



Registration No. 440

Certification Test Report

**CFR 47 FCC Part 15, Subpart C Section
15.247**

Industry Canada RSS 210, Issue 7

**Freescale Semiconductor
1322x Sensor Node**

**FCC ID # RUN1322X-SRB
IC # 6744A-1322XSRB
Project Code CG-760**

**(Report CG-760-RA-1-1)
Revision: 1**

June 20, 2008

Prepared for: Freescale Semiconductor

Author: Deniz Demirci
Senior EMC / Wireless Technologist

Approved by: Nick Kobrosly
Lab Manager

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Report Summary

Test Facility:	National Technical Systems, Canada Product Integrity Laboratory 5151-47 th Street, N.E. Calgary Alberta T3J 3R2
Accreditation Numbers:	FCC 101386 IC 3978A-1 - File 46405-3978 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:	Freescal 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@freescal.com

EUT Description

EUT Description	Manufacturer	Model	Revision	Serial Number
IEEE 802.15.4 2.4 GHz 1322x Sensor Node	Freescal Semiconductor	1322x Sensor Node	N/A	N/A

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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)	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: _____
Deniz Demirci
Senior EMC / Wireless Technologist

Reviewed By: _____
Glen Moore
EMC / Wireless Manager

Approved By: _____
Robyn Zuehlke
Quality Management Representative

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Register of revisions

Revision	Date	Description of Revisions
1	June 20, 2008	Final 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 1322x Sensor Node 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	1322x Sensor node	1322x Sensor node	N/A	N/A
Power Supply	PHIHONG	PSA05R-090	N/A	I44401076A4
Classification	Mobile			
Antenna	Integral (5dBi)			
Modulation	0-QPSK			
EUT Size with Enclosure (H x W x D) (in mm)	95 x 60 x 40			
EUT Weight (in grams)	Less than 200 g			
Channels/Frequency Range	16 channels, 2405 MHz -2480 MHz			
Functional Description	The 1322x Sensor Node is an IEEE 802.15.4 compliant evaluation board based on the Freescale MC1322X device. The heart of the 1322x Sensor Node is Freescale's MC1322x 99-pin LGA Platform-in-Package (PiP) solution that can be used for wireless applications ranging from simple proprietary point-to-point connectivity to complete ZigBee mesh networking. The 1322x Sensor Node provides a platform to evaluate the MC1322x device, develop software and applications, and demonstrate IEEE 802.15.4 and ZigBee networking capabilities. The Sensor Node surrounds the core device with capabilities that provide a complete 802.15.4 radio, user interface, debugging capabilities, connection to personal computers (PCs) and other devices, sensors, and portability.			

2.1.1 EUT POWERS

Voltage	9 VDC 120 VAC 60 Hz with PHIHONG Switching Power Supply Model :PSA05R-090
Number of Feeds	1 (1 Hot, 1 Return)

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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	USB	EUT	Computer	Shielded	USB A-B cable	2.8

2.3 MODE OF OPERATION DURING TESTS

The 1322x Sensor Node was tested while Continuous Transmit and Receive modes. The EUT was tuned to a low, middle, and high channel to perform power, occupied bandwidth and 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. Power level was reduced for Channel 26 (high channel) and set to 0E (hex) during the tests. This level will be implemented by Freescale Semiconductor in the production.

For all test cases pre-scans were completed in all modes to determine worst case levels.

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 and it was 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.

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APPENDICES

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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	NTS Conducted Emissions 150 kHz – 30 MHz Automated Test Method SOP-COR-EMC-04

A.2. Specifications

Frequency MHz	Limit	
	Quasi-Peak dB μ V	Average dB μ V
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-760
Model: FreeScale MC1322X Sensor Node
Comments: 120VAC,60Hz,Ch18,MC1322X Sensor node,Modulated TX max power(12),Power supply:Phihong Model:PSA05R-090

Tester: Lixin Wang
Test ID: CE02tc-10m-760

Standard:
FCC15_B

Voltage/Line	Frequency (MHz)	Measurement Detector	Measured Value (dBμV)	Correction Factors (dB)	Emission Level (dBμV)	Limit Type	Limit (dBμV)	Margin (dB)
AC 120V Line1A	0.164	QP	29.67	12.22	41.89	QP	65.25	23.36
AC 120V Line1A	0.653	QP	21.92	10.77	32.69	QP	56.00	23.31
AC 120V NeutralA	0.165	QP	32.97	12.08	45.05	QP	65.22	20.17
AC 120V NeutralA	0.220	QP	28.45	11.46	39.91	QP	62.80	22.89
AC 120V NeutralA	0.510	QP	23.98	10.75	34.73	QP	56.00	21.27
AC 120V NeutralA	0.653	QP	25.50	10.68	36.18	QP	56.00	19.82
AC 120V Line1A	0.163	AV	18.21	12.20	30.41	AV	55.30	24.89
AC 120V Line1A	0.656	AV	15.24	10.77	26.01	AV	46.00	19.99
AC 120V NeutralA	0.165	AV	24.79	12.07	36.86	AV	55.19	18.33
AC 120V NeutralA	0.226	AV	21.62	11.43	33.05	AV	52.60	19.55
AC 120V NeutralA	0.513	AV	17.45	10.75	28.20	AV	46.00	17.80
AC 120V NeutralA	0.653	AV	18.59	10.68	29.27	AV	46.00	16.73

The highest emission measured was 29.27 dB μ V with average detector at 653 kHz. It has 16.73 dB margin to the FCC Part 15.207 and RSS-Gen Issue 2 7.2.2 limits

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A.5. Observations

None

A.6. Deviations from Normal Operating Mode During Test

None

A.7. Sample Calculation

Emission Level = Measured Value + Correction Factors
Margin = Limit – Emission Level

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 Ended: June 3, 2008

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

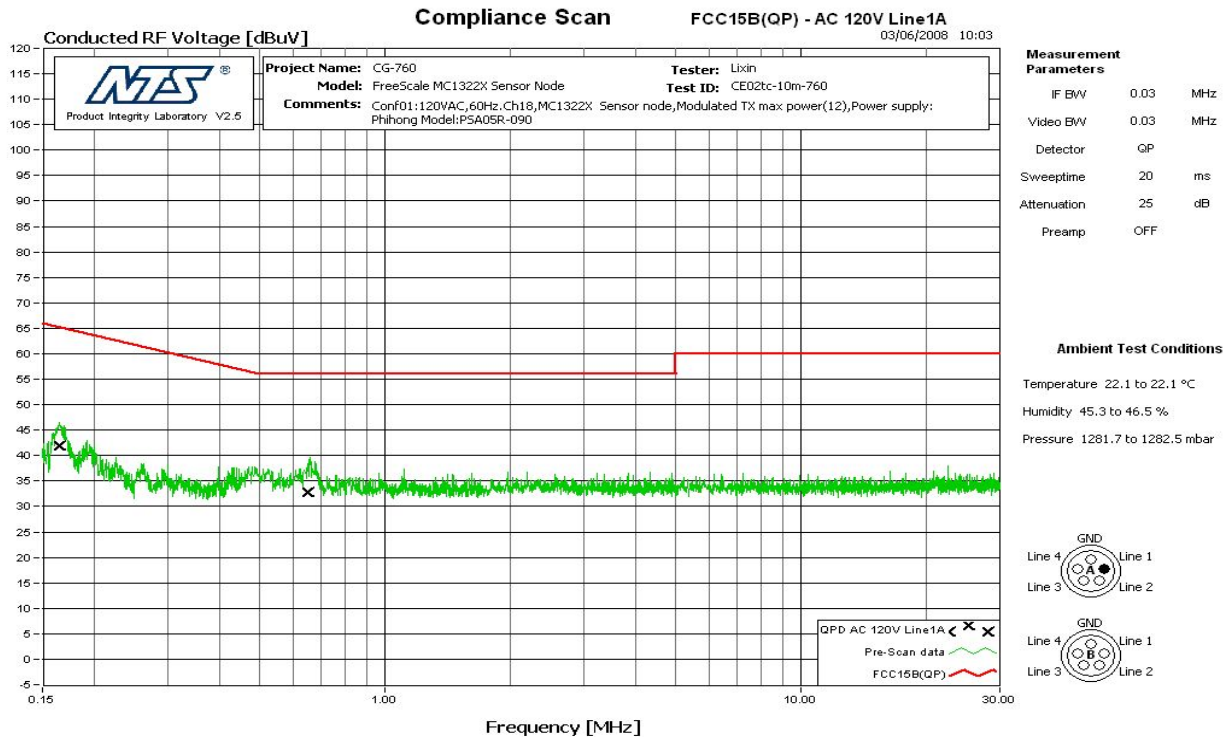
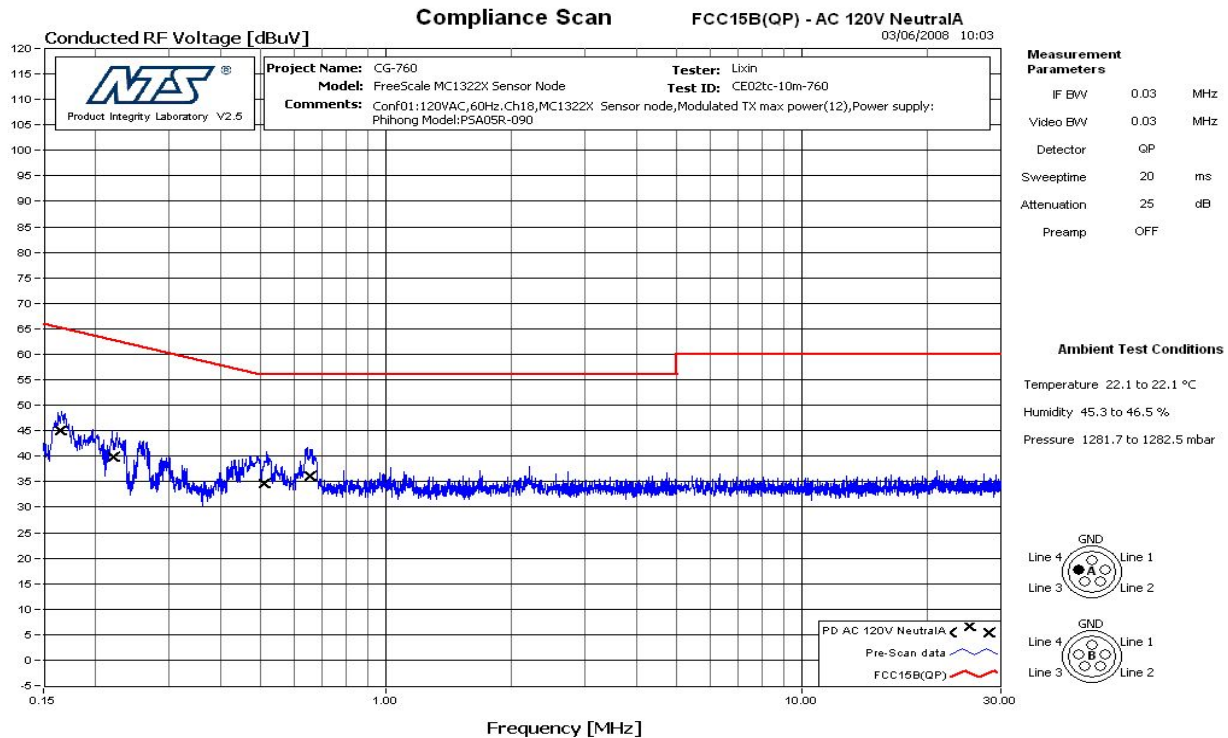


