Registration No. 440

Certification Test Report

CFR 47 FCC Part 15, Subpart C Section 15.247
Industry Canada RSS 210, Issue 7

Freescale Semiconductor
MC1322x Network Node

FCC ID # RUN1322X-NCB
IC # 6744A-1322XNCB
Project Code CG-758

(Report CG-758-RA-1-1)
Revision: 1

June 16, 2008

Prepared for: Freescale Semiconductor

Author: Glen Moore
Wireless/EMC Manager

Approved by: Nick Kobrosly
Lab Manager

Report Summary

Test Facility:	**National Technical Systems, Canada** Product Integrity Laboratory 5151-47th Street, N.E. Calgary Alberta T3J 3R2
Accreditation Numbers:	FCC 101386 IC 3978A-1 **Accredited by Standards Council of Canada** Accredited Laboratory No. 440 Conforms with requirements of CAN−P−4D (ISO/IEC 17025) CLIENTS SERVED: All interested parties FIELDS OF TESTING: Electrical/Electronic, Mechanical/Physical ACCREDITATION DATE:: 2002−03−20 VALID TO: 2009−03−20
Applicant:	Freescale Semiconductor 2100 E Elliot Rd MS EL542 Tempe, AZ 85284 USA
Customer Representative:	Name: Mark R Williams Phone #: 480-413-4730 Email Address: Mark.R.Williams@freescale.com

EUT Description

EUT Description	Manufacturer	Model	Revision	Serial Number
IEEE 802.15.4 2.4 GHz ZigBee Network Node Evaluation Board	Freescale Semiconductor	1322x-NCB	N/A	N/A

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)	RSS-Gen Issue 2 7.2.2
B	6 dB Bandwidth	No	No	No	Pass	FCC Subpart C 15.247 (a) (2)	RSS 210 Issue 7 A8.2 (a)
C	Occupied Bandwidth (99% emission bandwidth)	No	No	No	N/A	N/A	RSS-Gen Issue 2 4.6.1
D	Peak Power Output	No	No	No	Pass	FCC Subpart C 15.247 (b) (3)	RSS 210 Issue 7 A8.4 (4)
E	Power Spectral Density	No	No	No	Pass	FCC Subpart C 15.247 (e)	RSS 210 Issue 7 A8.2 (b)
F	Duty Cycle Correction Factor	No	No	No	N/A	FCC Subpart C 15.35 (c)	RSS-Gen Issue 2 4.5
G	Conducted Spurious Emissions	No	No	No	Pass	FCC Subpart C 15.247 (d)	RSS 210 Issue 7 A8.5
H	Conducted Spurious Emissions Band Edge	No	No	No	Pass	FCC Subpart C 15.247 (d)	RSS 210 Issue 7 A8.5
I	Radiated Spurious Emissions Band Edge	No	No	No	Pass	FCC Subpart C 15.247, 15.205	RSS 210 Issue 7 2.6, A8.5
J	Radiated Spurious Emissions (TX and RX)	No	No	No	Pass	FCC Subpart C 15.247, 15.205	RSS 210 Issue 7 2.6, A8.5

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

Prepared By: gmoore Digitally signed by gmoore DN: cn=gmoore, c=US, o=nts, email=glen.moore@ntscorp.com Date: 2008.08.01 17:41:34 -06'00'
_____
Glen Moore
EMC / Wireless Manager

Reviewed By: _____
Deniz Demirci
Senior EMC / Wireless Technologist

Approved By: Robyn Zuehlke 2008.08.01 17:49:07 -06'00'
_____
Robyn Zuehlke
Quality Management Representative

Table of Contents

Register of revisions

Revision	Date	Description of Revisions
1	June 17, 2008	Final release

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 ZigBee MC1322x-NCB Evaluation Board from Freescale Semiconductor to FCC Part 15 Subpart C section 15.247 for DTS transmitter and the equivalent sections of Industry Canada's RSS 210, Issue 7

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

Description of EUT

	Name	Model	Revision	Serial Number
EUT	MC1322x-NCB	MC1322x-NCB	N/A	N/A
Power Supply	PHIHONG	PSA05R-090	N/A	I44401076A4
Classification	Mobile			
Antenna	4.4 dbi			
Modulation	0-QPSK			
EUT Size (H x W x D) (in inches)	1 ¾ x 7 x 4 ½			
EUT Weight (in pounds)	0.25			
Channels/Frequency Range	15 channels, 2405 MHz -2480 MHz			
Functional Description	The MC1322x-NCB is an evaluation board for developing IEEE® 802.15.4/ZigBee™ software and applications ranging from simple proprietary point-to-point connectivity to complete ZigBee mesh networking on the QE microcontroller platform.			

2.1.1 EUT POWERS

Voltage	3 VDC 120 VAC 60 Hz with PHIHONG Switching Power Supply Model :PSA05R-090
Number of Feeds	1 (1 Hot, 1 Return)

2.2 EUT CABLES

Quantity	Model/Type	Routing		Shielded / Unshielded	Description	Cable Length (m)
		From	To			
1	Power	Power Supply	EUT	Unshielded	Permanent connection to power supply	1.8
1	Serial	EUT	Computer	Unshielded	Serial	1.8

2.3 MODE OF OPERATION DURING TESTS

The MC1322x-NCB was tested in PRBS* Tx and Receive modes. The EUT was tuned to a low, middle, and high channel in PRBS Tx modes to perform power and occupied bandwidth tests. The EUT was tuned to a low, middle, and high channel in PRBS Tx and Receive modes to perform spurious/harmonic tests. For AC conducted emissions the device was tuned to its center frequency. While transmitting the EUT was setup to operate at the intended maximum power output available to the end user. For all test cases pre-scans were completed in all modes to determine worst case levels.

* Pulse Pseudo Random Binary Sequence (PRBS)

3.0 SUPPORT EQUIPMENT

3.1 CONFIGURATION

Dell Inspiron Laptop computer s/n: TW-0791UH-12800-12G-5260 was used for setting up the EUT.
Telnet port settings: Bits per second: 38400, Data bits: 8, Parity: None, Stop bits: 1, Flow control: None

Computer was used for configuring the EUT only and it was not connected during the tests.

3.2 TEST BED/PERIPHERAL CABLES

NA

4.0 TEST ENVIRONMENT

4.1 NORMAL TEST CONDITIONS

Temperature:	20 – 23 °C
Relative Humidity:	28 – 35 %
Atmospheric pressure:	883 – 890 mbar
Nominal test voltage:	120 VAC 60Hz

The values are the limits registered during the test period.

APPENDICES

APPENDIX A: POWER LINE CONDUCTED EMISSION

A.1. Base Standard & Test Basis

Base Standard	FCC PART 15.207 (a) RSS-Gen Issue 2 7.2.2
Test Basis	ANSI C63.4-2003
Test Method	Conducted Emissions 150 kHz – 30 MHz Test Method SOP COR EMC 04

A.2. Specifications

Frequency	Limit	
	Quasi-Peak	Average
MHz	dBμV	dBμV
0.150 – 0.500	66 to 56[1]	56 to 46[1]
0.500 – 5.00	56	46
5.00 – 30.00	60	50

Note 1: decrease with the logarithm of the frequency

A.3. Deviations

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

A.4. Test Results

Product Integrity Laboratory **V2.5**

Project Number:	CG-758	**Tester:**	Lixin Wang
Model:	Freescale MC1322X Network Node	**Test ID:**	CE02tc-10m-758
Comments:	Conf03:120VAC,60Hz.Ch18,MC1322X Network node,Modulated TX max power(12),Power supply:Phihong Model:PSA05R-090		

Standard: FCC15.207

Voltage/Line	Frequency (MHz)	Measurement Detector	Measured Value (dBμV)	Correction Factors (dB)	Emission Level (dBμV)	Limit Type	Limit (dBμV)	Margin (dB)
AC 120V Line1A	0.16	QP	29.89	12.15	42.04	QP	65.28	**23.24**
AC 120V Line1A	0.48	QP	21.67	10.84	32.51	QP	56.35	**23.84**
AC 120V Line1A	0.68	QP	20.12	10.77	30.89	QP	56.00	**25.11**
AC 120V NeutralA	0.16	QP	33.04	12.08	45.12	QP	65.35	**20.23**
AC 120V NeutralA	0.49	QP	24.08	10.76	34.84	QP	56.22	**21.38**
AC 120V NeutralA	0.65	QP	24.31	10.68	34.99	QP	56.00	**21.01**
AC 120V Line1A	0.165	AV	20.57	12.21	32.78	AV	55.23	**22.45**
AC 120V Line1A	0.474	AV	14.89	10.84	25.73	AV	46.45	**20.72**
AC 120V Line1A	0.677	AV	14.20	10.77	24.97	AV	46.00	**21.03**
AC 120V NeutralA	0.164	AV	24.87	12.07	36.94	AV	55.28	**18.34**
AC 120V NeutralA	0.481	AV	18.64	10.76	29.40	AV	46.33	**16.93**
AC 120V NeutralA	0.656	AV	18.06	10.68	28.74	AV	46.00	**17.26**

The highest emission measured was 29.40 dBμV with average detector at 481 kHz. It has 16.93 dB margin to the FCC Part 15.207 and RSS-Gen Issue 2 7.2.2 limits

A.5. Observations

None

A.6. Deviations from Normal Operating Mode During Test

None

A.7. Sample Calculation

Corrected Value = Measured Value + Correction Factors
Margin = Limit – Corrected Value

A.8. Test Data & Photographs

The test data and photographs collected during this test appear following this page.

