CF1:10dB_PAD

PLOT 15 Conducted Antenna - Number of Channels - Part 2 of 2

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:	Limit2:
Limit3:	Limit4:
25 channels between 914.77MHz and 919.6MHz Total of 54 channels Continuous hopping mode.	
Facility:	Mode: 2
	Modification State: 1
File: H3910828	Analysyer: R8

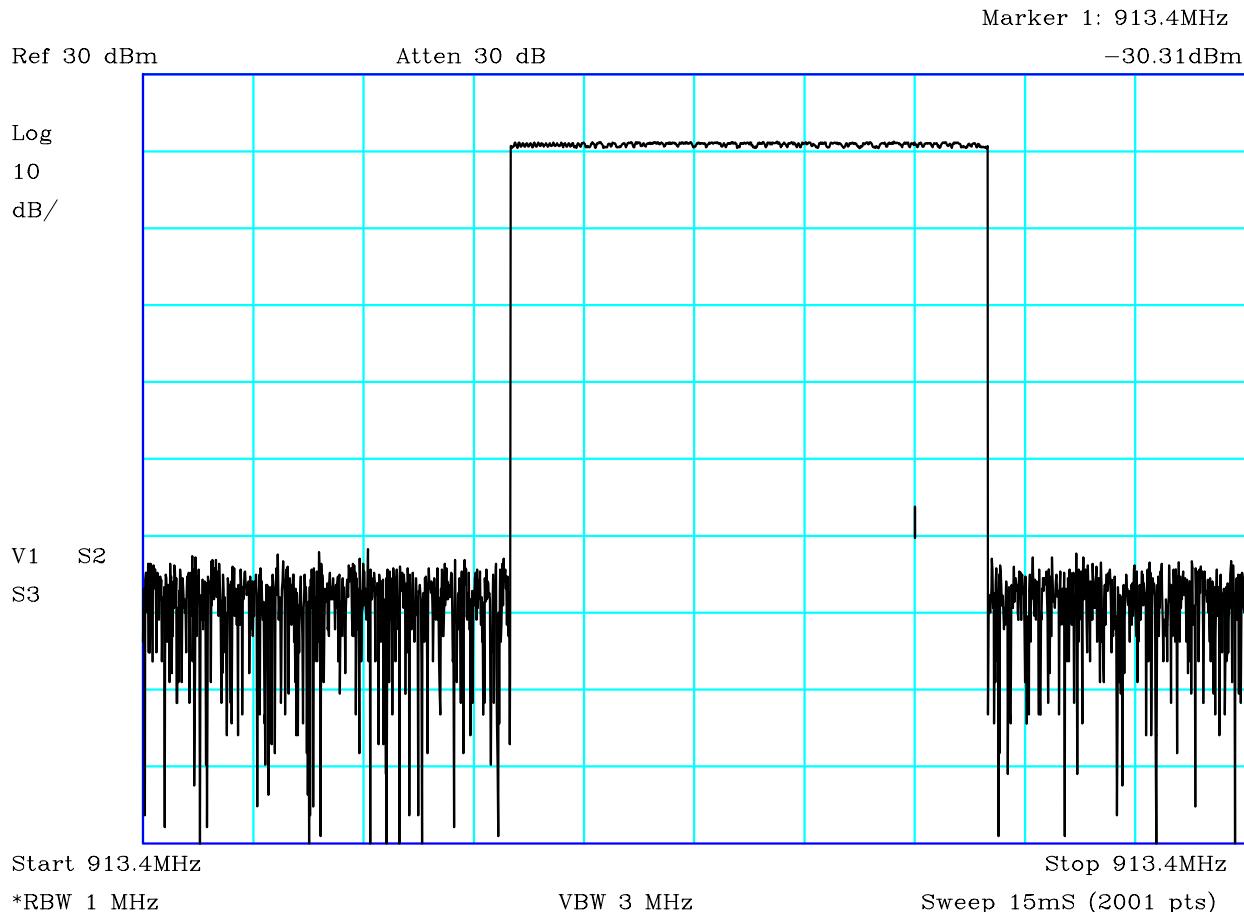
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 37 of 54



PLOT 16 Conducted Antenna - Channel Dwell Time - Long Duration Data Sequence

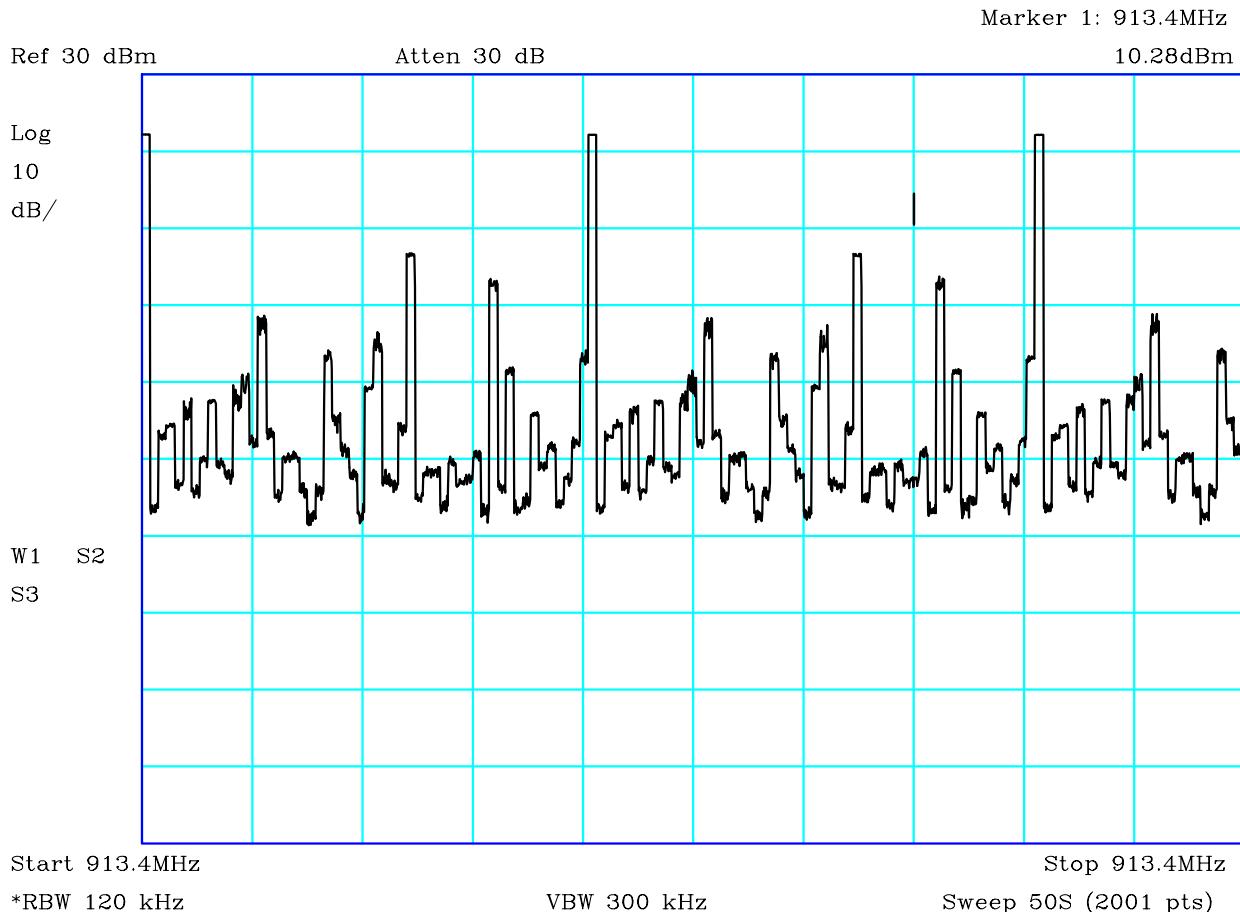
Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:	Limit2:
Limit3:	Limit4:
Dwell Time = 374.8msec (ignoring short gaps in pulse train) Continuous hopping mode.	
Facility:	Mode: 2
	Modification State: 1
File: H3910701	Analyser: R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 38 of 54



PLOT 17 Conducted Antenna - Channel Dwell Time - Short Pulse Data Sequence

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:	Limit2:
Limit3:	Limit4:
Dwell Time = 6.502msec Short pulse hopping mode.	
Facility:	Mode: 3
	Modification State: 1
File: H3910707	Analysyer: R8



