



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Tablet PC

Model: Smart Tab II⁷

Trade Name: Vodafone

Issued to

**Lenovo (Shanghai) Electronics Technology Co., Ltd.
No. 68 Building, 199 Fenju Road, Wai Gao Qiao FTZ , Shanghai , China**

Issued by

**Compliance Certification Services Inc.
No.11, Wu-Gong 6th Rd., Wugu Industrial Park,
New Taipei City 248, Taiwan (R.O.C.)
<http://www.ccsrf.com>
service@ccsrf.com
Issued Date: August 24, 2012**



Note: This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc. This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document.



Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		August 24, 2012		Initial Issue	ALL	Angel Cheng



TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION.....	4
2. EUT DESCRIPTION	5
3. TEST METHODOLOGY	7
3.1 EUT CONFIGURATION	7
3.2 EUT EXERCISE.....	7
3.3 GENERAL TEST PROCEDURES.....	7
3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS.....	8
3.5 DESCRIPTION OF TEST MODES	9
4 INSTRUMENT CALIBRATION.....	10
4.1 MEASURING INSTRUMENT CALIBRATION	10
4.2 MEASUREMENT EQUIPMENT USED	10
4.3 MEASUREMENT UNCERTAINTY	11
5 FACILITIES AND ACCREDITATIONS	12
5.1 FACILITIES	12
5.2 EQUIPMENT.....	12
5.3 TABLE OF ACCREDITATIONS AND LISTINGS.....	13
6 SETUP OF EQUIPMENT UNDER TEST	14
6.1 SETUP CONFIGURATION OF EUT.....	14
6.2 SUPPORT EQUIPMENT	14
7 FCC PART 15.247 REQUIREMENTS.....	15
7.1 6DB BANDWIDTH.....	15
7.2 PEAK POWER.....	18
7.3 AVERAGE POWER	21
7.4 BAND EDGES MEASUREMENT	24
7.5 PEAK POWER SPECTRAL DENSITY	31
7.6 SPURIOUS EMISSIONS.....	34
7.7 POWERLINE CONDUCTED EMISSIONS.....	49
APPENDIX I RADIO FREQUENCY EXPOSURE	52
APPENDIX II PHOTOGRAPHS OF TEST SETUP	53
APPENDIX 1 - PHOTOGRAPHS OF EUT	



1. TEST RESULT CERTIFICATION

Applicant: Lenovo (Shanghai) Electronics Technology Co., Ltd.
No. 68 Building, 199 Fenju Road,
Wai Gao Qiao FTZ , Shanghai , China

Equipment Under Test: Tablet PC

Trade Name: Vodafone

Model: Smart Tab II⁷

Date of Test: May 30 ~ August 24, 2012

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C	No non-compliance noted
Deviation from Applicable Standard	
N/A	

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in **ANSI C63.4: 2003** and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Reviewed by:

Jason Lin
Section Manager
Compliance Certification Services Inc.

Gina Lo
Section Manager
Compliance Certification Services Inc.



2. EUT DESCRIPTION

Product	Tablet PC
Trade Name	Vodafone
Model Number	Smart Tab II ⁷
Model Discrepancy	N/A
Received Date	June 6, 2012
Power Rating	VDC from Power adapter 1) HuntKey / Model: HKA00905015-3C I/P: 100~240Vac 50/60Hz, 0.25A O/P: 5.0Vdc 1.5A 2) HuntKey / Model: HKA00905015-4C I/P: 100~240Vac 50/60Hz, 0.25A O/P: 5.0Vdc 1.5A 3) HuntKey / Model: HKA00905015-LC I/P: 100~240Vac 50/60Hz, 0.25A O/P: 5.0Vdc 1.5A 4) HuntKey / Model: HKA00905015-9C I/P: 100~240Vac 50/60Hz, 0.25A O/P: 5.0Vdc 1.5A
Frequency Range	2402MHz ~ 2480MHz
Transmit Power	2.38dBm
Modulation Technique	GFSK (1Mbps)
Number of Channels	40 Channels
Antenna Specification	Gain: 5.1 dBi
Antenna Designation	PIFA Antenna

Remark:

1. The sample selected for test was production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: 057A2107VDF3G filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.





3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

The tests documented in this report were performed in accordance with IC RSS-210, IC RSS-Gen, IC RSS-102, IC RSS-212, and ANSI C63.4.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.



3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

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

² Above 38.6

- (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



3.5 DESCRIPTION OF TEST MODES

The EUT (model: Smart Tab II⁷) had been tested under operating condition.

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

BT 4.0

Tested Channel	Frequency (MHz)	Axis
Low	2402	Y
Mid	2440	Y
High	2480	Y

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (Y axis) and the worst case was recorded.



4 INSTRUMENT CALIBRATION

4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

4.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Remark: Each piece of equipment is scheduled for calibration once a year and Loop Antenna is scheduled for calibration once three years.

Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY43360131	03/16/2013
Power Meter	Anritsu	ML2495A	1012009	04/26/2013
Power Sensor	Anritsu	MA2411B	0917072	04/26/2013

3M Chamber Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510268	11/15/2012
EMI Test Receiver	R&S	ESCI	100064	03/01/2013
Pre-Amplifier	Mini-Circuits	ZFL-1000LN	SF350700823	01/13/2013
Pre-Amplifier	MITEQ	AFS44-00102650-42-10P-44	1415367	11/20/2012
Bilog Antenna	Sunol Sciences	JB3	A030105	10/03/2012
Horn Antenna	EMCO	3117	00055165	01/11/2013
Loop Antenna	EMCO	6502	8905/2356	06/10/2013
Turn Table	CCS	CC-T-1F	N/A	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R
Site NSA	CCS	N/A	N/A	12/23/2012
Test S/W	EZ-EMC (CCS-3A1RE)			

Conducted Emission room # B				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCI	101073	07/28/2012
LISN	R&S	ENV216	101054	06/06/2013
LISN	SCHWARZBECK	NSLK 8127	8127-541	12/14/2012
Coaxial Cable	Commate	CFD300-NL	NA	05/27/2013
Capacitive Voltage Probe	FCC	F-CVP-1	100185	02/15/2013
Test S/W	CCS-3A1-CE			



4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission	+/- 1.2575
3M Semi Anechoic Chamber / 30M~200M	+/- 4.0138
3M Semi Anechoic Chamber / 200M~1000M	+/- 3.9483
3M Semi Anechoic Chamber / 1G~8G	+/- 2.5975
3M Semi Anechoic Chamber / 8G~18G	+/- 2.6112
3M Semi Anechoic Chamber / 18G~26G	+/- 2.7389
3M Semi Anechoic Chamber / 26G~40G	+/- 2.9683

Remark: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.



5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.

Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wu-Gong 6th Rd., Wugu Industrial Park, New Taipei City 248, Taiwan (R.O.C.)

Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☐ No.81-1, Lane 210, Bade 2nd Rd., Lujhu Township, Taoyuan County 33841, TAIWAN, R.O.C.

Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."



5.3 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	 FCC MRA: TW1039
Taiwan	TAF	LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-210, RSS-310 IDA TS SRD, AS/NZS 4268, AS/NZS 4771, TS 12.1 & 12.2, ETSI EN 300 440-1, ETSI EN 300 440-2, ETSI EN 300 328, ETSI EN 300 220-1, ETSI EN 300 220-2, ETSI EN 301 893, ETSI EN 301 489-1/3/7/17 FCC OET Bulletin 65 + Supplement C, EN 50360, EN 50361, EN 50371, RSS 102, EN 50383, EN 50385, EN 50392, IEC 62209, CNS 14958-1, CNS 14959 FCC Method -47 CFR Part 15 Subpart B IEC / EN 61000-3-2, IEC / EN 61000-3-3, IEC / EN 61000-4-2/3/4/5/6/8/11	
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	 IC 2324G-1 IC 2324G-2

* No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.



6 SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1	Multimedia Headset	Labtec	Axis-301	N/A	FCC DoC	Unshielded, 1.8m x 2	N/A
2	Earphone	Logitech	NA	NA	NA	Unshielded, 1.8m	N/A
3	SIM Card	N/A	N/A	N/A	N/A	N/A	N/A
4	Micro SD Card	Transcend.	N/A	N/A	N/A	N/A	N/A
5	Wireless Pre-N Router (MIMO) (Remote)	BELKIN	F5D8230-4	N/A	SA3-AGN0901AP0100	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
6	Universal Radio Communication Tester (Remote)	R&S	CMU200	101245	N/A	N/A	Unshielded, 1.8m
7	BT Headset (Remote)	N/A	N/A	N/A	N/A	N/A	N/A
8	Notebook PC (Remote)	Lenovo	TP00013A	LR-9XH2K	FCC DoC	N/A	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m

Remark:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



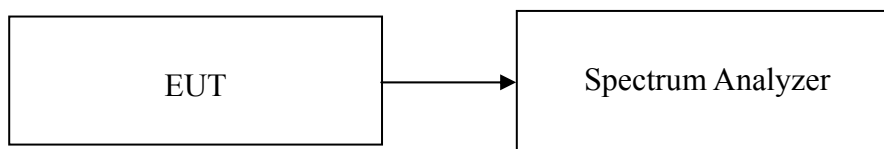
7 FCC PART 15.247 REQUIREMENTS

7.1 6DB BANDWIDTH

LIMIT

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. Set the RBW = 1% of the emission bandwidth, VBW $\geq 3 \times$ RBW, Detector = Peak, Trace mode = max hold, Sweep = auto couple. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6dB relative to the maximum level measured in the fundamental emission.

TEST RESULTS

No non-compliance noted

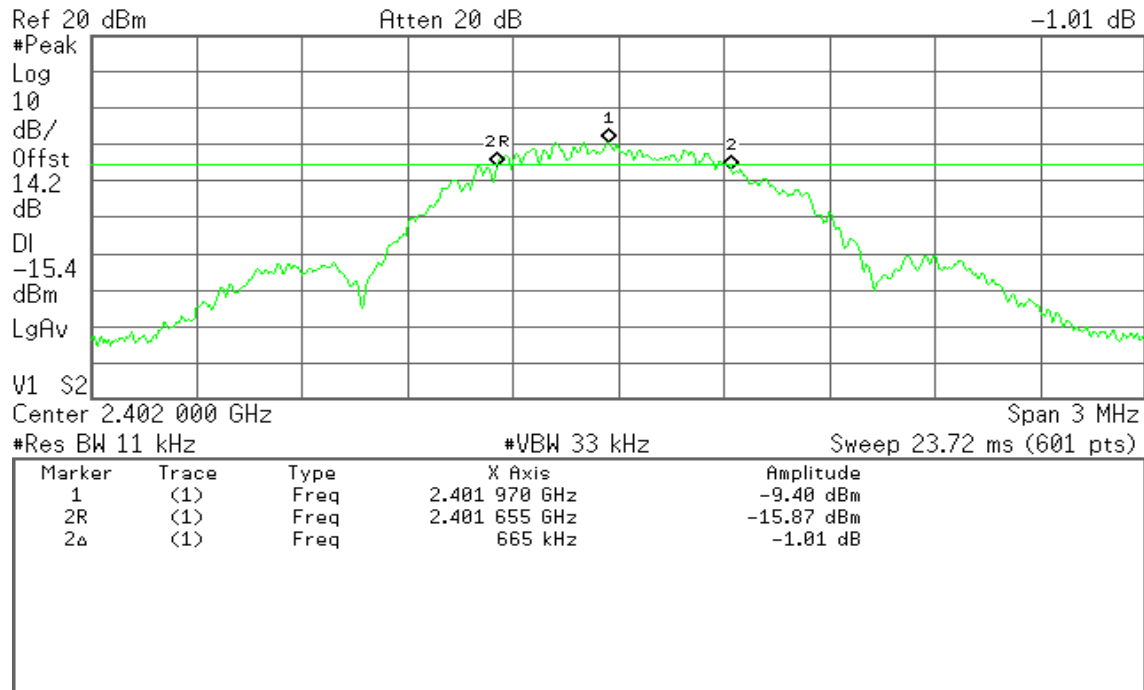
Test Data

Channel	Frequency (MHz)	6dB Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2402	665	>500	PASS
Mid	2440	665		PASS
High	2480	675		PASS

