

FCC Radio 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-RPW**

Issued for

Garmin International Inc

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

Issued by

Compliance Certification Services Inc.

Kun shan Laboratory

**No.10 Weiye Rd., Innovation park, Eco&Tec,
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TESTING CERT #2541.01

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	October 12, 2015	C150807R01-RPW	ALL	N/A

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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

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 C63.10: 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:

Jeff.Fang
RF Manager
Compliance Certification Service Inc.

Tested by:

James.Yan
Test Engineer
Compliance Certification Service 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 :	DC 5.0V
Frequency Range:	IEEE 802.11b/g: 2412MHz to 2462 MHz IEEE 802.11n HT20: 2412MHz to 2462 MHz Bluetooth:2402 ~ 2480 MHz
Transmit Power:	IEEE 802.11b mode: 16.30 dBm IEEE 802.11g mode: 16.26 dBm IEEE 802.11n HT20 mode: 14.57 dBm Bluetooth:3.73dBm
Modulation Technique:	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) Bluetooth:GFSK(1 Mbps), $\pi/4$ -DQPSK(2 Mbps),8-DPSK(3 Mbps)
Number of Channels:	IEEE 802.11b/g/n HT20 mode: 11 Channels Bluetooth:79 Channels
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 2013 and FCC CFR 47 15.207, 15.209 and 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.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 C63.10:2013 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 C63.10:2013.

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 C63.10:2013.

3.4.FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

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 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

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

² Above 38.6

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.DESRIPTION OF TEST MODES

The EUT transmitting and receiving with one antenna simultaneously working at b/g/n mode, so 1x1 configuration was used for all testing in this report.

The worst-case data rates are determined to be as follows for each mode based on investigation by measuring the average power, peak power and PSD across all data rates, bandwidths, and modulations.

The worst-case data rates:

IEEE802.11b mode:

Channel Low (2412MHz)

Channel Mid (2437MHz)

Channel High (2462MHz) with 1Mbps data rate was chosen for full testing.

IEEE802.11g mode:

Channel Low (2412MHz)

Channel Mid (2437MHz)

Channel High (2462MHz) with 6Mbps data rate was chosen for full testing.

IEEE 802.11 HT20 Channel mode:

Channel Low (2412MHz)

Channel Mid (2437MHz)

Channel High (2462MHz) with MCS0 data rate was chosen for full testing.

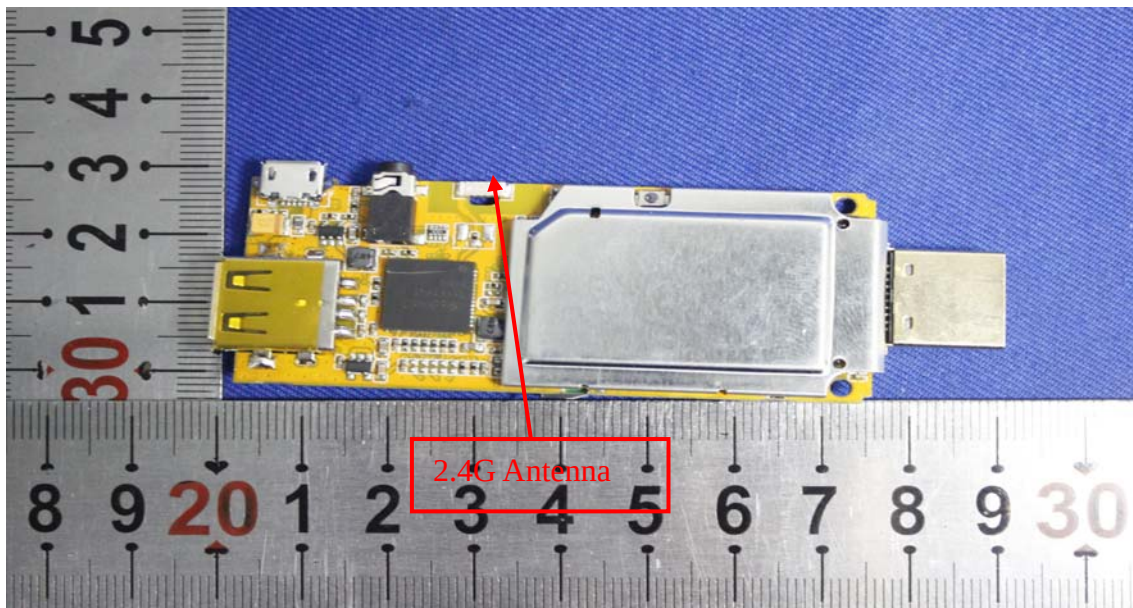
3.6.ANTENNA DESCRIPTION

According to FCC 47 CFR 15.203

“an intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached or an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section”

* the antenna of this EUT is a unique(chip Antenna).

* the EUT complies with the requirement of 15.203.



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.

Equipment Used for Emissions Measurement

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)	SCHWARZBEC K	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: The measurement uncertainty is less than $\pm 2.81\text{dB}$, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.

Expanded Uncertainty (95% CONFIDENCE INTERVAL): $K=2$

5. FACILITIES AND ACCREDITATIONS

5.1.FACILITIES

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 C63.7, ANSI C63.10:2013 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 and CISPR 22 requirements. In addition, the test facilities are listed with Industry Canada, Certification and Engineering Bureau, IC5743 for 10m chamber 10m, IC5743 for 10m chamber 3m.

5.4.TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	A2LA	47 CFR FCC Part 15/18 (using ANSI C63.10 :2013); VCCI V3; CNS 13438; CNS 13439; CNS 13803; CISPR 11; EN 55011; CISPR 13; EN 55013; CISPR 22:2005; CISPR 22:1997 +A1 :2000+A2 :2002; EN 55022:2006; EN55022 :1998 +A1 :2001+A2 :2003; EN 61000-6-3 (excluding discontinuous interference); EN 61000-6-4; AS/NZS CISPR 22; CAN/CSA-CEI/IEC CISPR 22; EN 61000-3-2; EN 61000-3-3; EN550024; EN 61000-4-2; EN 61000-4-3; EN61000-4-4; EN 61000-4-5; EN 61000-4-6; IEC 61000-4-8; EN 61000-4-11; IEC61000-3-2; IEC61000-3-3; IEC 61000-4-2; IEC 61000-4-3; IEC 61000-4-4; IEC 61000-4-5; IEC 61000-4-6; IEC 61000-4-8; IEC 61000-4-11; EN 300 220-3; EN 300 328; EN 300 330-2; EN 300 440-1; EN 300-440-2; EN 300 893; EN 301 489-01; EN 301 489-3; EN 301 489-07; EN 301 489-17; 47 CFR FCC Part 15, 22, 24	 TESTING CERT #2541.01
USA	FCC	3/10 meter Sites to perform FCC Part 15/18 measurements	 93105, 90471
Japan	VCCI	3/10 meter Sites and conducted test sites to perform radiated/conducted measurements	VCCI R-1600 C-1707 G-216

* 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 1 for the actual connections between EUT and support equipment.

6.2.SUPPORT EQUIPMENT

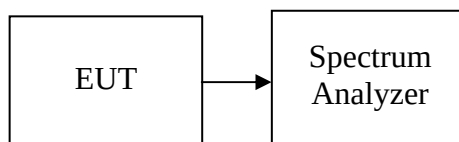
No.	Device Type	Brand	Model	Series No.	FCC DOC
1.	Monitor	L2221pwA	6M05424C4720256	N/A	N/A
2.	Mouse	M-UAE96	M-UAE96	N/A	N/A

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.

7. FCC PART 15.247 REQUIREMENTS**7.1. 6DB BANDWIDTH MEASUREMENT****LIMIT**

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

Test Configuration**TEST PROCEDURE**

1. The transmitter output is connected to the spectrum analyzer. Set RBW = 100 kHz. Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Sweep = auto couple.

TEST RESULTS

No non-compliance noted

Test Data**IEEE 802.11b mode**

Channel	Frequency (MHz)	Bandwidth(B) (MHz)	6dB Bandwidth Min. Limit(MHz)
Low	2412	7.042	0.5
Mid	2437	8.019	0.5
High	2462	8.057	0.5

IEEE 802.11g mode

Channel	Frequency (MHz)	Bandwidth(B) (MHz)	6dB Bandwidth Min. Limit(MHz)
Low	2412	15.170	0.5
Mid	2437	15.161	0.5
High	2462	13.607	0.5

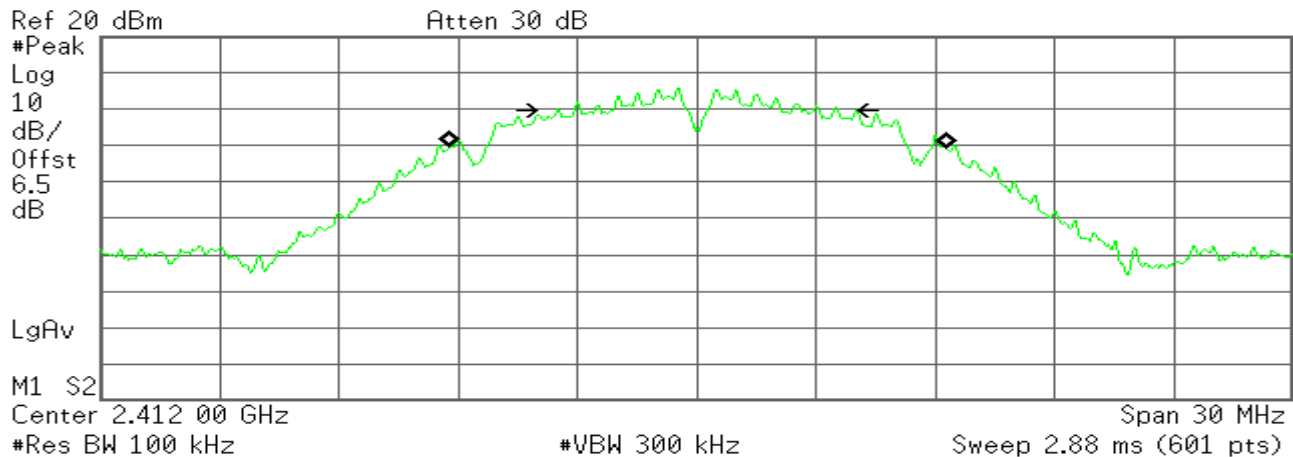
IEEE 802.11 HT20 Channel mode

Channel	Frequency (MHz)	Bandwidth(B) (MHz)	6dB Bandwidth Min. Limit(MHz)
Low	2412	16.944	0.5
Mid	2437	15.166	0.5
High	2462	15.151	0.5

Test Plot**IEEE 802.11b MODE****6dB Bandwidth (CH Low)**

* Agilent

R T



Occupied Bandwidth
12.5684 MHz

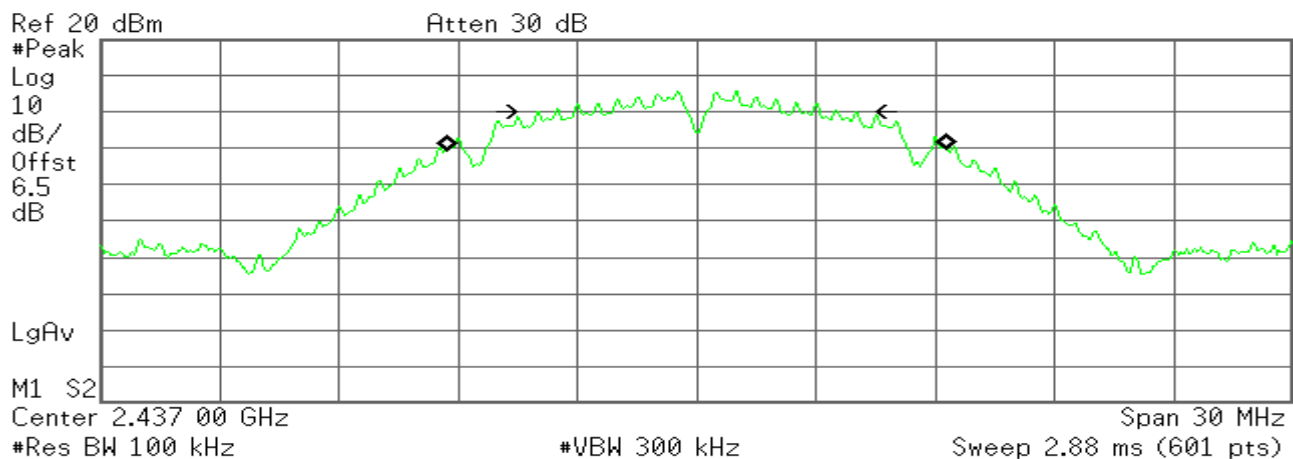
Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error 22.626 kHz
x dB Bandwidth 7.042 MHz

6dB Bandwidth (CH Mid)

* Agilent

R T



Occupied Bandwidth
12.6209 MHz

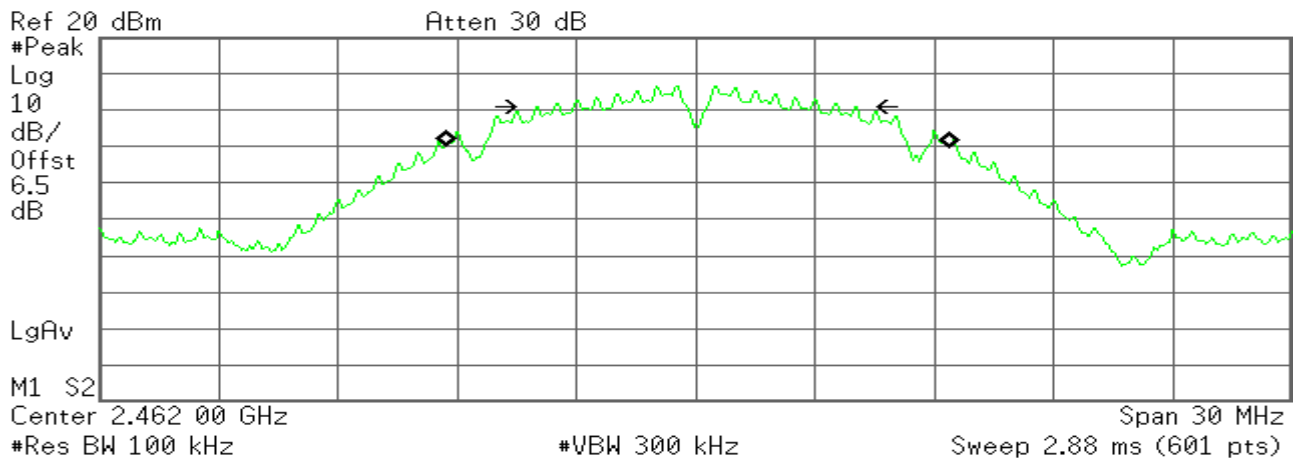
Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error 13.488 kHz
x dB Bandwidth 8.019 MHz

6dB Bandwidth (CH High)

Agilent

R T



Occupied Bandwidth
12.6906 MHz

Occ BW % Pwr 99.00 %
x dB -6.00 dB

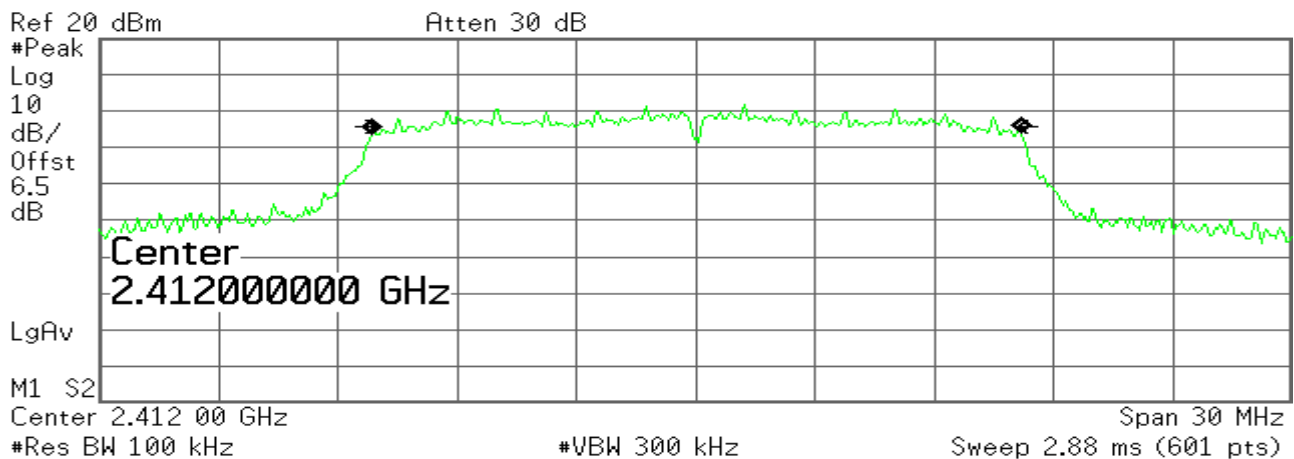
Transmit Freq Error 32.980 kHz
x dB Bandwidth 8.057 MHz

IEEE 802.11g MODE

6dB Bandwidth (CH Low)

Agilent

R T



Occupied Bandwidth
16.3445 MHz

Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error 6.422 kHz
x dB Bandwidth 15.170 MHz

6dB Bandwidth (CH Mid)

Agilent

R T

Ref 20 dBm

Atten 30 dB

#Peak
Log
10
dB/
Offst
6.5
dB

LgAv

M1 S2

Center 2.437 00 GHz

#Res BW 100 kHz

#VBW 300 kHz

Span 30 MHz
Sweep 2.88 ms (601 pts)Occupied Bandwidth
16.3539 MHzOcc BW % Pwr 99.00 %
x dB -6.00 dBTransmit Freq Error 9.630 kHz
x dB Bandwidth 15.161 MHz

6dB Bandwidth (CH High)

Agilent

R T

Ref 20 dBm

Atten 30 dB

#Peak
Log
10
dB/
Offst
6.5
dB

LgAv

M1 S2

Center 2.462 00 GHz

#Res BW 100 kHz

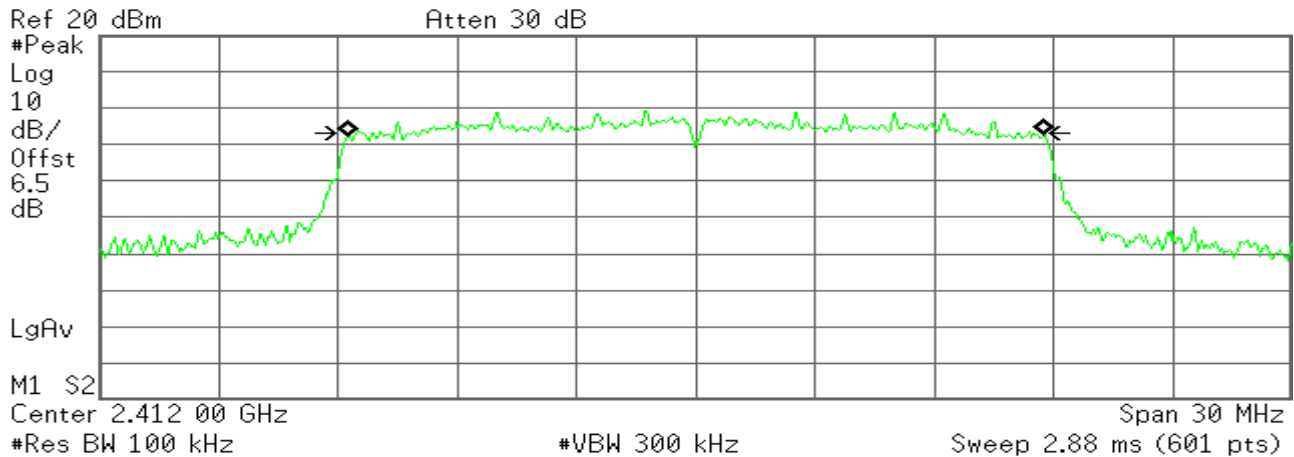
#VBW 300 kHz

Span 30 MHz
Sweep 2.88 ms (601 pts)Occupied Bandwidth
16.3621 MHzOcc BW % Pwr 99.00 %
x dB -6.00 dBTransmit Freq Error 13.698 kHz
x dB Bandwidth 13.607 MHz

802.11n HT20 MHz Channel mode

6dB Bandwidth (CH Low)

R T



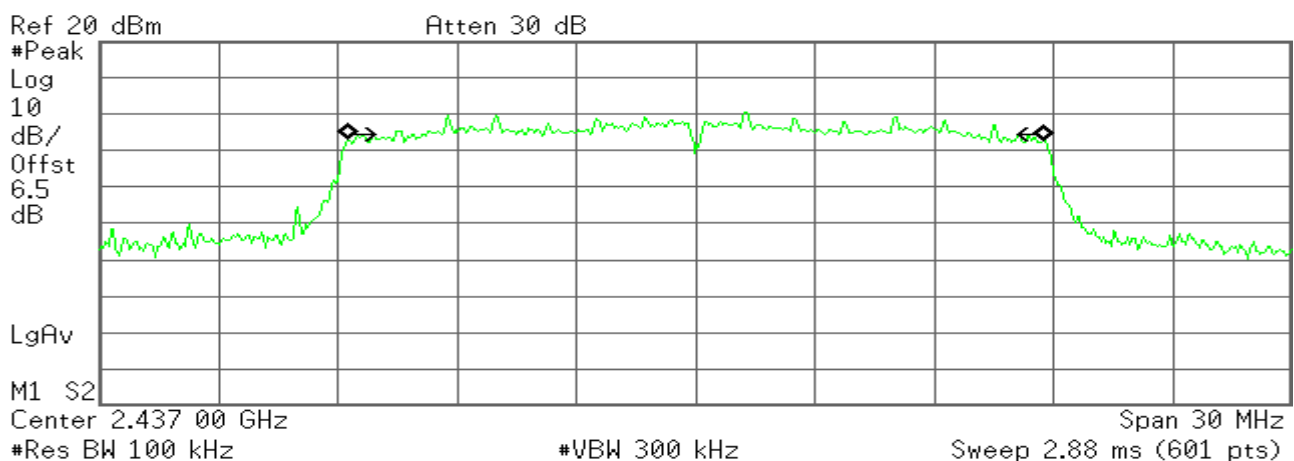
Occupied Bandwidth
17.4823 MHz

Occ BW % Pwr	99.00 %
x dB	-6.00 dB

Transmit Freq Error	12.110 kHz
x dB Bandwidth	16.944 MHz

6dB Bandwidth (CH Mid)

R T



Occupied Bandwidth
17.4700 MHz

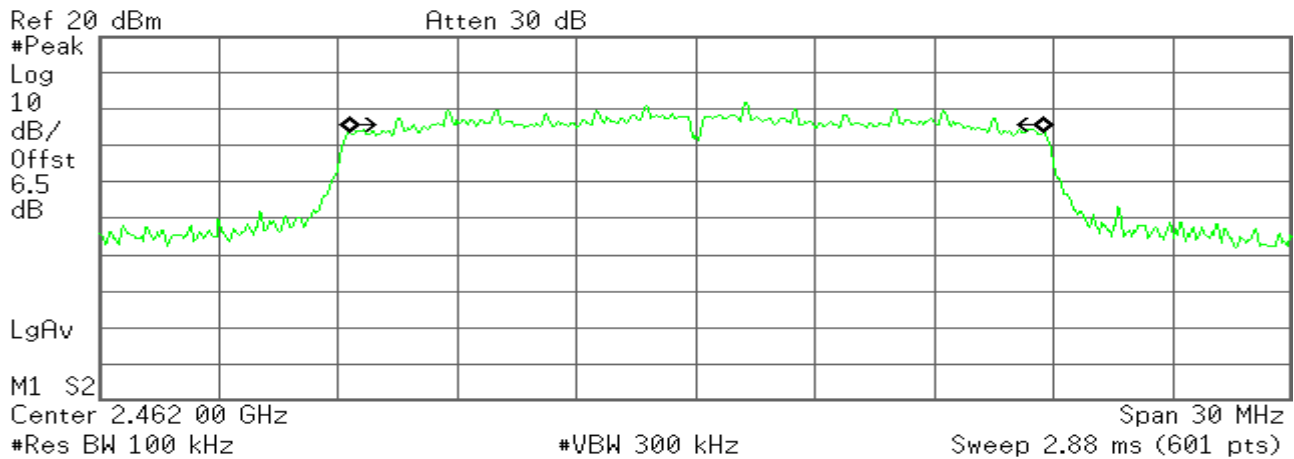
Occ BW % Pwr	99.00 %
x dB	-6.00 dB

Transmit Freq Error	7.561 kHz
x dB Bandwidth	15.166 MHz

6dB Bandwidth (CH High)

Agilent

R T



Occupied Bandwidth
17.4617 MHz

Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error 12.859 kHz
x dB Bandwidth 15.151 MHz

7.2. PEAK POWER

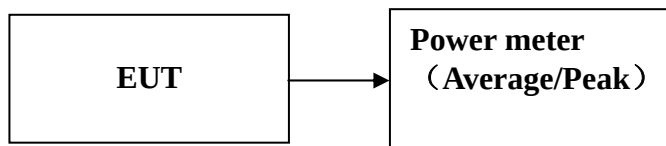
LIMIT

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, and 2400-2483.5 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

