

FCC 47 CFR PART 15 SUBPART C TEST REPORT

For

Product Name: vivohub 2

Brand Name: N/A

Model No.: A1545

Series Model:N/A

FCC ID:IPH-01545

Test Report Number:

C150807R01-RPB

Issued for

Garmin International Inc

1200 E. 151st. Street, Olathe, Kansas, United States 66062

Issued by

Compliance Certification Services Inc.

Kun shan Laboratory

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TESTING CERT #2541.01

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SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result
3.1	15.247(a)(1)	Number of Channels	≥ 15 Channels	Pass
3.2	15.247(a)(1)	Hopping Channel Separation	$\geq 2/3$ of 20dB BW	Pass
3.3	15.247(a)(1)	Dwell Time of Each Channel	≤ 0.4 sec in 31.6sec period	Pass
3.4	15.247(a)(1)	20dB Bandwidth	NA	Pass
3.5	15.247(b) (1)	Peak Output Power	≤ 125 mW	Pass
3.6	15.247(d)	Conducted Band Edges and Spurious Emission	≤ 20 dBc	Pass
3.7	15.247(d)	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass
3.8	15.207	AC Conducted Emission	15.207(a)	Pass
3.9	15.203 & 15.247(b)	Antenna Requirement	N/A	Pass

1. TEST RESULT CERTIFICATION

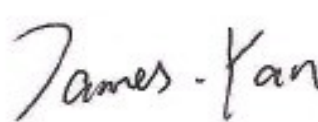
Product Name:	vivohub 2
Trade Name:	N/A
Model Name:	A1545
Series Model:	N/A
Applicant Discrepancy:	Initial
Device Category:	Mobile unit
Date of Test:	August 18, 2015~August 28, 2015 and October 12, 2015
Applicant:	Garmin International Inc 1200 E. 151st. Street, Olathe, Kansas, United States 66062
Manufacturer:	Garmin International Inc 1200 E. 151st. Street, Olathe, Kansas, United States 66062
Application Type:	Certification

APPLICABLE STANDARDS

STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C	No non-compliance noted

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 C63.10:2013 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:**Tested by:**

Jeff.Fang
RF Manager
Compliance Certification Services Inc.

James.yan
Test Engineer
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product Name:	vivohub 2
Brand Name:	N/A
Model Name:	A1545
Series Model:	N/A
Model Discrepancy:	N/A
Power Adapter Power Rating :	Power supply and ADP (rating) : Model : PSA105R-050Q Input: 100-240VAC 50/60HZ 0.3A 10-20VA Output: DC5.0V 1A
Frequency Range :	Bluetooth:2402 ~ 2480 MHz IEEE 802.11b/g: 2412MHz to 2462 MHz IEEE 802.11n HT20: 2412MHz to 2462 MHz
Transmit Power :	Bluetooth:3.73dBm IEEE 802.11b mode: 16.30 dBm IEEE 802.11g mode: 16.26 dBm IEEE 802.11n HT20 mode: 14.57 dBm
Modulation Technique :	Bluetooth:FHSS IEEE802.11b mode: DSSS IEEE802.11g mode: DSSS /OFDM IEEE802.11n HT20 mode: OFDM
Transmit Data Rate :	Bluetooth:GFSK(1 Mbps), π /4-DQPSK(2 Mbps),8-DPSK(3 Mbps) IEEE802.11b mode: DSSS (1,2,5.5 and 11 Mbps) IEEE802.11g mode: DSSS /OFDM (6,9,12,18,24,36,48 and 54 Mbps) IEEE802.11n HT20 mode: OFDM (MCS0~MCS7)
Number of Channels :	Bluetooth:79 Channels IEEE 802.11b/g/n HT20 mode: 11 Channels
Antenna Specification :	PIFA Antenna
Antenna Specification:	chip Antenna Gain 2.0 dBi
HDMI cable:	KF1305
USB cable:	AWG2464

Remark:

1.The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.

2.This submittal(s) (test report) is intended for **FCC ID:IPH-01545** 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 C63.10 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 ,15.247.

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 EXERCISE EUT

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 C63.10 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

Under 1GHz

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 C63.10.

Above 1GHz

The EUT is placed on a turn table, which is 1.5 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 C63.10.

3.4 TEST Mode

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate	Channel	Antenna
Peak Output Power	GFSK	1 Mbps	0/39/78	1
	8DPSK	3 Mbps		
Hopping Channel Bandwidth	GFSK	1 Mbps	0/39/78	1
	8DPSK	3 Mbps		
Hopping Channel Separation	GFSK	1 Mbps	38-39	1
	8DPSK	3 Mbps		
Number of Hopping Frequency	GFSK	1 Mbps	0-78	1
	8DPSK	3 Mbps		
Dwell Time	DH1/DH3/DH5	1 Mbps	39	1
	3DH1/3DH3/3DH5	3 Mbps		
Spurious Emission	GFSK	1 Mbps	0/39/78	1
	8DPSK	3 Mbps		
Band Edge Emissions	GFSK	1 Mbps	0/78	1
	8DPSK	3 Mbps		
Radiated Emissions Below 1GHz	GFSK	1 Mbps	78	1
Radiated Emissions Above 1GHz	GFSK	1 Mbps	0/39/78	1
	8DPSK	3 Mbps		
AC Power Conducted Emissions	CTX	-	-	-

Remark: For radiated test cases below 1 GHz, the worst mode data rate channel 78 of 1Mbps was reported only, because this data rate has the highest RF output power at preliminary tests.

3.5 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
0.0900 - 0.1100	16.420 - 16.423	399.9 - 410.0	4.50 - 5.15
0.4950 - 0.505 ⁽¹⁾	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960.0 - 1240	7.25 - 7.75
4.1250 - 4.1280	25.50 - 25.67	1300 - 1427	8.025 - 8.500
4.17725 - 4.17775	37.50 - 38.25	1435.0 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73.0 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.2150 - 6.2180	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108.00 - 121.94	1718.8 - 1722.2	13.25 - 13.40
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.50
8.2910 - 8.2940	149.90 - 150.05	2310 - 2390	15.35 - 16.20
8.3620 - 8.3660	156.52475 - 156.52525	2483.5 - 2500.0	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.1700	3260 - 3267	23.6 - 24.0
12.2900 - 12.2930	167.72 - 173.20	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345 - 3358	36.43 - 36.5 ⁽²⁾
12.57675 - 12.57725	322.0 - 335.4	3600 - 4400	
13.3600 - 13.4100			

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.

4. 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. facilities and accreditations

5. FACILITIES AND ACCREDITATIONS

5.1 FACILTIES

All measurement facilities used to collect the measurement data are located at CCS China Kunshan Lab at 10#Weiye Rd, Innovation Park Eco. & Tec. Development Zone Kunshan city JiangSu, (215300), CHINA.

The sites are constructed in conformance with the requirements of ANSI C63.10 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 LABORATORY ACCREDITATIONS AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by American Association for Laboratory Accreditation Program for the specific scope accreditation under Lab Code: 200581-0 to perform Electromagnetic Interference tests according to FCC Part 15 or 18 requirements. In addition, the test facilities are listed with Federal Communication Commission, Laboratory Division, 424105 for 10m chamber, 238958 for 3m chamber .

5.4 TABLE OF ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

Taiwan	TAF
USA	A2LA

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	Industry Canada
Japan	VCCI
Taiwan	BSMI
USA	FCC

Copies of granted accreditation certificates are available for downloading from our web site,
<http://www.ccsrf.com>

5.5 LIST OF MEASURING EQUIPMENT

Conducted Emissions Test Site					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Data	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY44020154	2015-4-9	2016-4-8
DETECTOR NEGATIVE	Agilent	8473B	MY42240176	2015-5-11	2016-5-10
OSCILLOSCOPE	Agilent	DSO6104A	MY44002585	2015-3-16	2016-3-15
Power meter	Anritsu	ML2495A	1445010	2014-12-01	2015-11-30
Power sensor	Anritsu	MA2411B	1339220	2014-12-06	2015-12-05
Power SPLITTER	Mini-Circuits	ZN2PD-9G	SF078500430	N.C.R	N.C.R
DC Power Supply	AGILENT	E3632A	MY50340053	N.C.R	N.C.R
Temp. / Humidity Chamber	TERCHY	MHK-120AK	X30109	2015-1-22	2016-1-21
Test Software			EZ-EMC		

977 Chamber					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Data	Calibration Due
Spectrum Analyzer	Agilent	E4446A	MY44020154	2015-4-9	2016-4-8
EMI Test Receiver	R&S	ESCI	101378	2015-1-22	2016-1-21
Pre-Amplifier	MINI	ZFL-1000VH2	d041703	2015-1-22	2016-1-21
Pre-Amplifier	Miteq	JS41-00101800-32-10P	1675713	2015-1-22	2016-1-21
Bilog Antenna	Sunol	JB1	A062604	2015-3-6	2016-3-5
Horn-antenna	SCHWARZBECK	BBHA9120D	D:266	2015-3-7	2016-3-6
Turn Table	CT	CT123	4165	N.C.R	N.C.R
Antenna Tower	CT	CTERG23	3256	N.C.R	N.C.R
Controller	CT	CT100	95637	N.C.R	N.C.R
Test Software			EZ-EMC		

Conducted Emission					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Data	Calibration Due
EMI TEST RECEIVER	R&S	ESCI	100781	2015-3-16	2016-3-15
V (V-LISN)	SCHWARZBECK	NNLK 8129	8129-143	N.C.R	N.C.R
LISN (EUT)	FCC	FCC-LISN-50/2 50-50-2-02	05012	2015-3-16	2016-3-15
Pulse LIMITER	R&S	ESH3-Z2	100524	2015-9-24	2016-9-23
Test Software			EZ-EMC		

Remark: Each piece of equipment is scheduled for calibration once a year.

5.6 SETUP CONFIGURATION

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

5.7 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID
1.	N/A	N/A	N/A	N/A	N/A

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.

6. FCC PART 15.247 REQUIREMENTS

6.1 PEAK POWER

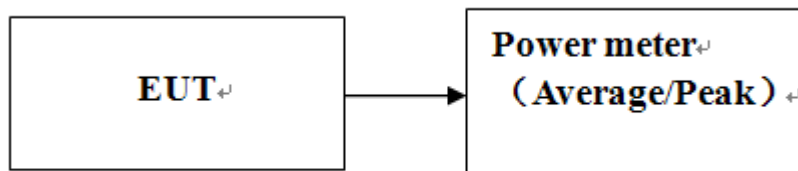
Limit

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

1. According to §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.
2. According to §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.
3. 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.
4. 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.

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



Test Procedure

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v03r02.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

Test Results*No non-compliance noted***Test RESULTS****1M GFSK Modulation mode**

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (mW)	Result
Low	2402	3.69	2.339	1000	PASS
Mid	2441	3.52	2.249		PASS
High	2480	3.73	2.360		PASS

3M 8-DPSK Modulation mode

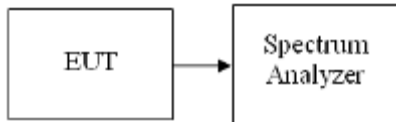
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)	Limit (mW)	Result
Low	2402	2.16	1.644	125	PASS
Mid	2441	2.23	1.671		PASS
High	2480	2.08	1.614		PASS

6.2 20DB BANDWIDTH MEASUREMENT

Limit

According to §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.

Test Configuration



Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 30kHz, VBW = 300kHz, Span = 3MHz, Sweep = auto.
4. Max hold, mark 2 peaks of hopping channel and record the 2 peaks frequency.

Test Results of Bandwidth*No non-compliance noted*

Operation Mode:	1 Mbps	Test Date:	August 27, 2015
Temperature:	24°C	Tested by:	James.Yan

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
00	2402	0.91
39	2441	0.91
78	2480	0.91

Operation Mode:	3 Mbps	Test Date:	August 27, 2015
Temperature:	24°C	Tested by:	James.Yan

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
00	2402	1.17
39	2441	1.17
78	2480	1.17

Test Plot**1M Channel 00**

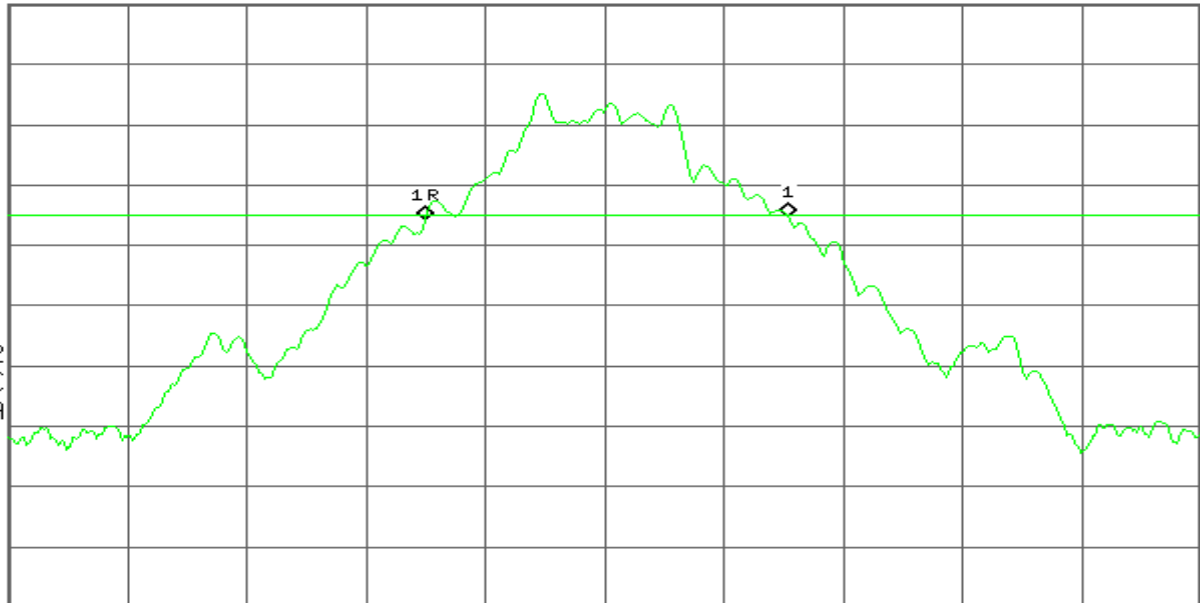
* Agilent

R T

▲ Mkr1 910 kHz
0.54 dB

Ref 20 dBm

Atten 30 dB

#Peak
Log
10
dB/
Offst
7
dB
DI
-14.9
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
f>50k
Swp

Center 2.402 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 300 kHz

Sweep 3.08 ms (601 pts)

1M Channel 39

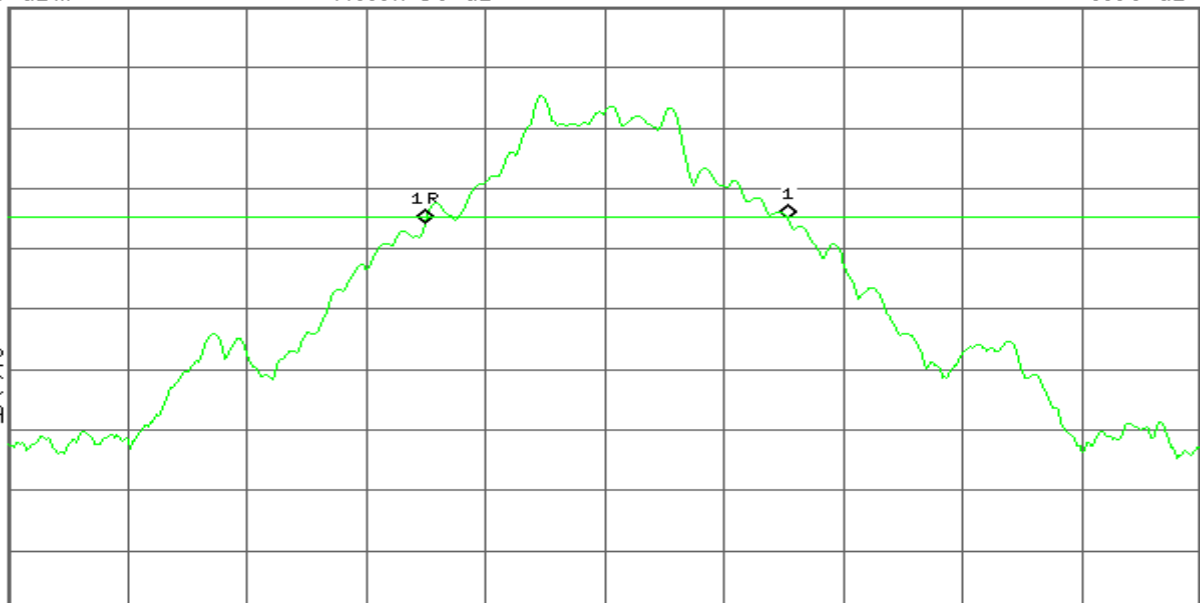
* Agilent

R T

▲ Mkr1 910 kHz
0.68 dB

Ref 20 dBm

Atten 30 dB

#Peak
Log
10
dB/
Offst
7
dB
DI
-14.7
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
f>50k
Swp

Center 2.441 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 300 kHz

Sweep 3.08 ms (601 pts)

1M Channel 78

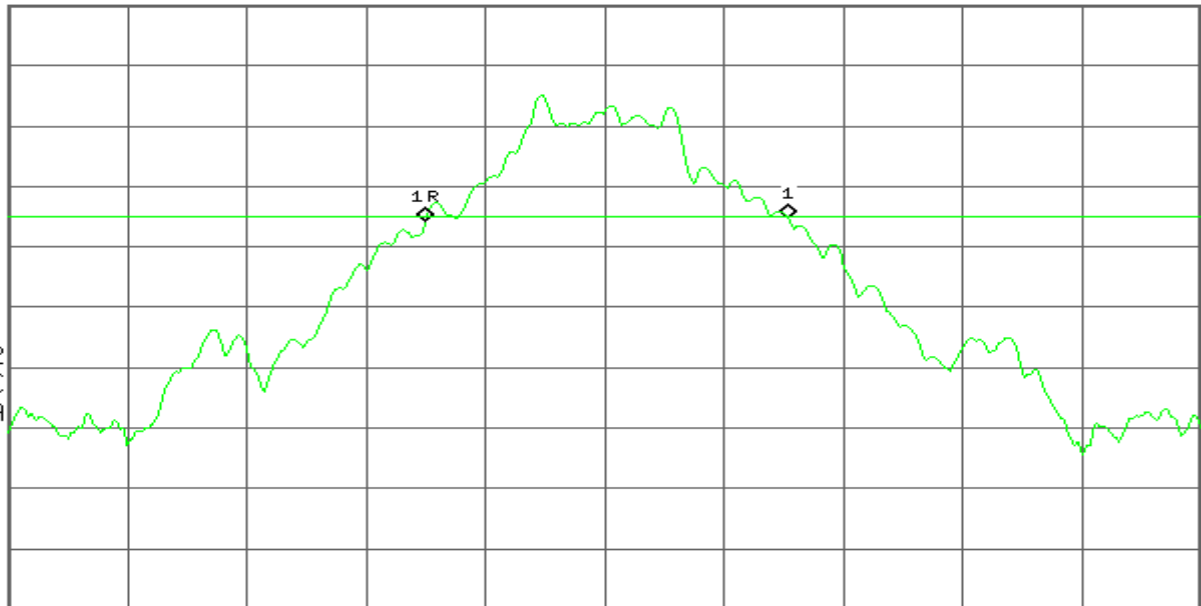
Agilent

R T

▲ Mkr1 910 kHz
0.61 dB

Ref 20 dBm

Atten 30 dB

#Peak
Log
10
dB/
Offst
7
dB
DI
-14.9
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
f>50k
Swp

Center 2.480 000 GHz

#Res BW 30 kHz

#VBW 300 kHz

Span 3 MHz
Sweep 3.08 ms (601 pts)

3M Channel 00

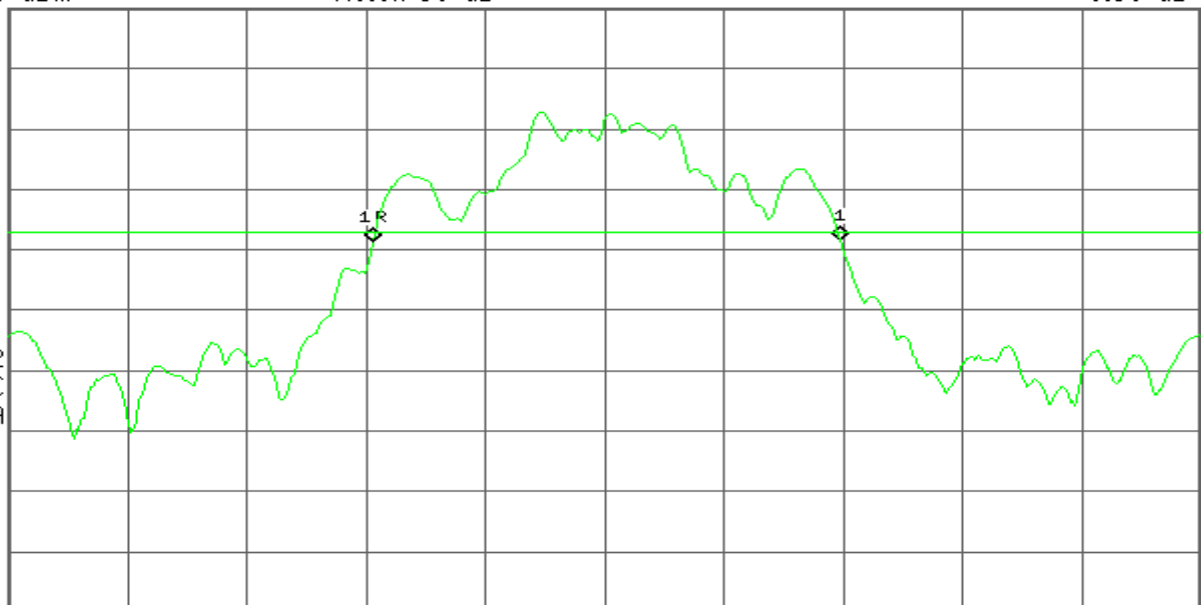
Agilent

R T

▲ Mkr1 1.170 MHz
0.30 dB

Ref 20 dBm

Atten 30 dB

#Peak
Log
10
dB/
Offst
7
dB
DI
-17.1
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
f>50k
Swp

Center 2.402 000 GHz

#Res BW 30 kHz

#VBW 300 kHz

Span 3 MHz
Sweep 3.08 ms (601 pts)

