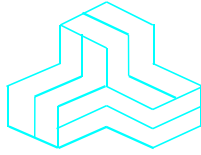


ENGINEERING TEST REPORT



2400MHz OEM Wireless Module
Model No.: n2420B

FCC ID: NS911P31

Applicant:

Microhard Systems Inc.
150 Country Hills Landing N.W.
Calgary, Alberta
Canada T3K 5P3

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247
Frequency Hopping Spread Spectrum (FHSS)
Operating in 2400– 2483.5 MHz Band

UltraTech's File No.: MCRS-041F15C247

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

Date: July 19, 2011

Report Prepared by: Dharmajit Solanki

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

Issued Date: July 19, 2011

Test Dates: June 20 to July 12, 2011

*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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FCC

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NVLAP Lab Code 200093-0



SL2-IN-E-1119R



Korea KCC-RRL
CA2049

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.247
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15
Purpose of Test:	To gain FCC Equipment Authorization for Frequency Hopping Spread Spectrum Transceiver 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:	[x] Commercial, industrial or business environment [x] Residential environment

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

None

1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 2 & 15	2010	Code of Federal Regulations – Telecommunication
ANSI C63.4	2009	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
996369 D01	2011	Module Certification Guide v01r03
FCC ET Docket No. 99-231	2002	Amendment to FCC Part 15 of the Commission's Rules Regarding to Spread Spectrum Devices

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

APPLICANT	
Name:	Microhard Systems Inc.
Address:	150 Country Hills Landing N.W. Calgary, Alberta Canada T3K 5P3
Contact Person:	Mr. Hany Shenouda Phone #: 403 248-0028 Fax #: 403 248 2762 Email Address: shenouda@microhardcorp.com

MANUFACTURER	
Name:	Microhard Systems Inc.
Address:	150 Country Hills Landing N.W. Calgary, Alberta Canada T3K 5P3
Contact Person:	Mr. Hany Shenouda Phone #: 403 248-0028 Fax #: 403 248-2762 Email Address: shenouda@microhardcorp.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

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

Brand Name:	Microhard Systems Inc.
Product Name:	2400MHz OEM Wireless Module
Model Name or Number:	n2420B
Serial Number:	Test Sample
Type of Equipment:	Spread Spectrum Transmitter
Input Power Supply Type:	External Regulated DC Sources
Primary User Functions of EUT:	Spread Spectrum OEM Transceiver

2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	▪ Mobile ▪ Base Station (fixed use)
Intended Operating Environment:	▪ Commercial, industrial or business environment ▪ Residential environment
Power Supply Requirement:	3.3V or (7 to 30VDC HV option)
RF Output Power Rating:	0.1 to 1 W
Operating Frequency Range:	2401.6 – 2477.6 MHz
RF Output Impedance:	50 Ohms
Channel Spacing:	25kHz/ 50kHz / 250kHz / 280kHz / 400kHz
Data Rates:	Low / Medium / High
Duty Cycle:	Continuous
Modulation Type:	FHSS
Antenna Connector Type:	MMCX connected to antennas via RPSMA & RPTNC pigtails.

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

There are four antenna types:

1. Rubber Ducky Antenna
2. Patch Antenna
3. Yagi Antenna
4. Omni Directional Antenna

The highest gain antenna from each of the above antenna types were selected for testing to represents the worst-case. Refer to antennas list exhibit for detailed specifications.

2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	RF IN/OUT Port	1	MMCX to connect external antenna using Pigtails	Shielded coaxial cable with unique coupling connectors
2	DC Supply & I/O Port	1	Pin Header	No cable, direct connection

2.6. 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:	Laptop
Brand name:	Dell Latitude
Model Name or Number:	PPL
Serial Number:	0009321C
Connected to EUT's Port:	Test Jig of the EUT

Ancillary Equipment # 2	
Description:	Test Jig
Brand name:	Microhard Systems Inc.
Connected to EUT's Port:	I/O Port

Ancillary Equipment # 3	
Description:	AC/DC Adaptor
Brand name:	GVC
Model Name or Number:	GM36-120200-1
Connected to EUT's Port:	Test jig of the EUT

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	20°C to 24°C
Humidity:	30% to 65%
Pressure:	98 to 110 kPa
Power Input Source:	3.3 VDC

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	▪ Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements. ▪ The EUT operates in normal Frequency Hopping mode for occupancy duration, and frequency separation.
Special Test Software & Hardware:	Special software provided by the Applicant was installed to allow the EUT to operate in hopping mode or at each channel frequency continuously. For example, the transmitter will be operated at each of lowest, middle and highest frequencies individually continuously during testing.
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as non-integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	2401.6 – 2477.6 MHz
Frequency(ies) Tested: (Near lowest, near middle & near highest frequencies in the frequency range of operation.)	2401.6, 2439.6 and 2477.6 MHz
RF Power Output: (measured maximum output power at antenna terminals)	1 Watt (conducted) and 36 dBm EIRP maximum
Normal Test Modulation:	See test data
Modulating Signal Source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. 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: April 14, 2014).

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Requirements	Compliance (Yes/No)
15.207(a)	Power Line Conducted Emissions Measurements	Yes
15.247(a)(1)	Provisions for Frequency Hopping Systems	Yes
15.247(b)	Peak Output Power	Yes
15.247(b) (5), 1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	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
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.		

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. TEST PROCEDURES

ANSI C63.4 and FCC Public Notice @ DA 00-705 (March 30, 2000) – Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

5.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement. Refer to Exhibit 7 for Measurement Uncertainties.

5.3. 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.

5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER

The essential function of the EUT is to correctly communicate data to and from radios over RF link.

5.5. COMPLIANCE WITH FCC PART 15 – GENERAL TECHNICAL REQUIREMENTS

FCC Section	FCC Rules	Manufacturer's Clarification
15.31	The hopping function must be disabled for tests, which should be performed with the EUT transmitting on the number of frequencies specified in this Section. The measurements made at the upper and lower ends of the band of operation should be made with the EUT tuned to the highest and lowest available channels.	See Operational Description
15.203	Described how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT. The exception is in those cases where EUT must be professionally installed. In order to demonstrate that professional installation is required, the following 3 points must be addressed: ➤ The application (or intended use) of the EUT ➤ The installation requirements of the EUT ➤ The method by which the EUT will be marketed	See Manufacturer Declaration on Modular Approval Request letter.
15.204	Provided the information for every antenna proposed for use with the EUT: ➤ type (e.g. Yagi, patch, grid, dish, etc...), ➤ manufacturer and model number ➤ gain with reference to an isotropic radiator	See proposed antenna list.
15.247(a)	Description of how the EUT meets the definition of a frequency hopping spread spectrum, found in Section 2.1. Based on the technical description.	See Operational Description
15.247(a)	Pseudo Frequency Hopping Sequence: Describe how the hopping sequence is generated. Provide an example of the hopping sequence channels, in order to demonstrate that the sequence meets the requirements specified in the definition of a frequency hopping spread spectrum system, found in Section 2.1	See Operational Description

FCC Section	FCC Rules	Manufacturer's Clarification
15.247(a)	<u>Equal Hopping Frequency Use:</u> Describe how each individual EUT meets the requirement that each of its hopping channels is used equally on average (e.g. that each new transmission event begins on the next channel in the hopping sequence after final channel used in the previous transmission events).	See Operational Description
15.247(g)	Describe how the EUT complies with the requirement that it be designed to be capable of operating as a true frequency hopping system	See Operational Description
15.247(h)	Describe how the EUT complies with the requirement that it not have the ability to coordinated with other FHSS is an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters	See Operational Description

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

5.6.1. Limit

The equipment shall meet the limits of the following table:

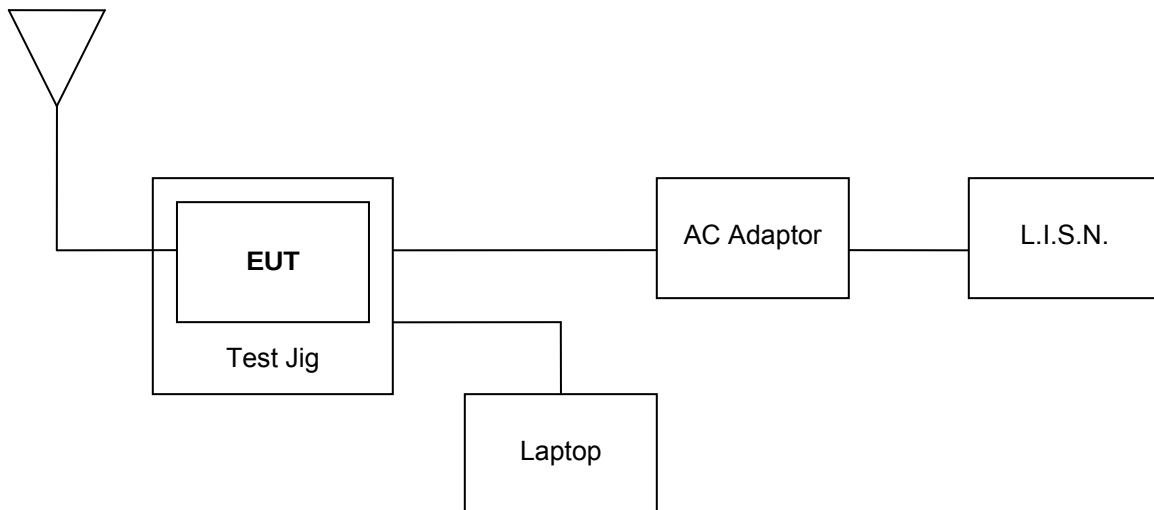
Frequency of emission (MHz)	Class B Conducted Limits (dB μ V)		Measuring Bandwidth
	Quasi-peak	Average	
0.15–0.5	66 to 56*	56 to 46*	RBW = 9 kHz VBW $\geq$ 9 kHz for QP VBW = 1 Hz for Average
0.5–5	56	46	
5–30	60	50	

*Decreases linearly with the logarithm of the frequency

5.6.2. Method of Measurements

ANSI C63.4

5.6.3. Test Arrangement



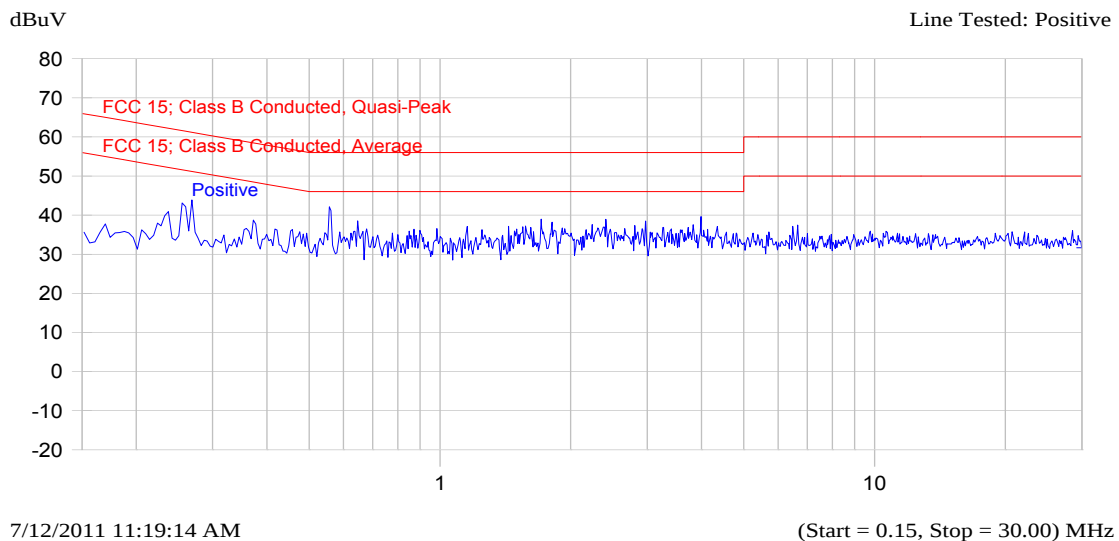
5.6.4. Test Data

Plot 5.6.4.1 Power Line Conducted Emissions - Transmitter mode
Line Voltage: 120VAC 60Hz
Line Tested: Positive

Test Header

Description: TX Mode
Setup Name: FCC 15 Class B
Customer Name: Microhard Systems Inc.
Project Number: MCRS-041Q
Operator Name: Hung Trinh
EUT Name: n2420B Radio Module
Date Created: 7/12/2011 10:50:13 AM
Date Modified: 7/12/2011 11:17:50 AM

Current Graph



Current List

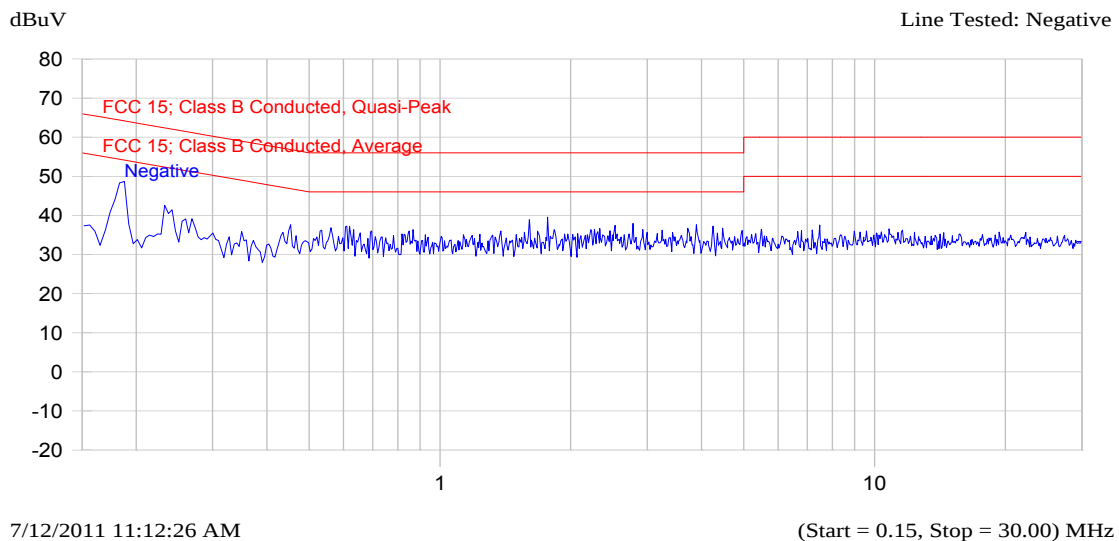
Frequency Name	Peak	QP	Delta	QP-QP Limit	Avg	Delta Avg-Avg Limit	Trace
MHz	dBuV	dB	dBuV	dB			
0.266	43.1	38.3	-24.3	30.3	-22.4	Positive	
0.556	42.2	37.6	-18.4	32.7	-13.3	Positive	
3.988	37.2	31.5	-24.5	23.8	-22.2	Positive	

Plot 5.6.4.2 Power Line Conducted Emissions - Transmitter mode
Line Voltage: 120VAC 60Hz
Line Tested: Negative

Test Header

Description: TX Mode
Setup Name: FCC 15 Class B
Customer Name: Microhard Systems Inc.
Project Number: MCRS-041Q
Operator Name: Hung Trinh
EUT Name: n2420B Radio Module
Date Created: 7/12/2011 10:50:13 AM
Date Modified: 7/12/2011 11:10:33 AM

Current Graph



Current List

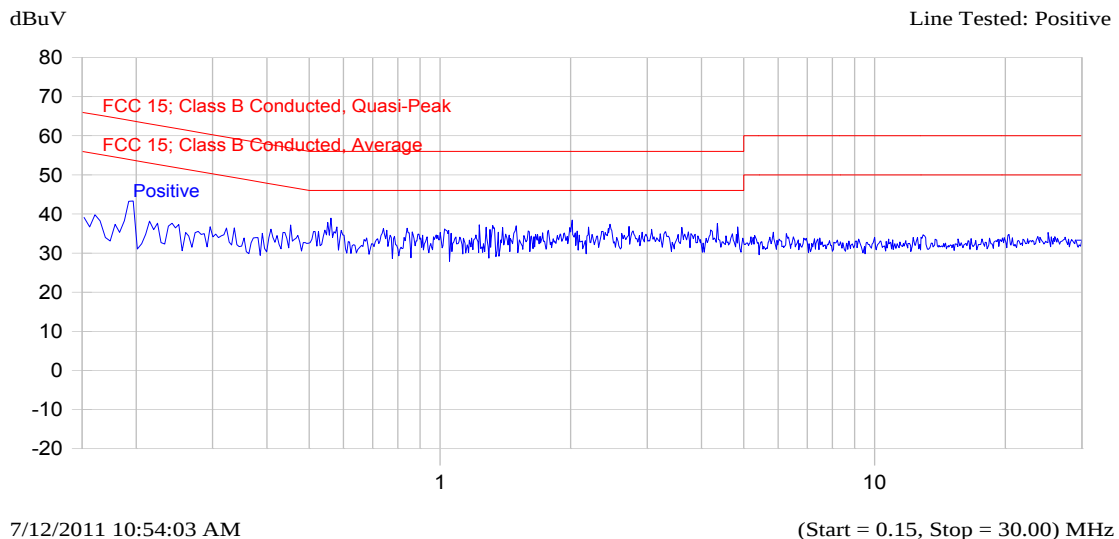
Frequency Name MHz	Peak dBuV	QP dB	Delta dBuV	QP-QP Limit dB	Avg	Delta Avg-Avg Limit	Trace
0.180	51.5	46.7	-18.5	31.2	-23.9	Negative	
0.228	47.3	41.6	-22.2	28.8	-24.9	Negative	
1.770	36.4	30.1	-25.9	22.6	-23.4	Negative	

Plot 5.6.4.3 Power Line Conducted Emissions - Receiver mode
Line Voltage: 120VAC 60Hz
Line Tested: L1

Test Header

Description: RX Mode
Setup Name: FCC 15 Class B
Customer Name: Microhard Systems Inc.
Project Number: MCRS-041Q
Operator Name: Hung Trinh
EUT Name: n2420B Radio Module
Date Created: 7/12/2011 10:50:13 AM
Date Modified: 7/12/2011 10:50:13 AM

Current Graph



Current List

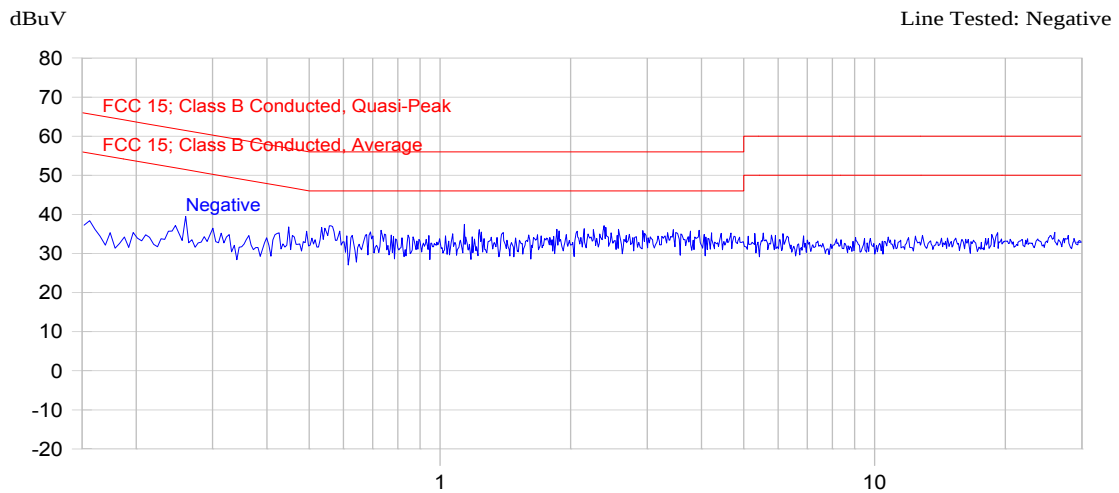
Frequency Name	Peak	QP	Delta QP-QP Limit		Avg	Delta Avg-Avg Limit	Trace
MHz	dBuV	dB	dBuV	dB			
0.192	42.4	36.9	-27.8	28.0	-26.7	Positive	
0.558	42.9	38.0	-18.0	33.7	-12.3	Positive	
4.356	34.9	28.8	-27.2	21.0	-25.0	Positive	

Plot 5.6.4.4 Power Line Conducted Emissions - Receiver mode
Line Voltage: 120VAC 60Hz
Line Tested: L2

Test Header

Description: RX Mode
Setup Name: FCC 15 Class B
Customer Name: Microhard Systems Inc.
Project Number: MCRS-041Q
Operator Name: Hung Trinh
EUT Name: n2420B Radio Module
Date Created: 7/12/2011 10:50:13 AM
Date Modified: 7/12/2011 11:02:22 AM

Current Graph



Current List

Frequency Name	Peak dBuV	QP dB	Delta QP-QP Limit	Avg	Delta Avg-Avg Limit	Trace
MHz	dBuV	dB	dBuV dB			
0.267	41.7	33.6	-29.0 25.2	-27.4	Negative	
1.128	35.6	29.8	-26.2 22.3	-23.7	Negative	
2.413	36.5	30.8	-25.2 23.5	-22.5	Negative	

5.7. PROVISIONS FOR FREQUENCY HOPPING SYSTEMS [§ 15.247(a)(1)]

5.7.1. Limit

§ 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

§ 15.247(a)(1)(iii): Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

5.7.2. Method of Measurements

FCC Public Notice DA 00-705

Carrier Frequency Separation:

The hopping function of the EUT is enabled. Use the spectrum analyzer setting as follows:

- Span = wide enough to capture the peaks of two adjacent channels
- RBW = 1% of the span
- VBW $\geq$ RBW
- Sweep = Auto
- Detector = peak
- Trace = max hold

Number of hopping frequency:

The hopping function of the EUT is enabled. Use the spectrum analyzer setting as follows:

- Span = the frequency band of operation
- RBW = 1% of the span
- VBW $\geq$ RBW
- Sweep = Auto
- Detector = peak
- Trace = max hold

Time of Occupancy (Dwell Time):

The hopping function of the EUT is enabled. Use the spectrum analyzer setting as follows:

- Span = 0 Hz centered on a hopping channel
- RBW = 1 MHz
- VBW $\geq$ RBW
- Sweep = as necessary to capture the entire dwell time per hopping channel
- Detector = peak
- Trace = max hold

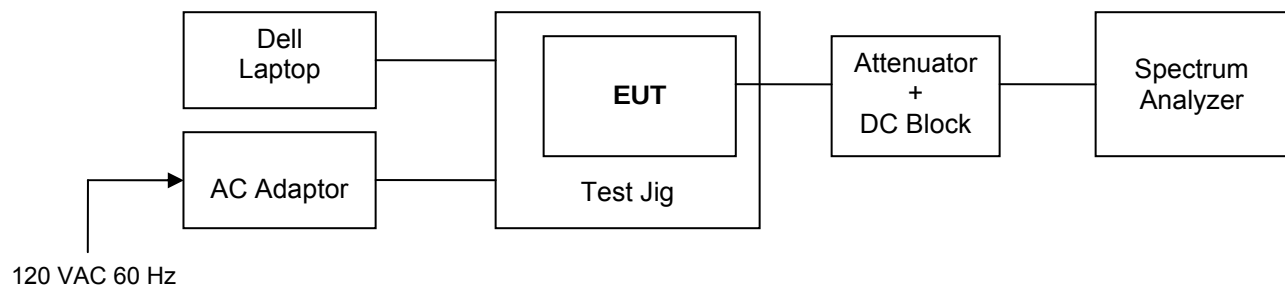
If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g. data rate modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). An oscilloscope may be used instead of a spectrum analyzer.

20 dB Bandwidth:

Use the spectrum analyzer setting as follows:

- Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
- RBW = 1% of the 20 dB bandwidth
- VBW $\geq$ RBW
- Sweep = auto
- Detector = peak
- Trace = max hold
- The transmitter shall be transmitting at its maximum data rate.
- Allow the trace to stabilize.
- Use the marker-to-peak function to set the marker to the peak of the emission.
- Use the marker-delta function to measure 20 dB down on both sides of the emission.
- The 20 dB BW is the delta reading in frequency between two markers.

5.7.3. Test Arrangement



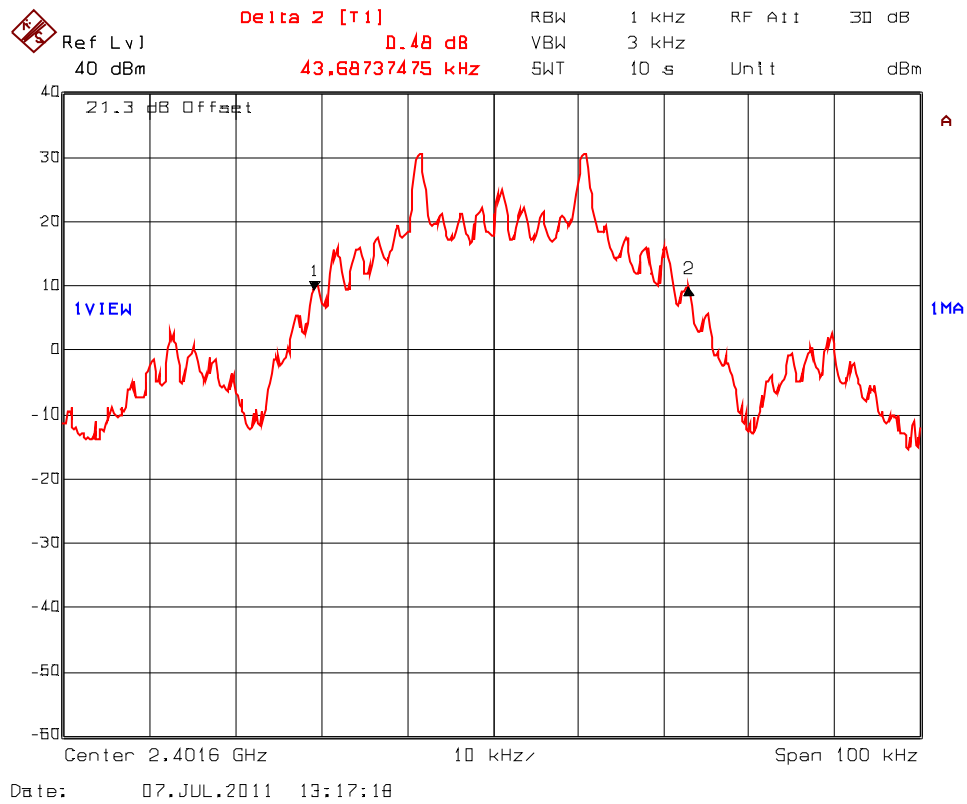
5.7.4. Test Data

Test Description	FCC Specification	Measured Values	Comments
Receiver Input Bandwidth and Hopping Capability	The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.	--	See Note 1
20 dB BW of the hopping channel	--	At very low data rate: 43.68 kHz At medium data rate: 206.41 kHz At high data rate: 388.77 kHz	See Note 2
Channel Hopping Frequency Separation	Minimum of 25 kHz or 20dB BW whichever is greater	At very low data rate: 50.60 kHz At medium data rate: 286.57 kHz At high data rate: 402.80 kHz	Complies See Note 2
Number of hopping frequencies	Shall use at least 15 channels	76 hopping frequencies found for all three Data rates (High, Medium & Low), only high & low data rates plots are shown in the report	Complies See Note 2 and 3
Time of Occupancy	The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed	At very low data rate: 224.45 ms At medium data rate: 48.7 ms At high data rate: 306.21 ms	Complies See Note 2

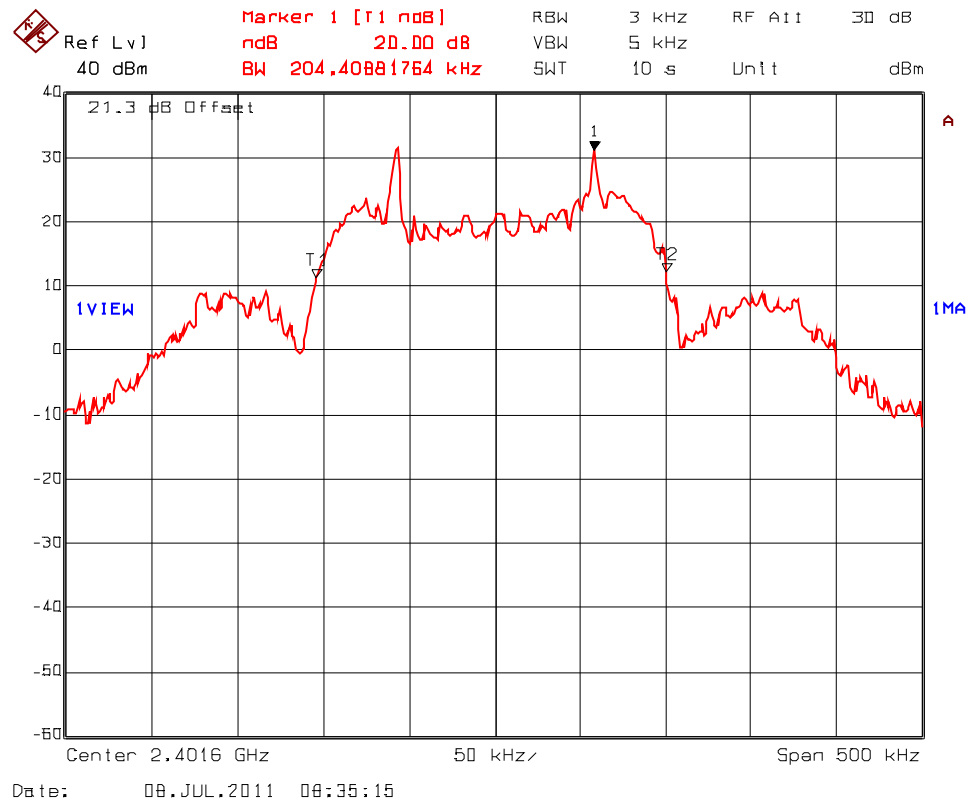
Note 1 & 3: See operational description exhibit for details.

Note 2: See the following plots for details.

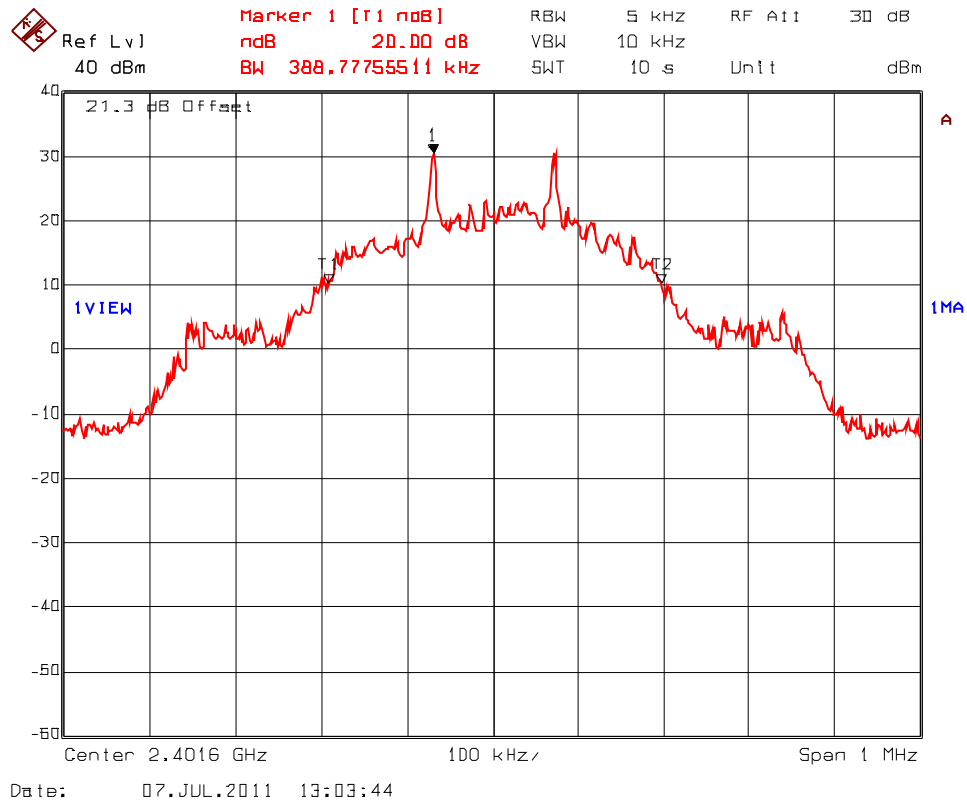
Plot 5.7.4.1 20 dB Bandwidth
Test Frequency: 2401.6 MHz (at very low data rate)



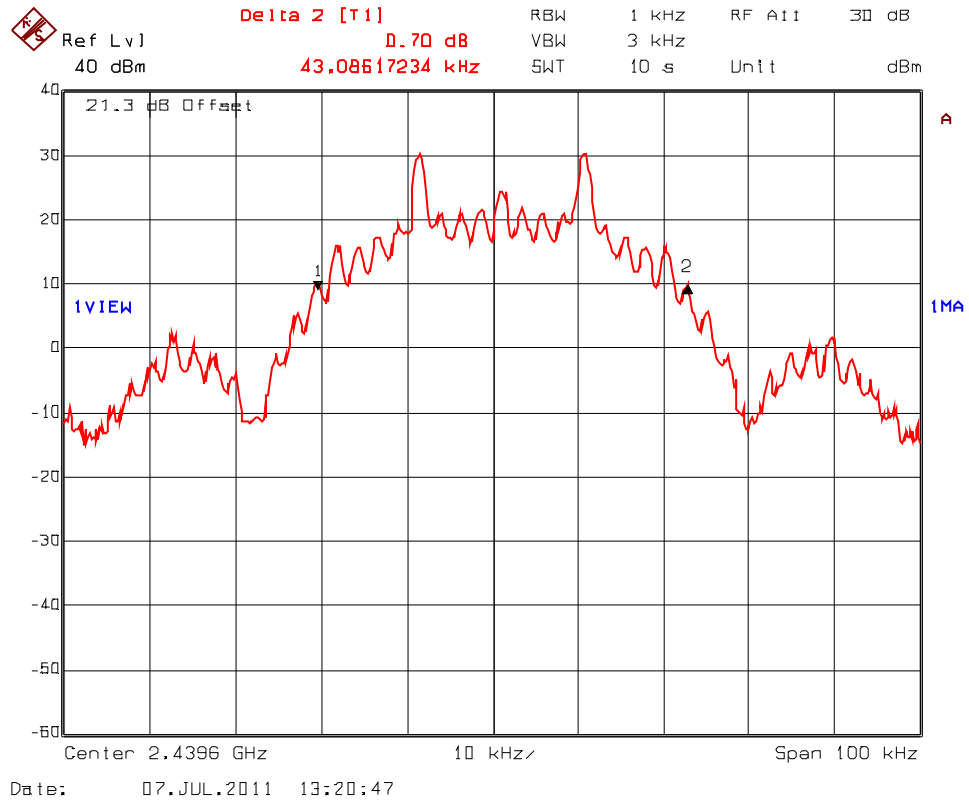
Plot 5.7.4.2 20 dB Bandwidth
Test Frequency: 2401.6 MHz (at medium data rate)



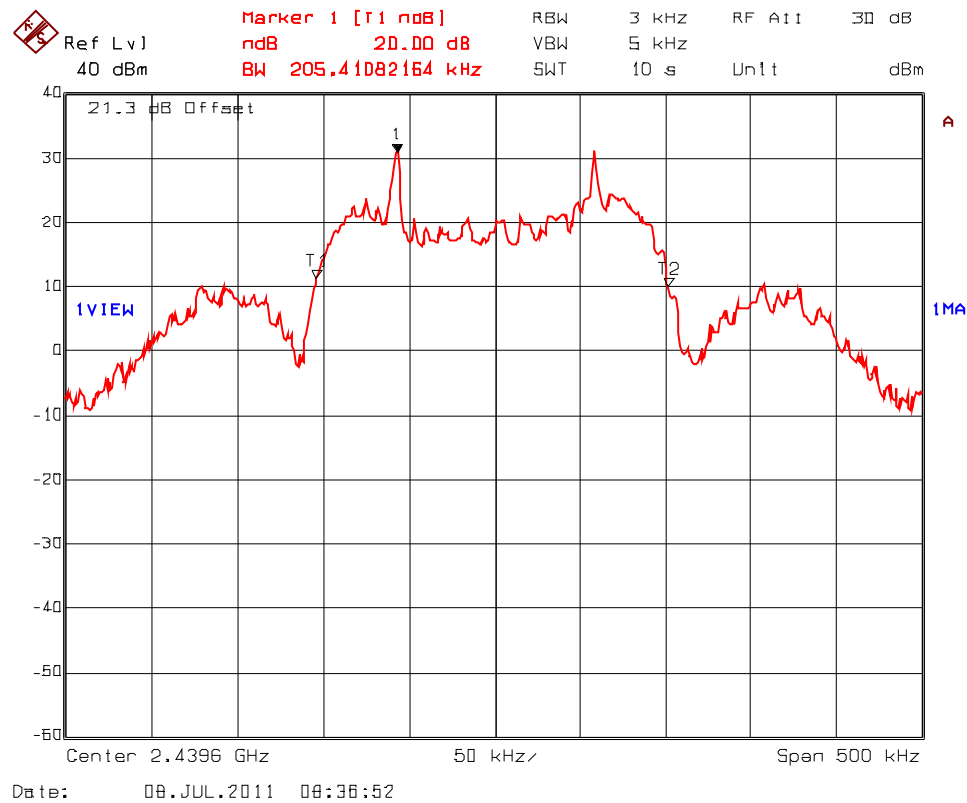
Plot 5.7.4.3 20 dB Bandwidth
Test Frequency: 2401.6 MHz (at high data rate)



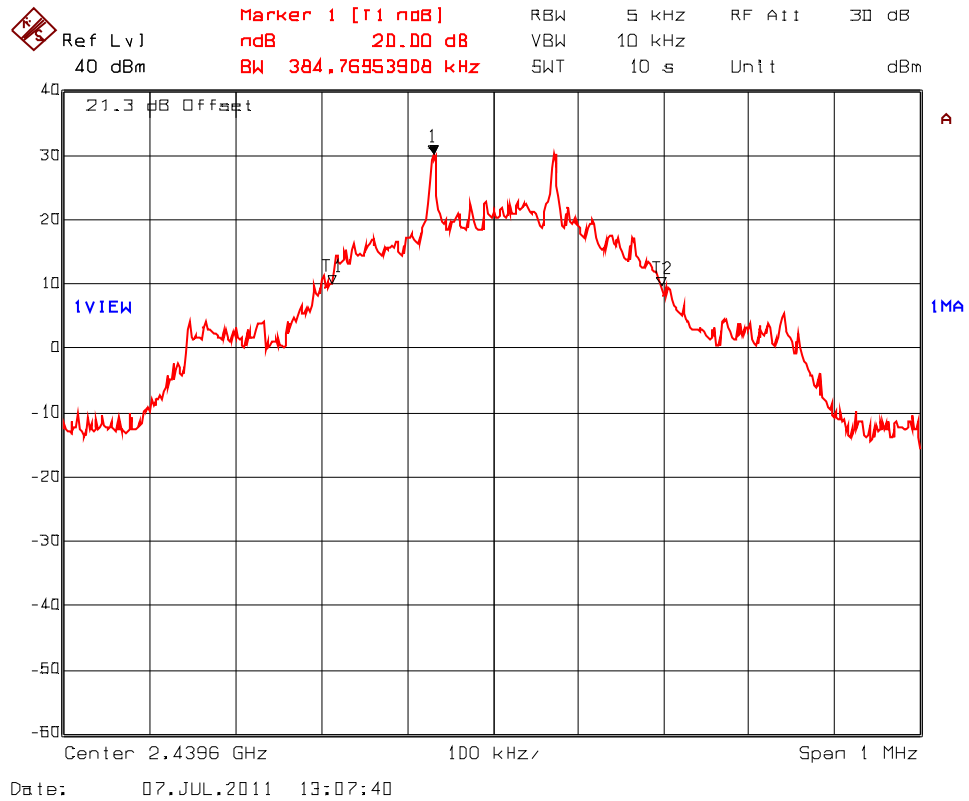
Plot 5.7.4.4 20 dB Bandwidth
Test Frequency: 2439.6 MHz (at very low data rate)



