

FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Stream

Model:

7610 Dual pH/ORP/ION, 7620 Dual EC, 7630 Dual DO, 7650 Dual
pH/ORP/ION/EC/DO, 6610 pH/ORP/ION/EC, 6620 pH/ORP/ION/DO, 6630
EC/DO, 5610 pH/ORP, 5620 EC 5630 DO

Trade Name: JENCO

Issued to

Jenco Electronics, Ltd
4F.,No.80,Sonde Rd., Xinyi Dist., Taipei City 110, Taiwan

Issued by

Compliance Certification Services Inc.
No.11, Wugong 6th Rd., Wugu Dist.,
New Taipei City 24891, Taiwan. (R.O.C.)
<http://www.ccsrf.com>
service@ccsrf.com
Issued Date: August 29, 2016



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Revision History

Rev.		Issue Date		Revisions	Effect Page	Revised By
00		August 29, 2016		Initial Issue	ALL	Becca Chen
01		April 7, 2017		Revise radiated emissions	P.63-82	Angel Cheng

TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION.....	4
2. EUT DESCRIPTION	5
3. TEST METHODOLOGY	6
3.1 EUT CONFIGURATION	6
3.2 EUT EXERCISE	6
3.3 GENERAL TEST PROCEDURES	6
3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS.....	7
3.5 DESCRIPTION OF TEST MODES	8
4. INSTRUMENT CALIBRATION.....	9
4.1 MEASURING INSTRUMENT CALIBRATION.....	9
4.2 MEASUREMENT EQUIPMENT USED.....	9
4.3 MEASUREMENT UNCERTAINTY	10
5. FACILITIES AND ACCREDITATIONS.....	11
5.1 FACILITIES	11
5.2 EQUIPMENT	11
5.3 LABORATORY ACCREDITATIONS AND LISTING	11
5.4 TABLE OF ACCREDITATIONS AND LISTINGS	12
6. SETUP OF EQUIPMENT UNDER TEST	13
6.1 SETUP CONFIGURATION OF EUT.....	13
6.2 SUPPORT EQUIPMENT	13
7. FCC PART 15.247 REQUIREMENTS	14
7.1 6DB BANDWIDTH.....	14
7.2 PEAK POWER	22
7.3 AVERAGE POWER	24
7.4 BAND EDGES MEASUREMENT	26
7.5 PEAK POWER SPECTRAL DENSITY	52
7.6 RADIATED EMISSIONS	60
7.7 POWERLINE CONDUCTED EMISSIONS.....	83
APPENDIX II PHOTOGRAPHS OF TEST SETUP	86

1. TEST RESULT CERTIFICATION

Applicant: Jenco Electronics, Ltd
4F.,No.80,Sonde Rd., Xinyi Dist., Taipei City 110, Taiwan

Equipment Under Test: Stream

Model Number: 7610 Dual pH/ORP/ION, 7620 Dual EC, 7630 Dual DO, 7650 Dual pH/ORP/ION/EC/DO, 6610 pH/ORP/ION/EC, 6620 pH/ORP/ION/DO, 6630 EC/DO, 5610 pH/ORP, 5620 EC 5630 DO

Trade Name: JENCO

Date of Test: August 21, 2016 ~ April 6, 2017

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

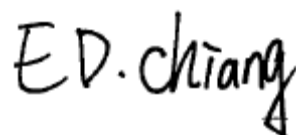
We hereby certify that:

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:

Tested by:



Sam Chuang
Manager
Compliance Certification Services Inc.

Ed Chiang
Engineer
Compliance Certification Services Inc.

2. EUT DESCRIPTION

Product	Stream			
Model Number	7610 Dual pH/ORP/ION, 7620 Dual EC, 7630 Dual DO, 7650 Dual pH/ORP/ION/EC/DO, 6610 pH/ORP/ION/EC, 6620 pH/ORP/ION/DO, 6630 EC/DO, 5610 pH/ORP, 5620 EC 5630 DO			
Trade Name	JENCO			
Model Discrepancy	Difference of the model numbers (list on this report) are just for marketing purpose only and please see as below:			
	Model number	pH/ORP	EC	DO
	7610 Dual pH/ORP/ION	N/A	N/A	N/A
	7650 Dual pH/ORP/ION/EC/DO	N/A	2	2
	7630 Dual DO	N/A	N/A	2
	7620 Dual EC	N/A	2	N/A
	6630 EC/DO	N/A	1	1
	6620 pH/ORP/ION/DO	N/A	N/A	1
	6610 pH/ORP/ION/EC	N/A	1	N/A
	5630 DO	N/A	N/A	1
	5620 EC	N/A	1	N/A
	5610 pH/ORP	1	N/A	N/A
Received Date	May 18, 2016			
EUT Power Rating	Powered from AC Adapter GVE / GM36-120300-1 I/P: 100-240Vac, 50/60Hz, 1.0A O/P: 12Vdc, 3.0A			
Frequency Range	IEEE 802.11b/g/ IEEE 802.11n HT 20 MHz Mode: 2412 ~ 2462 MHz			
Transmit Power	Mode	Frequency Range	Output Power (dBm)	Output Power (W)
	IEEE 802.11b	2412 - 2462	20.39	0.1094
	IEEE 802.11g	2412 - 2462	22.33	0.1710
	IEEE 802.11n HT 20 MHz	2412 - 2462	22.10	0.1622
Number of Channels	IEEE 802.11b/g mode: 11 Channels IEEE 802.11n HT 20 MHz mode: 11 Channels			
Antenna Specification	PIFA Antenna / 4 dBi			

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: 2AJSFARC7610** filing to comply with FCC Part 15C, Section 15.207, 15.209.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 Part 15.207, 15.209, 15.247, KDB 558074 D01 DTS Meas Guidance v03r05.

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

According to the requirements in 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

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 ANSI C63.10: 2013.

3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

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

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

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

² Above 38.6

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

3.5 DESCRIPTION OF TEST MODES

The EUT (model: 7610 Dual pH/ORP/ION) had been tested under operating condition.

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

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

IEEE 802.11b mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 1Mbps data rate were chosen for full testing.

IEEE 802.11g mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 6Mbps data rate were chosen for full testing.

IEEE 802.11n HT 20 MHz mode:

Channel Low (2412MHz), Channel Mid (2437MHz) and Channel High (2462MHz) with 6.5Mbps data rate were chosen for full testing.

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

4. INSTRUMENT CALIBRATION

4.1 MEASURING INSTRUMENT CALIBRATION

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

4.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Conducted Emissions Test Site					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Power Meter	Anritsu	ML2495A	1012009	2016/07/04	2017/07/03
Power Meter	Anritsu	MA2411B	917072	2016/07/04	2017/07/03

966A Chamber					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US42510252	2015/12/08	2016/12/07
Loop Antenna	COM-POWER	AL-130	121051	2016/02/25	2017/02/24
Bilog Antenna	Sunol Sciences	JB1	A052609	2016/03/20	2017/03/21
Pre-Amplifier	EMEC	EM330	60609	2016/06/08	2017/06/07
Horn Antenna	ETC	MCTD 1209	DRH13M02003	2015/09/02	2016/09/01
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R

Conducted Emission room # B					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
LISN	R&S	ENV216	101054	2016/05/11	2017/05/10
Receiver	R&S	ESCI	101073	2015/09/09	2016/09/08

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. N.C.R. = No Calibration Required.

4.3 MEASUREMENT UNCERTAINTY

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

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

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

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

- ☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029
- ☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045
- ☐ No.81-1, Lane 210, Bade 2nd Rd., Lujhu Township, Taoyuan County 33841, TAIWAN, R.O.C.
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10: 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, ridged waveguide, horn and/or Loop. 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.



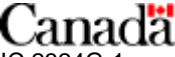
Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

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: 0824-01 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, IC 2324G-1 for 3M Semi Anechoic Chamber A, 2324G-2 for 3M Semi Anechoic Chamber B.

5.4 TABLE OF ACCREDITATIONS AND LISTINGS

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

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

6. SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

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

6.2 SUPPORT EQUIPMENT

No	Equipment	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	Temperature Probe	Jenco	6230AST	N/A	N/A	N/A	Shd, 1 m
2,	pH Electrode	Jenco	GB700E	N/A	N/A	N/A	Shd, 1 m
3,	Conductivity Prob	Jenco	N/A	N/A	N/A	N/A	Shd, 1 m
4,	BNC terminal	N/A	N/A	N/A	N/A	N/A	Non-shd, 0.05 m
5.	NB	Toshiba	Satellite L50D-C-12X	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.

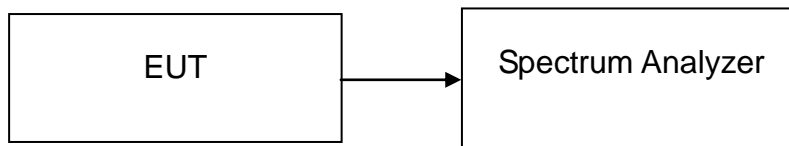
7. FCC PART 15.247 REQUIREMENTS

7.1 6DB BANDWIDTH

LIMIT

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

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in the 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 = 100 kHz, VBW= 300kHz, Span = 50 MHz, Sweep = auto.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

TEST RESULTS

No non-compliance noted

Test Data

IEEE 802.11b mode

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	2412	8.5576	>500	PASS
Mid	2437	8.0288		PASS
High	2462	8.0769		PASS

IEEE 802.11g mode

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	2412	16.4423	>500	PASS
Mid	2437	16.4423		PASS
High	2462	16.3942		PASS

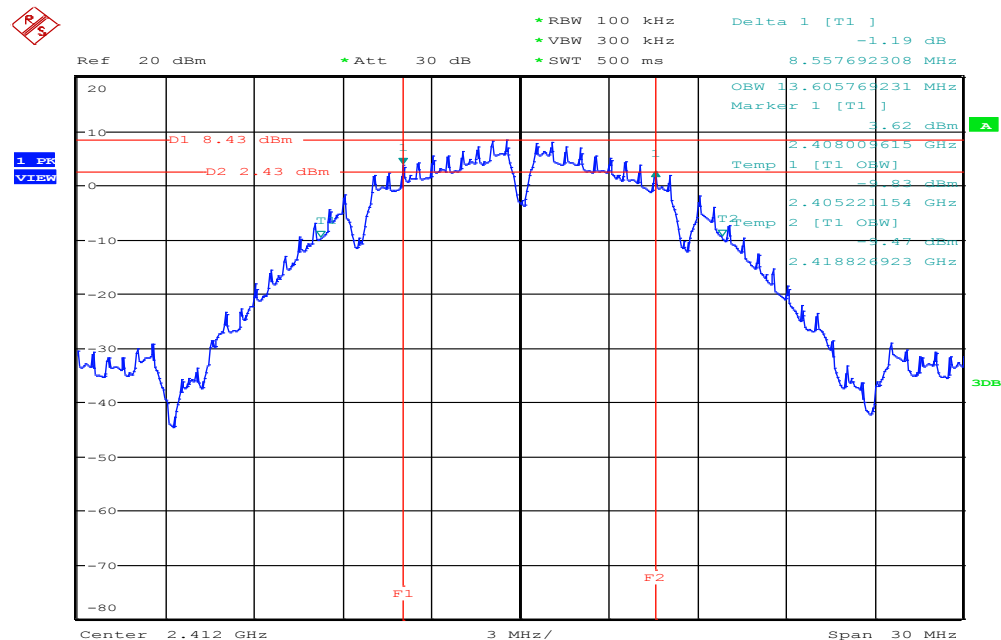
IEEE 802.11n HT 20 MHz mode

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
Low	2412	17.6923	>500	PASS
Mid	2437	17.6442		PASS
High	2462	17.6442		PASS

Test Plot

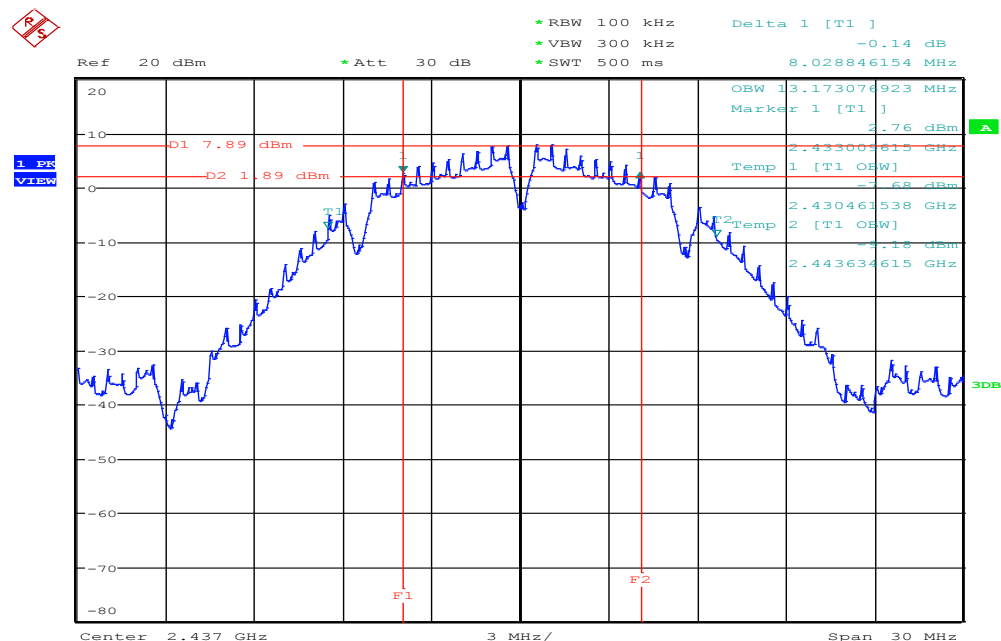
IEEE 802.11b mode

6dB Bandwidth (CH Low)



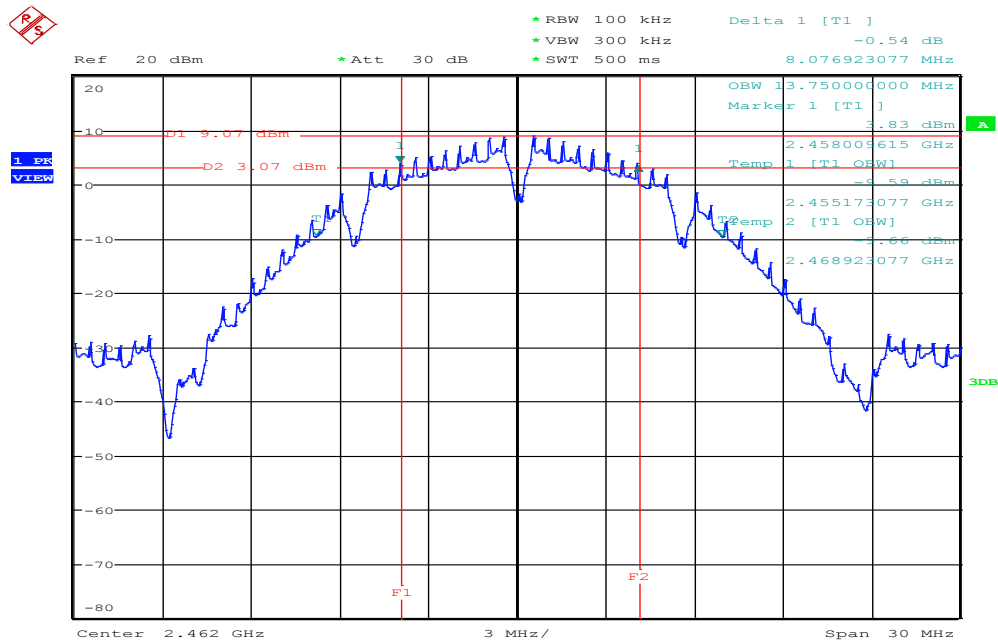
Date: 22.AUG.2016 09:56:25

6dB Bandwidth (CH Mid)



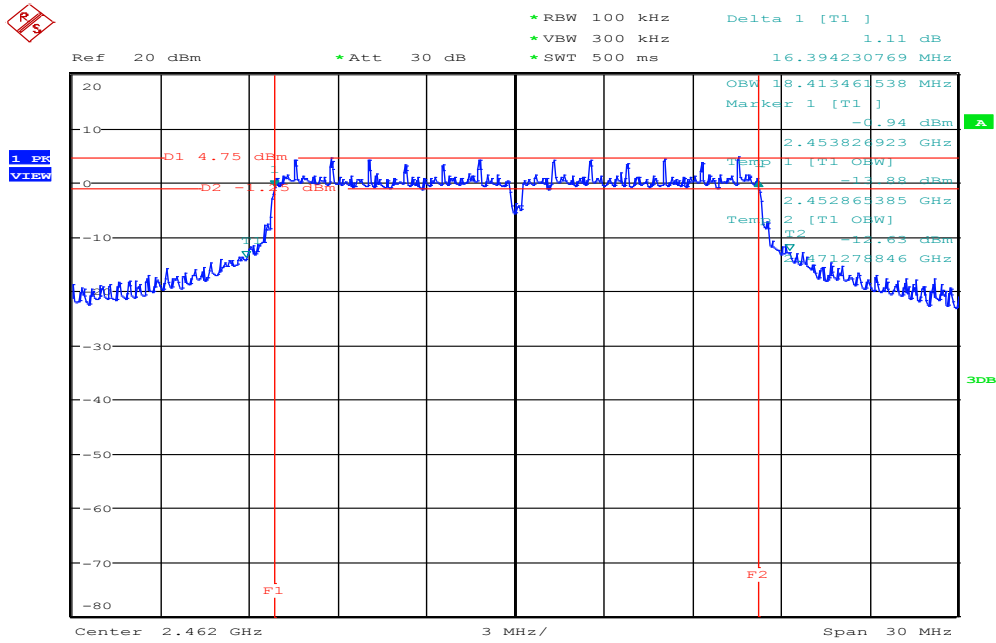
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6dB Bandwidth (CH High)



Date: 22.AUG.2016 10:00:43

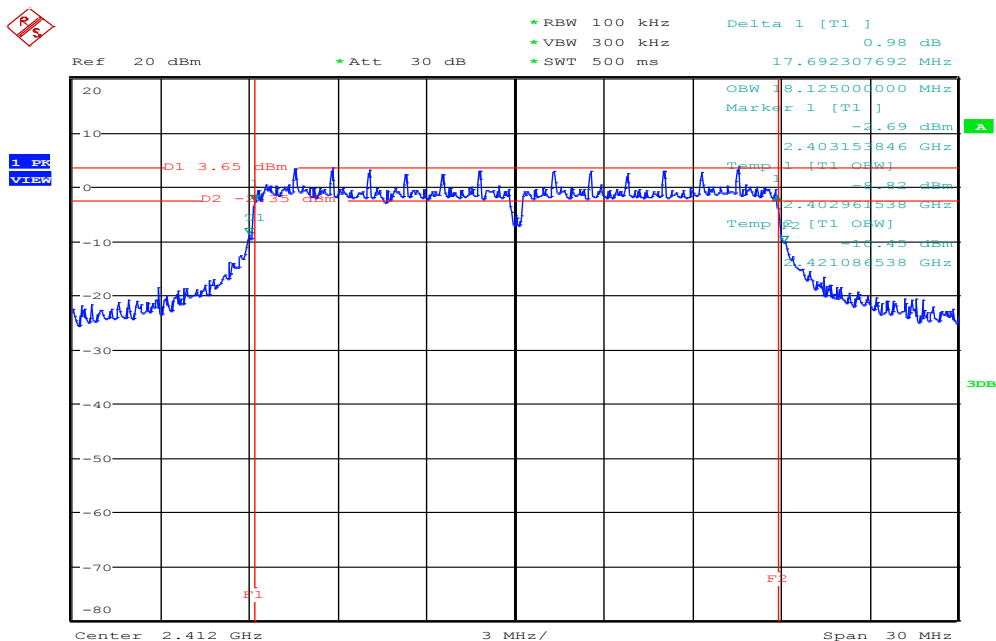
6dB Bandwidth (CH High)



Date: 22.AUG.2016 10:07:14

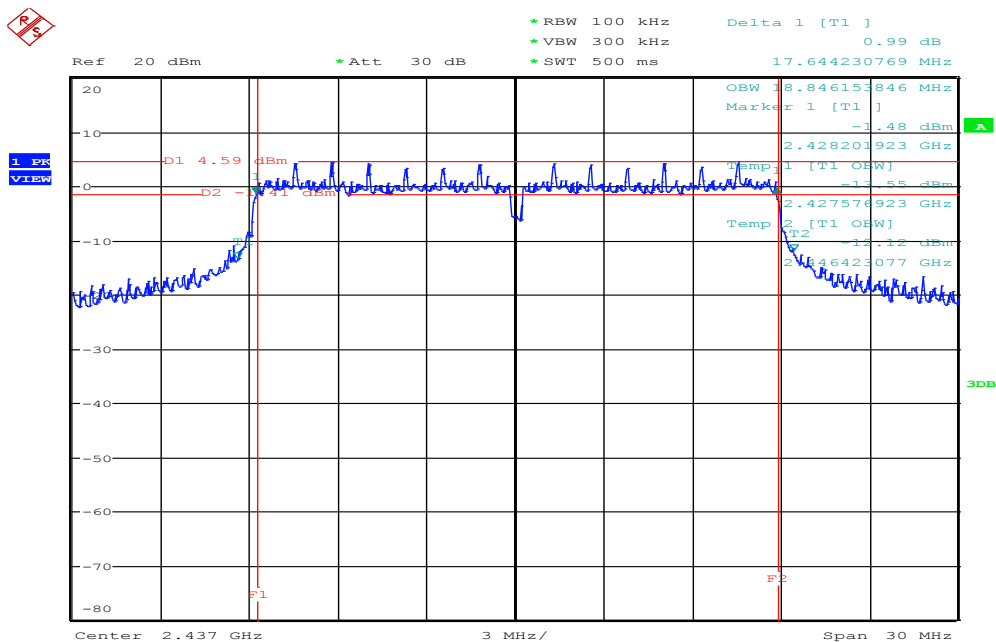
IEEE 802.11n HT 20 MHz mode

6dB Bandwidth (CH Low)



Date: 22.AUG.2016 10:11:22

6dB Bandwidth (CH Mid)



Date: 22.AUG.2016 10:12:52



Date: 22.AUG.2016 10:15:09

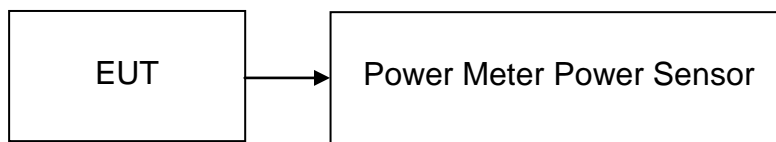
7.2 PEAK POWER

LIMIT

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

1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
2. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Power Meter. The Power Meter is set to the peak power detection.

TEST RESULTS

No non-compliance noted

Test Data

IEEE 802.11b mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (dBm)	Result
Low	2412	20.35	0.1084	30	PASS
Mid	2437	19.55	0.0902		PASS
High	2462	*20.39	0.1094		PASS

IEEE 802.11g mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (dBm)	Result
Low	2412	*22.33	0.1710	30	PASS
Mid	2437	21.98	0.1578		PASS
High	2462	21.87	0.1538		PASS

IEEE 802.11n HT 20 MHz mode

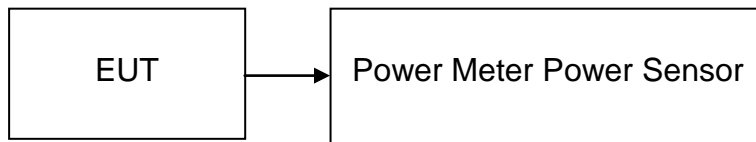
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (dBm)	Result
Low	2412	*22.10	0.1622	30	PASS
Mid	2437	21.83	0.1524		PASS
High	2462	21.46	0.1400		PASS

7.3 AVERAGE POWER

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Power Meter. The Power Meter is set to the peak power detection.