Figure 2 Conducted Emission 120 VAC Return 150 kHz – 30 MHz Quasi-peak Detector



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

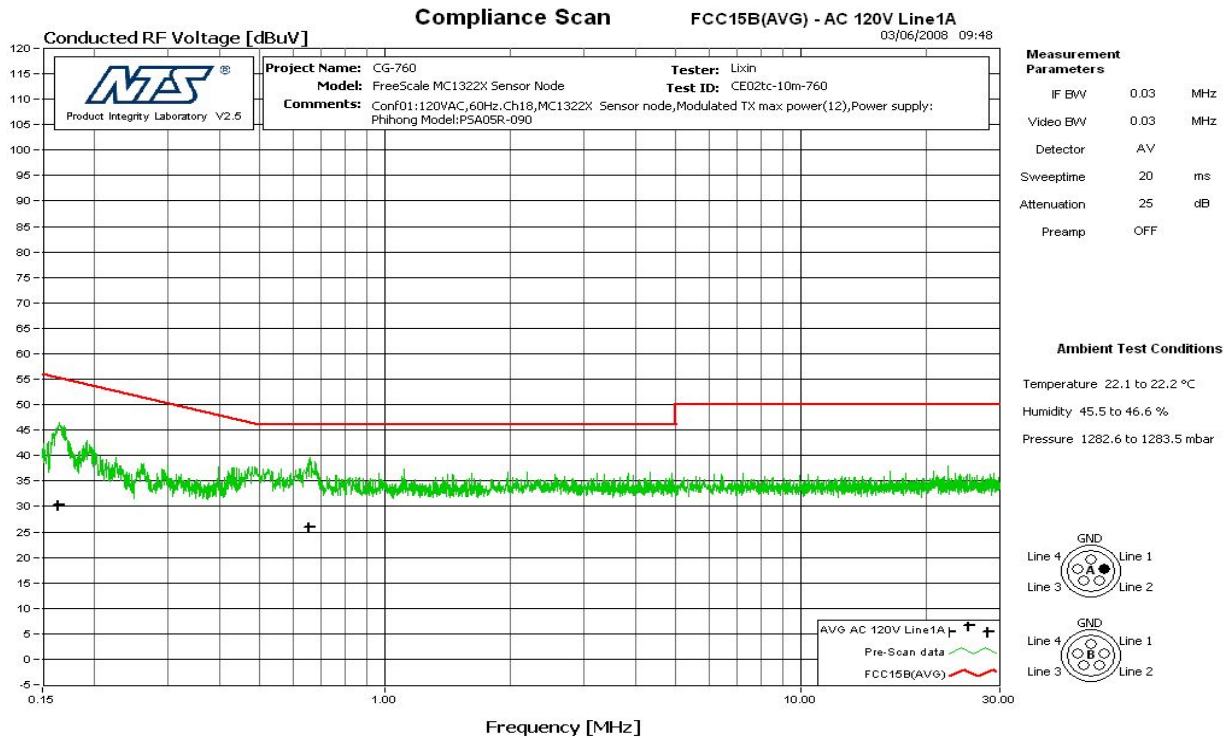
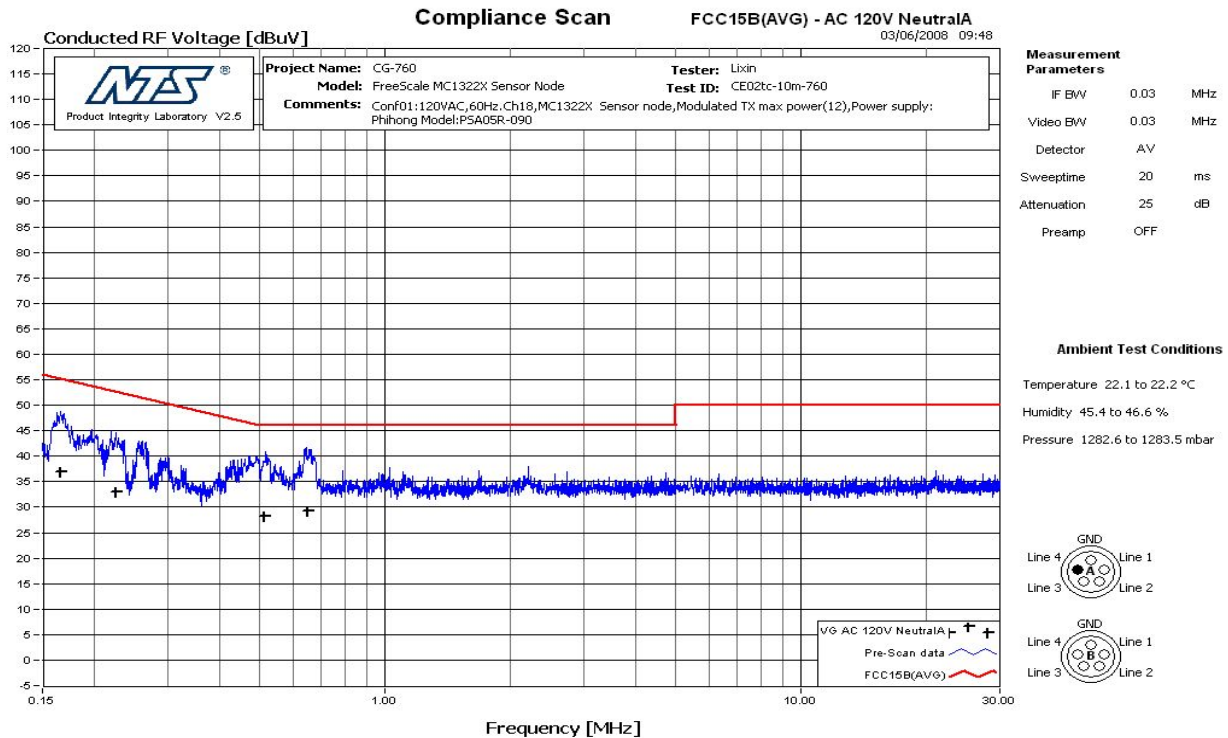


Figure 4 Conducted Emission 120 VAC Return 150 kHz – 30 MHz Average Detector



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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 7 A8.2 (a)
Test Basis	FCC Publication 558074 RSS-Gen Issue 2 4.6.2
Test Method	FCC Publication 558074 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	1.422
18	2440	1.603
26	2480	1.482

B.6. Operating Mode During Test

The 1322x Sensor 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).

