



Product Integrity Laboratory

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Certification Test Report

CFR 47 FCC Part 15, Subpart C Section
15.247

Industry Canada RSS 210, Issue 5

Axiom Manufacturing's AXM0367
FCC ID # TFY0605AXM0367

Project Code CG-05-0099
(Report CG-05-0099-1)

Revision: 0

June 27, 2005

Prepared for: Axiom Manufacturing

Author: Glen Moore
EMC Manager

Approved by: Nick Kobrosly
Lab Manager

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Report Summary

NTS Canada

Product Integrity Laboratory
5151-47th Street, N.E. Calgary Alberta T3J 3R2

Accreditation Numbers: FCC 101386
IC 46405-3978 File # IC3978-2
Standards Council of Canada Accredited Laboratory No. 440

Applicant Axiom Manufacturing
2813 Industrial Lane
Garland, Texas 75041
Phone (972) 926-9303

Customer Representative: Roger Forrester
Engineering Manager

EUT Description:

EUT Description	Manufacturer	Model	Revision	Serial Number
2.4 GHz Transceiver integrated in host Development Board for Freescale MCF5213 MCU	Axiom Manufacturing	AXM0367	B	TxCI2-0-94V-0-1605

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Test Summary

Appendix	Test/Requirement Description	Deviations* from:			Pass / Fail	Applicable Rule Parts
		Base Standard	Test Basis	NTS Procedure		
A	TX 6 dB Bandwidth	No	No	No	PASS	15.247
B	TX Peak Power Output	No	No	No	PASS	15.247
C	TX Peak Power Density	No	No	No	PASS	15.247
D	TX Radiated Spurious Emissions 1-26 GHz	No	No	No	PASS	15.247, 15.205
E	TX Radiated Spurious Emissions Band edge	No	No	No	PASS	15.247, 15.205
F	TX Radiated Spurious Emissions 30 MHz-1GHz	No	No	No	PASS	15.247, 15.205
G	RSS 210 Issue 5 RX Spurious Emissions	No	No	No	PASS	RSS 210
H	AC Power line Conducted Emissions	No	No	No	PASS	15.207
I	Test Equipment List	No	No	No	PASS	NA

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

Prepared By: _____
Glen Moore
EMC Manager

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REGISTER OF REVISIONS

Revision	Date	Description of Revisions
0	June 27, 2005	Draft release for review

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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 AXM0367 from Axiom Manufacturing to FCC Part 15 Subpart C section 15.247 for DTS transmitter and the equivalent sections of Industry Canada's RSS 210 Issue 5

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

Description of EUT

	Name	Model	Revision	Serial Number
EUT	Development Board	AXM0367	B	TxC12-0-94V-0-1605
Classification	Table Top			
Size (cm)	15cm x 9.5cm			
Power	120 VAC (From AC Power supply)			
Functional Description	The M5213EVB board provides a hardware and software evaluation platform for the Freescale MCF5213 Microcontroller device. The EVB unit with all supporting documentation is provided to manufacturers and product developers to provide a development platform for creation of other products and is not available for retail sale to the general public. A peripheral feature of the evaluation board is a MC13192 2.4GHz RF transceiver capable of Low Power ISM band operation compatible with IEEE 802.15.4 operation.. Note that the AXM0367 is only used in one orientation, sitting horizontal on the table top orientation			

RF Channel Assignment

Channel Number	Software Channel	IEEE 802.15.4 Channel	Channel Frequency
1	0x00	11	2405 MHz
2	0x01	12	2410 MHz
3	0x02	13	2415 MHz
4	0x03	14	2420 MHz
5	0x04	15	2425 MHz
6	0x05	16	2430 MHz
7	0x06	17	2435 MHz
8	0x07	18	2440 MHz
9	0x08	19	2445 MHz
10	0x09	20	2450 MHz
11	0x0A	21	2455 MHz
12	0x0B	22	2460 MHz
13	0x0C	23	2465 MHz
14	0x0D	24	2470 MHz
15	0x0E	25	2475 MHz
16	0x0F	26	2480 MHz

Bold indicates test channels

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2.1.1 EUT POWER

Voltage	120 VAC
Number of Feeds	1 (1 Hot, 1 Return)
Description	Sceptre switching power supply P/N 1212APLO5
Input Current	0.4 amps

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	1.85
1	Power	Power Supply	AC Mains	Shielded		1.8
1	Serial Data	EUT	PC		DB9 connectors	1.8

2.3 MODE OF OPERATION DURING TESTS

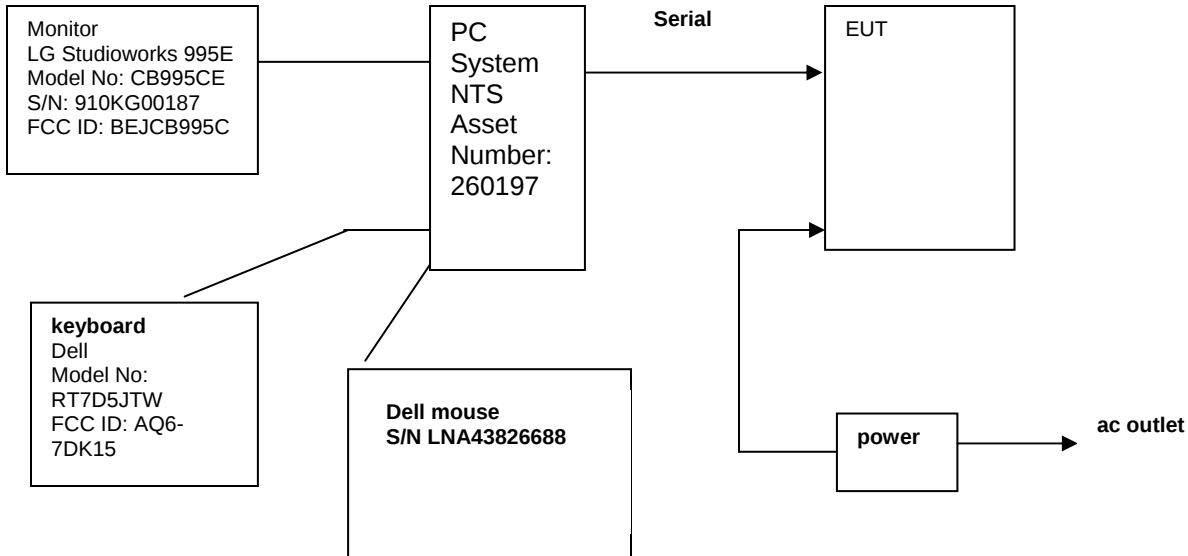
The AXM0367 was tested while in a continuous transmit mode. The EUT was tuned to a low, middle, and high channel to perform power, occupied bandwidth, and spurious/harmonic tests. For conducted emissions the device was tuned to its center frequency. The EUT continuously transmitted an un pulsed DSSS modulated packet with payload. While transmitting the EUT was setup to operate at the intended maximum power output available to the end user. For all test cases prescans were completed in all modes to determine worst case levels.

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3.0 SUPPORT EQUIPMENT

3.1 CONFIGURATION



3.2 TEST BED/PERIPHERAL CABLES

Quantity	Model/Type	Routing		Shielded / Unshielded	Description	Cable Length (m)
		From	To			
1	Power	PC	AC Mains	Unsheilded	Permanent connection to power supply	1.56
1	Power	Monitor	AC Mains	UnShielded		0.84
1	Keyboard cable	Keyboard	PC	Shielded		2.15
1	Mouse Cable	Mouse	PC	Unshielded		1

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APPENDICES

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APPENDIX A: 6 DB BANDWIDTH

A.1. Base Standard & Test Basis

Base Standard	FCC PART 15.247 (A)
Test Basis	Alternative measurement procedure (Radiated)
Test Method	NTS Radio Test Methods 001

A.2. Specifications

The 6dB bandwidth must be greater than 500 KHz,

A.3. Measurement Uncertainty

Radiated Emissions 1 GHz – 5 GHz	Measurement Uncertainty	Expanded Uncertainty (K=2)
(dB)	+3.48/-3.51	+6.96/-7.02

A.4. Deviations

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

A.5. Test Procedure

Alternative test procedure used as per FCC 15.247, all measurements were radiated field strength measurements at a measurement distance of 3 meters

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A.6. Test Results

The EUT is in compliance with the limits as specified above

Channel	6 dB Bandwidth (MHz)
2405 MHz	1.68
2440 MHz	1.68
2480 MHz	1.72

A.7. Operating Mode During Test

The AXM0367 was tested while in a continuous transmit mode. The EUT was tuned to a low, middle, and high channel to perform power, occupied bandwidth, and spurious/harmonic tests. For conducted emissions the device was tuned to its center frequency. The EUT continuously transmitted a pulsed DSSS modulated packet with a payload. While transmitting the EUT was setup to operate at maximum power.

A.8. Sample Calculation

NA

A.9. Test Data

See plots on following pages

A.10. Tested By

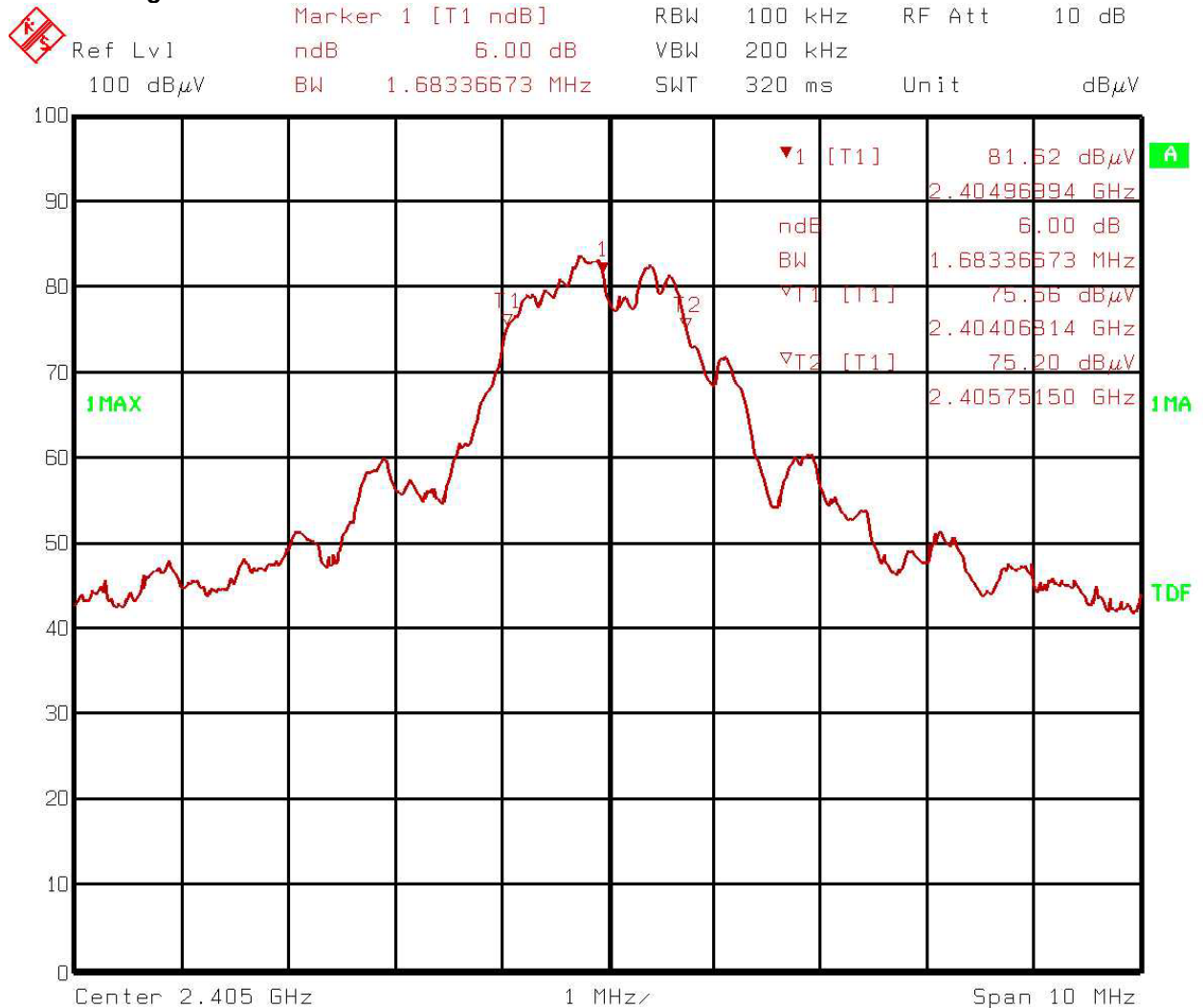
This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Glen Moore
Function: EMC Manager