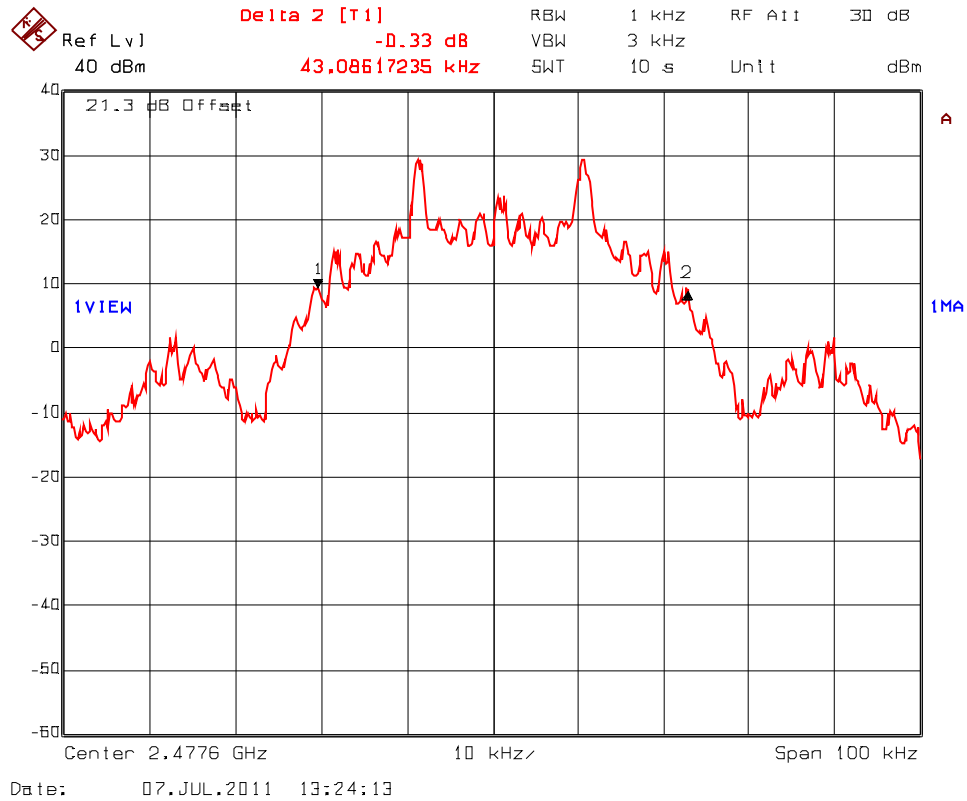
Plot 5.7.4.5 20 dB Bandwidth
Test Frequency: 2439.6 MHz (at medium data rate)



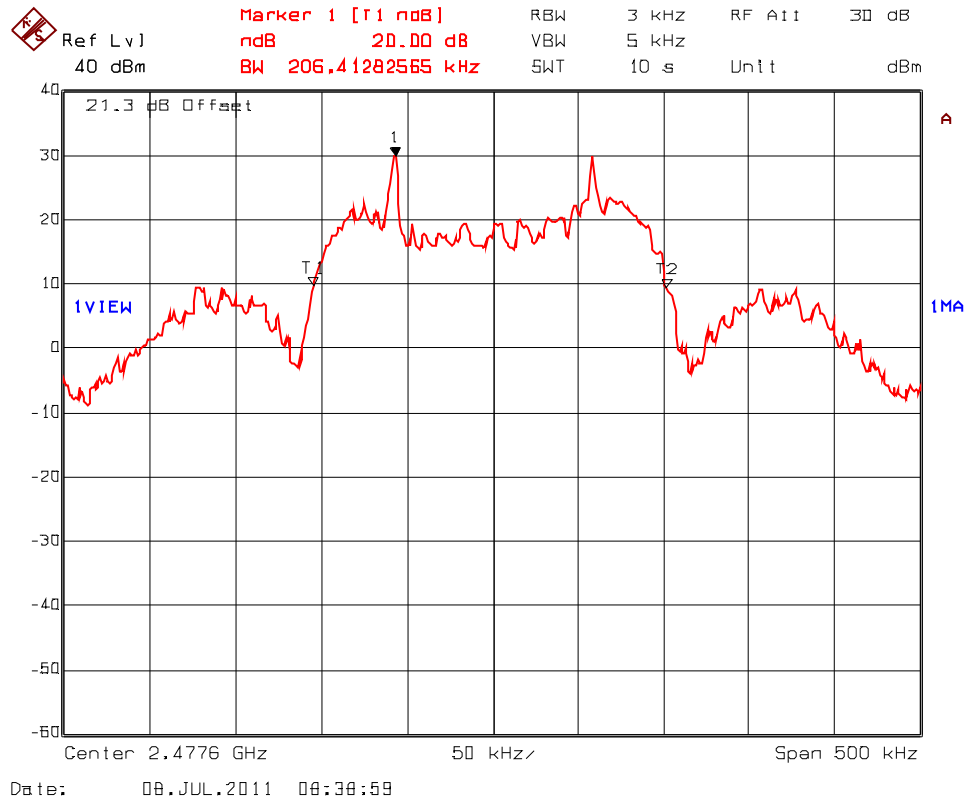
Plot 5.7.4.6 20 dB Bandwidth
Test Frequency: 2439.6 MHz (at high data rate)



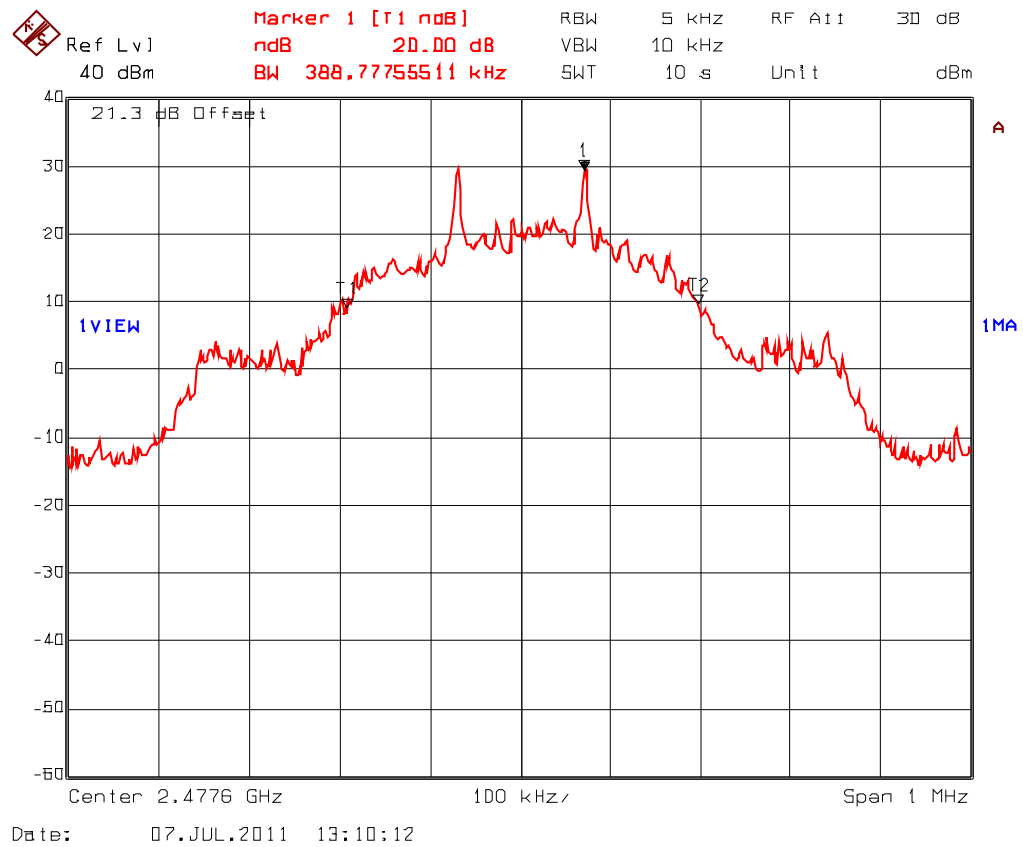
Plot 5.7.4.7 20 dB Bandwidth
Test Frequency: 2477.6 MHz (at very low data rate)



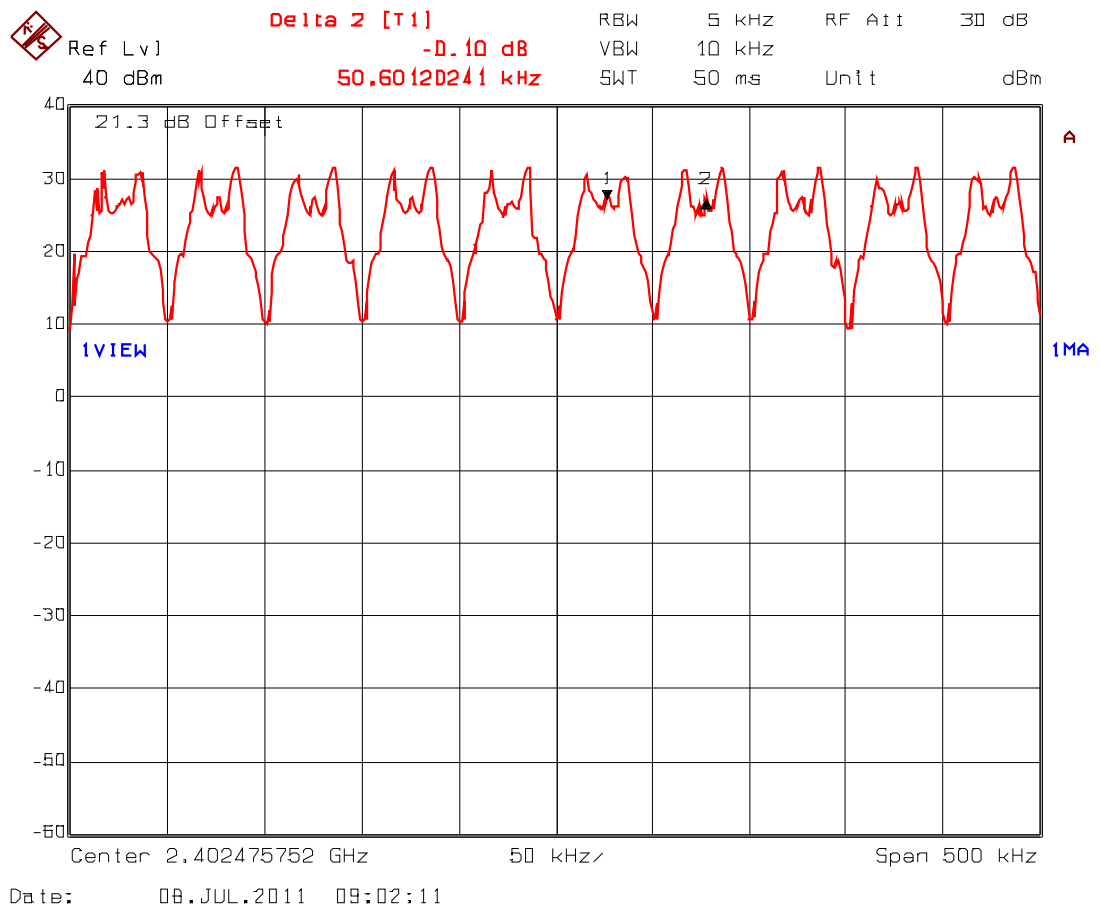
Plot 5.7.4.8 20 dB Bandwidth
Test Frequency: 2477.6 MHz (at medium data rate)



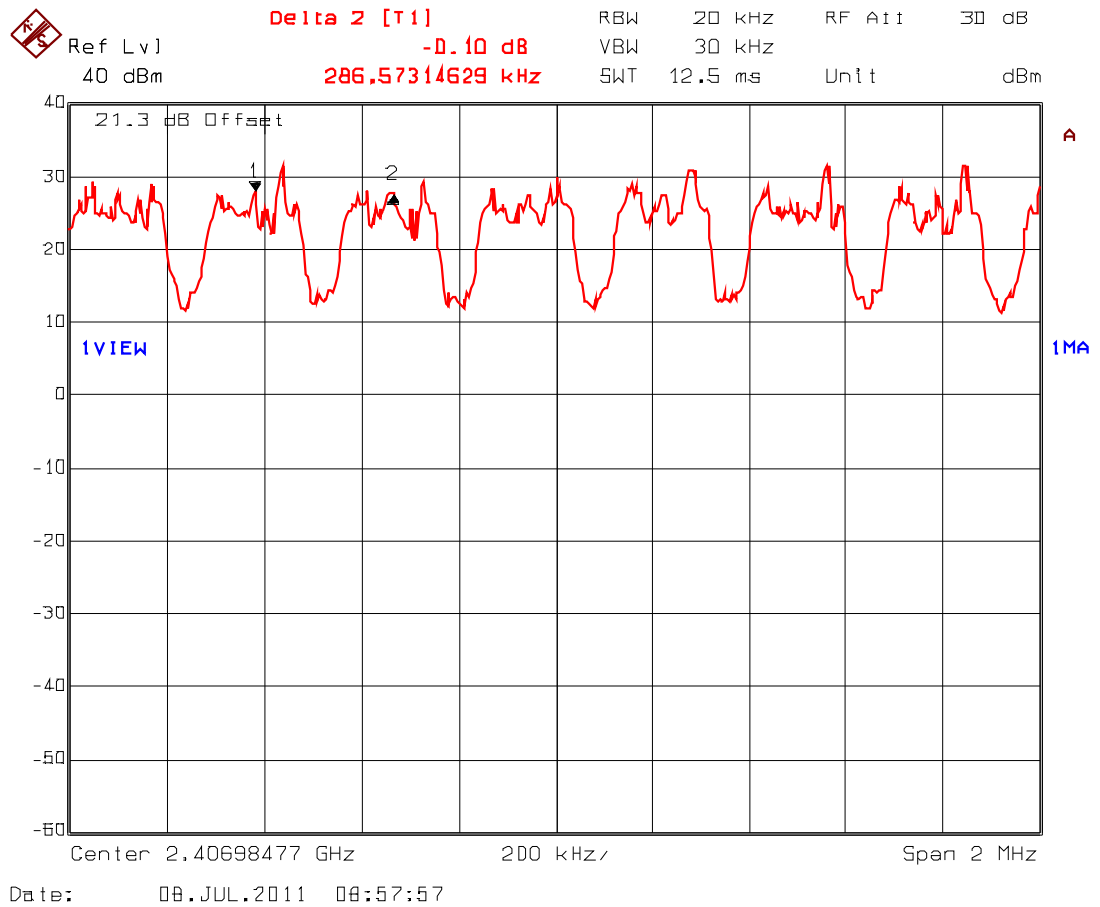
Plot 5.7.4.9 20 dB Bandwidth
Test Frequency: 2477.6 MHz (at high data rate)



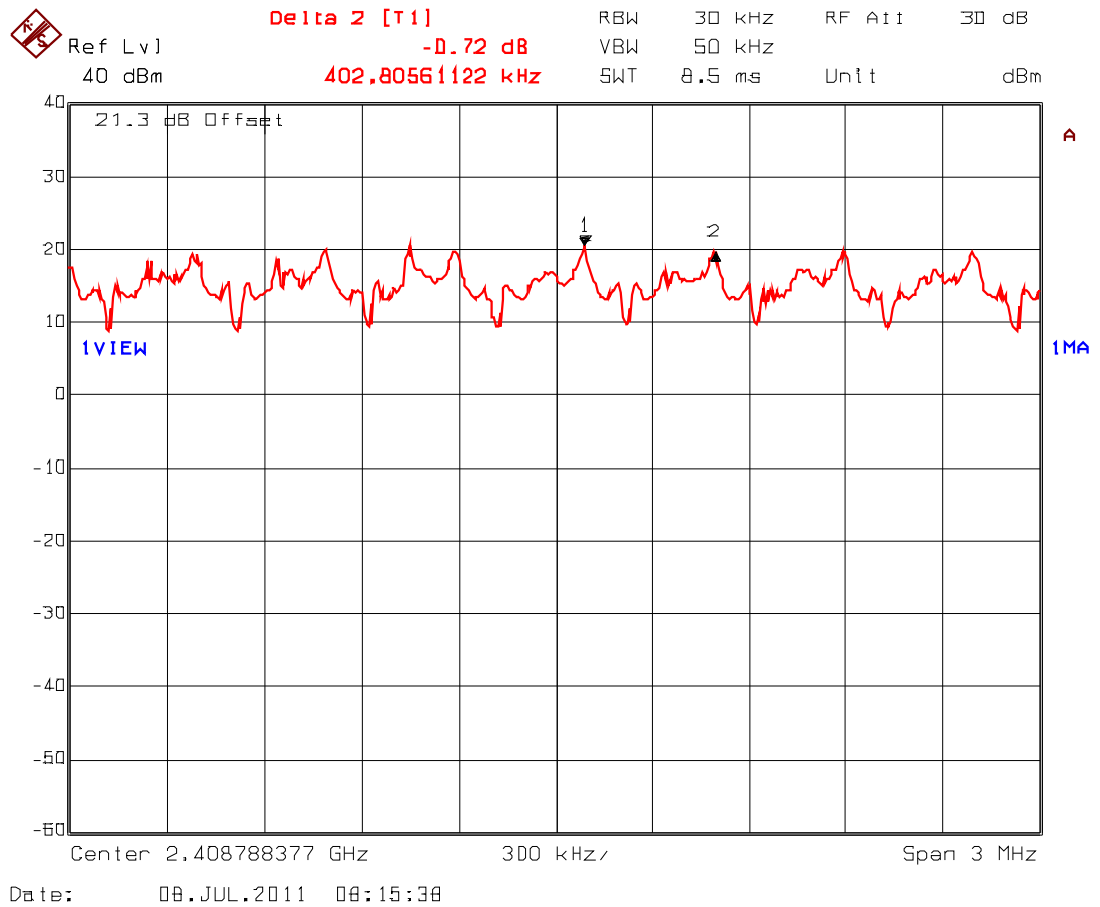
Plot 5.7.4.10 Carrier Frequency Separation
(at very low data rate)



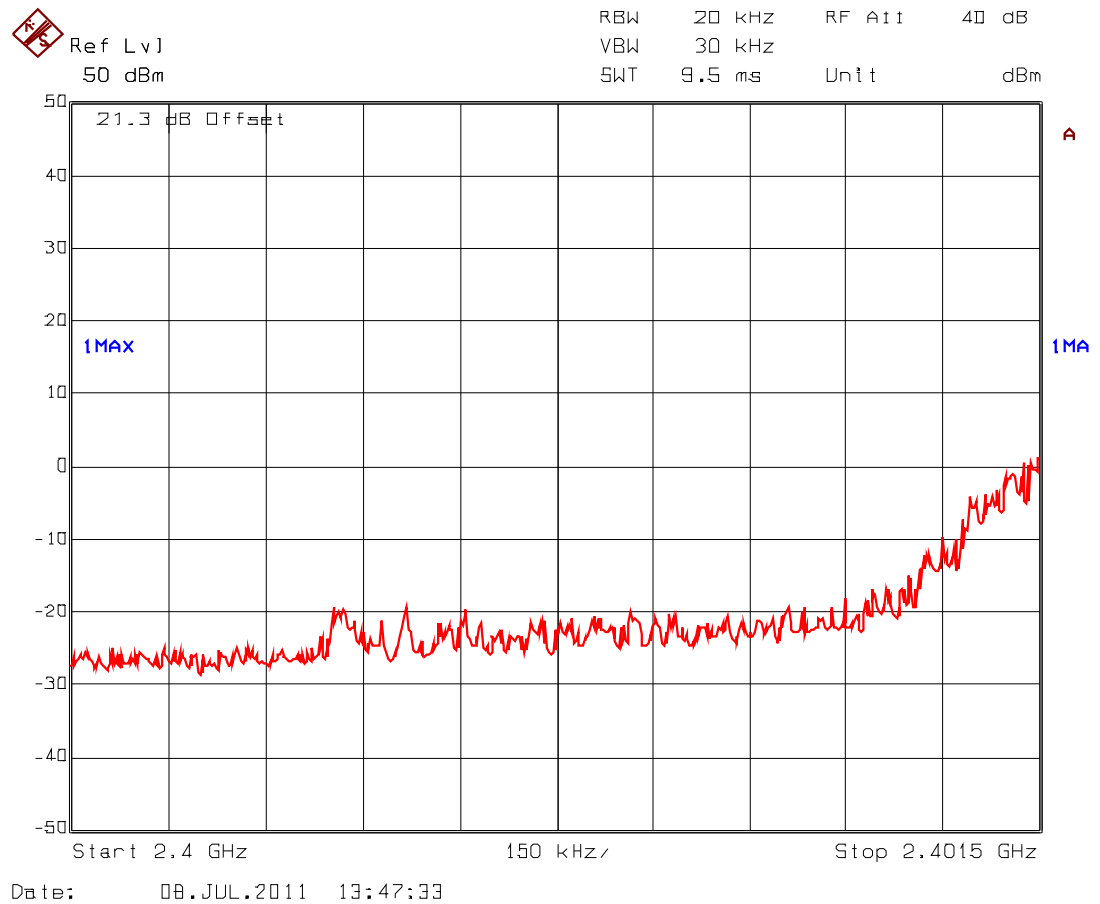
Plot 5.7.4.11 Carrier Frequency Separation
Data Rate Setting: 3 (at medium data rate)



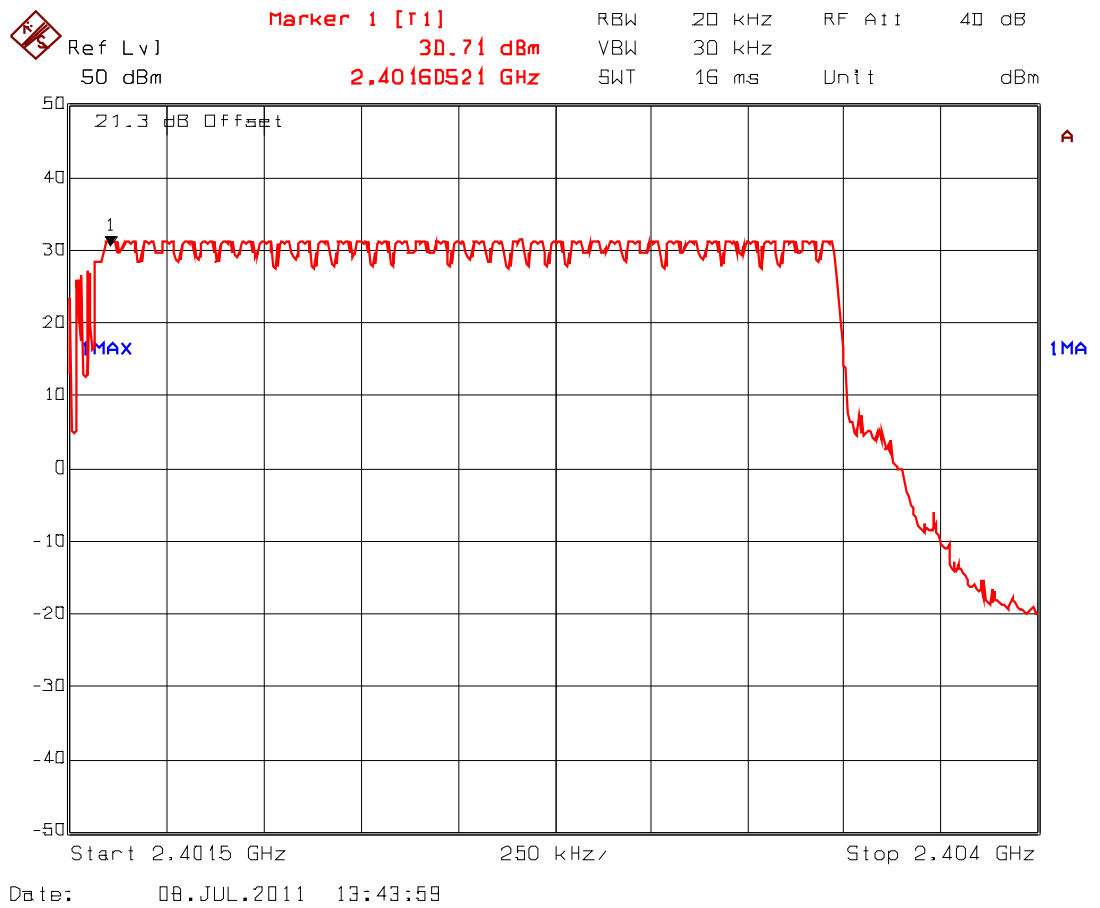
Plot 5.7.4.12 Carrier Frequency Separation
Data Rate Setting: 5 (at high data rate)



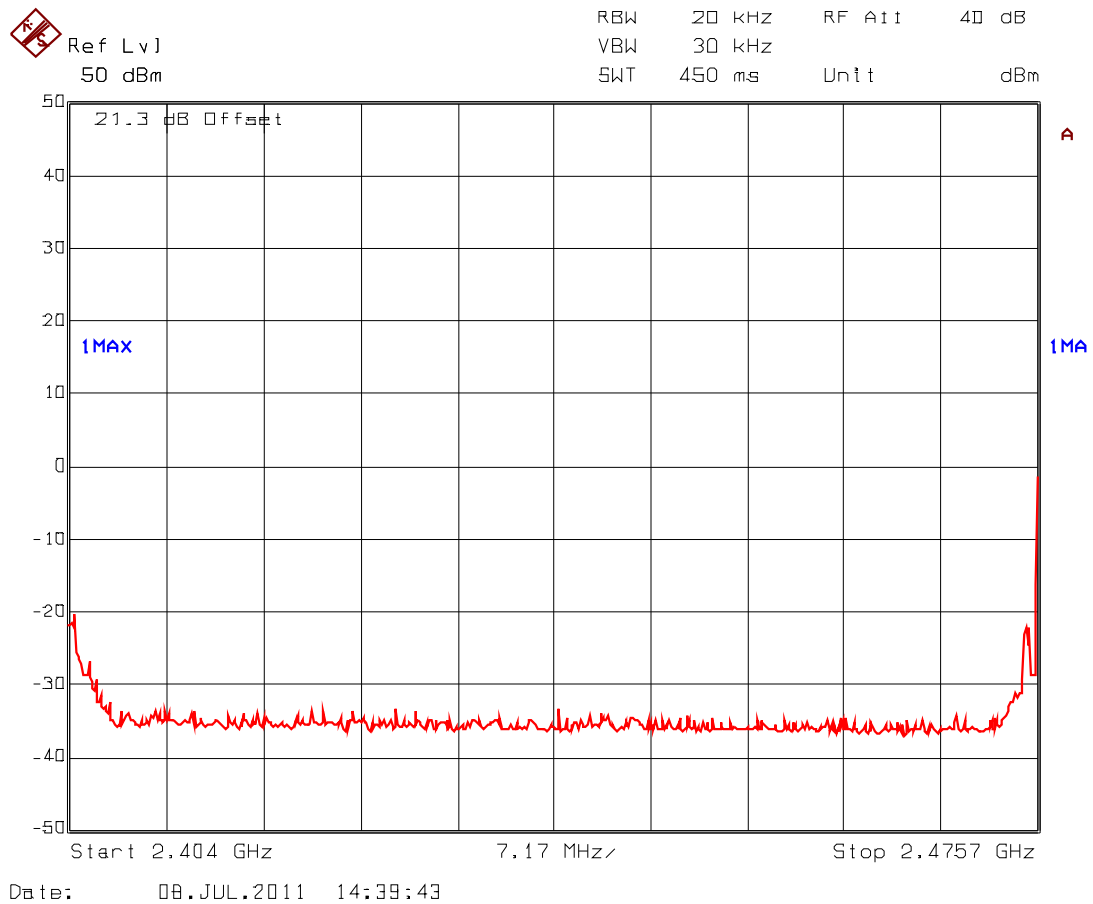
Plot 5.7.4.13 Number of Hopping Frequencies (at low data rate)
Zero Hopping Channels from 2400 – 2401.5 MHz



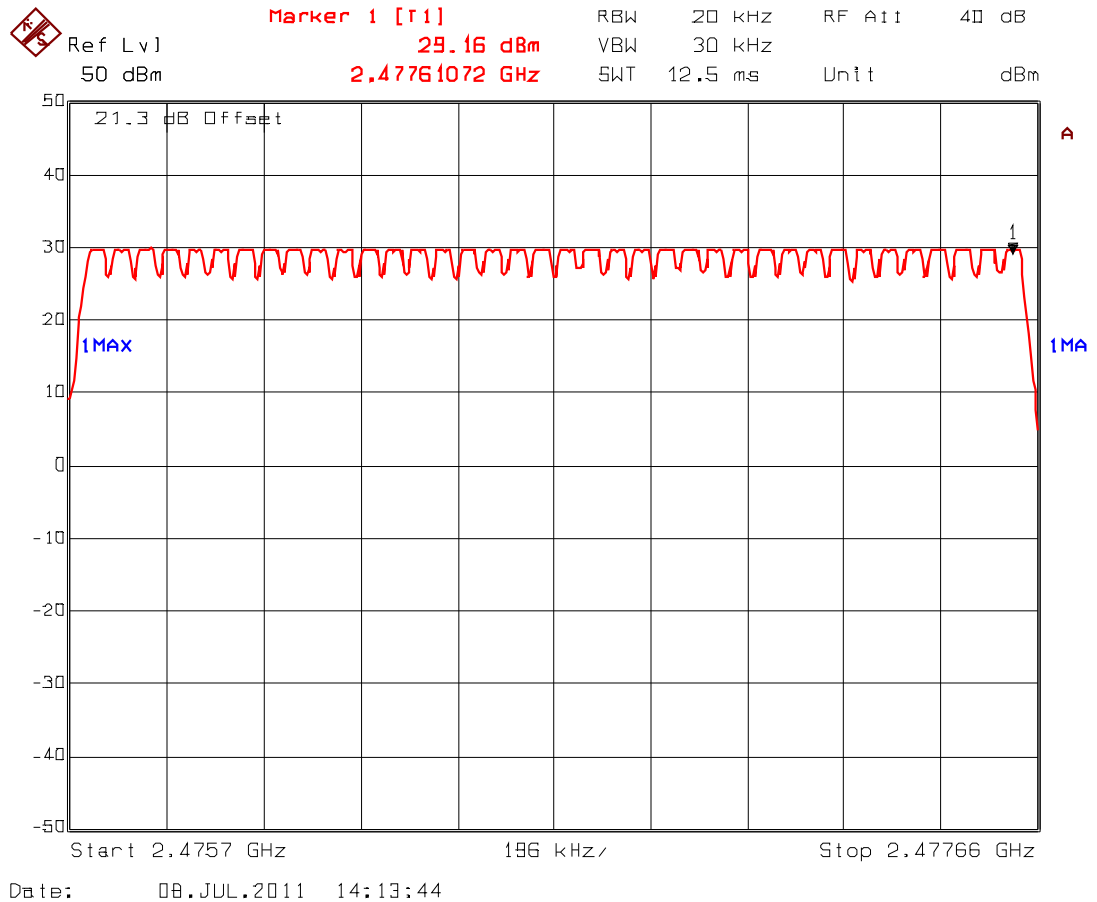
Plot 5.7.4.14 Number of Hopping Frequencies (at low data rate)
38 Hopping Channels from 2401.5 - 2404 MHz



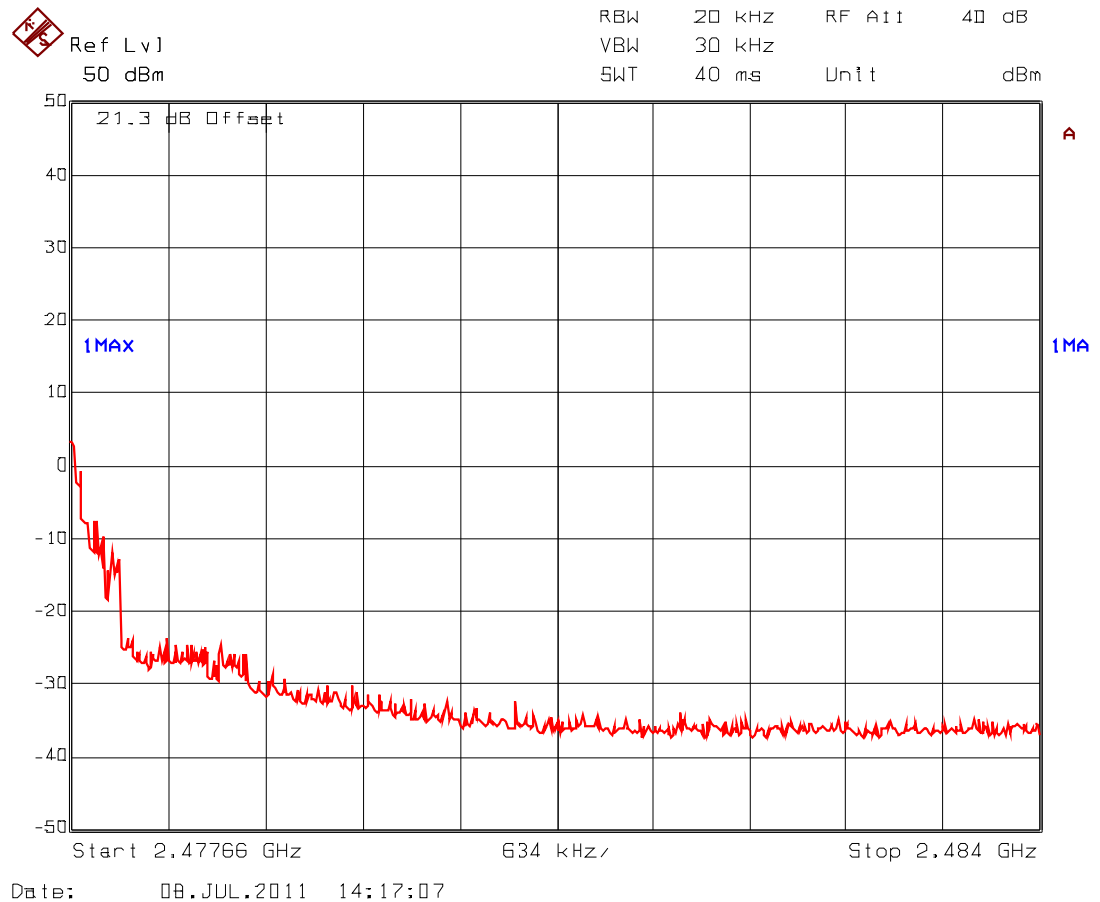
Plot 5.7.4.15 Number of Hopping Frequencies (at low data rate)
Zero Hopping Channels from 2404 – 2475.7 MHz



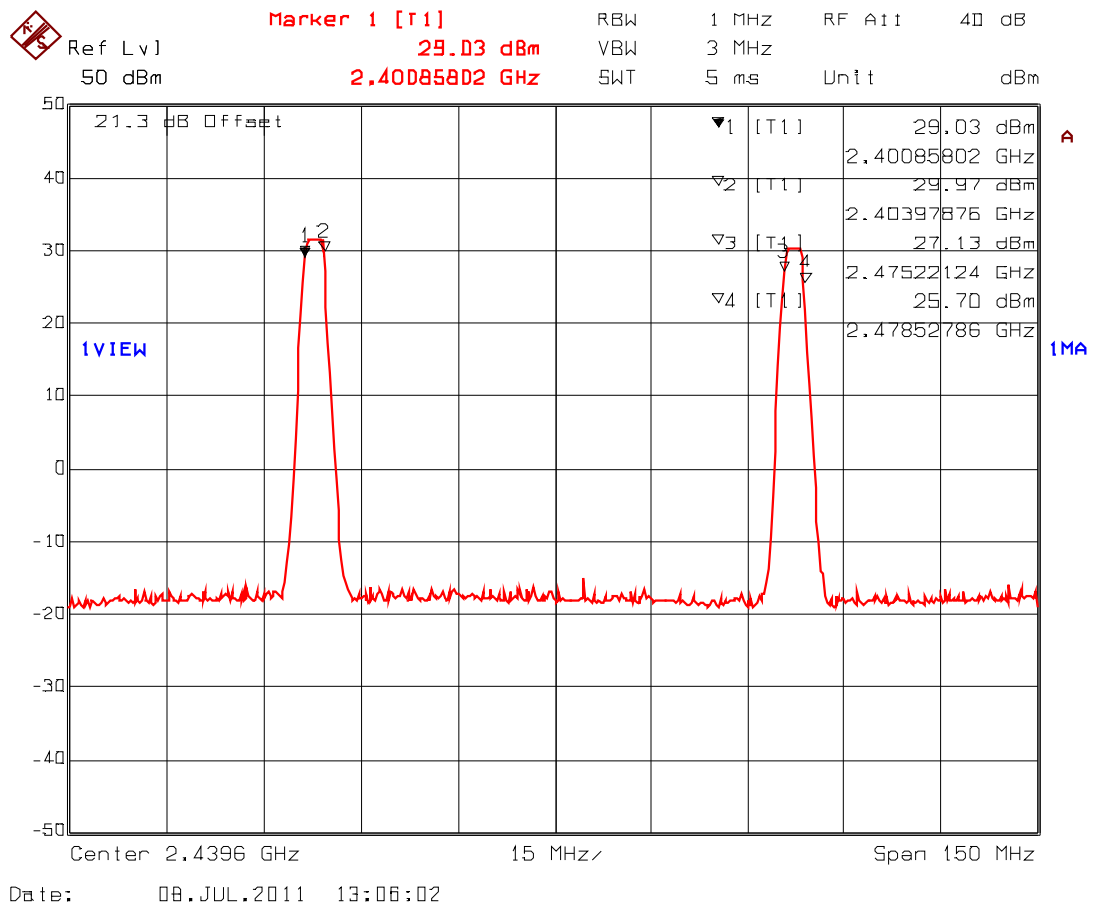
Plot 5.7.4.16 Number of Hopping Frequencies (at low data rate)
38 Hopping Channels from 2475.7- 2477.66 MHz



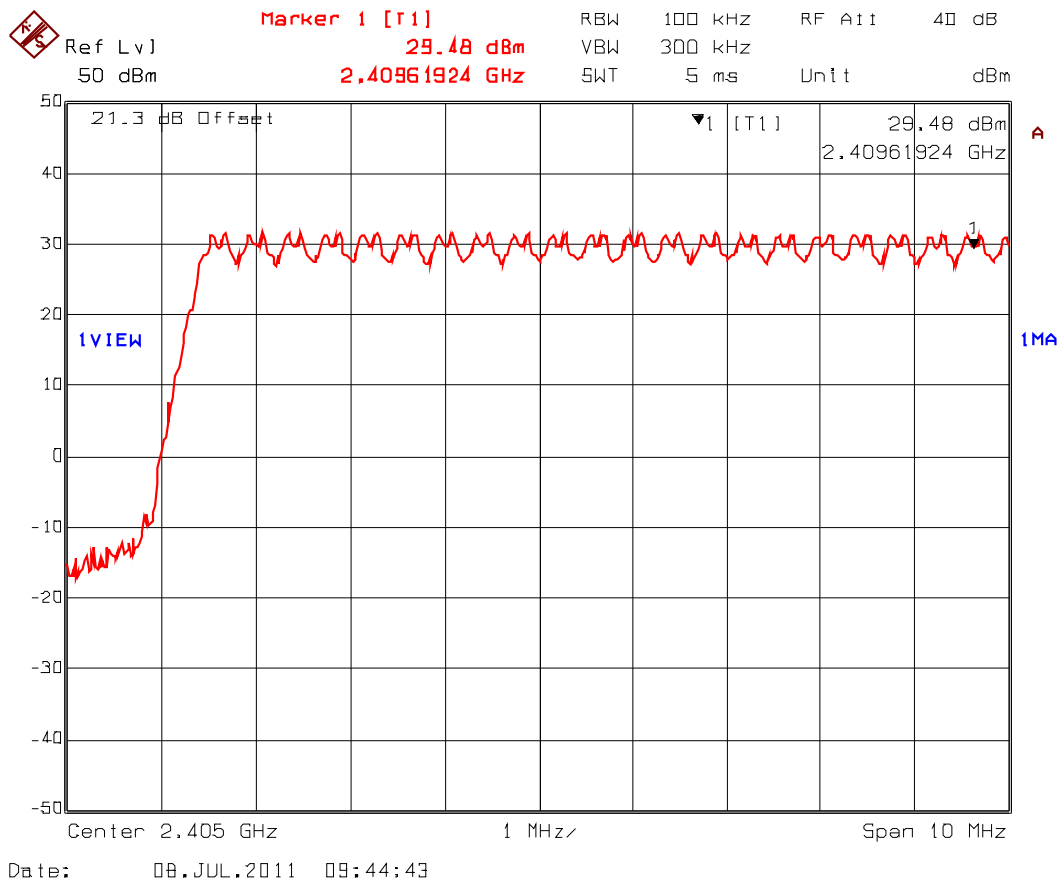
Plot 5.7.4.17 Number of Hopping Frequencies (at low data rate)
Zero Hopping Channels from 2477.66 - 2484 MHz