A.9. 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

A.10. Test Date

Test started: June 3, 2008 Test ended: June 3, 2008

Figure 1 Conducted Emission 120 VAC Line 150 kHz – 30 MHz Quasi-peak Detector

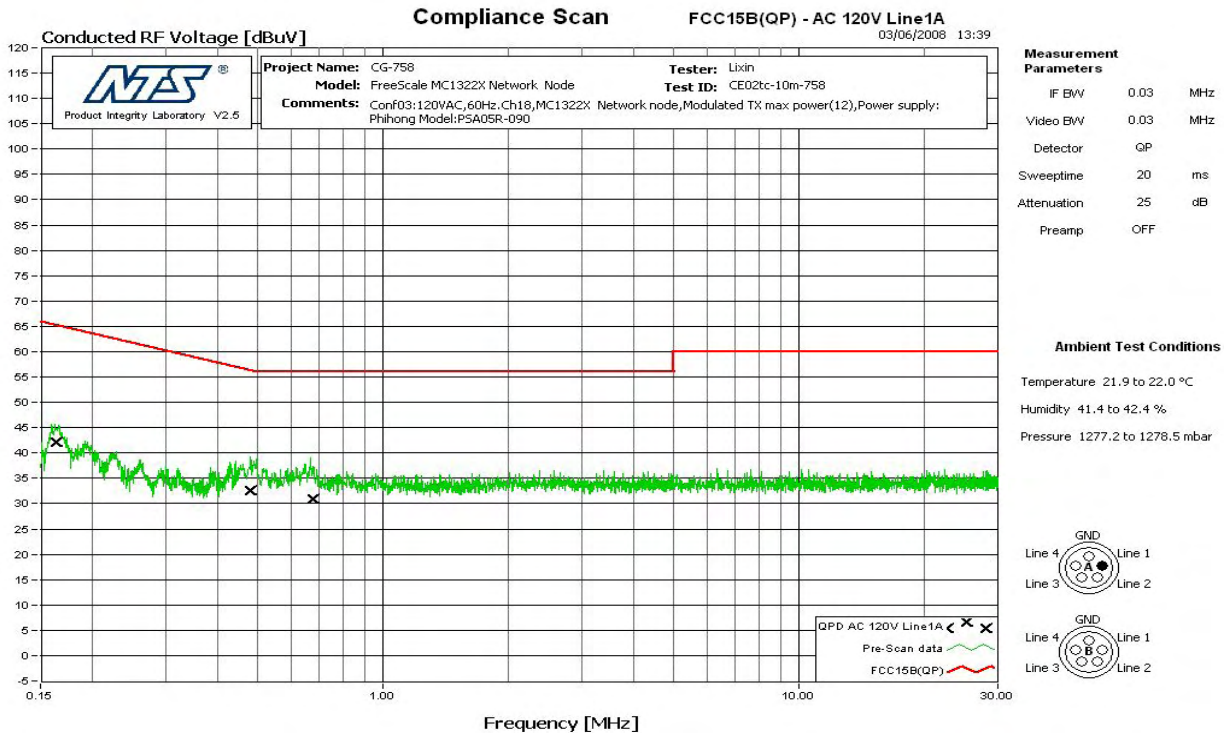


Figure 2 Conducted Emission 120 VAC Return 150 kHz – 30 MHz Quasi-peak Detector

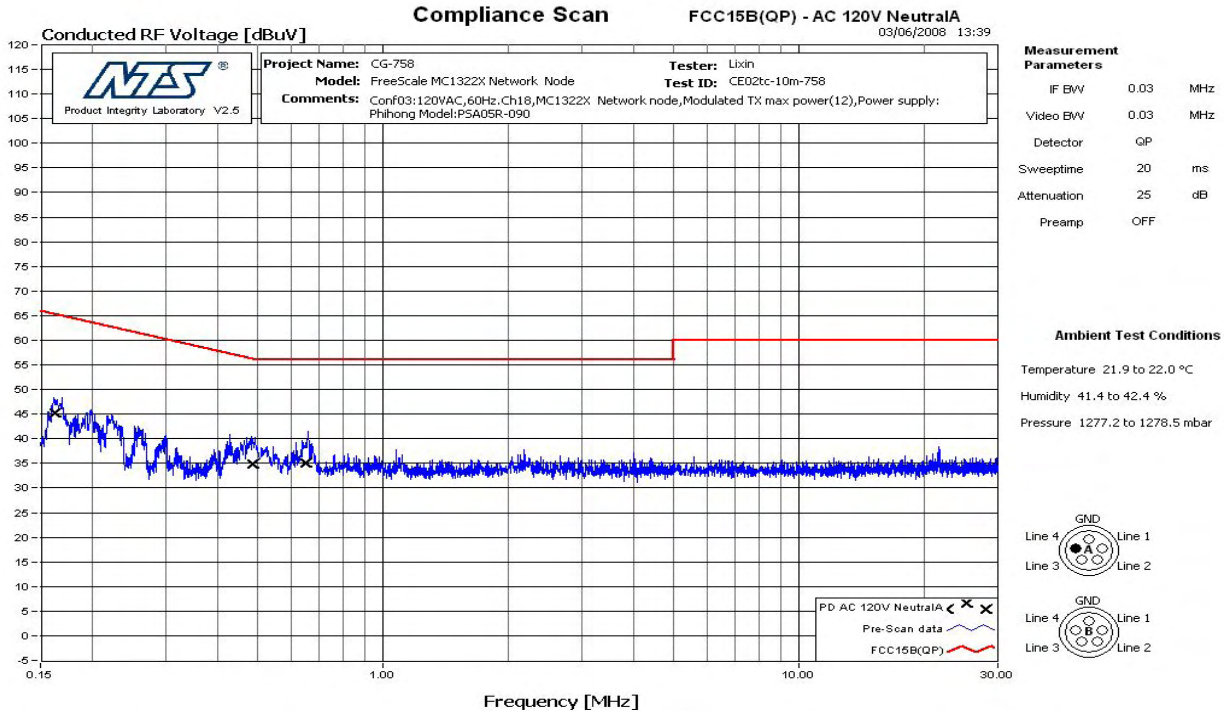


Figure 3 Conducted Emission 120 VAC Line 150 kHz – 30 MHz Average Detector

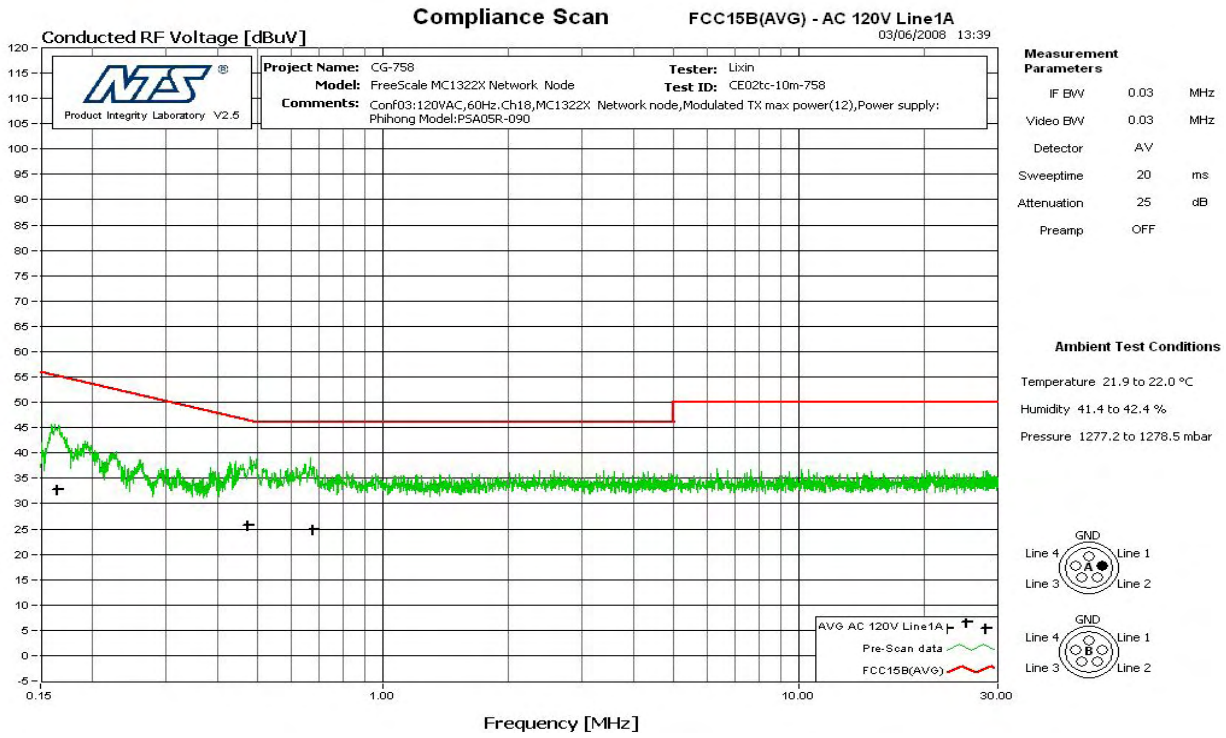
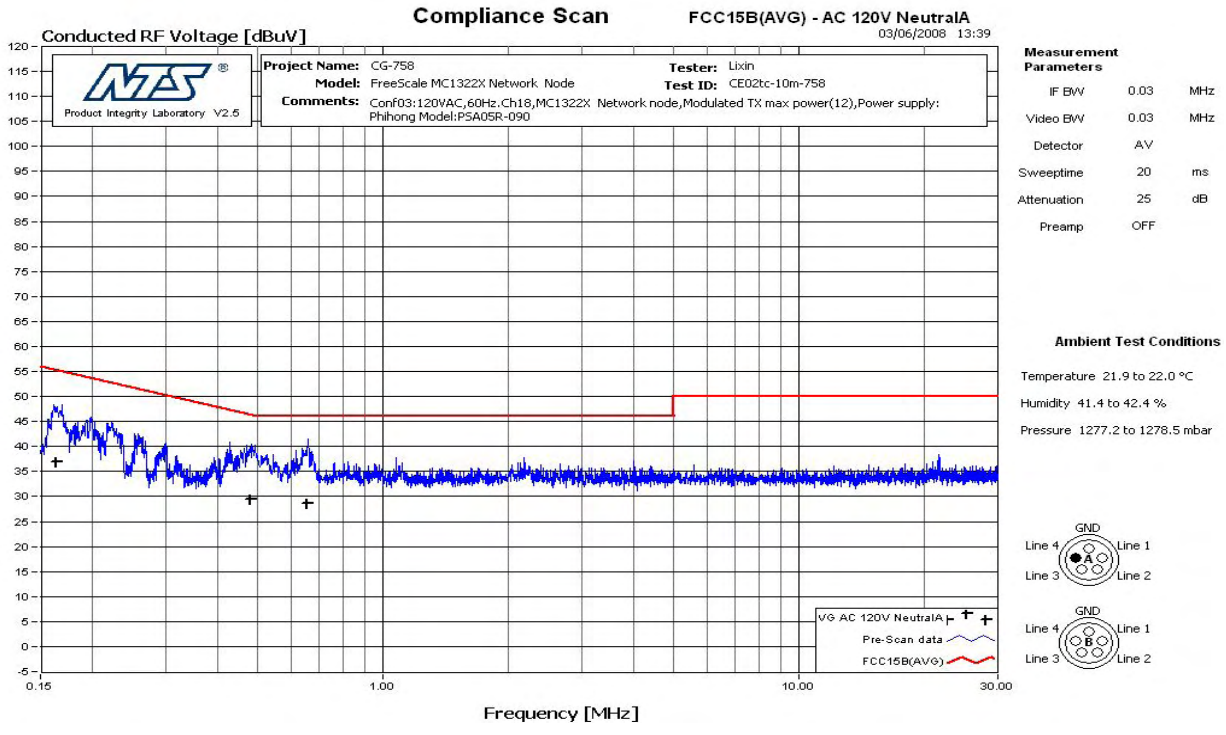


Figure 4 Conducted Emission 120 VAC Return 150 kHz – 30 MHz Average Detector



APPENDIX B: 6 DB BANDWIDTH

B.1. Base Standard & Test Basis

Base Standard	FCC PART 15.247 (a) (2) RSS 210 Issue 7 A8.2 (a)
Test Basis	FCC Publication 558074 RSS-Gen Issue 2 4.6.2
Test Method	Conducted measurement as per FCC Publication 558074 and RSS 210 Issue 7 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 .

B.5. Test Results

The EUT is in compliance with the requirement as specified above

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
11	2405	1.362
18	2440	1.122
26	2480	1.162

Power supply variation within 85 % (102 VAC) to 115 % (138 VAC) of nominal value has no measurable influence on the carrier frequency and carrier levels.

B.6. Operating Mode During Test

The MC1322X Network Node was tuned to a low, middle, and high channel operating at maximum rated RF output power in PRBS Tx mode.

B.7. Tested By

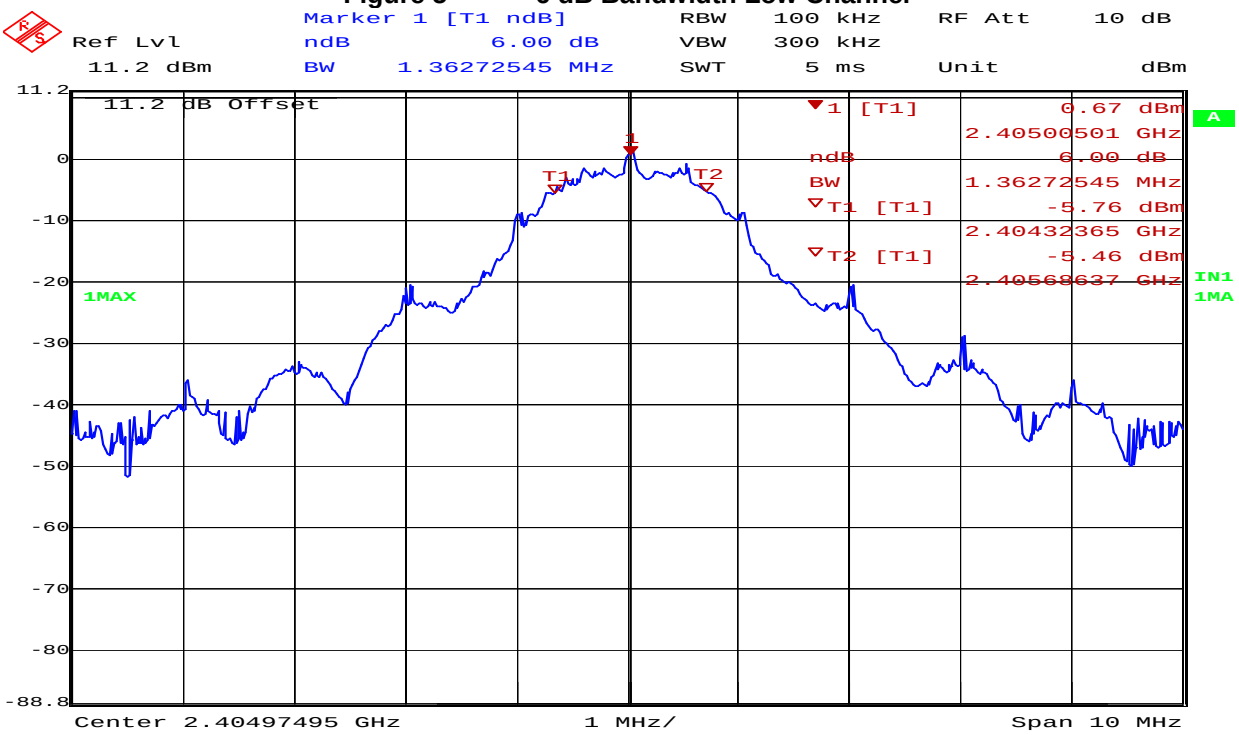
This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Glen Moore
Wireless/EMC Manager

B.8. Test Date

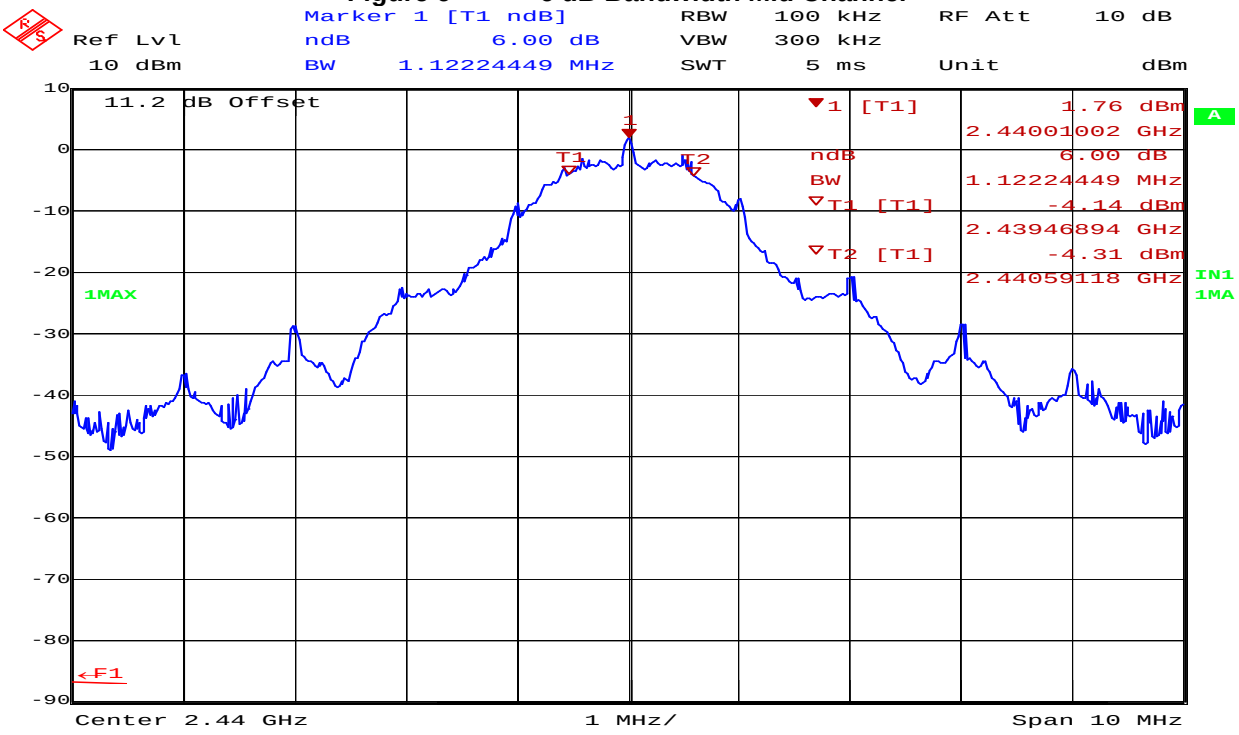
Test started: June 16, 2008 Test ended: June 16, 2008

