FCC 47 CFR PART15 SUBPART E

Test Report

For

Product Name: Pro series 3D Printer

Brand Name: RAISE 3D

Model No.: Pro2,Pro2 Plus

Series Model.: Pro1,Pro3,Pro3 Plus,Pro4,Pro5,Pro6

FCC ID: 2APQR-A

Test Report Number:

C180629R01-RPW2

Issued for

Shanghai Fusion Tech Co., Ltd.
Floor 4,Building B5,No.1600,Guoquan N Rd.Shanghai,200438 China

Issued by

Compliance Certification Services Inc.

Kun shan Laboratory

No.10 Weiye Rd., Innovation park, Eco&Tec,
Development Zone, Kunshan City, Jiangsu, China

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TESTING CERT #2541.01

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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
3.6 DUTY CYCLE 9
3.7 ANTENNA DESCRIPTION 11
4 INSTRUMENT CALIBRATION 11
4.1 MEASUREMENT EQUIPMENT USED 12
4.2 MEASUREMENT UNCERTAINTY 14
5 FACILITIES AND ACCREDITATIONS 15
5.1 FACILITIES 15
5.2 EQUIPMENT 15
5.3 TABLE OF ACCREDITATIONS AND LISTINGS 15
5.4 TABLE OF ACCREDITATIONS AND LISTINGS 16
6 SETUP OF EQUIPMENT UNDER TEST 18
6.1 SETUP CONFIGURATION OF EUT 18
6.2 SUPPORT EQUIPMENT 18
7 FCC PART 15 REQUIREMENTS 19
7.1 6 DB BANDWIDTH MEASUREMENT 19
7.2 MAXIMUM CONDUCTED OUTPUT POWER 29
7.3 BAND EDGES MEASUREMENT 31
7.4 POWER SPECTRAL DENSITY 39
7.5 FREQUENCY STABILITY MEASUREMENT 49
7.6 RADIATED UNDESIRABLE EMISSION 51
7.7 POWERLINE CONDUCTED EMISSIONS 65

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	June 25, 2018	C180502R02-RPW2	ALL	N/A
Update	June 29, 2018	C180629R01-RPW2	P1; P4	Modify Applicant's and Manufacturer's address
01	July 9, 2018	C180629R01-RPW2	P5; P6; P8; P29；P39; P51	Modify the data rate for HT20 and HT40; Add the directional gain for MIMO on P5; Add KDB 789033 and KDB 662911 to Section 3; Modify the description of the Radiated emission and powerline conducted emission; Modify the version of KDB 789033
02	July 16, 2018	C180629R01-RPW2	P5; P29-30; P39-40	Modify Directional gain

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1 TEST RESULT CERTIFICATION

Product Name:	Pro series 3D Printer
Trade Name:	RAISE 3D
Model Name.:	Pro2,Pro2 Plus
Series Model:	Pro1,Pro3,Pro3 Plus,Pro4,Pro5,Pro6
Applicant Discrepancy:	Initial
Device Category:	mobile unit
Date of Test:	May 9,2018~June 20, 2018
Applicant:	**Shanghai Fusion Tech Co., Ltd.** Floor 4,Building B5,No.1600,Guoquan N Rd.Shanghai,200438 China
Manufacturer:	**Shanghai Fusion Tech Co., Ltd.** Floor 4,Building B5,No.1600,Guoquan N Rd.Shanghai,200438 China
Application Type:	Certification

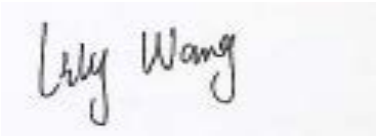
APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 15 Subpart E	No non-compliance noted

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10: 2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.407and KDB 789033.
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:



Lily.Wang
Test Engineer
Compliance Certification Service Inc.