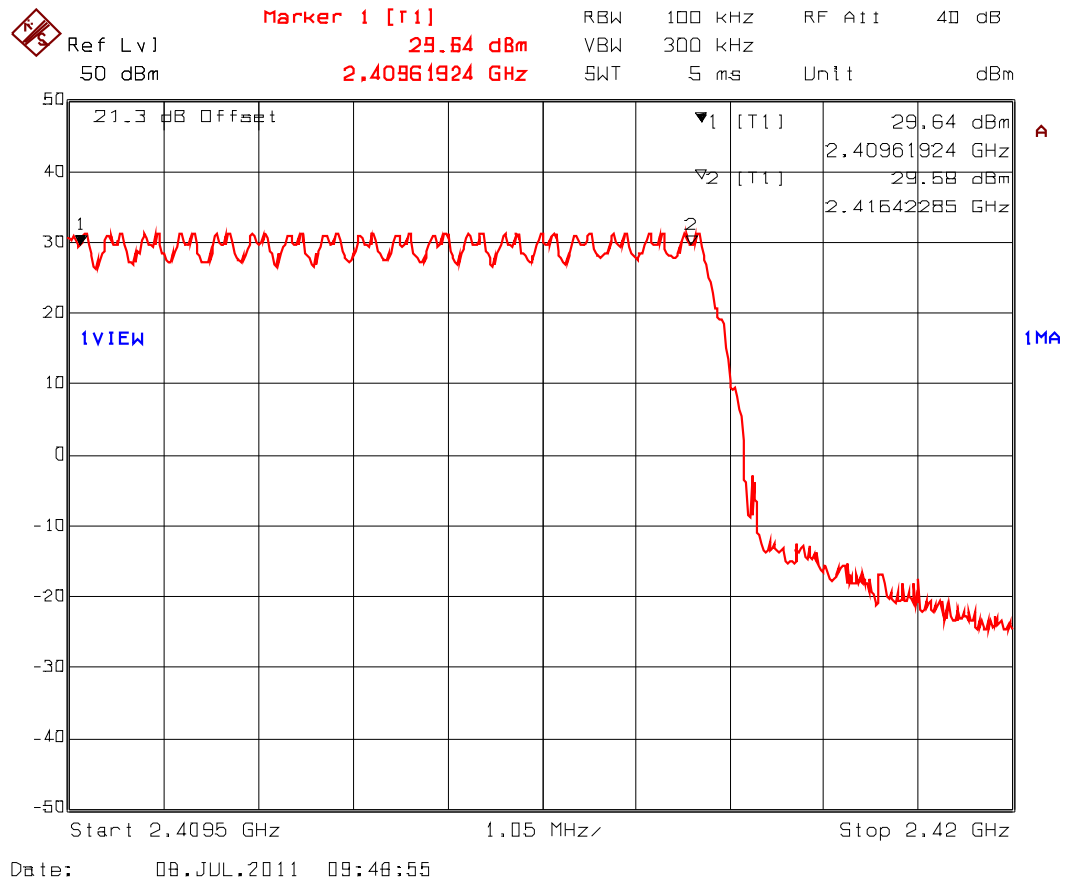
Plot 5.7.4.18 Number of Hopping Frequencies (at low data rate)
Total Hopping Channels from 2400-2483.5 MHz
There are 76 hopping channels (38+38)



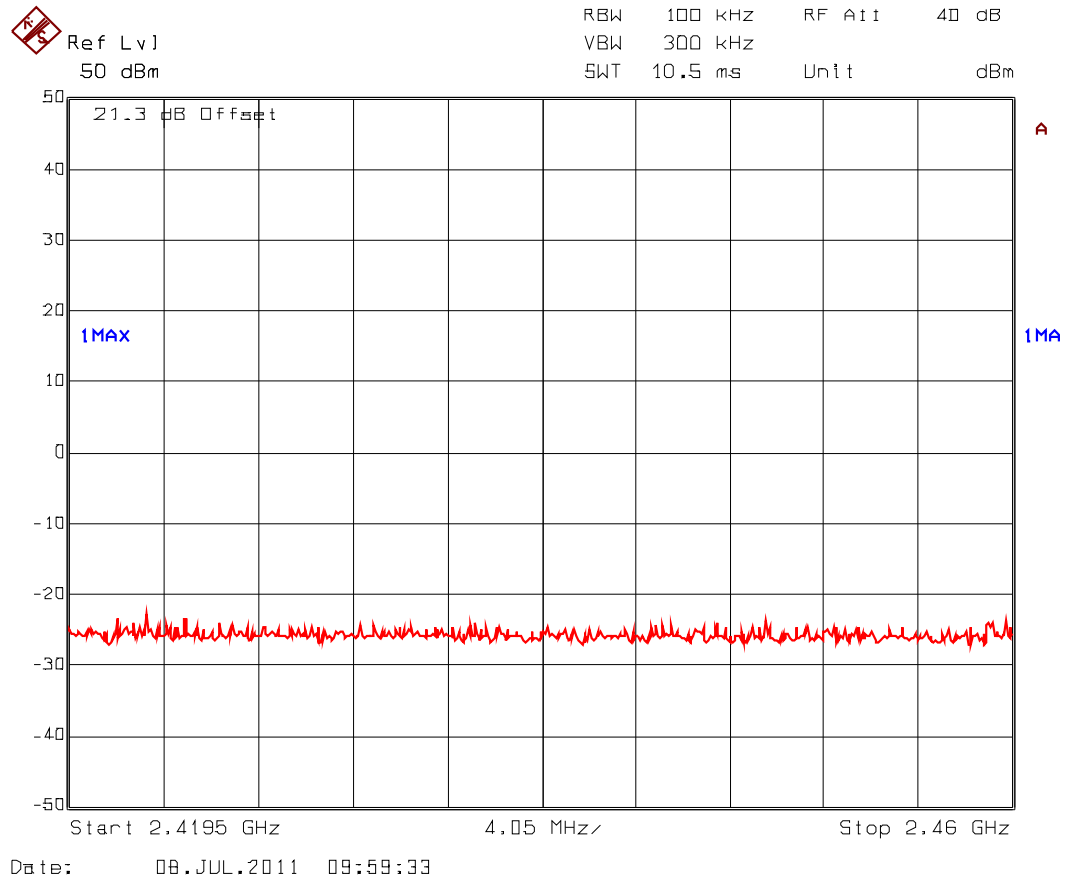
Plot 5.7.4.19 Number of Hopping Frequencies (at high data rate)
21 Hopping Channels from 2400 - 2410 MHz



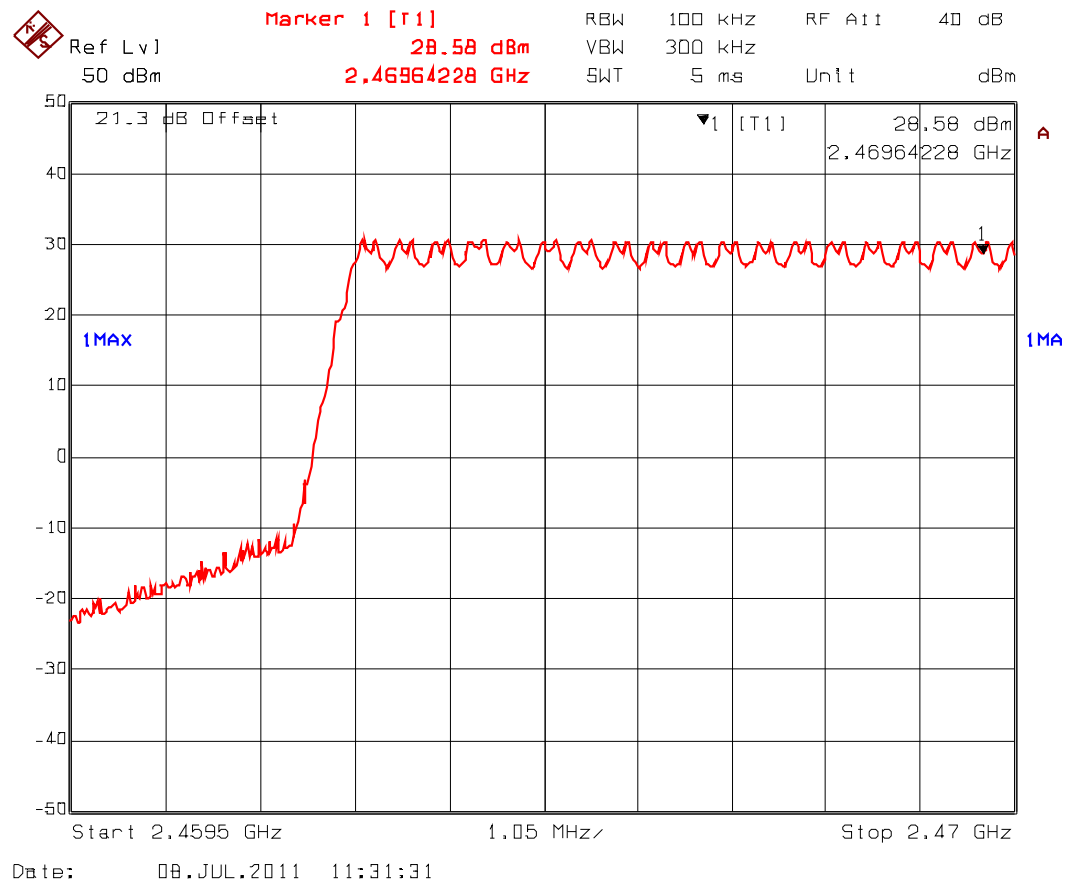
Plot 5.7.4.20 Number of Hopping Frequencies (at high data rate)
17 Hopping Channels from 2410 - 2420 MHz



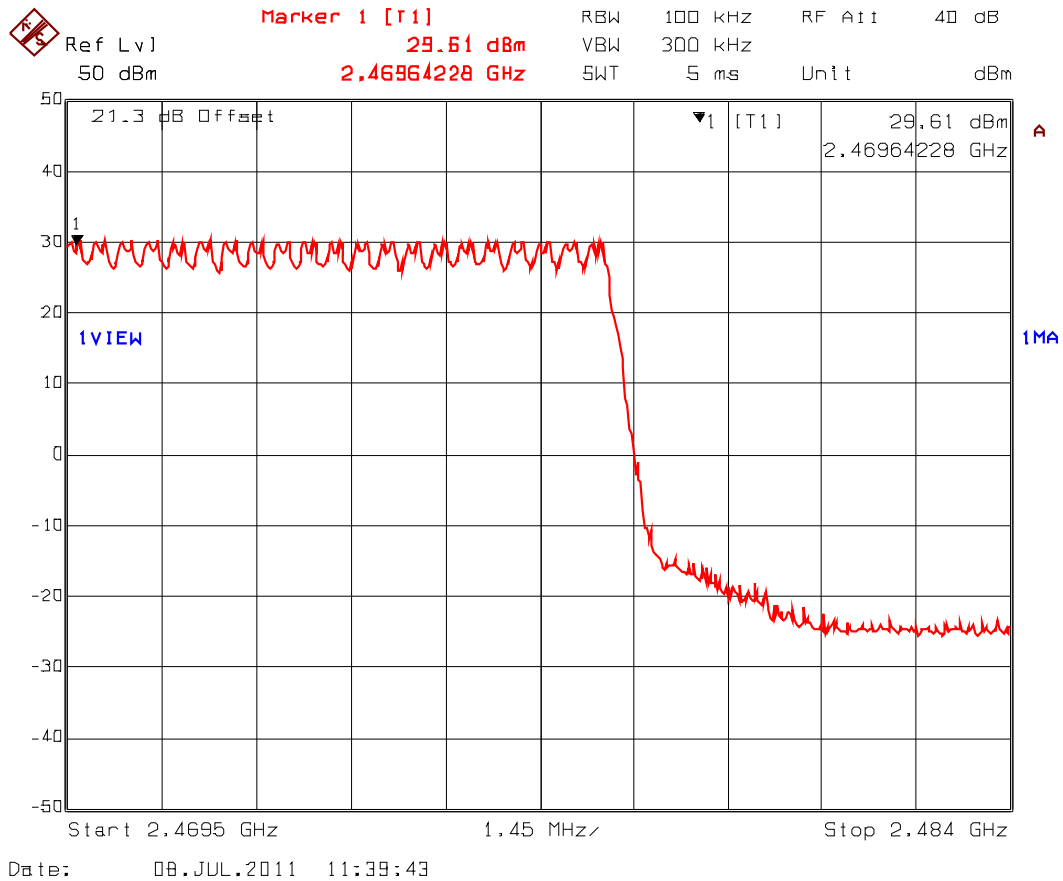
Plot 5.7.4.21 Number of Hopping Frequencies (at high data rate)
Zero Hopping Channels from 2420 - 2460 MHz



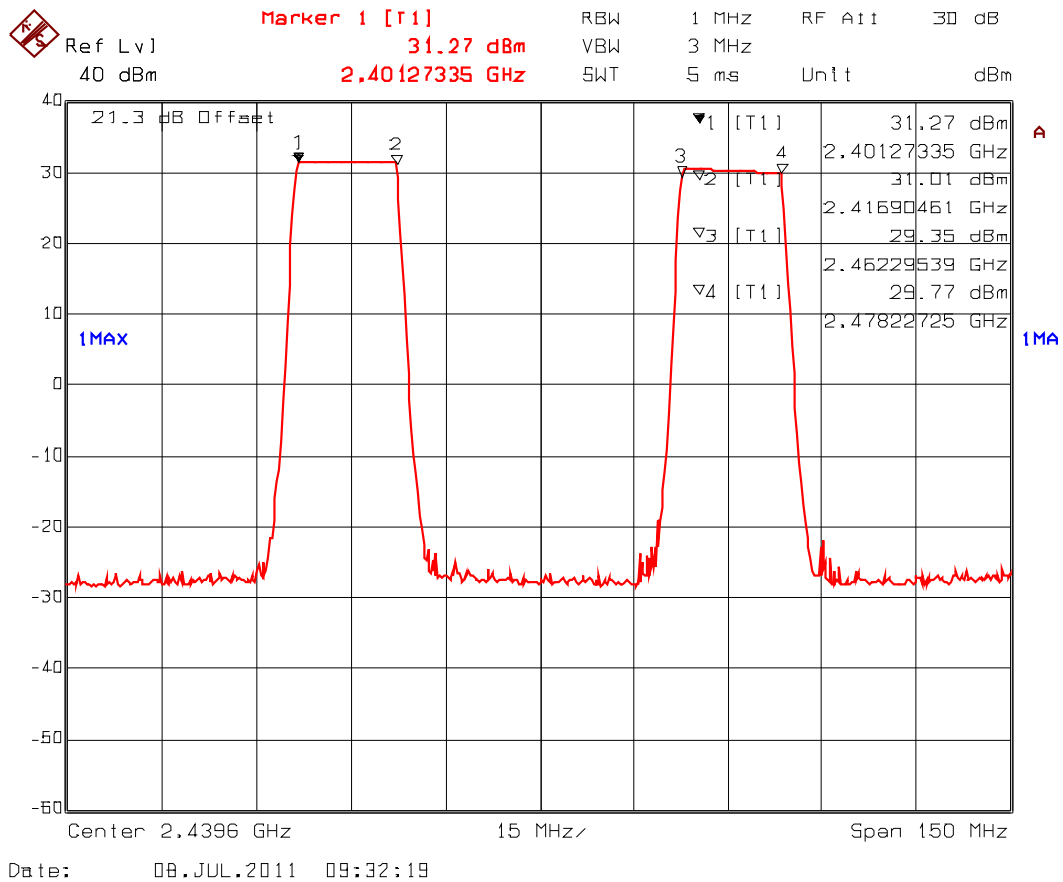
Plot 5.7.4.22 Number of Hopping Frequencies (at high data rate)
18 Hopping Channels from 2460 - 2470 MHz



Plot 5.7.4.23 Number of Hopping Frequencies (at high data rate)
20 Hopping Channels from 2470 - 2484 MHz

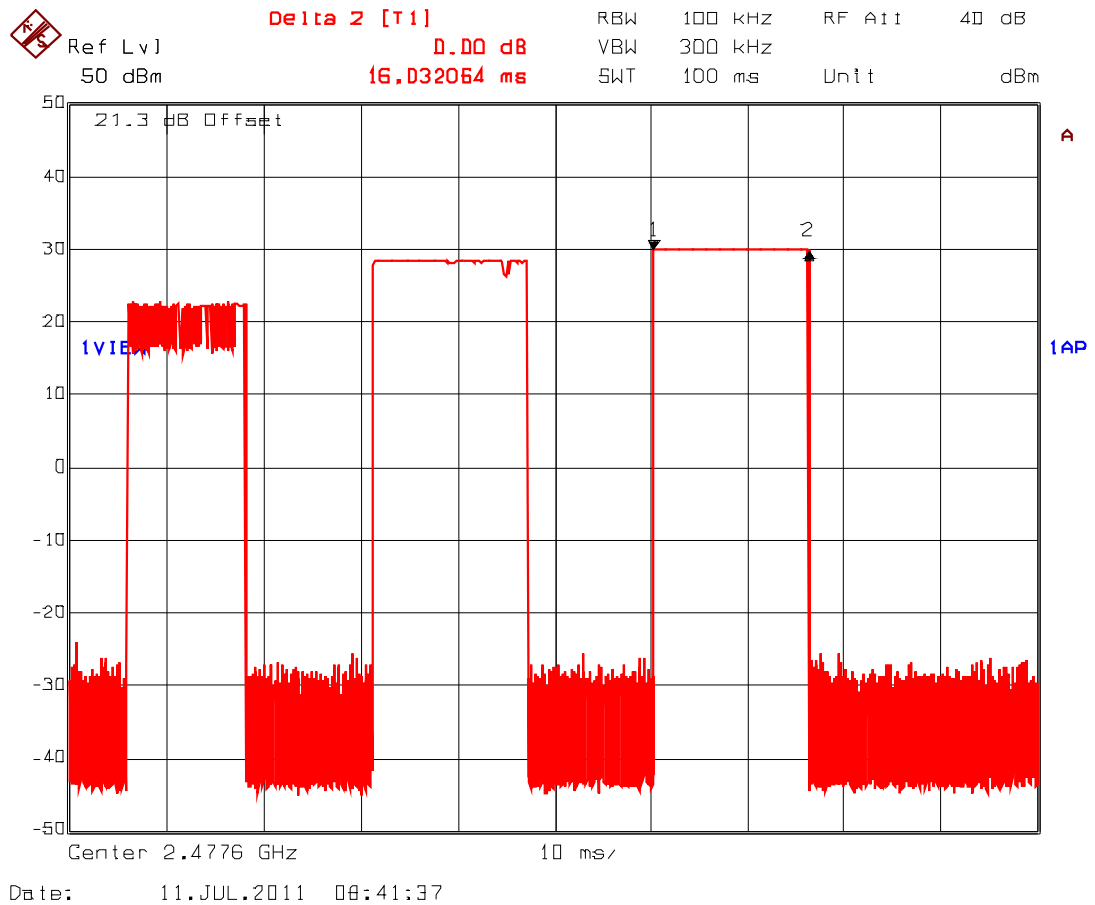


Plot 5.7.4.24 Number of Hopping Frequencies (at high data rate)
Total Hopping Channels from 2400-2483.5 MHz
There are 76 hopping channel



Plot 5.7.4.25 Time of Occupancy
Test Frequency: 2401.6 MHz (at very low data rate)

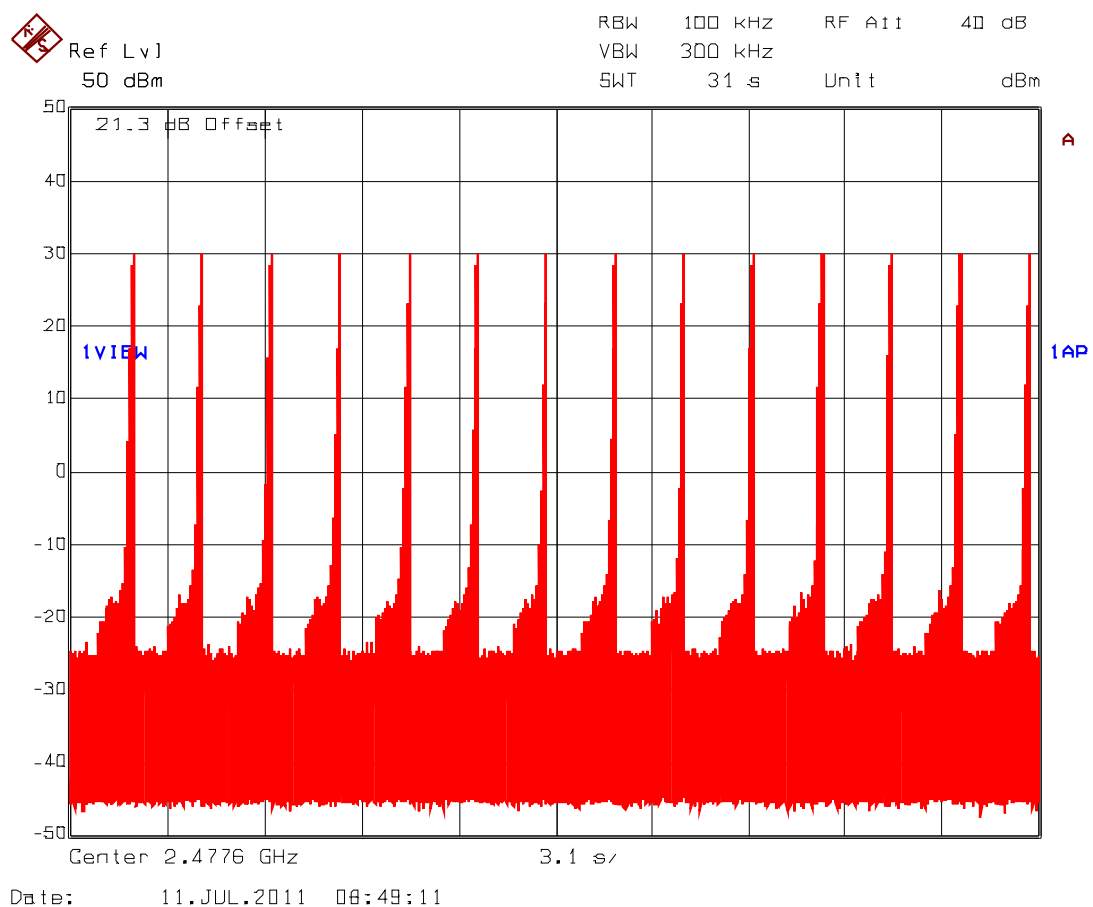
Dwell Time @ 2401.6 MHz = 16.032064 ms



Plot 5.7.4.26 Time of Occupancy
Test Frequency: 2401.6 MHz (at very low data rate)

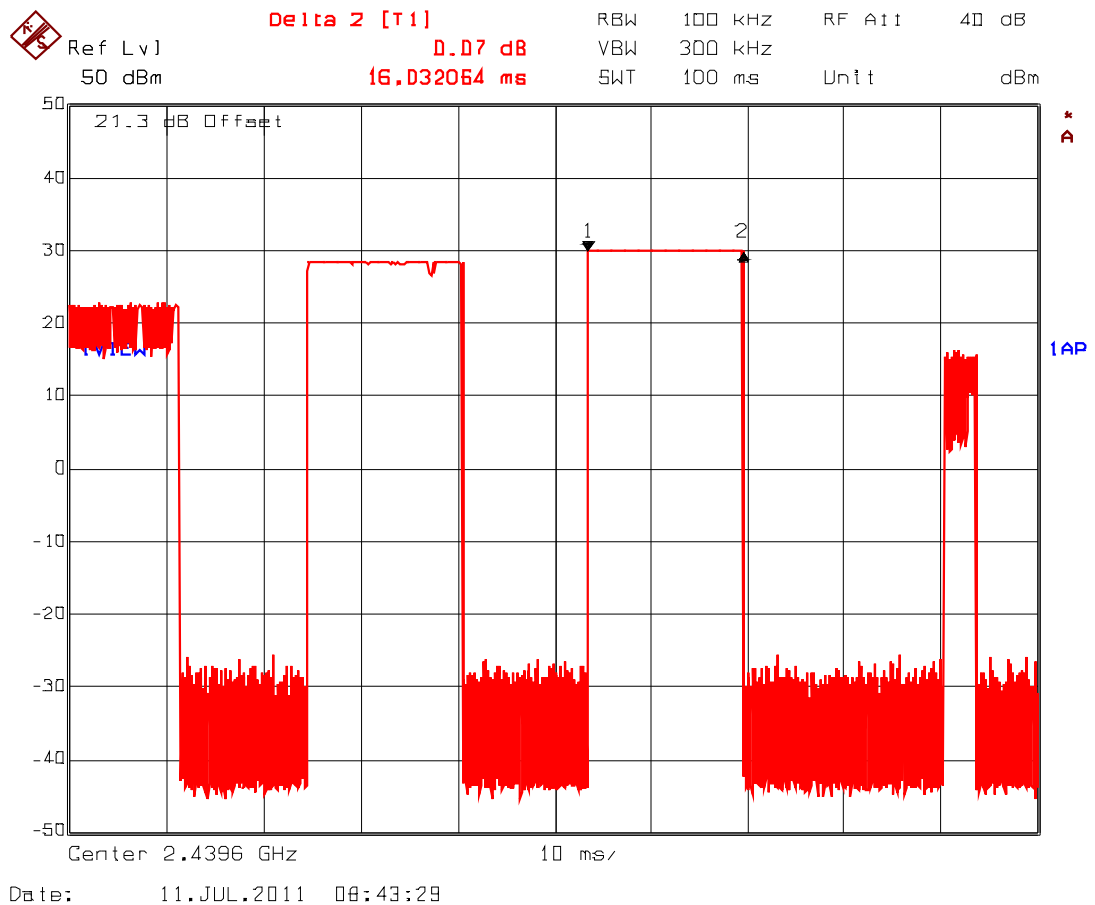
Time of occupancy = (Dwell Time @ 2401.6 MHz) x (number of hops within a period)
= 16.032064ms x 14 = 224.448ms < 400 ms (0.4 sec)

Period = 0.4 seconds * 76 (number of hopping channels employed) = 30.4 seconds



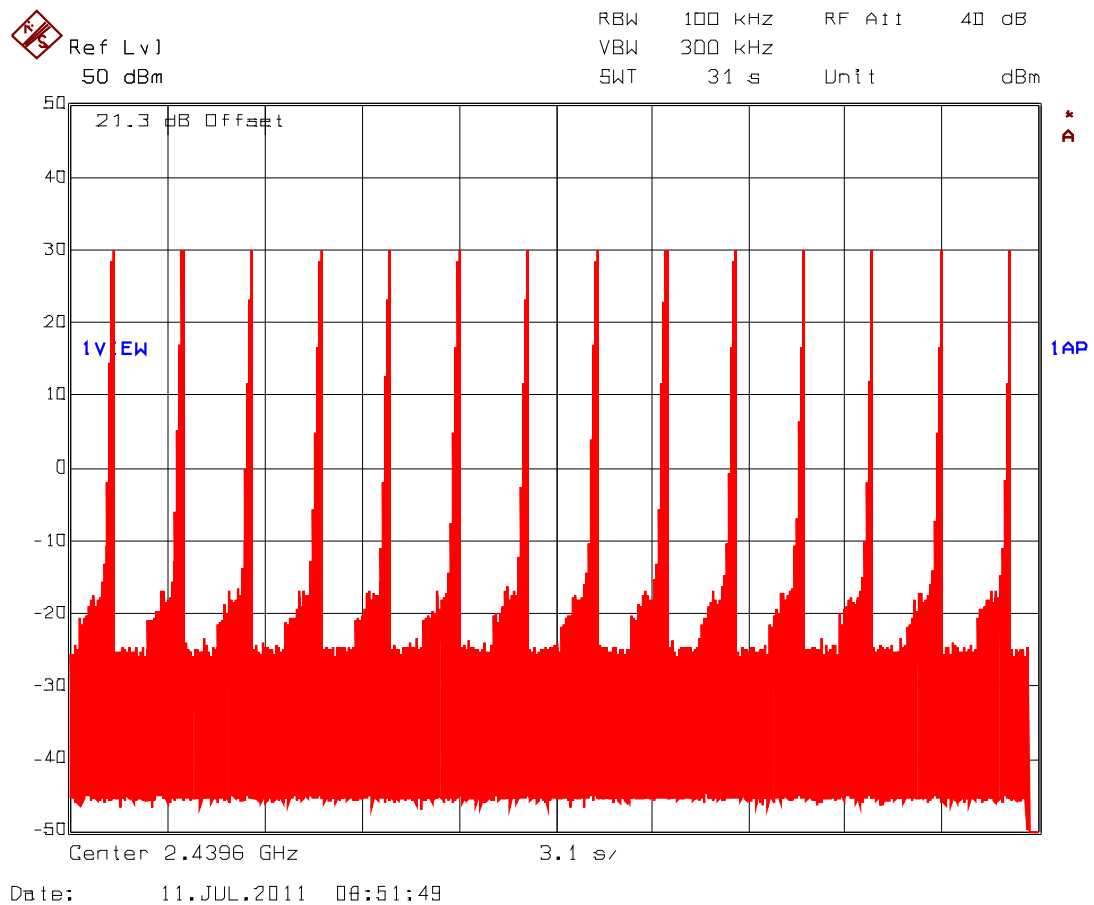
Plot 5.7.4.27 Time of Occupancy
Test Frequency: 2439.6 MHz (at very low data rate)

Dwell Time @ 2439.6 MHz = 16.032064 ms



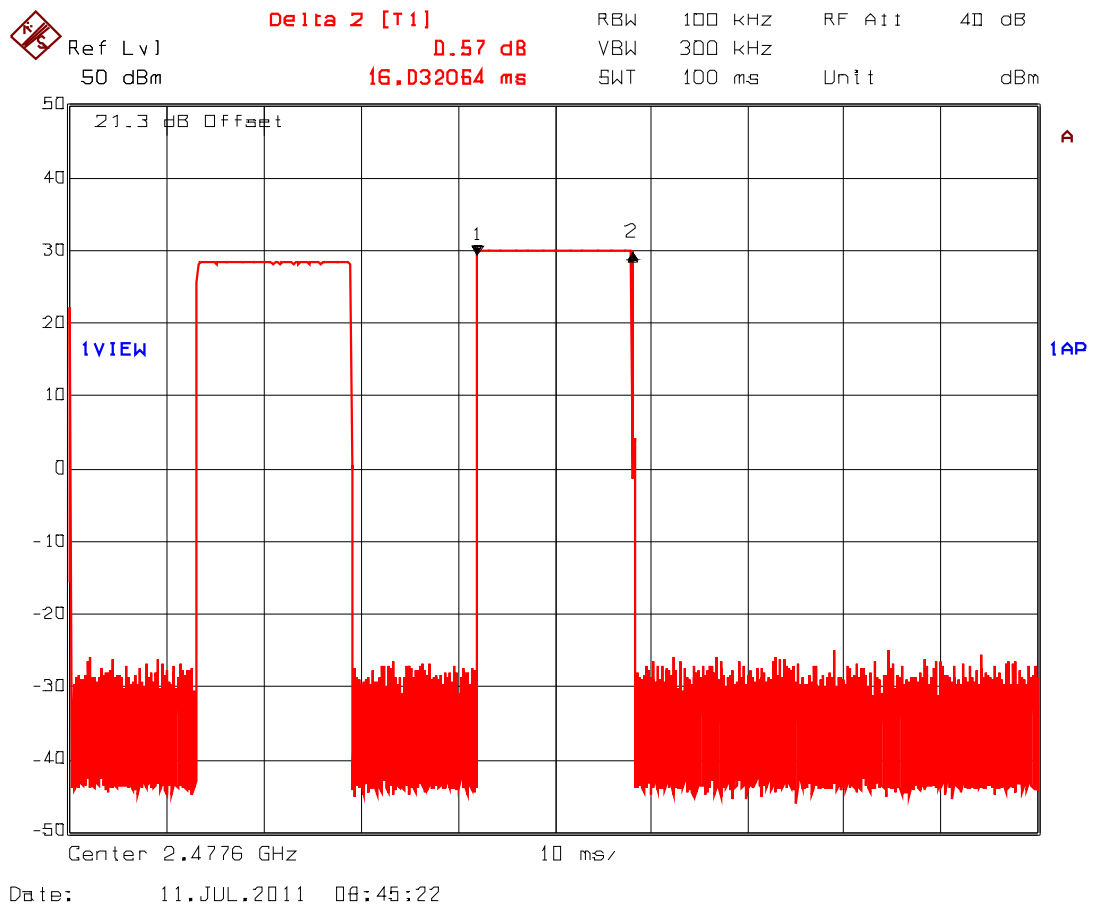
Plot 5.7.4.28 Time of Occupancy
Test Frequency: 2439.6 MHz (at very low data rate)

Average time of occupancy = (Dwell Time @ 2439.6 MHz) x (number of hops within a period)
= 16.032064ms x 14 = 224.448ms < 400 ms (0.4 sec)
Period = 0.4 seconds * 76 (number of hopping channels employed) = 30.4 seconds



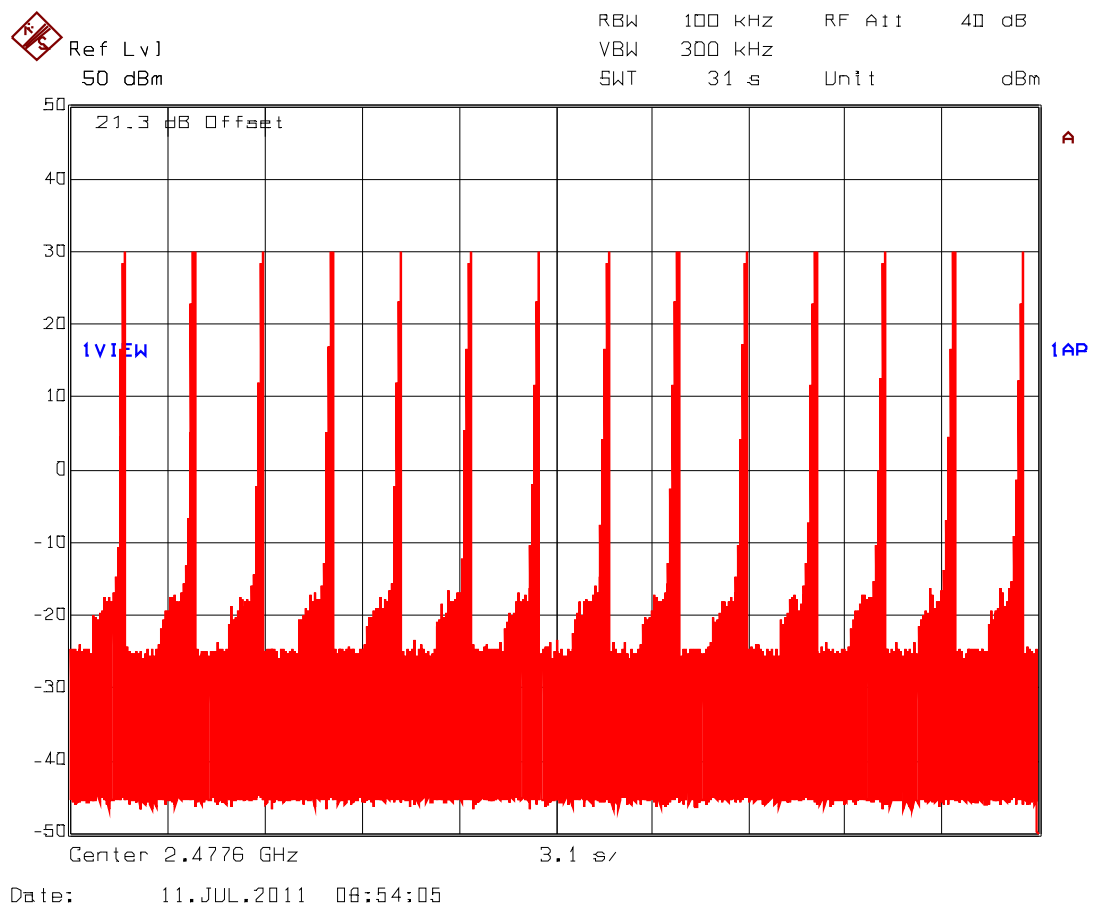
Plot 5.7.4.29 Time of Occupancy
Test Frequency: 2477.6 MHz (at very low data rate)

Dwell Time @ 2477.6 MHz = 16.032064 ms



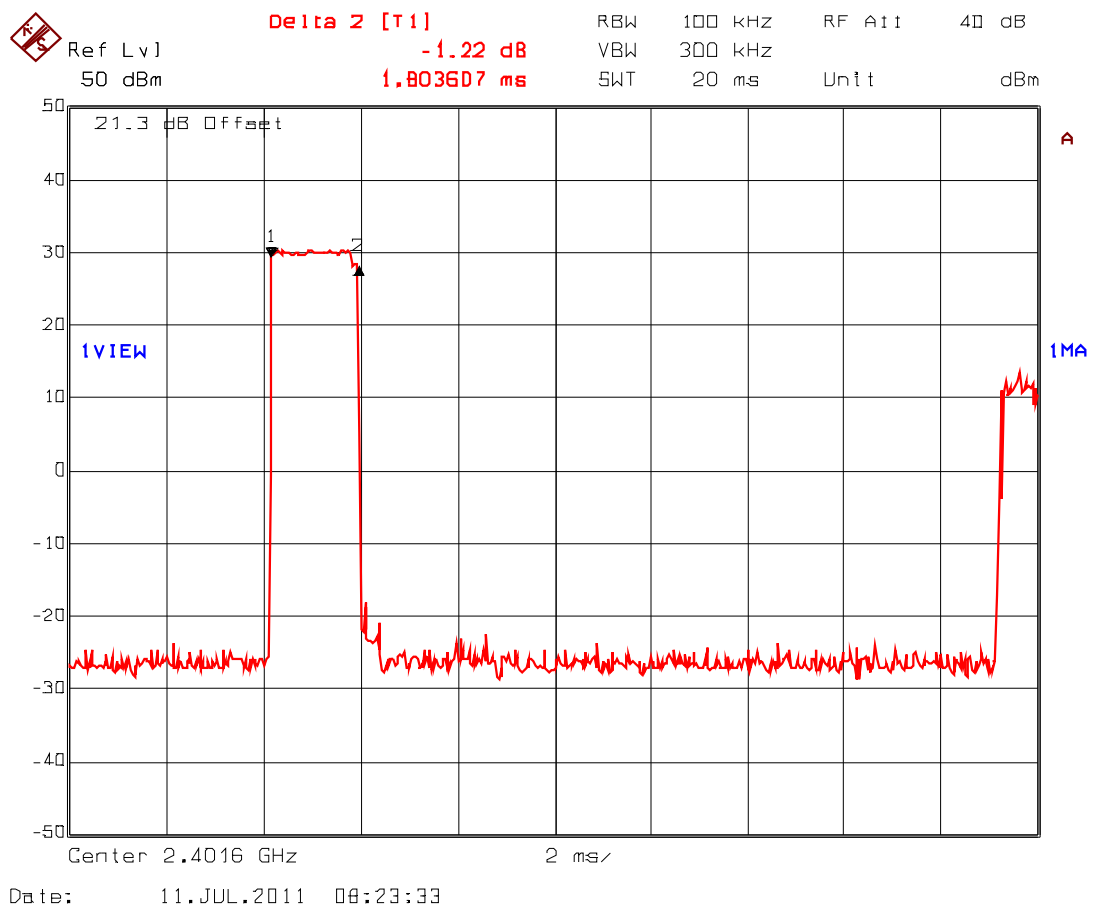
Plot 5.7.4.30 Time of Occupancy
Test Frequency: 2477.6 MHz (at very low data rate)

Average time of occupancy = (Dwell Time @ 2439.6 MHz) x (number of hops within a period)
= 16.032064ms x 14 = 224.448ms < 400 ms (0.4 sec)
Period = 0.4 seconds * 76 (number of hopping channels employed) = 30.4 seconds



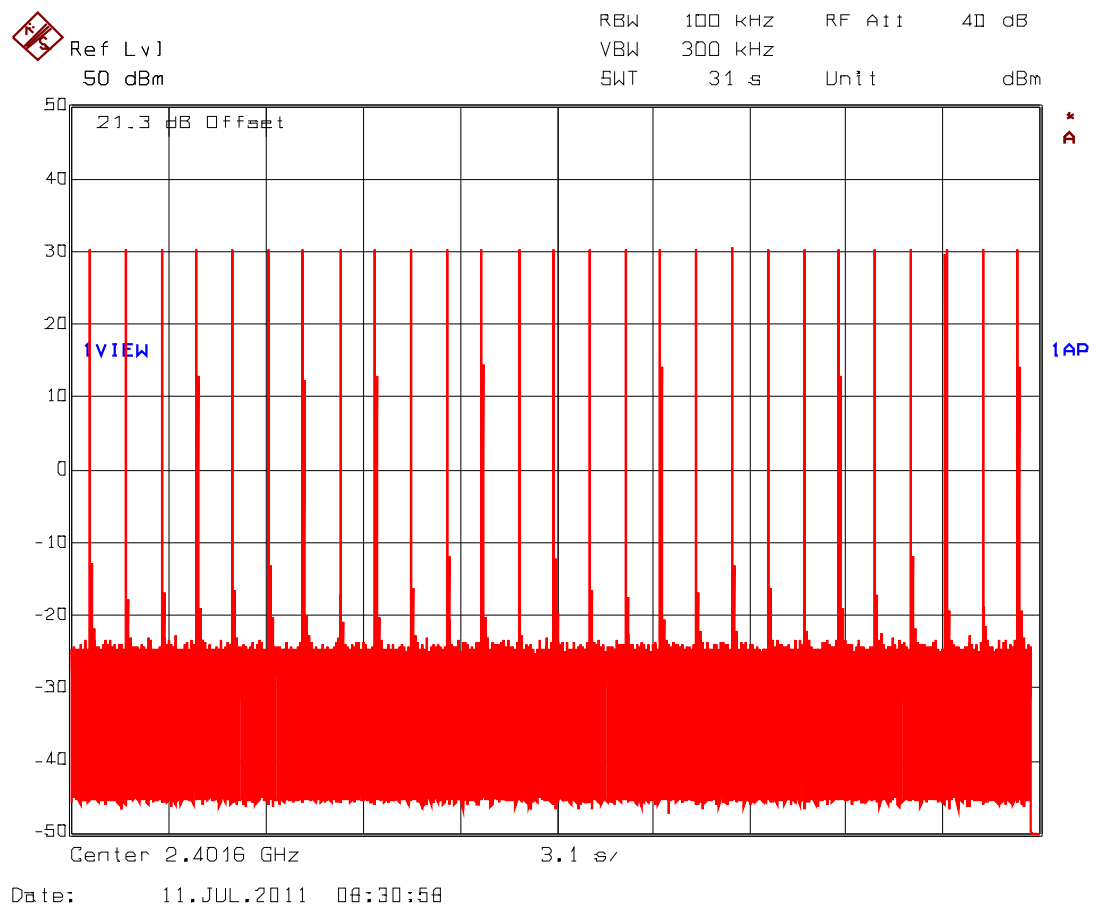
Plot 5.7.4.31 Time of Occupancy
Test Frequency: 2401.6 MHz (at medium data rate)

