



# Certification Test Report

Freescall Semiconductor

1323X-MRB+1323X-RCM

1323X-MRB+1323X-REM

FCC ID: RUN1323X-MRB

IC: 6744A-1323XMRB

Project Code C-0084542

(Report C-0084542-RA-1-1)

March 31, 2011

**Prepared for:** Freescall Semiconductor

**Author:** Lixin Wang  
EMC Technologist

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**Approved by:** Nick Kobrosly  
Director of Canadian Operations

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## Report Summary

<b>Test Facility:</b>	<b>National Technical Systems, Canada</b> Product Integrity Laboratory 5151-47 <sup>th</sup> Street, N.E. Calgary Alberta T3J 3R2
<b>Accreditation Numbers:</b>	0214.22 Electrical 0214.23 Mechanical Accredited by A2LA The American Association for Laboratory Accreditation  CLIENTS SERVED: All interested parties FIELDS OF TESTING: Electrical/Electronic, Mechanical/Physical ACCREDITATION DATE:: May 14, 2009 VALID TO: December 31, 2011
<b>Applicant:</b>	Freescal Semiconductor, Inc. 2100 E Elliot Road MD EL5 Tempe, AZ 85284 Tel: 480-413-4730 mark.r.williams@freescal.com
<b>Customer Representative:</b>	Name: Mark Williams Phone #: 480-413-4730 Email Address: mark.r.williams@freescal.com

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## Test Summary

Appendix	Test/Requirement Description	Deviations* from:			Pass / Fail	Applicable FCC Rule Parts	Applicable Industry Canada Rule Parts
		Base Standard	Test Basis	NTS Procedure			
A	Power line Conducted Emission	No	No	No	Pass	FCC Subpart C 15.207 (a) FCC Subpart B 15.107	RSS-Gen Issue 3 7.2.4 ICES-003 Issue 4
B	6 dB Bandwidth	No	No	No	Pass	FCC Subpart C 15.247 (a) (2)	RSS 210 Issue 8 A8.2 (a)
C	Occupied Bandwidth (99% emission bandwidth)	No	No	No	N/A	N/A	RSS-Gen Issue 3 4.6.1
D	Peak Power Output	No	No	No	Pass	FCC Subpart C 15.247 (b) (3)	RSS 210 Issue 8 A8.4 (4)
E	Power Spectral Density	No	No	No	Pass	FCC Subpart C 15.247 (e)	RSS 210 Issue 8 A8.2 (b)
F	Duty Cycle Correction Factor	No	No	No	N/A	FCC Subpart C 15.35 (c)	RSS-Gen Issue 3 4.5
G	Conducted Spurious Emissions	No	No	No	Pass	FCC Subpart C 15.247 (d)	RSS 210 Issue 8 A8.5
H	Conducted Spurious Emissions Band Edge	No	No	No	Pass	FCC Subpart C 15.247 (d)	RSS 210 Issue 8 A8.5
I	Radiated Spurious Emissions Band Edge	No	No	No	Pass	FCC Subpart C 15.247, 15.205	RSS 210 Issue 8 2.5, A8.5
J	Radiated Spurious Emissions (TX and RX)	No	No	No	Pass	FCC Subpart C 15.247, 15.205 FCC Subpart B 15.109	RSS 210 Issue 8 2.5, A8.5 RSS Gen Issue 3 section 4.10 and section 6 for RX ICES-003 Issue 4

Test Result: The product presented for testing complied with test requirements as shown above.

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Approved By: \_\_\_\_\_  
Alex Mathews  
Quality Management Representative

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## Register of revisions

Revision	Date	Description of Revisions
1	March 31, 2011	Initial release

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## 1.0 INTRODUCTION

### 1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Canada to demonstrate compliance of the 1323X-MRB zigbee module with 1323X-RCM motherboard and 1323X-REM motherboard from Freescale Semiconductor to FCC Part 15 Subpart C section 15.247 for DTS transmitter, the equivalent sections of Industry Canada's RSS 210, Issue 8 and FCC Subpart B (unintentional) and ICES-003 compliance.

## 2.0 EUT DESCRIPTION

### 2.1 CONFIGURATION

	Name	Model	Revision	Serial Number
<b>EUT</b>	1323X-MRB With RCM and REM mother board	1323X-RCB (MRB+RCM) 1323X-REB (MRB+REM)	E4	N/A
<b>Power Supply</b>	Sceptre	PXX5020AWPLUSB/S3	N/A	N/A
<b>Device Classification</b>	Mobile			
<b>Antenna</b>	Integral (5dBi)			
<b>Modulation</b>	O-QPSK			
<b>EUT Size with Enclosure (H x W x D) (in mm)</b>	1323X-MRB (18.1 x 66.5 x 51); 1323X-RCB (47.1 x 93 x 208.75); 1323X-REB (45.6 x 78.7 x 117.9)			
<b>EUT Weight (in grams)</b>	1323X-MRB (13.05gr); 1323X-RCB (146.15gr); 1323X-REB (56.2gr)			
<b>Channels/Frequency Range</b>	16 Channels, 2405 MHz – 2480 MHz			
<b>Functional Description</b>	<p>The MC1323x family is Freescale's low cost System-on-Chip (SoC) platform for the IEEE® 802.15.4 Standard that incorporates a complete, low power, 2.4 GHz radio frequency transceiver with Tx/Rx switch, an 8-bit HCS08 CPU, and a functional set of MCU peripherals into a 48-pin LGA package. This family of products is targeted for wireless RF remote control and other cost-sensitive applications ranging from home TV and entertainment systems such as ZigBee BeeStack Consumer (RF4CE) to low cost, low power, IEEE 802.15.4 and ZigBee end nodes. The MC1323x is a highly integrated solution, with very low power consumption.</p> <p>The MC1323x contains an RF transceiver which is an 802.15.4 Standard - 2006 compliant radio that operates in the 2.4 GHz ISM frequency band. The transceiver includes a low noise amplifier, 1mW nominal output power amplifier (PA), internal voltage controlled oscillator (VCO), integrated transmit/receive switch, on-board power supply regulation, and full spread-spectrum encoding and decoding.</p> <p>1323X-MRB: 1323X Modular Reference Board which is an IEEE 802.15.4 compliant evaluation board based on the Freescale MC 1323X device.</p> <p>1323X-RCM: 1323X Remote Control Module. RCM motherboard accepts the 1323X MRB plug-in module and supplies a power and a rich set of interface peripherals.</p> <p>1323X-REM: 1323X Remote Extender Board. REM motherboard accepts 1323X-MRB plug-in module and supplies a power and set of interface peripherals.</p>			

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### 2.1.1 EUT POWERS

<b>Voltage</b>	2.8 VDC Battery, 5 VDC USB, 120/240 VAC 60/50 Hz with Septre Power Supply Model PXX5020AWPLUSB/S3
<b>Number of Feeds</b>	1 (1 Hot, 1 Return)

### 2.2 EUT CABLES

Quantity	Model/Type	Routing		Description	Cable Length (m)
		From	To		
1	DC Power Cable	Power Supply	RCM/REM board	Power Cable	1.9

### 2.3 MODE OF OPERATION DURING TESTS

The 1323X-MRB was tested while in Continuous Transmit (100% duty cycle) and Receive modes. The EUT was tuned to a low, middle and high channel to perform power, occupied bandwidth and spurious/harmonic tests. While transmitting the EUT was setup to a level of "14" operate at the intended maximum power output available to the end user at low, middle and high channels.

1323X-MRB was tested with both 1323X-RCM and 1323X-REM motherboard. Worst case results were reported.

## 3.0 SUPPORT EQUIPMENT

None.



## APPENDICES

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## APPENDIX A: POWER LINE CONDUCTED EMISSION

### A.1. Base Standard & Test Basis

Base Standard	FCC PART 15.207 (a) FCC PART 15.107 RSS-Gen Issue 3 7.2.4 ICES-003 Issue 4
Test Basis	ANSI C63.4-2009 CAN/CSA-CEI/IEC CISPR 22-02
Test Method	SOP-CAG- EMC-02

### A.2. Specifications

Frequency	Limit FCC Part 15 RSS-Gen and ICES-003 Class B	
	Quasi-Peak	Average
MHz	dB $\mu$ V	dB $\mu$ V
0.150 – 0.500	66 to 56 <sup>1</sup>	56 to 46 <sup>1</sup>
0.500 – 5.00	56	46
5.00 – 30.00	60	50

**Note 1:** decrease with the logarithm of the frequency

### A.3. Test Procedure

ANSI C63.4-2009.


### A.4. Operating Mode During Test

The 1323X-MRB was tuned to middle channel in continuous transmit mode and 100 % duty cycle at maximum rated RF output power(setting 14). EUT powered from Switching Power Supply Model: PXX5020AWPLUSB/S3 with both RCM or REM motherboard..  
Both RCM motherboard and REM motherboard were tested and test results were reported.

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## A.5. Test Results

### A.5.1 RCM mother board test result



Product Integrity  
Laboratory V2.5

Project Number: C-0084542

Model: Freescale - RCM Board

Comments: Conf01: 120 VAC, 60 Hz with EUT transmitting (Power Step 14) with 100% duty cycle. TX in mid channel (Ch.18) @ 2.44 GHz. Large board: 1323X-RCM SN: 00089, Small Board: 1323X-MRB SN: 00750

Tester: James MacKay

Test ID: CE02tc-10m-C0084542

Standard:


FCC15\_B

Voltage/Line	Frequency (MHz)	Measurement Detector	Measured Value (dBμV)	Correction Factors (dB)	Emission Level (dBμV)	Limit Type	Limit (dBμV)	Margin (dB)
120 VAC Line	0.2456	Average	14.42	11.37	25.79	Average	51.90	26.11
120 VAC Line	0.2420	Quasi Peak	25.50	11.40	36.90	Quasi Peak	62.03	25.13
120 VAC Line	0.3275	Average	23.16	11.06	34.22	Average	49.51	15.29
120 VAC Line	0.3294	Quasi Peak	35.12	11.05	46.17	Quasi Peak	59.47	13.30
120 VAC Line	0.5628	Average	14.15	10.79	24.94	Average	46.00	21.06
120 VAC Line	0.5669	Quasi Peak	23.39	10.79	34.18	Quasi Peak	56.00	21.82
120 VAC Neutral	0.2615	Average	14.17	11.22	25.39	Average	51.38	25.99
120 VAC Neutral	0.2573	Quasi Peak	24.89	11.24	36.13	Quasi Peak	61.52	25.39
120 VAC Neutral	0.3255	Average	22.22	10.99	33.21	Average	49.57	16.36
120 VAC Neutral	0.3281	Quasi Peak	32.61	10.99	43.60	Quasi Peak	59.50	15.90
120 VAC Neutral	0.5376	Average	13.30	10.73	24.03	Average	46.00	21.97
120 VAC Neutral	0.5409	Quasi Peak	21.89	10.73	32.62	Quasi Peak	56.00	23.38

For the RCM board the emission measured with the least margin to the applicable limit was 46.17 dBμV with Quasi Peak detector at 0.3294 MHz. It has a 13.30 dB margin to the FCC Part 15.207, FCC Part 15.107 and RSS-Gen Issue 3, ICES-003 Quasi Peak limits.

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## A.5.2 REM mother board test result



Product Integrity Laboratory V2.5

Project Number: C-0084542

Model: Freescale - REM Board

Comments: Conf02: 120 VAC, 60 Hz with EUT transmitting (Power Step 14) with 100% duty cycle. TX in mid channel (Ch.18) @ 2.44 GHz. Large board: 1323X-REM SN: 00124, Small Board: 1323X-MRB SN: 00750

Tester: James MacKay

Test ID: CE02tc-10m-C0084542

Standard: FCC15\_B

Voltage/Line	Frequency (MHz)	Measurement Detector	Measured Value (dBµV)	Correction Factors (dB)	Emission Level (dBµV)	Limit Type	Limit (dBµV)	Margin (dB)
120 VAC Line	0.3322	Average	22.62	11.04	33.66	Average	49.40	15.74
120 VAC Line	0.3333	Quasi Peak	33.46	11.04	44.50	Quasi Peak	59.37	14.87
120 VAC Line	0.4713	Average	11.73	10.84	22.57	Average	46.49	23.92
120 VAC Line	0.4747	Quasi Peak	23.41	10.84	34.25	Quasi Peak	56.43	22.18
120 VAC Line	0.5494	Average	14.09	10.79	24.88	Average	46.00	21.12
120 VAC Line	0.5481	Quasi Peak	24.86	10.80	35.66	Quasi Peak	56.00	20.34
120 VAC Line	0.8913	Average	9.40	10.75	20.15	Average	46.00	25.85
120 VAC Line	0.8911	Quasi Peak	21.48	10.75	32.23	Quasi Peak	56.00	23.77
120 VAC Neutral	0.3268	Average	18.51	10.99	29.50	Average	49.53	20.03
120 VAC Neutral	0.3245	Quasi Peak	29.38	10.99	40.37	Quasi Peak	59.59	19.22
120 VAC Neutral	0.3287	Average	19.30	10.98	30.28	Average	49.48	19.20
120 VAC Neutral	0.3289	Quasi Peak	30.80	10.98	41.78	Quasi Peak	59.48	17.70
120 VAC Neutral	0.4724	Average	10.53	10.77	21.30	Average	46.47	25.17
120 VAC Neutral	0.4707	Quasi Peak	20.41	10.77	31.18	Quasi Peak	56.50	25.32
120 VAC Neutral	0.5546	Average	12.26	10.73	22.99	Average	46.00	23.01
120 VAC Neutral	0.5504	Quasi Peak	22.37	10.73	33.10	Quasi Peak	56.00	22.90

For the REM board the emission measured with the least margin to the applicable limit was 44.50 dBµV with Quasi Peak detector at 0.3333 MHz. It has a 14.87 dB margin to the FCC Part 15.207, FCC Part 15.107 and RSS-Gen Issue 3, ICES-003 Quasi Peak limits.