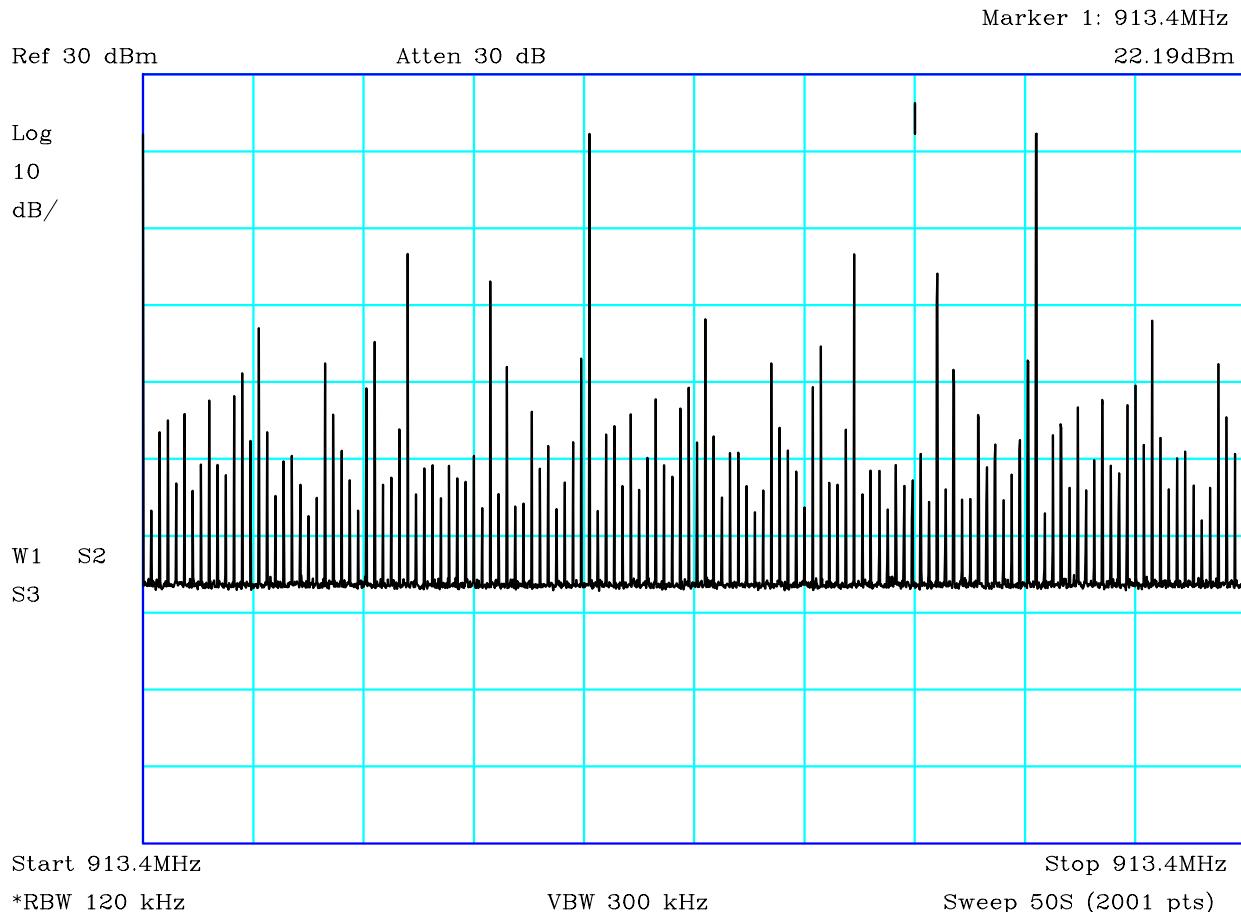
PLOT 18 Conducted Antenna - Channel Repetition Time - Long Data Sequence

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:	Limit2:
Limit3:	Limit4:

Time between transmissions per channel = 20.25 seconds
Continuous hopping mode.

Facility:	Mode: 2
	Modification State: 1
File: H3910724	Analyser: R8

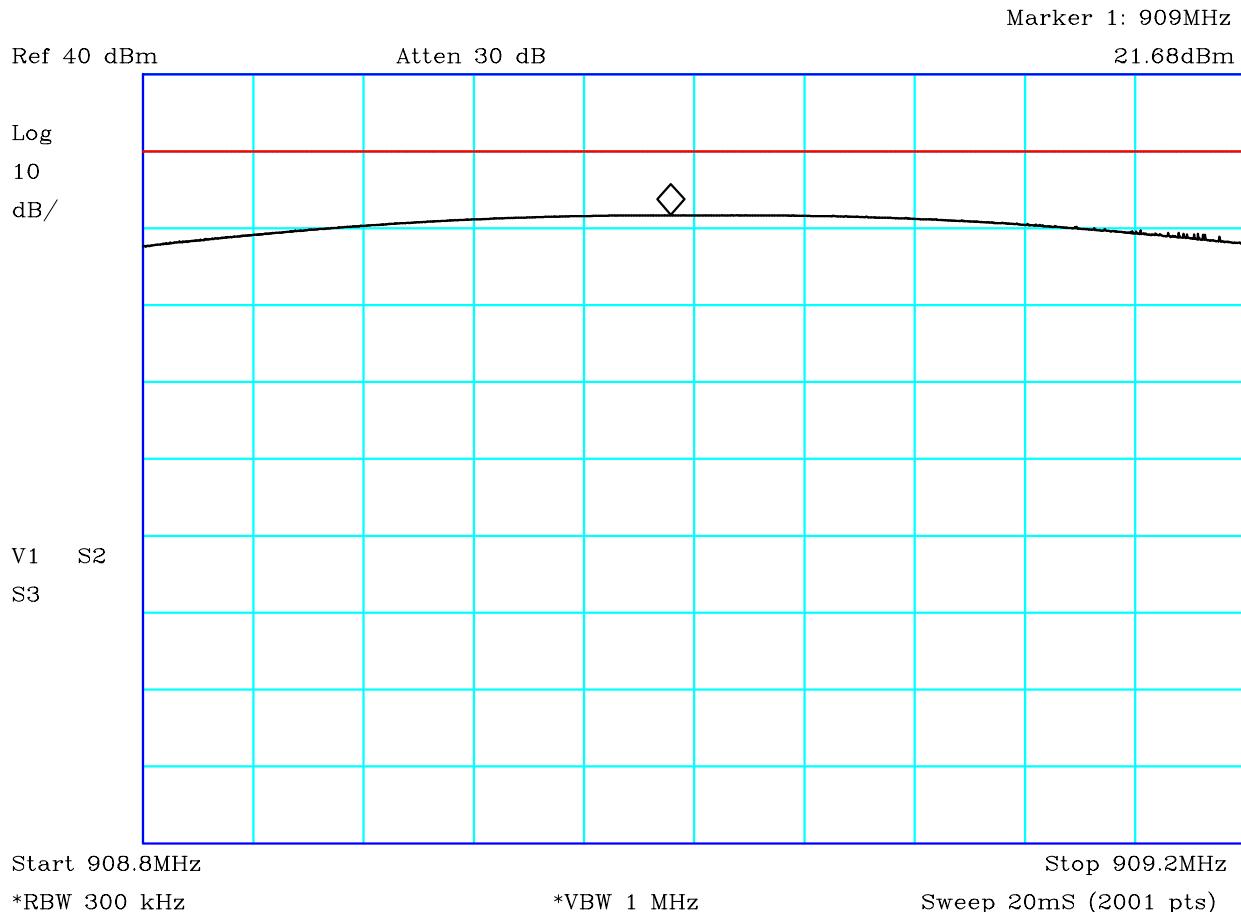
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 40 of 54



PLOT 19 Conducted Antenna - Channel Repetition Time - Short Data Sequence

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:	Limit2:
Limit3:	Limit4:
Time between transmissions per channel = 20.25 seconds Short pulse hopping mode.	
Facility:	Mode: 3
	Modification State: 1
File: H3910729	Analyser: R8

