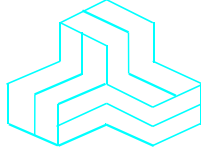


ENGINEERING TEST REPORT



XBee PRO S2B OEM Module
Model No.: PRO S2B

FCC ID: MCQ-PROS2B

Applicant:

Digi International Inc.
11001 Bren Road East
Minnetonka, MN 55343

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247
Digital Modulation Systems (DTS) Operating in 2400 – 2483.5 MHz Band

UltraTech's File No.: DIGI-020F15C247

This Test report is Issued under the Authority
of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs



Date: November 9, 2009

Report Prepared by: Dharmajit Solanki

Tested by: Mr. Hung Trinh, EMI/RFI Technician

Issued Date: November 9, 2009

Test Dates: October 8 - 30, 2009

*The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.
This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

UltraTech

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91038



1309



46390-2049



NVLAP Lab Code 200093-0



SL2-IN-E-1119R



Korea KCC-RRL
CA2049

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File #: DIGI-020F15C247

November 9, 2009

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
--	Test Report	<ul style="list-style-type: none"> ▪ Exhibit 1: Submittal check lists ▪ Exhibit 2: Introduction ▪ Exhibit 3: Performance Assessment ▪ Exhibit 4: EUT Operation and Configuration during Tests ▪ Exhibit 5: Summary of test Results ▪ Exhibit 6: Measurement Data ▪ Exhibit 7: Measurement Uncertainty 	OK
1	Test Setup Photos	<ul style="list-style-type: none"> ▪ Power Line Conducted Emissions Setup Photos ▪ Radiated Emissions Setup Photos 	OK
2	External EUT Photos	External EUT Photos	OK
3	Internal EUT Photos	Internal EUT Photos	OK
4	Cover Letters	<ul style="list-style-type: none"> ▪ Letter from Ultratech for Certification Request ▪ Letter from the Applicant to appoint Ultratech to act as an agent ▪ Letter from the Applicant to request for Confidentiality Filing ▪ Letter from the Applicant to request for Modular Approval 	OK
5	Attestation Statements	--	--
6	ID Label/Location Info	ID Label and Location of Label	OK
7	Block Diagrams	Block Diagram	OK
8	Schematic Diagrams	Schematics	OK
9	Parts List/Tune Up Info	Parts List	OK
10	Operational Description	Operation Description	OK
11	RF Exposure Info	MPE Evaluation, see section 6.11 in this Test Report for details.	OK
12	Users Manual	XBee™/ XBee-PRO ZB RF Modules	OK

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EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.247
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15
Purpose of Test:	Equipment Certification for Digital Modulation Systems (DTS) Transmitter Operating in the Frequency Band 2400-2483.5 MHz.
Test Procedures:	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	<input checked="" type="checkbox"/> Commercial, industrial or business environment <input checked="" type="checkbox"/> Residential environment

2.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

2.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2008	Code of Federal Regulations – Telecommunication
ANSI C63.4	2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 22 & EN 55022	2006 2006	Information Technology Equipment - Radio Disturbance Characteristics – Limits and Methods of Measurement
CISPR 16-1-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-2-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-1: Conducted disturbance measurement
KDB Publication No. 558074	2005	Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)
FCC Public Notice DA 00-1407	2000	Part 15 Unlicensed Modular Transmitter Approval

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT	
Name:	Digi International Inc.
Address:	11001 Bren Road East Minnetonka, MN 55343 USA
Contact Person:	Mr. Paul Dahl Phone #: 801-765-9885 Fax #: 801-765-9895 Email Address: Paul.dahl@digi.com

MANUFACTURER	
Name:	Digi International Inc.
Address:	11001 Bren Road East Minnetonka, MN 55343 USA
Contact Person:	Mr. Paul Dahl Phone #: 801-765-9885 Fax #: 801-765-9895 Email Address: Paul.dahl@digi.com

3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	Digi International Inc.
Product Name:	XBee PRO S2B OEM Module
Model Name or Number:	PRO S2B
Serial Number:	Test Sample
Type of Equipment:	Digital Modulation Transmitter
Input Power Supply Type:	3.3 Vdc using TENMA DC Regulated Power Supply Model: 72-7295
Primary User Functions of EUT:	Wireless modem

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3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	<ul style="list-style-type: none"> • Mobile • Base Station (fixed use)
Intended Operating Environment:	Commercial, industrial or business
Power Supply Requirement:	2.7VDC to 3.6VDC from -40 to +85C
RF Output Power Rating:	83.56 mW (+19.22 dBm) – High Power Setting 0.75 mW (-1.27 dBm) – Low Power Setting
Operating Frequency Range:	2405 – 2480 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	5 MHz
Duty Cycle:	27%
6 dB bandwidth:	1.75 MHz
Modulation Type:	QPSK
Oscillator Frequencies:	4.8 GHz
Antenna Connector/Types:	<ul style="list-style-type: none"> • Integral • Unique connector (RPSMA/U.FL)

3.4. ASSOCIATED ANTENNA DESCRIPTION

The highest gain antenna from each type of antenna was selected for testing to represent the worst case. The following antennas were selected for testing in this filing:

1. Dipole Antenna (P/N: A24-HABSM; Max. Antenna Gain: 2.1 dBi)
2. Astron Omni-directional Antenna (P/N: A24-F8NF; Max. Antenna Gain: 8 dBi)
3. D-Link Omni-directional Antenna (P/N: A24-F15NF; Max. Antenna Gain: 15 dBi)
4. Maxrad Yagi Antenna (P/N: A24-Y18NF; Max. Antenna Gain: 15 dBi)
5. ARC Panel Antenna (P/N: A24-P19NF; Max. Antenna Gain: 19 dBi)

3.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	RF Port	1	RPSMA/U.FL	Shielded
2	DC Supply & I/O Port	1	Pin Header	No cable, direct connection

3.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Test Jig Cable
Brand name:	Digi International
Model Name or Number:	N/A
Serial Number:	N/A
Connected to EUT's Port:	Module pin signals

EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21 to 23 °C
Humidity:	45 to 58%
Pressure:	102 kPa
Power input source:	3.3 Vdc

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements.
Special Test Software:	Special software and hardware by the Applicant to operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of the lowest, middle and highest frequencies individually continuously during testing.
Special Hardware Used:	The RF Module could be tested outside of the enclosure using Digi International Test Jig Cable connected to EUT.
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral / non-integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	2405 – 2480 MHz
Frequency(ies) Tested: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	2405, 2440, 2470, 2475 and 2480 MHz (Channels # 11, 18, 24, 25 & 26)
RF Power Output: (measured maximum output power at antenna terminals)	19.22 dBm (83.56mW) Peak
Normal Test Modulation:	QPSK
Modulating Signal Source:	Internal

EXHIBIT 5. SUMMARY OF TEST RESULTS

5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada Site No.: 2049A-3, Expiry Date: May 1, 2011)

5.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna requirements	Yes*
15.207(a)	AC Power Line Conducted Emissions	Yes
15.247(a)(2)	6 dB Bandwidth	Yes
15.247(b)(3)	Peak Conducted Output Power - DTS	Yes
15.247(d)	Band-Edge and RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	Yes
15.247(e)	Power Spectral Density	Yes
15.247(b)(5), (e)(i) 1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure	Yes
The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices. The engineering test report is available upon request.		

* The EUT complies with the requirement; it employs a unique (non-standard) antenna connector (RPSMA/U.FL/IPX), for all external antennas proposed for use with the EUT and permanently mounted integral antenna.

5.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

ULTRATECH GROUP OF LABS

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File #: DIGI-020F15C247
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EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

6.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.4; FCC KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems.

6.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

6.3. MEASUREMENT EQUIPMENT USED

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1-1.

6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

Wireless modem.

6.5. AC POWER LINE CONDUCTED EMISSIONS [§15.207(a)]

6.5.1. Limit(s)

The equipment shall meet the limits of the following table:

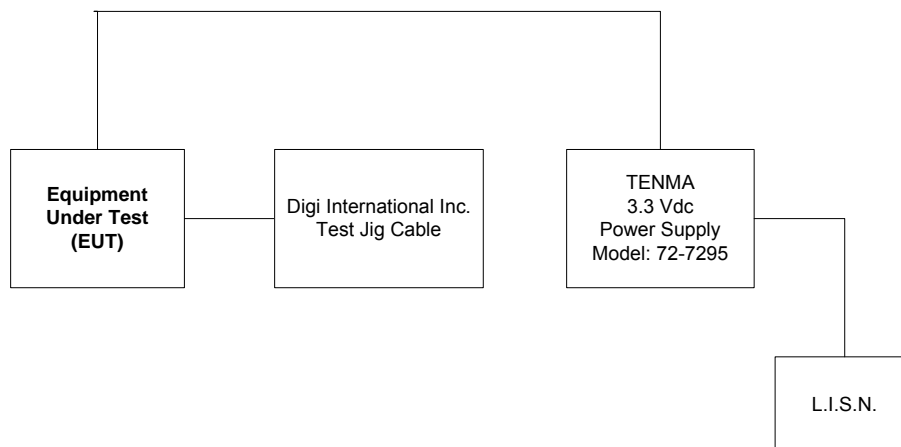
Frequency of emission (MHz)	Conducted Limits (dB μ V)		Measuring Bandwidth
	Quasi-peak	Average	
0.15–0.5	66 to 56*	56 to 46*	RBW = 9 kHz
0.5–5	56	46	VBW \geq 9 kHz for QP
5–30	60	50	VBW = 1 Hz for Average

*Decreases linearly with the logarithm of the frequency

6.5.2. Method of Measurements

ANSI C63.4

6.5.3. Test Arrangement



6.5.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Transient Limiter	Hewlett Packard	11947A	310701998	9 kHz – 200 MHz 10 dB attenuation
L.I.S.N.	EMCO	3825/2	89071531	9 kHz – 200 MHz 50 Ohms / 50 μ H
24'(L) x 16'(W) x 8'(H) RF Shielded Chamber	Braden Shielding	...	...	...

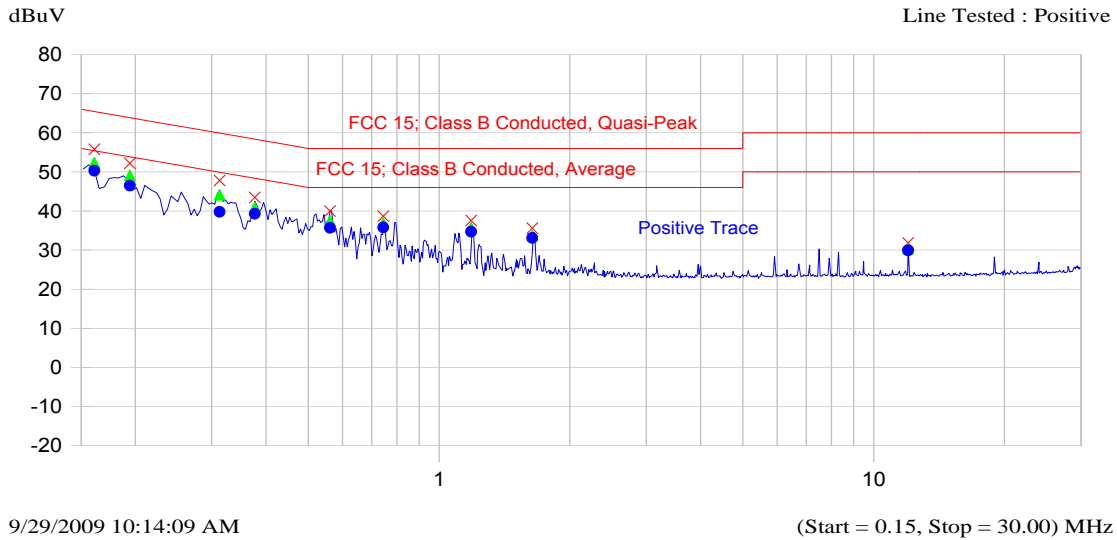
6.5.5. Test Data

Note: See the following test data plots for details.

Plot 6.5.5.1 Power Line Conducted Emissions
 Line Voltage: 3.3VDC
 Line Tested: Positive

Description: Supply Voltage 3.3 VDC
 Transmit High Power Mode
 Setup Name: FCC15; Conducted
 Customer Name: Digi International
 Project Number: DIGI-020Q
 Operator Name: Nimisha
 EUT Name: XBEE-PRO S2B
 Date Created: 9/29/2009 9:24:43 AM

Current Graph



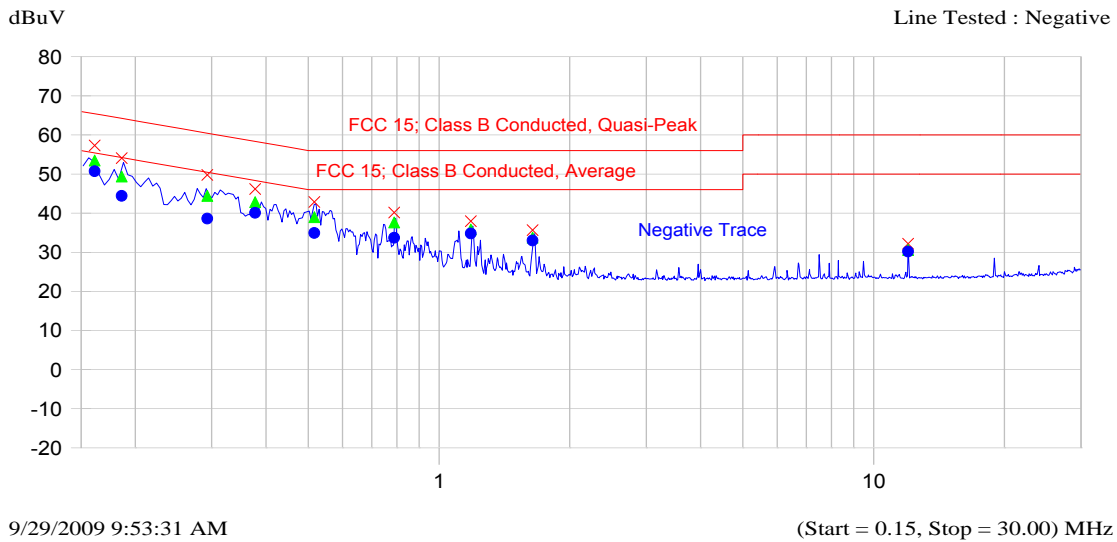
Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta Qp-Qp dB	Limit dB	Avg dBuV	Delta Avg-Avg dB	Limit dB	Trace Name
0.161	55.8	52.3	-13.3		50.3	-5.4		Positive Trace
0.194	52.2	49.1	-15.6		46.5	-8.2		Positive Trace
0.313	47.8	44.1	-17.1		39.8	-11.5		Positive Trace
0.377	43.5	40.9	-18.6		39.3	-10.2		Positive Trace
0.561	39.9	37.4	-18.6		35.7	-10.3		Positive Trace
0.745	38.7	36.9	-19.1		35.8	-10.2		Positive Trace
1.185	37.6	35.7	-20.3		34.7	-11.3		Positive Trace
1.640	35.6	33.8	-22.2		33.1	-12.9		Positive Trace
12.000	31.8	30.4	-29.6		29.9	-20.1		Positive Trace

Plot 6.5.5.2 Power Line Conducted Emissions
 Line Voltage: 3.4 VDC
 Line Tested: Negative

Description: Supply Voltage 3.3 VDC
 Transmit High Power Mode
 Setup Name: FCC15; Conducted
 Customer Name: Digi International
 Project Number: DIGI-020Q
 Operator Name: Nimisha
 EUT Name: XBEE-PRO S2B
 Date Created: 9/29/2009 9:24:43 AM
 Date Modified: 10/2/2009 10:11:45 AM

Current Graph



Current List

Frequency MHz	Peak dBuV	QP dBuV	Delta Qp-Qp Limit dB	Avg dBuV	Delta Avg-Avg Limit dB	Trace Name
0.161	57.3	53.4	-12.2	50.7	-4.9	Negative Trace
0.186	54.1	49.3	-15.6	44.4	-10.6	Negative Trace
0.293	49.8	44.4	-17.4	38.6	-13.2	Negative Trace
0.378	46.2	42.8	-16.6	40.1	-9.4	Negative Trace
0.517	42.9	39.0	-17.0	34.9	-11.1	Negative Trace
0.789	40.2	37.6	-18.4	33.7	-12.3	Negative Trace
1.183	37.9	35.8	-20.2	34.8	-11.2	Negative Trace
1.641	35.6	33.7	-22.3	33.0	-13.0	Negative Trace
12.000	32.2	30.6	-29.4	30.2	-19.8	Negative Trace

6.6. OCCUPIED BANDWIDTH [§ 15.247(a)(2)]

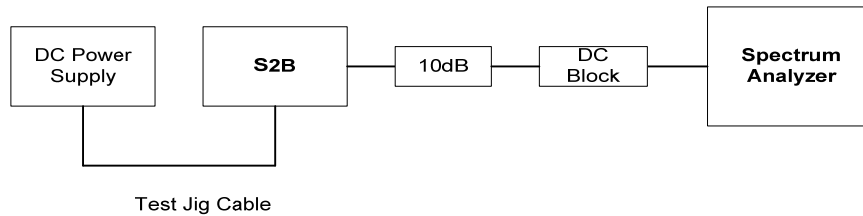
6.6.1. Limit(s)

For a Digital Modulation System, the minimum 6 dB bandwidth shall be at least 500 KHz.

6.6.2. Method of Measurements

KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

6.6.3. Test Arrangement



6.6.4. Test Equipment List

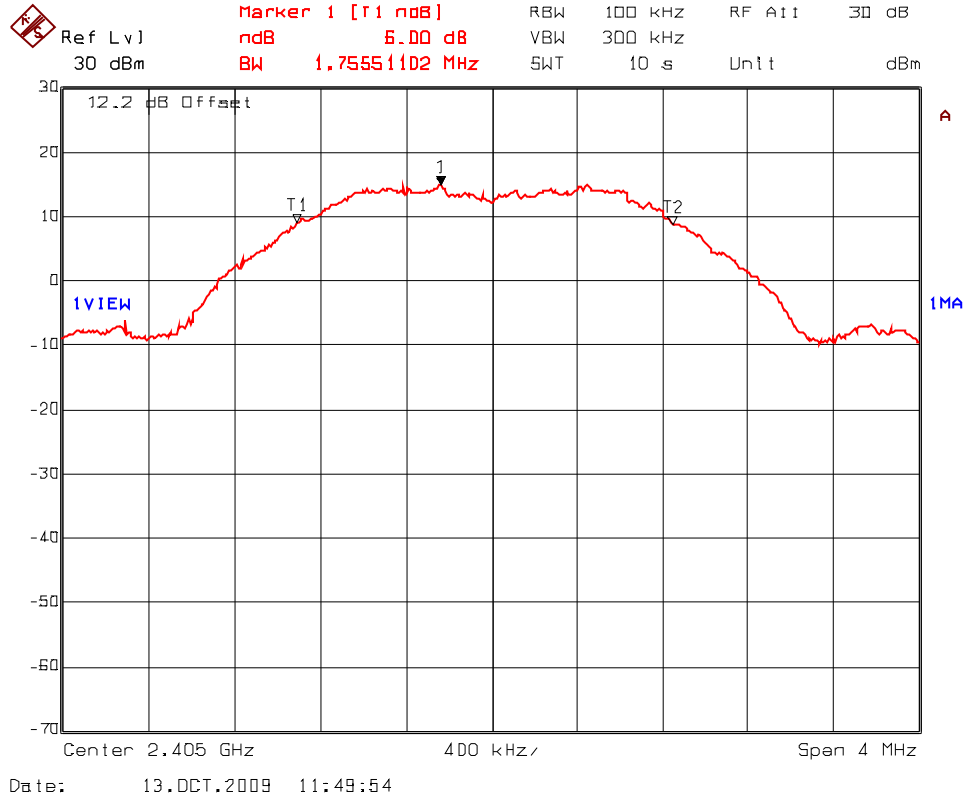
Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz with external mixer	August 10, 2010
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	N/A
Attenuator	Narda	4768-10	-	DC - 40 GHz	N/A

6.6.5. Test Data

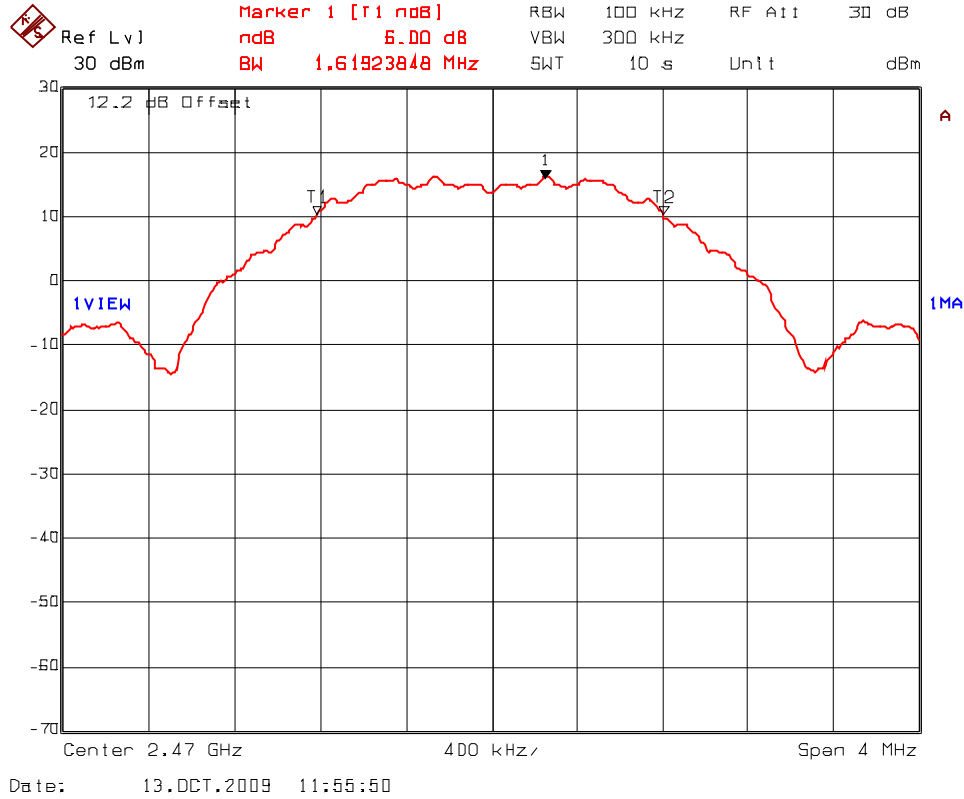
Frequency (MHz)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Compliance
2405	1.75	2.41	Yes
2440	1.65	2.42	Yes
2470	1.61	2.40	Yes
2475	1.62	2.39	Yes
2480	1.62	2.41	Yes

See the following plots for detailed measurements.

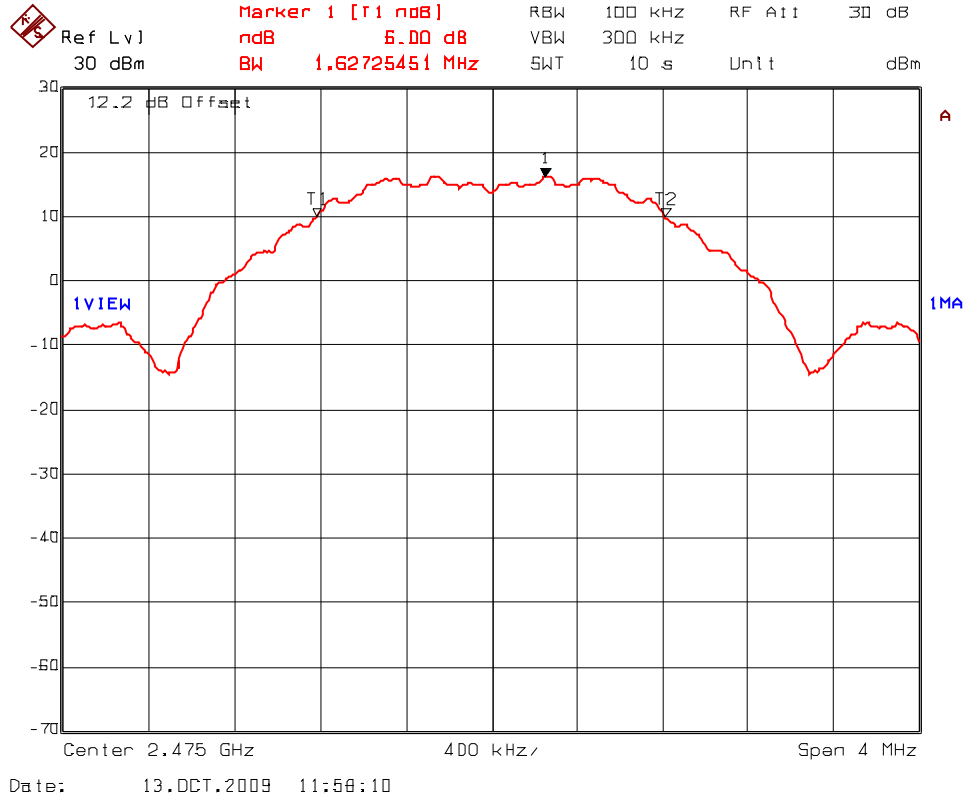
Plot 6.6.5.1 6 dB Bandwidth
Frequency: 2405 MHz



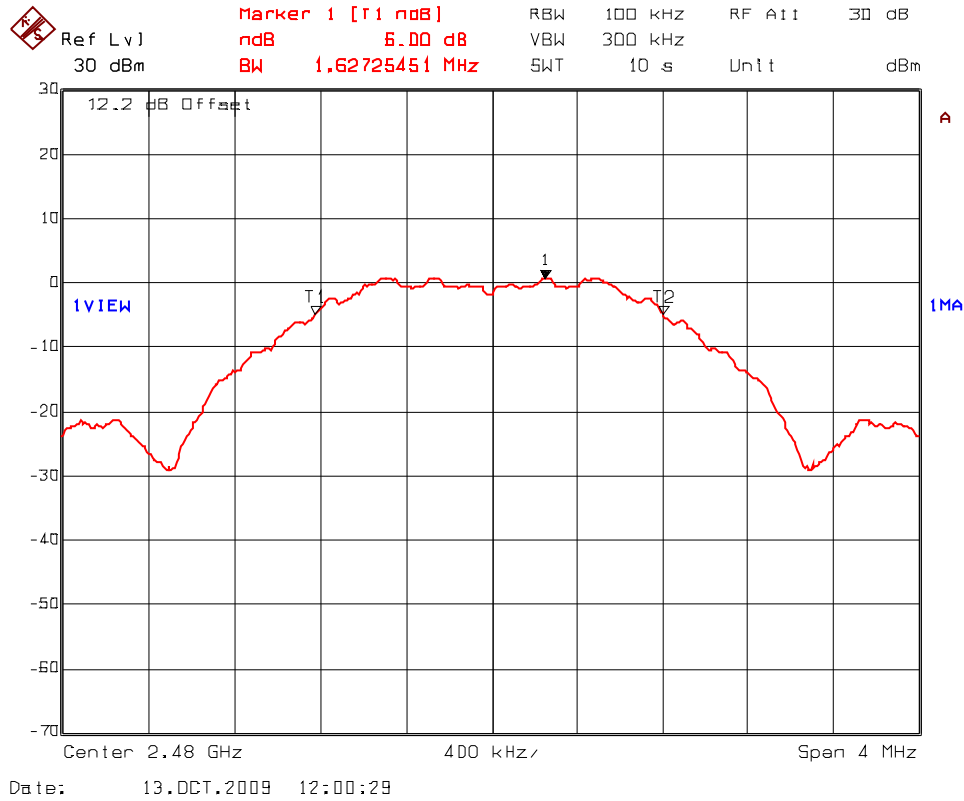
Plot 6.6.5.3 6 dB Bandwidth
Frequency: 2470 MHz