1. The EUT transmitter output is connected to the Power meter.
The Power meter is set to the peak power detection.
2. The testing follows the Measurement Procedure FCC KDB No. 558074 D01 DTS Meas. Guidance v03r02. 9.1.2 PKPM1 Peak power meter method.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b mode

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)
Low	2412	15.43	30
Mid	2437	15.84	30
High	2462	16.30	30

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)
Low	2412	15.39	30
Mid	2437	15.93	30
High	2462	16.26	30

Test mode: IEEE 802.11n HT20 mode

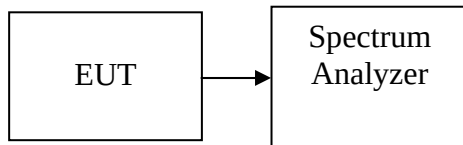
Channel	Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)
Low	2412	13.75	30
Mid	2437	14.21	30
High	2462	14.57	30

7.3. 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

1. Place the EUT on the table and set it in transmitting mode. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 3 kHz, VBW = 10 kHz, Span = 1.5 times the DTS bandwidth, Sweep = auto
3. Record the max reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

No non-compliance noted

Test Data**Test mode: IEEE 802.11b mode**

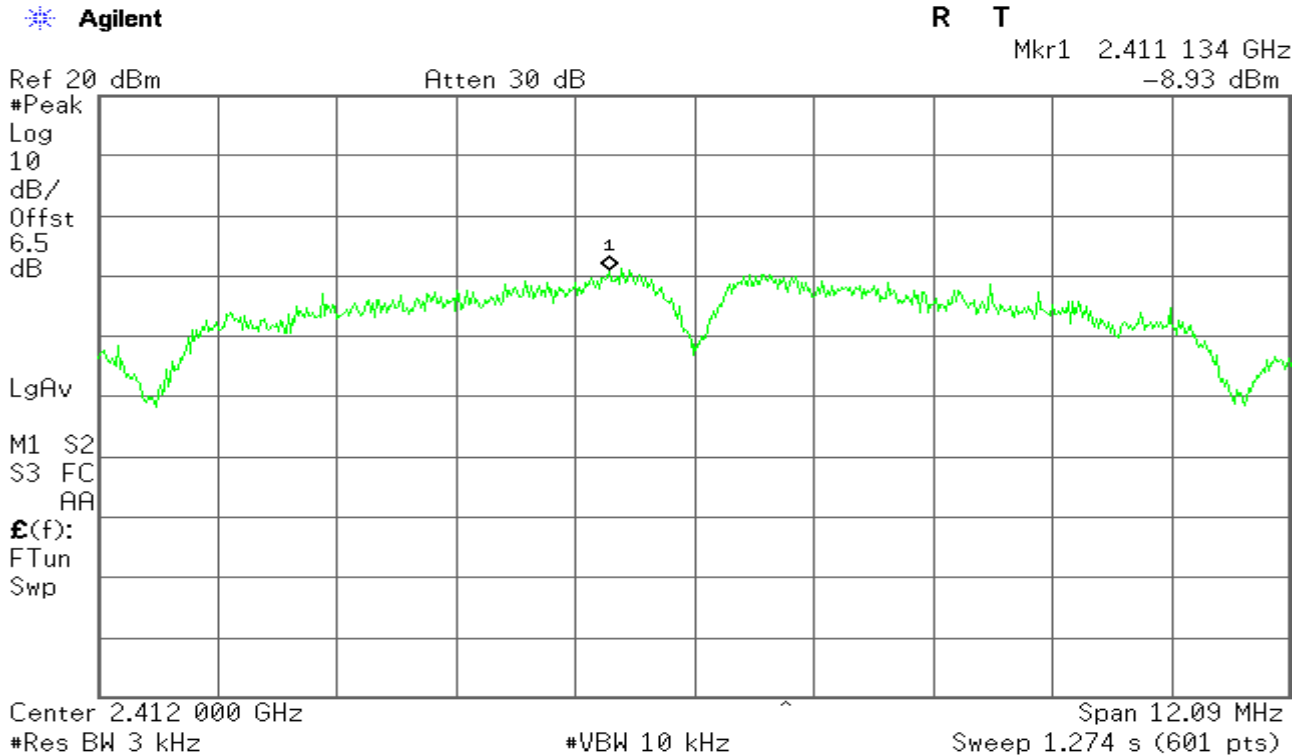
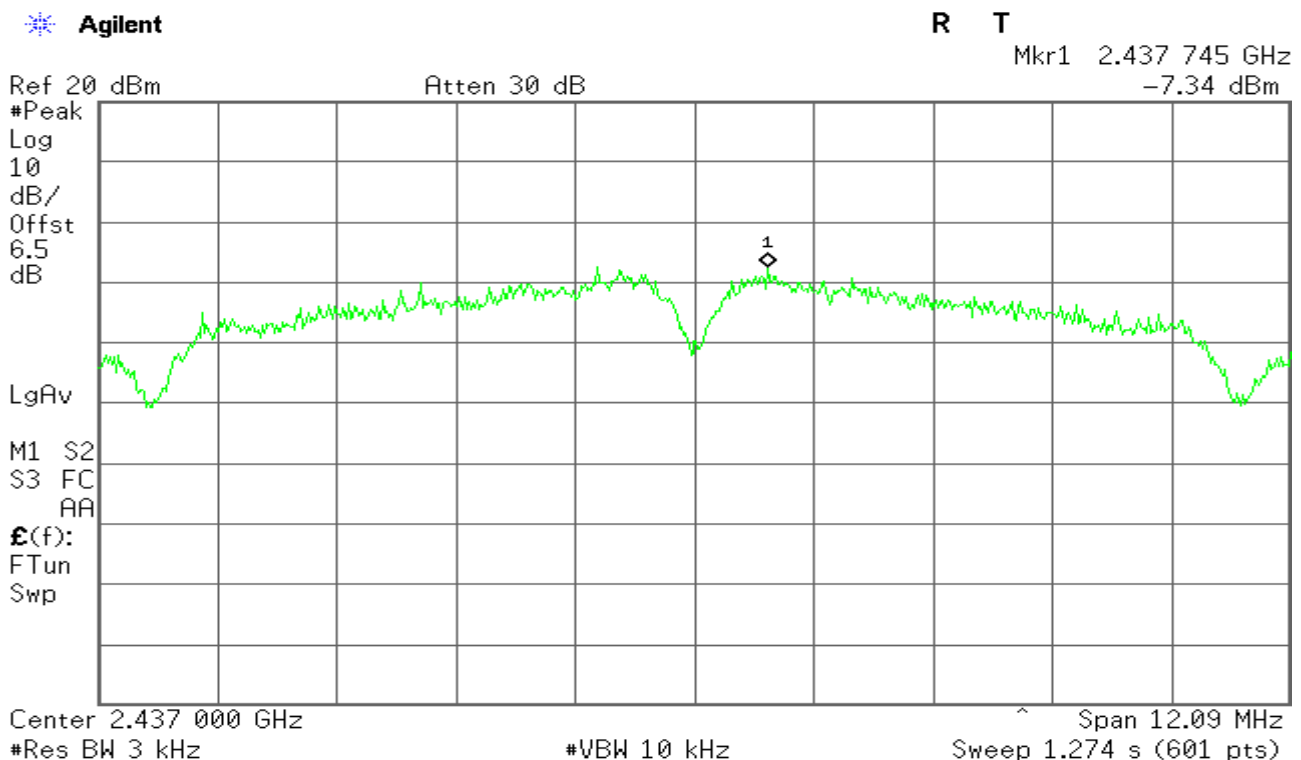
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-8.93	8.00	PASS
Mid	2437	-7.34	8.00	PASS
High	2462	-7.73	8.00	PASS

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-12.51	8.00	PASS
Mid	2437	-11.54	8.00	PASS
High	2462	-10.48	8.00	PASS

Test mode: IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-14.03	8.00	PASS
Mid	2437	-14.12	8.00	PASS
High	2462	-14.03	8.00	PASS

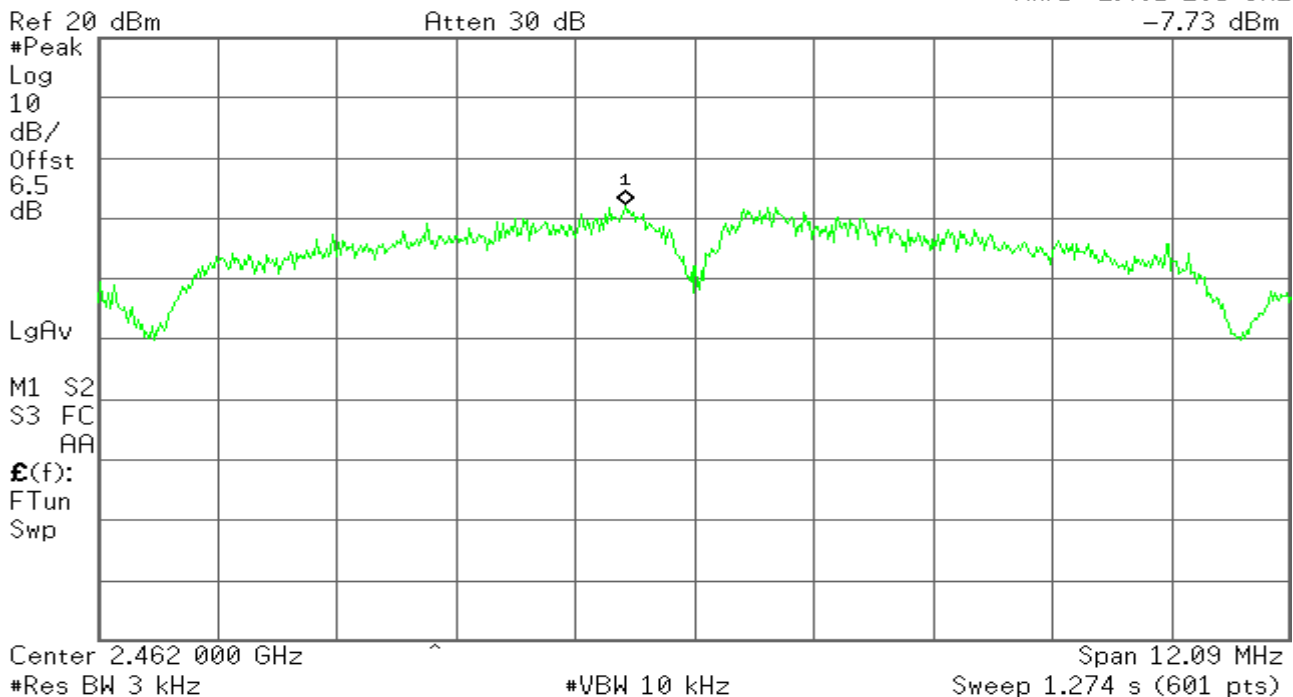
Test Plot**IEEE 802.11b mode****PPSD (CH Low)****PPSD (CH Mid)**

PPSD (CH High)

 **Agilent**

R T

Mkr1 2.461 295 GHz
-7.73 dBm



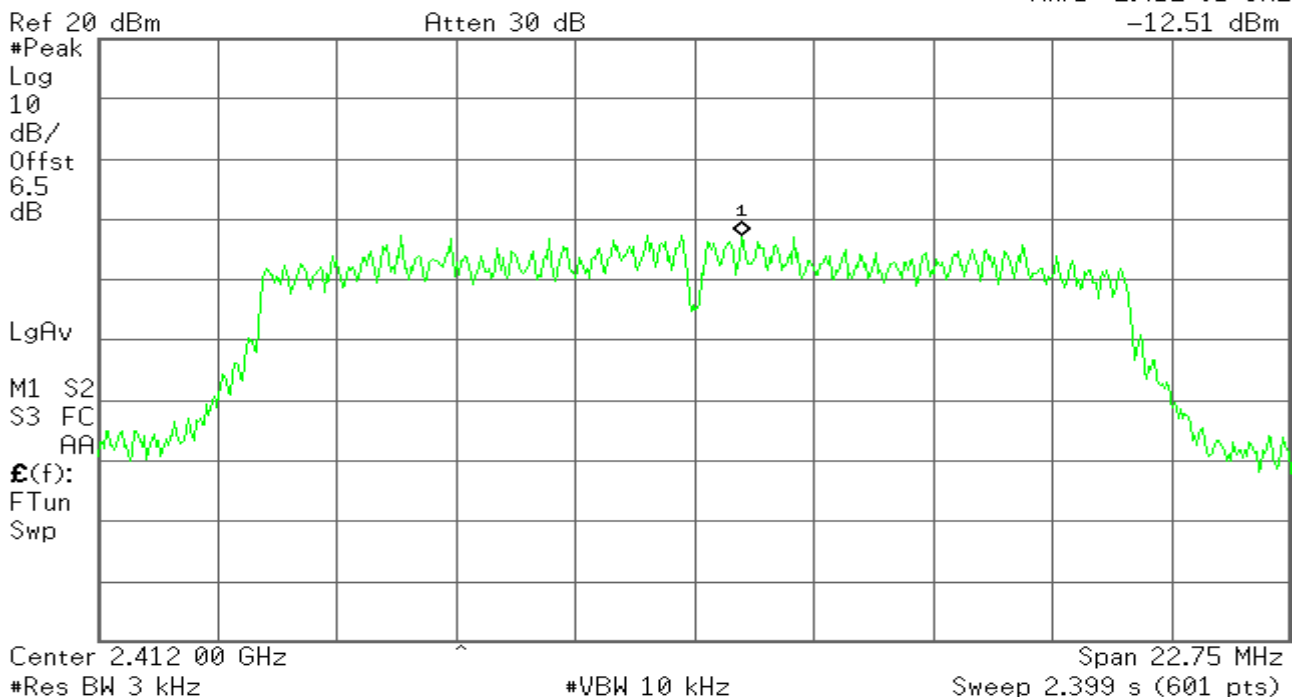
IEEE 802.11g mode

PPSD (CH Low)

 **Agilent**

R T

Mkr1 2.412 91 GHz
-12.51 dBm



PPSD (CH Mid)

 **Agilent**

R T

Mkr1 2.436 13 GHz
-11.54 dBm

Ref 20 dBm

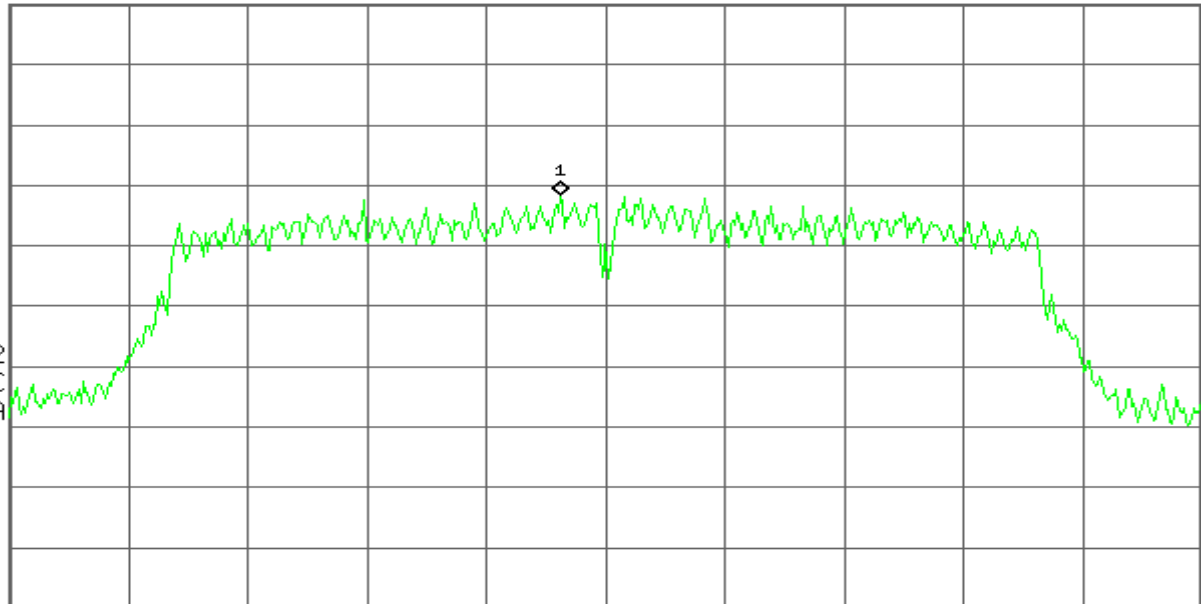
Atten 30 dB

#Peak
Log
10
dB/
Offst
6.5
dB

LgAv

M1 S2
S3 FC
AA

$\mathcal{E}(f)$:
FTun
Swp



Center 2.437 00 GHz

#Res BW 3 kHz

#VBW 10 kHz

Span 22.75 MHz
Sweep 2.399 s (601 pts)

PPSD (CH High)

 **Agilent**

R T

Mkr1 2.462 99 GHz
-10.48 dBm

Ref 20 dBm

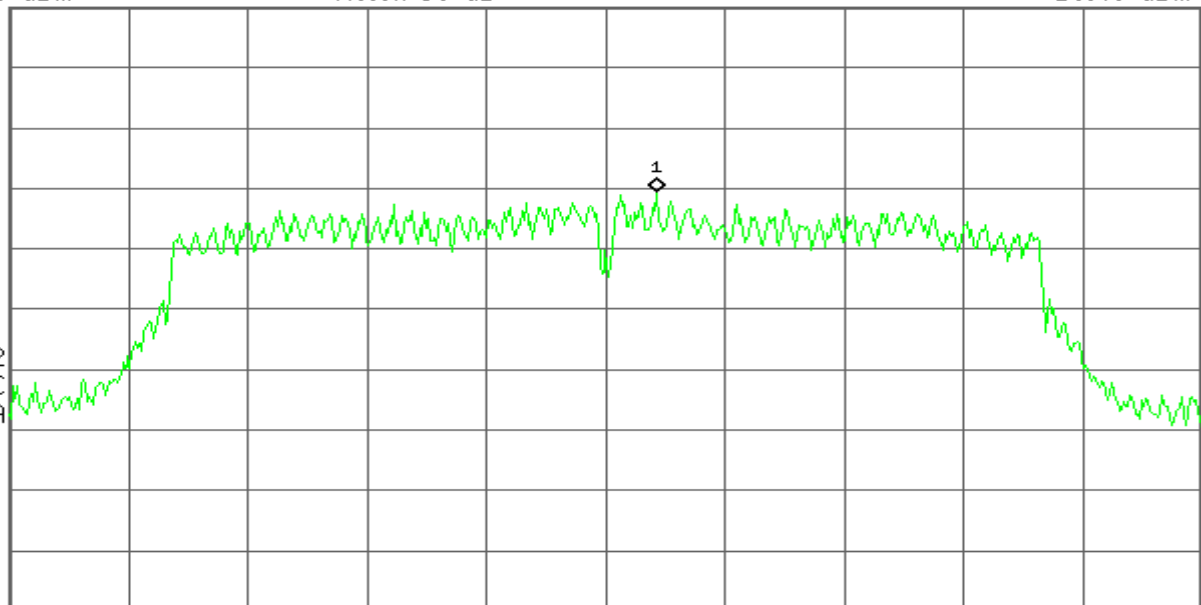
Atten 30 dB

#Peak
Log
10
dB/
Offst
6.5
dB

LgAv

M1 S2
S3 FC
AA

$\mathcal{E}(f)$:
FTun
Swp

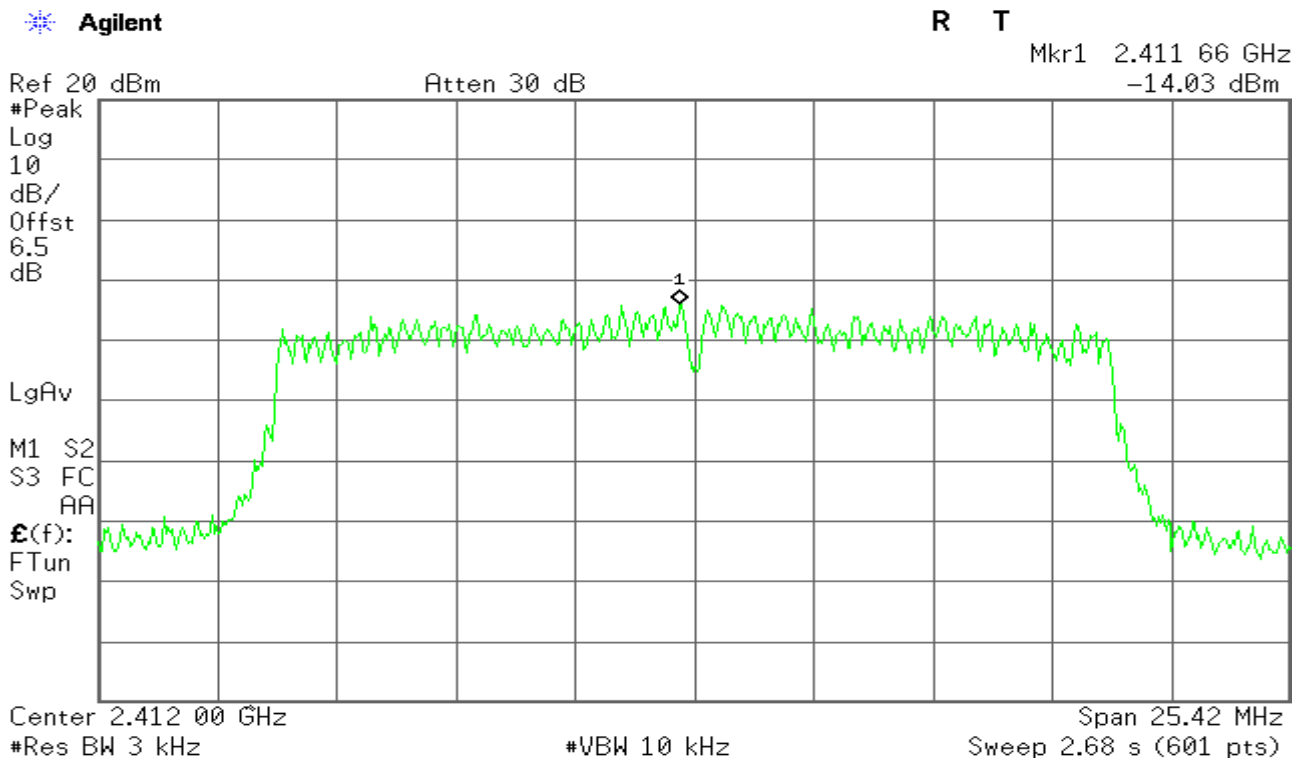
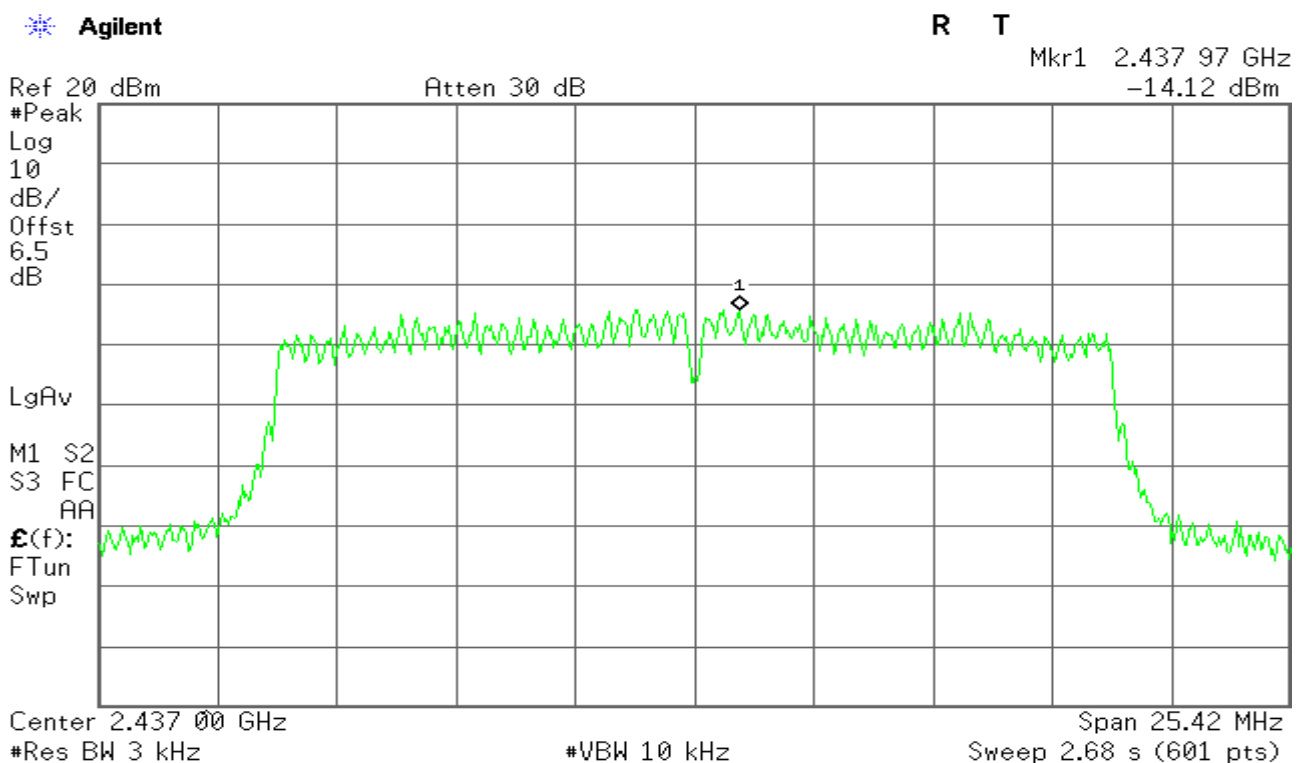


Center 2.462 00 GHz

#Res BW 3 kHz

#VBW 10 kHz

Span 22.75 MHz
Sweep 2.399 s (601 pts)

IEEE 802.11n HT20 mode**PPSD (CH Low)****PPSD (CH Mid)**

PPSD (CH High)

 **Agilent**

R T

Mkr1 2.463 57 GHz
-14.03 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

LgAv

M1 S2

S3 FC

AA

$E(f)$:

FTun

Swp

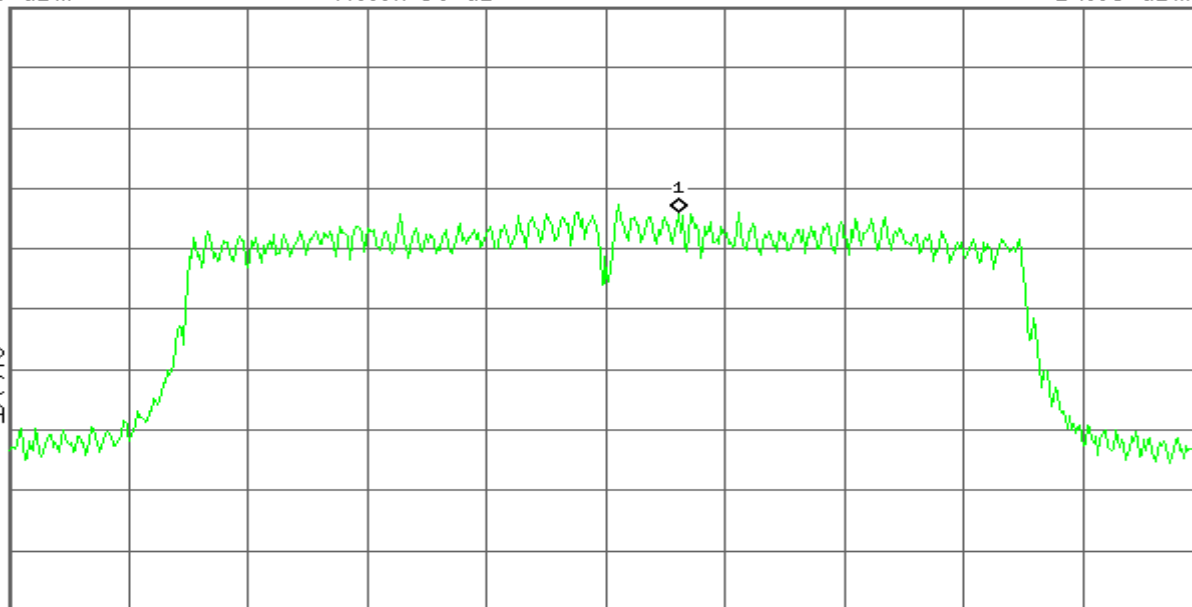
Center 2.462 00 GHz

#Res BW 3 kHz

#VBW 10 kHz

Span 25.42 MHz

Sweep 2.68 s (601 pts)



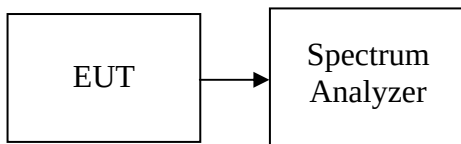
7.4.SPURIOUS EMISSIONS

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

Measurements are made over the 30MHz to 40GHz range with the transmitter set to the lowest, middle, and highest channels.