Figure 5 6 dB Bandwidth Low Channel



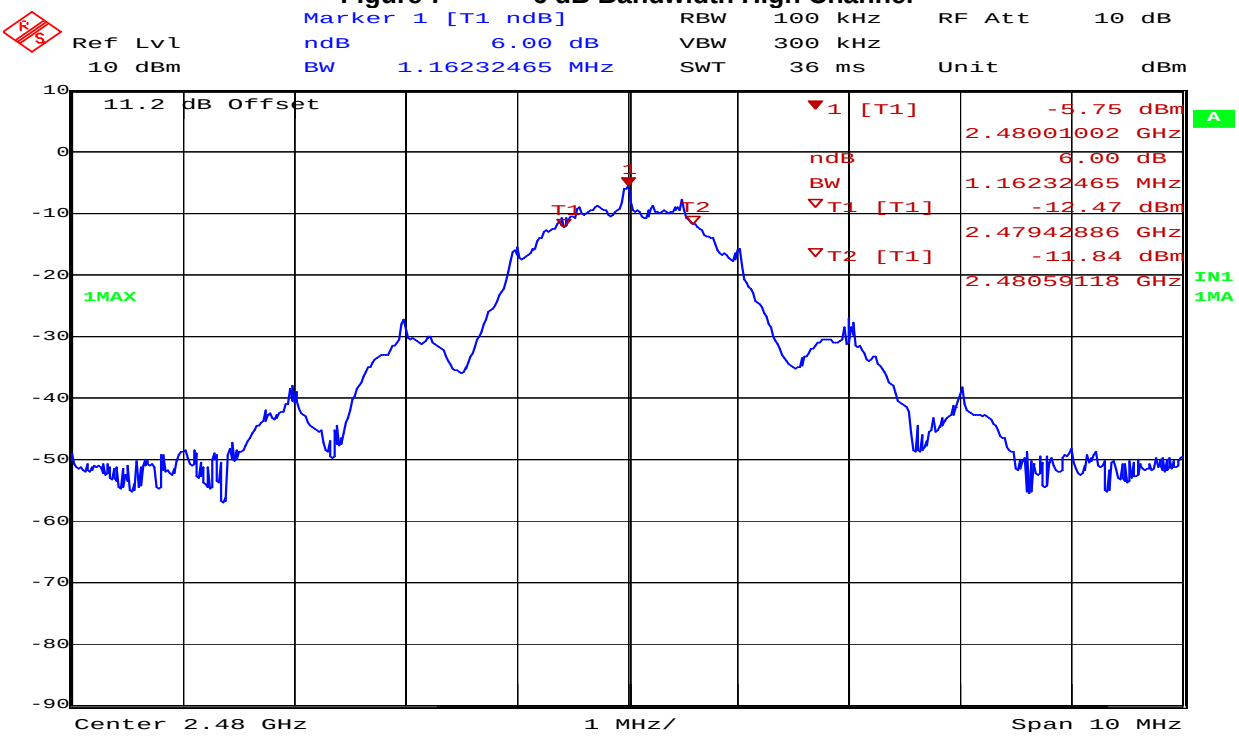
Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 11, PRBS Mode
Date: 16.JUN.2008 10:00:47

Figure 6 6 dB Bandwidth Mid Channel



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 18, PRBS Mode
Date: 16.JUN.2008 11:31:36

Figure 7 6 dB Bandwidth High Channel



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 26, PRBS Mode
Date: 16.JUN.2008 12:35:05

APPENDIX C: OCCUPIED BANDWIDTH

C.1. Base Standard & Test Basis

Base Standard	RSS-Gen Issue 2 4.6.1
Test Basis	RSS-Gen Issue 2 4.6.1
Test Method	Conducted measurement as per RSS-Gen Issue 2 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. Deviations

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

C.4. Test Procedure

RSS-Gen Issue 2

C.5. Test Results

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
11	2405	2.725
18	2440	2.825
26	2480	2.505

Power supply variation within 85 % (102 VAC) to 115 % (138 VAC) of nominal value has no measurable influence on the carrier frequency and carrier levels.

C.6. Operating Mode During Test

The MC1322x Network Node was tuned to a low, middle, and high channel operating at maximum rated RF output power in PRBS Tx mode.

C.7. Sample Calculation

NA

C.8. Tested By

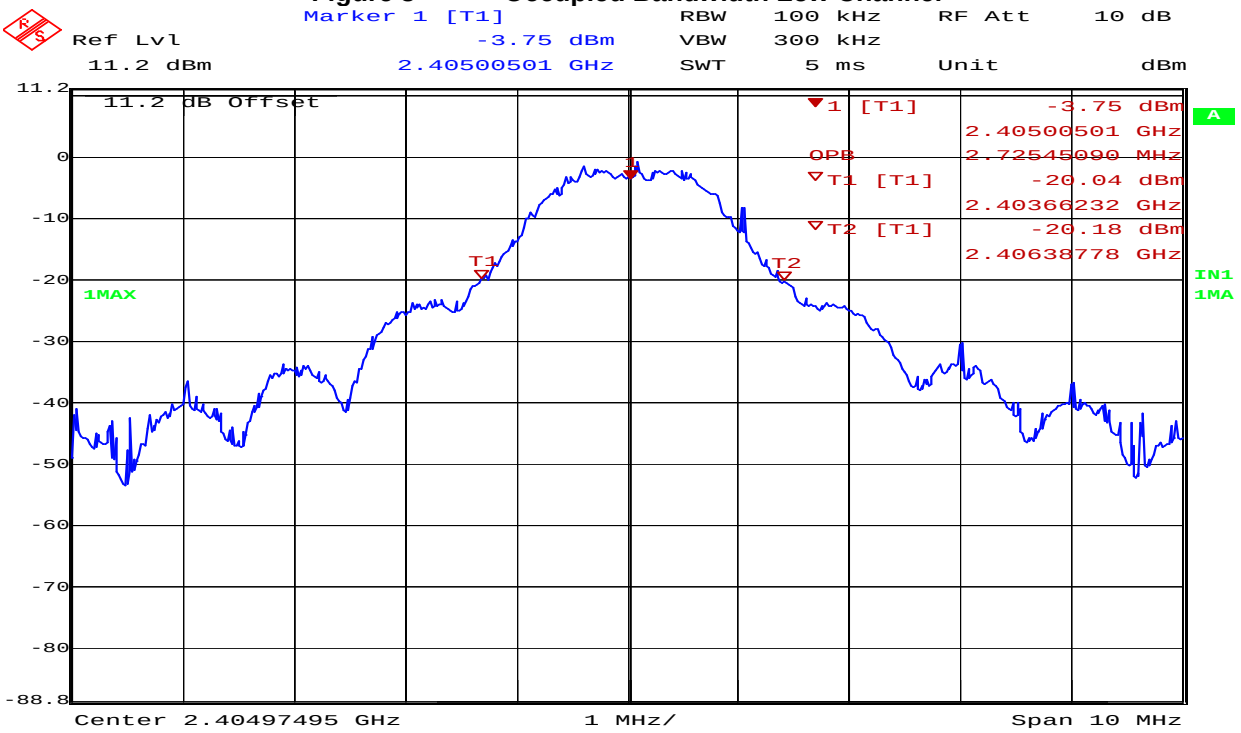
This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Glen Moore
Function: Wireless/EMC Manager

C.9. Test Date

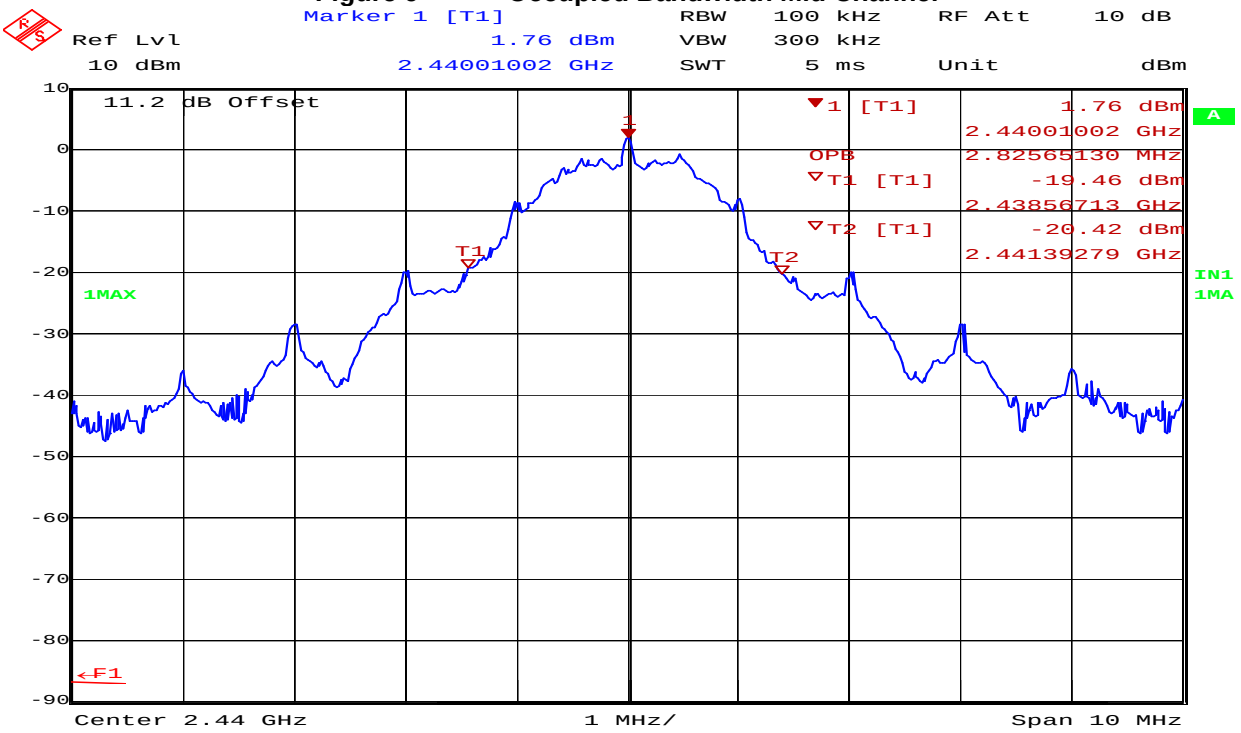
Test started: June 16, 2008 Test ended: June 16, 2008

Figure 8 Occupied Bandwidth Low Channel



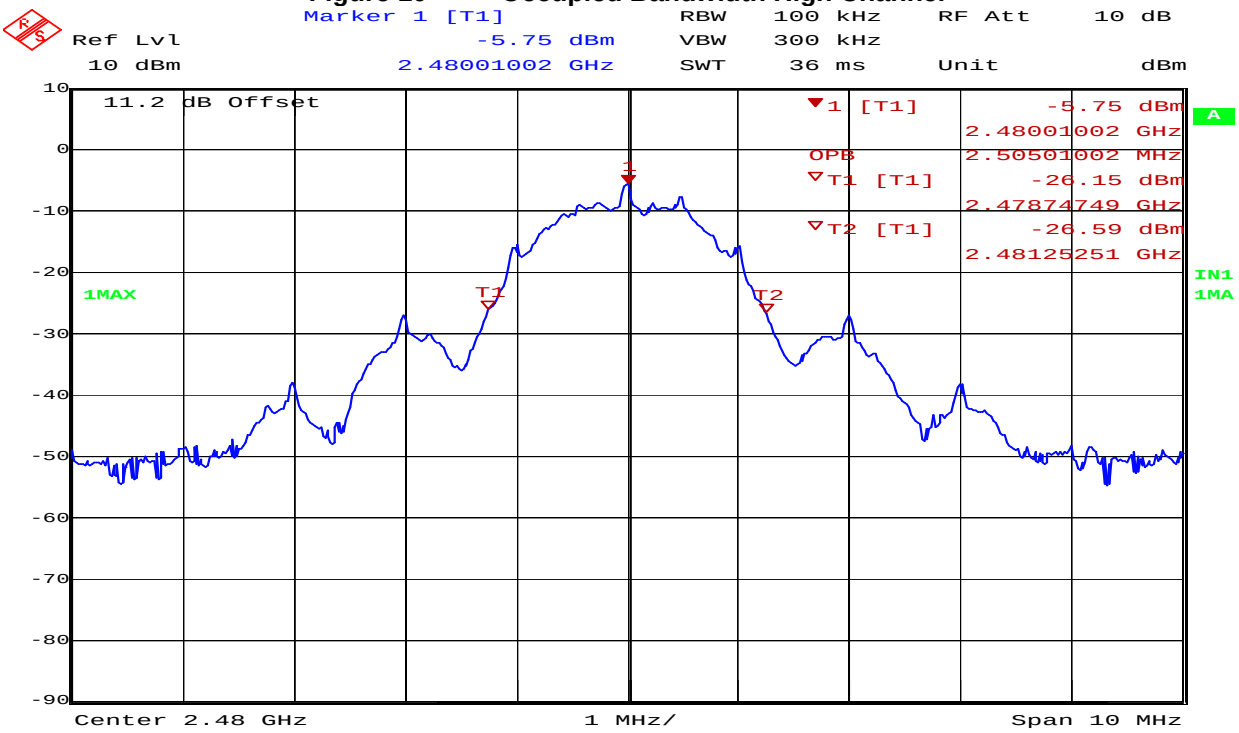
Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 11, PRBS Mode
Date: 16.JUN.2008 10:02:14

Figure 9 Occupied Bandwidth Mid Channel



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 18, PRBS Mode
Date: 16.JUN.2008 11:32:37

Figure 10 Occupied Bandwidth High Channel



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 26, PRBS Mode
Date: 16.JUN.2008 12:36:03

APPENDIX D: PEAK POWER OUTPUT

D.1. Base Standard & Test Basis

Base Standard	FCC 15.247 RSS 210 Issue 7 A8.4 (4)
Test Basis	FCC 15.247 as per FCC Publication 558074 RSS-Gen Issue 2 4.8
Test Method	Conducted measurement as per FCC Publication 558074 and RSS-Gen Issue 2 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. Deviations

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

D.4. Test Procedure

FCC Publication 558074 and RSS-Gen Issue 2 4.8

D.5. Operating Mode During Test

The MC1322x Network Node was tuned to a low, middle, and high channel operating at maximum rated RF output power in PRBS Tx mode.