B.7. 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

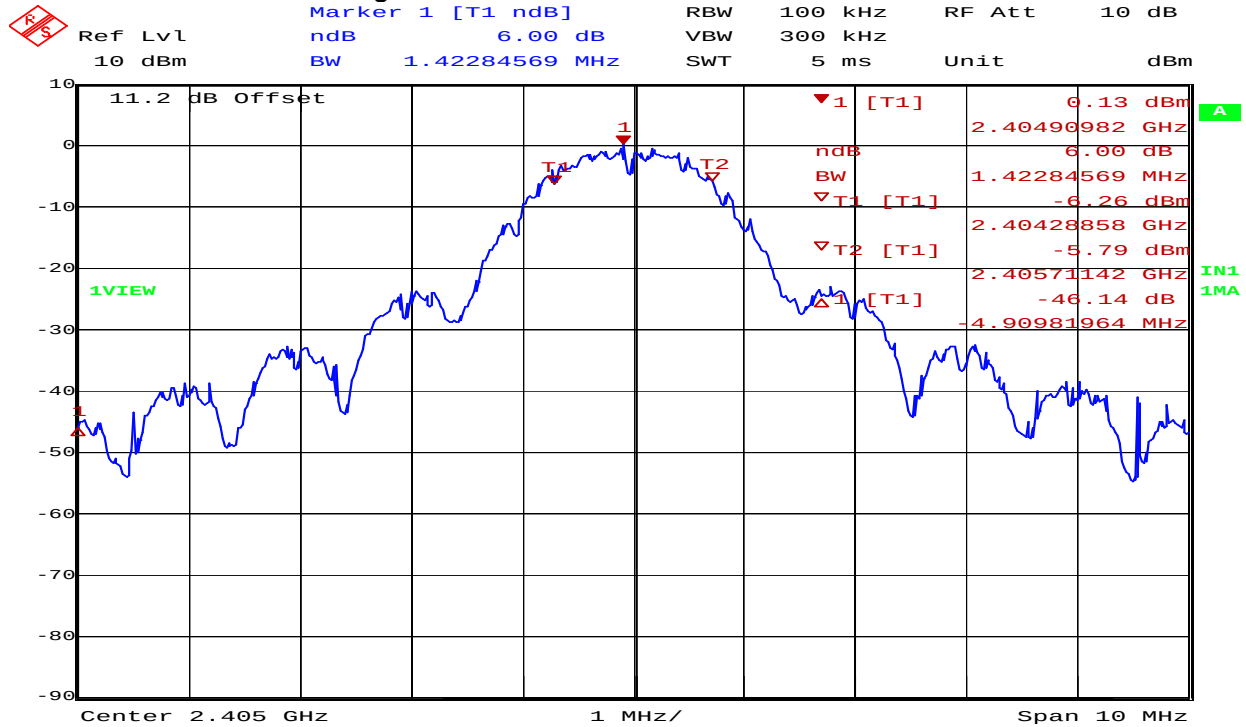
B.8. Test date

Test started: June 16, 2008 Ended: June 16, 2008

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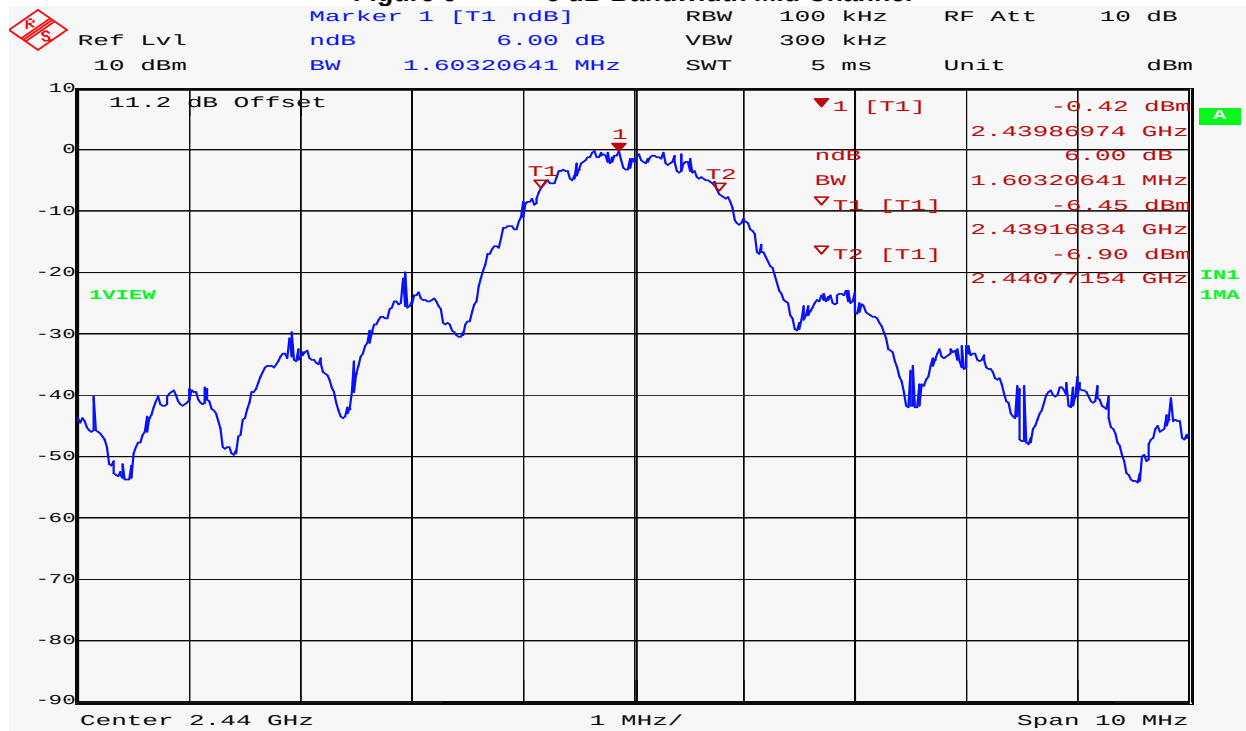
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Figure 5 6 dB Bandwidth Low Channel



Title: CG-760 Freescale Semiconductor MC1322X Sensor Node
Comment A: Channel 11, PRBS Tx, Power Setting: 12
Date: 16.JUN.2008 17:57:33

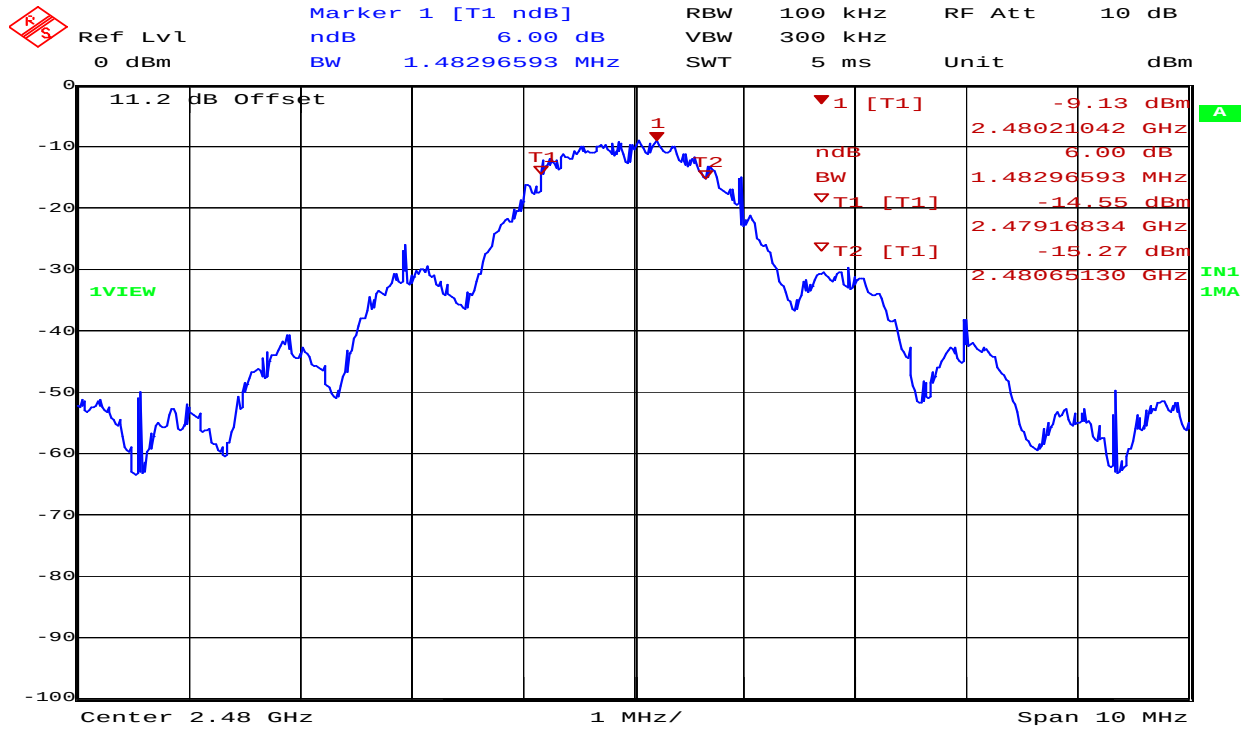
Figure 6 6 dB Bandwidth Mid Channel



Title: CG-760 Freescale Semiconductor MC1322X Sensor Node
Comment A: Channel 18, PRBS Tx, Power Setting: 12
Date: 17.JUN.2008 13:19:43

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Figure 7 6 dB Bandwidth High Channel



Title: CG-760 Freescall Semiconductor MC1322X Sensor Node
Comment A: Channel 26, PRBS Tx, Power Setting: 0E
Date: 17.JUN.2008 13:45:37

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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	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	2.464
18	2440	2.464
26	2480	2.685

C.6. Operating Mode During Test

The 1322x Sensor 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).

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: Deniz Demirci
Function: Senior EMC / Wireless Technologist

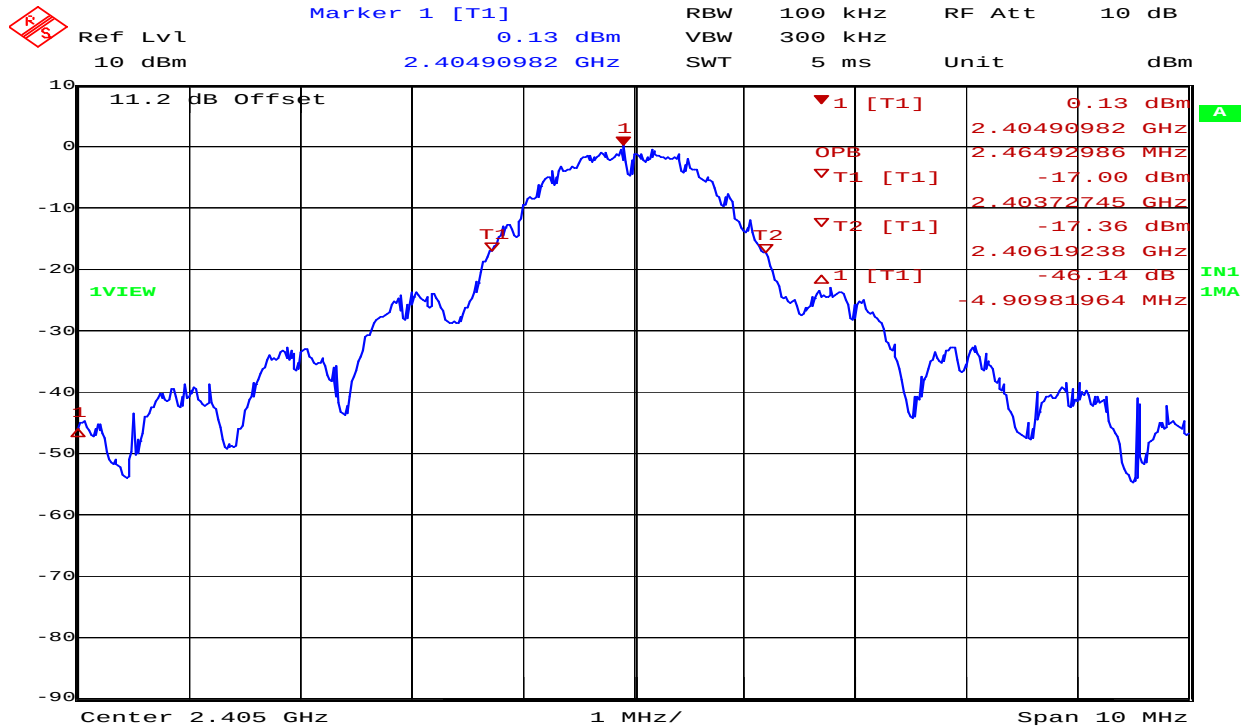
C.9. Test date

Test started: June 16, 2008 Ended: June 16, 2008

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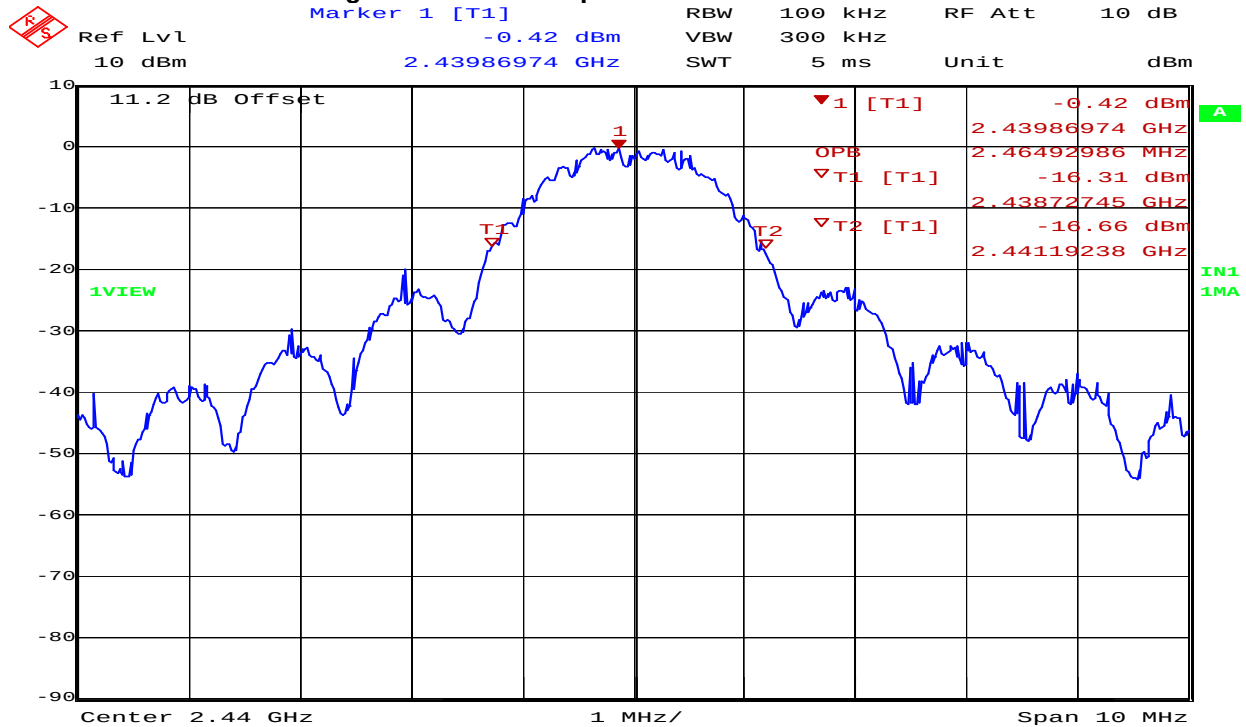
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Figure 8 Occupied Bandwidth Low Channel