3M Channel 39

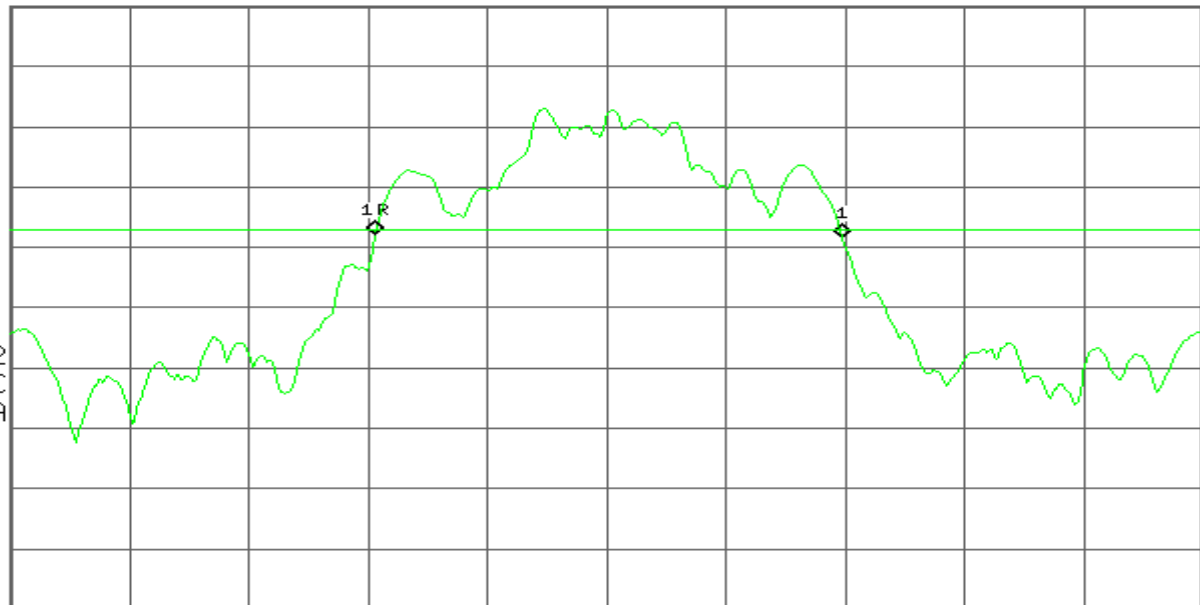
Agilent

R T

▲ Mkr1 1.170 MHz
-0.45 dB

Ref 20 dBm

Atten 30 dB

#Peak
Log
10
dB/
Offst
7
dB
DI
-17.2
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
f>50k
Swp

Center 2.441 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 300 kHz

Sweep 3.08 ms (601 pts)

3M Channel 78

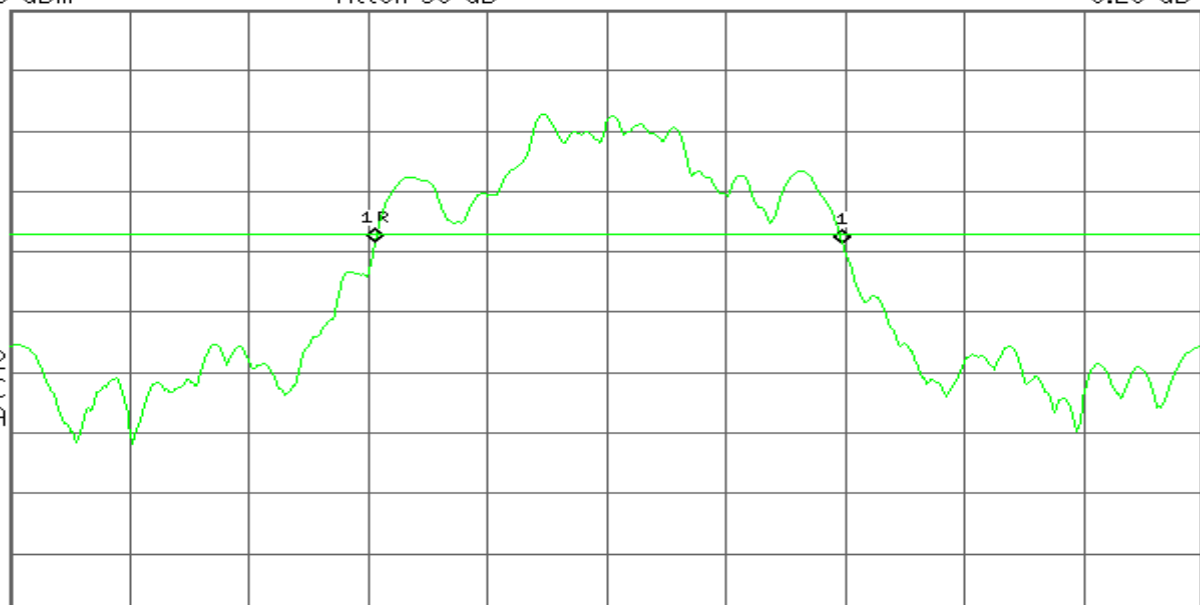
Agilent

R T

▲ Mkr1 1.170 MHz
-0.29 dB

Ref 20 dBm

Atten 30 dB

#Peak
Log
10
dB/
Offst
7
dB
DI
-17.2
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
f>50k
Swp

Center 2.480 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 300 kHz

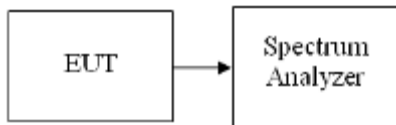
Sweep 3.08 ms (601 pts)

6.3 HOPPING CHANNEL SEPARATION

LIMIT

According to §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.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel.
4. Set the spectrum analyzer as RBW = 30kHz, VBW = 100kHz, Span = 3MHz, Sweep = auto.
5. Max hold, mark 2 peaks of hopping channel and record the 2 peaks frequency.

TEST RESULTS

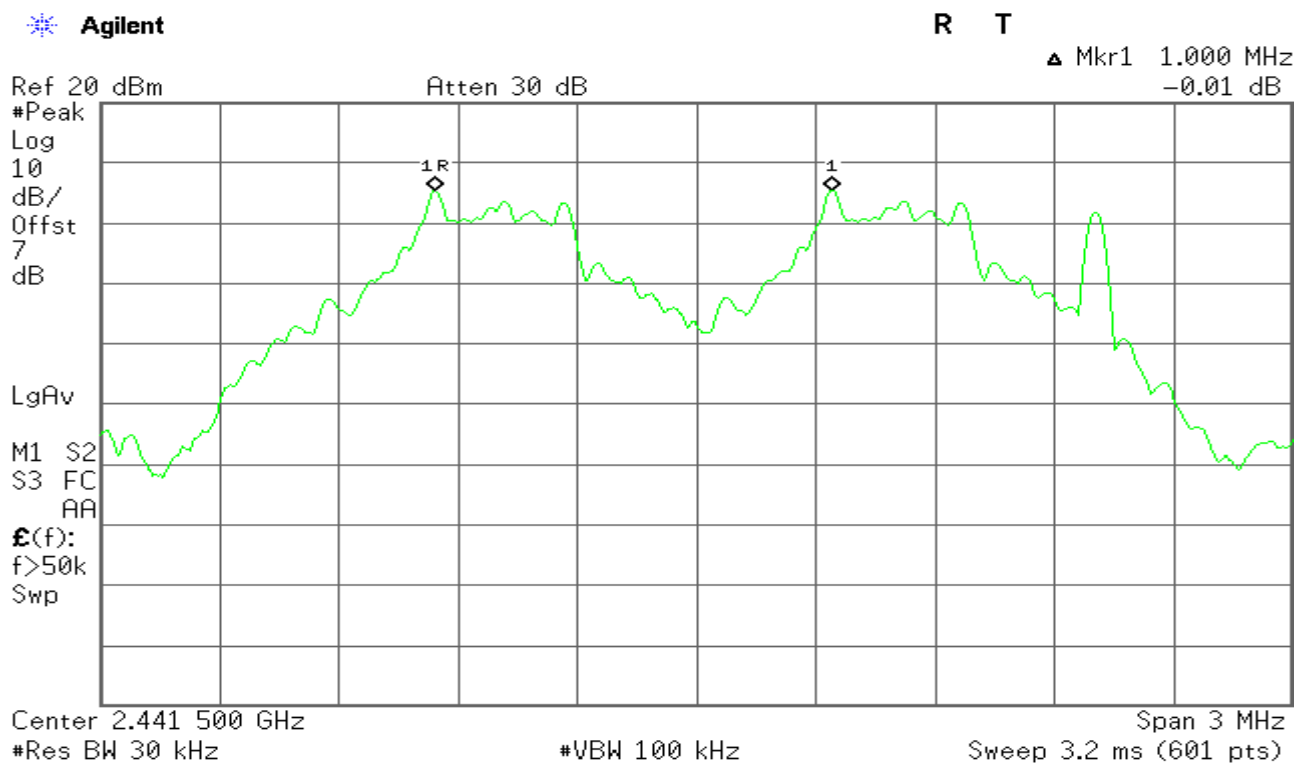
No non-compliance noted

Operation Mode:	1 Mbps	Test Date:	August 27, 2015
Temperature:	24°C	Tested by:	James.Yan

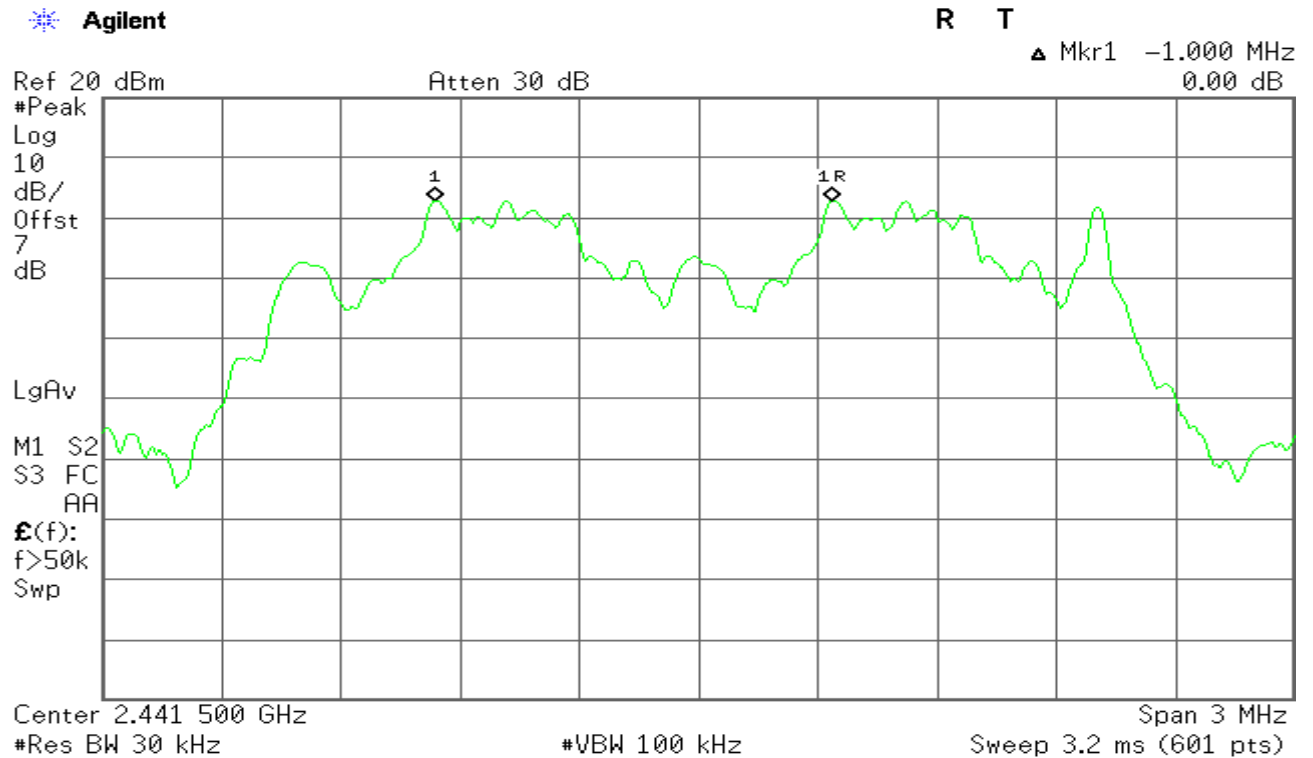
Channel	Frequency	Separation	(20dB BW)	Result
	(MHz)	(MHz)	Limits (MHz)	
39~40	2441~2442	1.000	0.910	Pass

Operation Mode:	3 Mbps	Test Date:	August 27, 2015
Temperature:	24°C	Tested by:	James.Yan

Channel	Frequency	Separation	(2/3 of 20dB BW)	Result
	(MHz)	(MHz)	Limits (MHz)	
39~40	2441~2442	1.000	0.780	Pass

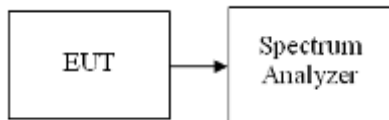
1M Channel Separation Plot on Channel 39-40

3M Channel Separation Plot on Channel 39-40



6.4 NUMBER OF HOPPING FREQUENCY**LIMIT**

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

Test Configuration**TEST PROCEDURE**

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2441.5MHz, Sweep = auto and Start=2441.5MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW, VBW=1MHz.
5. Max hold, view and count how many channel in the band.

TEST RESULTS

No non-compliance noted

Test Data

Operation Mode:	1 Mbps	Test Date:	August 27, 2015
Temperature:	24°C	Tested by:	James.Yan

Result (No. of CH)	Limit (No. of CH)	Result
79	>15	PASS

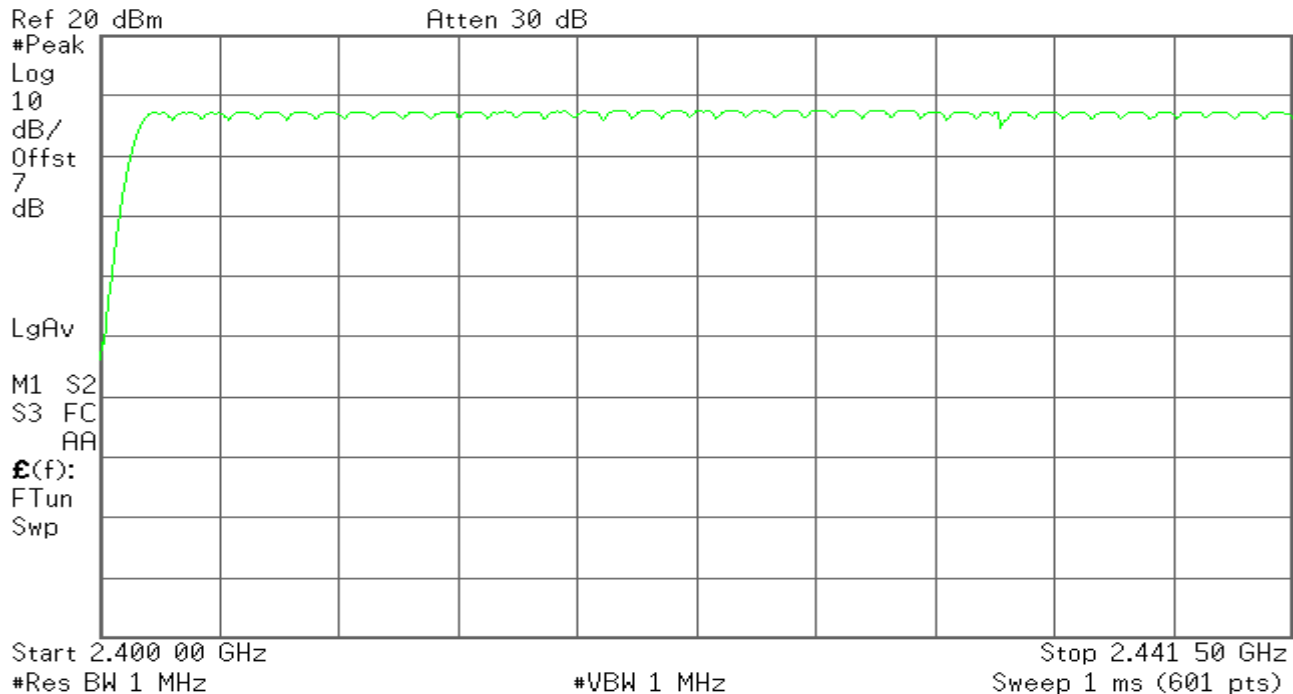
Operation Mode:	3 Mbps	Test Date:	August 27, 2015
Temperature:	24°C	Tested by:	James.Yan

Result (No. of CH)	Limit (No. of CH)	Result
79	>15	PASS

Test Plot:1M**Channel Number 2.4 GHz – 2.441.5 GHz**

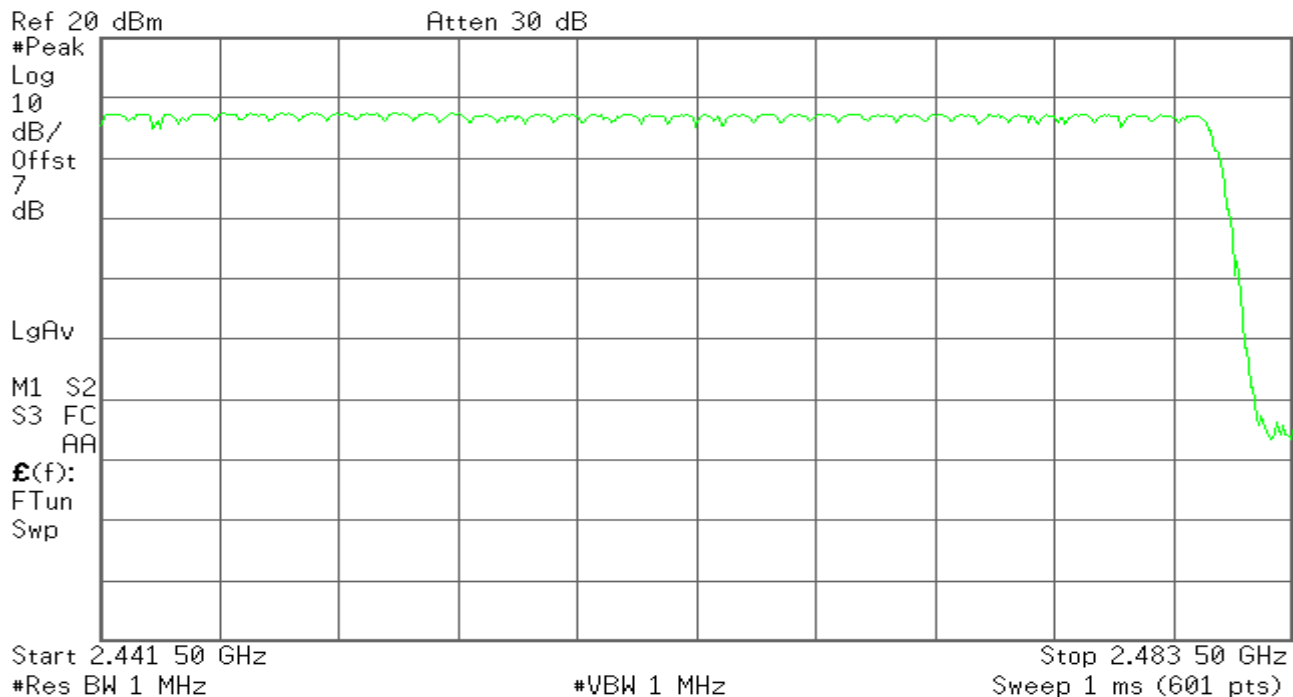
* Agilent

R T

**Channel Number 2.441.5 GHz – 2.4835 GHz**

* Agilent

R T

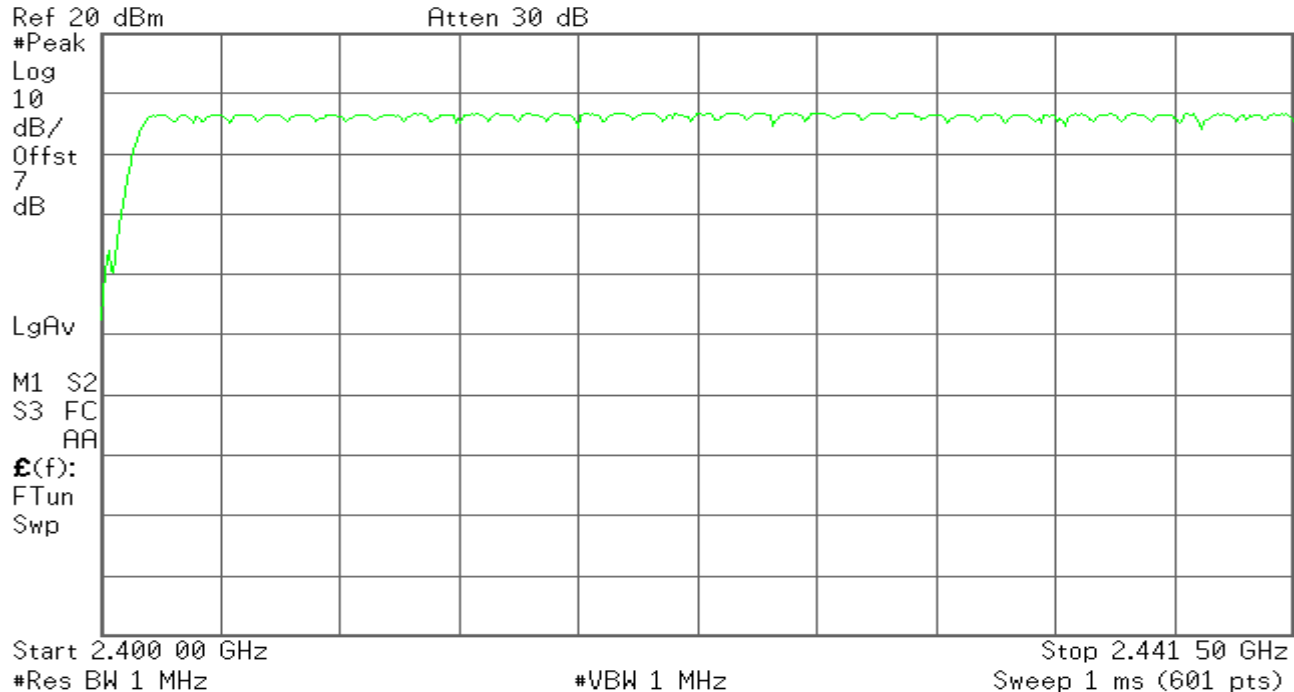


Test Plot:3M

Channel Number 2.4 GHz – 2.441.5 GHz

Agilent

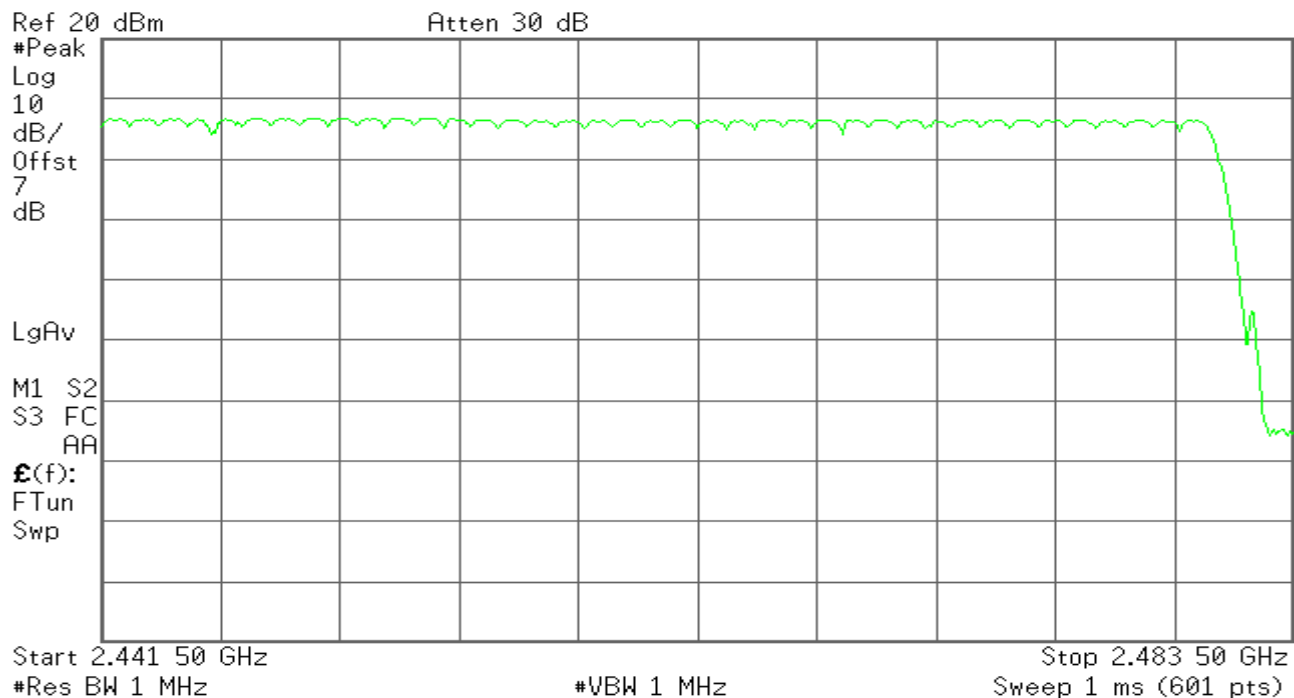
R T



Channel Number 2.441.5 GHz – 2.4835 GHz

Agilent

R T

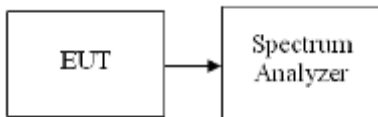


6.5 TIME OF OCCUPANCY (DWELL TIME)

LIMIT

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
5. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