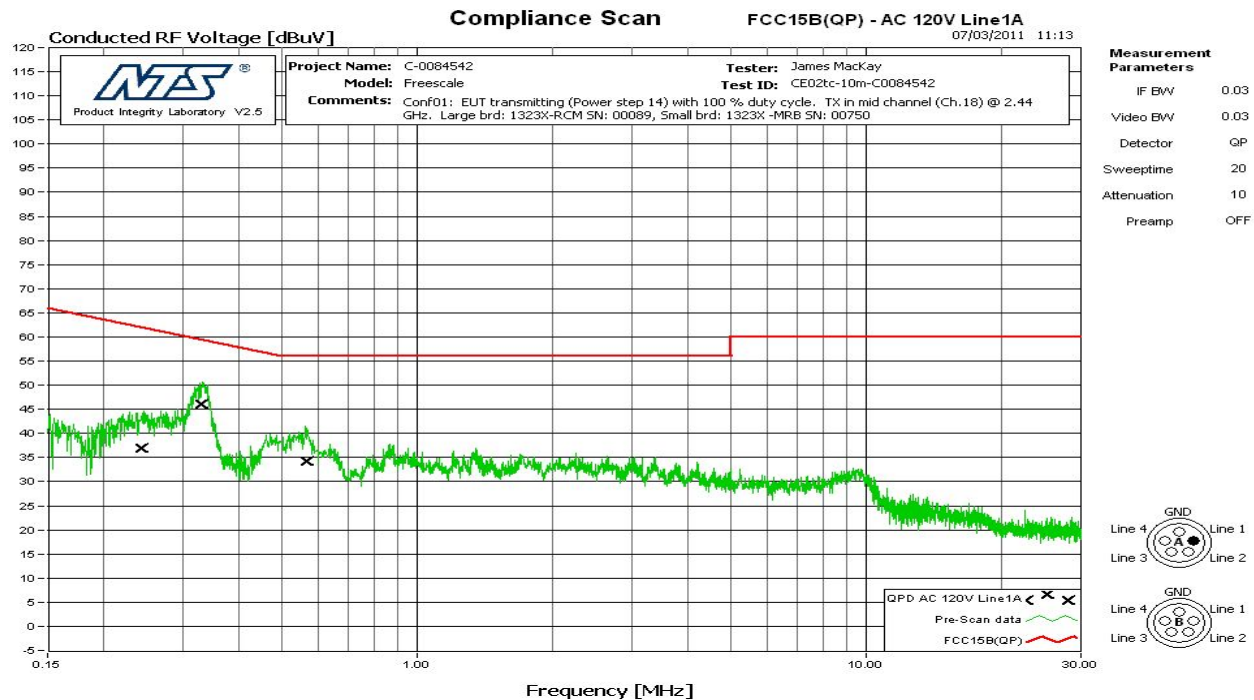
## A.6. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

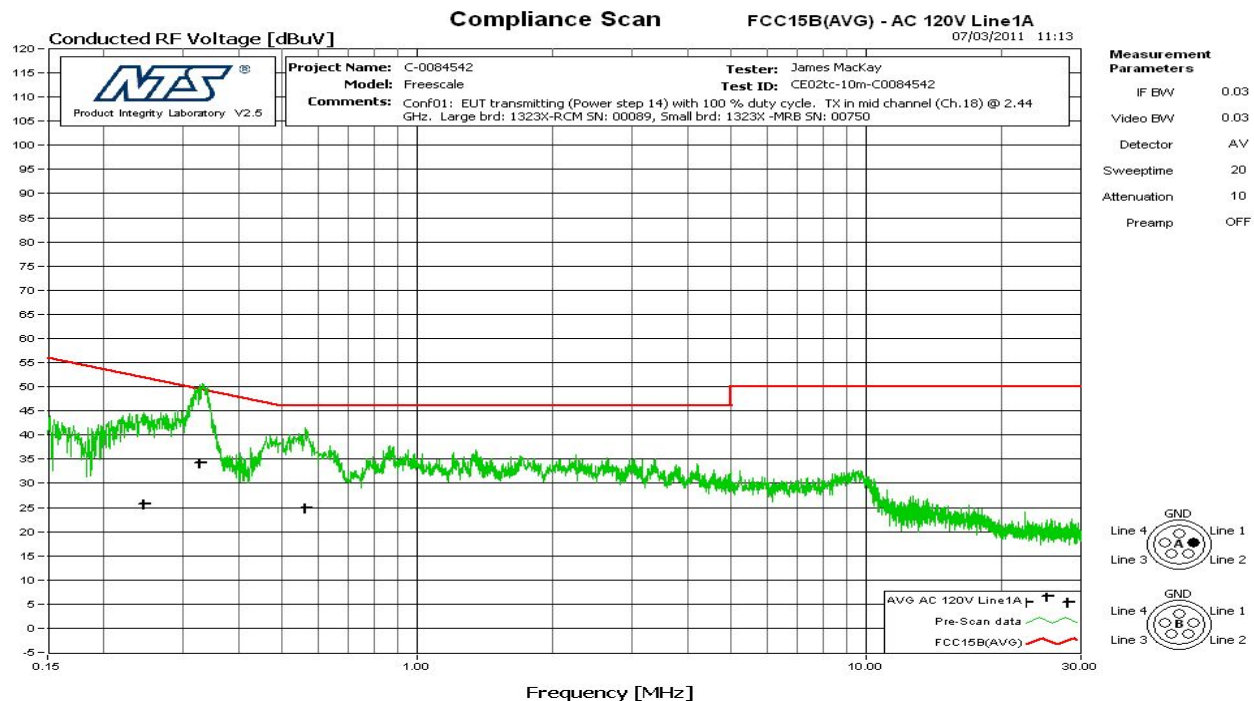
Name: James MacKay  
Function: Compliance Specialist

A.7. Test date March 07,2011

**Figure 1** Conducted Emission Line 150 kHz – 30 MHz Quasi-peak Detector with RCM

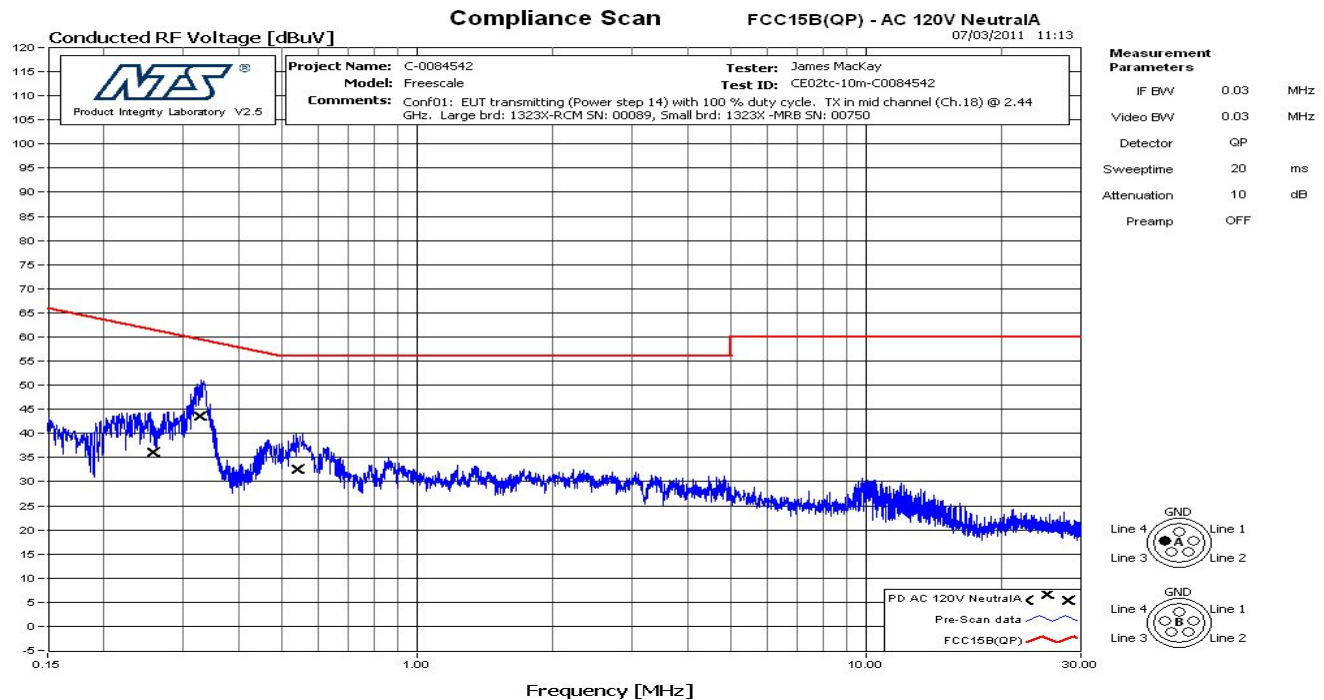


**Figure 2** Conducted Emission Line 150 kHz – 30 MHz Average Detector with RCM

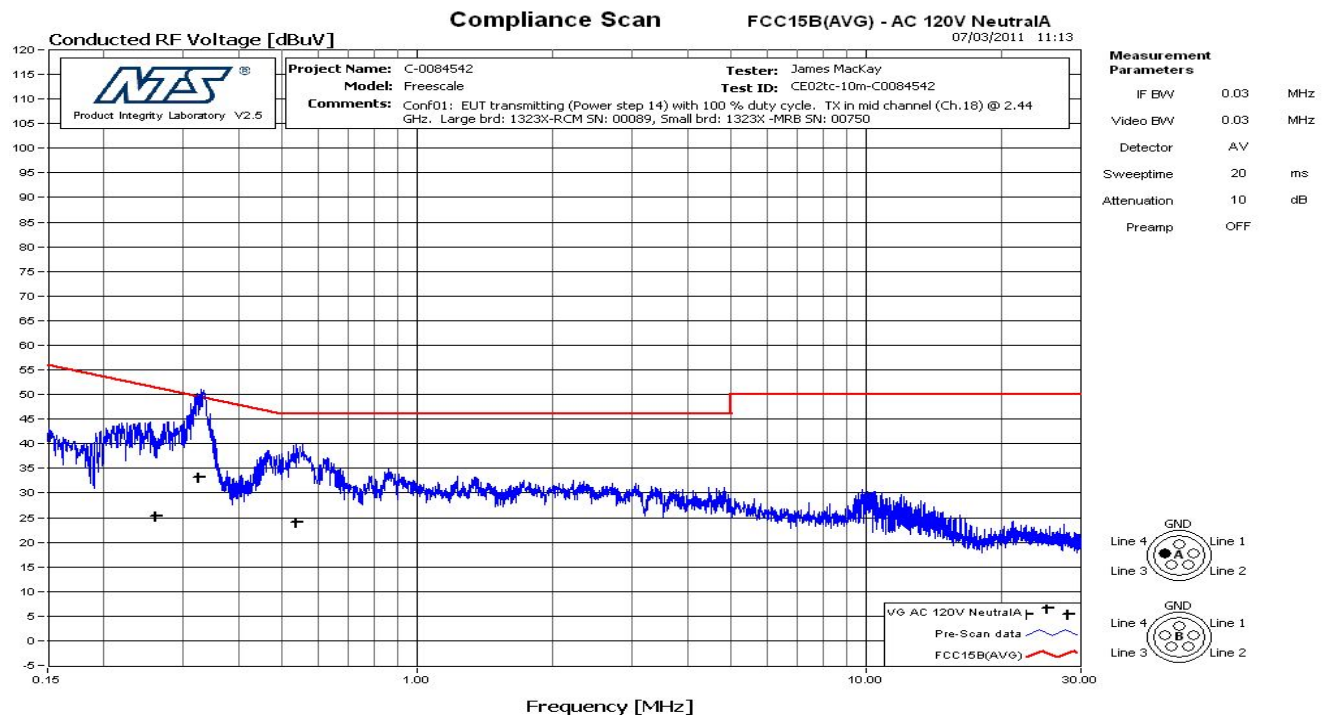


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**Figure 3 Conducted Emission Neutral 150 kHz – 30 MHz Quasi-peak Detector with RCM**



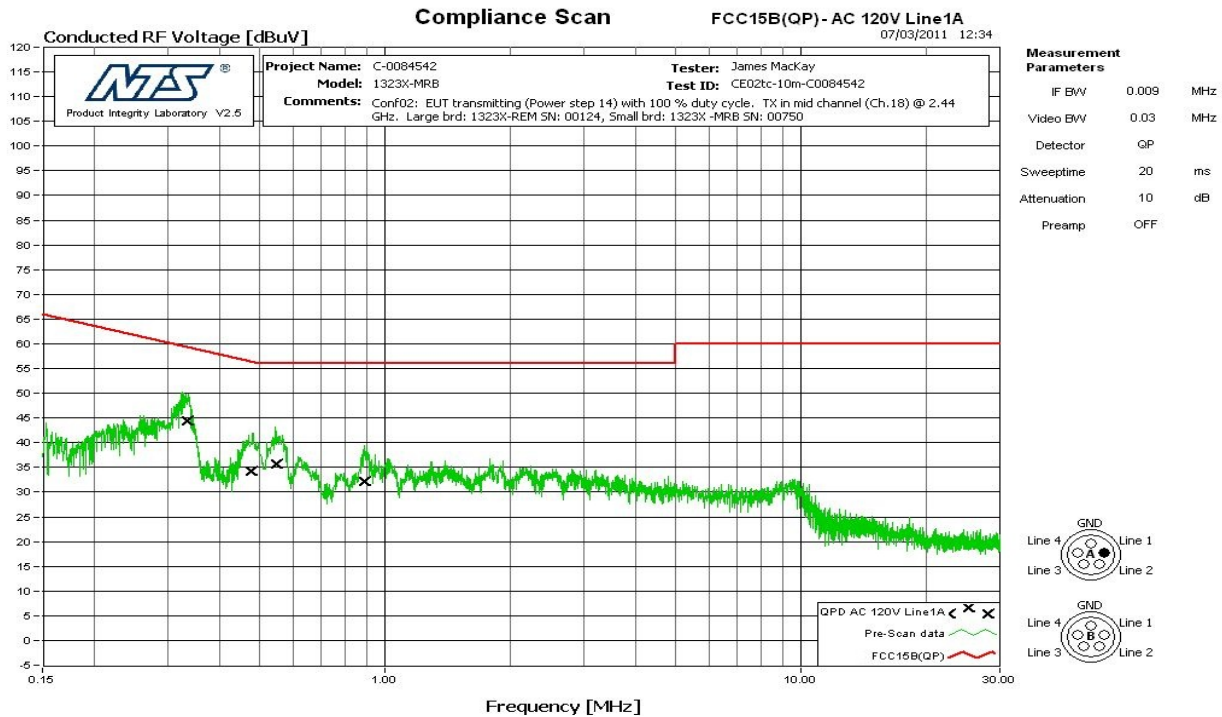
**Figure 4 Conducted Emission Neutral 150 kHz – 30 MHz Average Detector with RCM**