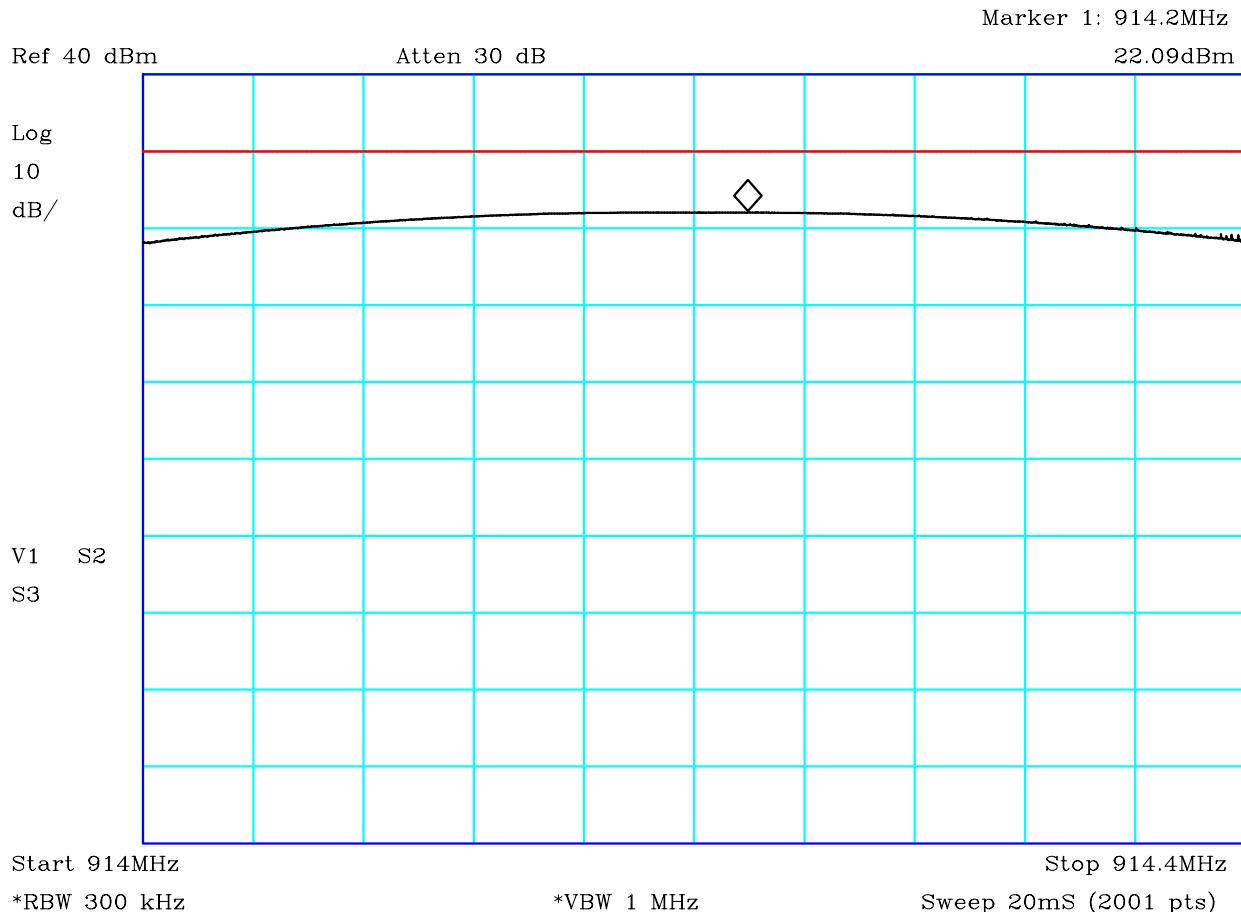
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 41 of 54



PLOT 20 Conducted Antenna - Peak Power - Low Channel

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1: 30dBm	Limit2:
Limit3:	Limit4:
Continuous modulation - Low Channel.	
Facility:	Mode: 1
	Modification State: 1
File: H3910798	Analyser: R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 42 of 54

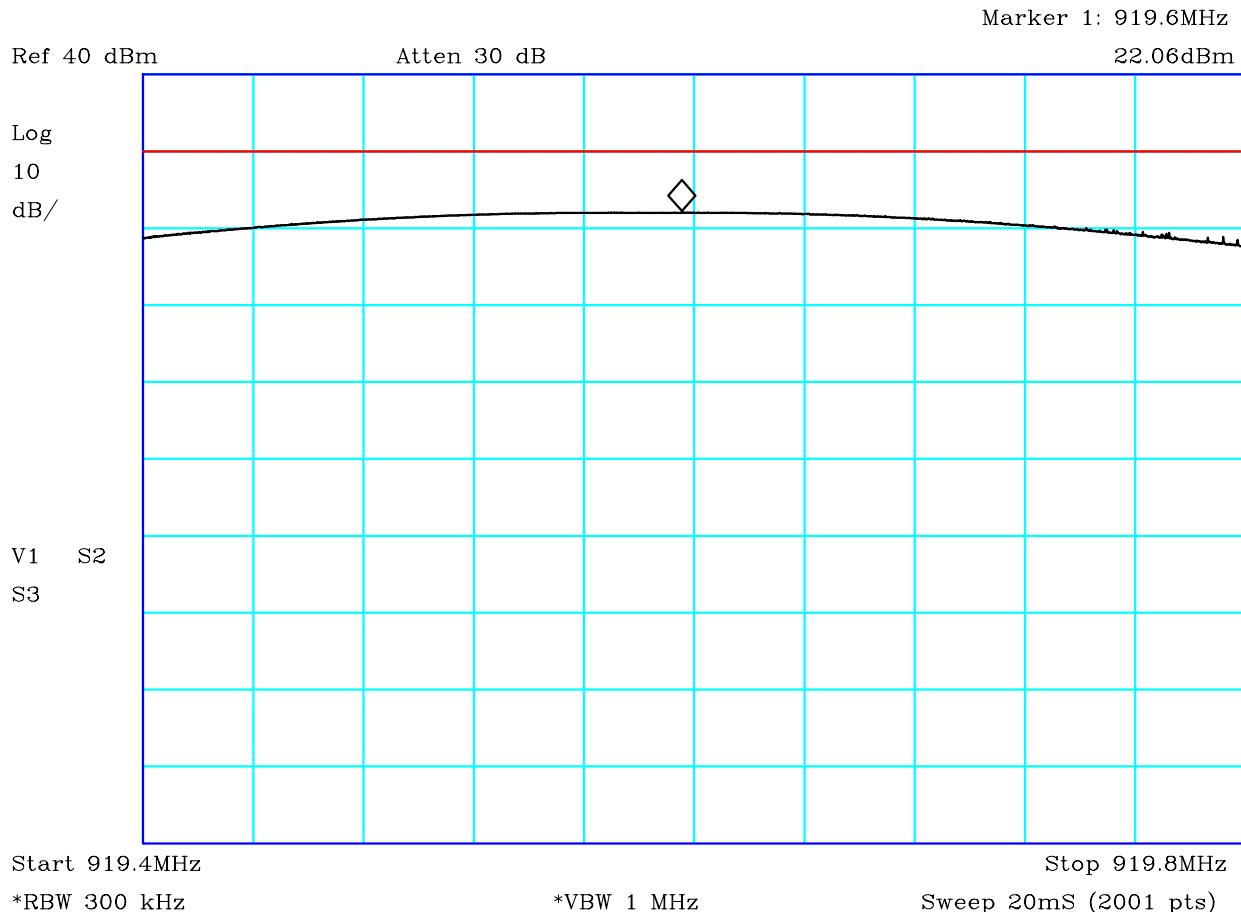


CF1:10dB_PAD

PLOT 21 Conducted Antenna - Peak Power - Mid Channel

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1: 30dBm	Limit2:
Limit3:	Limit4:
Continuous modulation - Mid Channel.	
Facility:	Mode: 1
	Modification State: 1
File: H3910796	Analyser: R8

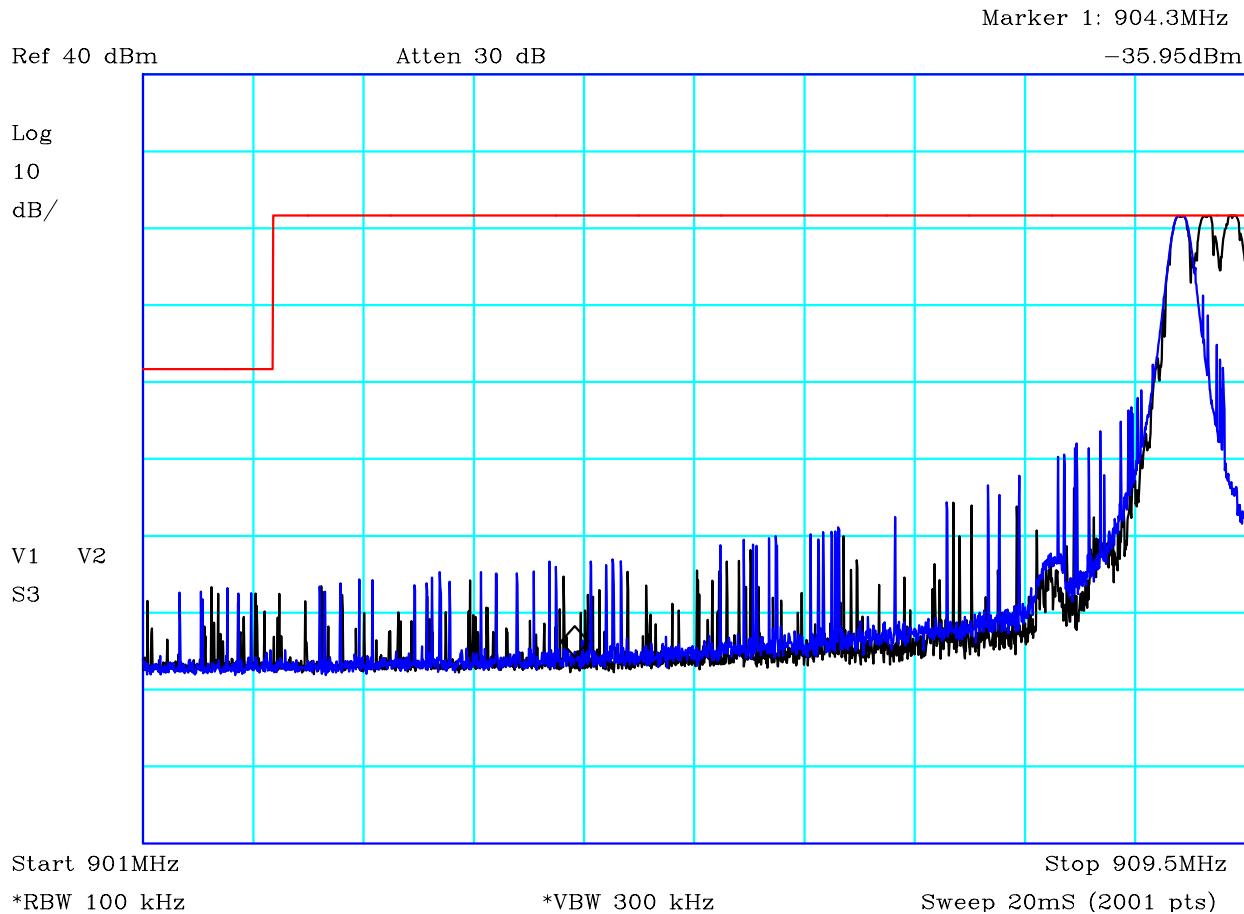
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 43 of 54