D.6. Test Results

Compliant – The maximum peak power was 1.76 dBm

D.7. Sample Calculation

None

D.8. Test Data Summary

Channel	Frequency (MHz)	Peak RF power (dBm)
11	2404.634	1.76
18	2439.128	1.52
26	2480.060	-5.10

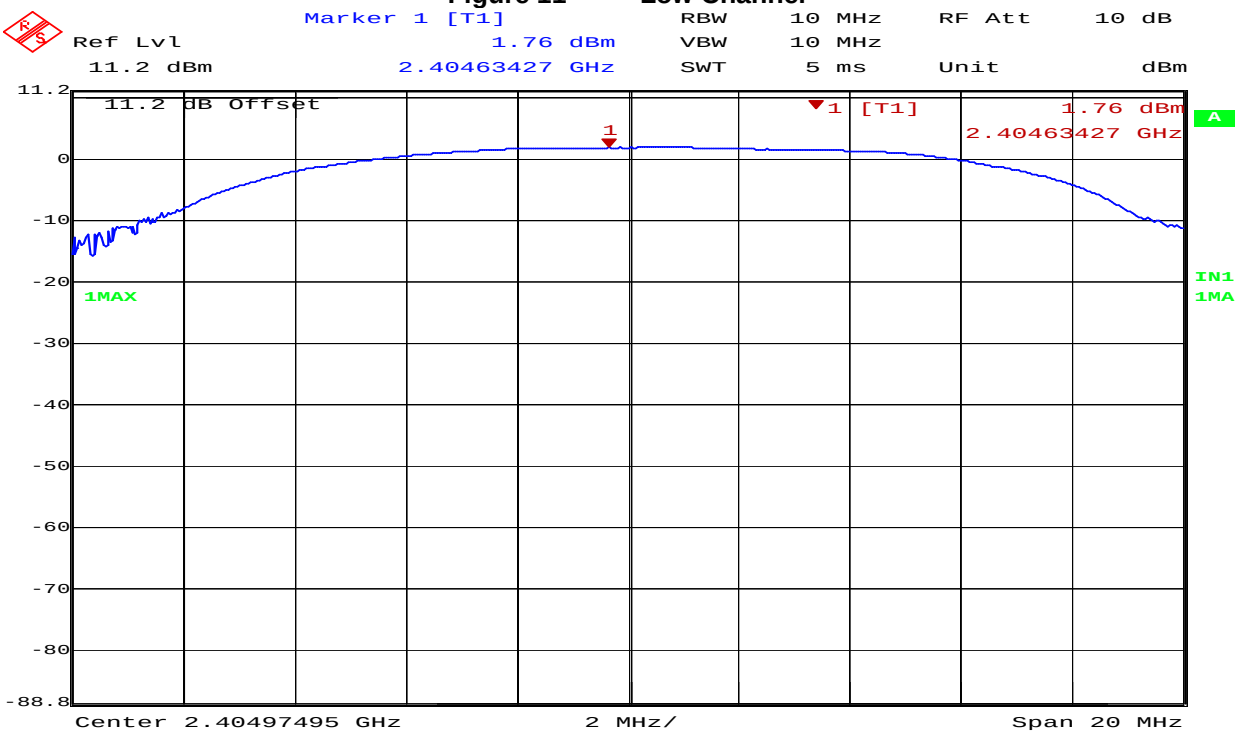
D.9. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Glen Moore
Function: Wireless/EMC Manager

D.10. Test Date

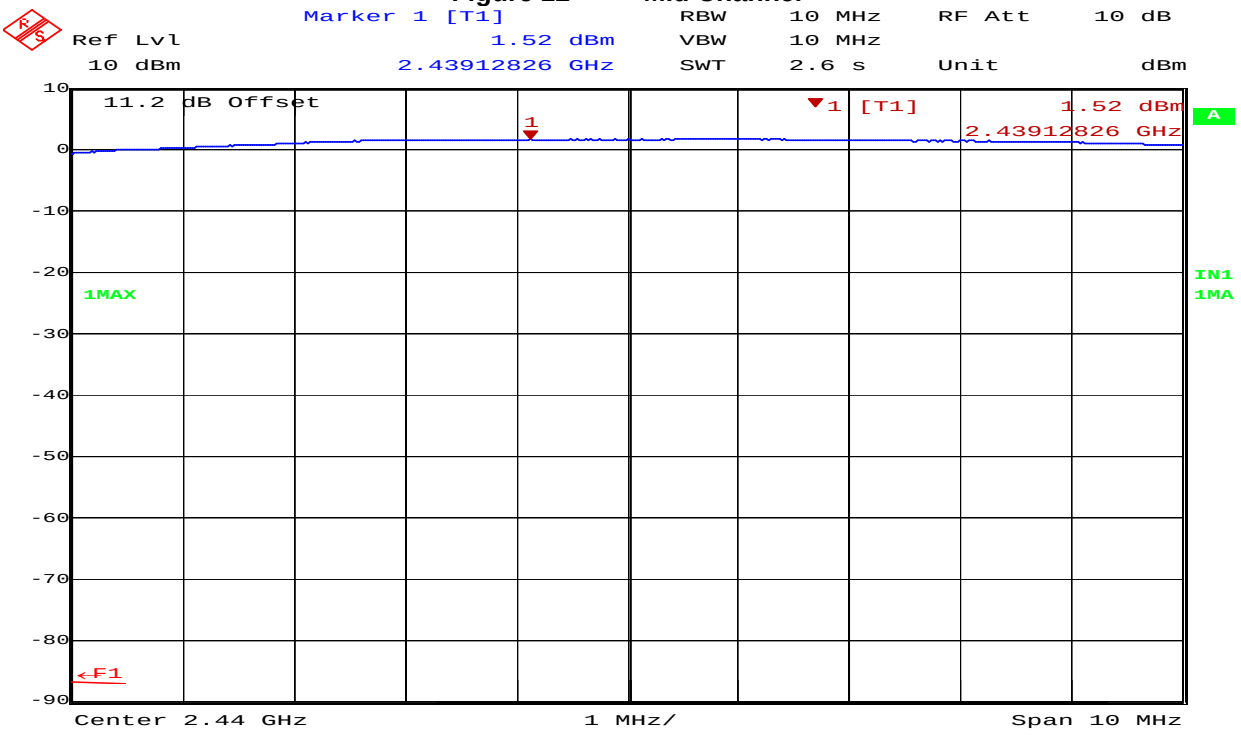
Test started: June 16, 2008 Test ended: June 16, 2008

Figure 11 Low Channel



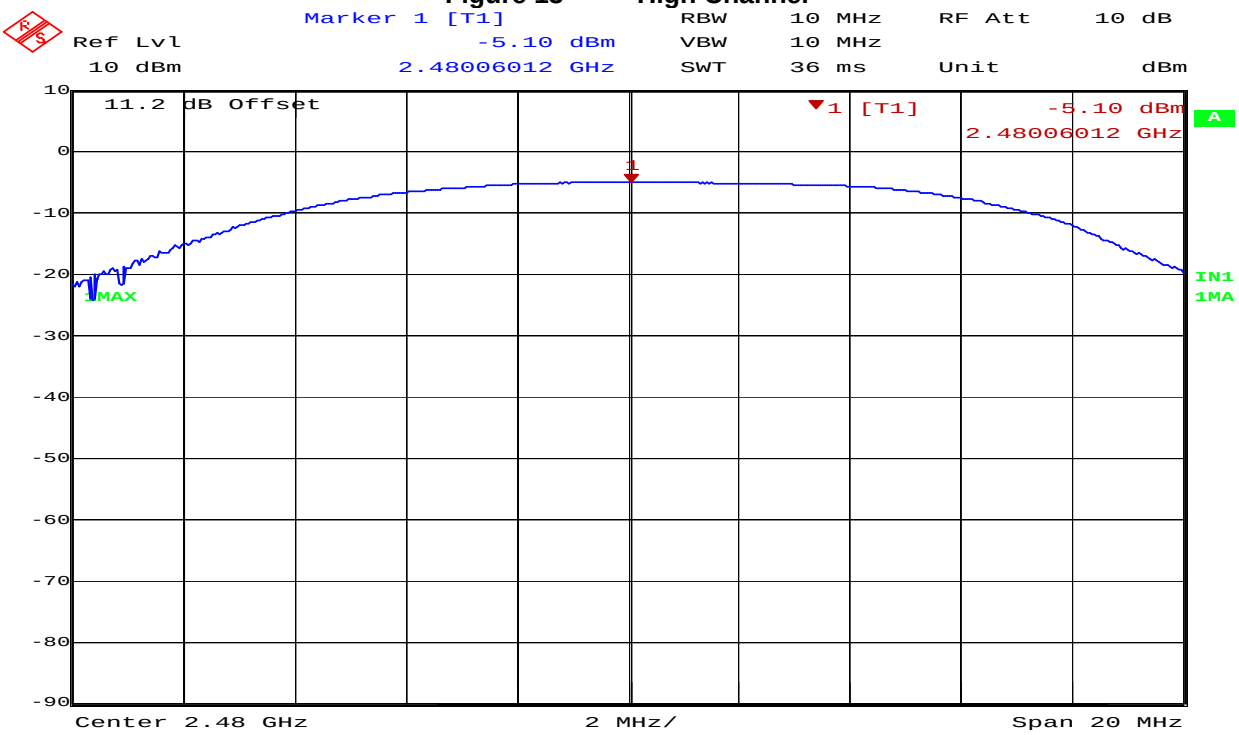
Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 11, PRBS Mode
Date: 16.JUN.2008 09:56:57

Figure 12 Mid Channel



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 18, PRBS Mode
Date: 16.JUN.2008 11:33:57

Figure 13 High Channel



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 26, PRBS Mode
Date: 16.JUN.2008 12:32:29

APPENDIX E: POWER SPECTRAL DENSITY

E.1. Base Standard & Test Basis

Base Standard	FCC 15.247 (e) RSS 210 Issue 7 A8.2 (b)
Test Basis	FCC 15.247 as per FCC Publication 558074 RSS 210 Issue 7 A8.2 (b)
Test Method	Conducted measurement as per FCC Publication 558074 and RSS 210 Issue 7 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. Deviations

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

E.4. Test Procedure

FCC Publication 558074

E.5. Operating Mode During Test

The MC1322x-Network Node was tuned to a low, middle, and high channel operating at maximum rated RF output power in PRBS Tx mode.

E.6. Test Results

Compliant. The maximum measured power spectral density was -12.05 dBm

E.7. Sample Calculation

None

E.8. Test Data Summary

Channel	Frequency (MHz)	PSD (dBm)
11	2405.069	-12.05
18	2440.070	-12.09
26	2480.070	-19.63

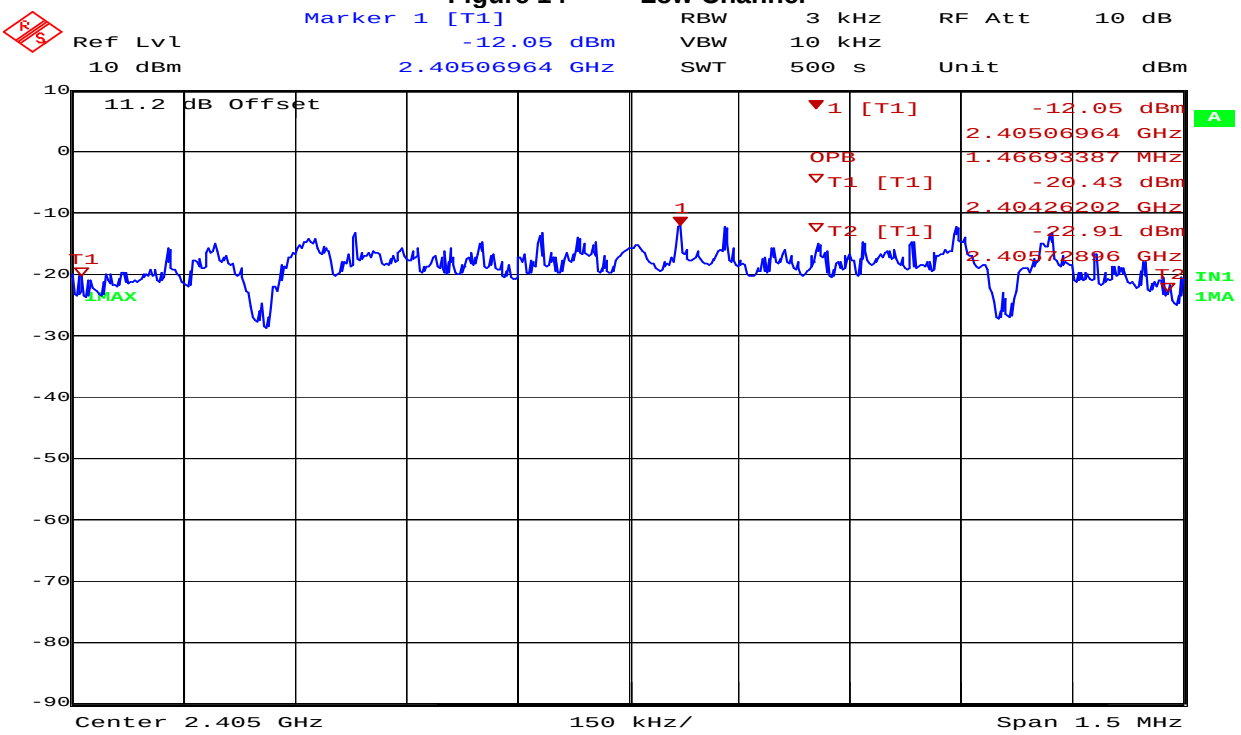
E.9. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Glen Moore
Function: Wireless/EMC Manager