Title: CG-760 Freescale Semiconductor MC1322X Sensor Node
Comment A: Channel 11, PRBS Tx, Power Setting: 12
Date: 16.JUN.2008 17:58:03

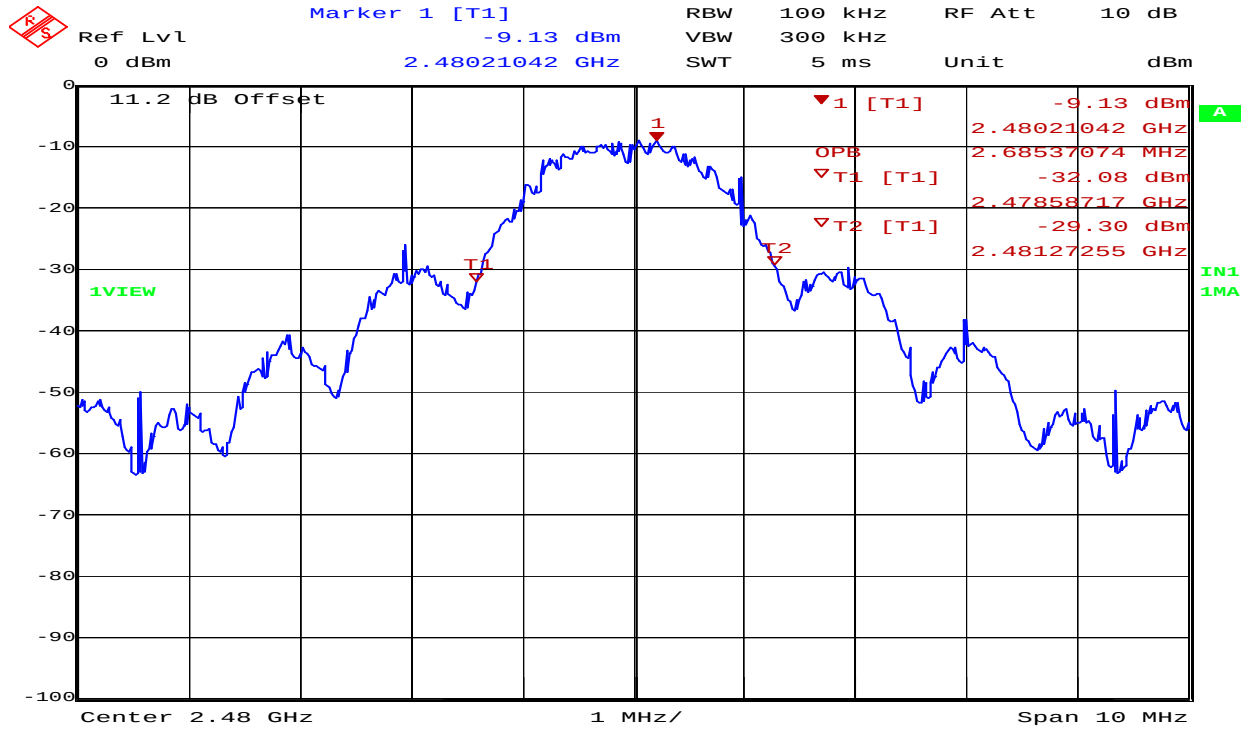
Figure 9 Occupied Bandwidth Mid Channel



Title: CG-760 Freescale Semiconductor MC1322X Sensor Node
Comment A: Channel 18, PRBS Tx, Power Setting: 12
Date: 17.JUN.2008 13:20:24

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Figure 10 Occupied Bandwidth High Channel



Title: CG-760 Freescall Semiconductor MC1322X Sensor Node
 Comment A: Channel 26, PRBS Tx, Power Setting: 0E
 Date: 17.JUN.2008 13:46:04

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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	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 1322x Sensor 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).

D.6. Test Results

Compliant – The maximum peak power was 3.42 dBm

D.7. Sample Calculation

None

D.8. Test Data Summary

Channel	Frequency (MHz)	Peak RF power (dBm)
11	2404.899	3.30
18	2437.975	3.42
26	2478.939	-4.34

D.9. Tested By

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

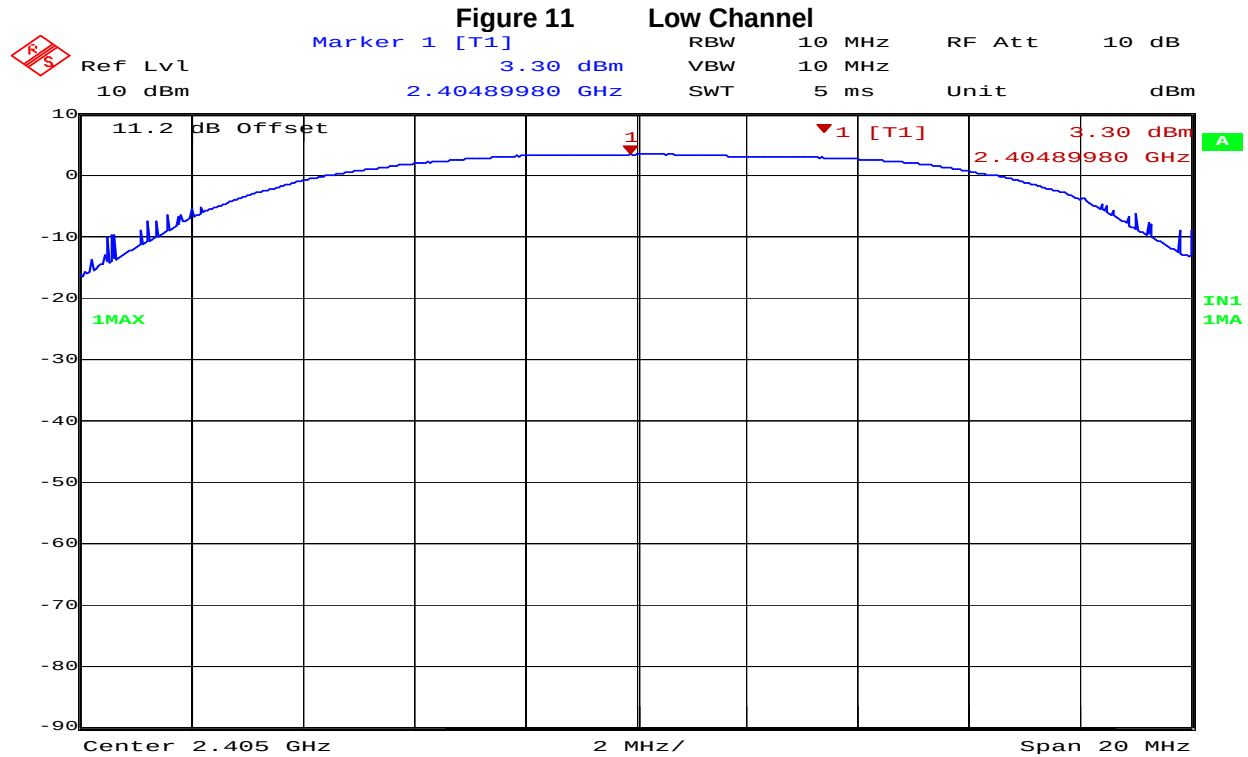
Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

D.10. Test date

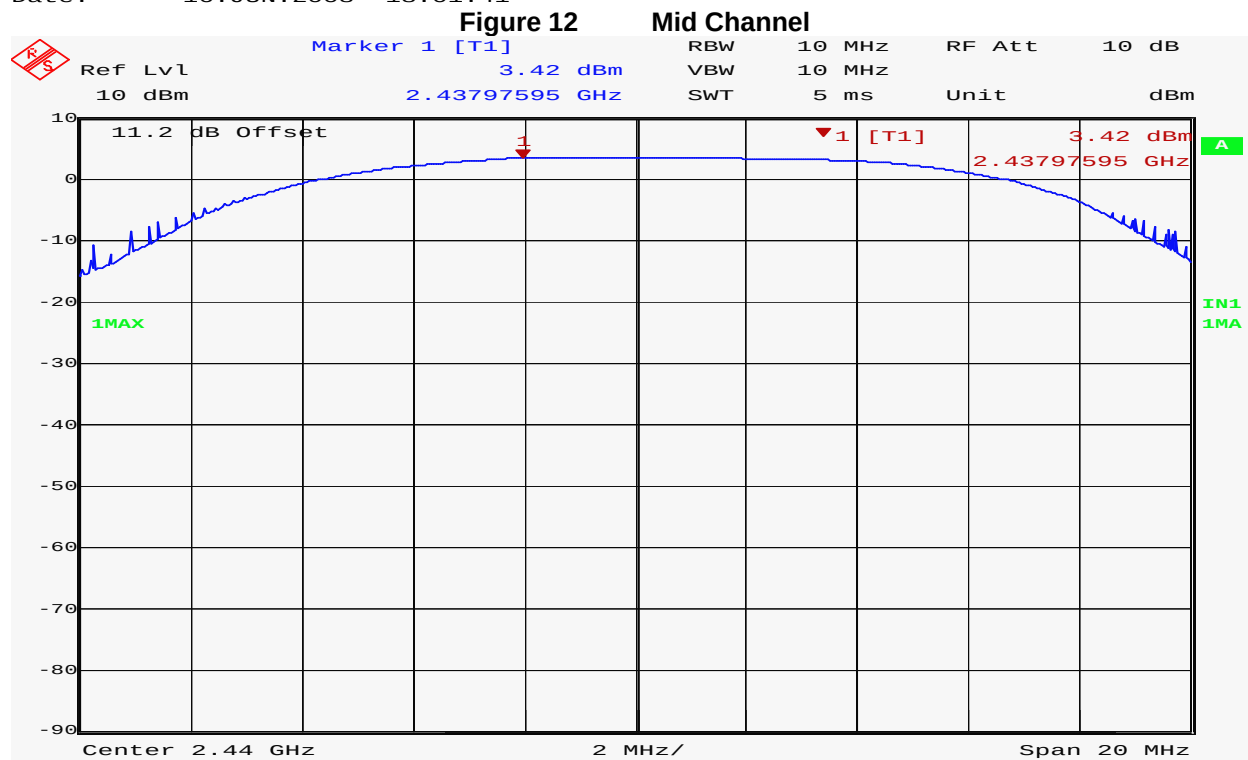
Test started: June 16, 2008 Ended: June 16, 2008