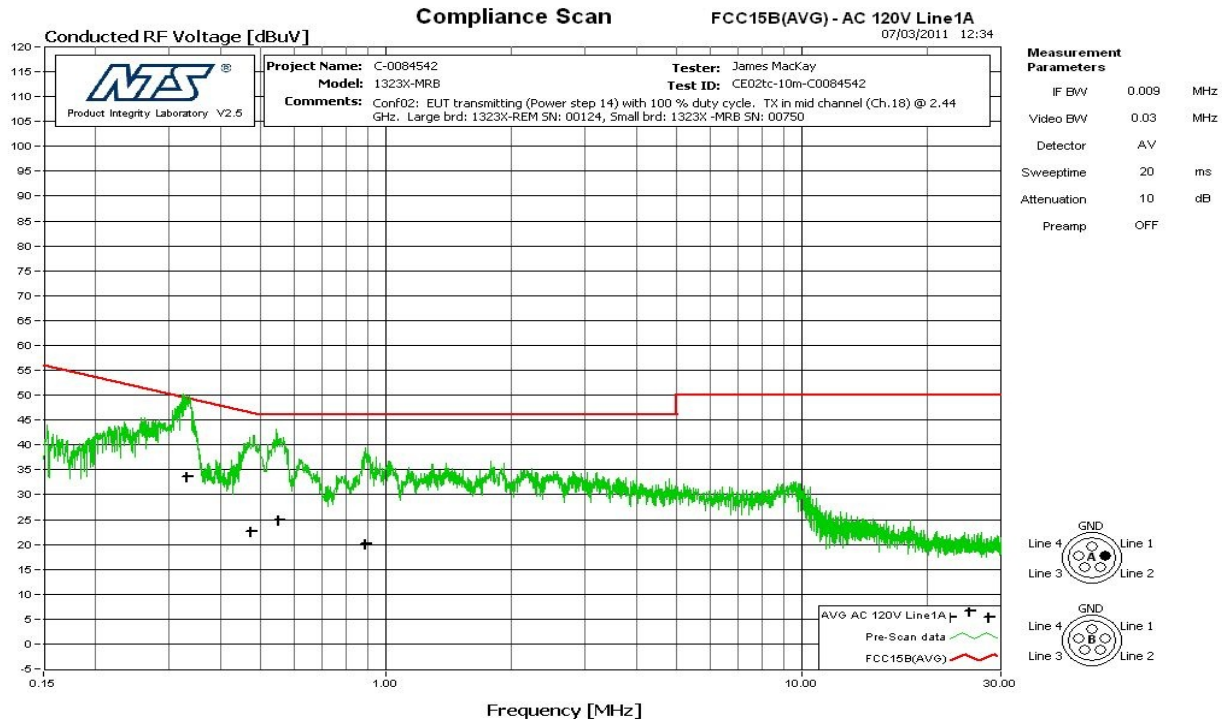
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**Figure 5** Conducted Emission Line 150 kHz – 30 MHz Quasi Peak detector with REM

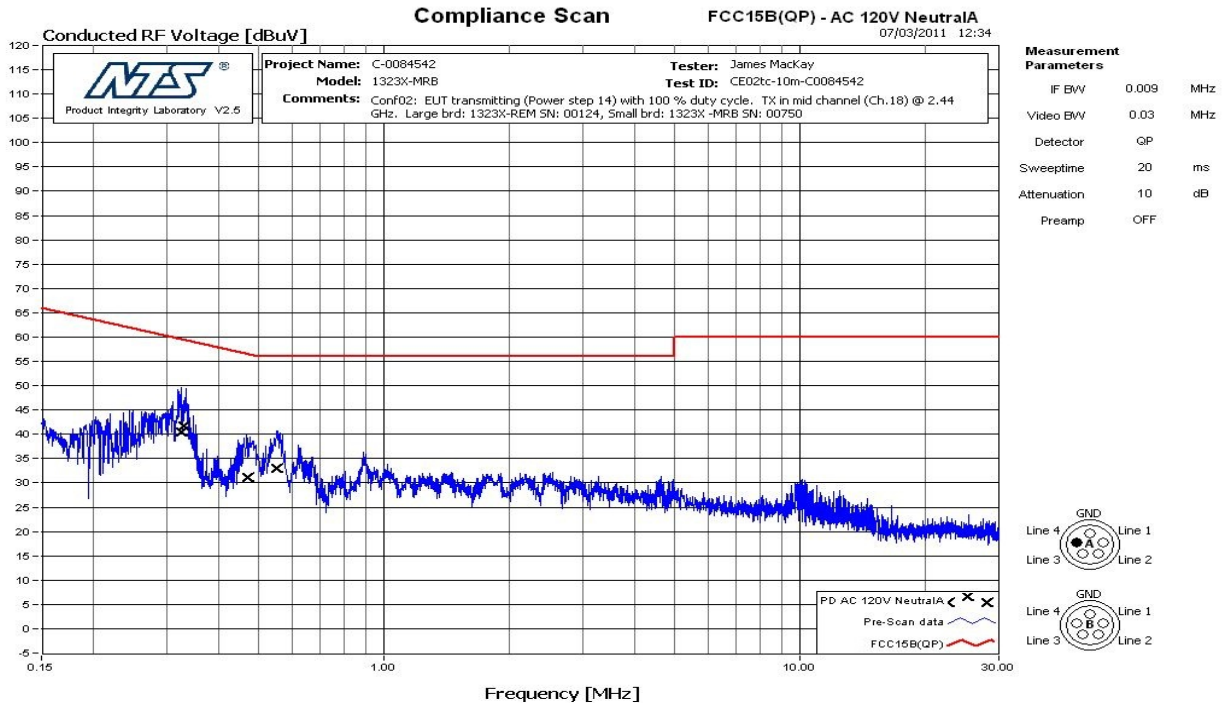


**Figure 6** Conducted Emission Line 150 kHz – 30 MHz Average detector with REM

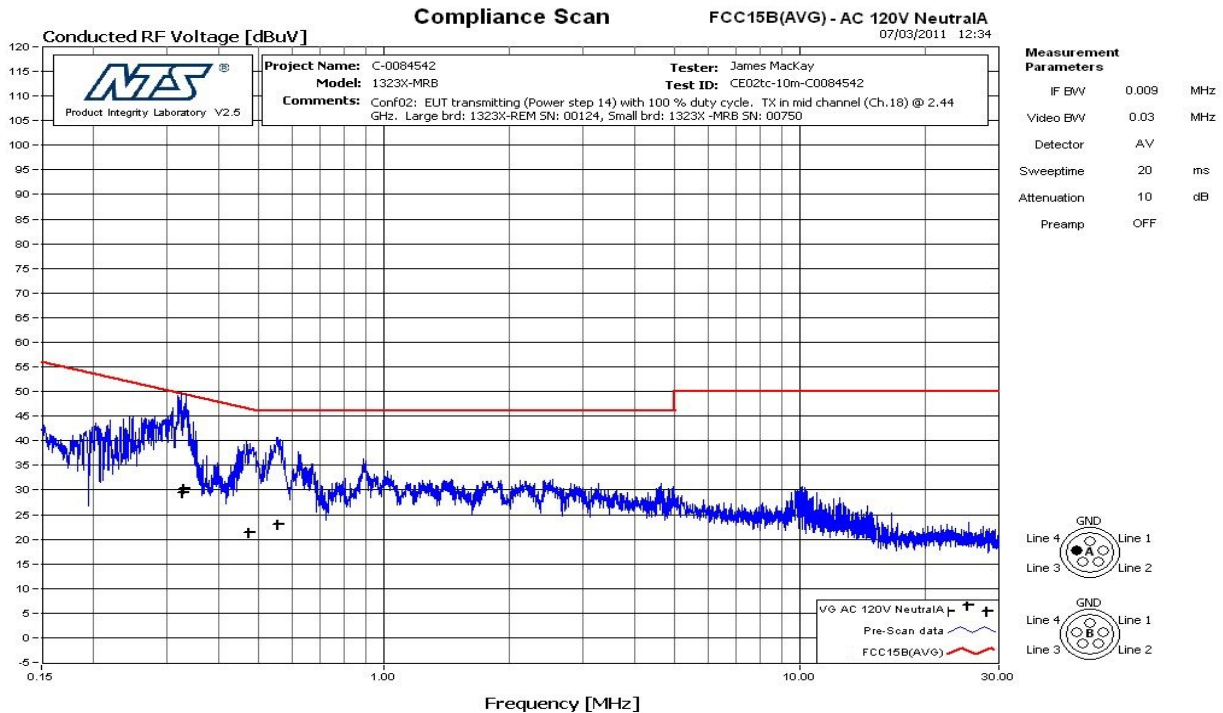


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**Figure 7 Conducted Emission Neutral 150 kHz – 30 MHz Quasi Peak detector with REM**



**Figure 8 Conducted Emission Neutral 150 kHz – 30 MHz Average detector with REM**



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**Figure 9 Conducted Emission Test Setup with RCM**



**Figure 10 Conducted Emission Test Setup with REM**



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## APPENDIX B: 6 DB BANDWIDTH

### B.1. Base Standard & Test Basis

Base Standard	FCC PART 15.247 (a) (2) RSS 210 Issue 8 A8.2 (a)
Test Basis	FCC Publication 558074 RSS-Gen Issue 3 4.6.2
Test Method	FCC Publication 558074 RSS 210 Issue 8 A8.2 (a)

### B.2. Specifications

15.247 (2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### B.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
None						

### B.4. Test Procedure

FCC Publication 558074 and RSS 210.

### B.5. Test Results

The EUT is in compliance with the requirement as specified above

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
11	2405	1.577
18	2440	1.491
26	2480	1.592

All final reported values are corrected values.

### B.6. Operating Mode During Test

The 1323X-MRB was tuned to a low, middle and high channel in continuous transmit mode and 100 % duty cycle at maximum rated RF output power (setting 14).

### B.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Lixin Wang  
Function: EMC Technologist

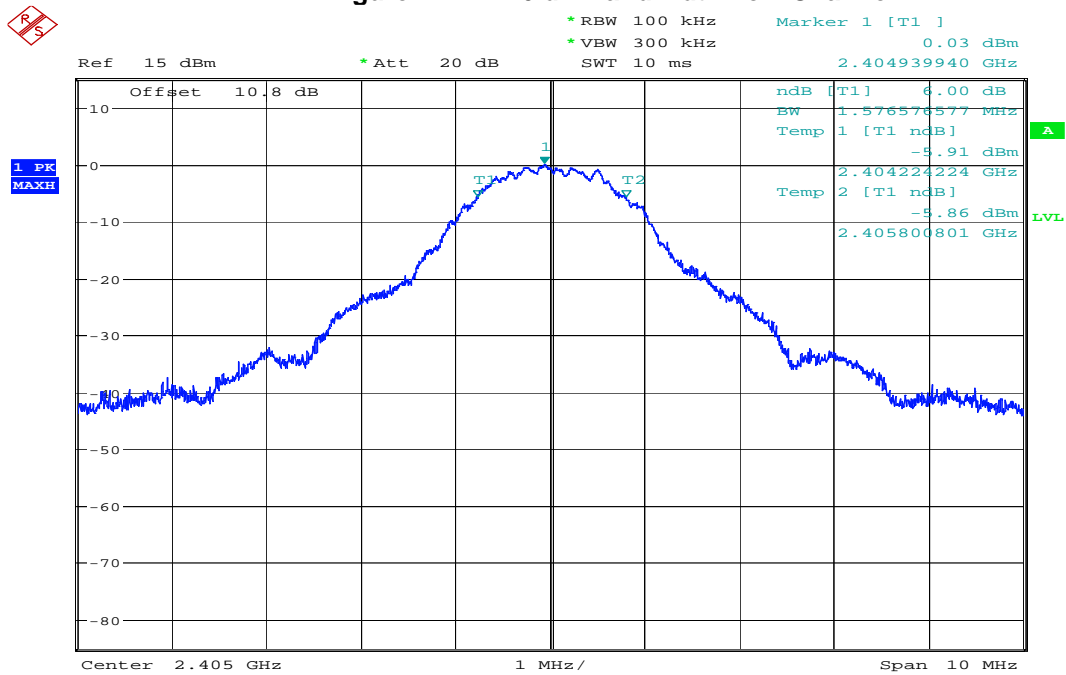
### B.8. Test date

March 14, 2011

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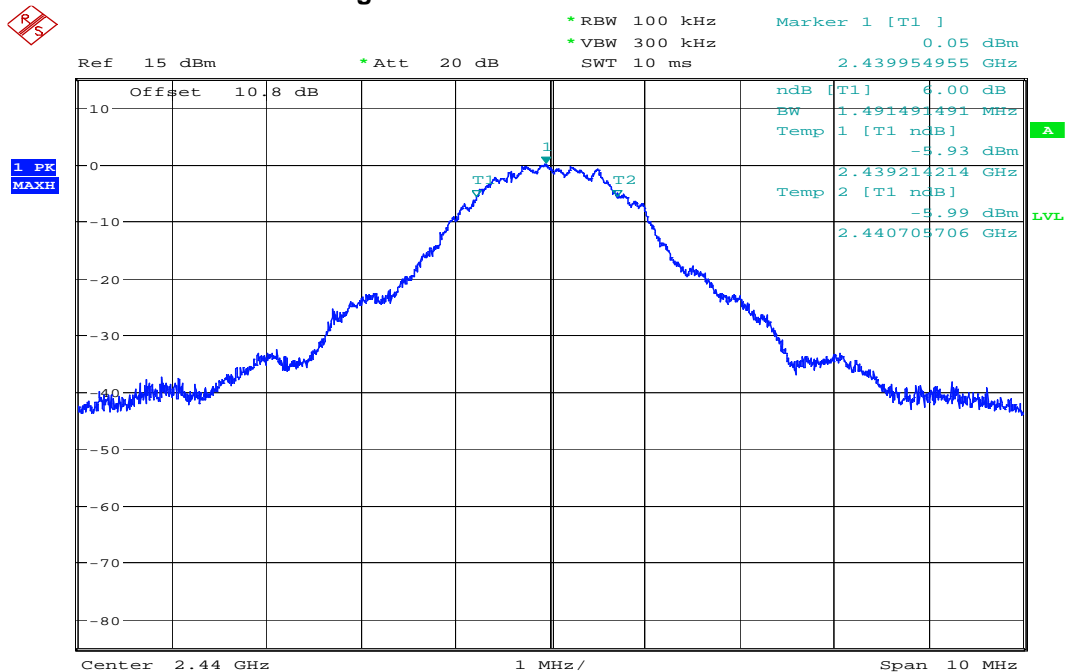
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**Figure 11      6 dB Bandwidth Low Channel**