**Test Plot****6dB Bandwidth (CH Low)**

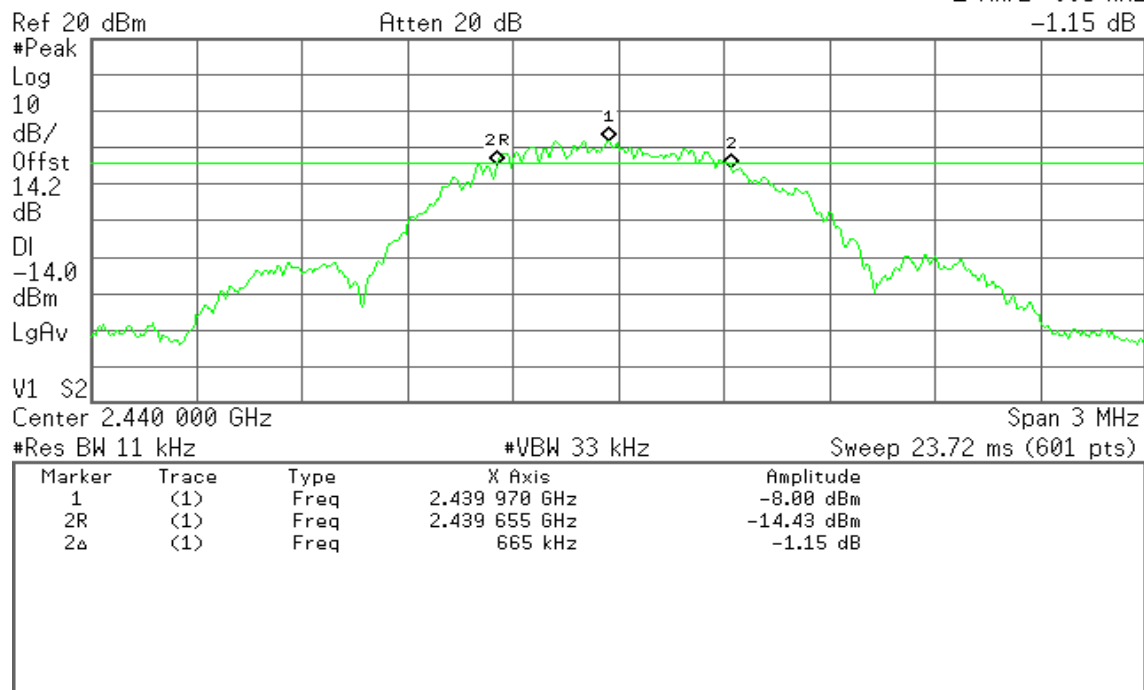
* Agilent 11:07:43 May 30, 2012

R T

▲ Mkr2 665 kHz
-1.01 dB**6dB Bandwidth (CH Mid)**

* Agilent 11:06:10 May 30, 2012

R T

▲ Mkr2 665 kHz
-1.15 dB

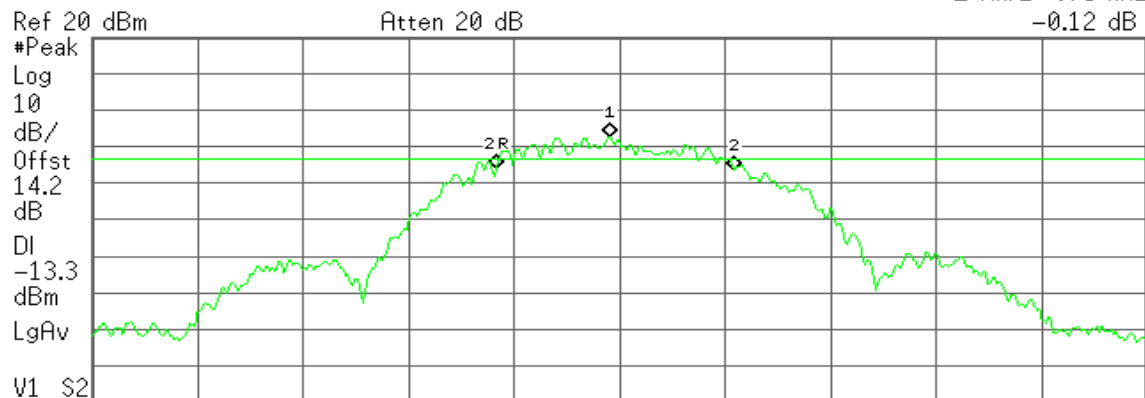


6dB Bandwidth (CH High)

Agilent 11:04:29 May 30, 2012

R T

▲ Mkr2 675 kHz
-0.12 dB



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 970 GHz	-7.33 dBm
2R	(1)	Freq	2.479 650 GHz	-16.13 dBm
2▲	(1)	Freq	675 kHz	-0.12 dB



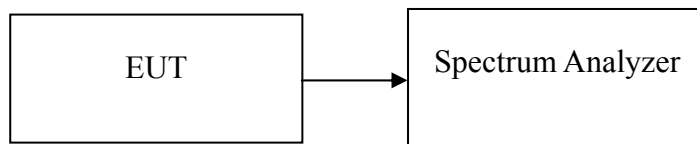
7.2 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §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.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. Set the RBW = 1MHz, VBW = 3MHz, Detector = Peak, Trace mode = max hold, Allow trace to fully stabilize. Sweep = auto couple. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges record the max reading. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted

Test Data

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Test Result
Low	2402	1.38	0.0013	1	PASS
Mid	2440	1.63	0.0014		PASS
High	2480	2.38	0.0017		PASS

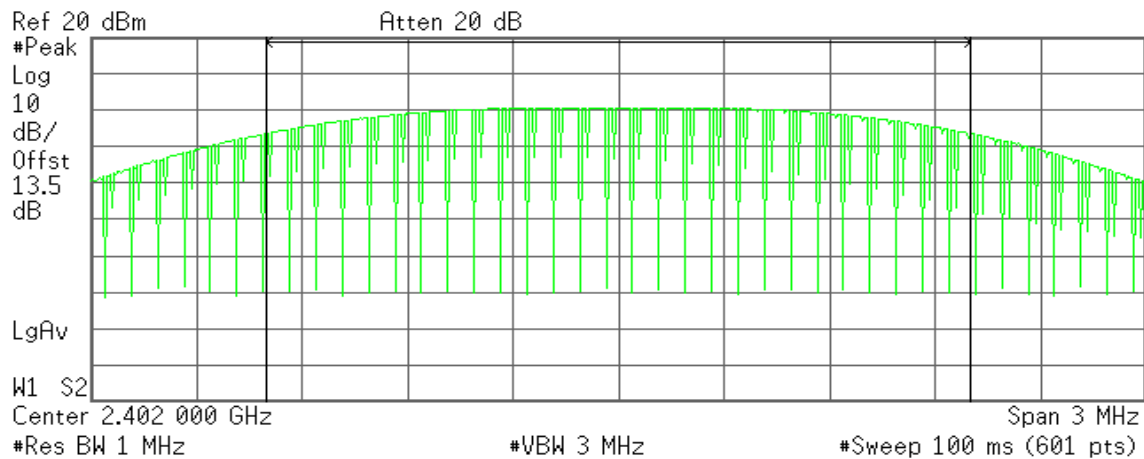


BT4.0

Peak power (CH Low)

Agilent 19:15:33 Jun 26, 2012

R T



Channel Power

1.38 dBm /2.0000 MHz

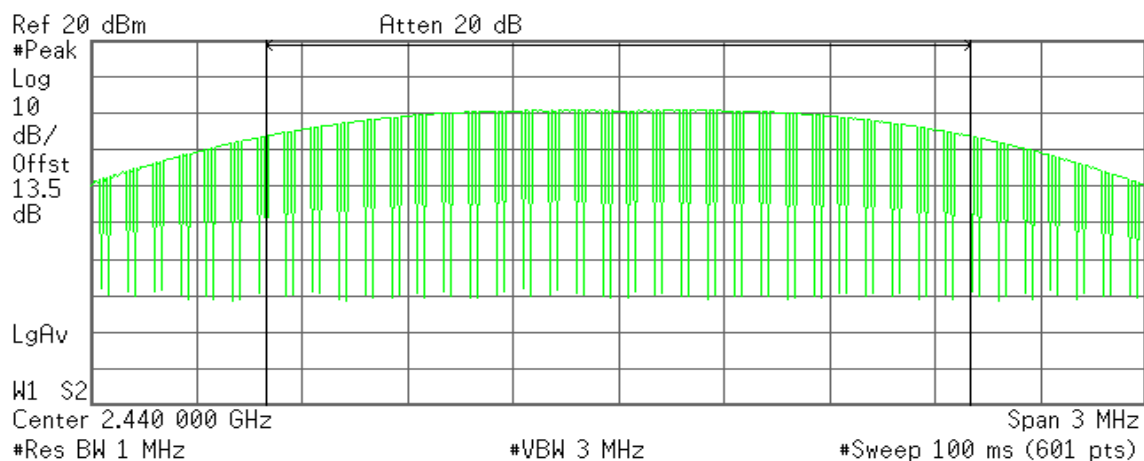
Power Spectral Density

-61.63 dBm/Hz

Peak power (CH Mid)

Agilent 19:20:23 Jun 26, 2012

R T



Channel Power

1.63 dBm /2.0000 MHz

Power Spectral Density

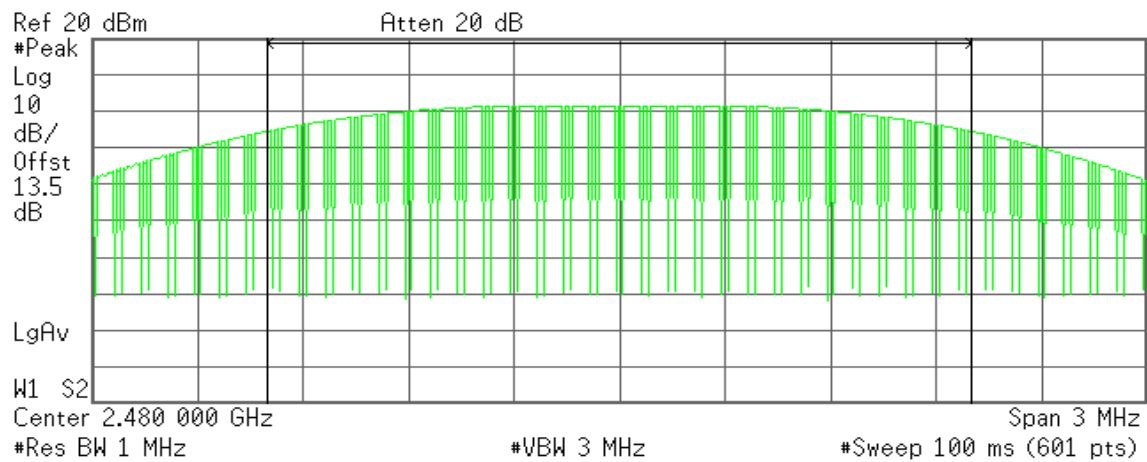
-61.39 dBm/Hz



Peak power (CH High)

Agilent 19:27:13 Jun 26, 2012

R T



Channel Power

2.38 dBm /2.0000 MHz

Power Spectral Density

-60.63 dBm/Hz

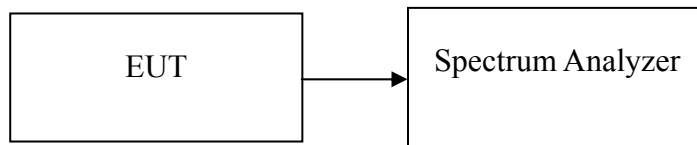


7.3 AVERAGE POWER

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. Set the RBW = 1MHz, VBW = 3MHz, Detector = Sample, Trace mode = averaging of 100 traces, Sweep = auto couple. Use the spectrum analyzer's integrated band power measurement function with band limits set equal to the EBW band edges record the max reading. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted

Test Data

Channel	Frequency (MHz)	Output Power (dBm)
Low	2402	-1.76
Mid	2440	-1.63
High	2480	-0.96

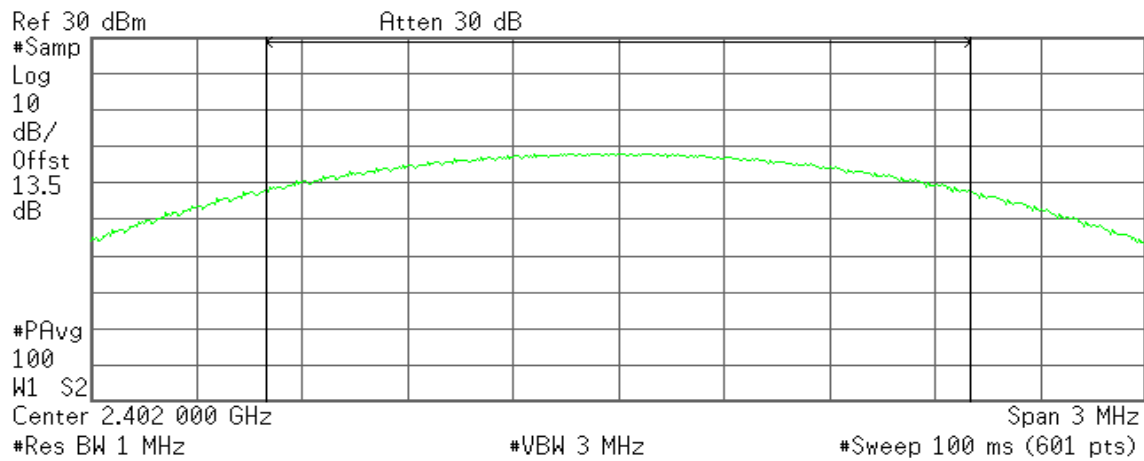


BT4.0

Peak power (CH Low)