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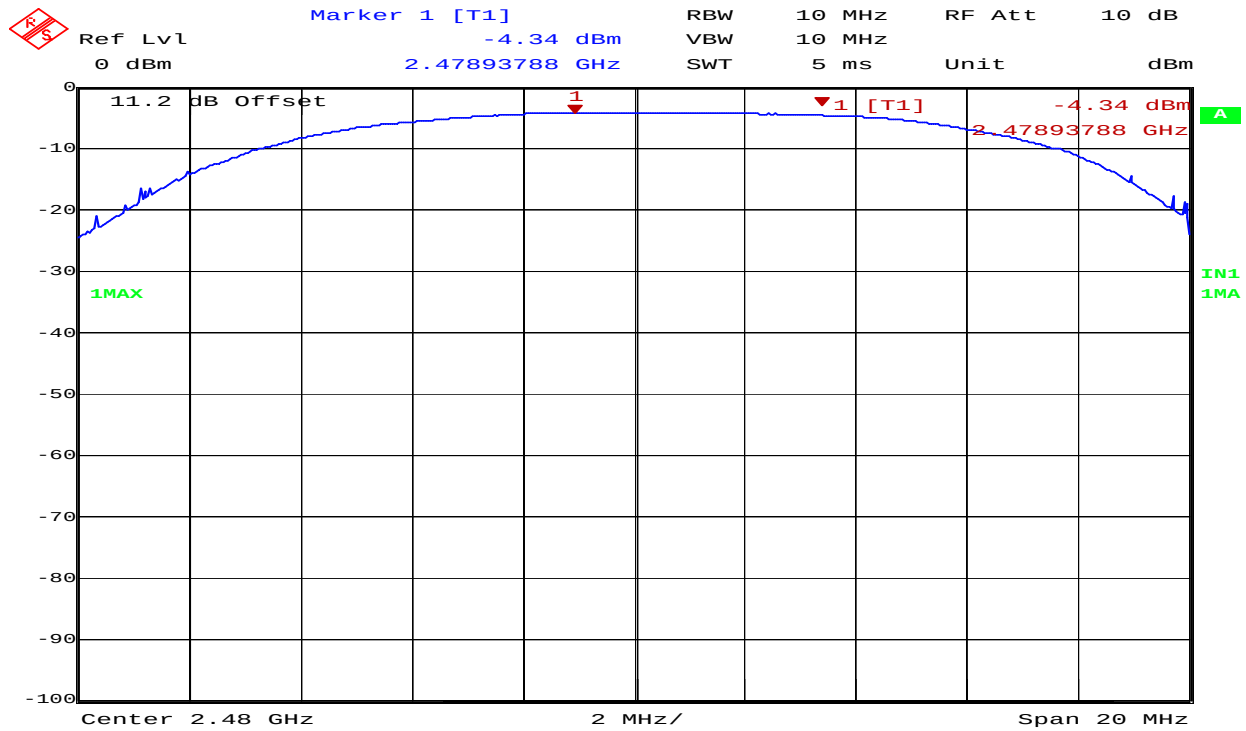
Title: CG-760 Freescal Semiconductor MC1322X Sensor Node
Comment A: Channel 11, PRBS Tx, Power Setting: 12
Date: 16.JUN.2008 18:01:41



Title: CG-760 Freescal Semiconductor MC1322X Sensor Node
Comment A: Channel 18, PRBS Tx, Power Setting: 12
Date: 17.JUN.2008 13:22:07

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Figure 13 High Channel



Title: CG-760 Freescall Semiconductor MC1322X Sensor Node
Comment A: Channel 26, PRBS Tx, Power Setting: 0E
Date: 17.JUN.2008 13:47:17

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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	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 1322x Sensor 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).

E.6. Test Results

Compliant. The maximum measured power spectral density was -10.74 dBm

E.7. Sample Calculation

None

E.8. Test Data Summary

Channel	Frequency (MHz)	PSD (dBm)
11	2405.021	-10.74
18	2440.018	-10.90
26	2480.020	-18.69

E.9. Tested By

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

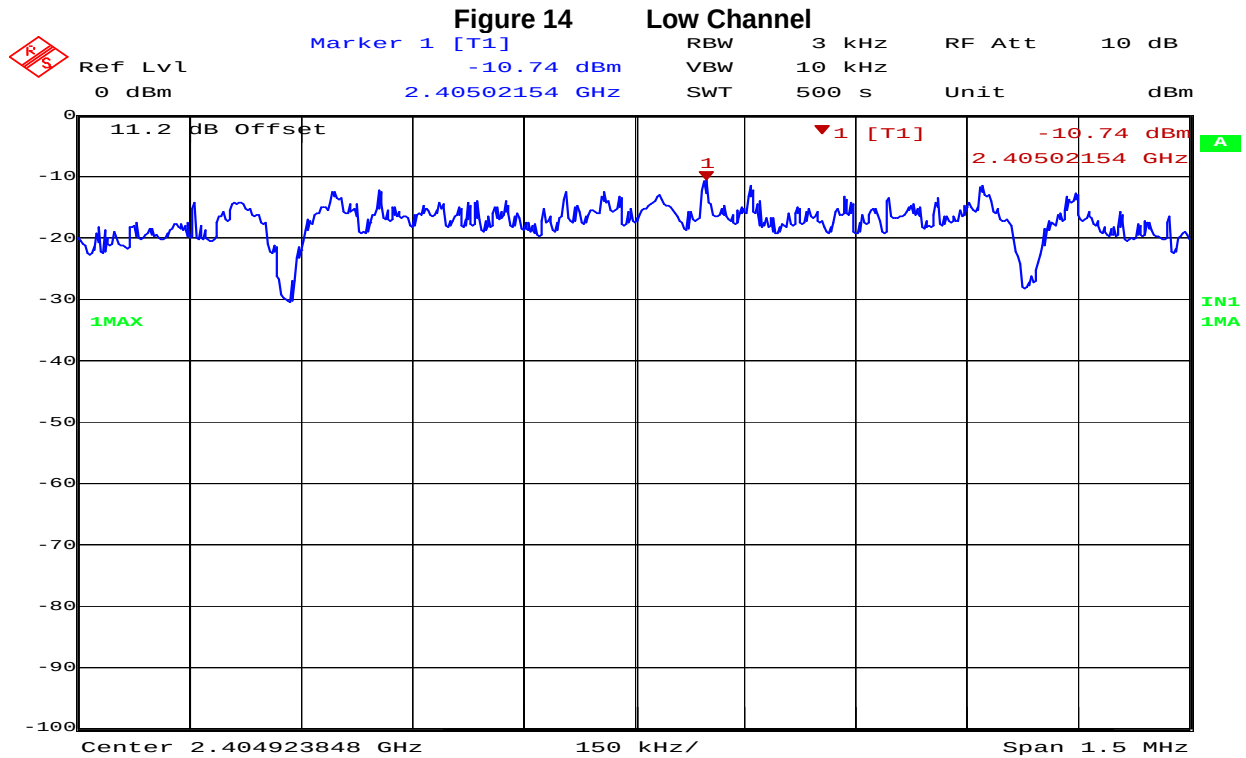
Name: Deniz Demirci
Function: Senior EMC / Wireless Technologist

E.10. Test date

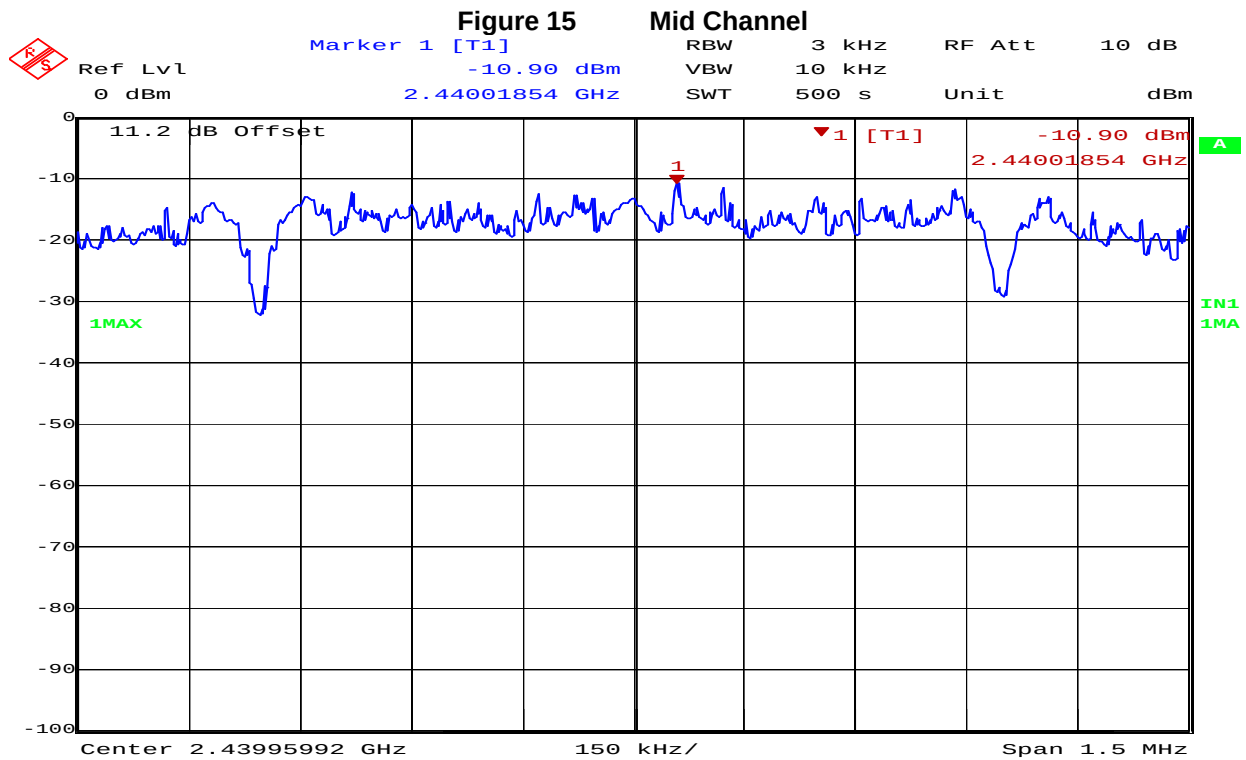
Test started: June 16, 2008 Ended: June 16, 2008

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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Title: CG-760 Freescall Semiconductor MC1322X Sensor Node
Comment A: Channel 11, PRBS Tx, Power Setting: 12
Date: 16.JUN.2008 18:21:02