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Figure 1 6 dB Bandwidth Low Channel



Comment A: FCC15.247 6dB BW EUT AXM0367 Channel 1 - 2405 MHz
Date: 20.JUN.2005 11:09:08

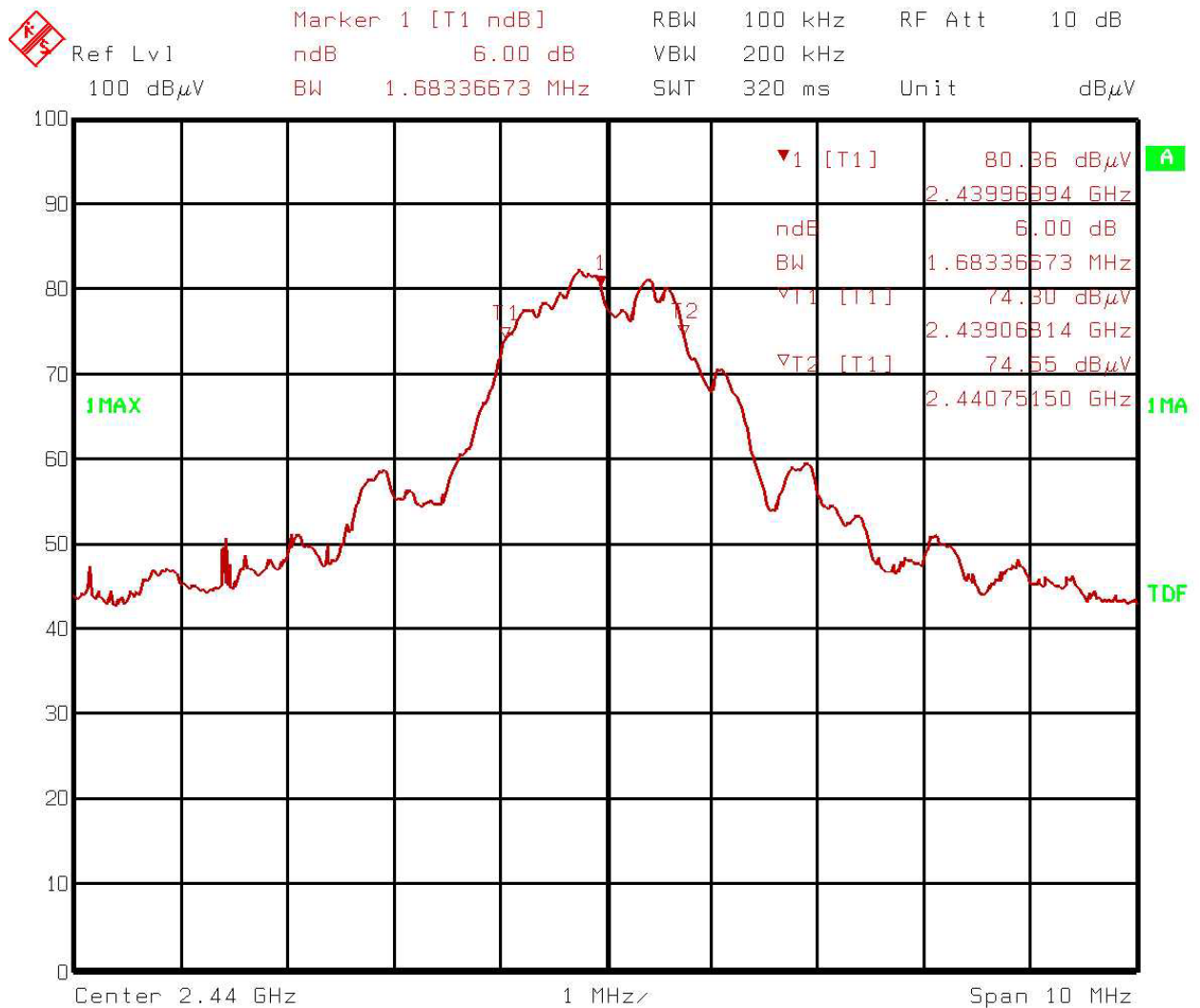
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Figure 2 6 dB Bandwidth Mid Channel



Comment A: FCC15.247 6dB BW EUT AXM0367 Channel 8 - 2440 MHz
Date: 20.JUN.2005 10:54:18

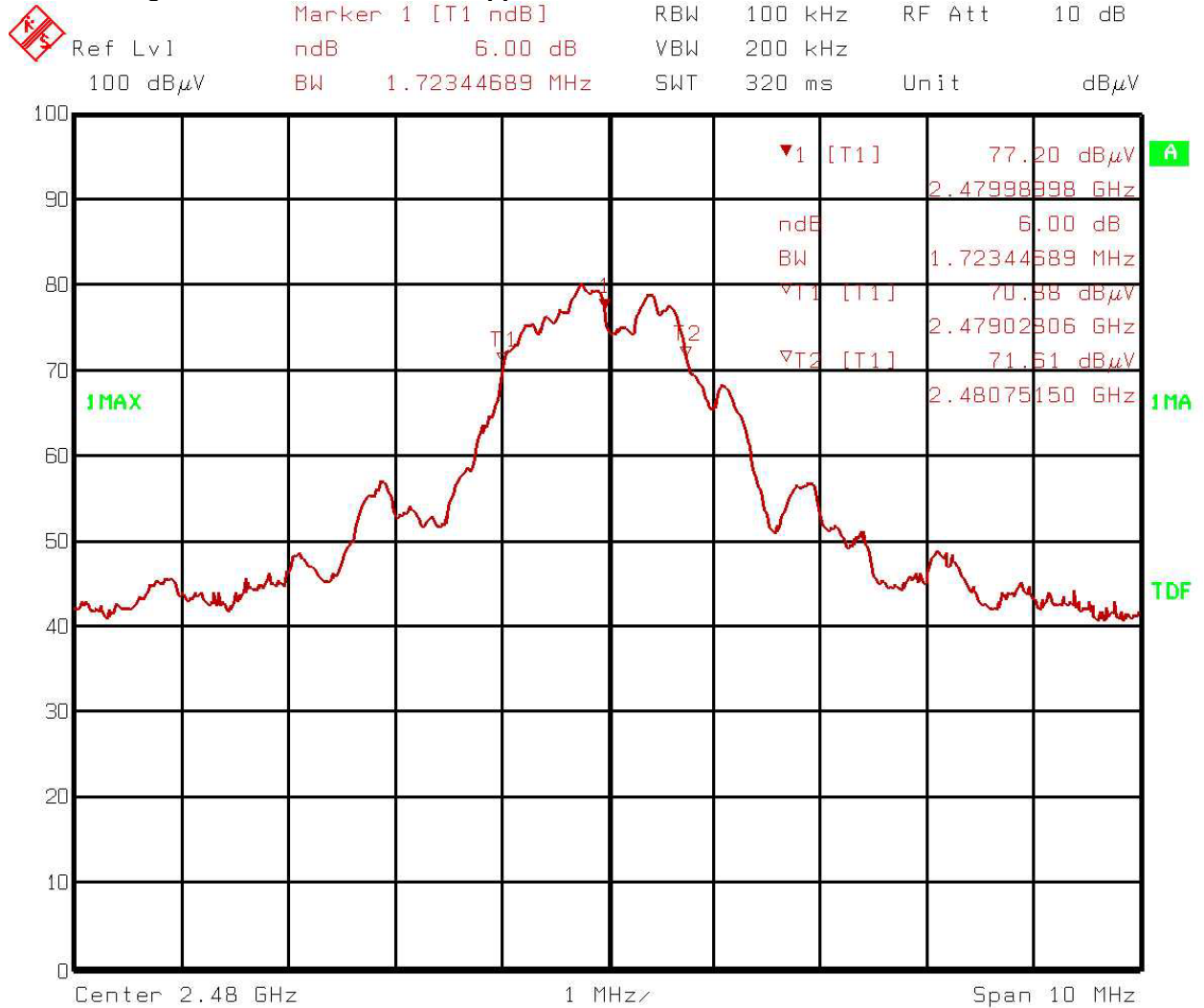
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Figure 3 6 dB Bandwidth Upper Channel



Comment A: FCC15.247 6dB BW EUT AXM0367 Channel 16 - 2480 MHz
Date: 20.JUN.2005 11:26:59

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APPENDIX B: PEAK POWER OUTPUT

B.1. Base Standard & Test Basis

Base Standard	FCC 15.247
Test Basis	ANSI C63.4 - 2003
Test Method	NTS Radio Test Methods 001

B.2. Specifications

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

B.3. Measurement Uncertainty

Radiated Emissions 1 GHz – 5 GHz	Measurement Uncertainty	Expanded Uncertainty (K=2)
(dB)	+3.48/-3.51	+6.96/-7.02

B.4. Deviations

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

B.5. Test Method

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable. The fundamental field strength was maximized by rotating the turntable through 360 degrees, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT, and scanned from 1-4 meters.

A spectrum analyzer with peak detection was used to find the maximum field strength during the scans.

B.6. Test Results

Compliant – The maximum peak power was -2.4 dBm

B.7. Sample Calculation

Note that ERIP in the table below was calculated using $P = \frac{(E * d)^2}{30 * G}$

Where E = Maximum measured field strength in V/M
d = Measurement distance in meters
G = Numeric Gain of transmitting antenna

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B.8. Test Data Summary



Project Number:

CG-05-0099

Tester:

Glen Moore

Model:

Axiom AXM0367

Test ID:

Comments:

Peak Power Output

Standard

FCC 15.247

Measurement Distance

3 Meters

Transmitter Antenna Gain

1 dbi

Frequency (MHz)	Ant Pol	AF (dB)	CL+LNA (dB)	Attenuation (dB)	Total CF (dB)	Detector	Measured Value dBuV/m	Corrected Value dBuV/m	V/M	EIRP (watts)	EIRP (dBm)	Mast Height cm	Turntable Angle degrees
2405	H	28.31	-28.37	10.01	9.96	Pk	82.87	92.83	0.0438026	0.000576	-2.398787	100	275
2440	H	28.38	-28.43	10.01	9.96	Pk	80.76	90.72	0.0343558	0.000354	-4.508787	100	278
2480	H	28.46	-28.35	10.02	10.13	Pk	78.37	88.5	0.0266073	0.000212	-6.728787	100	287
2405	V	28.29	-28.37	10.01	9.94	Pk	79.47	89.41	0.0295461	0.000262	-5.818787	100	351
2440	V	28.37	-28.43	10.01	9.95	Pk	78.65	88.6	0.0269153	0.000217	-6.628787	100	290
2480	V	28.46	-28.35	10.02	10.12	Pk	77.46	87.58	0.0239332	0.000172	-7.648787	100	286