Agilent 19:17:02 Jun 26, 2012

R T



Channel Power

-1.76 dBm /2.0000 MHz

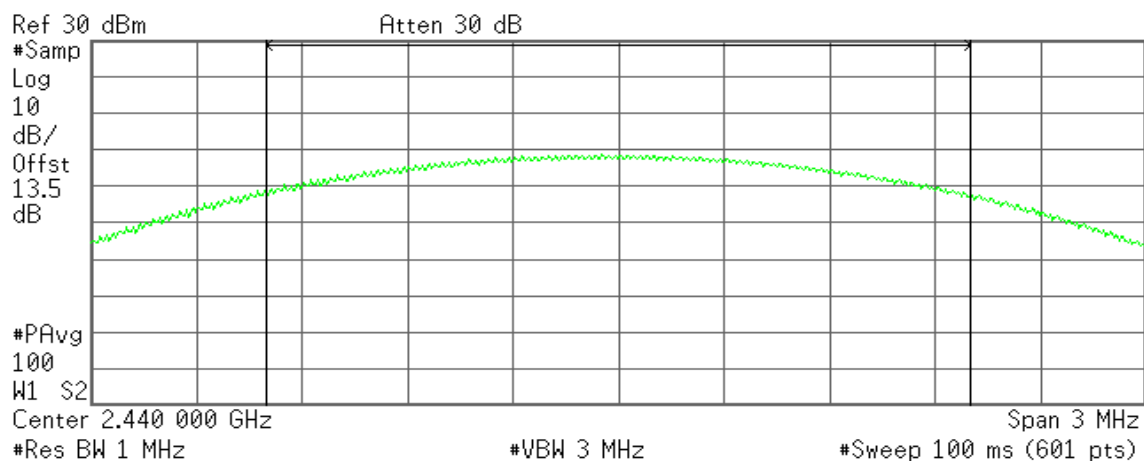
Power Spectral Density

-64.77 dBm/Hz

Peak power (CH Mid)

Agilent 19:21:51 Jun 26, 2012

R T



Channel Power

-1.63 dBm /2.0000 MHz

Power Spectral Density

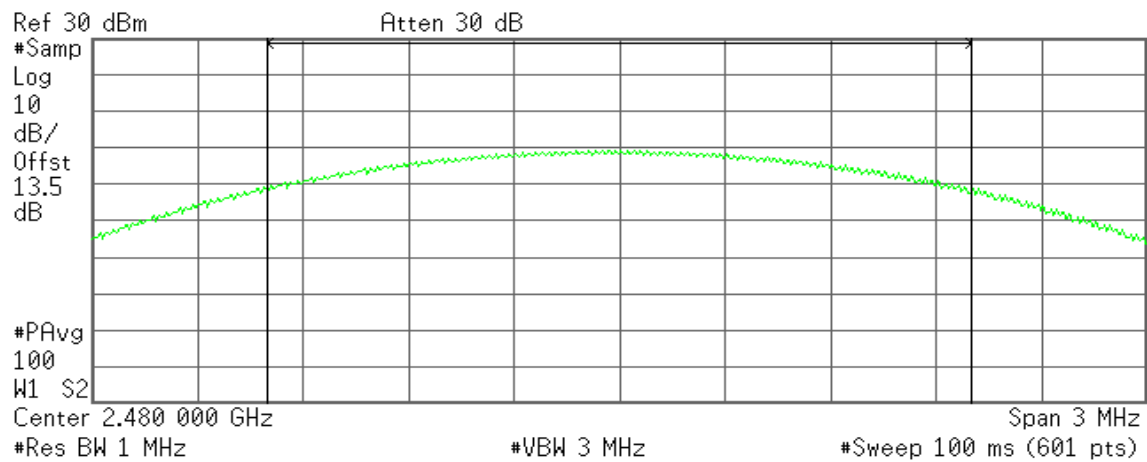
-64.64 dBm/Hz



Peak power (CH High)

Agilent 19:28:52 Jun 26, 2012

R T



Channel Power

-0.96 dBm /2.0000 MHz

Power Spectral Density

-63.97 dBm/Hz



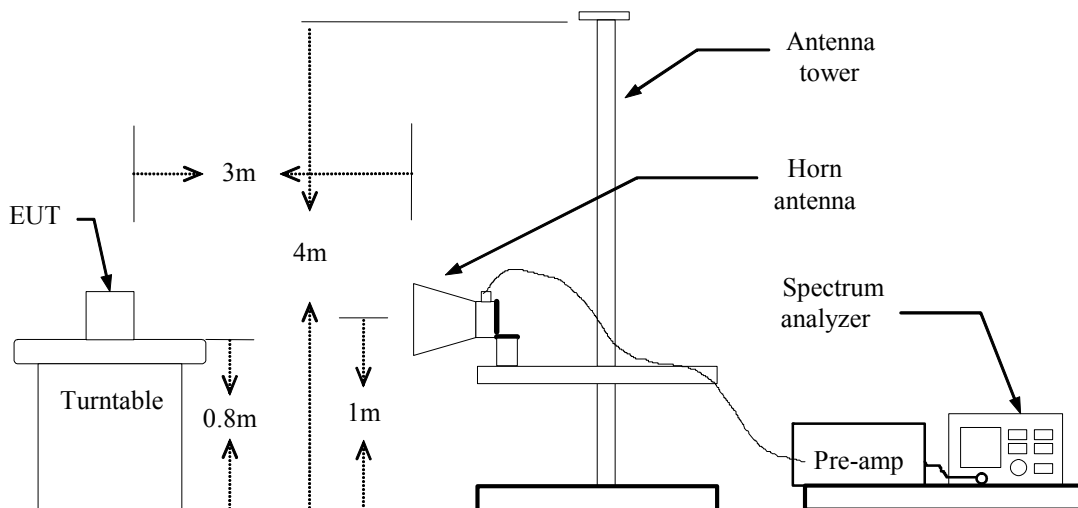
7.4 BAND EDGES MEASUREMENT

LIMIT

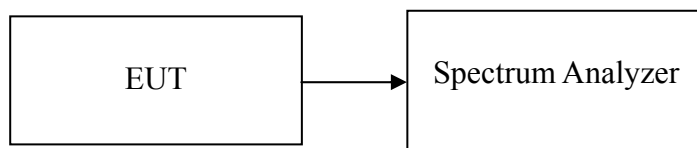
According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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. 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 Section 15.205(c)).

Test Configuration

For Radiated



For Conducted





TEST PROCEDURE

For Radiated

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

For Conducted

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

TEST RESULTS

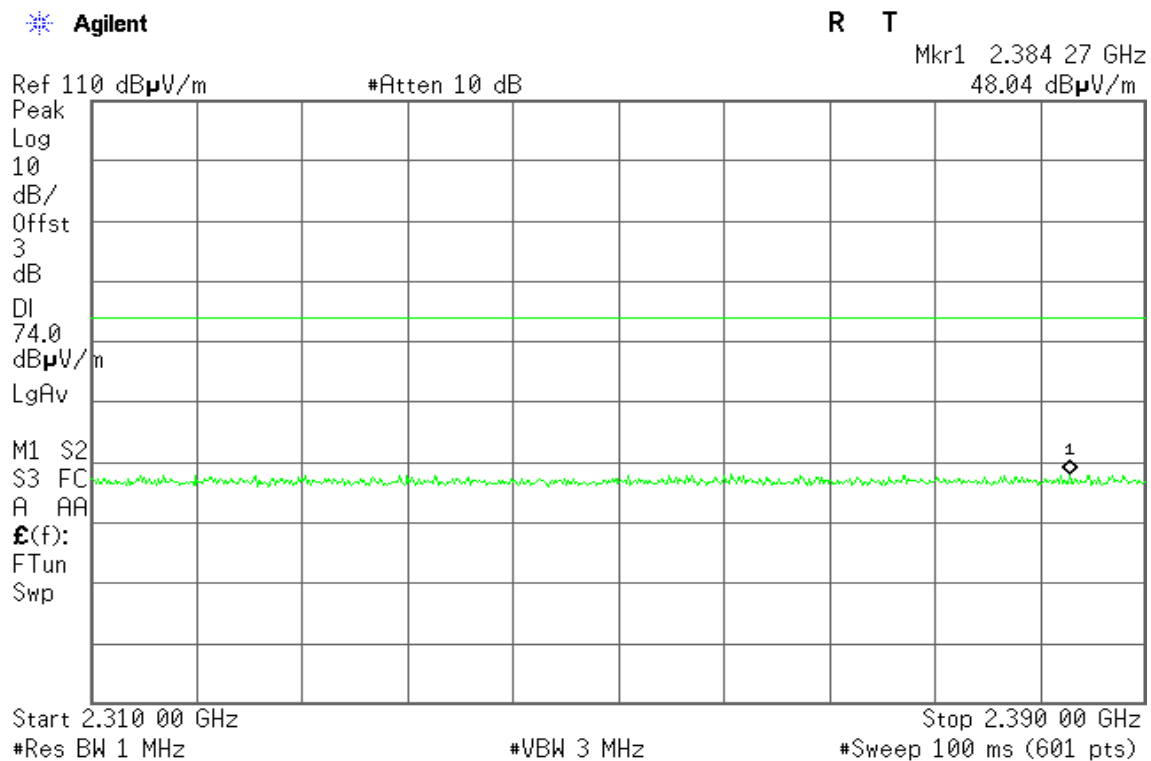
Refer to attach spectrum analyzer data chart.



Band Edges (CH Low)

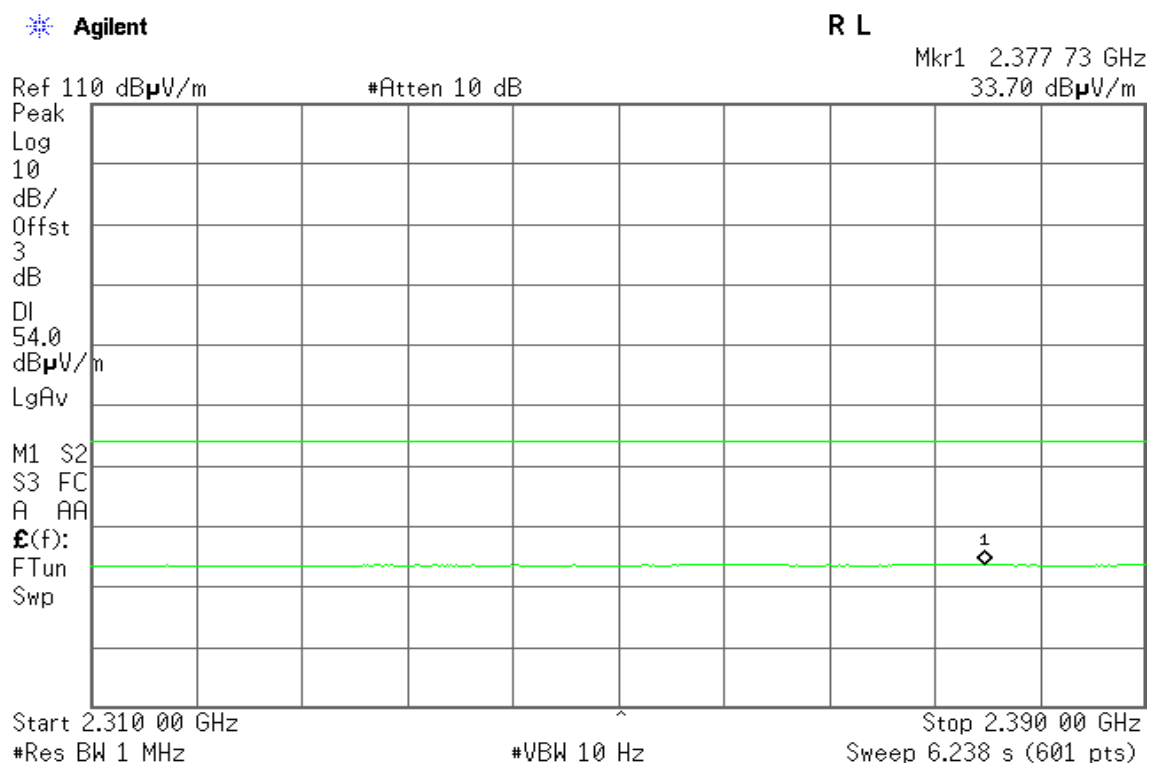
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

Polarity: Vertical





Detector mode: Peak

Polarity: Horizontal

Agilent

R T

Mkr1 2.336 00 GHz

49.14 dB μ V/mRef 110 dB μ V/m

#Atten 10 dB

Peak

Log

10

dB/

Offst

3

dB

DI

74.0

dB μ V/m

LgAv

M1 S2

S3 FC

A AA

E(f):

FTun

Swp

Start 2.310 00 GHz

#Res BW 1 MHz

#VBW 3 MHz

Stop 2.390 00 GHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Horizontal

Agilent

R T

Mkr1 2.386 40 GHz

33.79 dB μ V/mRef 110 dB μ V/m

#Atten 10 dB

Peak

Log

10

dB/

Offst

3

dB

DI

54.0

dB μ V/m

LgAv

M1 S2

S3 FC

A AA

E(f):

FTun

Swp

Start 2.310 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Stop 2.390 00 GHz