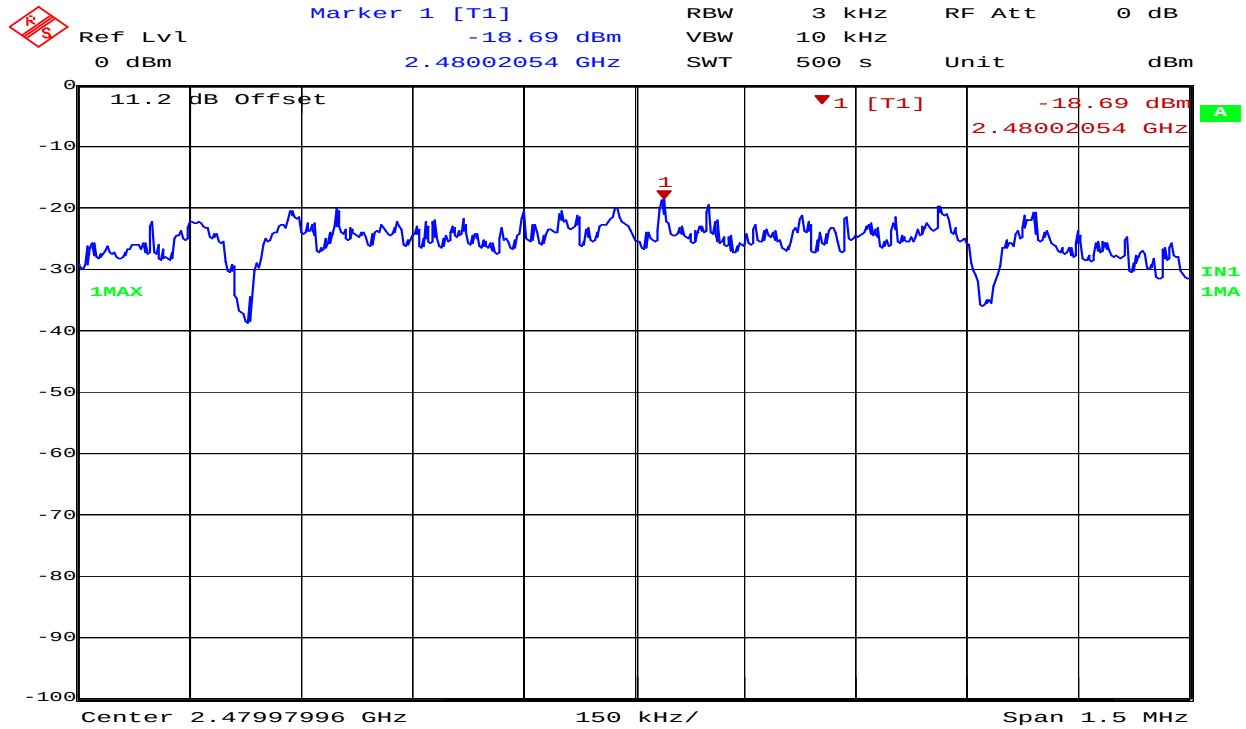


Title: CG-760 Freescall Semiconductor MC1322X Sensor Node
Comment A: Channel 18, PRBS Tx, Power Setting: 12
Date: 17.JUN.2008 13:40:59

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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Figure 16 High Channel



Title: CG-760 Freescall Semiconductor MC1322X Sensor Node
Comment A: Channel 26, PRBS Tx, Power Setting: 0E
Date: 17.JUN.2008 14:47:12

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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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	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 1322x Sensor Node was tuned to Channel 11 operating at maximum rated RF output power.

F.6. Test Results

Duty cycle correction factor = $20 \cdot \log(2.507/11.032) = 12.86$ dB

F.7. 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

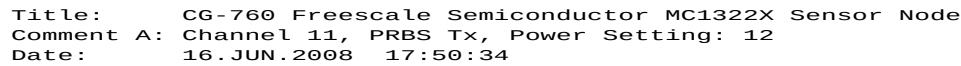
F.8. Test date

Test started: June 16, 2008 Ended: June 16, 2008

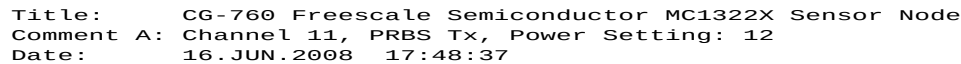
The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

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Period



On Time



June 20, 2008

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 1322x Sensor 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).

G.6. Test Results

Compliant,
Worst case spurious emission was 52.25 dB below the carrier at Channel 26.

G.7. 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

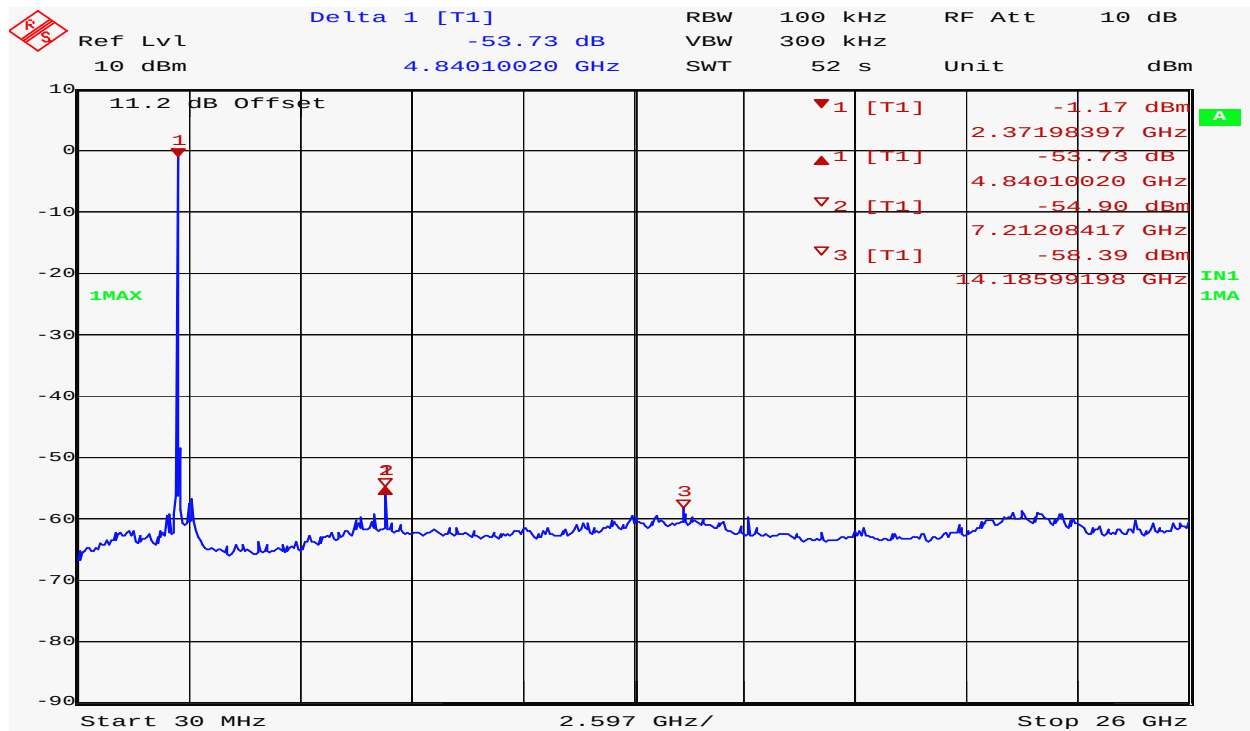
G.8. Test date

Test started: June 16, 2008 Ended: June 16, 2008

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.

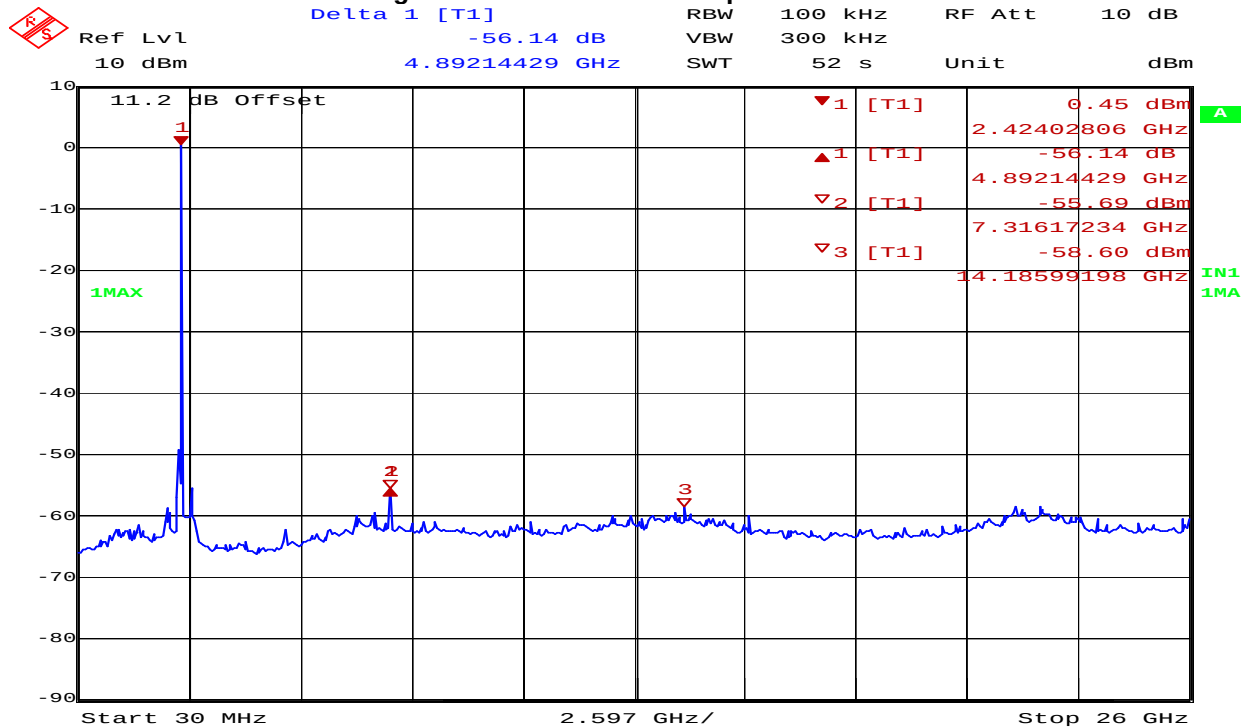
NTS Product Integrity Laboratory, 5151-47th Street N.E. Tel: 403-568-6605, Fax: 403-568-6970

Figure 19 Conducted Spurious Ch11



Title: CG-760 Freescal Semiconductor MC1322X Sensor Node
Comment A: Channel 11, PRBS Tx, Power Setting: 12
Date: 16.JUN.2008 18:08:53