Date: 14.MAR.2011 16:45:36

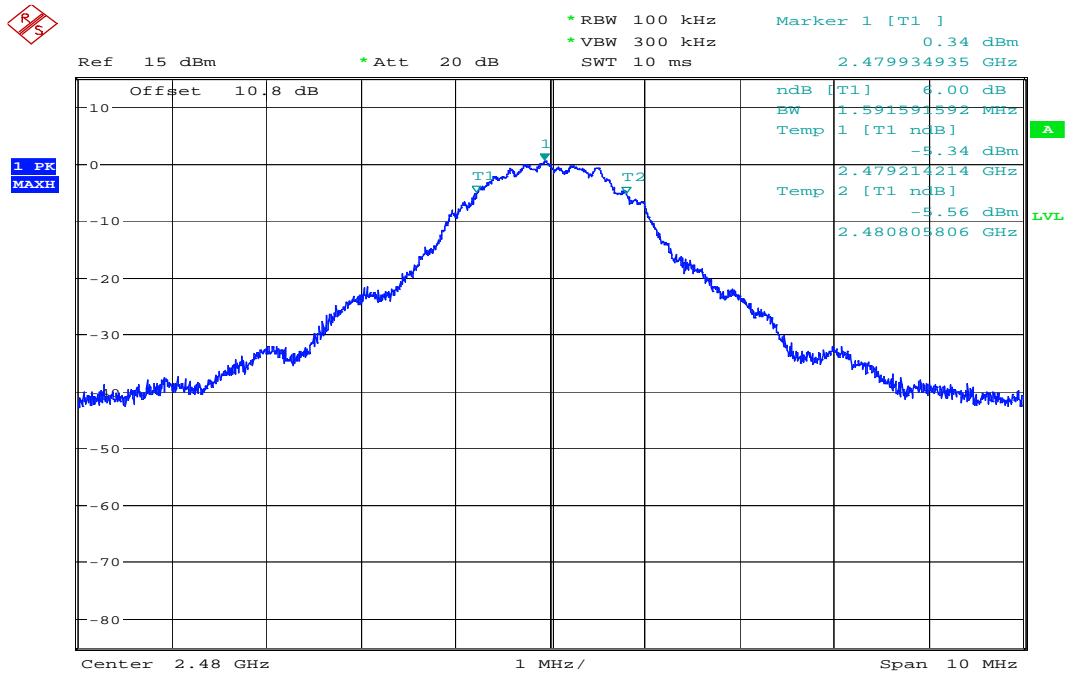
**Figure 12      6 dB Bandwidth Mid Channel**



Date: 14.MAR.2011 16:47:18

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**Figure 13      6 dB Bandwidth High Channel**



Date: 14.MAR.2011 16:50:05

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## APPENDIX C: OCCUPIED BANDWIDTH

### C.1. Base Standard & Test Basis

Base Standard	RSS-Gen Issue 3 4.6.1
Test Basis	RSS-Gen Issue 3 4.6.1
Test Method	RSS-Gen Issue 3 4.6.1

### C.2. Specifications

4.6.1 When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

### C.3. Test Procedure

RSS-Gen Issue 3

### C.4. Test Results

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
11	2405	2.853
18	2440	2.848
26	2480	2.873

All final reported values are corrected values

### C.5. Operating Mode During Test

The 1323X-MRB was tuned to a low, middle and high channel in continuous transmit mode and 100 % duty cycle at maximum rated RF output power (setting 14).

### C.6. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Lixin Wang  
Function: EMC Technologist

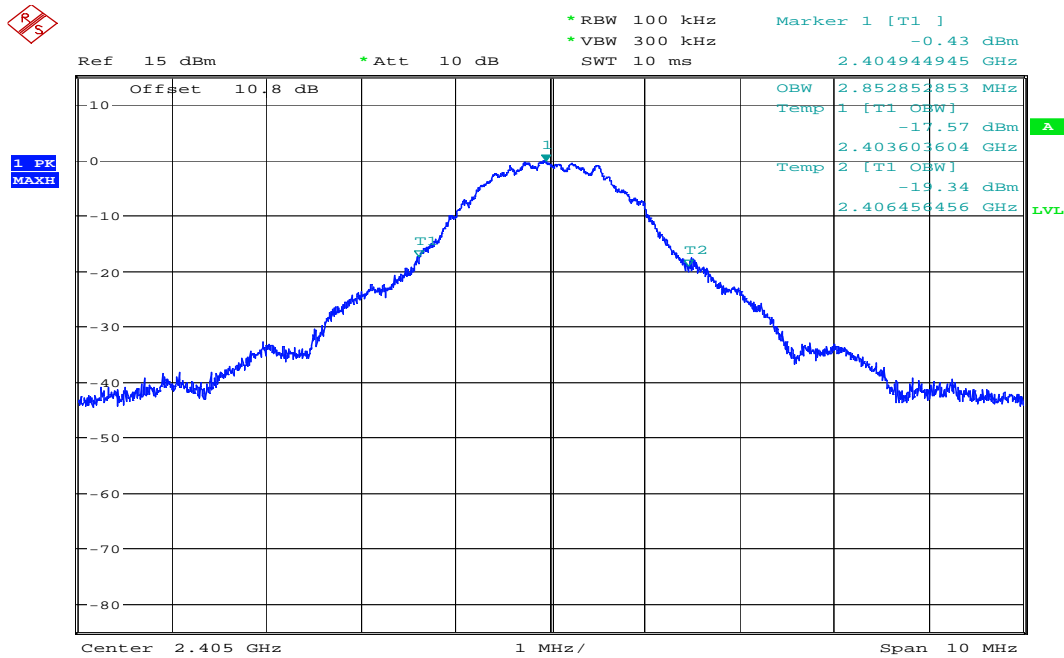
### C.7. Test date

March 14, 2011

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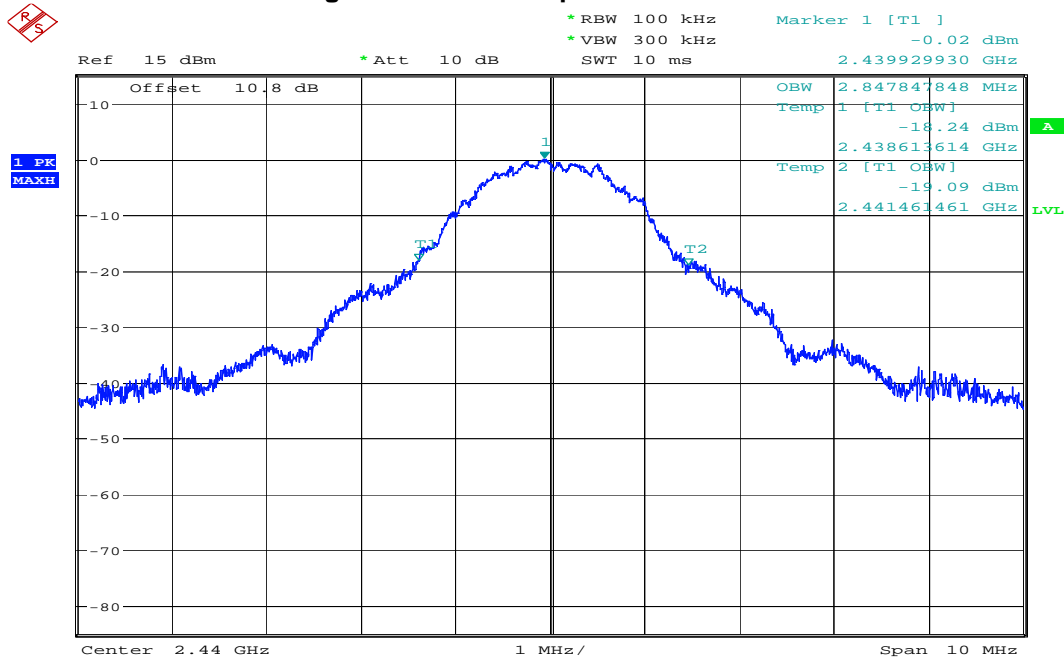
NTS Product Integrity Laboratory, 5151-47<sup>th</sup> Street N.E. Tel: 403-568-6605, Fax: 403-568-6970

**Figure 14 Occupied Bandwidth Low Channel**



Date: 14.MAR.2011 17:08:16

**Figure 15 Occupied Bandwidth Mid Channel**

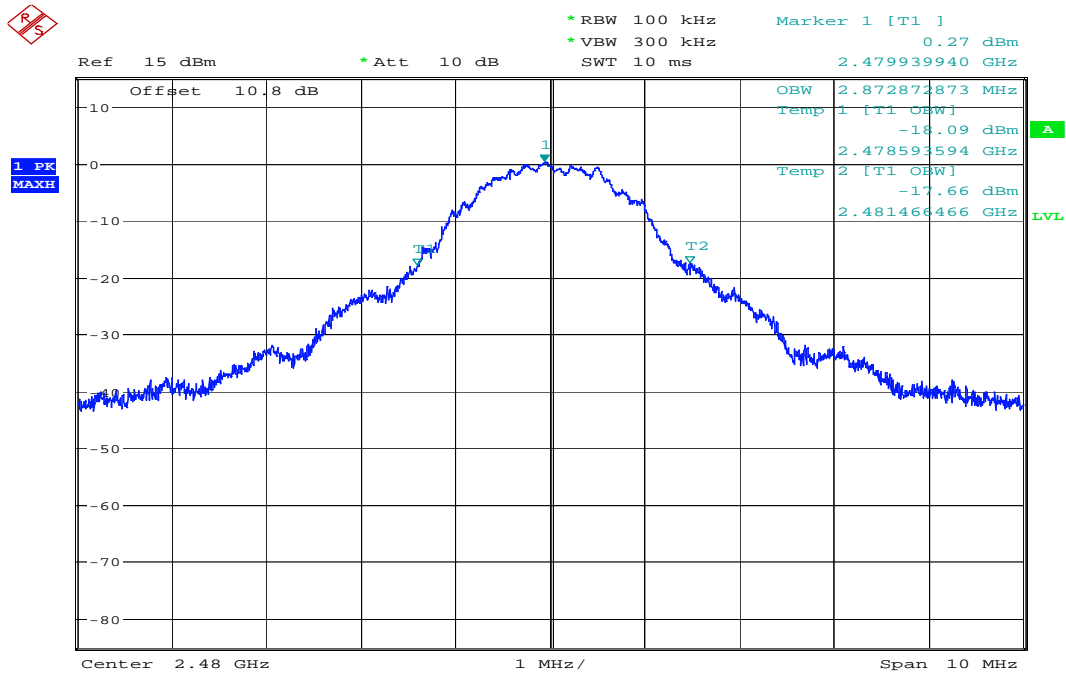


Date: 14.MAR.2011 17:09:37

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**Figure 16 Occupied Bandwidth High Channel**



Date: 14.MAR.2011 17:05:21

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## APPENDIX D: PEAK POWER OUTPUT

### D.1. Base Standard & Test Basis

Base Standard	FCC 15.247 RSS 210 Issue 8 A8.4 (4)
Test Basis	FCC 15.247 as per FCC Publication 558074 RSS-Gen Issue 3 4.8
Test Method	FCC Publication 558074 and RSS-Gen Issue 3 4.8

### D.2. Specifications

The maximum peak output power shall not exceed 30 dBm in the 2400 MHz- 2483.5 MHz band

### D.3. Test Procedure

FCC Publication 558074 and RSS-Gen Issue 3 4.8

### D.4. Operating Mode During Test

The 1323X-MRB was tuned to a low, middle and high channel in continuous transmit mode and 100 % duty cycle at maximum rated RF output power (setting 14).

### D.5. Test Results

Compliant – The maximum peak power was 3.68 dBm as measured conducted at the RF output port

### D.6. Test Data Summary

Channel	Frequency (MHz)	Peak RF power (dBm)
11	2405	3.44
18	2440	3.55
26	2480	3.68

Device antenna gain 5 dBi.

All final reported values are corrected values

### D.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Lixin Wang  
Function: EMC Technologist

### D.8. Test date

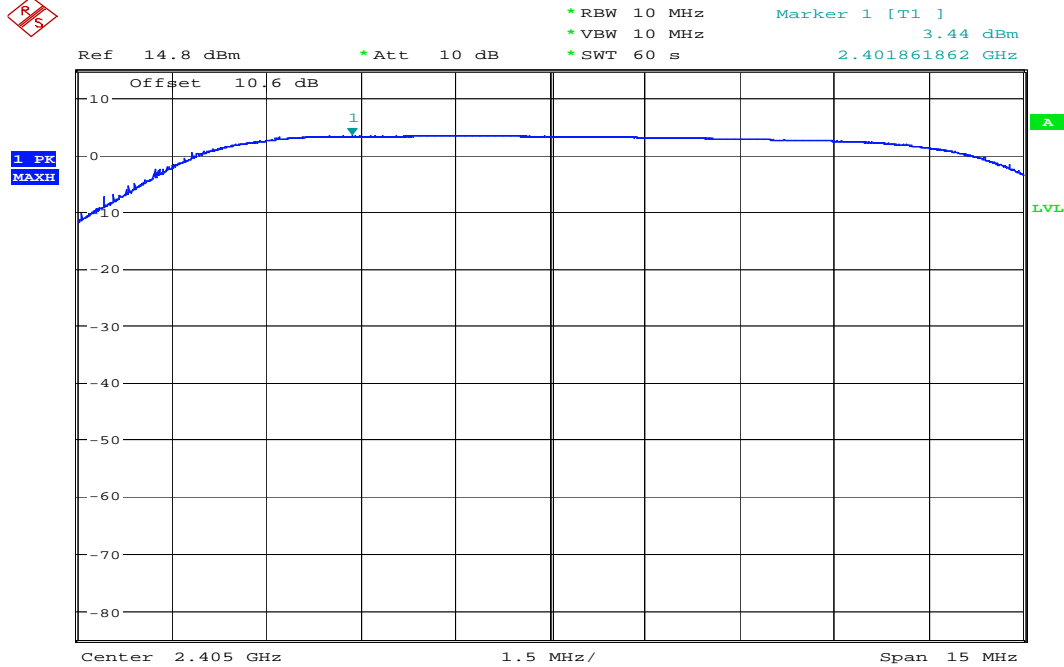
March 14, 2011

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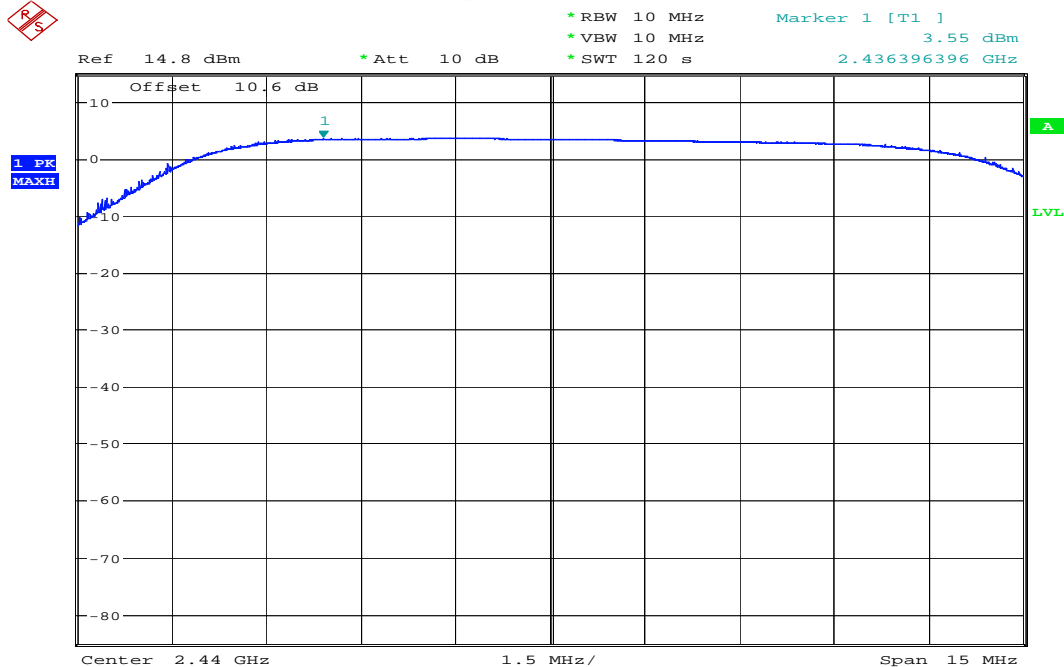