TEST RESULTS

No non-compliance noted

Test Plot

OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

IEEE 802.11b mode

CH Low

 **Agilent**

R T

Mkr1 2.412 524 GHz
5.77 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-14.2

dBm

LgAv

M1 S2

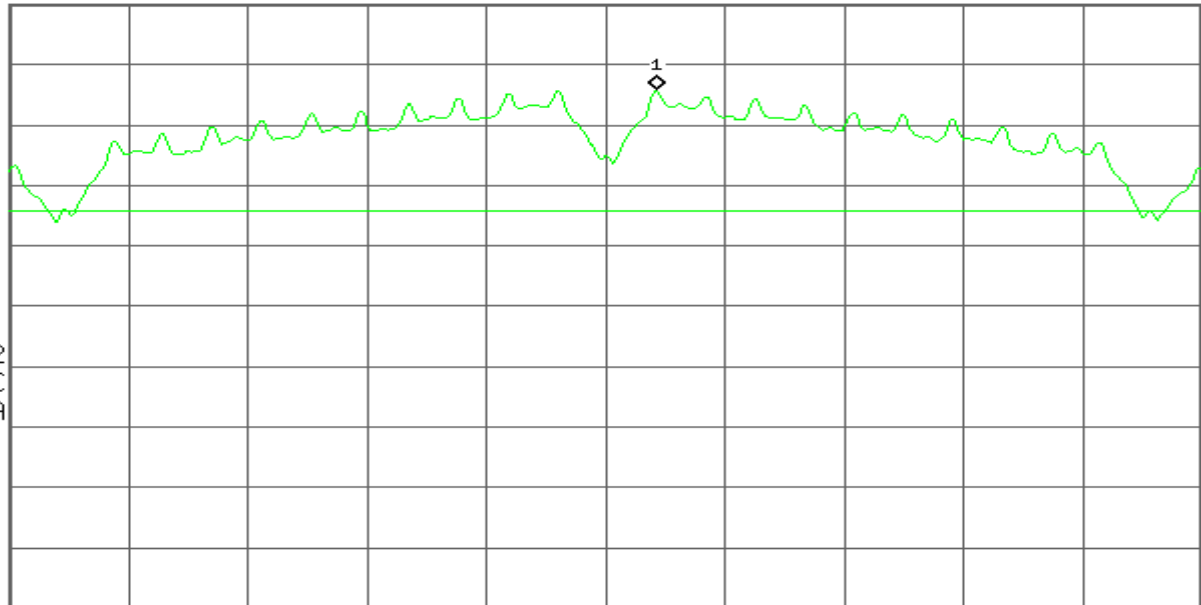
S3 FC

AA

$E(f)$:

FTun

Swp



Center 2.412 000 GHz

Span 12.09 MHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 1.16 ms (601 pts)

 **Agilent**

R T

Mkr1 2.400 000 GHz
-38.32 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-14.2

dBm

LgAv

M1 S2

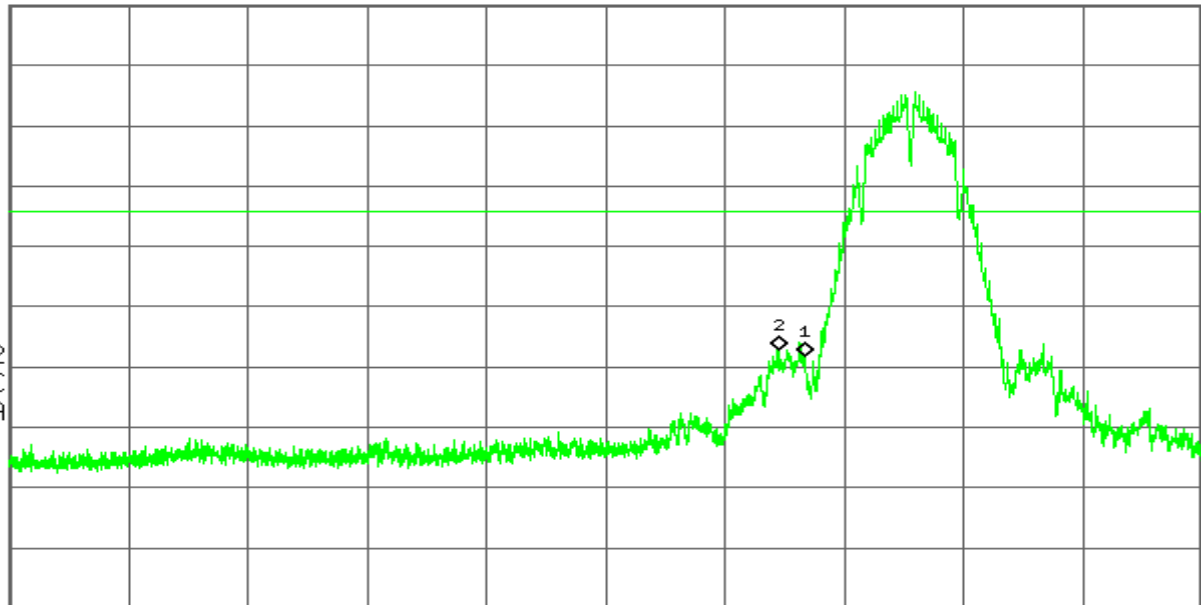
S3 FC

AA

$E(f)$:

FTun

Swp



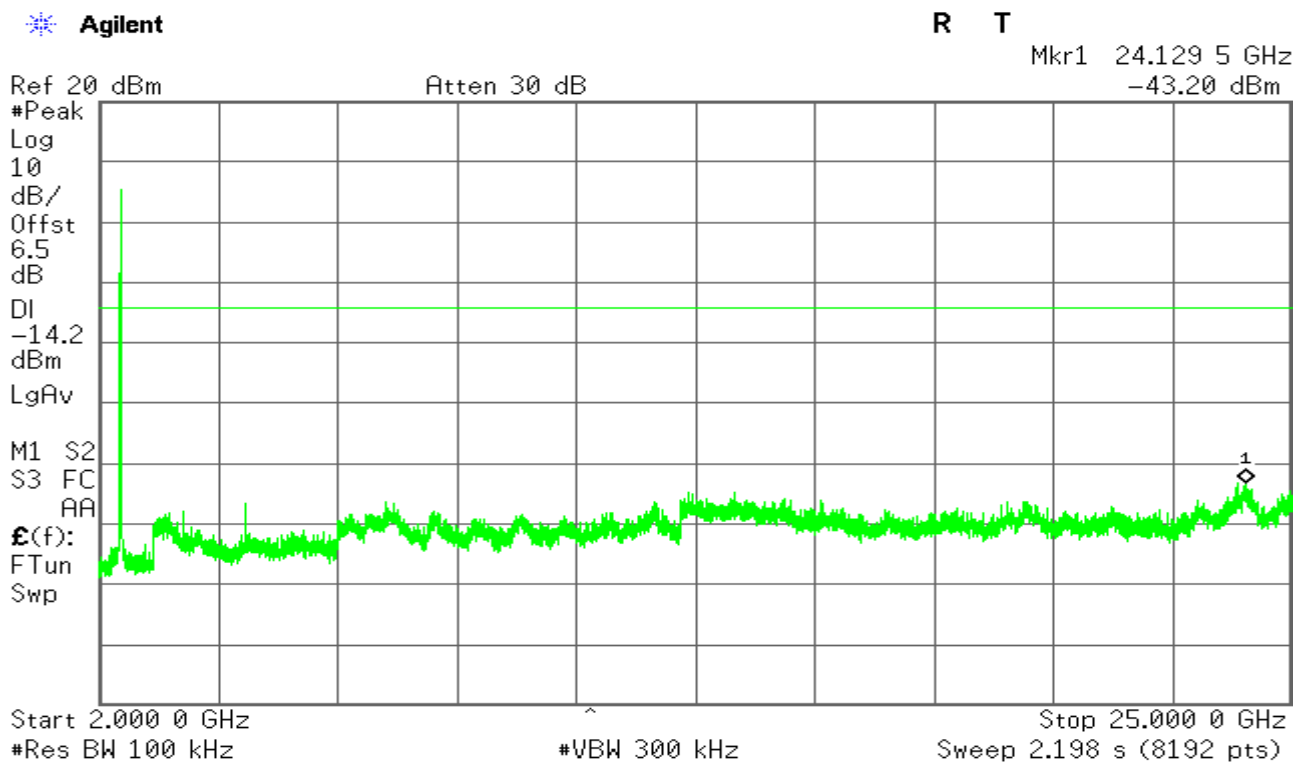
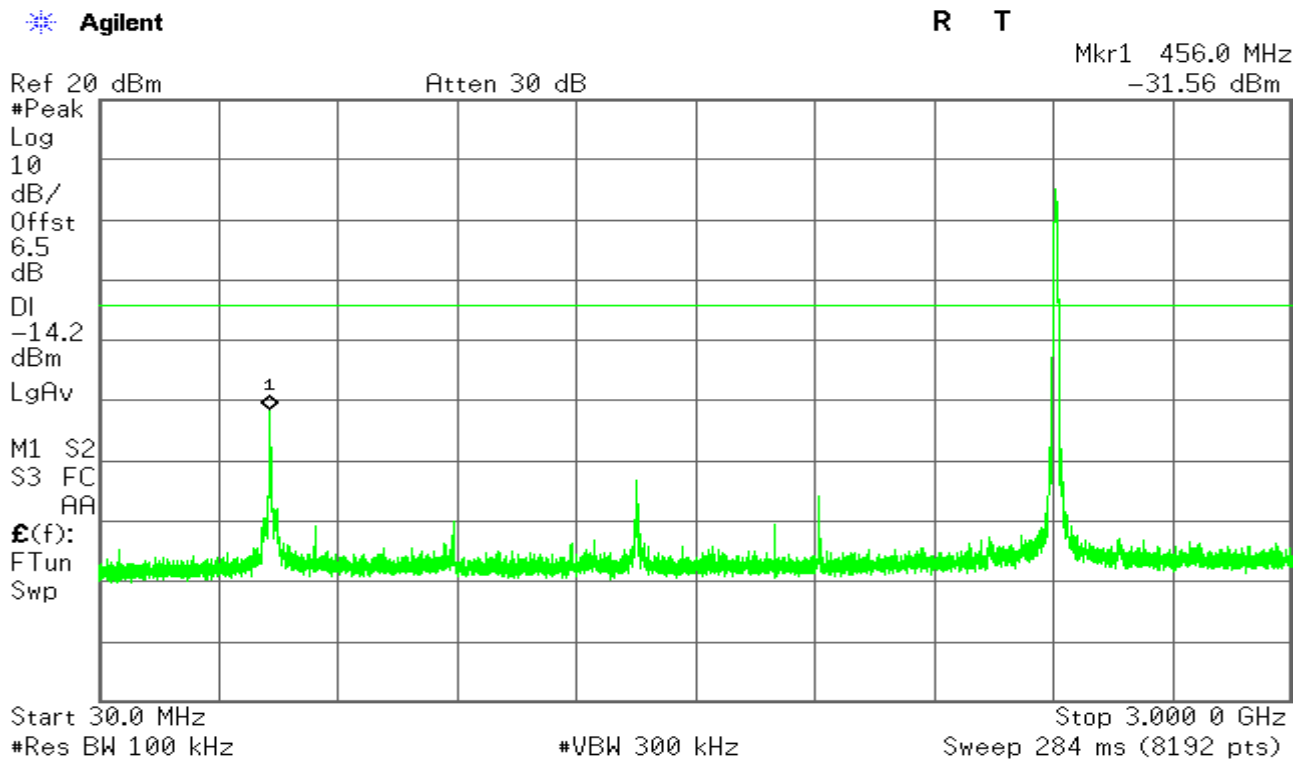
Start 2.310 000 GHz

Stop 2.445 000 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 13.11 ms (8192 pts)



CH Mid

Agilent

R T

Mkr1 2.437 524 GHz
6.07 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-13.9

dBm

LgAv

M1 S2

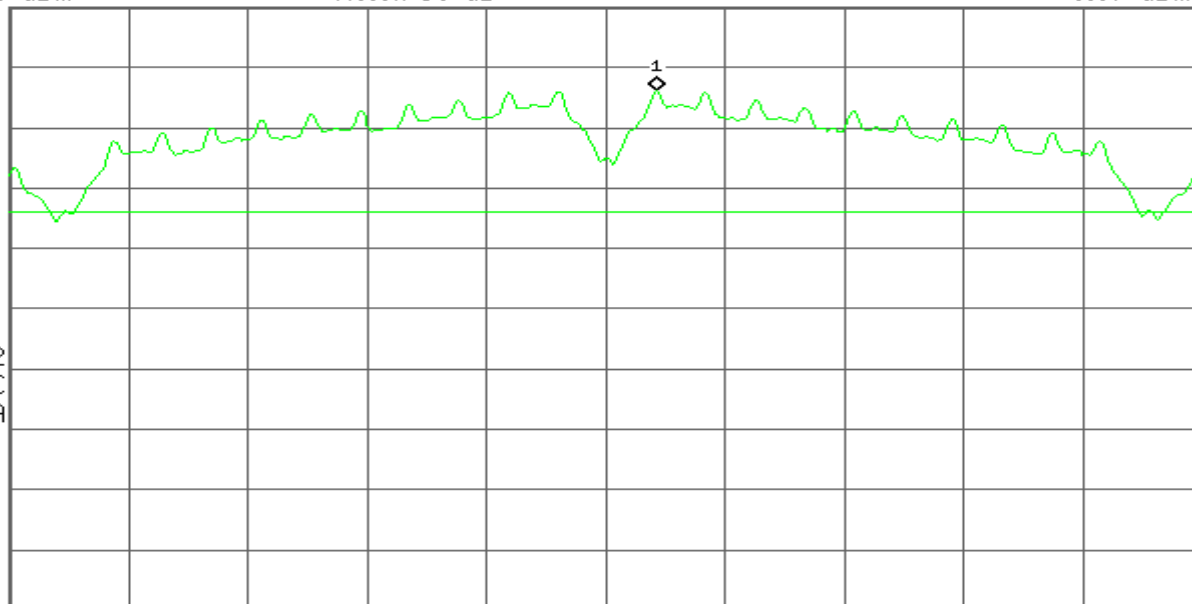
S3 FC

AA

E(f):

FTun

Swp



Center 2.437 000 GHz

Span 12.09 MHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 1.16 ms (601 pts)

Agilent

R T

Mkr1 456.0 MHz
-32.30 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-13.9

dBm

LgAv

M1 S2

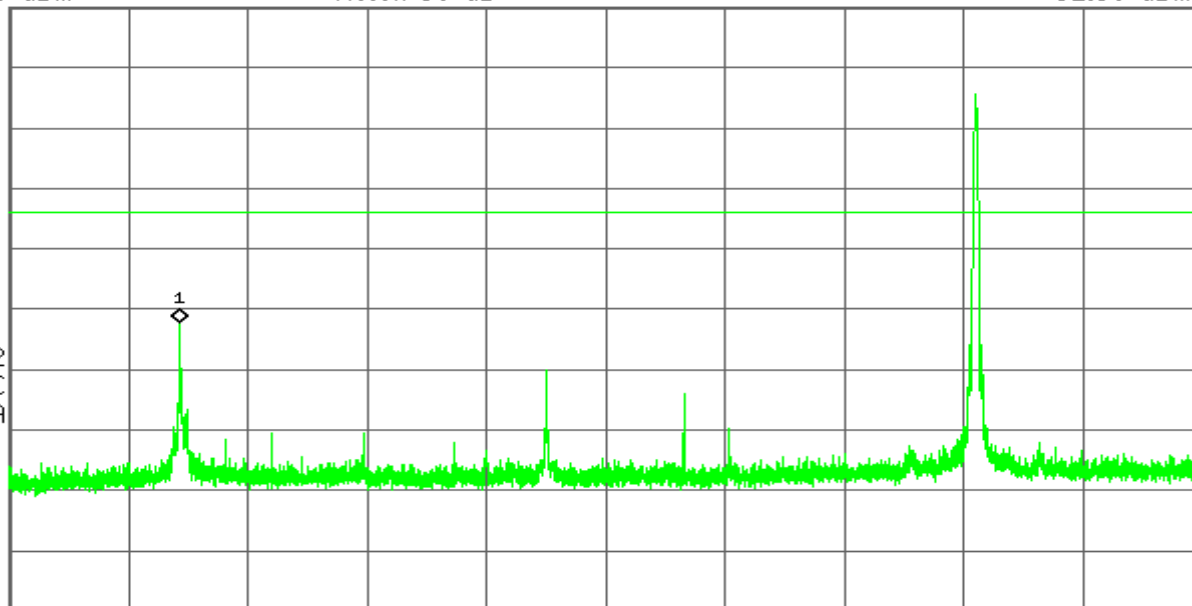
S3 FC

AA

E(f):

FTun

Swp



Start 30.00 MHz

Stop 3.000 00 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 284 ms (8192 pts)

Agilent

R T

Mkr1 24.081 8 GHz
-43.15 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-13.9

dBm

LgAv

M1 S2

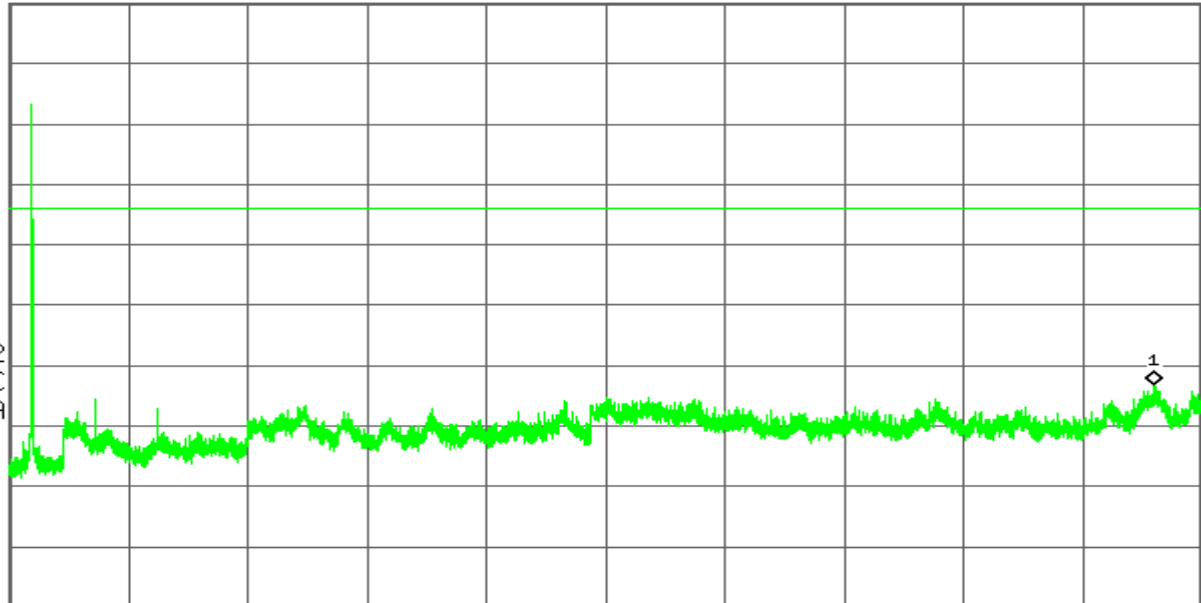
S3 FC

AA

E(f):

FTun

Swp



Start 2.000 0 GHz

Stop 25.000 0 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 2.198 s (8192 pts)

CH High

Agilent

R T

Mkr1 2.462 504 GHz
6.85 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-13.1

dBm

LgAv

M1 S2

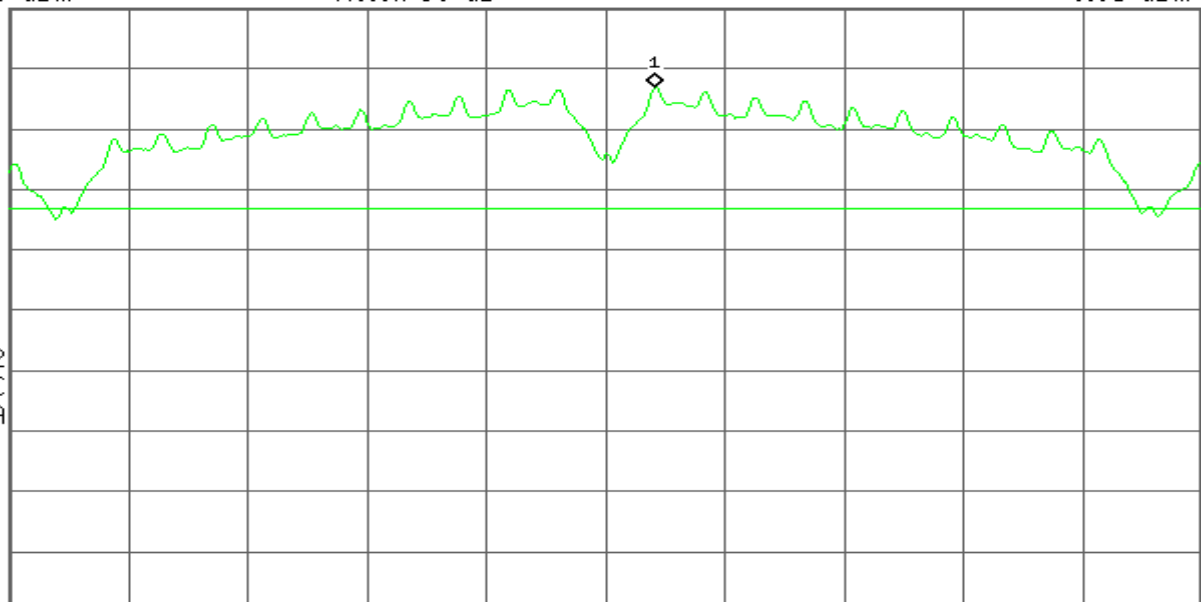
S3 FC

AA

E(f):