E.10. Test Date

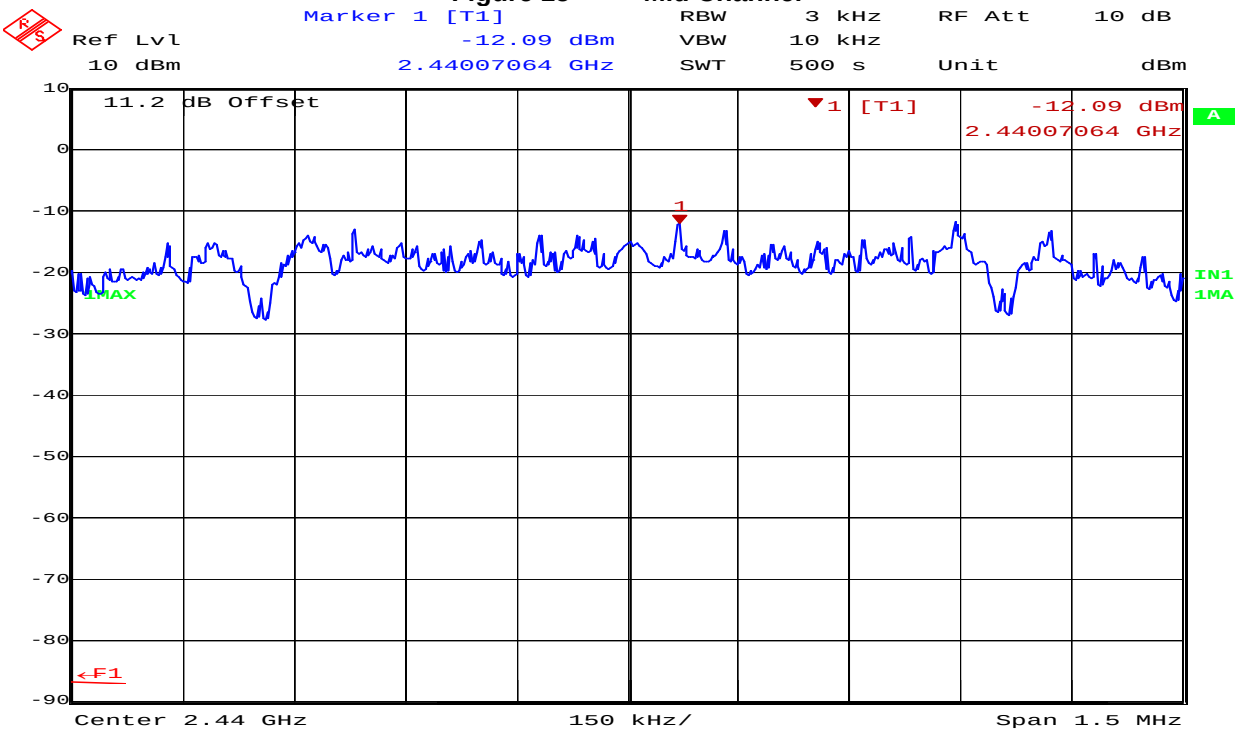
Test started: June 16, 2008 Test ended: June 16, 2008

Figure 14 Low Channel



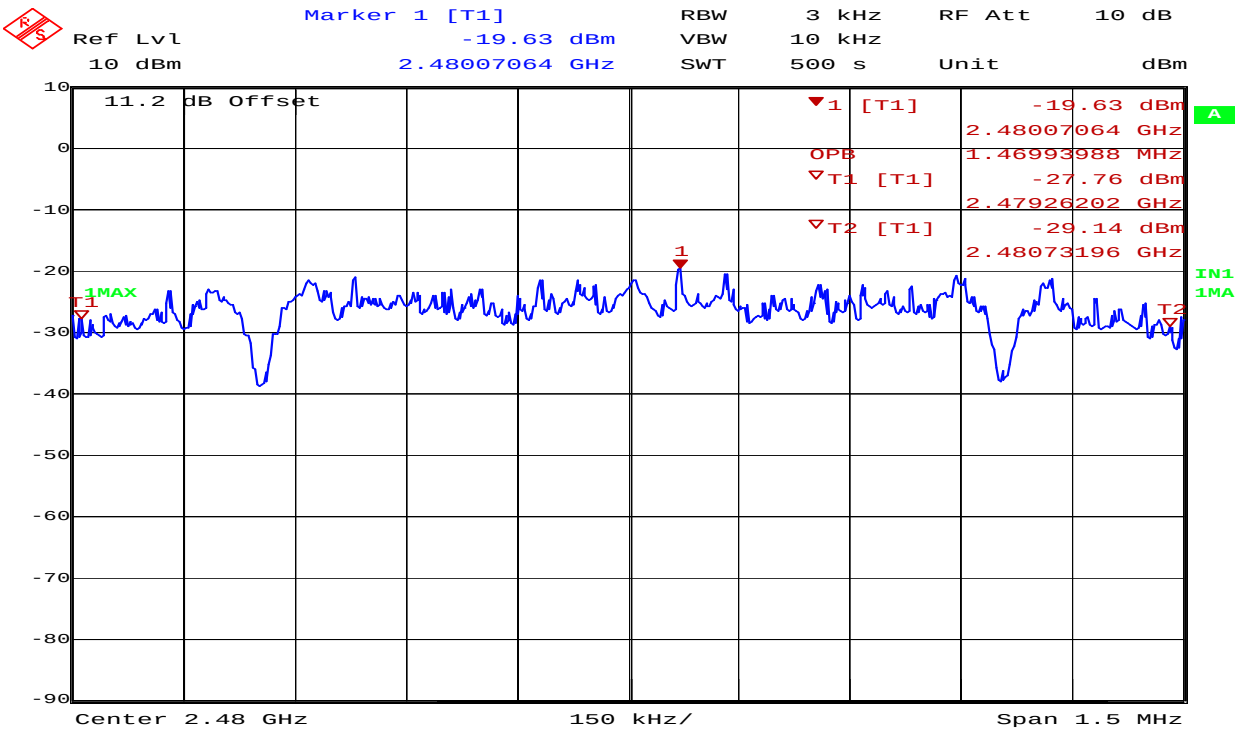
Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 11, PRBS Mode
Date: 16.JUN.2008 10:34:17

Figure 15 Mid Channel



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 18, PRBS Mode
Date: 16.JUN.2008 12:00:20

Figure 16 High Channel



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 26, PRBS Mode
Date: 16.JUN.2008 12:48:51

APPENDIX F: DUTY CYCLE CORRECTION FACTOR

F.1. Base Standard & Test Basis

Base Standard	FCC 15.35 (c) RSS-Gen Issue 2 4.5
Test Basis	FCC 15.35 (c) as per FCC Publication 558074 RSS-Gen Issue 2 4.5
Test Method	Conducted measurement (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 MC1322x Network Node was tuned to Channel 26 operating at maximum rated RF output power with PRBS Tx mode.

F.6. Test Results

Duty cycle correction factor = 20*Log (2.436874/11.062164) = -13.14dB

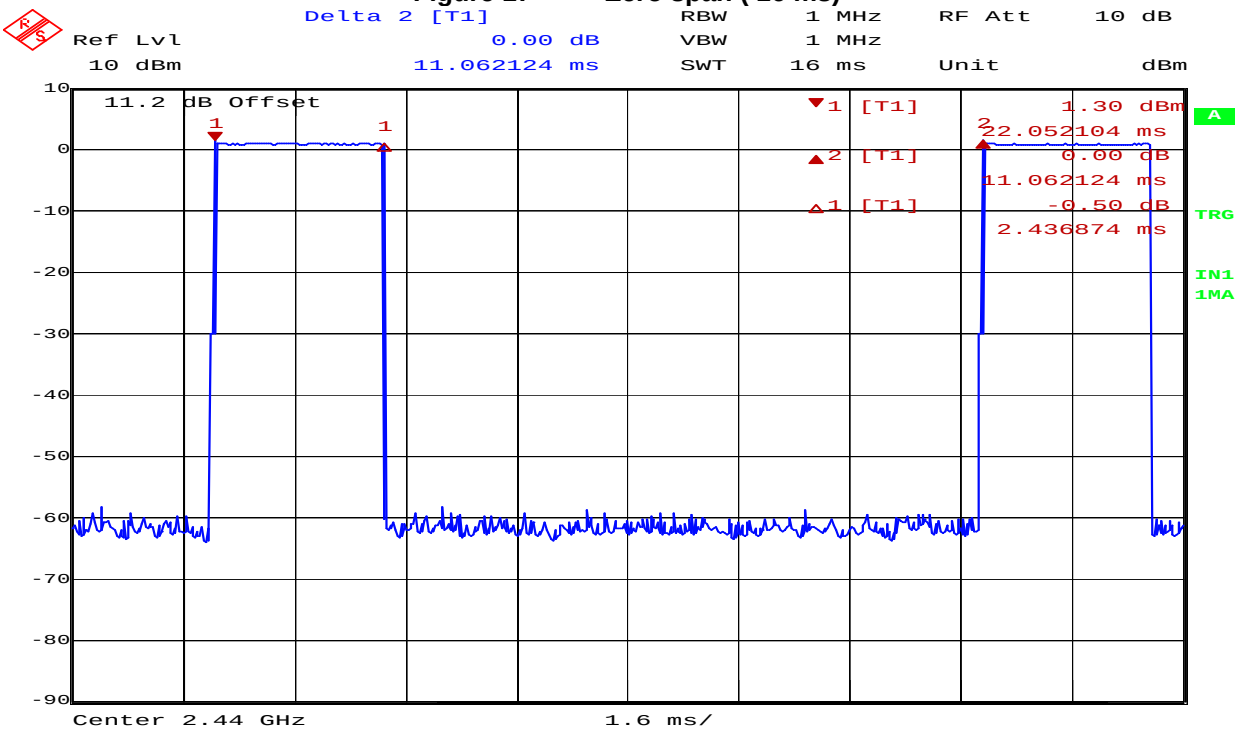
F.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Glen Moore
Function: Wireless/EMC Manager

F.8. Test Date

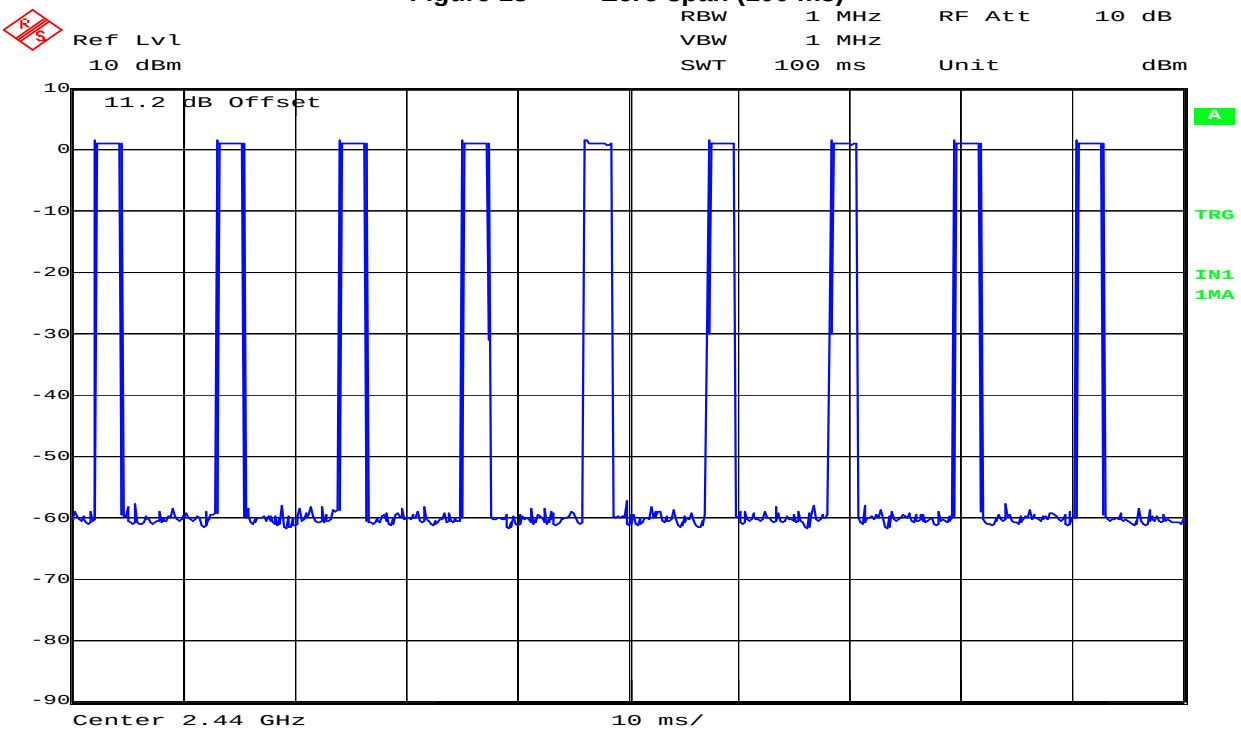
Test started: June 16, 2008 Test ended: June 16, 2008

Figure 17 Zero span (16 ms)



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 18, PRBS Mode
Date: 16.JUN.2008 12:15:25

Figure 18 Zero span (100 ms)



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 18, PRBS Mode
Date: 16.JUN.2008 12:18:30

APPENDIX G: CONDUCTED SPURIOUS EMISSIONS

G.1. Base Standard & Test Basis

Base Standards	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.247 (d) RSS-210 Issue 7 A8.5
Test Basis	RF conducted as per FCC Publication 558074 RSS-210 Issue 7 A8.5
Test Method	RF conducted as per FCC Publication 558074 RSS-210 Issue 7 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. Deviations

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

G.4. Test Procedure

FCC Publication 558074

G.5. Operating Mode During Test

The MC1322x Network Node was tuned to a low and high channel operating at maximum rated RF output power with PRBS Tx mode.