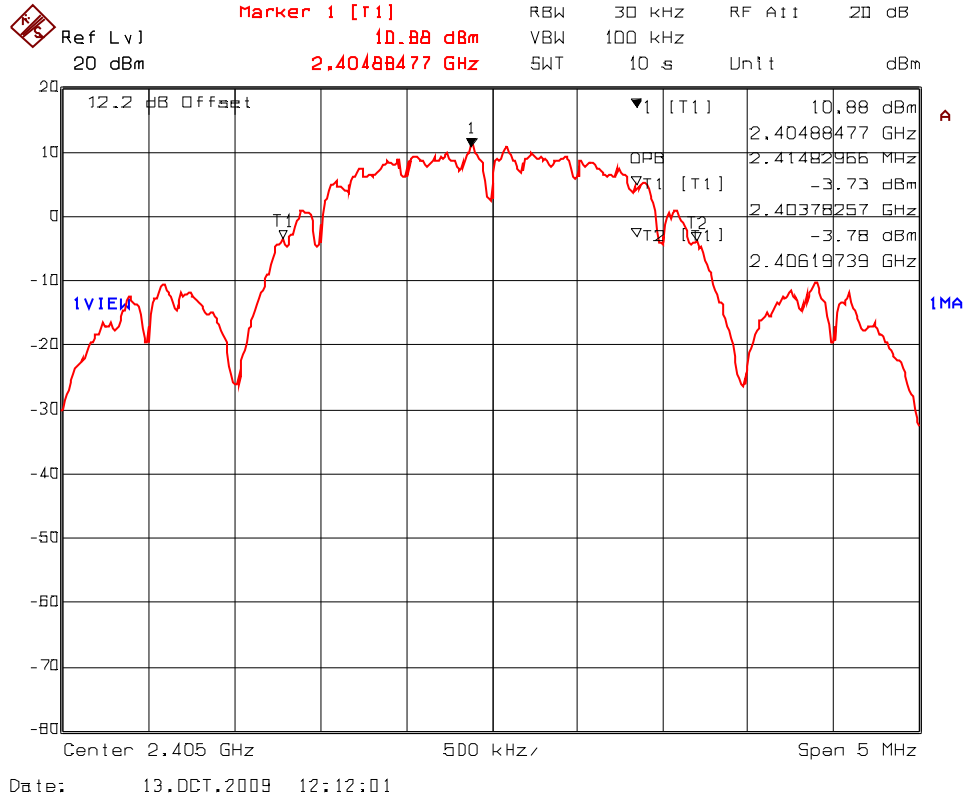
Plot 6.6.5.4 6 dB Bandwidth
Frequency: 2475 MHz



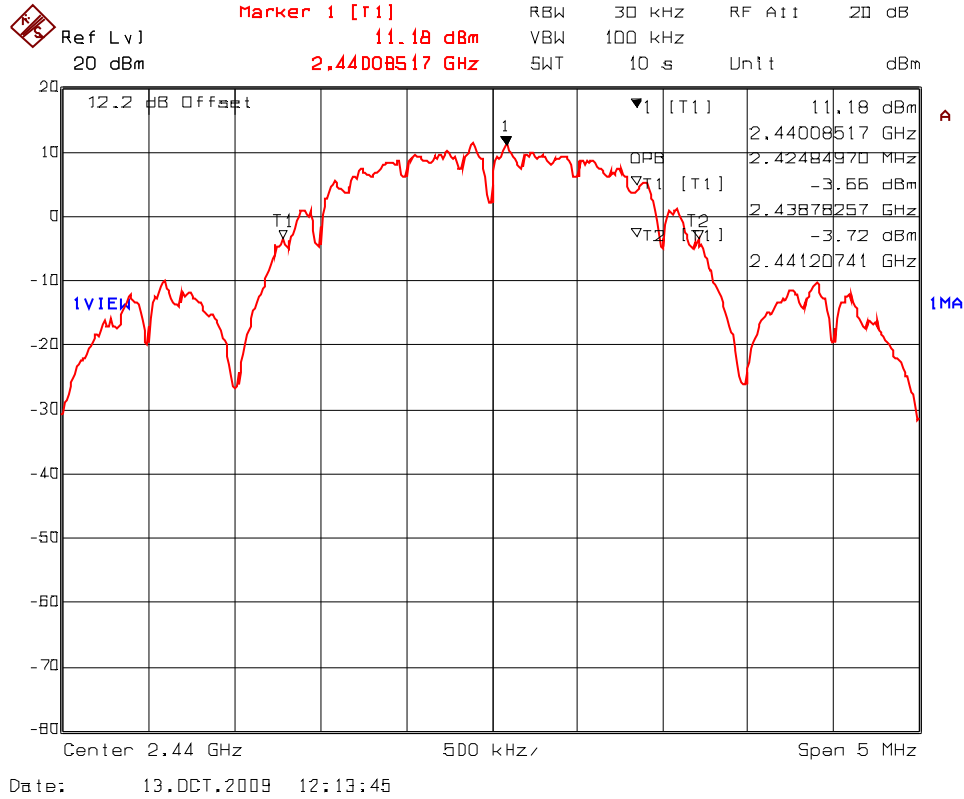
Plot 6.6.5.5 6 dB Bandwidth
Frequency: 2480 MHz



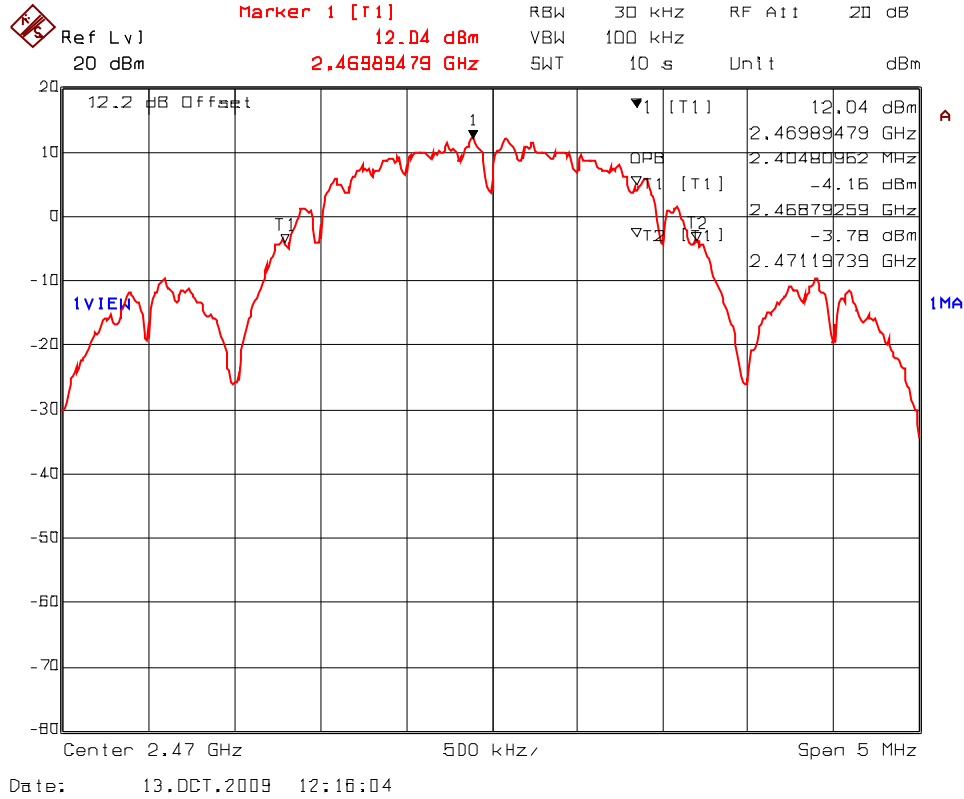
Plot 6.6.5.6 99% Occupied Bandwidth
 Frequency: 2405 MHz



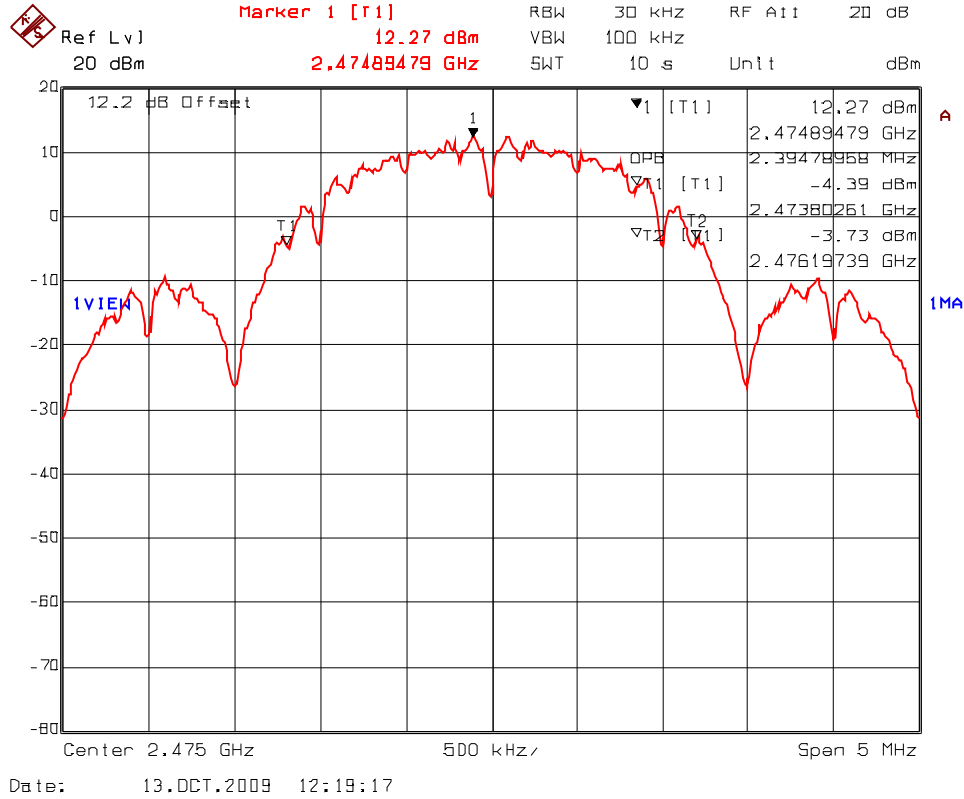
Plot 6.6.5.7 99% Occupied Bandwidth
 Frequency: 2440 MHz



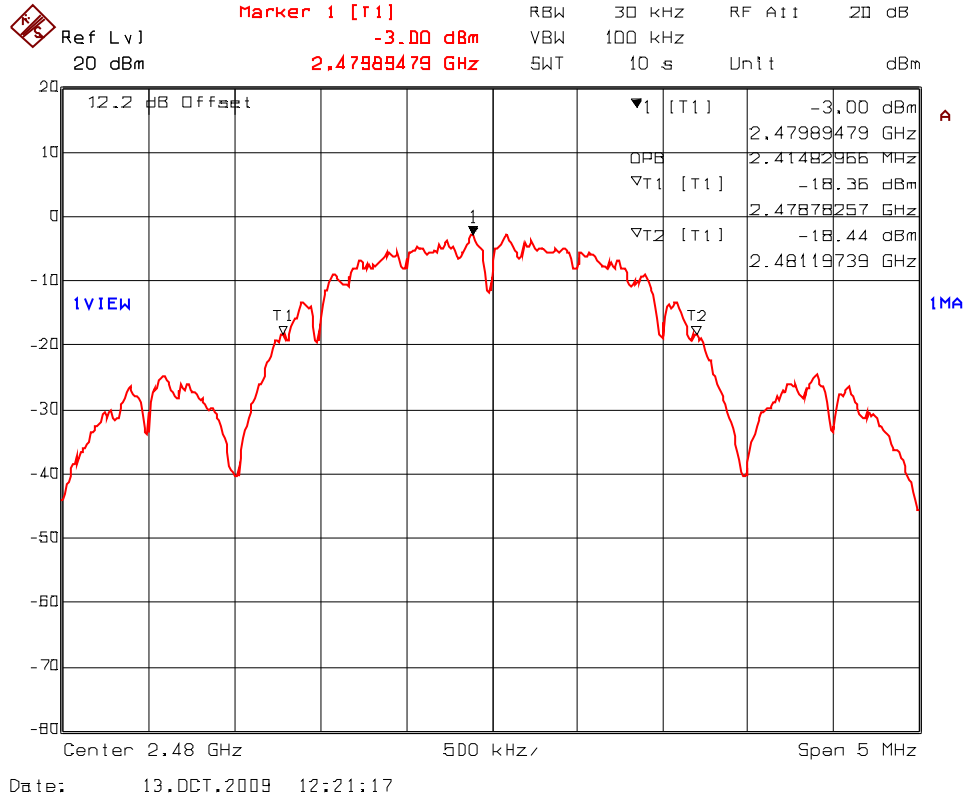
Plot 6.6.5.8 99% Occupied Bandwidth
 Frequency: 2470 MHz



Plot 6.6.5.9 99% Occupied Bandwidth
 Frequency: 2475 MHz



Plot 6.6.5.10 99% Occupied Bandwidth
 Frequency: 2480 MHz



6.7. PEAK CONDUCTED OUTPUT POWER - DTS [§ 15.247(b)(3)]

6.7.1. Limit(s)

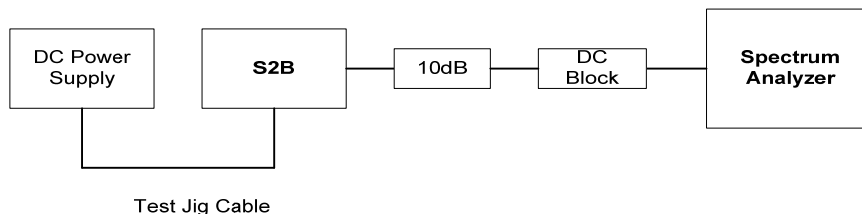
§ 15.247(b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

§15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.7.2. Method of Measurements & Test Arrangement

KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

6.7.3. Test Arrangement



6.7.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz with external mixer	August 10, 2010
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	N/A
Attenuator	Narda	4768-10	-	DC - 40 GHz	N/A

6.7.5. Test Data

Channel No.	Frequency (MHz)	Peak Conducted Power (dBm)	Peak Conducted Power (mW)	Peak Conducted Power Limit (dBm)
High Power Setting, DC Voltage Input of 3.3 Vdc				
11	2405	18.24	66.68	30
18	2440	18.60	72.44	30
24	2470	19.22	83.56	30
25	2475	19.22	83.56	30
26	2480	3.90	2.45	30
Low Power Setting, DC Voltage Input of 3.3 Vdc				
11	2405	-2.11	0.62	30
18	2440	-2.11	0.62	30
24	2470	-1.40	0.72	30
25	2475	-1.40	0.72	30
26	2480	-1.27	0.75	30

Note:- The following is the list of various allowed antennas with highest gain in respective type and allowed operating channels to comply with FCC 15.247 requirements.

Antenna 1: Type- Dipole, Gain- 2.1 dBi, Operates on Channels # 11 to 26

Channel No.	Frequency MHz	Power Measured (dBm)	Power Measured (mW)	Peak EIRP (Note 1) (dBmi)	EIRP Limit (dBm)	Margin (dB)
11	2405	18.24	66.68	20.34	36	-15.66
18	2440	18.60	72.44	20.70	36	-15.30
24	2470	19.22	83.56	21.32	36	-14.68
25	2475	19.22	83.56	21.32	36	-14.68
26	2480	3.90	2.45	6.00	36	-30.00

Note 1: The Peak EIRP is calculated as the sum of Peak Conducted Power in dBm and antenna assembly gain of EUT in dBi (antenna gain – cable loss), cable loss is 0.0 dB.

Antenna 2: Type- Astron Omni Directional, Gain- 8 dBi, Operates on Channels # 11 to 25

Channel No.	Frequency MHz	Power Measured (dBm)	Power Measured (mW)	Peak EIRP (Note 1) (dBmi)	EIRP Limit (dBm)	Margin (dB)
11	2405	18.24	66.68	25.55	36	-10.45
18	2440	18.60	72.44	25.91	36	-10.09
24	2470	19.22	83.56	26.53	36	-9.47
25	2475	19.22	83.56	26.53	36	-9.47
26	2480	N/A	N/A	N/A	N/A	N/A

Note 1: The Peak EIRP is calculated as the sum of Peak Conducted Power in dBm and antenna assembly gain of EUT in dBi (antenna gain – cable loss), cable loss is 0.69 dB.

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File #: DIGI-020F15C247
 November 9, 2009

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Antenna 3: Type- D-link Omni Directional, Gain- 15 dBi, Operates on Channels # 11 to 24

Channel No.	Frequency MHz	Power Measured (dBm)	Power Measured (mW)	Peak EIRP (Note 1) (dBm)	EIRP Limit (dBm)	Margin (dB)
11	2405	18.24	66.68	32.55	36	-3.45
18	2440	18.60	72.44	32.91	36	-3.09
24	2470	19.22	83.56	33.53	36	-2.47
25	2475	N/A	N/A	N/A	N/A	N/A
26	2480	N/A	N/A	N/A	N/A	N/A

Note 1: The Peak EIRP is calculated as the sum of Peak Conducted Power in dBm and antenna assembly gain of EUT in dBi (antenna gain – cable loss), cable loss is 0.69 dB.

Antenna 4: Type- Maxrad Yagi, Gain- 15 dBi, Operates on Channels # 11 to 24

Channel No.	Frequency MHz	Power Measured (dBm)	Power Measured (mW)	Peak EIRP (Note 1) (dBm)	EIRP Limit (dBm)	Margin (dB)
11	2405	18.24	66.68	32.55	36	-3.45
18	2440	18.60	72.44	32.91	36	-3.09
24	2470	19.22	83.56	33.53	36	-2.47
25	2475	N/A	N/A	N/A	N/A	N/A
26	2480	N/A	N/A	N/A	N/A	N/A

Note 1: The Peak EIRP is calculated as the sum of Peak Conducted Power in dBm and antenna assembly gain of EUT in dBi (antenna gain – cable loss), cable loss is 0.69 dB.

Antenna 5: Type- ARC Panel, Gain- 19 dBi, Operates on Channels # 11 to 24

Channel No.	Frequency MHz	Power Measured (dBm)	Power Measured (mW)	Peak EIRP (Note 1) (dBm)	EIRP Limit (dBm)	Margin (dB)
11	2405	18.24	66.68	31.44	36	-4.56
18	2440	18.60	72.44	31.80	36	-4.20
24	2470	19.22	83.56	32.42	36	-3.58
25	2475	N/A	N/A	N/A	N/A	N/A
26	2480	N/A	N/A	N/A	N/A	N/A

Note 1: The Peak EIRP is calculated as the sum of Peak Conducted Power in dBm and antenna assembly gain of EUT in dBi (antenna gain – cable loss), manufacturer has declared minimum cable loss of 5.8 dBi for 19 dBi gain antenna.

6.8. TRANSMITTER BAND-EDGE & SPURIOUS CONDUCTED EMISSIONS [§ 15.247(d)]

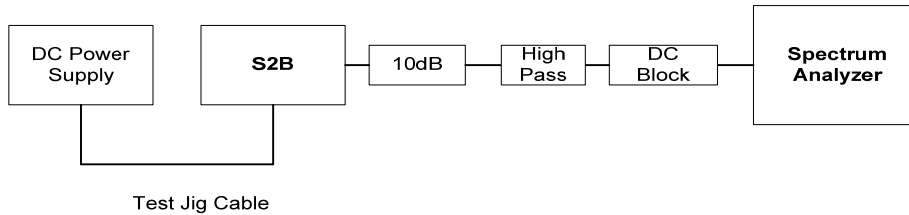
6.8.1. Limit(s)

§ 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.

6.8.2. Method of Measurements

KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

6.8.3. Test Arrangement



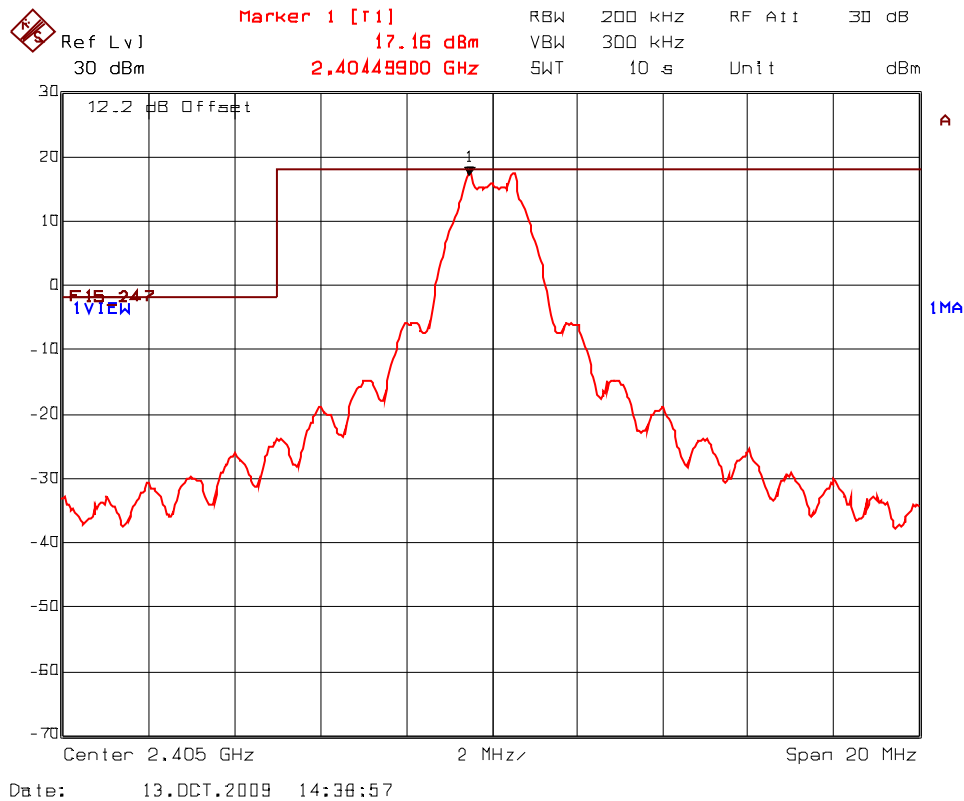
6.8.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz with external mixer	August 10, 2010
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	N/A
Attenuator	Narda	4768-10	-	DC - 40 GHz	N/A
High Pass Filter	K & L	11SH10-4000/T12000	4	Cut off 3.4 GHz	N/A

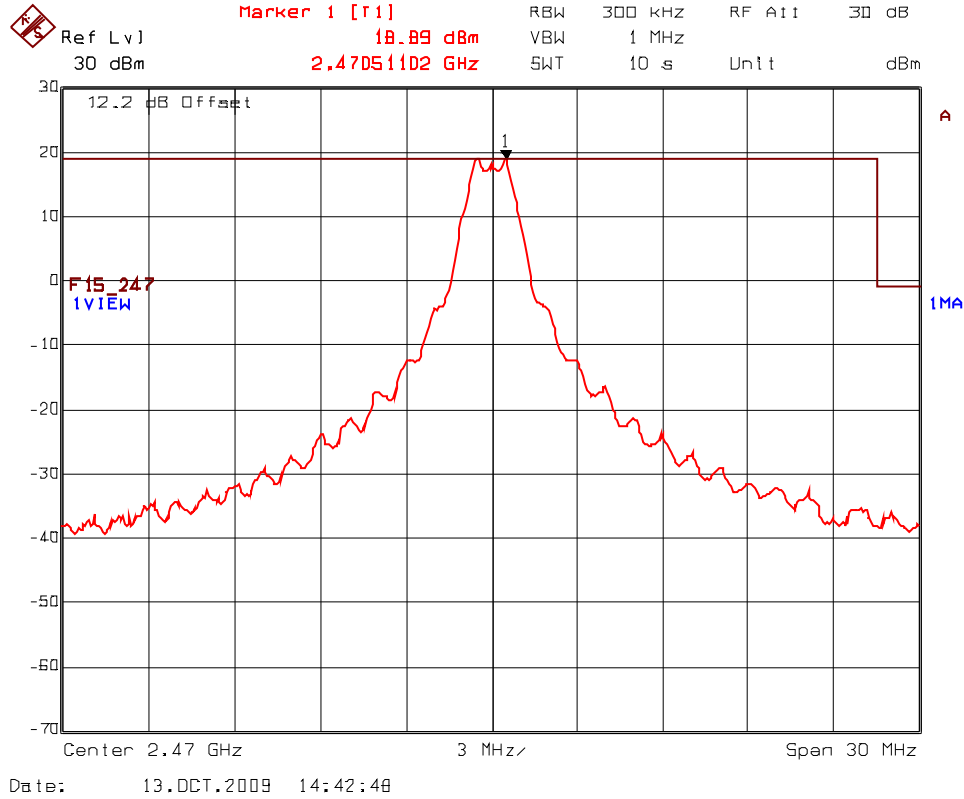
6.8.5. Test Data

6.8.5.1. Band-Edge RF Conducted Emissions

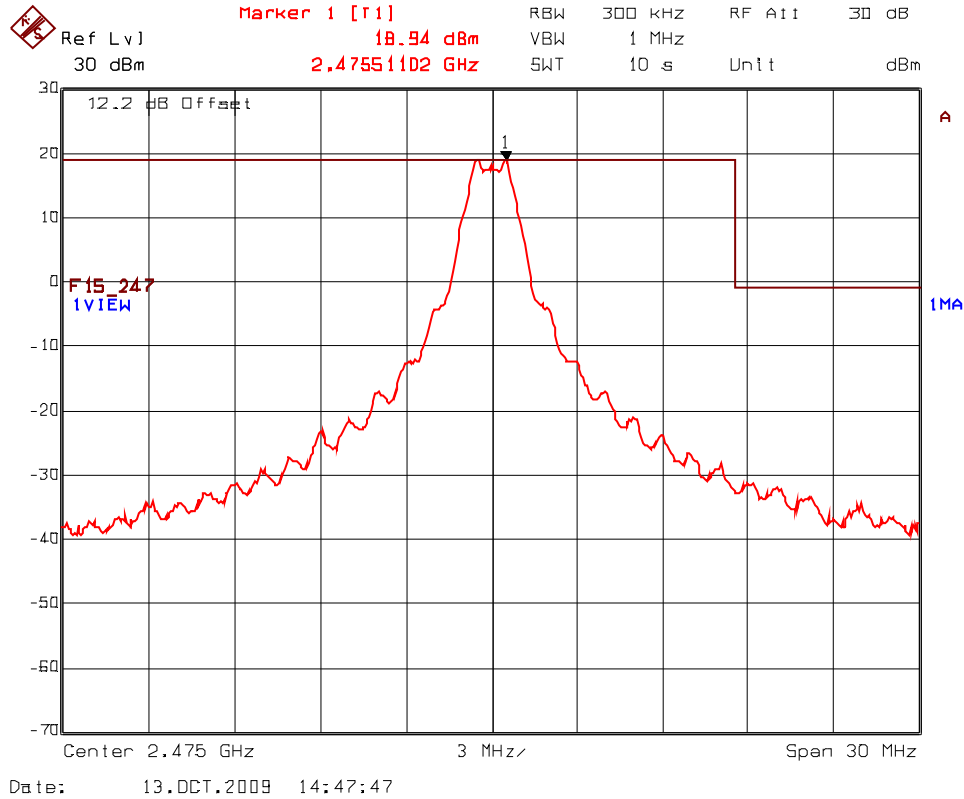
Plot 6.8.5.1.1 Band-Edge RF Conducted Emissions
Low End of Frequency Band (2405 MHz)