Dwell Time @ 2401.6 MHz = 1.803607 ms



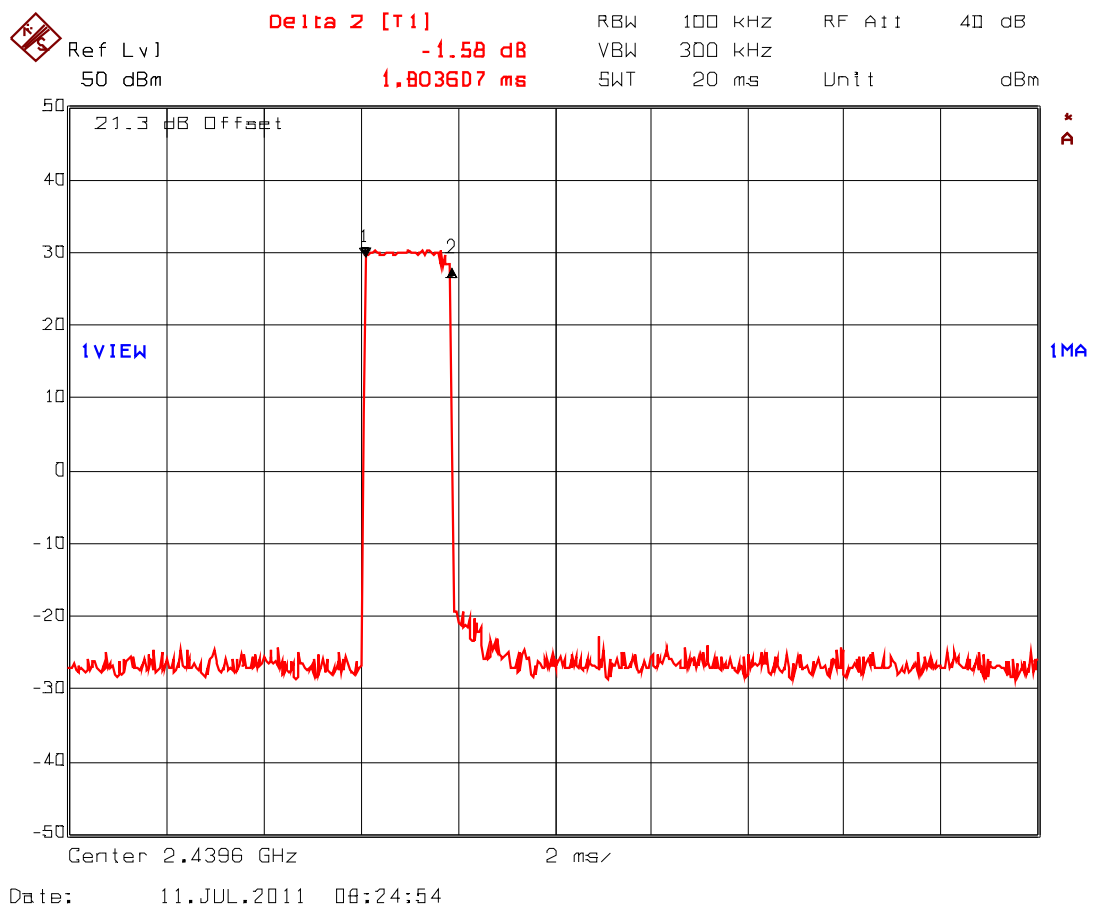
Plot 5.7.4.32 Time of Occupancy
Test Frequency: 2401.6 MHz (at medium data rate)

Time of occupancy = (Dwell Time @ 2401.6 MHz) x (number of hops within a period)
= 1.803607ms x 27 = 48.697ms < 400 ms (0.4 sec)
Period= 0.4 seconds * 76 (number of hopping channels employed) = 30.4 seconds



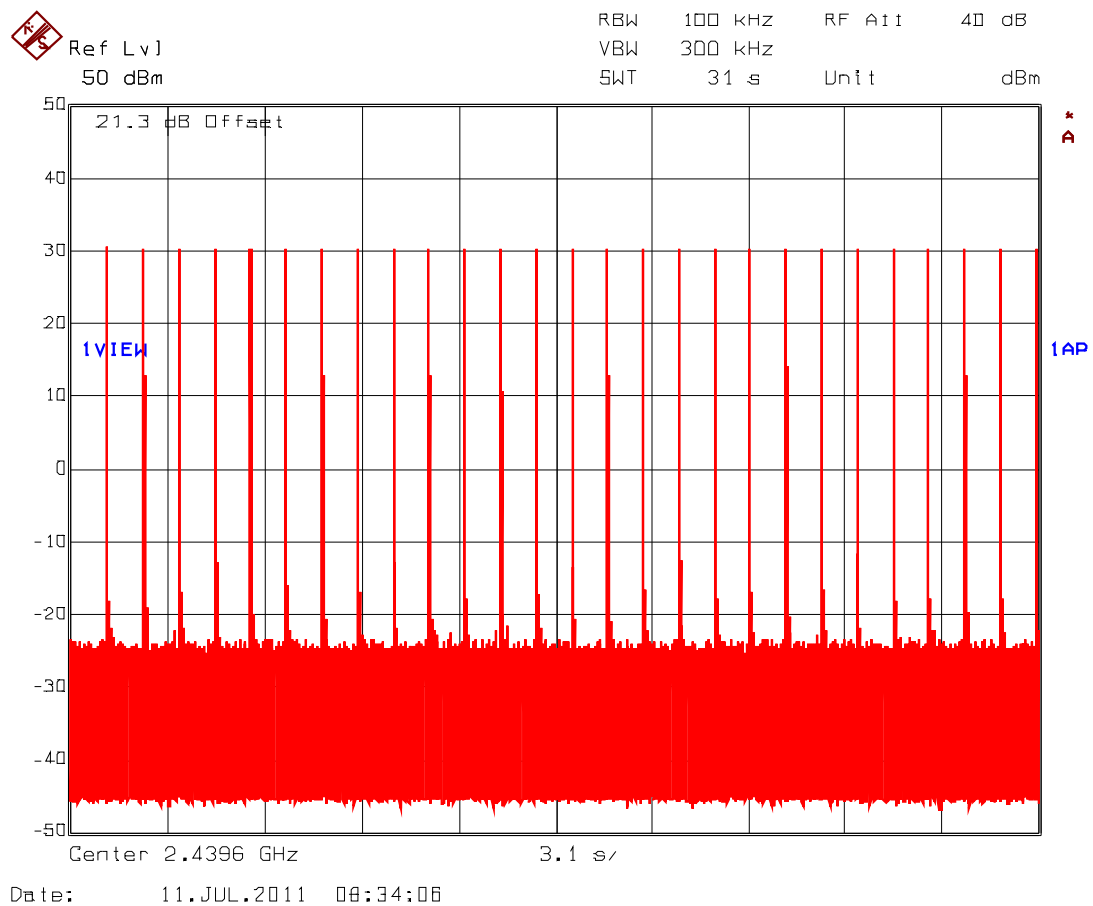
Plot 5.7.4.33 Time of Occupancy
Test Frequency: 2439.6 MHz (at medium data rate)

Dwell Time @ 2439.6 MHz = 1.803607 ms



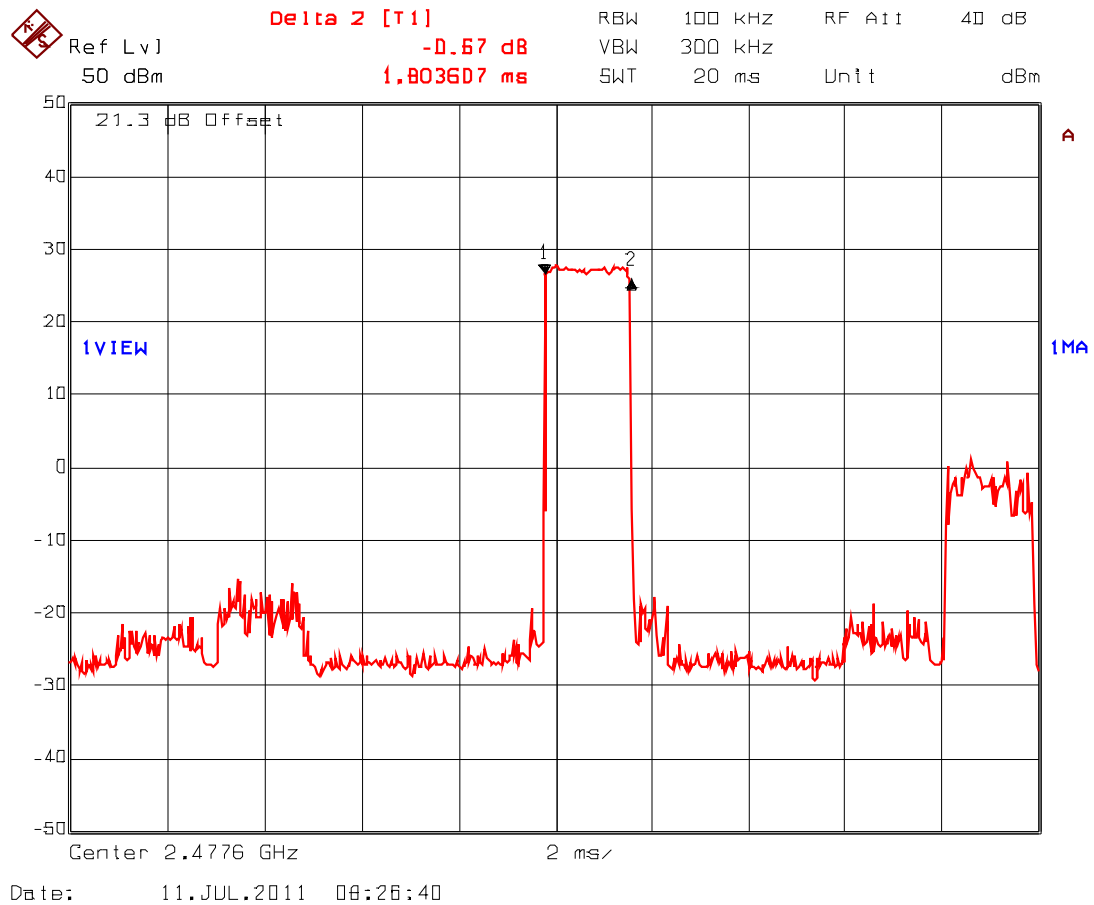
Plot 5.7.4.34 Time of Occupancy
Test Frequency: 2439.6 MHz (at medium data rate)

Time of occupancy = (Dwell Time @ 2439.6 MHz) x (number of hops within a period)
= 1.803607ms x 27 = 48.697ms < 400 ms (0.4 sec)
Period= 0.4 seconds * 76 (number of hopping channels employed) = 30.4 seconds



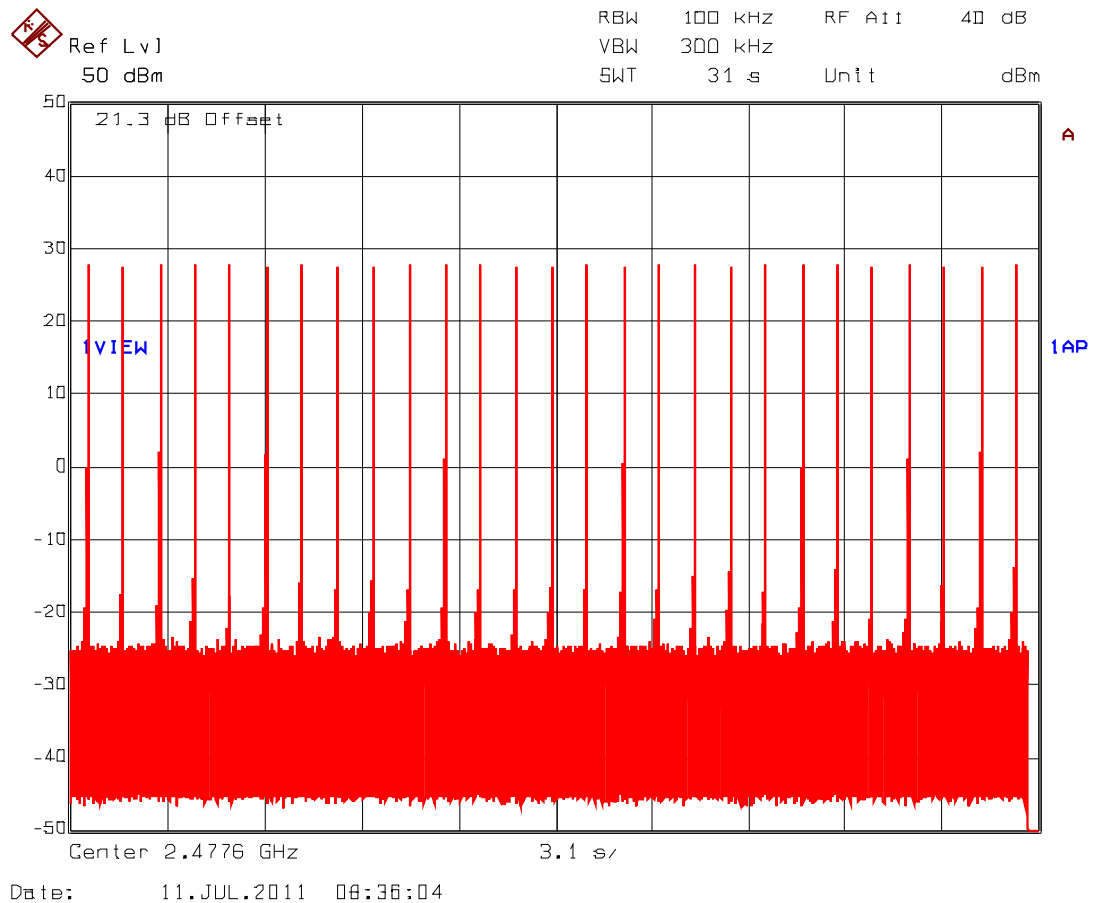
Plot 5.7.4.35 Time of Occupancy
Test Frequency: 2477.6 MHz (at medium data rate)

Dwell Time @ 2477.6 MHz = 1.803607 ms



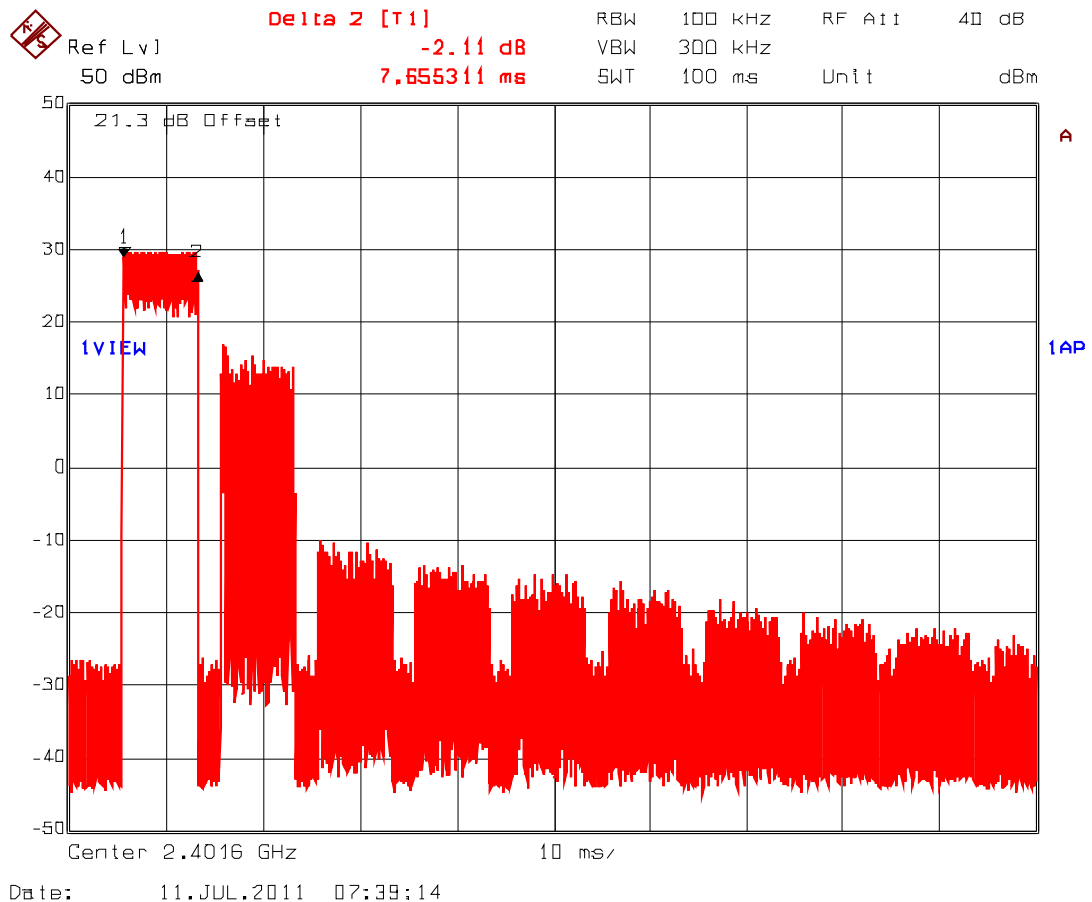
Plot 5.7.4.36 Time of Occupancy
Test Frequency: 2477.6 MHz (at medium data rate)

Time of occupancy = (Dwell Time @ 2477.6 MHz) x (number of hops within a period)
= 1.803607ms x 27 = 48.697ms < 400 ms (0.4 sec)
Period= 0.4 seconds * 76 (number of hopping channels employed) = 30.4 seconds



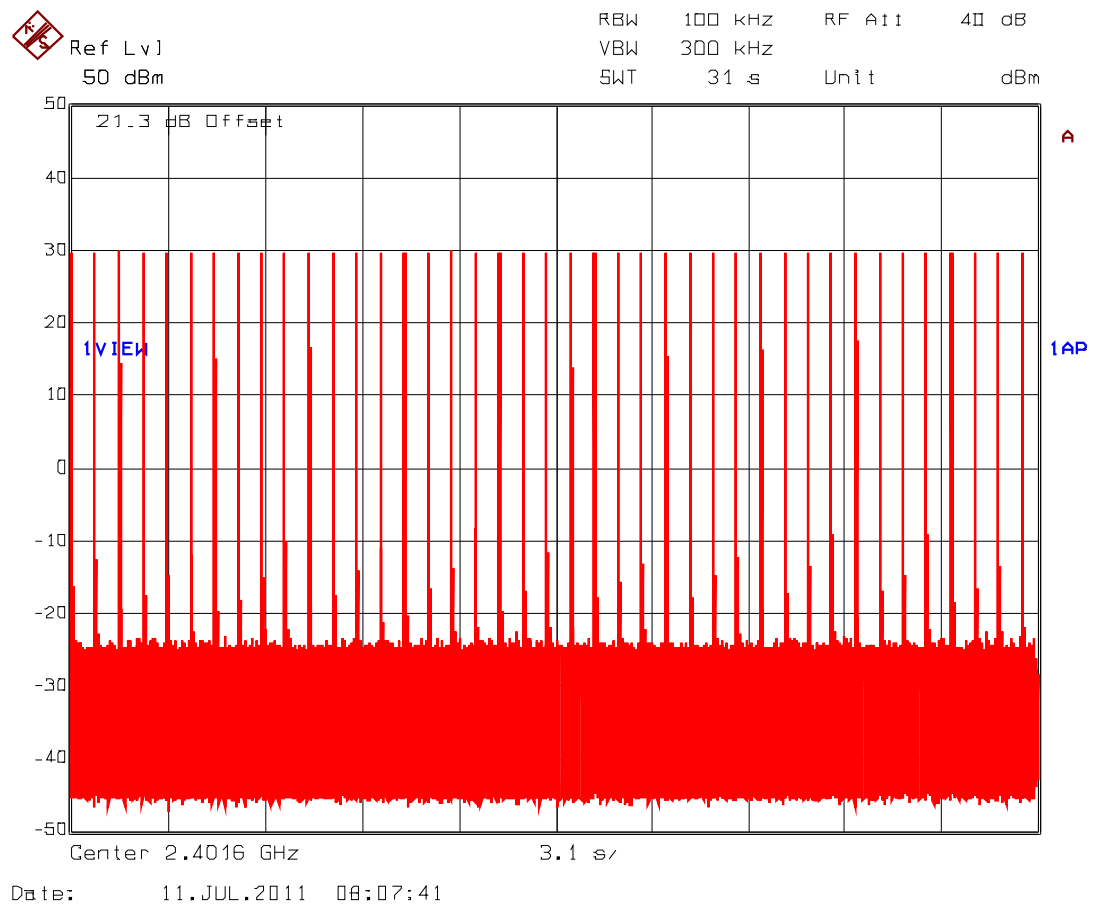
Plot 5.7.4.37 Time of Occupancy
Test Frequency: 2401.6 MHz (at high data rate)

Dwell Time @ 2401.6 MHz = 7.655311 ms



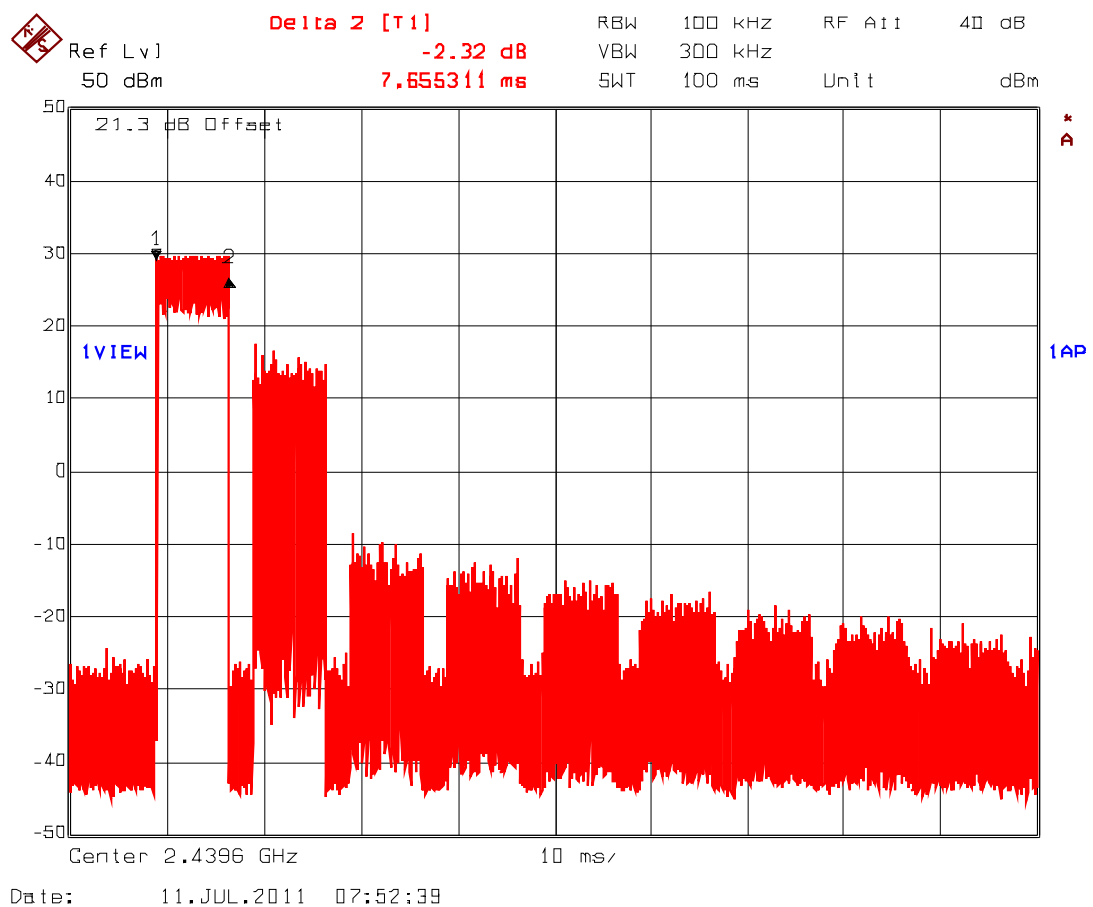
Plot 5.7.4.38 Time of Occupancy
Test Frequency: 2401.6 MHz (at high data rate)

Time of occupancy = (Dwell Time @ 2401.6 MHz) x (number of hops within a period)
= 7.655311ms x 40 = 306.212ms < 400 ms (0.4 sec)
Period= 0.4 seconds * 76 (number of hopping channels employed) = 30.4 seconds



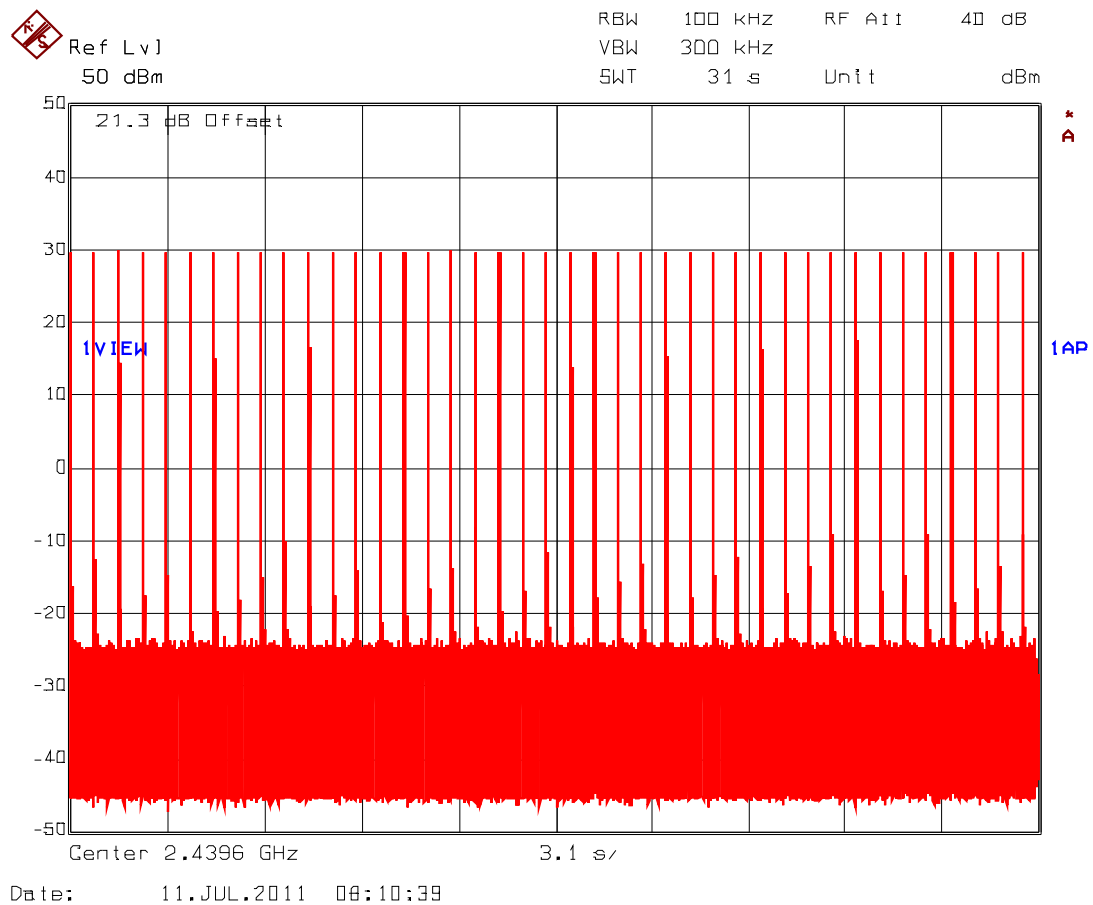
Plot 5.7.4.39 Time of Occupancy
Test Frequency: 2439.6 MHz (at high data rate)

Dwell Time @ 2439.6 MHz = 7.655311 ms



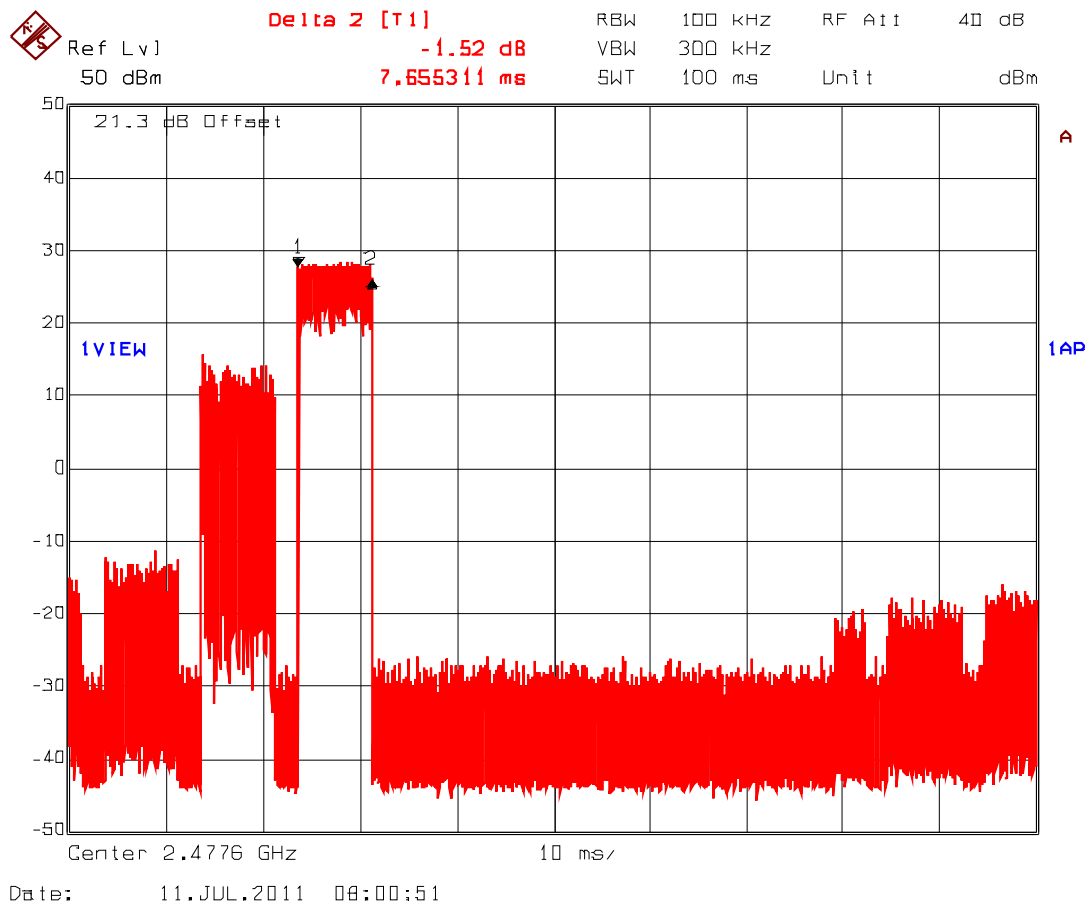
Plot 5.7.4.40 Time of Occupancy
Test Frequency: 2439.6 MHz (at high data rate)

Time of occupancy = (Dwell Time @ 2439.6 MHz) x (number of hops within a period)
= 7.655311ms x 40 = 306.212ms < 400 ms (0.4 sec)
Period= 0.4 seconds * 76 (number of hopping channels employed) = 30.4 seconds



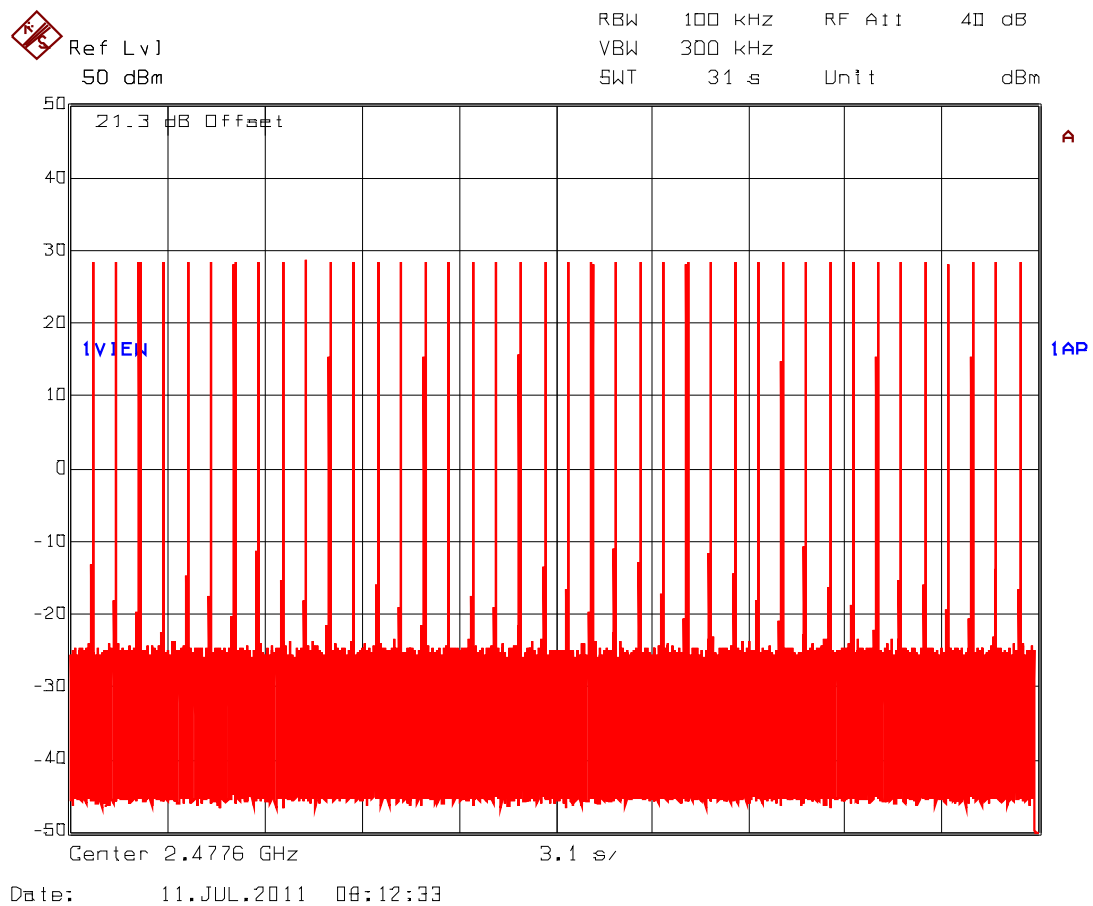
Plot 5.7.4.41 Time of Occupancy
Test Frequency: 2477.6 MHz (at high data rate)

Dwell Time @ 2477.6 MHz = 7.655311 ms



Plot 5.7.4.42 Time of Occupancy
Test Frequency: 2477.6 MHz (at high data rate)

Time of occupancy = (Dwell Time @ 2477.6 MHz) x (number of hops within a period)
= 7.655311ms x 40 = 306.212ms < 400 ms (0.4 sec)
Period= 0.4 seconds * 76 (number of hopping channels employed) = 30.4 seconds



5.8. PEAK OUTPUT POWER & EQUIVALENT ISOTROPIC RADIATED POWER (EIRP) [§ 15.247(b)]

5.8.1. Limit

§15.247(b)(1): For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

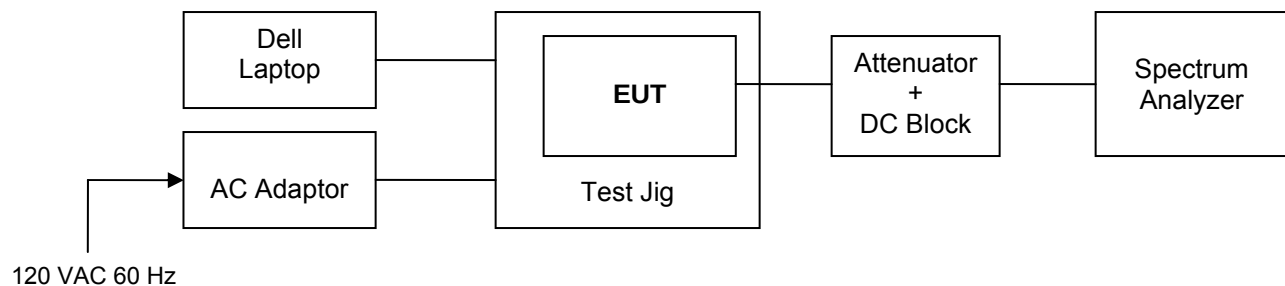
§15.247(b)(4): The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted 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.

§15.247(b)(4)(i): Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

5.8.2. Method of Measurements

FCC Public Notice DA 00-705 and ANSI C63.4.

5.8.3. Test Arrangement



5.8.4. Test Data

(a) High Power Setting for Rubber Ducky Antenna with Max 2 dBi Gain:

Frequency (MHz)	Data Rate	Output Power Measured (dBm)	Output Power Measured (W)	Power with assembly cable loss of 0.81dB (dBm)	EIRP (dBm)	EIRP Limit (dBm)
2401.6	High	29.98	0.9954	29.17	31.17	36.00
2439.6	High	29.98	0.9954	29.17	31.17	36.00
2477.6	High	29.49	0.8892	28.68	30.68	36.00

(b) High Power Setting for Flat Patch Antenna with Max 14 dBi Gain:

Frequency (MHz)	Data Rate	Output Power Measured (dBm)	Output Power Measured (W)	Power with assembly cable loss of 1.41dB (dBm)	EIRP (dBm)	EIRP Limit (dBm)
2401.6	High	22.35	0.1718	20.94	34.94	36.00
2439.6	High	22.35	0.1718	20.94	34.94	36.00
2477.6	High	22.22	0.1667	20.81	34.81	36.00

(c) High Power Setting for Yagi Antenna with Max 14.5 dBi Gain:

Frequency (MHz)	Data Rate	Output Power Measured (dBm)	Output Power Measured (W)	Power with assembly cable loss of 1.41dB (dBm)	EIRP (dBm)	EIRP Limit (dBm)
2401.6	High	22.35	0.1718	20.94	35.44	36.00
2439.6	High	22.35	0.1718	20.94	35.44	36.00
2477.6	High	22.22	0.1667	20.81	35.31	36.00

(d) High Power Setting for Omni Directional Antenna with Max 15 dBi Gain:

Frequency (MHz)	Data Rate	Output Power Measured (dBm)	Output Power Measured (W)	Power with assembly cable loss of 1.41dB (dBm)	EIRP (dBm)	EIRP Limit (dBm)
2401.6	High	22.35	0.1718	20.94	35.94	36.00
2439.6	High	22.35	0.1718	20.94	35.94	36.00
2477.6	High	22.22	0.1667	20.81	35.81	36.00

(e) Low Power Setting applicable to all Antenna types:

Frequency (MHz)	Data Rate	Output Power Measured (dBm)	Output Power Measured (W)
2401.6	High	19.98	0.0995
2439.6	High	19.43	0.0877
2477.6	High	19.43	0.0877

Notes:

1. The EIRP shall be calculated based on the transmitter antenna gain (G_{dBi}), cable loss (CL_{dB}) and peak output power at antenna terminal (P_{dBm}). Calculated EIRP = $P_{dBm} + G_{dBi} - CL_{dB}$
2. EIRP shall not exceed 36 dBm limit (Power Setting = $36\text{ dBm} - G_{dBi} + CL_{dB}$). See page 2 of the Operating Manual for instruction of power setting.
3. The output powers of the module was checked for all three data rates and found identical hence the output powers with highest data rate are recorded.

5.9. RF EXPOSURE REQUIRMENTS [§§ 15.247(b)(5), 1.1310 & 2.1091]

5.9.1. Limit

§ 15.247(b)(5): Systems operating under provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1).

§ 1.1310:- The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

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.