**Figure 17 Low Channel**



Date: 14.MAR.2011 17:28:42

**Figure 18 Mid Channel**

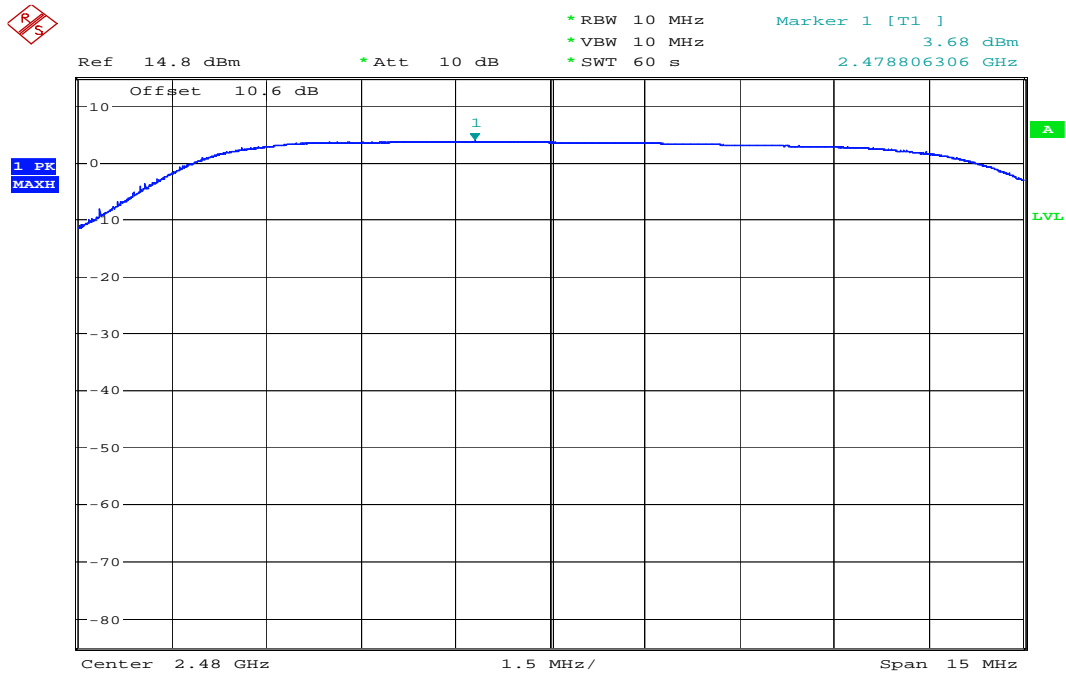


Date: 14.MAR.2011 17:24:24

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Figure 19 High Channel



Date: 14.MAR.2011 17:32:24

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## APPENDIX E: POWER SPECTRAL DENSITY

### E.1. Base Standard & Test Basis

<b>Base Standard</b>	FCC 15.247 (e) RSS 210 Issue 8 A8.2 (b)
<b>Test Basis</b>	FCC 15.247 as per FCC Publication 558074 RSS 210 Issue 8 A8.2 (b)
<b>Test Method</b>	FCC Publication 558074 and RSS 210 Issue 8 A8.2 (b)

### E.2. Specifications

15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### E.3. Test Procedure

FCC Publication 558074 and RSS 210 Issue 8 A8.2 (b)

### E.4. Operating Mode During Test

The 1323X-MRB was tuned to a low, middle and high channel in continuous transmit mode and 100 % duty cycle at maximum rated RF output power (setting 14).

### E.5. Test Results

Compliant. The maximum measured power spectral density was -12.22 dBm as measured conducted at the RF output port

### E.6. Test Data Summary

Channel	Frequency (MHz)	PSD (dBm)
11	2404.92	-12.70
18	2439.94	-13.23
26	2480.43	-12.22

Device antenna gain: 5 dBi.

All final reported values are corrected values

### E.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Lixin Wang  
Function: EMC Technologist

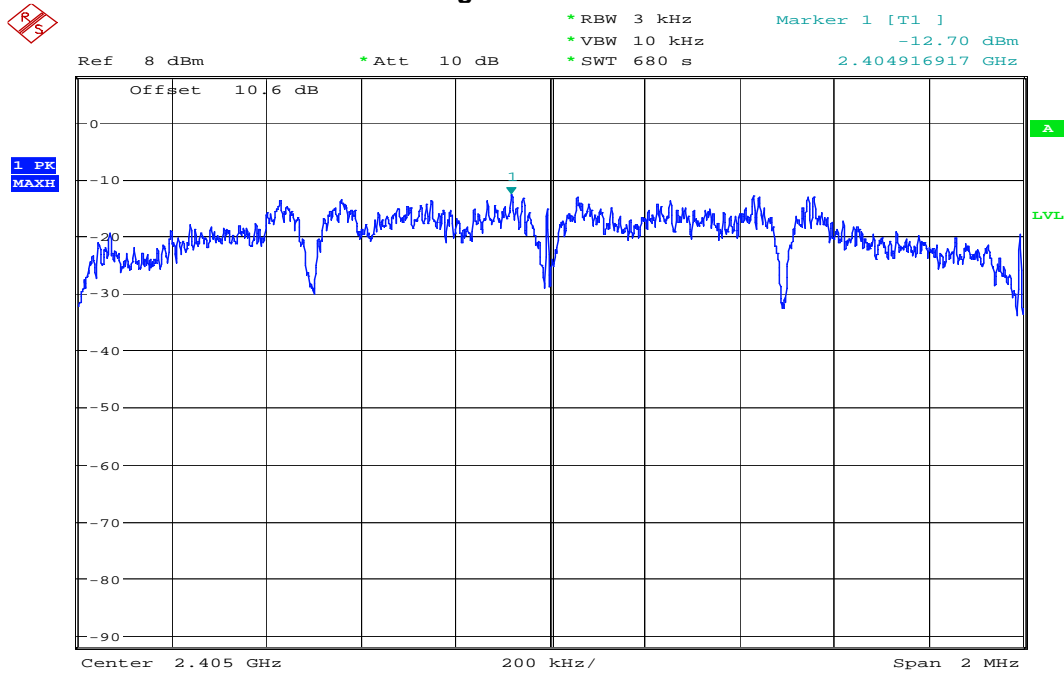
### E.8. Test date

March 14, 2011

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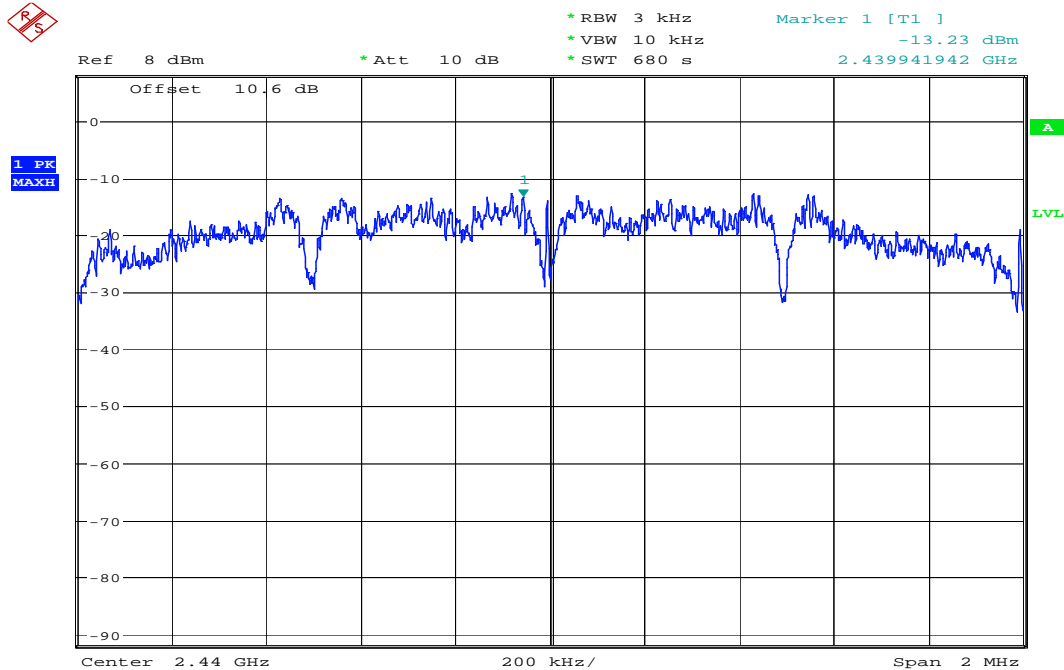
NTS Product Integrity Laboratory, 5151-47<sup>th</sup> Street N.E. Tel: 403-568-6605, Fax: 403-568-6970

Figure 20 Low Channel



Date: 14.MAR.2011 18:35:18

Figure 21 Mid Channel

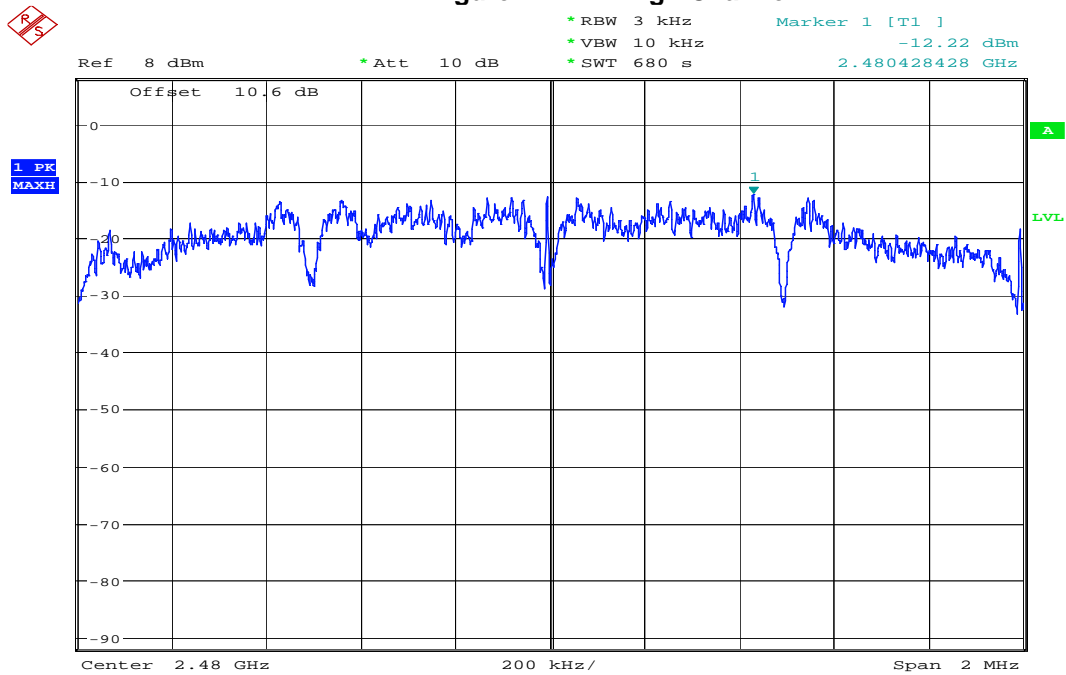


Date: 14.MAR.2011 19:01:41

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Figure 22 High Channel



Date: 14.MAR.2011 18:10:33

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## APPENDIX F: DUTY CYCLE CORRECTION FACTOR

### F.1. Base Standard & Test Basis

Base Standard	FCC 15.35 (c) RSS-Gen Issue 3 4.5
Test Basis	FCC 15.35 (c) as per FCC Publication 558074 RSS-Gen Issue 3 4.5
Test Method	Zero span

### F.2. Specifications

15.35 (c) Unless otherwise specified, e.g. §15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

### F.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

### F.4. Test Procedure

Zero span.

### F.5. Operating Mode During Test

The 1323x-MRB was tuned to Channel 18 operating at maximum rated RF output power. PRBS9 (Transmission 9<sup>th</sup> Order Binary Polynomial) mode.