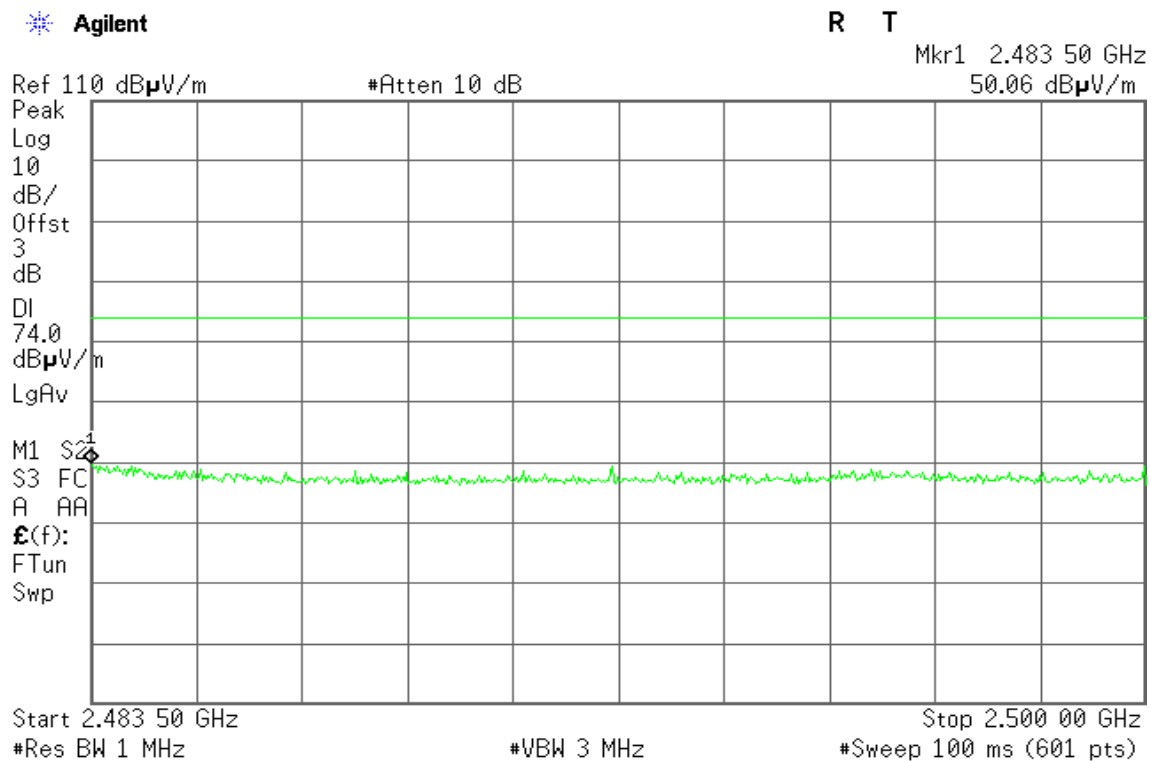
Sweep 6.238 s (601 pts)



Band Edges (CH High)

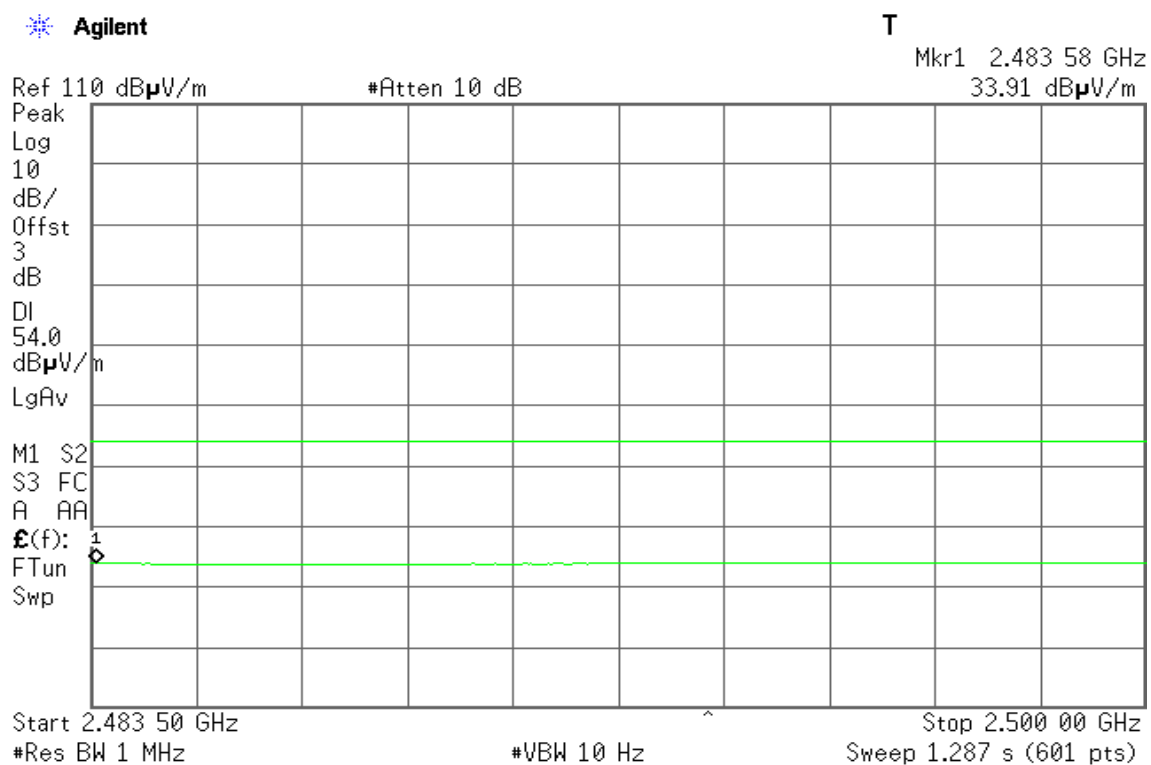
Detector mode: Peak

Polarity: Vertical



Detector mode: Average

Polarity: Vertical





Detector mode: Peak

Polarity: Horizontal

Agilent

R T

Mkr1 2.483 53 GHz

54.84 dB μ V/m

Ref 110 dB μ V/m

#Atten 10 dB

Peak

Log

10

dB/

Offst

3

dB

DI

74.0

dB μ V/m

LgAv

M1 S2

S3 FC

A AA

E(f):

FTun

Swp

Start 2.483 50 GHz

#Res BW 1 MHz

#VBW 3 MHz

Stop 2.500 00 GHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Horizontal

Agilent

R T

Mkr1 2.495 88 GHz

36.32 dB μ V/m

Ref 110 dB μ V/m

#Atten 10 dB

Peak

Log

10

dB/

Offst

3

dB

DI

54.0

dB μ V/m

LgAv

M1 S2

S3 FC

A AA

E(f):

FTun

Swp

Start 2.483 50 GHz

#Res BW 1 MHz

#VBW 10 Hz

Stop 2.500 00 GHz

Sweep 1.287 s (601 pts)

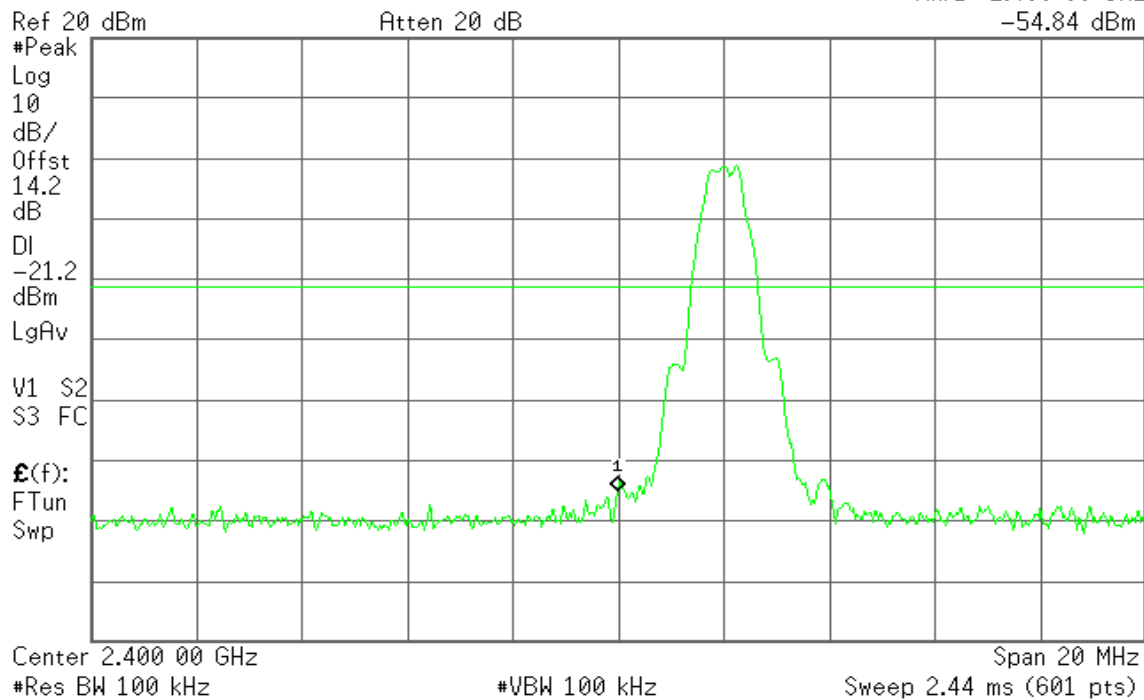


Conducted Band Edges (CH Low)

Agilent 10:48:00 May 30, 2012

R T

Mkr1 2.400 00 GHz
-54.84 dBm

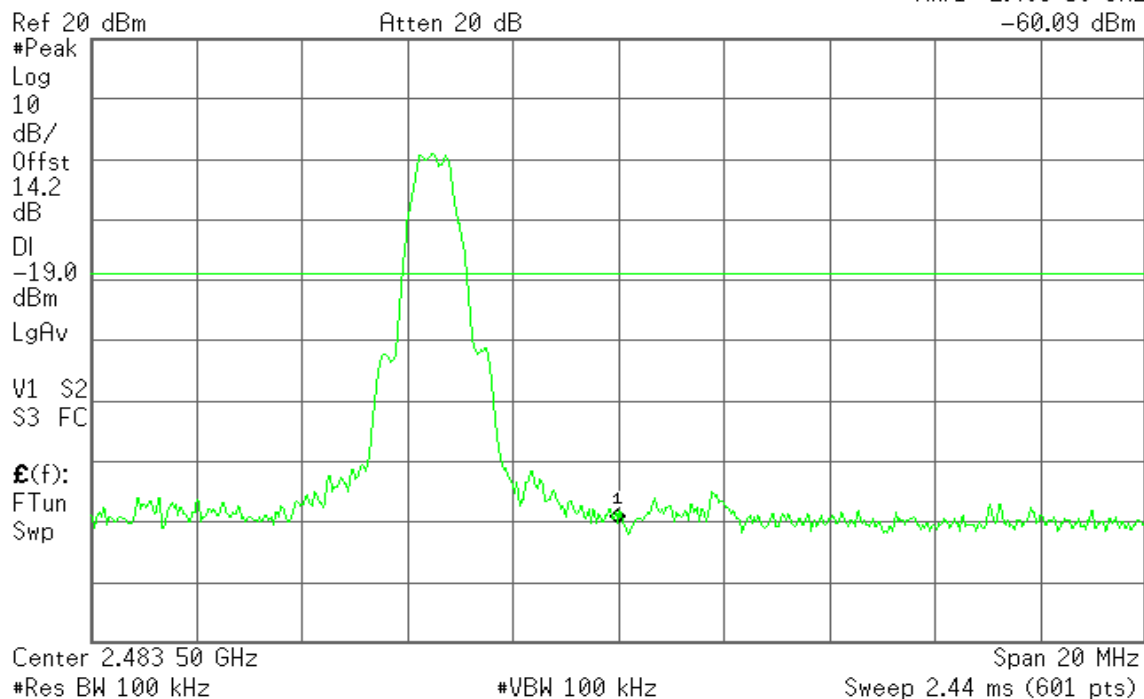


Conducted Band Edges (CH High)

Agilent 11:00:52 May 30, 2012

R T

Mkr1 2.483 50 GHz
-60.09 dBm



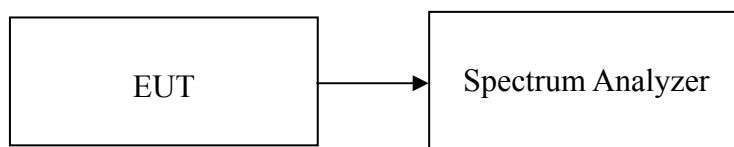


7.5 PEAK POWER SPECTRAL DENSITY

LIMIT

1. According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
2. According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. Set the RBW = 100 kHz, VBW = 300 kHz, Span > 5% of the bandwidth, Detector = peak, Trace mode = max hold, Sweep = auto couple. Record the maximum reading. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted

Test Data

Channel	Frequency (MHz)	100kHz PPSD (dBm)	3kHz PPSD (dBm)	Limit (dBm)	Result
Low	2402	-0.78	-15.98	8	PASS
Mid	2440	0.63	-14.57		PASS
High	2480	1.20	-14.00		PASS