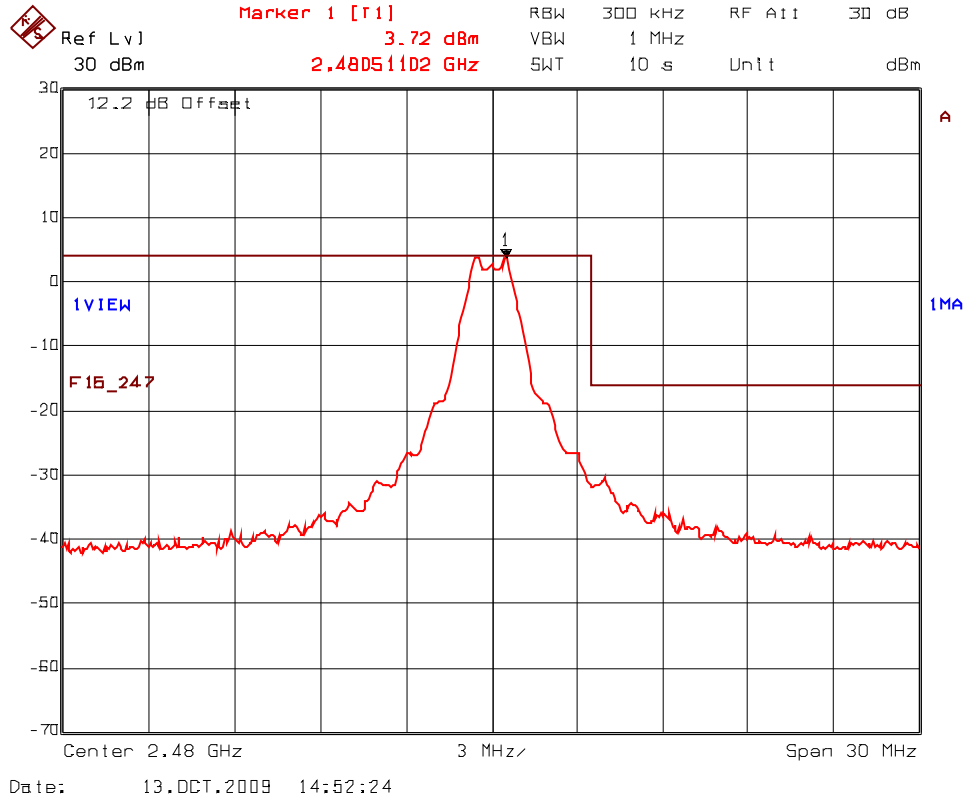
Plot 6.8.5.1.2 Band-Edge RF Conducted Emissions
High End of Frequency Band (2470 MHz)



Plot 6.8.5.1.3 Band-Edge RF Conducted Emissions
High End of Frequency Band (2475 MHz)

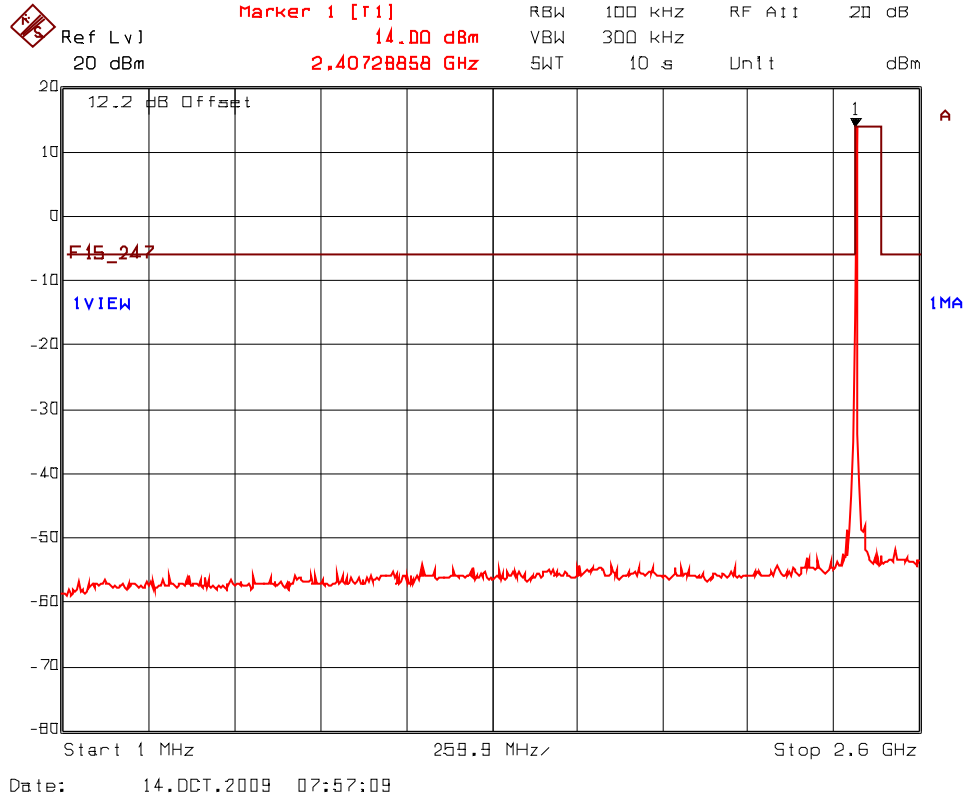


Plot 6.8.5.1.4 Band-Edge RF Conducted Emissions
High End of Frequency Band (2480 MHz)

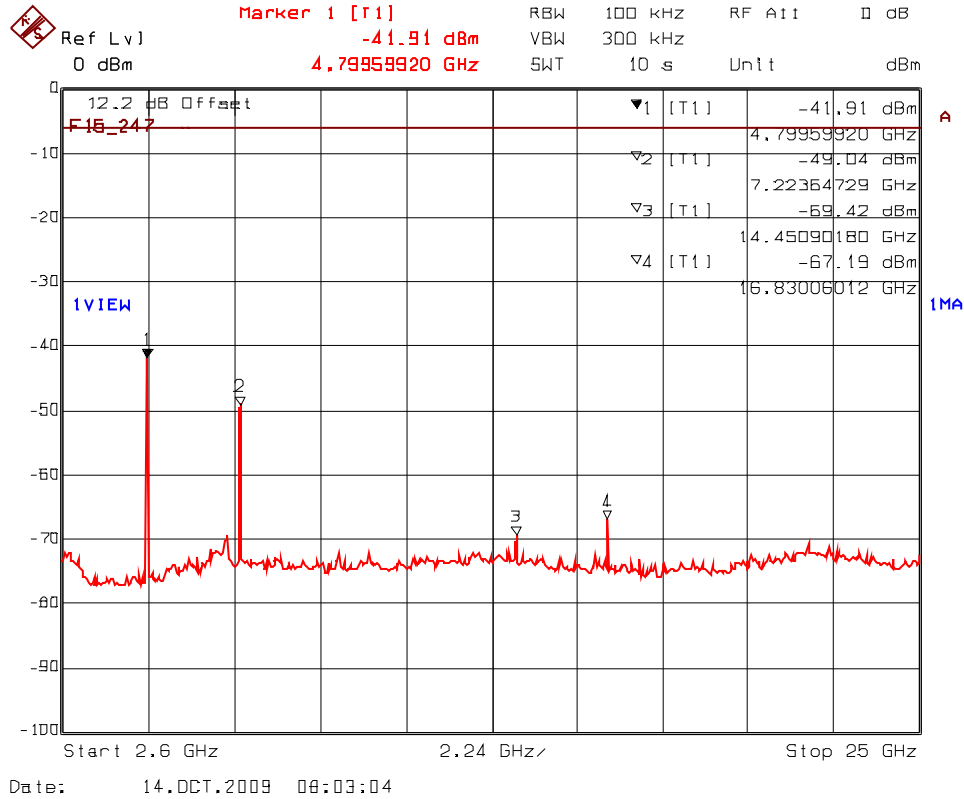


6.8.5.2. Spurious RF Conducted Emissions

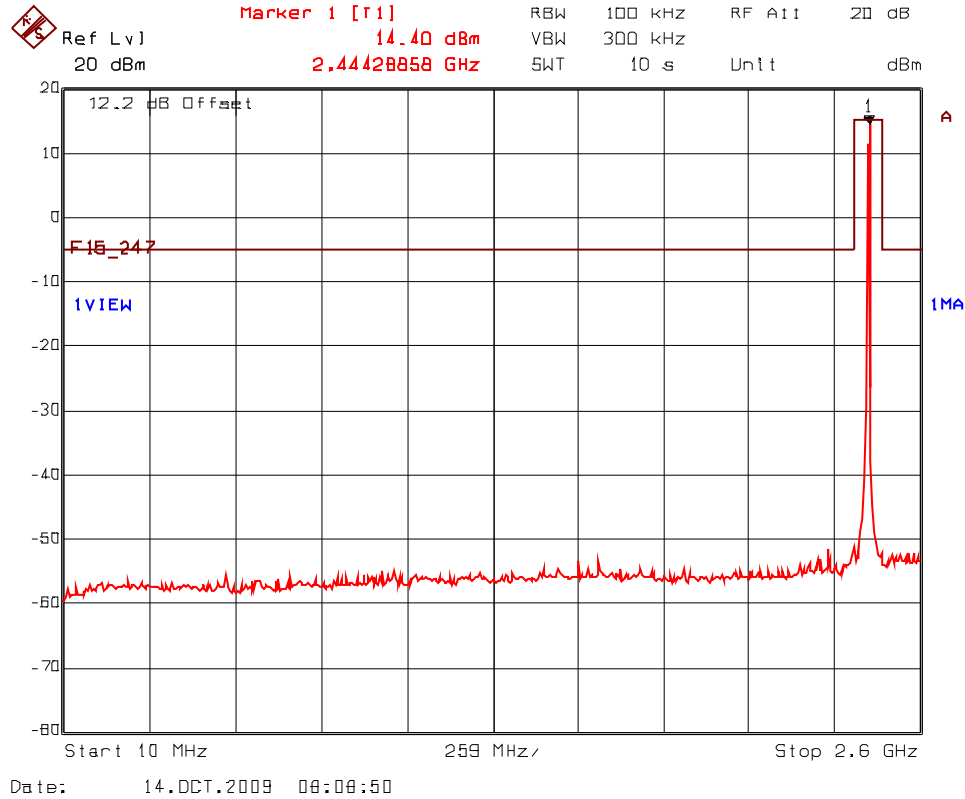
Plot 6.8.5.2.1 Spurious RF Conducted Emissions
Transmitter Frequency: 2405 MHz, High Power



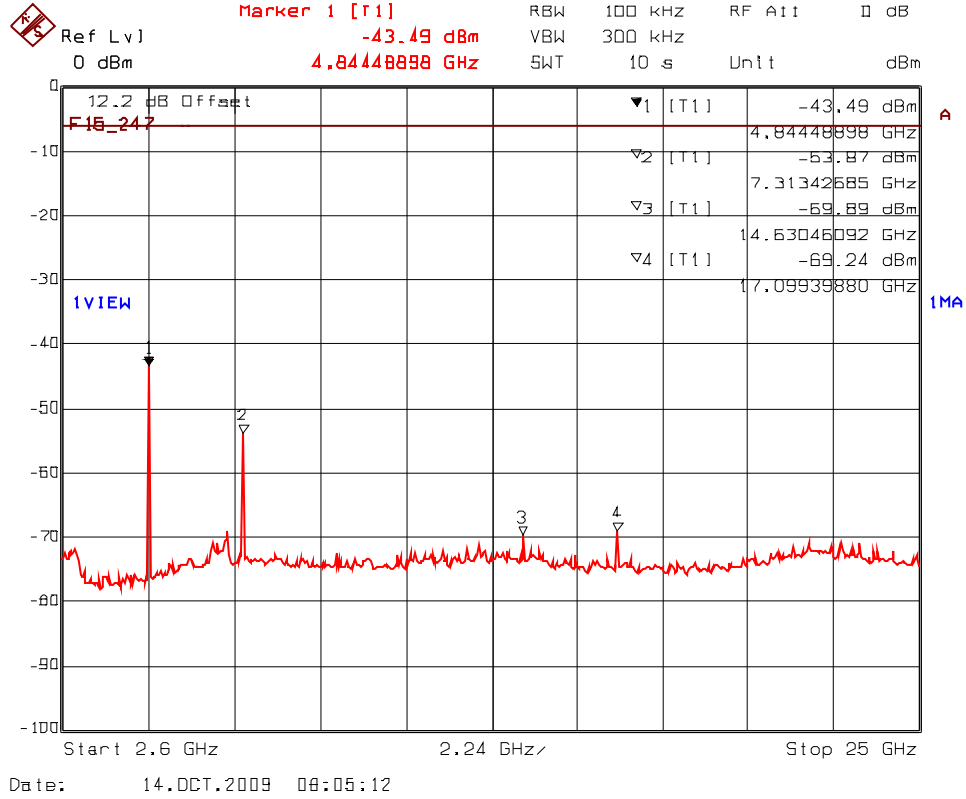
Plot 6.8.5.2.2 Spurious RF Conducted Emissions
 Transmitter Frequency: 2405 MHz, High Power



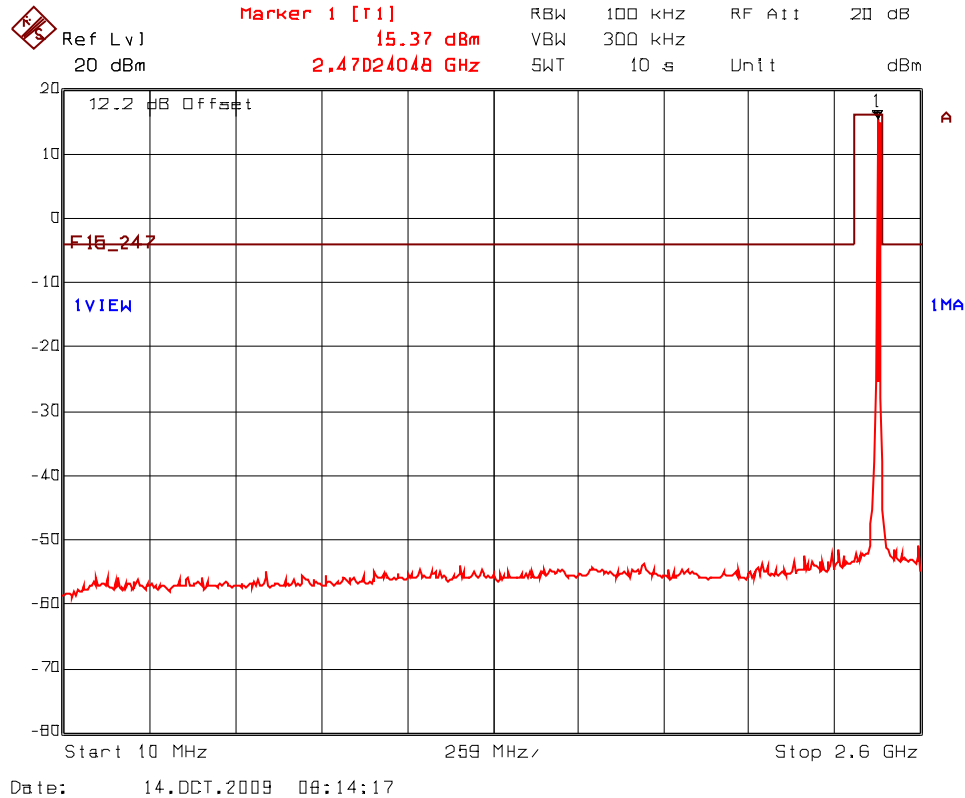
Plot 6.8.5.2.3 Spurious RF Conducted Emissions
Transmitter Frequency: 2440 MHz, High Power



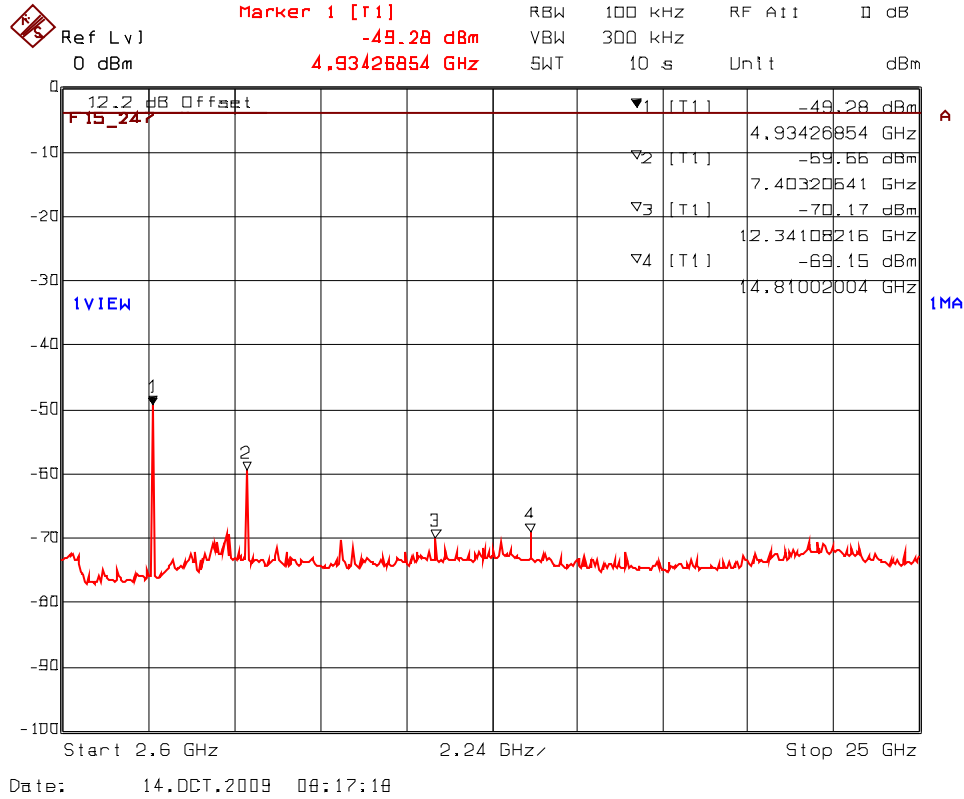
Plot 6.8.5.2.4 Spurious RF Conducted Emissions
 Transmitter Frequency: 2440 MHz, High Power



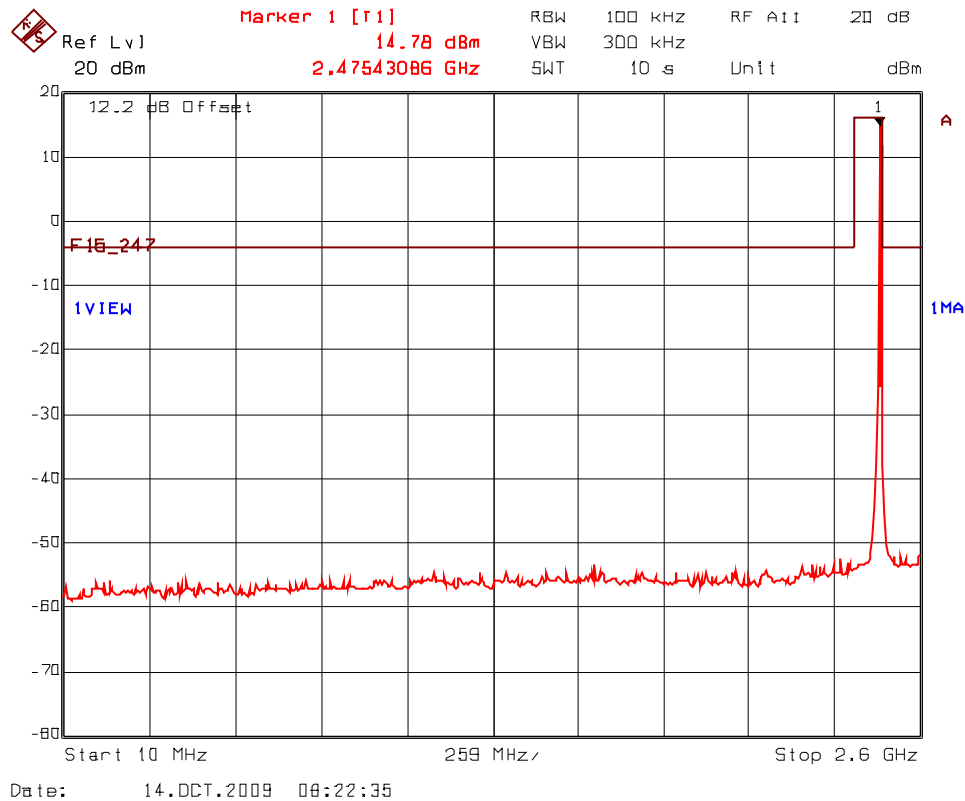
Plot 6.8.5.2.5 Spurious RF Conducted Emissions
Transmitter Frequency: 2470 MHz, High Power



Plot 6.8.5.2.6 Spurious RF Conducted Emissions
 Transmitter Frequency: 2470 MHz, High Power



Plot 6.8.5.2.7 Spurious RF Conducted Emissions
Transmitter Frequency: 2475 MHz, High Power



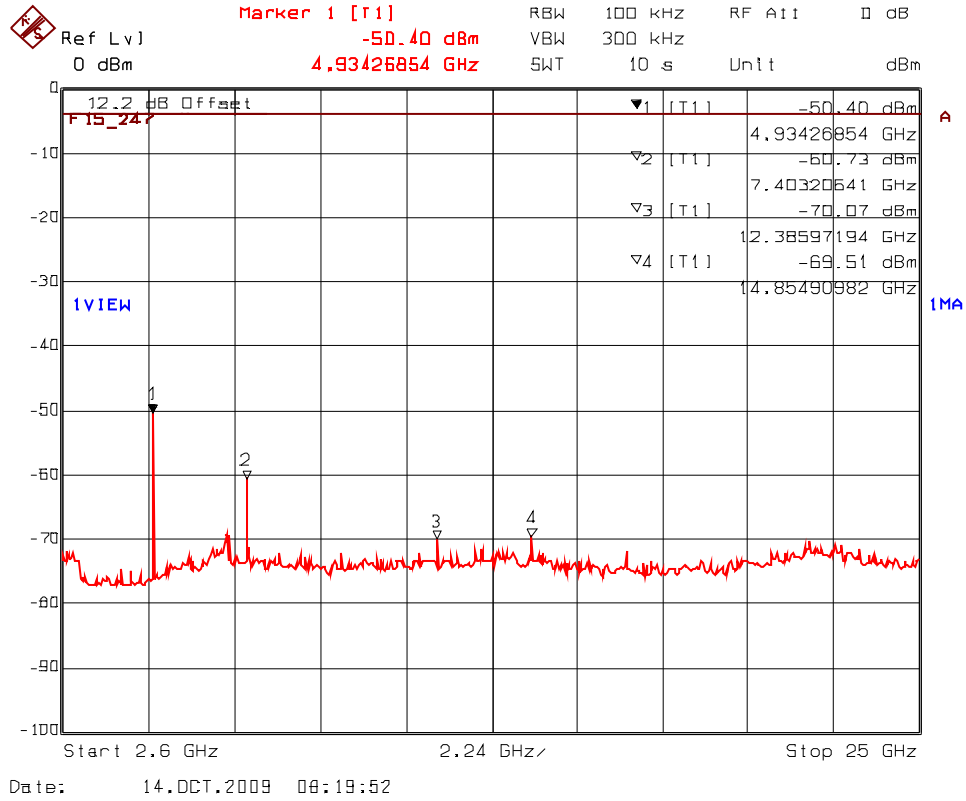
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

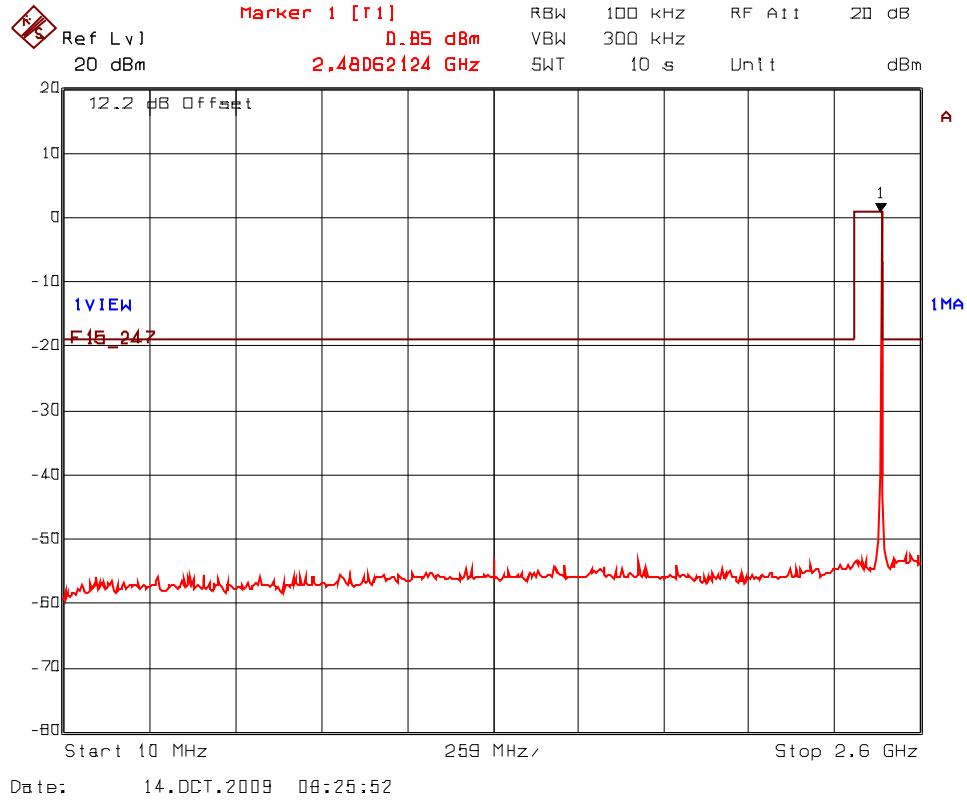
File #: DIGI-020F15C247
November 9, 2009