FTun

Swp



Center 2.462 000 GHz

Span 12.09 MHz

#Res BW 100 kHz

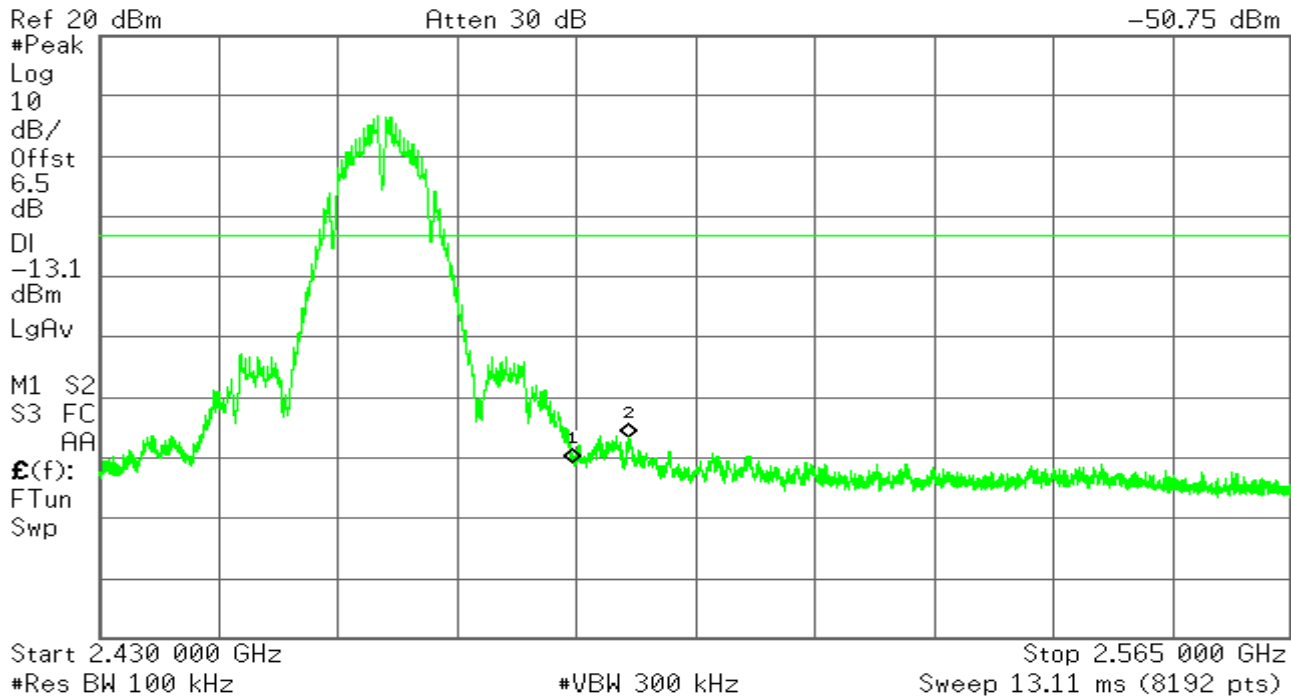
#VBW 300 kHz

Sweep 1.16 ms (601 pts)

Agilent

R T

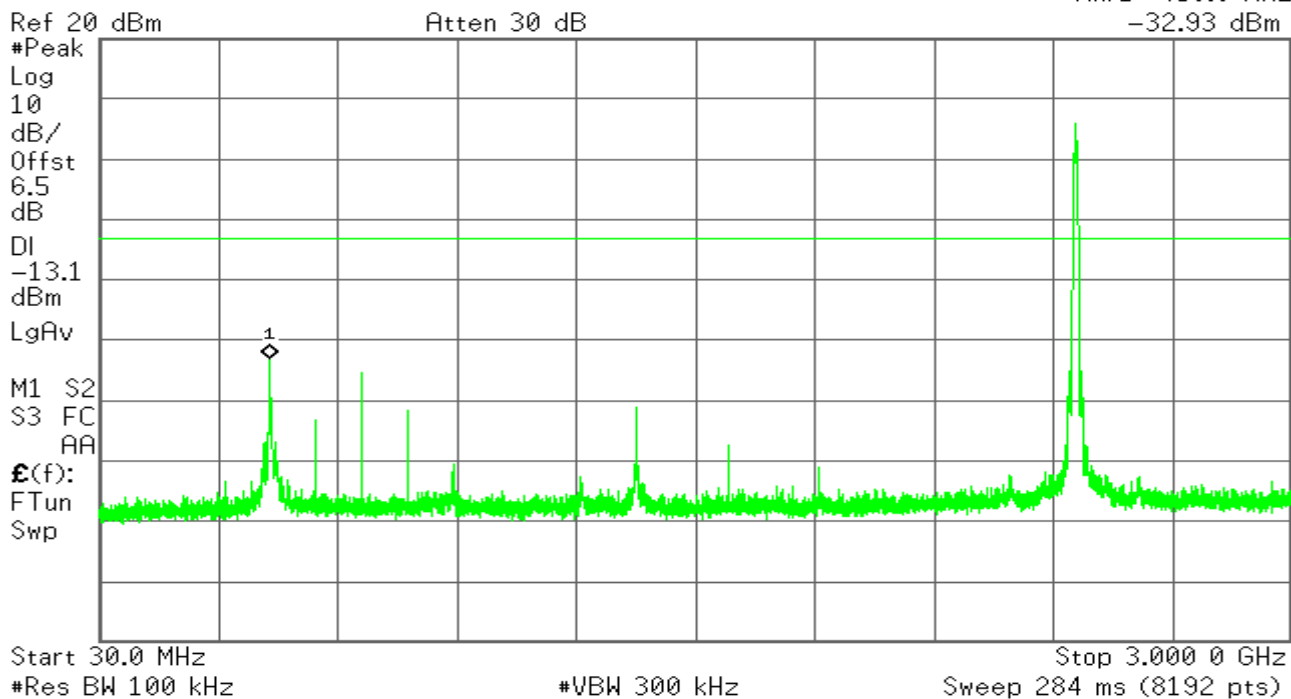
Mkr1 2.483 500 GHz
-50.75 dBm



Agilent

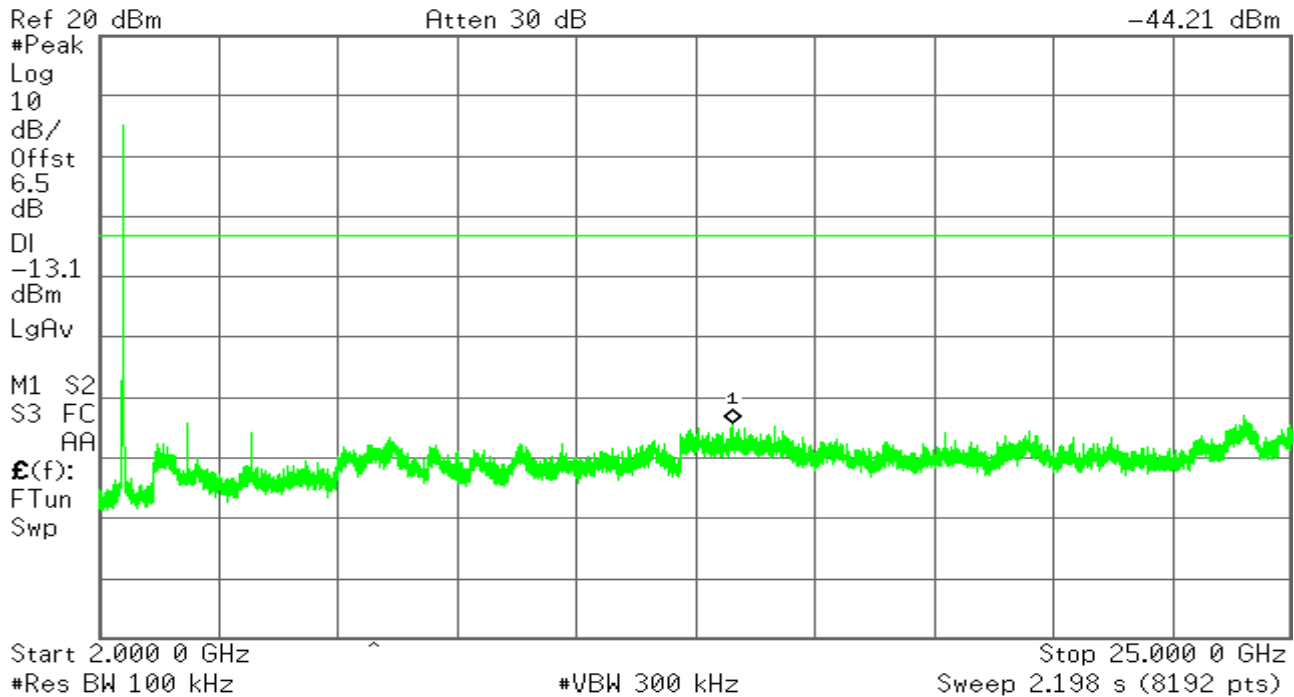
R T

Mkr1 456.0 MHz
-32.93 dBm



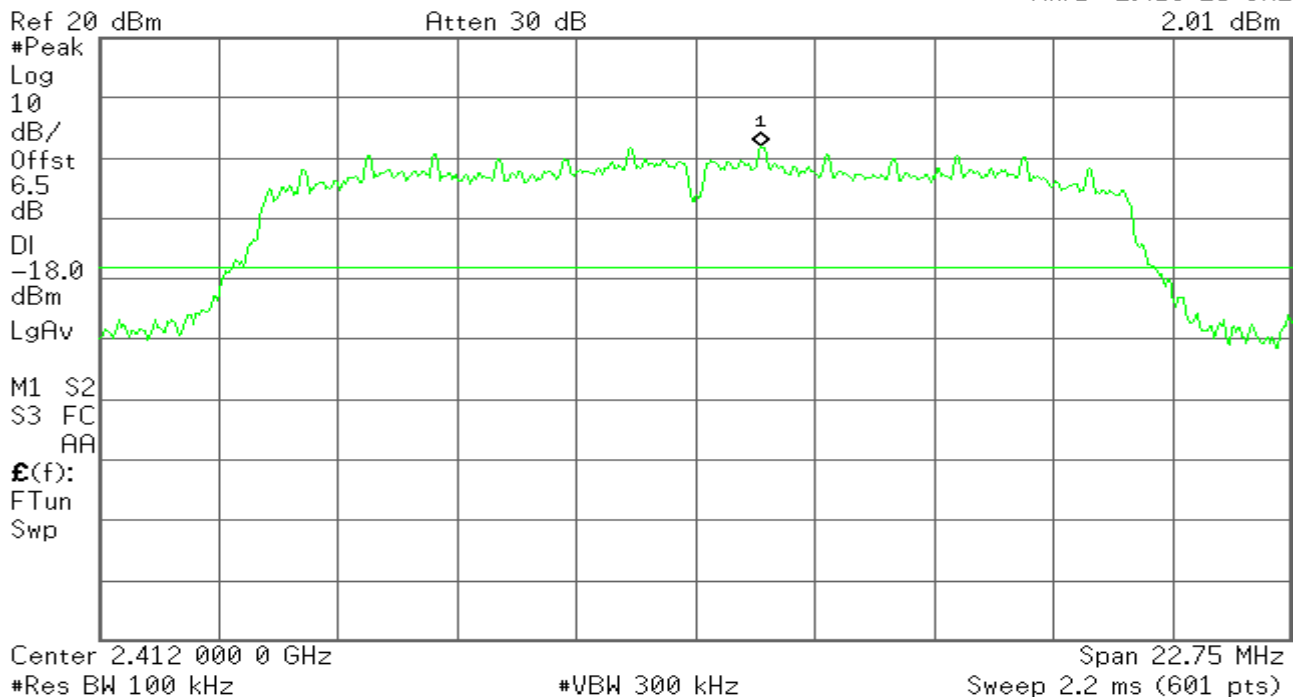
Agilent

R T

Mkr1 14.217 4 GHz
-44.21 dBm**IEEE 802.11g mode****CH Low**

Agilent

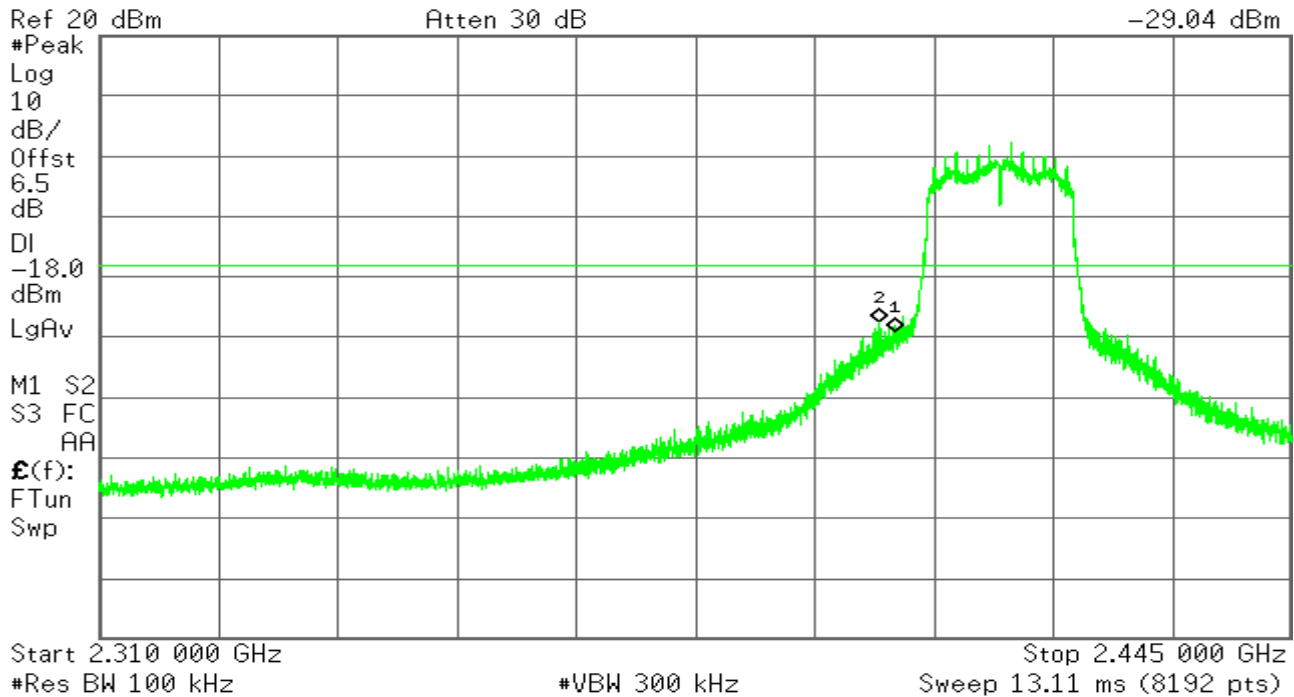
R T

Mkr1 2.413 25 GHz
2.01 dBm

Agilent

R T

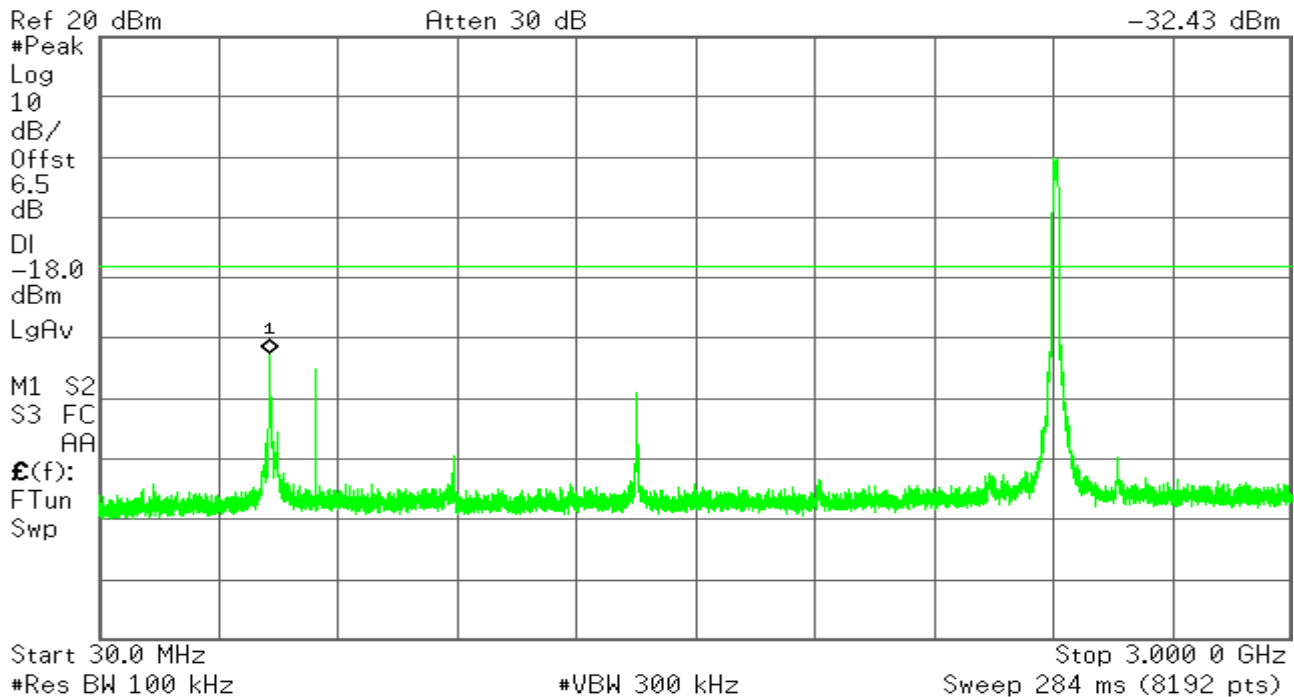
Mkr1 2.400 000 GHz
-29.04 dBm



Agilent

R T

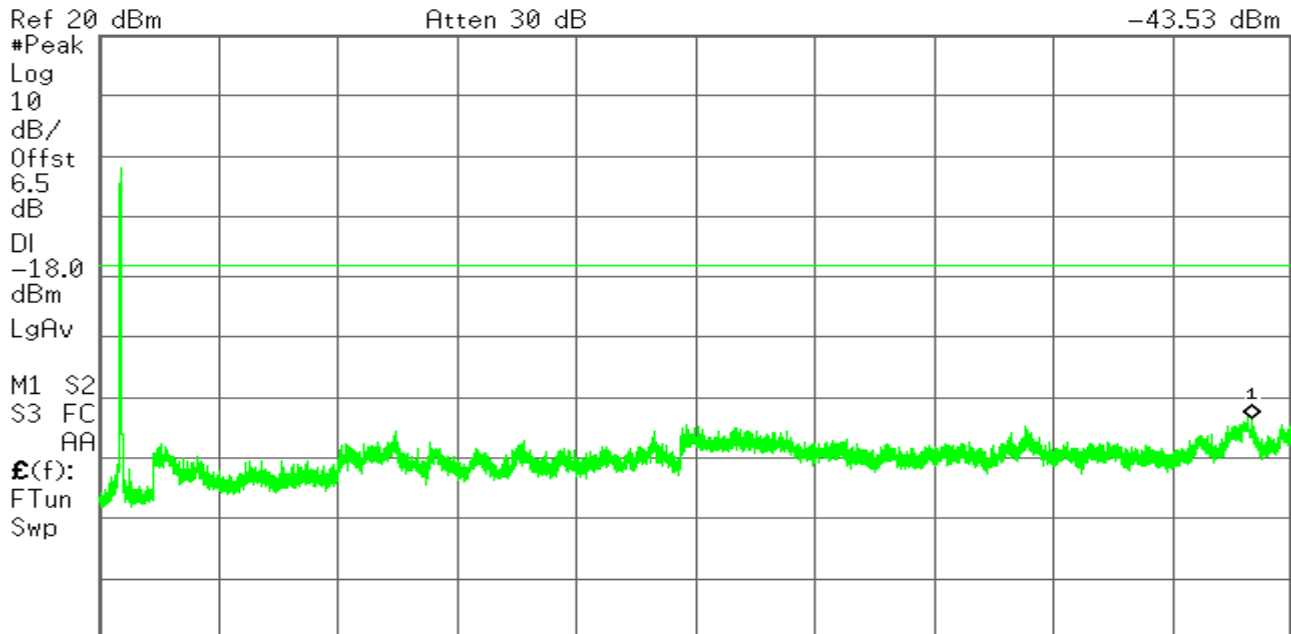
Mkr1 456.0 MHz
-32.43 dBm



Agilent

R T

Mkr1 24.241 9 GHz
-43.53 dBm



Start 2.000 0 GHz

Stop 25.000 0 GHz

#Res BW 100 kHz

#VBW 300 kHz

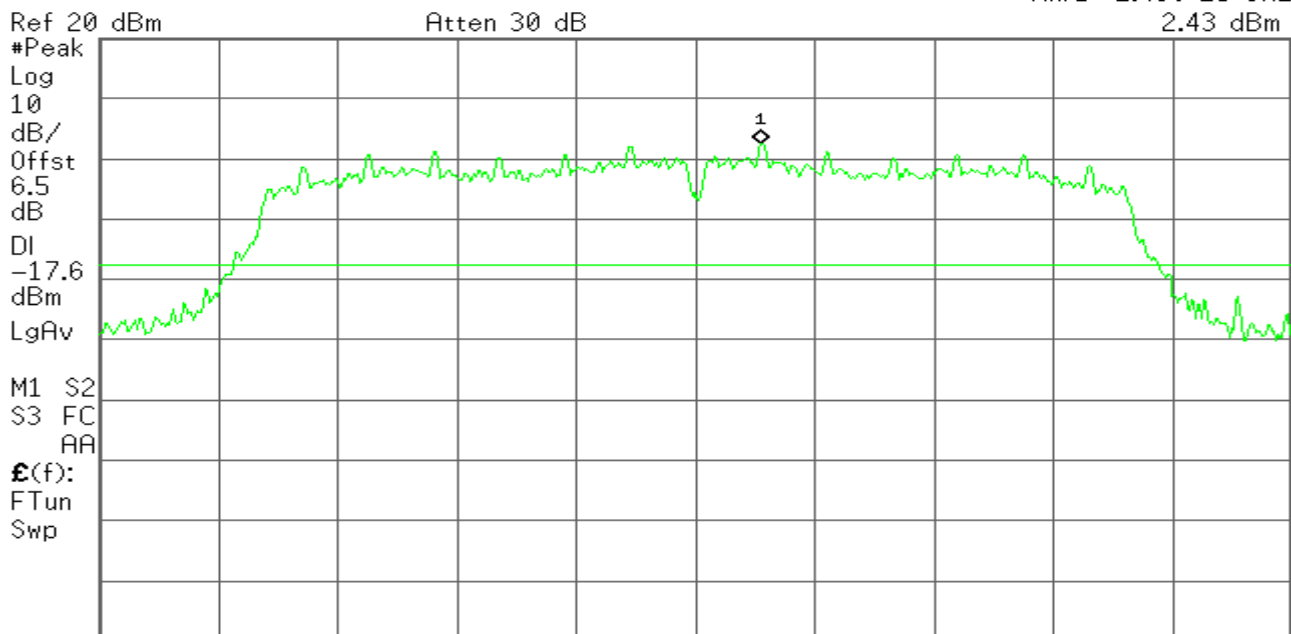
Sweep 2.198 s (8192 pts)

CH Mid

Agilent

R T

Mkr1 2.438 25 GHz
2.43 dBm



Center 2.437 000 0 GHz

Span 22.75 MHz

#Res BW 100 kHz

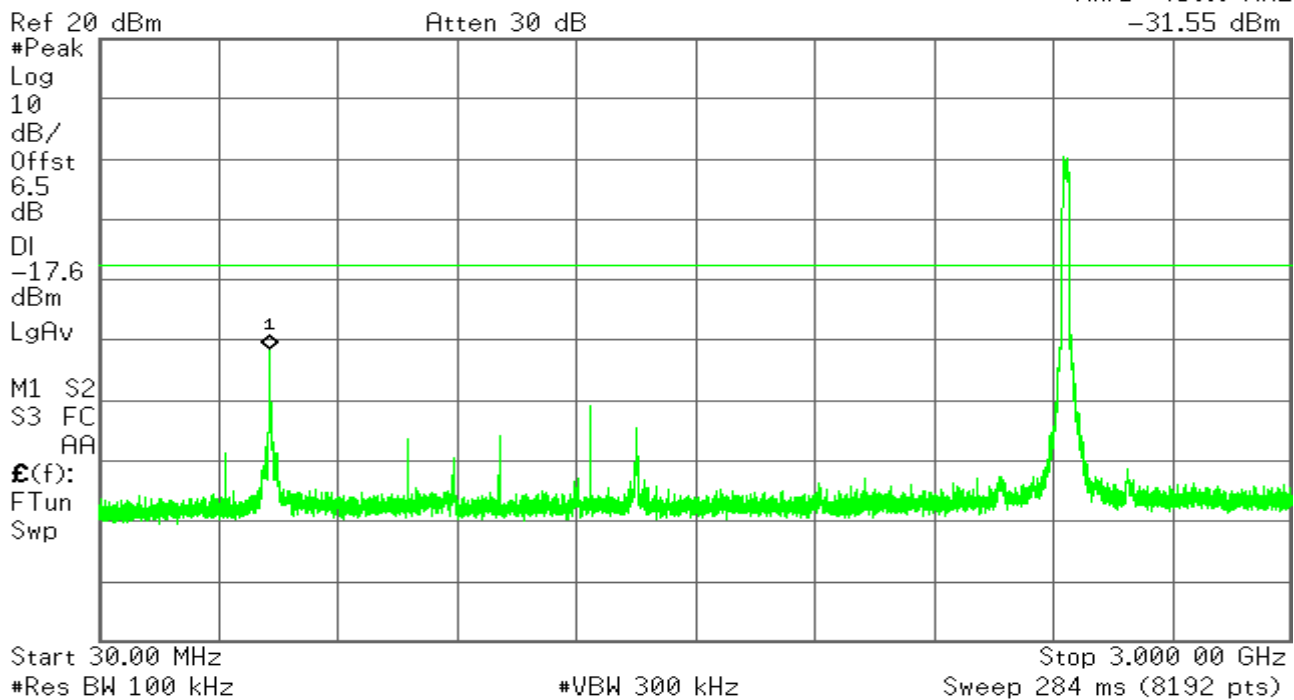
#VBW 300 kHz

Sweep 2.2 ms (601 pts)