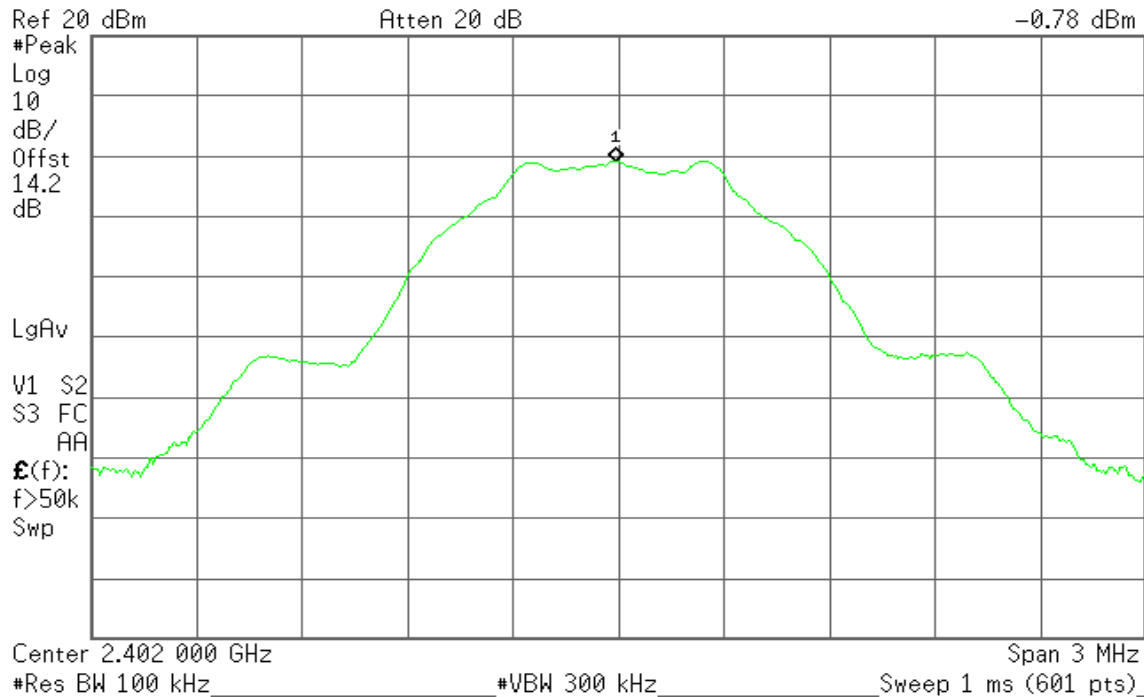
Test Plot

PPSD (CH Low)

Agilent 11:09:28 May 30, 2012

R T

Mkr1 2.401 990 GHz
-0.78 dBm

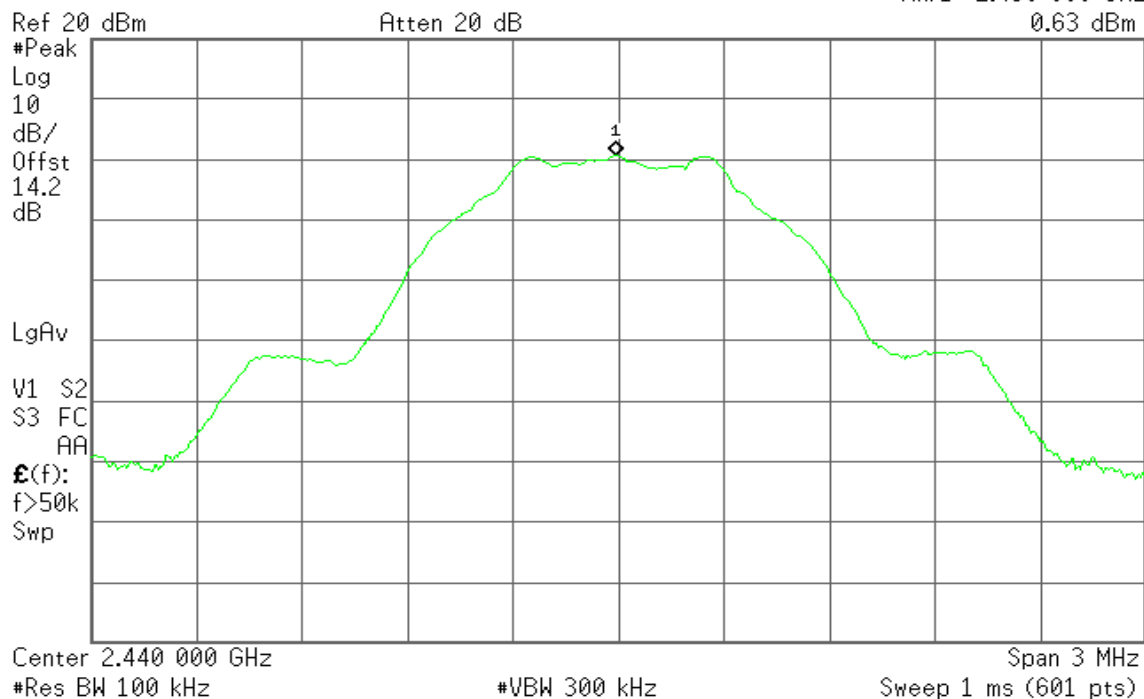


PPSD (CH Mid)

Agilent 11:10:17 May 30, 2012

R T

Mkr1 2.439 990 GHz
0.63 dBm



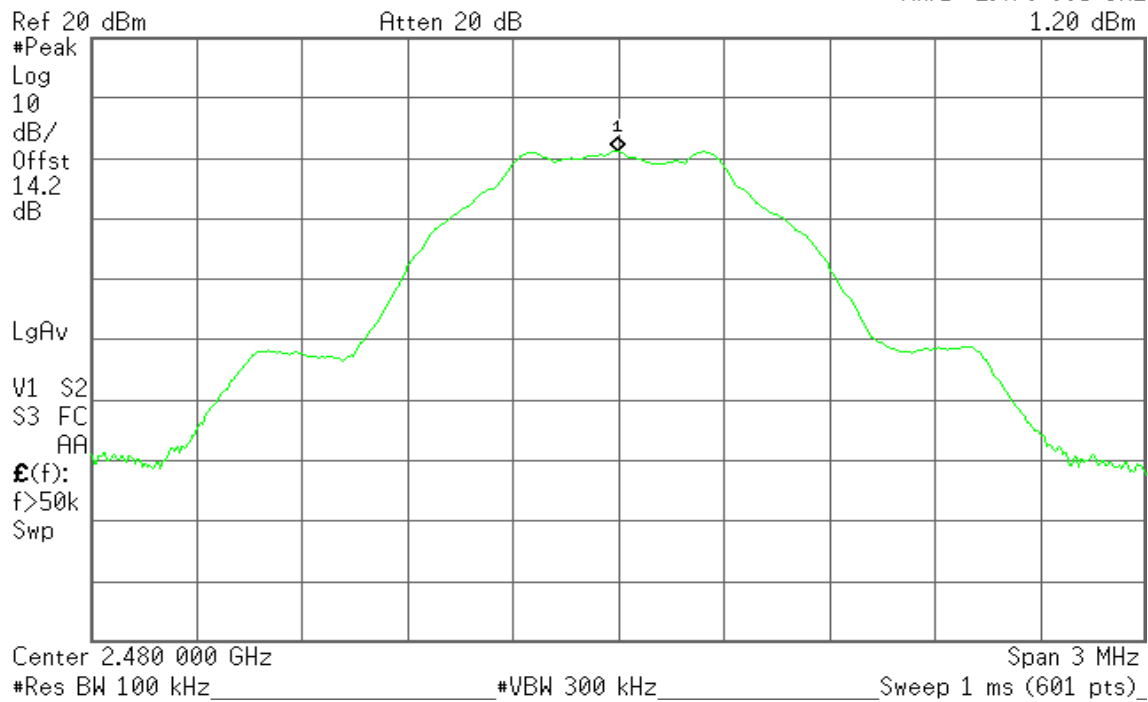


PPSD (CH High)

Agilent 11:11:07 May 30, 2012

R T

Mkr1 2.479 995 GHz
1.20 dBm





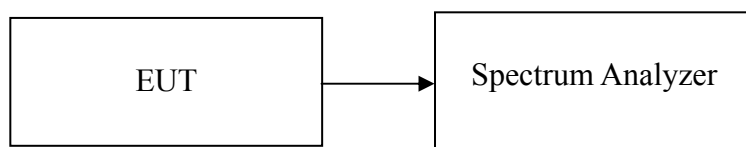
7.6 SPURIOUS EMISSIONS

7.6.1 Conducted Measurement

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. 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 Section 15.205(c)).

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer.

Reference Level: Set the RBW = 100 kHz, VBW $\geq$ 300 kHz, span to 5-30 % greater than the EBW, Detector = peak, Sweep time = auto couple, Trace mode = max hold.

Unwanted Emissions: Set RBW = 100 kHz, VBW $\geq$ 300 kHz, Set span to encompass the spectrum to be examined, Detector = peak, Trace Mode = max hold, Sweep = auto couple.

Measurements are made over the 30MHz to 1GHz, 1GHz to 15GHz, 15GHz to 26.5GHz range with the transmitter set to the lowest, middle, and highest channels.