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

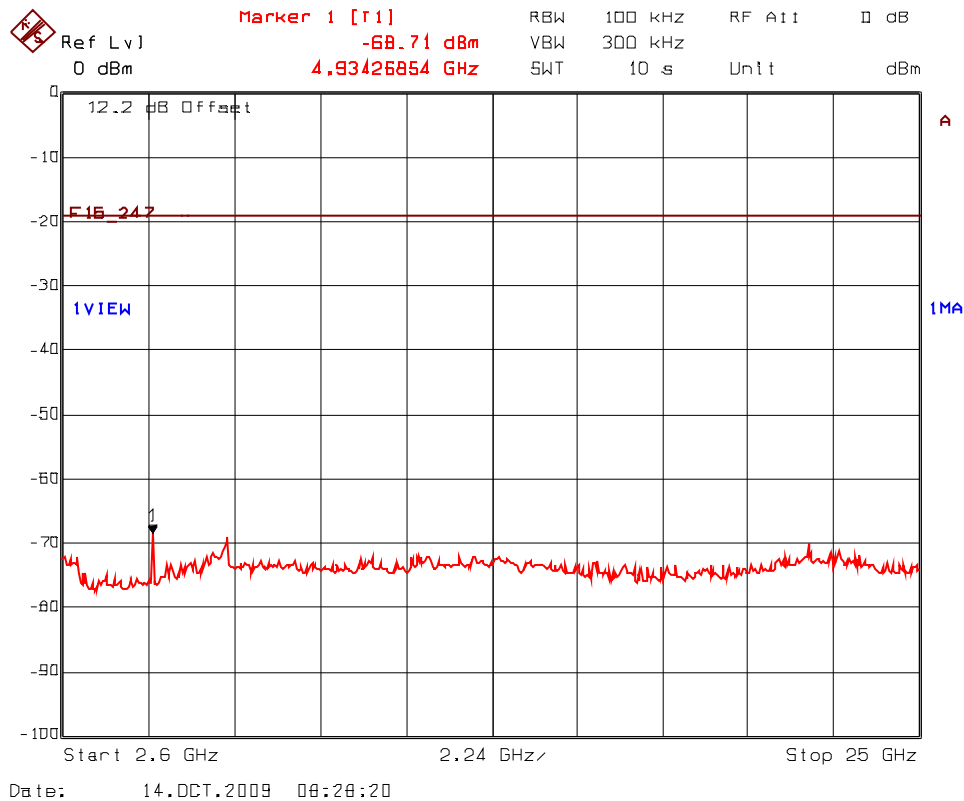
Plot 6.8.5.2.8 Spurious RF Conducted Emissions
 Transmitter Frequency: 2475 MHz, High Power



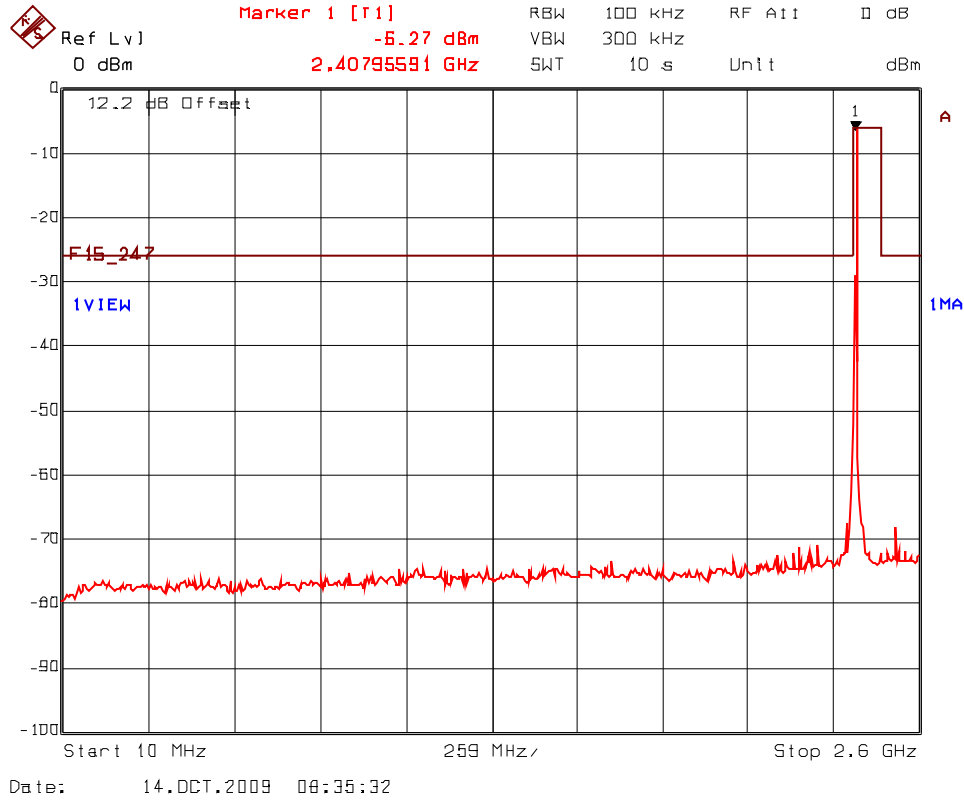
Plot 6.8.5.2.9 Spurious RF Conducted Emissions
Transmitter Frequency: 2480 MHz, High Power



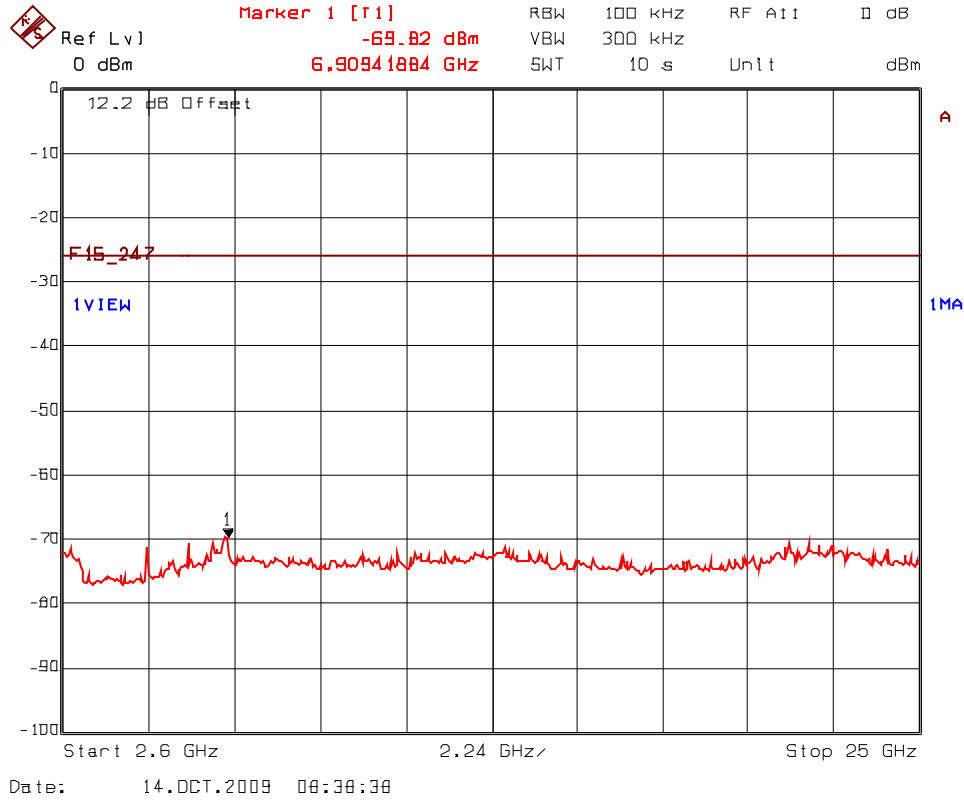
Plot 6.8.5.2.10 Spurious RF Conducted Emissions
Transmitter Frequency: 2480 MHz, High Power



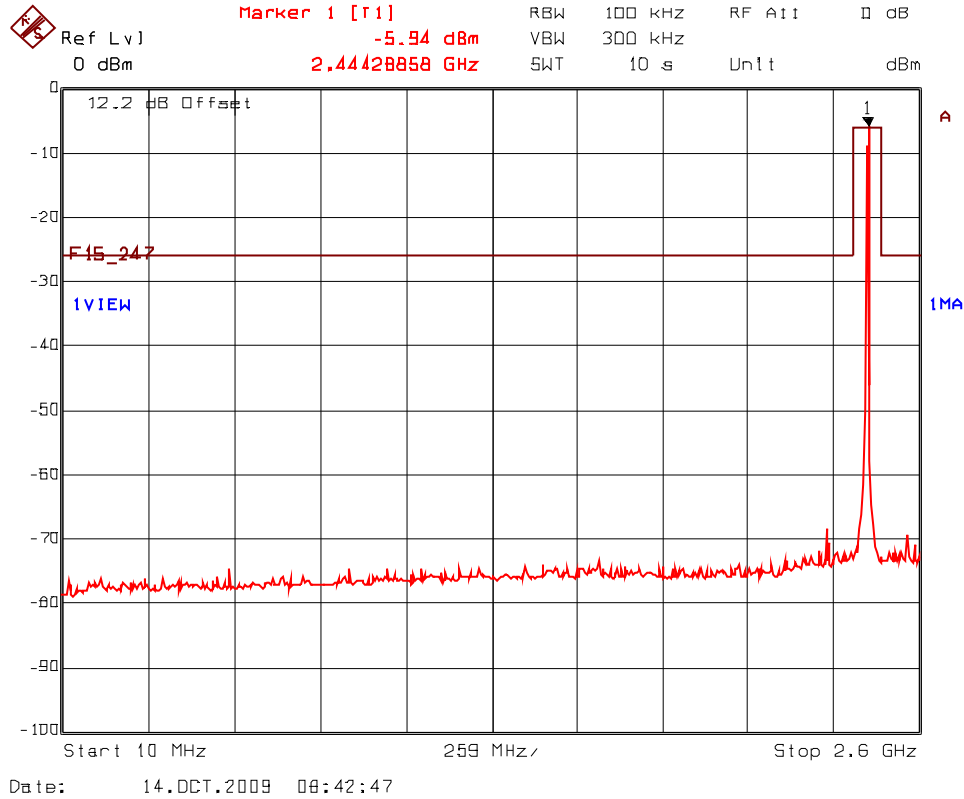
Plot 6.8.5.2.11 Spurious RF Conducted Emissions
Transmitter Frequency: 2405 MHz, Low Power



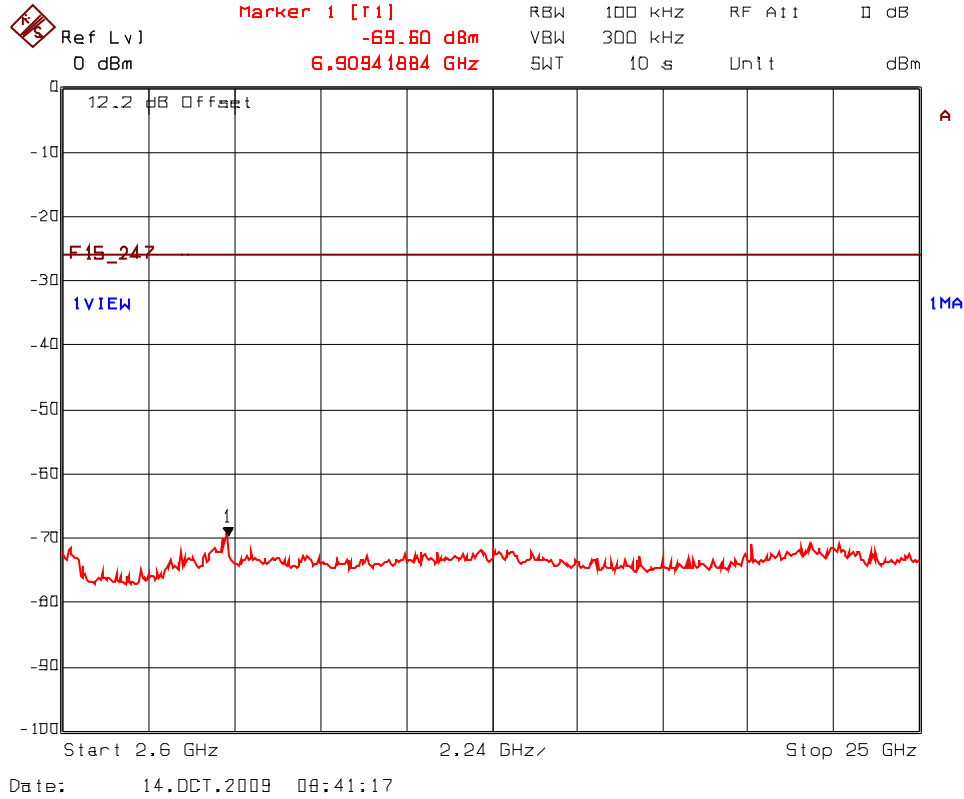
Plot 6.8.5.2.12 Spurious RF Conducted Emissions
Transmitter Frequency: 2405 MHz, Low Power



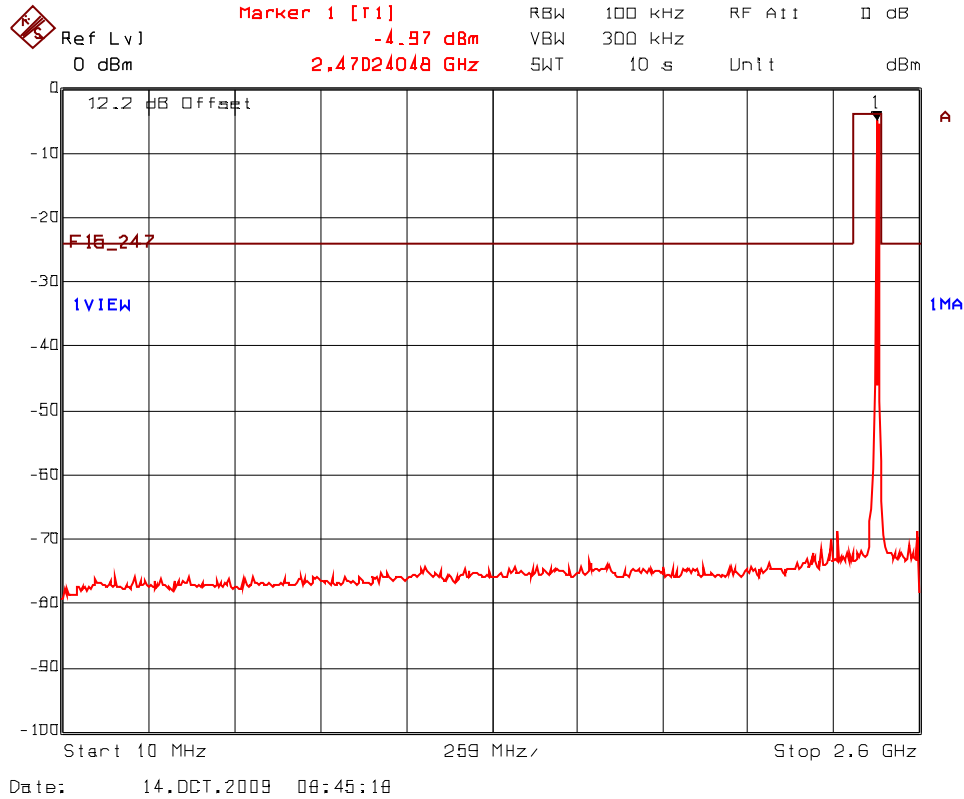
Plot 6.8.5.2.13 Spurious RF Conducted Emissions
Transmitter Frequency: 2440 MHz, Low Power



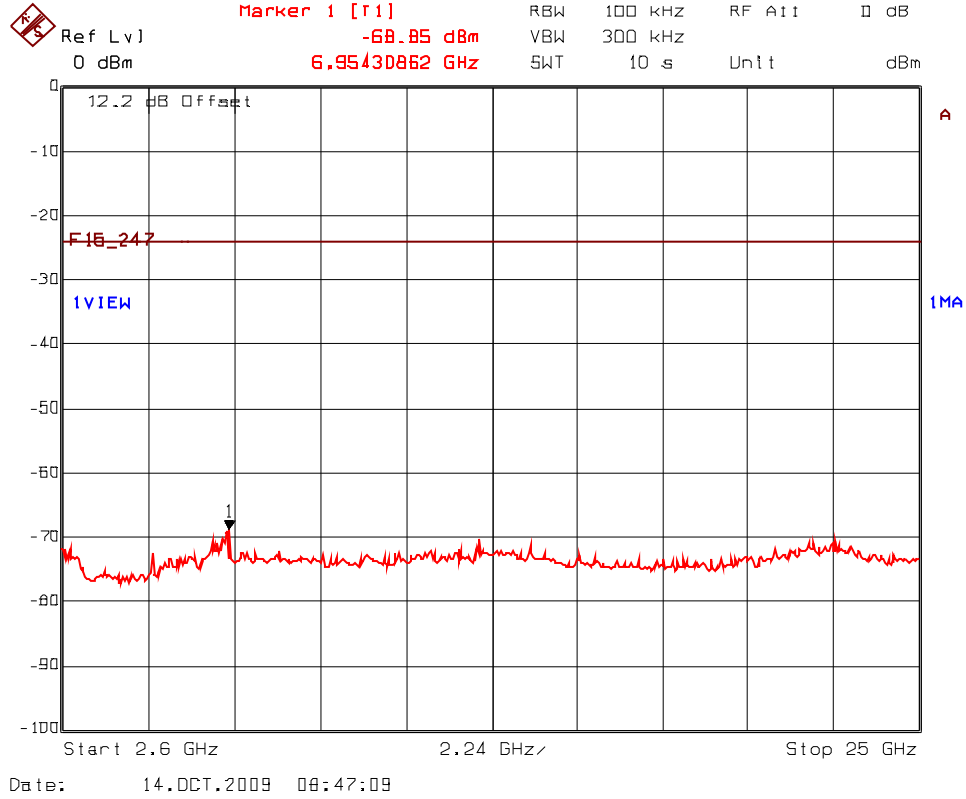
Plot 6.8.5.2.14 Spurious RF Conducted Emissions
Transmitter Frequency: 2440 MHz, Low Power



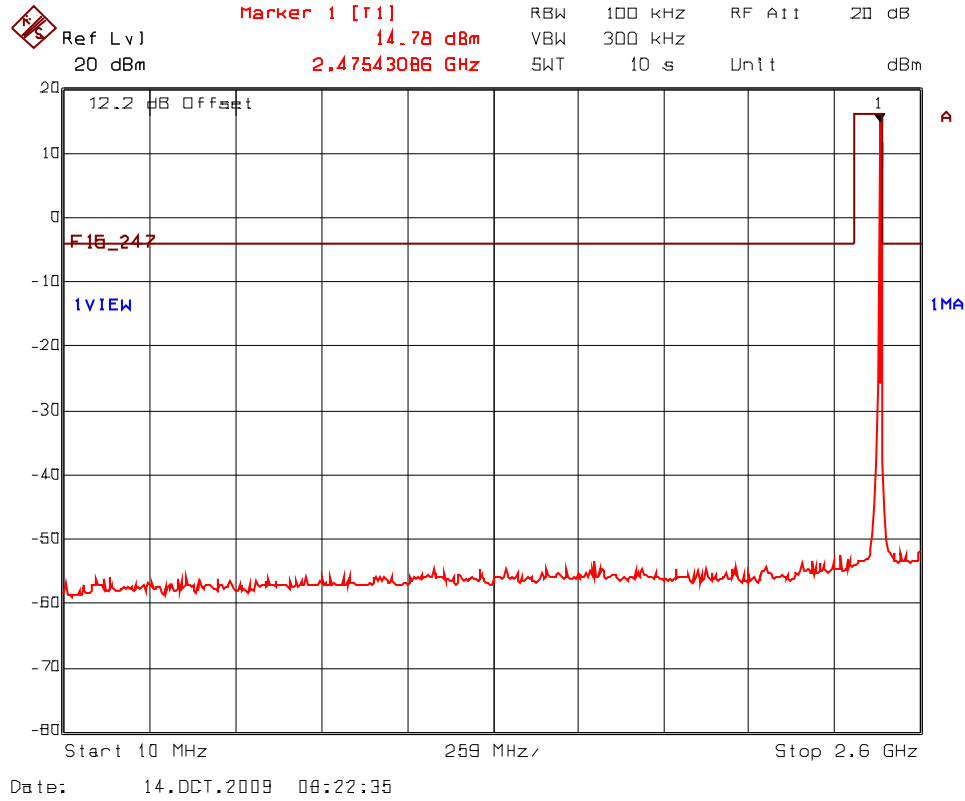
Plot 6.8.5.2.15 Spurious RF Conducted Emissions
Transmitter Frequency: 2470 MHz, Low Power



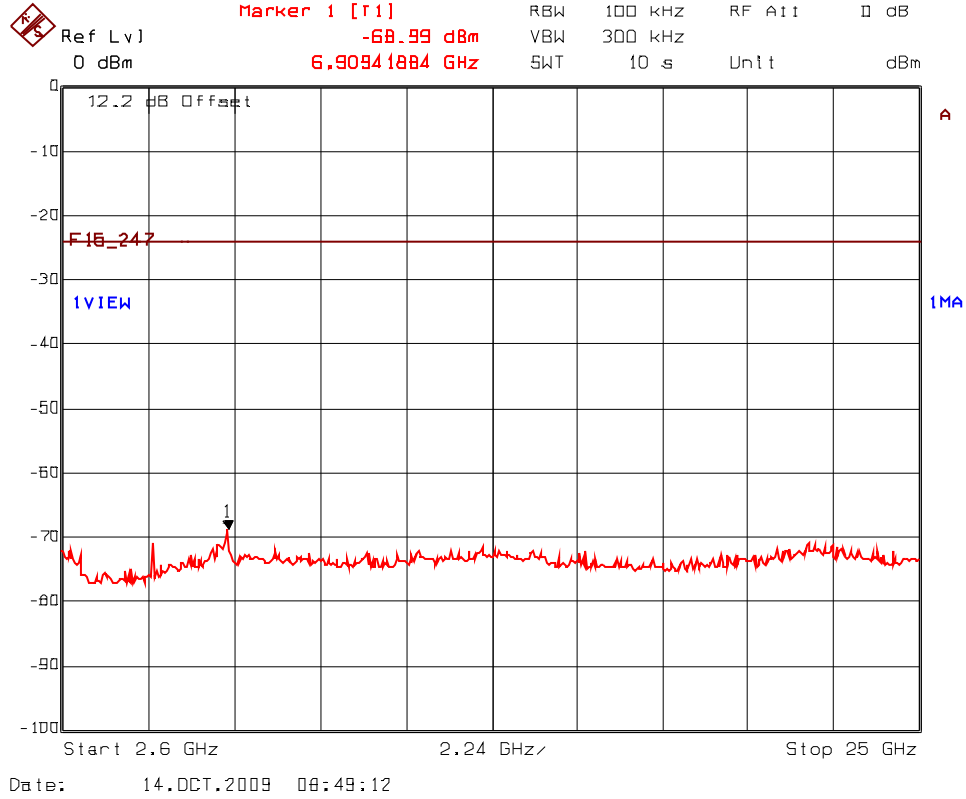
Plot 6.8.5.2.16 Spurious RF Conducted Emissions
Transmitter Frequency: 2470 MHz, Low Power



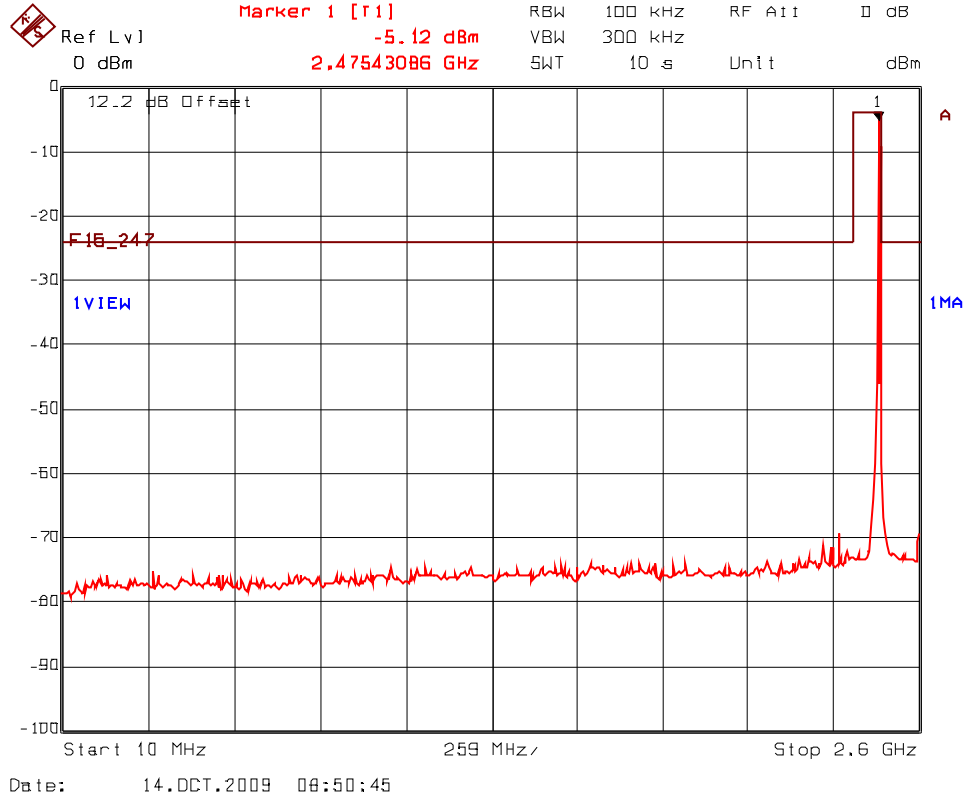
Plot 6.8.5.2.17 Spurious RF Conducted Emissions
Transmitter Frequency: 2475 MHz, Low Power



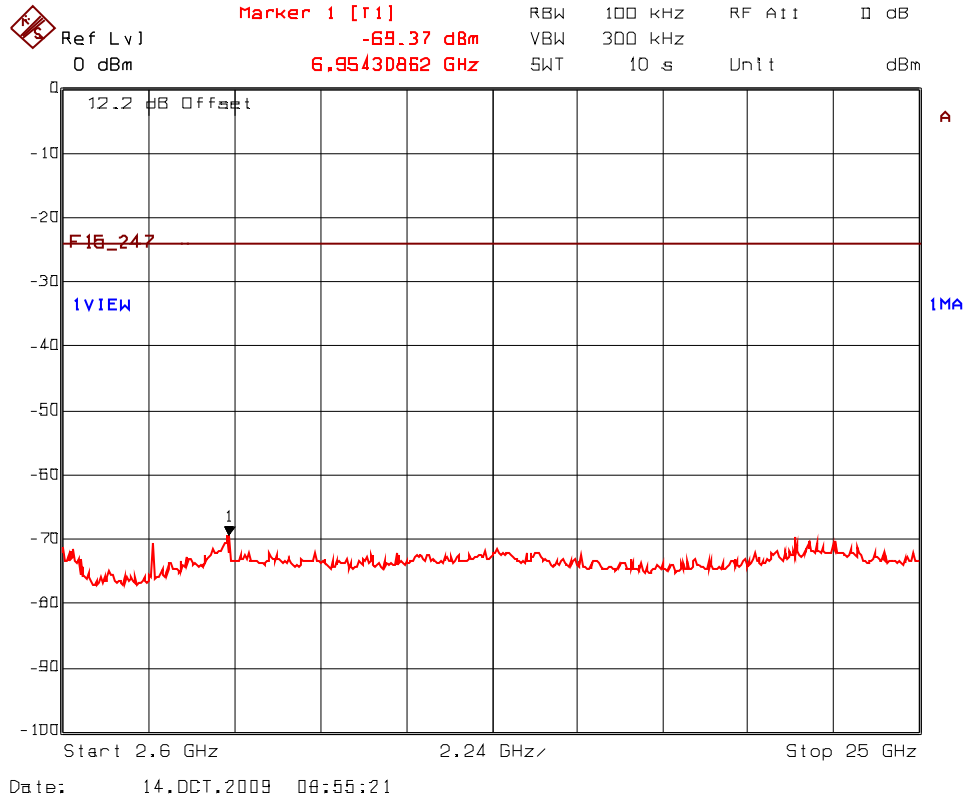
Plot 6.8.5.2.18 Spurious RF Conducted Emissions
Transmitter Frequency: 2475 MHz, Low Power



Plot 6.8.5.2.19 Spurious RF Conducted Emissions
Transmitter Frequency: 2480 MHz, Low Power



Plot 6.8.5.2.20 Spurious RF Conducted Emissions
Transmitter Frequency: 2480 MHz, Low Power



6.9. TRANSMITTER SPURIOUS RADIATED EMISSIONS AT 3 METERS [§§ 15.247(d), 15.209 & 15.205]

6.9.1. Limit(s)

§ 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Section 15.205(a) - 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	2655–2900	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

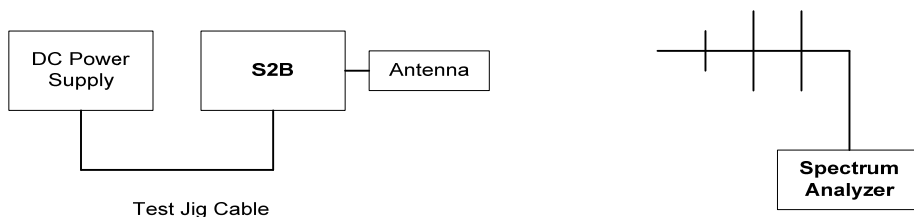
Section 15.209(a) -- Field Strength Limits within Restricted Frequency Bands --

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 - 1.705	24,000 / F (kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.9.2. Method of Measurements

KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247)

6.9.3. Test Arrangement



6.9.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz with external mixer	August 10, 2010
EMI-Test Receiver	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz Build in amplifier	February 17, 2010
Pre-Amplifier	Hewlett Packard	8449B	3008A00769	1 – 26.5 GHz	June 01, 2010
Pre-Amplifier	A.H. Systems Inc.	PAM-0118	225	20 MHz – 18 GHz	February 26, 2010
Biconilog Antenna	EMCO	3142	1005	26 MHz – 2000 MHz	April 18, 2010
Horn Antenna	EMCO	3115	5061	1 – 18 GHz	September 21, 2010
High Pass Filter	K & L	11SH10-4000/T12000	4	Cut off 3.4 GHz	N/A

6.9.5. Test Data

Remarks:

- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- EUT is tested in three orthogonal positions.
- The following test results are the worst-case measurements.
- A duty cycle correction factor of 27% (-11.37dB) shall be applied to a measurement made with an average detector.
- Band-edges compliance condition: EUT connected to antennas via antenna feedline must have a minimum cable loss as specified in the test configurations and the following table.