PLOT 22 Conducted Antenna - Peak Power - High Channel

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1: 30dBm	Limit2:
Limit3:	Limit4:
Continuous modulation - High Channel.	
Facility:	Mode: 1
	Modification State: 1
File: H3910793	Analysyer: R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 44 of 54



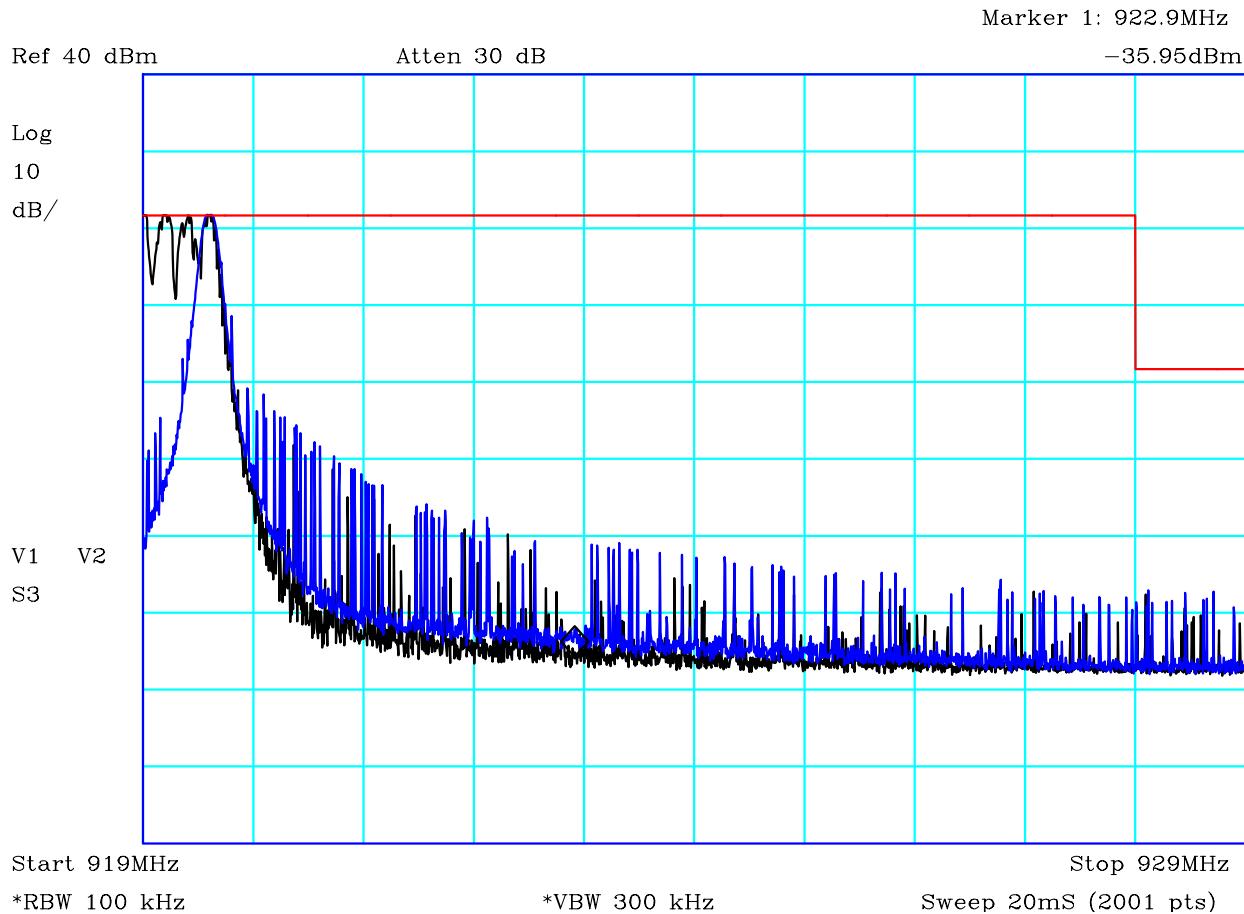
PLOT 23 Conducted Antenna - Spurious Emissions - Low Channel Band Edge

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:(RED) -20dBc	Limit2:
Limit3:	Limit4:

Black: Hopping
Blue: Low Channel
Continuous modulation

Facility:	Mode: 1
	Modification State: 1
File: H39107BD	Analyser: R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 45 of 54



CF1:10dB_PAD

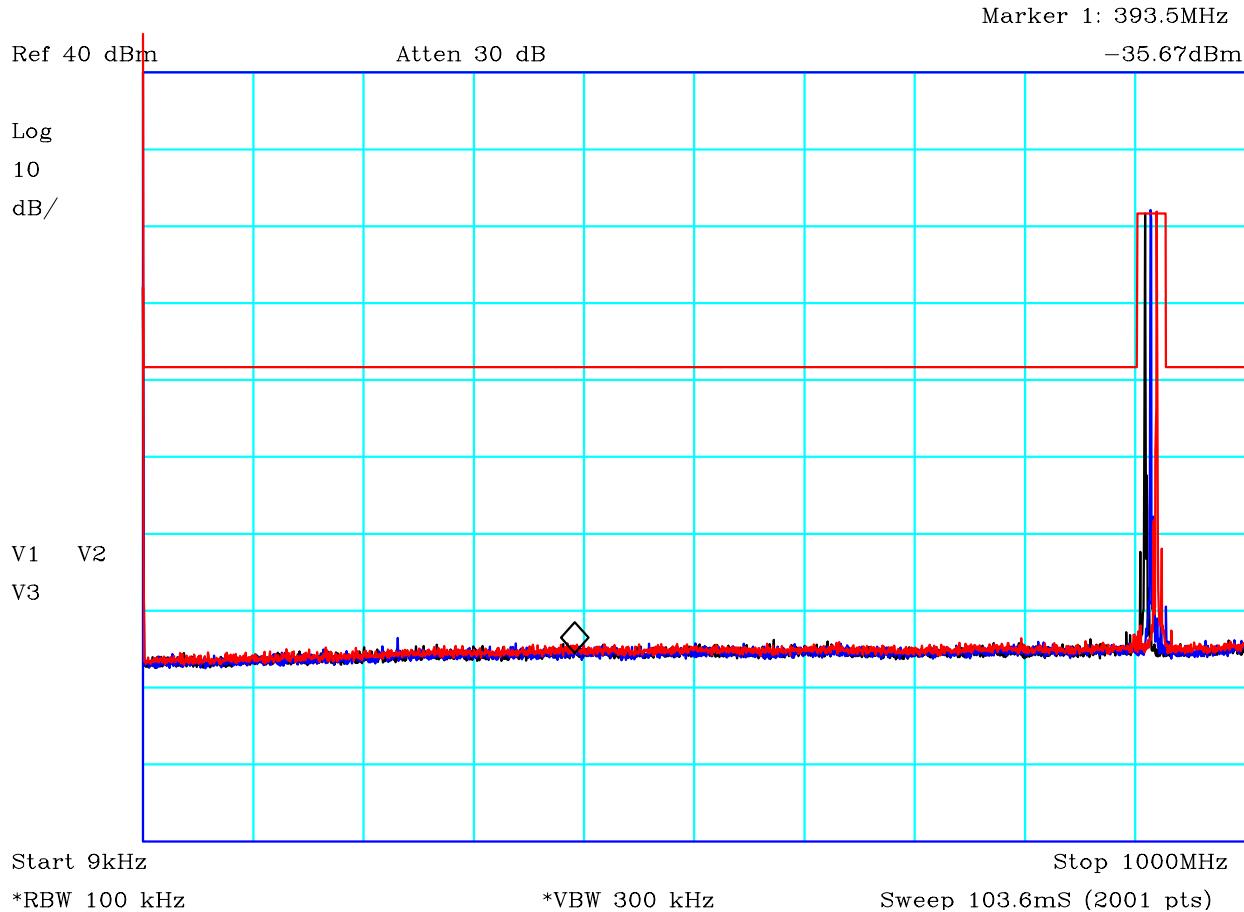
PLOT 24 Conducted Antenna - Spurious Emissions - High Channel Band Edge