### F.6. Test Results

Duty cycle correction factor =  $20 \cdot \log(14 \cdot 2.33 / 100) = -9.72$  dB

### F.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Lixin Wang  
Function: EMC Technologist

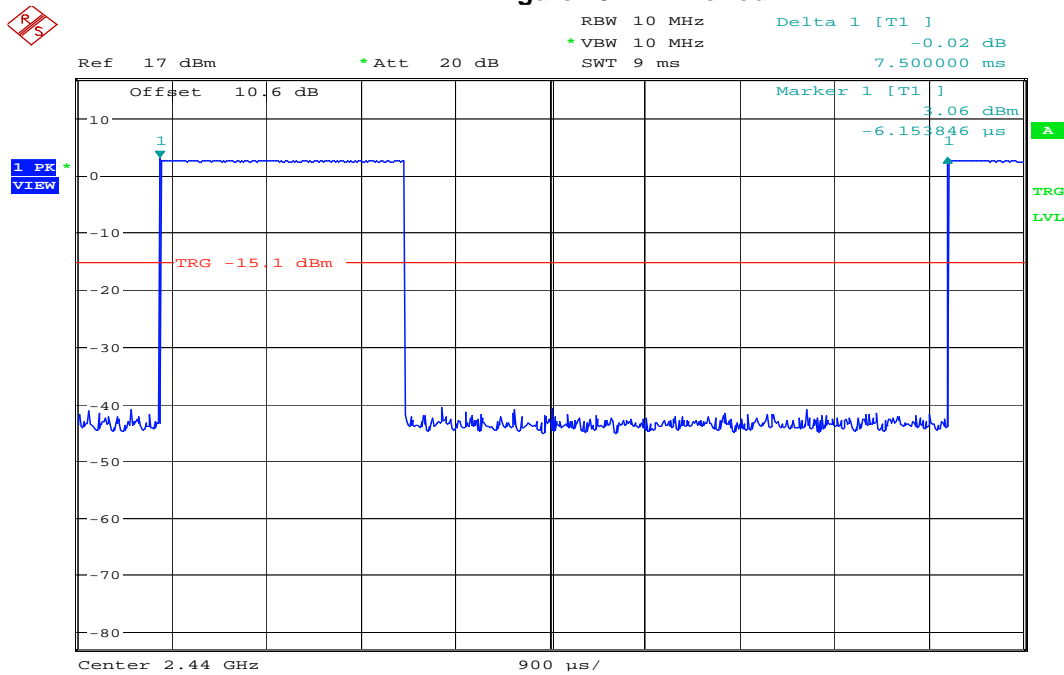
### F.8. Test date

Test started: March 7, 2011      Ended: March 7, 2011

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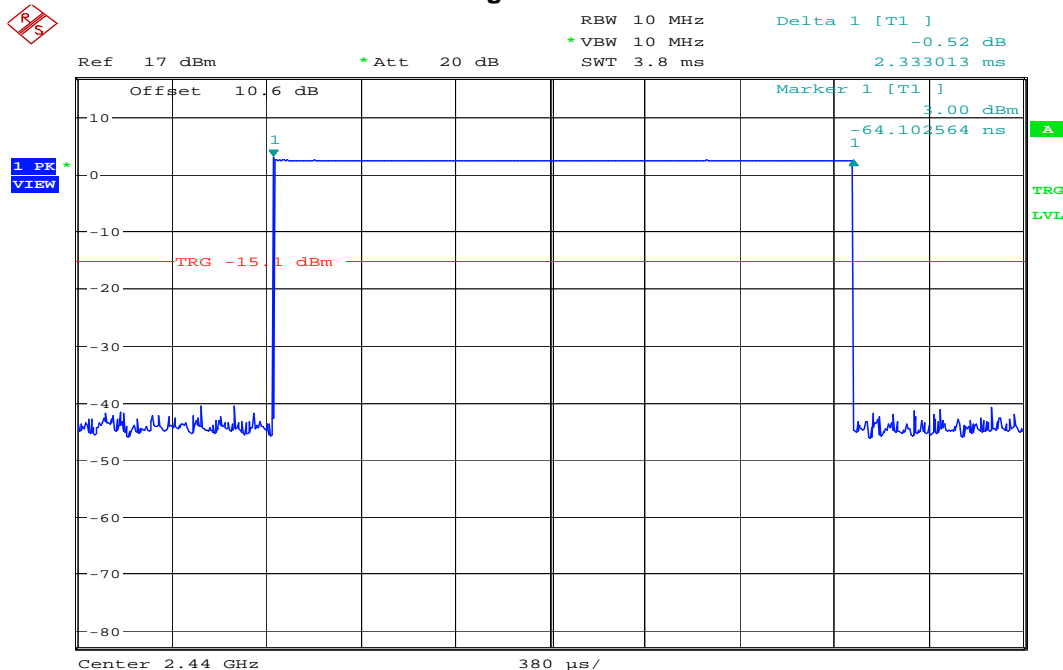
NTS Product Integrity Laboratory, 5151-47<sup>th</sup> Street N.E. Tel: 403-568-6605, Fax: 403-568-6970

**Figure 23 Period**



Date: 7.MAR.2011 05:59:27

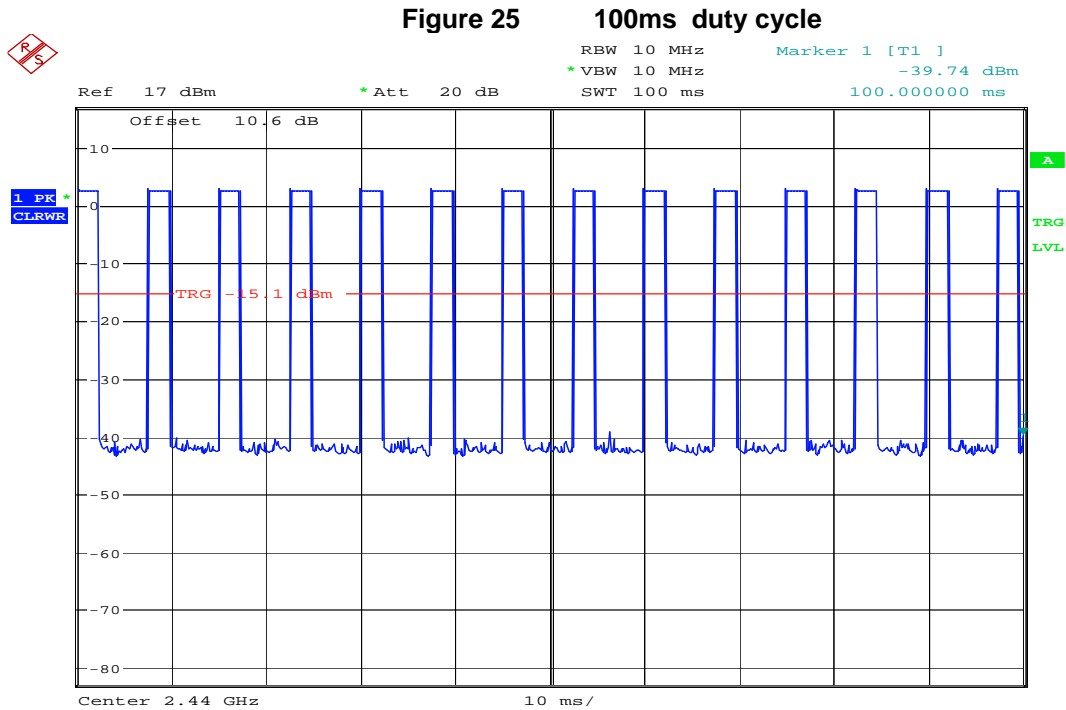
**Figure 24 On Time**



Date: 7.MAR.2011 06:03:06

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Date: 7.MAR.2011 05:54:25

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## APPENDIX G: CONDUCTED SPURIOUS EMISSIONS (TX )

### G.1. Base Standard & Test Basis

Base Standards	FCC 15.247 (d) RSS-210 Issue 8 A8.5
Test Basis	RF conducted as per FCC Publication 558074 RSS-210 Issue 8 A8.5
Test Method	RF conducted as per FCC Publication 558074 RSS-210 Issue 8 A8.5

### G.2. Specifications

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### G.3. Test Procedure

FCC Publication 558074

### G.4. Operating Mode During Test

The 1323X-MRB was tuned to a low, middle and high channel in continuous transmit mode and 100 % duty cycle at maximum rated RF output power (setting 14).

### G.5. Test Results Summary

Compliant.

TX Channel	Worst Case Spurious Frequency (MHz)	Emission Level Lower Than Carrier (dBc)
11	4816.14	-42.46
18	4857.76	-43.01
26	4940.99	-44.04

TX mode: The worst case spurious emission was 42.46 dB below the carrier at Channel 11.

All final reported values are corrected values

### G.6. Tested By

This testing was conducted in accordance with the ISO 17025: 2005 scope of accreditation, table 1; Quality Manual.

Name: Lixin Wang  
Function: EMC Technologist

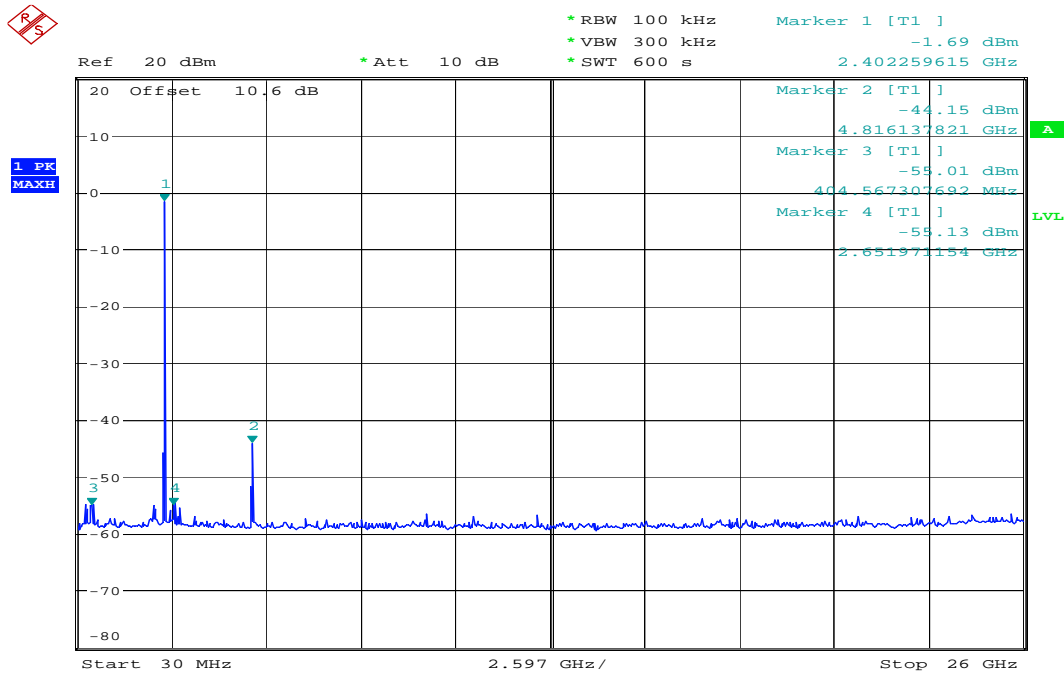
### G.7. Test date

March 15, 2011

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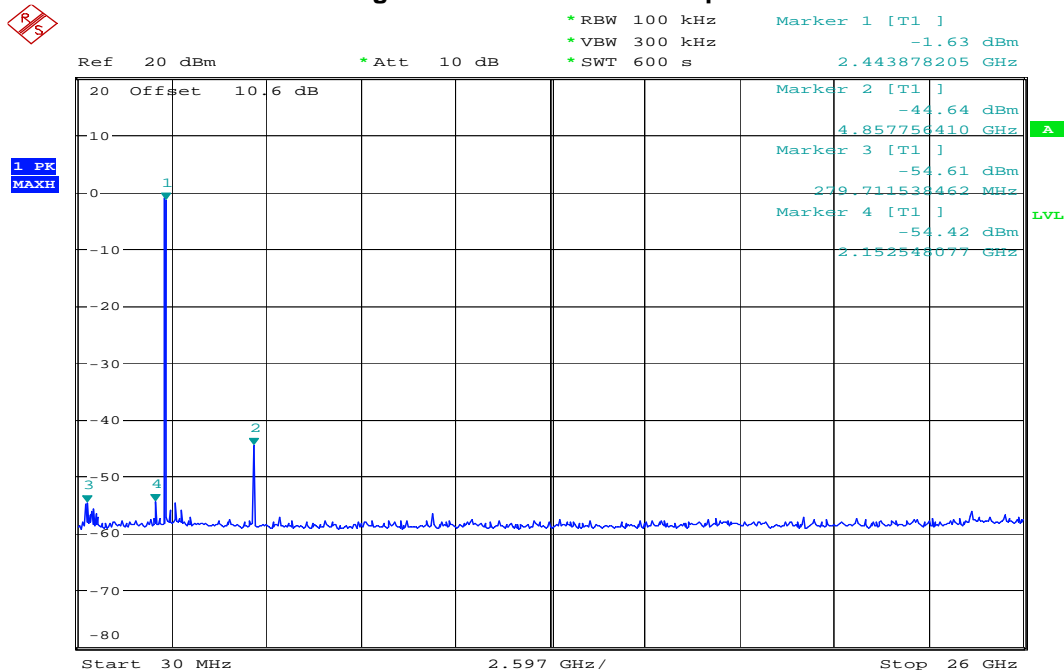
NTS Product Integrity Laboratory, 5151-47<sup>th</sup> Street N.E. Tel: 403-568-6605, Fax: 403-568-6970

**Figure 26 Conducted Spurious Ch11**



Date: 15.MAR.2011 12:38:48

**Figure 27 Conducted Spurious Ch18**

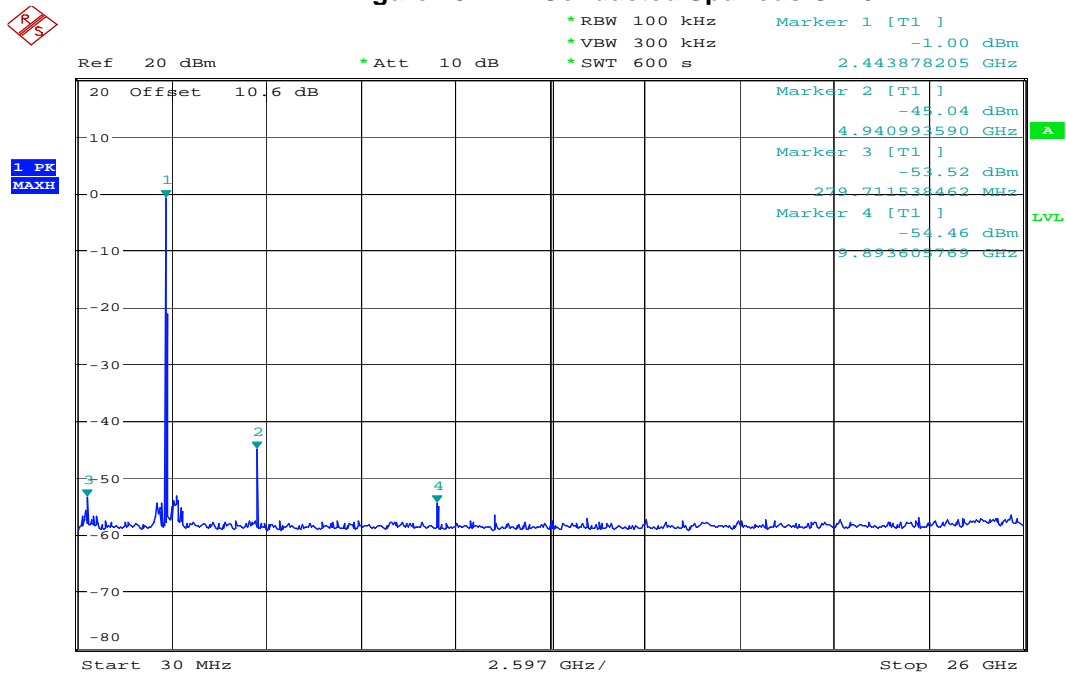


Date: 15.MAR.2011 13:03:24

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**Figure 28 Conducted Spurious Ch26**



Date: 15.MAR.2011 13:29:42

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## APPENDIX H: CONDUCTED SPURIOUS EMISSIONS BAND EDGE

### H.1. Base Standard & Test Basis

Base Standards	FCC 15.247 (d) RSS-210 Issue 8 A8.5
Test Basis	RF conducted as per FCC Publication 558074 RSS-210 Issue 8 A8.5
Test Method	RF conducted as per FCC Publication 558074 RSS-210 Issue 8 A8.5

### H.2. Specifications

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### H.3. Test Procedure

FCC Publication 558074

### H.4. Operating Mode During Test

The 1323X-MRB was tuned to a low and high channel in continuous transmit mode and 100 % duty cycle at maximum rated RF output power (setting 14).