TEST RESULTS

No non-compliance noted

Test Data

Test mode: IEEE 802.11b mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2412	18.03	0.0635
Mid	2437	16.89	0.0489
High	2462	*18.14	0.0652

Test mode: IEEE 802.11g mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2412	*17.00	0.0501
Mid	2437	16.76	0.0474
High	2462	16.67	0.0465

Test mode: IEEE 802.11n HT 20 MHz mode

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2412	16.08	0.0406
Mid	2437	*16.64	0.0461
High	2462	15.85	0.0385

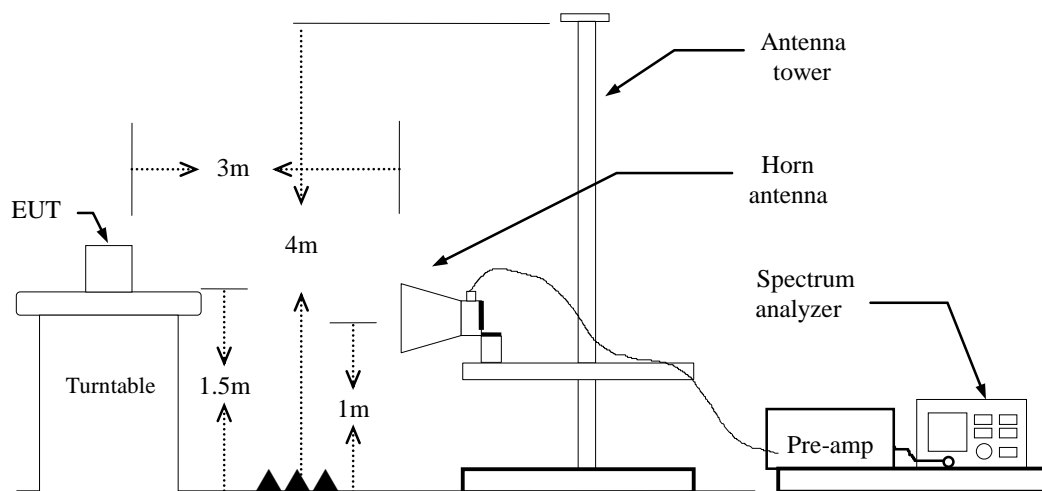
7.4 BAND EDGES MEASUREMENT

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

Test Configuration

For Radiated



TEST PROCEDURE

For Radiated

1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz,
if duty cycle $\geq 98\%$, VBW=10Hz.
if duty cycle $< 98\%$ VBW=1/T.
IEEE 802.11b mode: $\geq 98\%$, VBW=10Hz
IEEE 802.11g mode: $\approx 97\%$, VBW=510Hz
IEEE 802.11n HT 20 MHz mode: $\approx 96\%$, VBW=560Hz
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.
6. Result = Spectrum Reading + cable loss(spectrum to Amp) - Amp Gain + Cable loss(Amp to receive Ant)+ Receive Ant

For Un-restricted Band Emissions

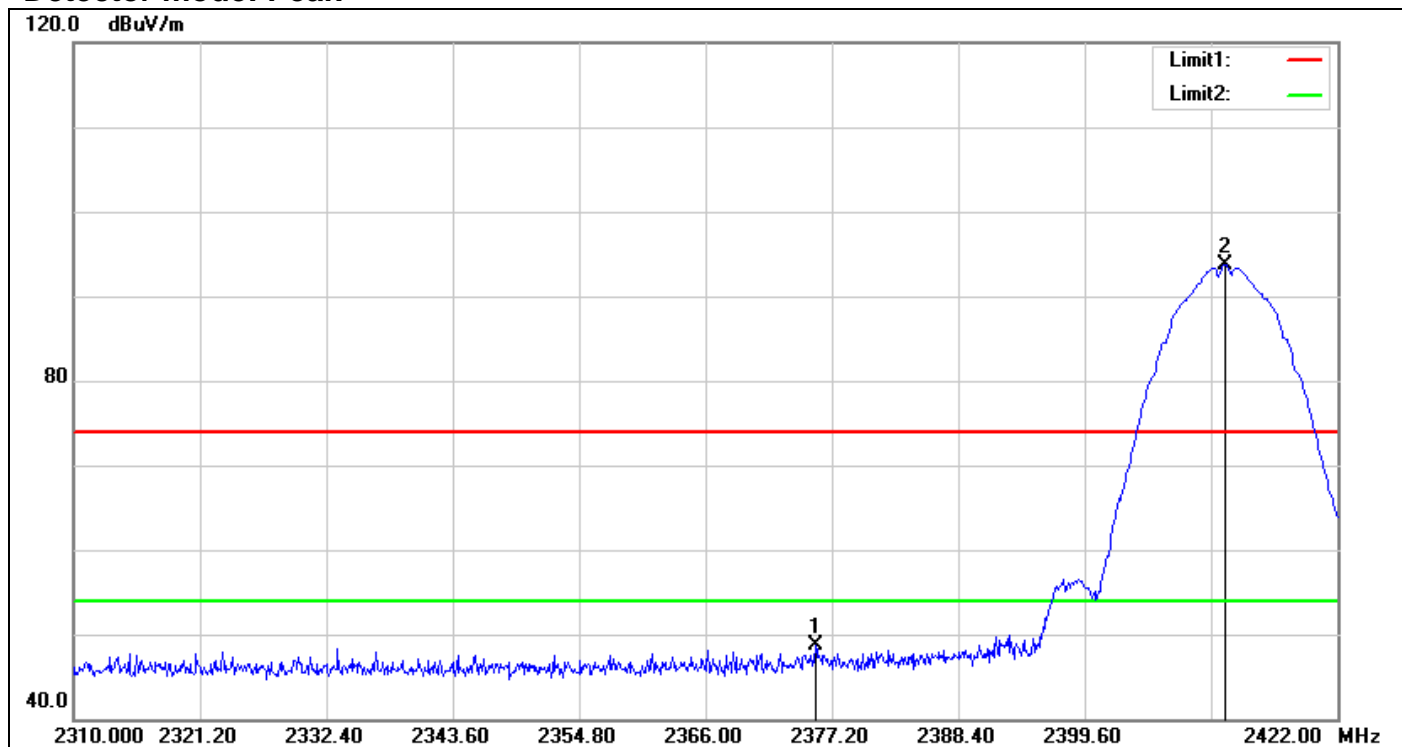
The peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

TEST RESULTS

Refer to attach spectrum analyzer data chart.

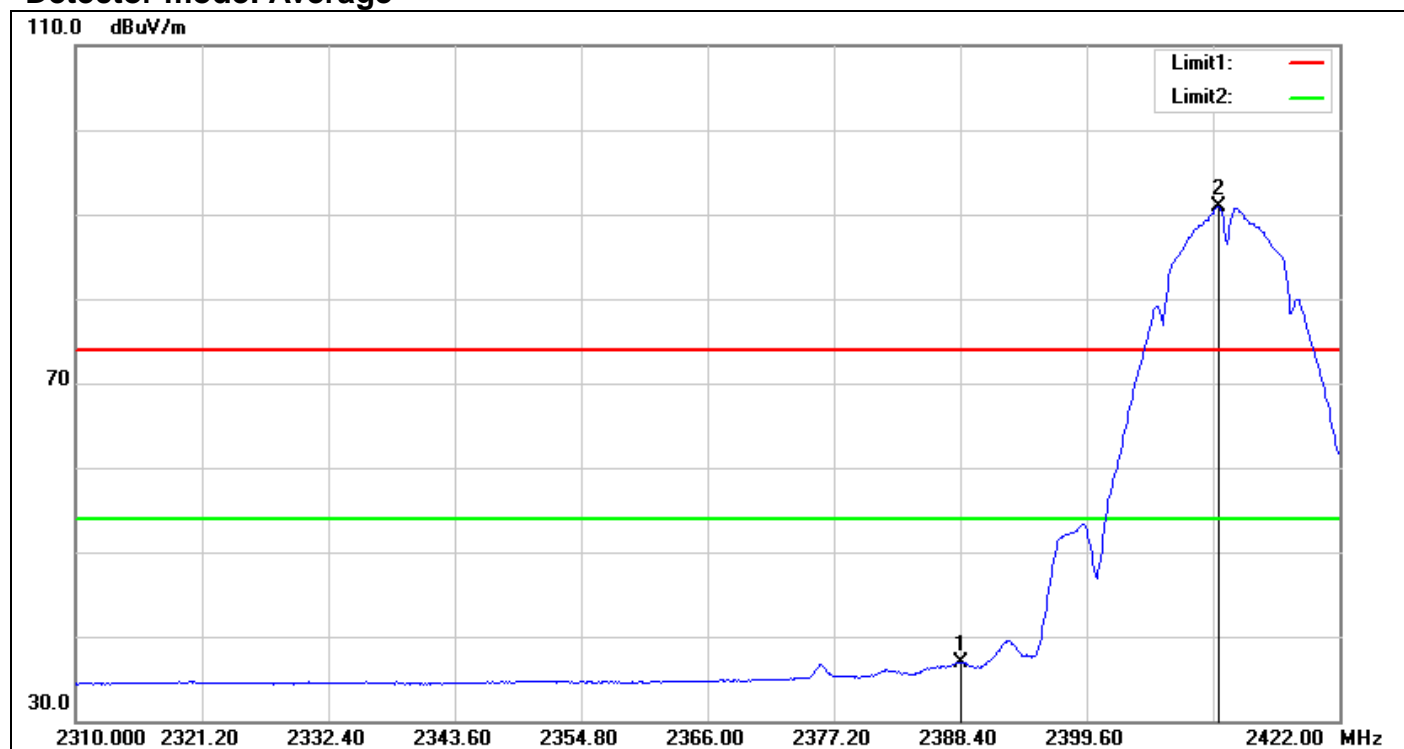
Band Edges (IEEE 802.11b mode / CH Low)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2375.744	51.24	-2.61	48.63	74.00	-25.37	peak
2	2412.032	96.14	-2.42	93.72	--	--	peak

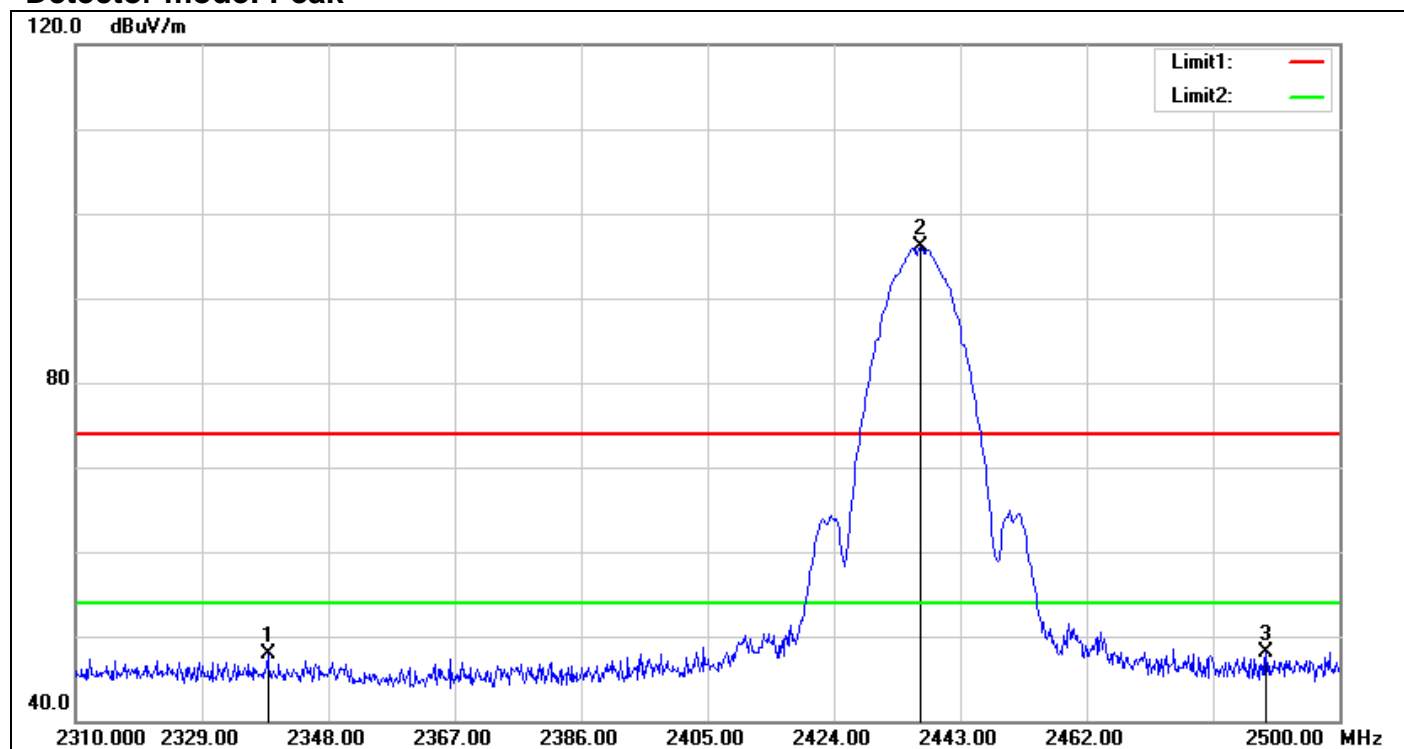
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2388.512	39.48	-2.50	36.98	54.00	-17.02	AVG
2	2411.248	93.40	-2.42	90.98	--	--	AVG

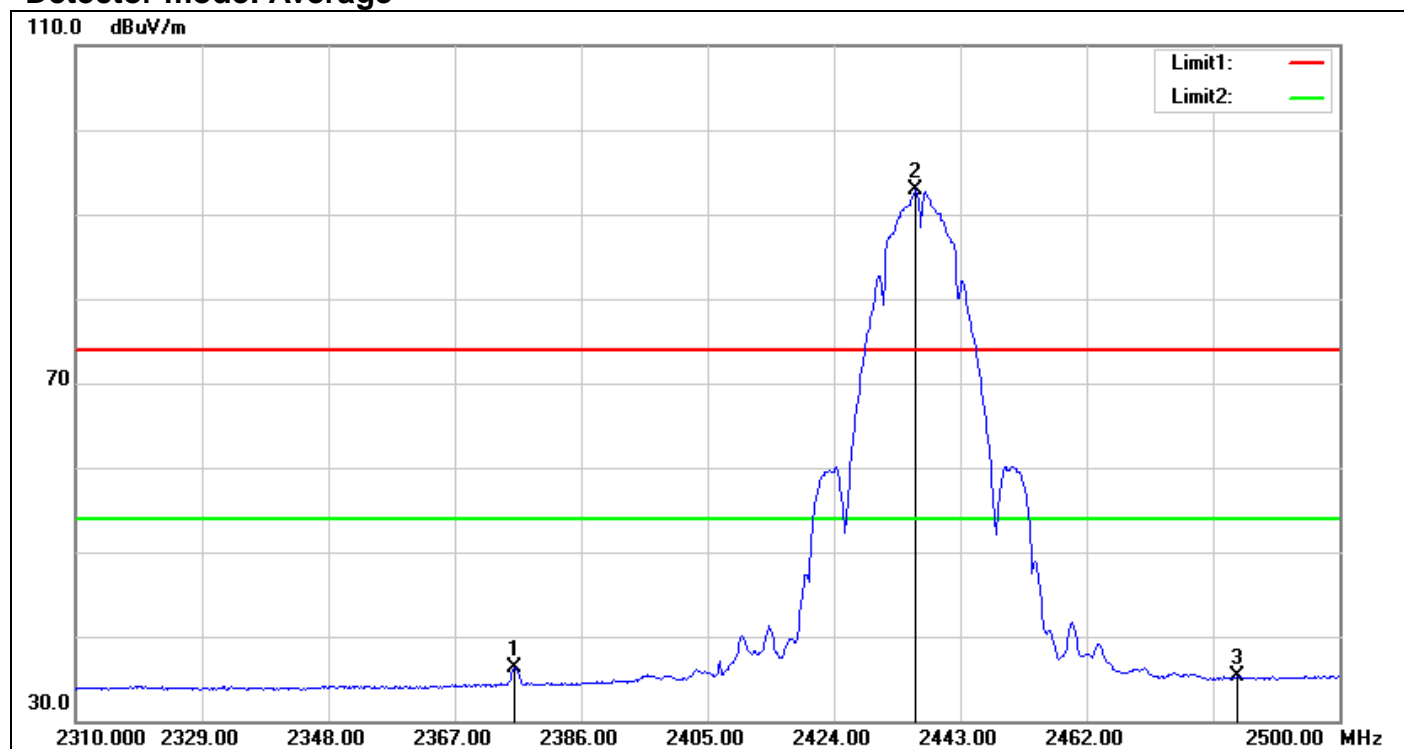
Band Edges (IEEE 802.11b mode / CH Mid)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2338.880	50.90	-2.96	47.94	74.00	-26.06	peak
2	2437.110	98.42	-2.23	96.19	--	--	peak
3	2488.980	50.11	-1.94	48.17	74.00	-25.83	peak

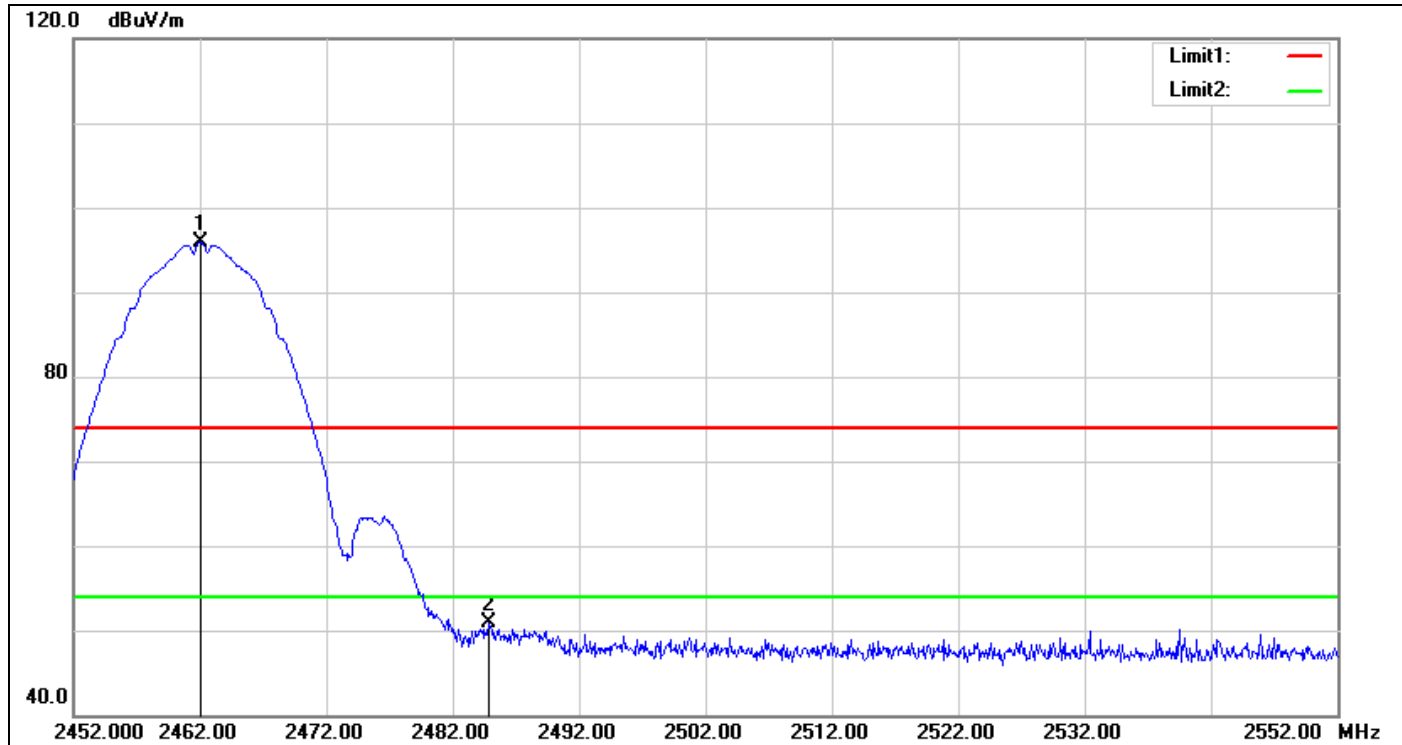
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2375.930	38.94	-2.61	36.33	54.00	-17.67	AVG
2	2436.350	95.05	-2.24	92.81	--	--	AVG
3	2484.610	37.24	-1.98	35.26	54.00	-18.74	AVG

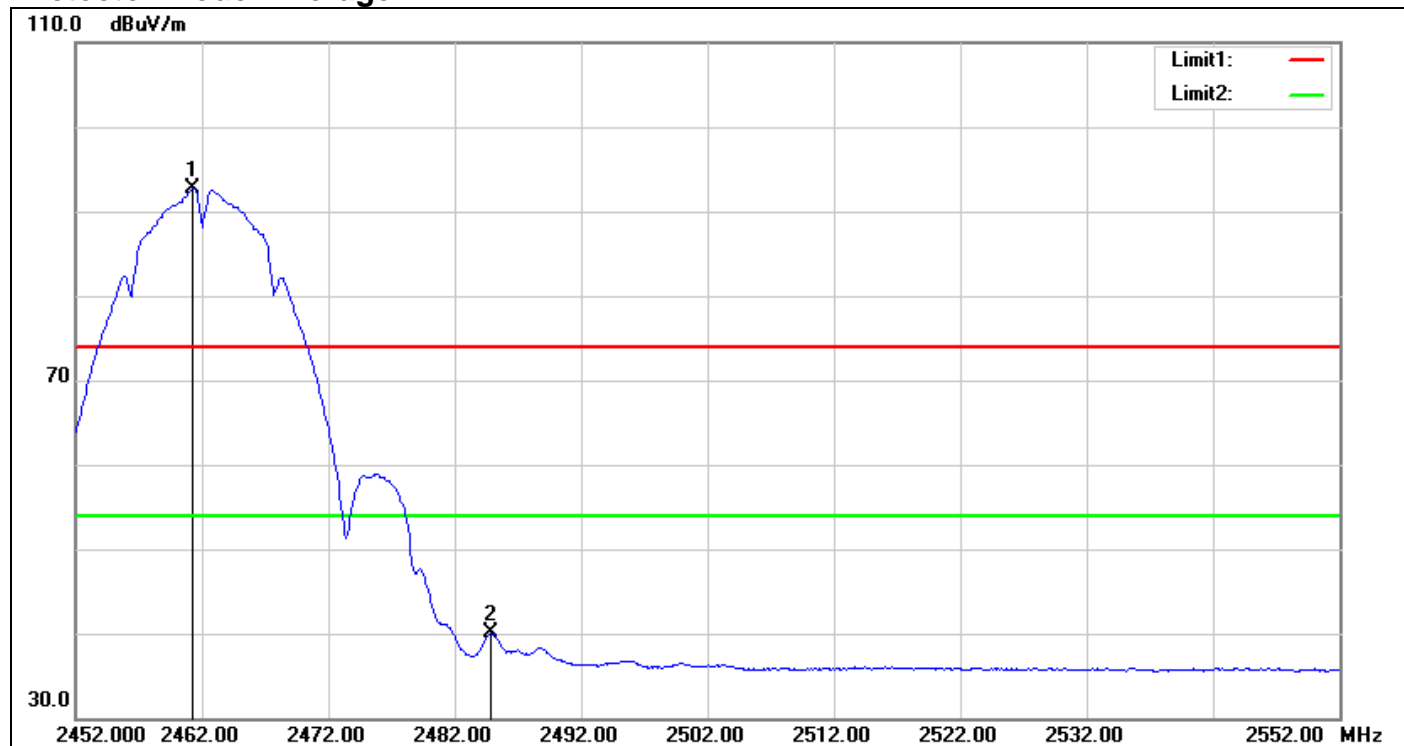
Band Edges (IEEE 802.11b mode / CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2462.100	97.99	-2.10	95.89	--	--	peak
2	2484.800	52.87	-1.98	50.89	74.00	-23.11	peak

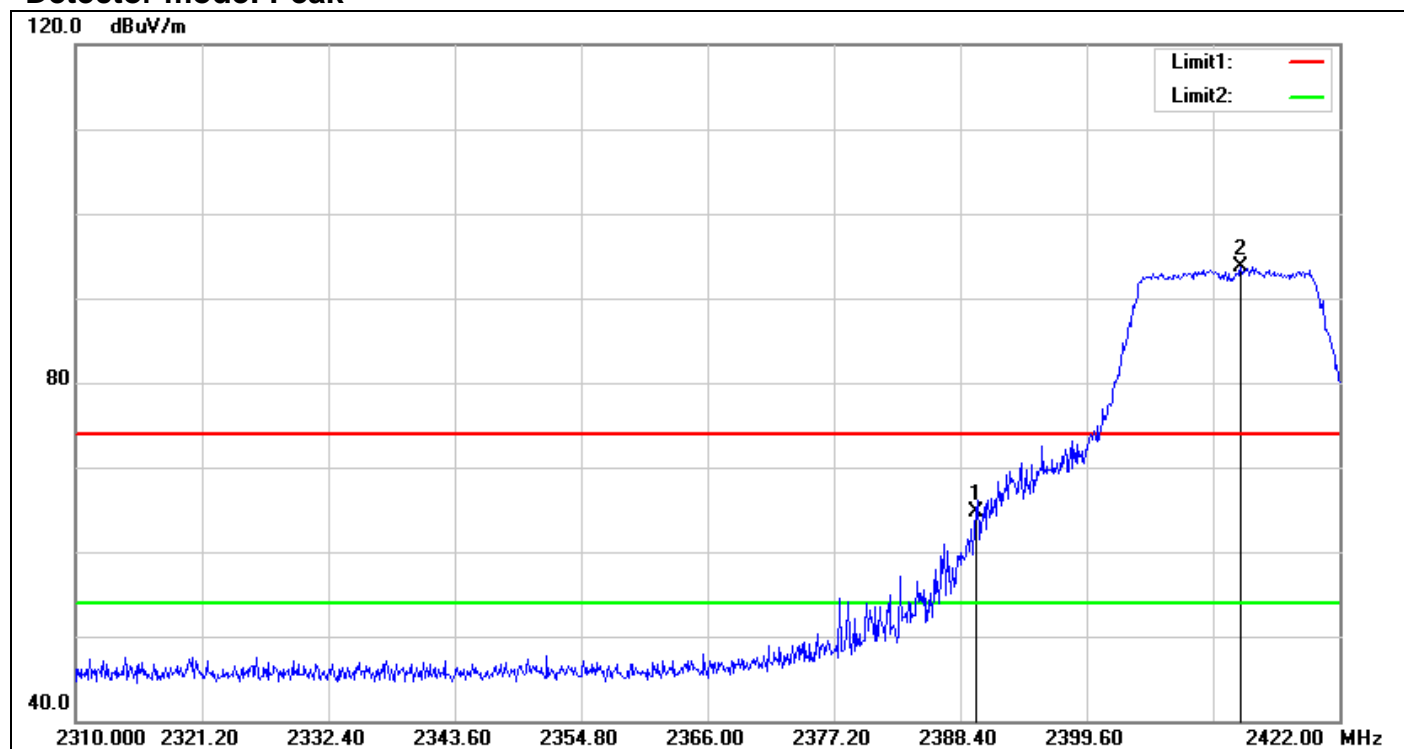
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2461.300	94.81	-2.10	92.71	--	--	AVG
2	2484.800	42.10	-1.98	40.12	54.00	-13.88	AVG