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:(RED) -20dBc	Limit2:
Limit3:	Limit4:

Black: Hopping
Blue: High Channel
Continuous modulation

Facility:	Mode: 1
	Modification State: 1
File: H39107C3	Analyser: R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
	Test No: T4651	Test Report	Page: 46 of 54



CF1:10dB_PAD

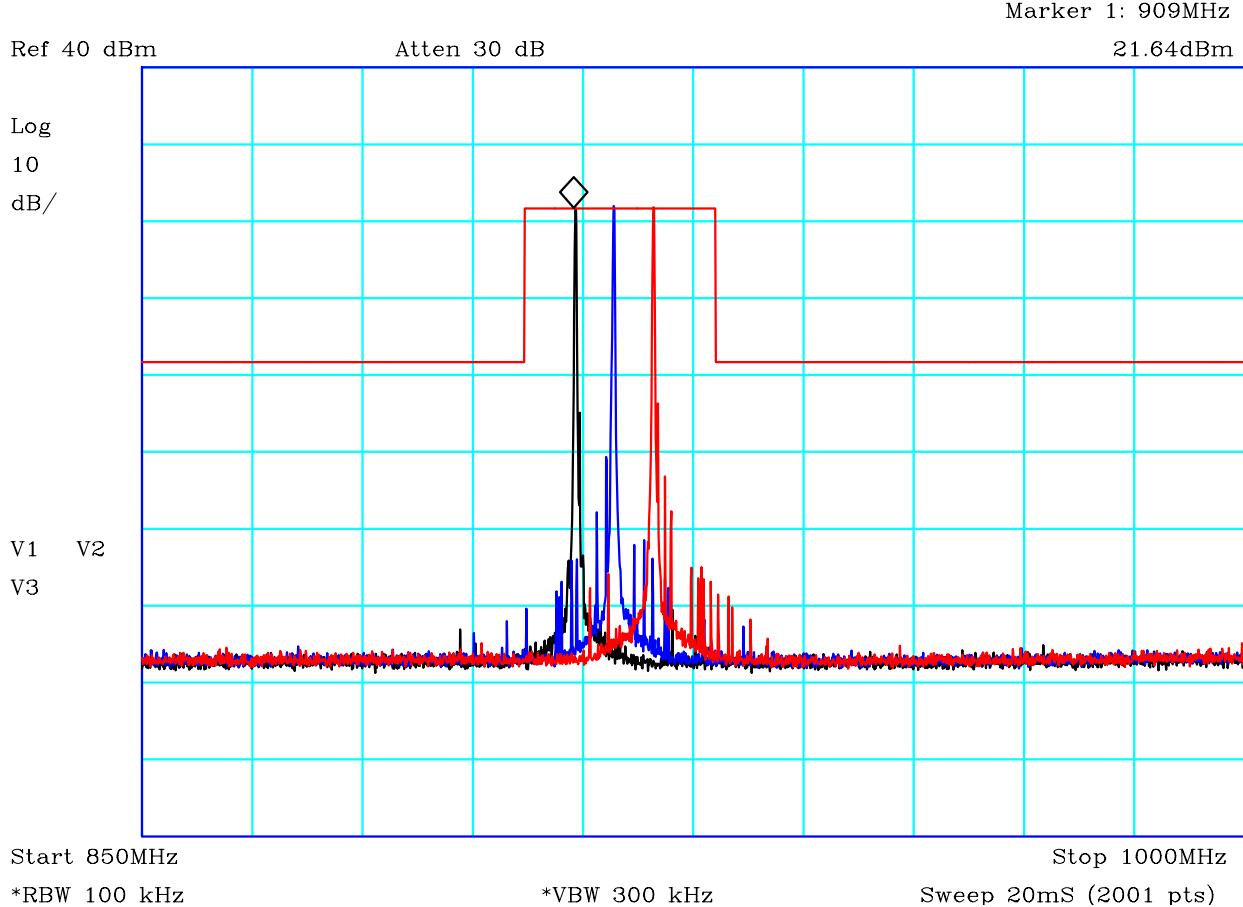
PLOT 25 Conducted Antenna - Spurious Emissions - 9kHz to 1GHz - Fixed Freq.

Company:	Quatro	Product:	Frequency Hopping Module
Date:	10/10/2013	Test Eng:	Dave Smith
Method:	DA 00-705	Method:	
Limit1:(RED)	-20dBc	Limit2:	
Limit3:		Limit4:	

Black: fixed at low channel
Blue: fixed at high channel
Red: fixed at high channel
Continuous modulation

Facility:	Height	Mode:	1
Distance	Polarisation	Modification State:	1
Angle	File: H39145D4	Analyser:	R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
	Test No: T4651	Test Report	Page: 47 of 54



CF1:10dB_PAD

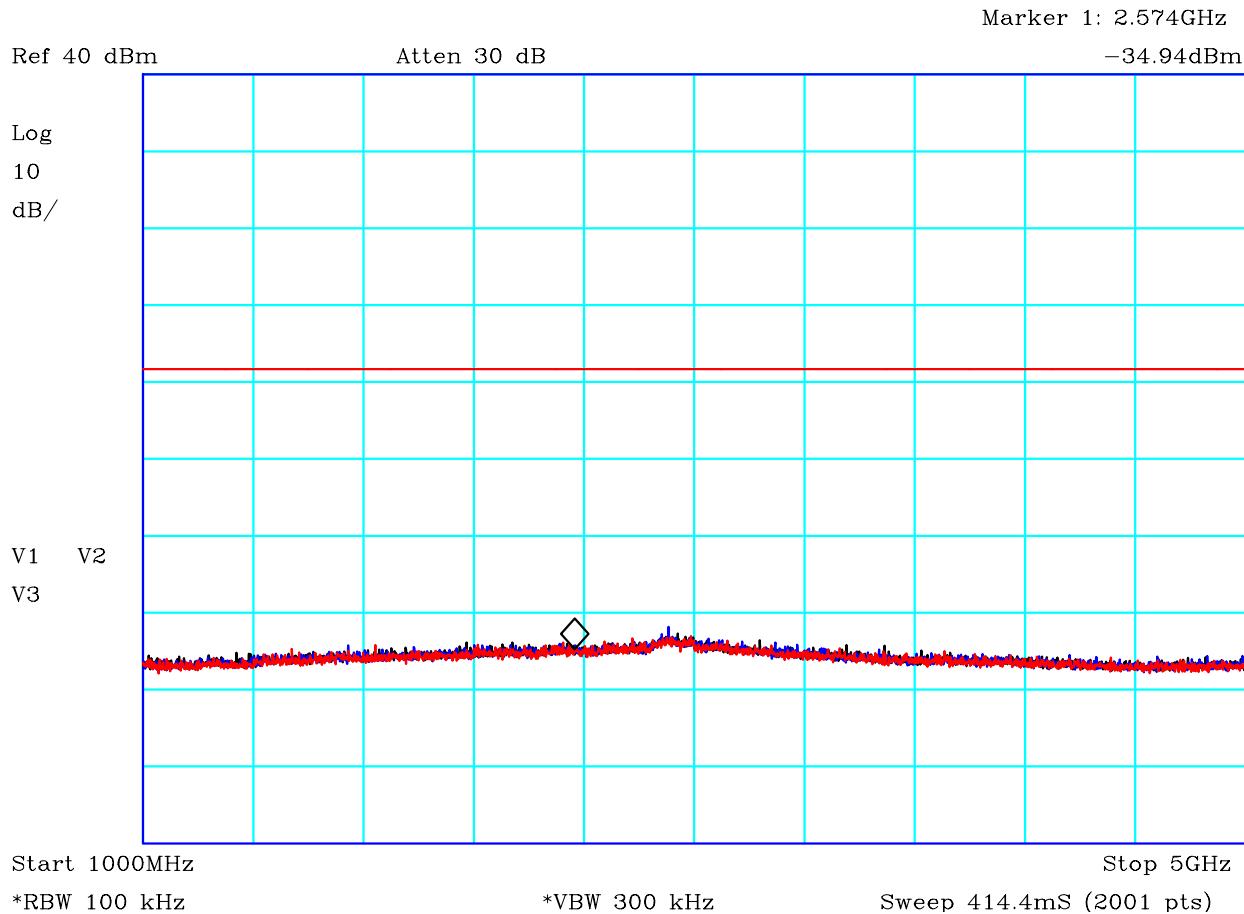
PLOT 26 Conducted Antenna - Spurious Emissions - 850MHz to 1GHz Fixed Freq.