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2 EUT DESCRIPTION

Product Name:	Pro series 3D Printer	
Brand Name:	RAISE 3D	
Model Name:	Pro2,Pro2 Plus	
Series Model:	Pro1,Pro3,Pro3 Plus,Pro4,Pro5,Pro6	
Model Discrepancy:	The Pro2, Pro2 Plus, Pro1, Pro3, Pro3 Plus, Pro4 ,Pro5 ,Pro6 3D Printer are belong to Pro series 3D printer. All of them are manufactured by Shanghai Fusion. The Pro1,Pro2,Pro3,Pro4,Pro5,Pro6 are basic model. All height in dimension are lower. They use the same parts and components only for different markets. For Pro2 Plus, Pro3 Plus, that are plus series printer based on the Pro2 and Pro3. Only the printer's height is different. The Pro2 's height is 760 mm. The Pro2 Plus's height is 1105mm.	
Power Rating:	100-240V,50/60Hz	
Frequency Range :	5725MHz-5850MHz	
Transmit Power:	IEEE802.11a mode: 15.48dBm IEEE802.11an HT20 mode: 14.49dBm IEEE802.11an HT40 mode: 14.06dBm	
Modulation Technique:	IEEE802.11a mode: OFDM (6,9,12,18,24,36,48 and 54 Mbps) IEEE802.11an HT20 mode: OFDM (MCS8~MCS15) IEEE802.11an HT40 mode: OFDM (MCS8~MCS15)	
Number of Channels:	IEEE 802.11a/n HT20: 5 Channels IEEE 802.11an HT40:2 Channels	
Antenna Specification:		Gain(dBi)
		BandIV
	Antenna 1	4.26
	Antenna 2	4.26
	Directional gain	7.27
Beamforming Function:	☐ With beamforming	☒ Without beamforming

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: 2APQR-A*** filing to comply with FCC Part 15, Subpart E Rules.

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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, 15.407 and KDB 789033, KDB 662911.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed for RF field strength measurement to meet the Commissions requirement, and is operated in a manner intended to generate the maximum emission in a continuous normal application.

3.2 EUT EXERCISE

The EUT is operated in the engineering mode to fix the Tx frequency for the purposes of measurement.

According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.1 m above ground plane. According to the requirements in Section 6.2 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 0.1 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 6.4 & 6.5 of ANSI C63.10:2013.

Above 1GHz

The EUT is placed on a turn table, which is 0.1 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 6.6 of ANSI C63.10:2013.

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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 0.495 - 0.505 [1] 2.1735 - 2.1905 4.125 - 4.128 4.17725 - 4.17775 4.20725 - 4.20775 6.215 - 6.218 6.26775 - 6.26825 6.31175 - 6.31225 8.291 - 8.294 8.362 - 8.366 8.37625 - 8.38675 8.41425 - 8.41475 12.29 - 12.293 12.51975 - 12.52025 12.57675 - 12.57725 13.36 - 13.41	16.42 - 16.423 16.69475 - 16.69525 16.80425 - 16.80475 25.50 - 25.67 37.50 - 38.25 73.00 - 74.60 74.80 - 75.20 108.00 - 121.94 123 - 138 149.90 - 150.05 156.52475 - 156.52525 156.70 - 156.90 162.0125 - 167.1700 167.72 - 173.20 240 - 285 322.0- 335.4	399.9 - 410 608 - 614 960.0 - 1240 1300 - 1427 1435.0 - 1626.5 1645.5 - 1646.5 1660 - 1710 1718.8 - 1722.2 2200 - 2300 2310 - 2390 2483.5 – 2500.0 2655 - 2900 3260 - 3267 3332 - 3339 3345.8 - 3358.0 3600 - 4400	4.50 - 5.15 5.35 - 5.46 7.25 - 7.75 8.025 - 8.500 9.0 - 9.2 9.3 - 9.5 10.6 - 12.7 13.25 - 13.4 14.47 - 14.5 15.35 - 16.2 17.7 - 21.4 22.01 - 23.12 23.6 - 24.0 31.2 - 31.8 36.43 - 36.5([2])

[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.

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3.5 DESCRIPTION OF TEST MODES

Description	Modulation Technology	Modulation Type
6dB Bandwidth	OFDM	BPSK
Maximum conducted output power	OFDM	BPSK
Band edges measurement	OFDM	BPSK
Peak Power Spectral Density	OFDM	BPSK
Radiated undesirable emission	OFDM	BPSK
Conducted undesirable emission	OFDM	BPSK
Powerline conducted emission	OFDM	BPSK

Test Mode	Antenna 1	Antenna 2	Antenna 1+2
802.11a	√	√	x
802.11an HT20	√	√	√
802.11an HT40	√	√	√

IEEE 802.11a mode:

Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with 54Mbps data rate were chosen for full testing.

IEEE 802.11an HT20 mode:

Channel Low (5745MHz), Channel Mid (5785MHz) and Channel High (5825MHz) with MCS15 data rate were chosen for full testing.

IEEE 802.11an HT40 mode:

Channel Low (5755MHz) and Channel High (5795MHz) with MCS15 data rate were chosen for full testing.