Antenna Type	Antenna Gain (dBi)	Minimum Required Cable Loss (dB)
Dipole Antenna	2.1	0.0
Astron Omni Directional	8.0	0.69
D-Link Omni Directional	15.0	0.69
Maxrad Yagi	15.0	0.69
ARC Panel	19.0	5.8

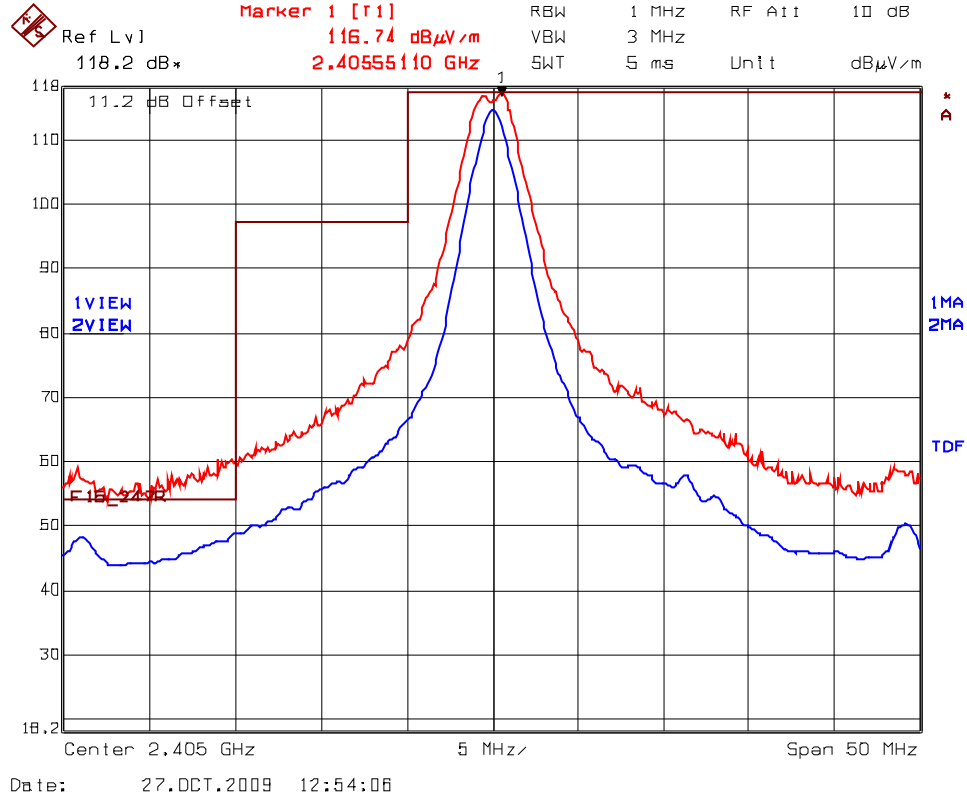
6.9.5.1. EUT with Dipole Antenna (2.1dBi Gain)

Fundamental Frequency:		2405 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2405	113.96	--	V	--	--	--	--
2405	116.74	--	H	--	--	--	--
4810	65.22	43.63	V	54.0	96.7	-10.37	Pass*
4810	67.92	47.62	H	54.0	96.7	-6.38	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

See the following test data plots for band-edge emissions.

Plot 6.9.5.1.1(i) Band-Edge RF Radiated Emissions @ 3 m
Low End of Frequency Band
Rx Antenna Orientation: Horizontal



Trace 1: RBW= 1 MHz, VBW= 3 MHz
Trace 2: RBW= 1 MHz, VBW= 10 Hz

Fundamental Frequency:		2440 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2440	115.21	--	V	--	--	--	--
2440	116.40	--	H	--	--	--	--
4880	67.79	45.93	V	54.0	96.4	-8.07	Pass*
4880	65.86	45.98	H	54.0	96.4	-8.02	Pass*
7320	64.59	41.61	V	54.0	96.4	-12.39	Pass*
7320	64.03	41.84	H	54.0	96.4	-12.16	Pass*
12200	61.96	39.17	V	54.0	96.4	-14.83	Pass*
12200	58.95	35.71	H	54.0	96.4	-18.29	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

Fundamental Frequency:		2470 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2470	114.01	--	V	--	--	--	--
2470	114.70	--	H	--	--	--	--
4940	68.40	48.70	V	54.0	94.7	-5.30	Pass*
4940	67.27	47.22	H	54.0	94.7	-6.78	Pass*
7410	63.10	40.39	V	54.0	94.7	-13.61	Pass*
7410	64.36	40.61	H	54.0	94.7	-13.39	Pass*
12350	62.20	39.90	V	54.0	94.7	-14.10	Pass*
12350	61.28	26.97	H	54.0	94.7	-27.03	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

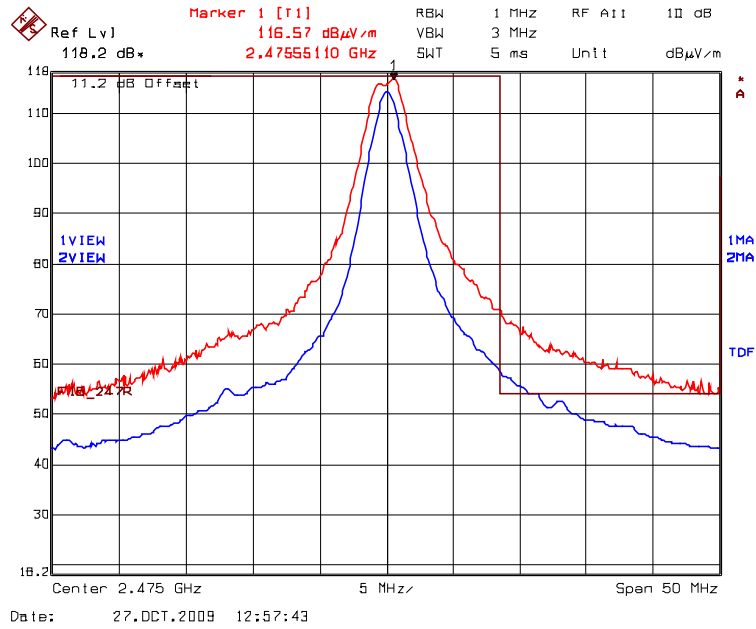
Fundamental Frequency:		2475 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2475	115.17	--	V	--	--	--	--
2475	116.57	--	H	--	--	--	--
4950	70.55	51.25	V	54.0	96.6	-2.75	Pass*
4950	66.47	46.80	H	54.0	96.6	-7.20	Pass*
7425	65.43	43.57	V	54.0	96.6	-10.43	Pass*
7425	61.47	38.18	H	54.0	96.6	-15.82	Pass*
12375	61.98	38.44	V	54.0	96.6	-15.56	Pass*
12375	58.50	36.62	H	54.0	96.6	-17.38	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

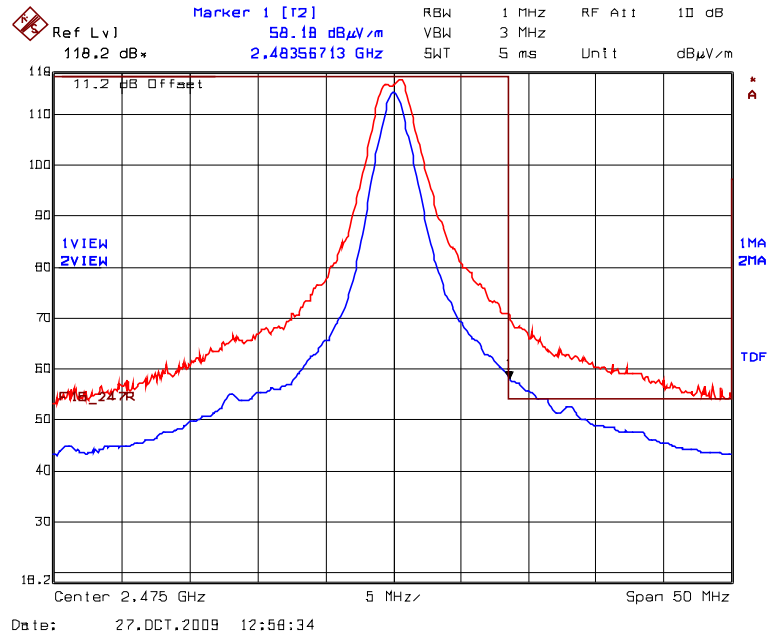
Fundamental Frequency:		2480 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2480	101.03	--	V	--	--	--	--
2480	103.67	--	H	--	--	--	--
All spurious emissions are more than 20 dB below the specified limit							

See the following test data plots for band-edge emissions.

Plot 6.9.5.1.3(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2475 MHz
 Rx Antenna Orientation: Horizontal

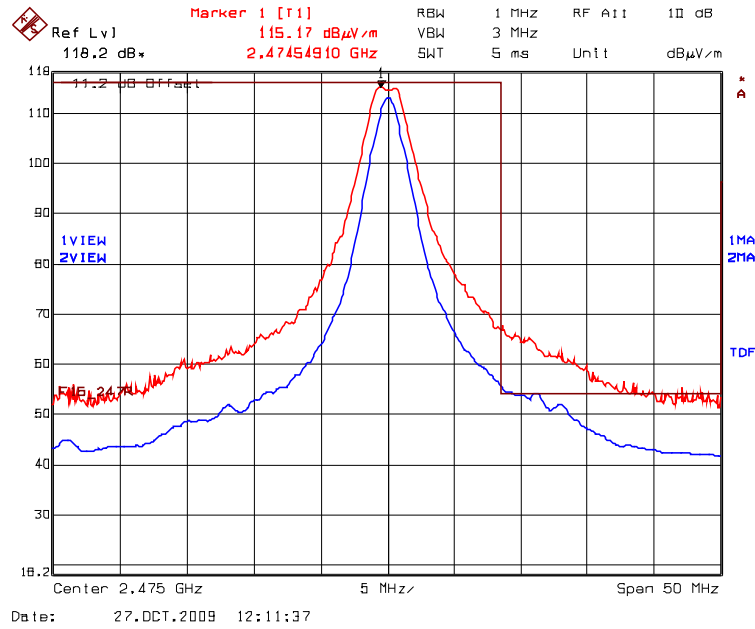


Plot 6.9.5.1.3(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2475 MHz
 Rx Antenna Orientation: Horizontal

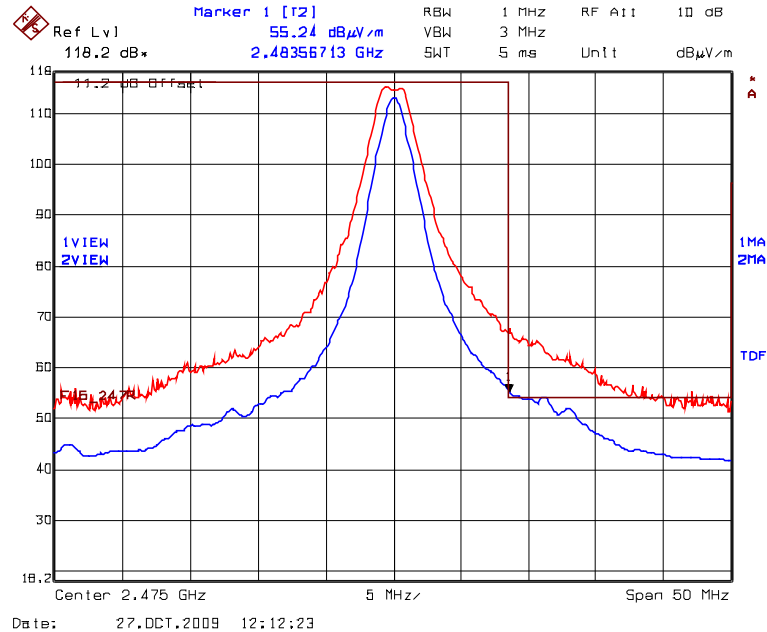


Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz
 Average: 58.18dBuV/m – 11.37dB= 46.81dBuV/m (limit 54dBuV/m)

Plot 6.9.5.1.4(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2475 MHz
 Rx Antenna Orientation: Vertical

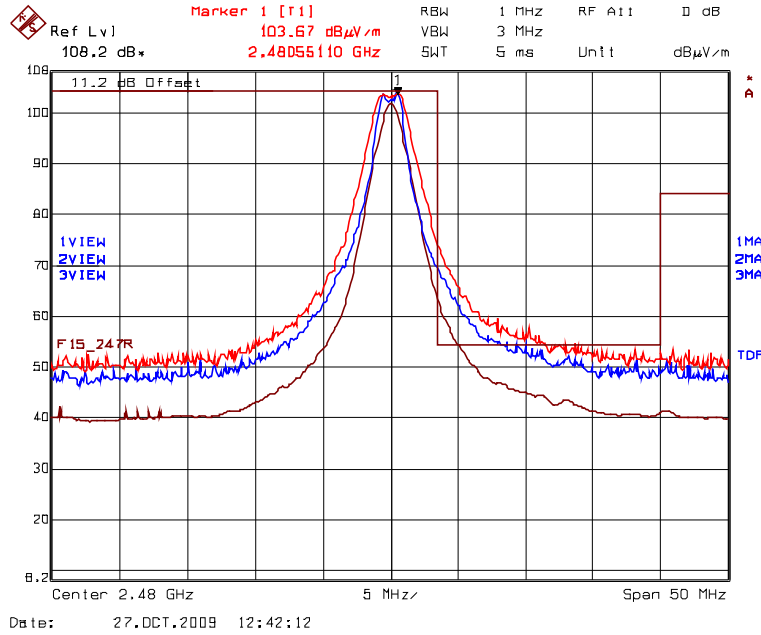


Plot 6.9.5.1.4(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2475 MHz
 Rx Antenna Orientation: Vertical

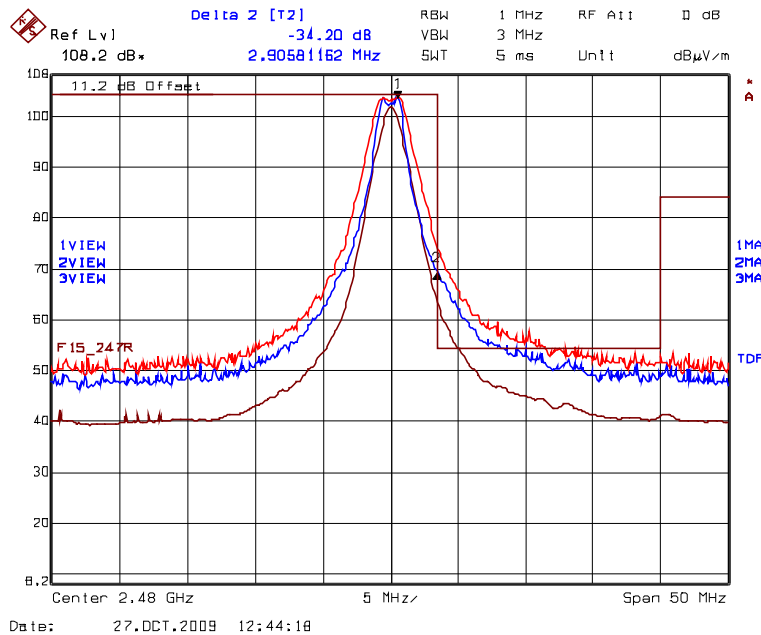


Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz
 Average: 55.24dBuV/m – 11.37dB= 43.87dBuV/m (limit 54dBuV/m)

Plot 6.9.5.1.5(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2480 MHz
 Rx Antenna Orientation: Horizontal

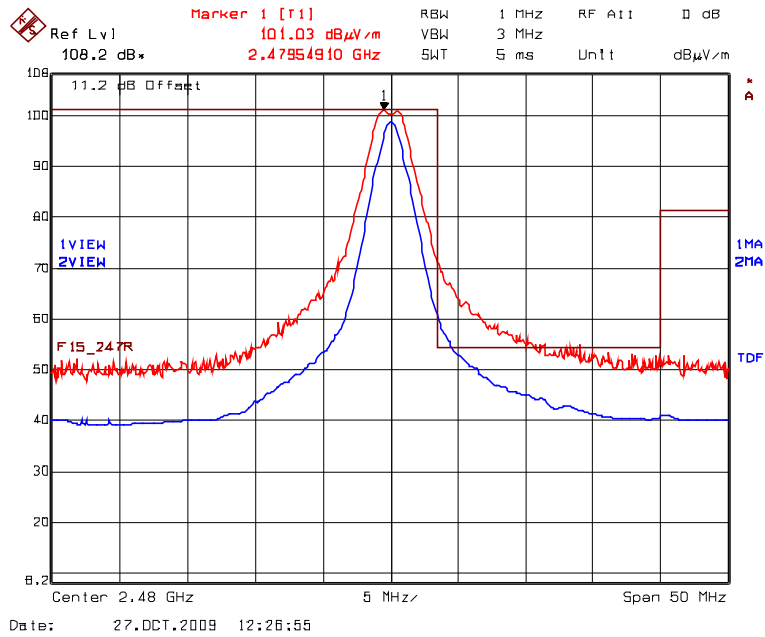


Plot 6.9.5.1.5(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2480 MHz
 Rx Antenna Orientation: Horizontal

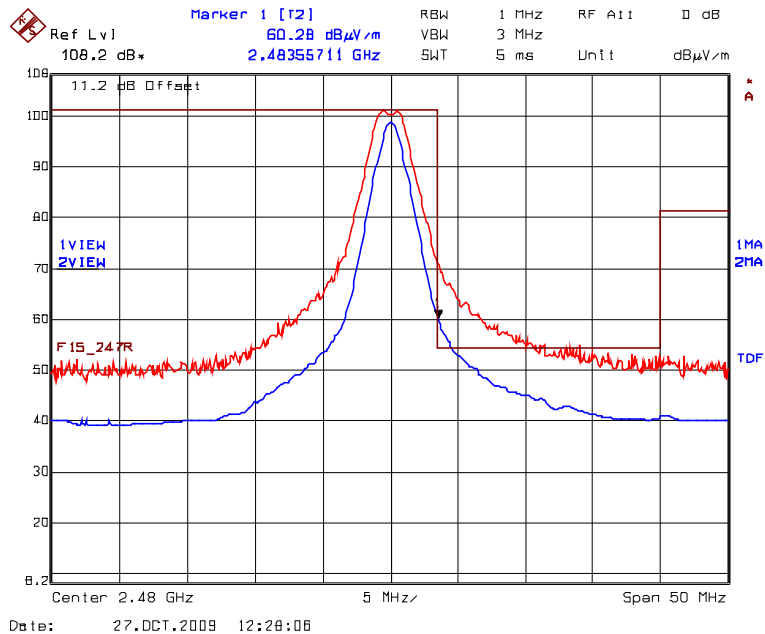


Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 500 kHz, VBW= 1 MHz, Delta (Peak to Band-Edge): 34.20dB
 Trace 3: RBW= 1 MHz, VBW= 10 Hz
 Peak Band-Edge at 2483.5 MHz: Peak= 103.67dBuV/m – 34.20dB= 69.47dBuV/m (limit 74dBuV/m)
 Average: 63.12dBuV/m – 11.37dB= 51.75dBuV/m (limit 54dBuV/m)

Plot 6.9.5.1.6(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2480 MHz
 Rx Antenna Orientation: Vertical



Plot 6.9.5.1.6(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2480 MHz
 Rx Antenna Orientation: Vertical



Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz
 Average: 60.28dBuV/m – 11.37dB= 48.91dBuV/m (limit 54dBuV/m)

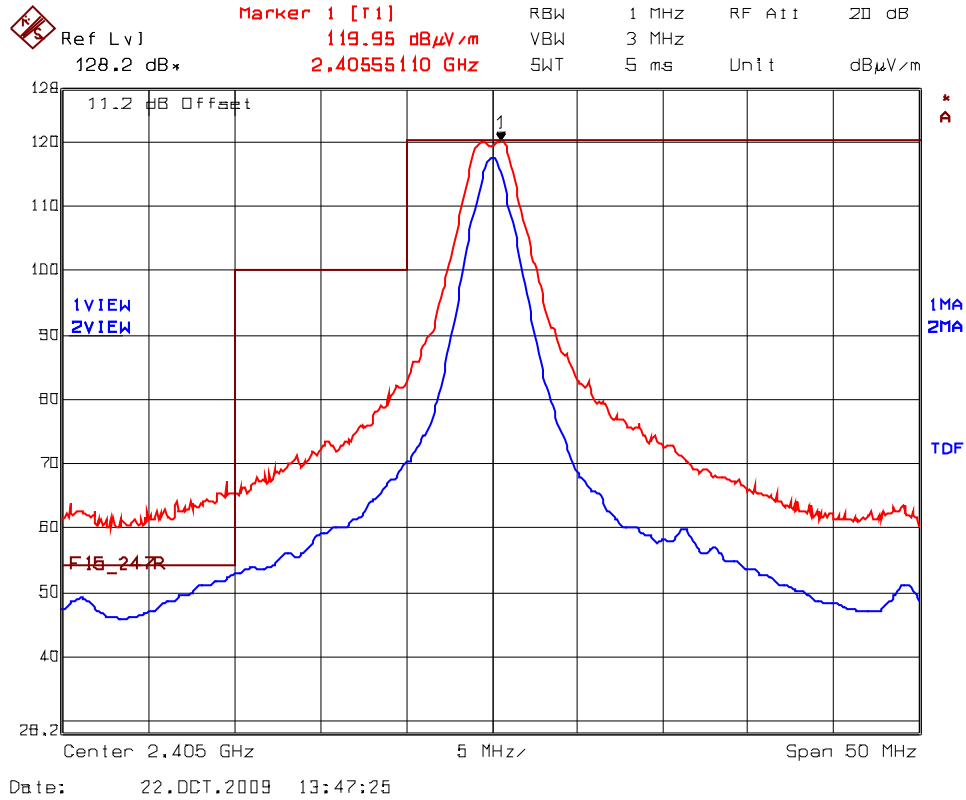
6.9.5.2. EUT with Astron Omni Directional Antenna (8dBi with 0.69dBi cable loss)

Fundamental Frequency:		2405 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2405	123.56	--	V	--	--	--	--
2405	119.95	--	H	--	--	--	--
4810	66.76	45.98	V	54.0	103.6	-8.02	Pass*
4810	66.81	44.81	H	54.0	103.6	-9.19	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

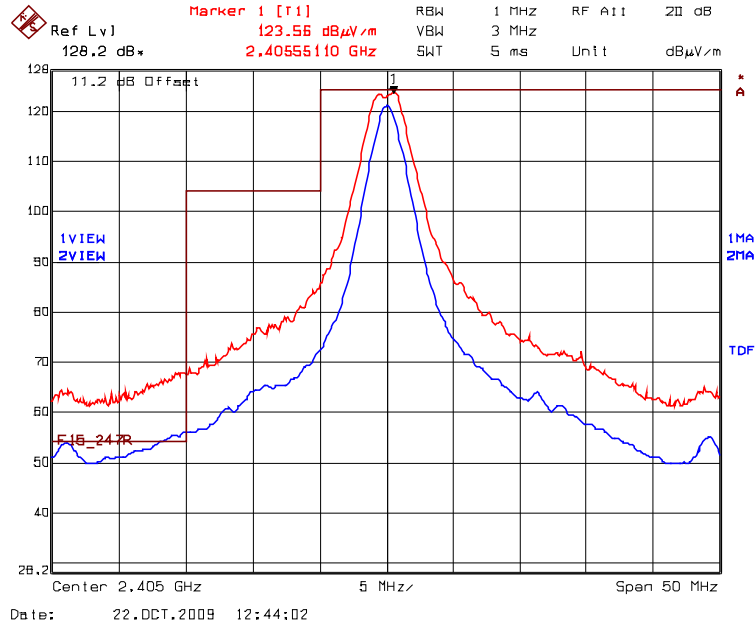
See the following test data plots for band-edge emissions.