Agilent

R T

Mkr1 456.0 MHz
-31.55 dBm



Agilent

R T

Mkr1 23.989 1 GHz
-43.54 dBm



CH High

 **Agilent**

R T

Mkr1 2.463 29 GHz
2.92 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-17.1

dBm

LgAv

M1 S2

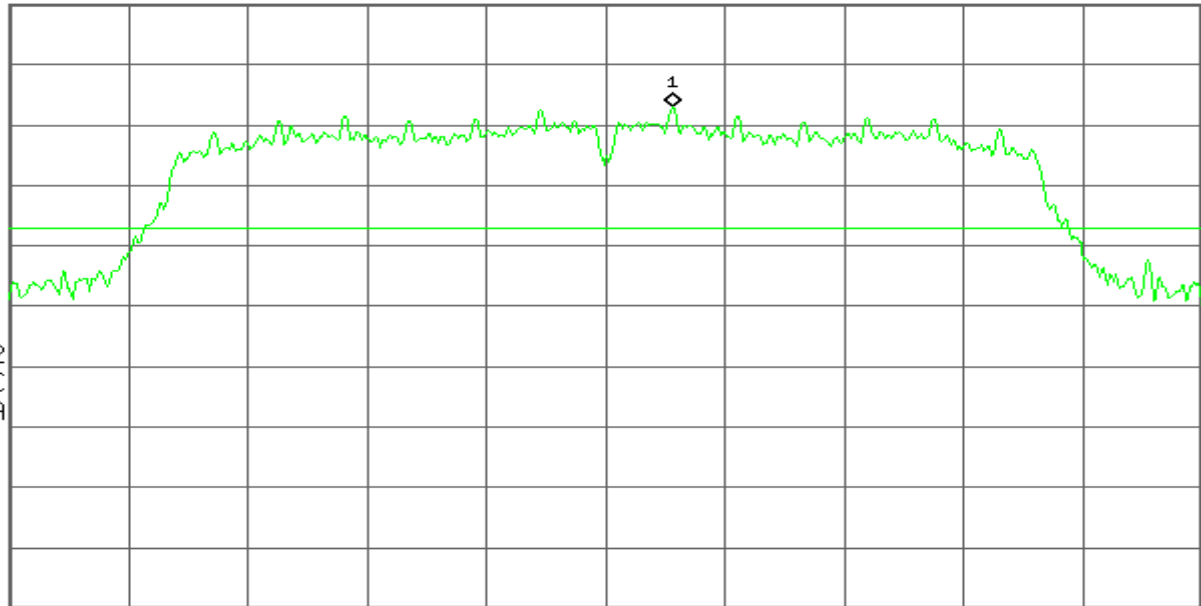
S3 FC

AA

$\mathcal{E}(f)$:

FTun

Swp



Center 2.462 000 0 GHz

#Res BW 100 kHz

#VBW 300 kHz

Span 22.75 MHz

Sweep 2.2 ms (601 pts)

 **Agilent**

R T

Mkr1 2.483 500 GHz
-38.01 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-17.1

dBm

LgAv

M1 S2

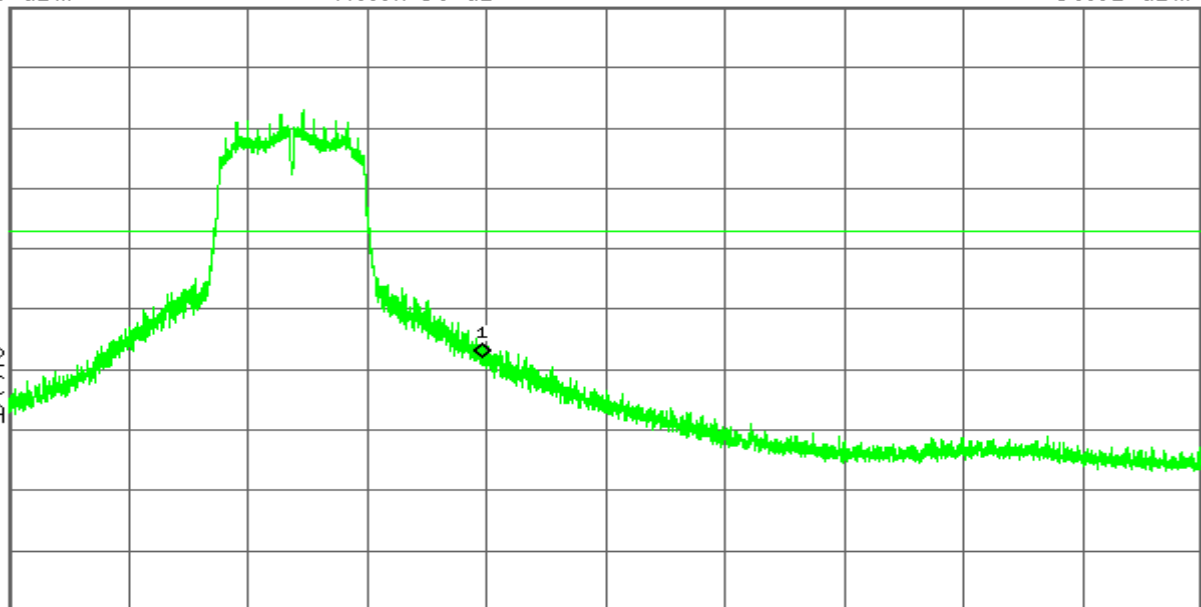
S3 FC

AA

$\mathcal{E}(f)$:

FTun

Swp



Start 2.430 000 GHz

#Res BW 100 kHz

#VBW 300 kHz

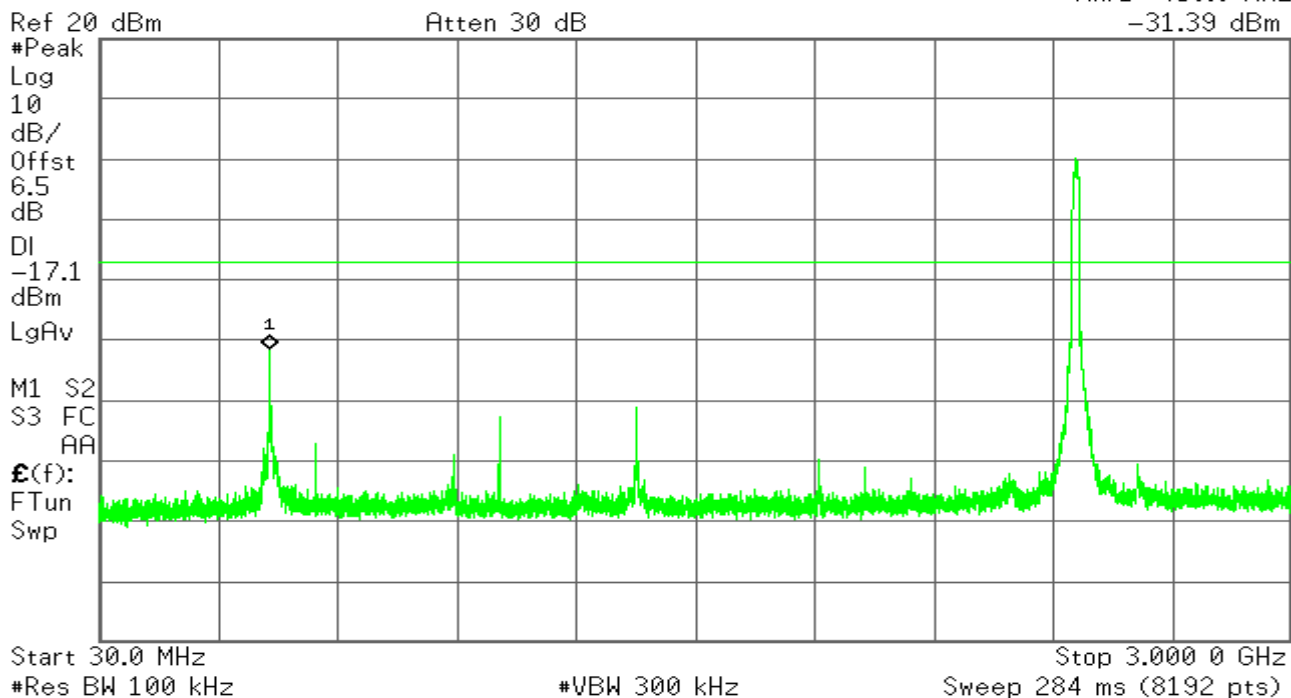
Stop 2.565 000 GHz

Sweep 13.11 ms (8192 pts)

Agilent

R T

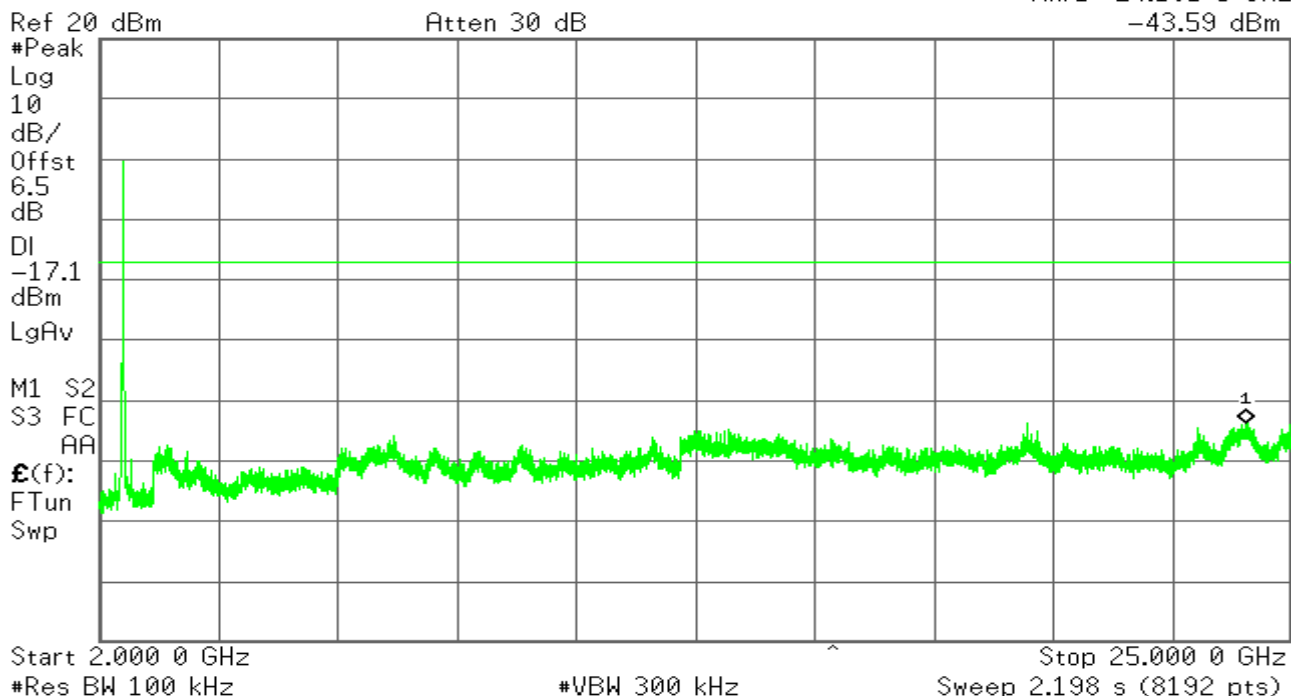
Mkr1 456.0 MHz
-31.39 dBm



Agilent

R T

Mkr1 24.101 5 GHz
-43.59 dBm



IEEE 802.11n HT20 mode**CH Low**

* Agilent

R T

Mkr1 2.413 27 GHz
0.72 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-19.3

dBm

LgAv

M1 S2

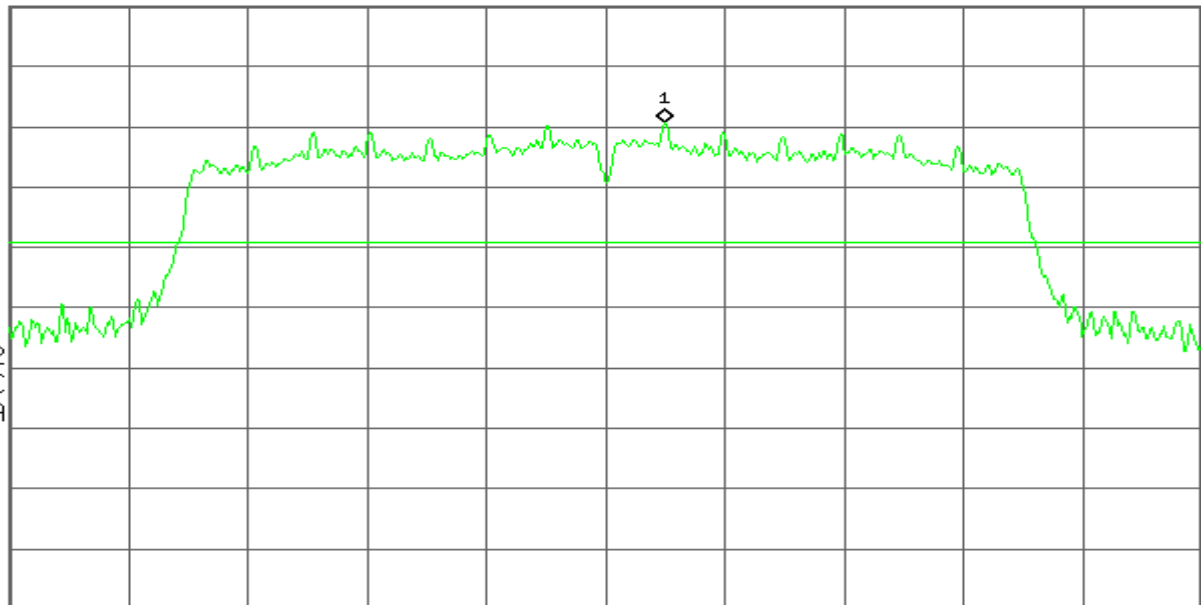
S3 FC

AA

E(f):

FTun

Swp



* Agilent

R T

Mkr1 2.400 000 GHz
-35.56 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-19.3

dBm

LgAv

M1 S2

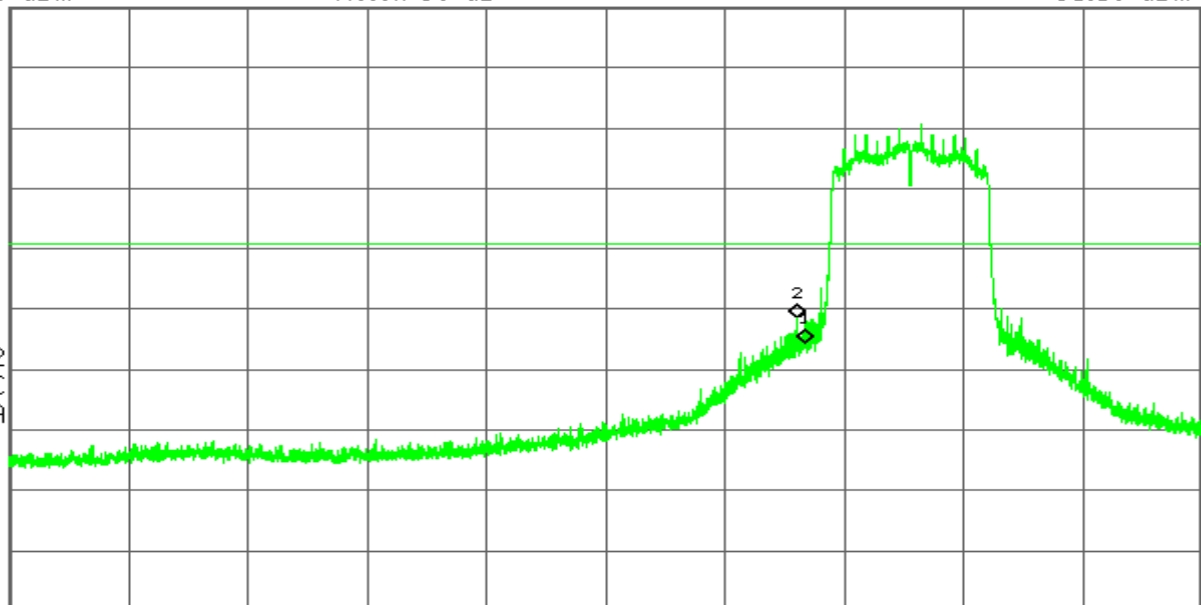
S3 FC

AA

E(f):

FTun

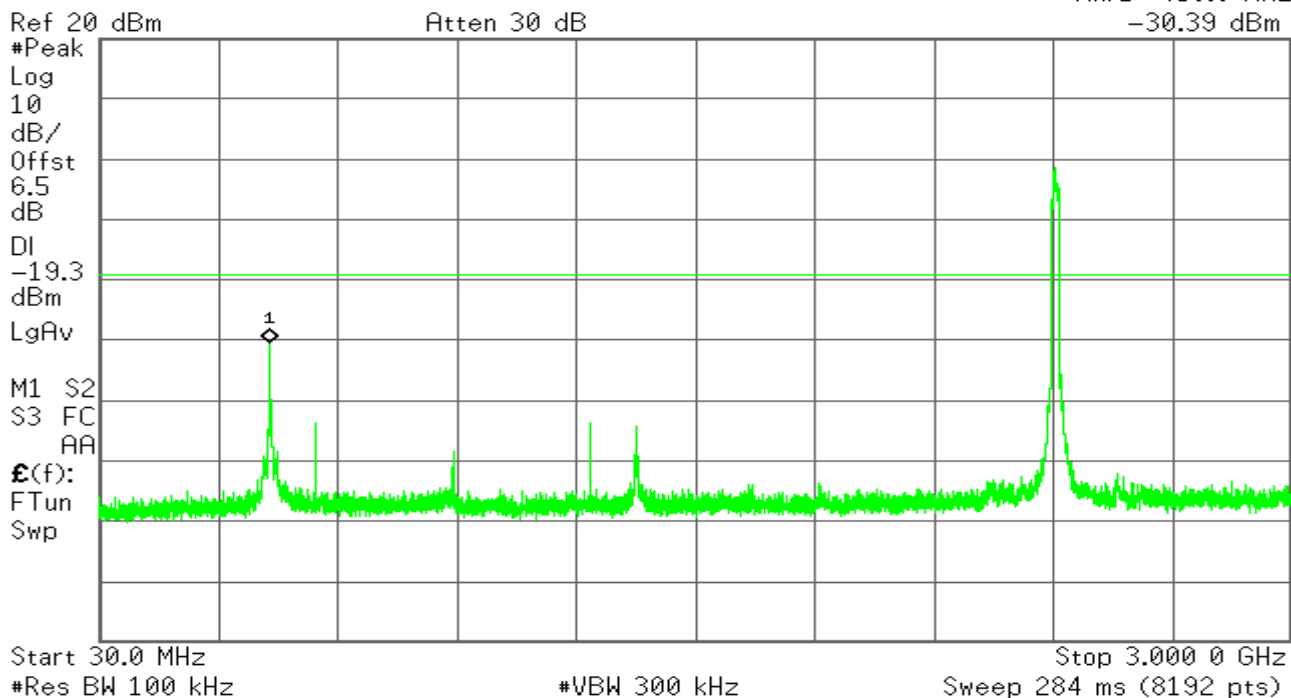
Swp



Agilent

R T

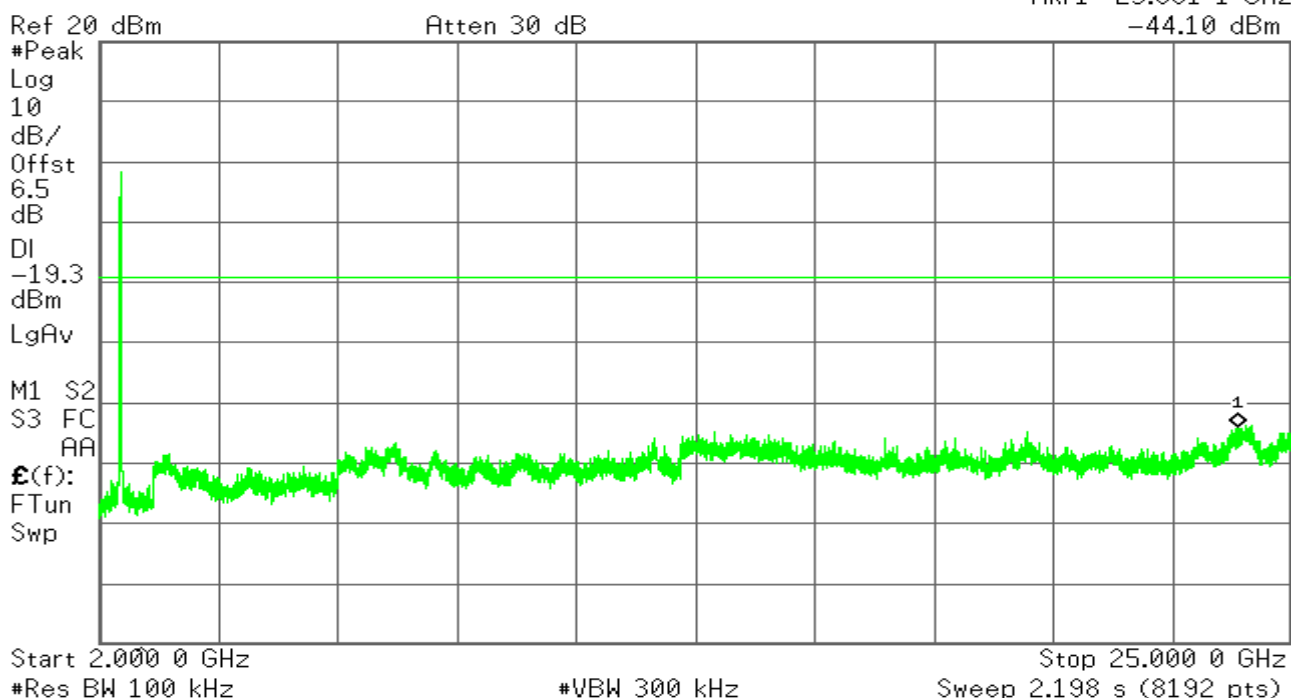
Mkr1 456.0 MHz
-30.39 dBm



Agilent

R T

Mkr1 23.961 1 GHz
-44.10 dBm



CH Mid

 **Agilent**

R T

Mkr1 2.438 27 GHz
1.11 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-18.9

dBm

LgAv

M1 S2

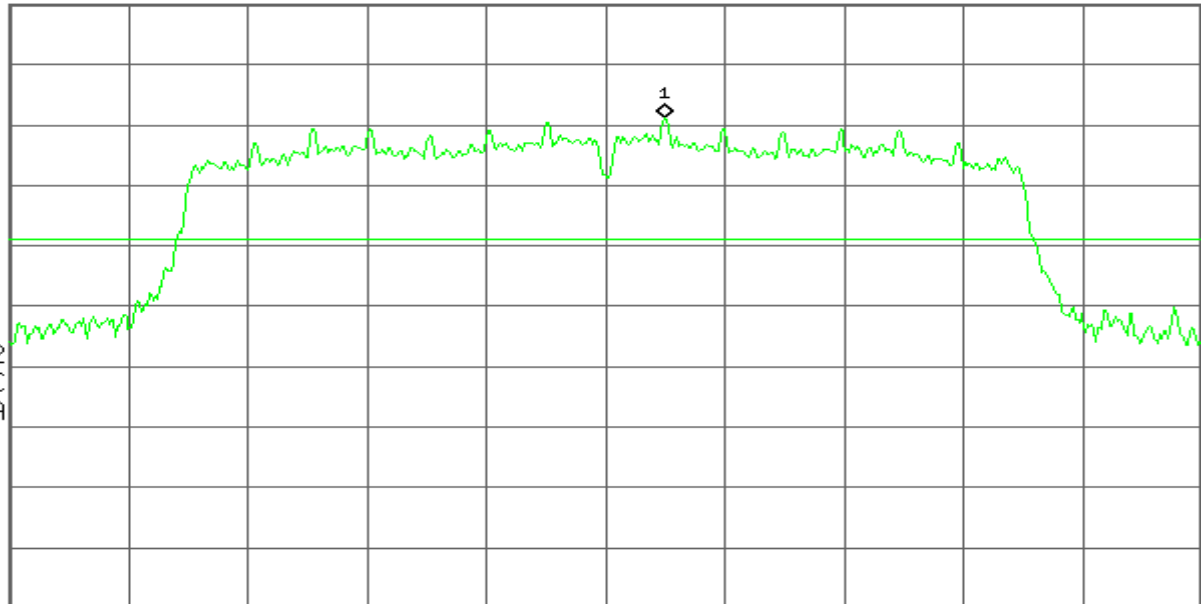
S3 FC

AA

$\mathcal{E}(f)$:

FTun

Swp



Center 2.437 000 GHz

#Res BW 100 kHz

#VBW 300 kHz

Span 25.42 MHz
Sweep 2.44 ms (601 pts)

 **Agilent**

R T

Mkr1 456.0 MHz
-31.51 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-18.9

dBm

LgAv

M1 S2

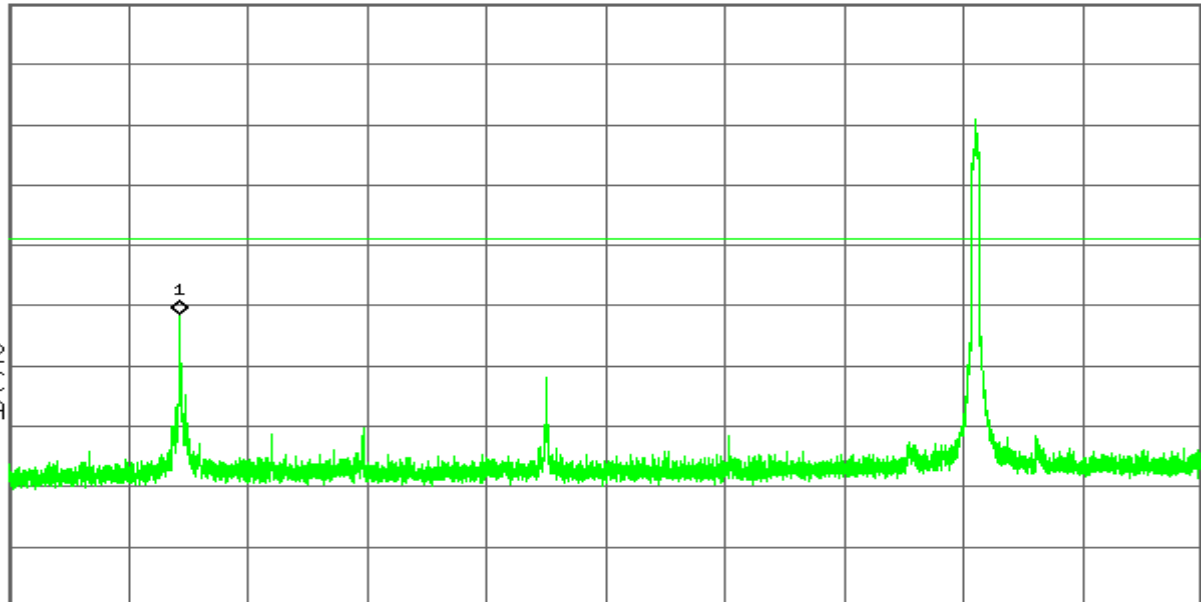
S3 FC

AA

$\mathcal{E}(f)$:

FTun

Swp



Start 30.00 MHz

#Res BW 100 kHz

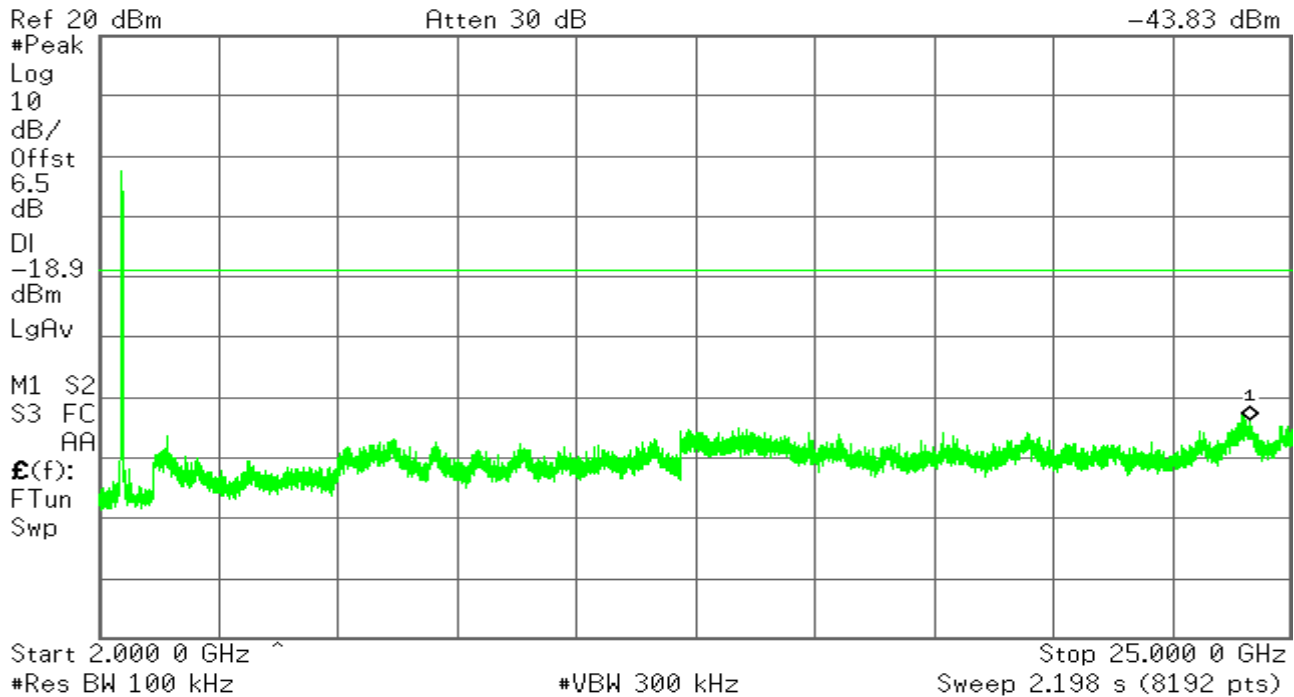
#VBW 300 kHz

Stop 3.000 00 GHz
Sweep 284 ms (8192 pts)

 **Agilent**

R T

Mkr1 24.196 9 GHz
-43.83 dBm

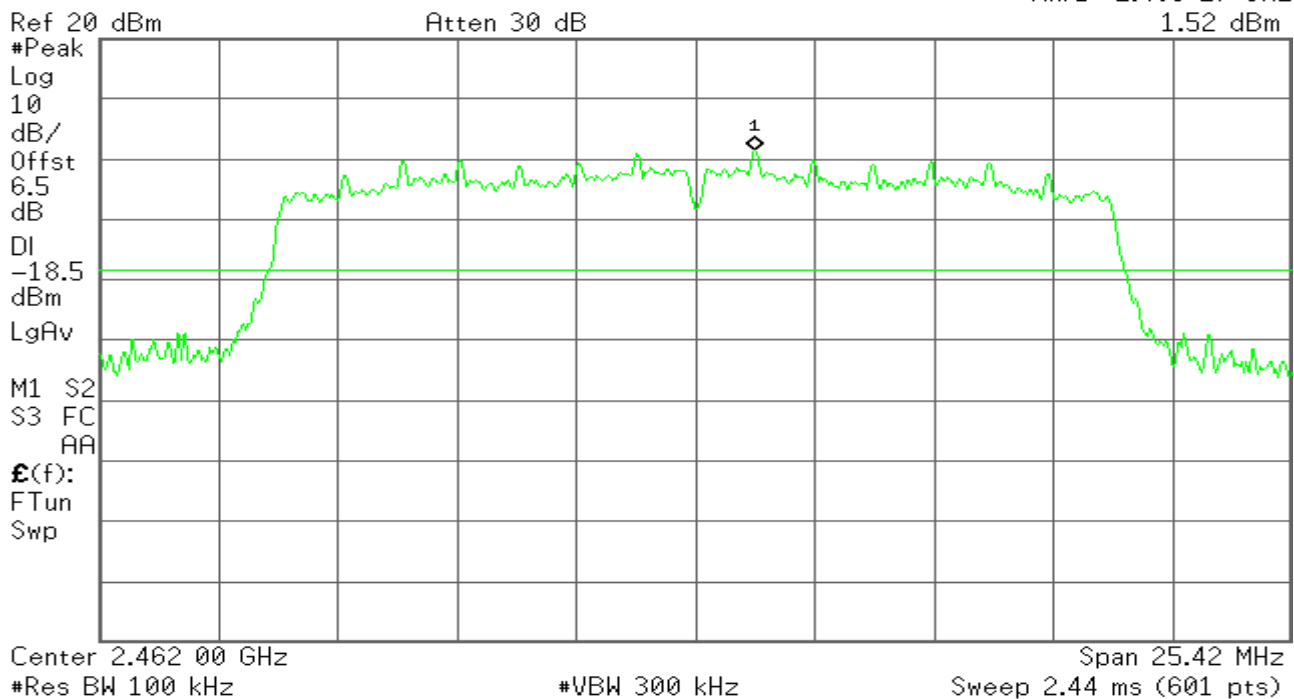


CH High

 **Agilent**

R T

Mkr1 2.463 27 GHz
1.52 dBm



Agilent

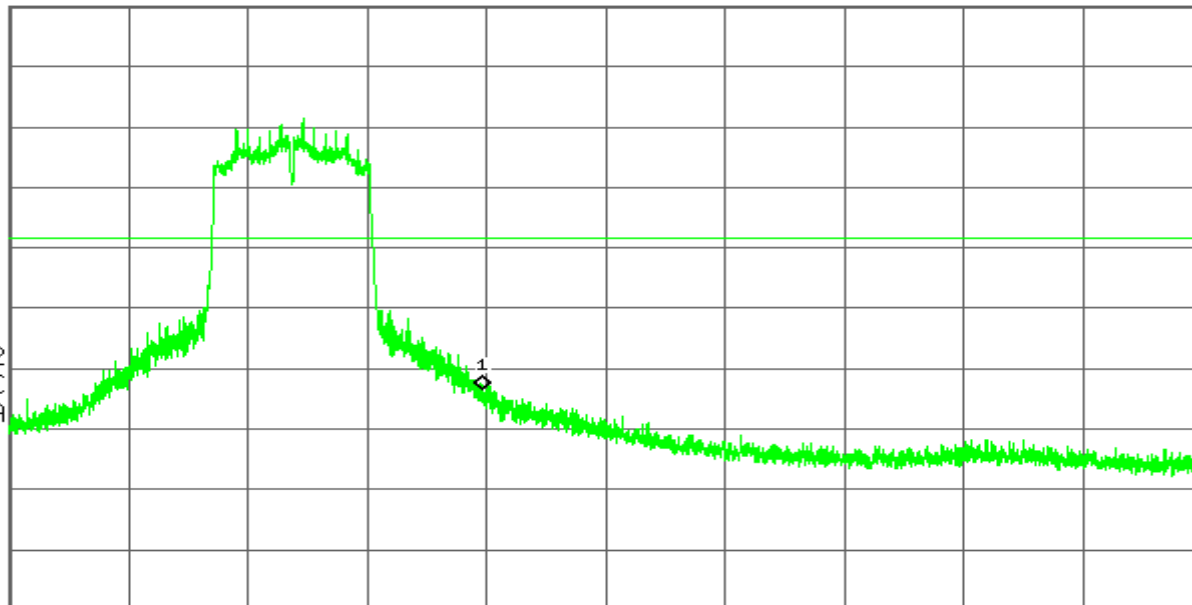
R T

Mkr1 2.483 500 GHz
-43.44 dBm

Ref 20 dBm

Atten 30 dB

#Peak
Log
10
dB/
Offst
6.5
dB
DI
-18.5
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp



Start 2.430 000 GHz

Stop 2.565 000 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 13.11 ms (8192 pts)

Agilent

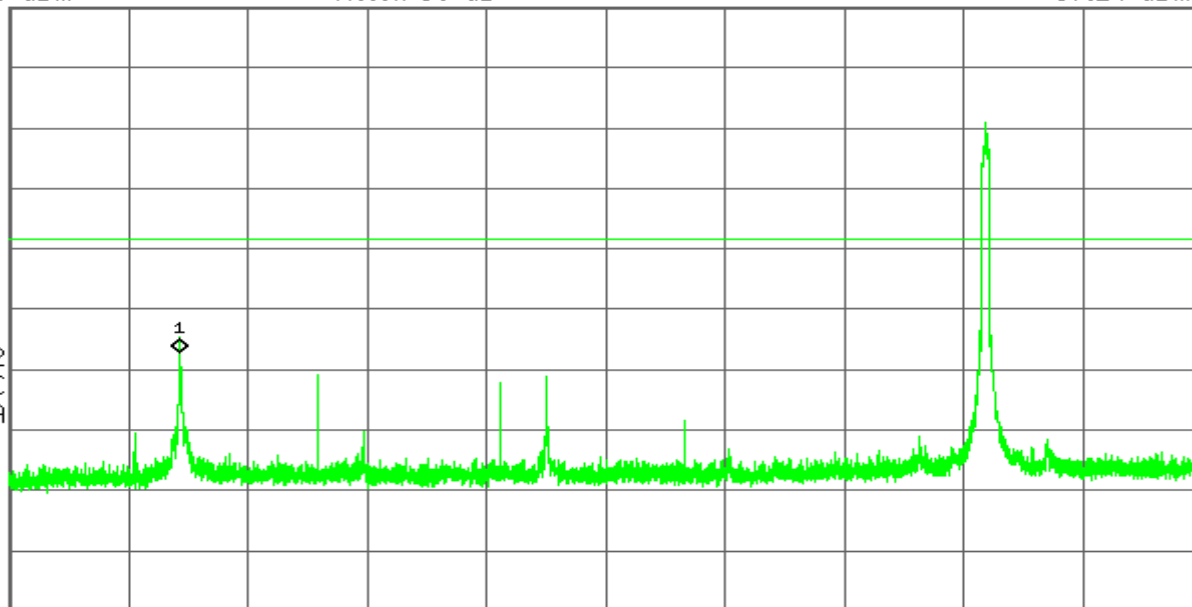
R T

Mkr1 455.3 MHz
-37.24 dBm

Ref 20 dBm

Atten 30 dB

#Peak
Log
10
dB/
Offst
6.5
dB
DI
-18.5
dBm
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp



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 23.924 6 GHz
-42.69 dBm

Ref 20 dBm

Atten 30 dB

#Peak

Log

10

dB/

Offst

6.5

dB

DI

-18.5

dBm

LgAv

M1 S2

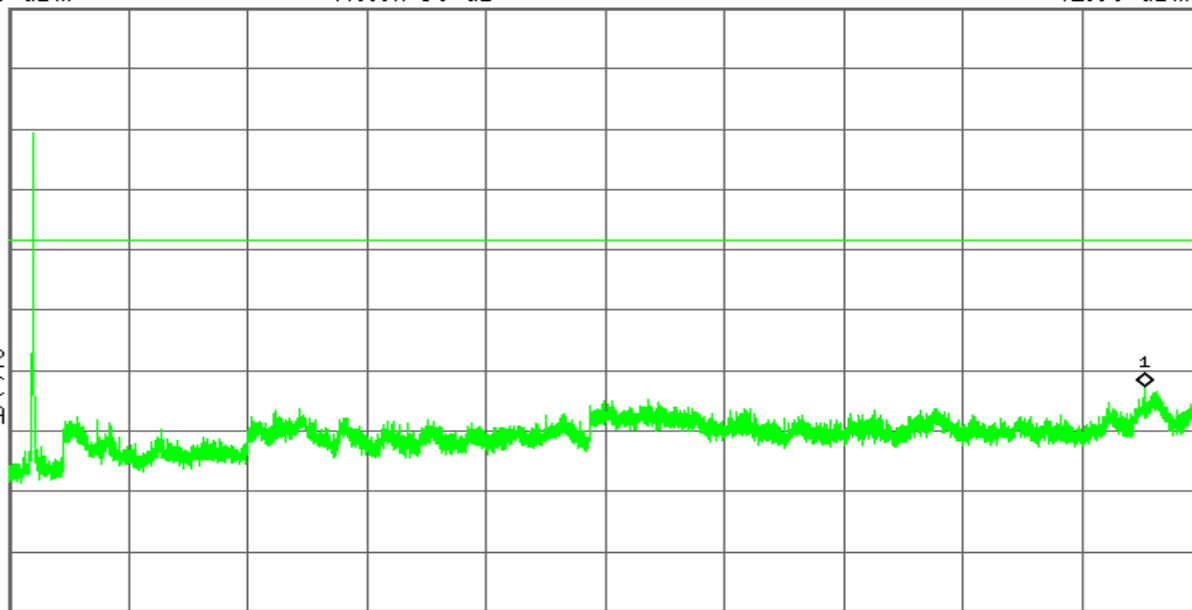
S3 FC

AA

$\mathcal{E}(f)$:

FTun

Swp



Start 2.000 0 GHz

#VBW 300 kHz

Stop 25.000 0 GHz

#Res BW 100 kHz

Sweep 2.198 s (8192 pts)

7.5.RADIATED EMISSIONS

LIMIT

Radiated emissions from 9 kHz to 25 GHz were measured according to the methods defines in ANSI C63.10-2013. The EUT was placed above the ground plane, 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

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:

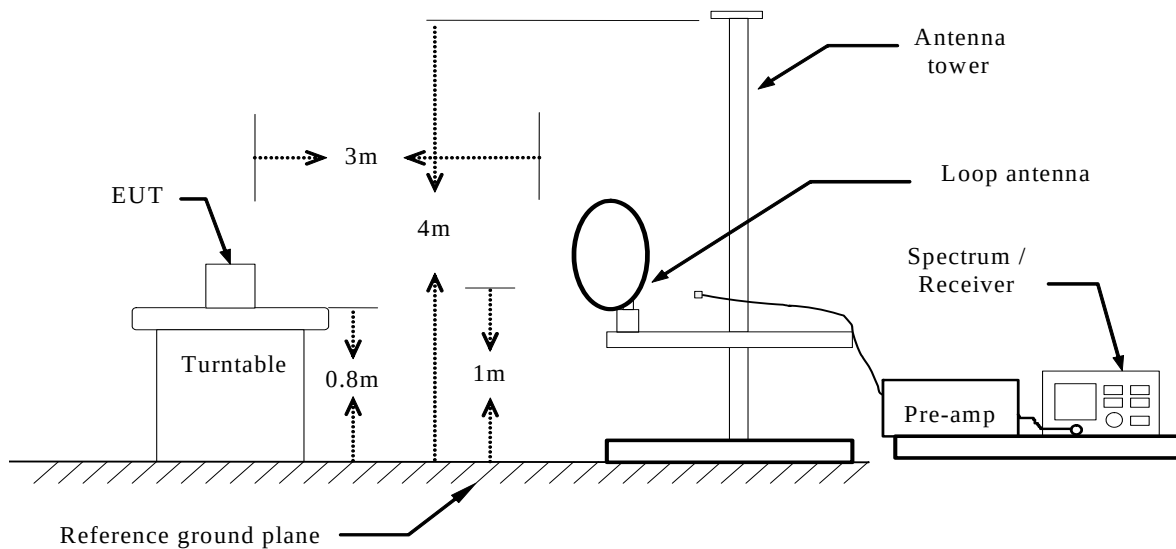
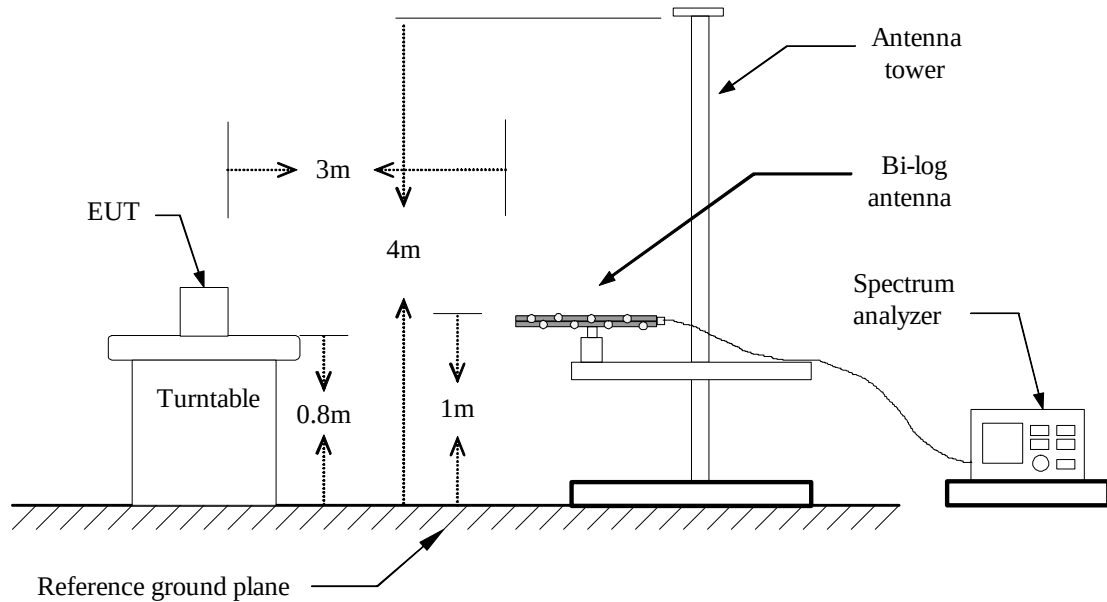
FREQUENCIES(MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE(meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

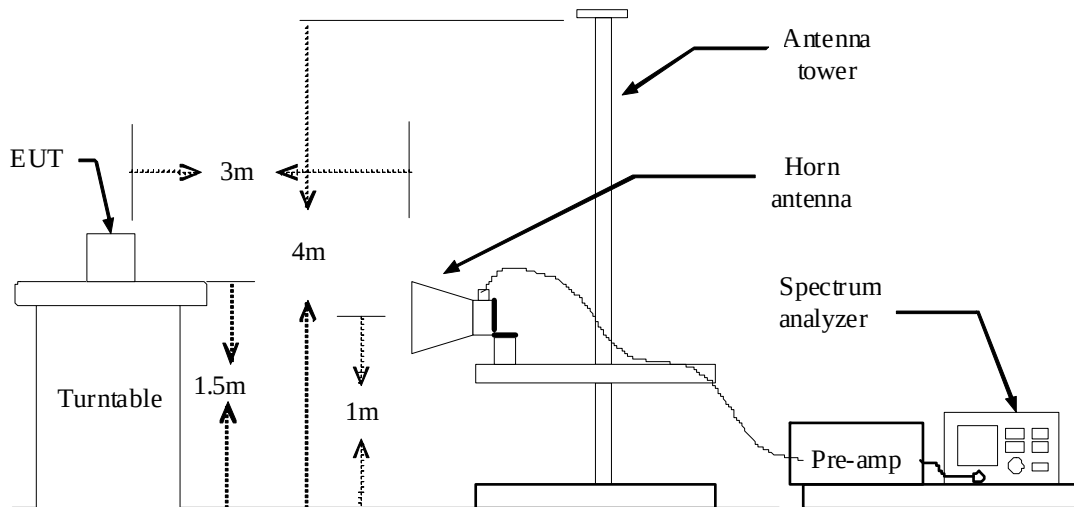
Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of 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 (μ V/m at 3-meter)	Field Strength (dB μ 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:

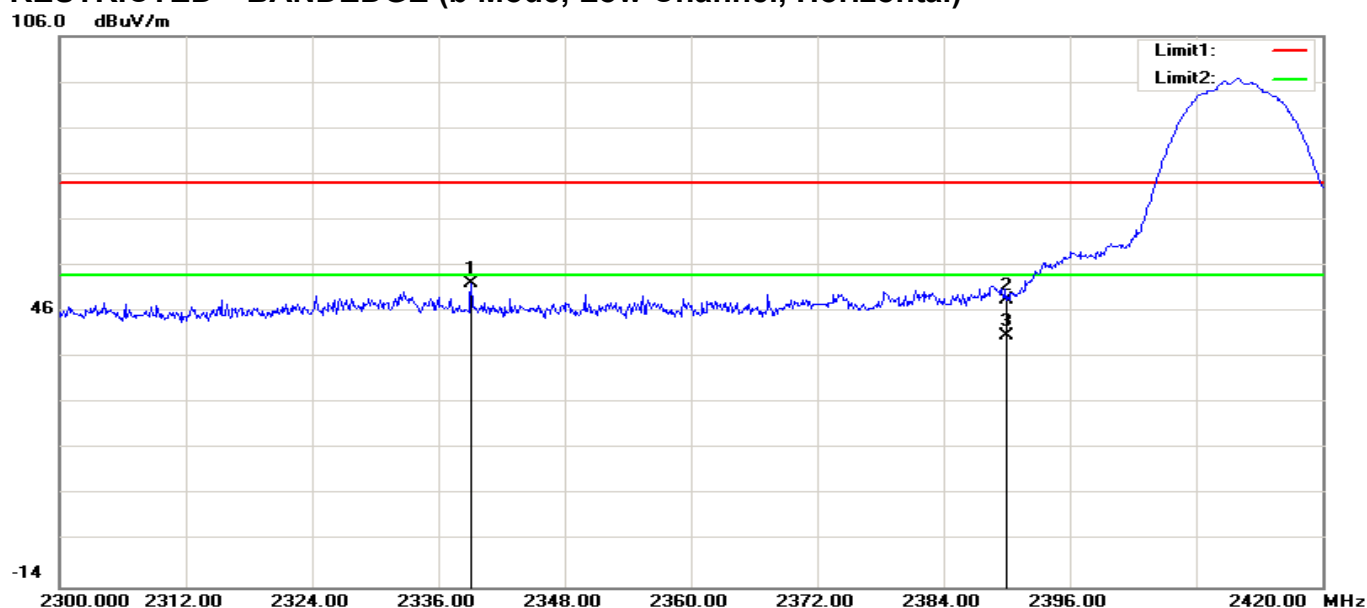
PEAK: RBW=VBW=1MHz / Sweep=AUTO, PEAK DETECTOR

AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO, PEAK DETECTOR

7. Repeat above procedures until the measurements for all frequencies are complete.

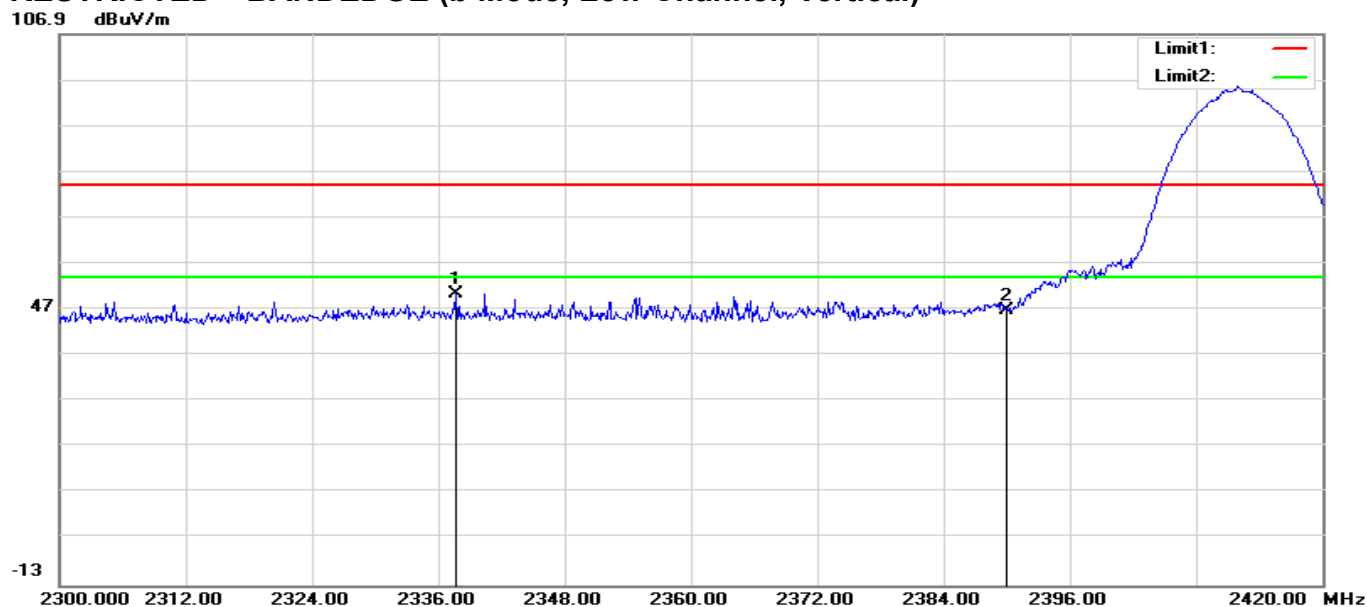
TEST RESULTS

RESTRICTED BANDEDGE (b Mode, Low Channel, Horizontal)

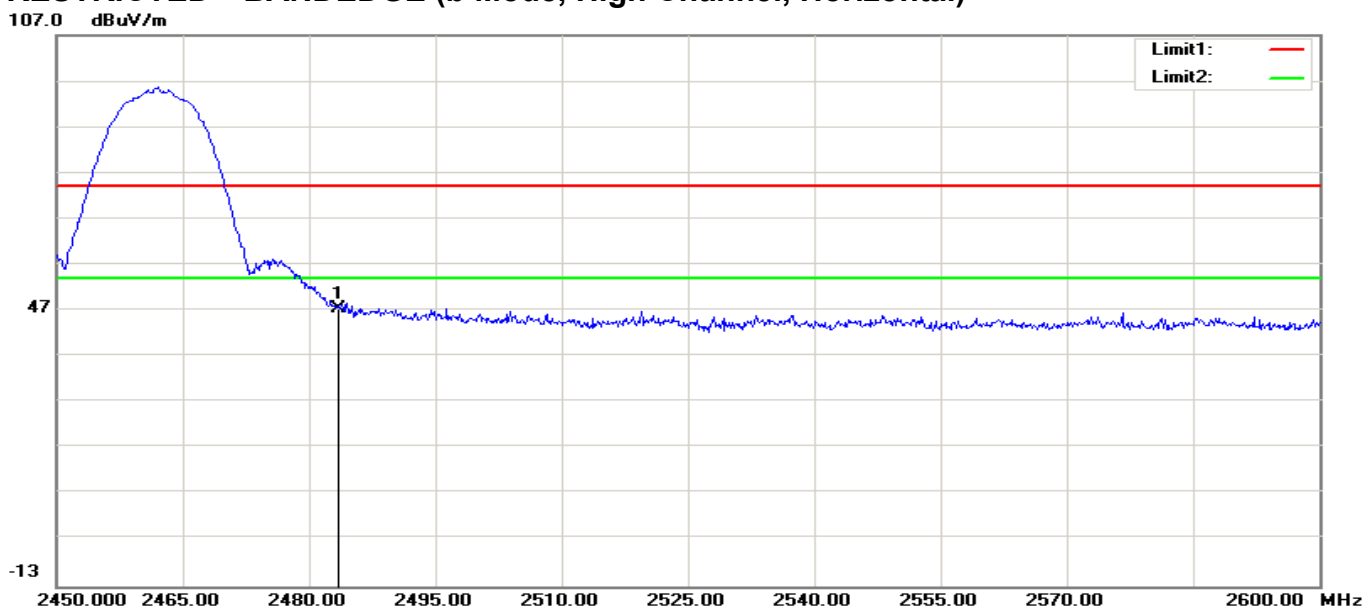


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2339.120	55.97	-3.91	52.06	74.00	-21.94	100	239	peak
2	2390.000	52.42	-3.78	48.64	74.00	-25.36	100	234	peak
3	2390.000	44.51	-3.78	40.73	54.00	-13.27	103	237	AVG

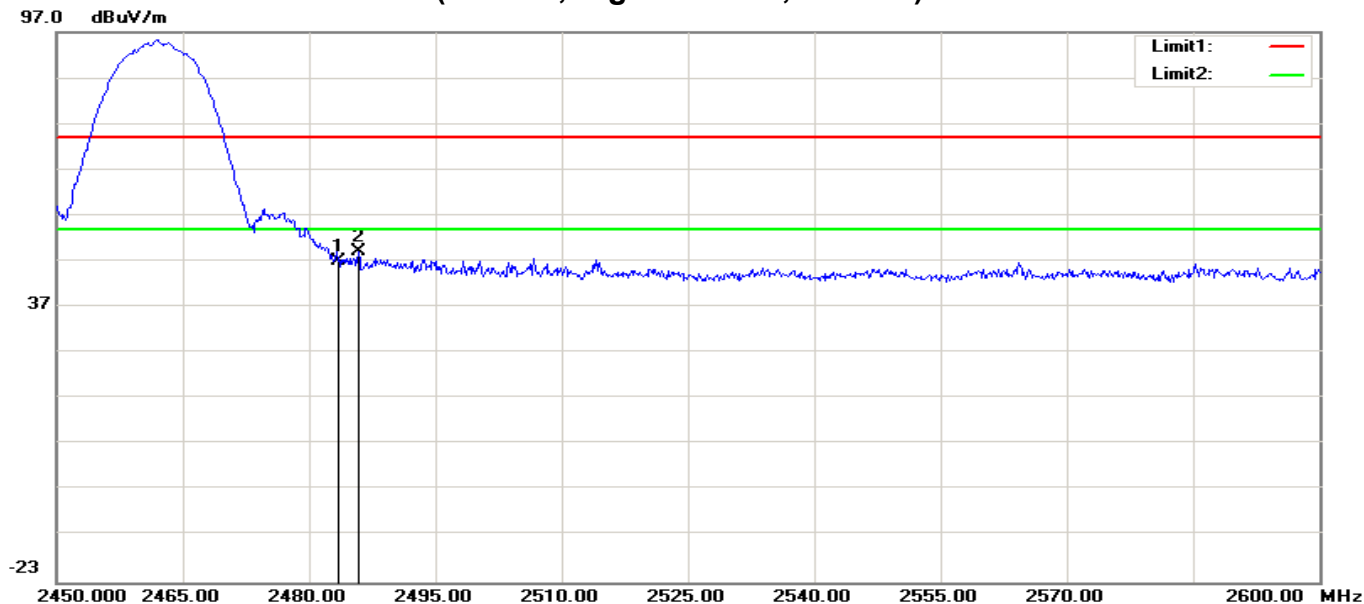
RESTRICTED BANDEDGE (b Mode, Low Channel, Vertical)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2337.680	54.41	-3.91	50.50	74.00	-23.50	100	215	peak
2	2390.000	50.68	-3.78	46.90	74.00	-27.10	100	2	peak

RESTRICTED BANDEDGE (b Mode, High Channel, Horizontal)

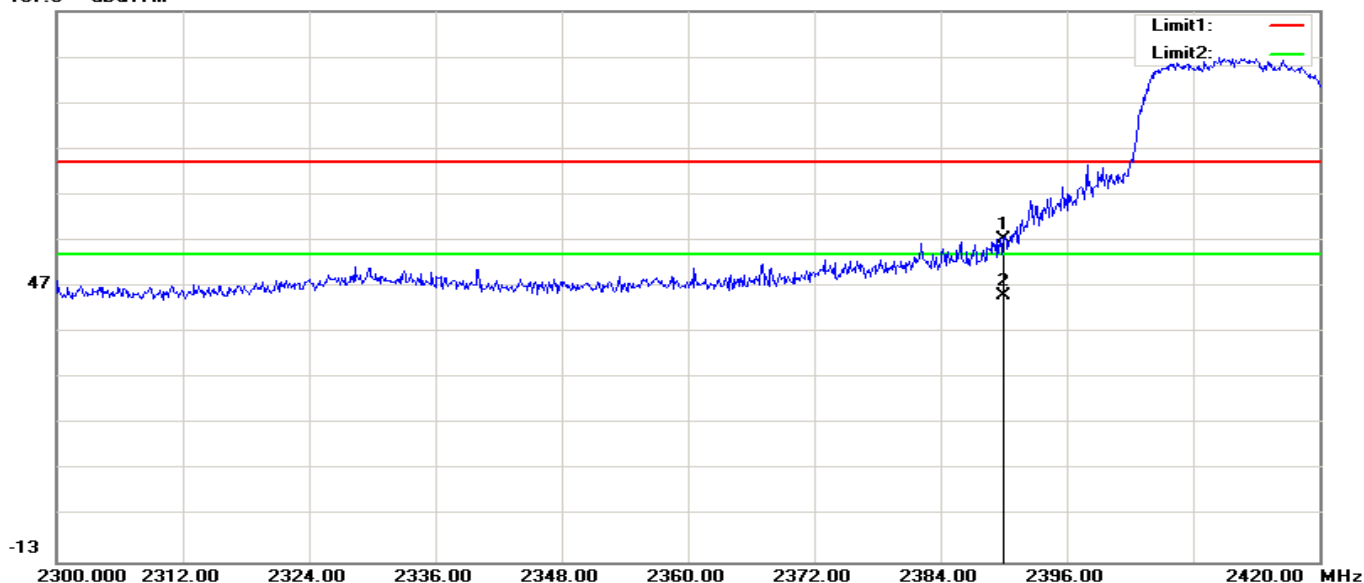
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2483.500	50.94	-3.56	47.38	74.00	-26.62	100	297	peak

RESTRICTED BANDEDGE (b Mode, 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	50.51	-3.56	46.95	74.00	-27.05	100	38	peak
2	2485.850	52.55	-3.55	49.00	74.00	-25.00	100	236	peak

RESTRICTED BANDEDGE (g Mode, Low Channel, Horizontal)

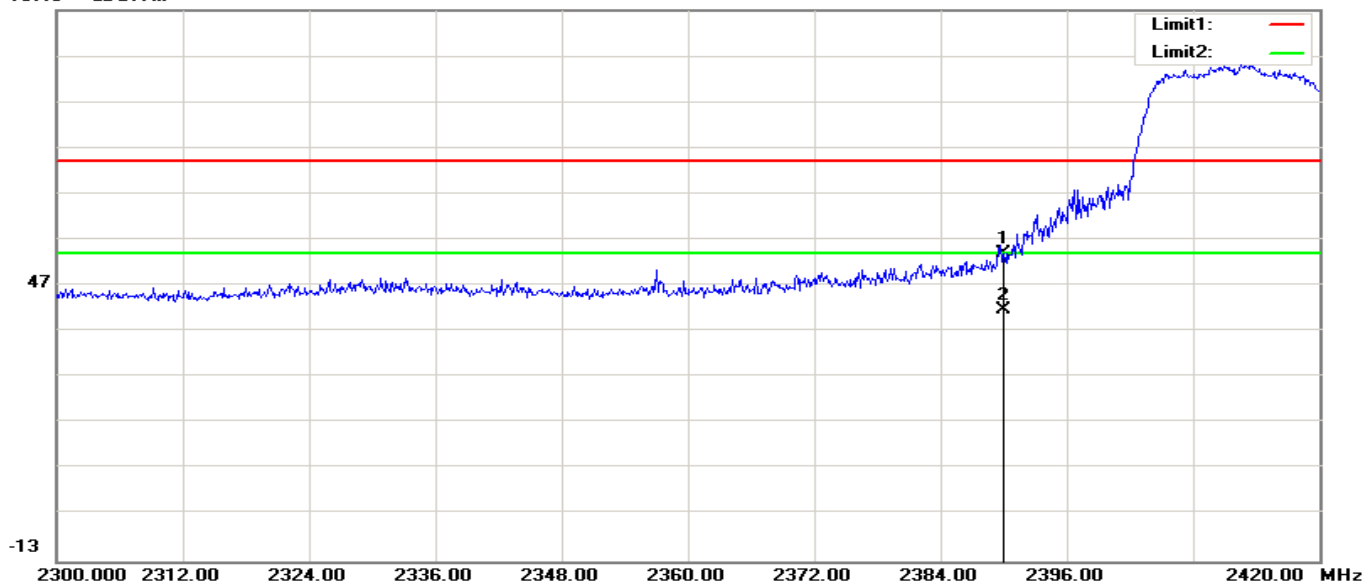
107.0 dBuV/m



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	61.17	-3.78	57.39	74.00	-16.61	100	241	peak
2	2390.000	48.78	-3.78	45.00	54.00	-9.00	104	361	AVG

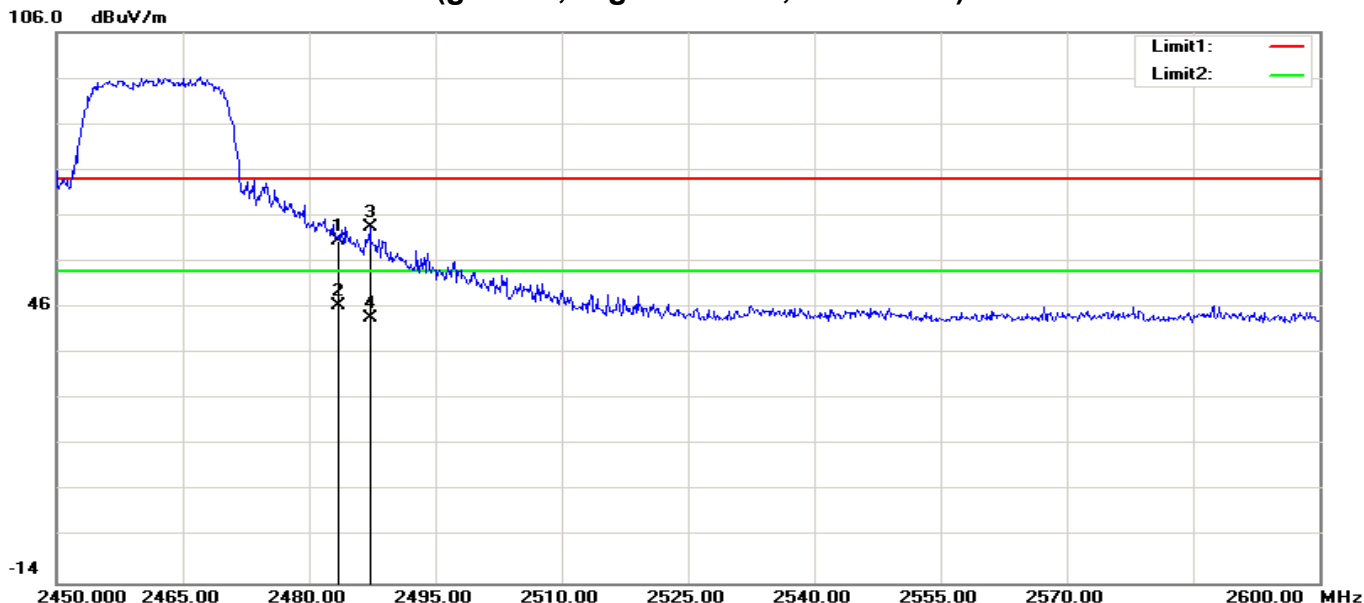
RESTRICTED BANDEDGE (g Mode, Low Channel, Vertical)

107.0 dBuV/m



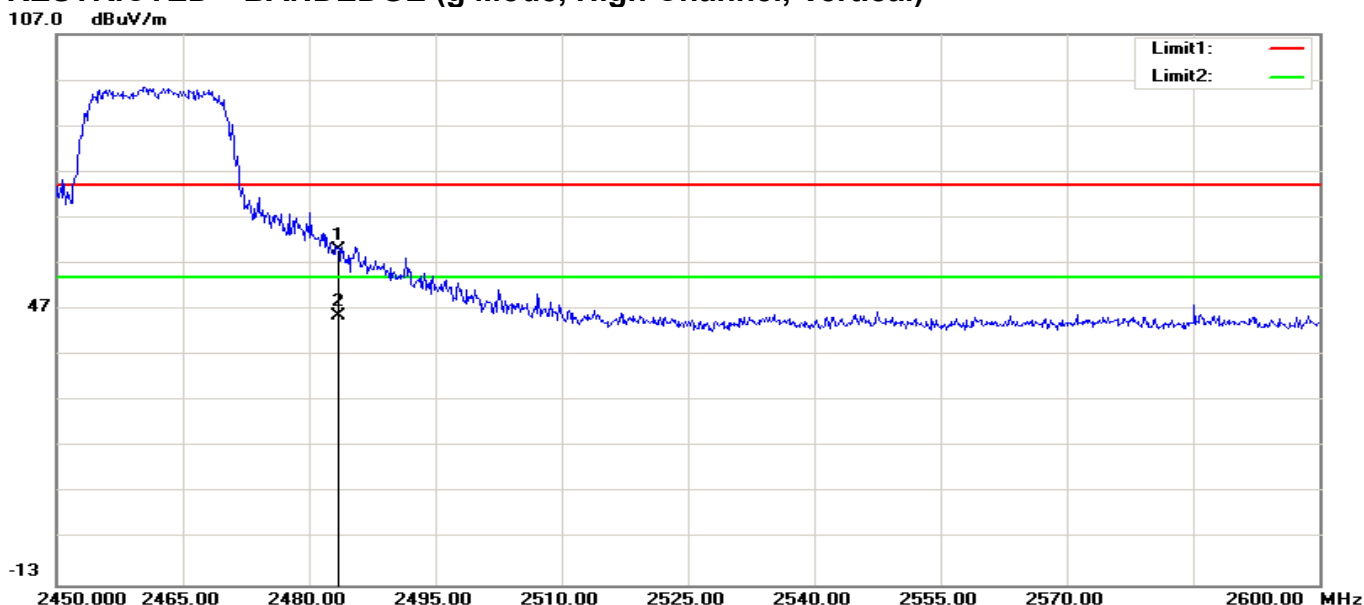
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2390.000	57.80	-3.78	54.02	74.00	-19.98	100	305	peak
2	2390.000	45.54	-3.78	41.76	54.00	-12.24	98	363	AVG

RESTRICTED BANDEDGE (g 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	64.15	-3.56	60.59	74.00	-13.41	100	360	peak
2	2483.500	50.08	-3.56	46.52	54.00	-7.48	100	360	AVG
3	2487.200	67.09	-3.55	63.54	74.00	-10.46	100	204	peak
4	2487.200	47.17	-3.55	43.62	54.00	-10.38	100	204	AVG

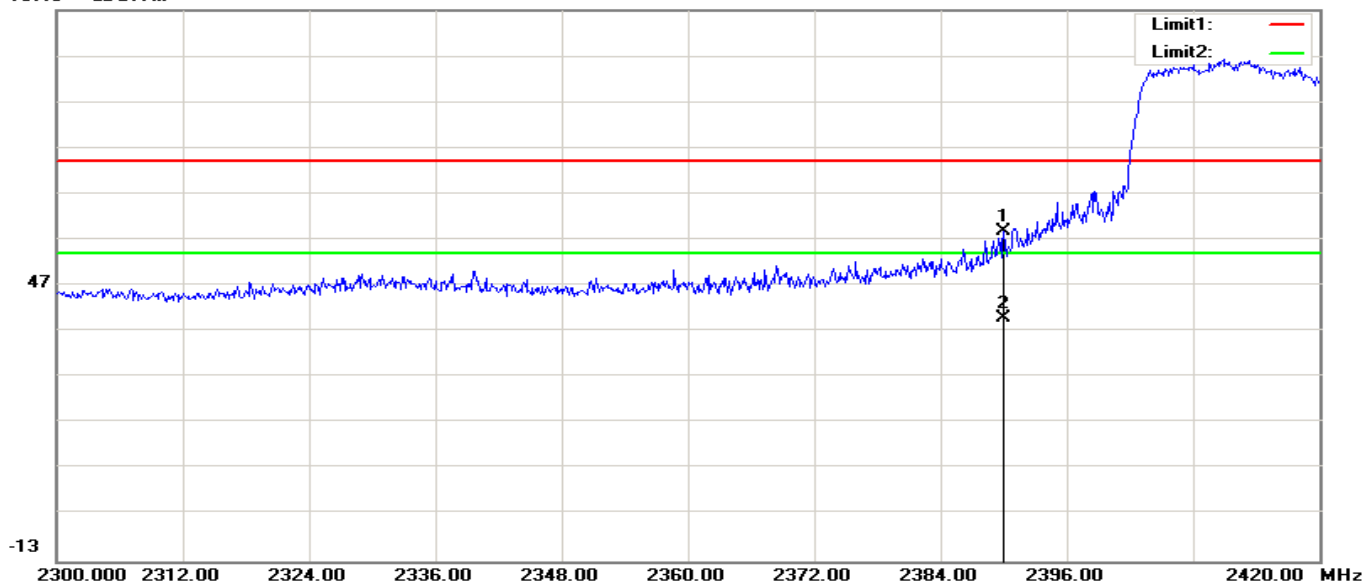
RESTRICTED BANDEDGE (g Mode, High Channel, Vertical)



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	63.49	-3.56	59.93	74.00	-14.07	100	38	peak
2	2483.500	49.16	-3.56	45.60	54.00	-8.40	100	38	AVG

RESTRICTED BANDEDGE (IEEE 802.11n HT20 mode, Low Channel, Horizontal)