No non-compliance noted

Test Data

1M

DH 1

$$0.376 * (1600/2)/79 * 31.6 = 120.32(\text{ms})$$

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
0.376	120.32	31.60	400	PASS

DH 3

$$1.640 * (1600/4)/79 * 31.6 = 262.40 (\text{ms})$$

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
1.640	262.40	31.60	400	PASS

DH 5

$$2.900 * (1600/6)/79 * 31.6 = 309.33 (\text{ms})$$

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2.900	309.33	31.60	400	PASS

3M

DH 1

$$0.384 * (1600/2)/79 * 31.6 = 122.88 \text{ (ms)}$$

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
0.384	122.88	31.60	400	PASS

DH 3

$$1.640 * (1600/4)/79 * 31.6 = 261.28 \text{ (ms)}$$

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
1.640	261.28	31.60	400	PASS

DH 5

$$2.900 * (1600/6)/79 * 31.6 = 305.81 \text{ (ms)}$$

Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
2.900	305.81	31.60	400	PASS

1M-DH1

Agilent

R T

Mkr3 1.558 ms
-58.89 dBm

Ref 10 dBm

#Atten 20 dB

#Peak
Log
10
dB/
Offst
7.0
dB

LgAv

W1 S2

Center 2.441 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 2 ms (1001 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Time	308 μ s	-59.98 dBm
2	(1)	Time	684 μ s	-61.90 dBm
3	(1)	Time	1.558 ms	-58.89 dBm

1M-DH3

Agilent

R T

Mkr3 2.715 ms
-61.13 dBm

Ref 10 dBm

#Atten 20 dB

#Peak
Log
10
dB/
Offst
7.0
dB

LgAv

W1 S2

Center 2.441 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 5 ms (1001 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Time	215 μ s	-59.38 dBm
2	(1)	Time	1.855 ms	-59.08 dBm
3	(1)	Time	2.715 ms	-61.13 dBm

1M-DH5

* Agilent

R T

Mkr3 4.14 ms

-59.64 dBm

Ref 10 dBm

#Atten 20 dB

#Peak

Log

10

dB/

Offst

7.0

dB

LgAv

W1 S2

Center 2.441 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 10 ms (1001 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Time	390 μ s	-62.36 dBm
2	(1)	Time	3.29 ms	-59.81 dBm
3	(1)	Time	4.14 ms	-59.64 dBm

3M-DH1

* Agilent

R T

Mkr2 794 μ s

-59.54 dBm

Ref 10 dBm

#Atten 20 dB

#Peak

Log

10

dB/

Offst

7.0

dB

LgAv

W1 S2

Center 2.441 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 2 ms (1001 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Time	410 μ s	-59.64 dBm
2	(1)	Time	794 μ s	-59.54 dBm
3	(1)	Time	1.658 ms	-59.87 dBm

3M-DH3

Agilent

R T

Mkr3 3.185 ms
-61.94 dBm

Ref 10 dBm

#Atten 20 dB

#Peak

Log

10

dB/

Offst

7.0

dB

LgAv

W1 S2

Center 2.441 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 5 ms (1001 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Time	685 μ s	-59.95 dBm
2	(1)	Time	2.325 ms	-59.74 dBm
3	(1)	Time	3.185 ms	-61.94 dBm

3M-DH5

Agilent

R T

Mkr3 5.03 ms
-62.91 dBm

Ref 10 dBm

#Atten 20 dB

#Peak

Log

10

dB/

Offst

7.0

dB

LgAv

W1 S2

Center 2.441 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 10 ms (1001 pts)

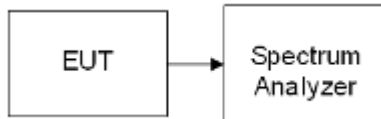
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Time	1.28 ms	-60.39 dBm
2	(1)	Time	4.18 ms	-58.92 dBm
3	(1)	Time	5.03 ms	-62.91 dBm

6.6 Conducted Band Edges Measurement

LIMIT

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

Test Configuration



TEST PROCEDURE

1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz ($\geq 1\%$ span=10MHz), VBW = 300kHz (≥ 3 RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

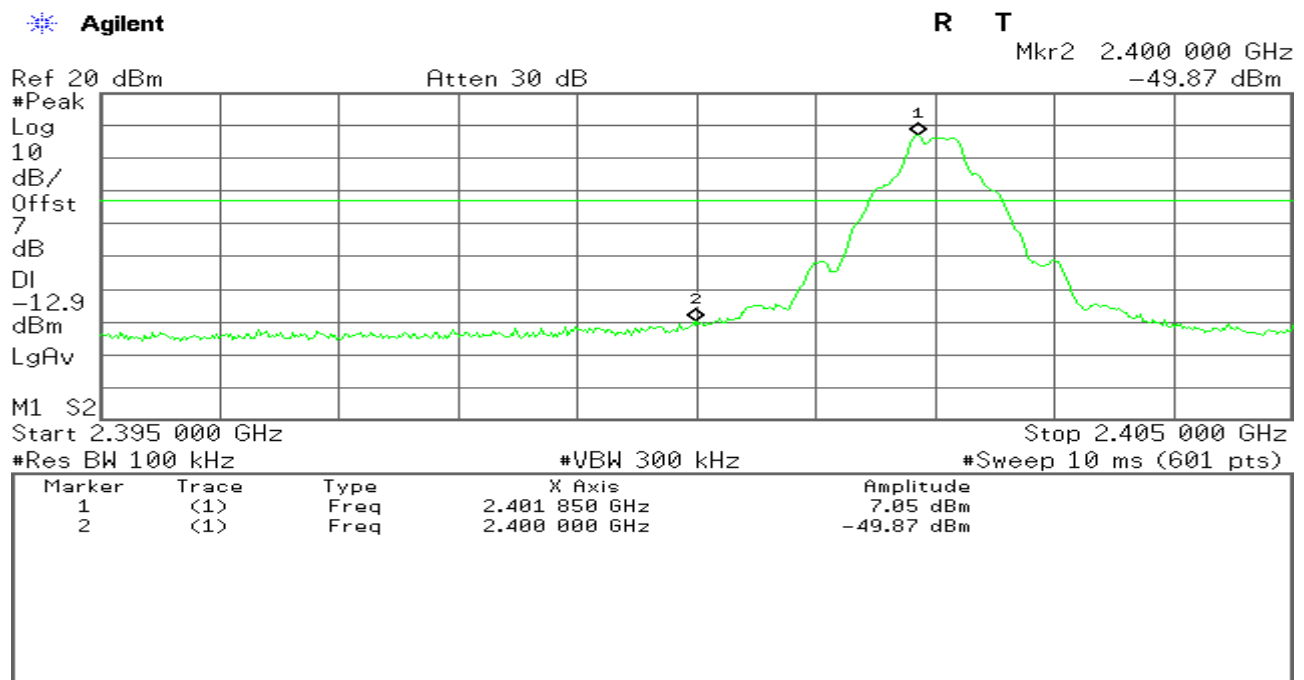
TEST RESULTS

No non-compliance noted

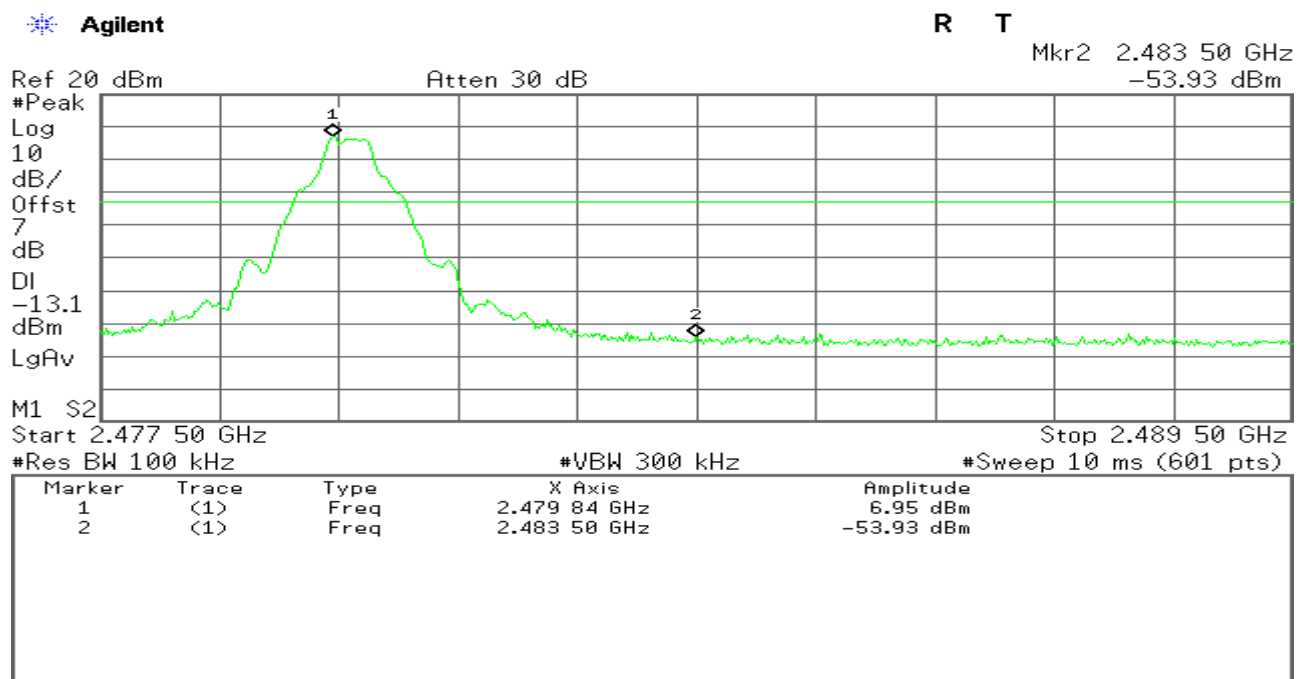
Test Result of Conducted Band Edges

Operation Mode:	1 Mbps	Test Date:	August 27, 2015
Test Channel:	00 and 78	Tested by:	James.Yan
Humidity:	52 % RH	Temperature:	24°C

Low Band Edge Plot on Channel 00

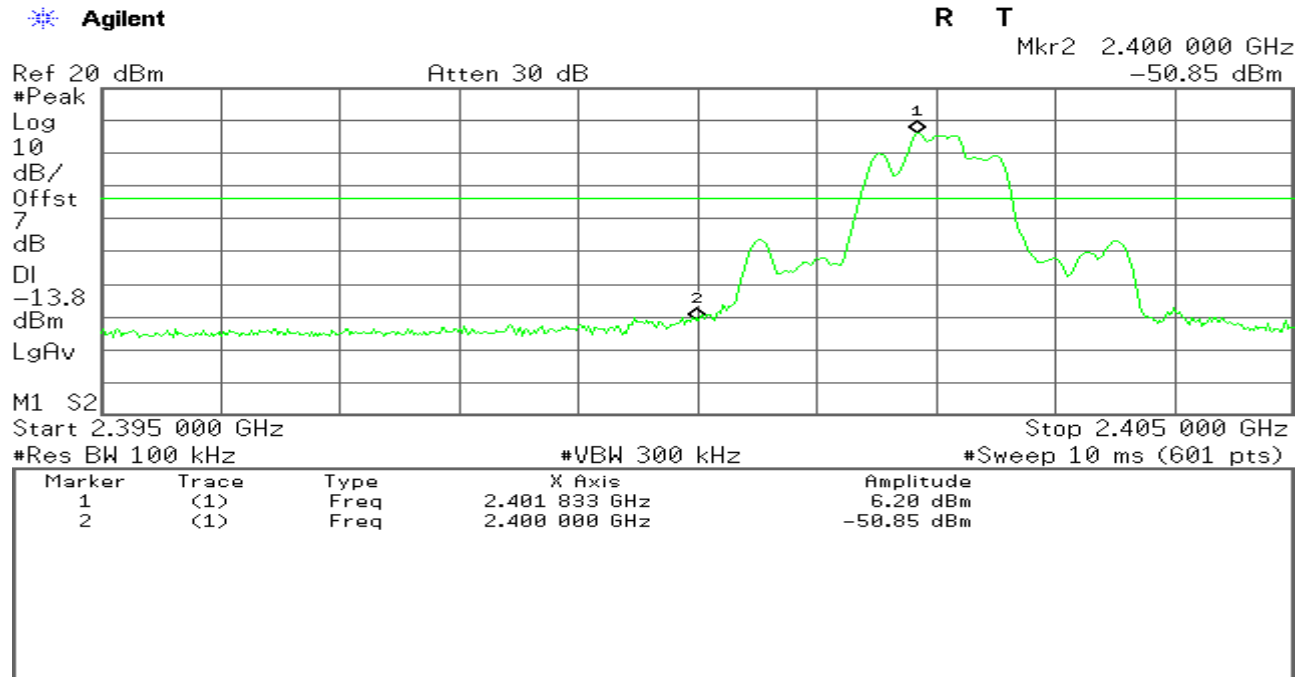


High Band Edge Plot on Channel 78

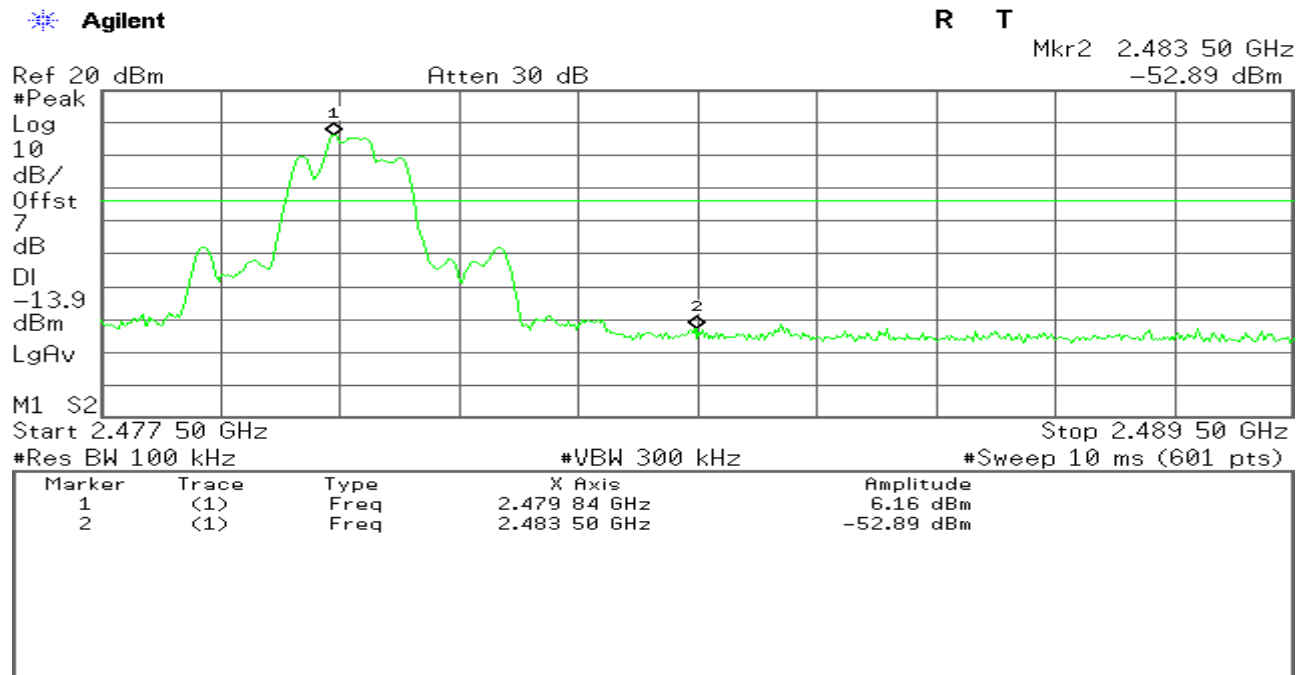


Operation Mode:	3 Mbps	Test Date:	August 27, 2015
Test Channel:	00 and 78	Tested by:	James.Yan
Humidity:	52 % RH	Temperature:	24°C

Low Band Edge Plot on Channel 00



High Band Edge Plot on Channel 78



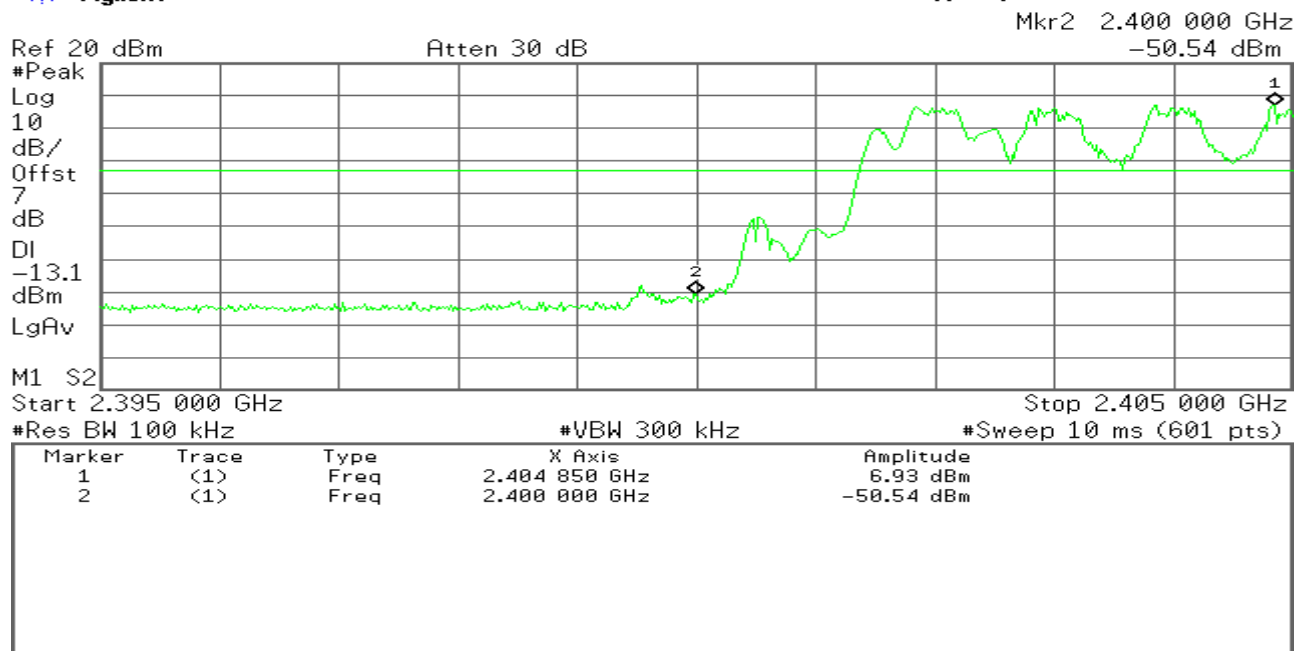
Test Result of Conducted Hopping Mode Band Edges

Operation Mode:	1 Mbps	Test Date:	August 27, 2015
Humidity:	52 % RH	Temperature:	24°C

1Mbps Hopping Mode Low Band Edge Plot

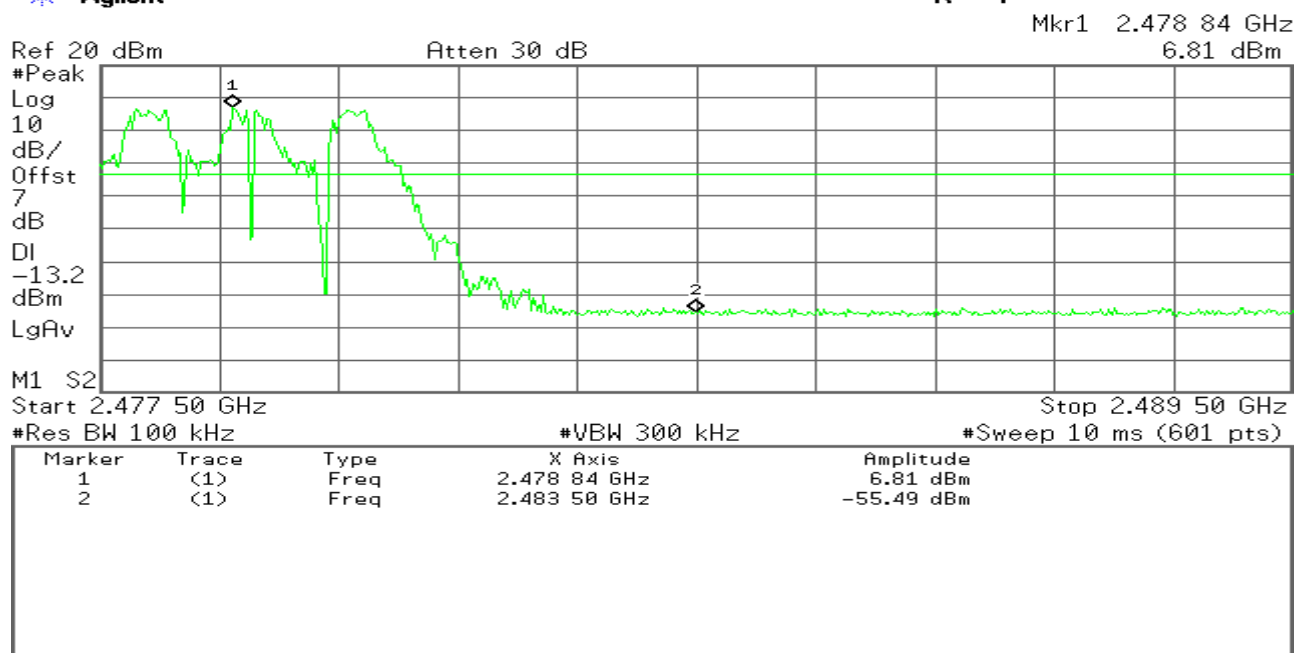
Agilent

R T

**1Mbps Hopping Mode High Band Edge Plot**

Agilent

R T

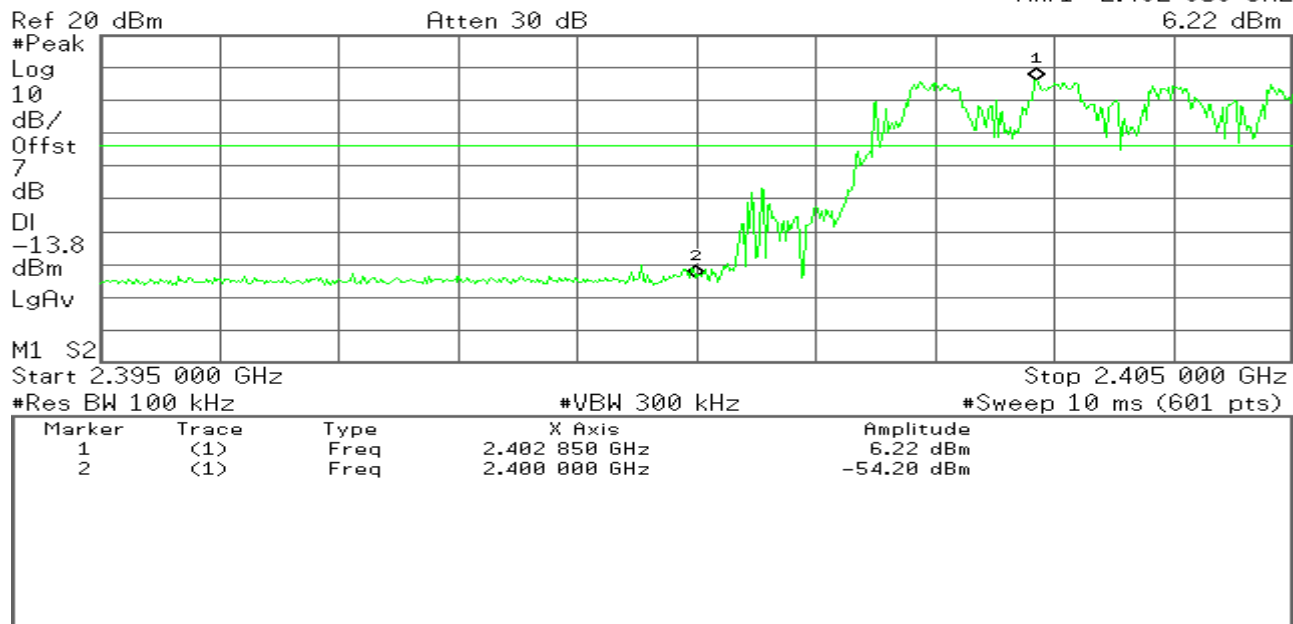


Operation Mode:	3 Mbps	Test Date:	August 27, 2015
Humidity:	52 % RH	Temperature:	24°C