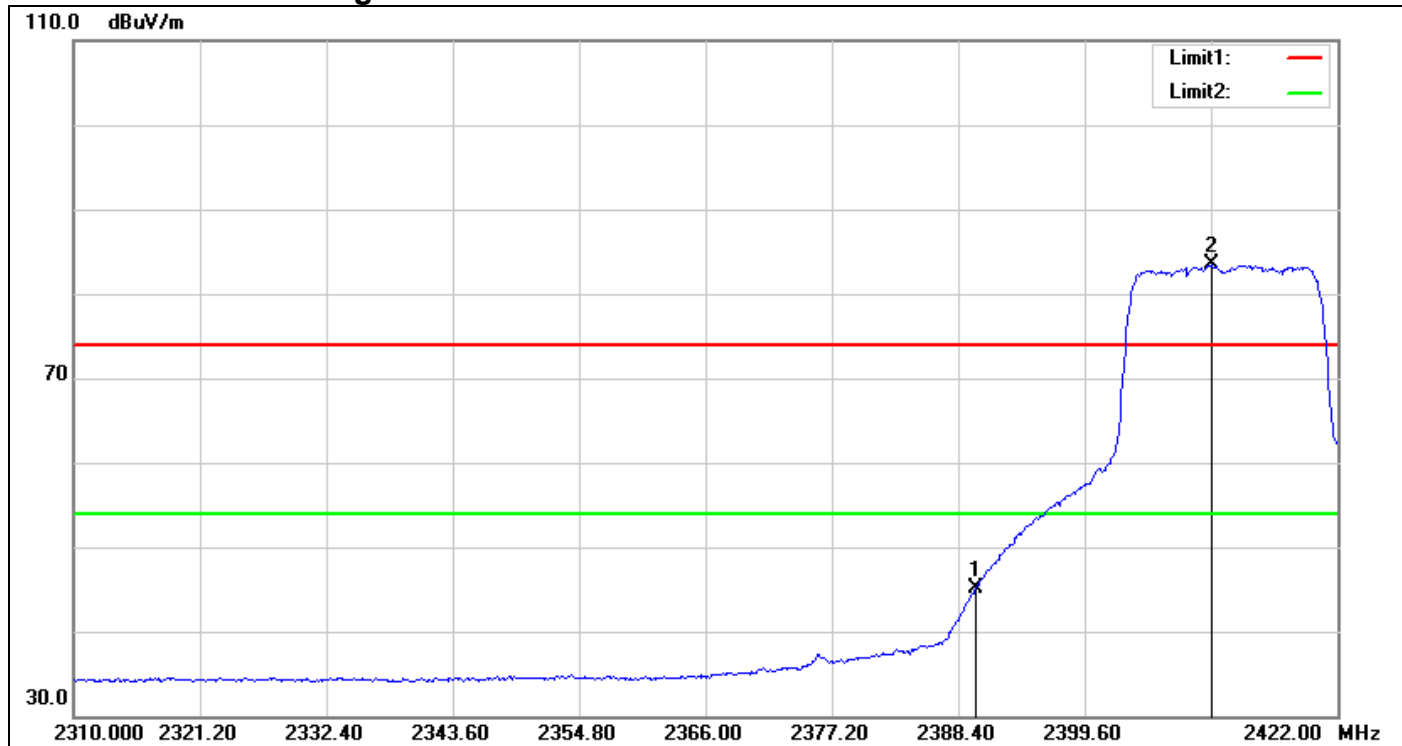
Band Edges (IEEE 802.11g mode / CH Low)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.856	67.27	-2.49	64.78	74.00	-9.22	peak
2	2413.264	96.02	-2.41	93.61	--	--	peak

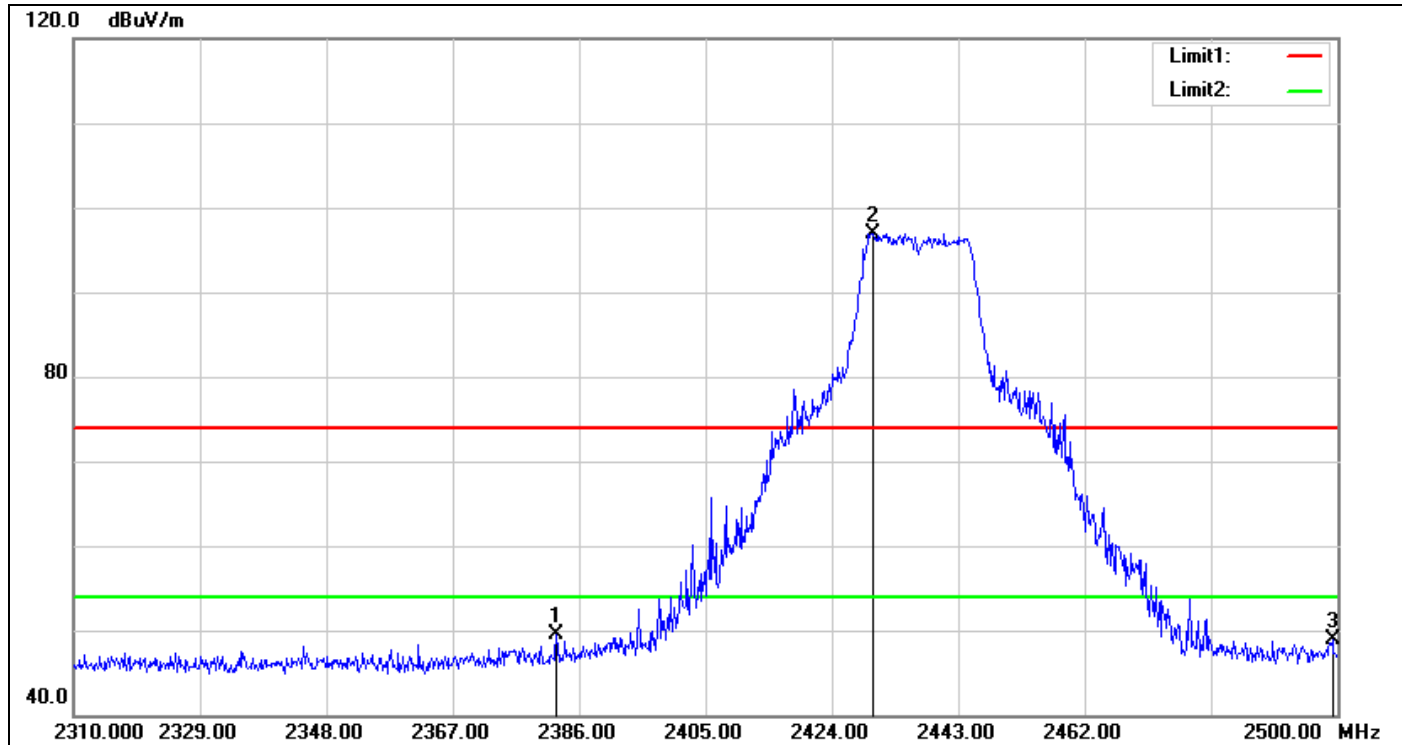
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.968	47.64	-2.49	45.15	54.00	-8.85	AVG
2	2410.800	85.94	-2.42	83.52	--	--	AVG

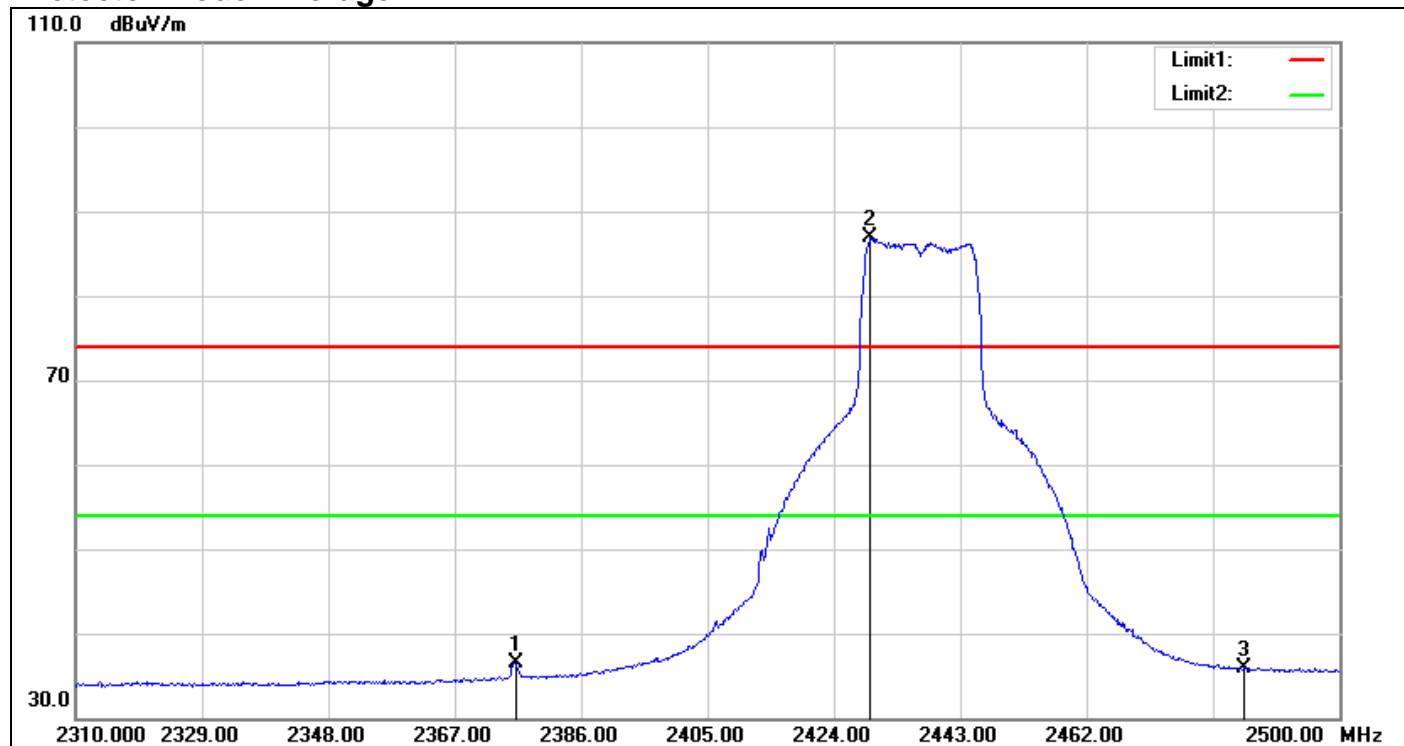
Band Edges (IEEE 802.11g mode / CH Mid)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2382.580	51.97	-2.56	49.41	74.00	-24.59	peak
2	2430.080	99.28	-2.28	97.00	--	--	peak
3	2499.240	50.73	-1.87	48.86	74.00	-25.14	peak

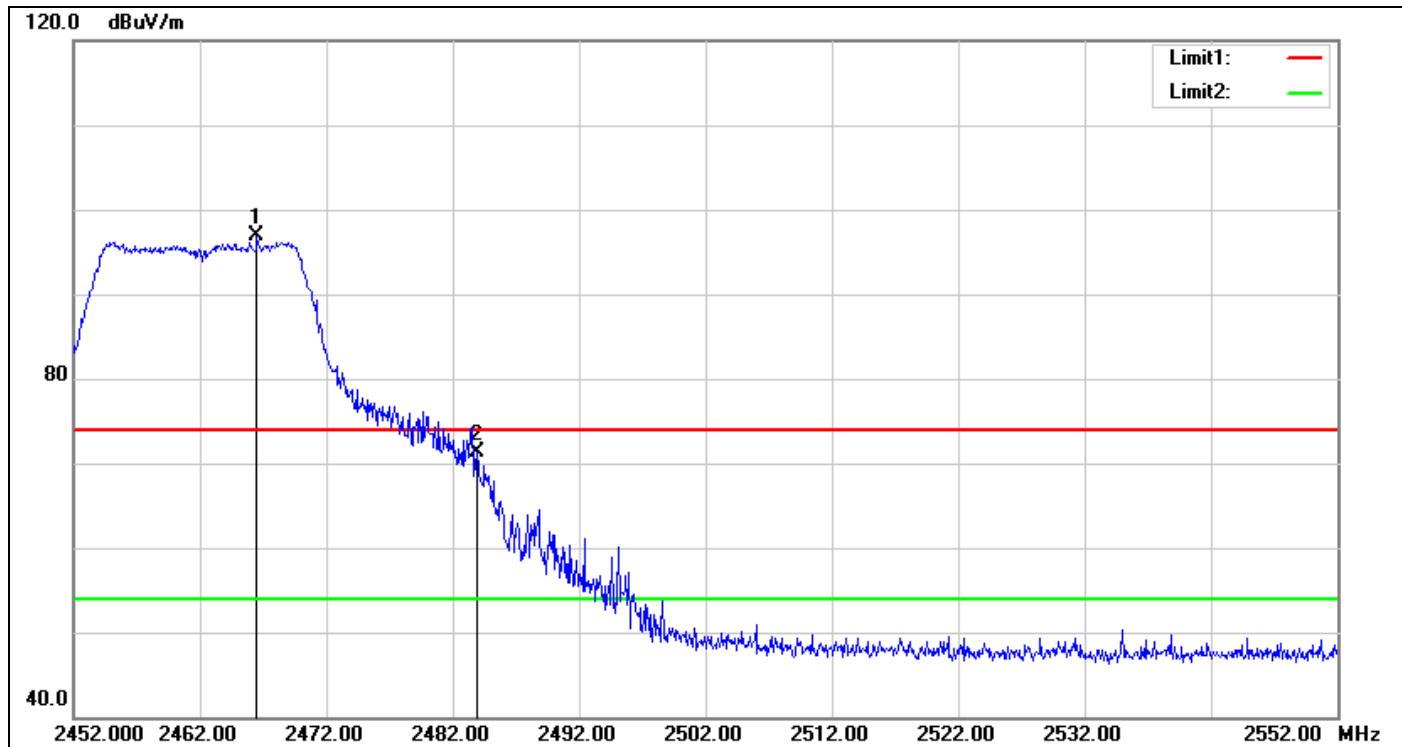
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2376.120	39.11	-2.61	36.50	54.00	-17.50	AVG
2	2429.510	89.15	-2.29	86.86	--	--	AVG
3	2485.750	37.97	-1.97	36.00	54.00	-18.00	AVG

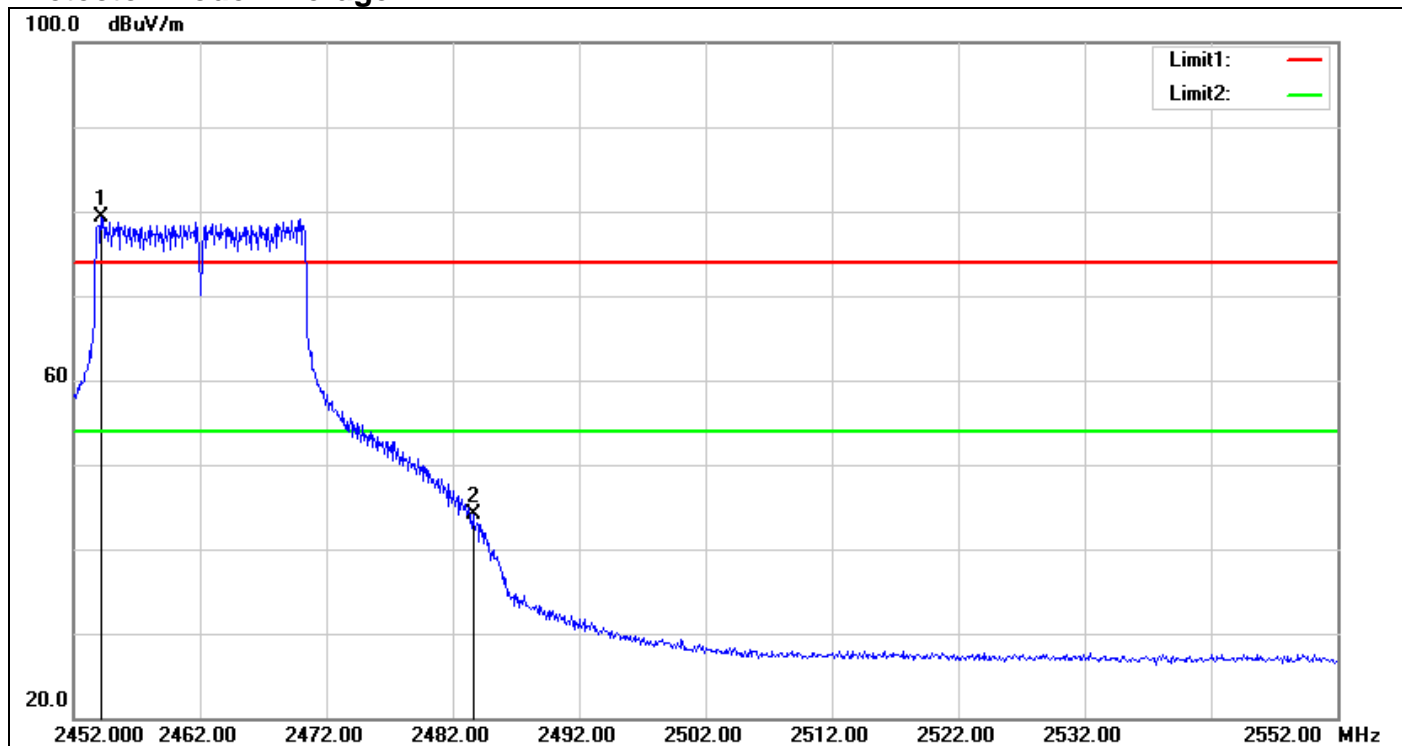
Band Edges (IEEE 802.11g mode / CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2466.500	98.91	-2.08	96.83	--	--	peak
2	2483.900	73.20	-1.99	71.21	74.00	-2.79	peak

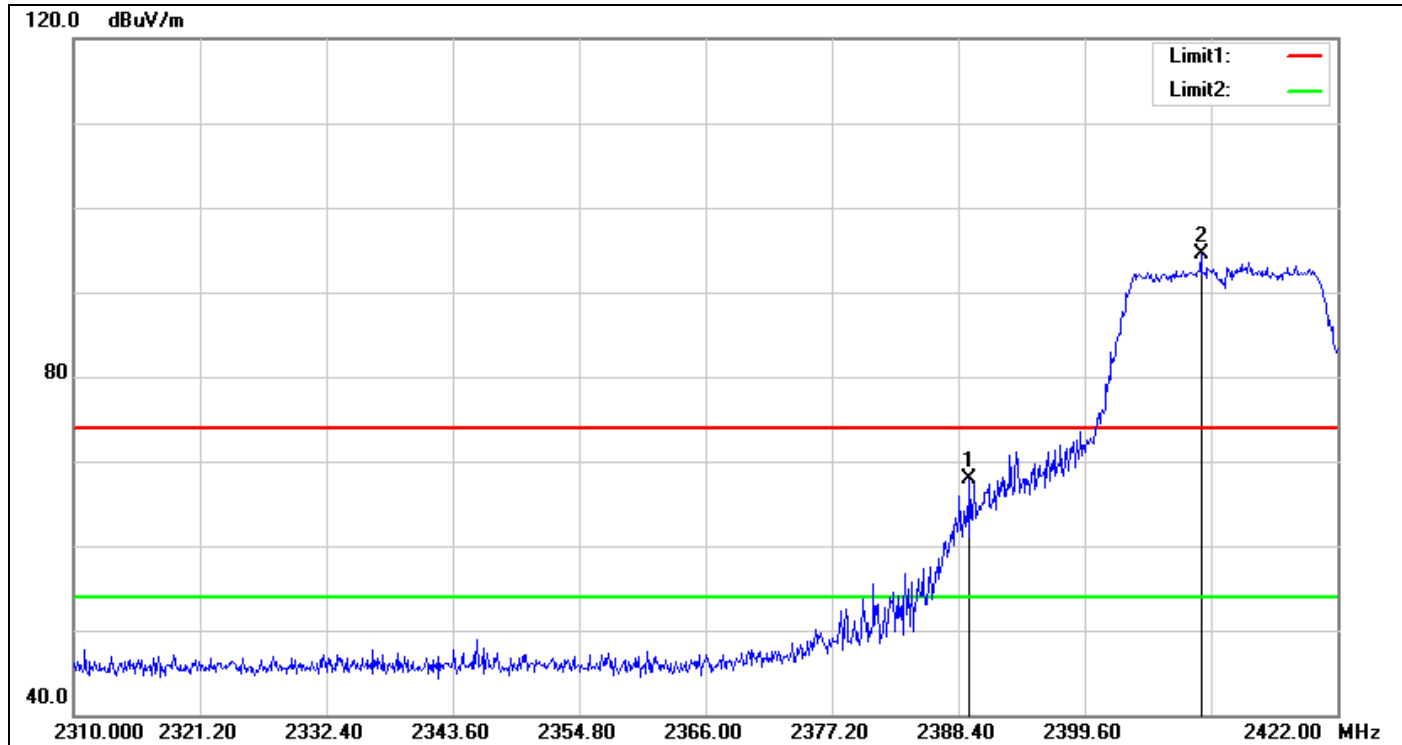
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2454.200	81.51	-2.12	79.39	--	--	AVG
2	2483.600	46.11	-1.99	44.12	54.00	-9.88	AVG

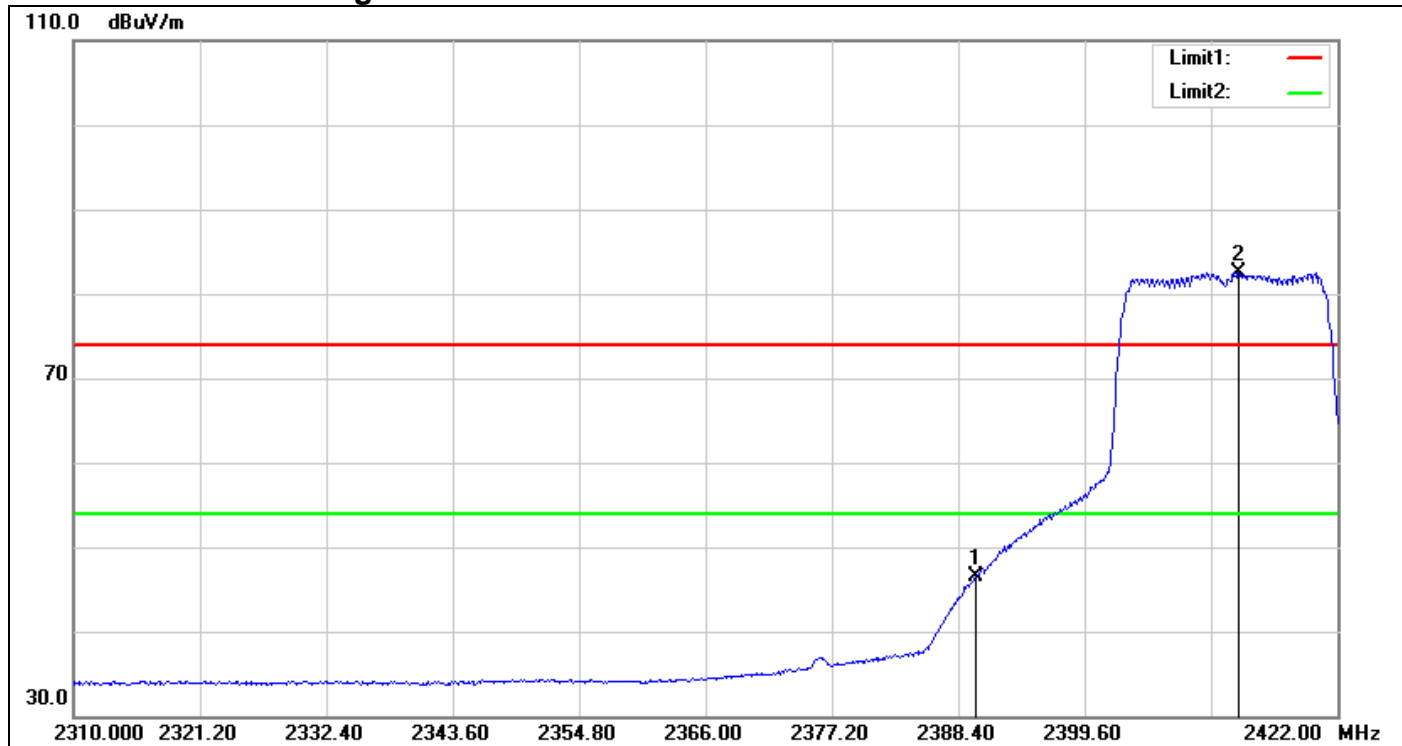
Band Edges (IEEE 802.11n HT 20 MHz mode / CH Low)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.408	70.36	-2.50	67.86	74.00	-6.14	peak
2	2409.904	96.97	-2.43	94.54	--	--	peak