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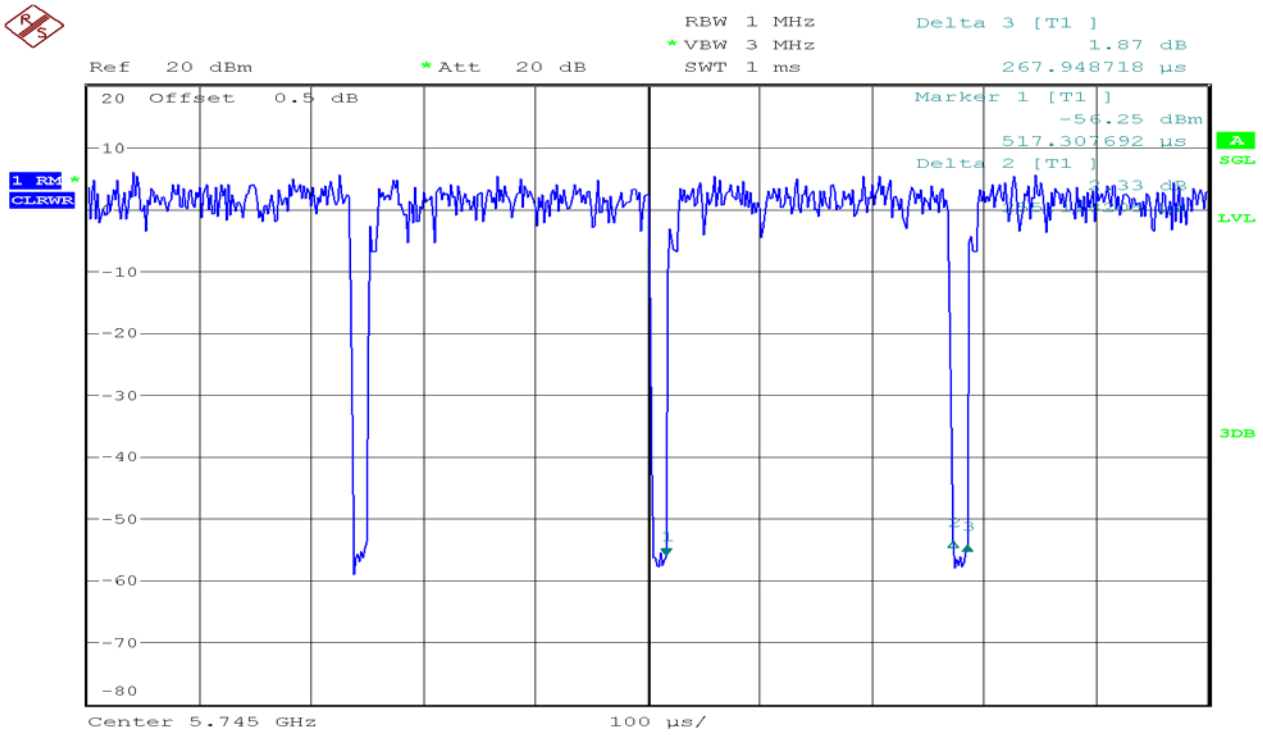
3.6 DUTY CYCLE

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
IEEE 802.11 a	95.15	0.255	3.92	5KHz
IEEE 802.11an HT20	90.97	0.141	7.09	10KHz
IEEE 802.11an HT40	87.62	0.092	10.87	20KHz