### H.5. Test Results

Compliant.

Channel/Measurement	Frequency (MHz)	Emission Level Lower Than Carrier (dBc)
11 (Lower band edge)	2399.83	-41.56
26 (Upper band edge)	2483.50	-35.79

Worst case spurious emission was 35.79 dB below the carrier at Channel 26

All final reported values are corrected values

### H.6. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Lixin Wang  
Function: EMC Technologist

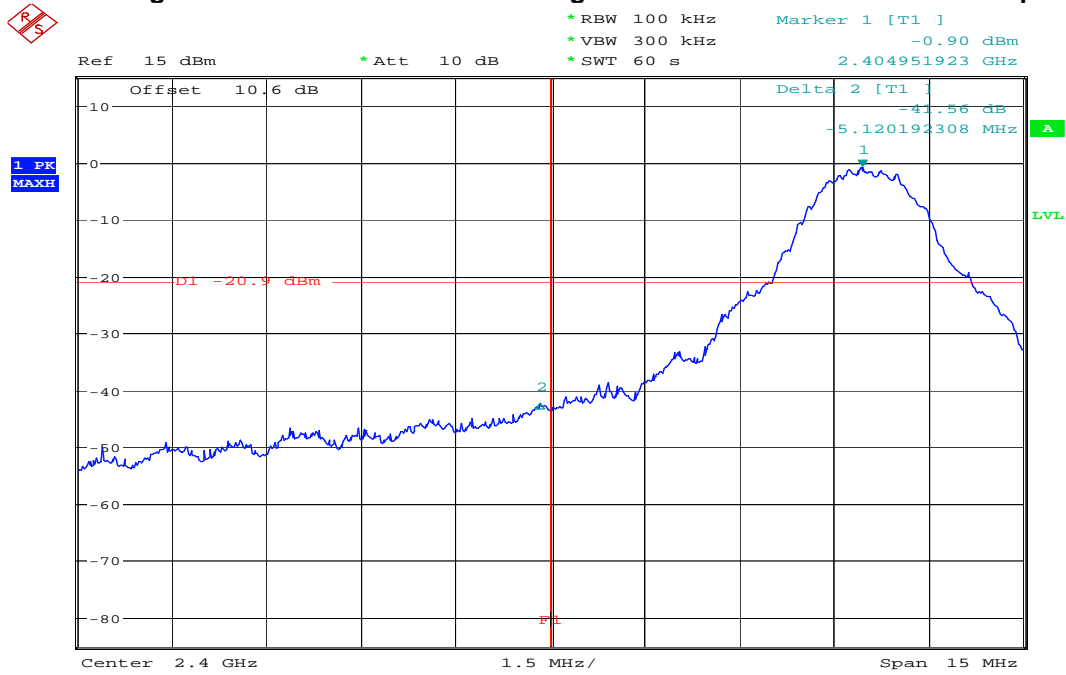
### H.7. Test date

March 15, 2011

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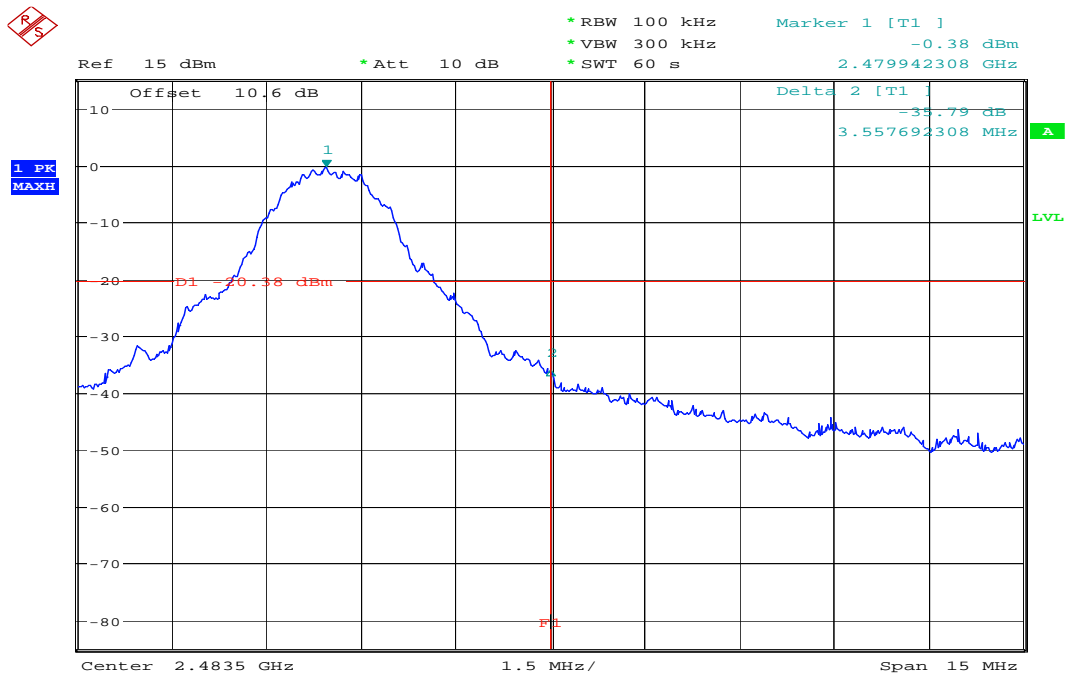
NTS Product Integrity Laboratory, 5151-47<sup>th</sup> Street N.E. Tel: 403-568-6605, Fax: 403-568-6970

**Figure 29 Conducted Band edge Measurement Ch11 with max Tx power**



Date: 15.MAR.2011 13:57:32

**Figure 30 Conducted Band edge Measurement Ch26 with max Tx power**



Date: 15.MAR.2011 13:52:08

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## APPENDIX I: RADIATED SPURIOUS EMISSIONS BAND EDGE

### I.1. Base Standard & Test Basis

<b>Base Standard</b>	FCC 15.247 (d) Part 15.209 – Radio Frequency Devices, Part 15.205 – Restricted bands of operation RSS 210 Issue 8 2.5 A8.5
<b>Test Basis</b>	FCC Publication 558074 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz,
<b>Test Method</b>	NTS Radiated Emissions Test Method SOP-CAG-EMC-02 and FCC Publication 558074

### I.2. Specifications: FCC 15.205 and RSS 210 Issue 8 2.2 Restricted bands of operation.

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
<sup>1</sup> 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	N/A
13.36–13.41	N/A	N/A	N/A

(b) The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

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### I.3. Test Procedure

RF radiated measurement at 3 meters distance.

FCC Publication 558074

Radiated emission test: Applies to harmonics/spurs that fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209. A pre-amp (and possibly a high-pass filter) is necessary for this measurement.

For measurements above 1 GHz, set RBW = 1 MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation, use the settings shown above, and then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation.

### I.4. Operating Mode During Test

The 1323X-MRB was tuned to the low and high channel in continuous transmit mode at maximum rated RF output power (Setting "14"). EUT was set to operating at 100% duty cycle.

### I.5. Test Results

Compliant

Channel	Frequency (MHz)	Detector	Band Edge Emission Level (dBμV/m)	Duty cycle Correction Factor (dB)	Band Edge Corrected Value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
11	2372.88	PK	60.49	N/A	60.49	73.98	13.49
11	2372.88	AV	47.48	-9.72	37.76	53.98	16.22
26	2483.50	PK	71.71	N/A	71.71	73.98	2.27
26	2483.50	AV	58.88	-9.72	49.16	53.98	4.82

Maximum emission measured was at channel 26 at 2483.5MHz. It has 2.27 dB margin to the 15.209 peak limits.

### I.6. Sample Calculations

Part 15.209 Average Limit:  $500 \mu\text{V/m} @ 3\text{m} = 20 \cdot \log(500) = 53.98 \text{ dB}\mu\text{V/m}$ , Peak limit =  $73.98 \text{ dB}\mu\text{V/m}$

Band Edge Emission Level or Carrier Emission Level (dBμV/m) = Measured level (dBμV) + Receive antenna factor (dB) + Receive cable loss (dB) – LNA gain (dB)

Average Band Edge Corrected value (dBμV/m) = Band Edge Emission Level (dBμV/m) - Duty cycle correction factor (dB)

**Note:** Duty Cycle Correction Factor was used for Average measurements per FCC Publication 558074.

### I.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Lixin Wang  
Function: EMC Technologist

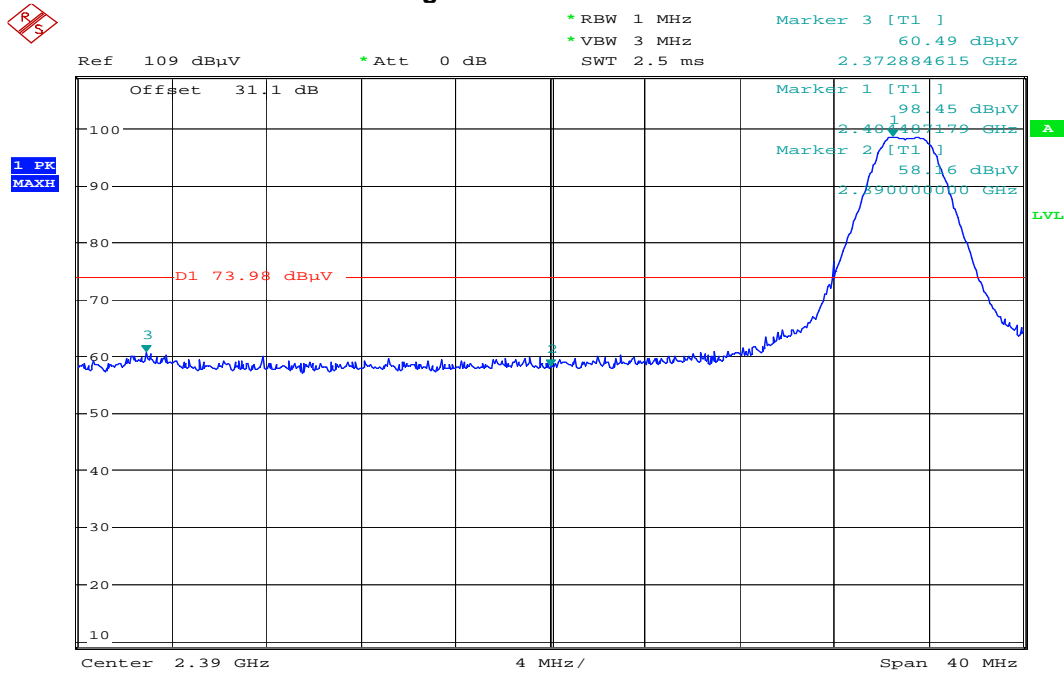
### I.8. Test date

March 07, 2011

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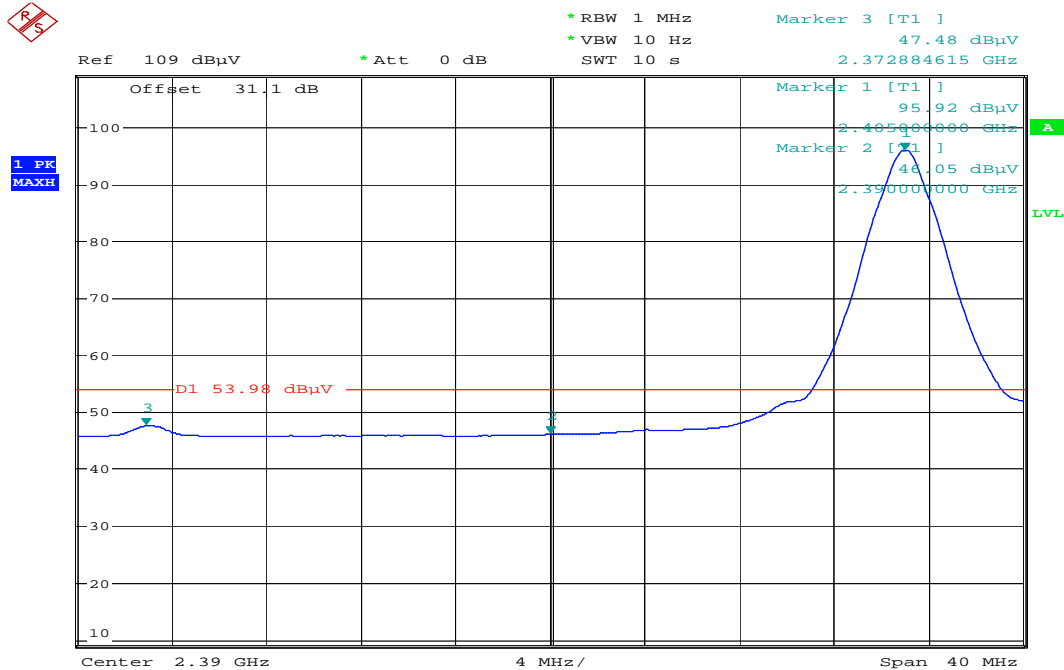
NTS Product Integrity Laboratory, 5151-47<sup>th</sup> Street N.E. Tel: 403-568-6605, Fax: 403-568-6970