3Mbps Hopping Mode Low Band Edge Plot

Agilent

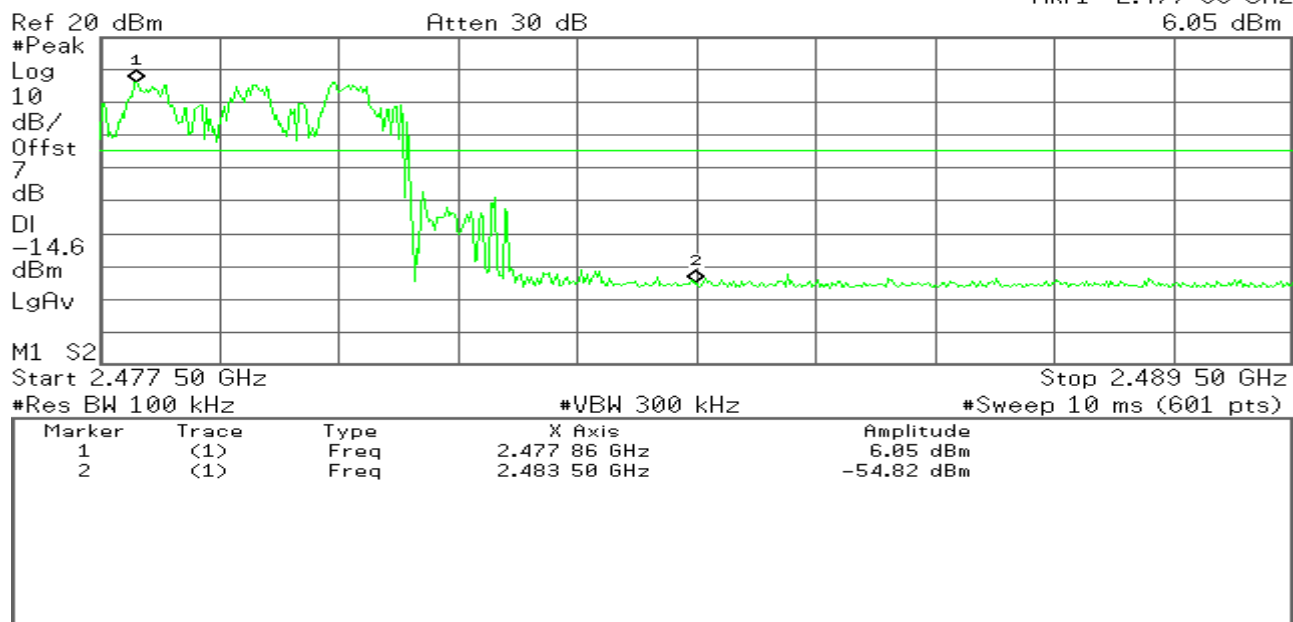
R T

Mkr1 2.402 850 GHz
6.22 dBm

3Mbps Hopping Mode High Band Edge Plot

Agilent

R T

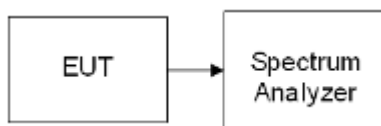
Mkr1 2.477 86 GHz
6.05 dBm

6.7 Conducted Spurious Emission Measurement

LIMIT

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

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. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 300 KHz.

Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

TEST RESULTS

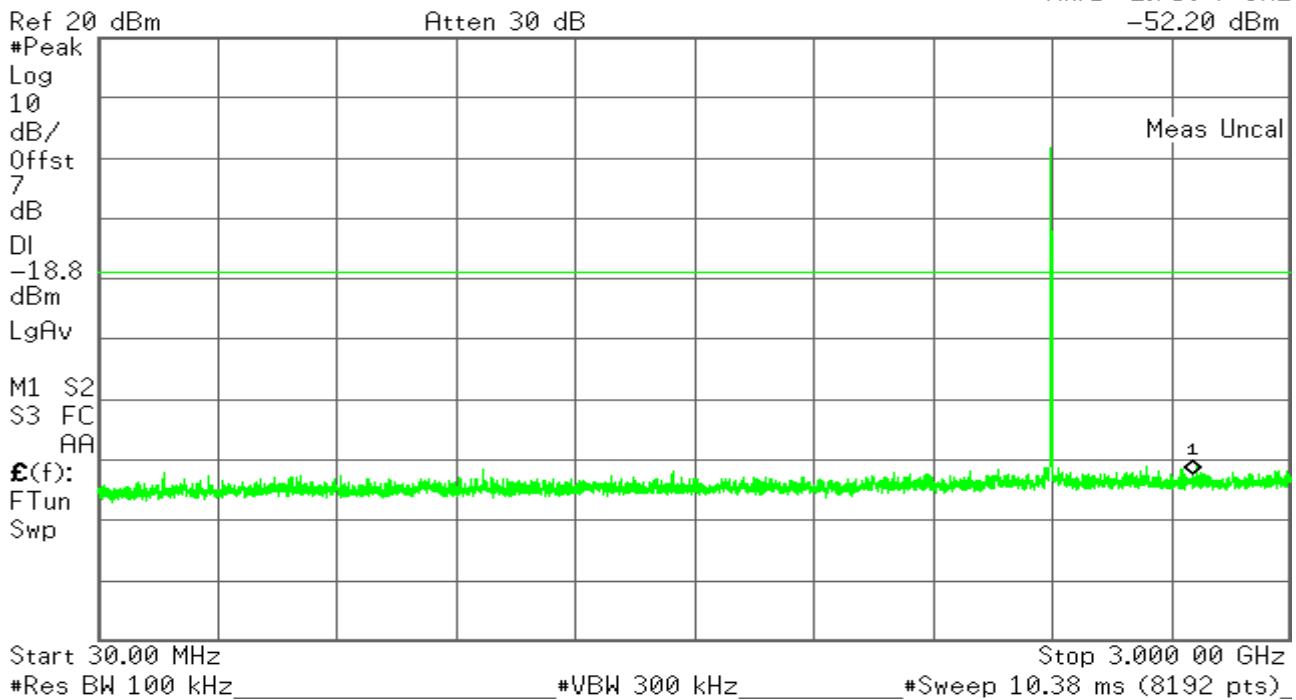
No non-compliance noted

Operation Mode:	1 Mbps	Test Date:	August 27, 2015
Test Channel:	00	Tested by:	James.Yan
Humidity:	52 % RH	Temperature:	24°C

Agilent

R T

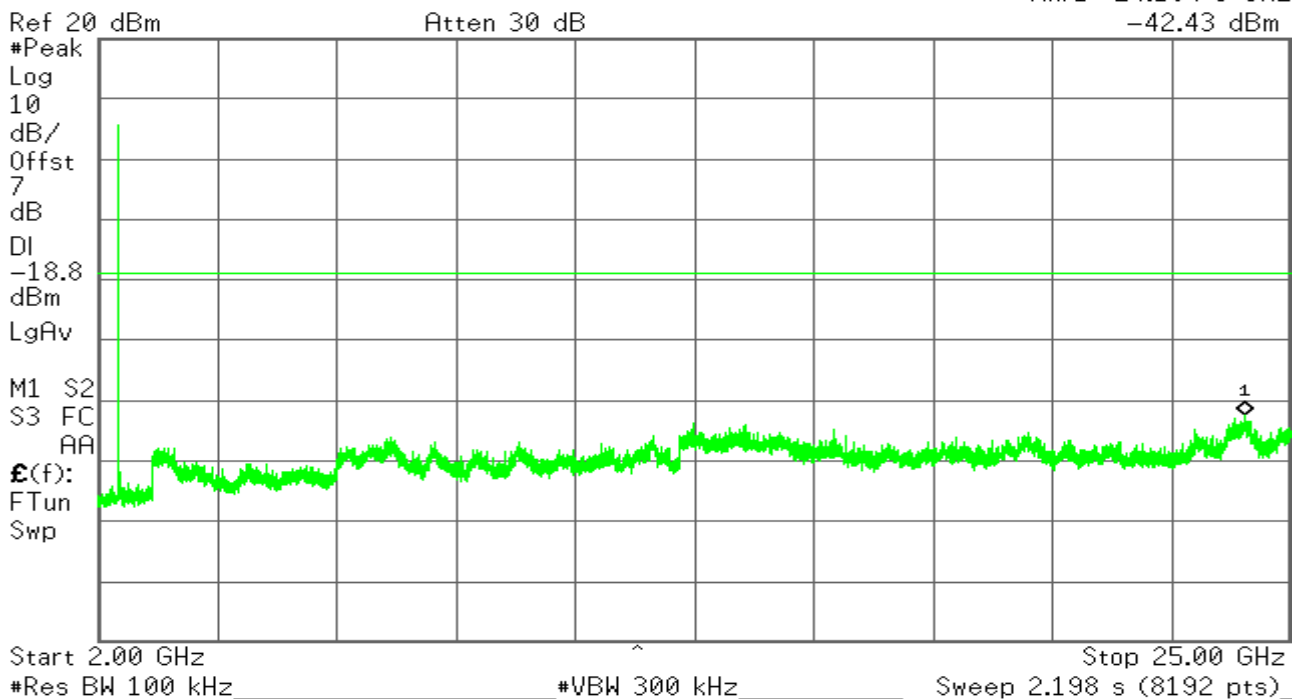
Mkr1 2.756 7 GHz
-52.20 dBm



Agilent

R T

Mkr1 24.104 3 GHz
-42.43 dBm

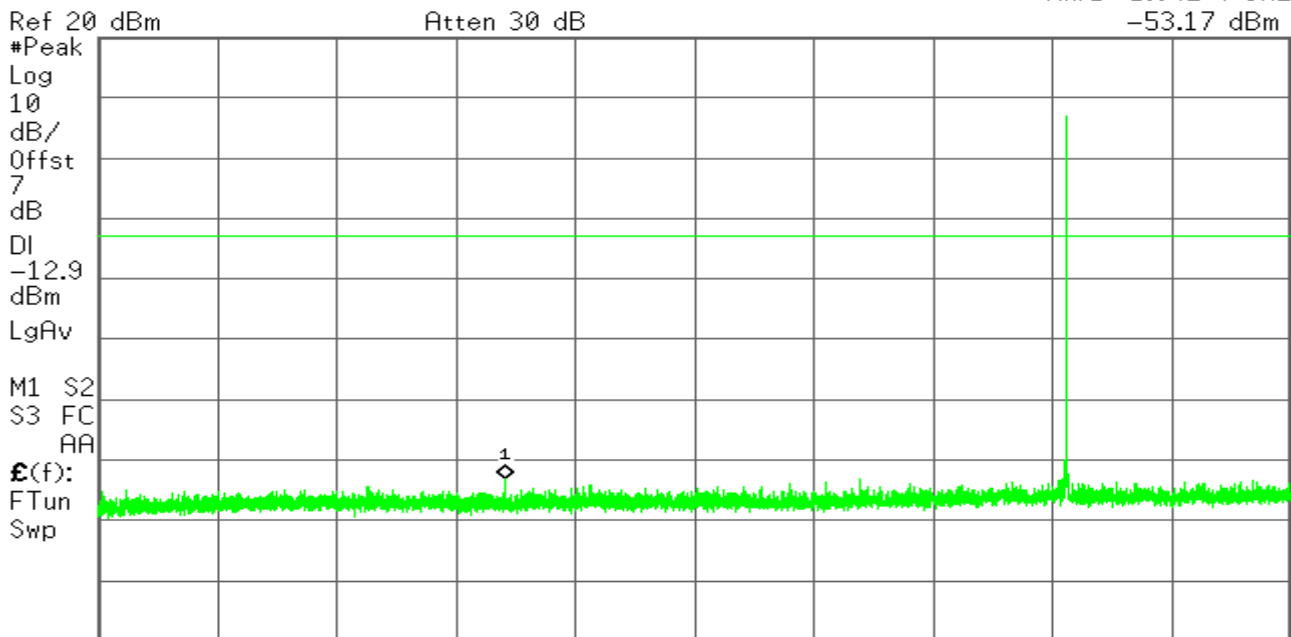


Operation Mode:	1 Mbps	Test Date:	August 27, 2015
Test Channel:	39	Tested by:	James.Yan
Humidity:	52 % RH	Temperature:	24°C

Agilent

R T

Mkr1 1.042 4 GHz
-53.17 dBm

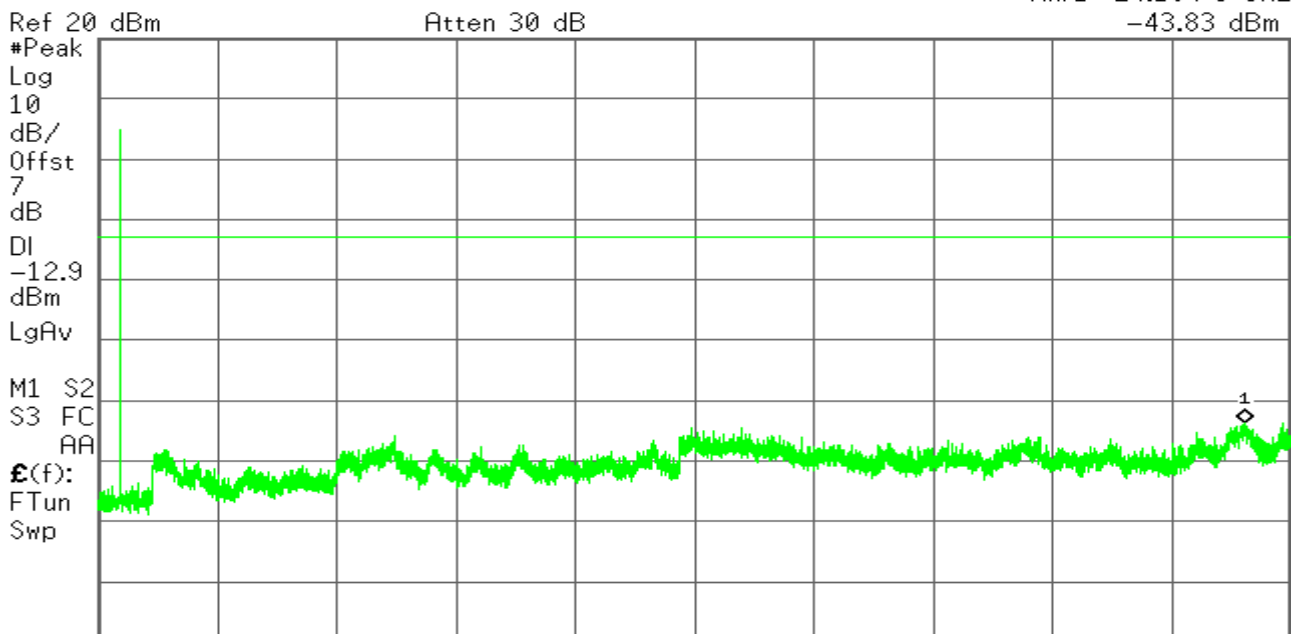


Start 30.0 MHz Stop 3.000 0 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 284 ms (8192 pts)_

Agilent

R T

Mkr1 24.104 3 GHz
-43.83 dBm



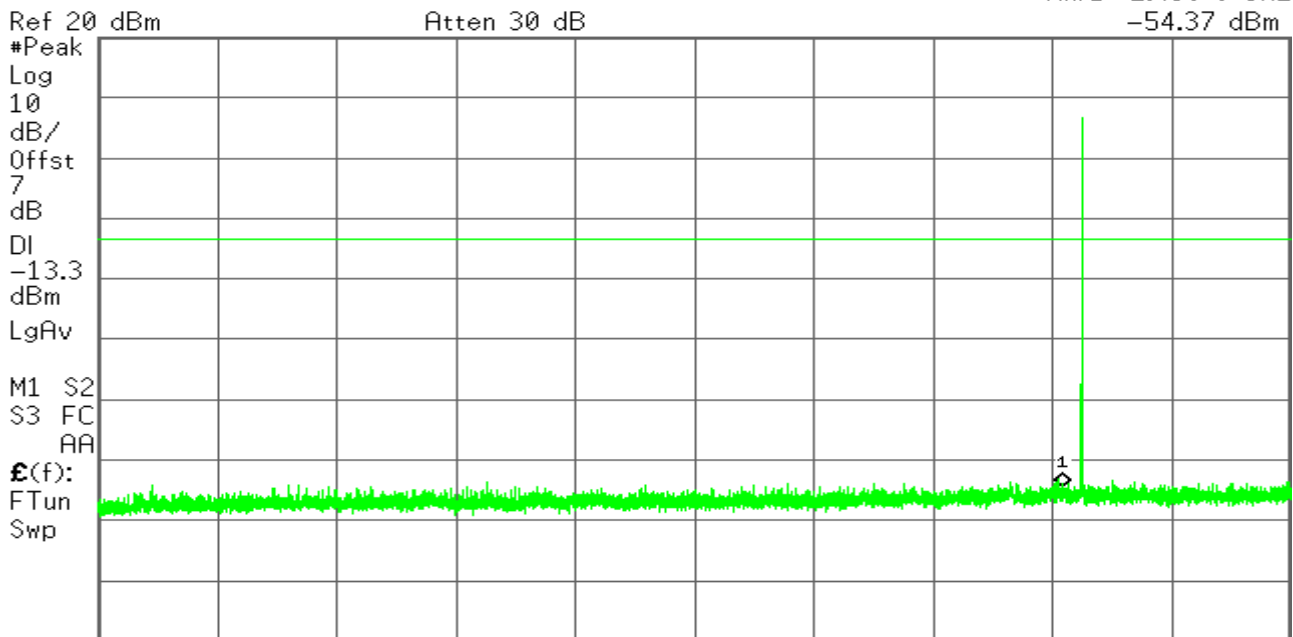
Start 2.000 0 GHz Stop 25.000 0 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.198 s (8192 pts)_

Operation Mode:	1 Mbps	Test Date:	August 27, 2015
Test Channel:	78	Tested by:	James.Yan
Humidity:	52 % RH	Temperature:	24°C

Agilent

R T

Mkr1 2.430 0 GHz
-54.37 dBm

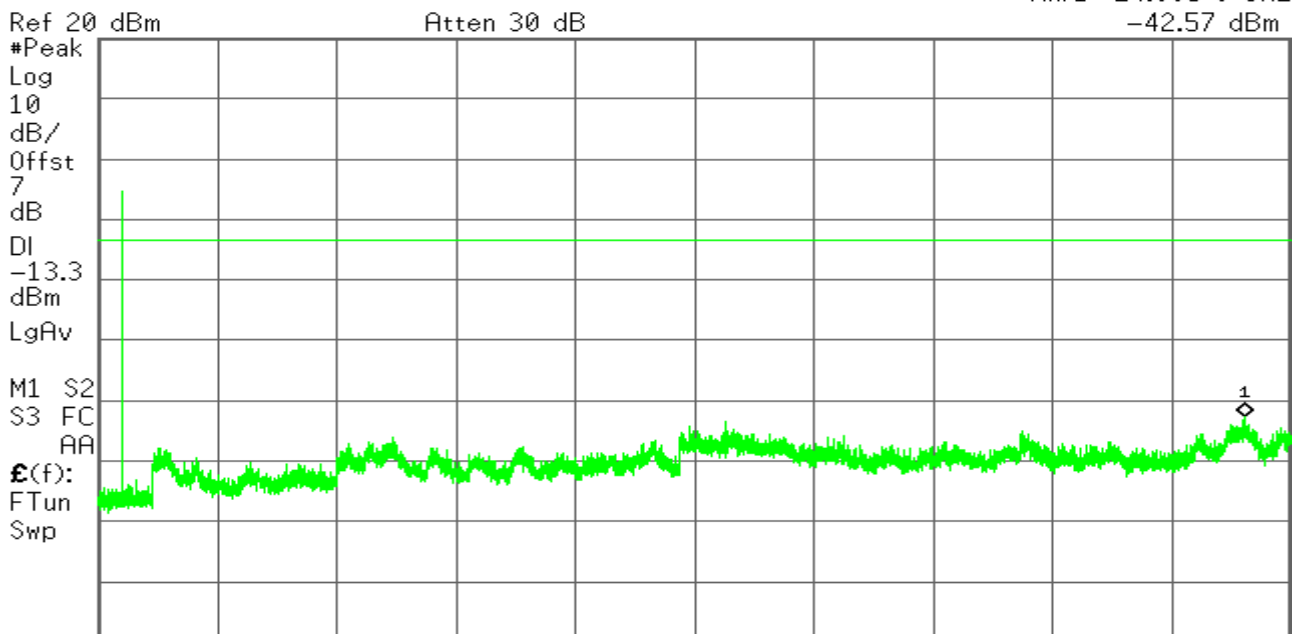


Start 30.0 MHz Stop 3.000 0 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 284 ms (8192 pts)_