5.9.2. Method of Measurements

Refer to Sections 1.1310, 2.1091 and Public Notice DA 00-705 (March 30, 2000)

Spread spectrum transmitters operating under section 15.247 are categorically from routine environmental evaluation to demonstrating RF exposure compliance with respect to MPE and/or SAR limits. These devices are not exempted from compliance (As indicated in Section 15.247(b)(4), these transmitters are required to operate in a manner that ensures that exposure to public users and nearby persons) does not exceed the Commission's RF exposure guidelines (see Section 1.1307 and 2.1093). Unless a device operates at substantially low power levels, with a low gain antenna(s), supporting information is generally needed to establish the various potential operating configurations and exposure conditions of a transmitter and its antenna(s) in order to determine compliance with the RF exposure guidelines.

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

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

For portable transmitters (see Section 2.1093), or devices designed to operate next to a person's body, compliance is determined with respect to the SAR limit (define in the body tissues) for near-field exposure conditions. If the maximum average output power, operating condition configurations and exposure conditions are comparable to those of existing cellular and PCS phones, SAR evaluation may be required in order to determine if such a device complies with SAR limit. When SAR evaluation data is not available, and the additional supporting information cannot assure compliance, the Commission may request that an SAR evaluation be performed, as provided for in Section 1.1307(d)

5.9.3. Test Data

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: 23 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:

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

$$S = 1 \text{ mW/cm}^2$$

$$EIRP = 36.0 \text{ dBm} = 10^{36/10} \text{ mW max. (Worst Case)}$$

$$r = (EIRP/4\pi S)^{1/2} = (10^{36/10}/4\pi(1))^{1/2} = \mathbf{18 \text{ cm}}$$

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

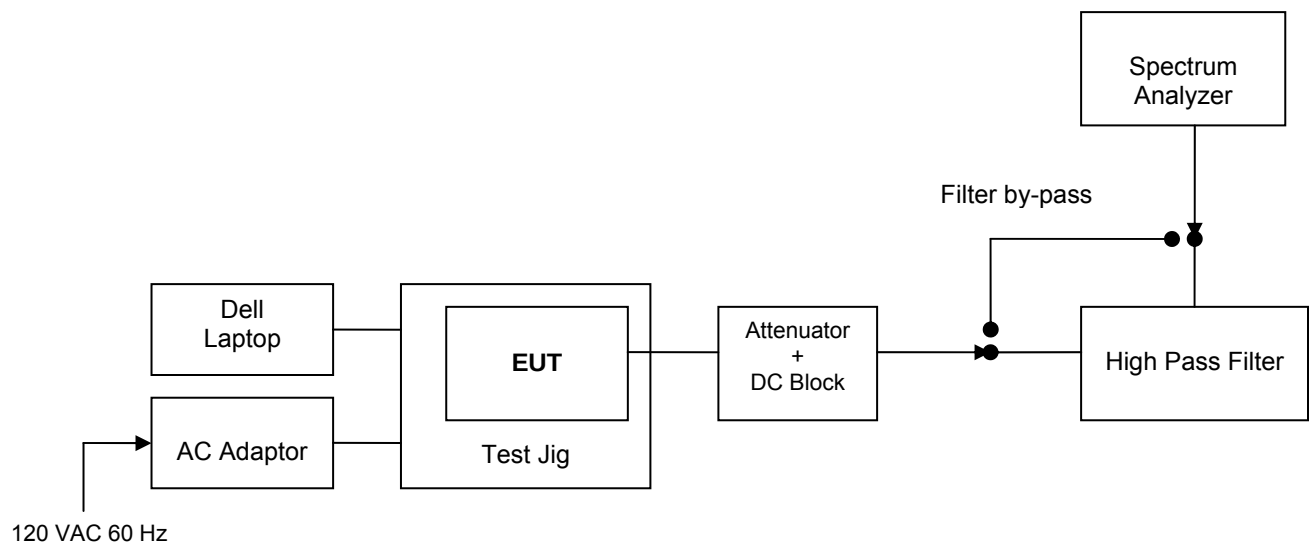
5.10.1. Limit

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

5.10.2. Method of Measurements

FCC Public Notice DA 00-705.

5.10.3. Test Arrangement

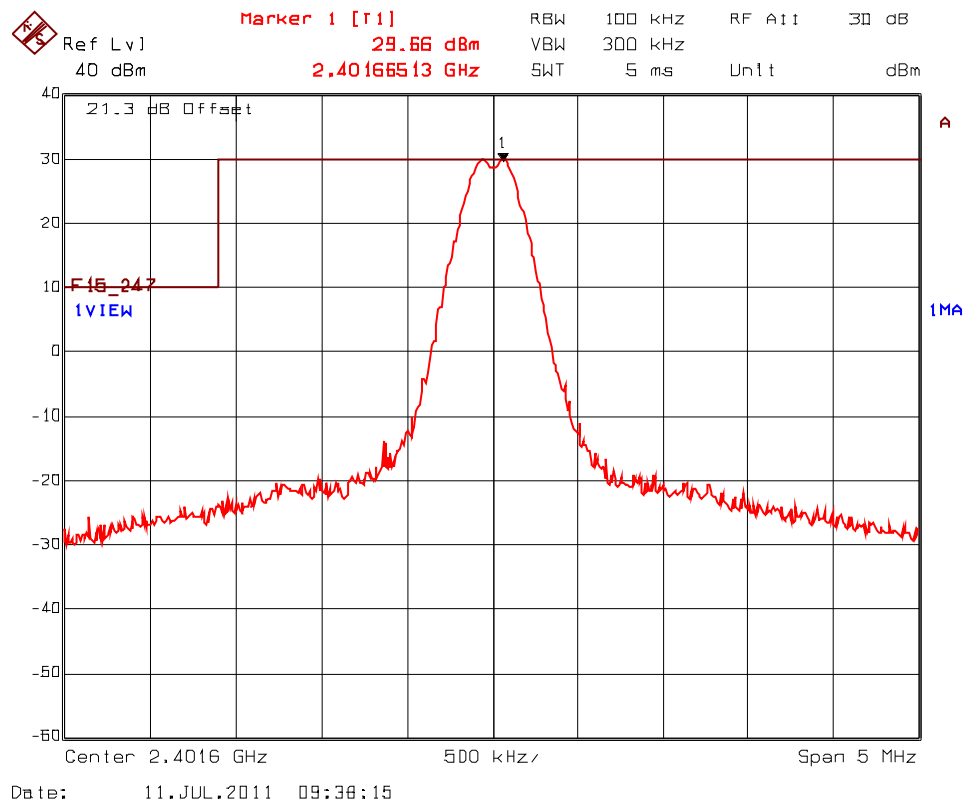


5.10.4. Test Data

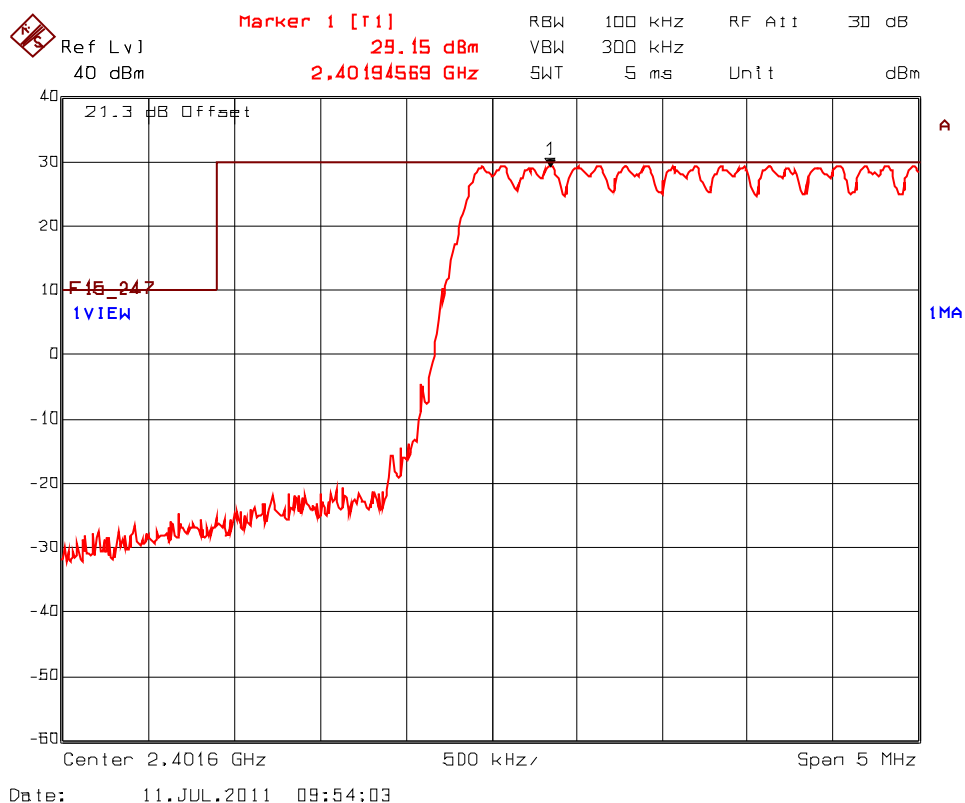
5.10.4.1. Band-Edge RF Conducted Emissions

See the following test data plots for measurement results:

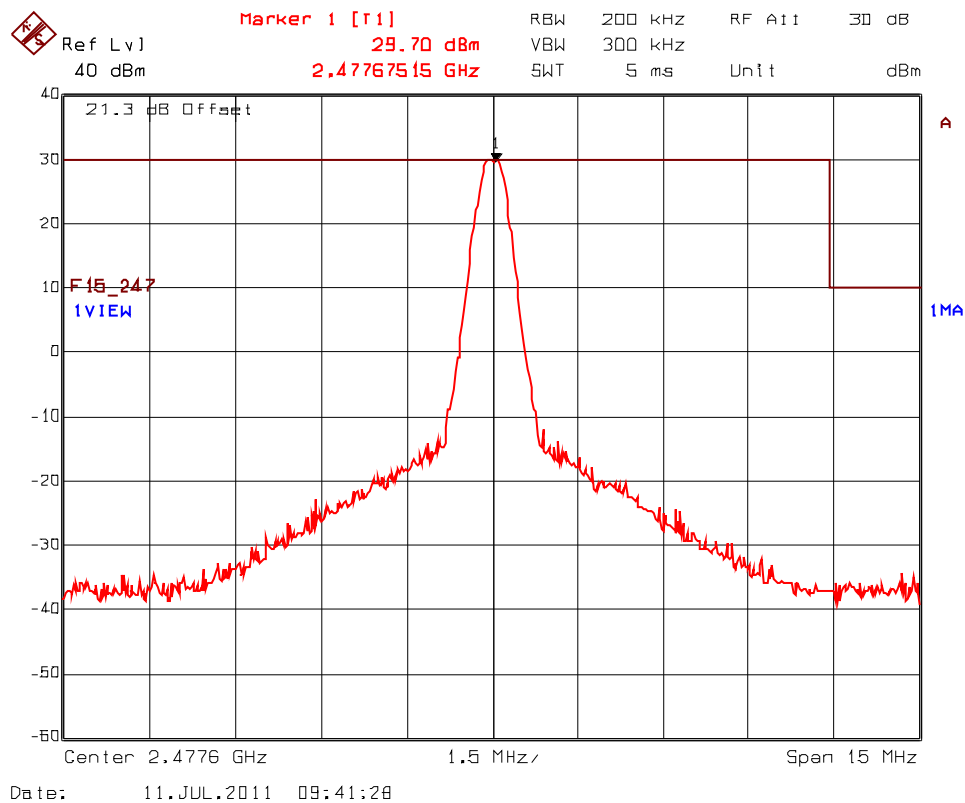
Plot 5.10.4.1.1 Band-Edge RF Conducted Emissions
Low End of Frequency Band
Single Frequency Mode (at high data rate)



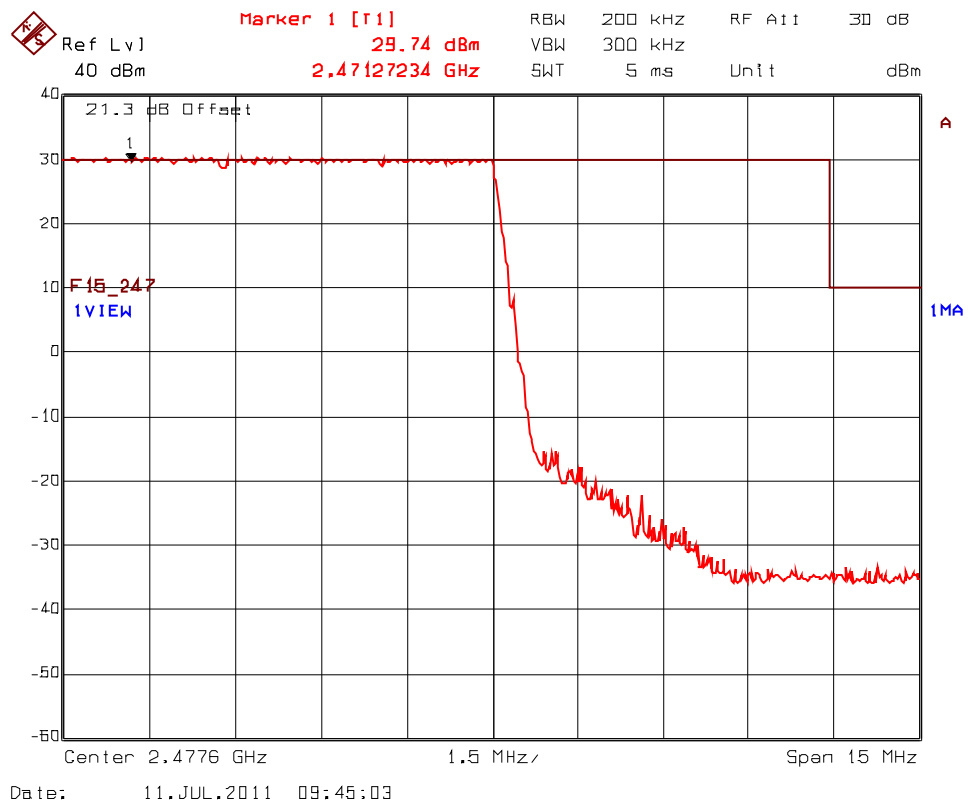
Plot 5.10.4.1.2 Band-Edge RF Conducted Emissions
Low End of Frequency Band
Pseudorandom Channel Hopping Mode (at high data rate)



Plot 5.10.4.1.3 Band-Edge RF Conducted Emissions
High End of Frequency Band
Single Frequency Mode (at high data rate)



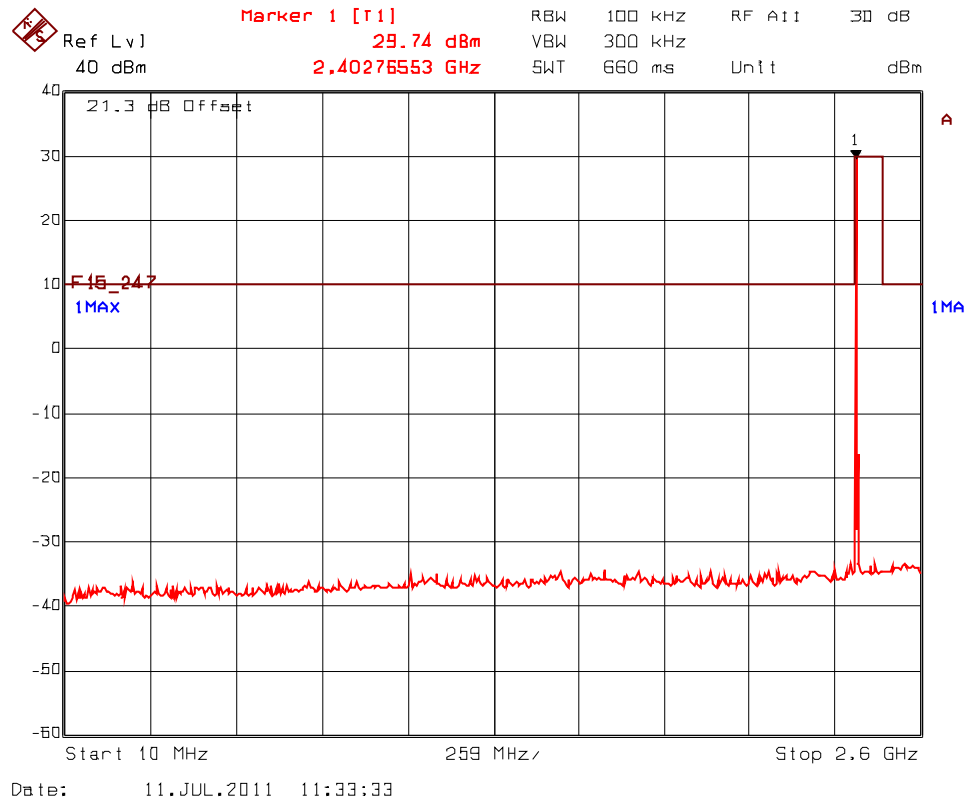
Plot 5.10.4.1.4 Band-Edge RF Conducted Emissions
High End of Frequency Band
Pseudorandom Channel Hopping Mode (at high data rate)



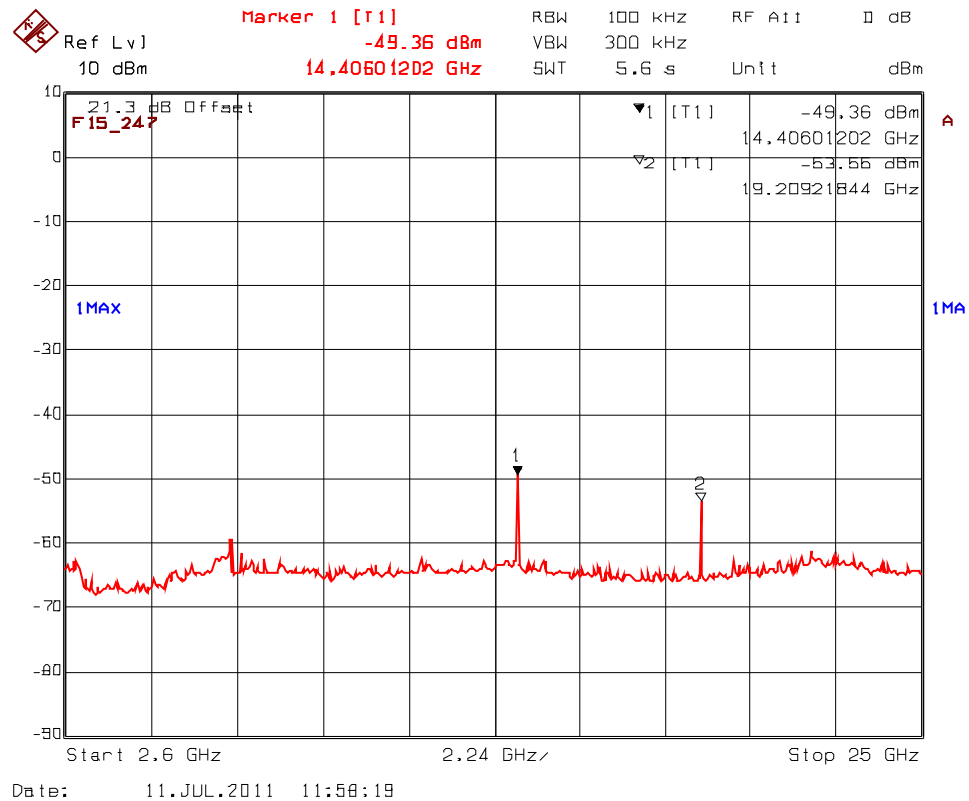
5.10.4.2. Spurious RF Conducted Emissions

The emissions were scanned from 10 MHz to 25 GHz; see the following test data plots for measurement results.

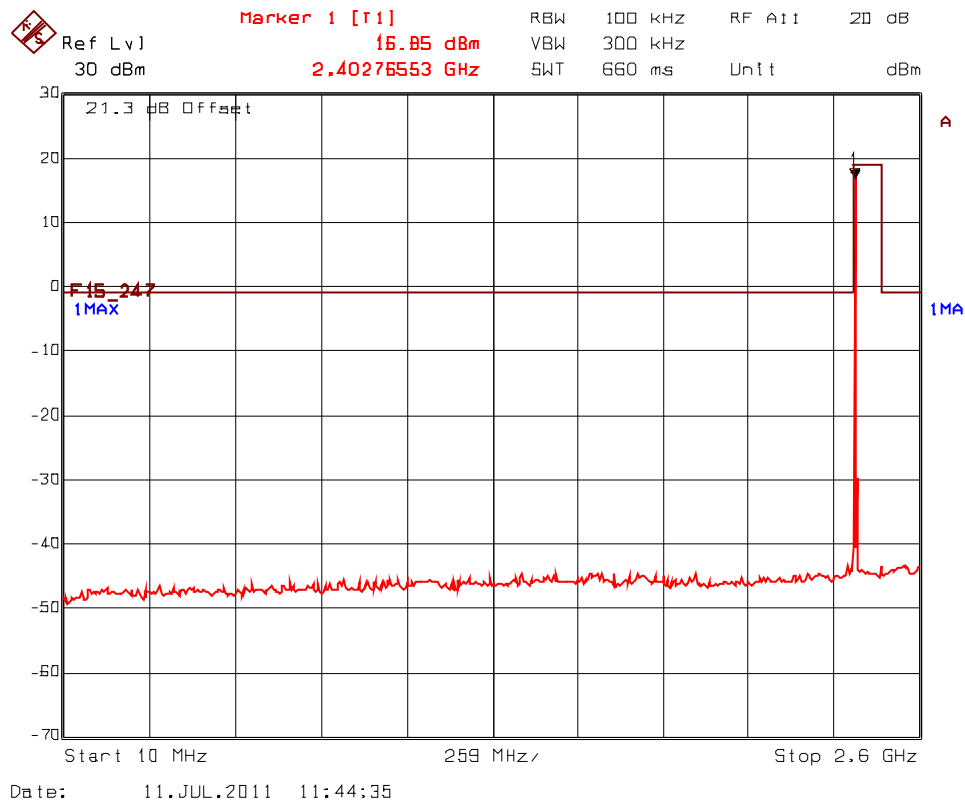
Plot 5.10.4.2.1 Spurious RF Conducted Emissions
Transmitter Frequency: 2401.6 MHz at 1W Output Power Setting, High Data Rate



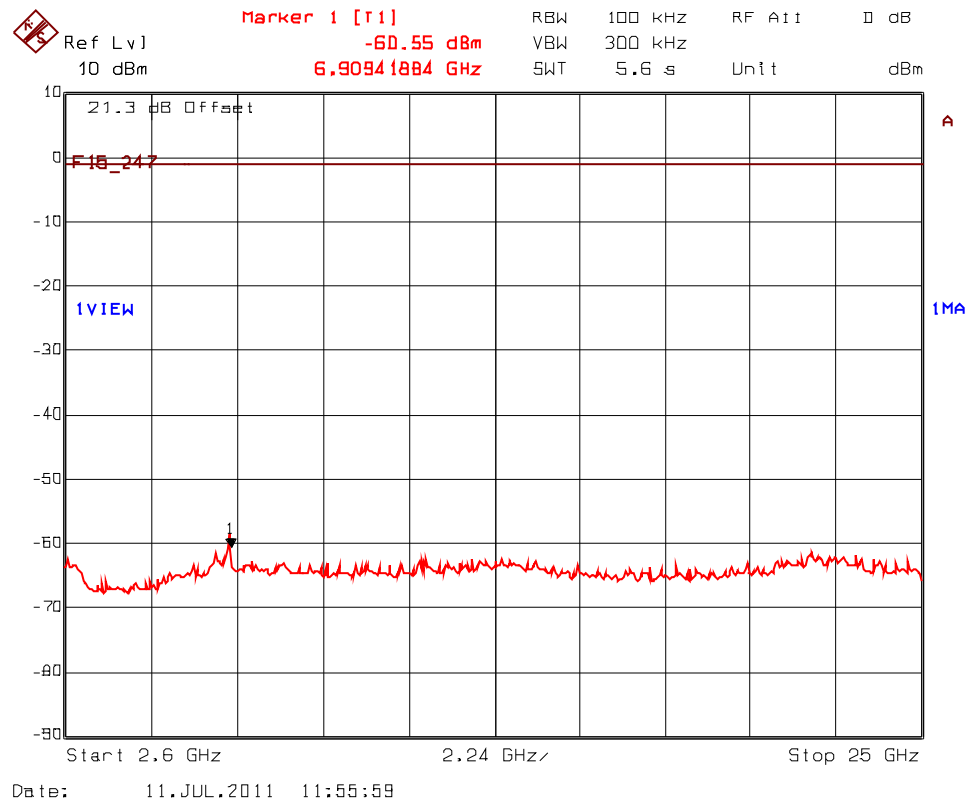
Plot 5.10.4.2.2 Spurious RF Conducted Emissions
Transmitter Frequency: 2401.6 MHz at 1W Output Power Setting, High Data Rate



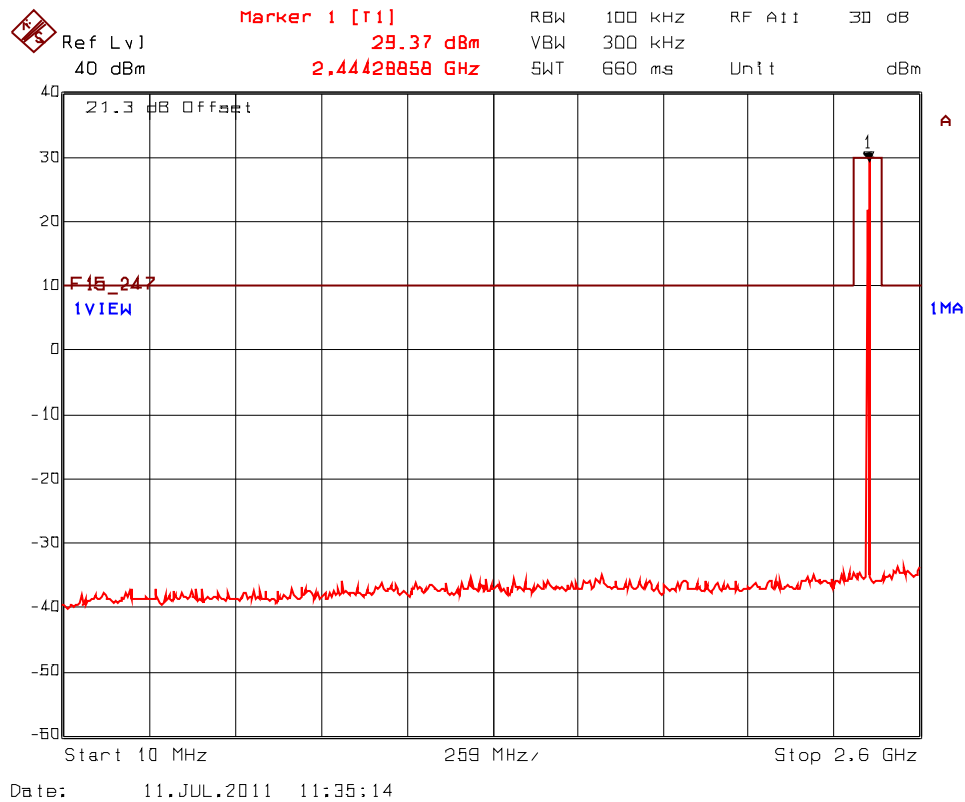
Plot 5.10.4.2.3 Spurious RF Conducted Emissions
Transmitter Frequency: 2401.6 MHz at 100mW Output Power Setting, High Data Rate



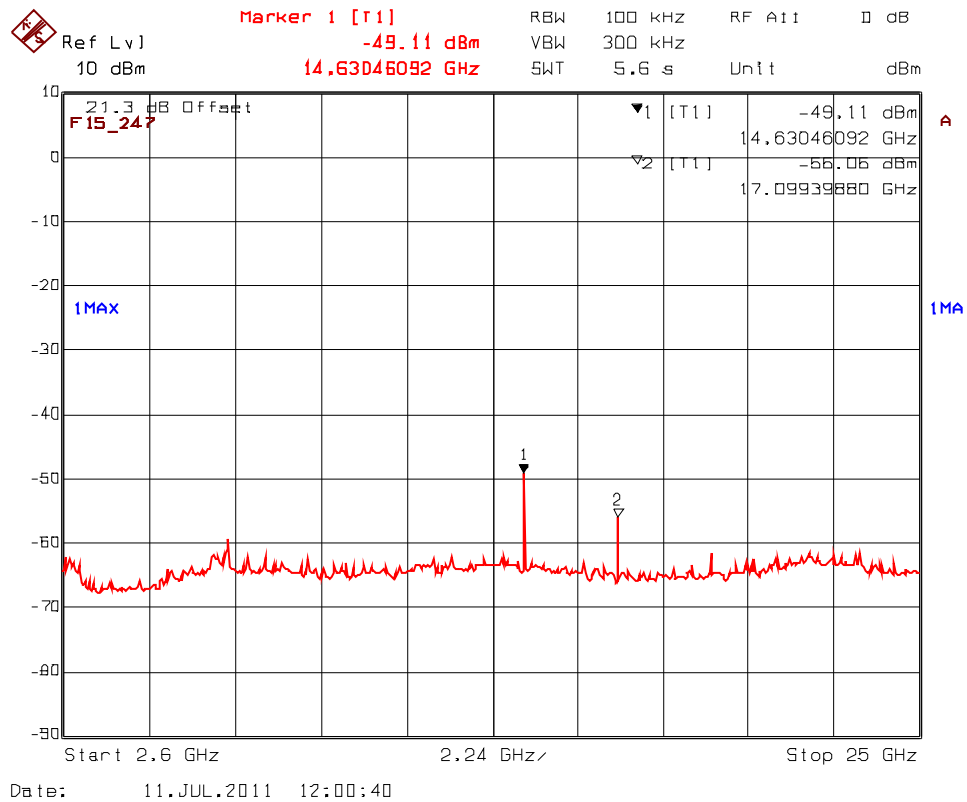
Plot 5.10.4.2.4 Spurious RF Conducted Emissions
Transmitter Frequency: 2401.6 MHz at 100mW Output Power Setting, High Data Rate



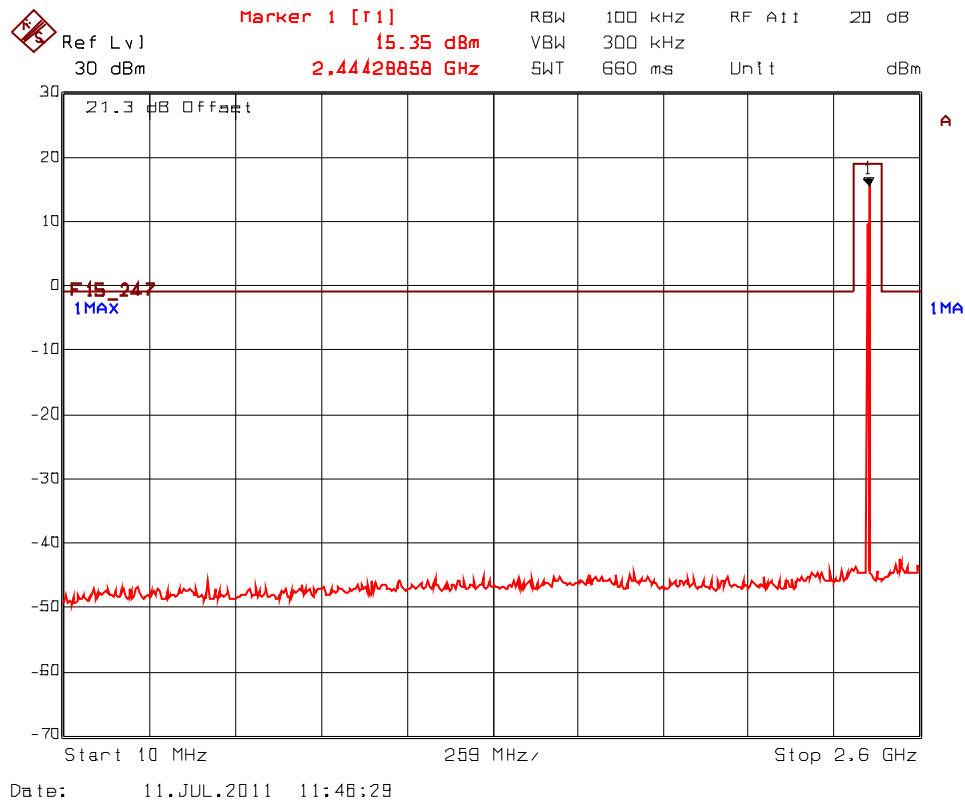
Plot 5.10.4.2.5 Spurious RF Conducted Emissions
Transmitter Frequency: 2439.6 MHz at 1W Output Power Setting, High Data Rate



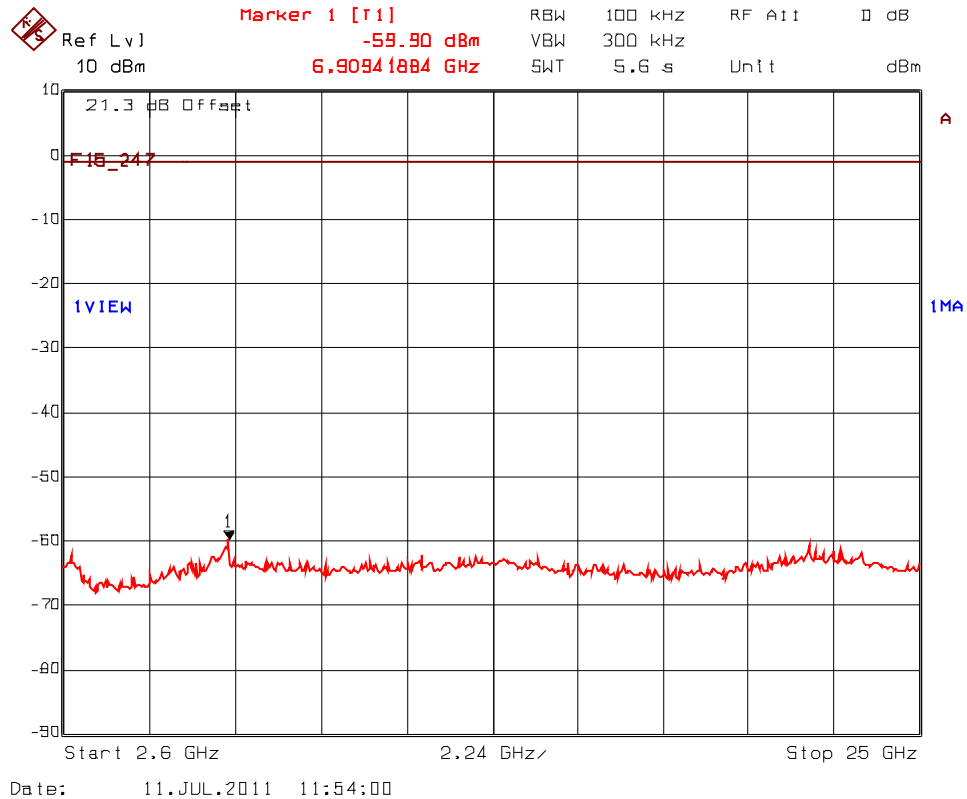
Plot 5.10.4.2.6 Spurious RF Conducted Emissions
Transmitter Frequency: 2439.6 MHz at 1W Output Power Setting, High Data Rate



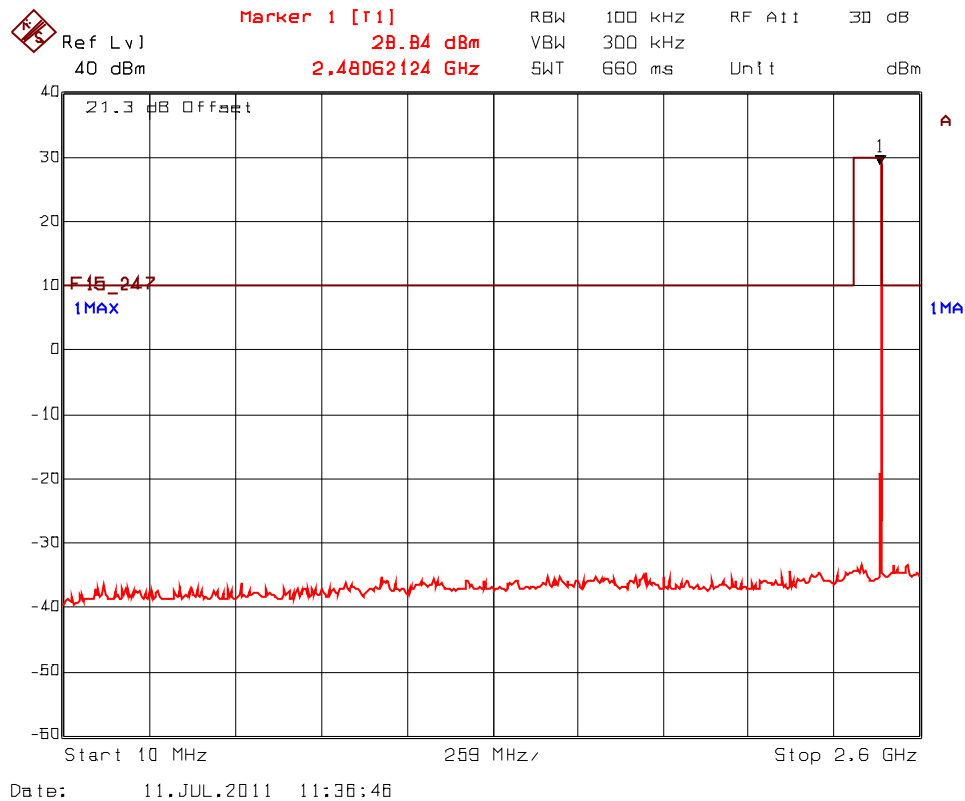
Plot 5.10.4.2.7 Spurious RF Conducted Emissions
Transmitter Frequency: 2439.6 MHz at 100mW Output Power Setting, High Data Rate



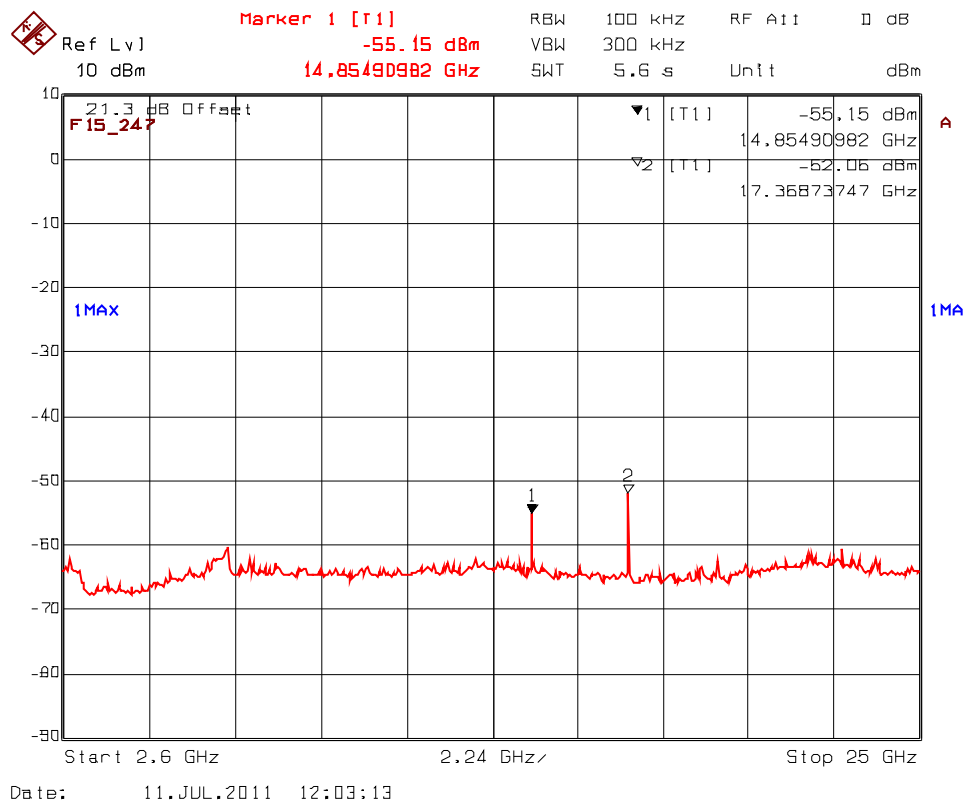
Plot 5.10.4.2.8 Spurious RF Conducted Emissions
Transmitter Frequency: 2439.6 MHz at 100mW Output Power Setting, High Data Rate