Positive Margin indicates a Pass

AF: Antenna Factors,

Atten: Attenuator Loss,

CF: Correction Factor,

CL= Cable Loss,

Det: Detector Type,

FL: Filter Loss

LNA: Low Noise Amplifier

Total CF = AF + CL + LNA + FL + Atten

Corrected Value = Measured Value + Total CF

Plots of the horizontal polarization for the worst case channel is provided

B.9. Tested By

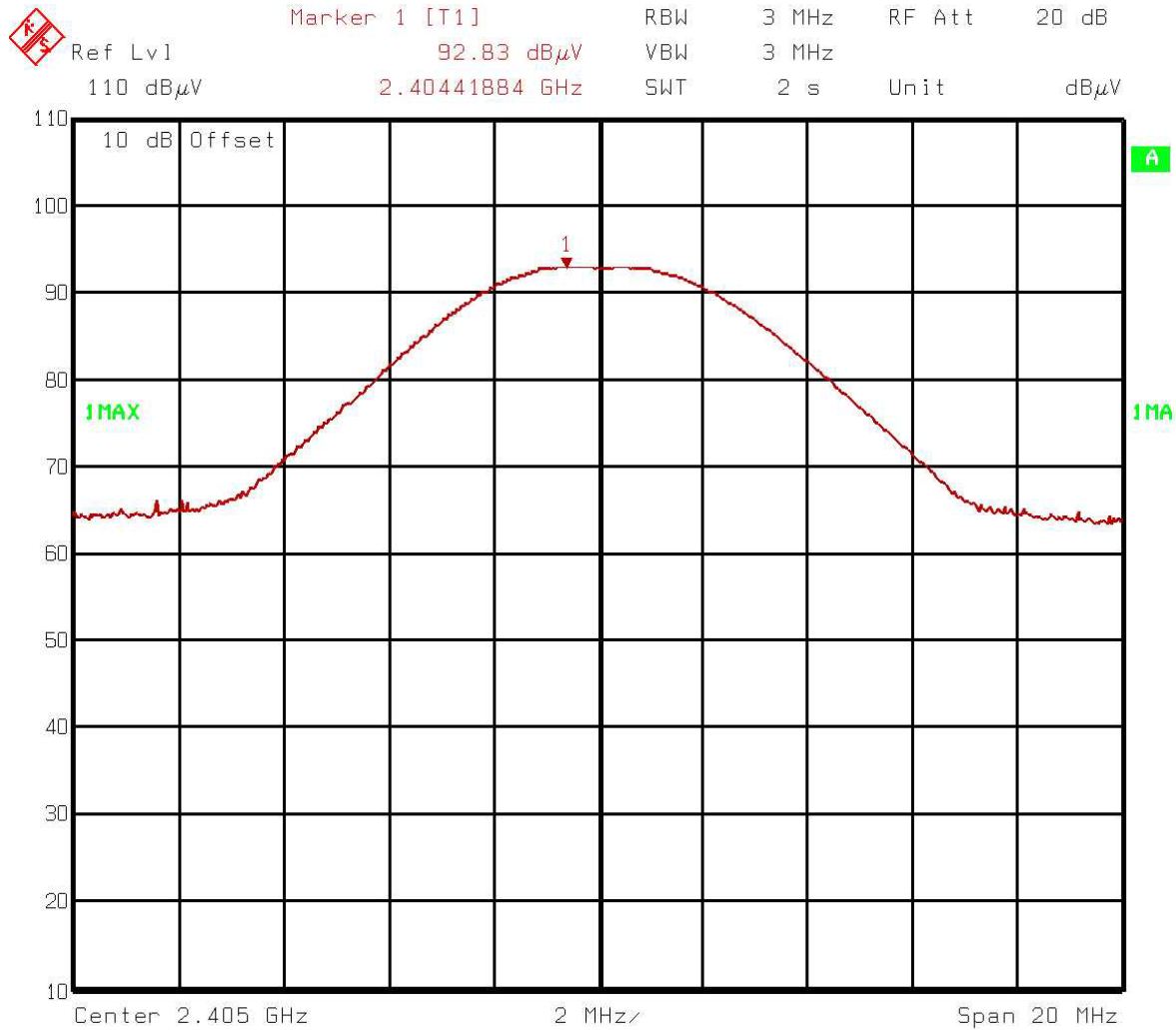
This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Glen Moore
Function: EMC Manager

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Figure 4 2405 MHz – Horizontal Polarization



Comment A: RF Power Output (field strength) H pol, Channel 1 2405 Mhz
Date: 24.JUN.2005 11:10:39

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APPENDIX C: PEAK POWER DENSITY

C.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15.247 – Radio Frequency Devices - Subpart C– intentional Radiators
Test Basis	FCC Publication 558074
Test Method	NTS Radiated Emissions Test Method E006R4

C.2. Specifications

The Power Density shall be less than 8 dBm

C.3. Measurement Uncertainty

Radiated Emissions 1 GHz – 5 GHz	Measurement Uncertainty	Expanded Uncertainty (K=2)
(dB)	+3.48/-3.51	+6.96/-7.02

C.4. Deviations

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

C.5. Test Method

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a motorized turntable. The fundamental field strength was maximized by rotating the turntable through 360 degrees, a measurement antenna was positioned at a distance of 3 meters as measured from the closest point of the EUT, and scanned from 1-4 meters.

A spectrum analyzer with peak detection was used to find the maximum field strength during the scans.

C.6. Test Results

Compliant. The maximum measured Power Density was -11.89dBm

C.7. Deviations from Normal Operating Mode During Test

None

C.8. Sample Calculation

Note that ERIP in the table below was calculated using $P = \frac{(E * d)^2}{30 * G}$

Where E = Maximum measured field strength in V/M

d = Measurement distance in meters

G = Numeric Gain of transmitting antenna

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C.9. Test Data

 Project Number: CG-05-0099 Model: Axiom AXM0367 Comments: Power Density Tester: Glen Moore Test ID:													
Standard FCC 15.247				Measurement Distance 3 Meters				Transmitter Antenna Gain 1 dBi					
Frequency (MHz)	Ant Pol	AF (dB)	CL+LNA (dB)	Attenuation (dB)	Total CF (dB)	Detector	Measured Value dBuV/m	Corrected Value dBuV/m	V/M	EIRP (watts)	EIRP (dBm)	Mast Height cm	Turntable Angle degrees
2405	H	28.31	-28.37	10.01	9.96	Pk	68.61	78.57	0.008482	6.47504E-05	-11.88757	100	275
2440	H	28.38	-28.43	10.01	9.96	Pk	66.63	76.59	0.0067531	1.36811E-05	-18.63879	100	278
2480	H	28.46	-28.35	10.02	10.13	Pk	62.72	72.85	0.0043904	5.78257E-06	-22.37879	100	287
Positive Margin indicates a Pass AF: Antenna Factors, Atten: Attenuator Loss, CF: Correction Factor, CL= Cable Loss, Det: Detector Type, FL: Filter Loss LNA: Low Noise Amplifier Total CF = AF + CL + LNA + FL + Atten Corrected Value = Measured Value + Total CF													

Note: Power density data is only provided for Horizontal Polarization (worst case)

C.10. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

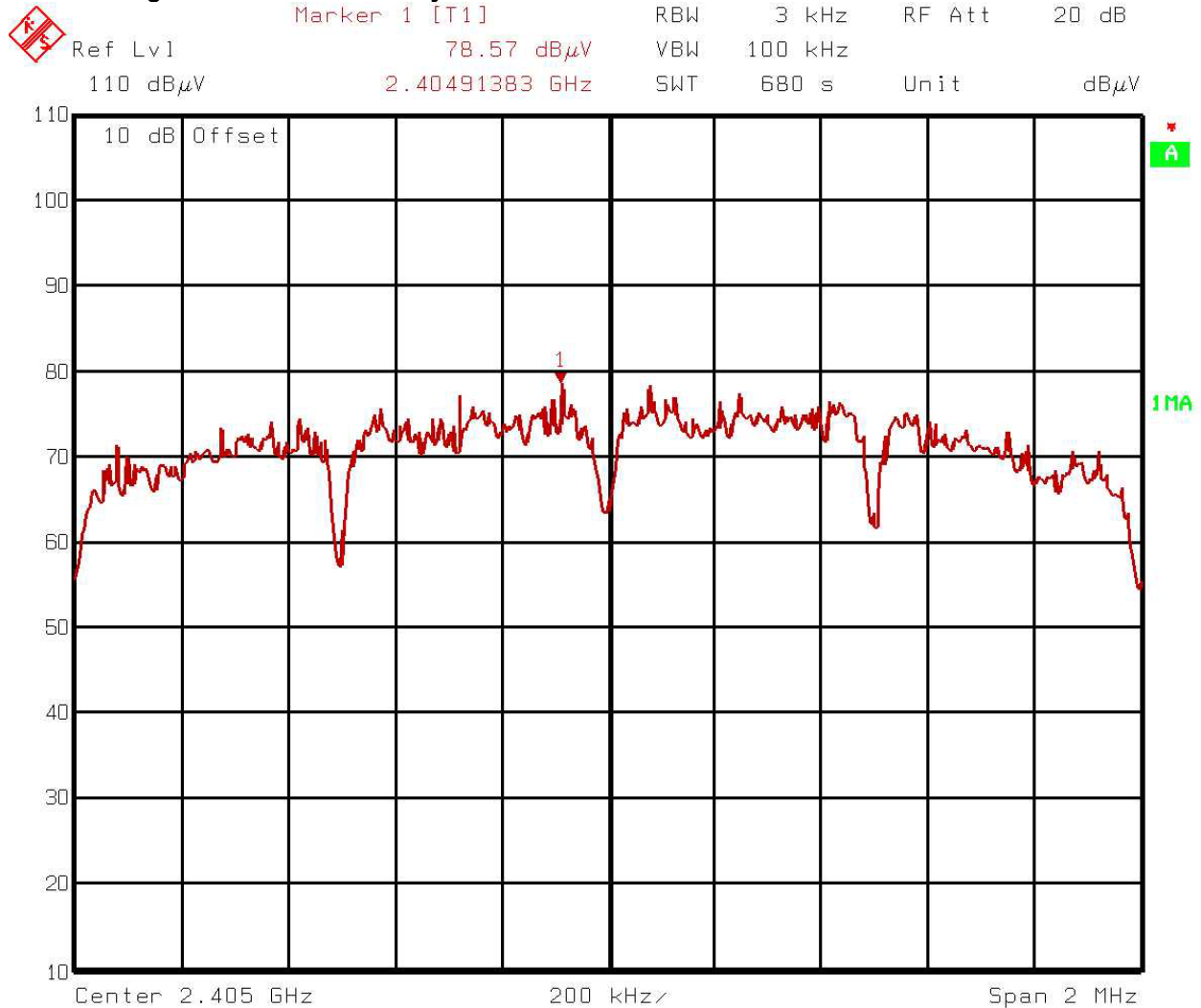
Name: Glen Moore
Function: EMC Manager

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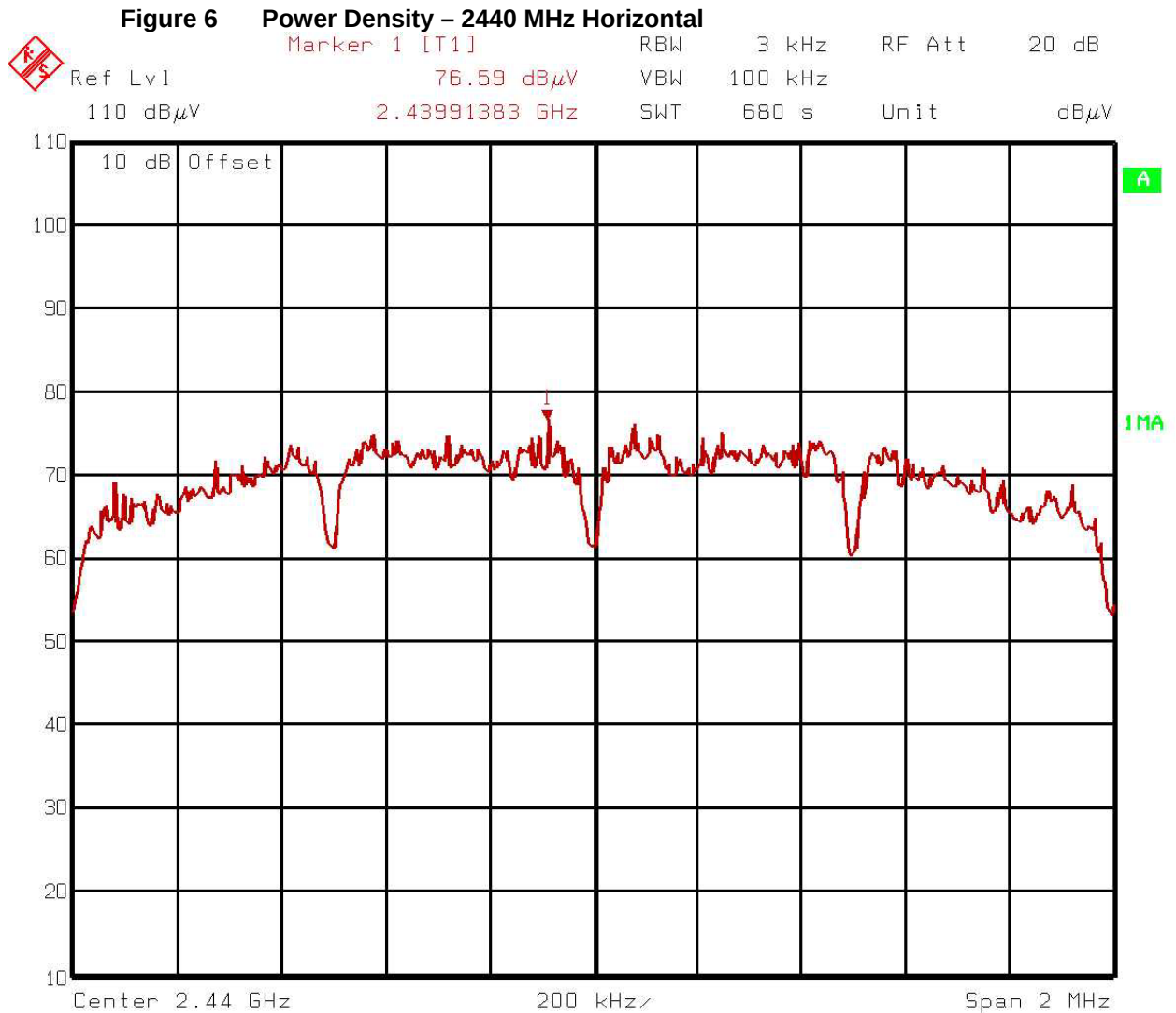
Figure 5 Power Density – 2405 MHz Horizontal