G.6. Test Results

Compliant,
Worst case spurious emission was 31.88 dB below the carrier at Channel 26 with Modulated Tx mode.

G.7. Tested By

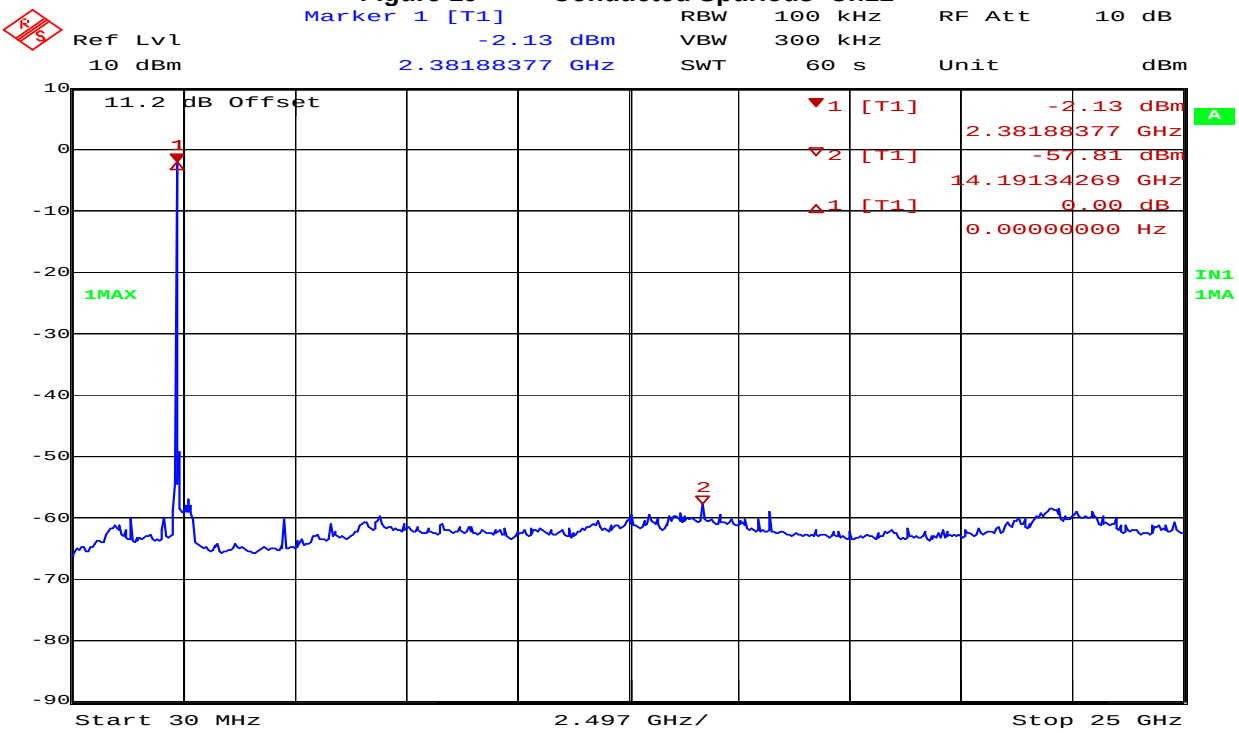
This testing was conducted in accordance with the ISO 17025: 2005 scope of accreditation, table 1; Quality Manual.

Name: Glen Moore
Function: Wireless/EMC Manager

G.8. Test Date

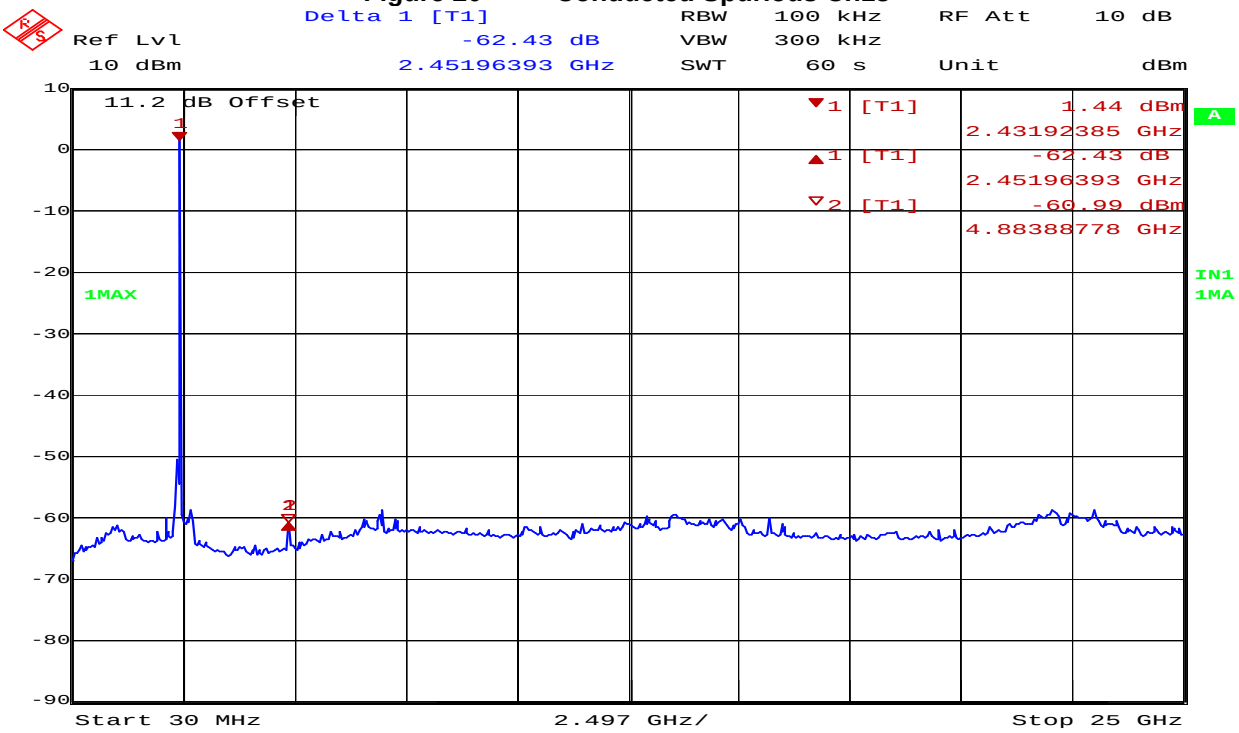
Test started: June 16, 2008 Test ended: June 16, 2008

Figure 19 Conducted Spurious Ch11



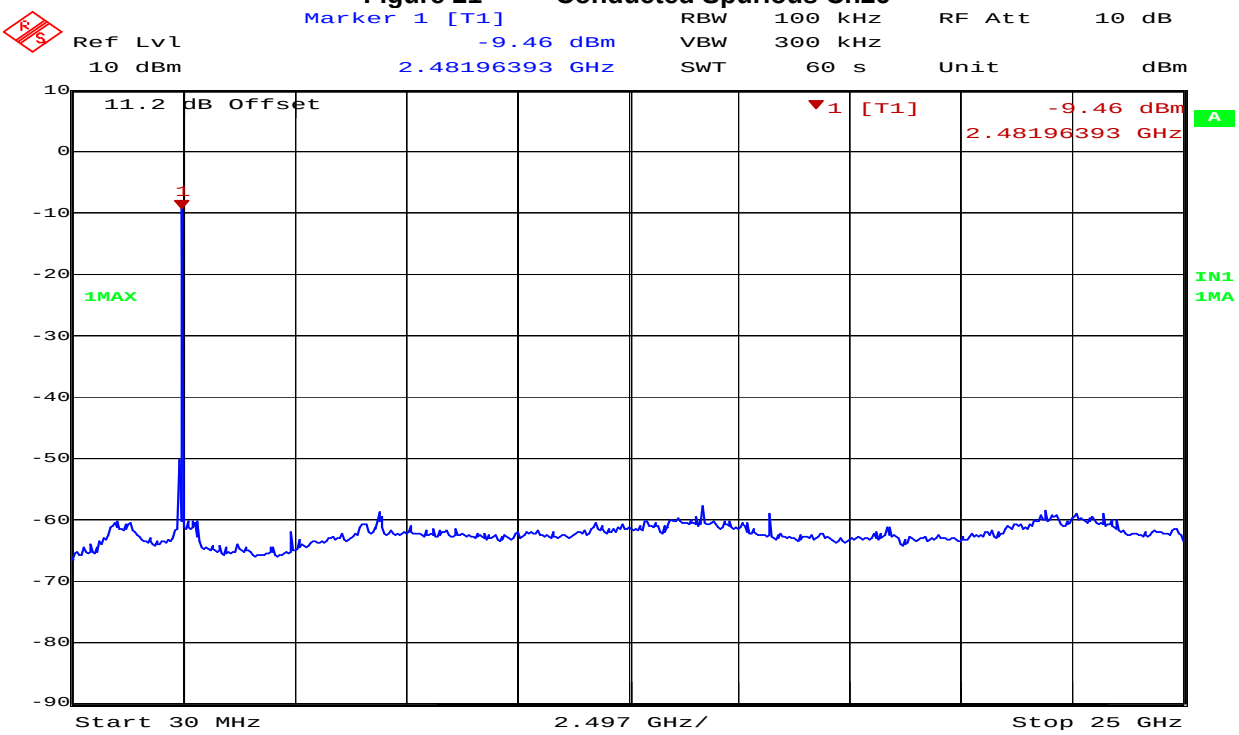
Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 11, PRBS Mode
Date: 16.JUN.2008 11:06:55

Figure 20 Conducted Spurious Ch18



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 18, PRBS Mode
Date: 16.JUN.2008 12:06:06

Figure 21 Conducted Spurious Ch26



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 26, PRBS Mode
Date: 16.JUN.2008 12:55:10

APPENDIX H: CONDUCTED SPURIOUS EMISSIONS BAND EDGE

H.1. Base Standard & Test Basis

Base Standards	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.247 (d) RSS-210 Issue 7 A8.5
Test Basis	RF conducted as per FCC Publication 558074 RSS-210 Issue 7 A8.5
Test Method	RF conducted as per FCC Publication 558074 RSS-210 Issue 7 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. Deviations

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

H.4. Test Procedure

FCC Publication 558074

H.5. Operating Mode During Test

The MC1322x-NCB was tuned to a low and high channel operating at maximum rated RF output power with PRBS Tx mode.

H.6. Test Results

Compliant
Worst case spurious emission was 41.92 dB below the carrier at Channel 26 with PRBS Tx mode.

H.7. Sample Calculation

None.

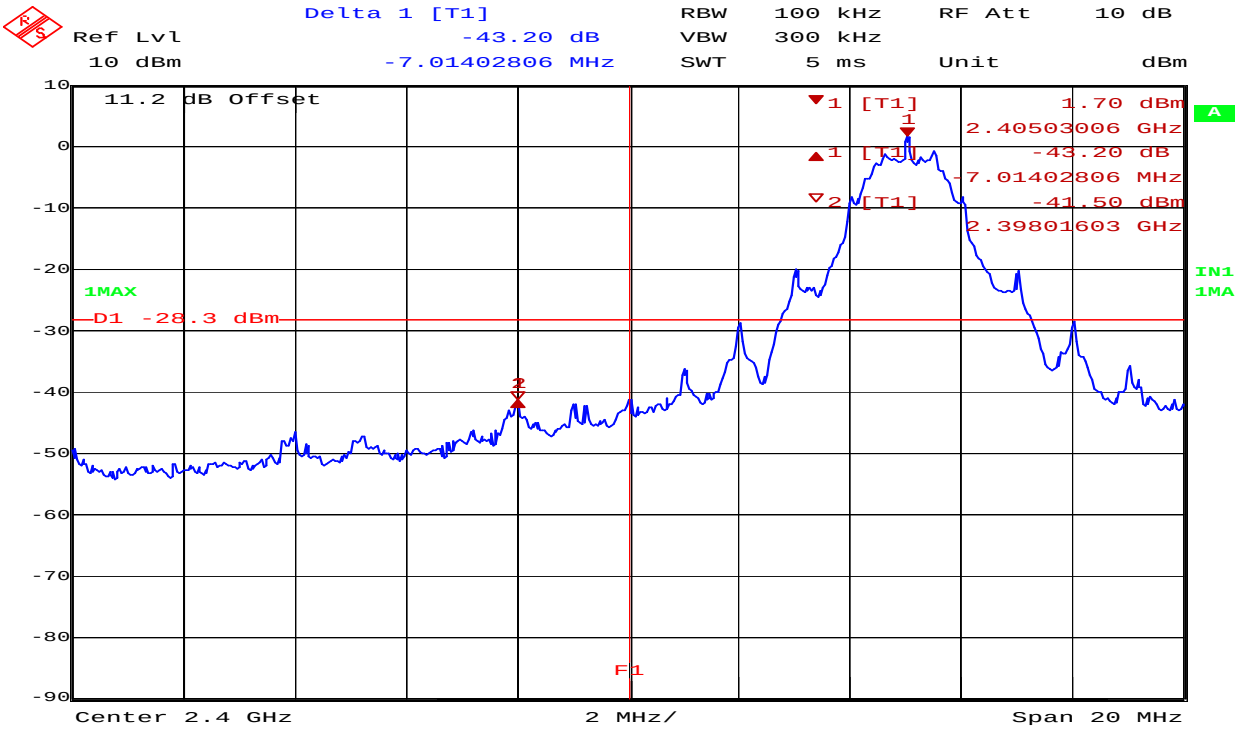
H.8. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Glen Moore
Function: Wireless/EMC Manager