Agilent

R T

Mkr1 24.095 8 GHz
-42.57 dBm



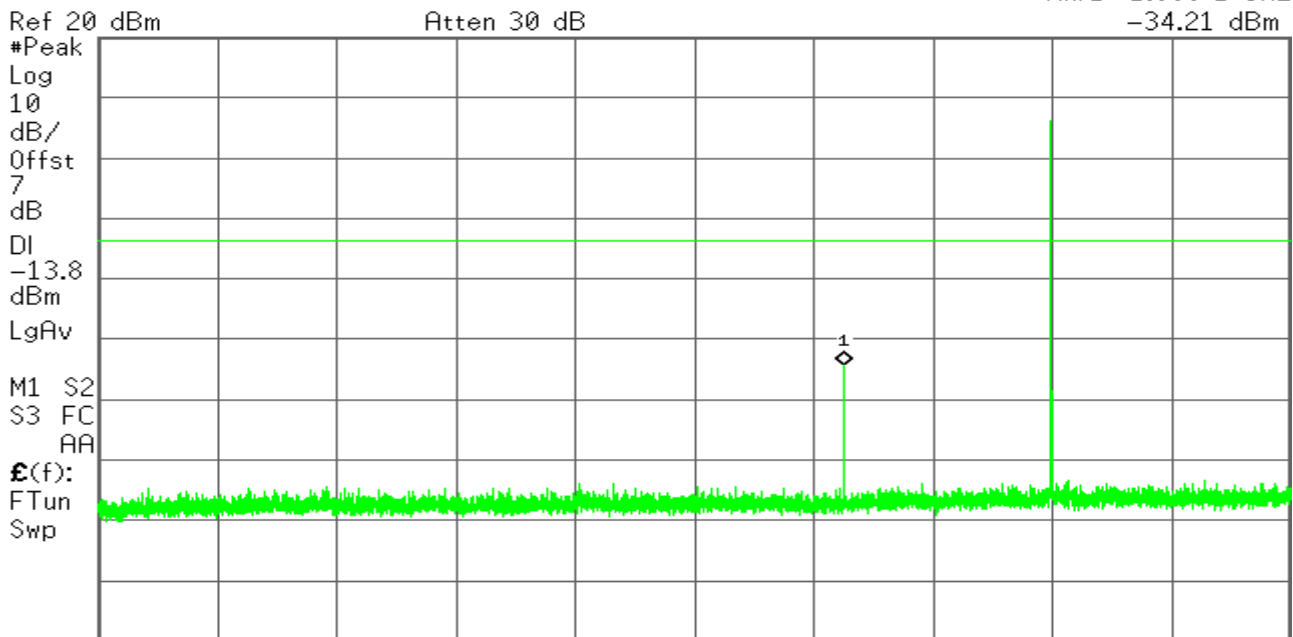
Start 2.000 0 GHz Stop 25.000 0 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.198 s (8192 pts)_

Operation Mode:	3 Mbps	Test Date:	August 27, 2015
Test Channel:	00	Tested by:	James.Yan
Humidity:	52 % RH	Temperature:	24°C

Agilent

R T

Mkr1 1.886 1 GHz
-34.21 dBm

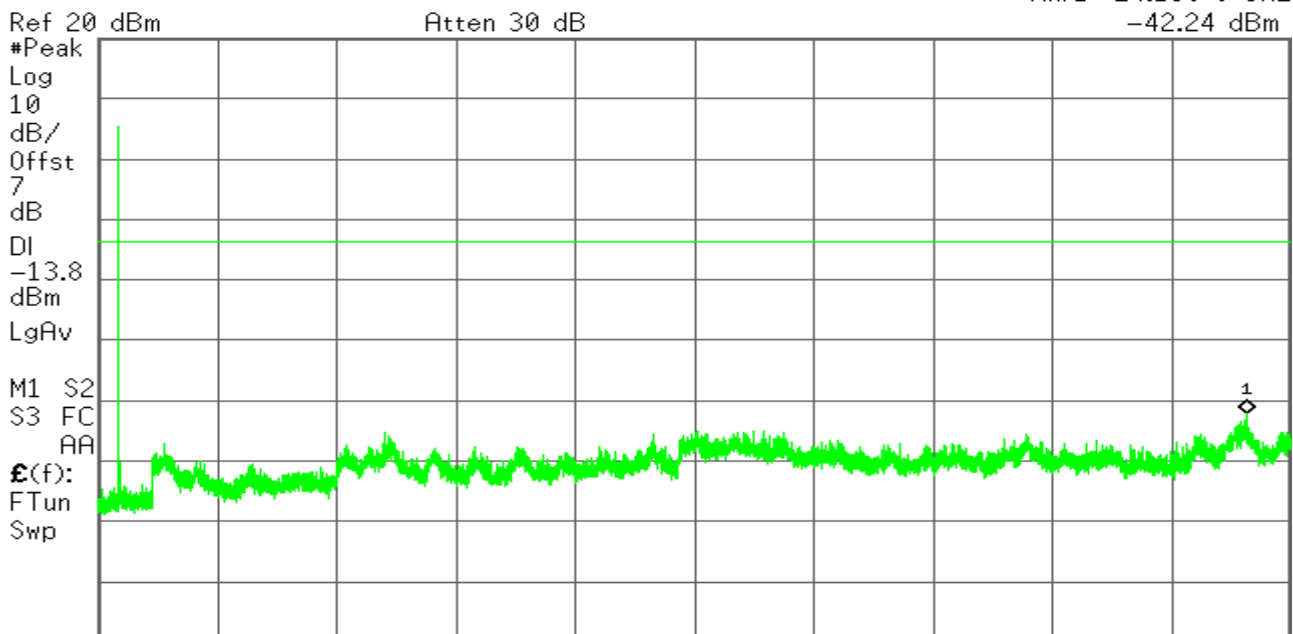


Start 30.0 MHz Stop 3.000 0 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 284 ms (8192 pts)_

Agilent

R T

Mkr1 24.138 0 GHz
-42.24 dBm



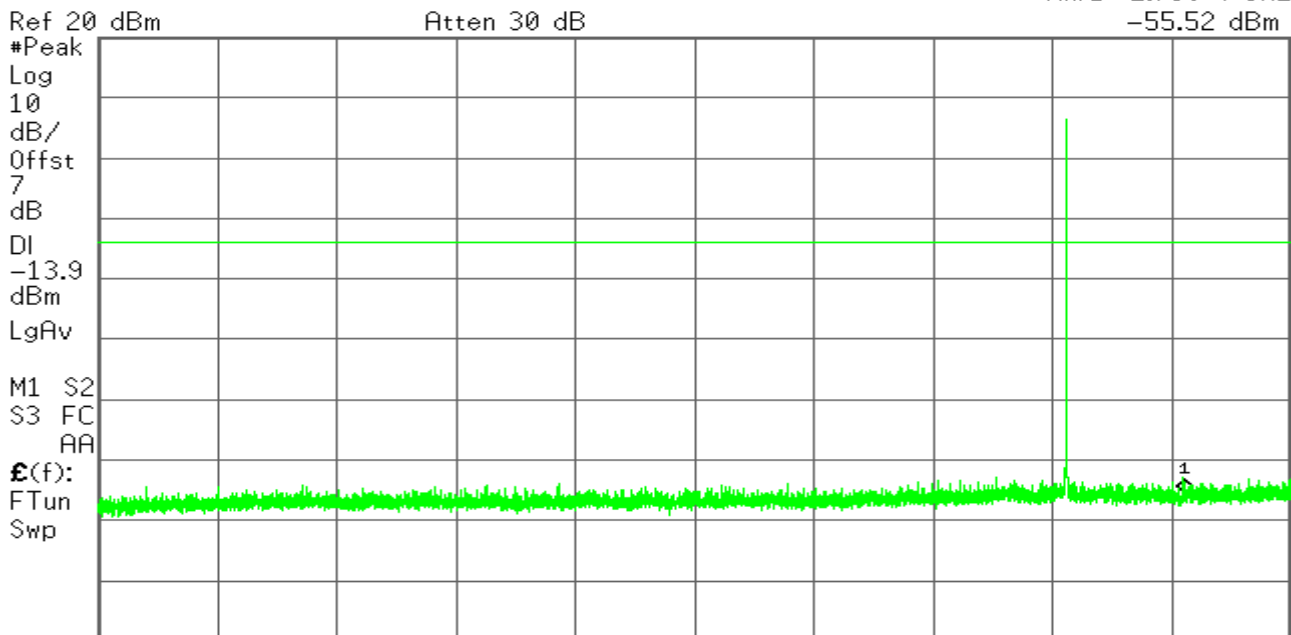
Start 2.000 0 GHz Stop 25.000 0 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.198 s (8192 pts)_

Operation Mode:	3 Mbps	Test Date:	August 27, 2015
Test Channel:	39	Tested by:	James.Yan
Humidity:	52 % RH	Temperature:	24°C

Agilent

R T

Mkr1 2.736 4 GHz
-55.52 dBm

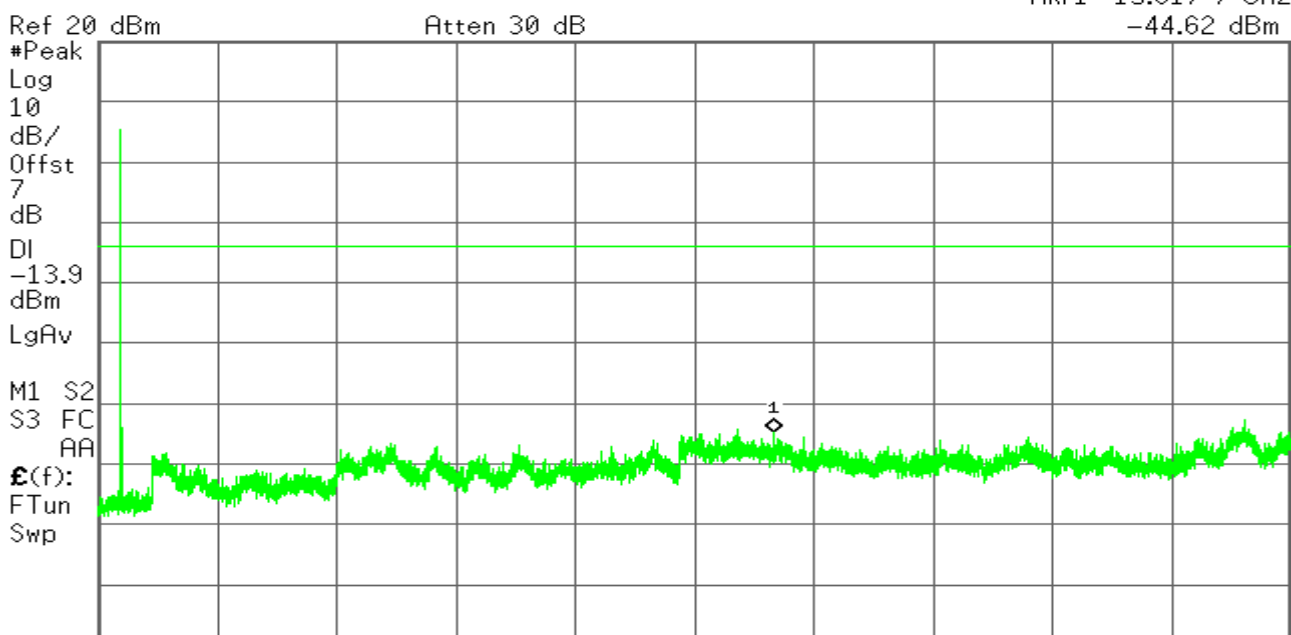


Start 30.0 MHz Stop 3.000 0 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 284 ms (8192 pts)_

Agilent

R T

Mkr1 15.017 7 GHz
-44.62 dBm



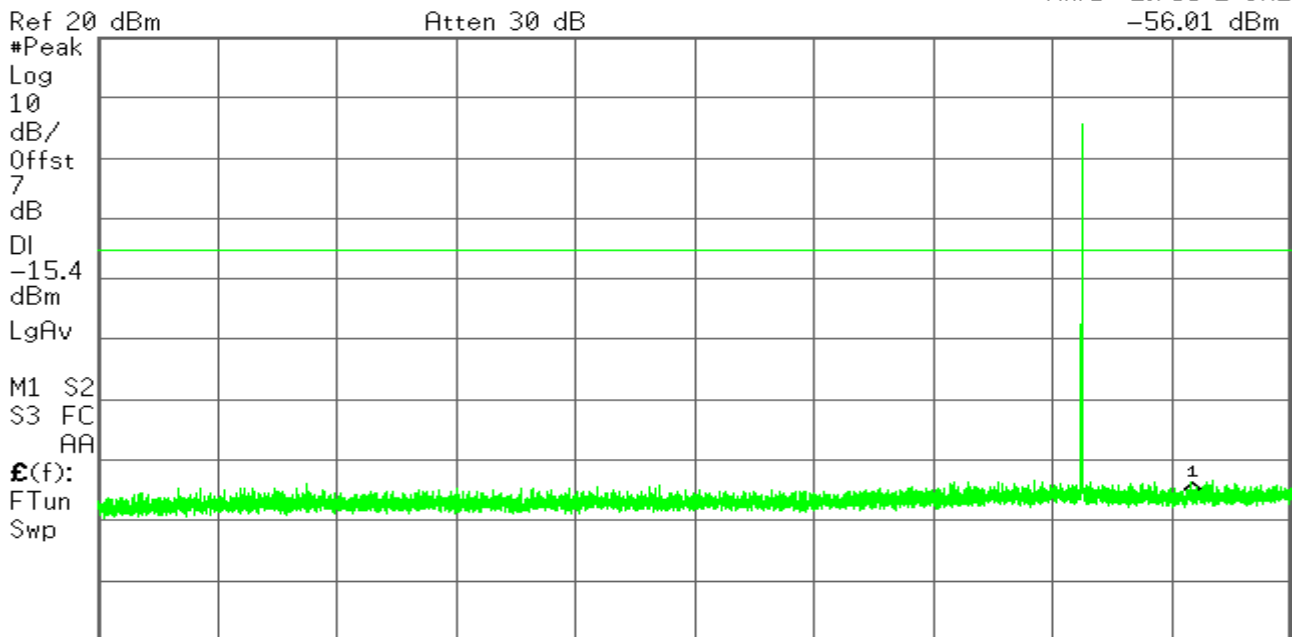
Start 2.000 0 GHz Stop 25.000 0 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.198 s (8192 pts)_

Operation Mode:	3 Mbps	Test Date:	August 27, 2015
Test Channel:	78	Tested by:	James.Yan
Humidity:	52 % RH	Temperature:	24°C

Agilent

R T

Mkr1 2.755 2 GHz
-56.01 dBm

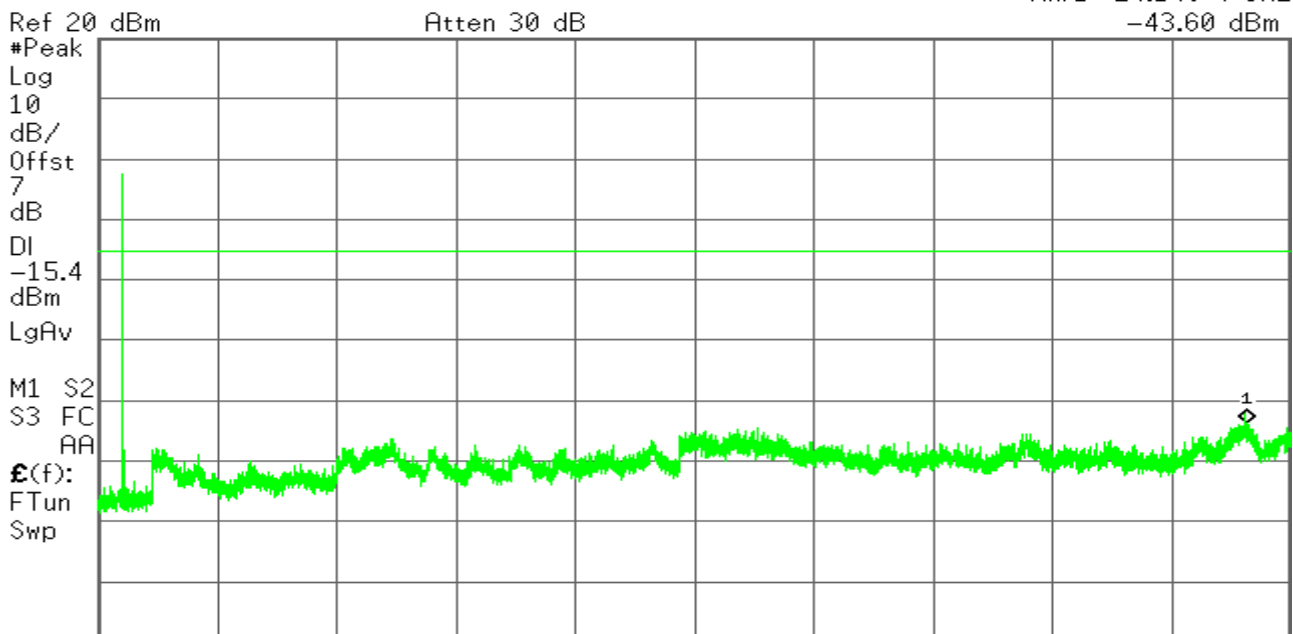


Start 30.0 MHz Stop 3.000 0 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 284 ms (8192 pts)

Agilent

R T

Mkr1 24.146 4 GHz
-43.60 dBm



Start 2.000 0 GHz Stop 25.000 0 GHz
#Res BW 100 kHz #VBW 300 kHz Sweep 2.198 s (8192 pts)

6.8 Radiated Band Edge and Spurious Emission Measurement

LIMIT

1. 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 (mV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

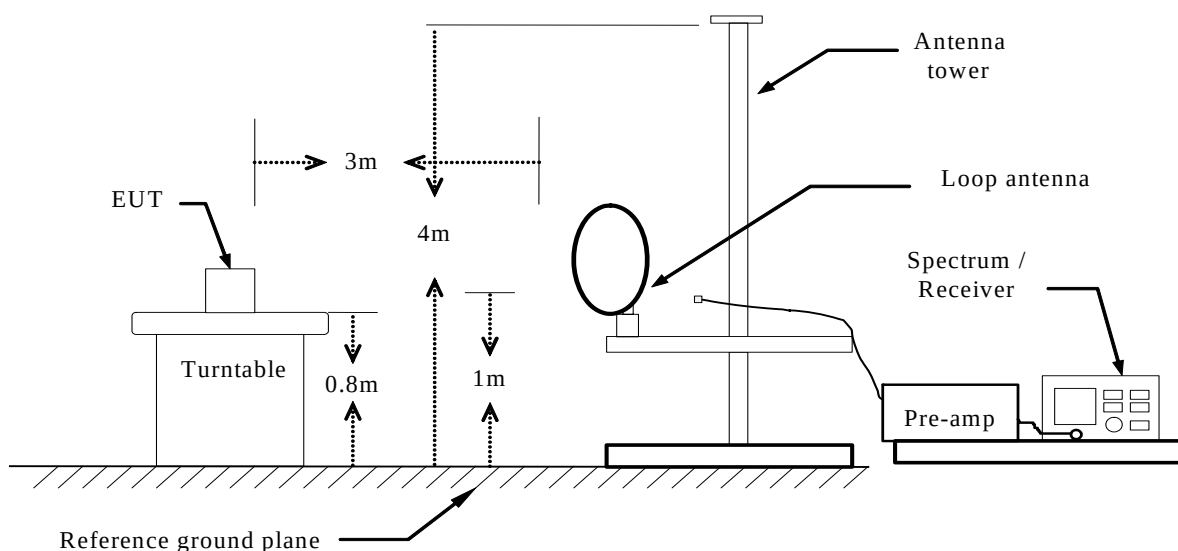
Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

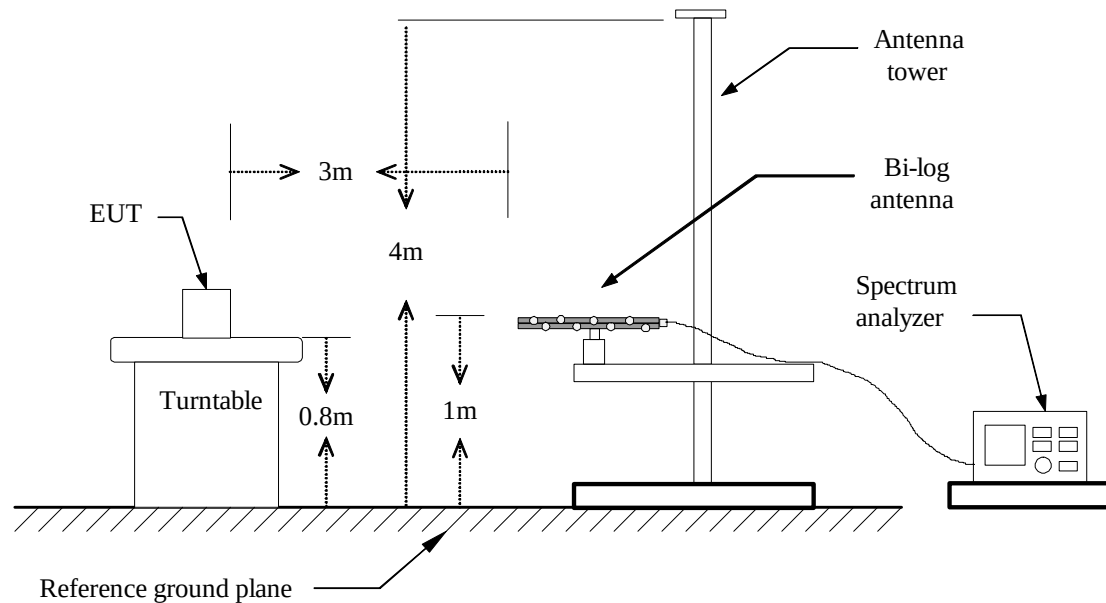
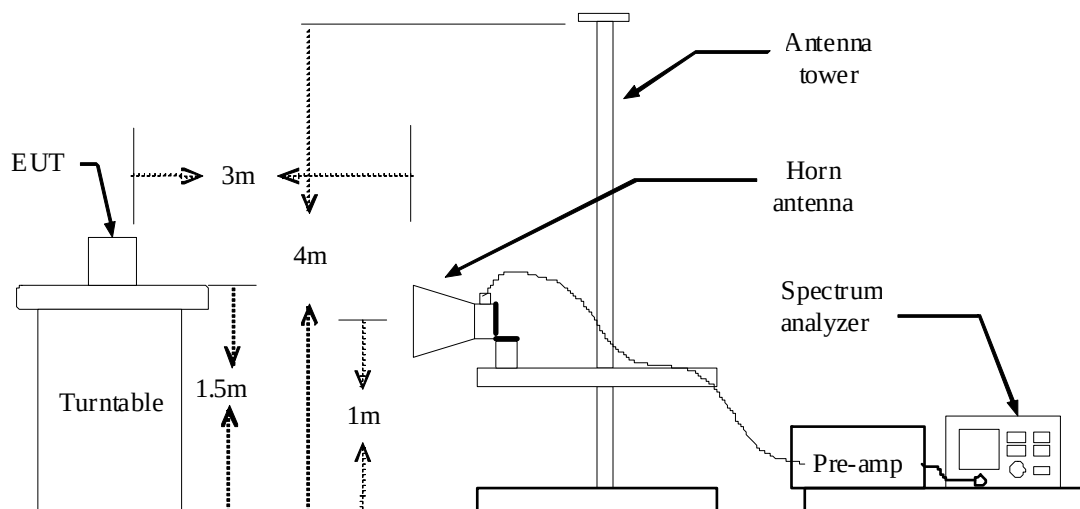
2. In the above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	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