Plot 6.9.5.2.1(i) Band-Edge RF Radiated Emissions @ 3 m
Low End of Frequency Band
Rx Antenna Orientation: Horizontal

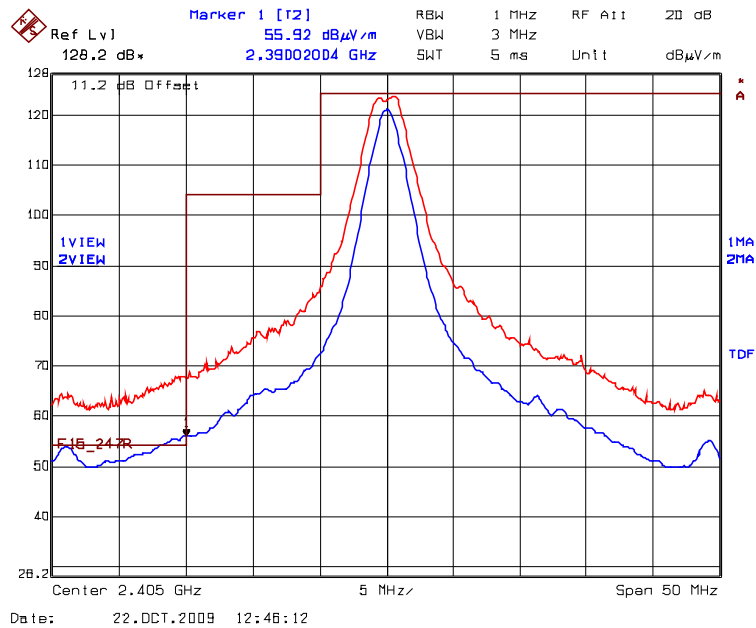


Trace 1: RBW= 1 MHz, VBW= 3 MHz
Trace 2: RBW= 1 MHz, VBW= 10 Hz

Plot 6.9.5.2.2(i) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Vertical



Plot 6.9.5.2.2(ii) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Vertical



Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz
 Average: 56.92dB μ V/m – 11.37dB= 45.55dB μ V/m (limit 54dB μ V/m)

Fundamental Frequency: 2440 MHz							
Frequency Test Range: 30 MHz – 25 GHz							
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2440	123.79	--	V	--	--	--	--
2440	120.85	--	H	--	--	--	--
4880	69.30	48.72	V	54.0	103.8	-5.28	Pass*
4880	64.55	44.99	H	54.0	103.8	-9.01	Pass*
7320	64.88	41.12	V	54.0	103.8	-12.88	Pass*
7320	63.04	39.76	H	54.0	103.8	-14.24	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

Fundamental Frequency: 2470 MHz							
Frequency Test Range: 30 MHz – 25 GHz							
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2470	125.00	--	V	--	--	--	--
2470	122.79	--	H	--	--	--	--
4940	68.61	47.52	V	54.0	105.0	-6.48	Pass*
4940	64.86	44.89	H	54.0	105.0	-9.11	Pass*
7410	60.62	37.19	V	54.0	105.0	-16.81	Pass*
7410	62.18	39.72	H	54.0	105.0	-14.28	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

Fundamental Frequency: 2475 MHz							
Frequency Test Range: 30 MHz – 25 GHz							
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2475	122.19	--	V	--	--	--	--
2475	123.14	--	H	--	--	--	--
4950	70.72	45.94	V	54.0	103.1	-8.06	Pass*
4950	67.14	47.38	H	54.0	103.1	-6.62	Pass*
7425	61.09	38.80	V	54.0	103.1	-15.20	Pass*
7425	60.16	37.49	H	54.0	103.1	-16.51	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

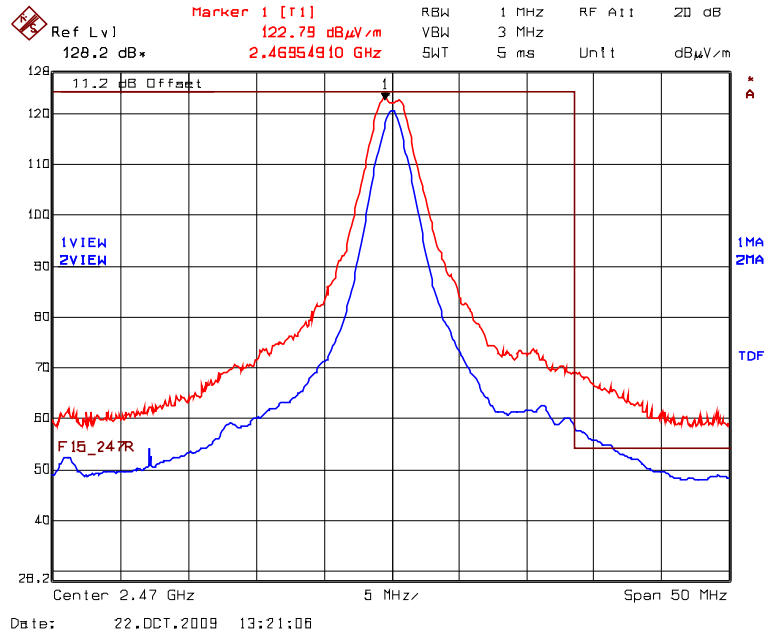
ULTRATECH GROUP OF LABS

3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

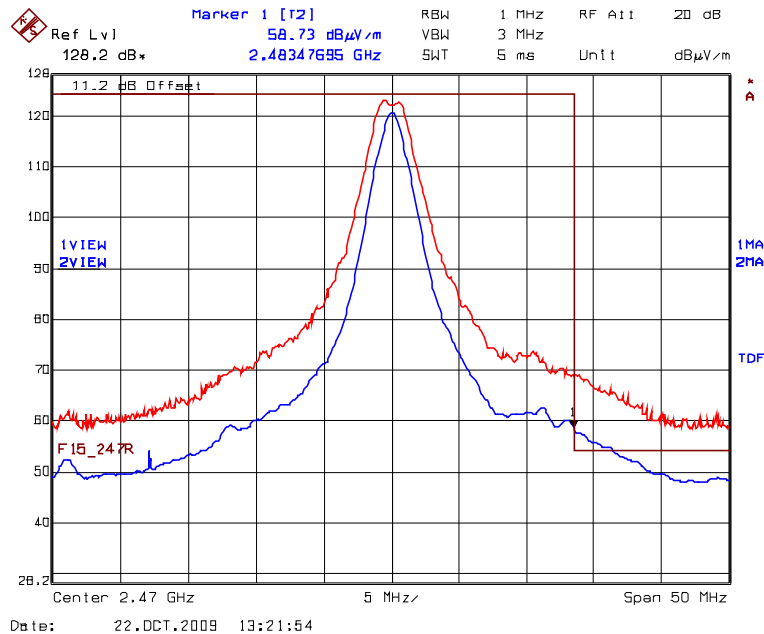
File #: DIGI-020F15C247
 November 9, 2009

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot 6.9.5.2.3(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Horizontal

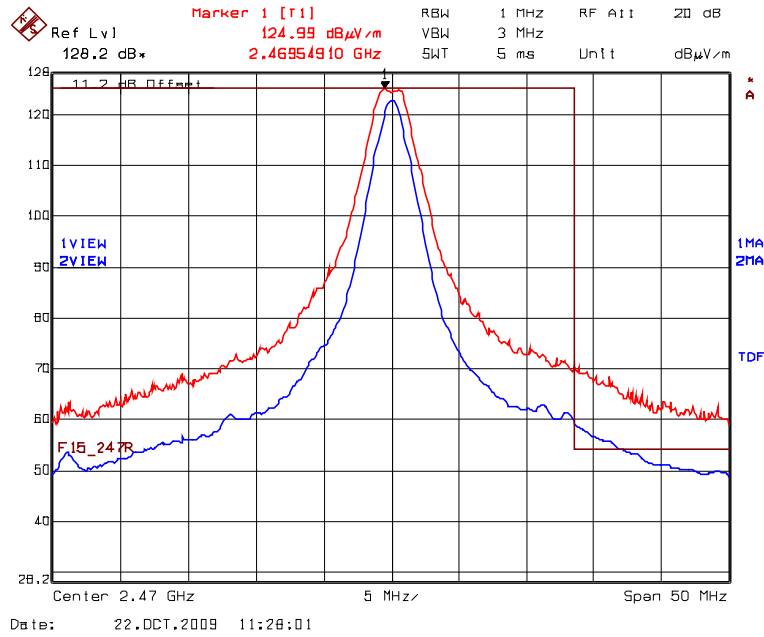


Plot 6.9.5.2.3(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Horizontal

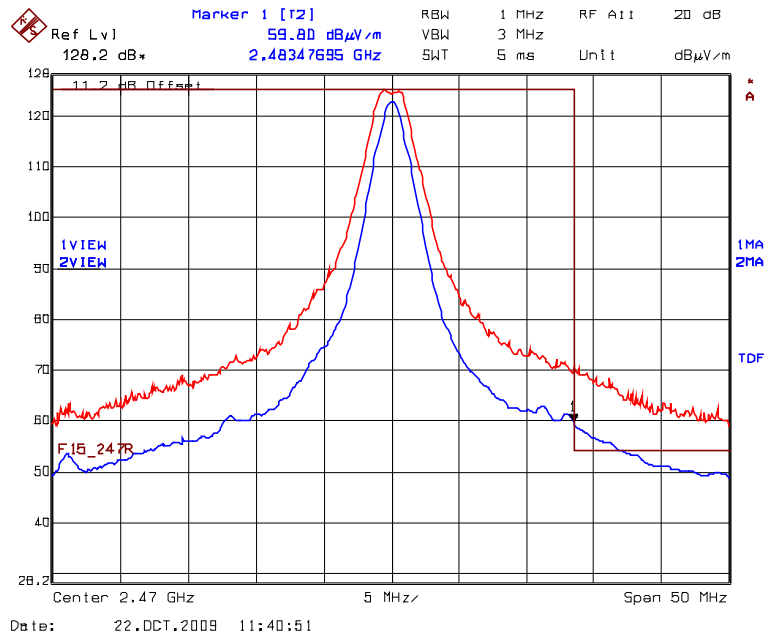


Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz
 Average: 58.73dBuV/m – 11.37dB= 47.36dBuV/m (limit 54dBuV/m)

Plot 6.9.5.2.4(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Vertical

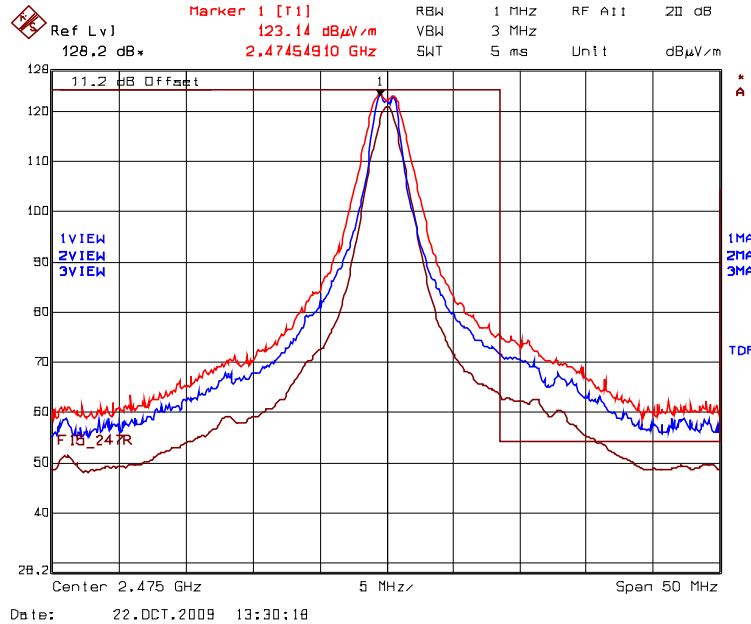


Plot 6.9.5.2.4(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Vertical

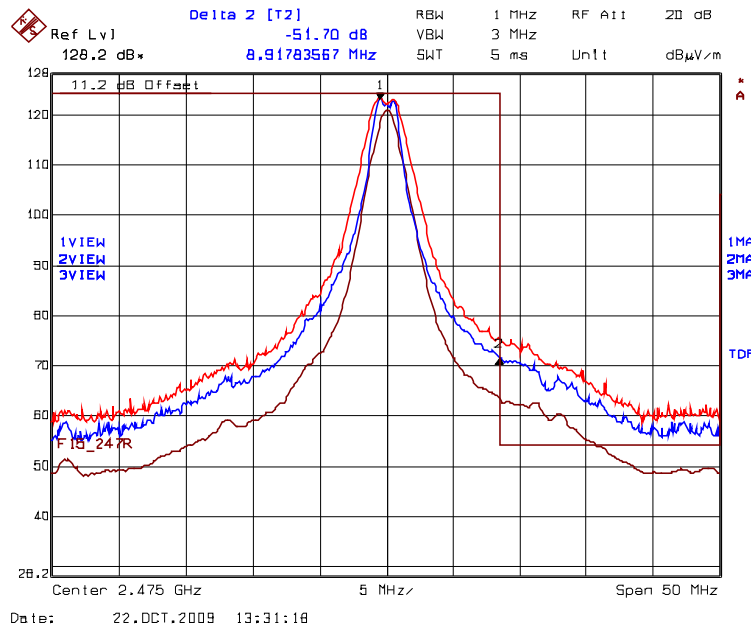


Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz
 Average: 59.80dBuV/m – 11.37dB= 47.14dBuV/m (limit 54dBuV/m)

Plot 6.9.5.2.5(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2475 MHz
 Rx Antenna Orientation: Horizontal

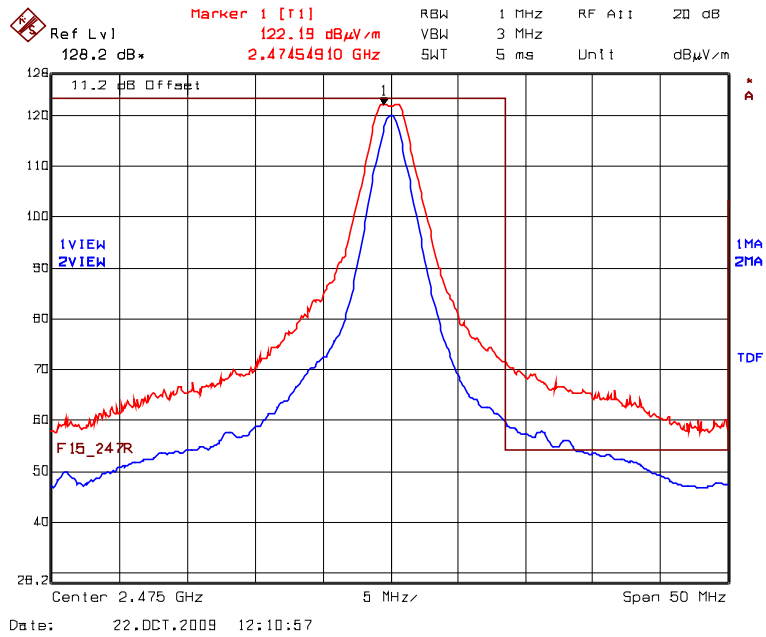


Plot 6.9.5.2.5(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2475 MHz
 Rx Antenna Orientation: Horizontal

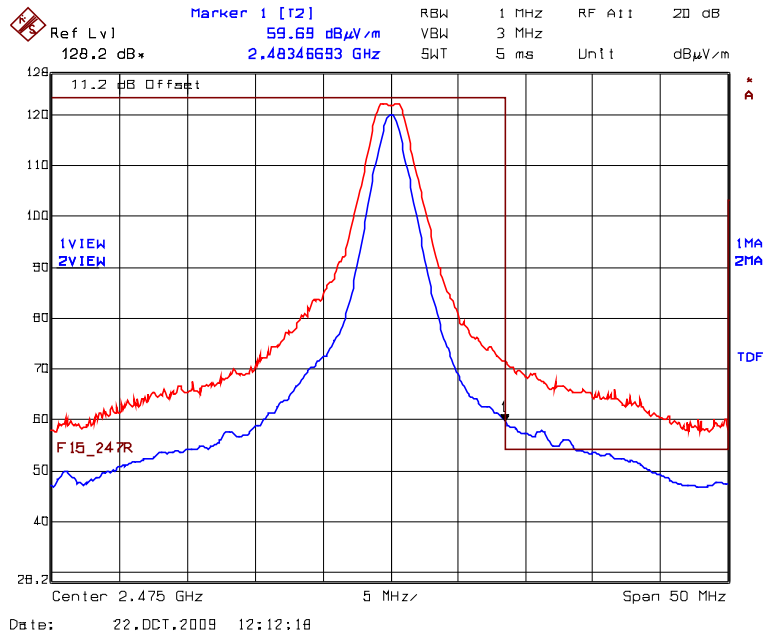


Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 500 kHz, VBW= 1 MHz, Delta (Peak to Band-Edge): 34.20dB
 Trace 3: RBW= 1 MHz, VBW= 10 Hz
 Peak Band-Edge at 2483.5 MHz: Peak= 123.14dBuV/m – 51.70dB= 71.44dBuV/m (limit 74dBuV/m)
 Average: 63.02dBuV/m – 11.37dB= 51.65dBuV/m (limit 54dBuV/m)

Plot 6.9.5.2.6(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2475 MHz
 Rx Antenna Orientation: Vertical



Plot 6.9.5.2.6(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2475 MHz
 Rx Antenna Orientation: Vertical



Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz
 Average: 59.69dBuV/m – 11.37dB= 48.32dBuV/m (limit 54dBuV/m)

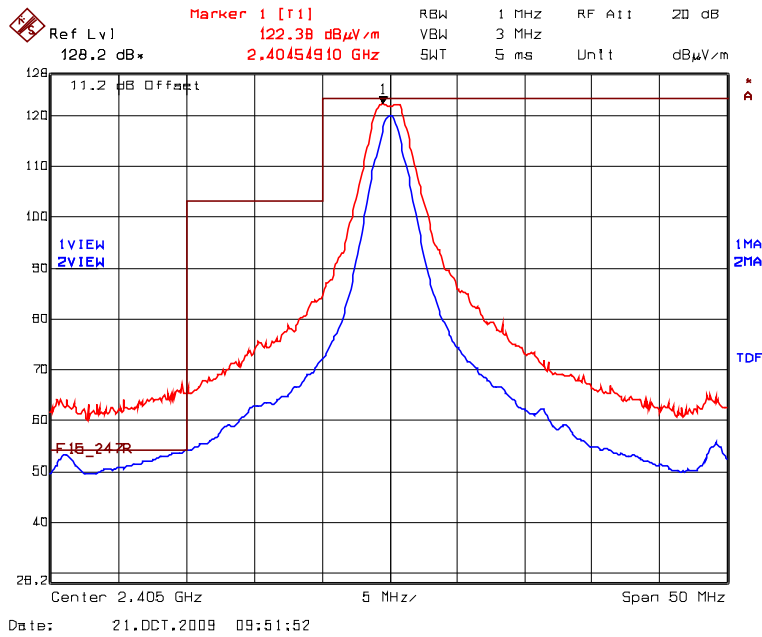
6.9.5.3. EUT with D-Link Omni Directional Antenna (15dBi Gain with minimum 0.69dB cable loss)

Fundamental Frequency:		2405 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2405	124.45	--	V	--	--	--	--
2405	122.38	--	H	--	--	--	--
4810	67.41	47.07	V	54.0	104.5	-6.93	Pass*
4810	63.19	42.09	H	54.0	104.5	-11.91	Pass*

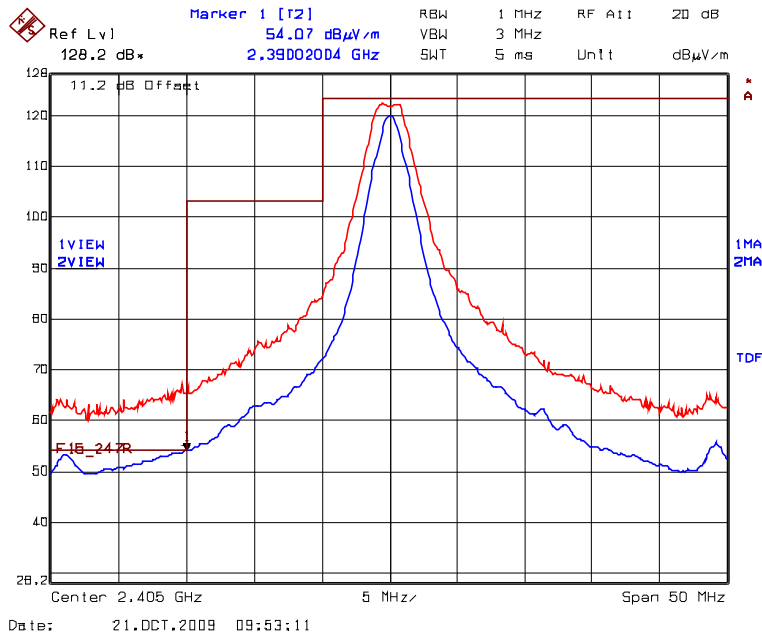
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

See the following test data plots for band-edge emissions.

Plot 6.9.5.3.1(i) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Horizontal

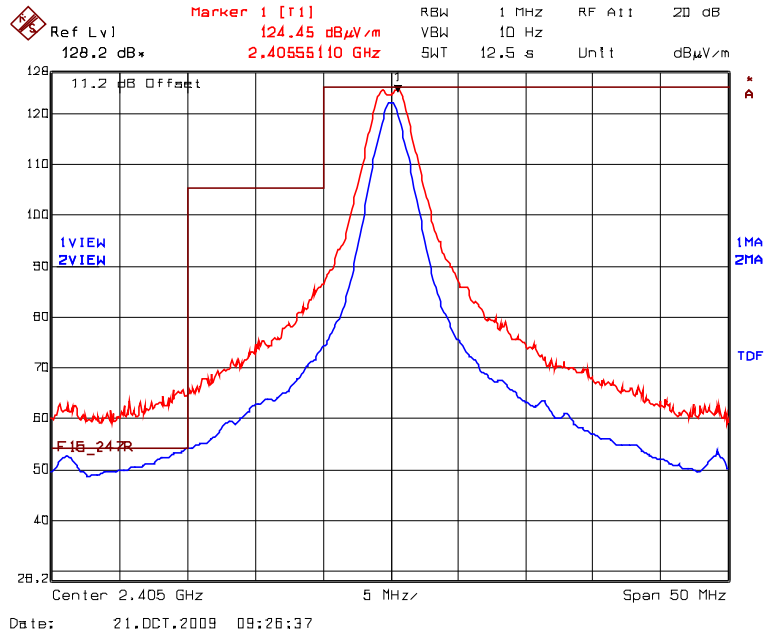


Plot 6.9.5.3.1(ii) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Horizontal

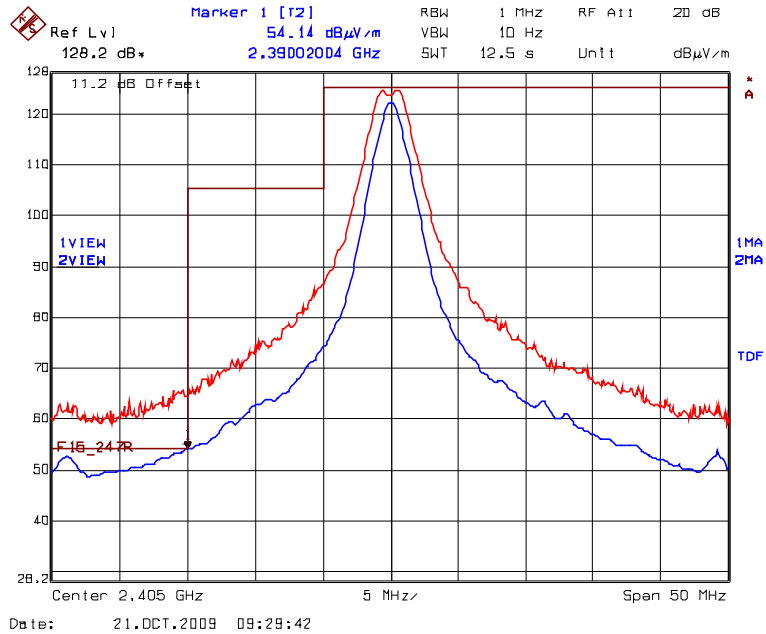


Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz
 Average: 54.07dBuV/m – 11.37dB= 42.70dBuV/m (limit 54dBuV/m)

Plot 6.9.5.3.2(i) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Vertical



Plot 6.9.5.3.2(ii) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Vertical



Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz
 Average: 54.14dBuV/m – 11.37dB= 42.77dBuV/m (limit 54dBuV/m)

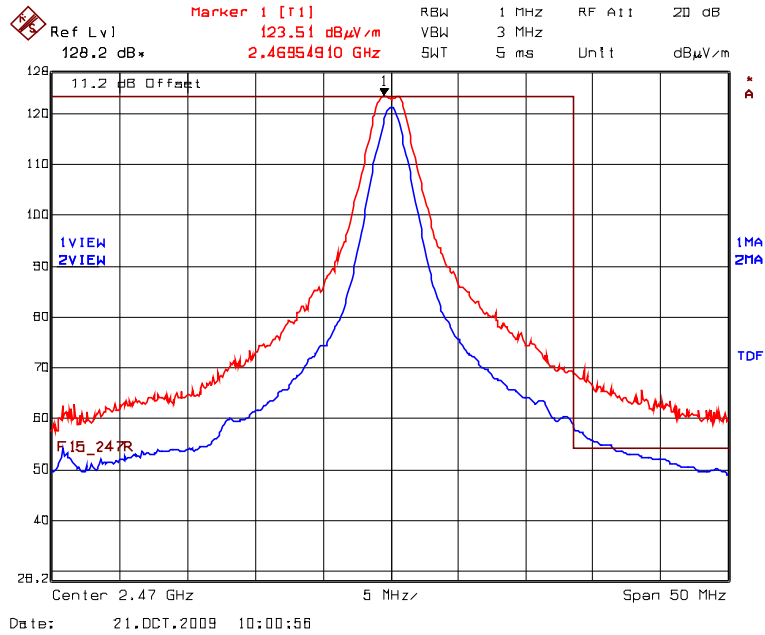
Fundamental Frequency:		2440 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2440	124.48	--	V	--	--	--	--
2440	121.01	--	H	--	--	--	--
4880	66.30	45.97	V	54.0	104.5	-8.03	Pass*
4880	63.38	42.24	H	54.0	104.5	-11.76	Pass*
7320	65.78	42.96	V	54.0	104.5	-11.04	Pass*
7320	61.24	38.68	H	54.0	104.5	-15.32	Pass*
12200	59.36	36.18	V	54.0	104.5	-17.82	Pass*
12200	56.41	33.02	H	54.0	104.5	-20.98	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

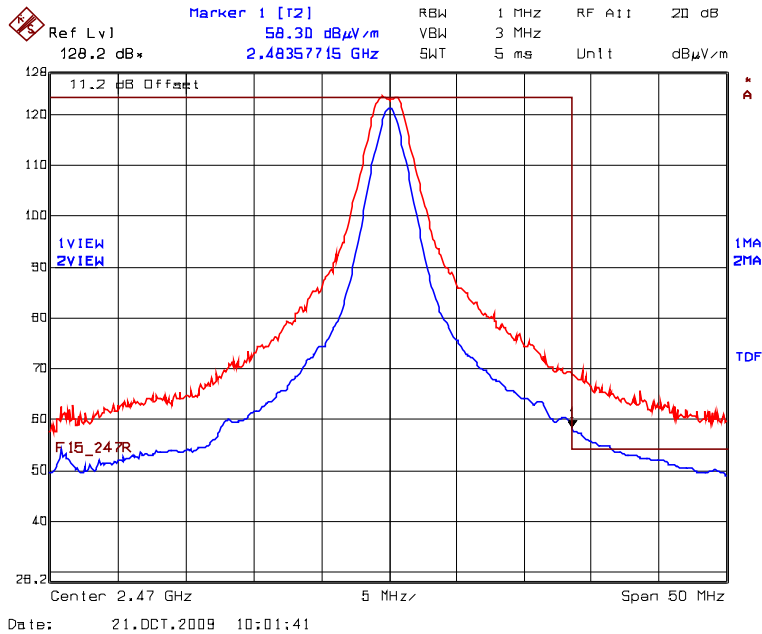
Fundamental Frequency:		2470 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2470	125.53	--	V	--	--	--	--
2470	123.51	--	H	--	--	--	--
4940	67.88	47.68	V	54.0	105.5	-6.32	Pass*
4940	63.61	43.56	H	54.0	105.5	-10.44	Pass*
7410	64.41	41.03	V	54.0	105.5	-12.97	Pass*
7410	62.00	39.00	H	54.0	105.5	-15.00	Pass*
12350	58.86	36.08	V	54.0	105.5	-17.92	Pass*
12350	58.41	35.63	H	54.0	105.5	-18.37	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