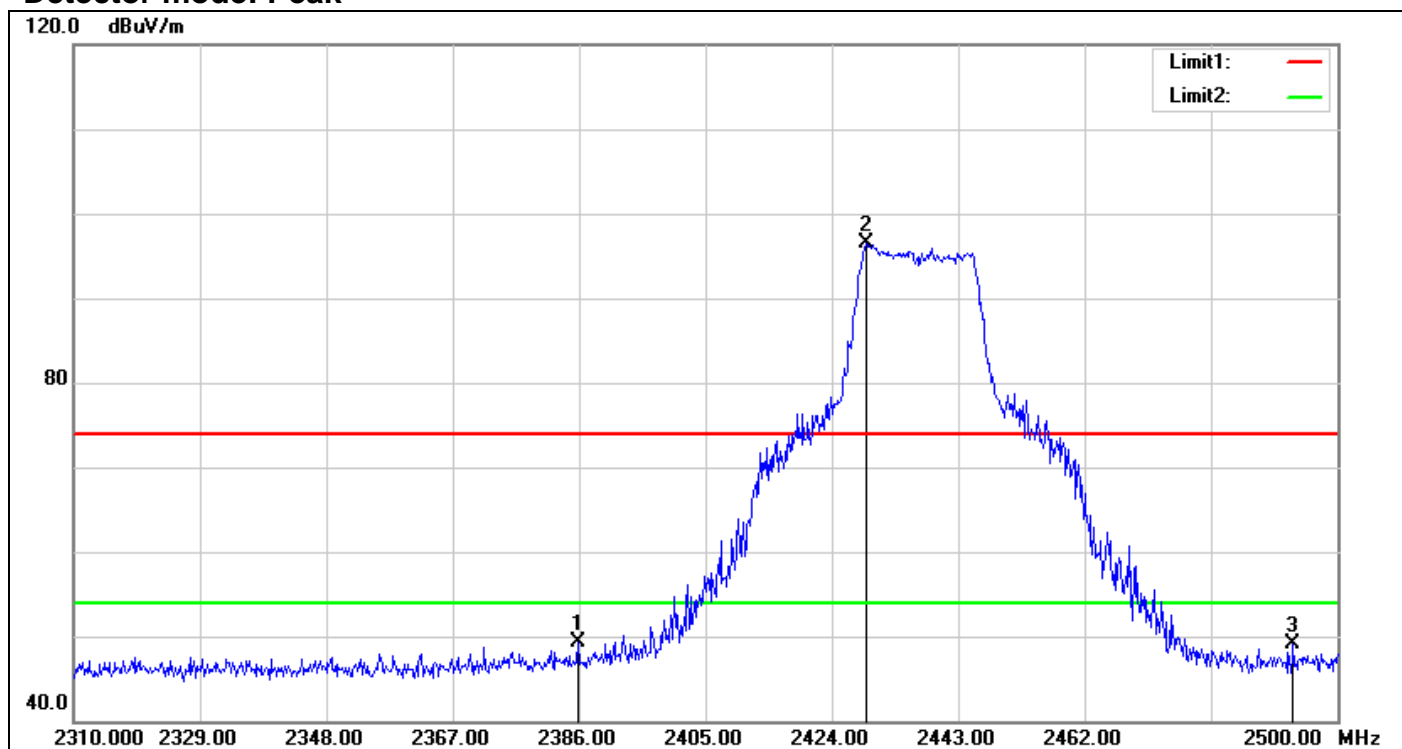
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2389.968	49.00	-2.49	46.51	54.00	-7.49	AVG
2	2413.264	84.93	-2.41	82.52	--	--	AVG

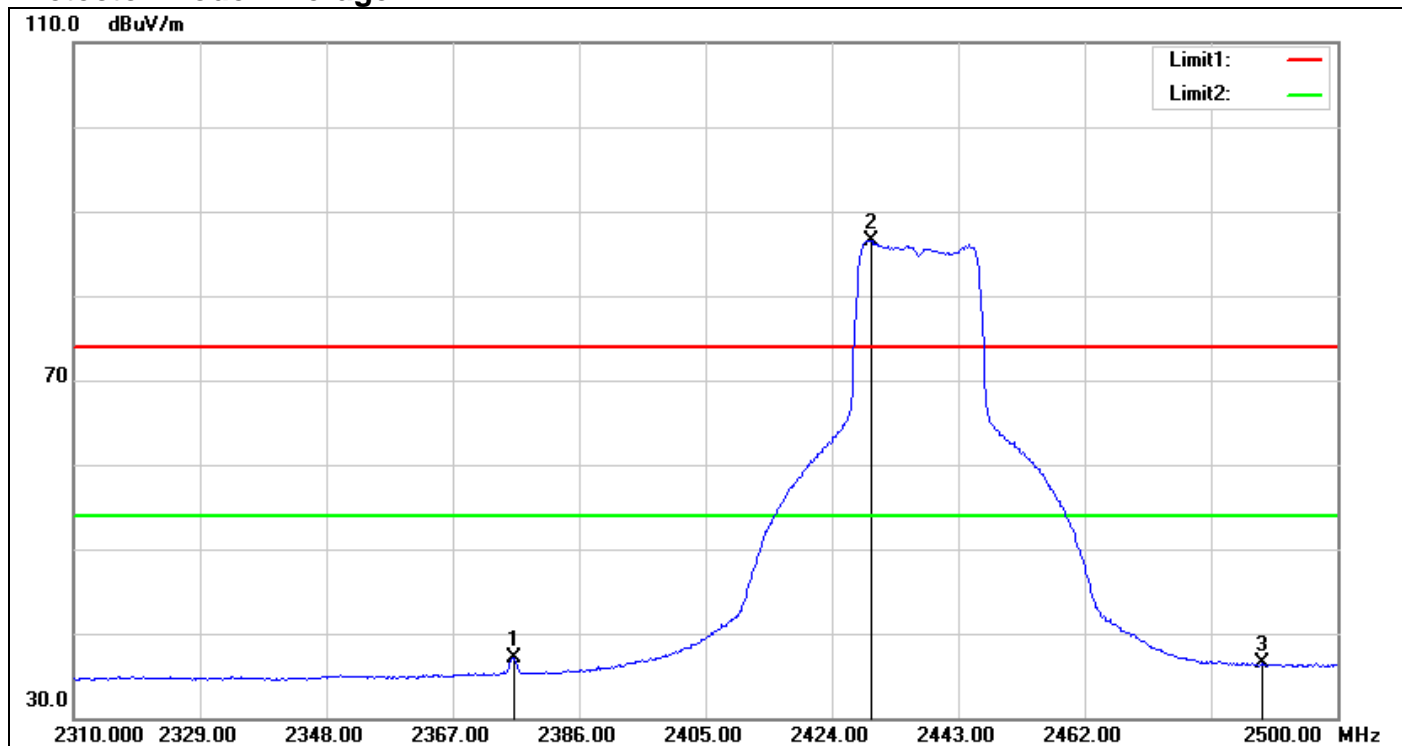
Band Edges (IEEE 802.11n HT 20 MHz mode / CH Mid)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2385.810	51.74	-2.53	49.21	74.00	-24.79	peak
2	2429.130	98.79	-2.29	96.50	--	--	peak
3	2493.350	50.93	-1.91	49.02	74.00	-24.98	peak

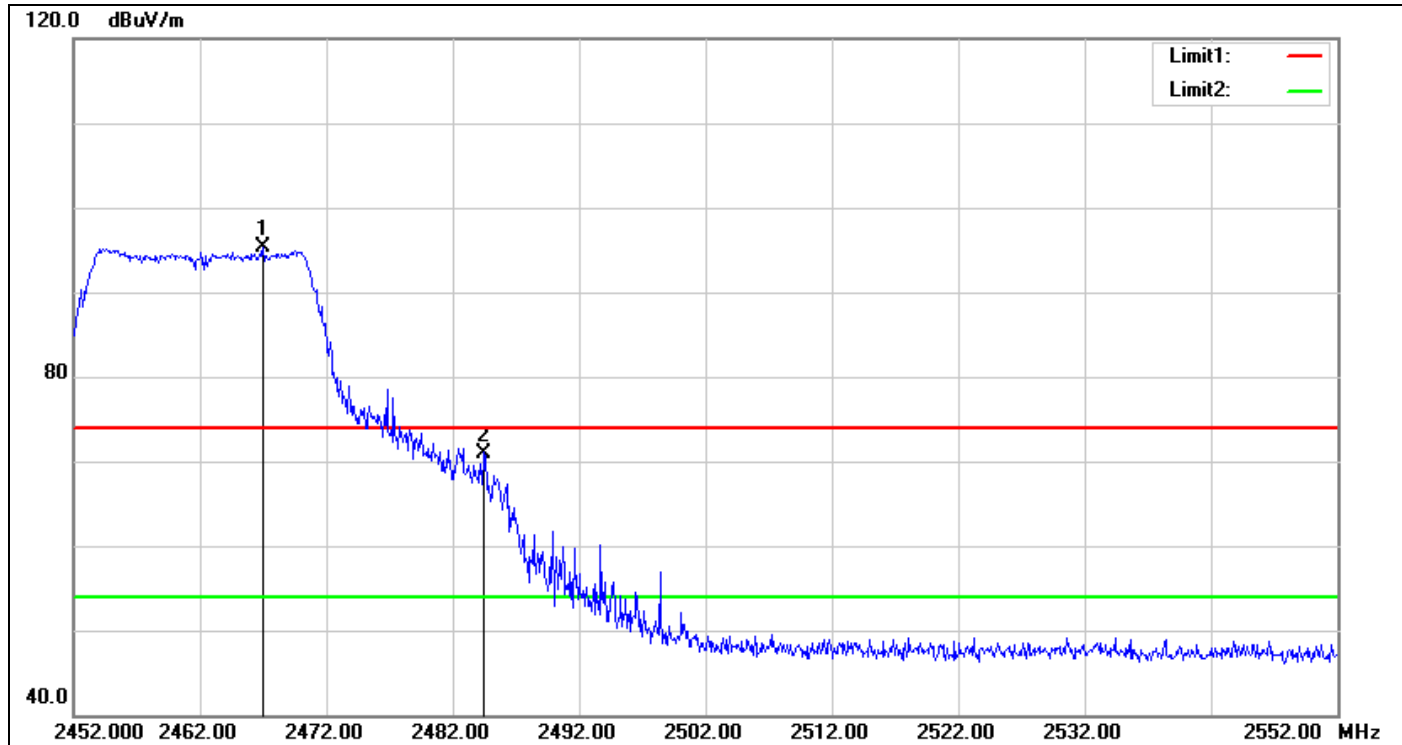
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2376.120	39.78	-2.61	37.17	54.00	-16.83	AVG
2	2429.890	88.80	-2.29	86.51	--	--	AVG
3	2488.600	38.44	-1.94	36.50	54.00	-17.50	AVG

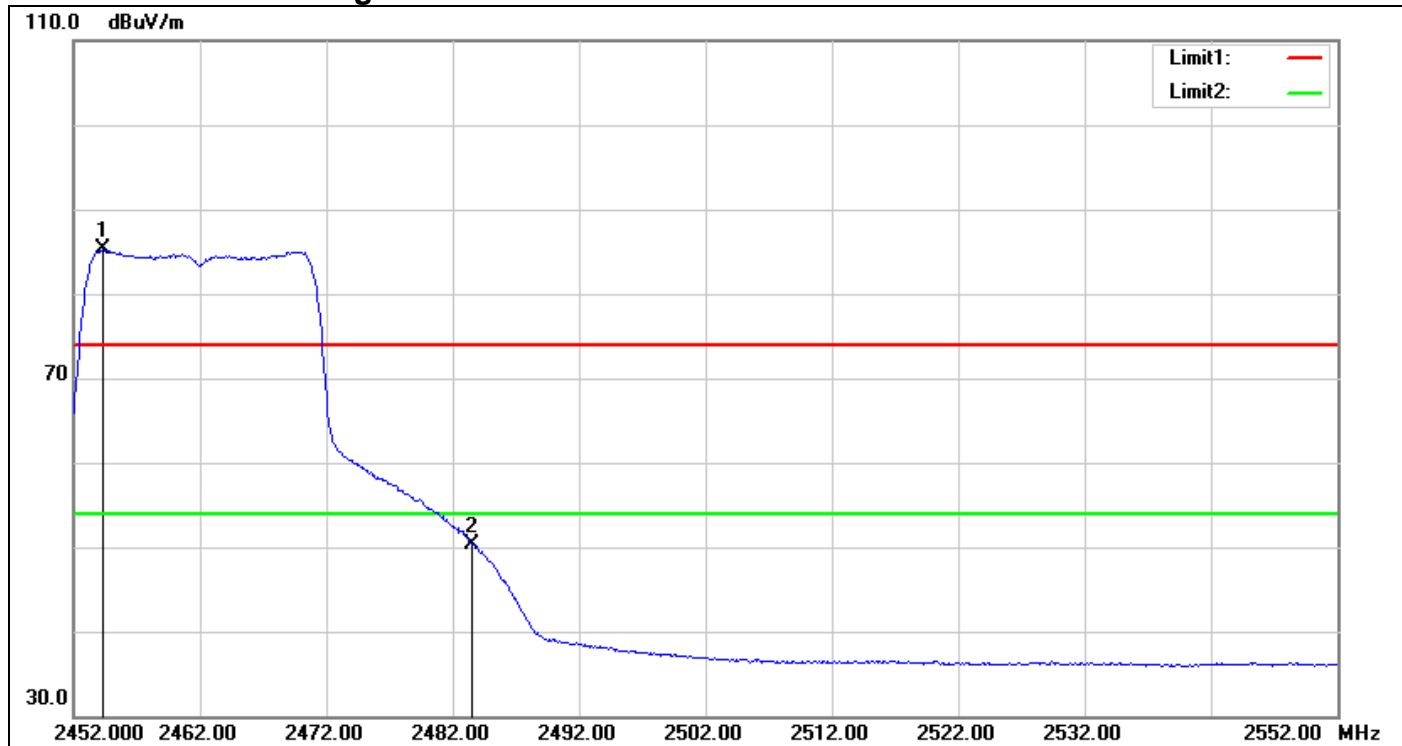
Band Edges (IEEE 802.11n HT 20 MHz mode / CH High)

Detector mode: Peak



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2467.000	97.30	-2.08	95.22	--	--	peak
2	2484.500	72.98	-1.98	71.00	74.00	-3.00	peak

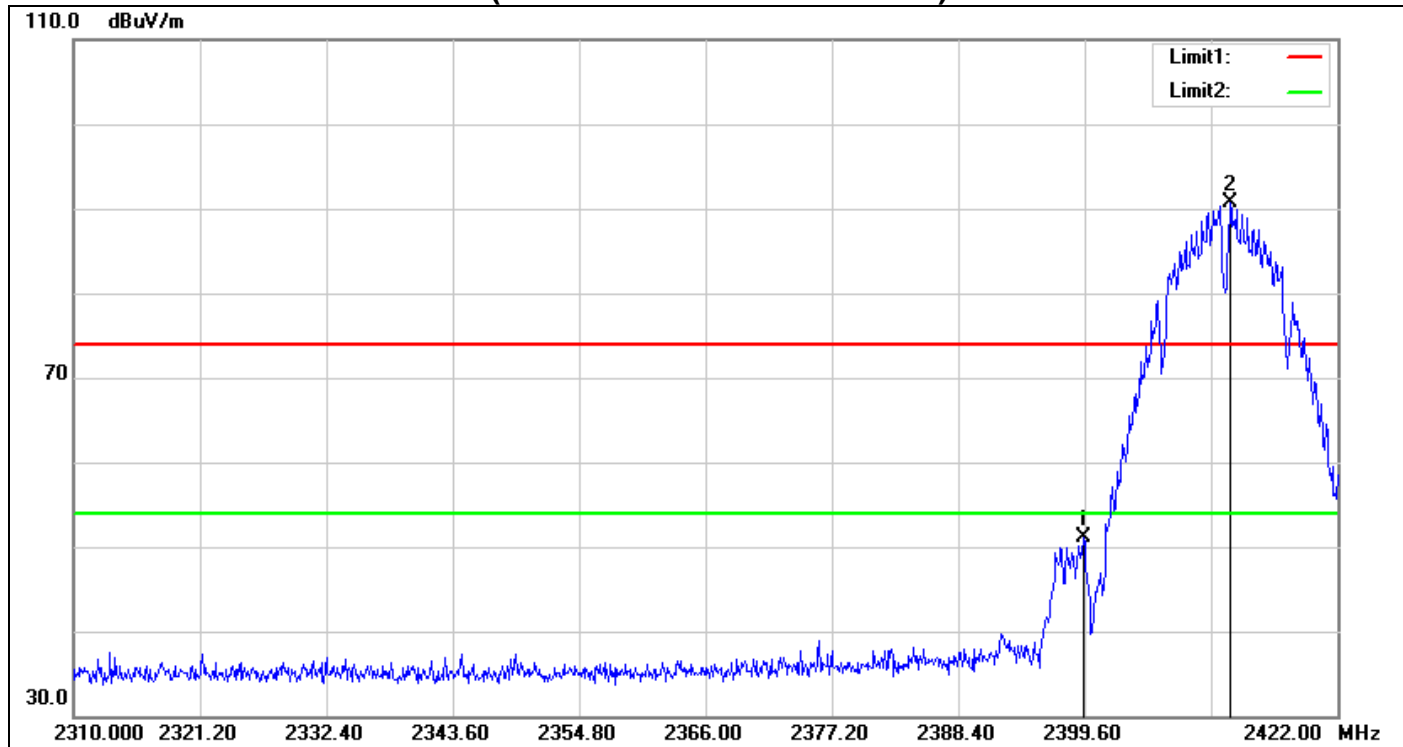
Detector mode: Average



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2454.300	87.35	-2.12	85.23	--	--	AVG
2	2483.500	52.37	-1.99	50.38	54.00	-3.62	AVG

Test Plot

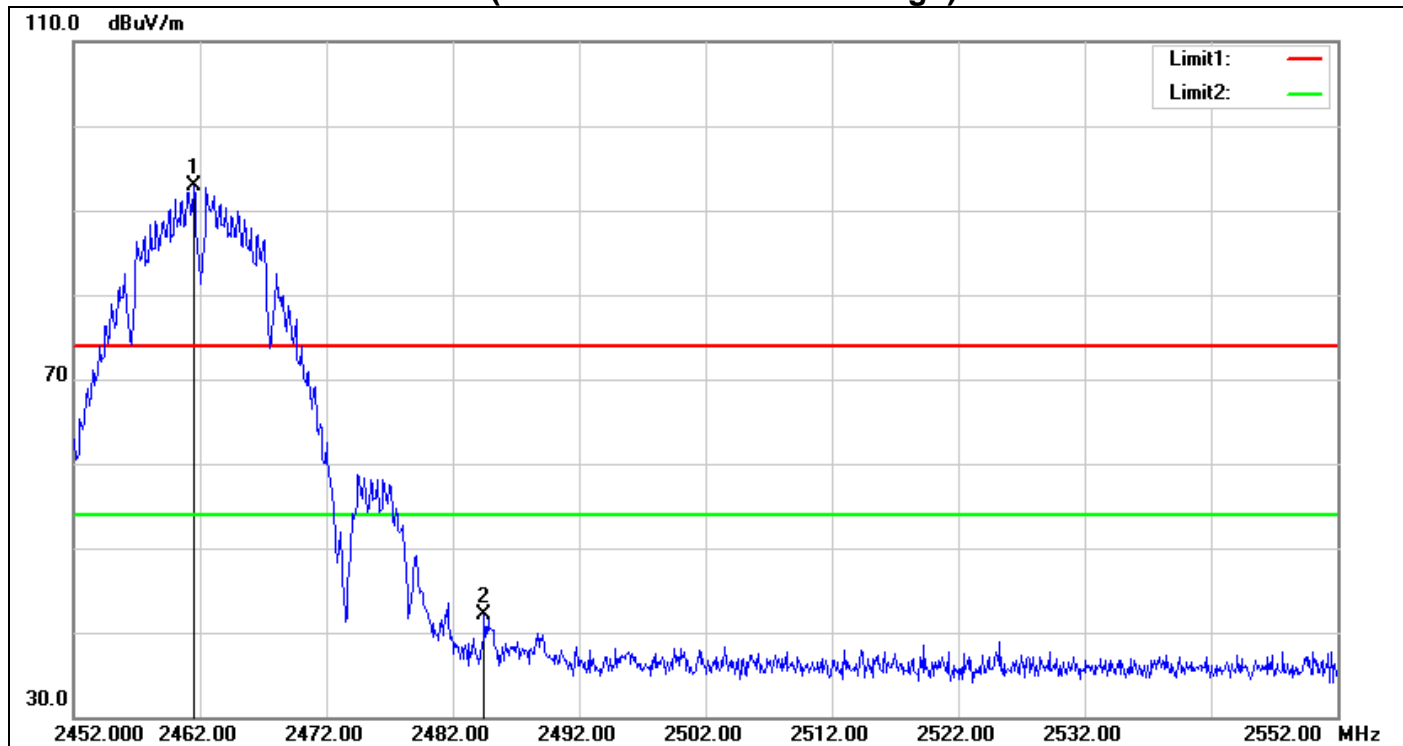
Un-restricted Band Emissions (IEEE 802.11b mode / CH Low)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Remark
1	2399.488	53.56	-2.41	51.15	peak
2	2412.480	93.16	-2.41	90.75	peak

Note: Spurious emission levels that exceed the level of 20 dB below the applicable limit.

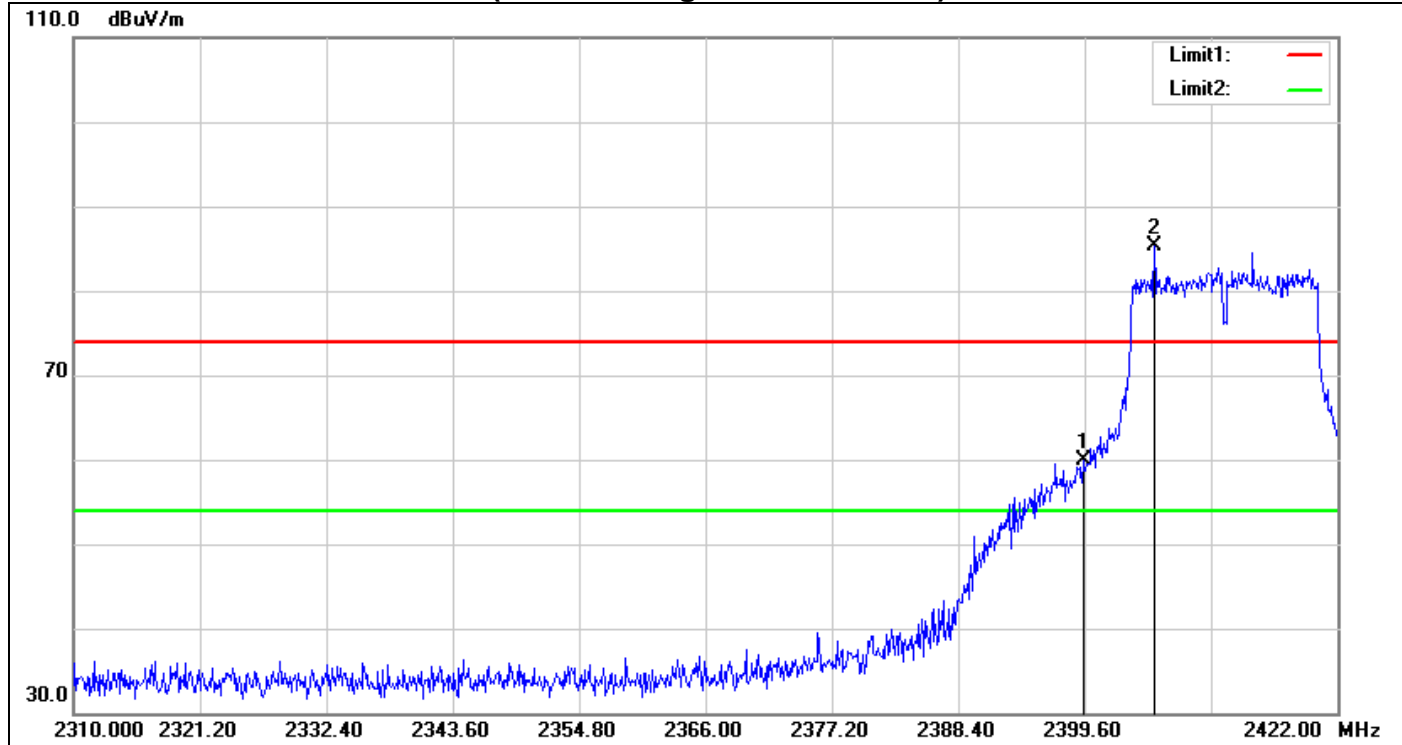
Un-restricted Band Emissions (IEEE 802.11b mode / CH High)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Remark
1	2461.500	95.03	-2.10	92.93	peak
2	2484.500	44.09	-1.98	42.11	peak

Note: Spurious emission levels that exceed the level of 20 dB below the applicable limit.