Below 30MHz

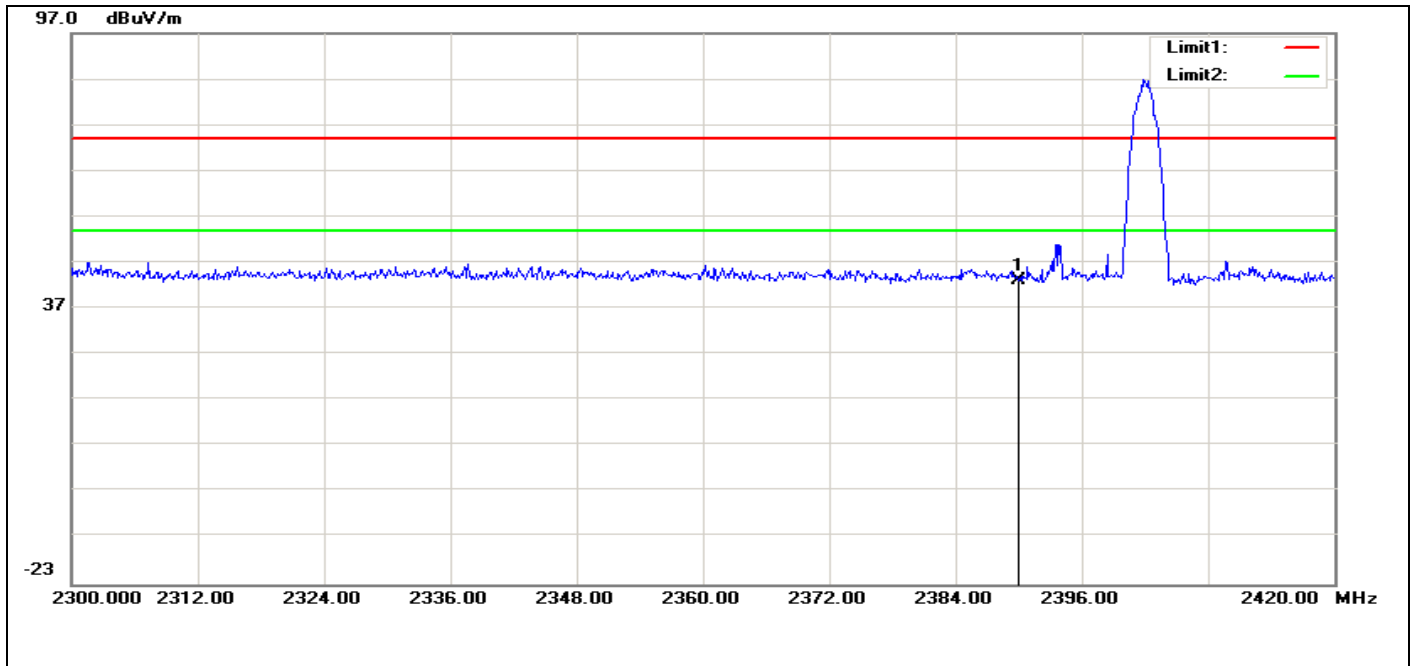


Below 1 GHz**Above 1 GHz**

TEST PROCEDURE

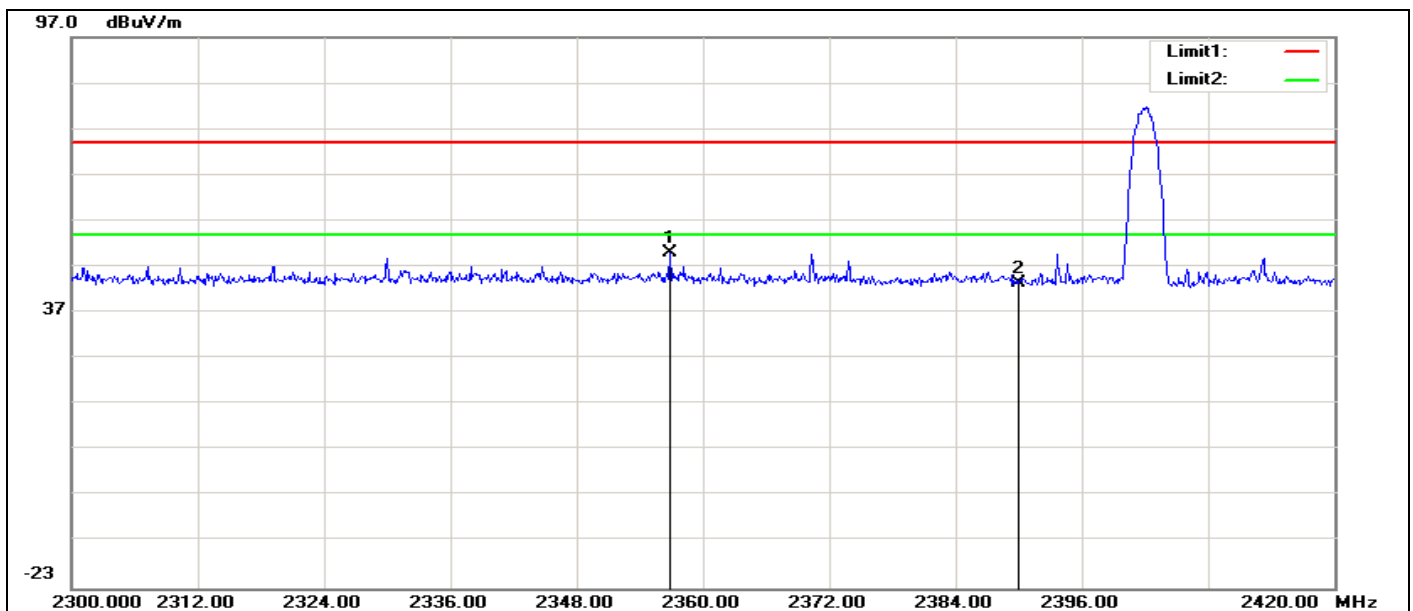
1. The EUT is placed on a turntable above ground plane, which is 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is 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=VBW=1MHz / Sweep=AUTO
(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

RESTRICTED BANDEDGE (1Mbps, Low Channel, Horizontal)

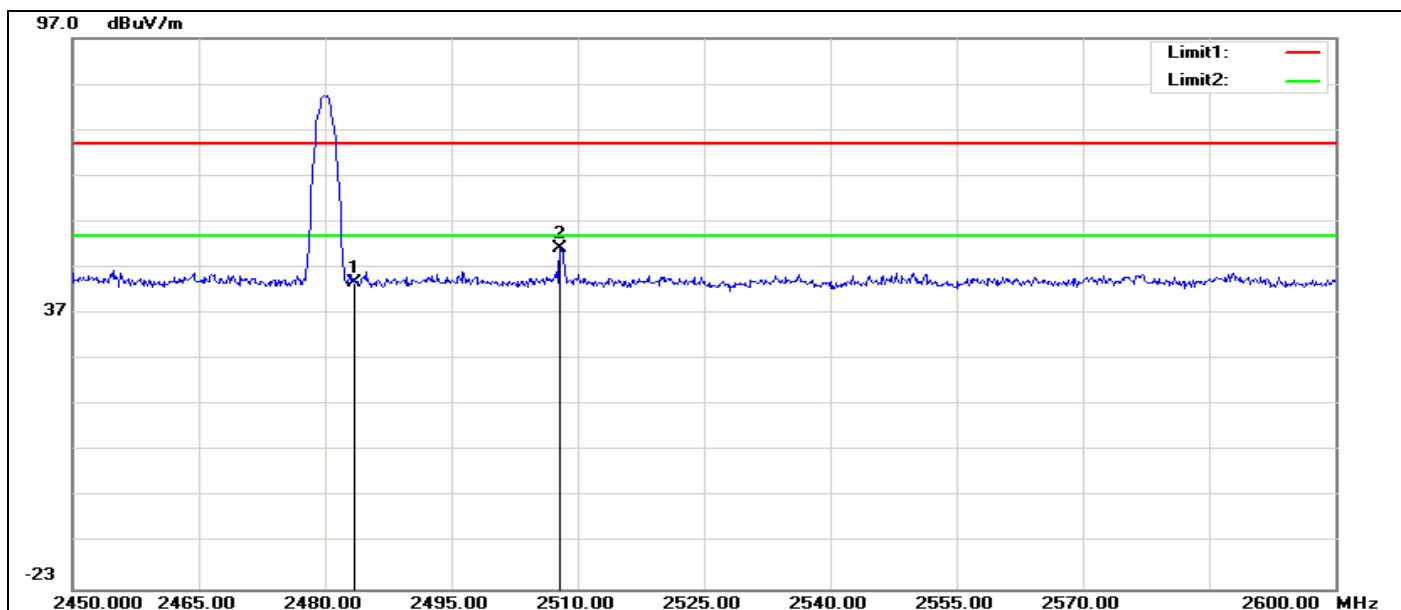


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2390.000	47.06	-3.78	43.28	74.00	-30.72	100	9	peak

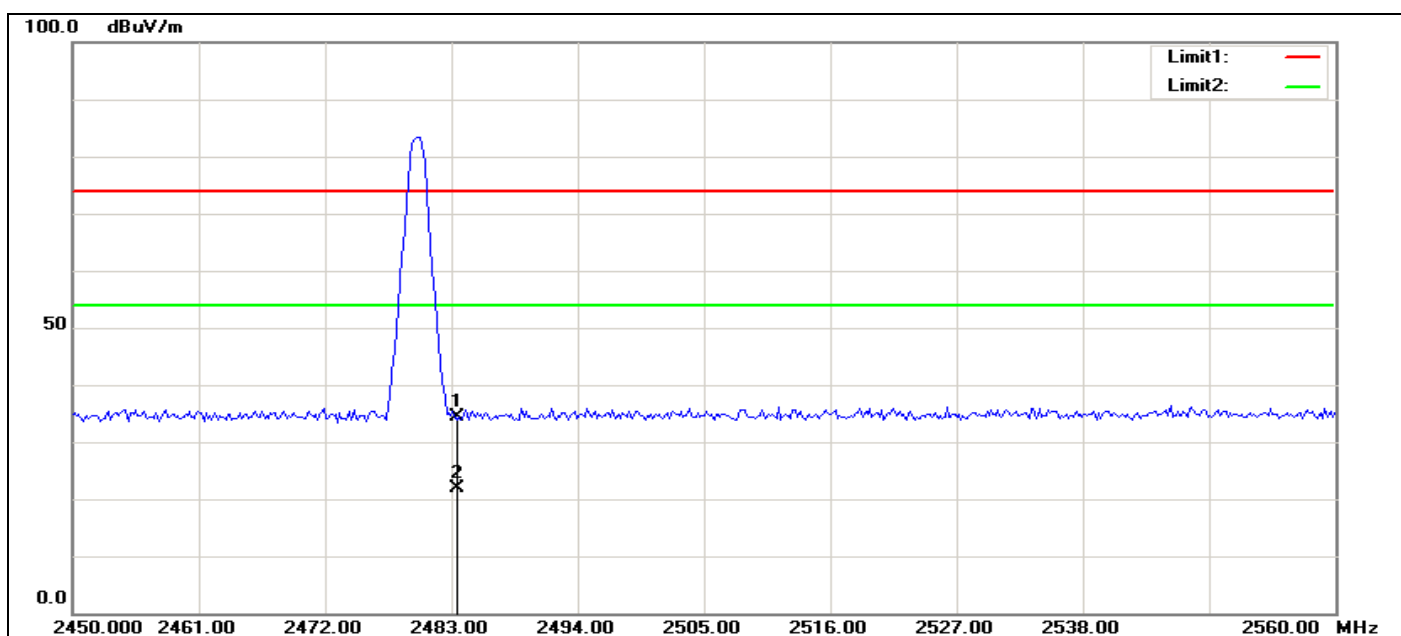
RESTRICTED BANDEDGE (1Mbps, Low Channel, Vertical)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2356.880	53.95	-3.86	50.09	74.00	-23.91	100	160	peak
2	2390.000	47.16	-3.78	43.38	74.00	-30.62	100	359	peak

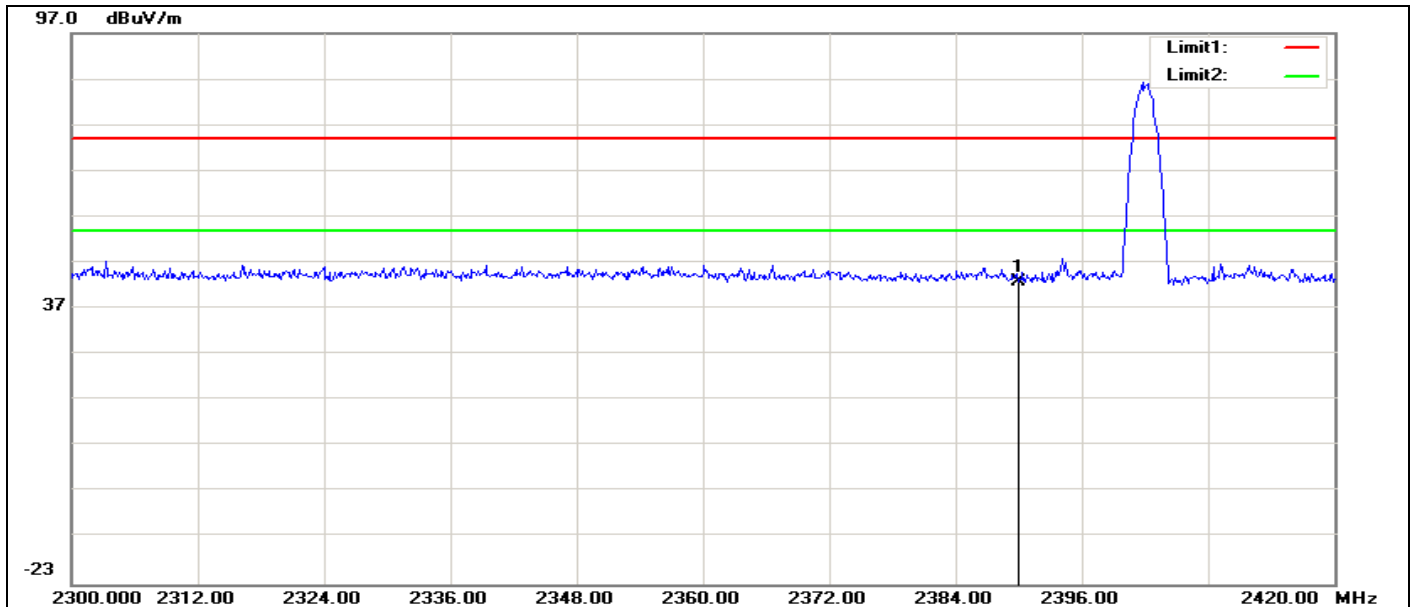
RESTRICTED BANDEDGE (1Mbps Mode, High Channel, Horizontal)

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2483.500	47.29	-3.56	43.73	74.00	-30.27	100	269	peak
2	2507.900	54.87	-3.50	51.37	74.00	-22.63	100	174	peak

RESTRICTED BANDEDGE (1Mbps, High Channel, Vertical)

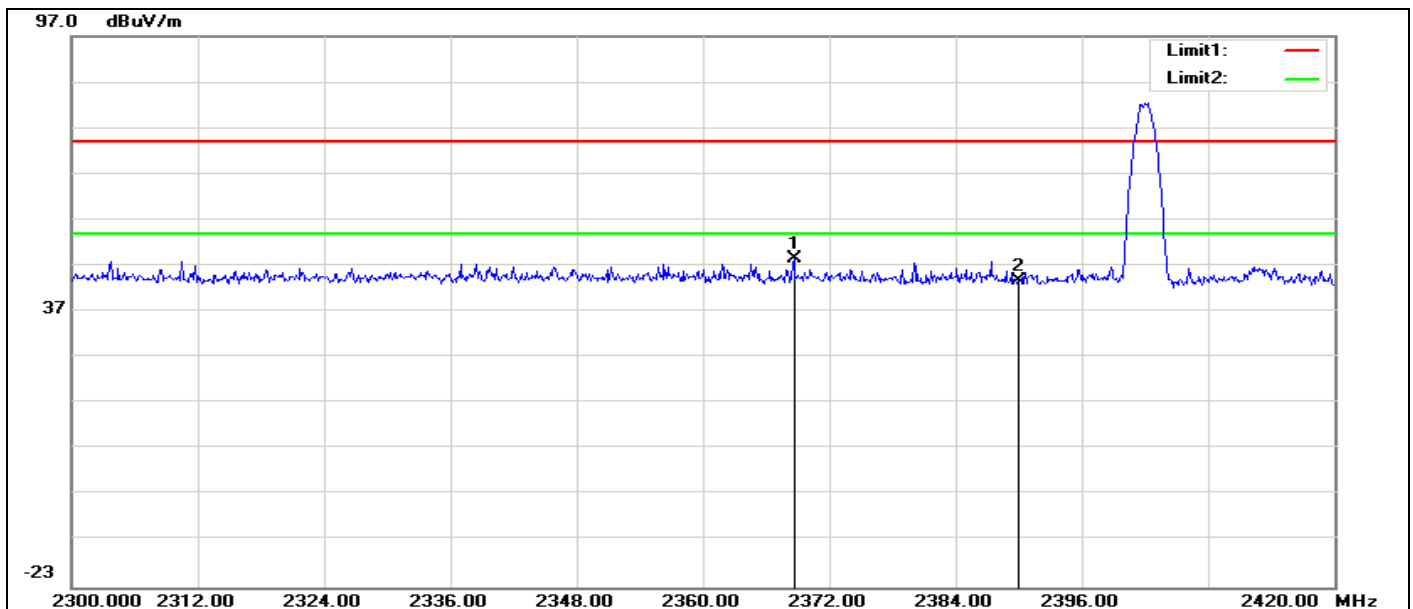
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2483.500	46.58	-12.27	34.31	74.00	-39.69	100	360	peak
2	2483.500	34.24	-12.27	21.97	54.00	-32.03	100	360	AVG

RESTRICTED BANDEDGE (3Mbps, Low Channel, Horizontal)

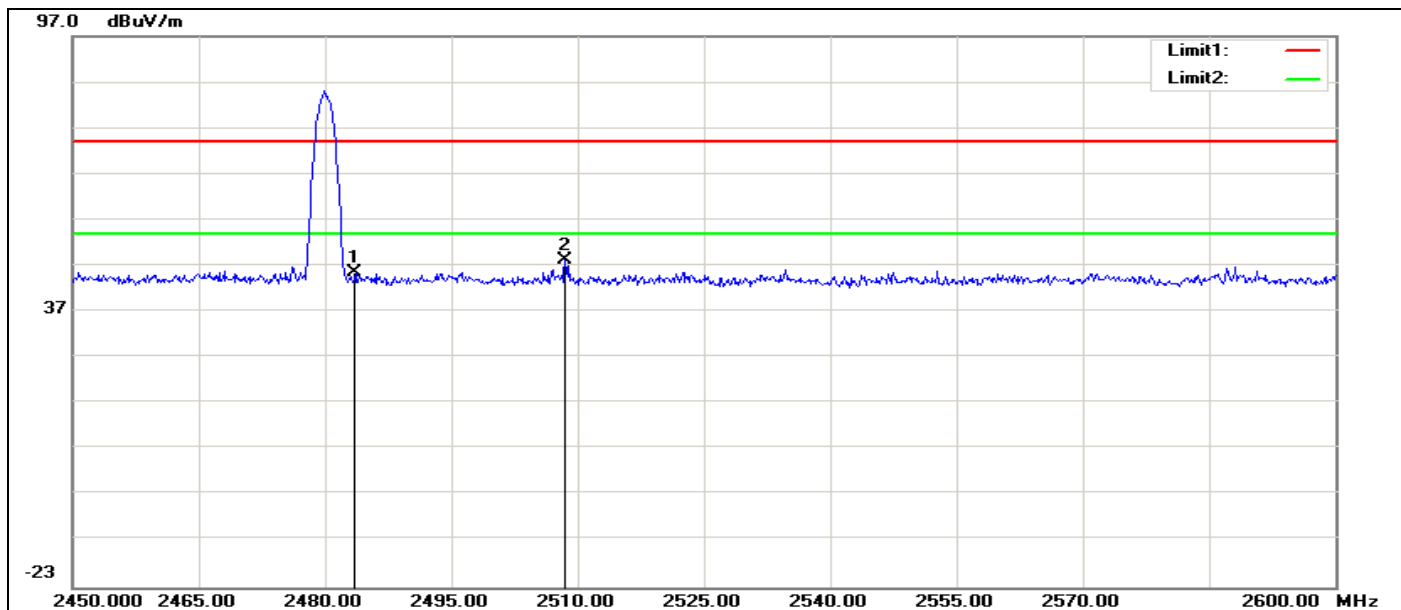


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2390.000	46.60	-3.78	42.82	74.00	-31.18	100	95	peak

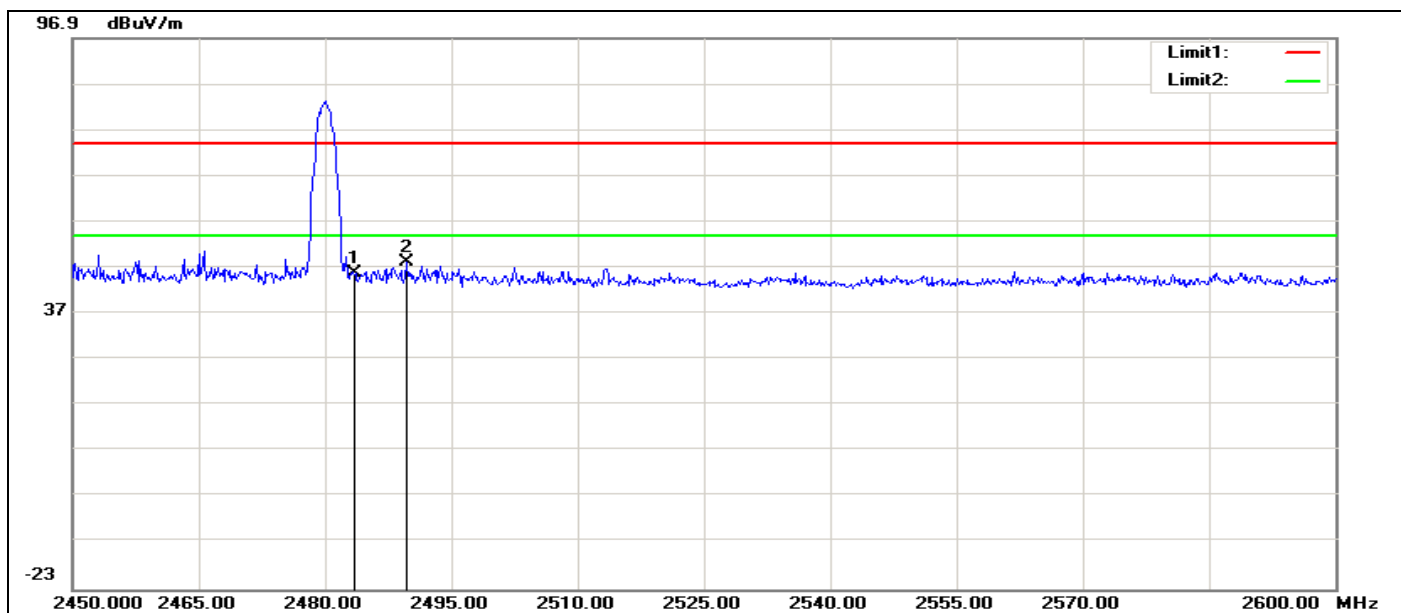
RESTRICTED BANDEDGE (3Mbps, Low Channel, Vertical)