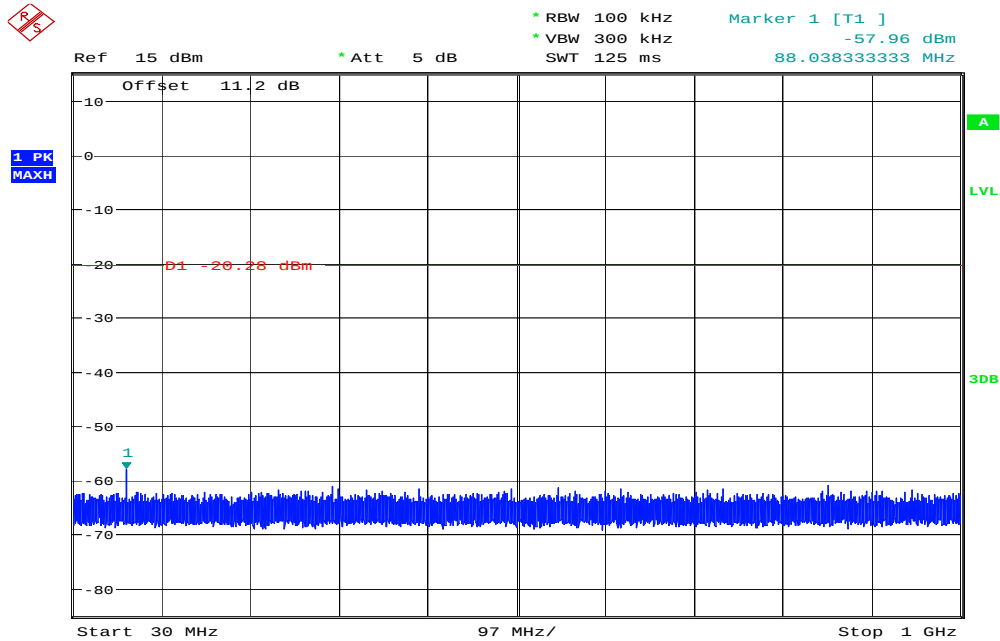
TEST RESULTS

No non-compliance noted

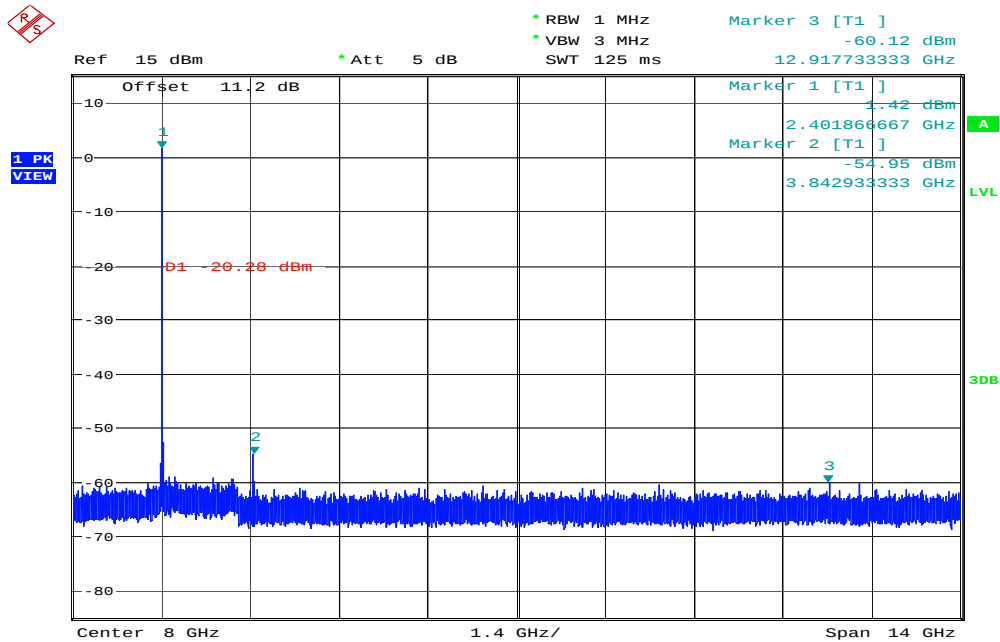


Test Plot

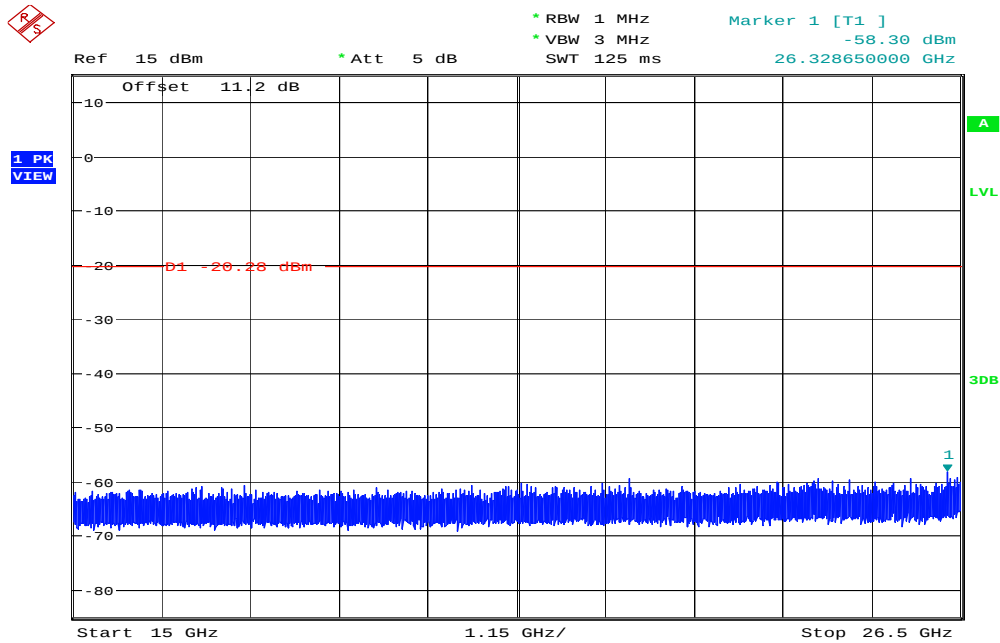
CH Low



Date: 24.AUG.2012 16:02:09



Date: 24.AUG.2012 15:45:23



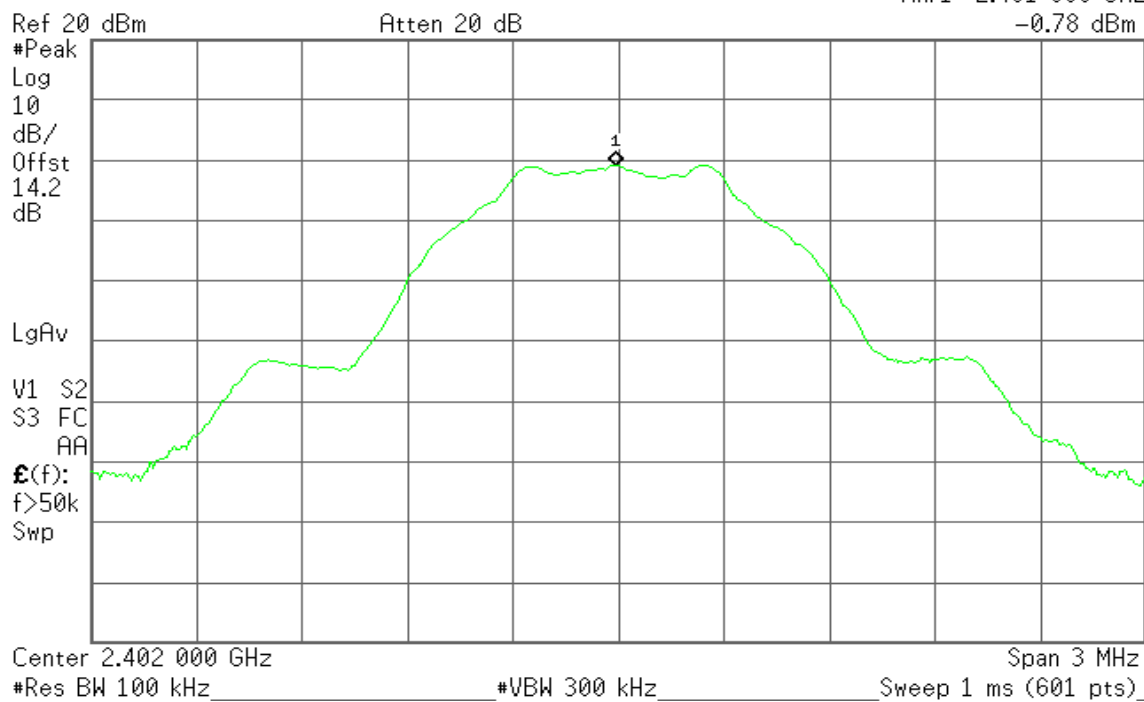
Date: 24.AUG.2012 16:38:05



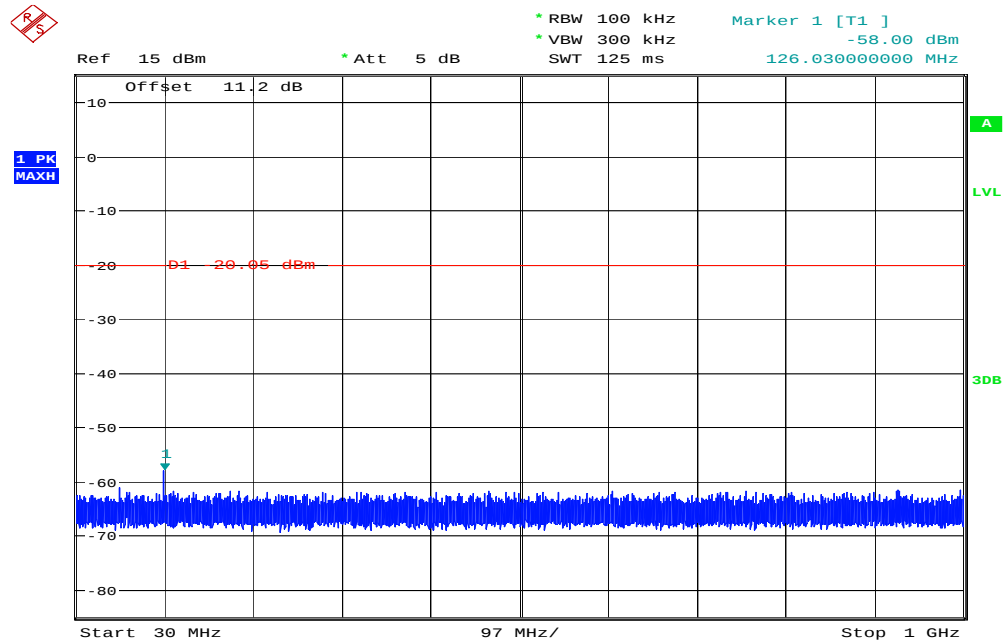
Agilent 11:09:28 May 30, 2012

R T

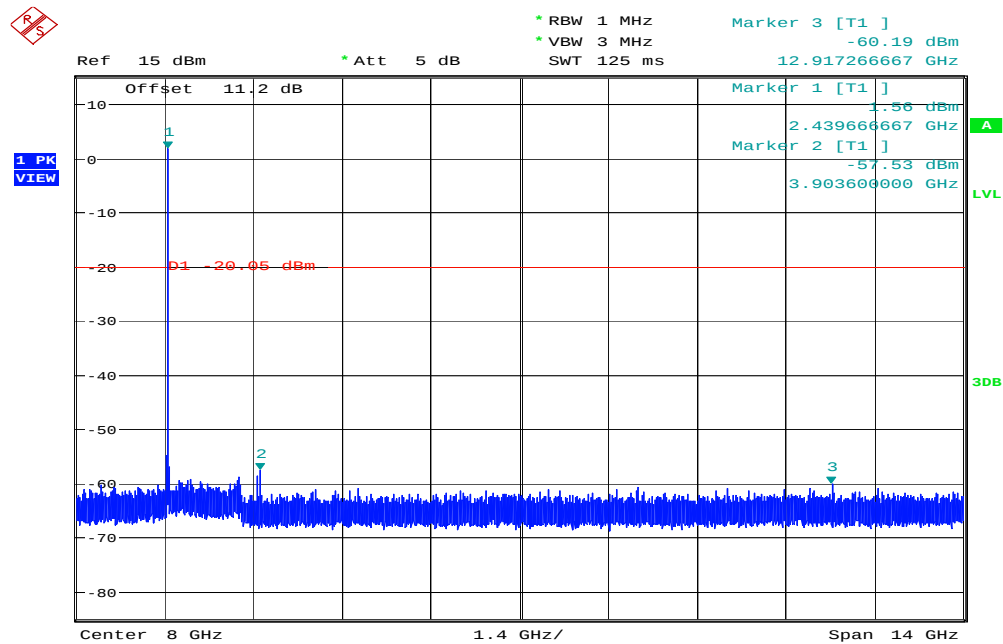
Mkr1 2.401 990 GHz
-0.78 dBm



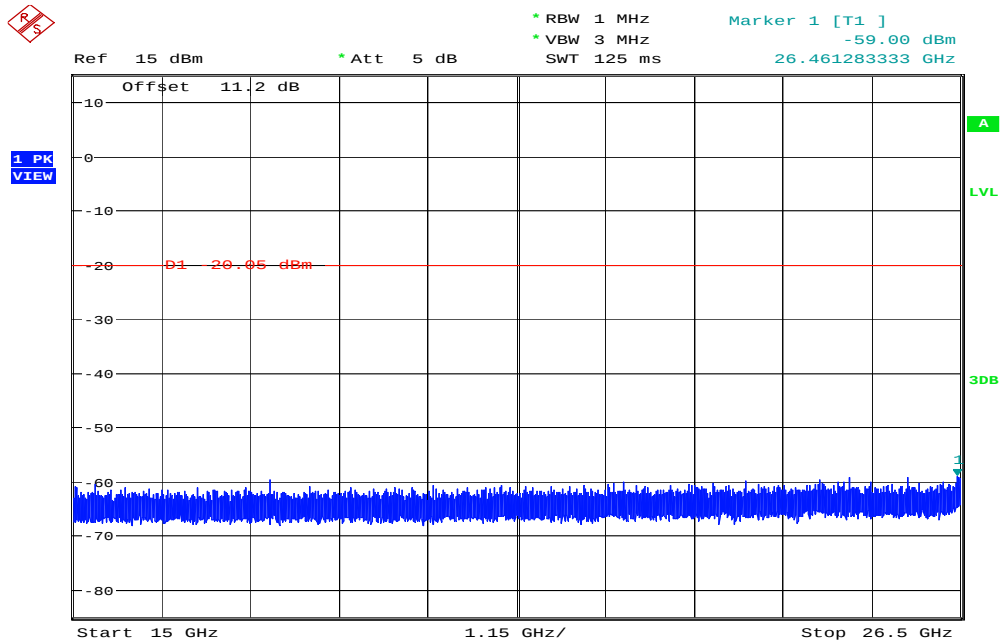
CH Mid



Date: 24.AUG.2012 16:03:14



Date: 24.AUG.2012 15:48:14



Date: 24.AUG.2012 16:40:26

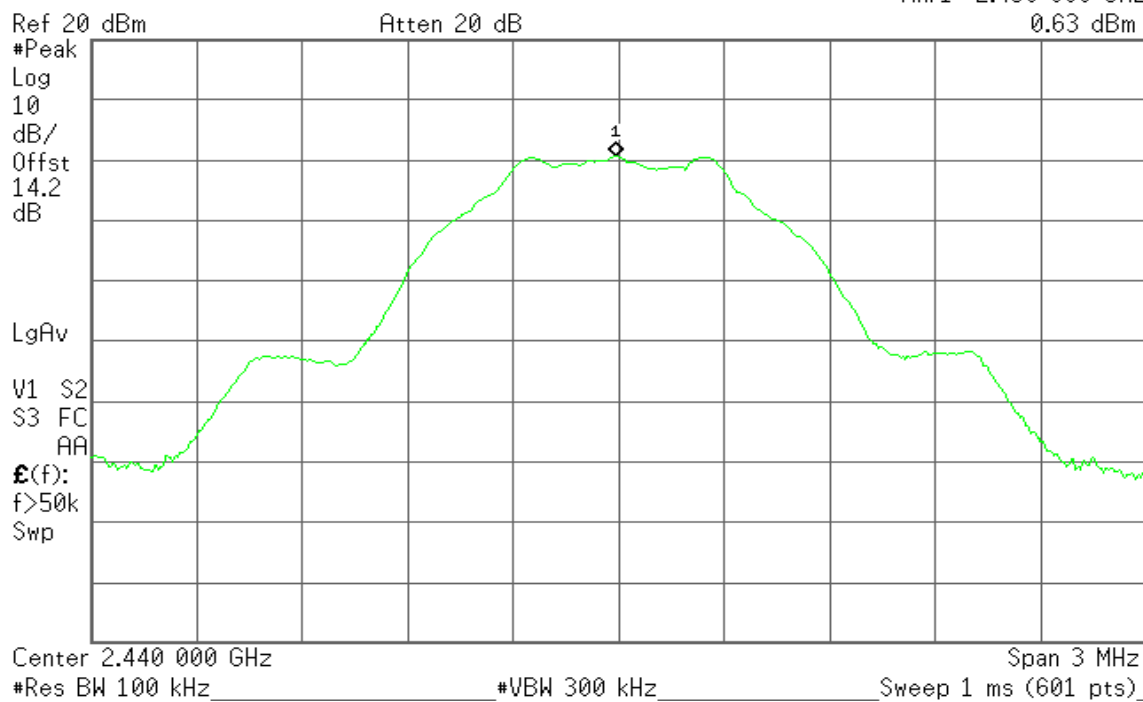


Agilent 11:10:17 May 30, 2012

R T

Mkr1 2.439 990 GHz

0.63 dBm

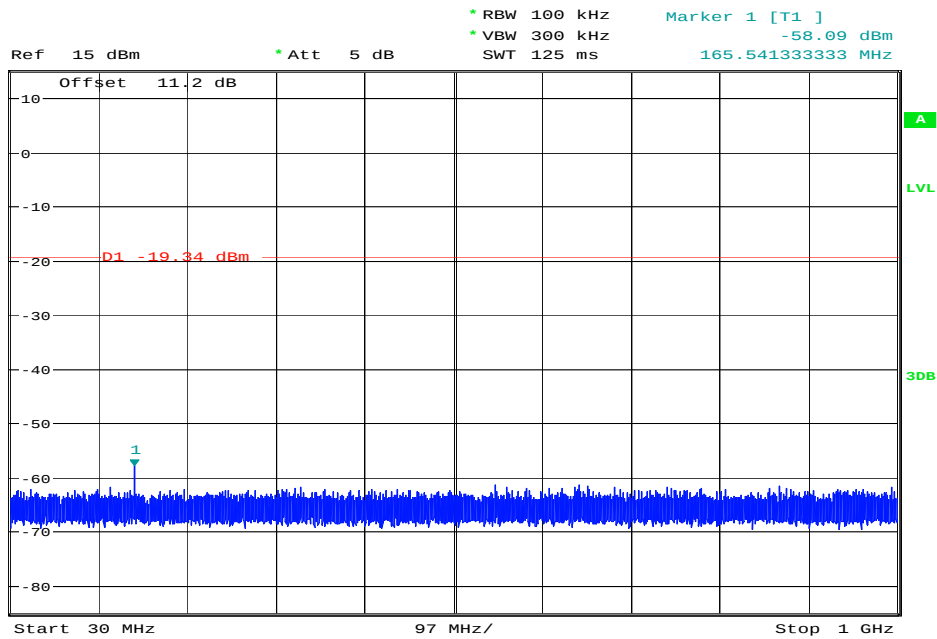




CH High



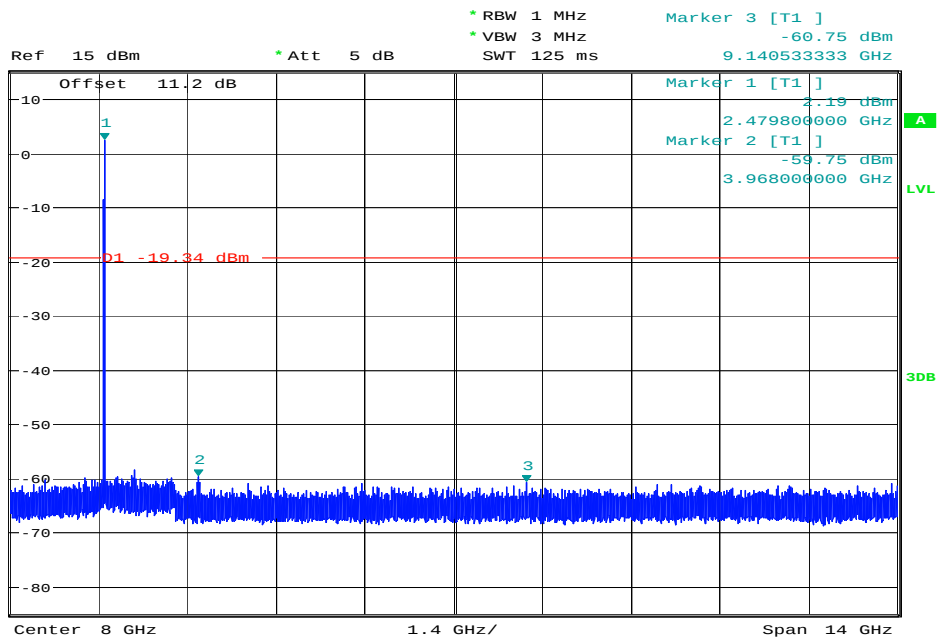
1 PK
MAXH



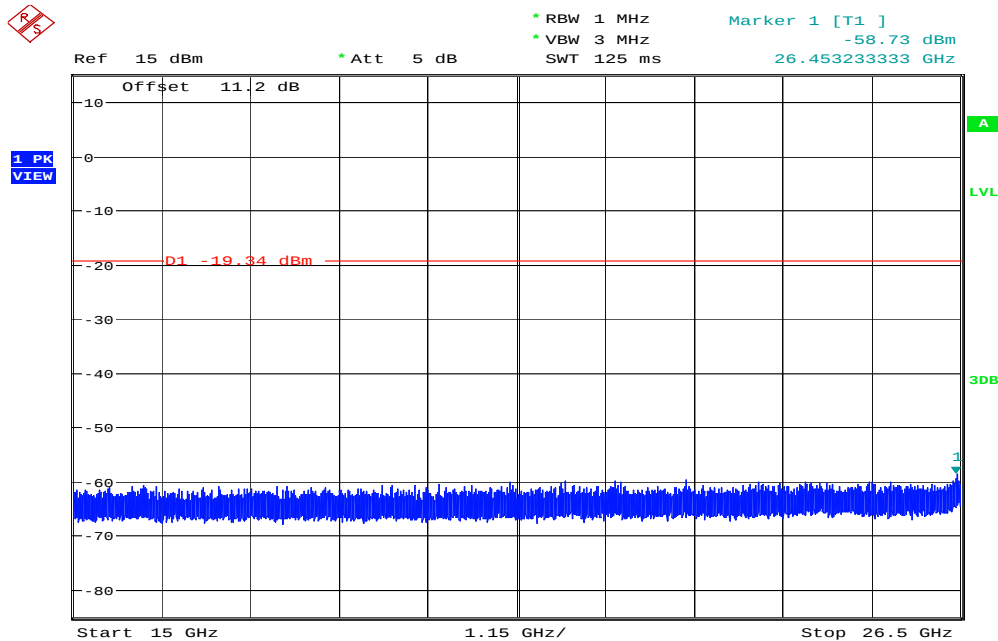
Date: 24.AUG.2012 16:04:22