Company:	Quatro	Product:	Frequency Hopping Module
Date:	10/10/2013	Test Eng:	Dave Smith
Method:	DA 00-705	Method:	
Limit1:(RED)	-20dBc	Limit2:	
Limit3:		Limit4:	

Black: fixed at low channel
Blue: fixed at high channel
Red: fixed at high channel
Continuous modulation

Facility:	Height	Mode:	1
Distance	Polarisation	Modification State:	1
Angle	File: H39145D6	Analyser:	R8

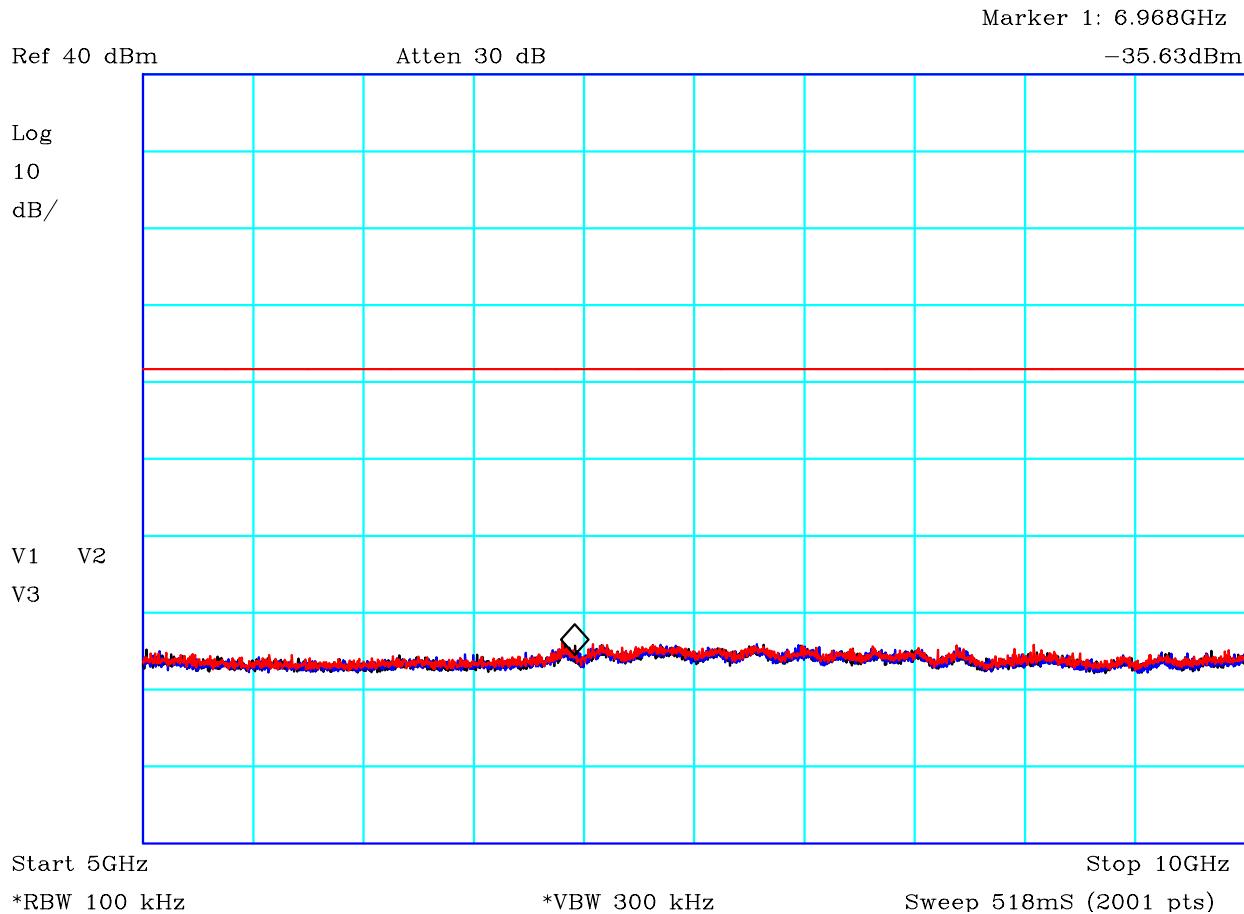
	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 48 of 54



PLOT 27 Conducted Antenna - Spurious Emissions - 1GHz to 5GHz - Fixed Freq.

Company:	Quatro	Product:	Frequency Hopping Module
Date:	10/10/2013	Test Eng:	Dave Smith
Method:	DA 00-705	Method:	
Limit1:(RED)	-20dBc	Limit2:	
Limit3:		Limit4:	
Black: fixed at low channel Blue: fixed at high channel Red: fixed at high channel Continuous modulation			
Facility:	Height	Mode:	1
Distance	Polarisation	Modification State:	1
Angle	File: H39145D7	Analyser:	R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 49 of 54



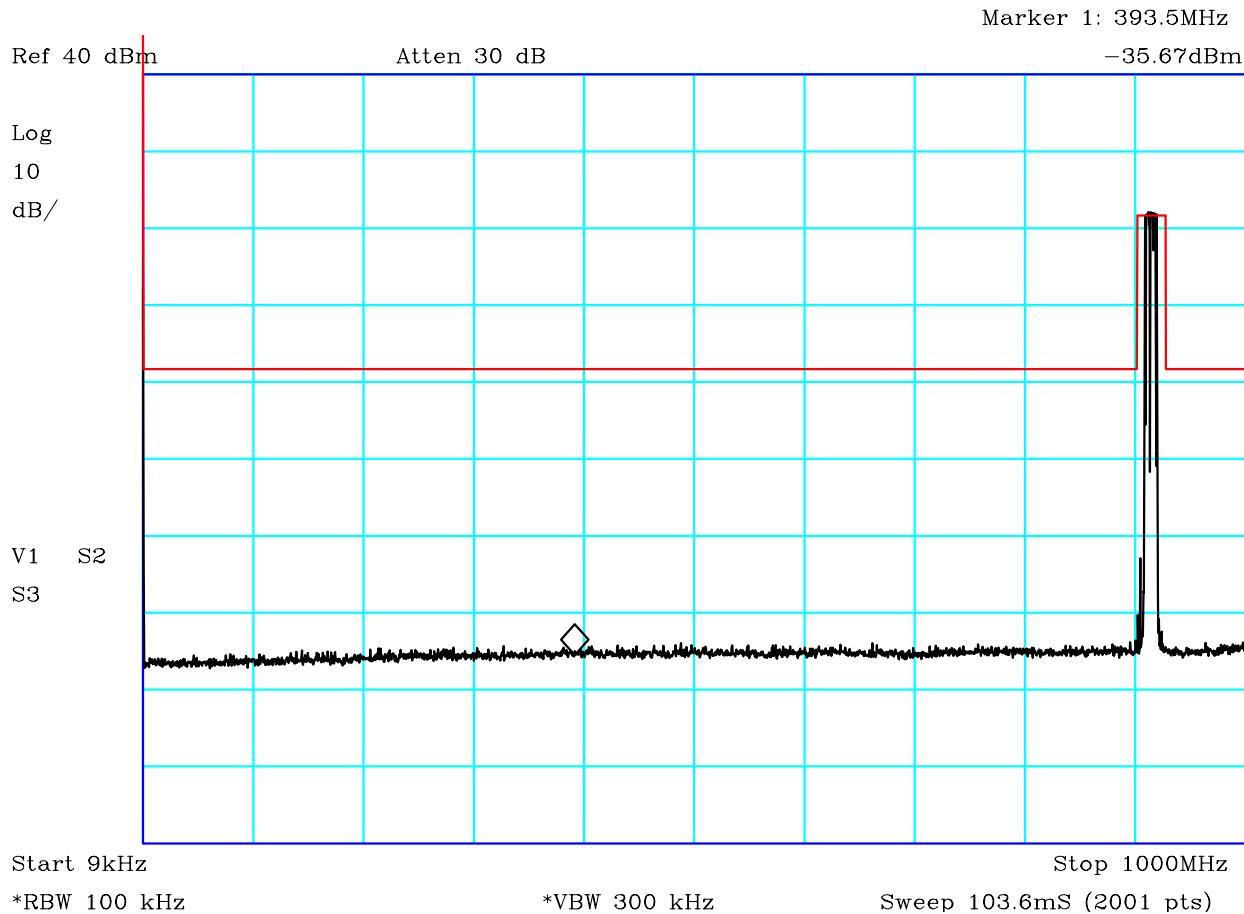
PLOT 28 Conducted Antenna - Spurious Emissions - 5GHz to 10GHz - Fixed Freq.