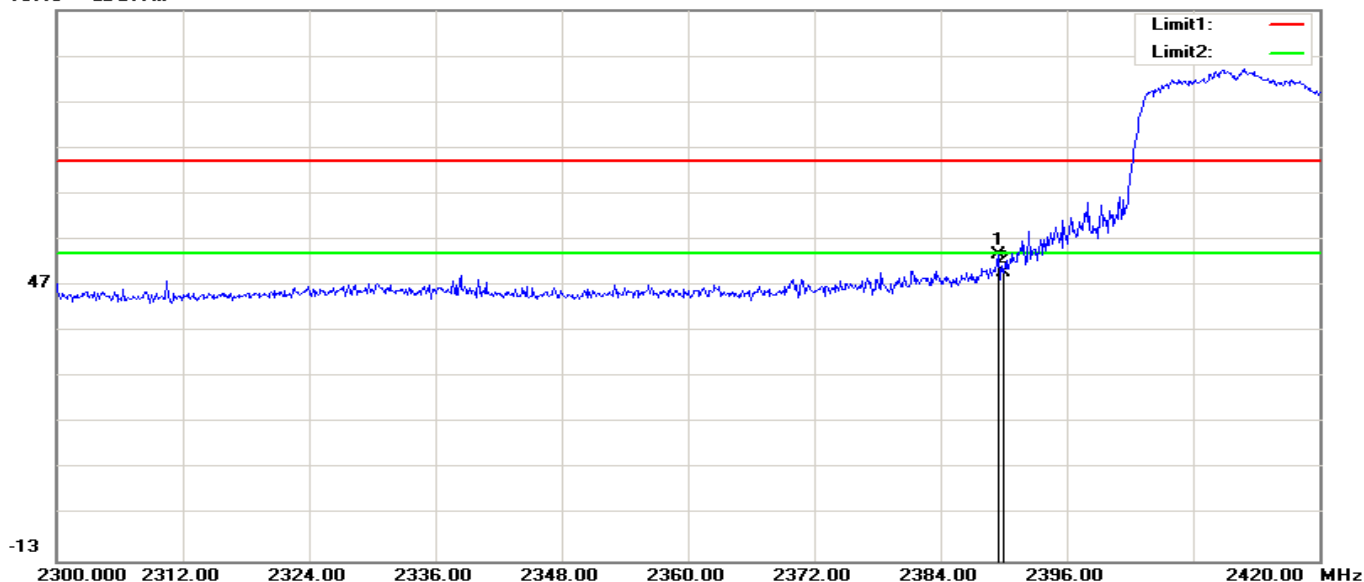
107.0 dBuV/m



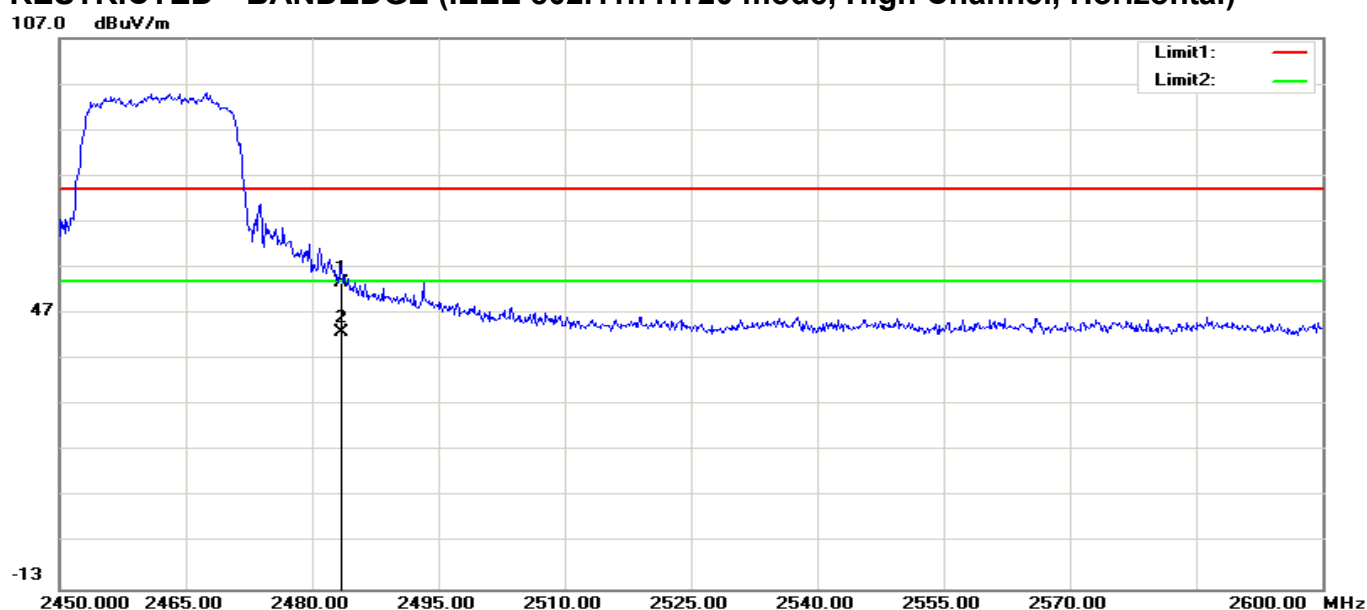
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2390.000	62.63	-3.78	58.85	74.00	-15.15	100	130	peak
2	2390.000	43.85	-3.78	40.07	54.00	-13.93	100	130	AVG

RESTRICTED BANDEDGE (IEEE 802.11n HT20 mode, Low Channel, Vertical)

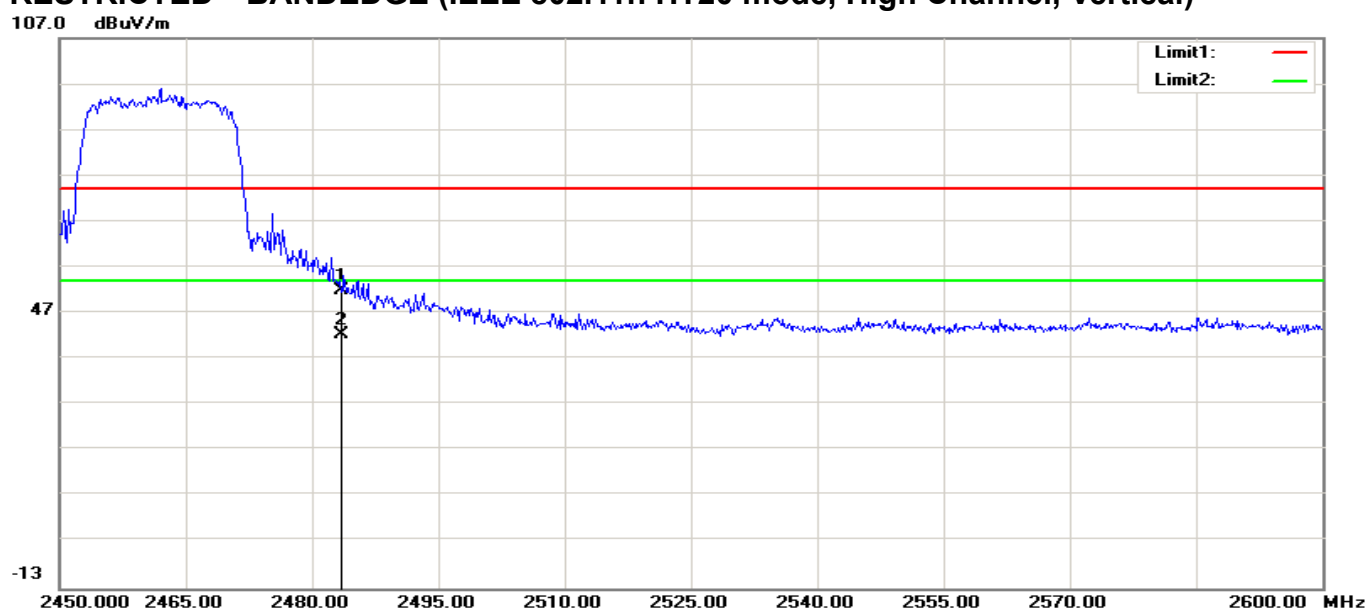
107.0 dBuV/m



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	2389.520	57.56	-3.79	53.77	74.00	-20.23	100	307	peak
2	2390.000	53.76	-3.78	49.98	74.00	-24.02	100	307	peak

RESTRICTED BANDEDGE (IEEE 802.11n HT20 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	57.32	-3.56	53.76	74.00	-20.24	100	213	peak
2	2483.500	46.36	-3.56	42.80	54.00	-11.20	100	213	AVG

RESTRICTED BANDEDGE (IEEE 802.11n HT20 mode, 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	55.64	-3.56	52.08	74.00	-21.92	100	37	peak
2	2483.500	46.02	-3.56	42.46	54.00	-11.54	100	37	AVG

Below 1GHz**Operation Mode:** Keeping TX**Test Date:** 2015-8-18**Temperature:** 24°C**Tested by:** James.Yan**Humidity:** 48% RH**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

Remark:

1. Measuring frequencies from 30 MHz to the 1GHz (No emission found between lowest internal used/generated frequency to 30 MH).
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. 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.
4. $\text{Margin (dB)} = \text{Result (dBuV/m)} - \text{Limit (dBuV/m)}$.

Above 1 GHz**Operation Mode:** TX / IEEE 802.11b / CH Low**Test Date:** 2015-8-18**Temperature:** 24°C**Tested by:** James.Yan**Humidity:** 48 % RH**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	52.52	3.76	56.28	74.00	-17.72	100	228	peak
2	4825.000	36.09	3.76	39.85	54.00	-14.15	100	228	AVG
3	7183.000	43.63	9.14	52.77	74.00	-21.23	100	337	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	56.79	3.76	60.55	74.00	-13.45	100	244	peak
2	4825.000	38.75	3.76	42.51	54.00	-11.49	100	244	AVG
3	7228.000	44.45	9.26	53.71	74.00	-20.29	100	170	peak
N/A									

Operation Mode: TX / IEEE 802.11b / CH Mid**Test Date:** 2015-8-18**Temperature:** 24°C**Tested by:** James.Yan**Humidity:** 48 % RH**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	4870.000	51.71	3.94	55.65	74.00	-18.35	100	185	peak
2	4870.000	34.33	3.94	38.27	54.00	-15.73	100	185	AVG
3	7192.000	43.71	9.17	52.88	74.00	-21.12	100	321	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	4870.000	56.32	3.94	60.26	74.00	-13.74	100	231	peak
2	4870.000	40.36	3.94	44.30	54.00	-9.70	100	231	AVG
3	7075.000	44.34	8.88	53.22	74.00	-20.78	100	35	peak
N/A									



Compliance Certification Services Inc.

Date of Issue :October 12, 2015

Report No: C150807R01-RPW

FCC ID:IPH-01545

Operation Mode: TX / IEEE 802.11b / CH High

Test Date: 2015-8-18

Temperature: 24°C

Tested by:James.Yan

Humidity: 48 % RH

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	51.30	4.16	55.46	74.00	-18.54	100	184	peak
2	4924.000	46.62	4.16	50.78	54.00	-3.22	100	184	AVG
3	7129.000	42.77	9.01	51.78	74.00	-22.22	100	8	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	4924.000	55.00	4.16	59.16	74.00	-14.84	100	250	peak
2	4924.000	46.70	4.16	50.86	54.00	-3.14	100	250	AVG
3	7228.000	44.01	9.26	53.27	74.00	-20.73	100	272	peak
N/A									

Operation Mode: TX / IEEE 802.11g / CH Low

Test Date: 2015-8-18

Temperature: 24°C

Tested by:James.Yan

Humidity: 48 % RH

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	49.22	3.76	52.98	74.00	-21.02	100	181	peak
2	7255.000	43.89	9.32	53.21	74.00	-20.79	100	168	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	53.23	3.76	56.99	74.00	-17.01	100	230	peak
2	4825.000	35.80	3.76	39.56	54.00	-14.44	100	230	AVG
3	7228.000	44.00	9.26	53.26	74.00	-20.74	100	126	peak
N/A									



Compliance Certification Services Inc.

Date of Issue :October 12, 2015

Report No: C150807R01-RPW

FCC ID:IPH-01545

Operation Mode: TX / IEEE 802.11g / CH Mid

Test Date: 2015-8-18

Temperature: 24°C

Tested by: James.Yan

Humidity: 48 % RH

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	4879.000	49.09	3.98	53.07	74.00	-20.93	100	297	peak
2	7237.000	43.20	9.28	52.48	74.00	-21.52	100	331	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	4870.000	52.49	3.94	56.43	74.00	-17.57	100	228	peak
2	4870.000	42.63	3.94	46.57	54.00	-7.43	100	228	AVG
3	7111.000	43.88	8.97	52.85	74.00	-21.15	100	150	peak
N/A									

Operation Mode: TX / IEEE 802.11g / CH High

Test Date: 2015-8-18

Temperature: 24°C

Tested by: James.Yan

Humidity: 48 % RH

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	49.89	4.16	54.05	74.00	-19.95	100	183	peak
2	4924.000	35.47	4.16	39.63	54.00	-14.37	100	183	AVG
3	7210.000	43.72	9.21	52.93	74.00	-21.07	100	354	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	4924.000	51.15	4.16	55.31	74.00	-18.69	100	294	peak
2	4924.000	34.43	4.16	38.59	54.00	-15.41	100	294	AVG
3	7219.000	43.04	9.23	52.27	74.00	-21.73	100	171	peak
N/A									



Compliance Certification Services Inc.

Date of Issue :October 12, 2015

Report No: C150807R01-RPW

FCC ID:IPH-01545

Operation Mode: TX / IEEE 802.11n HT20 mode / CH Low

Test Date: 2015-8-18

Temperature: 24°C

Tested by: James.Yan

Humidity: 48 % RH

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	47.41	3.76	51.17	74.00	-22.83	100	173	peak
2	7255.000	43.25	9.32	52.57	74.00	-21.43	100	69	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	52.47	3.76	56.23	74.00	-17.77	100	220	peak
2	4825.000	35.16	3.76	38.92	54.00	-15.08	100	220	AVG
3	7237.000	43.88	9.28	53.16	74.00	-20.84	100	351	peak
N/A									

Operation Mode: TX / IEEE 802.11n HT20 mode / CH Mid

Test Date: 2015-8-18

Temperature: 24°C

Tested by: James.Yan

Humidity: 48 % RH

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	4870.000	47.24	3.94	51.18	74.00	-22.82	100	185	peak
2	7228.000	43.44	9.26	52.70	74.00	-21.30	100	337	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	4879.000	54.20	3.98	58.18	74.00	-15.82	100	228	peak
2	4879.000	35.99	3.98	39.97	54.00	-14.03	100	228	AVG
3	7201.000	43.98	9.19	53.17	74.00	-20.83	100	69	peak
N/A									



Compliance Certification Services Inc.

Date of Issue :October 12, 2015

Report No: C150807R01-RPW

FCC ID:IPH-01545

Operation Mode: TX / IEEE 802.11n HT20 mode / CH High **Test Date:** 2015-8-18

Temperature: 24°C

Tested by:James.Yan

Humidity: 48 % RH

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	4915.000	47.65	4.13	51.78	74.00	-22.22	100	187	peak
2	7156.000	43.78	9.08	52.86	74.00	-21.14	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	4924.000	52.15	4.16	56.31	74.00	-17.69	100	230	peak
2	4924.000	34.43	4.16	38.59	54.00	-15.41	100	230	AVG
3	7201.000	43.56	9.19	52.75	74.00	-21.25	100	1	peak
N/A									

7.6.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

* Decreases with the logarithm of the frequency.

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.

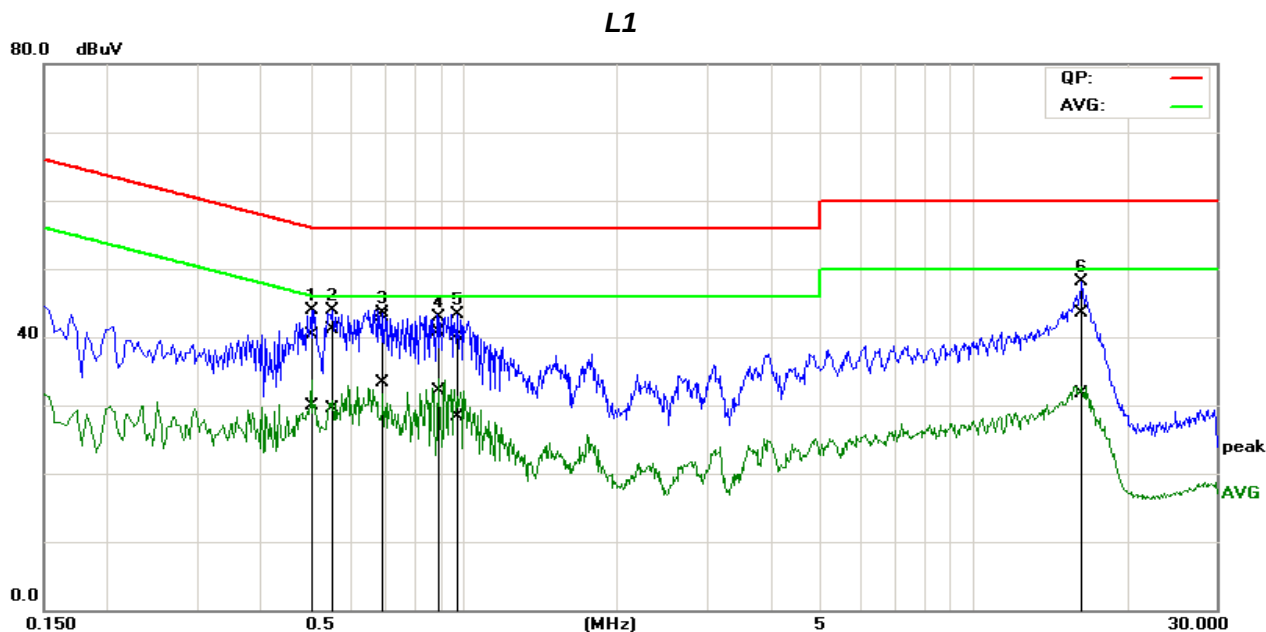
TEST RESULTS

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:

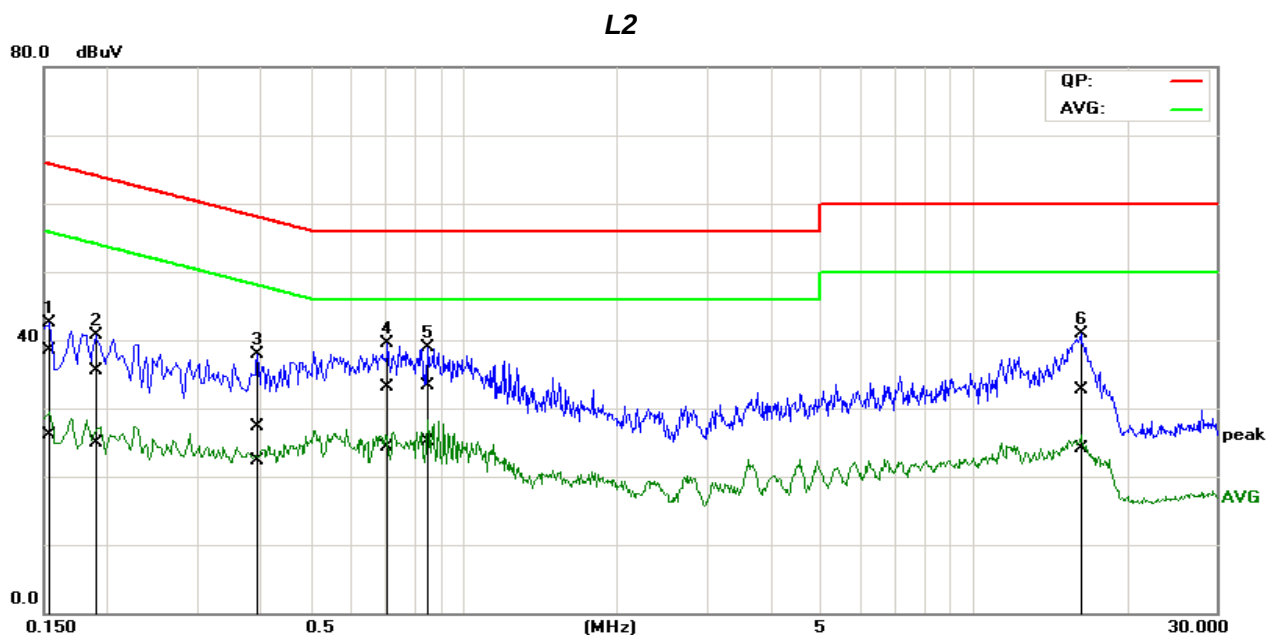


No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1	0.5012	20.50	10.05	19.83	40.33	29.88	56.00	46.00	-15.67	-16.12	Pass
2	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
 Model: A1545
 Standard: FCC Class B
 Test item: Conduction test
 Line: L2
 Model:

Date: 2015-8-18
 Time: 9:36:59
 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	0.1524	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

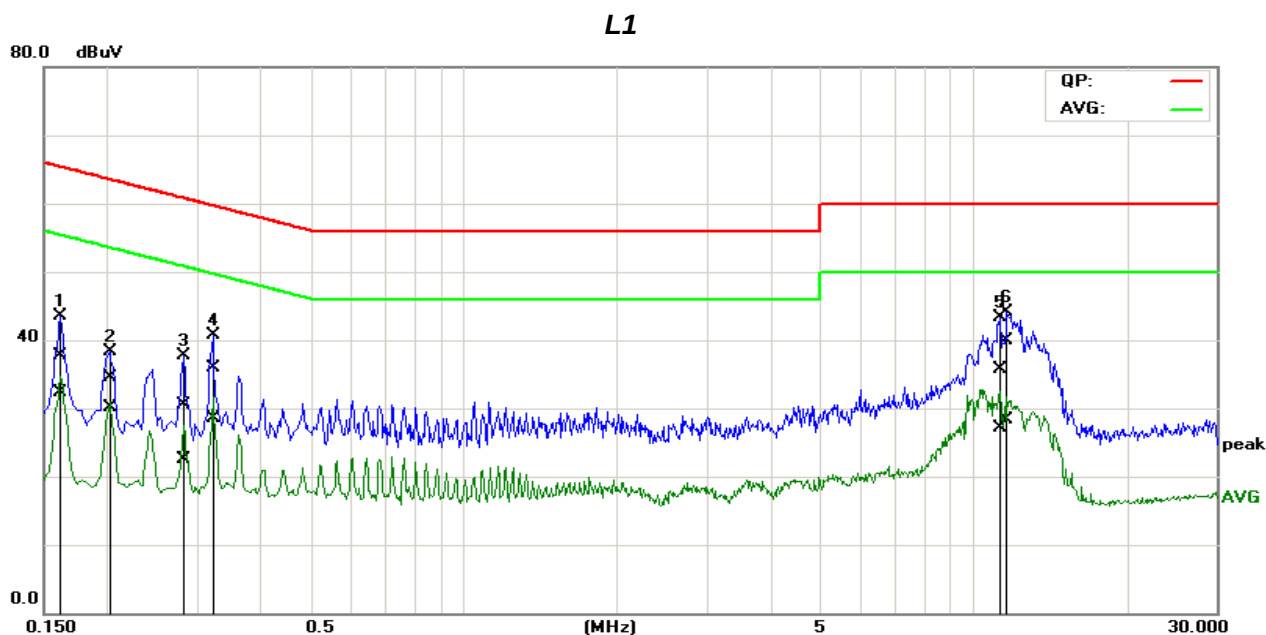
Note: 1. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line).

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:

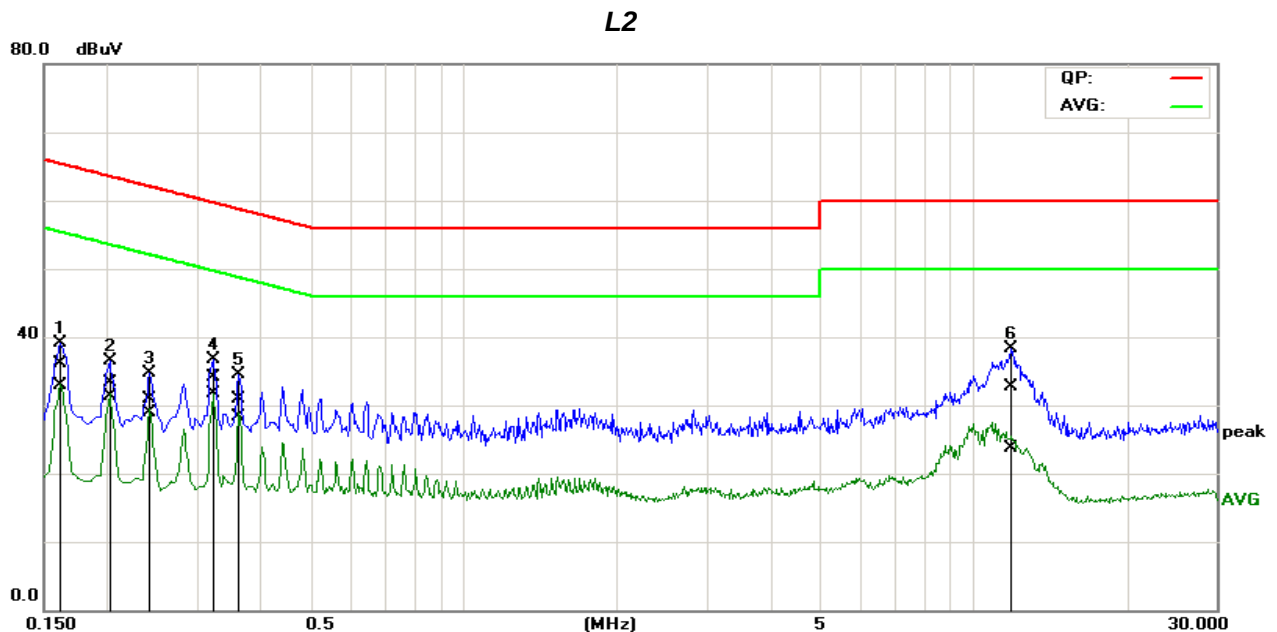


No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1	0.1603	17.89	12.57	19.77	37.66	32.34	65.45	55.45	-27.79	-23.11	Pass
2	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
 Model: A1545
 Standard: FCC Class B
 Test item: Conduction test
 Line: L2
 Model:

Date: 2015-10-12
 Time: 10:14:37
 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	0.1615	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:

- The measuring frequencies range between 0.15 MHz and 30 MHz.
- 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.
- "—" denotes the emission level was or more than 2dB below the Average limit, and no re-check was made.
- 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