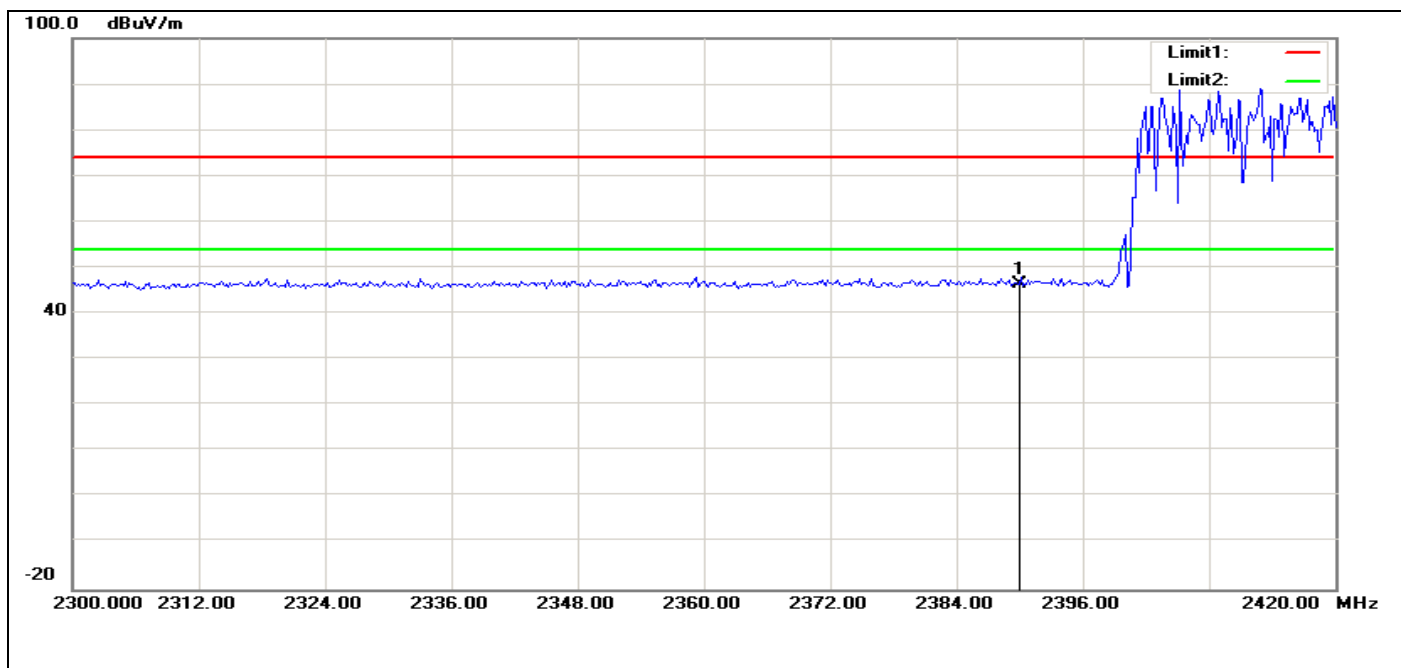
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2368.640	52.52	-3.84	48.68	74.00	-25.32	100	223	peak
2	2390.000	47.60	-3.78	43.82	74.00	-30.18	100	52	peak

RESTRICTED BANDEDGE (3Mbps, High Channel, Horizontal)

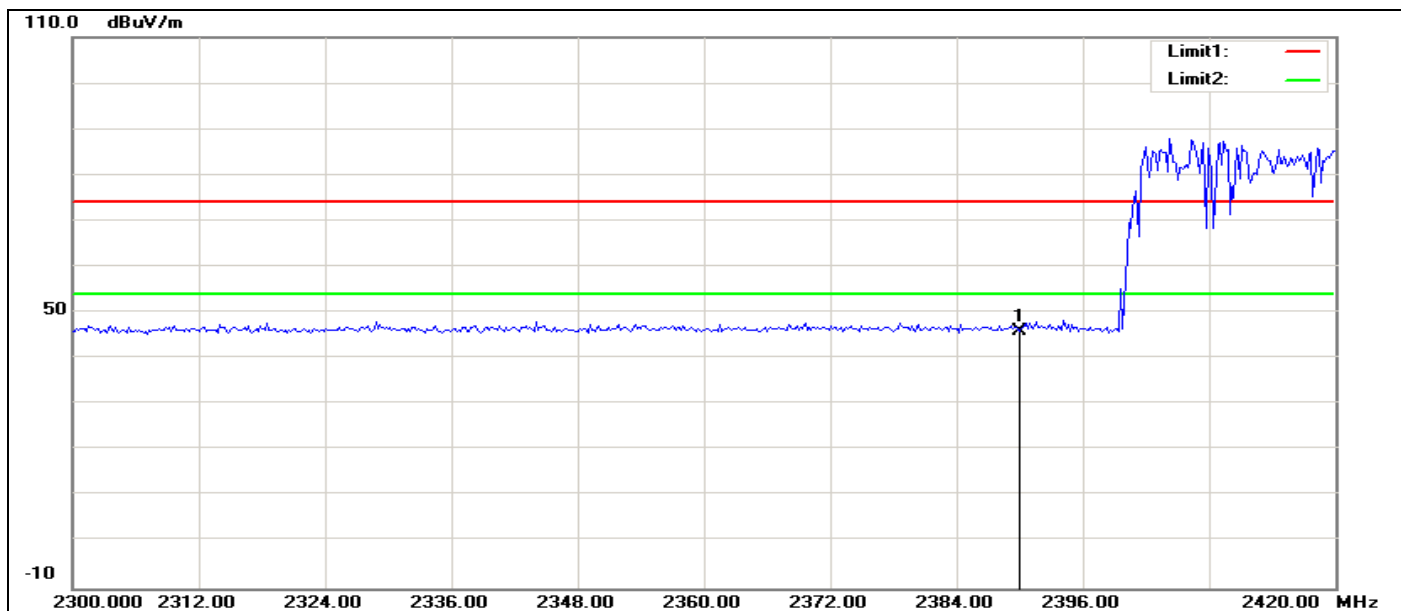
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2483.500	48.98	-3.56	45.42	74.00	-28.58	100	237	peak
2	2508.500	51.73	-3.50	48.23	74.00	-25.77	100	171	peak

RESTRICTED BANDEDGE (3Mbps, High Channel, Vertical)

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2483.500	49.41	-3.56	45.85	74.00	-28.15	100	243	peak
2	2489.600	51.66	-3.54	48.12	74.00	-25.88	100	234	peak

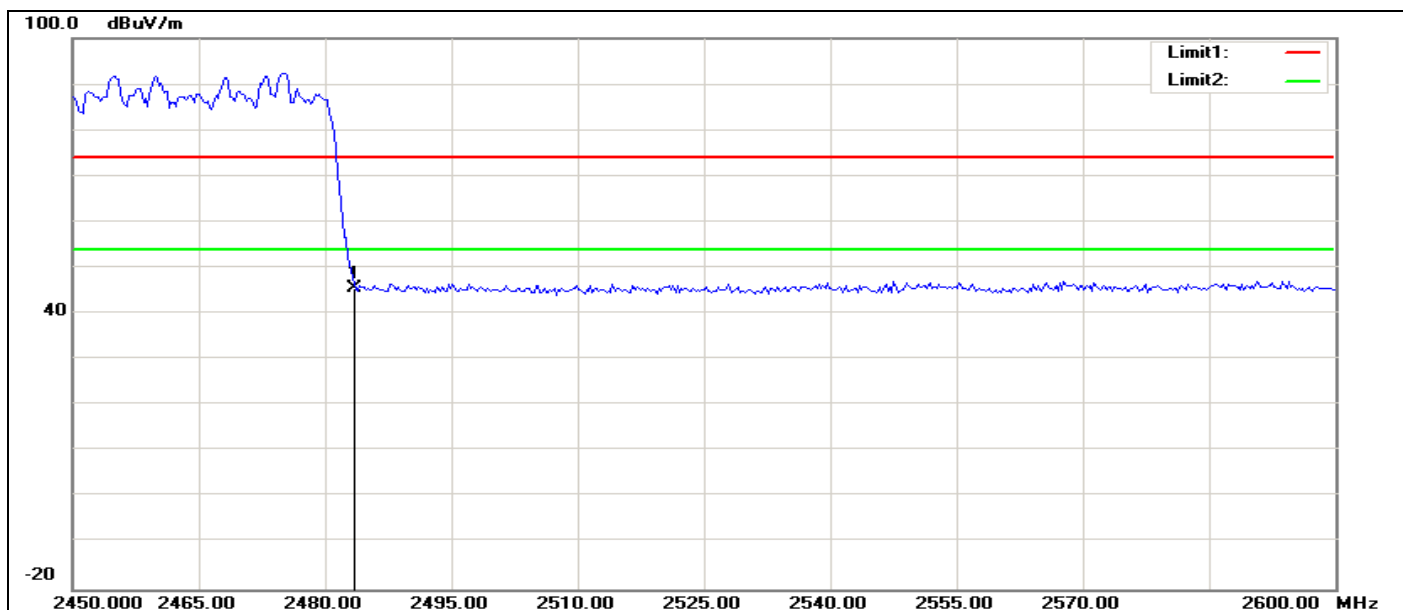
RESTRICTED BANDEDGE (1Mbps, Low Channel, Horizontal,hopping)

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2390.000	49.98	-3.53	46.45	74.00	-27.55	100	61	peak

RESTRICTED BANDEDGE (1Mbps, Low Channel, Vertical,hopping)

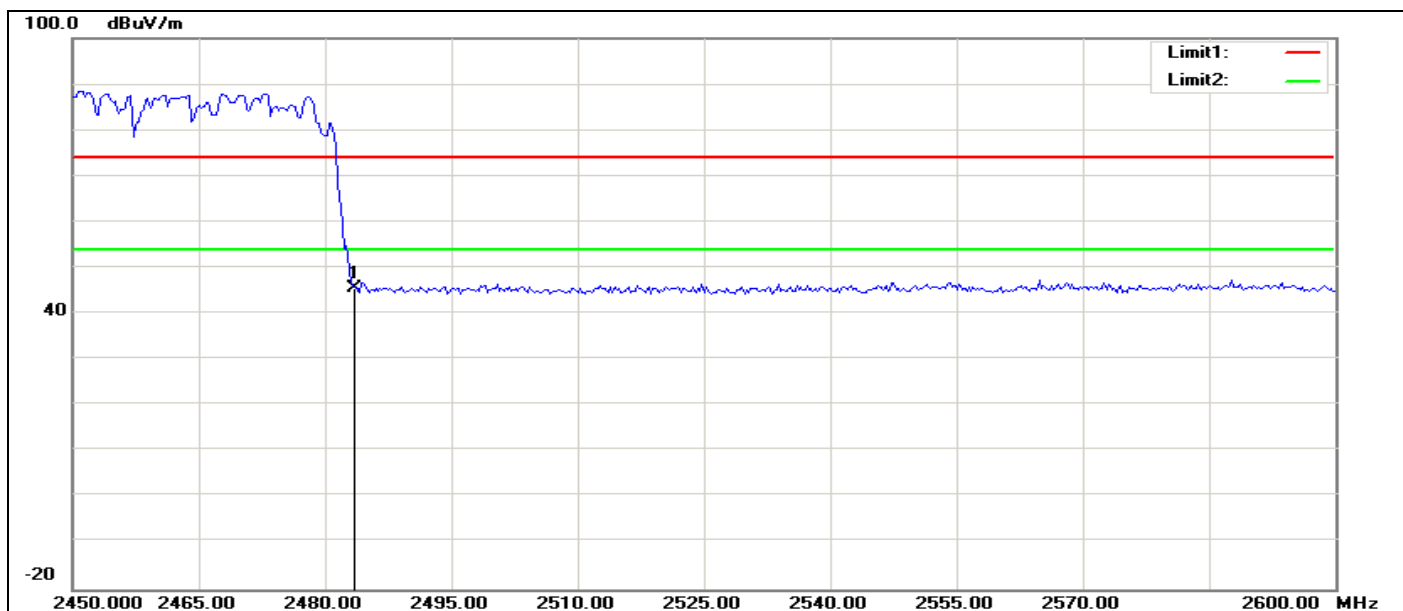
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2390.000	49.34	-3.53	45.81	74.00	-28.19	100	83	peak

RESTRICTED BANDEDGE (1Mbps Mode, High Channel, Horizontal,hopping)

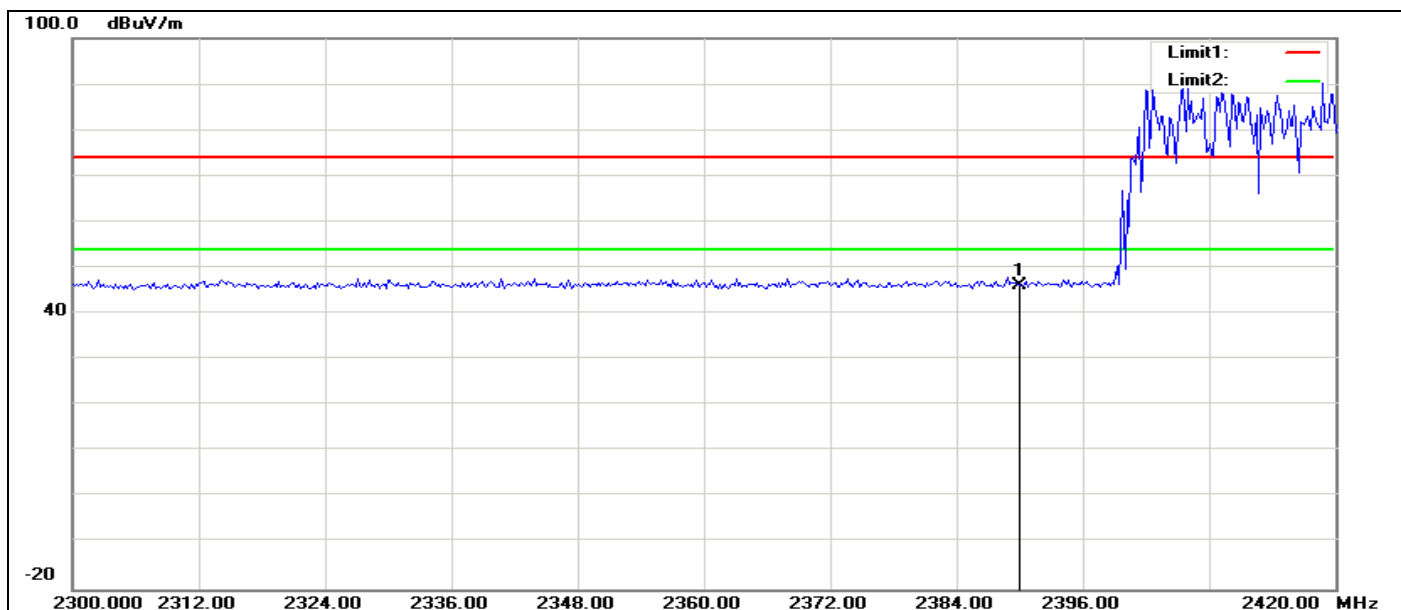


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2483.500	48.59	-3.17	45.42	74.00	-28.58	100	155	peak

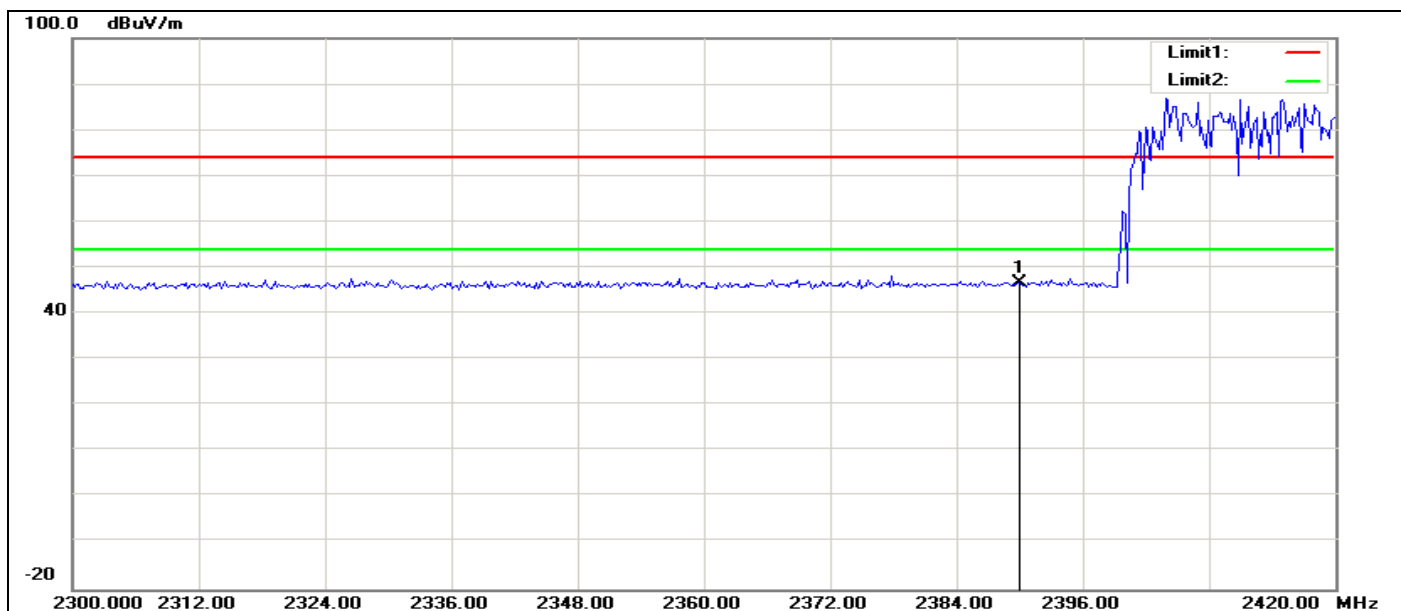
RESTRICTED BANDEDGE (1Mbps, High Channel, Vertical,hopping)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2483.500	48.67	-3.17	45.50	74.00	-28.50	100	304	peak

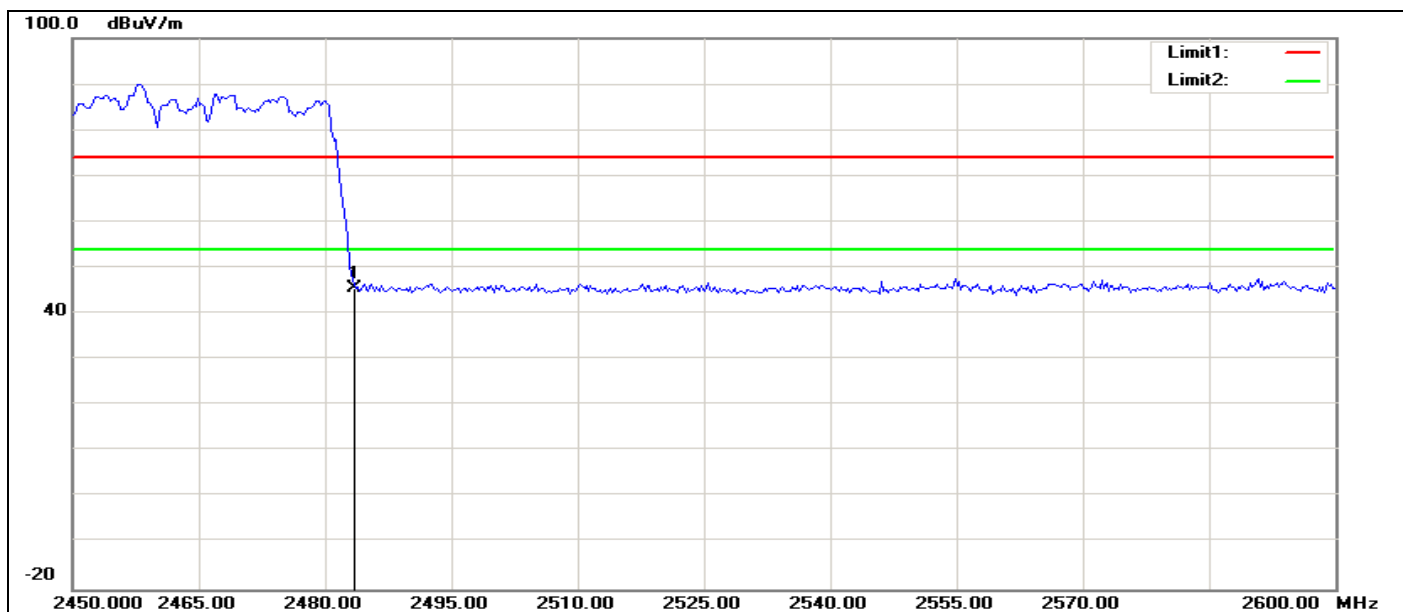
RESTRICTED BANDEDGE (3Mbps, Low Channel, Horizontal,hopping)

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2390.000	49.70	-3.53	46.17	74.00	-27.83	100	180	peak

RESTRICTED BANDEDGE (3Mbps, Low Channel, Vertical,hopping)

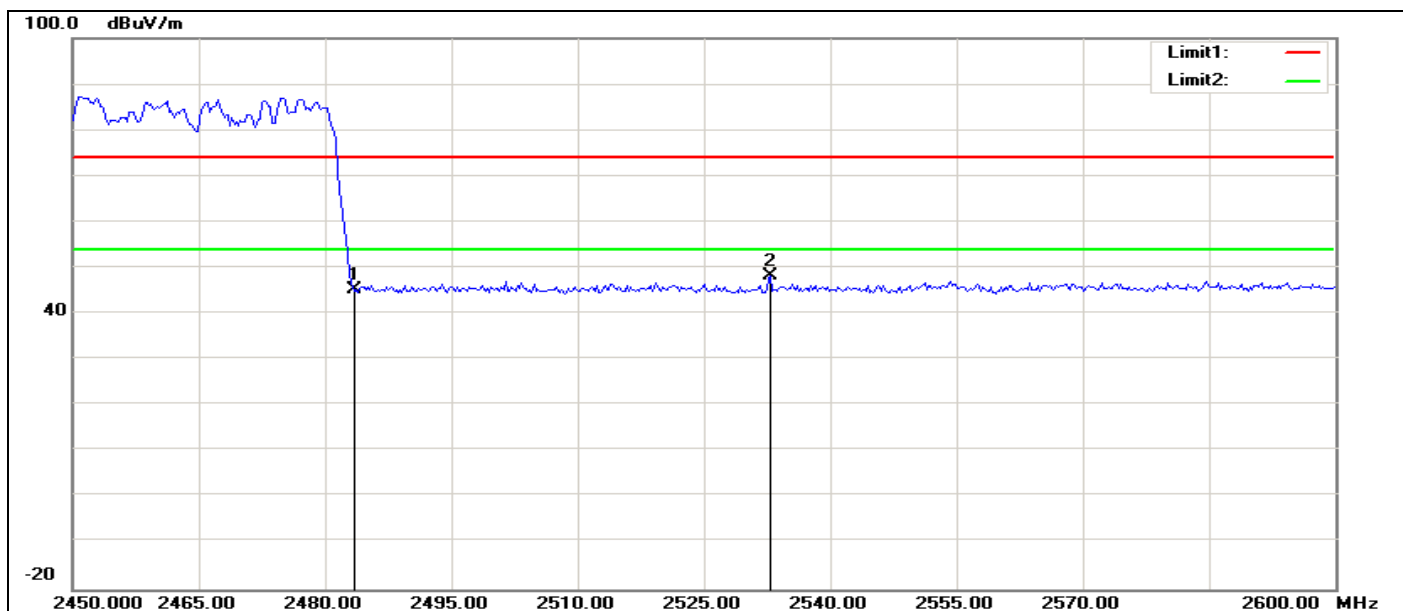
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2390.000	50.27	-3.53	46.74	74.00	-27.26	100	226	peak

RESTRICTED BANDEDGE (3Mbps, High Channel, Horizontal,hopping)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2483.500	48.60	-3.17	45.43	74.00	-28.57	100	241	peak

RESTRICTED BANDEDGE (3Mbps, High Channel, Vertical)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2483.500	48.53	-3.17	45.36	74.00	-28.64	100	291	peak
2	2532.933	51.16	-3.03	48.13	74.00	-25.87	100	108	peak

TEST RESULT OF RADIATED EMISSION**30MHz-1GHz****Operation Mode:** 1 Mbps**Test Date:** August 27, 2015**Test Channel:** CH78**Tested by:** James.Yan**Temperature:** 25°C**Polarity:** Ver. / Hor.