Plot 6.9.5.3.3(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Horizontal

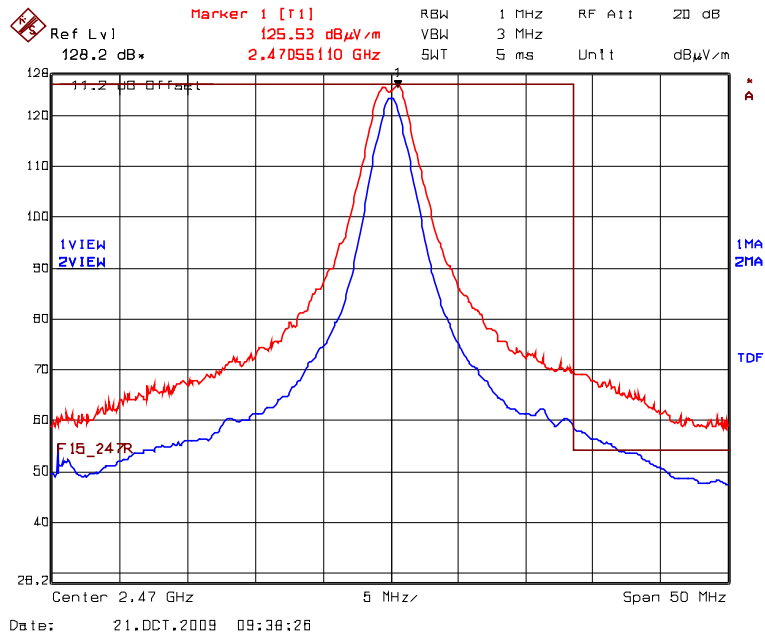


Plot 6.9.5.3.3(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Horizontal

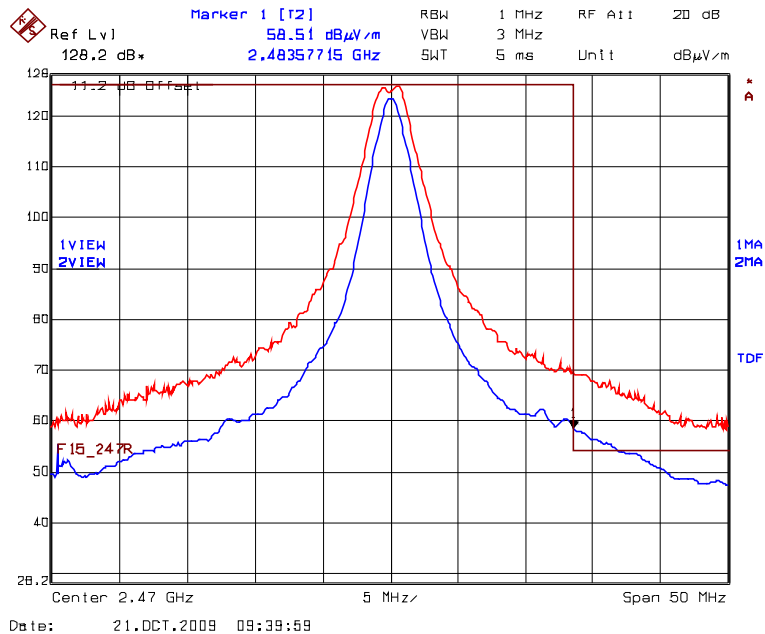


Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz
 Average: 58.30dBuV/m – 11.37dB= 46.93dBuV/m (limit 54dBuV/m)

Plot 6.9.5.3.4(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Vertical



Plot 6.9.5.3.4(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Vertical



Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz
 Average: 58.51dBuV/m – 11.37dB= 47.14dBuV/m (limit 54dBuV/m)

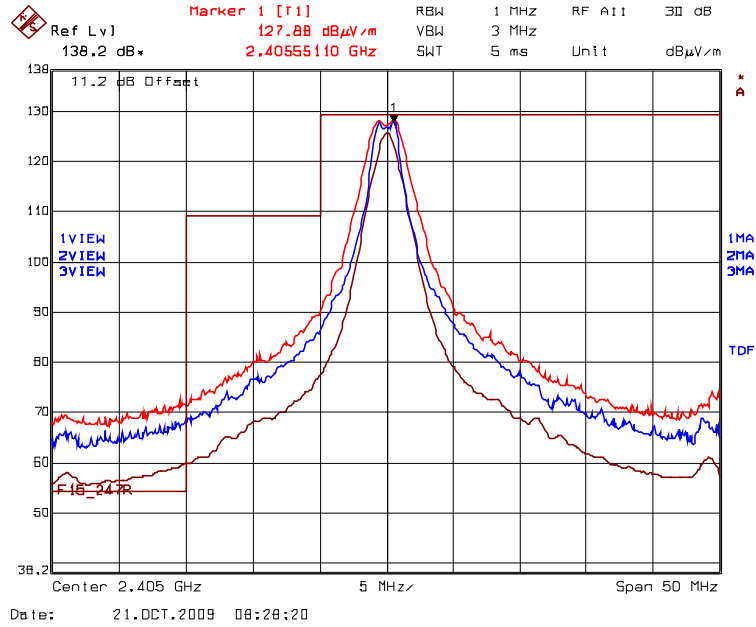
6.9.5.4. EUT with Maxrad Yagi Antenna (15dBi gain with minimum cable loss of 0.69dB)

Fundamental Frequency:		2405 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2405	127.82	--	V	--	--	--	--
2405	127.88	--	H	--	--	--	--
4810	70.00	49.28	V	54.0	127.9	-4.72	Pass*
4810	66.56	45.25	H	54.0	127.9	-8.75	Pass*

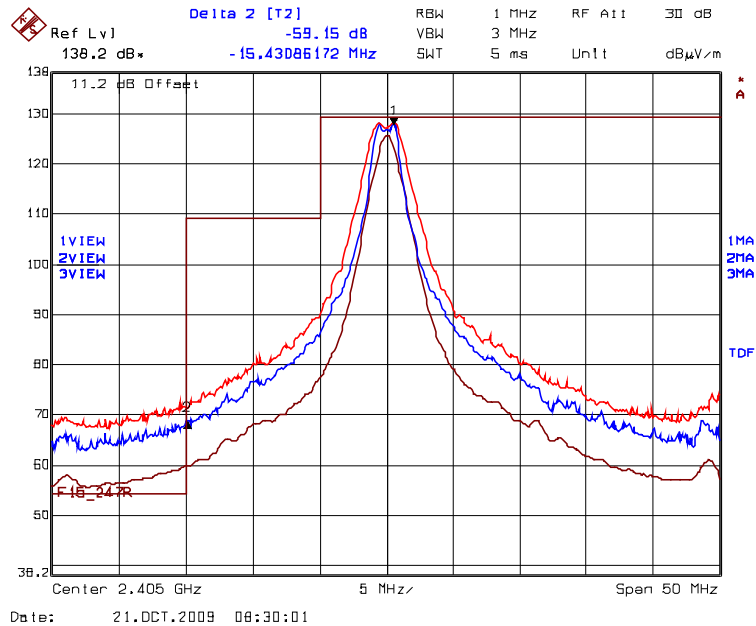
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

See the following test data plots for band-edge emissions.

Plot 6.9.5.4.1(i) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Horizontal



Plot 6.9.5.4.1(ii) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Horizontal



Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 500 kHz, VBW= 1 MHz, Delta (Peak to Band-Edge): 59.15dB
 Trace 3: RBW= 1 MHz, VBW= 10 Hz
 Peak Band-Edge at 2390 MHz: Peak= 127.88dBuV/m – 59.15dB= 68.73dBuV/m (limit 74dBuV/m)
 Average: 59.93dBuV/m – 11.37dB= 48.56dBuV/m (limit 54dBuV/m)

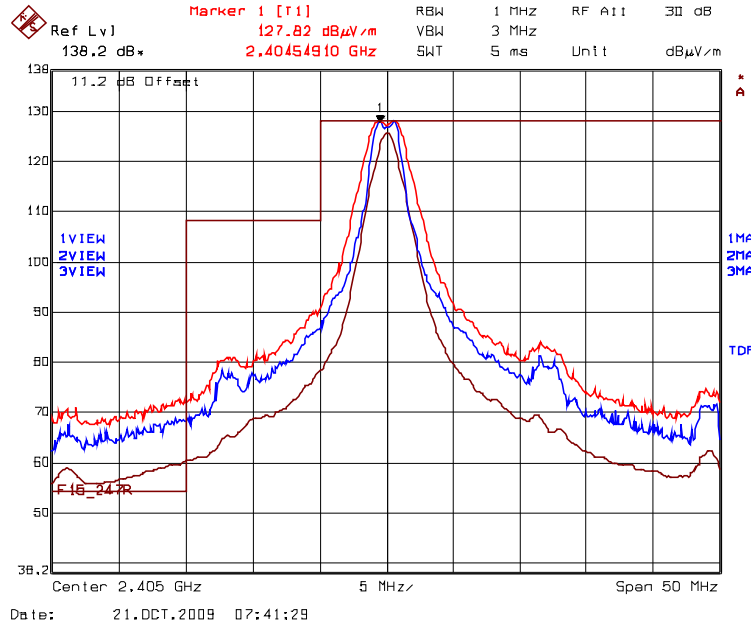
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3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
 Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

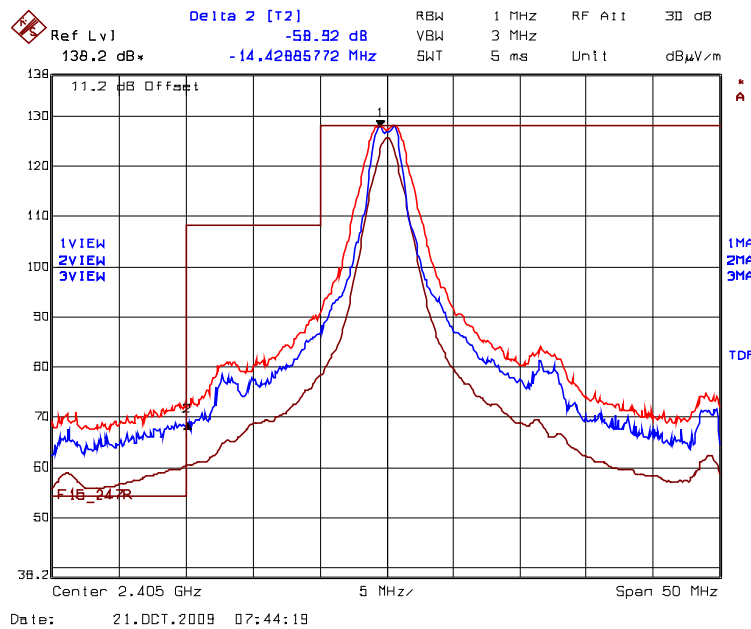
File #: DIGI-020F15C247
 November 9, 2009

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot 6.9.5.4.2(i) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Vertical



Plot 6.9.5.4.2(ii) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Vertical



Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 500 kHz, VBW= 1 MHz, Delta (Peak to Band-Edge): 58.92dB
 Trace 3: RBW= 1 MHz, VBW= 10 Hz
 Peak Band-Edge at 2390 MHz: Peak= 127.82dBuV/m – 58.92dB= 68.90dBuV/m (limit 74dBuV/m)
 Average: 60.23dBuV/m – 11.37dB= 48.86dBuV/m (limit 54dBuV/m)

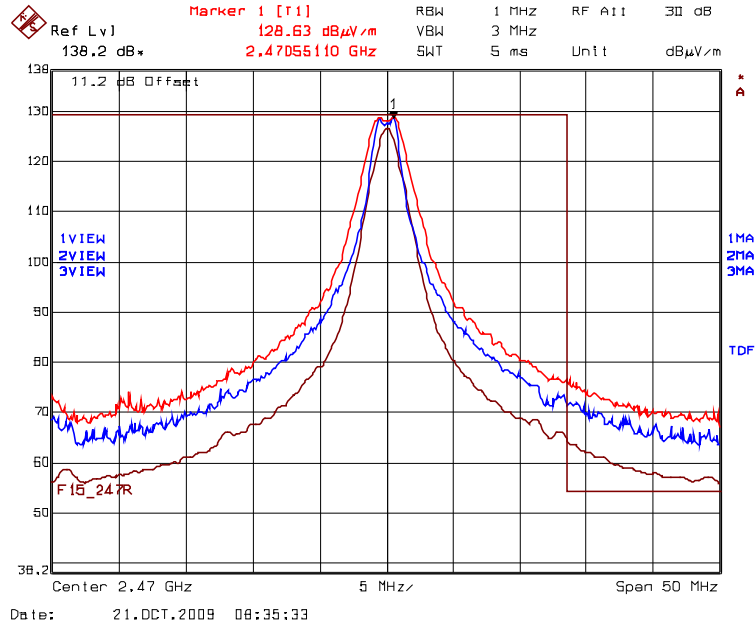
Fundamental Frequency: 2440 MHz							
Frequency Test Range: 30 MHz – 25 GHz							
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2440	128.56	--	V	--	--	--	--
2440	128.43	--	H	--	--	--	--
4880	70.56	49.86	V	54.0	108.5	-4.14	Pass*
4880	66.67	46.49	H	54.0	108.5	-7.51	Pass*
7320	63.15	40.30	V	54.0	108.5	-13.70	Pass*
7320	60.48	38.34	H	54.0	108.5	-15.66	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

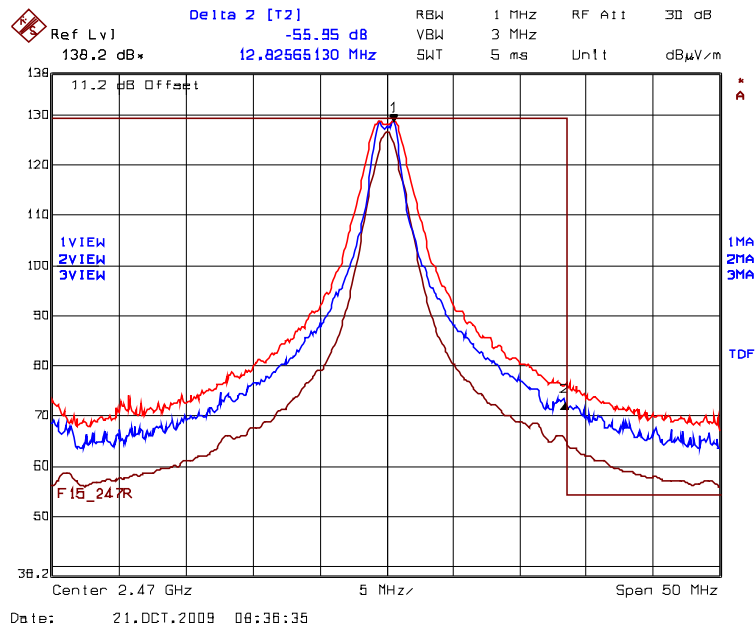
Fundamental Frequency: 2470 MHz							
Frequency Test Range: 30 MHz – 25 GHz							
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2470	128.99	--	V	--	--	--	--
2470	128.63	--	H	--	--	--	--
4940	71.56	51.36	V	54.0	109.0	-2.64	Pass*
4940	65.94	46.14	H	54.0	109.0	-7.86	Pass*
7410	63.27	40.65	V	54.0	109.0	-13.35	Pass*
7410	61.58	39.64	H	54.0	109.0	-14.36	Pass*
12350	58.59	36.17	V	54.0	109.0	-17.83	Pass*
12350	57.70	34.84	H	54.0	109.0	-19.16	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

Plot 6.9.5.4.3(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Horizontal

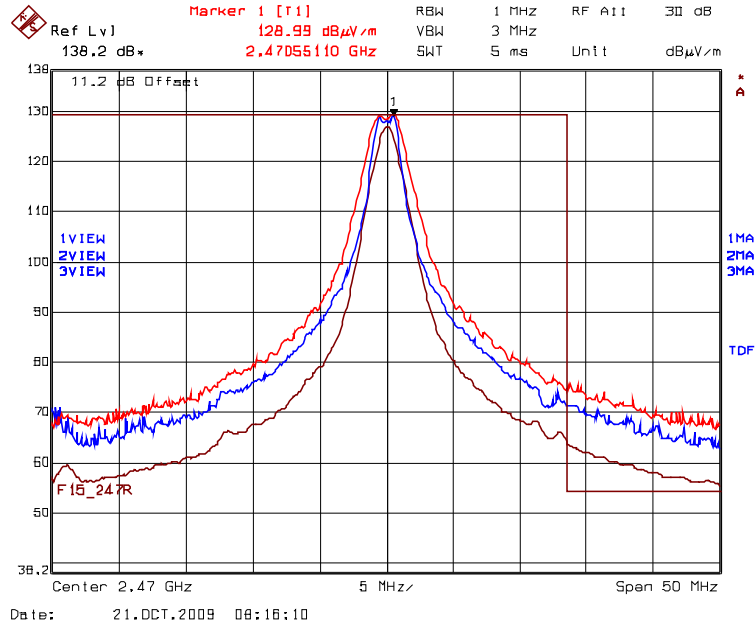


Plot 6.9.5.4.3(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Horizontal

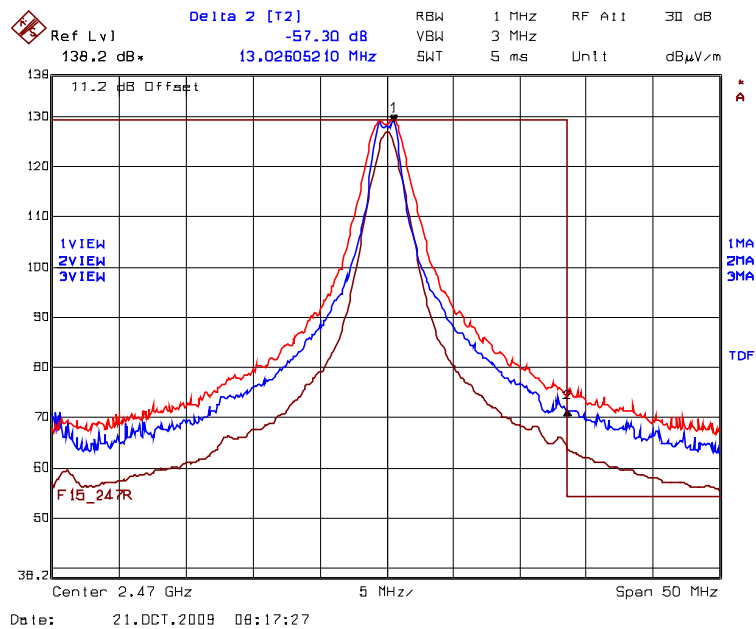


Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 500 kHz, VBW= 1 MHz, Delta (Peak to Band-Edge): 55.95dB
 Trace 3: RBW= 1 MHz, VBW= 10 Hz
 Peak Band-Edge at 2483.5 MHz: Peak= 128.63dBuV/m – 55.95dB= 72.68dBuV/m (limit 74dBuV/m)
 Average: 64.21dBuV/m – 11.37dB= 52.84dBuV/m (limit 54dBuV/m)

Plot 6.9.5.4(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Vertical



Plot 6.9.5.4(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Vertical



Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 500 kHz, VBW= 1 MHz, Delta (Peak to Band-Edge): 57.30dB
 Trace 3: RBW= 1 MHz, VBW= 10 Hz
 Peak Band-Edge at 2483.5 MHz: Peak= 128.99dBuV/m – 57.30dB= 71.69dBuV/m (limit 74dBuV/m)
 Average: 63.86dBuV/m – 11.37dB= 52.49dBuV/m (limit 54dBuV/m)

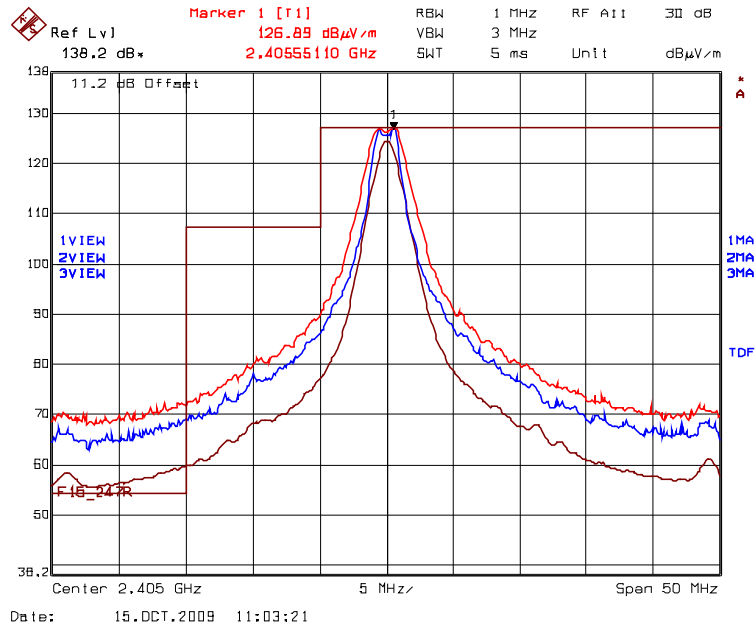
6.9.5.5. EUT with ARC Panel Antenna (19 dBi gain with minimum cable loss of 5.8 dB)

Fundamental Frequency:		2405 MHz					
Frequency Test Range:		30 MHz – 25 GHz					
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
2405	126.40	--	V	--	--	--	--
2405	126.89	--	H	--	--	--	--
4810	65.98	44.96	V	54.0	106.9	-9.04	Pass*
4810	69.10	48.63	H	54.0	106.9	-5.37	Pass*

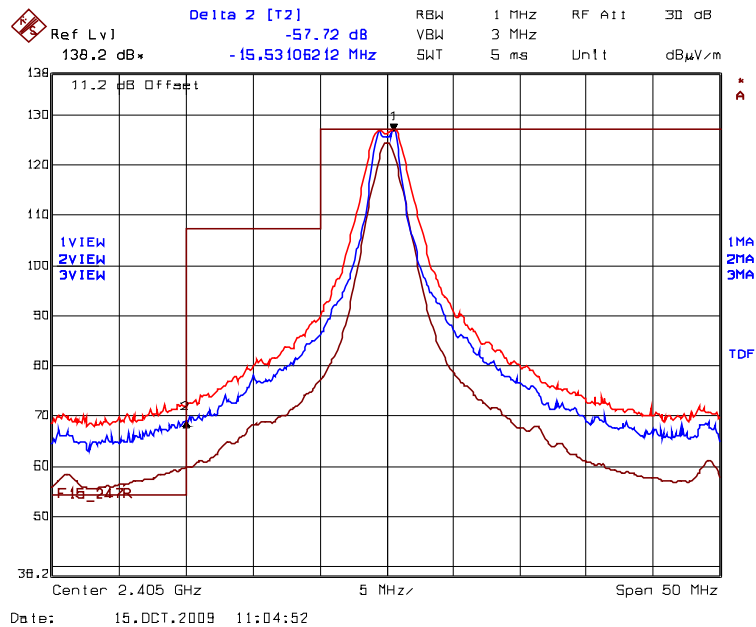
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

See the following test data plots for band-edge emissions.