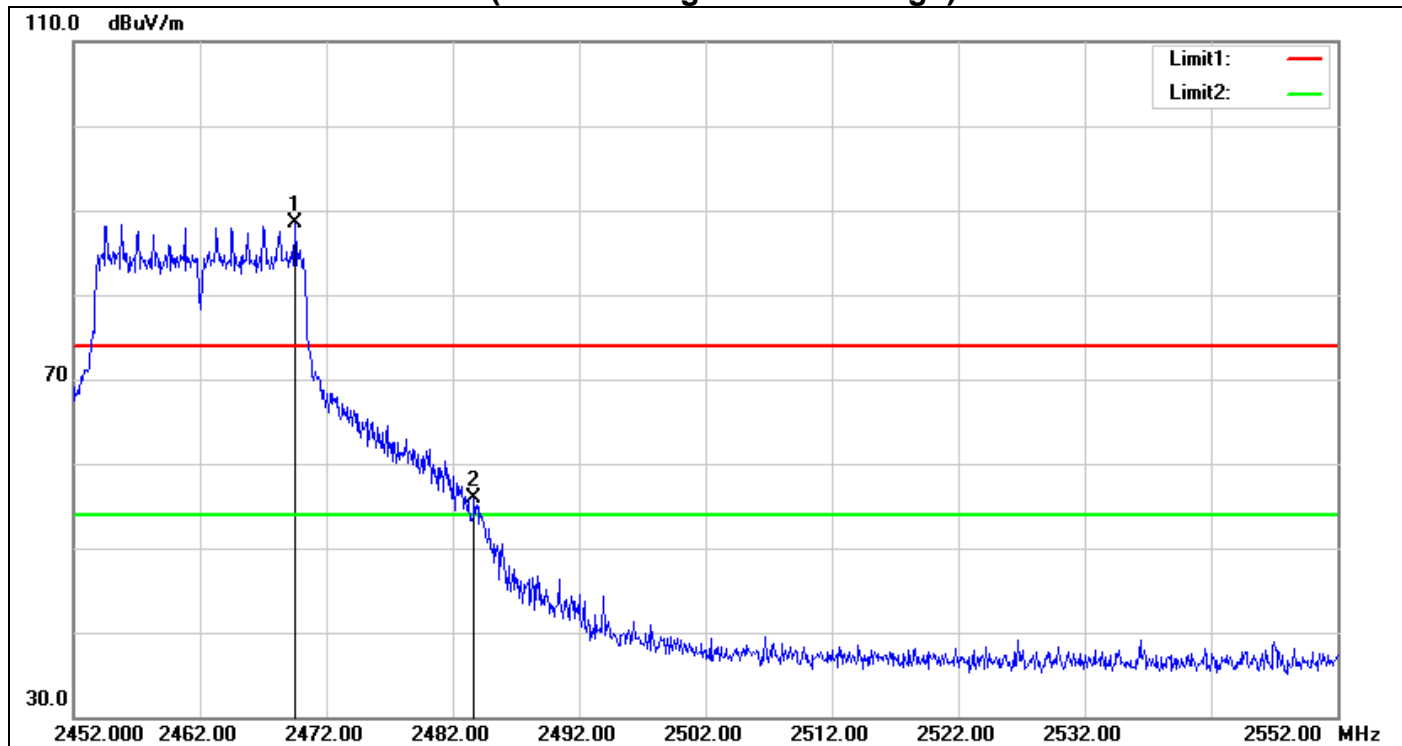
Un-restricted Band Emissions (IEEE 802.11g mode / CH Low)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Remark
1	2399.488	62.33	-2.41	59.92	peak
2	2405.760	87.82	-2.42	85.40	peak

Note: Spurious emission levels that exceed the level of 20 dB below the applicable limit.

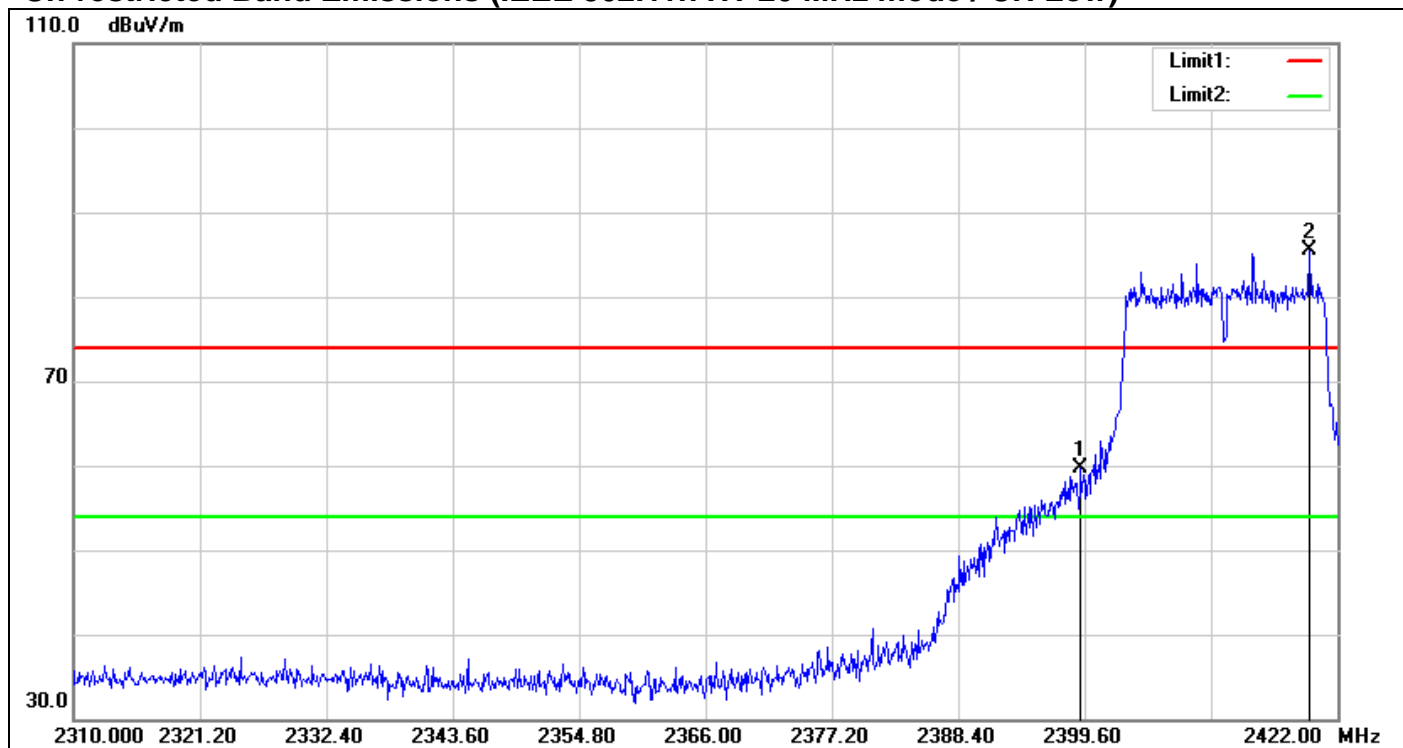
Un-restricted Band Emissions (IEEE 802.11g mode / CH High)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Remark
1	2469.500	90.58	-2.07	88.51	peak
2	2483.700	57.89	-1.99	55.90	peak

Note: Spurious emission levels that exceed the level of 20 dB below the applicable limit.

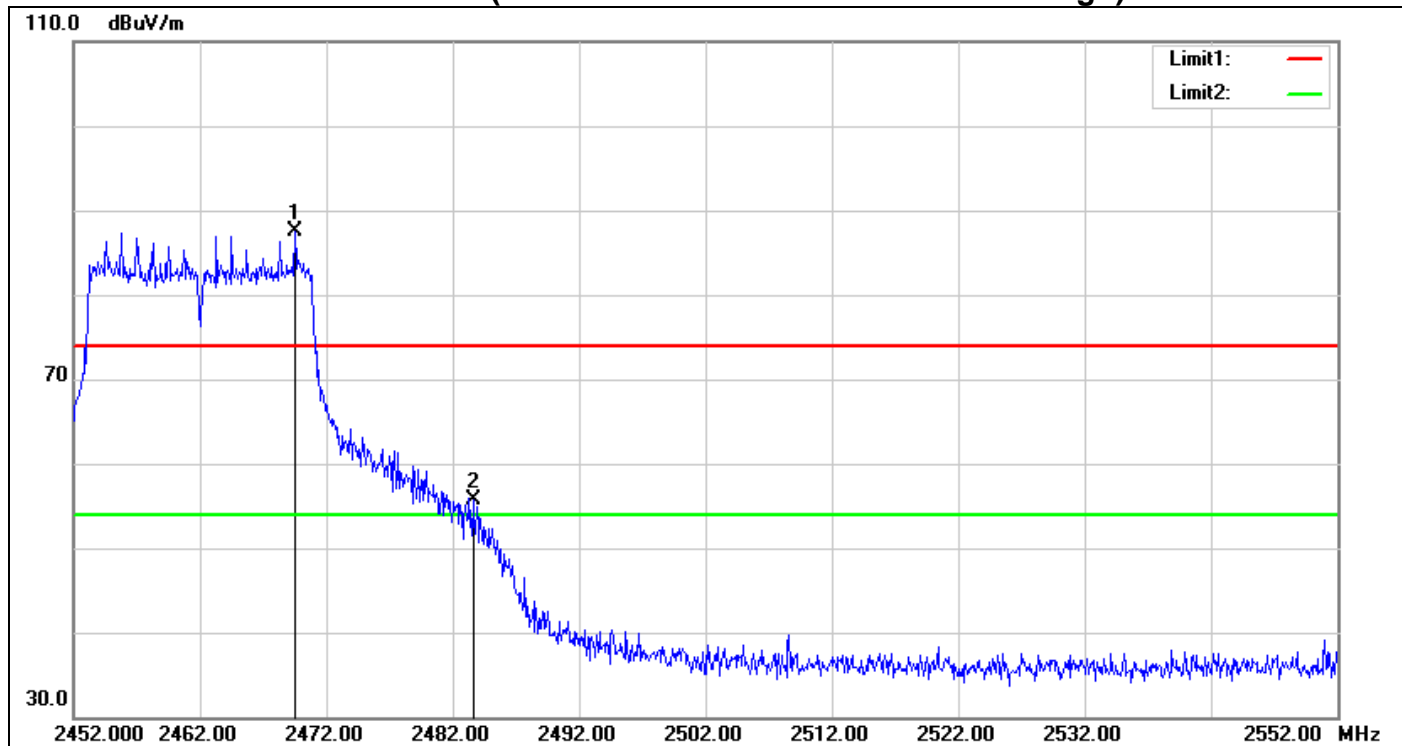
Un-restricted Band Emissions (IEEE 802.11n HT 20 MHz mode / CH Low)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Remark
1	2399.264	62.05	-2.42	59.63	peak
2	2419.536	87.80	-2.36	85.44	peak

Note: Spurious emission levels that exceed the level of 20 dB below the applicable limit.

Un-restricted Band Emissions (IEEE 802.11n HT 20 MHz mode / CH High)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Remark
1	2469.500	89.65	-2.07	87.58	peak
2	2483.600	57.76	-1.99	55.77	peak

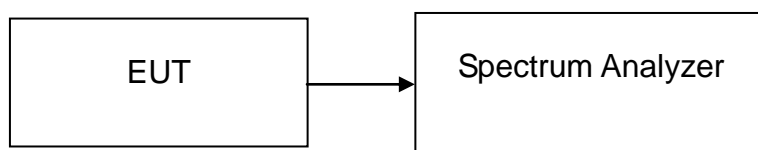
Note: Spurious emission levels that exceed the level of 20 dB below the applicable limit.

7.5 PEAK POWER SPECTRAL DENSITY

LIMIT

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

Test Configuration



TEST PROCEDURE

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 = 30 kHz, Span = 300 kHz, Sweep time = 100 s
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

IEEE 802.11b mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-3.90	8.00	PASS
Mid	2437	-5.51		PASS
High	2462	-6.05		PASS

IEEE 802.11g mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-10.46	8.00	PASS
Mid	2437	-10.38		PASS
High	2462	-8.42		PASS

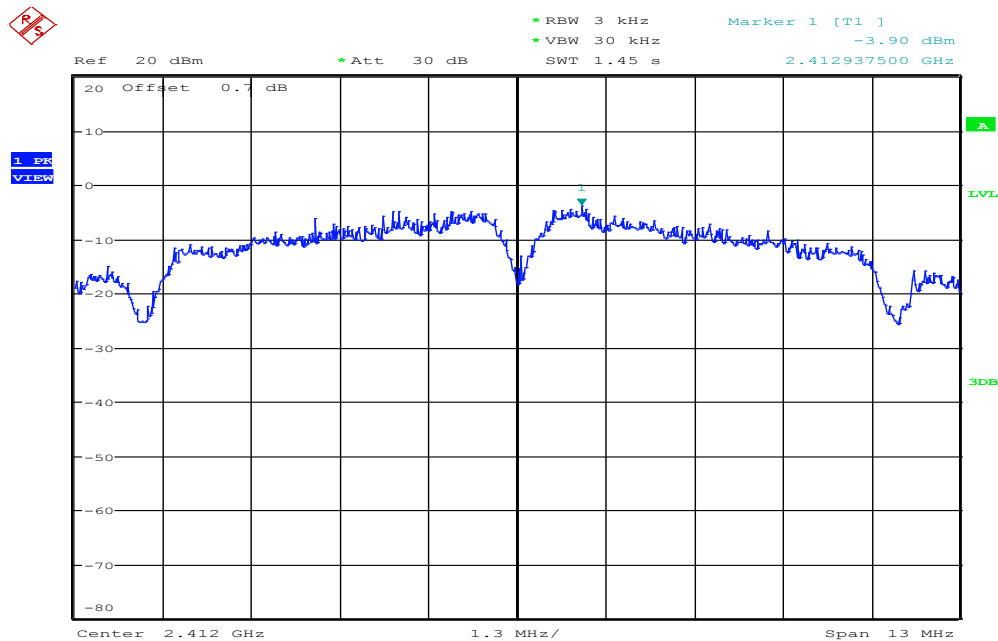
IEEE 802.11n HT 20 MHz mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Result
Low	2412	-11.49	8.00	PASS
Mid	2437	-10.20		PASS
High	2462	-10.75		PASS

Test Plot

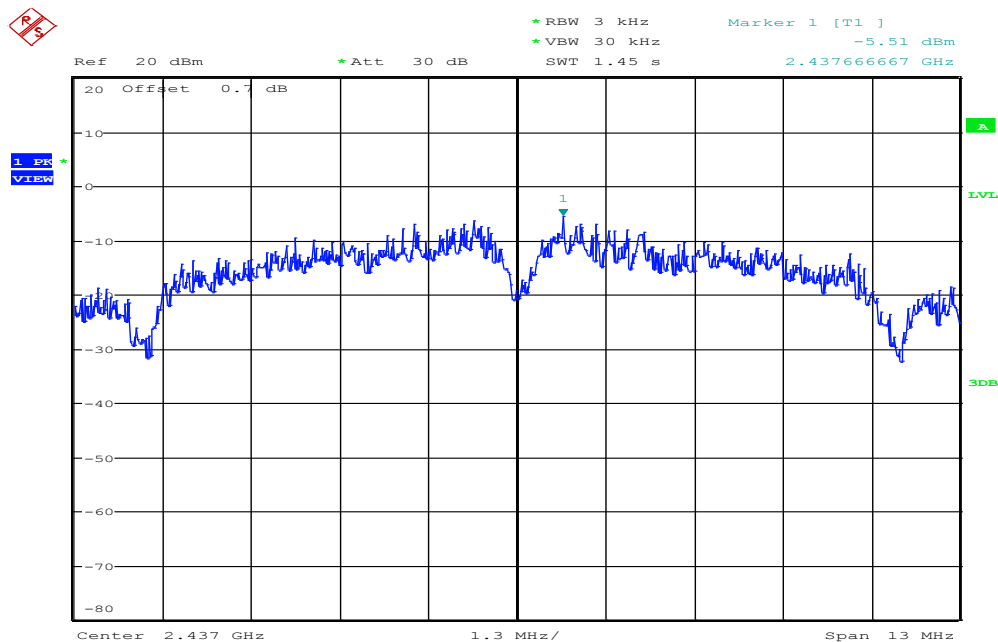
IEEE 802.11b mode

PPSD (CH Low)



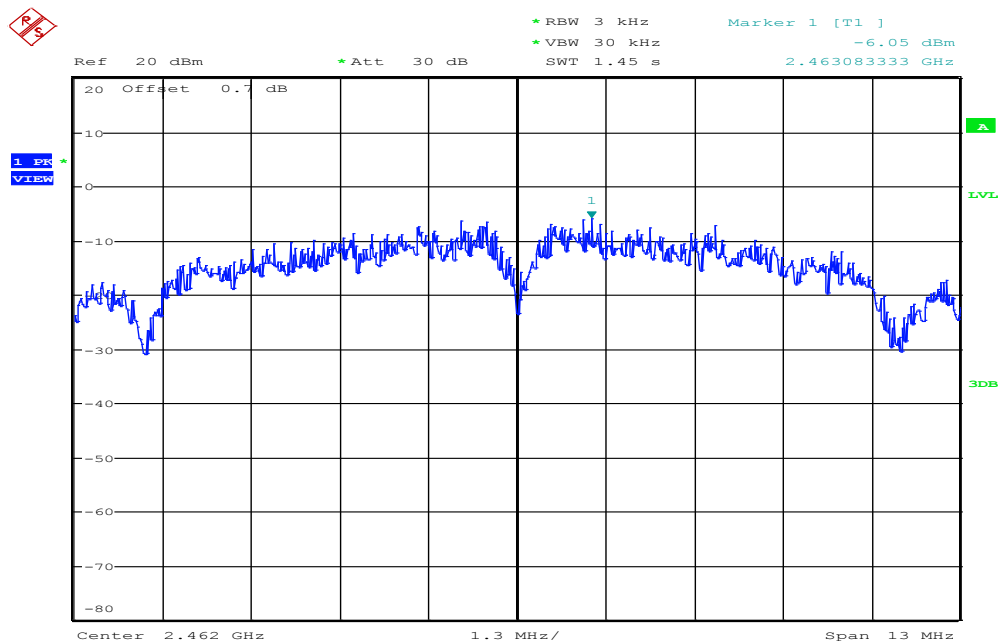
Date: 22.AUG.2016 11:02:05

PPSD (CH Mid)



Date: 22.AUG.2016 11:10:12

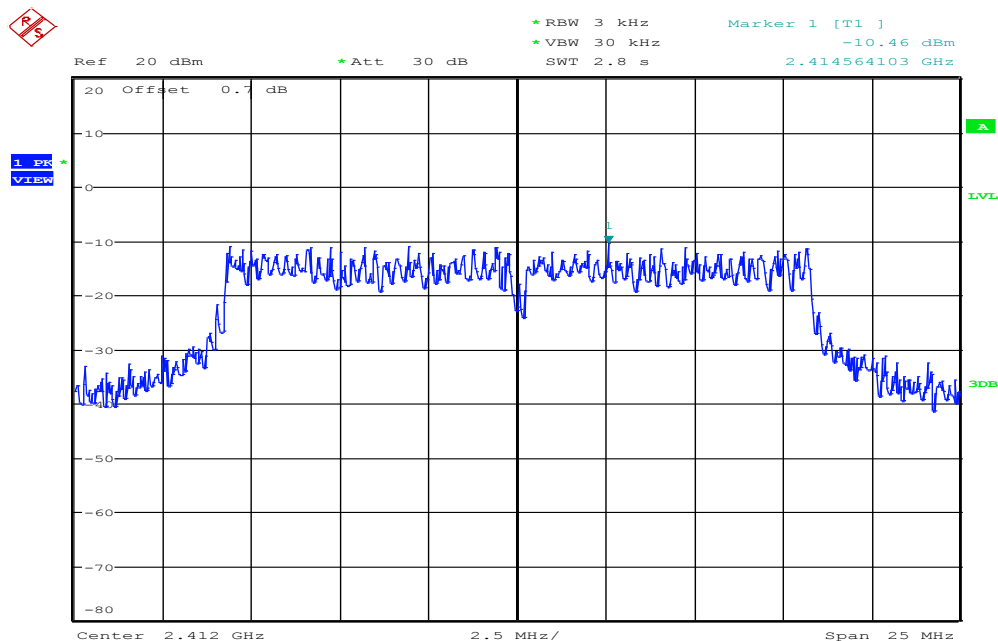
PPSD (CH High)



Date: 22.AUG.2016 11:11:50

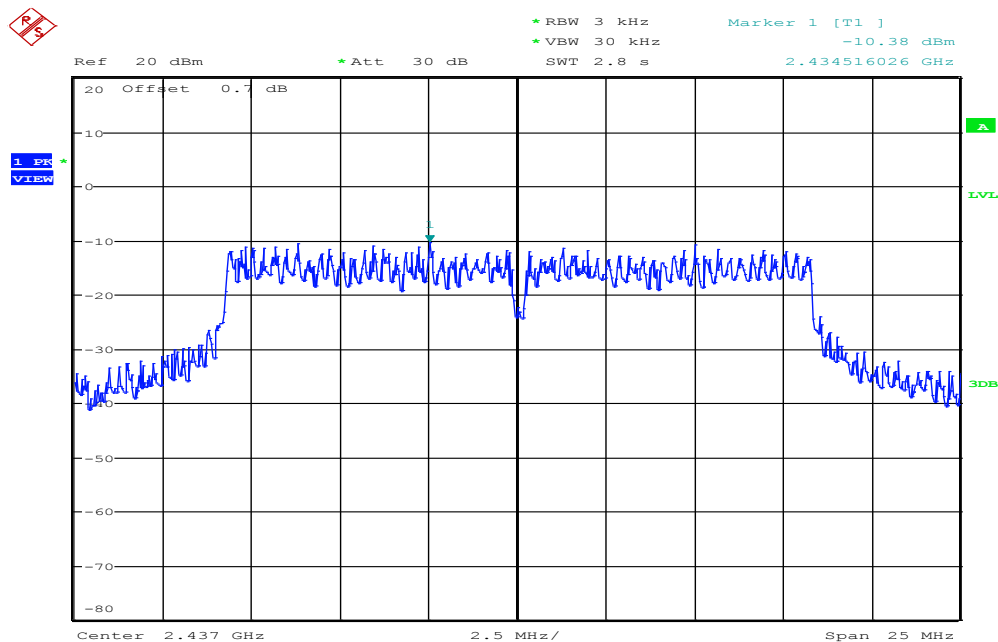
IEEE 802.11g mode

PPSD (CH Low)



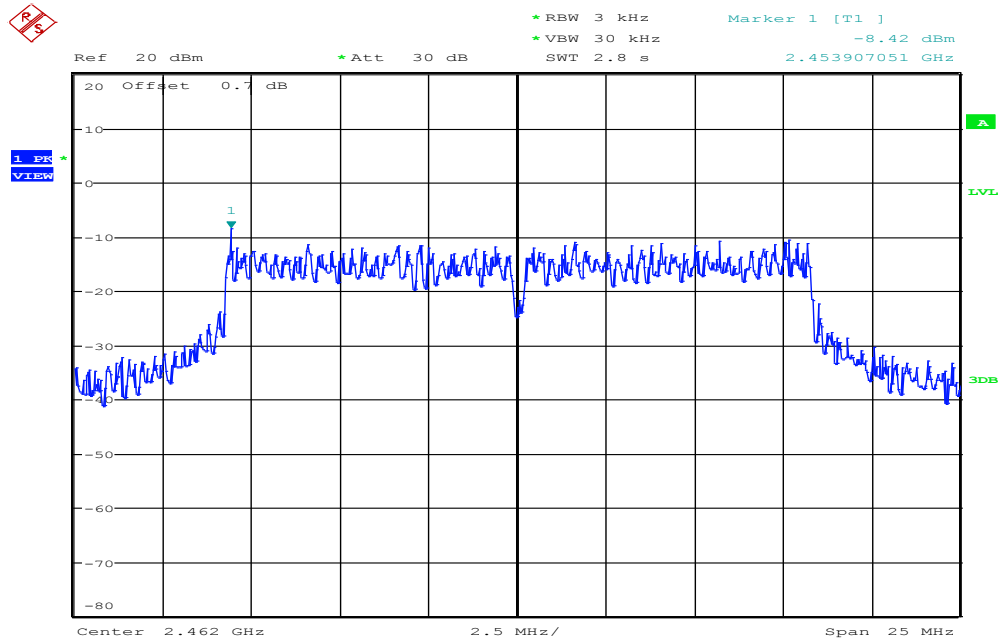
Date: 22.AUG.2016 11:14:14

PPSD (CH Mid)