H.9. Test Date

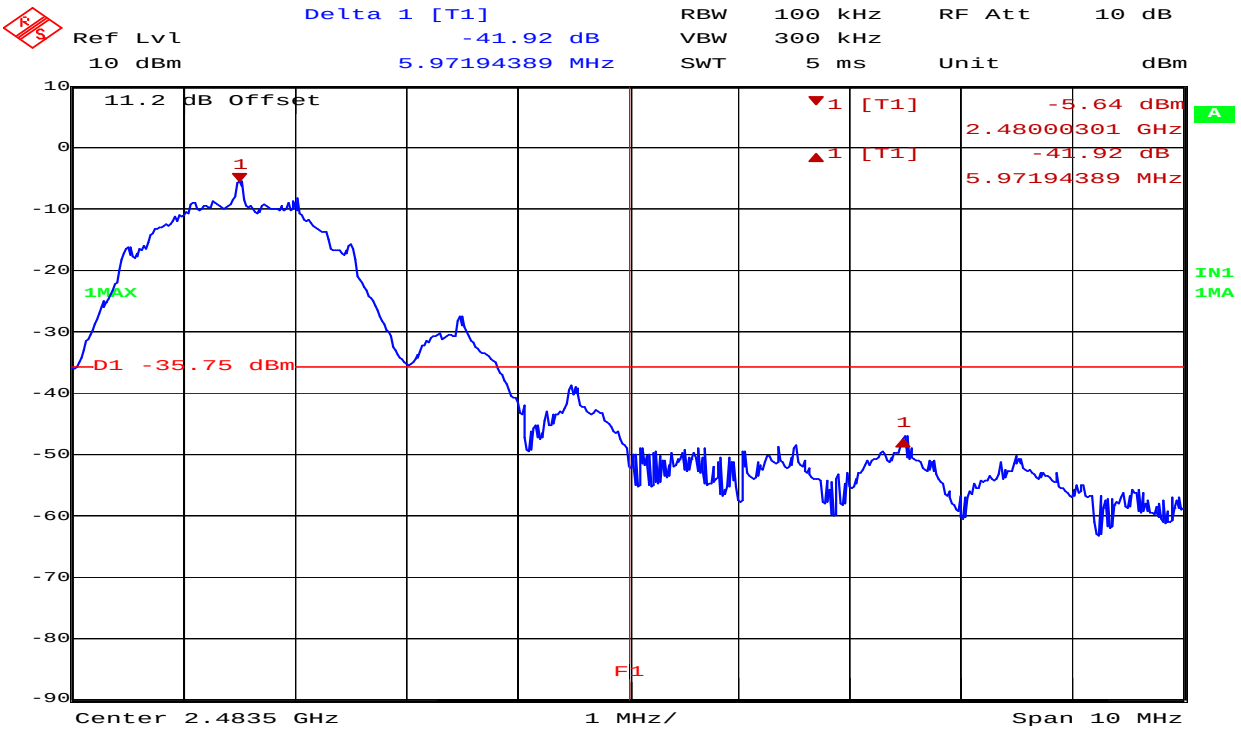
Test started: June 16, 2008 Test ended: June 16, 2008

Figure 22 Conducted Band edge Measurement Ch11



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 11, PRBS Mode
Date: 16.JUN.2008 11:24:51

Figure 23 Conducted Band edge Measurement Ch26



Title: CG-758 Freescale Semiconductor Network Node
Comment A: Channel 26, PRBS Mode
Date: 16.JUN.2008 12:58:18

APPENDIX I: RADIATED SPURIOUS EMISSIONS BAND EDGE

I.1. Base Standard & Test Basis

Base Standard	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.209 – Radio Frequency Devices, Part 15.205 – Restricted bands of operation RSS 210 Issue 7 A8.5
Test Basis	ANSI C63.4-2003 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz, FCC Publication 558074
Test Method	NTS Radiated Emissions Test Method SOP CAG EMC 01 and FCC Publication 558074

I.2. Specifications: FCC 15.205 and RSS 210 Issue 7 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
[1]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.

I.3. Deviations

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

I.4. Test Procedure

RF radiated measurement at 3 meters distance per FCC Publication 558074
558074 (c) (2) 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, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation.

I.5. Operating Mode During Test

The MC1322x-Network Node was tuned to a low channel operating at maximum rated RF output power with power Setting 12 (hex) and high channel reduced power setting 0E (hex).
The EUT was tuned to Channel 25 operating at maximum rated RF output power with power setting 12 (hex) also.
Peak measurements were taken with PRBS modes (worst case for peak measurements).
Video average measurements were taken with Modulated Tx modes (100 % duty cycle)

I.6. Test Results

Compliant

EUT Tx Mode	Ch.	Frequency (MHz)	Detector	Radiated emission level (dBµV/m)	Duty cycle correction factor (dB)	Corrected value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
PRBS	11	2390.000	PK	61.95	N/A	61.95	73.98	12.03
Modulated	11	2382.144	AV	47.00	-13.14	33.86	53.98	20.12
PRBS	25	2483.500	PK	68.35	N/A	68.35	73.98	5.63
PRBS	26	2483.500	PK	70.03	N/A	70.03	73.98	3.95
Modulated	26	2483.500	AV	57.00	-13.14	43.86	53.98	10.12

Maximum peak measurement was 70.03 dBµV/m at 2483.500 MHz. It has 3.95 dB margin to the 15.209 peak limits. Antenna height was 100 cm at horizontal polarization and turntable angle was 287 degree.

I.7. Sample Calculations

Part 15.209 Average Limit: 500 µV/m @ 3m = 20*Log (500) = 53.98 dBµV/m, Peak limit = 73.98 dBµV/m
Radiated emission level (dBµV/m) = Measured level (dBµV) + Receive antenna factor (dB) + Receive cable loss (dB)
Corrected value (dBµV/m) = Radiated emission level (dBµV/m) - Duty cycle correction factor (dB)

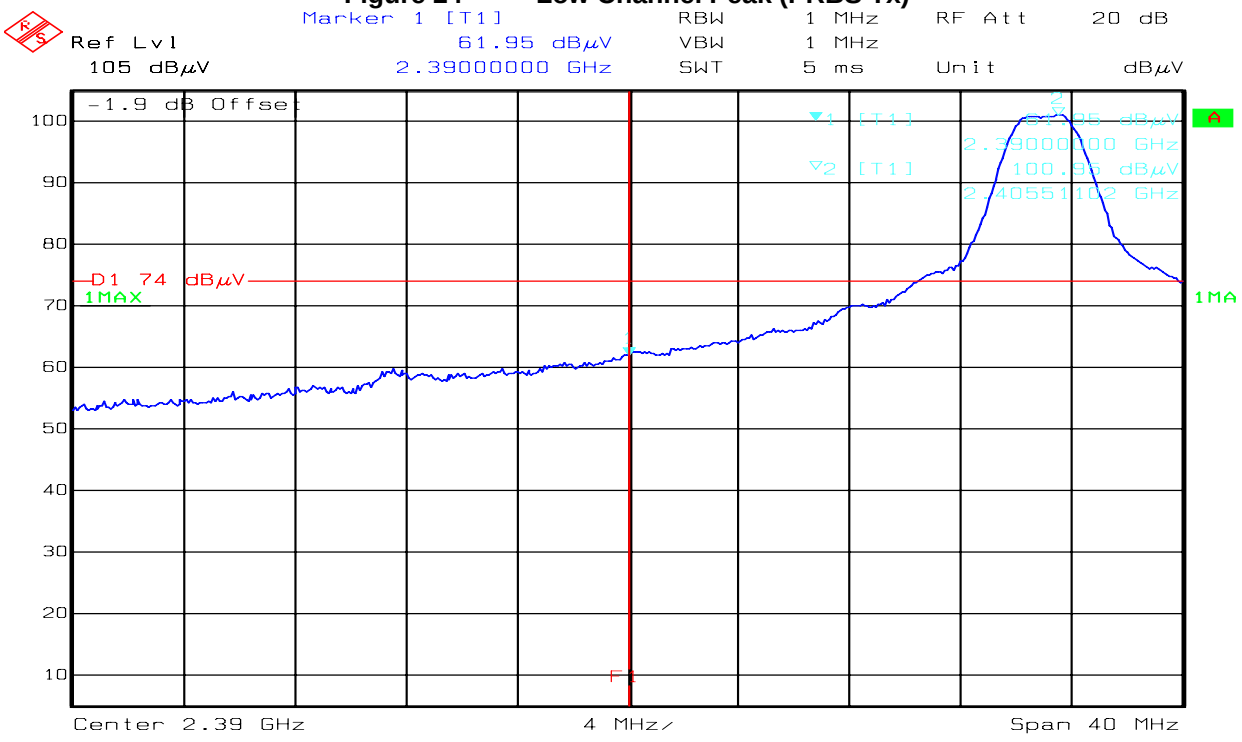
I.8. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

I.9. Test Date

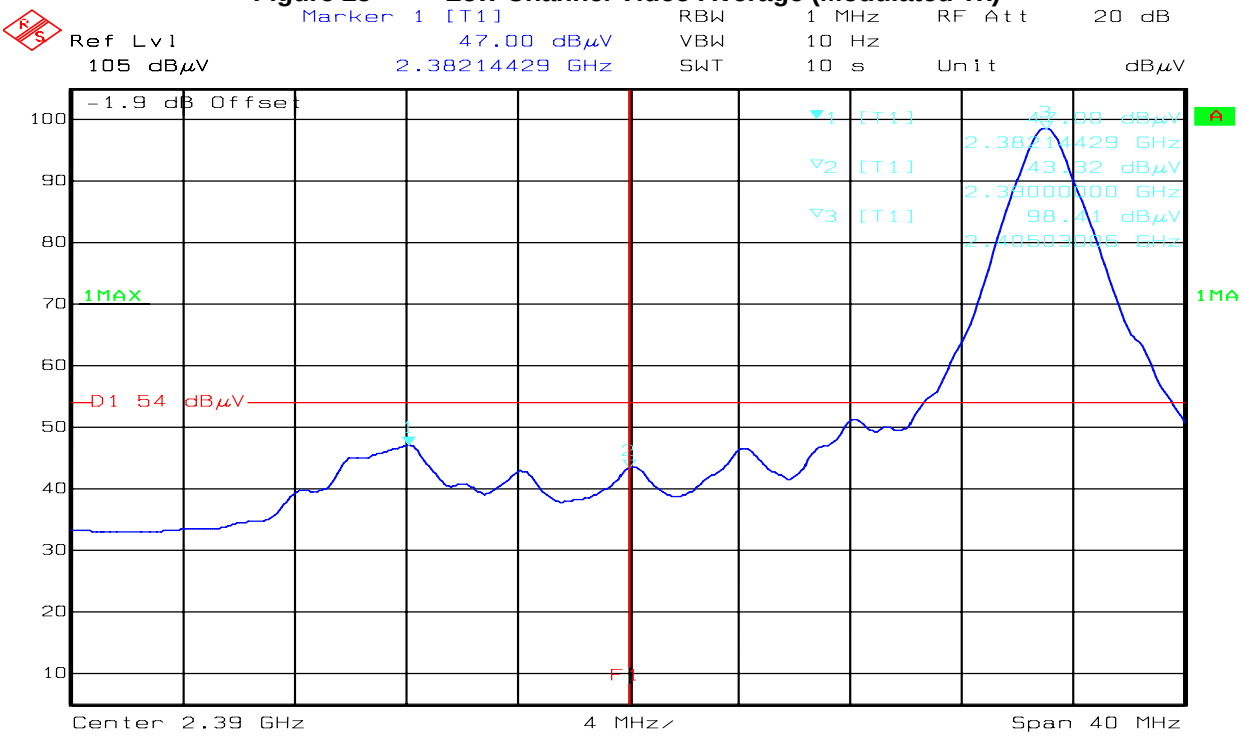
Test started: June 4, 2008 Test ended: June 4, 2008

Figure 24 Low Channel Peak (PRBS Tx)