Frequency (MHz)	Ant. Pol. (H/V)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
46.4900	V	22.87	14.95	37.82	40.00	-2.18	Peak
59.1000	V	23.43	12.82	36.25	40.00	-3.75	Peak
212.3600	V	27.61	12.23	39.84	43.50	-3.66	Peak
227.8800	V	29.05	12.78	41.83	46.00	-4.17	Peak
397.6300	V	22.95	19.69	42.64	46.00	-3.36	Peak
569.3200	V	18.53	20.72	39.25	46.00	-6.75	Peak
87.2300	H	27.57	11.37	38.94	40.00	-1.06	Peak
151.2500	H	23.68	13.61	37.29	43.50	-6.21	Peak
397.6300	H	23.32	19.69	43.01	46.00	-2.99	Peak
570.2900	H	18.13	20.72	38.85	46.00	-7.15	Peak
690.5700	H	14.51	23.87	38.38	46.00	-7.62	Peak
798.2400	H	15.49	24.50	39.99	46.00	-6.01	Peak

Notes:

1. Measurements above show only up to maximum emissions noted, 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.
2. Radiated emissions measured in frequency range from 9 KHz to 1000MHz were made with an instrument using Peak detector mode.
3. 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.
4. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.



Compliance Certification Services Inc.

Date of Issue :October 12, 2015

Report No: C150807R01-RPB

FCC ID:IPH-01545

Above 1 GHz

Operation Mode: 1 Mbps

Test Date: August 27, 2015

Test Channel: CH00

Tested by: James.Yan

Temperature: 25°C

Polarity: Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	4789.000	45.09	3.62	48.71	74.00	-25.29	100	35	peak
2	7201.000	43.71	9.19	52.90	74.00	-21.10	100	78	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	4744.000	45.11	3.44	48.55	74.00	-25.45	100	333	peak
2	7219.000	43.45	9.23	52.68	74.00	-21.32	100	145	peak
N/A									

Operation Mode: 1 Mbps

Test Date: August 27, 2015

Test Channel: CH39

Tested by: James.Yan

Temperature: 25°C

Polarity: Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	4816.000	44.86	3.73	48.59	74.00	-25.41	100	137	peak
2	7966.000	42.31	10.17	52.48	74.00	-21.52	100	71	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5014.000	44.37	4.51	48.88	74.00	-25.12	100	344	peak
2	7804.000	42.86	10.09	52.95	74.00	-21.05	100	0	peak
N/A									



Compliance Certification Services Inc.

Date of Issue :October 12, 2015

Report No: C150807R01-RPB

FCC ID:IPH-01545

Operation Mode: 1 Mbps

Test Date: August 27, 2015

Test Channel: CH78

Tested by: James.Yan

Temperature: 25°C

Polarity: Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	4825.000	44.96	3.76	48.72	74.00	-25.28	100	200	peak
2	7174.000	43.42	9.12	52.54	74.00	-21.46	100	268	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	4825.000	44.27	3.87	48.14	74.00	-25.86	100	276	peak
2	7192.000	43.80	9.17	52.97	74.00	-21.03	100	359	peak
N/A									

Operation Mode: 3 Mbps

Test Date: August 27, 2015

Test Channel: CH00

Tested by: James.Yan

Temperature: 25°C

Polarity: Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	4987.000	42.58	4.42	47.00	74.00	-27.00	100	362	peak
2	7966.000	41.64	10.17	51.81	74.00	-22.19	100	350	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	4987.000	43.75	4.42	48.17	74.00	-25.83	100	345	peak
2	7858.000	41.44	10.12	51.56	74.00	-22.44	100	360	peak
N/A									



Compliance Certification Services Inc.

Date of Issue :October 12, 2015

Report No: C150807R01-RPB

FCC ID:IPH-01545

Operation Mode: 3 Mbps

Test Date: August 27, 2015

Test Channel: CH39

Tested by: James.Yan

Temperature: 25°C

Polarity: Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	4825.000	42.62	3.76	46.38	74.00	-27.62	100	337	peak
2	6976.000	42.91	8.64	51.55	74.00	-22.45	100	362	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	4987.000	43.75	4.42	48.17	74.00	-25.83	100	345	peak
2	7858.000	41.44	10.12	51.56	74.00	-22.44	100	360	peak
N/A									

Operation Mode: 3 Mbps

Test Date: August 27, 2015

Test Channel: CH78

Tested by: James.Yan

Temperature: 25°C

Polarity: Ver. / Hor.

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	4924.000	44.97	4.16	49.13	74.00	-24.87	100	34	peak
2	7201.000	43.11	9.19	52.30	74.00	-21.70	100	0	peak
N/A									

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	4843.000	43.90	3.84	47.74	74.00	-26.26	100	5	peak
2	7165.000	42.70	9.10	51.80	74.00	-22.20	100	31	peak
N/A									

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.*
3. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.*
4. *Spectrum setting:*
 - a. *Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 1MHz, Sweep time = Auto.*
 - b. *AV Setting 1GHz to 10th harmonics of fundamental, RBW = 1MHz, VBW = 10Hz, Sweep time = Auto.*

6.9 POWERLINE CONDUCTED EMISSIONS

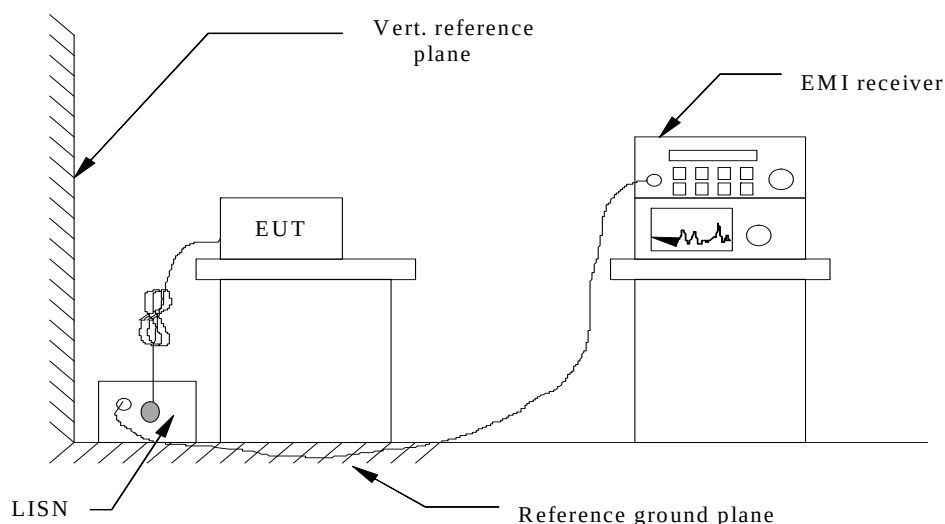
LIMIT

For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

Test Configuration



See test photographs attached in Appendix 1 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.

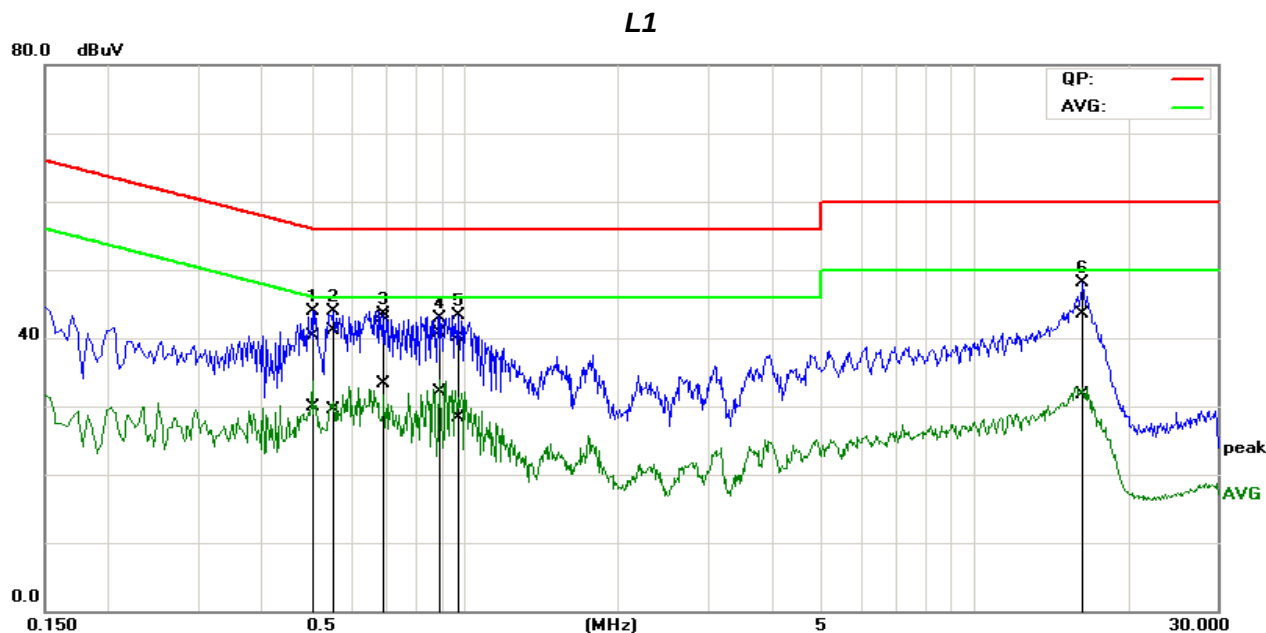
TEST RESULTS

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

Job No.: C150807R01-RPW
 Model: A1545
 Standard: FCC Class B
 Test item: Conduction test
 Line: L1
 Model:

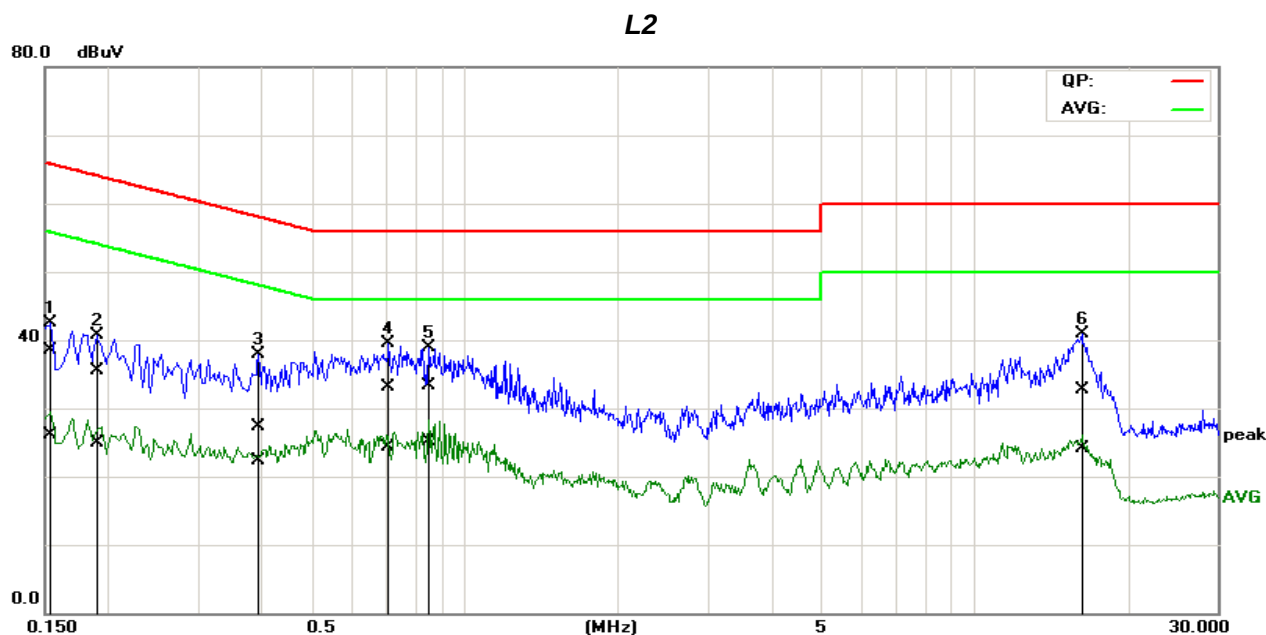
Date: 2015-8-18
 Time: 9:32:29
 Temp.(C)/Hum.(%): 22(C)/48%
 Test By: James.Yan
 Test Voltage: AC 120V/60Hz
 Description:



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1	0.5012	20.50	10.05	19.83	40.33	29.88	56.00	46.00	-15.67	-16.12	Pass
2	0.5486	21.22	9.77	19.83	41.05	29.60	56.00	46.00	-14.95	-16.40	Pass
3*	0.6928	23.15	13.55	19.83	42.98	33.38	56.00	46.00	-13.02	-12.62	Pass
4	0.8947	20.92	12.21	19.84	40.76	32.05	56.00	46.00	-15.24	-13.95	Pass
5	0.9654	20.26	8.52	19.84	40.10	28.36	56.00	46.00	-15.90	-17.64	Pass
6	16.4239	22.60	10.87	20.92	43.52	31.79	60.00	50.00	-16.48	-18.21	Pass

Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

Job No.:	C150807R01-RPW	Date:	2015-8-18
Model:	A1545	Time:	9:36:59
Standard:	FCC Class B	Temp.(C)/Hum.(%):	22(C)/48%
Test item:	Conduction test	Test By:	James.Yan
Line:	L2	Test Voltage:	AC 120V/60Hz
Model:		Description:	



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1	0.1524	18.84	6.33	19.73	38.57	26.06	65.87	55.87	-27.30	-29.81	Pass
2	0.1865	15.92	5.17	19.66	35.58	24.83	64.19	54.19	-28.61	-29.36	Pass
3	0.3946	7.62	2.57	19.78	27.40	22.35	57.97	47.97	-30.57	-25.62	Pass
4	0.7028	13.23	4.39	19.84	33.07	24.23	56.00	46.00	-22.93	-21.77	Pass
5*	0.8354	13.57	5.19	19.83	33.40	25.02	56.00	46.00	-22.60	-20.98	Pass
6	16.2493	11.94	3.28	20.78	32.72	24.06	60.00	50.00	-27.28	-25.94	Pass

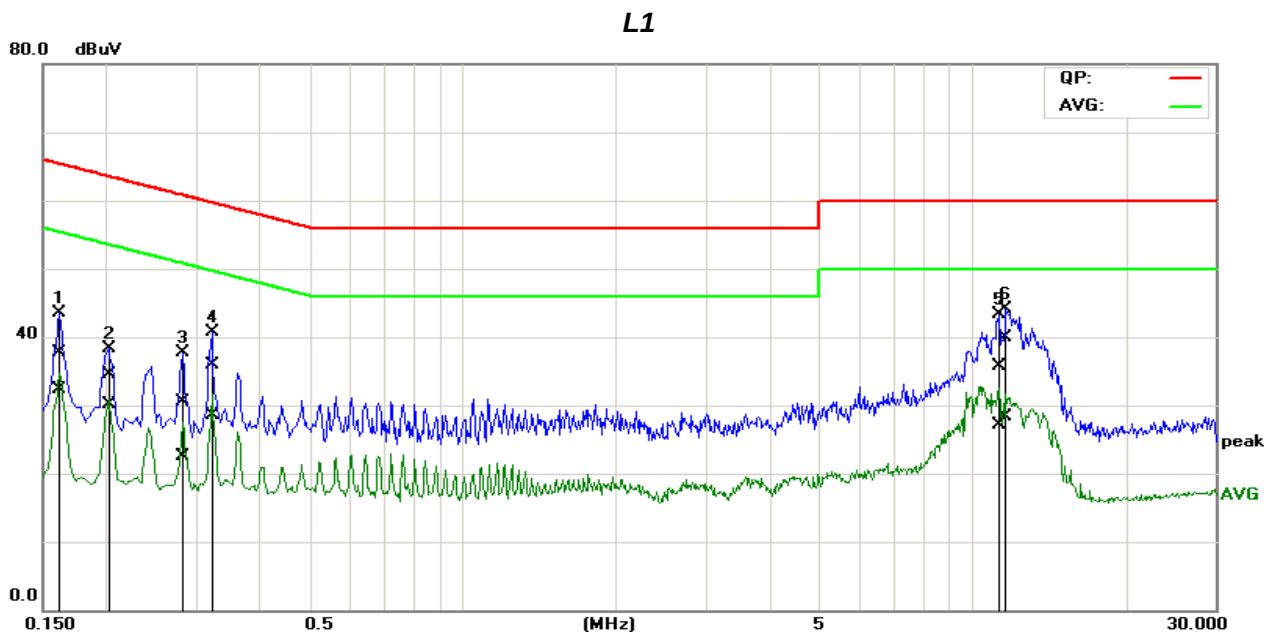
Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

Remark:

- 1.The measuring frequencies range between 0.15 MHz and 30 MHz.
- 2.The emissions measured in the frequency range between 0.15 MHz and 30MHz were made with an instrument using Quasi-peak detector and Average detector.
- 3.“—” denotes the emission level was or more than 2dB below the Average limit, and no re-check was made.
- 4.The IF bandwidth of SPA between 0.15MHz and 30MHz was 10KHz. The IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz.

Job No.: C150807R01-RPW
 Model: A1545
 Standard: FCC Class B
 Test item: Conduction test
 Line: L1
 Model:

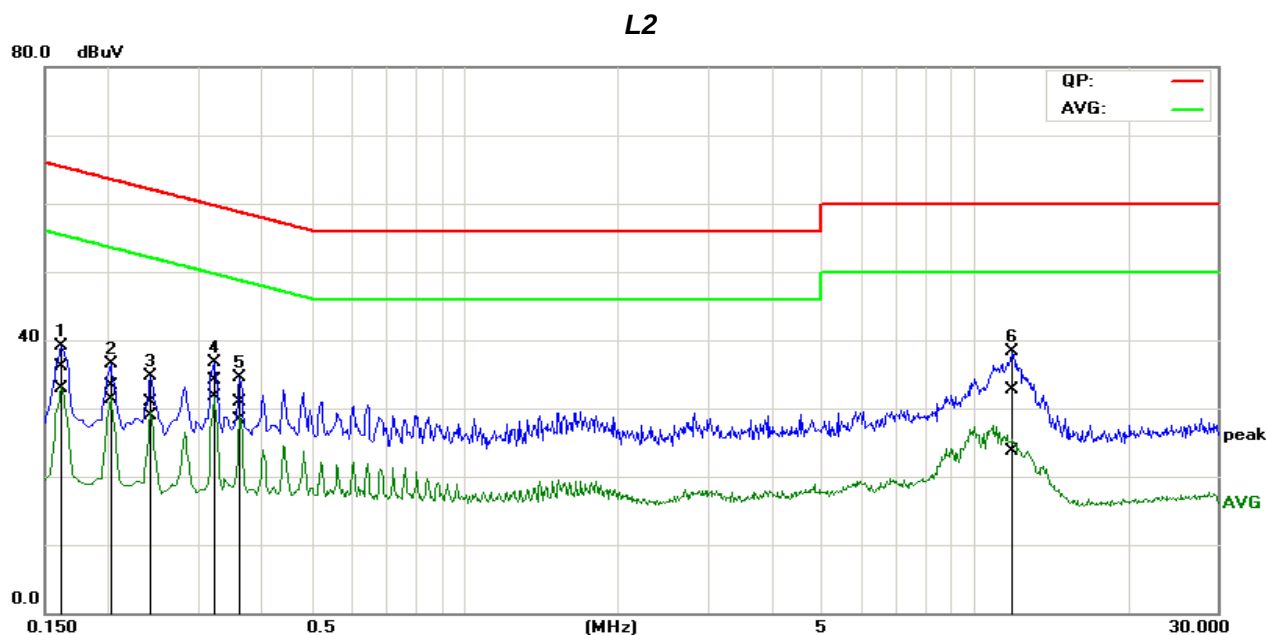
Date: 2015-10-12
 Time: 10:09:16
 Temp.(C)/Hum.(%): 22(C)/48%
 Test By: James.Yan
 Test Voltage: AC 240V/60Hz
 Description:



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1	0.1603	17.89	12.57	19.77	37.66	32.34	65.45	55.45	-27.79	-23.11	Pass
2	0.2006	14.84	10.55	19.60	34.44	30.15	63.59	53.59	-29.15	-23.44	Pass
3	0.2822	10.81	2.89	19.66	30.47	22.55	60.75	50.75	-30.28	-28.20	Pass
4	0.3206	16.17	8.73	19.69	35.86	28.42	59.69	49.69	-23.83	-21.27	Pass
5	11.3598	14.99	6.31	20.79	35.78	27.10	60.00	50.00	-24.22	-22.90	Pass
6*	11.6888	19.16	7.45	20.79	39.95	28.24	60.00	50.00	-20.05	-21.76	Pass

Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

Job No.:	C150807R01-RPW	Date:	2015-10-12
Model:	A1545	Time:	10:14:37
Standard:	FCC Class B	Temp.(C)/Hum.(%):	22(C)/48%
Test item:	Conduction test	Test By:	James.Yan
Line:	L2	Test Voltage:	AC 240V/60Hz
Model:		Description:	



No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1	0.1615	16.43	13.27	19.71	36.14	32.98	65.39	55.39	-29.25	-22.41	Pass
2	0.2008	13.57	11.75	19.64	33.21	31.39	63.58	53.58	-30.37	-22.19	Pass
3	0.2413	11.14	9.28	19.67	30.81	28.95	62.05	52.05	-31.24	-23.10	Pass
4*	0.3211	14.42	11.93	19.72	34.14	31.65	59.68	49.68	-25.54	-18.03	Pass
5	0.3616	11.11	8.61	19.75	30.86	28.36	58.69	48.69	-27.83	-20.33	Pass
6	11.8367	11.85	3.02	20.76	32.61	23.78	60.00	50.00	-27.39	-26.22	Pass

Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

Remark:

- 1.The measuring frequencies range between 0.15 MHz and 30 MHz.
- 2.The emissions measured in the frequency range between 0.15 MHz and 30MHz were made with an instrument using Quasi-peak detector and Average detector.
- 3.“—” denotes the emission level was or more than 2dB below the Average limit, and no re-check was made.
- 4.The IF bandwidth of SPA between 0.15MHz and 30MHz was 10KHz. The IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz.

END OF REPORT