Date: 22.AUG.2016 11:15:19

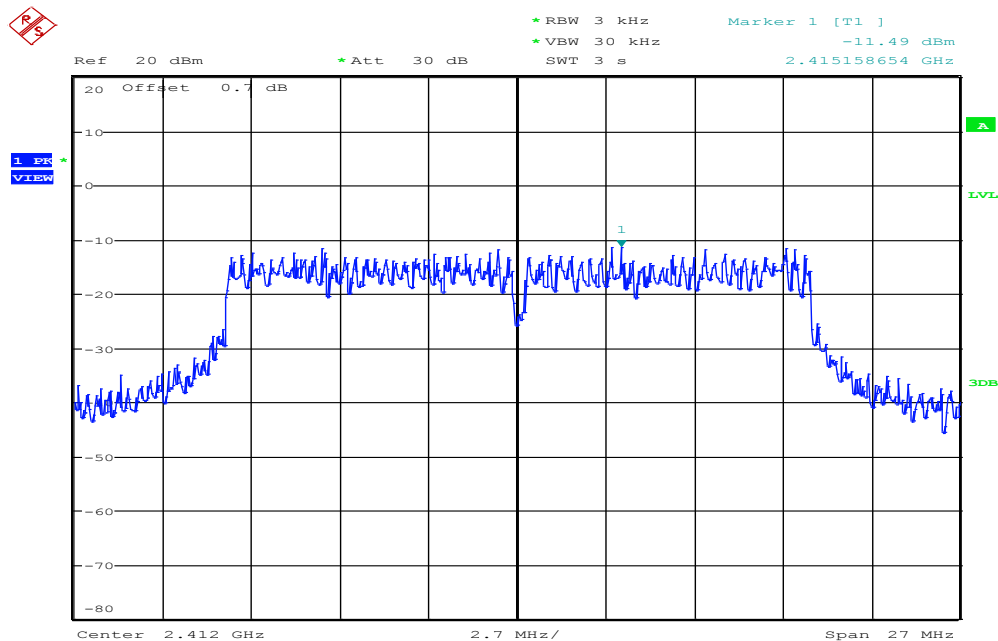
PPSD (CH High)



Date: 22.AUG.2016 11:16:08

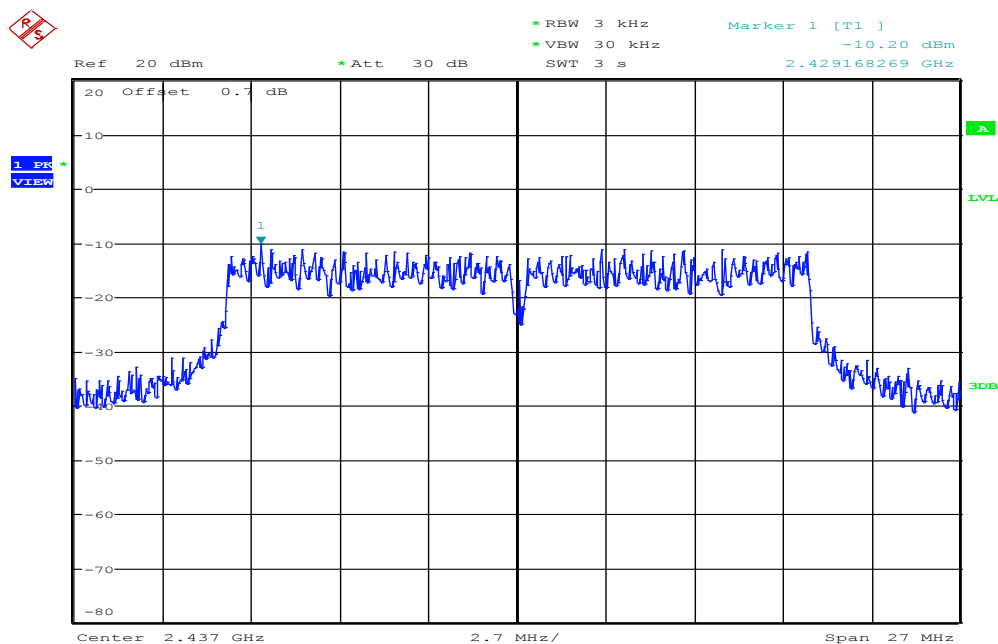
IEEE 802.11n HT 20 MHz mode

PPSD (CH Low)



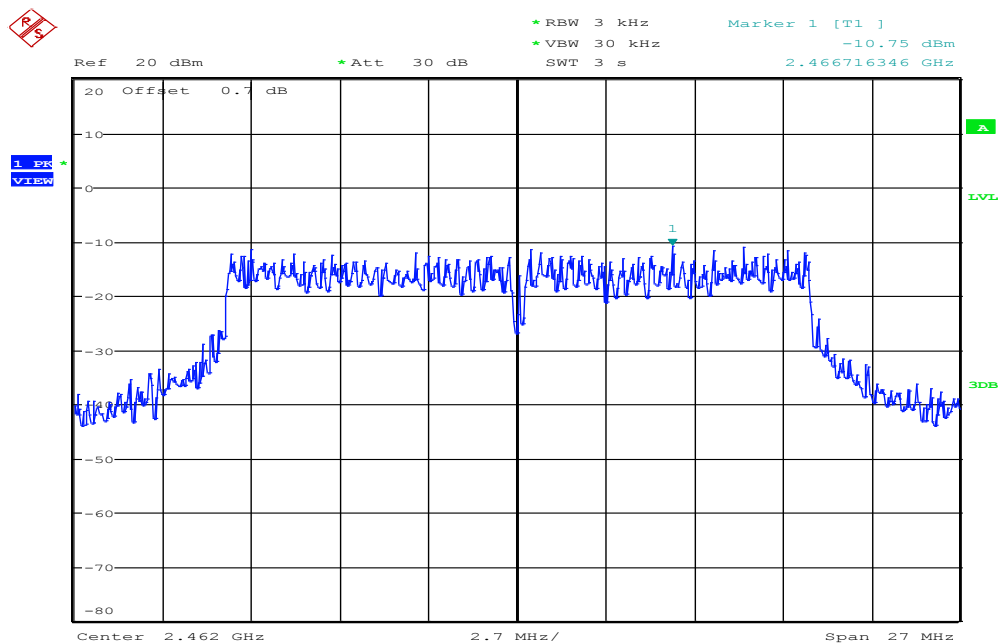
Date: 22.AUG.2016 11:18:57

PPSD (CH Mid)



Date: 22.AUG.2016 11:19:59

PPSD (CH High)



Date: 22.AUG.2016 11:20:52

7.6 RADIATED EMISSIONS

LIMIT

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

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
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

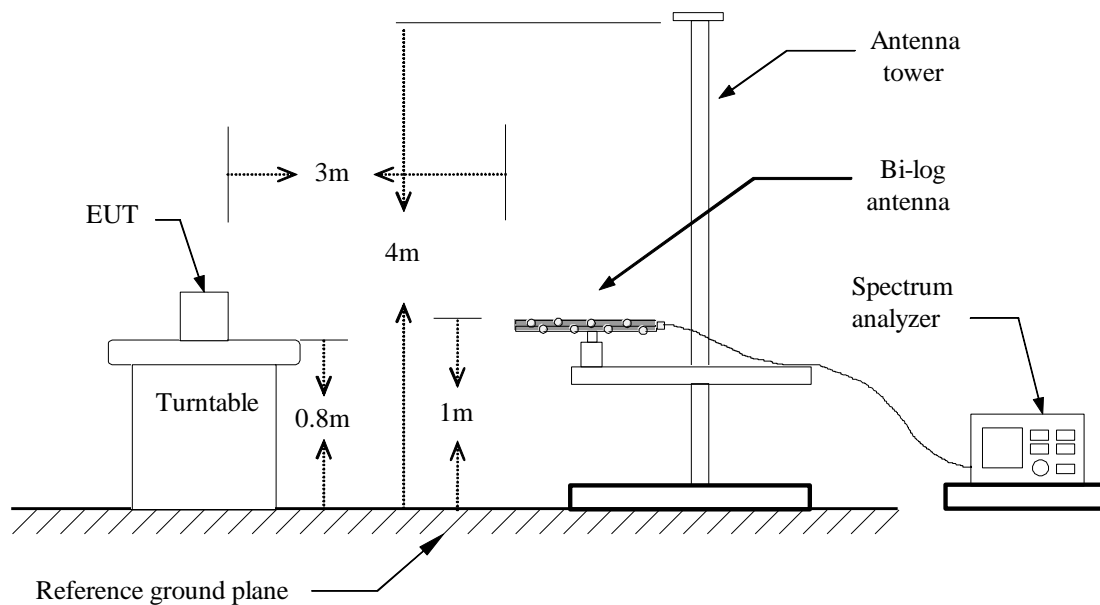
Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

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

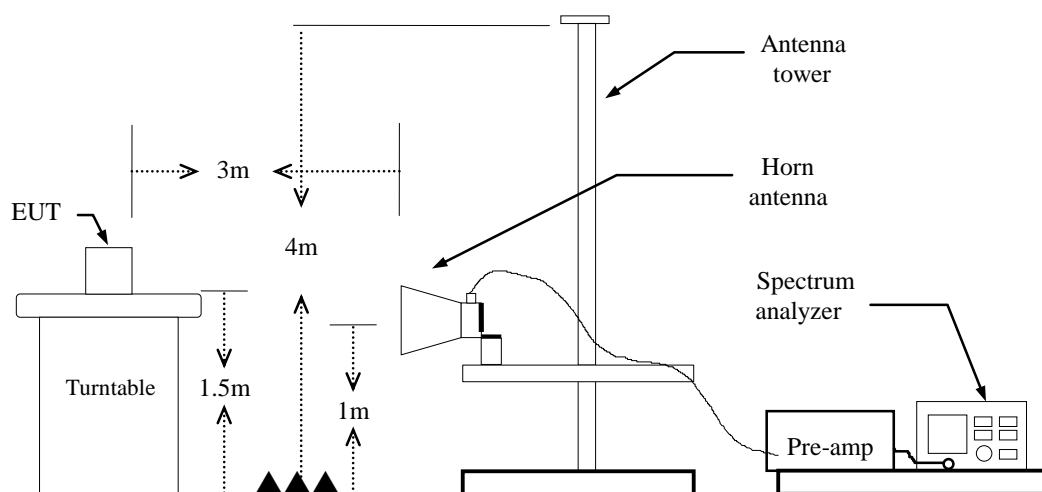
Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
0.009 - 0.490	2400/F(kHz) +80	20LOG((2400/F(kHz))+80)
0.490 - 1.705	24000/F(kHz) +40	20LOG((24000/F(kHz))+40)
1.705 – 30.0	30	69.54
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

30MHz ~ 1GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m high and below 1 GHz is 0.8m high above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

(a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz,
if duty cycle $\geq 98\%$, VBW=10Hz.
if duty cycle $< 98\%$ VBW=1/T.

IEEE 802.11b mode: $\geq 98\%$, VBW=10Hz

IEEE 802.11g mode: $\approx 97\%$, VBW=510Hz

IEEE 802.11n HT 20 MHz mode: $\approx 96\%$, VBW=560kHz

7. Repeat above procedures until the measurements for all frequencies are complete.
8. Result = Spectrum Reading + cable loss(spectrum to Amp) - Amp Gain + Cable loss(Amp to receive Ant)+ Receive Ant

Note: We checked every harmonics frequencies from Fundamental frequencies with reduced VBW, and we mark a point to prove pass or not if we find any emission. For this case, there are no emissions hidden in the noise floor.

Below 1GHz

Operation Mode: Normal Link

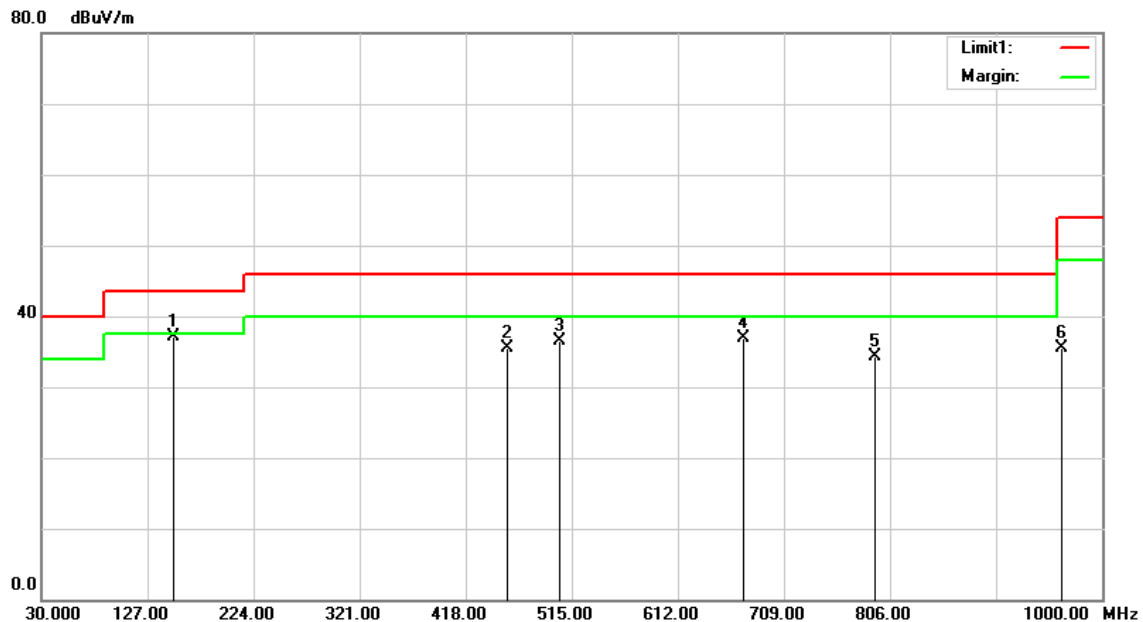
Test Date: April 6, 2017

Temperature: 27°C

Tested by: Ed Chiang

Humidity: 53% RH

Polarity: Ver.



Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
151.2500	53.30	-16.11	37.19	43.50	-6.31	peak	V
455.8300	45.66	-10.08	35.58	46.00	-10.42	peak	V
504.3300	45.70	-9.18	36.52	46.00	-9.48	peak	V
672.1400	43.26	-6.35	36.91	46.00	-9.09	peak	V
792.4200	38.82	-4.56	34.26	46.00	-11.74	peak	V
963.1400	37.66	-2.18	35.48	54.00	-18.52	peak	V

Remark:

1. Measuring frequencies from 30 MHz to the 1GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. $\text{Margin (dB)} = \text{Result (dBuV/m)} - \text{Limit (dBuV/m)}$.

Operation Mode: Normal Link

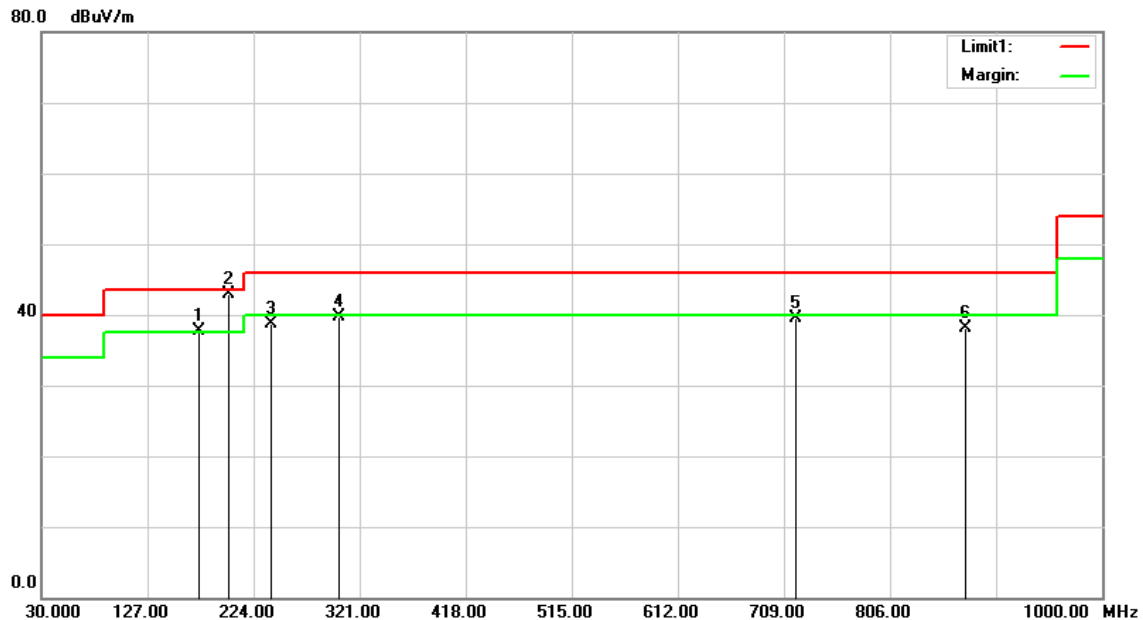
Test Date: April 6, 2017

Temperature: 27°C

Tested by: Ed Chiang

Humidity: 53% RH

Polarity: Hor.



Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
174.5300	54.74	-17.07	37.67	43.50	-5.83	QP	H
200.7200	58.52	-15.60	42.92	43.50	-0.58	QP	H
239.5200	55.31	-16.52	38.79	46.00	-7.21	QP	H
301.6000	53.87	-14.20	39.67	46.00	-6.33	peak	H
719.6700	45.03	-5.62	39.41	46.00	-6.59	peak	H
874.8700	41.57	-3.49	38.08	46.00	-7.92	peak	H

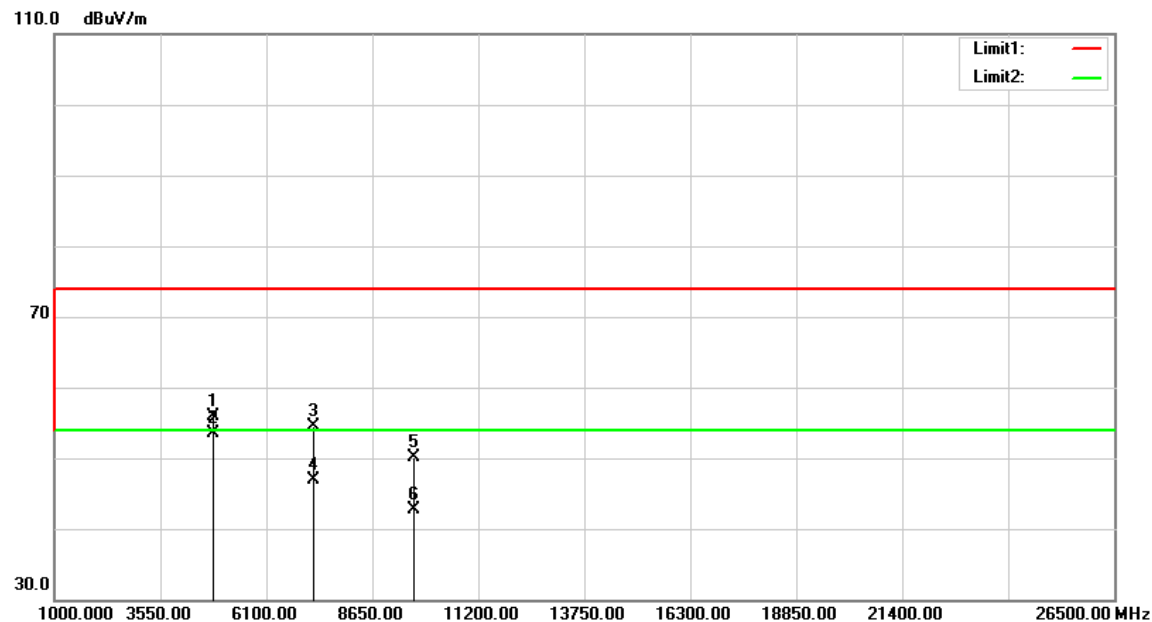
Remark:

1. Measuring frequencies from 30 MHz to the 1GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. $\text{Margin (dB)} = \text{Result (dBuV/m)} - \text{Limit (dBuV/m)}$.

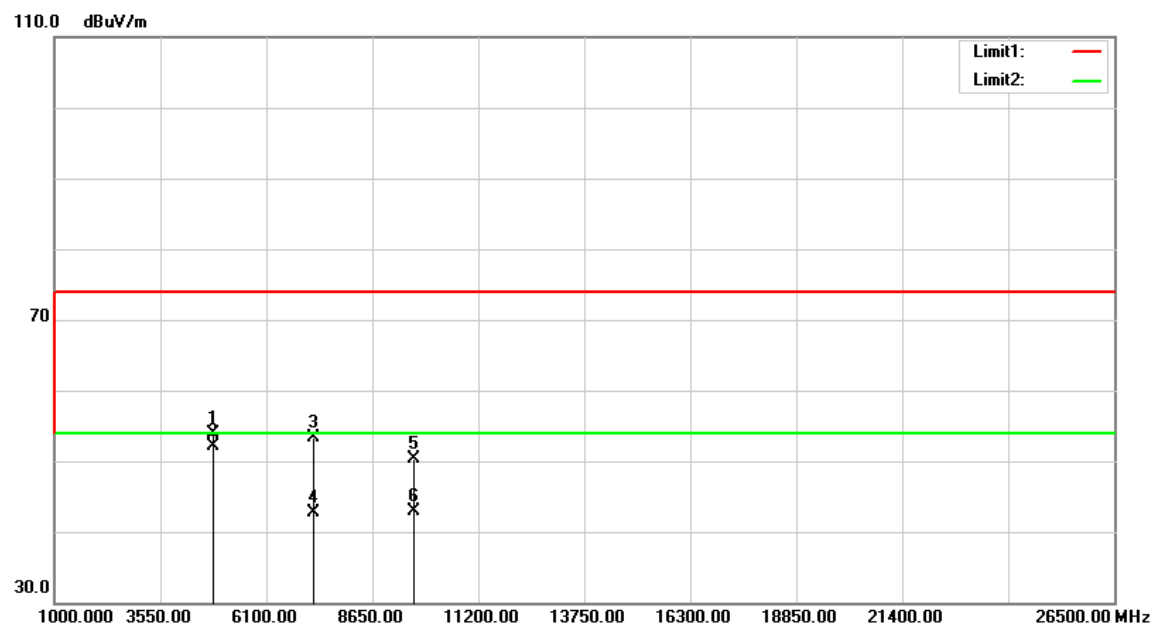
Above 1 GHz

TX / IEEE 802.11b / CH Low

Polarity: Vertical



Polarity: Horizontal



Above 1 GHz**Operation Mode:** TX / IEEE 802.11b / CH Low**Test Date:** April 6, 2017**Temperature:** 27°C**Tested by:** Ed Chiang**Humidity:** 53% RH**Polarity:** Ver. / Hor.