Company:	Quatro	Product:	Frequency Hopping Module
Date:	10/10/2013	Test Eng:	Dave Smith
Method:	DA 00-705	Method:	
Limit1:(RED)	-20dBc	Limit2:	
Limit3:		Limit4:	

Black: fixed at low channel
 Blue: fixed at high channel
 Red: fixed at high channel
 Continuous modulation

Facility:	Height	Mode:	1
Distance	Polarisation	Modification State:	1
Angle	File:	Analyser:	R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 50 of 54

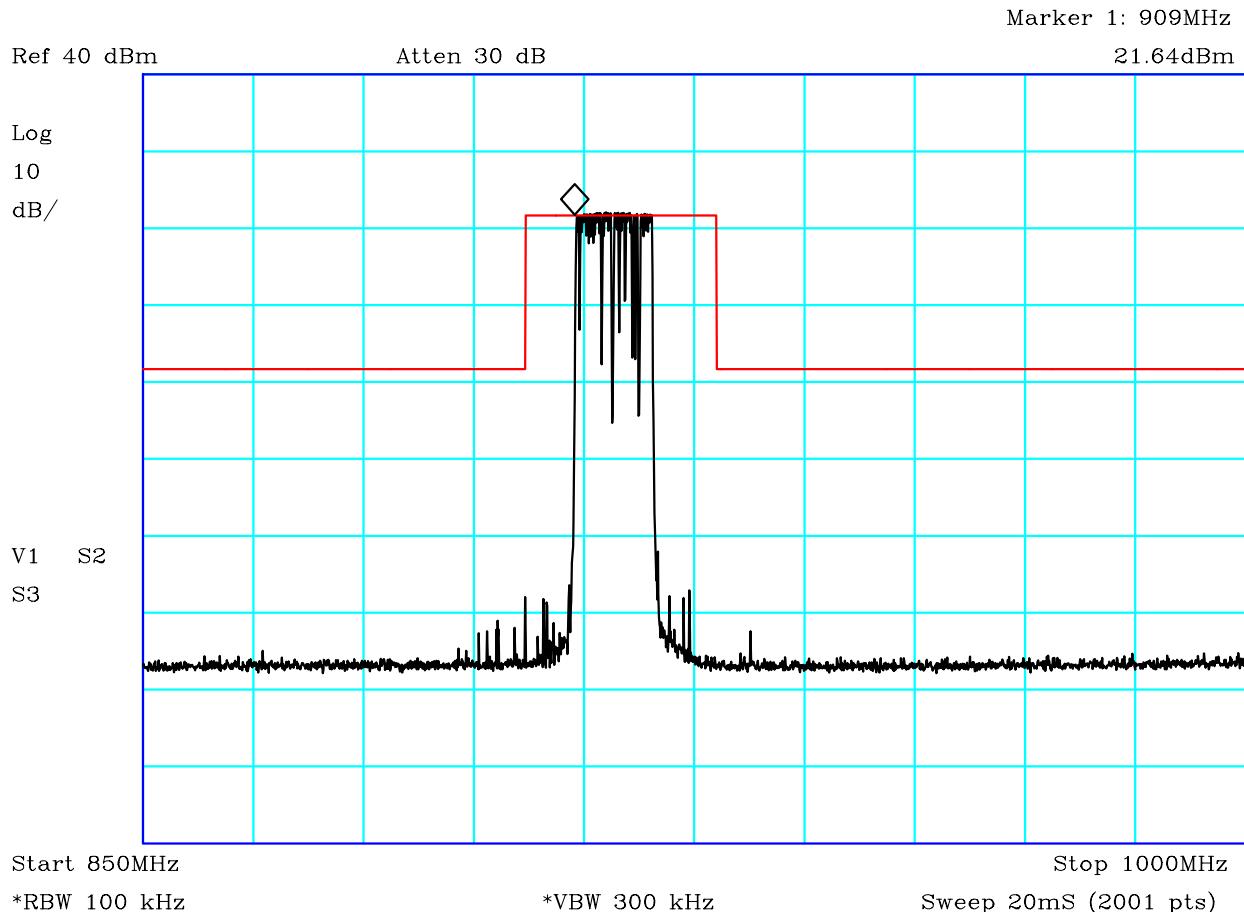


CF1:10dB_PAD

PLOT 29 Conducted Antenna -Spurious Emissions - 9kHz to 1GHz - Hopping

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:(RED) -20dBc	Limit2:
Limit3:	Limit4:
Hopping Continuous modulation	
Facility:	Mode: 2
	Modification State: 1
File: H39107CA	Analyser: R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 51 of 54

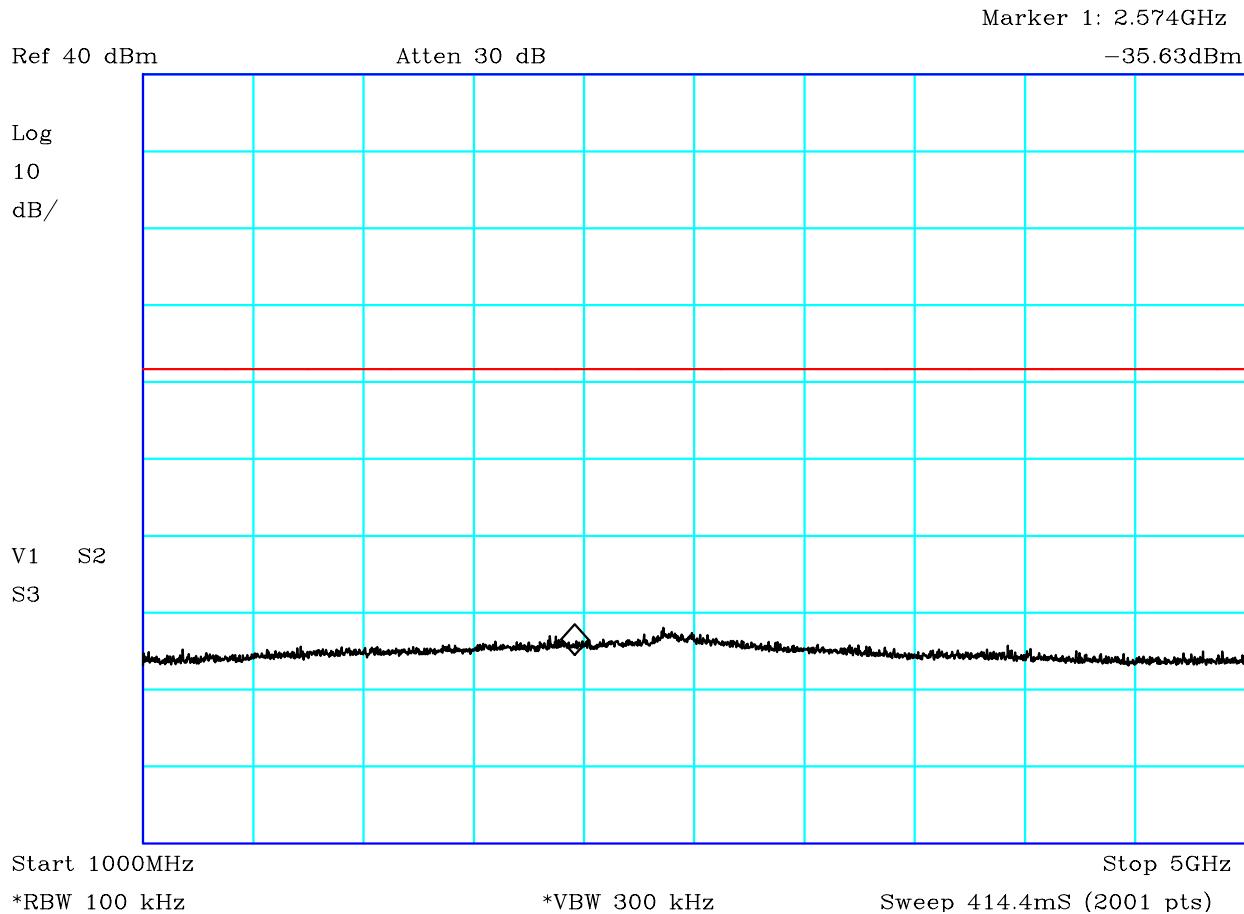


CF1:10dB_PAD

PLOT 30 Conducted Antenna - Spurious Emissions - 850MHz to 1GHz Hopping

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:(RED) -20dBc	Limit2:
Limit3:	Limit4:
Hopping Continuous modulation	
Facility:	Mode: 2
	Modification State: 1
File: H39107B7	Analyser: R8