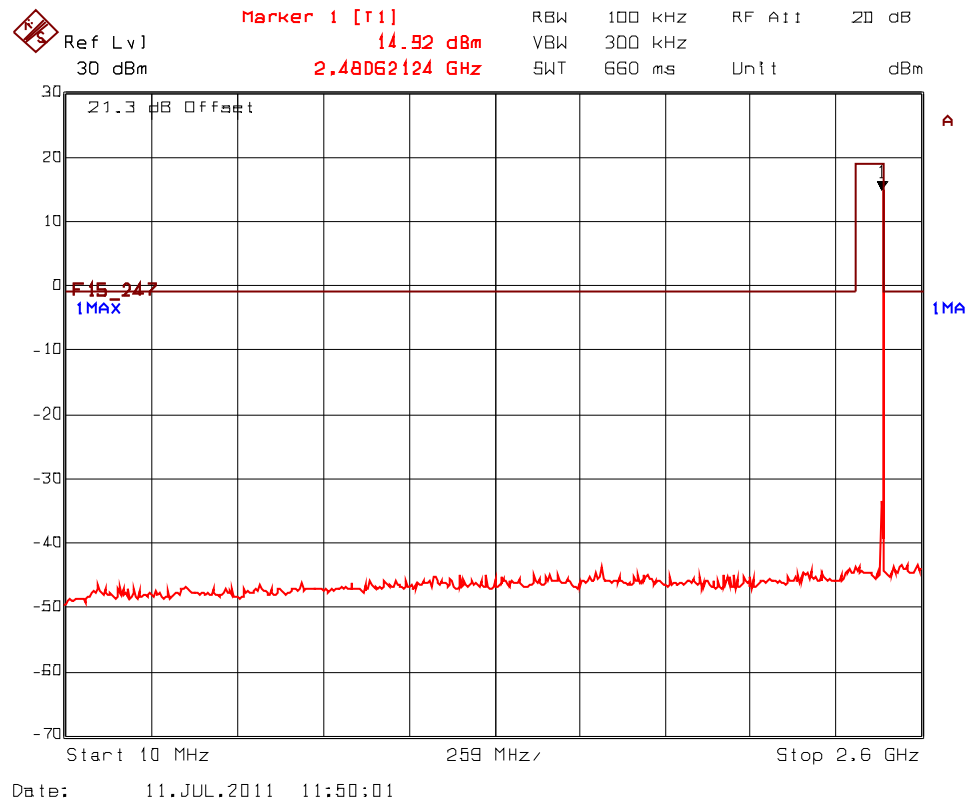
Plot 5.10.4.2.9 Spurious RF Conducted Emissions
Transmitter Frequency: 2477.6 MHz at 1W Output Power Setting, High Data Rate



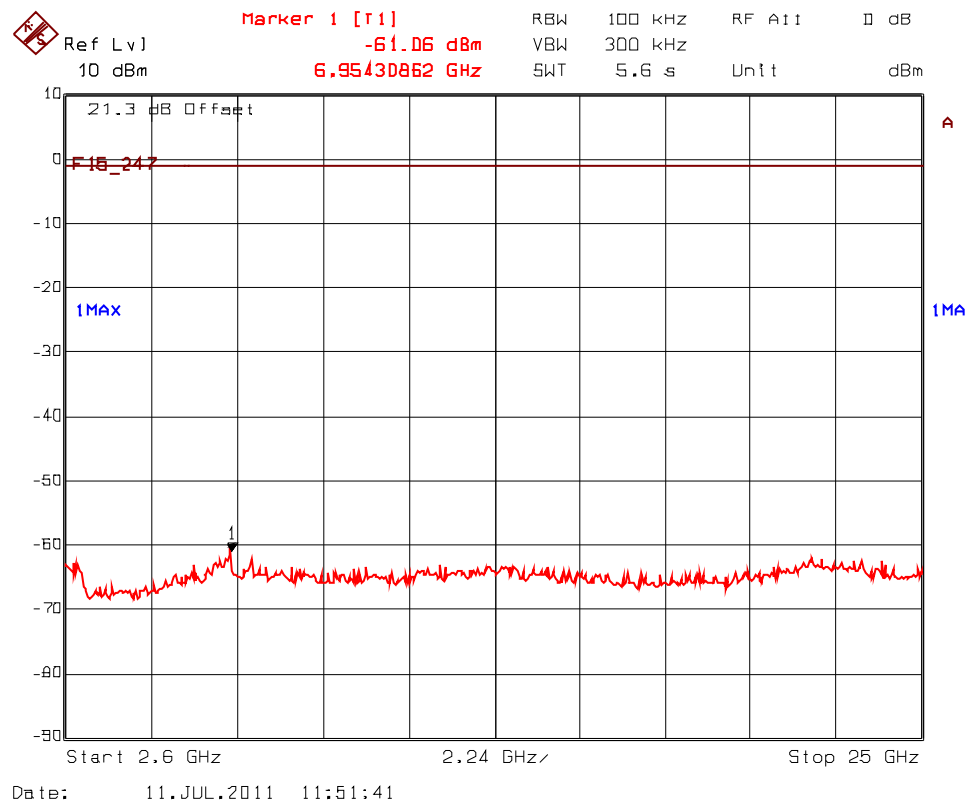
Plot 5.10.4.2.10 Spurious RF Conducted Emissions
Transmitter Frequency: 2477.6 MHz at 1W Output Power Setting, High Data Rate



Plot 5.10.4.2.11 Spurious RF Conducted Emissions
Transmitter Frequency: 2477.6 MHz at 100 mW Output Power Setting, High Data Rate



Plot 5.10.4.2.12 Spurious RF Conducted Emissions
Transmitter Frequency: 2477.6 MHz at 100 mW Output Power Setting, High Data Rate



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

5.11.1. Limit

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

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

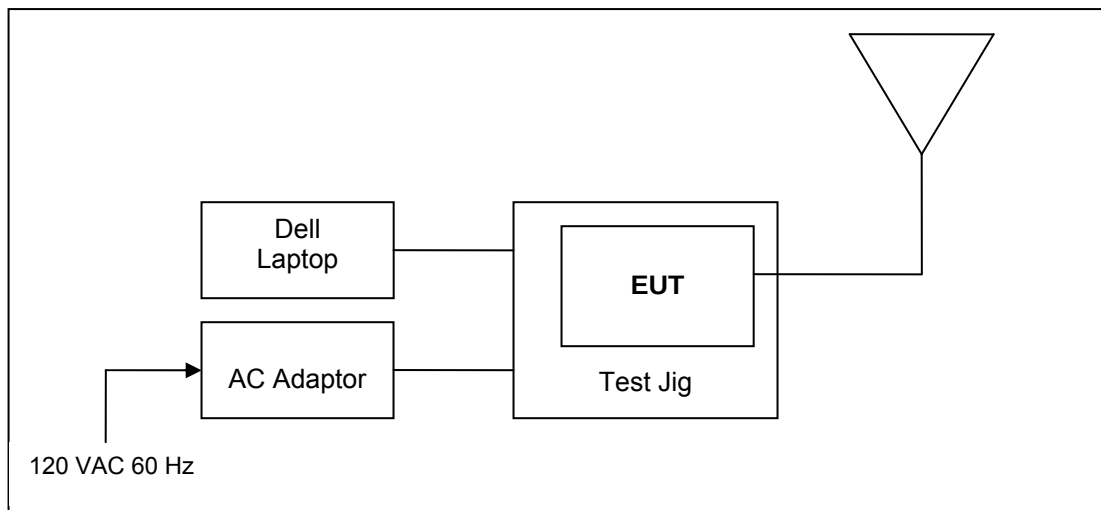
5.11.2. Method of Measurements

ANSI C63.4.

The following measurement procedures were also applied:

- Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.
- For measurement below 1 GHz, set RBW = 100 KHz, VBW $\geq$ 100 KHz, SWEEP=AUTO.
- For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz (Peak) & VBW = 10 Hz (Average), SWEEP=AUTO.
- If the emission is pulsed, modified the unit for continuous operation, then use the settings above for measurements, then correct the reading by subtracting the peak-average correction factor derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

5.11.3. Test Arrangement



5.11.4. Test Data

The following test results are the worst-case measurements.

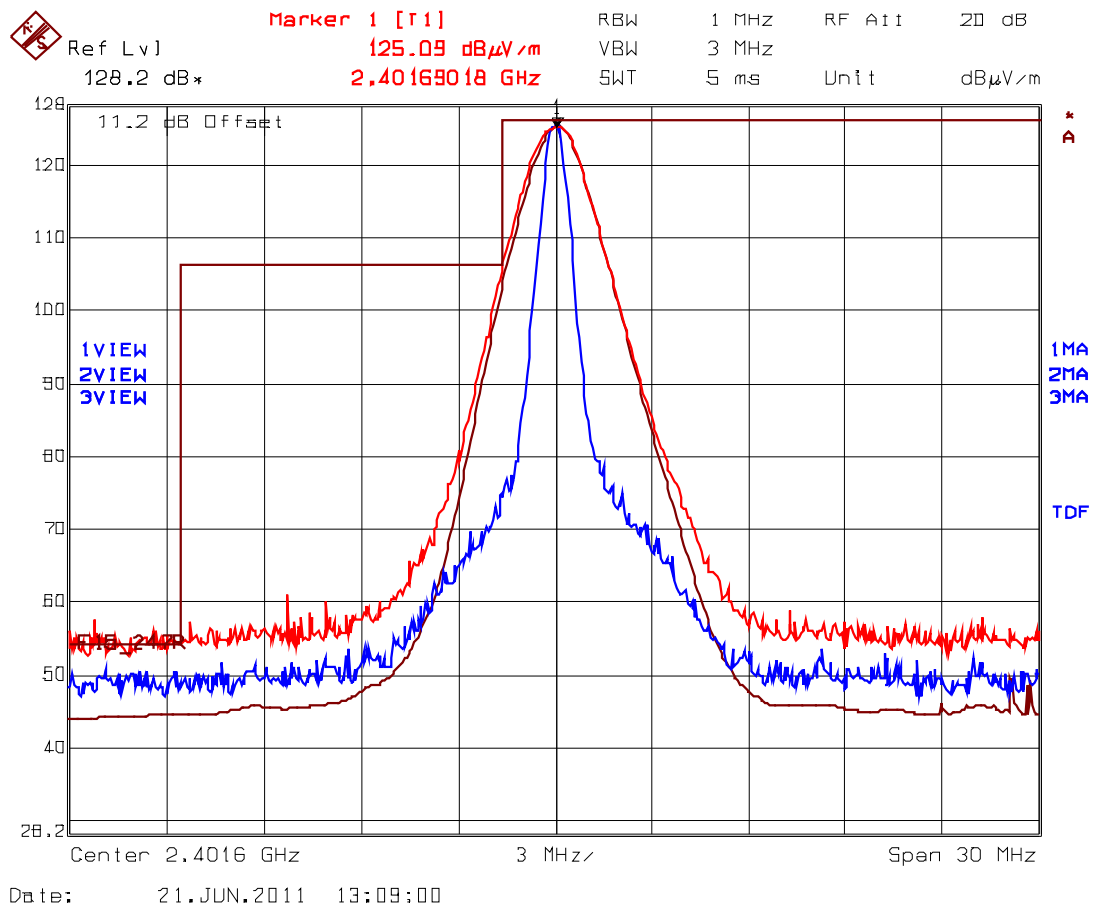
5.11.4.1. EUT with 2 dBi Rubber Ducky Antenna and 0.81 dB Assembly Cable Loss

Fundamental Frequency:		2401.6 MHz					
Measured Conducted Power:		29.98 dBm					
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
2401.6	128.04	--	V	--	--	--	--
2401.6	125.09	--	H	--	--	--	--
4803.2	55.26	51.25	V	54.0	108.0	-2.7	Pass*
4803.2	52.72	48.86	H	54.0	108.0	-5.1	Pass*
12008.0	58.08	46.33	V	54.0	112.6	-7.7	Pass*
12008.0	58.59	46.87	H	54.0	112.6	-7.1	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit. See the following test data plots for band-edge emissions.							

* Emission within the restricted frequency bands.

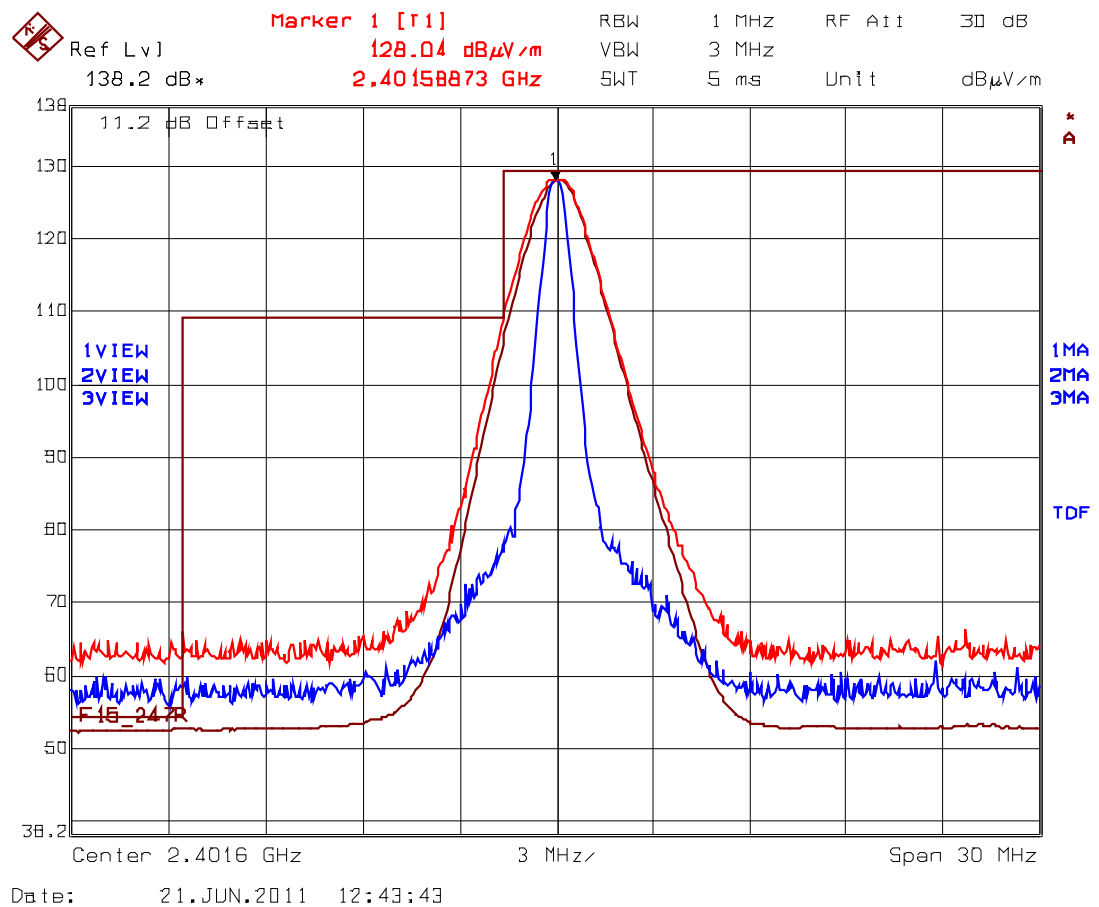
Plot 5.11.4.1.1 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

Trace 1: RBW= 1 MHz, VBW= 3 MHz
Trace 2: RBW= 300 kHz, VBW= 500 kHz, Band-Edge at 2400 MHz comply
Trace 3: RBW= 1 MHz, VBW= 10 Hz



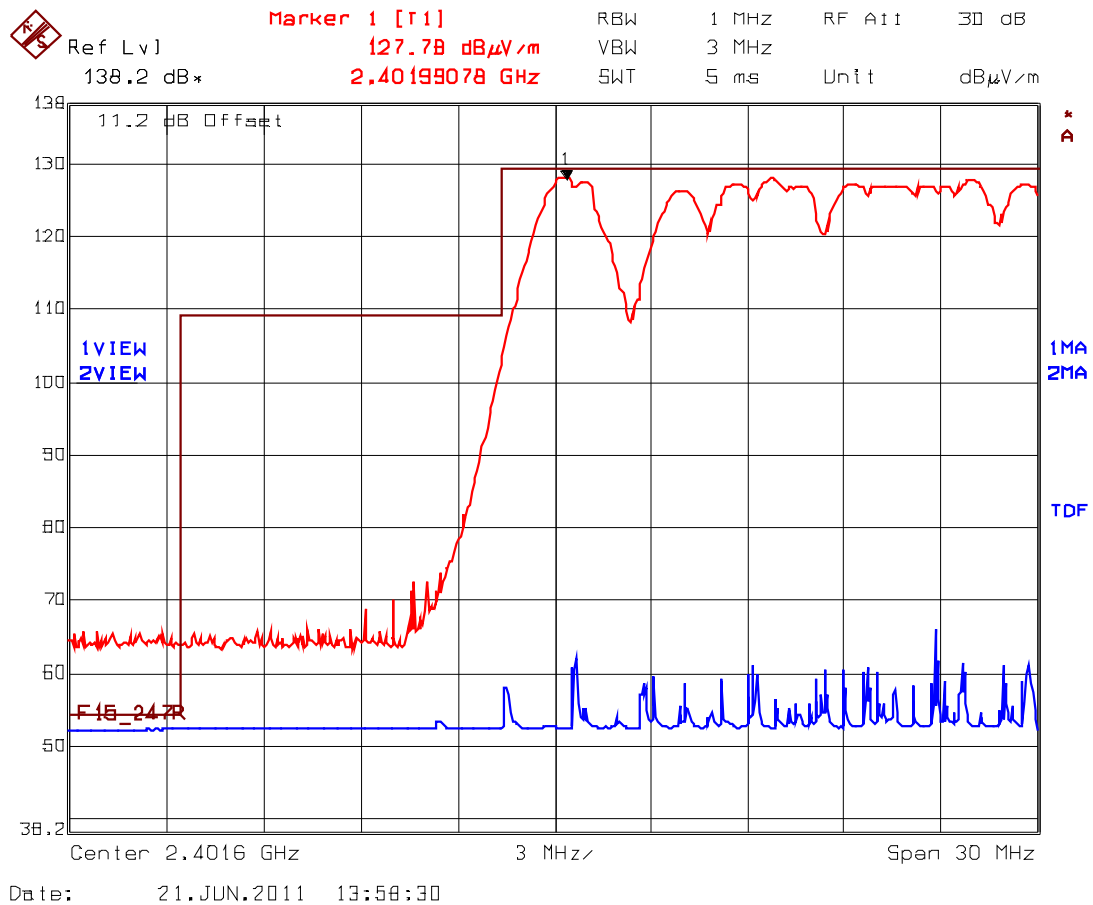
Plot 5.11.4.1.2 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

Trace 1: RBW= 1 MHz, VBW= 3 MHz
Trace 2: RBW= 300 kHz, VBW= 500 kHz, Band-Edge at 2400 MHz comply
Trace 3: RBW= 1 MHz, VBW= 10 Hz



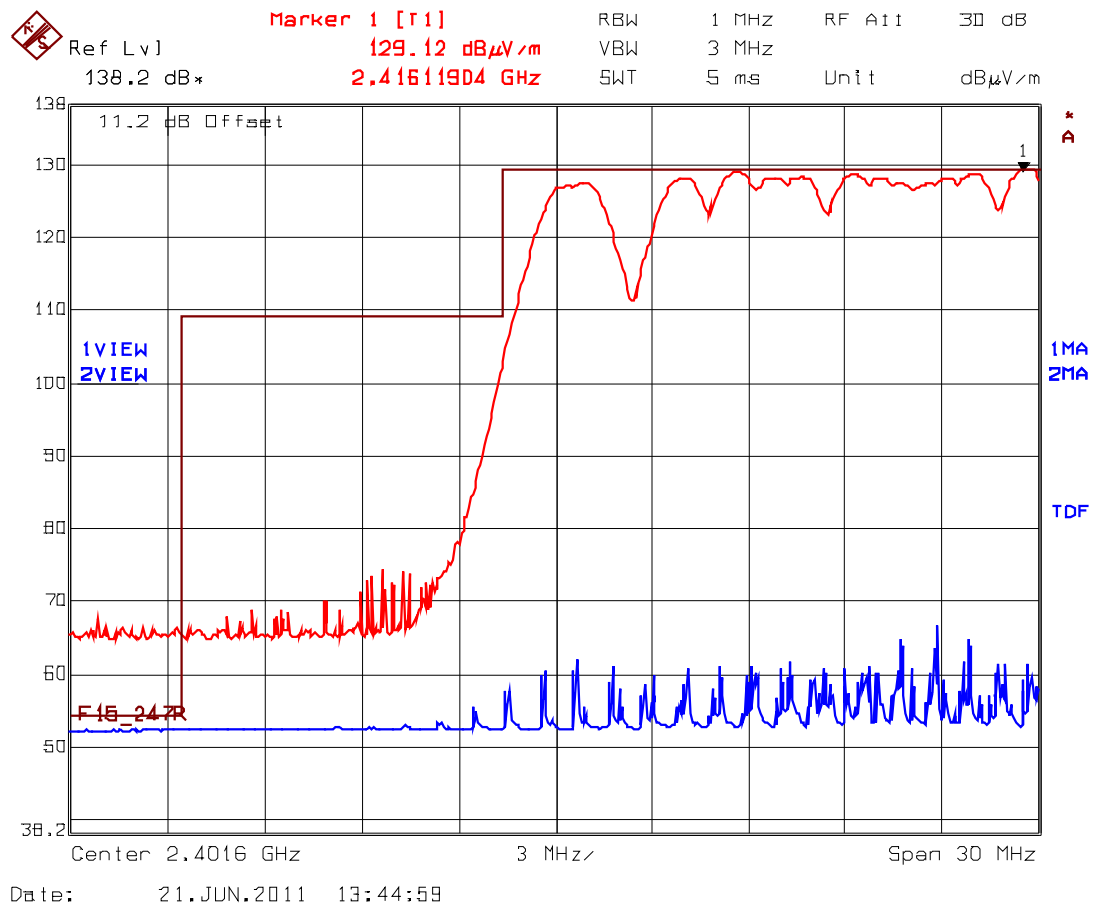
Plot 5.11.4.1.3 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

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



Plot 5.11.4.1.4 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

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



Fundamental Frequency: 2439.6 MHz							
Measured Conducted Power: 29.98 dBm							
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
2439.6	126.21	--	V	--	--	--	--
2439.6	126.35	--	H	--	--	--	--
4879.2	52.37	45.89	V	54.0	106.4	-8.1	Pass*
4879.2	51.55	47.07	H	54.0	106.4	-6.9	Pass*
7318.8	56.26	50.39	V	54.0	106.4	-3.6	Pass*
7318.8	57.04	51.89	H	54.0	106.4	-2.1	Pass*
12198.0	59.64	45.93	V	54.0	106.4	-8.1	Pass*
12198.0	59.57	47.02	H	54.0	106.4	-7.0	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

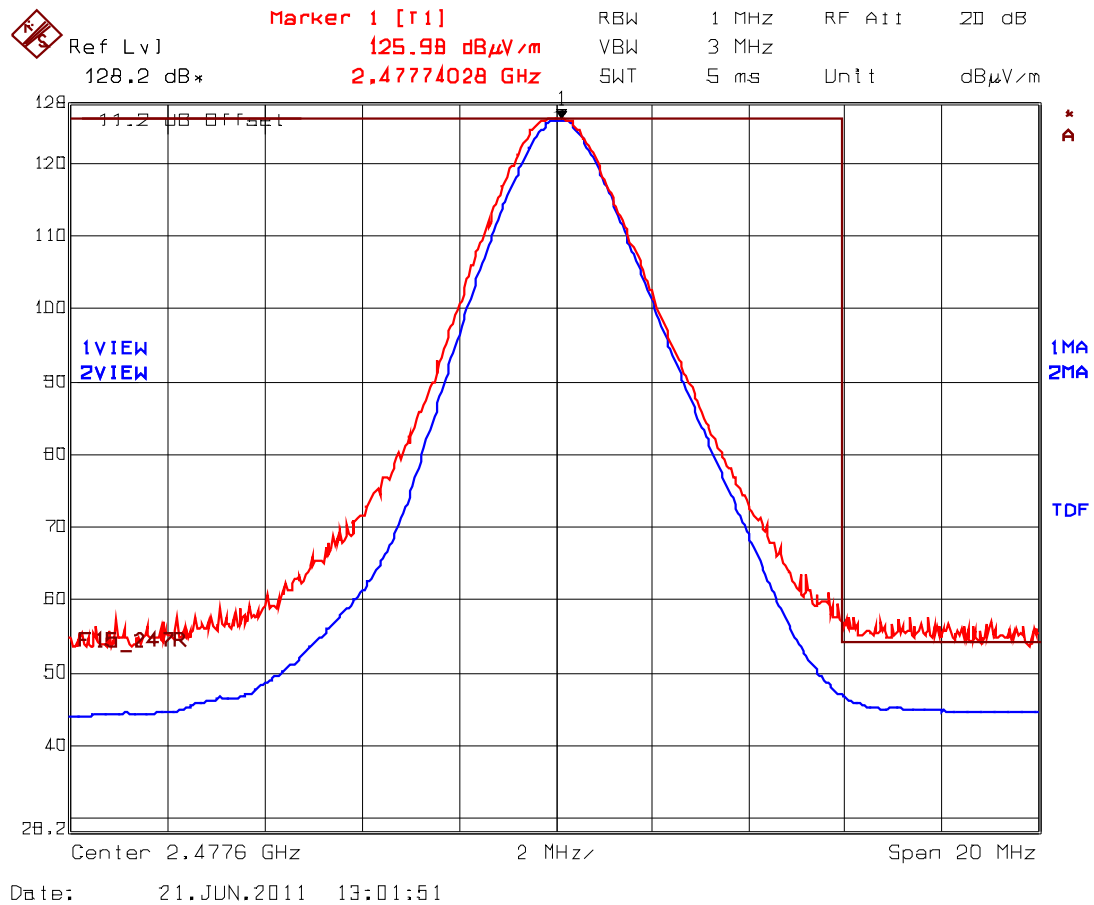
* Emission within the restricted frequency bands.

Fundamental Frequency: 2477.6 MHz							
Measured Conducted Power: 29.49 dBm							
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
2477.6	127.13	--	V	--	--	--	--
2477.6	125.98	--	H	--	--	--	--
4955.2	51.23	46.23	V	54.0	107.1	-7.8	Pass*
4955.2	50.89	44.02	H	54.0	107.1	-10.0	Pass*
7432.8	56.44	50.01	V	54.0	107.1	-4.0	Pass*
7432.8	56.72	50.22	H	54.0	107.1	-3.8	Pass*
12388.0	59.27	46.72	V	54.0	107.1	-7.3	Pass*
12388.0	59.15	46.80	H	54.0	107.1	-7.2	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit. See the following test data plots for band-edge emissions.							

* Emission within the restricted frequency bands.

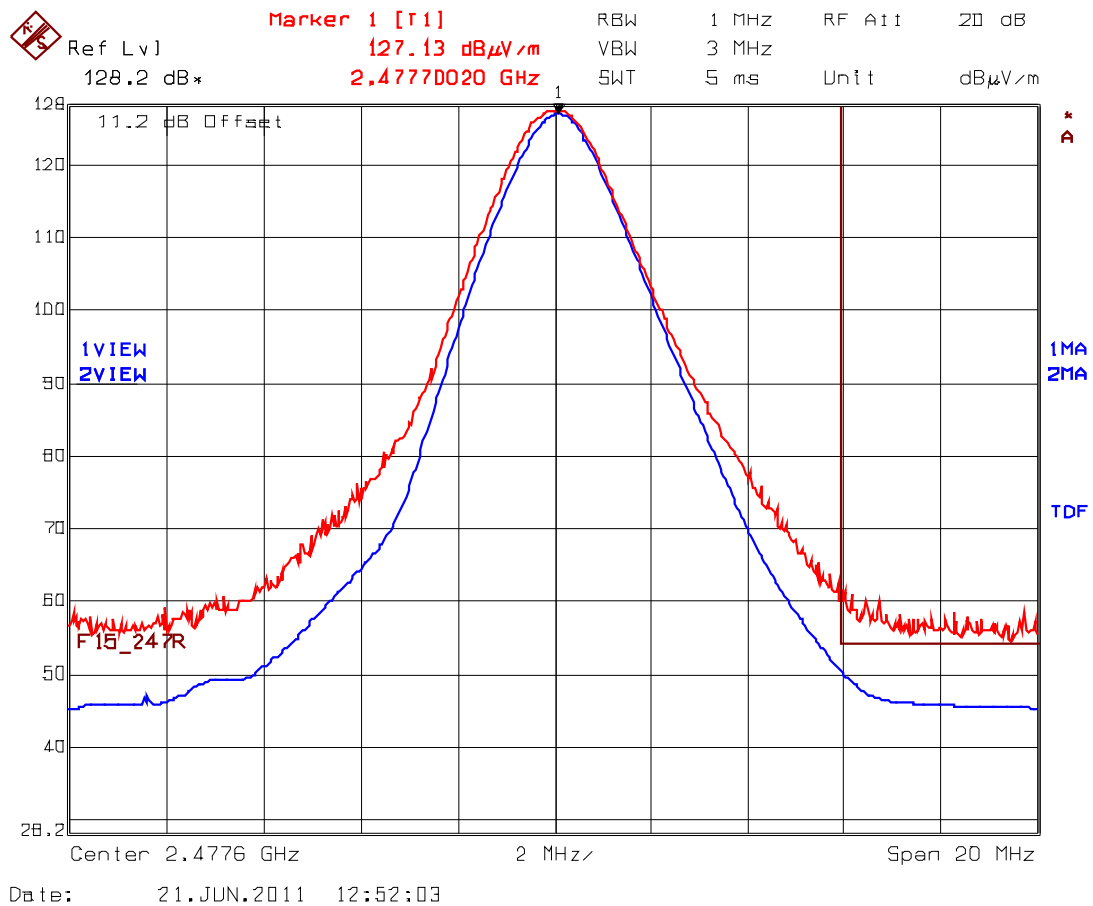
Plot 5.11.4.1.5 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

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



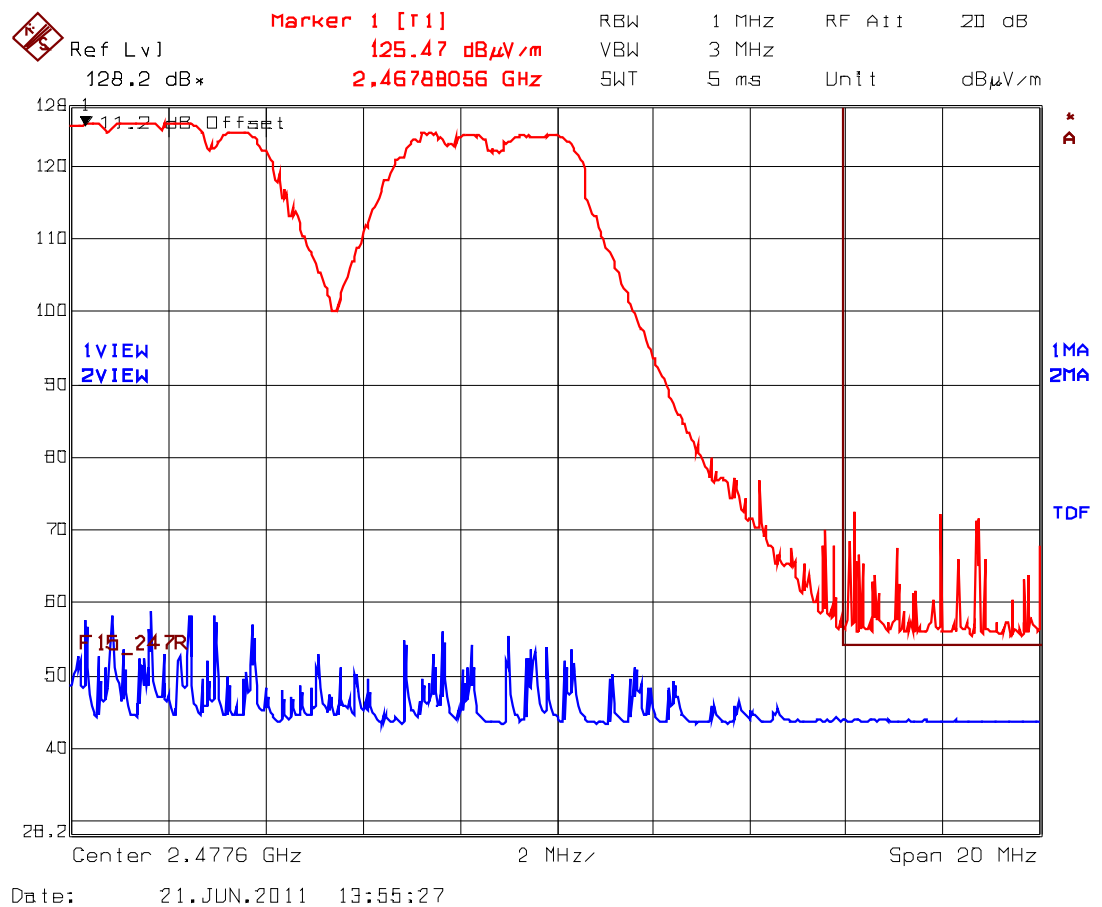
Plot 5.11.4.1.6 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

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



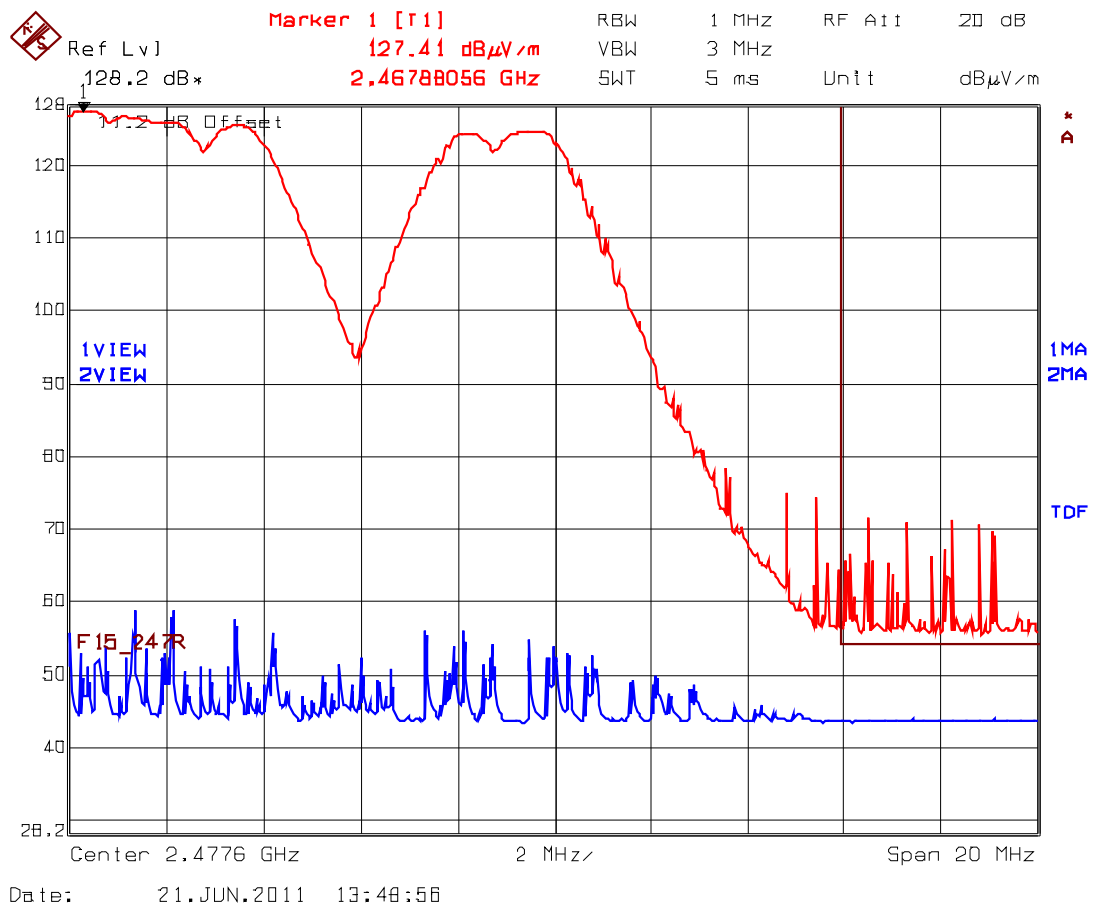
Plot 5.11.4.1.7 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

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



Plot 5.11.4.1.8 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

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



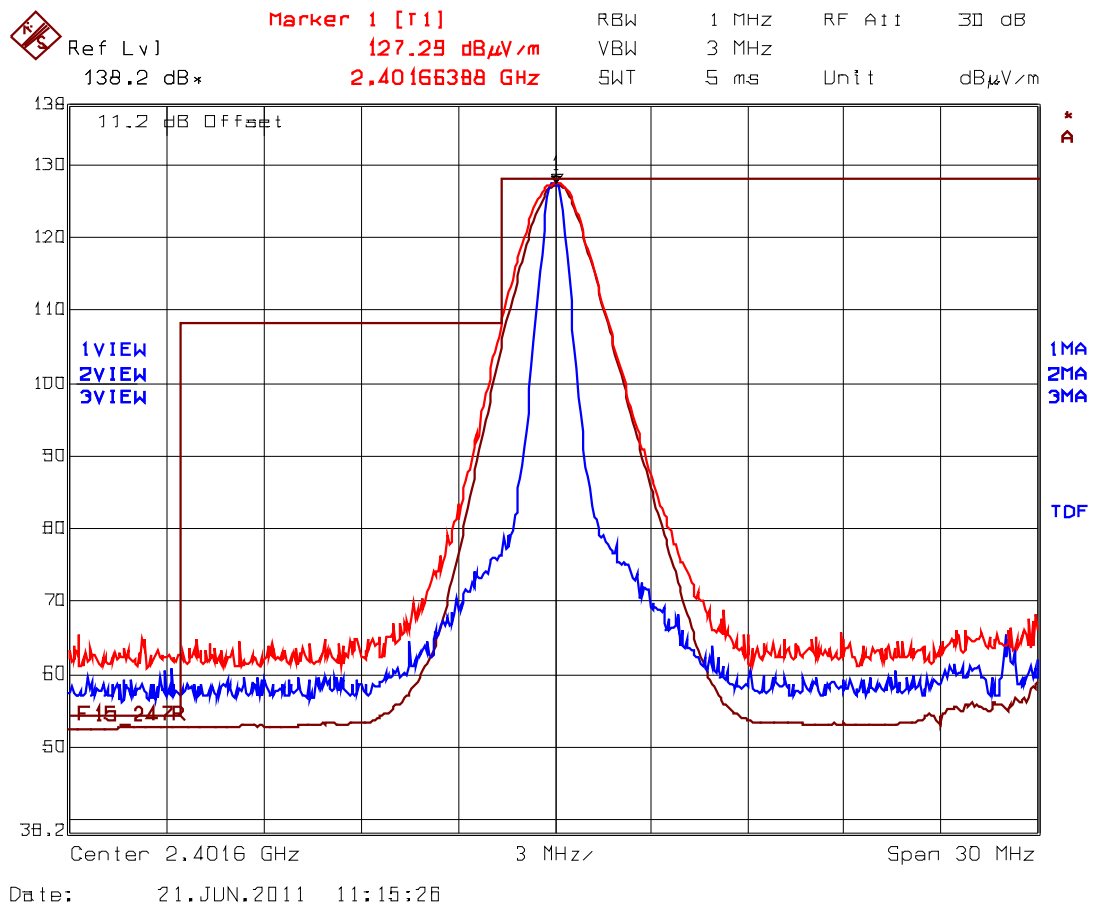
5.11.4.2. EUT with 14 dBi Flat Patch Antenna and 1.41 dB Assembly Cable Loss

Fundamental Frequency:		2401.6 MHz					
Measured Conducted Power:		22.35 dBm					
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
2401.6	127.56	--	V	--	--	--	--
2401.6	127.29	--	H	--	--	--	--
4803.2	51.51	46.13	V	54.0	107.6	-7.9	Pass*
4803.2	51.27	46.17	H	54.0	107.6	-7.8	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit. See the following test data plots for band-edge emissions.							

* Emission within the restricted frequency bands.