Comment A: RF Power Density (field strength) H pol, Channel 1 2405 Mhz
Date: 24.JUN.2005 11:21:36

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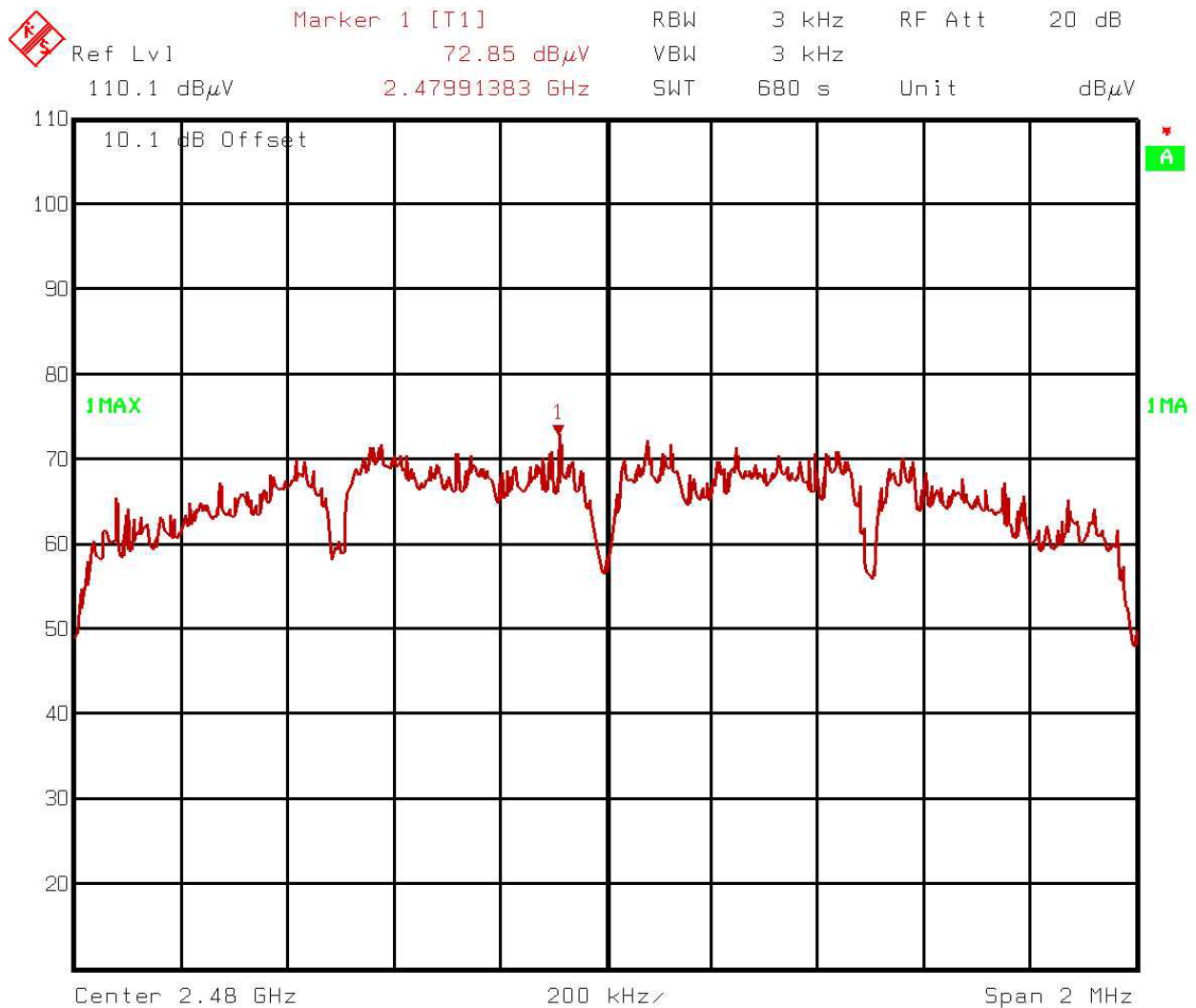


Comment A: RF Power Density (Field Strength) H pol channel 8 -2440 MHz
Date: 24.JUN.2005 11:55:29

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Figure 7 Power Density – 2480 MHz Horizontal



Comment A: RF Power Density (Field Strength) Hpo1 Channel 16 2480 MHz
Date: 24.JUN.2005 12:38:04

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APPENDIX D: 15.247 AND 15.205 RADIATED SPURIOUS EMISSIONS 1- 26 GHZ TX MODE AND RX MODE

D.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I – FCC Part 15.247 – Radio Frequency Devices - Subpart C– intentional Radiators FCC Part 15.205 Restricted Bands of Operation
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
Test Method	NTS Radiated Emissions Test Method E006R4

D.2. Specifications

	☒	47 CFR FCC Part 15
		15.205
3-m Limit	Average	Peak
MHz	dBμV/m	dBμV/m
1000 - 5000	53.98	73.98

D.3. Measurement Uncertainty

Radiated Emissions 1 GHz – 25 GHz	Measurement Uncertainty	Expanded Uncertainty (K=2)
(dB)	+3.48/-3.51	+6.96/-7.02

D.4. Deviations

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

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D.5. Test Results

Compliant. The worst case average emission level was 52 dBuV/M @3 m at 7320 MHz a 2 dB pass margin. All peak emissions had greater than 14 dB margin to the peak limit

D.6. Deviations from Normal Operating Mode During Test

None

D.7. Sample Calculation

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

D.8. Test Data & Photographs

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

D.9. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Adrian Wong
Function: EMC Specialist

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Figure 8 Compliance Table Transmitter Data 1-25 GHz

Project Number: CG-05-0099 Model: AXM0367 Comments: Tester: Glen Moore													
Standard		FCC 15.247				Measurement Distance: 3 meters							
TX Channel	Emission Freq. (MHz)	RX Ant Pol	Total CF (dB)	Detector	Measured Value (dBuV/m)	Duty Cycle Correction Factor	Corrected Value (dBuV/m)	Corrected Value (dBuV/m) (df included)	Limit (dBuV/m)	Margin (dB)	Mast Height (cm)	Turntable Angle (degrees)	Result
Low	4810	H	8.77	Av	31.43	0.58	40.2	39.62	54	14.38	100	78.5	Pass
Low	7215	H	15.94	Av	32.43	0.58	48.37	47.79	54	6.21	100	104.9	Pass
Low	4810	V	8.74	Av	38.01	0.58	46.75	46.17	54	7.83	150	93.3	Pass
Low	7215	V	15.89	Av	34.23	0.58	50.12	49.54	54	4.46	150.3	27.9	Pass
Low	4810	H	8.77	Pk	38.73	0.58	47.5	46.92	74	27.08	100	78.5	Pass
Low	7215	H	15.94	Pk	39.86	0.58	55.8	55.22	74	18.78	100	104.9	Pass
Low	4810	V	8.74	Pk	45.76	0.58	54.5	53.92	74	20.08	150	93.3	Pass
Low	7215	V	15.89	Pk	41.21	0.58	57.1	56.52	74	17.48	150.3	27.9	Pass
Mid	4880	H	9.19	Av	30.82	0.58	40.01	39.43	54	14.57	100	188.60	Pass
Mid	7320	H	15.41	Av	31.62	0.58	47.03	46.45	54	7.55	100	126.70	Pass
Mid	4880	V	9.17	Av	40.20	0.58	49.37	48.79	54	5.21	154	216.80	Pass
Mid	7320	V	15.35	Av	37.23	0.58	52.58	52.00	54	2.00	154	77.90	Pass
Mid	4880	H	9.19	Pk	38.32	0.58	47.51	46.93	74	27.07	100	188.60	Pass
Mid	7320	H	15.41	Pk	40.22	0.58	55.63	55.05	74	18.95	100	126.70	Pass
Mid	4880	V	9.17	Pk	47.2	0.58	56.37	55.79	74	18.21	154	216.80	Pass
Mid	7320	V	15.35	Pk	44.53	0.58	59.88	59.30	74	14.70	154	77.90	Pass
Hi	4960	H	9.31	Av	36.89	0.58	46.2	45.62	54	8.38	100	188.4	Pass
Hi	7440	H	16.10	Av	32.18	0.58	48.28	47.70	54	6.30	100	16.1	Pass
Hi	4960	V	9.30	Av	43.2	0.58	52.5	51.92	54	2.08	100	96.2	Pass
Hi	7440	V	16.02	Av	30.12	0.58	46.14	45.56	54	8.44	100	88	Pass
Hi	4960	H	9.31	Pk	44.58	0.58	53.89	53.31	74	20.69	100	188.4	Pass
Hi	7440	H	16.10	Pk	40.18	0.58	56.28	55.70	74	18.30	100	16.1	Pass
Hi	4960	V	9.30	Pk	50.7	0.58	60	59.42	74	14.58	100	96.2	Pass
Hi	7440	V	16.02	Pk	38.12	0.58	54.14	53.56	74	20.44	100	88	Pass
Positive Margin indicates a Pass													
Correction Factor includes Antenna Factors, CL= Cable Loss, FL: Filter Loss, LNA: Low Noise Amplifier													
Total CF = AF + CL + LNA + FL + Atten Corrected Value = Measured Value + Total CF-duty cycle correction factor													

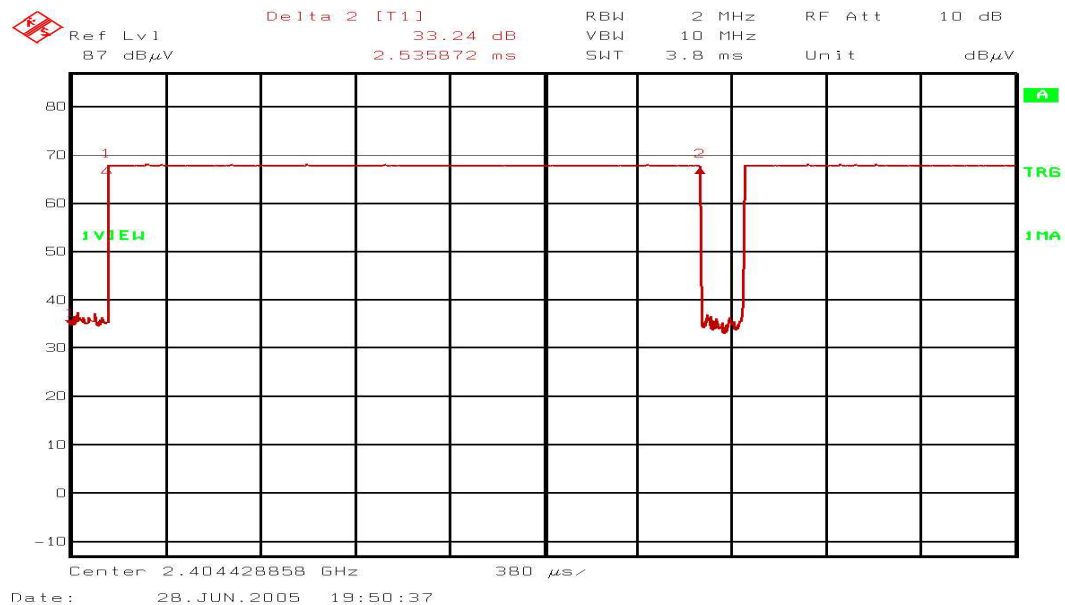
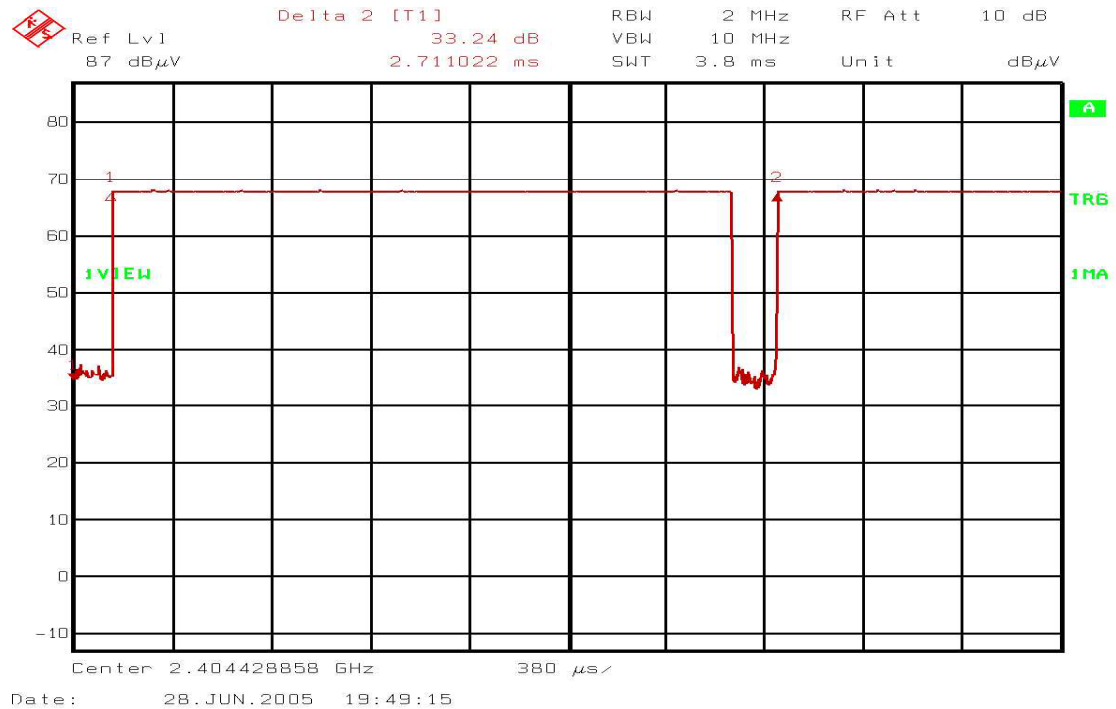
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Duty Cycle Calculation:

RF duty cycle: Calculation according to RF burst Para 15.35 (c)
 $20 \cdot \log(2.535872 \text{ ms} / 2.711022 \text{ ms}) = -.58 \text{ dB}$

Figure 9 Duty Cycle Plots



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APPENDIX E: RADIATED SPURIOUS EMISSIONS BAND EDGE MEASUREMENTS

E.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I – FCC Part 15.247 – Radio Frequency Devices - Subpart C– intentional Radiators
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
Test Method	As per FCC publication 913591

E.2. Limits

	☒	47 CFR FCC Part 15	
		15.205	
3-m Limit		Average	Peak
MHz		dBμV/m	dBμV/m
1000 - 5000		53.98	73.98

E.3. Measurement Uncertainty

Radiated Emissions 1 GHz – 25 GHz	Measurement Uncertainty	Expanded Uncertainty (K=2)
(dB)	+3.48/-3.51	+6.96/-7.02

E.4. Deviations

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

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E.5. Test Results

Compliant. The worst case emission level was 50.76 dBuV, a 3.24 dB margin against the average limit

E.6. Deviations from Normal Operating Mode During Test

None

E.7. Sample Calculation

Emission Level = Measured Level + Correction Factors

Margin = Limit – Emission Level

E.8. Test Data

 Project Number: CG-05-0099 Tester: Glen Moore Model: Axiom AXM0367 Test ID: Comments: Peak Power Output									
Standard FCC 15.247				Measurement Distance 3 Meters				Transmitter Antenna Gain 1 dbi	
Freq(MHz)	Ant Pol	Total CF (dB)	Corrected Fund Field Value (Peak)dBuV/m	Corrected Fund Field Value (Average) dBuV/m	Delta Value (from plot)	Final Band edge field Pk Strength Level (dBuV/m)	Final Band edge field Ave Strength Level (dBuV/m)	Margin Pk Limit (dB)	Margin Ave Limit (dB)
2398	H	9.96	93.47	91.42	40.66	52.81	50.76	21.19	3.24
2483.5 Mhz	H	10.13	89.83	87.83	37.51	52.32	50.32	21.68	3.68
Worst case data only reported (hpol) Positive Margin indicates a Pass AF: Antenna Factors, Atten: Attenuator Loss, CF: Correction Factor, CL= Cable Loss, Det: Detector Type, FL: Filter Loss LNA: Low Noise Amplifier Total CF = AF + CL + LNA + FL + Atten Corrected Value = Measured Value + Total CF									

See plots on following pages

E.9. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Glen Moore
Function: EMC Manager

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Figure 10 Reference Peak Power Level Measurement (2405 MHz)

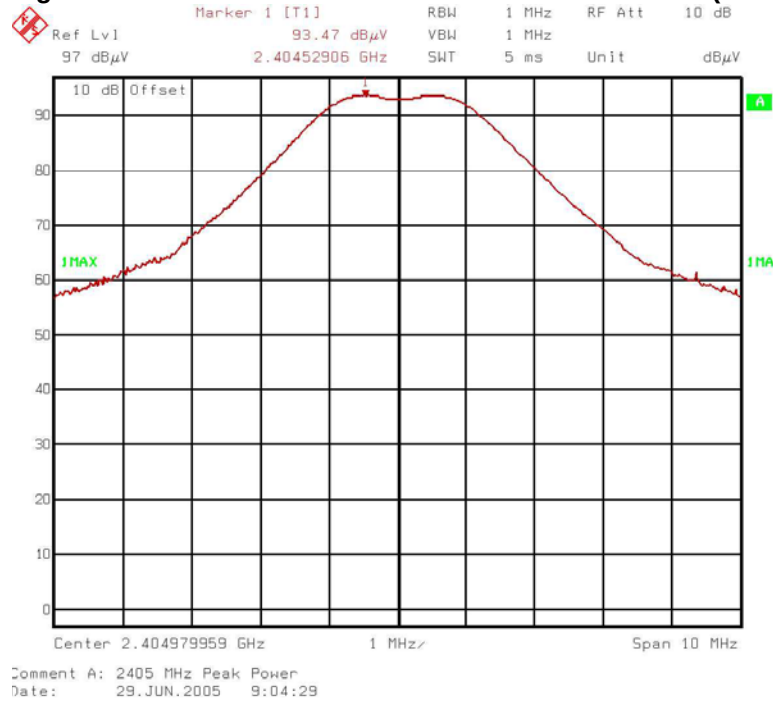
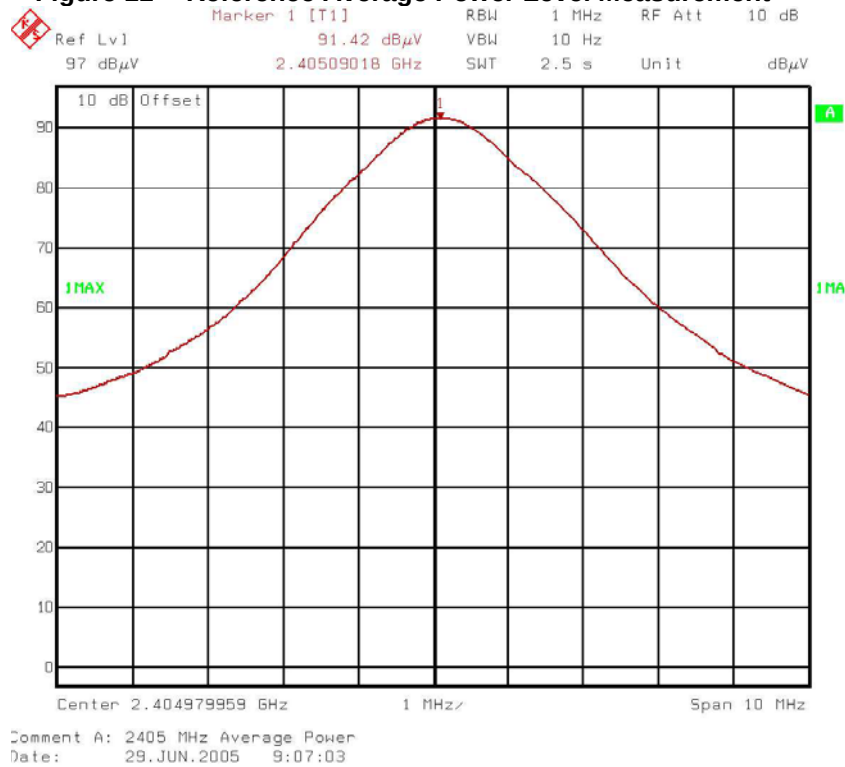


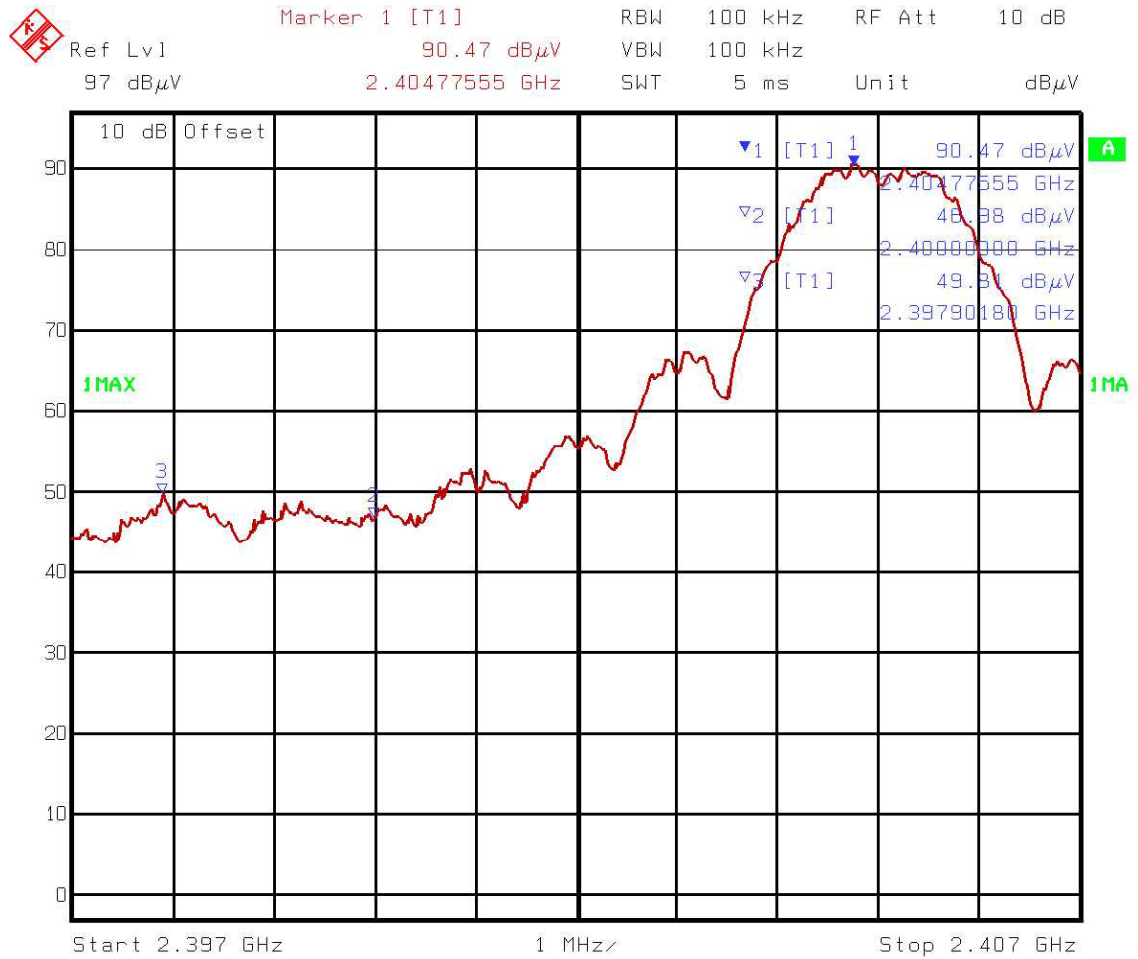
Figure 11 Reference Average Power Level Measurement



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Figure 12 Marker Delta Measurement Lower Band edge