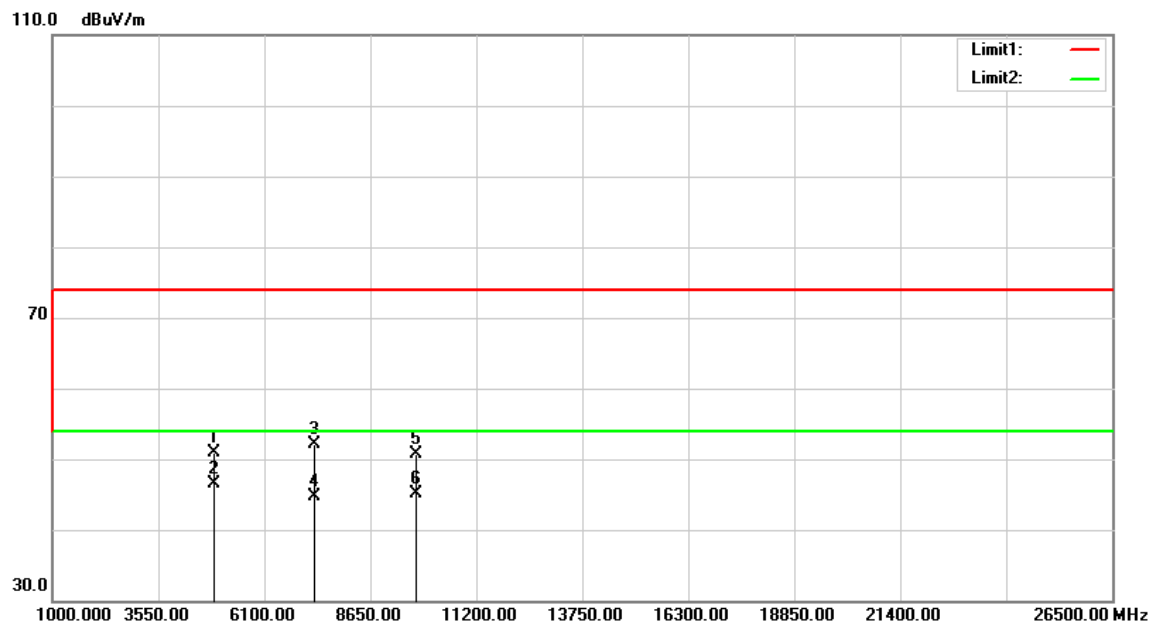
Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
4827.000	50.82	5.11	55.93	74.00	-18.07	peak	V
4827.000	48.49	5.11	53.60	54.00	-0.40	AVG	V
7235.000	41.75	12.71	54.46	74.00	-19.54	peak	V
7235.000	34.12	12.71	46.83	54.00	-7.17	AVG	V
9648.000	32.58	17.60	50.18	74.00	-23.82	peak	V
9648.000	25.07	17.60	42.67	54.00	-11.33	AVG	V
4827.000	48.82	5.11	53.93	74.00	-20.07	peak	H
4827.000	46.93	5.11	52.04	54.00	-1.96	AVG	H
7235.000	40.63	12.71	53.34	74.00	-20.66	peak	H
7235.000	29.97	12.71	42.68	54.00	-11.32	AVG	H
9648.000	32.69	17.60	50.29	74.00	-23.71	peak	H
9648.000	25.21	17.60	42.81	54.00	-11.19	AVG	H

Remark:

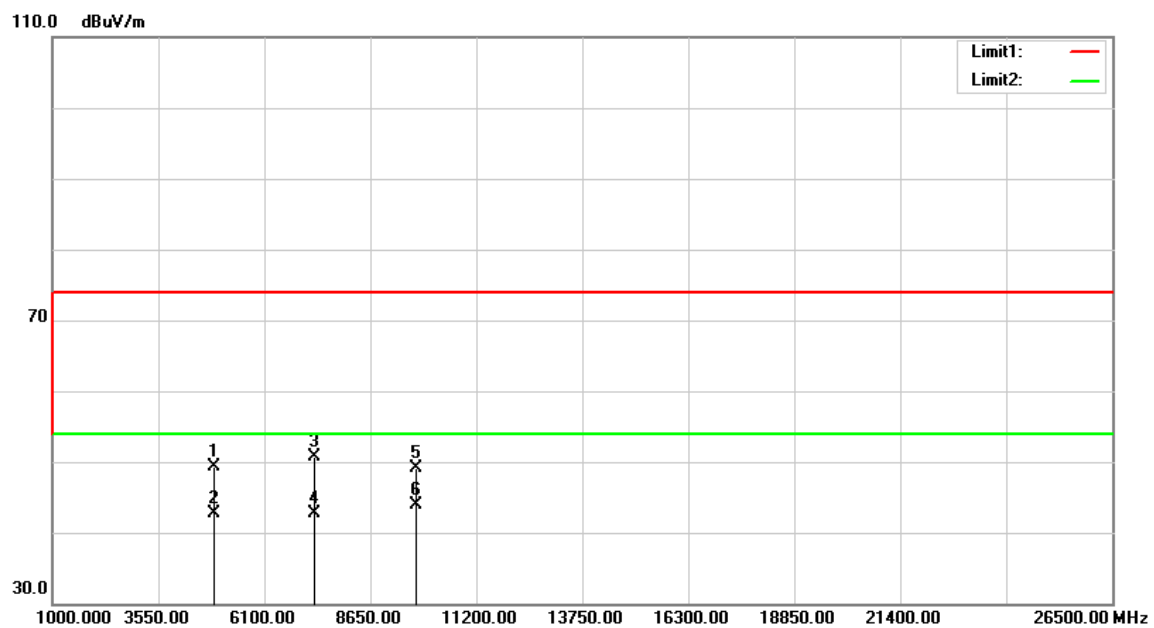
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit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

TX / IEEE 802.11b / CH Mid

Polarity: Vertical



Polarity: Horizontal



Operation Mode: TX / IEEE 802.11b / CH Mid

Test Date: April 6, 2017

Temperature: 27°C

Tested by: Ed Chiang

Humidity: 53% RH

Polarity: Ver. / Hor.

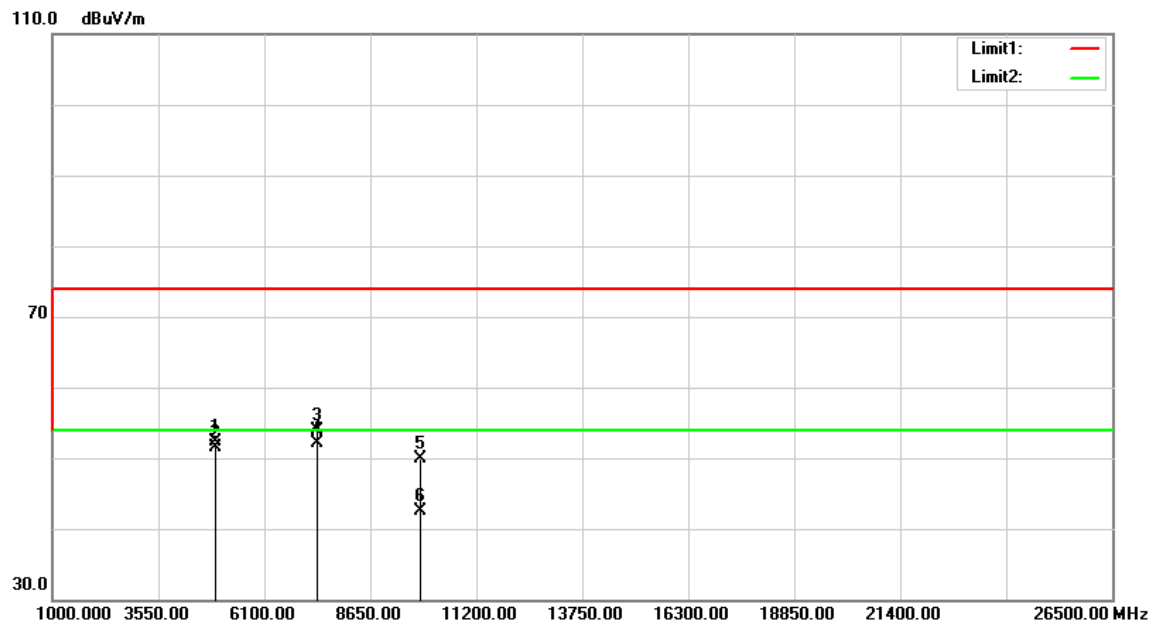
Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
4876.000	45.60	5.24	50.84	74.00	-23.16	peak	V
4876.000	41.34	5.24	46.58	54.00	-7.42	AVG	V
7312.000	39.14	12.94	52.08	74.00	-21.92	peak	V
7312.000	31.67	12.94	44.61	54.00	-9.39	AVG	V
9748.000	33.20	17.60	50.80	74.00	-23.20	peak	V
9748.000	27.58	17.60	45.18	54.00	-8.82	AVG	V
4876.000	44.14	5.24	49.38	74.00	-24.62	peak	H
4876.000	37.56	5.24	42.80	54.00	-11.20	AVG	H
7312.000	37.82	12.94	50.76	74.00	-23.24	peak	H
7312.000	29.77	12.94	42.71	54.00	-11.29	AVG	H
9748.000	31.50	17.60	49.10	74.00	-24.90	peak	H
9748.000	26.24	17.60	43.84	54.00	-10.16	AVG	H

Remark:

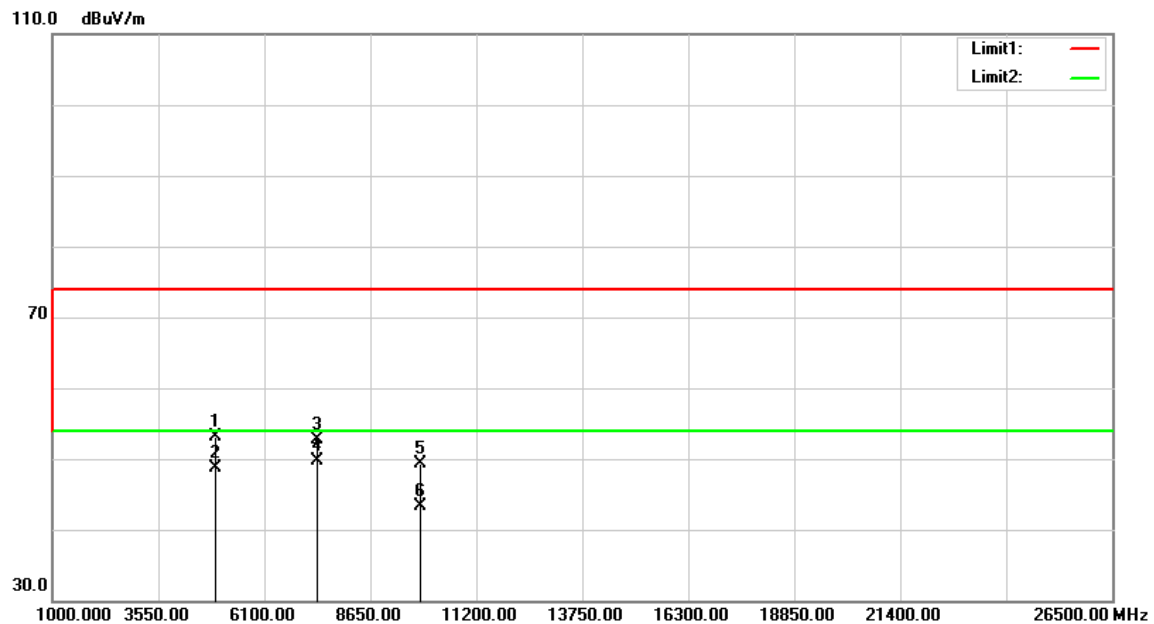
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit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

TX / IEEE 802.11b / CH High

Polarity: Vertical



Polarity: Horizontal



Operation Mode: TX / IEEE 802.11b / CH High

Test Date: April 6, 2017

Temperature: 27°C

Tested by: Ed Chiang

Humidity: 53% RH

Polarity: Ver. / Hor.

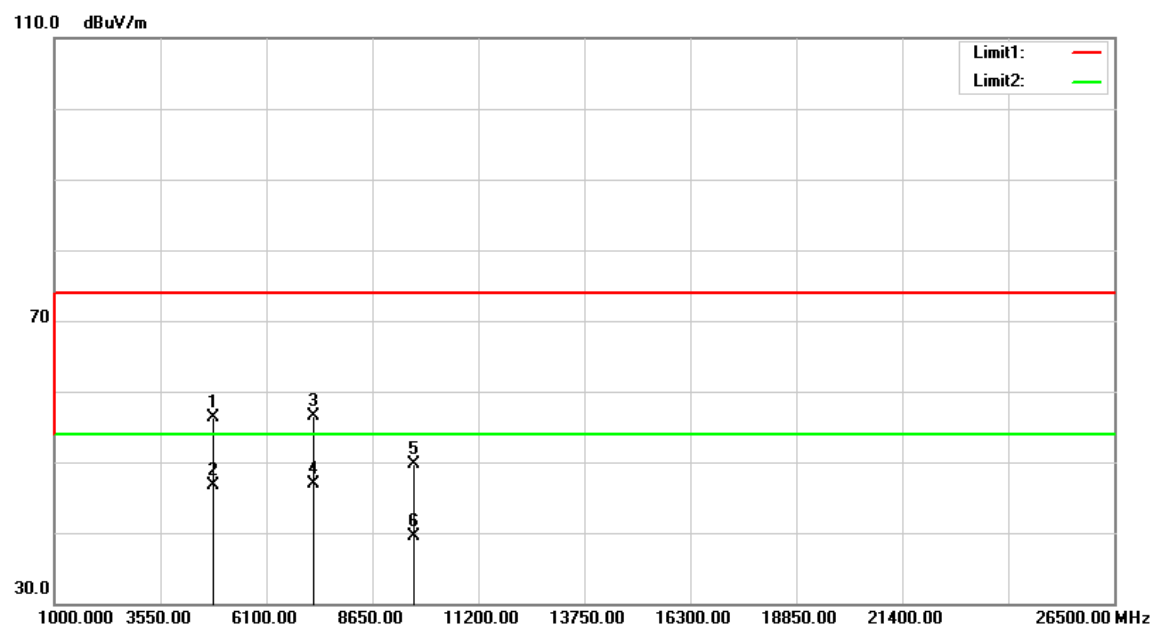
Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
4925.000	46.91	5.37	52.28	74.00	-21.72	peak	V
4925.000	46.06	5.37	51.43	54.00	-2.57	AVG	V
7389.000	40.75	13.17	53.92	74.00	-20.08	peak	V
7389.000	38.91	13.17	52.08	54.00	-1.92	AVG	V
9848.000	32.34	17.60	49.94	74.00	-24.06	peak	V
9848.000	24.88	17.60	42.48	54.00	-11.52	AVG	V
4925.000	47.71	5.37	53.08	74.00	-20.92	peak	H
4925.000	43.37	5.37	48.74	54.00	-5.26	AVG	H
7382.000	39.55	13.15	52.70	74.00	-21.30	peak	H
7382.000	36.53	13.15	49.68	54.00	-4.32	AVG	H
9848.000	31.80	17.60	49.40	74.00	-24.60	peak	H
9848.000	25.64	17.60	43.24	54.00	-10.76	AVG	H

Remark:

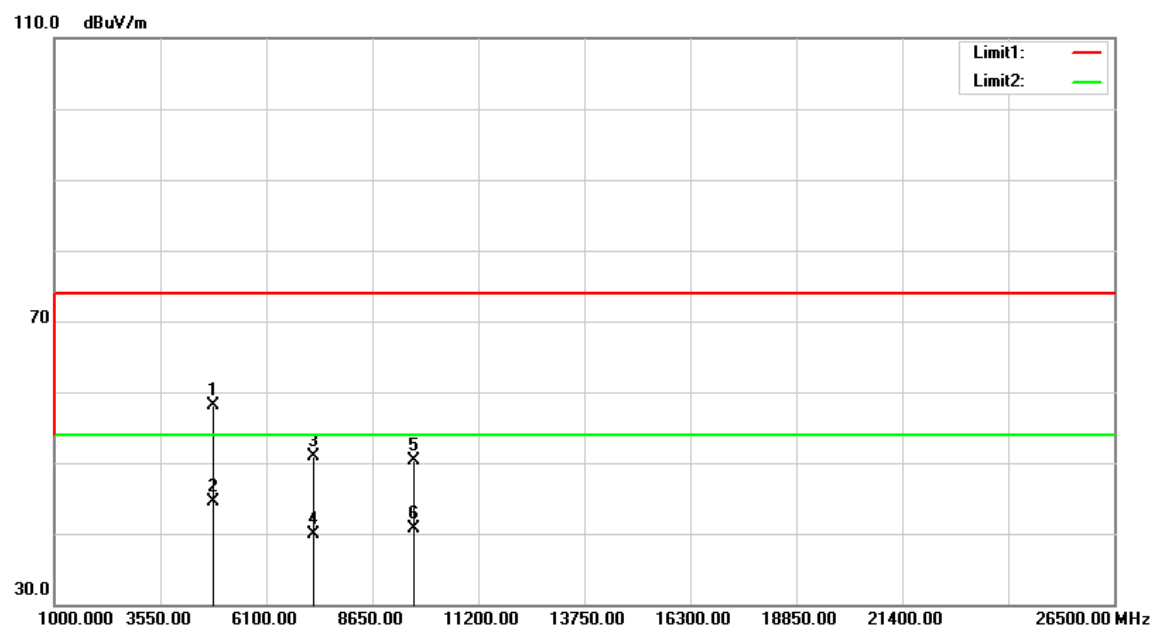
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit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

TX / IEEE 802.11g / CH Low

Polarity: Vertical



Polarity: Horizontal



Operation Mode: TX / IEEE 802.11g / CH Low

Test Date: April 6, 2017

Temperature: 27°C

Tested by: Ed Chiang

Humidity: 53% RH

Polarity: Ver. / Hor.

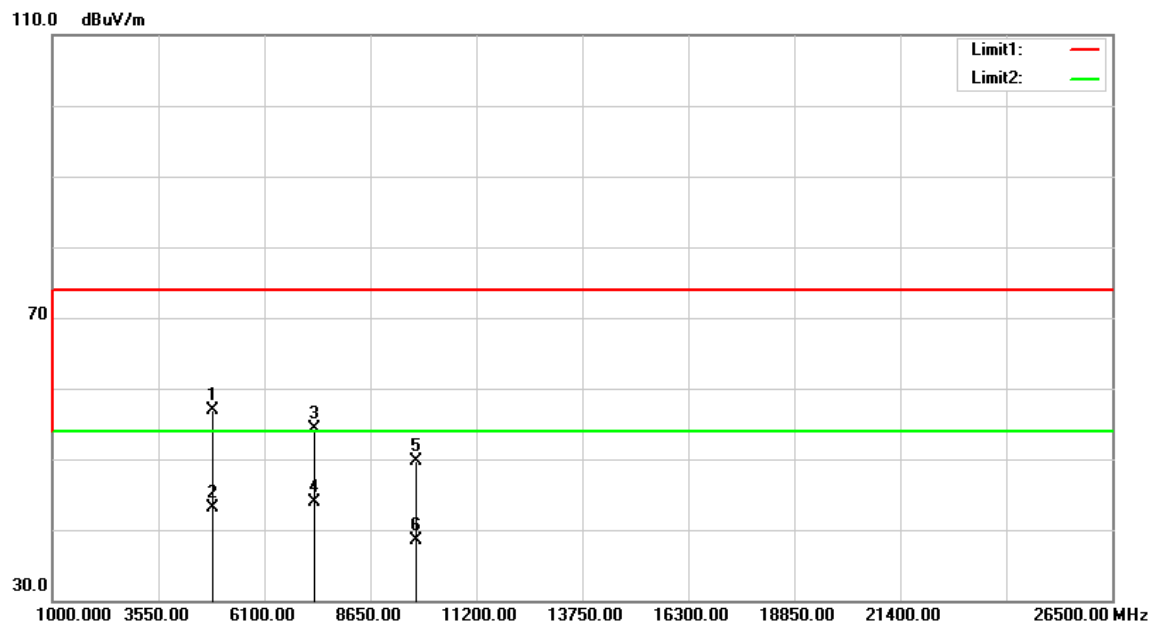
Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
4827.000	51.16	5.11	56.27	74.00	-17.73	peak	V
4827.000	41.68	5.11	46.79	54.00	-7.21	AVG	V
7235.000	43.71	12.71	56.42	74.00	-17.58	peak	V
7235.000	34.12	12.71	46.83	54.00	-7.17	AVG	V
9648.000	32.20	17.60	49.80	74.00	-24.20	peak	V
9648.000	21.88	17.60	39.48	54.00	-14.52	AVG	V
4820.000	53.04	5.09	58.13	74.00	-15.87	peak	H
4820.000	39.33	5.09	44.42	54.00	-9.58	AVG	H
7249.000	38.06	12.75	50.81	74.00	-23.19	peak	H
7249.000	27.09	12.75	39.84	54.00	-14.16	AVG	H
9648.000	32.73	17.60	50.33	74.00	-23.67	peak	H
9648.000	23.02	17.60	40.62	54.00	-13.38	AVG	H

Remark:

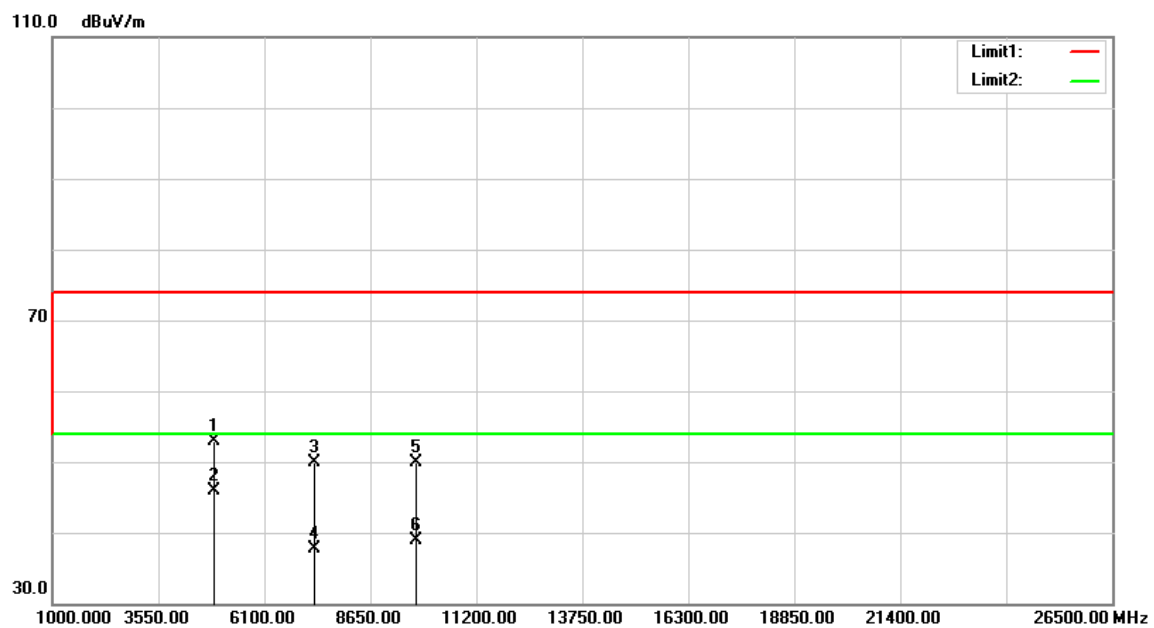
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit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

TX / IEEE 802.11g / CH Mid

Polarity: Vertical



Polarity: Horizontal



Operation Mode: TX / IEEE 802.11g / CH Mid

Test Date: April 6, 2017

Temperature: 27°C

Tested by: Ed Chiang

Humidity: 53% RH

Polarity: Ver. / Hor.

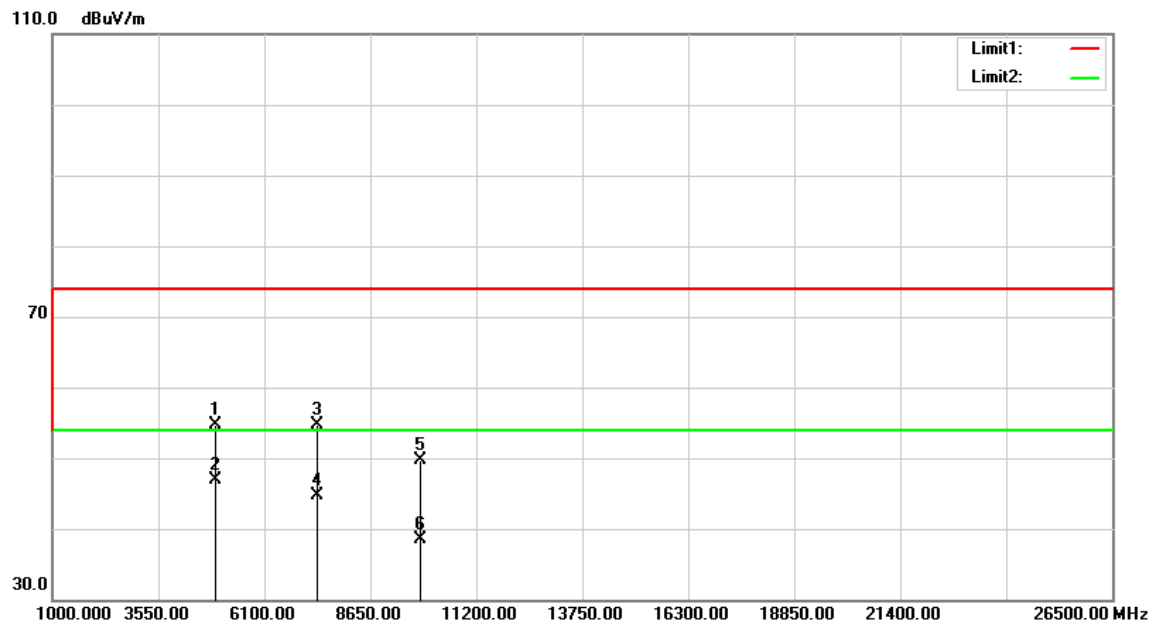
Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
4862.000	51.72	5.20	56.92	74.00	-17.08	peak	V
4862.000	37.84	5.20	43.04	54.00	-10.96	AVG	V
7312.000	41.39	12.94	54.33	74.00	-19.67	peak	V
7312.000	30.88	12.94	43.82	54.00	-10.18	AVG	V
9748.000	32.02	17.60	49.62	74.00	-24.38	peak	V
9748.000	20.87	17.60	38.47	54.00	-15.53	AVG	V
4876.000	47.76	5.24	53.00	74.00	-21.00	peak	H
4876.000	40.60	5.24	45.84	54.00	-8.16	AVG	H
7305.000	37.05	12.92	49.97	74.00	-24.03	peak	H
7305.000	24.70	12.92	37.62	54.00	-16.38	AVG	H
9748.000	32.21	17.60	49.81	74.00	-24.19	peak	H
9748.000	21.31	17.60	38.91	54.00	-15.09	AVG	H

Remark:

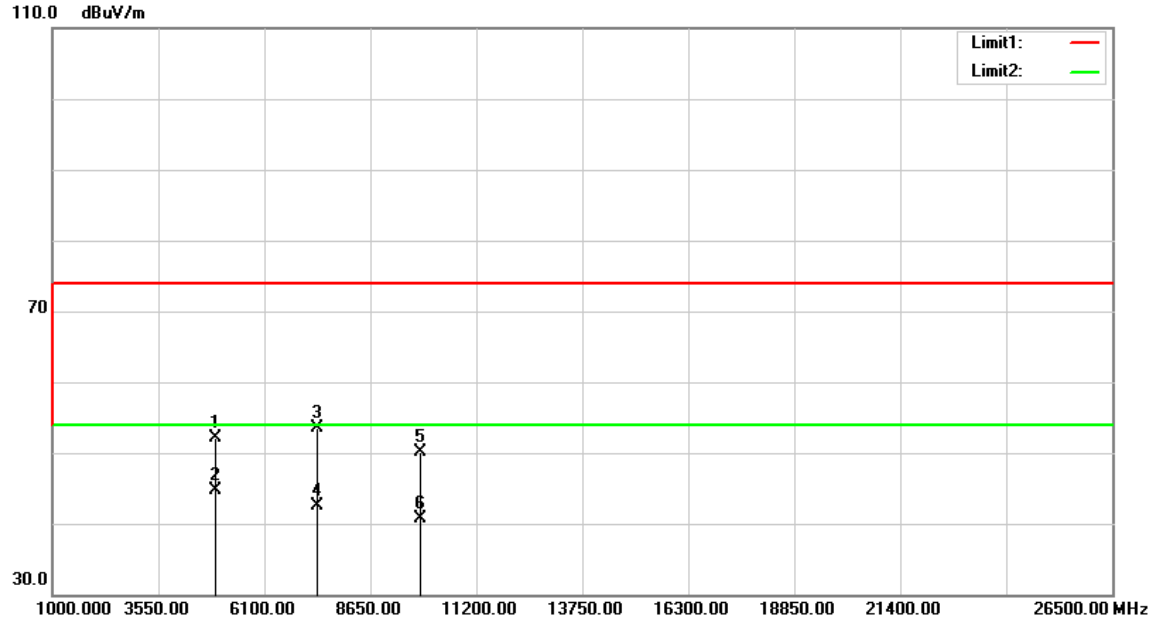
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit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

TX / IEEE 802.11g / CH High

Polarity: Vertical



Polarity: Horizontal



Operation Mode: TX / IEEE 802.11g / CH High

Test Date: April 6, 2017

Temperature: 27°C

Tested by: Ed Chiang

Humidity: 53% RH

Polarity: Ver. / Hor.