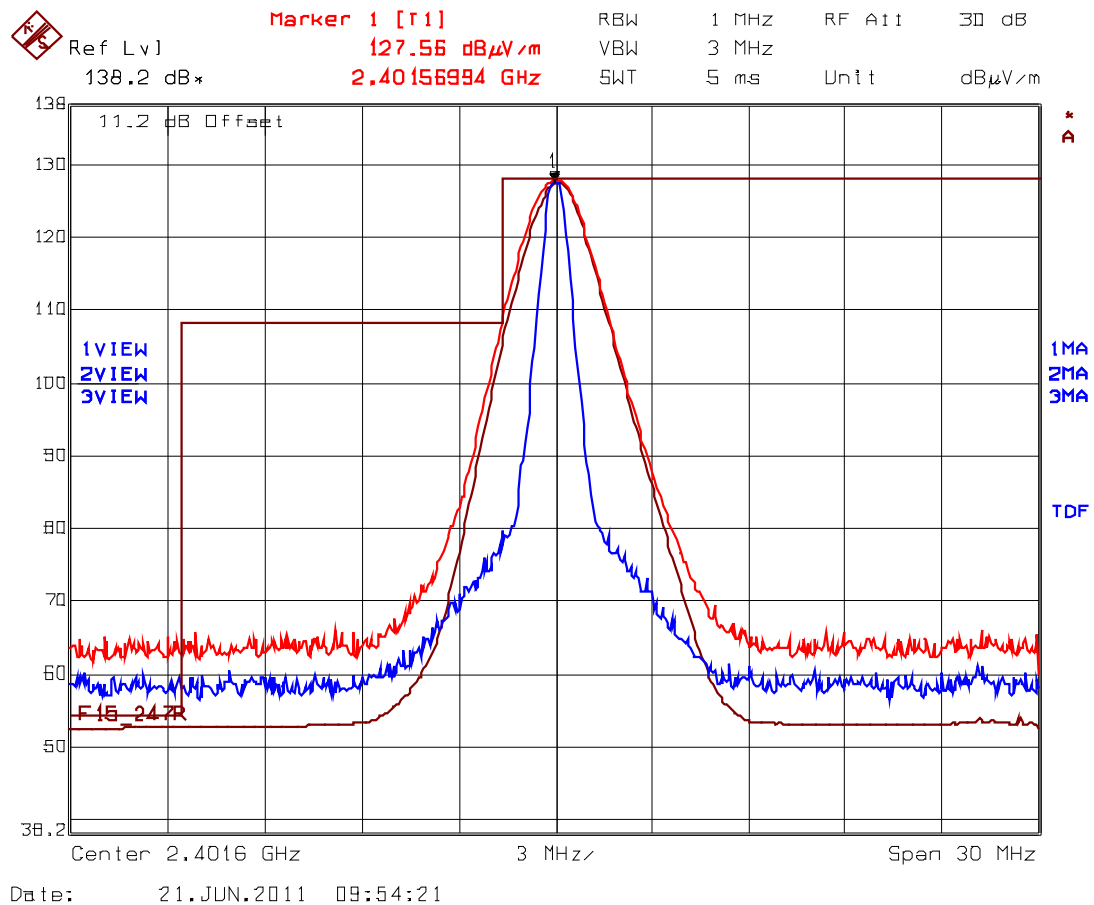
Plot 5.11.4.2.1 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

Trace 1: RBW= 1 MHz, VBW= 3 MHz
Trace 2: RBW= 300 kHz, VBW= 500 kHz, Band-Edge at 2400 MHz comply
Trace 3: RBW= 1 MHz, VBW= 10 Hz



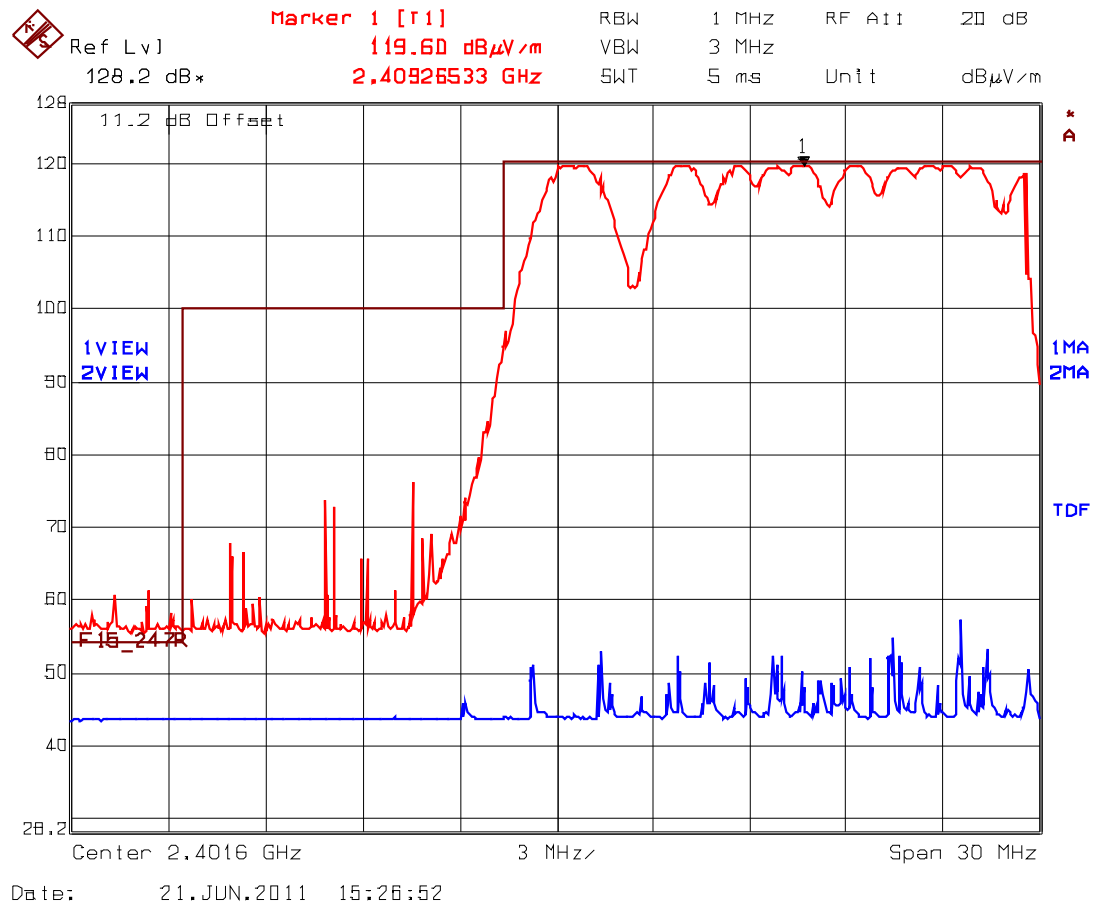
Plot 5.11.4.2.2 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
 Low End of Frequency Band (at high power and data rate)
 Rx Antenna Orientation: Vertical

Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 300 kHz, VBW= 500 kHz, Band-Edge at 2400 MHz comply
 Trace 3: RBW= 1 MHz, VBW= 10 Hz



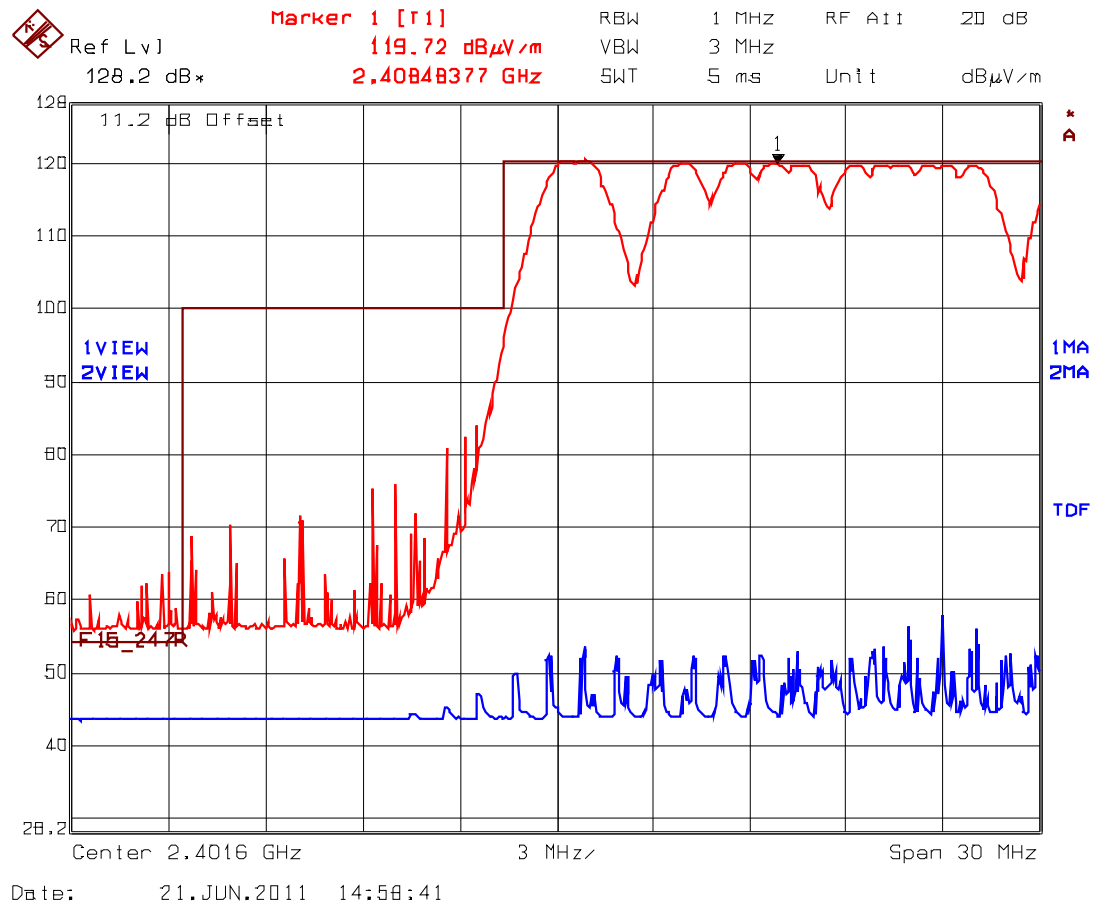
Plot 5.11.4.2.3 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

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



Plot 5.11.4.2.4 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

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



Fundamental Frequency: 2439.6 MHz							
Measured Conducted Power: 22.35 dBm							
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
2439.6	127.51	--	V	--	--	--	--
2439.6	126.94	--	H	--	--	--	--
4879.2	51.84	47.24	V	54.0	107.5	-6.8	Pass*
4879.2	51.85	46.73	H	54.0	107.5	-7.3	Pass*
7318.8	54.16	42.01	V	54.0	107.5	-12.0	Pass*
7318.8	54.35	42.37	H	54.0	107.5	-11.6	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

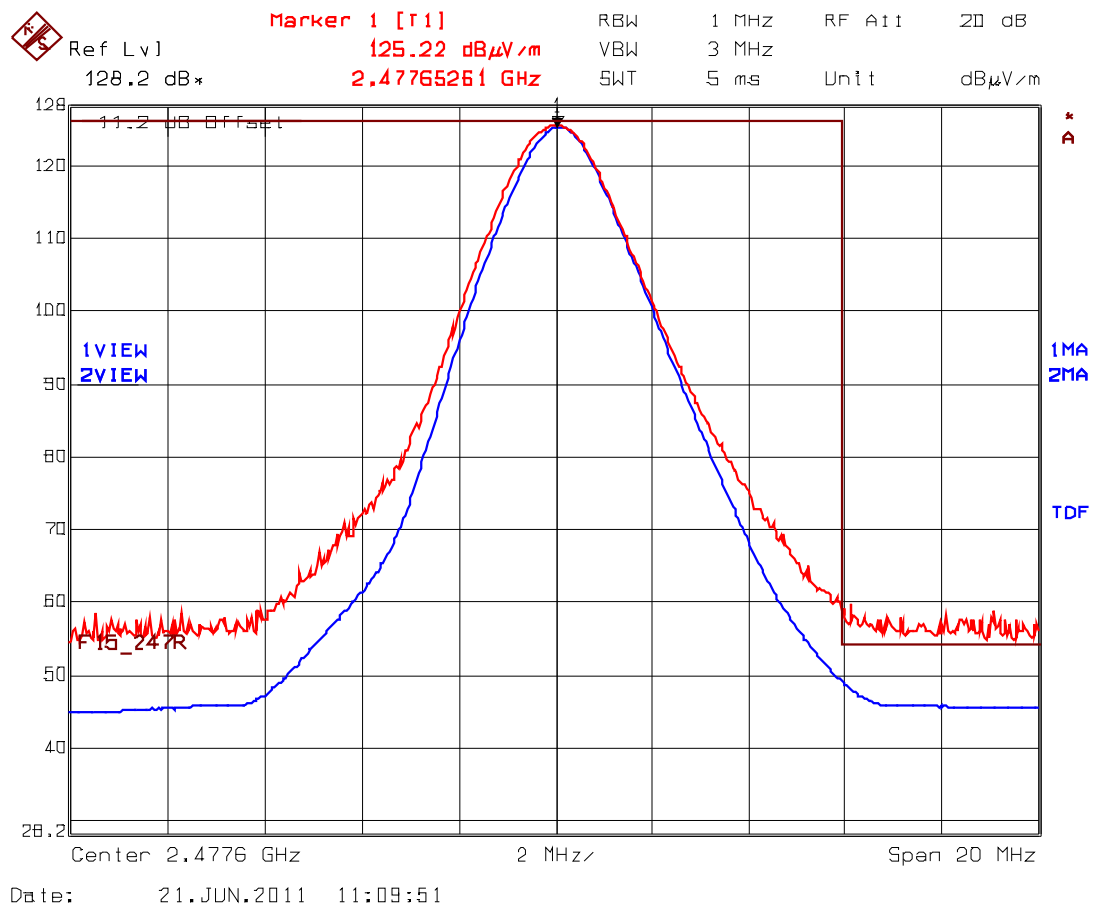
* Emission within the restricted frequency bands.

Fundamental Frequency: 2477.6 MHz							
Measured Conducted Power: 22.22 dBm							
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
2477.6	125.49	--	V	--	--	--	--
2477.6	125.22	--	H	--	--	--	--
4955.2	50.34	44.30	V	54.0	105.5	-9.7	Pass*
4955.2	50.81	45.51	H	54.0	105.5	-8.5	Pass*
7432.8	54.23	42.23	V	54.0	105.5	-11.8	Pass*
7432.8	54.40	42.14	H	54.0	105.5	-11.9	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit. See the following test data plots for band-edge emissions.							

* Emission within the restricted frequency bands.

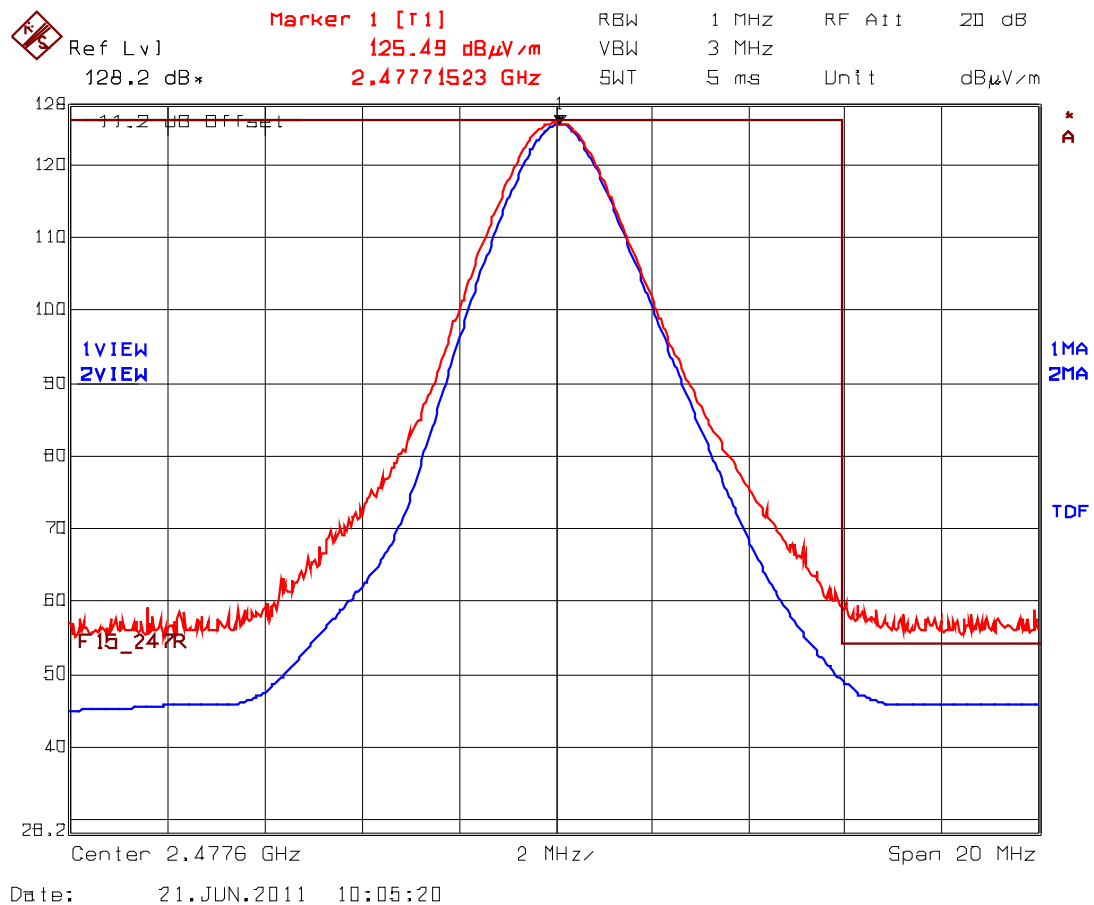
Plot 5.11.4.2.5 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
 High End of Frequency Band (at high power and data rate)
 Rx Antenna Orientation: Horizontal

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



Plot 5.11.4.2.6 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

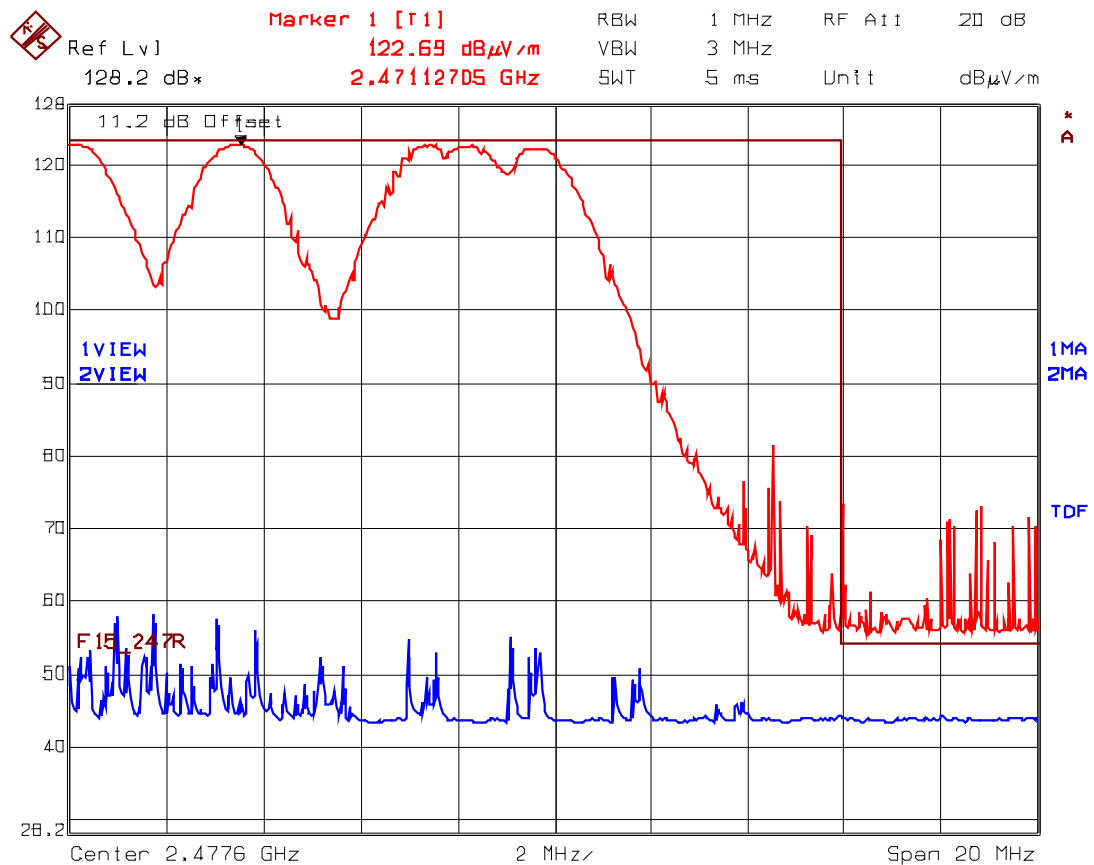
Trace 1: RBW= 1 MHz, VBW= 3 MHz
Trace 2: RBW= 1 MHz, VBW= 10 Hz



Plot 5.11.4.2.7 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

Trace 1: RBW= 1 MHz, VBW= 3 MHz

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

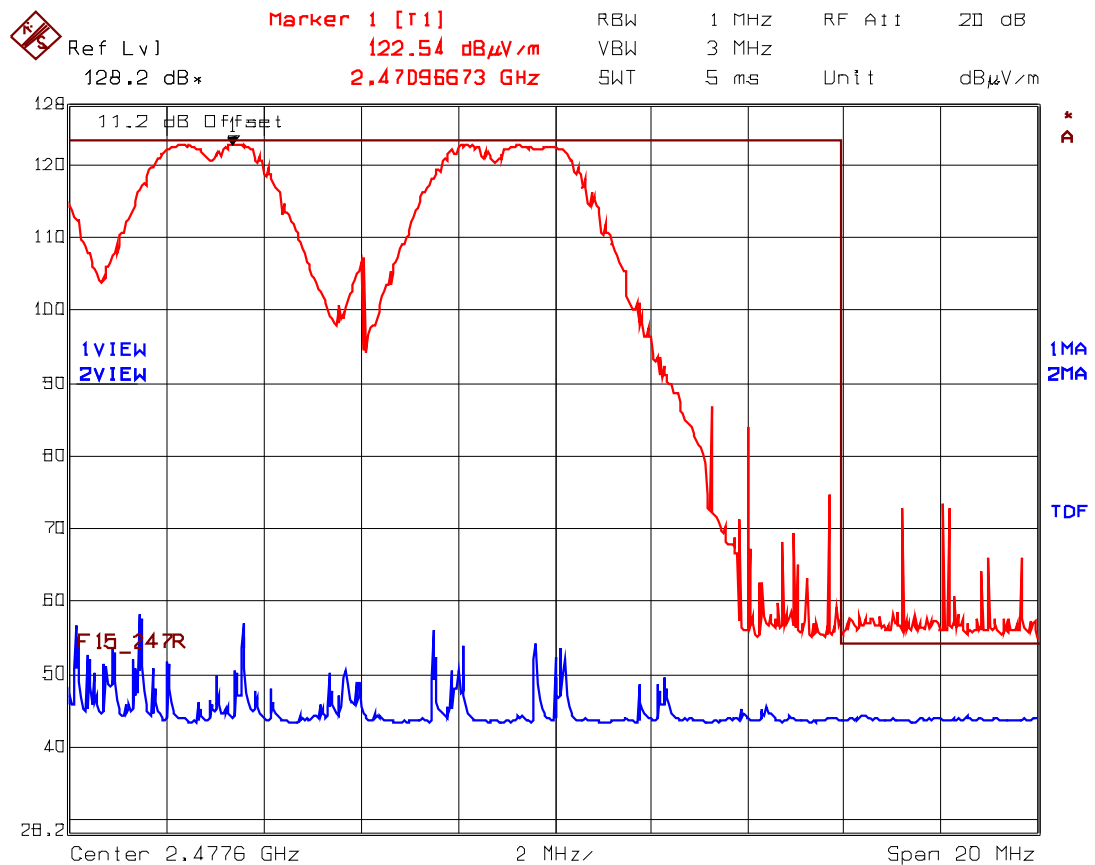


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Plot 5.11.4.2.8 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

Trace 1: RBW= 1 MHz, VBW= 3 MHz

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



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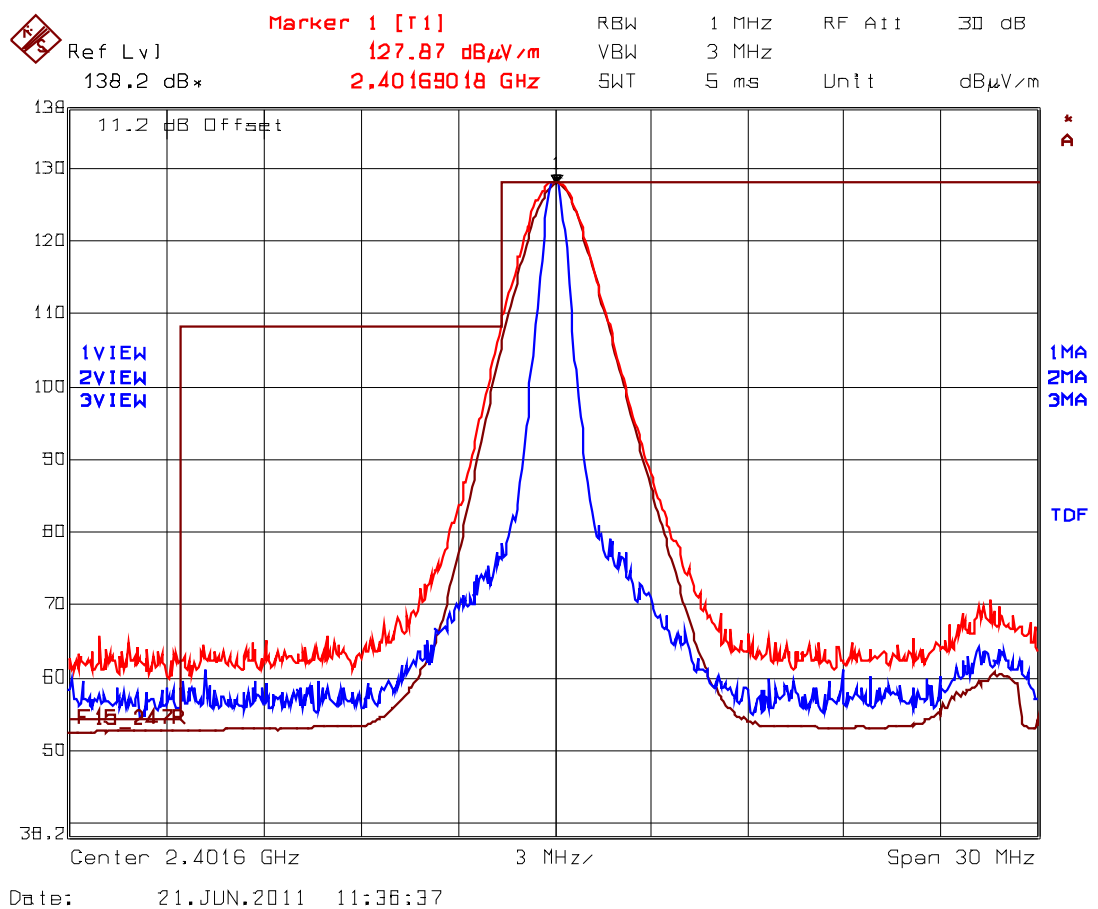
5.11.4.3. EUT with 14.5 dBi Yagi Antenna and 1.41 dB Assembly Cable Loss

Fundamental Frequency:		2401.6 MHz					
Measured Conducted Power:		22.35 dBm					
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
2401.6	128.32	--	V	--	--	--	--
2401.6	127.87	--	H	--	--	--	--
4803.2	51.97	46.54	V	54.0	108.3	-7.5	Pass*
4803.2	52.35	46.69	H	54.0	108.3	-7.3	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit. See the following test data plots for band-edge emissions.							

* Emission within the restricted frequency bands.

Plot 5.11.4.3.1 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

Trace 1: RBW= 1 MHz, VBW= 3 MHz
Trace 2: RBW= 300 kHz, VBW= 500 kHz, Band-Edge at 2400 MHz comply
Trace 3: RBW= 1 MHz, VBW= 10 Hz

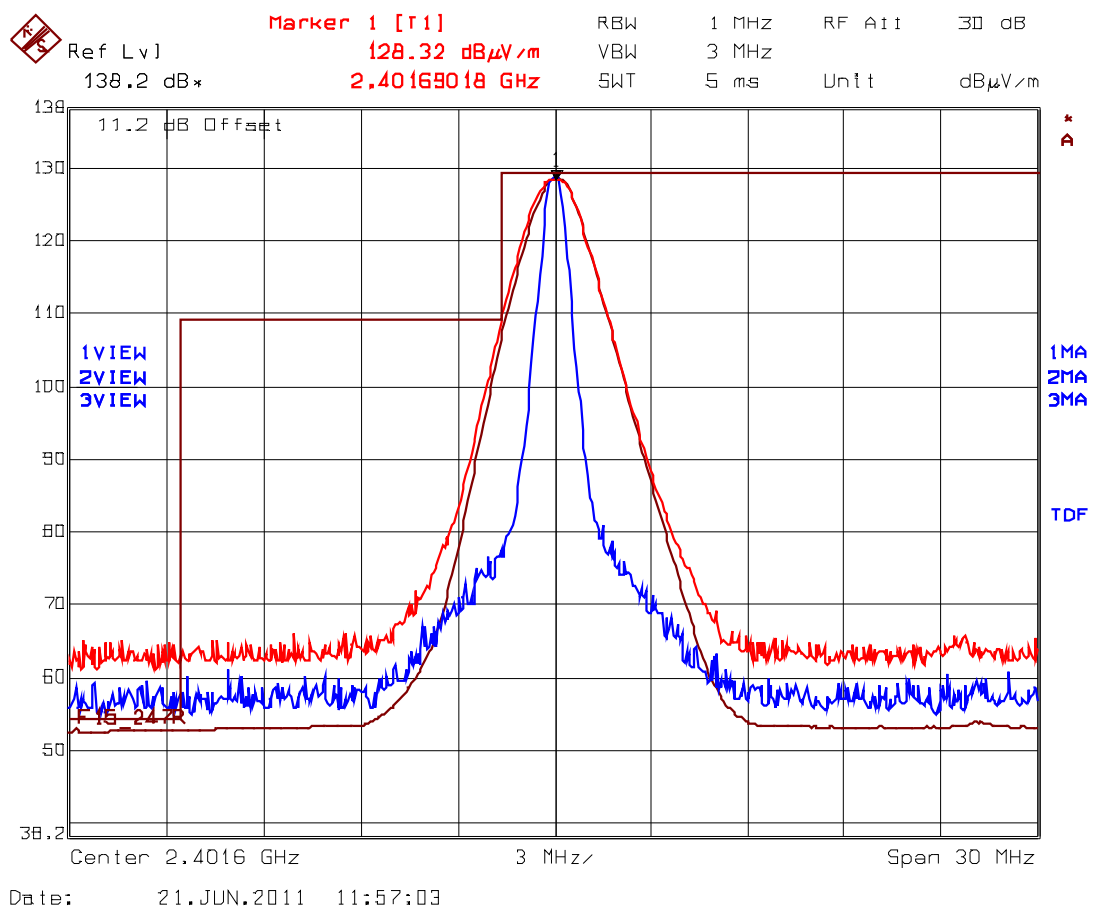


Plot 5.11.4.3.2 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
 Low End of Frequency Band (at high power and data rate)
 Rx Antenna Orientation: Vertical

Trace 1: RBW= 1 MHz, VBW= 3 MHz

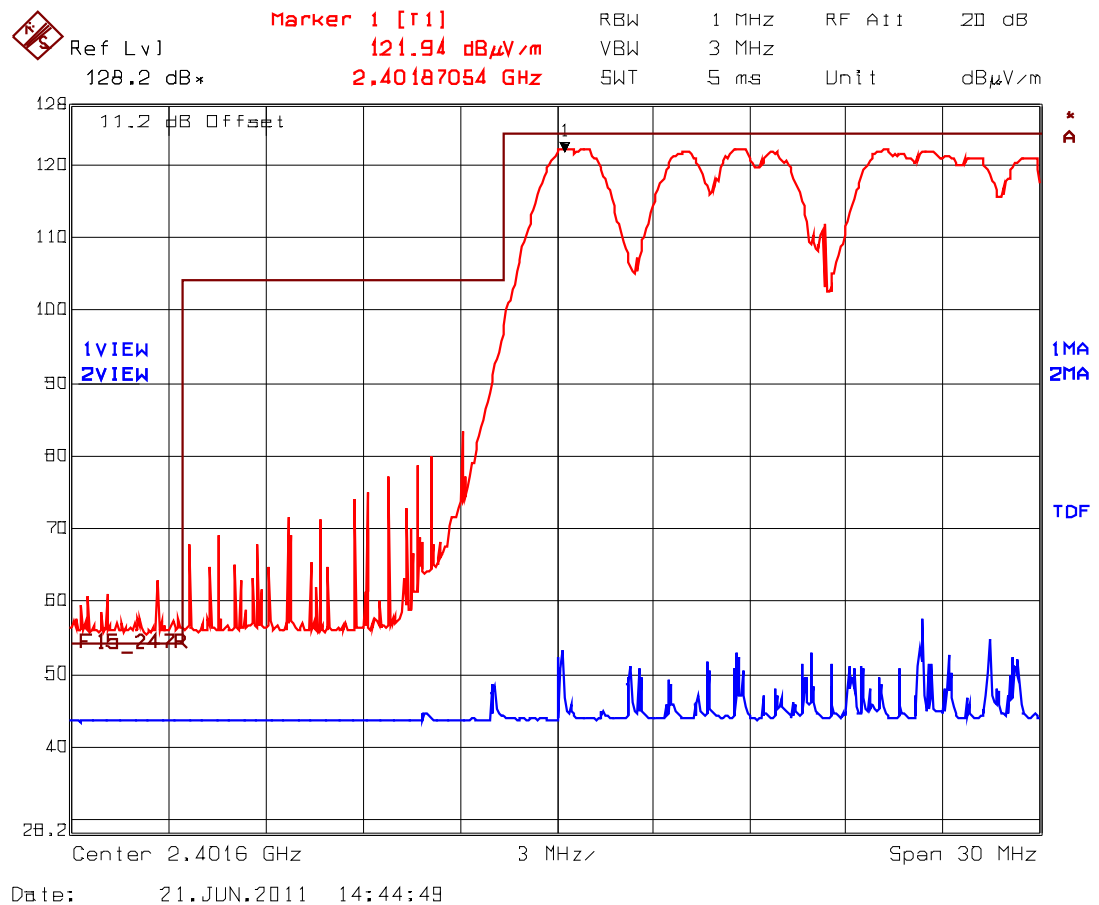
Trace 2: RBW= 300 kHz, VBW= 500 kHz, Band-Edge at 2400 MHz comply

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



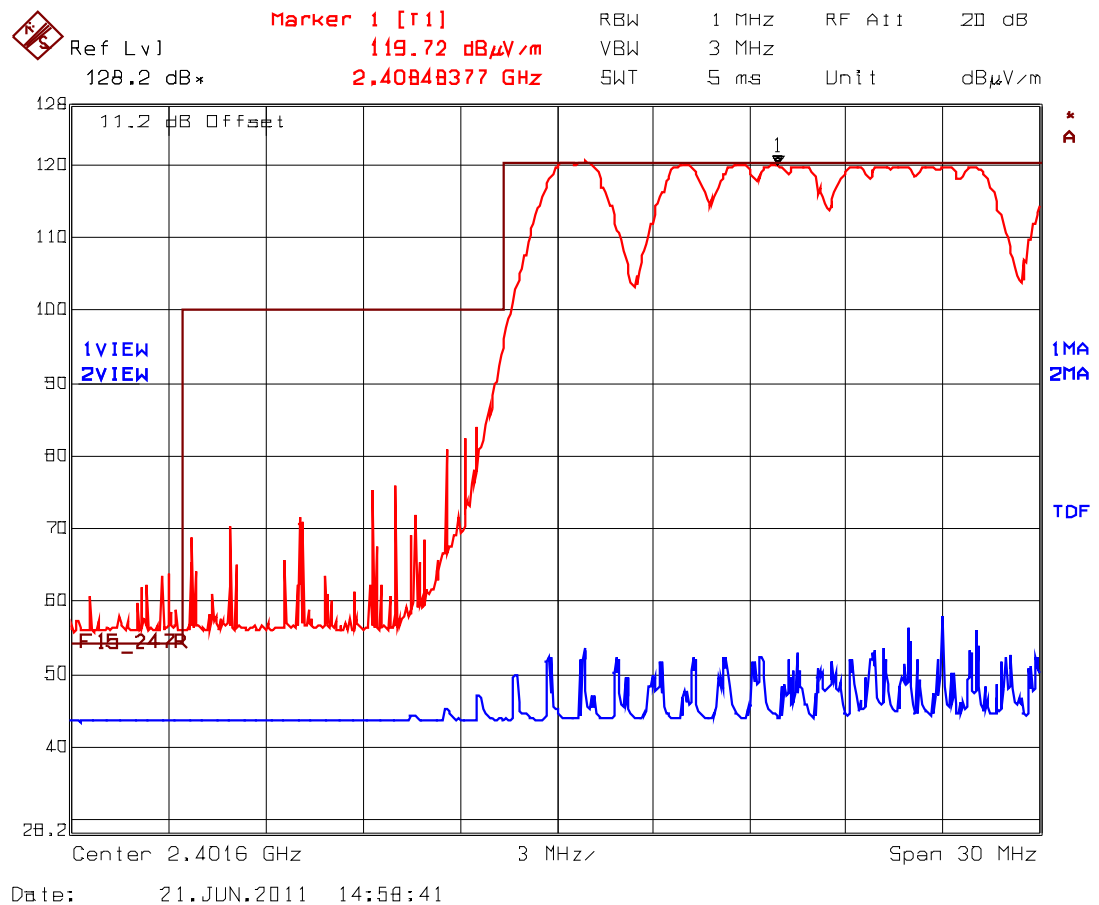
Plot 5.11.4.3.3 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

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



Plot 5.11.4.3.4 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

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



Fundamental Frequency: 2439.6 MHz							
Measured Conducted Power: 22.35 dBm							
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
2439.6	127.62	--	V	--	--	--	--
2439.6	128.61	--	H	--	--	--	--
4879.2	52.31	47.29	V	54.0	108.6	-6.7	Pass*
4879.2	50.65	45.92	H	54.0	108.6	-8.1	Pass*
7318.8	53.12	43.01	V	54.0	108.6	-11.0	Pass*
7318.8	53.64	43.78	H	54.0	108.6	-10.2	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

* Emission within the restricted frequency bands.

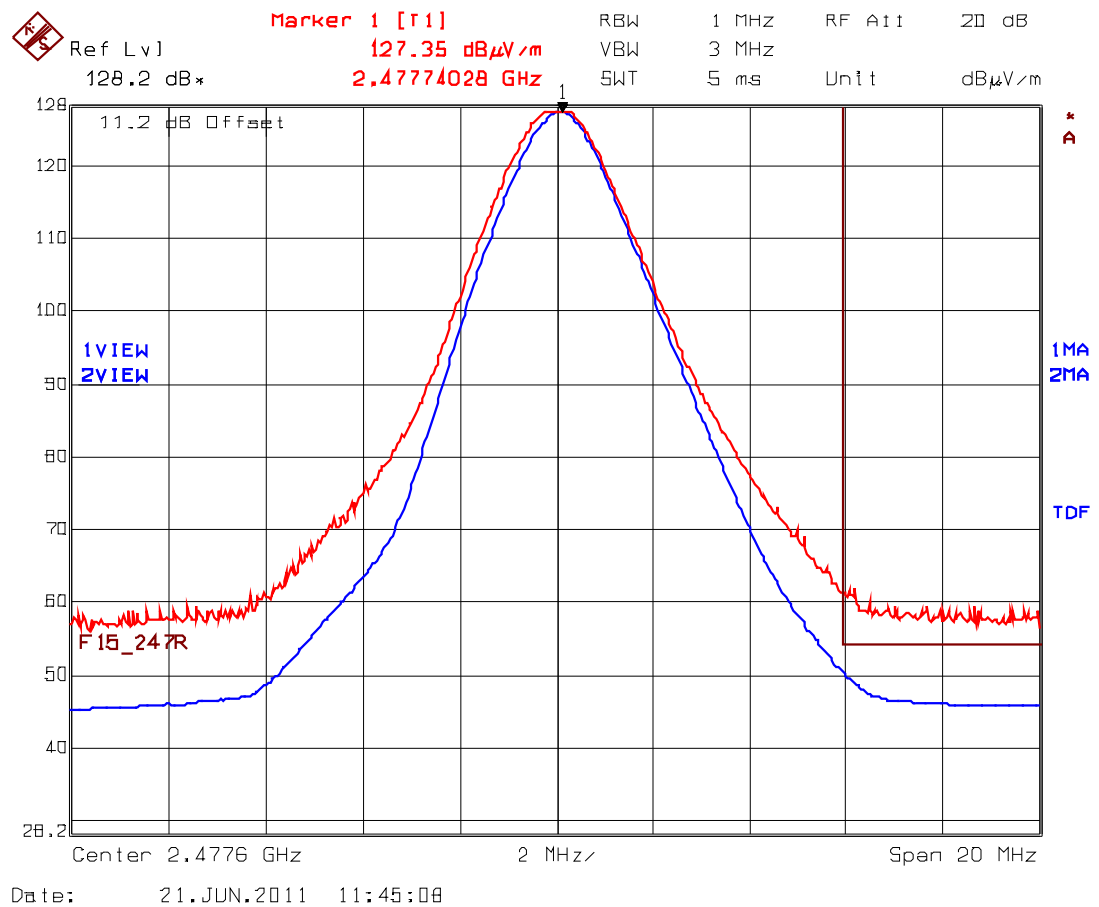
Fundamental Frequency: 2477.6 MHz							
Measured Conducted Power: 22.22 dBm							
Frequency Test Range: 30 MHz – 25 GHz							
Frequency (MHz)	RF Peak Level (dBμV/m)	RF Avg Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
2477.6	126.15	--	V	--	--	--	--
2477.6	127.35	--	H	--	--	--	--
4955.2	51.52	46.01	V	54.0	107.4	-8.0	Pass*
4955.2	49.87	41.74	H	54.0	107.4	-12.3	Pass*
7432.8	52.14	41.37	V	54.0	107.4	-12.6	Pass*
7432.8	52.78	41.65	H	54.0	107.4	-12.3	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit. See the following test data plots for band-edge emissions.							