1 PK
VIEW



Date: 24.AUG.2012 15:50:00



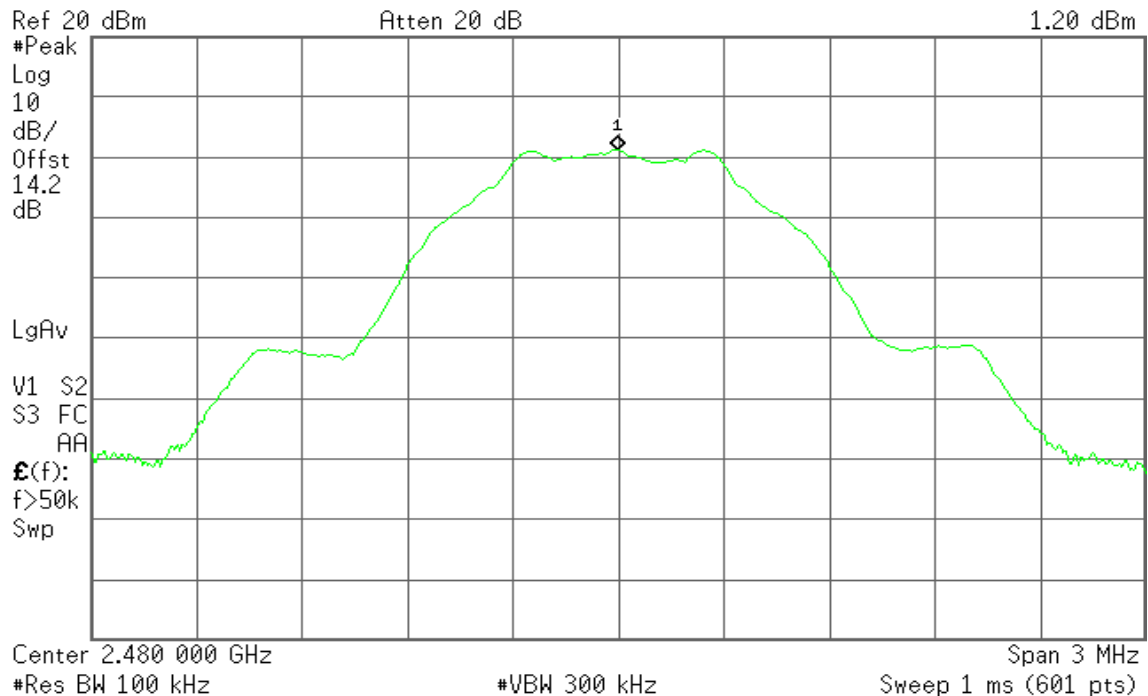
Date: 24.AUG.2012 16:42:03



Agilent 11:11:07 May 30, 2012

R T

Mkr1 2.479 995 GHz
1.20 dBm





7.6.2 Radiated Emissions

LIMIT

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

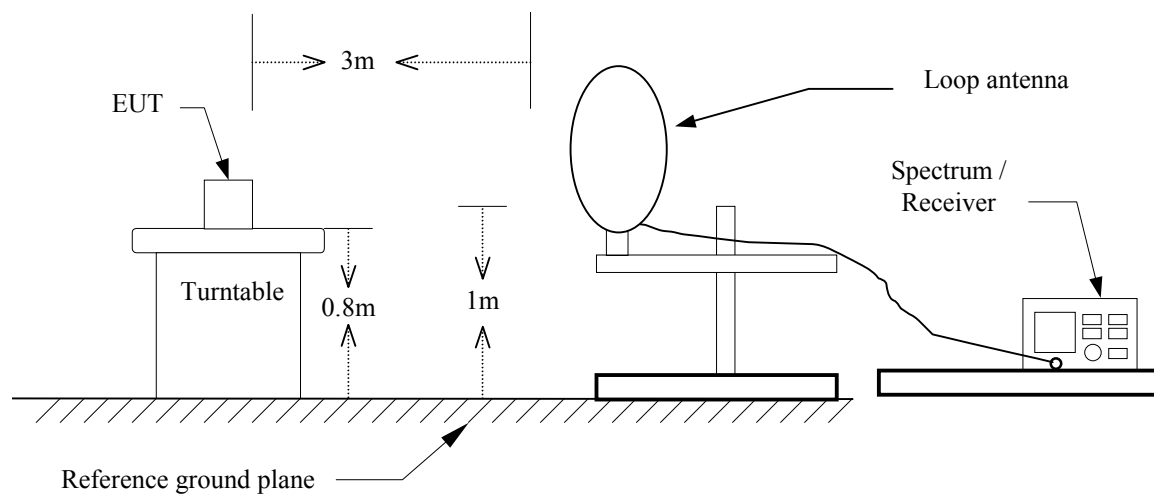
2. In the emission table above, the tighter limit applies at the band edges.

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3-meter)	Field Strength (dB $\mu\text{V/m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

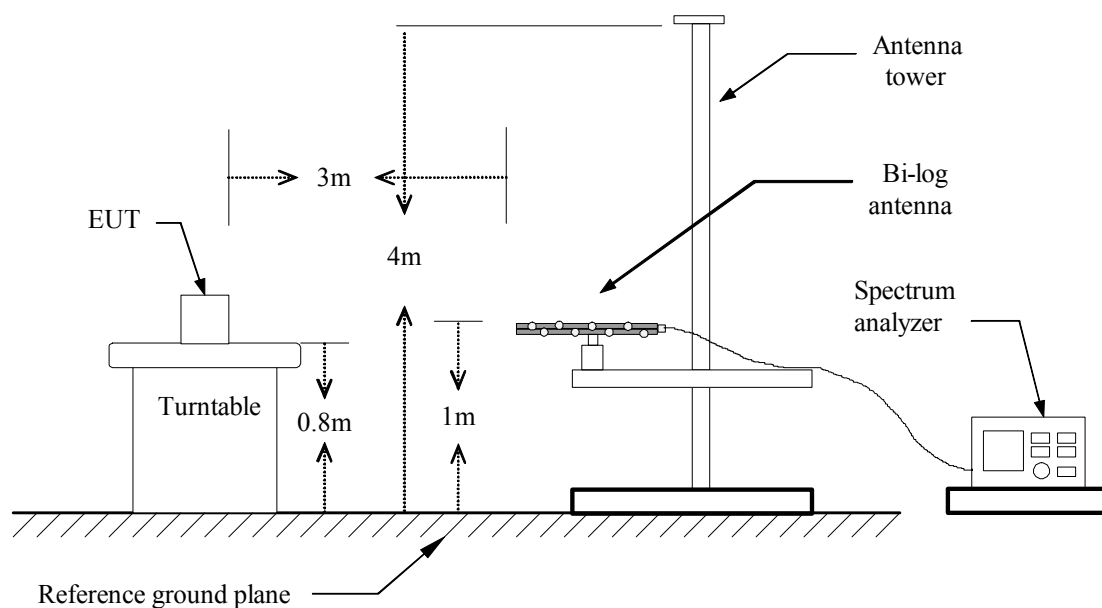


Test Configuration

9kHz ~ 30MHz

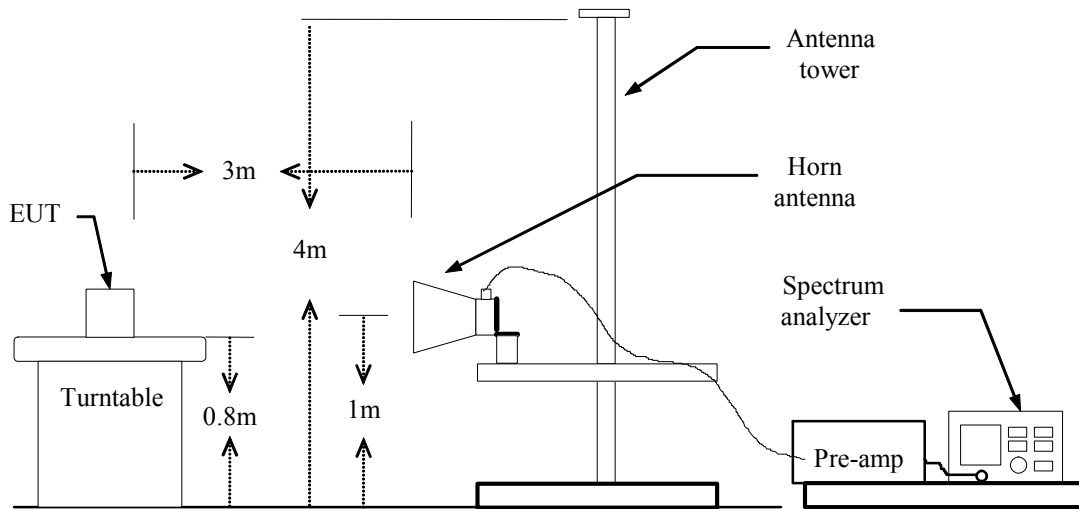


30MHz ~ 1GHz





Above 1 GHz





TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:
Below 1GHz:
RBW=100kHz / VBW=300kHz / Sweep=AUTO
Above 1GHz:
(a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