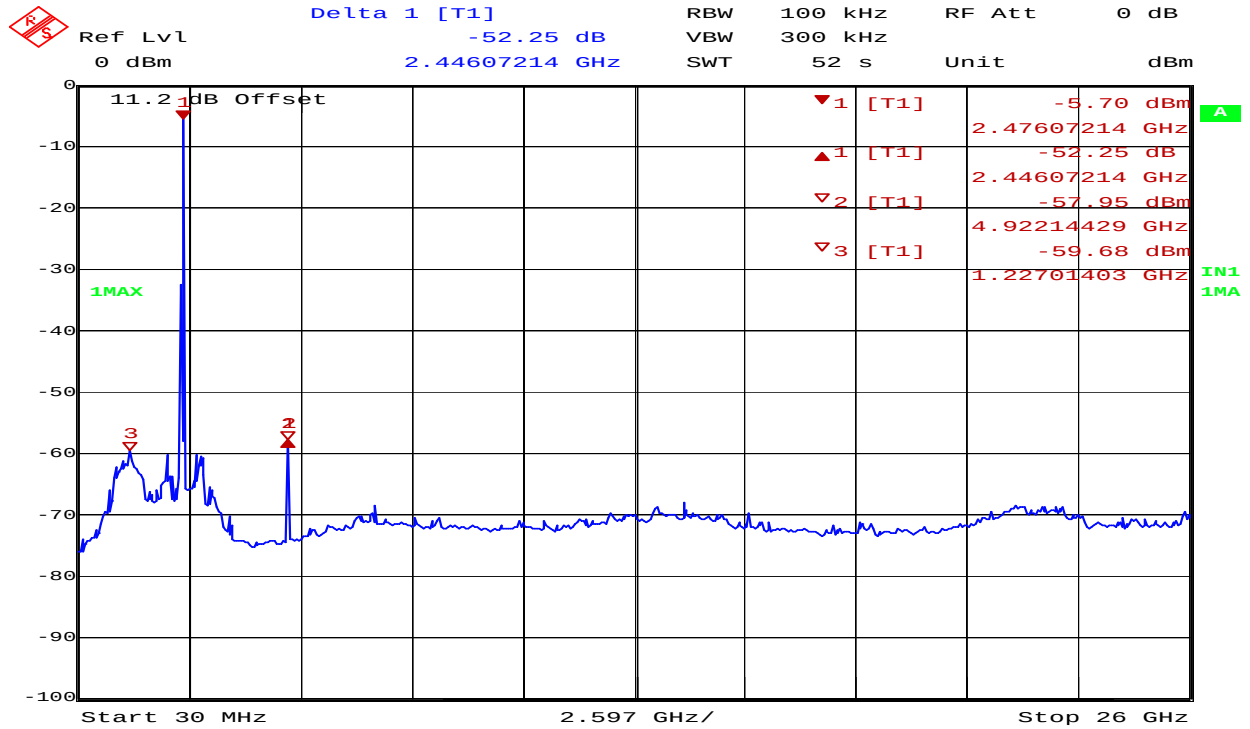
Figure 20 Conducted Spurious Ch18



Title: CG-760 Freescal Semiconductor MC1322X Sensor Node
Comment A: Channel 18, PRBS Tx, Power Setting: 12
Date: 17.JUN.2008 13:27:29

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.

Figure 21 Conducted Spurious Ch26



Title: CG-760 Freescal Semiconductor MC1322X Sensor Node
Comment A: Channel 26, PRBS Tx, Power Setting: 0E
Date: 17.JUN.2008 14:26:10

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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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 1322x Sensor 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).

H.6. Test Results

Compliant

Worst case spurious emission was 41.81 dB below the carrier at Channel 26

H.7. 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

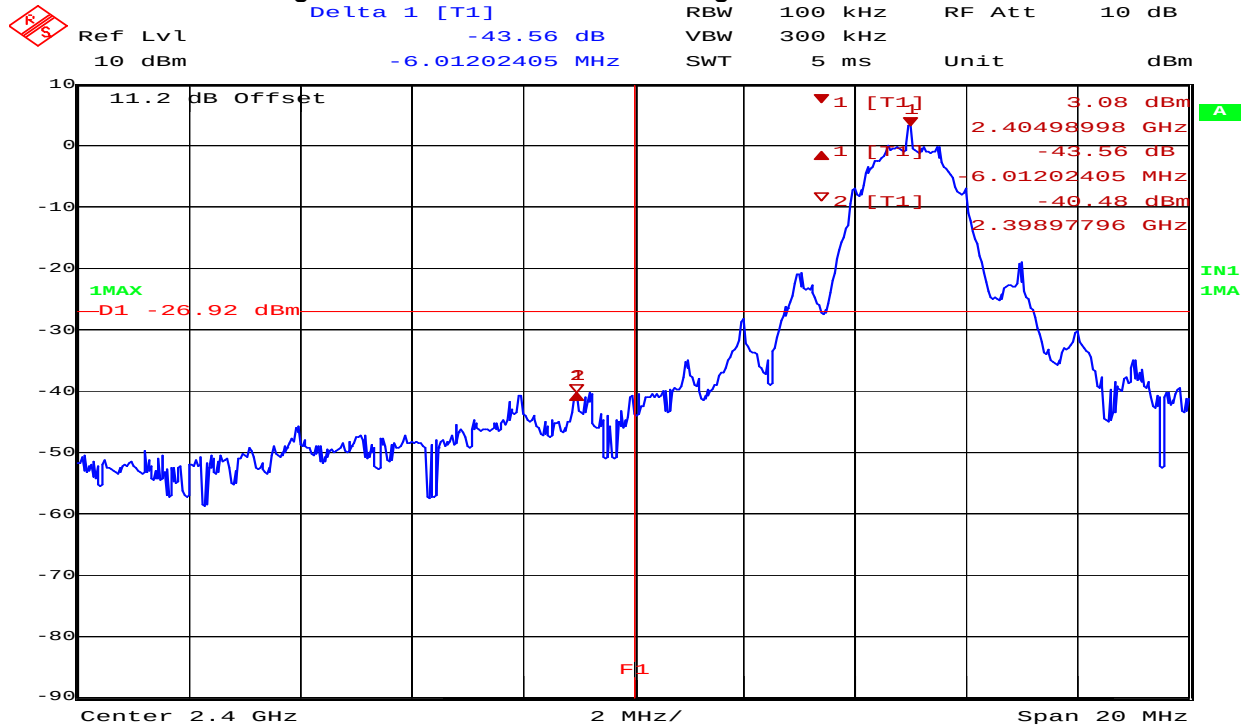
H.8. Test date

Test started: June 16, 2008 Ended: June 16, 2008

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.

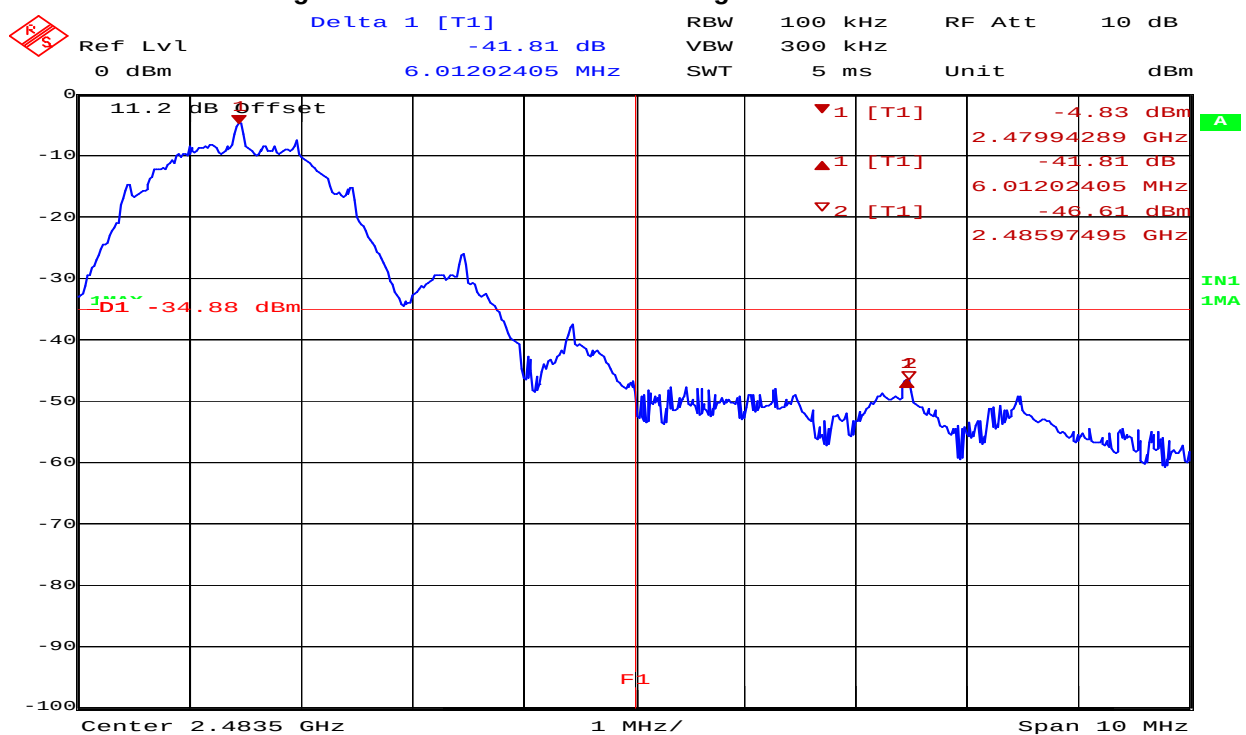
NTS Product Integrity Laboratory, 5151-47th Street N.E. Tel: 403-568-6605, Fax: 403-568-6970

Figure 22 Conducted Band edge Measurement Ch11



Title: CG-760 Freescall Semiconductor MC1322X Sensor Node
Comment A: Channel 11, PRBS Tx, Power Setting: 12
Date: 16.JUN.2008 18:00:33

Figure 23 Conducted Band edge Measurement Ch26



Title: CG-760 Freescall Semiconductor MC1322X Sensor Node
Comment A: Channel 26, PRBS Tx, Power Setting: 0E
Date: 17.JUN.2008 13:50:39

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.

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.

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.

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

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 1322x Sensor 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.

I.6. Test Results

Compliant

Channel	Frequency (MHz)	Detector	Radiated emission level (dBμV/m)	Duty cycle correction factor (dB)	Corrected value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
11	2390.000	PK	62.28	N/A	62.28	73.98	11.70
11	2382.104	AV	46.79	-12.86	33.93	53.98	20.05
25	2483.720	PK	71.59	N/A	71.59	73.98	2.39
26	2483.500	PK	71.98	N/A	71.98	73.98	2.00
26	2483.500	AV	58.03	-12.86	45.17	53.98	8.81

Maximum peak measurement was 71.98 dBμV/m at 2483.500 MHz. It has 2.00 dB margin to the 15.209 limits.

Antenna height was 128 cm at horizontal polarization and turntable angle was 26 degree.