* Emission within the restricted frequency bands.

Plot 5.11.4.3.5 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

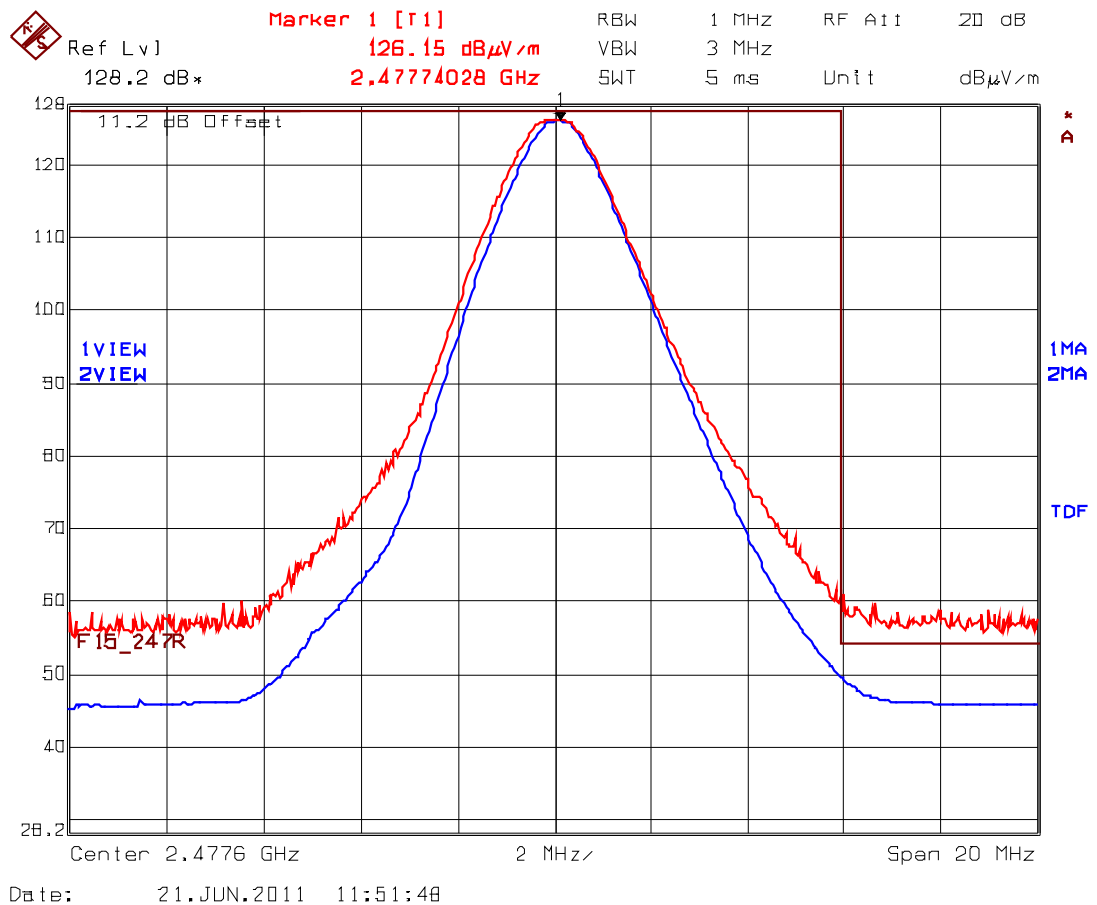
Trace 1: RBW= 1 MHz, VBW= 3 MHz

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



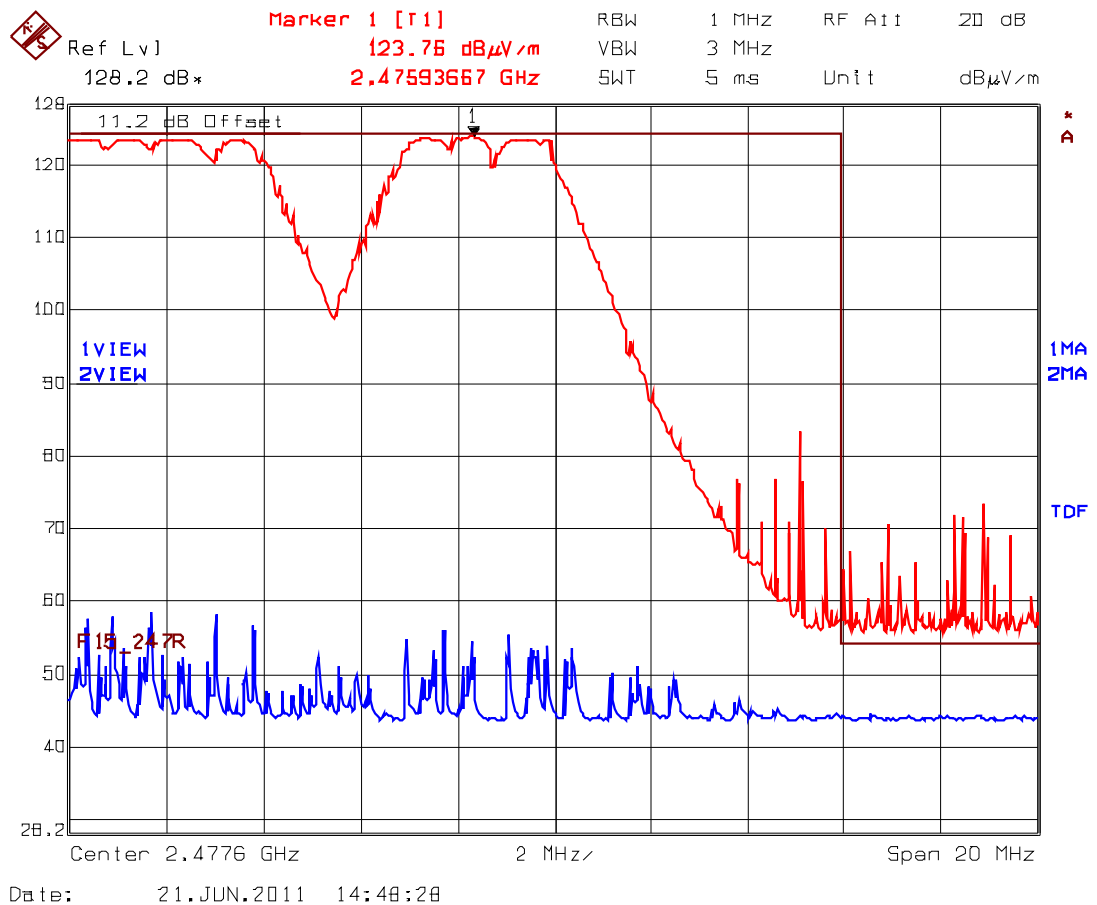
Plot 5.11.4.3.6 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

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



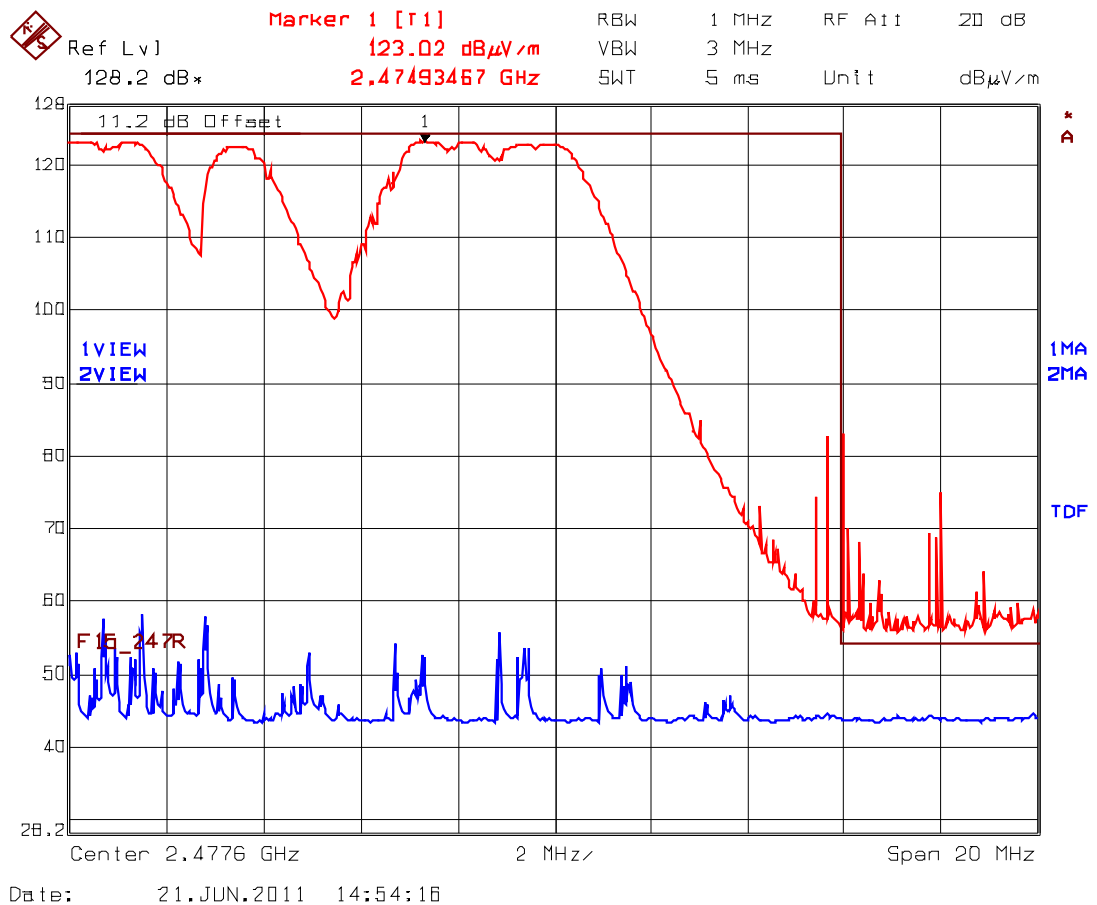
Plot 5.11.4.3.7 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

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



Plot 5.11.4.3.8 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

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



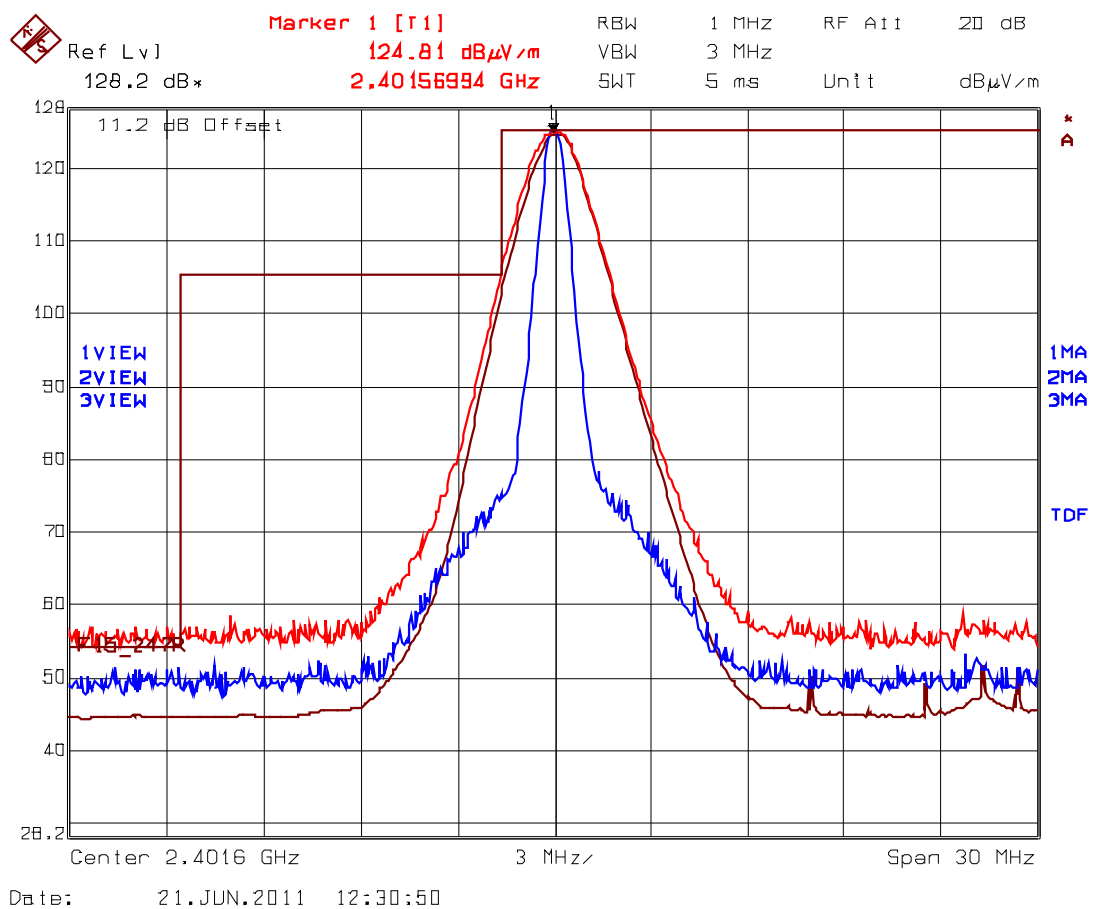
5.11.4.4. EUT with 15 dBi Omni Directional Antenna and 1.41 dB Assembly Cable Loss

Fundamental Frequency:		2401.6 MHz					
Measured Conducted Power:		22.35 dBm					
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
2401.6	126.07	--	V	--	--	--	--
2401.6	124.81	--	H	--	--	--	--
4803.2	51.56	46.42	V	54.0	106.1	-7.6	Pass*
4803.2	50.65	42.23	H	54.0	106.1	-11.8	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit. See the following test data plots for band-edge emissions.							

* Emission within the restricted frequency bands.

Plot 5.11.4.4.1 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

Trace 1: RBW= 1 MHz, VBW= 3 MHz
Trace 2: RBW= 300 kHz, VBW= 500 kHz, Band-Edge at 2400 MHz comply
Trace 3: RBW= 1 MHz, VBW= 10 Hz

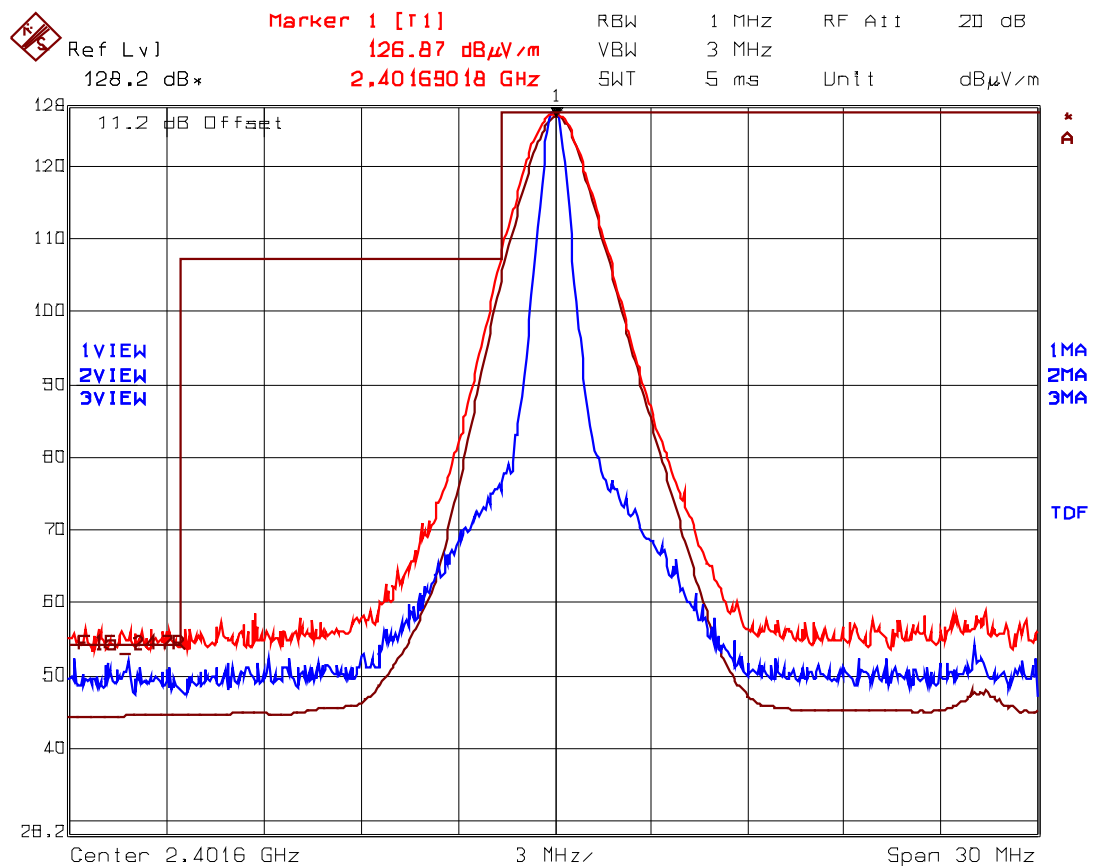


Plot 5.11.4.4.2 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
 Low End of Frequency Band (at high power and data rate)
 Rx Antenna Orientation: Vertical

Trace 1: RBW= 1 MHz, VBW= 3 MHz

Trace 2: RBW= 300 kHz, VBW= 500 kHz, Band-Edge at 2400 MHz comply

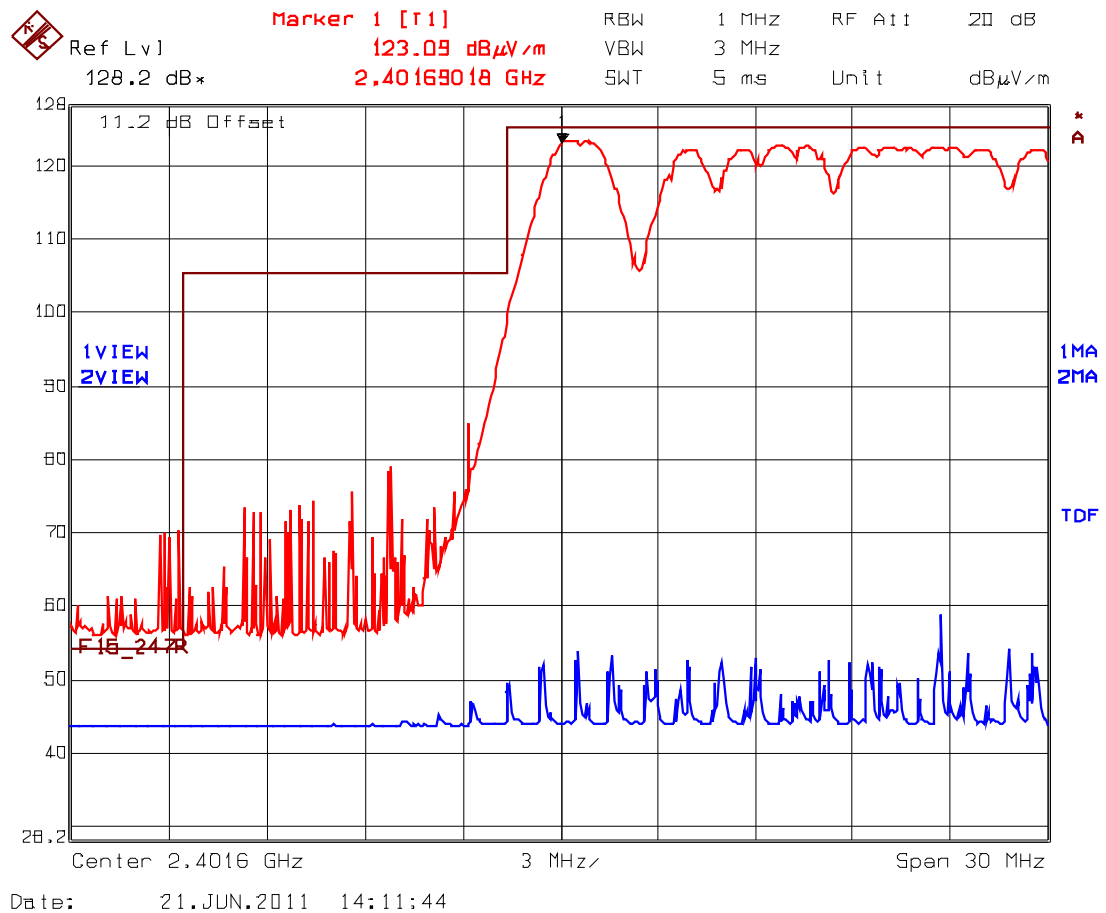
Trace 3: RBW= 1 MHz, VBW= 10 Hz



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Plot 5.11.4.4.3 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
 Low End of Frequency Band (at high power and data rate)
 Rx Antenna Orientation: Horizontal

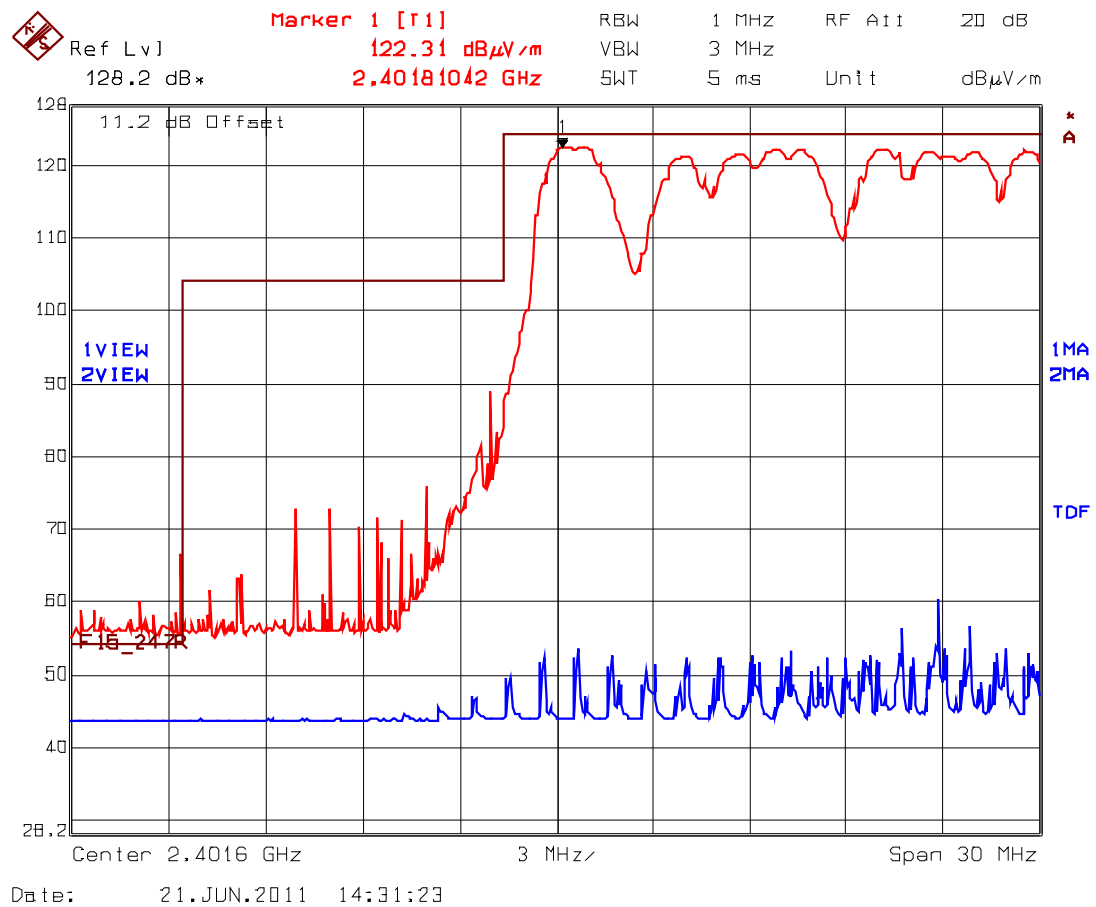
Trace 1: RBW= 1 MHz, VBW= 3 MHz
 Trace 2: RBW= 1 MHz, VBW= 10 Hz



Plot 5.11.4.4.4 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
Low End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

Trace 1: RBW= 1 MHz, VBW= 3 MHz

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



Fundamental Frequency: 2439.6 MHz							
Measured Conducted Power: 22.35 dBm							
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
2439.6	125.64	--	V	--	--	--	--
2439.6	122.37	--	H	--	--	--	--
4879.2	52.61	47.54	V	54.0	105.6	-7.5	Pass*
4879.2	50.57	45.29	H	54.0	105.6	-8.3	Pass*
7318.8	55.16	45.96	V	54.0	105.6	-8.0	Pass*
7318.8	54.45	44.32	H	54.0	105.6	-9.7	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit.							

* Emission within the restricted frequency bands.

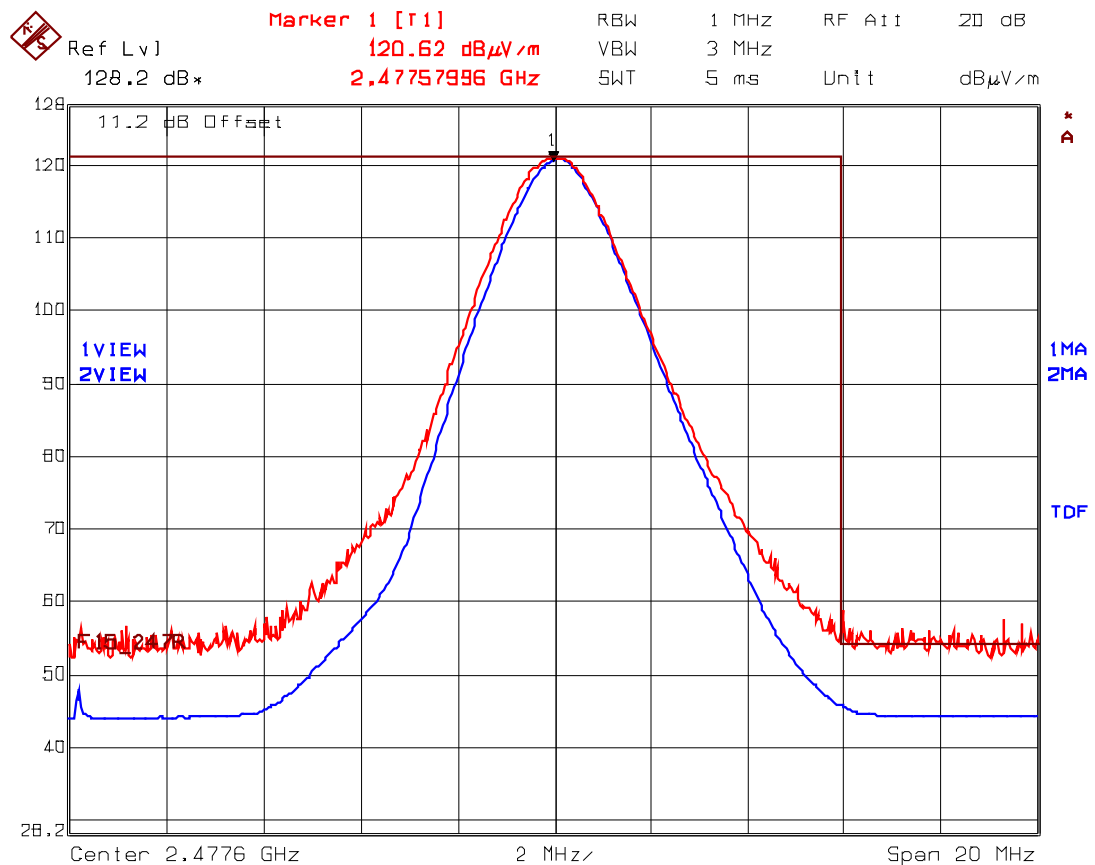
Fundamental Frequency: 2477.6 MHz							
Measured Conducted Power: 22.22 dBm							
Frequency Test Range: 30 MHz – 25 GHz							
Frequency (MHz)	RF Peak Level (dBμV/m)	RF Avg Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
2477.6	125.23	--	V	--	--	--	--
2477.6	120.62	--	H	--	--	--	--
4955.2	52.43	43.79	V	54.0	105.2	-10.2	Pass*
4955.2	51.65	43.16	H	54.0	105.2	-10.8	Pass*
7432.8	53.56	42.48	V	54.0	105.2	-10.5	Pass*
7432.8	53.98	42.69	H	54.0	105.2	-10.3	Pass*
All other spurious emissions and harmonics are more than 20 dB below the applicable limit. See the following test data plots for band-edge emissions.							

* Emission within the restricted frequency bands.

Plot 5.11.4.4.5 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

Trace 1: RBW= 1 MHz, VBW= 3 MHz

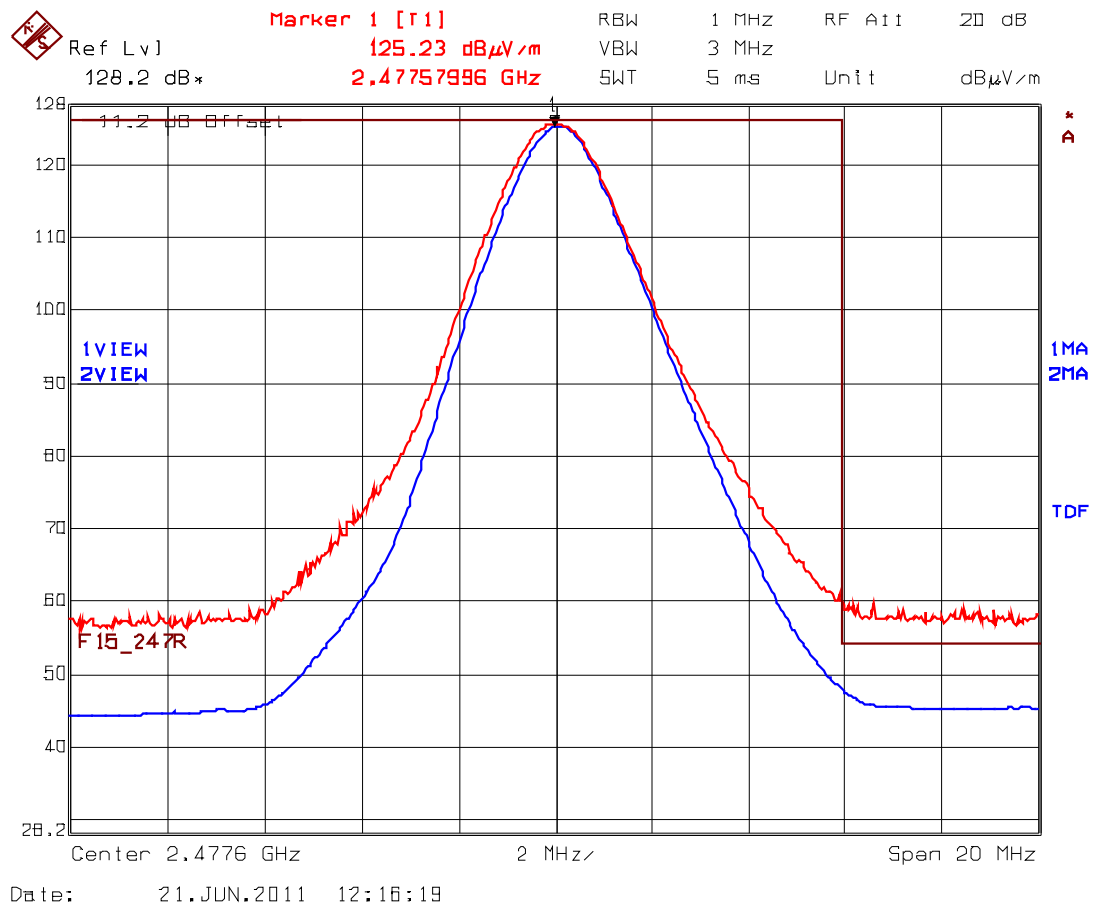
Trace 2: RBW= 1 MHz, VBW= 10 Hz



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Plot 5.11.4.4.6 Band-Edge RF Radiated Emissions @ 3 meter, Single Frequency Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

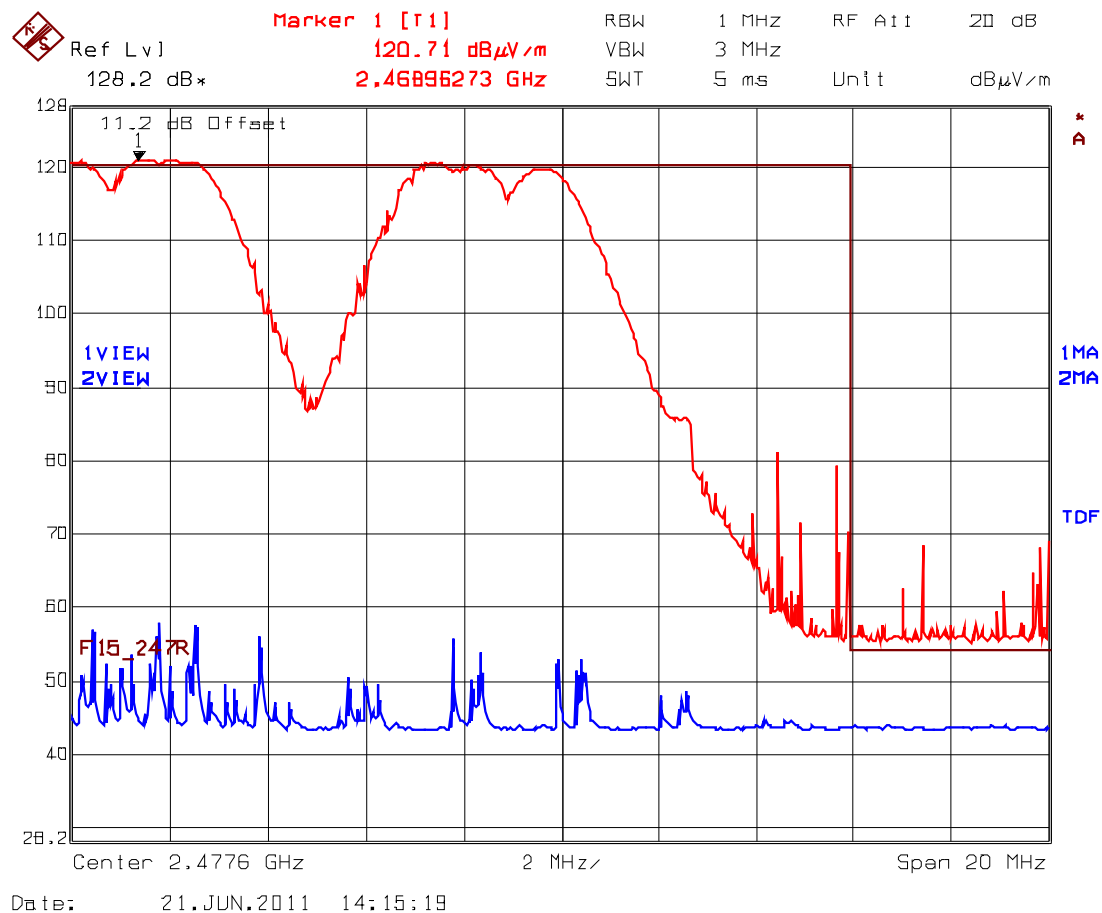
Trace 1: RBW= 1 MHz, VBW= 3 MHz
Trace 2: RBW= 1 MHz, VBW= 10 Hz



Plot 5.11.4.4.7 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Horizontal

Trace 1: RBW= 1 MHz, VBW= 3 MHz

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



Plot 5.11.4.2.8 Band-Edge RF Radiated Emissions @ 3 meter, Pseudorandom Hopping Mode
High End of Frequency Band (at high power and data rate)
Rx Antenna Orientation: Vertical

Trace 1: RBW= 1 MHz, VBW= 3 MHz

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

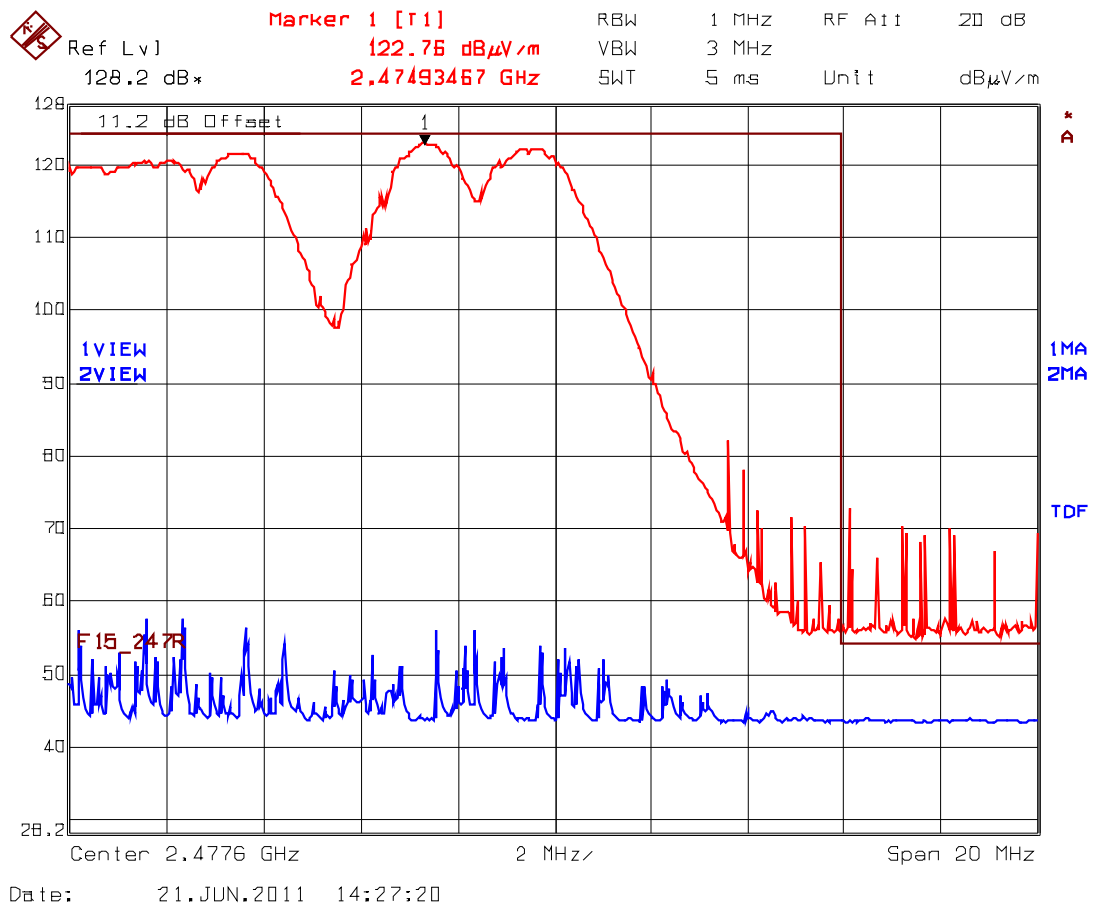


EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Calibration Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK30	100077	20 Hz – 40 GHz	14 Aug 2011
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	15 Mar 2012
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	17 Feb 2012
RF Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	15 Mar 2012
High Pass Filter	K & L	11SH10-4000/T12000	4	Cut off 2.4 GHz	Cal. on use
Horn Antenna	Emco	3155	6570	1 – 18 GHz	22 Feb 2012
Biconi-Log Antenna	Emco	3142C	00034792	26 – 3000 MHz	26 April 2012
Horn Antenna	ETS Lindgren	3160-09	00118385	18 – 26.5 GHz	30 May 2012
Signal Generator	Hewlett Packard	8648C	3443U00391	100 kHz – 3200 MHz	16 Dec 2011
Attenuator	Narda	4768-20	-	DC – 40 GHz	Cal. on use
Power Divider	Mini-Circuits	15542	0235	DC – 18 GHz	Cal. on use
Spectrum Analyzer	Hewlett Packard	HP 8593EM	3710A00223	9 kHz – 22 GHz	25 April 2012
LISN	EMCO	3825/2R	1165	10 kHz – 30 MHz	08 April 2012
Attenuator	Pasternack	PE7010-20	-	-	18 Jan 2012

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. Line Conducted Emission Measurement Uncertainty (0.15-30 MHz)

	Line Conducted Emission Measurement Uncertainty (150 kHz – 30 MHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 1.57	± 1.8
U	Expanded uncertainty U: $U = 2u_c(y)$	± 3.14	± 3.6

7.2. Radiated Emission Measurement Uncertainty

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 2.15	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.30	± 5.2

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 2.39	± 2.6
U	Expanded uncertainty U: $U = 2u_c(y)$	± 4.78	± 5.2

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal & Vertical (1 – 18 GHz):	Measured	Limit
u_c	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	± 1.87	Under consideration
U	Expanded uncertainty U: $U = 2u_c(y)$	± 3.75	Under consideration