**Figure 31 Low Channel Peak**



Date: 7.MAR.2011 08:53:49

**Figure 32 Low Channel Video Average**



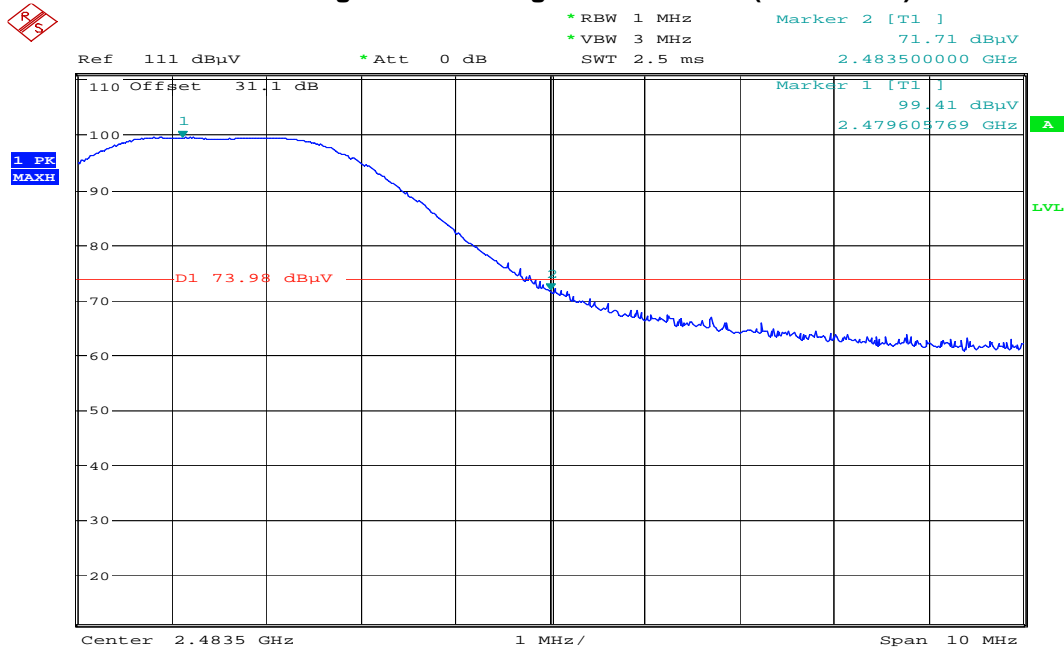
Date: 7.MAR.2011 08:55:23

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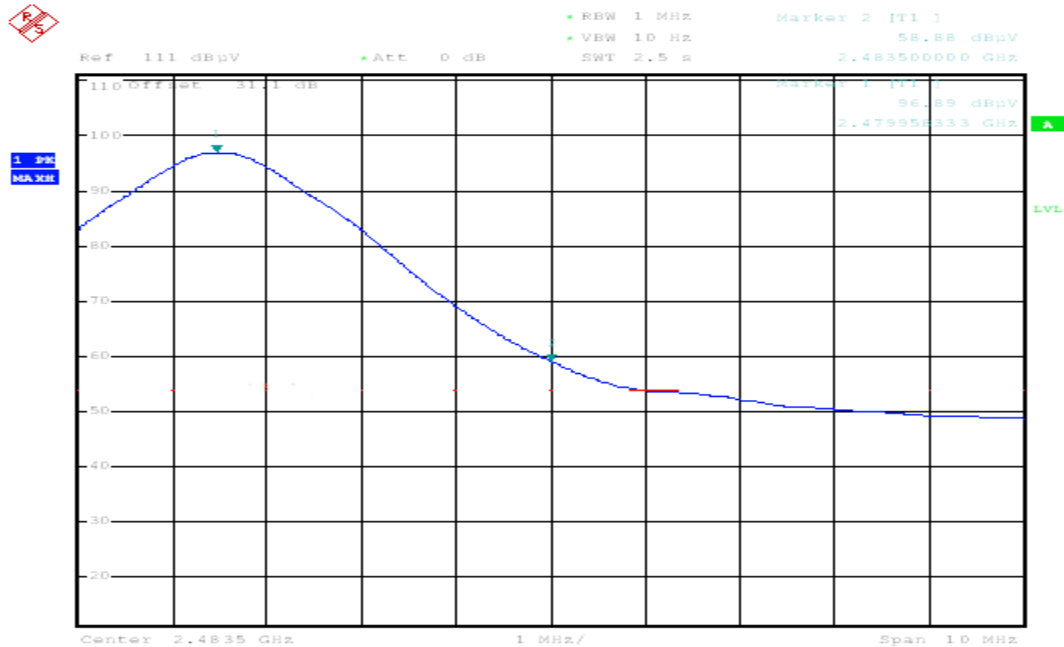


**Figure 33 High Channel Peak (Channel 26)**



Date: 7.MAR.2011 07:40:44

**Figure 34 High Channel Video Average (Channel 26)**



Date: 7.MAR.2011 07:43:29

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## APPENDIX J: RADIATED SPURIOUS EMISSIONS (TX AND RX)

### J.1. Base Standard & Test Basis

<b>Base Standard</b>	FCC 15.247(d) Part 15.209 – Radio Frequency Devices, Part 15.205 – Restricted bands of operation Part 15.109 – Radiated Emission Limits for Un-intentional Radiators RSS 210 Issue 8 2.5 and A8.5 RSS Gen Issue 3 4.10 and 6 for Receiver Spurious Emission ICES-003 Issue 4 Emission test method and limits for digital apparatus
<b>Test Basis</b>	ANSI C63.4: 2009 FCC Publication 558074
<b>Test Method</b>	NTS Radiated Emissions Test Method SOP-CAG-EMC-02, RSS Gen Issue 3, FCC Publication 558074

### J.2. Specifications:

#### J.2.1 FCC 15.205 and RSS 210 Issue 8 2.2 Restricted bands of operation.

(a) Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
<sup>1</sup> 0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	N/A
13.36–13.41	N/A	N/A	N/A

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(b) The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

## J.2.2 Specifications FCC Part 15.109 and ICES-003

Frequency (MHz)	FCC Part 15 <sup>1</sup> /ICES003 Class B at 10m distance (dBμV/m)
30 – 230	30.00 QP @ 10m
230 – 1000	37.00 QP @ 10m

Note: FCC Part 15.109(g): As an alternative to the radiated emission limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in the Third Edition of International Electrotechnical Commission ("IEC"), International Special Committee on Radio Interference (CISPR) Pub. 22 (1997), "Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement."

## J.2.3 Specifications RSS Gen Issue 3 section 4.10 and 6 for RX spurious emissions

Spurious Frequency (MHz)	Field Strength (microvolt/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960	500

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### J.3. Test Procedure

#### J.3.1 Tx Spurious measurements

FCC Publication 558074:

Radiated emission test Applies to harmonics/spurs that fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209. A pre-amp (and possibly a high-pass filter) is necessary for this measurement.

For measurements above 1 GHz, set RBW = 1 MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation, use the settings shown above, and then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation. EUT was tested from 30MHz to 26 GHz for Tx mode.

#### J.3.2 RSS Gen Issue 3, 4.10 Receiver Spurious Emission

The receiver shall be operated in the normal receive mode near the mid-point of the band over which the receiver is designed to operate.

Unless otherwise specified in the applicable RSS, the radiated emission measurement is the standard measurement method (with the device's antenna in place) to measure receiver spurious emissions.

Radiated emission measurements are to be performed using a calibrated open-area test site. As an alternative, the conducted measurement method may be used when the antenna is detachable. In such a case, the receiver spurious signal may be measured at the antenna port.

For either method, the search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tuneable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz.

For emissions below 1 GHz, measurements shall be performed using a CISPR quasi-peak detector and the related measurement bandwidth. As an alternative to CISPR quasi-peak measurement, compliance with the emission limit can be demonstrated using measuring equipment employing a peak detector with the same measurement bandwidth as that for CISPR quasi-peak measurements. Above 1 GHz, measurements shall be performed using an average detector and a resolution bandwidth of 300 kHz to 1 MHz.

The EUT was tested from 30 MHz to 10 GHz for Rx mode.

### J.4. Operating Mode During Test

The 1323X-MRB was tuned to the low, mid and high channel in continuous transmit mode at maximum rated RF output power (Setting 14) for all TX spurious emissions. EUT was set to operate at 100% duty cycle.

For receiver spurious emissions the 1323X MRB was tuned to the receive only mode at mid channel.

### J.5. Test Results

Compliant.

#### J.5.1 Rx mode for RSS Gen Issue 3 section 4.10 and 6 for RX emissions


Antenna Polarization	Frequency (MHz)	Detector	Radiated emission level (dBμV/m)	Limit type	Limit (dBμV/m)	Margin (dB)
H-pol	2375.12	Average	43.65	Average	53.98	10.33

The worst case Rx spurious emission was 43.65 dBμV/m at 3m distance with average detector at 2375.12 MHz. It has 10.33 dB margin to the average limits.

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## J.5.2 Tx mode 30-1000 MHz Test Result FCC 15.109 and ICES-003



Product Integrity Laboratory

V2.5

Project Number: C-0084542

Model: Freescale - 1323X MRB

Comments: 120 VAC, 60 Hz. RCM motherboard with daughterboard. Tx Mid Channel at full power, 100% Duty Cycle

Tester: David Raynes

Test ID: RE02-10m-0084542

Standard: FCC15_B		Measurement Distance:		<1GHz	10	meters				
				>1GHz	3	meters				

Antenna Polarization	Frequency (MHz)	Measured Level (dBµV)	Measurement Detector	Correction Factors (dB/m)	Emission Level (dBµV/m)	Limit Line	Limit (dBµV/m)	Margin (dB)	Mast Height (cm)	Turntable Angle (degrees)
Horizontal	31.2317	19.69	Quasi Peak	-8.84	10.85	Quasi Peak	29.54	18.69	369.5	166.0
Horizontal	380.6799	24.13	Quasi Peak	-8.56	15.57	Quasi Peak	35.56	19.99	298.0	154.2
Horizontal	550.3267	23.80	Quasi Peak	-5.34	18.46	Quasi Peak	35.56	17.10	288.4	249.2
Vertical	94.6901	30.13	Quasi Peak	-15.64	14.49	Quasi Peak	33.06	18.57	169.0	353.9
Vertical	130.8625	26.39	Quasi Peak	-13.03	13.36	Quasi Peak	33.06	19.70	119.2	201.9
Vertical	545.4653	23.75	Quasi Peak	-5.41	18.34	Quasi Peak	35.56	17.22	344.7	321.2

1. Positive Margin indicates a Pass

2. EUT faces normal to antenna at 10.6° turntable position.

3. Correction Factors include all factors between the receiving antenna and the receiver, including the antenna.

Both RCM and REM motherboard were tested and worst case test results reported.

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### J.5.3 TX Mode 1-25 GHz Test Result FCC 15.205 and RSS 210

Channel	Antenna Polarization	Frequency (MHz)	Detector	Radiated emission level (dBμV/m)	Duty Cycle Correction Factor (dB)	Corrected Level (dBμV/m)	Limit type	Limit (dBμV/m)	Margin (dB)
11	H-pol	4809.05	PK	52.38	N/A	N/A	PK	73.98	21.60
	H-pol	12022.33	PK	55.32	N/A	N/A	PK	73.98	18.66
	V-pol	4809.00	PK	49.59	N/A	N/A	PK	73.98	24.39
18	H-pol	4880.97	PK	53.67	N/A	N/A	PK	73.98	20.31
	H-pol	12202.05	PK	53.68	N/A	N/A	PK	73.98	20.30
	V-pol	4879.10	PK	51.19	N/A	N/A	PK	73.98	22.79
26	H-pol	4960.85	PK	54.14	N/A	N/A	PK	73.98	19.84
	H-pol	12398.17	PK	52.46	N/A	N/A	PK	73.98	21.52
	V-pol	4958.72	PK	52.65	N/A	N/A	PK	73.98	21.33
11	H-pol	4809.88	AV	43.22	-9.72	33.50	AV	53.98	20.48
	H-pol	12026.87	AV	41.78	-9.72	32.06	AV	53.98	21.92
	V-pol	4810.00	AV	39.94	-9.72	30.22	AV	53.98	23.76
18	H-pol	4879.90	AV	45.01	-9.72	35.29	AV	53.98	18.69
	H-pol	12202.02	AV	40.84	-9.72	31.12	AV	53.98	22.86
	V-pol	4879.93	AV	42.19	-9.72	32.47	AV	53.98	21.51
26	H-pol	4959.90	AV	45.81	-9.72	36.09	AV	53.98	17.89
	H-pol	12401.98	AV	38.30	-9.72	28.58	AV	53.98	25.40
	V-pol	4959.97	AV	44.15	-9.72	34.43	AV	53.98	19.55

Worst case spurious emission was 36.09 dBμV/m at 4959.90 MHz with horizontal polarization in Channel 26. It has 17.89 dB margin to the average limit.

**Note:** Plots were not provided in order to reduce file size

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## J.6. Sample Calculations

Part 15.209

Average Limit for above 960 MHz =  $500 \mu\text{V/m}$  @ 3m =  $20 \cdot \log(500) = 53.98 \text{ dB}\mu\text{V/m}$

Peak Limit for above 960 MHz = Average Limit + 20 (dB) =  $73.98 \text{ dB}\mu\text{V/m}$

Total correction factor (dB) = Receive antenna factor (dB) + Receive cable loss (dB) + High pass filter loss (dB) – LNA gain (dB)

Radiated emission level (dB $\mu\text{V/m}$ ) = Measured level (dB $\mu\text{V}$ ) + Total correction factor (dB)

Average Spurious Corrected value (dB $\mu\text{V/m}$ ) = Radiated Emission Level (dB $\mu\text{V/m}$ ) - Duty cycle correction factor (dB)

## J.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Lixin Wang  
Function: EMC Technologist

David Raynes  
Senior EMC Technologist

## J.8. Test date

Test started: March 07, 2011      Test completed: March 11, 2011.

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## APPENDIX K: TEST EQUIPMENT LIST

Descriptions	Manufacturer	Type/Model	Serial #	Cal Due	Cal Date
Table Top LISN	EMCO	3825	CG0367	29JAN12	29JAN09
Test Receiver	Rohde & Schwarz	ESMI	CG0433	04MAY11	04MAY10
			CG0434	04MAY11	04MAY10
Bilog Antenna	Teseq	CBL 6112D	CG1177	14SEP12	14SEP10
HPIB Extender	HP	37204	CG0181	N/A	N/A
Mast Controller	EMCO	2090	CG0179	N/A	N/A
Turntable Controller	EMCO	2090	CG0178	N/A	N/A
Horn Antenna (Rx) 1 GHz – 18 GHz	EMCO	3115	CG0368	08SEP11	08SEP09
Standard Gain Horn (Rx) 18 GHz – 26.5 GHz	EMCO	3160-09	CG0075	N/A <sup>(1)</sup>	27NOV01
High pass filter f >1000 MHz	MicroTronics	HPM14576	CG0963	13NOV11	13NOV09
High pass filter f >2800 MHz	MicroTronics	HPM50111	CG0964	N/A	N/A
LNA 1 GHz - 18 GHz	Miteq	JSD00121	CG0761	13NOV11	13NOV09
LNA 18 GHz - 26.5 GHz	Miteq	JSD00119	CG0482	02OCT11	02OCT09
Signal Analyzer 20 Hz – 26.5 GHz	Rohde & Schwarz	FSQ	CG1462	20DEC11	20DEC10
Spectrum Analyzer	HP	8564E	CG0352	01DEC11	01DEC10
Spectrum Analyzer	Agilent	E4446A	CGRenta -11292	09SEP12	09SEP10
Attenuator	Weinschel	10 dB	19981	N/A	N/A
RF cable	Sucoflex	104	115776	N/A	N/A
LNA DC Power Supply	Xantrex	LXO 30-2	CG0493	N/A	N/A
HPIB Extender	HP	37204	CG0110	N/A	N/A
Turntable and Mast Controller	EMCO	2090	CG0161	N/A	N/A

(1): As per manufacturer recommend, this item does not require periodic calibration. Its electromagnetic performance is almost exclusively depended on the physical dimension of the horn. A thorough mechanical check is all that is needed to guarantee the antenna performance.

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