Comment A: 2405 MHz Bandedge reference
Date: 29.JUN.2005 9:36:03

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Figure 13 Reference Peak Power Level Measurement (2480 MHz)

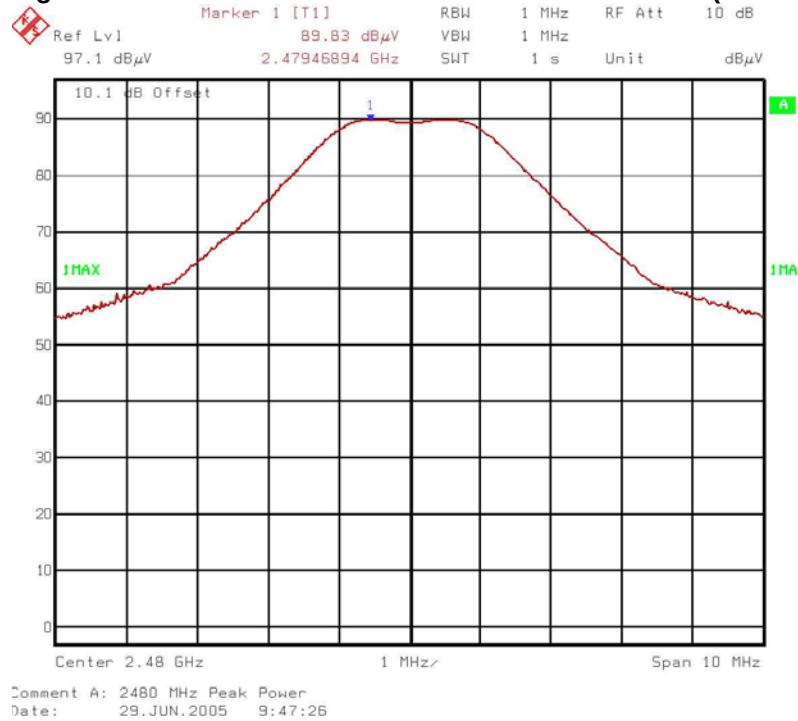
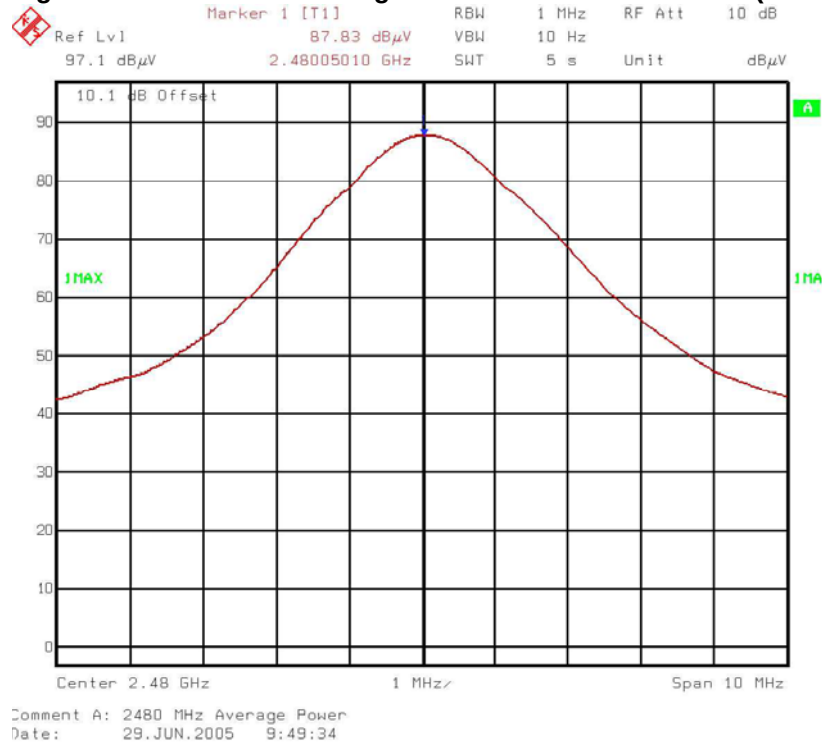


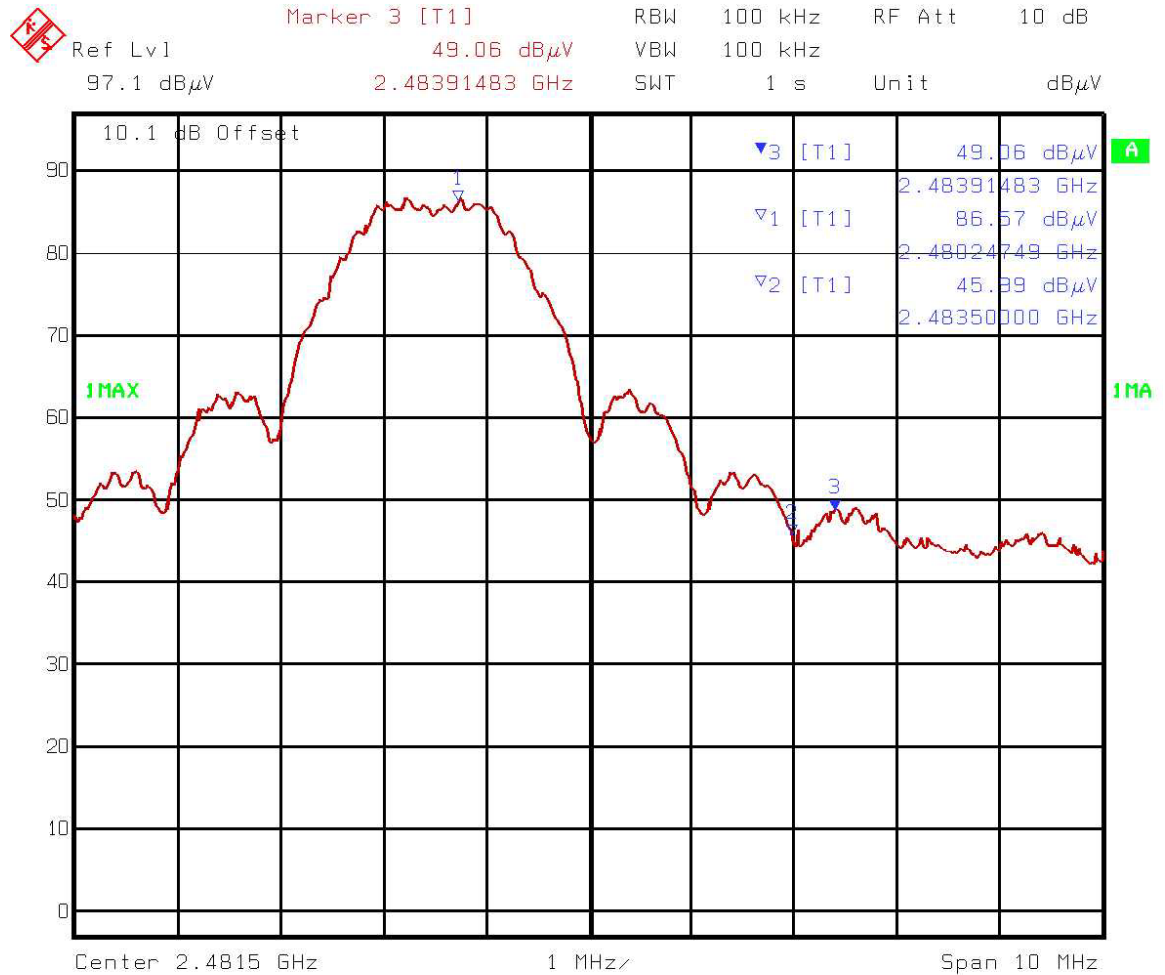
Figure 14 Reference Average Power Level Measurement (2480 MHz)



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Figure 15 Marker Delta Measurement Lower Band edge



Comment A: 2480 MHz Band Edge Reference
Date: 29.JUN.2005 9:52:50

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APPENDIX F: RADIATED SPURIOUS EMISSIONS 30 MHZ – 1 GHZ

F.1. Base Standard & Test Basis

Base Standard	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15.209 – Radio Frequency Devices
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
Test Method	NTS Radiated Emissions Test Method E001R7

Specifications

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	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

(b) Except as provided in paragraphs (d) and (e) of this section, 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.

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Note:

1. Limit extrapolated from 3m using 10m Limit = 3m Limit – 20 * log(10/3)

F.2. Measurement Uncertainty

Radiated Emissions 30 MHz – 1 GHz	Measurement Uncertainty	Expanded Uncertainty (K=2)
(dB)	+2.32/-2.36	+4.65/-4.72

F.3. Deviations

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

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F.4. Test Results

Compliance Scan Summary



Product Integrity Laboratory V2.5

Project Number:

CG-05-0099-Axiom

Model:

Axiom-M5213EVB

Comments:

Axiom Transceiver with host computer, Monitor, Keyboard and mouse

Tester:

Alex Mathews

Test ID:

RE02C-10m-05-0099

Standard		FCC15 B		Measurement Distance		10		meters				
Antenna	CL	Frequency	AF	CL+LNA	Total CF	Detector	Measured Value	Corrected Value	Limit	Margin	Mast Height	Turntable Angle
Horizontal		MHz	dB/m	dB	dB/m		dBuV	dBuV/m	dBuV/m	dB	cm	degrees
2701 RX BiCon Hpol	10M Total Link Factor	80.01	6.97	-25.30	-18.34	QP	42.64	24.30	29.54	5.24	399.2	100.8
2701 RX BiCon Hpol	10M Total Link Factor	144.02	11.13	-24.51	-13.38	QP	40.38	27.00	33.06	6.07	399.9	285.2
2701 RX BiCon Hpol	10M Total Link Factor	176.01	9.73	-24.18	-14.45	QP	42.23	27.78	33.06	5.28	400.8	286.8
Vertical												
2701 RX BiCon Vpol	10M Total Link Factor	80.01	6.70	-25.30	-18.60	QP	43.02	24.42	29.54	5.12	160.7	150.3
2701 RX BiCon Vpol	10M Total Link Factor	176.01	9.90	-24.18	-14.28	QP	40.20	25.92	33.06	7.14	102.0	214.7

Positive Margin indicates a Pass

The EUT is in compliance with FCC CFR47 Part 15.205/15209 Radiated emission limits

F.5. Observations

None

F.6. Deviations from Normal Operating Mode During Test

None

F.7. Sample Calculation

Emission Level = Measured Level + Correction Factors

Margin = Limit – Emission Level

F.8. Test Data & Photographs

Plots were not provided in order to reduce file size

F.9. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Alex Mathews
Function: Regulatory Specialist

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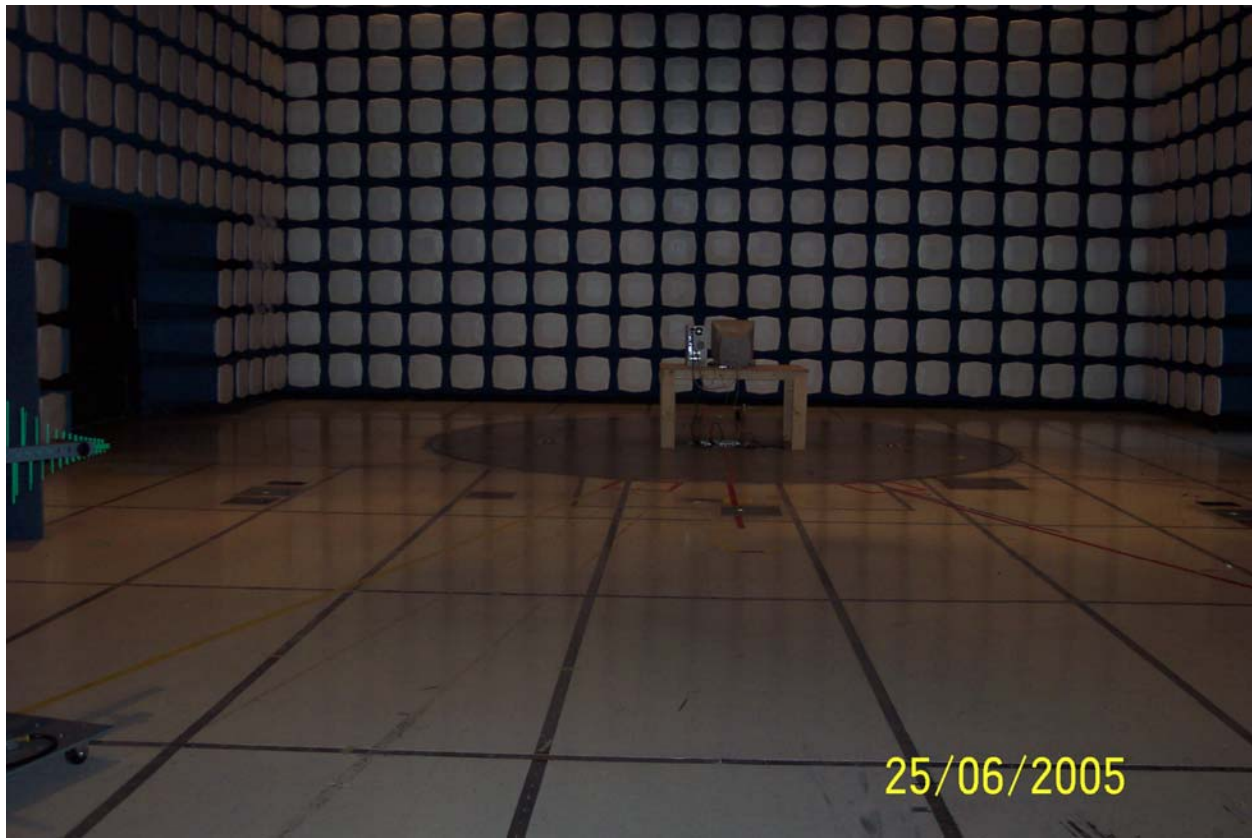