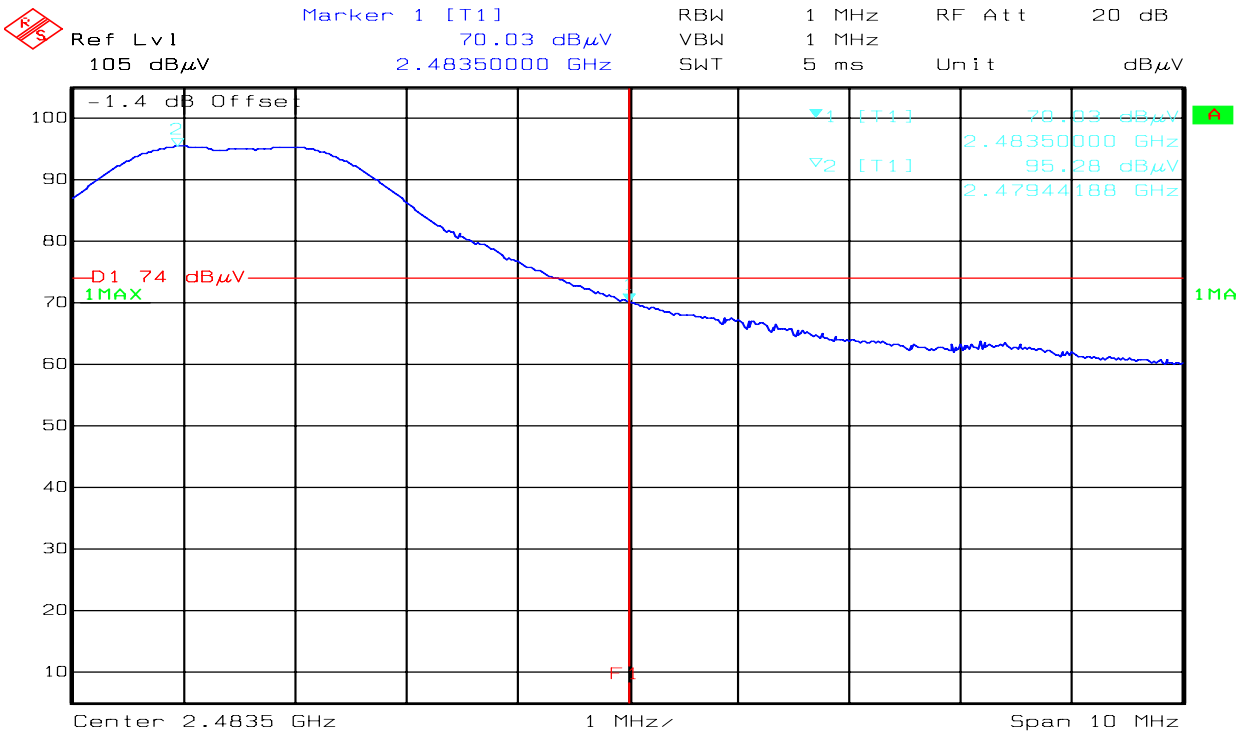
Title: CG-758 Freescale MC1322X Network Node
Comment A: Ch11, Power Setting 12, PRBS Tx
Date: 4.JUN.2008 15:58:23

Figure 25 Low Channel Video Average (Modulated Tx)



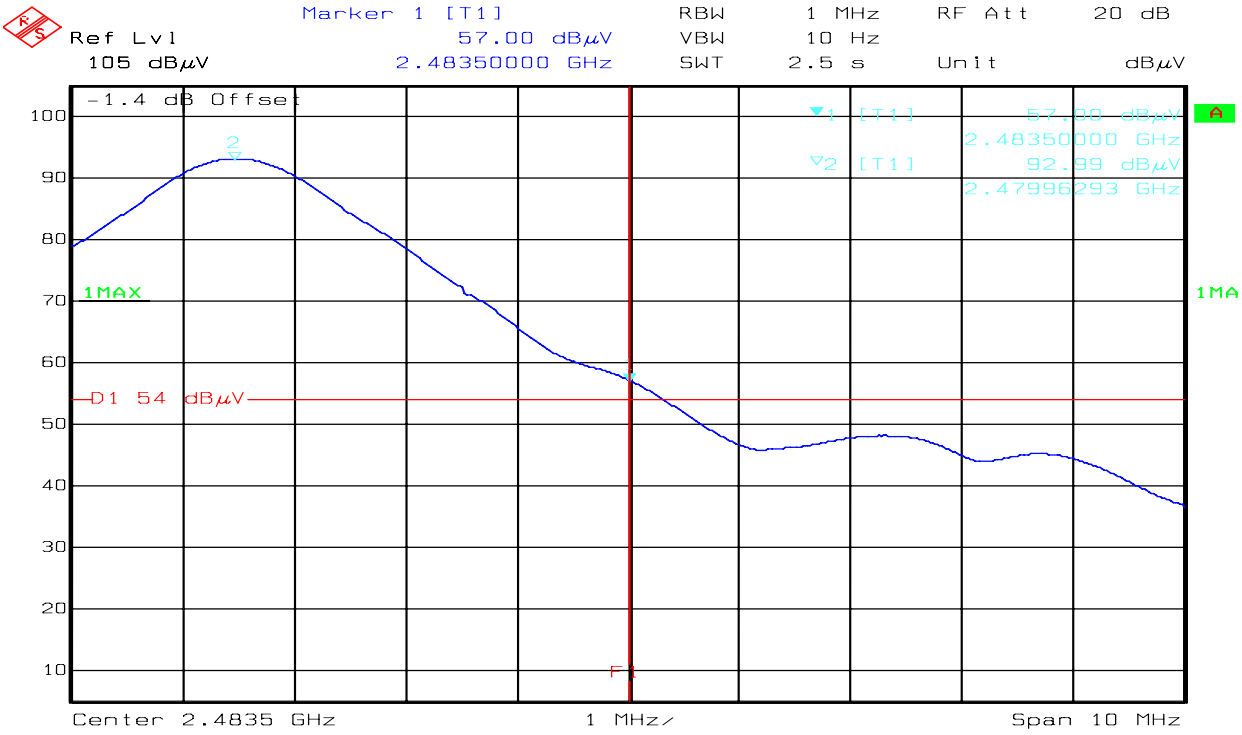
Title: CG-758 Freescale MC1322X Network Node
Comment A: Ch11, Power Setting 12, Modulated Tx
Date: 4.JUN.2008 16:03:55

Figure 26 High channel Peak (PRBS Tx)



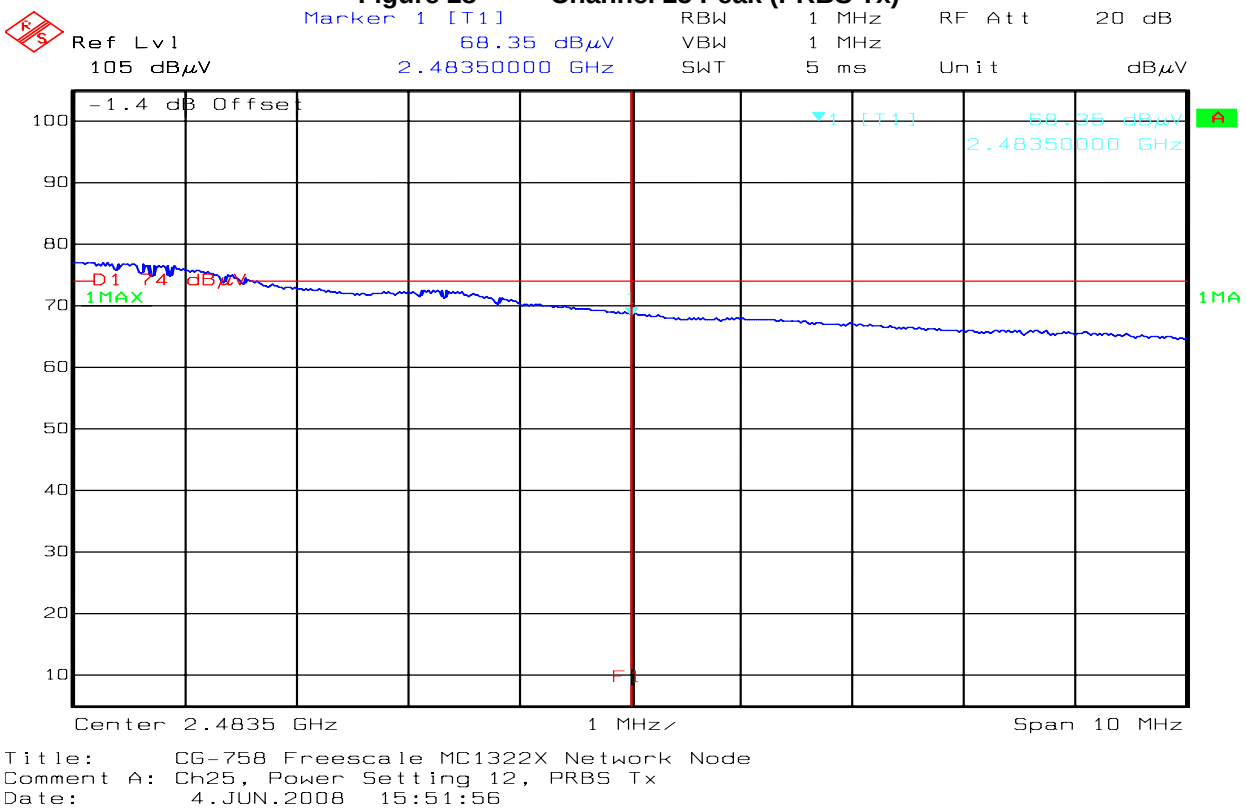
Title: CG-758 Freescale MC1322X Network Node
Comment A: Ch26, Power Setting 0E, PRBS Tx
Date: 4.JUN.2008 15:46:16

Figure 27 High Channel Video Average (Modulated Tx)



Title: CG-758 Freescale MC1322X Network Node
Comment A: Ch26, Power Setting 0E, Modulated Tx
Date: 4.JUN.2008 15:41:23

Figure 28 Channel 25 Peak (PRBS Tx)



APPENDIX J: RADIATED SPURIOUS EMISSIONS (TX AND RX)

J.1. Base Standard & Test Basis

Base Standard	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.209 – Radio Frequency Devices, Part 15.205 – Restricted bands of operation RSS 210 Issue 7 2.6 and A8.5
Test Basis	ANSI C63.4-2003 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz, FCC Publication 558074
Test Method	NTS Radiated Emissions Test Method SOP CAG EMC 01 and FCC Publication 558074

Specifications: FCC 15.205 and RSS 210 Issue 7 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
[1]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.

J.2. Deviations

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

J.3. Test Procedure

FCC Publication 558074 (c) (2) 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, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation.

Note: In some bands, a lower RBW detector was used to identify and detect emissions with better measurement system sensitivity.

J.4. Operating Mode During Test

The 1322x-Network Node was tuned to a low and middle channel operating at maximum rated RF output power with power Setting 12 (hex) and high channel reduced power setting 0E (hex).

The EUT was tuned to a low, mid and high channel operating with Receive mode.

Worst case emissions presented

J.5. Sample Calculations

Limit at 54.00 MHz for 10 m = 20*Log(100) + 20*Log(3/10) = 29.54 dBµV/m

Part 15.209 Average Limit: 500 µV/m @ 3m = 20*Log (500) = 53.98 dBµV/m
Peak Limit = Average Limit + 20 (dB) = 73.98 dBµV/m

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

Radiated emission level (dBµV/m) = Measured level (dBµV) + Total correction factor (dB)

J.6. Tested By

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

Name:	Deniz Demirci	&	Spencer Watson
Function:	Senior EMC / Wireless Technologist		EMC Technologist

J.7. Test Date

Test started: June 3, 2008 Test ended: June 4, 2008

J.8. Test Results

Compliant

Channel	Mode	Frequency (MHz)	Detector	Radiated emission level (dBµV)	Limit type	Limit (dBµV/m)	Margin (dB)	Antenna Polarization	Antenna Height (cm)	TT Angle (°)
11	Tx	2452.40*	PK	51.46	PK	73.98	22.52	Horizontal	128	270
11	Tx	2452.76*	Video AV	42.53	AV	53.98	11.45	Vertical	128	270
18	Tx	4805.21	PK	35.09	PK	73.98	38.89	Vertical	100	45
18	Rx	54.00*	QP	21.87	QP	29.54**	7.67	Vertical	100	0

* Not in the restricted band
**Limit at 3 m (15.249)

Tx Mode:
In the restricted bands, maximum measured level was 21.87 dBµV/m with peak detector at 4805.21 MHz, when antenna was vertically polarized. It has 38.89 dB margin to the limits.

A carrier related spurious emission measured at 2452.76 MHz which is not in the restricted bands.

Rx Mode:
Maximum measured level was 21.87 dBµV/m with quasi-peak detector at 54.00 MHz, when antenna was vertically polarized. It has 7.67 dB margin to the radiated emission limits.
There was no measurable emission between 1 GHz and 26 GHz with EUT receive mode.

Plots were not provided in order to reduce file size

APPENDIX K: MEASUREMENT EQUIPMENT

10 m SEMI-ANECHOIC CHAMBER 150 kHz – 30 MHz Conducted Emission and 30 MHz – 1 GHz Radiated Emission					
Descriptions	**Manufacturer**	**Type/Model**	**Serial #**	**Cal Due**	**Cal Date**
Table Top LISN	EMCO	3825	CG0367	18JAN10	18JAN08
Test Receiver	Rohde & Schwarz	ESMI	CG0433 CG0434	02APR09	02APR08
Bilog Antenna	Teseq	CBL 6112D	CG1177	10OCT08	10OCT07
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
Digital Barometer / Thermometer	Cole-Parmer	1870	CG0728	19JUN08	19JUN07
3 m SEMI-ANECHOIC CHAMBER 1 GHz – 26 GHz Radiated Emission and Radio					
Horn Antenna (Rx) 1 GHz – 18 GHz	EMCO	3115	CG0103	30AUG08	30AUG06
Standard Gain Horn (Rx) 18 GHz – 26.5 GHz	EMCO	3160-09	CG0075	N/A (1)	27NOV01
High pass filter F > 1000 MHz	MicroTronics	HPM14576	CG0963	10AUG08	10AUG06
High pass filter F > 2800 MHz	MicroTronics	HPM50111	CG0964	10AUG08	10AUG06
LNA 1 GHz - 18 GHz	Miteq	JSD00121	CG0317	10AUG08	10AUG06
LNA 18 GHz - 26.5 GHz	Miteq	JSD00119	CG0482	19JAN09	19JAN07
Spectrum Analyzer 9 kHz – 40 GHz	Rohde & Schwarz	FSEK-20	CG0118	19JUN08	19JUN07
EMI Receiver 9 kHz – 40 GHz	Rohde & Schwarz	ESI	CG0109	12NOV08	12NOV07
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.

END OF DOCUMENT