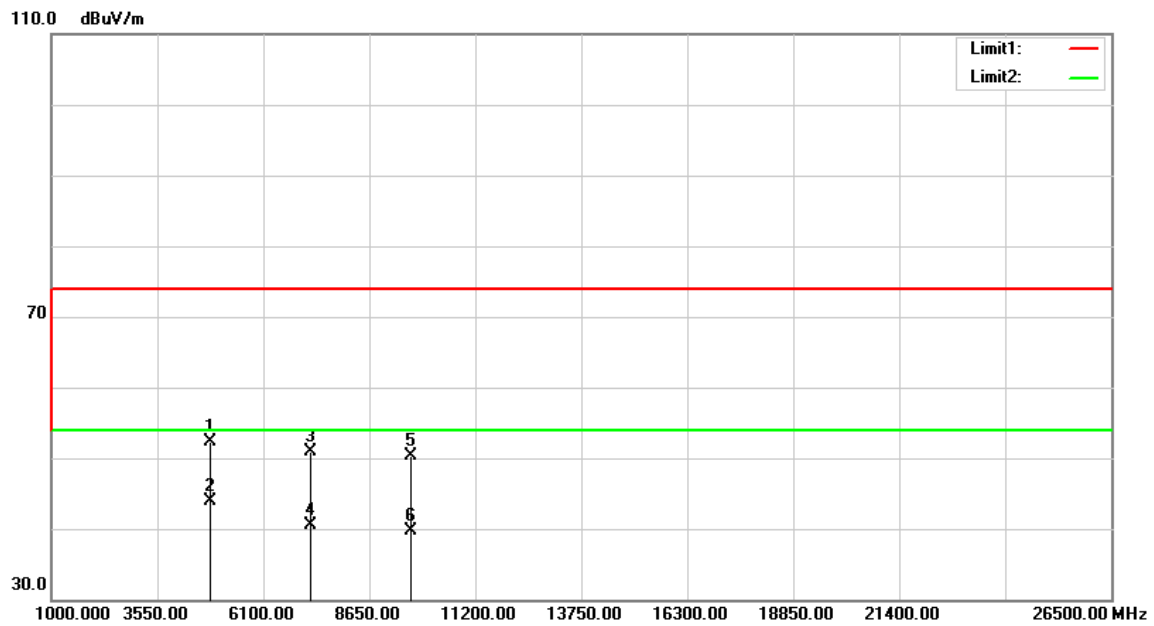
Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
4918.000	49.44	5.35	54.79	74.00	-19.21	peak	V
4918.000	41.47	5.35	46.82	54.00	-7.18	AVG	V
7389.000	41.56	13.17	54.73	74.00	-19.27	peak	V
7389.000	31.46	13.17	44.63	54.00	-9.37	AVG	V
9848.000	32.09	17.60	49.69	74.00	-24.31	peak	V
9848.000	20.94	17.60	38.54	54.00	-15.46	AVG	V
4925.000	46.79	5.37	52.16	74.00	-21.84	peak	H
4925.000	39.31	5.37	44.68	54.00	-9.32	AVG	H
7382.000	40.27	13.15	53.42	74.00	-20.58	peak	H
7382.000	29.36	13.15	42.51	54.00	-11.49	AVG	H
9848.000	32.47	17.60	50.07	74.00	-23.93	peak	H
9848.000	23.15	17.60	40.75	54.00	-13.25	AVG	H

Remark:

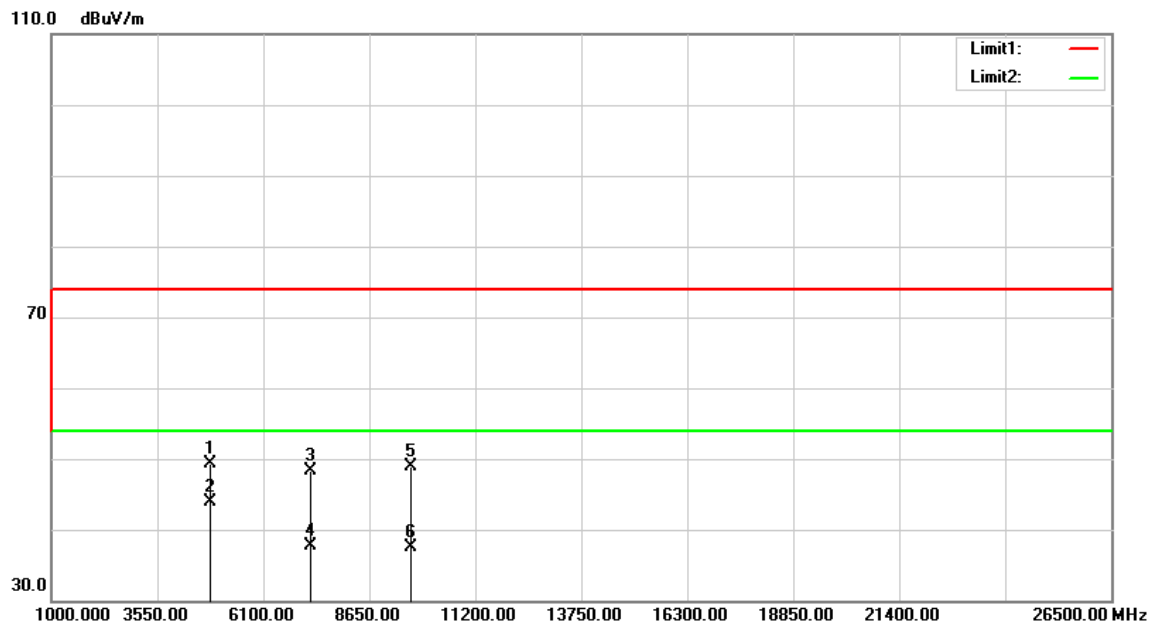
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit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

TX / IEEE 802.11n HT 20 MHz mode / CH Low

Polarity: Vertical



Polarity: Horizontal



Operation Mode: TX / IEEE 802.11n HT 20 MHz mode / CH Low Test Date: April 6, 2017

Temperature: 27°C

Tested by: Ed Chiang

Humidity: 53% RH

Polarity: Ver. / Hor.

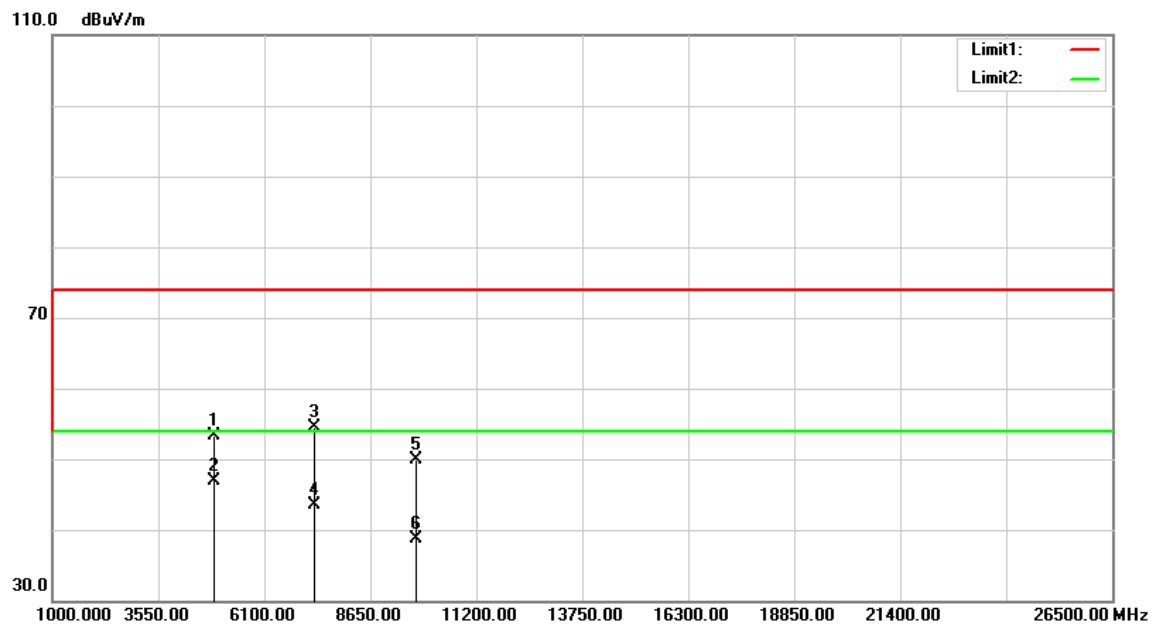
Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
4827.000	47.11	5.11	52.22	74.00	-21.78	peak	V
4827.000	38.75	5.11	43.86	54.00	-10.14	AVG	V
7228.000	38.29	12.69	50.98	74.00	-23.02	peak	V
7228.000	27.88	12.69	40.57	54.00	-13.43	AVG	V
9648.000	32.71	17.60	50.31	74.00	-23.69	peak	V
9648.000	22.08	17.60	39.68	54.00	-14.32	AVG	V
4827.000	44.22	5.11	49.33	74.00	-24.67	peak	H
4827.000	38.75	5.11	43.86	54.00	-10.14	AVG	H
7235.000	35.66	12.71	48.37	74.00	-25.63	peak	H
7235.000	24.91	12.71	37.62	54.00	-16.38	AVG	H
9648.000	31.27	17.60	48.87	74.00	-25.13	peak	H
9648.000	19.81	17.60	37.41	54.00	-16.59	AVG	H

Remark:

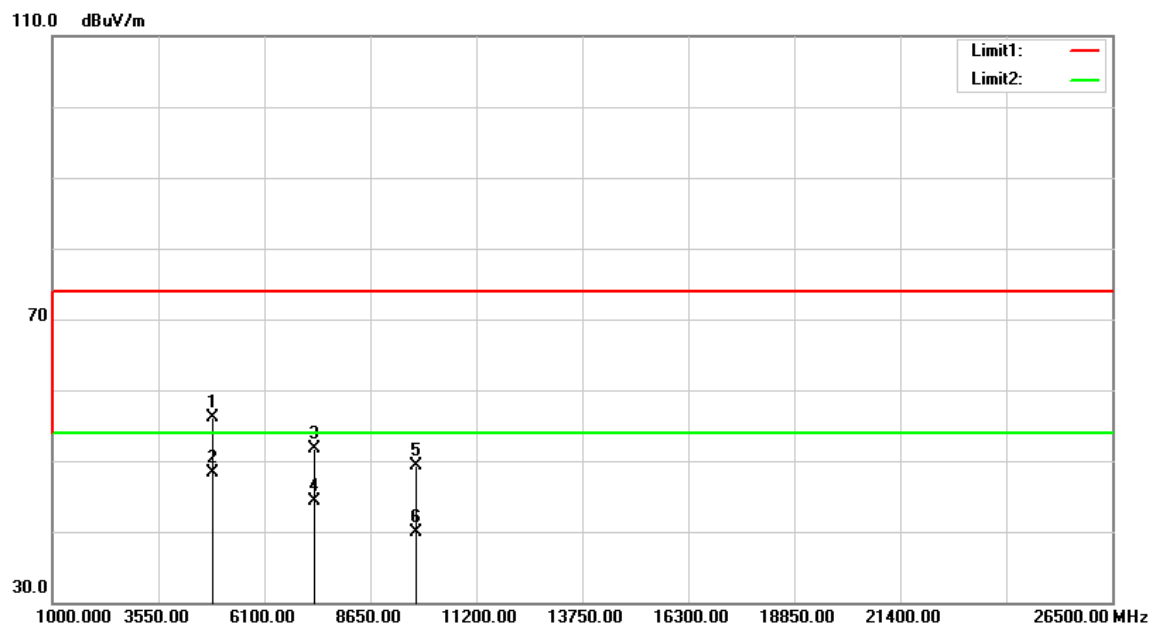
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit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

TX / IEEE 802.11n HT 20 MHz mode / CH Mid

Polarity: Vertical



Polarity: Horizontal



Operation Mode: TX / IEEE 802.11n HT 20 MHz mode / CH Mid **Test Date:** April 6, 2017

Temperature: 27°C

Tested by: Ed Chiang

Humidity: 53% RH

Polarity: Ver. / Hor.

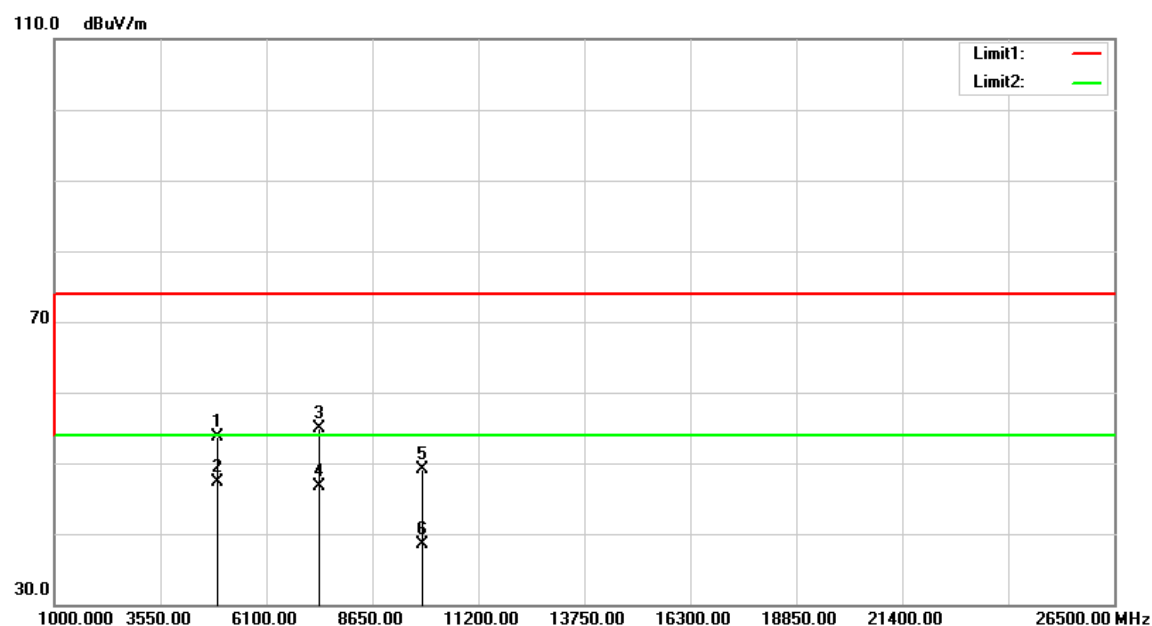
Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
4876.000	48.11	5.24	53.35	74.00	-20.65	peak	V
4876.000	41.57	5.24	46.81	54.00	-7.19	AVG	V
7305.000	41.49	12.92	54.41	74.00	-19.59	peak	V
7305.000	30.68	12.92	43.60	54.00	-10.40	AVG	V
9748.000	32.38	17.60	49.98	74.00	-24.02	peak	V
9748.000	21.10	17.60	38.70	54.00	-15.30	AVG	V
4869.000	50.95	5.22	56.17	74.00	-17.83	peak	H
4869.000	43.02	5.22	48.24	54.00	-5.76	AVG	H
7312.000	38.76	12.94	51.70	74.00	-22.30	peak	H
7312.000	31.36	12.94	44.30	54.00	-9.70	AVG	H
9748.000	31.65	17.60	49.25	74.00	-24.75	peak	H
9748.000	22.22	17.60	39.82	54.00	-14.18	AVG	H

Remark:

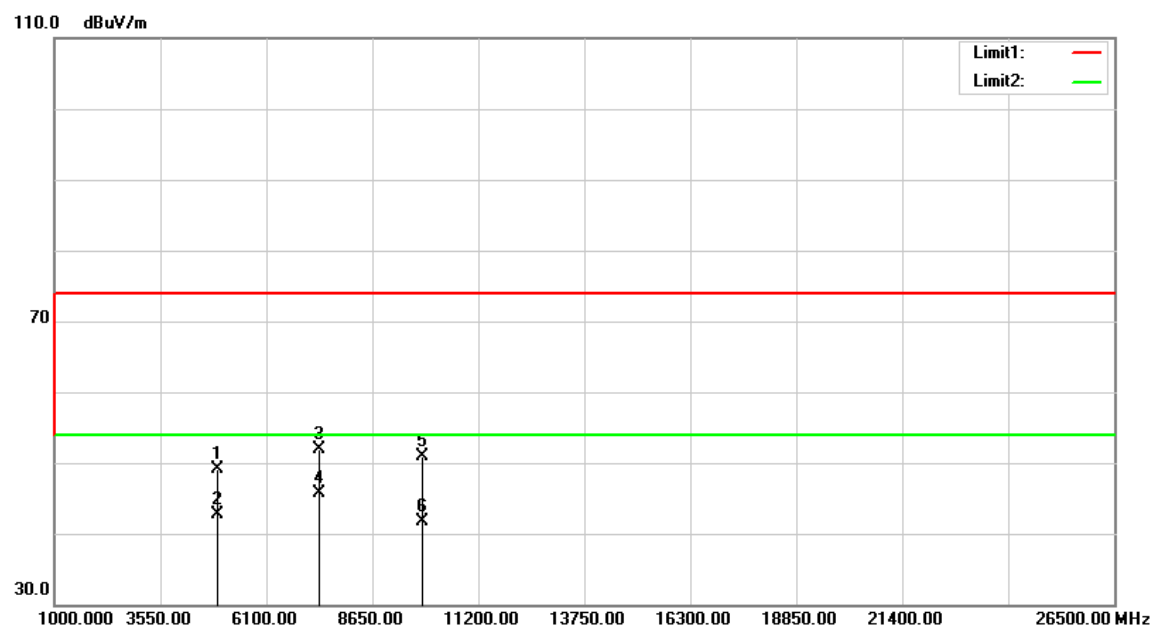
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit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

TX / IEEE 802.11n HT 20 MHz mode / CH High

Polarity: Vertical



Polarity: Horizontal



Operation Mode: TX / IEEE 802.11n HT 20 MHz mode / CH High **Test Date:** April 6, 2017

Temperature: 27°C

Tested by: Ed Chiang

Humidity: 53% RH

Polarity: Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Pol. (H/V)
4932.000	48.24	5.39	53.63	74.00	-20.37	peak	V
4932.000	41.89	5.39	47.28	54.00	-6.72	AVG	V
7375.000	41.83	13.13	54.96	74.00	-19.04	peak	V
7375.000	33.58	13.13	46.71	54.00	-7.29	AVG	V
9848.000	31.45	17.60	49.05	74.00	-24.95	peak	V
9848.000	20.88	17.60	38.48	54.00	-15.52	AVG	V
4925.000	43.64	5.37	49.01	74.00	-24.99	peak	H
4925.000	37.27	5.37	42.64	54.00	-11.36	AVG	H
7389.000	38.66	13.17	51.83	74.00	-22.17	peak	H
7389.000	32.60	13.17	45.77	54.00	-8.23	AVG	H
9848.000	33.24	17.60	50.84	74.00	-23.16	peak	H
9848.000	24.08	17.60	41.68	54.00	-12.32	AVG	H

Remark:

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

7.7 POWERLINE CONDUCTED EMISSIONS

LIMIT

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

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

* Decreases with the logarithm of the frequency.

Test Configuration

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

TEST PROCEDURE

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

TEST RESULTS

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

Test Data

Operation Mode: Normal Link

Test Date: August 25, 2016

Temperature: 24°C

Tested by: Dennis Li

Humidity: 50% RH

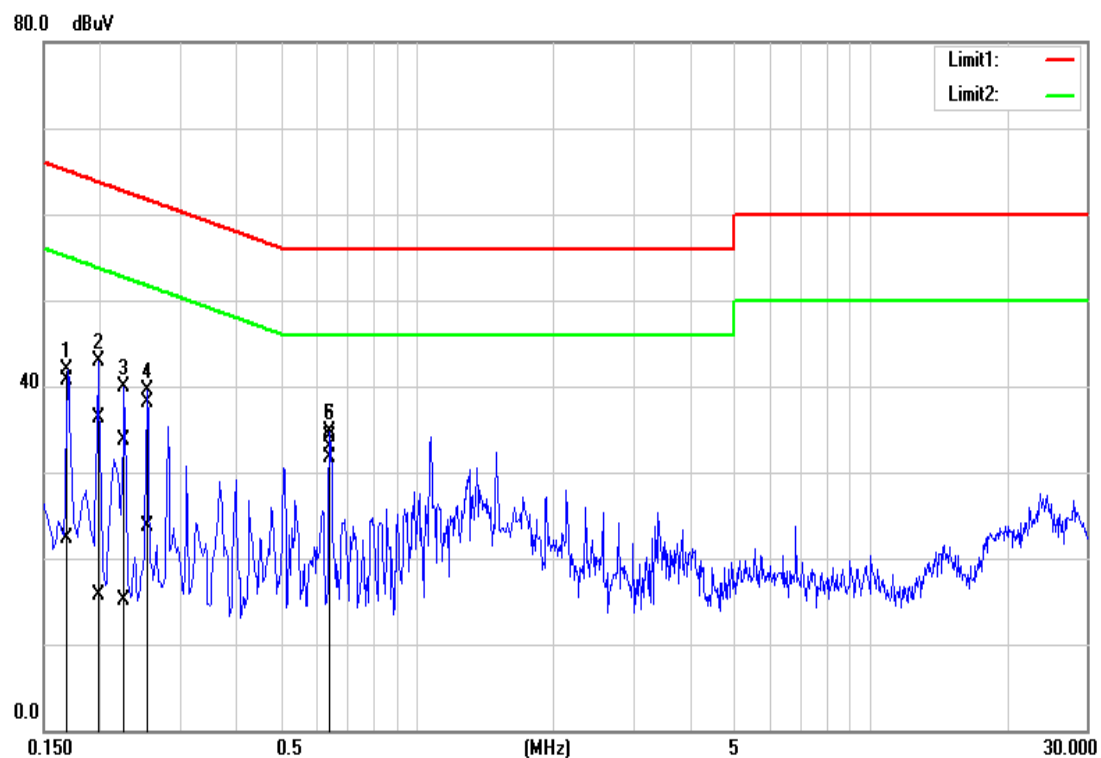
Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB/m)	QP Result (dBuV/m)	AV Result (dBuV/m)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.1700	30.98	12.55	9.71	40.69	22.26	64.96	54.96	-24.27	-32.70	L1
0.1980	26.58	6.09	9.70	36.28	15.79	63.69	53.69	-27.41	-37.90	L1
0.2260	24.01	5.40	9.70	33.71	15.10	62.60	52.60	-28.89	-37.50	L1
0.2540	28.48	13.94	9.70	38.18	23.64	61.63	51.63	-23.45	-27.99	L1
0.6420	23.23	22.09	9.70	32.93	31.79	56.00	46.00	-23.07	-14.21	L1
0.6420	24.38	24.38	9.70	34.08	34.08	56.00	46.00	-21.92	-11.92	L1
0.1580	27.97	10.54	9.78	37.75	20.32	65.57	55.57	-27.82	-35.25	L2
0.1860	32.68	17.23	9.77	42.45	27.00	64.21	54.21	-21.76	-27.21	L2
0.2180	33.13	21.27	9.77	42.90	31.04	62.89	52.89	-19.99	-21.85	L2
0.2460	23.81	8.23	9.77	33.58	18.00	61.89	51.89	-28.31	-33.89	L2
0.6420	22.98	21.53	9.76	32.74	31.29	56.00	46.00	-23.26	-14.71	L2
1.2900	16.08	10.14	9.77	25.85	19.91	56.00	46.00	-30.15	-26.09	L2

Remark:

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

Test Plots

Conducted emissions (Line 1)



Conducted emissions (Line 2)