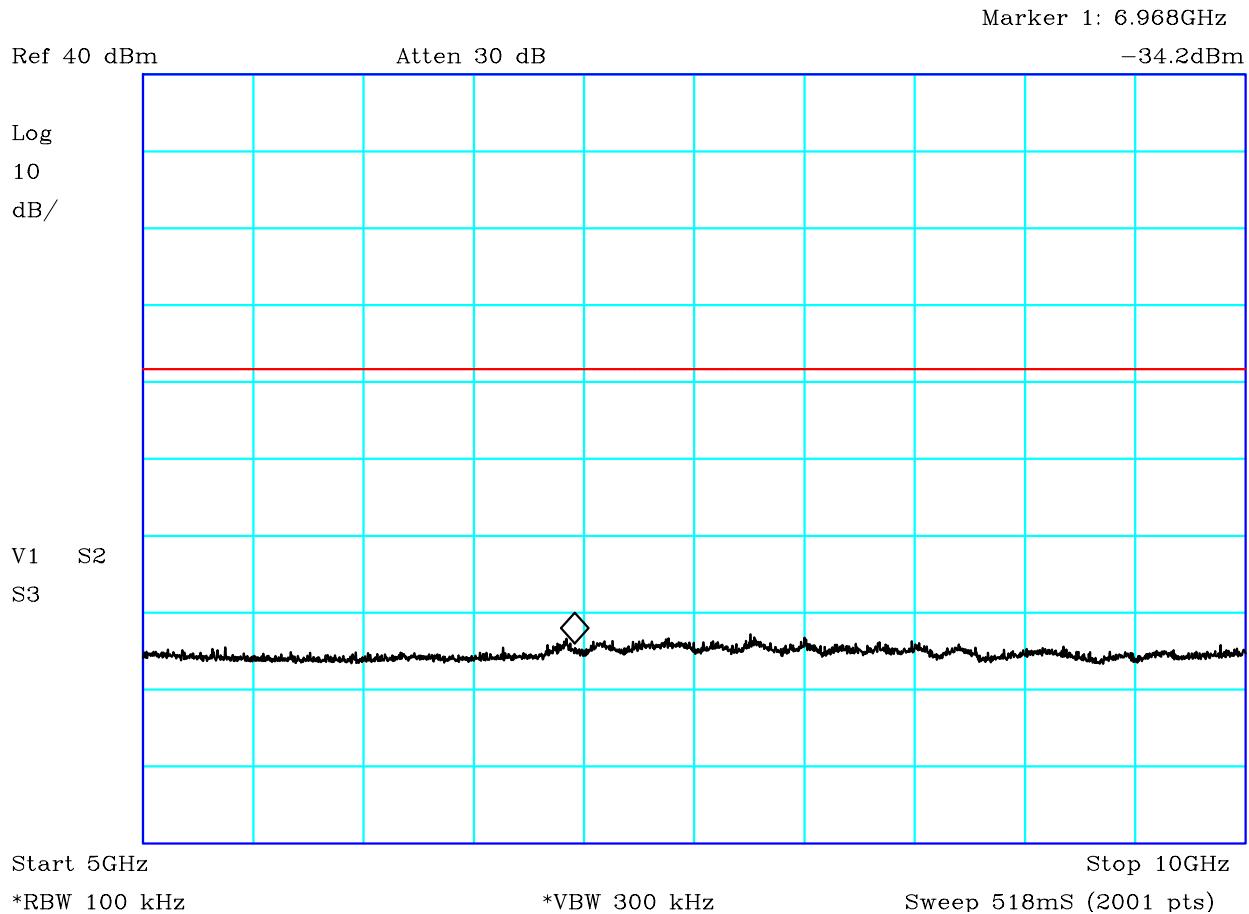
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Test No: T4651		Test Report	Page: 52 of 54



PLOT 31 Conducted Antenna - Spurious Emissions - 1GHz to 5GHz - Hopping

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:(RED) -20dBc	Limit2:
Limit3:	Limit4:
Hopping Continuous modulation	
Facility:	Mode: 2
	Modification State: 1
File: H39107DA	Analyser: R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 53 of 54

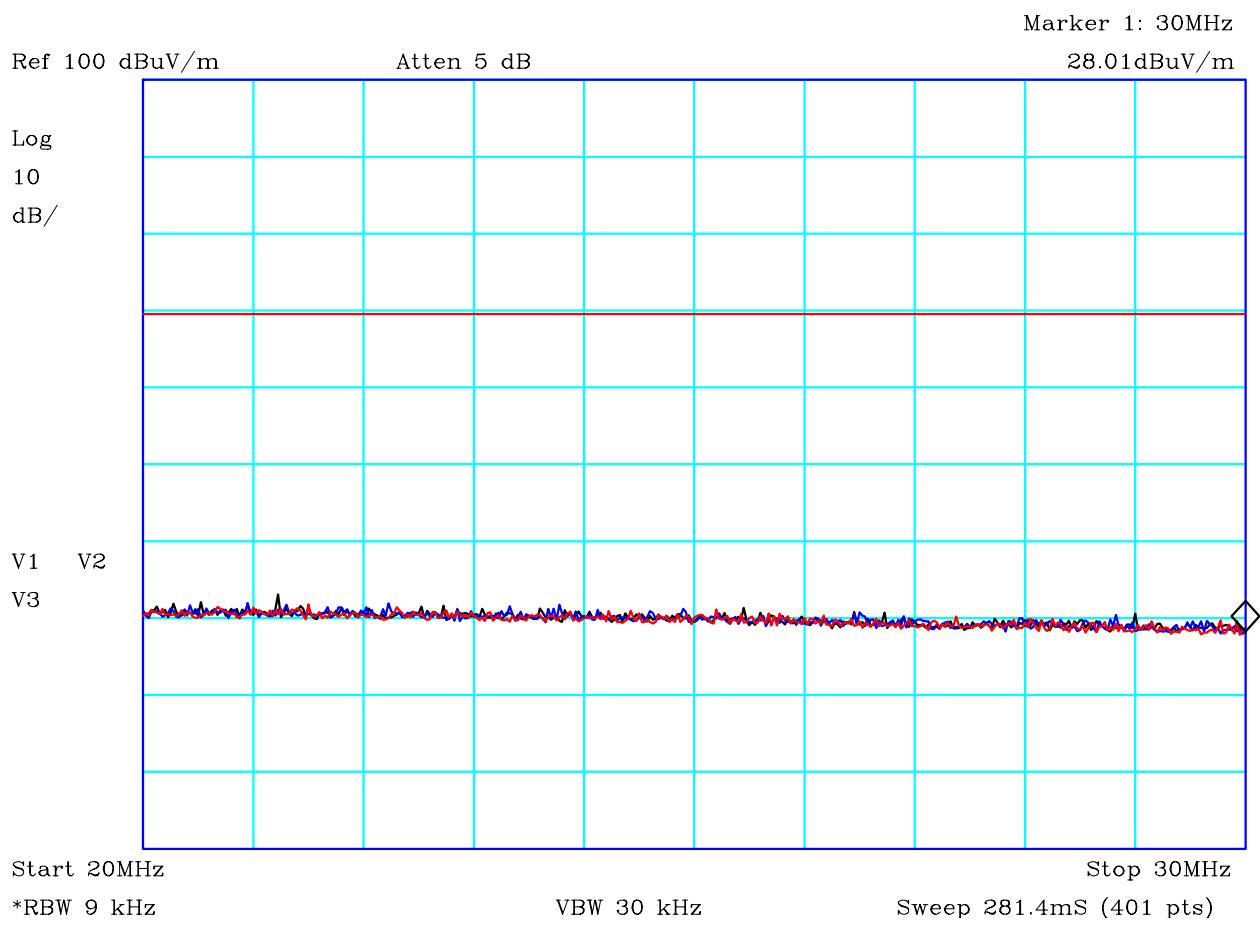


CF1:10dB_PAD

PLOT 32 Conducted Antenna - Spurious Emissions - 5GHz to 10GHz - Hopping

Company: Quatro	Product: Frequency Hopping Module
Date: 10/10/2013	Test Eng: Dave Smith
Method: DA 00-705	Method:
Limit1:(RED) -20dBc	Limit2:
Limit3:	Limit4:
Hopping Continuous modulation	
Facility:	Mode: 2
	Modification State: 1
File: H39107E4	Analyser: R8

	Report No: R3295 Issue No: 3	FCC ID: XL8WDLM914HP	
Test No: T4651		Test Report	Page: 54 of 54



PLOT 33 Radiated Emissions - 20MHz to 30MHz

Company:	Quatro	Product:	Frequency Hopping Module
Date:	22/01/2014	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC 15.209	Limit2:	
Limit3:		Limit4:	
<p>Black: 909 MHz Carrier. Blue: 914 MHz Carrier. Red: 919 MHz Carrier. High power. Antenna fitted. Upright and on side. Maximum with receiving antenna face on and edge on.</p> <p>Limits extrapolated to 3m using 40dB/decade.</p>			
Facility:	Anech_1	Height	1m
Distance	3m	Polarisation	F+E
Angle	0-360	File:	H402241B
		Mode:	Tx Mode
		Modification State:	2
		Analyser:	R8