Figure 16 Radiated Emissions Photo

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APPENDIX G: RSS 210 ISSUE 5, RECEIVER EMISSIONS

G.1. Base Standard & Test Basis

Base Standard	RSS 210 Issue 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
Test Method	NTS Radiated Emissions Test Method E006R4

G.2. Specifications

	☒	RSS 210 Issue 5	
3-m Limit	Average	Peak	
MHz	dBμV/m	dBμV/m	
1000 -26 GHz	53.98	NA	

G.3. Measurement Uncertainty

Radiated Emissions 1 GHz – 25 GHz	Measurement Uncertainty	Expanded Uncertainty (K=2)
(dB)	+3.48/-3.51	+6.96/-7.02

G.4. Deviations

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

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G.5. Test Results

No emissions from the receiver were detected

G.6. Deviations from Normal Operating Mode During Test

None

G.7. Sample Calculation

Emission Level = Measured Level + Correction Factors

Margin = Limit – Emission Level

G.8. Test Data

The test data collected during this test appear following this page. Note no emissions were detected above 1 GHz. The emissions in the plots below were all measured in transmit mode (worst case)

G.9. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Adrian Wong
Function: EMC Specialist

APPENDIX H: FCC PART 15.207 CONDUCTED VOLTAGE EMISSIONS 150 KHZ – 30 MHZ

H.1. Base Standard & Test Basis

Base Standard	☒	CFR Title 47 – Telecommunications, Chapter I - FCC Part 15.207 – Radio Frequency Devices - Subpart C – Unintentional Radiators
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
Test Method		NTS Radiated Emissions Test Method E011R1

H.2. Specifications

Frequency	☐	Class A		☒	Class B	
Limit		Quasi-Peak	Average	Quasi-Peak	Average	
MHz		dBμV	dBμV	dBμV	dBμV	
0.150 – 0.500		79.00	66.00	66 to 56 ¹	56 to 46 ¹	
0.500 – 5.00		73.00	60.00	56	46	
5.00 – 30.00		73.00	60.00	60	50	

Note 1: decrease with the logarithm of the frequency

H.3. Measurement Uncertainty

Conducted Current Emissions 150 kHz – 30 MHz	Measurement Uncertainty	Expanded Uncertainty (K=2)
(dB)	+1.21/-1.33	+2.41/-2.66

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H.4. Deviations

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

H.5. Special Considerations

None.

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H.6. Test Results

Power Line Voltage Emissions

NTS® Product Integrity Laboratory V25		Project Name: CG-05-0099-Axiom Model: Axiom M6213EV-B Comments: Axiom- Max power, channel 8(2445 M-hz carrier); Tx on modulated		Tester: Stephen Ching Test ID: CE02C-10m05-0099					
Standard: FCC15 B									
Voltage/Line	USN/Lead	Frequency	Measurement Detector	Measured Value	CF	Corrected Value	Limit Detector Type	Limit	Margin
		M-hz		dBuV	dB	dBuV		dBuV	dB
120 VAC 60-hz Line 1	TT USNA1	0.15	Avg	17.33	12.38	29.71	Avg	55.82	26.11
120 VAC 60-hz Line 1	TT USNA1	0.16	Avg	15.56	12.29	27.85	Avg	55.56	27.72
120 VAC 60-hz Line 1	TT USNA1	0.16	Avg	15.44	12.27	27.71	Avg	55.53	27.81
120 VAC 60-hz Line 1	TT USNA1	0.16	Avg	15.33	12.25	27.58	Avg	55.47	27.89
120 VAC 60-hz Line 1	TT USNA1	0.17	Avg	14.67	12.03	26.70	Avg	54.77	28.07
120 VAC 60-hz Line 1	TT USNA1	0.19	Avg	26.51	11.79	38.30	Avg	53.91	15.61
120 VAC 60-hz Line 1	TT USNA1	0.19	Avg	26.48	11.79	38.27	Avg	53.91	15.64
120 VAC 60-hz Line 1	TT USNA1	0.19	Avg	26.35	11.79	38.14	Avg	53.91	15.77
120 VAC 60-hz Line 1	TT USNA1	0.19	Avg	26.35	11.79	38.14	Avg	53.91	15.77
120 VAC 60-hz Line 1	TT USNA1	0.19	Avg	26.43	11.79	38.22	Avg	53.91	15.69
120 VAC 60-hz Line 1	TT USNA1	0.19	Avg	26.38	11.79	38.17	Avg	53.91	15.74
120 VAC 60-hz Neutral	TT USNA4	0.15	Avg	15.54	12.20	27.74	Avg	55.83	28.09
120 VAC 60-hz Neutral	TT USNA4	0.16	Avg	15.36	12.11	27.47	Avg	55.57	28.10
120 VAC 60-hz Neutral	TT USNA4	0.16	Avg	15.33	12.04	27.37	Avg	55.38	28.01
120 VAC 60-hz Neutral	TT USNA4	0.16	Avg	15.21	12.06	27.27	Avg	55.43	28.16
120 VAC 60-hz Neutral	TT USNA4	0.17	Avg	14.80	11.89	26.69	Avg	54.92	28.22
120 VAC 60-hz Neutral	TT USNA4	0.19	Avg	26.63	11.60	38.23	Avg	53.90	15.67
120 VAC 60-hz Neutral	TT USNA4	0.19	Avg	26.74	11.60	38.34	Avg	53.91	15.56
120 VAC 60-hz Neutral	TT USNA4	0.19	Avg	26.53	11.60	38.13	Avg	53.90	15.77
120 VAC 60-hz Neutral	TT USNA4	0.21	Avg	13.51	11.45	24.96	Avg	53.26	28.30
120 VAC 60-hz Neutral	TT USNA4	0.21	Avg	13.51	11.40	24.91	Avg	53.02	28.11
120 VAC 60-hz Neutral	TT USNA4	0.29	Avg	21.61	10.98	32.59	Avg	50.54	17.94
120 VAC 60-hz Line 1	TT USNA1	0.15	QP	33.08	12.41	45.49	Avg	55.89	10.40
120 VAC 60-hz Line 1	TT USNA1	0.16	QP	31.79	12.24	44.03	Avg	55.45	11.41
120 VAC 60-hz Line 1	TT USNA1	0.17	QP	31.05	12.12	43.17	Avg	55.07	11.90
120 VAC 60-hz Line 1	TT USNA1	0.19	QP	34.51	11.78	46.29	Avg	53.88	7.59
120 VAC 60-hz Line 1	TT USNA1	0.22	QP	25.39	11.55	36.94	Avg	52.82	15.88
120 VAC 60-hz Line 1	TT USNA1	0.29	QP	27.60	11.19	38.79	Avg	50.52	11.73
120 VAC 60-hz Neutral	TT USNA4	0.15	QP	33.49	12.20	45.69	Avg	55.82	10.13
120 VAC 60-hz Neutral	TT USNA4	0.16	QP	32.98	12.14	45.12	Avg	55.65	10.53
120 VAC 60-hz Neutral	TT USNA4	0.16	QP	32.20	12.02	44.22	Avg	55.34	11.11
120 VAC 60-hz Neutral	TT USNA4	0.17	QP	30.95	11.87	42.82	Avg	54.83	12.01
120 VAC 60-hz Neutral	TT USNA4	0.19	QP	35.75	11.60	47.35	Avg	53.88	6.54
120 VAC 60-hz Neutral	TT USNA4	0.29	QP	29.07	10.98	40.05	Avg	50.52	10.47

Positive Margin indicates a Pass

Compliant. The worst case emission level was 47.35 dBuV a 6.54 db margin, to the limits

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H.7. Deviations from Normal Operating Mode During Test

None

H.8. Sample Calculation

Correction Factor = LISN Correction Factor + Cable Loss

Corrected Value = Measurement + Correction Factor

Margin = Limit – Corrected Emission Level

H.9. Test Data & Photographs

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

H.10. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Stephen Ching
Function: EMC Technician

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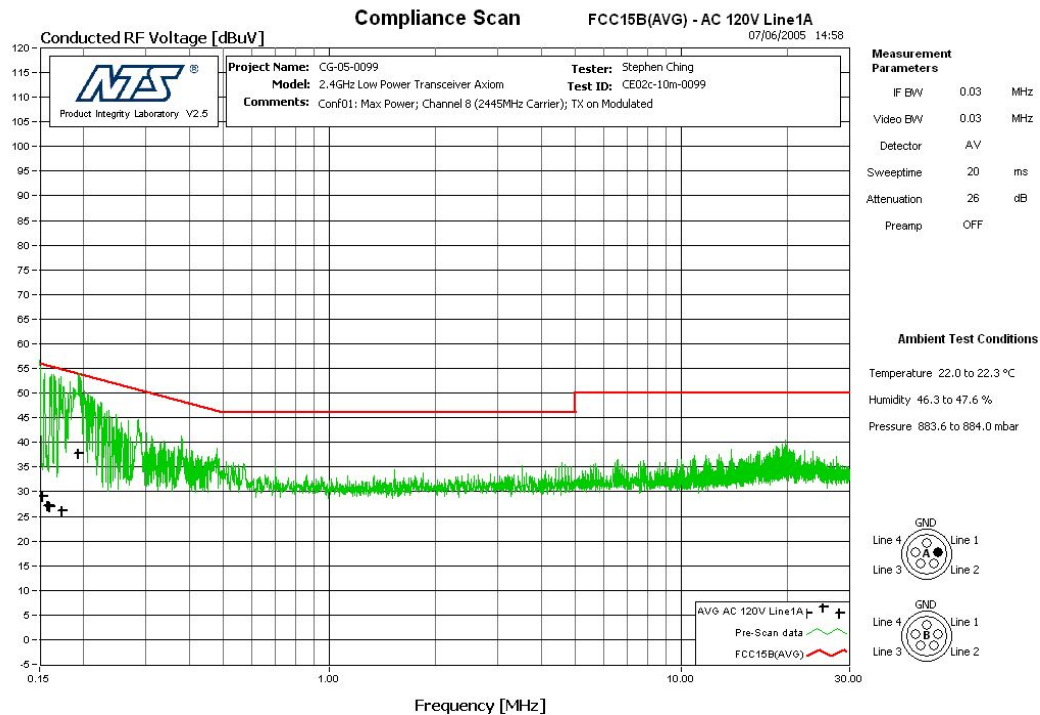


Figure 17CE –Line A1 – 150 kHz – 30 MHz (Avg Detector)