Plot 6.9.5.5.1(i) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Horizontal

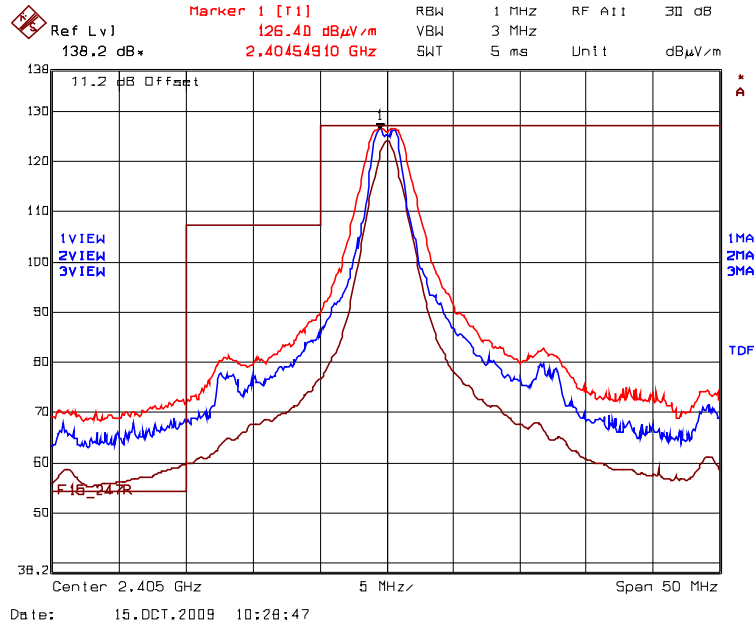


Plot 6.9.5.5.1(ii) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Horizontal

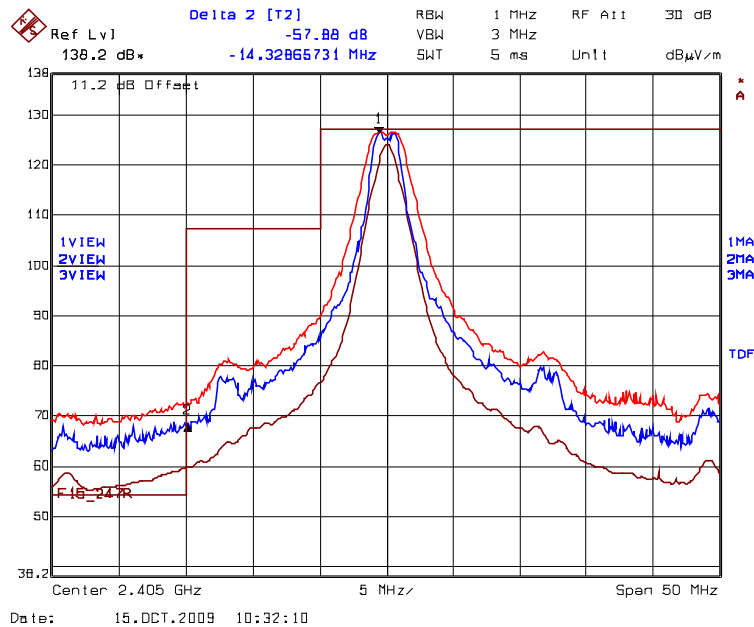


Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 500 kHz, VBW= 1 MHz, Delta (Peak to Band-Edge): 57.72dB
 Trace 3: RBW= 1 MHz, VBW= 10 Hz
 Peak Band-Edge at 2390 MHz: Peak= 126.89dBuV/m – 57.72dB= 69.17dBuV/m (limit 74dBuV/m)
 Average: 59.81dBuV/m – 11.37dB= 48.44dBuV/m (limit 54dBuV/m)

Plot 6.9.5.5.2(i) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Vertical



Plot 6.9.5.5.2(ii) Band-Edge RF Radiated Emissions @ 3 m
 Low End of Frequency Band
 Rx Antenna Orientation: Vertical



Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 500 kHz, VBW= 1 MHz, Delta (Peak to Band-Edge): 57.88dB
 Trace 3: RBW= 1 MHz, VBW= 10 Hz
 Peak Band-Edge at 2390 MHz: Peak= 126.40dBuV/m – 57.88dB= 68.52dBuV/m (limit 74dBuV/m)
 Average: 59.75dBuV/m – 11.37dB= 48.38dBuV/m (limit 54dBuV/m)

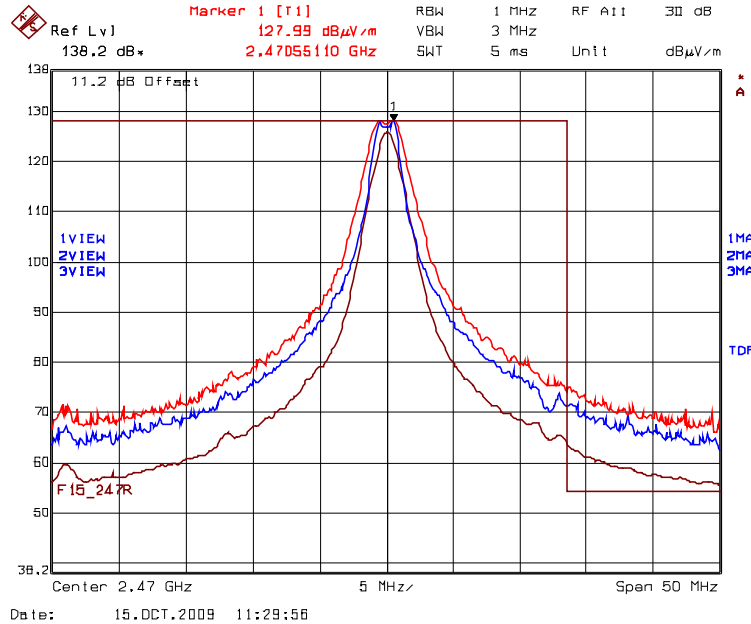
Fundamental Frequency: 2440 MHz							
Frequency Test Range: 30 MHz – 25 GHz							
Frequency (MHz)	RF Peak Level (dB μ V/m)	RF Avg Level (dB μ V/m)	Antenna Plane (H/V)	Limit 15.209 (dB μ V/m)	Limit 15.247 (dB μ V/m)	Margin (dB)	Pass/Fail
2440	127.91	--	V	--	--	--	--
2440	127.85	--	H	--	--	--	--
4880	64.67	45.97	V	54.0	104.5	-8.03	Pass*
4880	69.18	42.24	H	54.0	104.5	-11.76	Pass*
7320	61.13	42.96	V	54.0	104.5	-11.04	Pass*
7320	63.96	38.68	H	54.0	104.5	-15.32	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

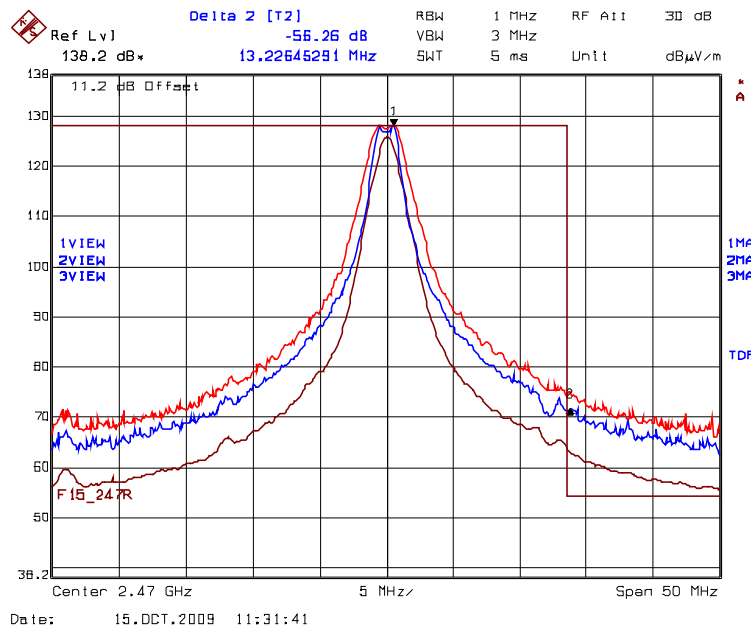
Fundamental Frequency: 2470 MHz							
Frequency Test Range: 30 MHz – 25 GHz							
Frequency (MHz)	RF Peak Level (dB μ V/m)	RF Avg Level (dB μ V/m)	Antenna Plane (H/V)	Limit 15.209 (dB μ V/m)	Limit 15.247 (dB μ V/m)	Margin (dB)	Pass/Fail
2470	128.90	--	V	--	--	--	--
2470	127.99	--	H	--	--	--	--
4940	68.34	48.12	V	54.0	108.9	-5.88	Pass*
4940	69.77	50.20	H	54.0	108.9	-3.80	Pass*
7410	62.37	38.96	V	54.0	108.9	-15.04	Pass*
7410	65.61	43.34	H	54.0	108.9	-10.66	Pass*
12350	60.21	36.78	V	54.0	108.9	-17.22	Pass*
12350	59.51	36.83	H	54.0	108.9	-17.17	Pass*

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits shown in § 15.209.

Plot 6.9.5.3(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Horizontal

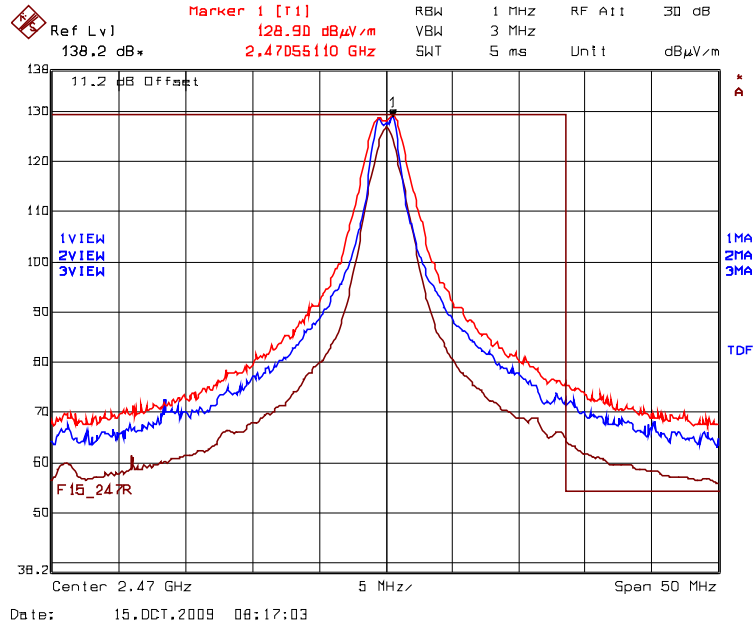


Plot 6.9.5.3(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Horizontal

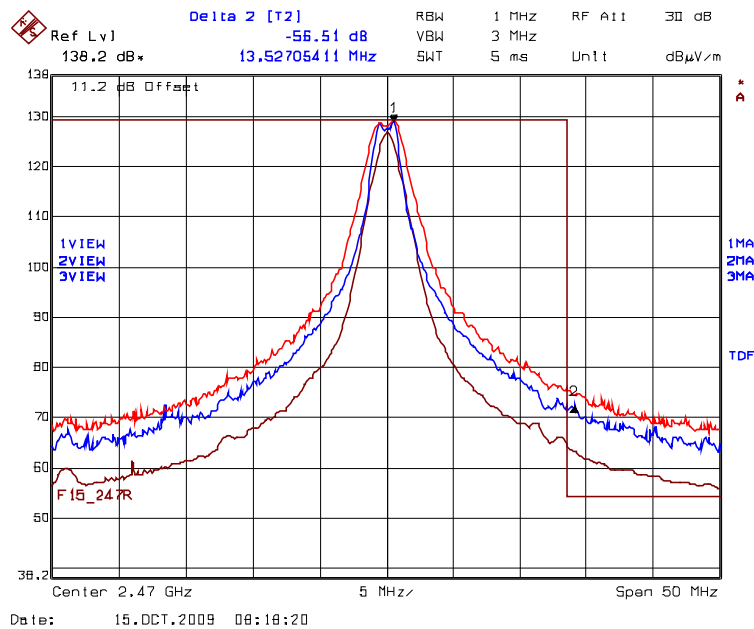


Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 500 kHz, VBW= 1 MHz, Delta (Peak to Band-Edge): 56.26dB
 Trace 3: RBW= 1 MHz, VBW= 10 Hz
 Peak Band-Edge at 2483.5 MHz: Peak= 127.99dBuV/m – 56.26dB= 71.73dBuV/m (limit 74dBuV/m)
 Average: 63.54dBuV/m – 11.37dB= 52.17dBuV/m (limit 54dBuV/m)

Plot 6.9.5.4(i) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Vertical



Plot 6.9.5.4(ii) Band-Edge RF Radiated Emissions @ 3 m
 High End of Frequency Band, 2470 MHz
 Rx Antenna Orientation: Vertical



Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 500 kHz, VBW= 1 MHz, Delta (Peak to Band-Edge): 56.51dB
 Trace 3: RBW= 1 MHz, VBW= 10 Hz
 Peak Band-Edge at 2483.5 MHz: Peak= 128.90dBuV/m – 56.51dB= 72.39dBuV/m (limit 74dBuV/m)
 Average: 64.25dBuV/m – 11.37dB= 52.88dBuV/m (limit 54dBuV/m)

6.10. POWER SPECTRAL DENSITY [§ 15.247(e)]

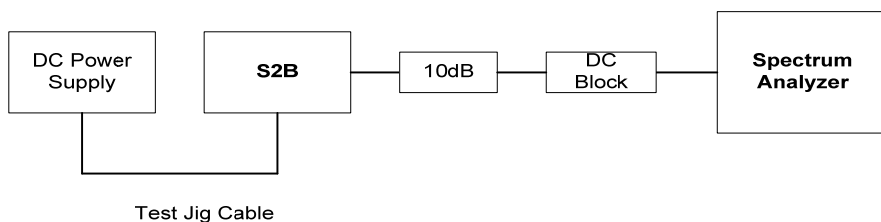
6.10.1. Limit(s)

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.

6.10.2. Method of Measurements

KDB Publication No. 558074: Guidance on Measurements for Digital Transmission Systems (47 CFR 15.247), PSD Option 1 method.

6.10.3. Test Arrangement



6.10.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz with external mixer	August 10, 2010
DC Block	Hewlett Packard	11742A	12460	0.045 – 26.5 GHz	N/A
Attenuator	Narda	4768-10	-	DC - 40 GHz	N/A

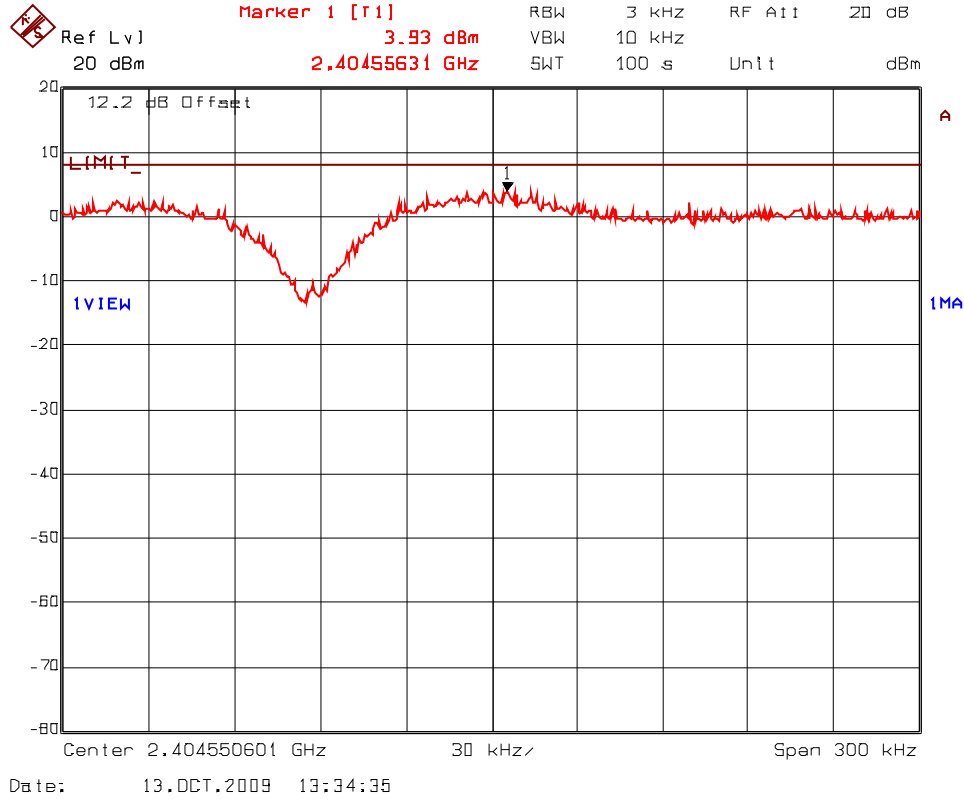
6.10.5. Test Data

Remark: Measurement method: Power spectral density (PSD) Option 1.

Frequency (MHz)	*PSD in 3 kHz BW (dBm)	Limit (dBm)	Margin (dB)	Comments (Pass/Fail)
2405	3.93	8	-4.07	Pass
2440	3.87	8	-4.13	Pass
2470	4.64	8	-3.36	Pass
2475	4.71	8	-3.29	Pass
2480	-10.16	8	-18.16	Pass

*See the following plots for measurement details.

Plot 6.10.5.1 Power Spectral Density
Frequency: 2405 MHz



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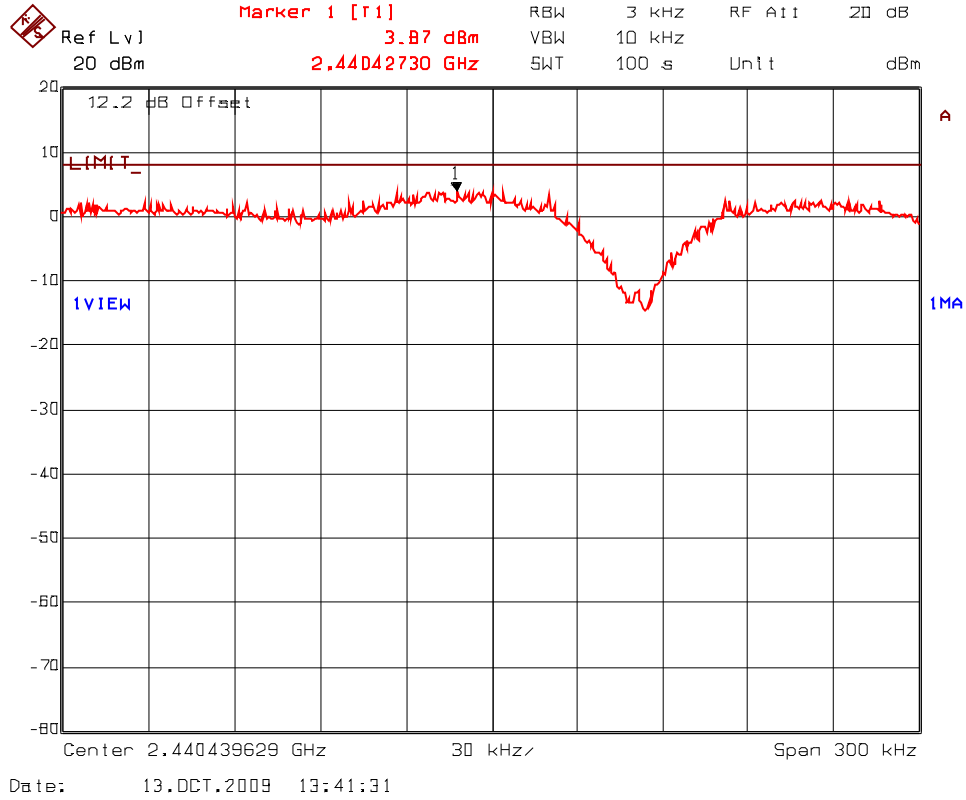
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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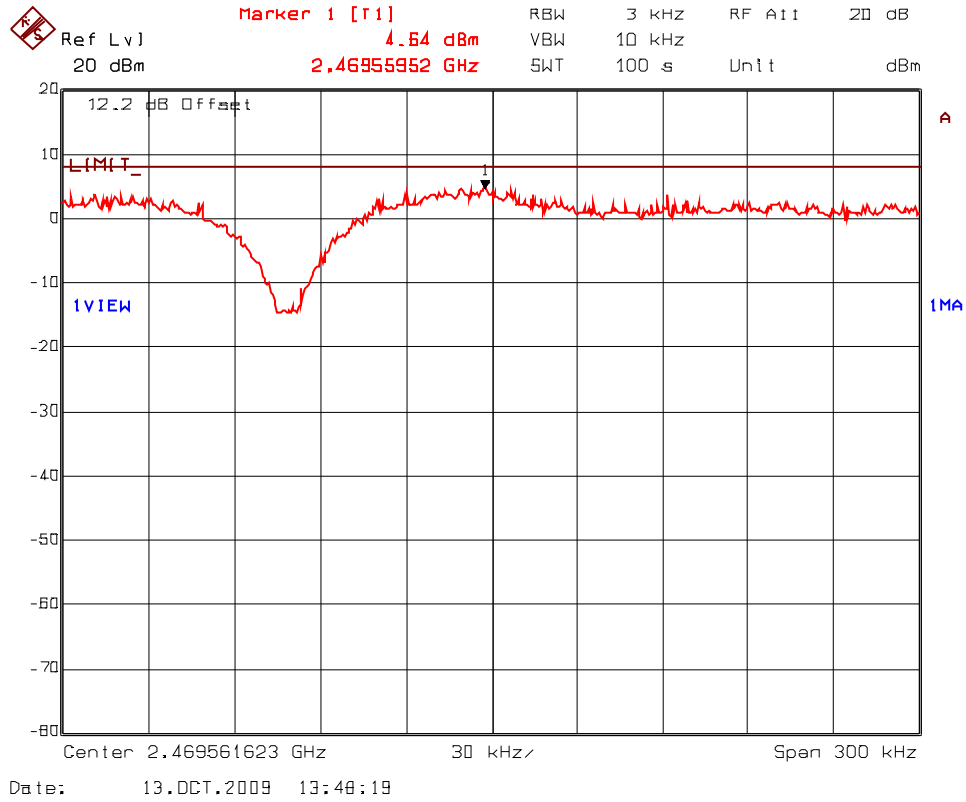
November 9, 2009

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Plot 6.10.5.2 Power Spectral Density
Frequency: 2440 MHz



Plot 6.10.5.3 Power Spectral Density
Frequency: 2470 MHz



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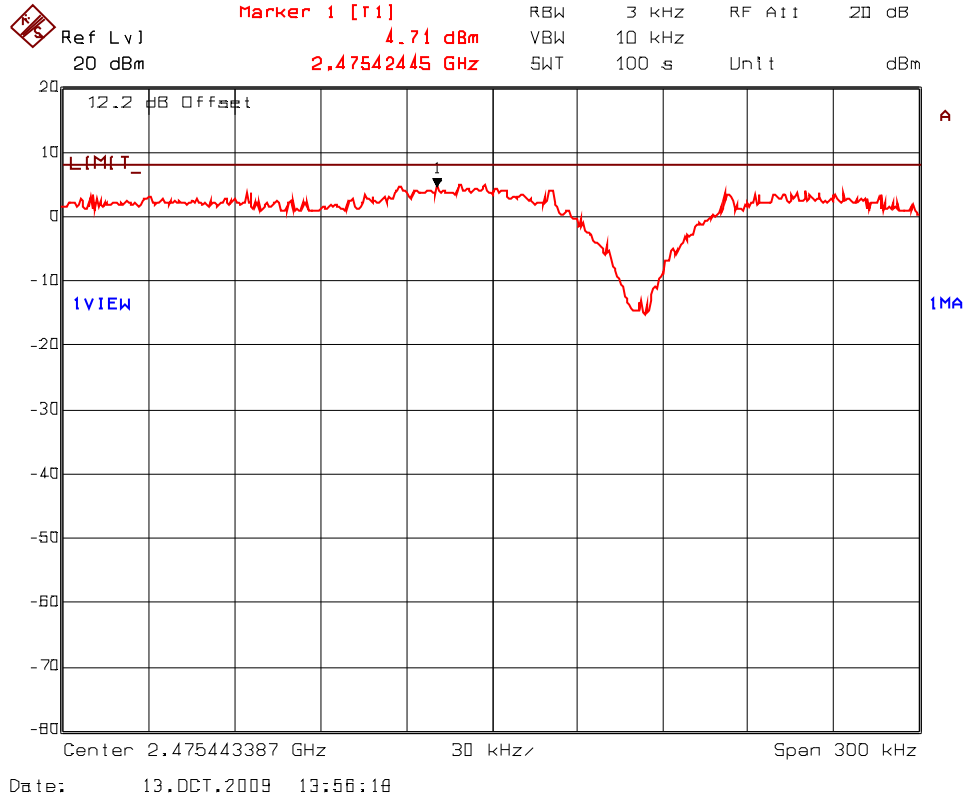
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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Plot 6.10.5.4 Power Spectral Density
Frequency: 2475 MHz



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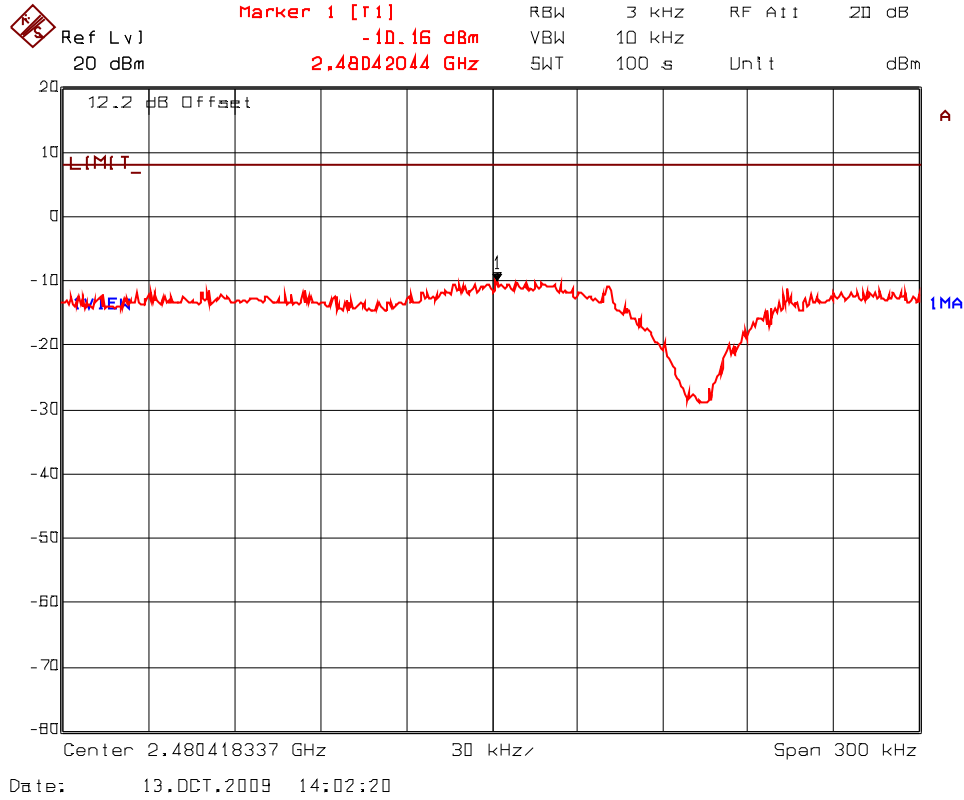
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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Plot 6.10.5.5 Power Spectral Density
Frequency: 2480 MHz



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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

File #: DIGI-020F15C247

November 9, 2009

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

6.11. RF EXPOSURE REQUIRMENTS [§§ 15.247(e)(i), 1.1310 & 2.1091]

The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation.

FCC 47 CFR § 1.1310:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30
30–300	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

6.11.1. Method of Measurements

Refer to Sections 1.1310, 2.1091

In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

- (1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
- (2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
- (3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
- (4) Any other RF exposure related issues that may affect MPE compliance

Calculation Method of RF Safety Distance:

$$S = PG/4\pi r^2 = EIRP/4\pi r^2$$

Where: P: power input to the antenna in mW
 EIRP: Equivalent (effective) isotropic radiated power
 S: power density mW/cm²
 G: numeric gain of antenna relative to isotropic radiator
 r: distance to centre of radiation in cm

$$r = \sqrt{EIRP/4\pi S}$$

6.11.2. RF Evaluation

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	Compliance with FCC Rules
Minimum calculated separation distance between antenna and persons required: *18 cm	Manufacturer' instruction for separation distance between antenna and persons required: 20 cm.
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	Antenna installation and device operating instructions shall be provided to installers to maintain and ensure compliance with RF exposure requirements.
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Refer to User's Manual for RF Exposure Information.
Any other RF exposure related issues that may affect MPE compliance	None.

*The minimum separation distance between the antenna and bodies of users are calculated using the following formula:

$$\text{RF EXPOSURE DISTANCE LIMITS: } r = (PG/4\pi S)^{1/2} = (EIRP/4\pi S)^{1/2}$$

$$S = 1.0 \text{ mW/cm}^2$$

$$EIRP = 36 \text{ dBm} = 10^{3.6} \text{ mW (assuming worst case)}$$

$$r = (EIRP/4\pi S)^{1/2} = (10^{3.6/10} / 4\pi(1.0))^{1/2} = 18 \text{ cm}$$

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	± 1.5	± 1.5
LISN coupling specification	Rectangular	± 1.5	± 1.5
Cable and Input Transient Limiter calibration	Normal (k=2)	± 0.3	± 0.5
Mismatch: Receiver VRC $\Gamma_1 = 0.03$ LISN VRC $\Gamma_R = 0.8(9 \text{ kHz}) 0.2 (30 \text{ MHz})$ Uncertainty limits $20\text{Log}(1 \pm \Gamma_1 \Gamma_R)$	U-Shaped	± 0.2	± 0.3
System repeatability	Std. deviation	± 0.2	± 0.05
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	± 1.25	± 1.30
Expanded uncertainty U	Normal (k=2)	± 2.50	± 2.60

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30 \text{ dB}$$

$$U = 2u_c(y) = \pm 2.6 \text{ dB}$$

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (\pm dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	± 1.0	± 1.0
Cable Loss Calibration	Normal (k=2)	± 0.3	± 0.5
EMI Receiver specification	Rectangular	± 1.5	± 1.5
Antenna Directivity	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	± 2.0	± 0.5
Antenna phase center variation	Rectangular	0.0	± 0.2
Antenna factor frequency interpolation	Rectangular	± 0.25	± 0.25
Measurement distance variation	Rectangular	± 0.6	± 0.4
Site imperfections	Rectangular	± 2.0	± 2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67$ (Bi) 0.3 (Lp) Uncertainty limits $20\text{Log}(1+\Gamma_1\Gamma_R)$	U-Shaped	+1.1 -1.25	± 0.5
System repeatability	Std. Deviation	± 0.5	± 0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k = 2 is used:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$