I.7. 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 = $73.98 \text{ dB}\mu\text{V/m}$

Radiated emission level (dBμV/m) = Measured level (dBμV) + Receive antenna factor (dB) + Receive cable loss (dB) – LNA gain (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

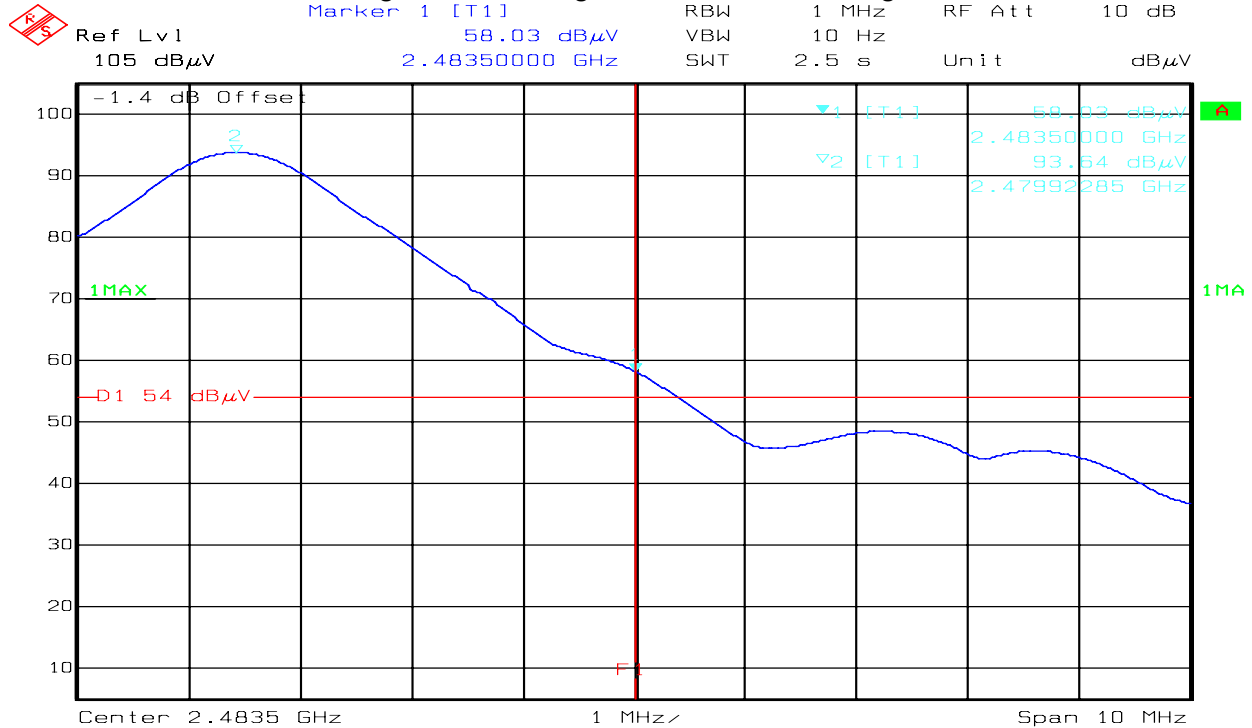
I.9. Test date

Test started: June 4, 2008 Ended: June 4, 2008

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.

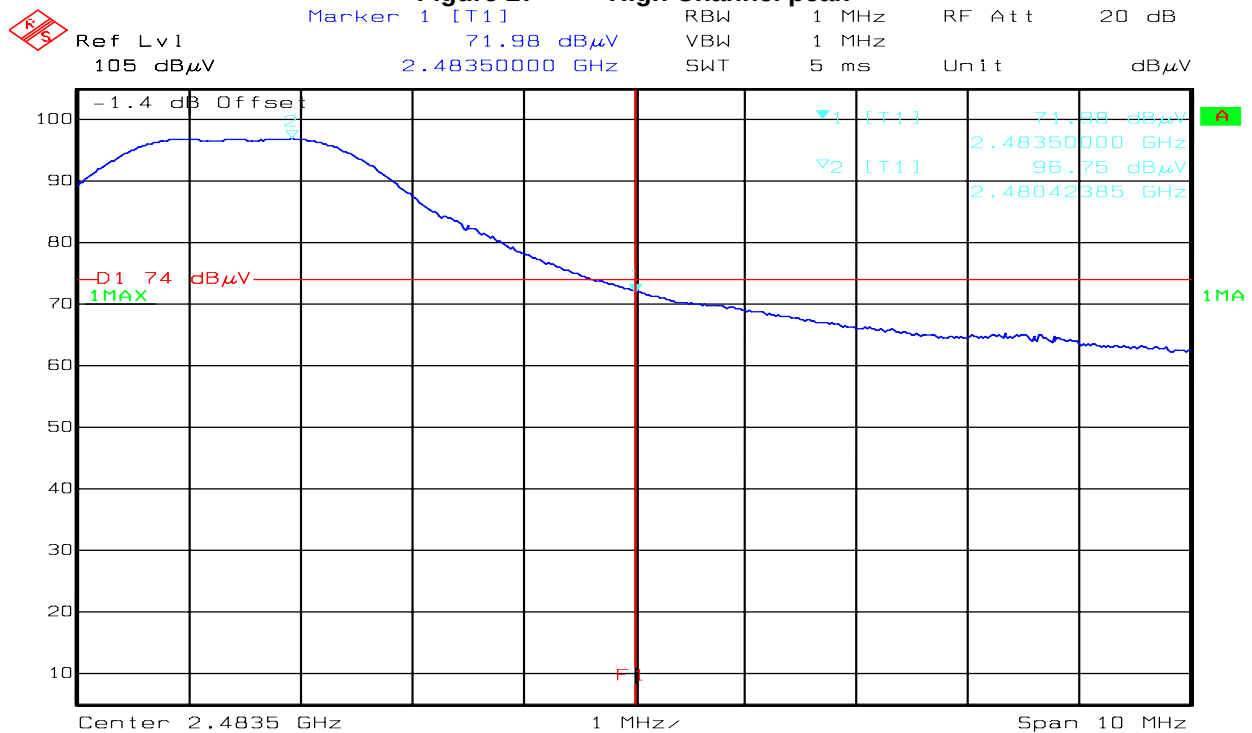
NTS Product Integrity Laboratory, 5151-47th Street N.E. Tel: 403-568-6605, Fax: 403-568-6970

Figure 26 High Channel Video Average



Title: CG-760 Freescale MC1322X Sensor Node
Comment A: Ch26, Power Setting OE, Modulated Tx
Date: 4.JUN.2008 12:37:44

Figure 27 High Channel peak

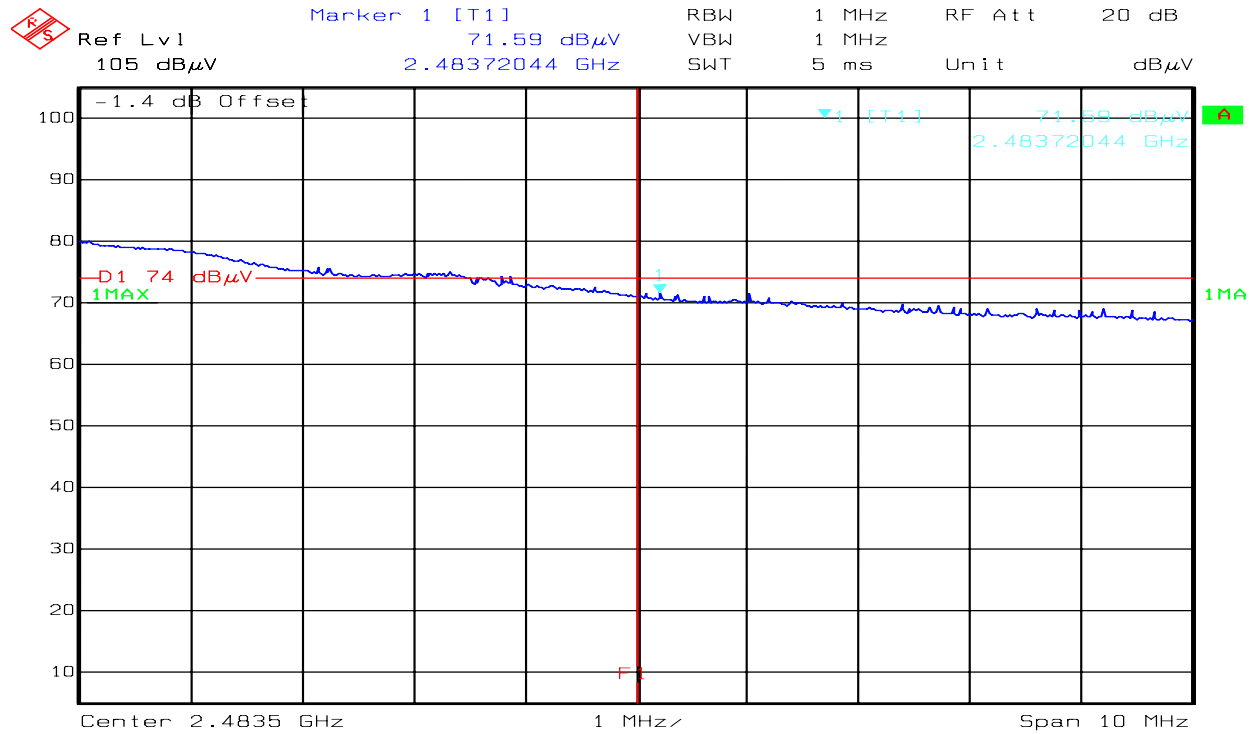


Title: CG-760 Freescale MC1322X Sensor Node
Comment A: Ch26, Power Setting OE, PRBS Tx
Date: 4.JUN.2008 12:07:26

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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Figure 28 Channel 25 with maximum power, Peak



Title: CG-760 Freescale MC1322X Sensor Node
Comment A: Ch25, Power Setting 12, PRBS Tx
Date: 4.JUN.2008 12:12:19

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.

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 E001R7 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.

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.

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

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 Sensor 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 1322x Sensor Node was tuned to a low, mid and high channel operating with Receive mode.

Worst case emissions presented

J.5. Sample Calculations

Part 15.209

Limit at 124.00 MHz for 10 m = $20 \cdot \log(150) - 20 \cdot \log(3/10) = 33.07 \text{ dB}\mu\text{V/m}$

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

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 μV) + 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
Function: Senior EMC / Wireless Technologist

J.7. Test date

Test started: June 4, 2008 Ended: June 18, 2008

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.

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

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 (°)
18	Tx	124.00	QP	27.96	QP	33.07*	5.11	Vertical	100	0
11	Tx	2738.48	PK	35.37	AV	53.98**	18.61	Horizontal	103	15
11	Tx	4809.82	PK	39.67	AV	53.98**	14.30	Horizontal	103	15
18	Rx	124.00	QP	27.96	QP	33.07*	5.11	Vertical	100	0

*Limit at 10 m (15.249)

**Limit at 3 m (15.249)

Tx Mode:

In the restricted bands, maximum measured level was 27.96 dBμV/m with quasi-peak detector at 124.00 MHz, when antenna was vertically polarized. It has 5.11 dB margin to the limits.

Rx Mode:

Maximum measured level was 27.96 dBμV/m with quasi-peak detector at 124.00 MHz, when antenna was vertically polarized. It has 5.11 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

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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.

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END OF DOCUMENT

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