**Below 1 GHz****Operation Mode:** Normal Link**Test Date:** June 9, 2012**Temperature:** 26°C**Tested by:** Shawn Wu**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
30.00	46.12	-19.87	26.25	40.00	-13.75	Peak	V
99.52	55.52	-31.37	24.16	43.50	-19.34	Peak	V
169.03	55.20	-29.18	26.02	43.50	-17.48	Peak	V
448.72	46.26	-22.87	23.39	46.00	-22.61	Peak	V
631.40	41.61	-20.02	21.59	46.00	-24.41	Peak	V
780.13	43.45	-17.72	25.72	46.00	-20.28	Peak	V
30.00	41.61	-19.87	21.74	40.00	-18.26	Peak	H
136.70	42.01	-27.94	14.07	43.50	-29.43	Peak	H
204.60	43.16	-28.40	14.76	43.50	-28.74	Peak	H
429.32	42.39	-23.26	19.13	46.00	-26.87	Peak	H
663.73	40.96	-19.34	21.62	46.00	-24.38	Peak	H
780.13	46.12	-17.72	28.39	46.00	-17.61	Peak	H

Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).

**Above 1 GHz****Operation Mode:** GFSK / TX / CH Low**Test Date:** June 9, 2012**Temperature:** 26°C**Tested by:** Shawn Wu**Humidity:** 50 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
1923.33	52.19	---	-6.25	45.94	---	74.00	54.00	-8.06	Peak	V
N/A										
1920.00	56.09	---	-6.28	49.81	---	74.00	54.00	-4.19	Peak	H
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** GFSK / TX / CH Mid**Test Date:** June 9, 2012**Temperature:** 25°C**Tested by:** Shawn Wu**Humidity:** 60 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2223.33	51.62	---	-4.89	46.74	---	74.00	54.00	-7.26	Peak	V
N/A										
2373.33	52.94	---	-4.39	48.55	---	74.00	54.00	-5.45	Peak	H
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).

**Operation Mode:** GFSK / TX / CH High**Test Date:** June 9, 2012**Temperature:** 25°C**Tested by:** Shawn Wu**Humidity:** 60 % RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark	Ant.Pol. (H/V)
2223.33	51.97	---	-4.89	47.08	---	74.00	54.00	-6.92	Peak	V
N/A										
2383.33	51.86	---	-4.35	47.51	---	74.00	54.00	-6.49	Peak	H
N/A										

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



7.7 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

Test Configuration

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.



TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Test Data

Operation Mode: Normal Link **Test Date:** June 14, 2012
Temperature: 24°C **Tested by:** Stan Lin
Humidity: 50% RH

Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB/m)	QP Result (dBuV/m)	AV Result (dBuV/m)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.4735	25.62	14.08	9.66	35.28	23.74	56.45	46.45	-21.17	-22.71	L1
0.6122	33.13	19.90	9.67	42.80	29.57	56.00	46.00	-13.20	-16.43	L1
0.7205	32.55	19.06	9.68	42.23	28.74	56.00	46.00	-13.77	-17.26	L1
0.9643	28.23	9.26	9.69	37.92	18.95	56.00	46.00	-18.08	-27.05	L1
1.4730	29.33	11.54	9.70	39.03	21.24	56.00	46.00	-16.97	-24.76	L1
2.2729	25.96	8.90	9.74	35.70	18.64	56.00	46.00	-20.30	-27.36	L1
0.5754	32.92	19.18	9.68	42.60	28.86	56.00	46.00	-13.40	-17.14	L2
0.6126	33.26	20.22	9.68	42.94	29.90	56.00	46.00	-13.06	-16.10	L2
0.7238	32.25	19.77	9.69	41.94	29.46	56.00	46.00	-14.06	-16.54	L2
0.9770	32.81	19.64	9.70	42.51	29.34	56.00	46.00	-13.49	-16.66	L2
1.4364	29.59	11.33	9.71	39.30	21.04	56.00	46.00	-16.70	-24.96	L2
1.8366	30.52	14.40	9.73	40.25	24.13	56.00	46.00	-15.75	-21.87	L2

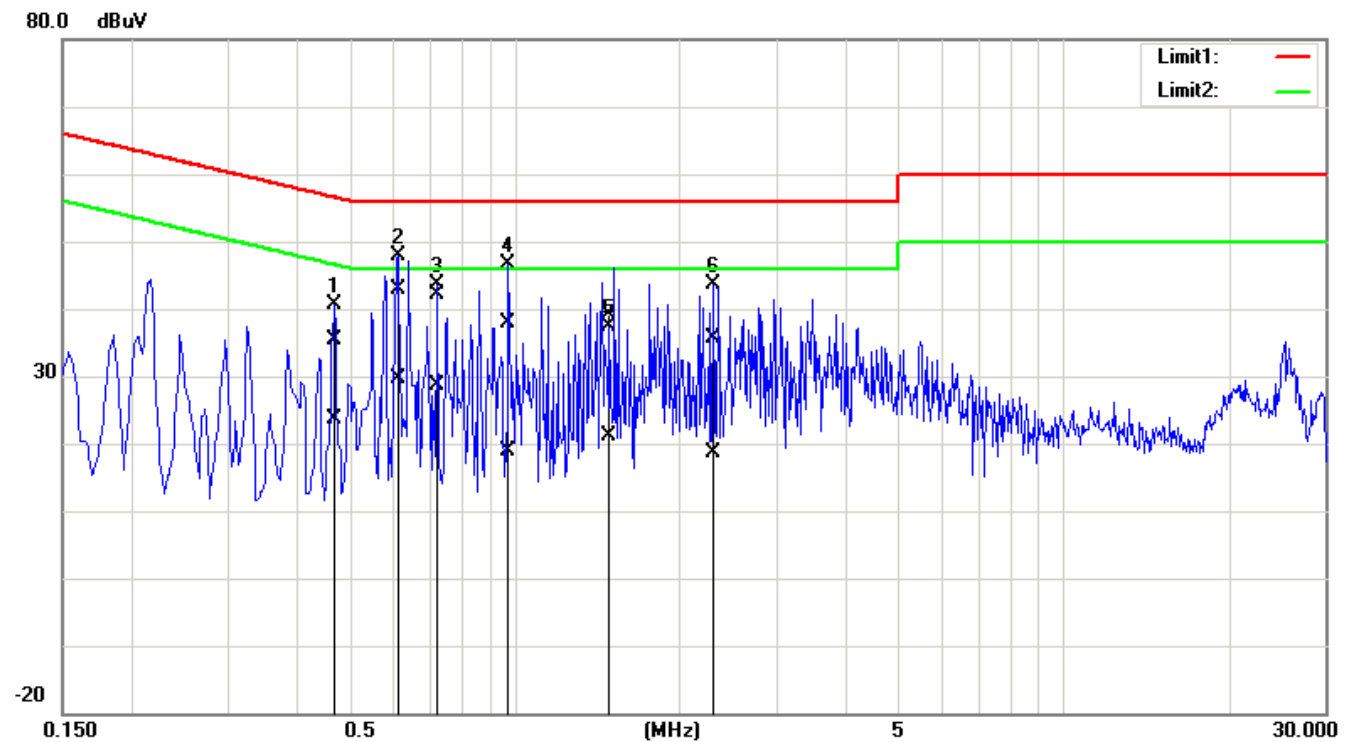
Remark:

1. Measuring frequencies from 0.15 MHz to 30MHz.
2. The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.
3. The IF bandwidth of SPA between 0.15MHz to 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9kHz;
4. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)

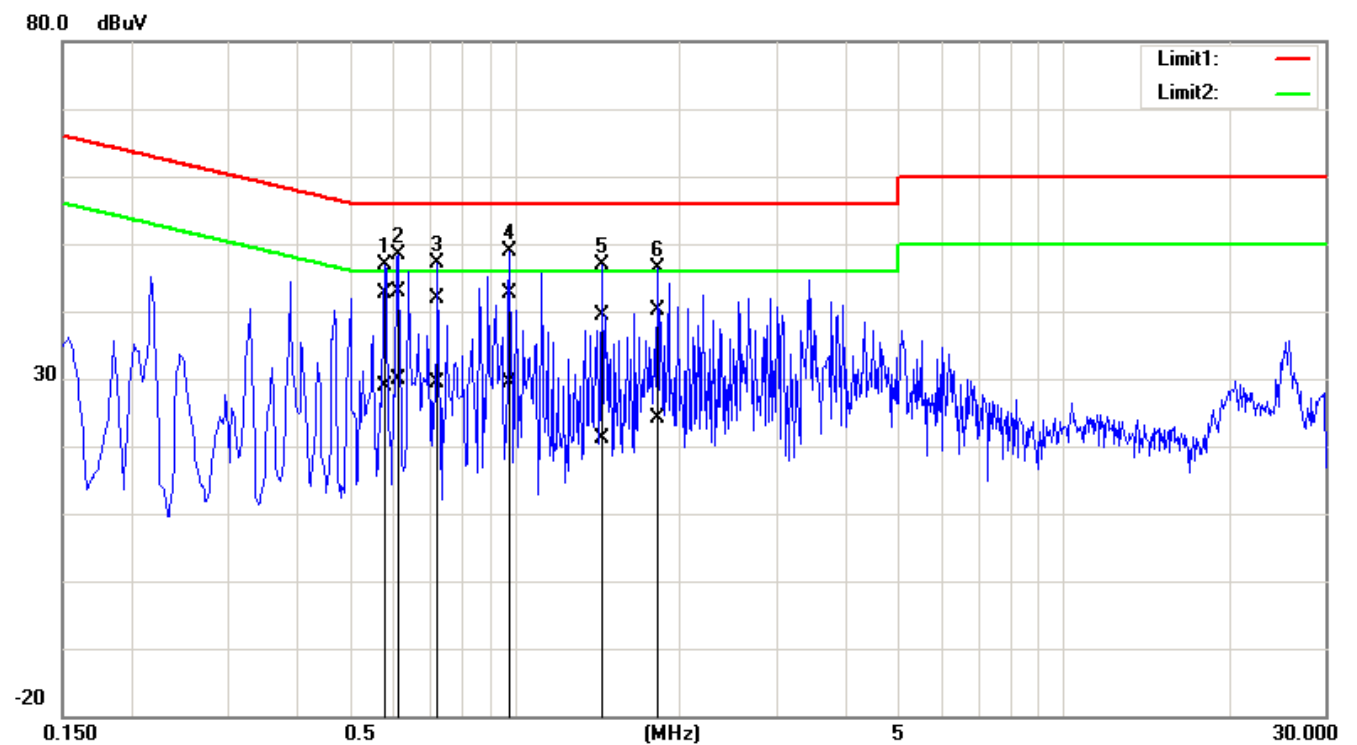


Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)





APPENDIX I

RADIO FREQUENCY EXPOSURE

LIMIT

Systems operating under the 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 §15.247(i) and §1.1307(b)(1) of this chapter.

EUT Specification

EUT	Tablet PC
Frequency band (Operating)	☐ WLAN: 2.412GHz ~ 2.462GHz ☐ WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz ☐ WLAN: 5.745GHz ~ 5.825GHz ☒ Bluetooth: <u>2.402GHz ~ 2.480 GHz</u>
Device category	☒ Portable (<20cm separation) ☐ Mobile (>20cm separation)
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm ²) ☒ General Population/Uncontrolled exposure (S=1mW/cm ²)
Antenna diversity	☐ Single antenna ☒ Multiple antennas ☐ Tx diversity ☐ Rx diversity ☒ Tx/Rx diversity
Max. output power	2.38 dBm (1.73mW)
Antenna gain (Max)	5.1 dBi (Numeric gain: 3.23)
Evaluation applied	☐ MPE Evaluation ☒ SAR Evaluation* ☐ N/A
Remark: <i>The maximum output power is <u>2.84dBm (1.92mW)</u> at <u>2480MHz</u> (with <u>3.23numeric antenna gain.</u>)</i>	

TEST RESULTS

No non-compliance noted.

(SAR evaluation is not required for the PORTABLE device while its maximum output power is lower than the general population low threshold: $60/f_{(GHz)} = 60/2.441 = 24.58mW$)

Remark: Please refer to the separated SAR report.

MPE EVALUATION

Not applicable.