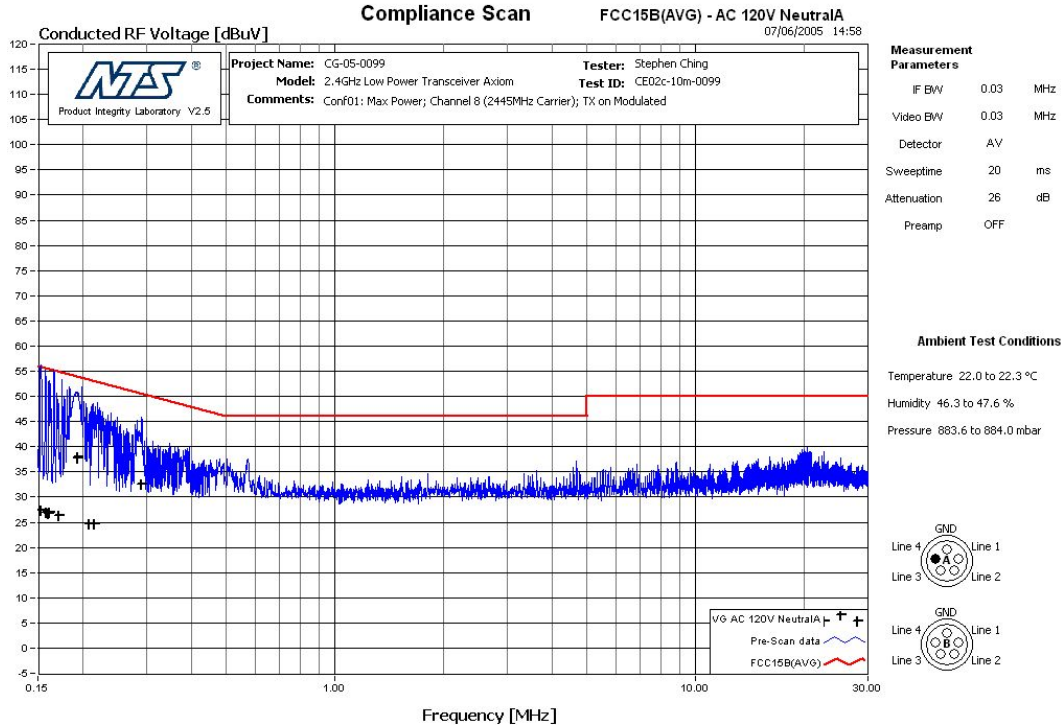


Figure 18CE – Neutral A4 – 150 kHz – 30 MHz (Avg Detector)

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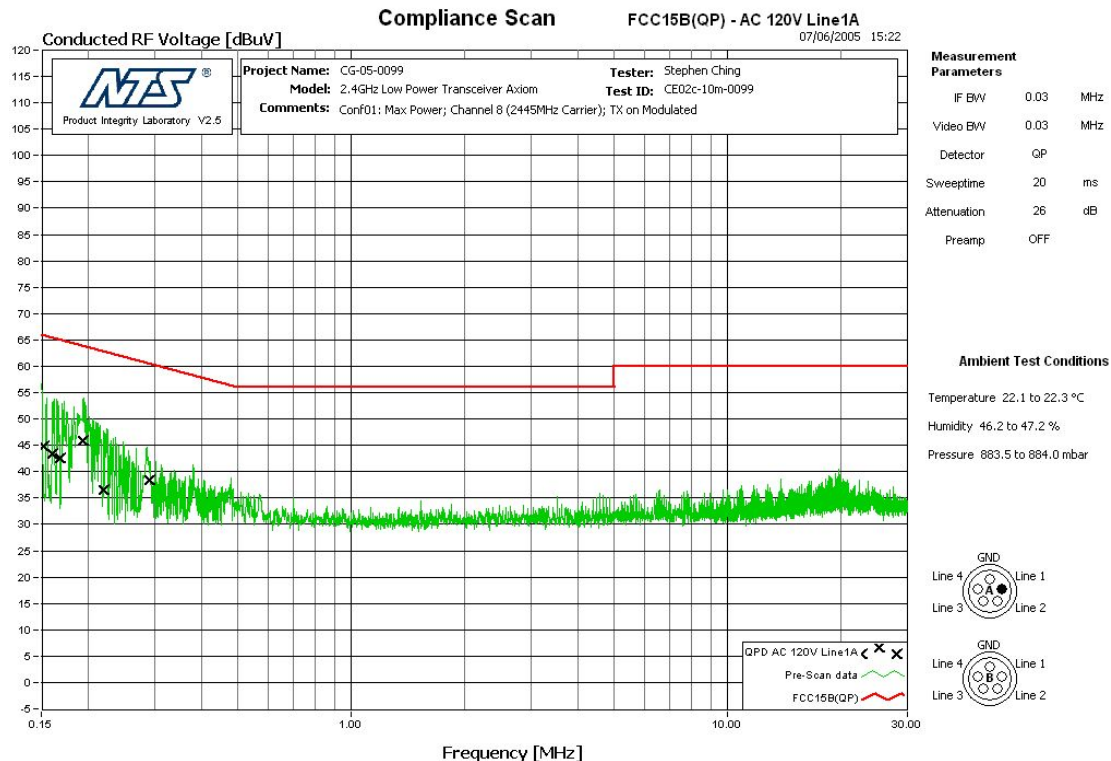


Figure 19CE –Line A1 – 150 kHz – 30 MHz (QP Detector)

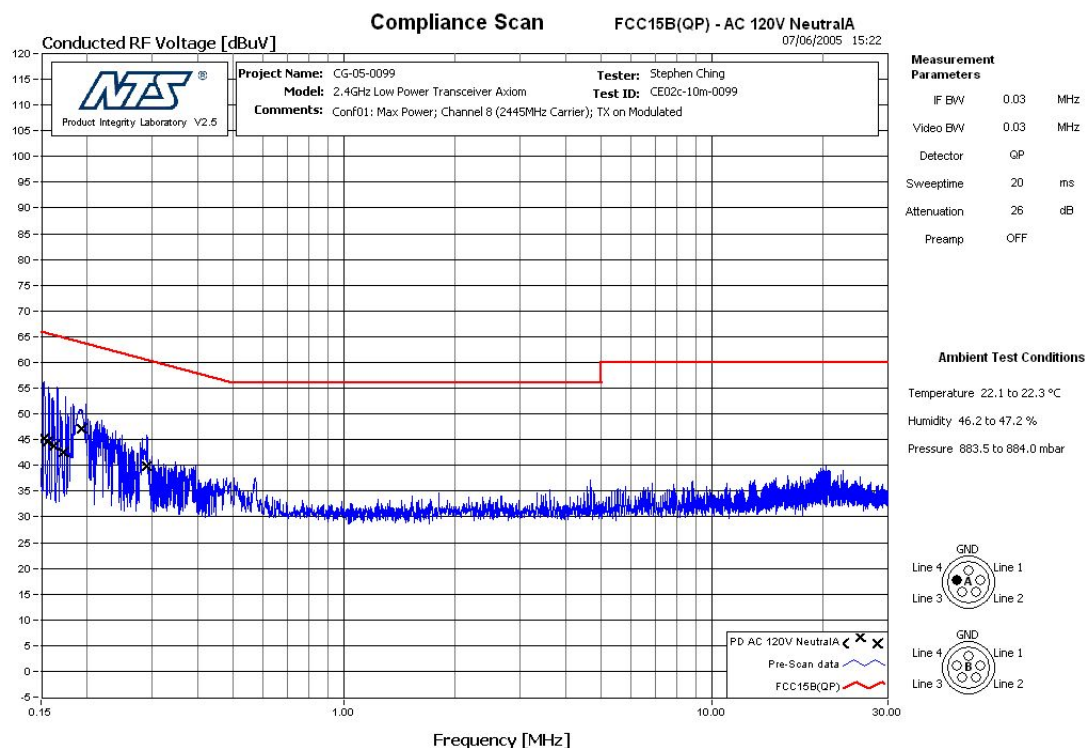


Figure 20CE – Neutral A4 – 150 kHz – 30 MHz (QP Detector)

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APPENDIX I: TEST EQUIPMENT LIST

Description		Manufacturer	Type/Model	Serial #	Cal Due	Cal Date
10m ANECHOIC CHAMBER						
A LISN Link					07JAN06	07JAN04
-LISN A Switch	☒ A	NA	NA	263177		
-Cable Switch to Limiter	☒ A	NA	NA	263164		
- Cable LISN to Switch	☒ A1	Succoflex	NA	263168	07JAN06	07JAN04
	☐ A2	Succoflex	NA	263169	07JAN06	07JAN04
	☐ A3	Succoflex	NA	263170	07JAN06	07JAN04
	☒ A4	Succoflex	NA	263171	07JAN06	07JAN04
- LISN	☐ A1	EMCO	38100/1SPEC	260454	07JAN06	07JAN04
- LISN	☐ A2	EMCO	38100/1SPEC	260268	07JAN06	07JAN04
- LISN	☐ A3	EMCO	38100/1SPEC	260458	07JAN06	07JAN04
- LISN	☐ A4	EMCO	38100/1SPEC	260265	07JAN06	07JAN04
- Table Top LISN	☒ TT	EMCO	3825	260354	08JAN06	08JAN04
B LISN Link					07JAN06	07JAN04
-LISN B Switch	☐ B	NA	NA	263176		
-Cable Switch to Limiter	☐ B	NA	NA	263165		
- Cable LISN to Switch	☐ B1	Succoflex	NA	263172	07JAN06	07JAN04
	☐ B2	Succoflex	NA	263173	07JAN06	07JAN04
	☐ B3	Succoflex	NA	263174	07JAN06	07JAN04
	☐ B4	Succoflex	NA	263175	07JAN06	07JAN04
- LISN	☐ B1	EMCO	38100/4	260266	07JAN06	07JAN04
- LISN	☐ B2	EMCO	38100/4	260457	07JAN06	07JAN04
- LISN	☐ B3	EMCO	38100/4	260456	07JAN06	07JAN04
- LISN	☐ B4	EMCO	38100/4	260267	07JAN06	07JAN04

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CONTROL ROOM					
		Rohde & Schwarz	ESAI	260110 / 260111	
Mast Controller		EMCO	2090	260166	N/A
Switch Matrix		TDL	SMC-002	260162	07JAN06
Cable Switch Matrix to Receiver		NA	NA	263166	07JAN06
A LISN Link				07JAN06	07JAN04
-LISN A Limiter	☒ A	NA	NA		
-Cable Switch to Limiter	☒ A	NA	NA		
B LISN Link				07JAN06	07JAN04
-LISN B Limiter	☐ B	NA	NA		
-Cable Switch to Limiter	☐ B	NA	NA		

Description	Manufacturer	Type/Model	Asset #	Cal Due	Cal Date
10m ANECHOIC CHAMBER					
Bilog Antenna	☐ Chase	CBL 6111B	260398	09JULY05	09JULY04
	☒ Chase	CBL 6112B	260301		
RF Cable	Suhner Succoflex	Ferrite bead loaded cable	260388	07JAN06	07JAN04
CONTROL ROOM					
Test Receiver	☒ Rohde & Schwarz	ESAI	260110 / 260111	2FEB06	2FEB05
Mast Controller	EMCO	2090	260165	N/A	N/A
Multi Device Controller TT1 (Turntable)	07JAN06	07JAN04		N/A	N/A
RF 10m East site Link				Suhner Succoflex	NA
- Cable 1	Suhner Succoflex	NA	263135		
- Cable 2	Suhner Succoflex	NA	263161		
- Cable 3	Suhner Succoflex	NA	263162		
- Cable 4	TDL	SMC-002	260162		
- Switch Matrix Controller	Hewlett Packard	8447F	260164		
- Amplifier					

I.1. Radiated Emissions 1 GHz – 5 GHz Measurement Equipment

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Description	Manufacturer	Type/Model	Asset #	Cal Due	Cal Date
10m ANECHOIC CHAMBER					
Horn Antenna (Rx) 1 GHz – 18 GHz	EMCO	3115	260092	16Oct05	16JUN04
High pass filter	K&L	11SH10-3860	263124	08JAN06	08JAN04
High frequency Link				07JAN06	07JAN04
Step Attenuator/Switch (0dB & 10 dB)	HP	11713A	260048 260097		
LNA	Miteq	JSD000121	260477		
Cable from LNA to SA	Succoflex	101PEA	263187		
Spectrum Analyzer 9k-40GHz	Rohde & Schwarz	FSEK	260104	27MAR05	27MAR04
LNA DC Power Supply	Xantrex	LXO 30-2	260483	NA	NA
HPIB Extender	HP	37204	260096	N/A	N/A
10dB Attenuator	Wiltron	41KC-10	260449	05APR05	05APR04
CONTROL ROOM					
PC with FSEK Manual ctrl S/W	N/A	N/A	N/A	N/A	N/A
HPIB Extender	HP	37204	260168	N/A	N/A
Mast Controller	EMCO	2090	260166	N/A	N/A
Multi Device Controller TT1	EMCO	2090	260165	N/A	N/A
Horn Antenna (Tx)	EMCO	3160	260088	N/A	N/A

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END OF DOCUMENT

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