IEEE 802.11 a



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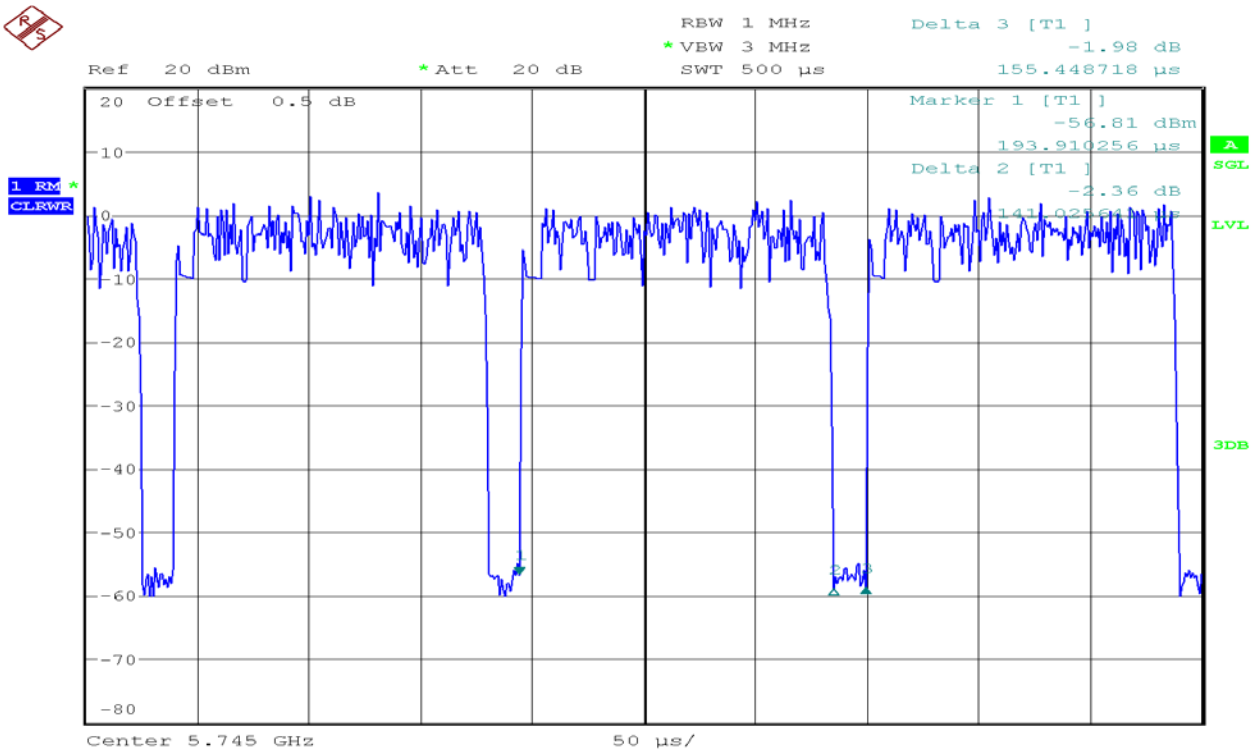
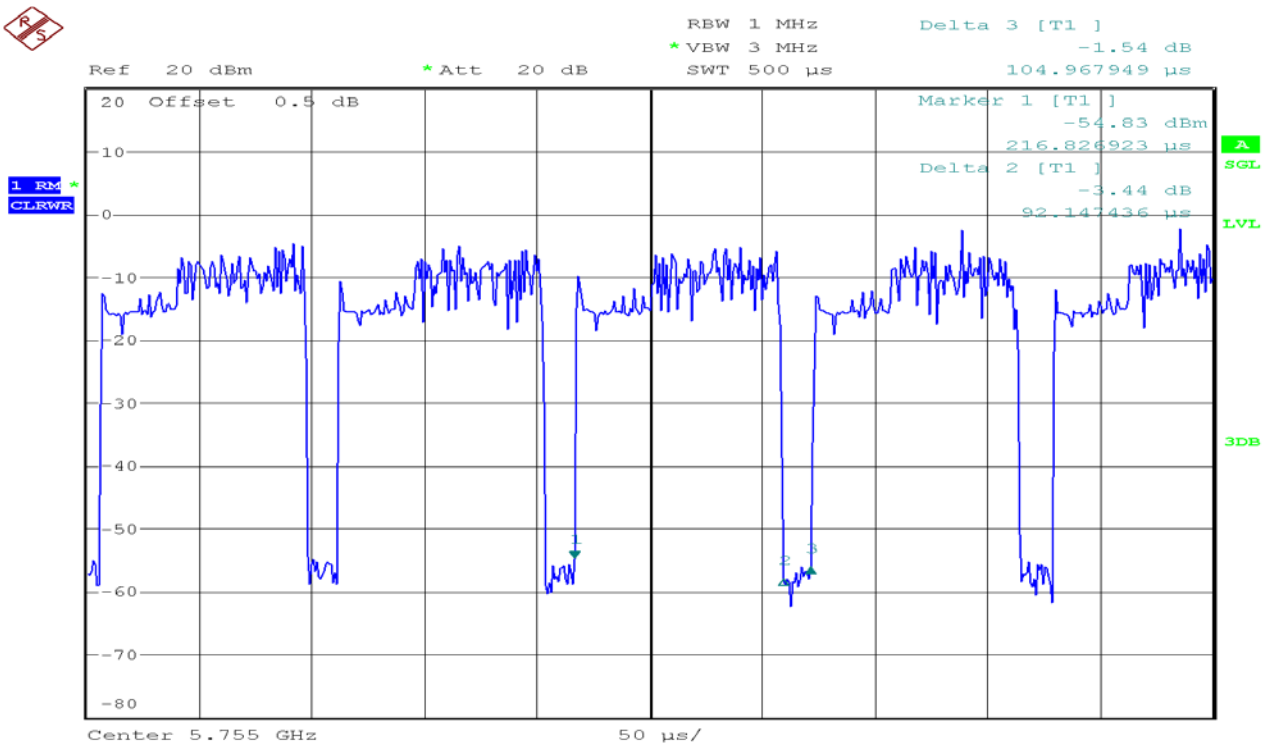
IEEE 802.11an HT20



IEEE 802.11an HT40



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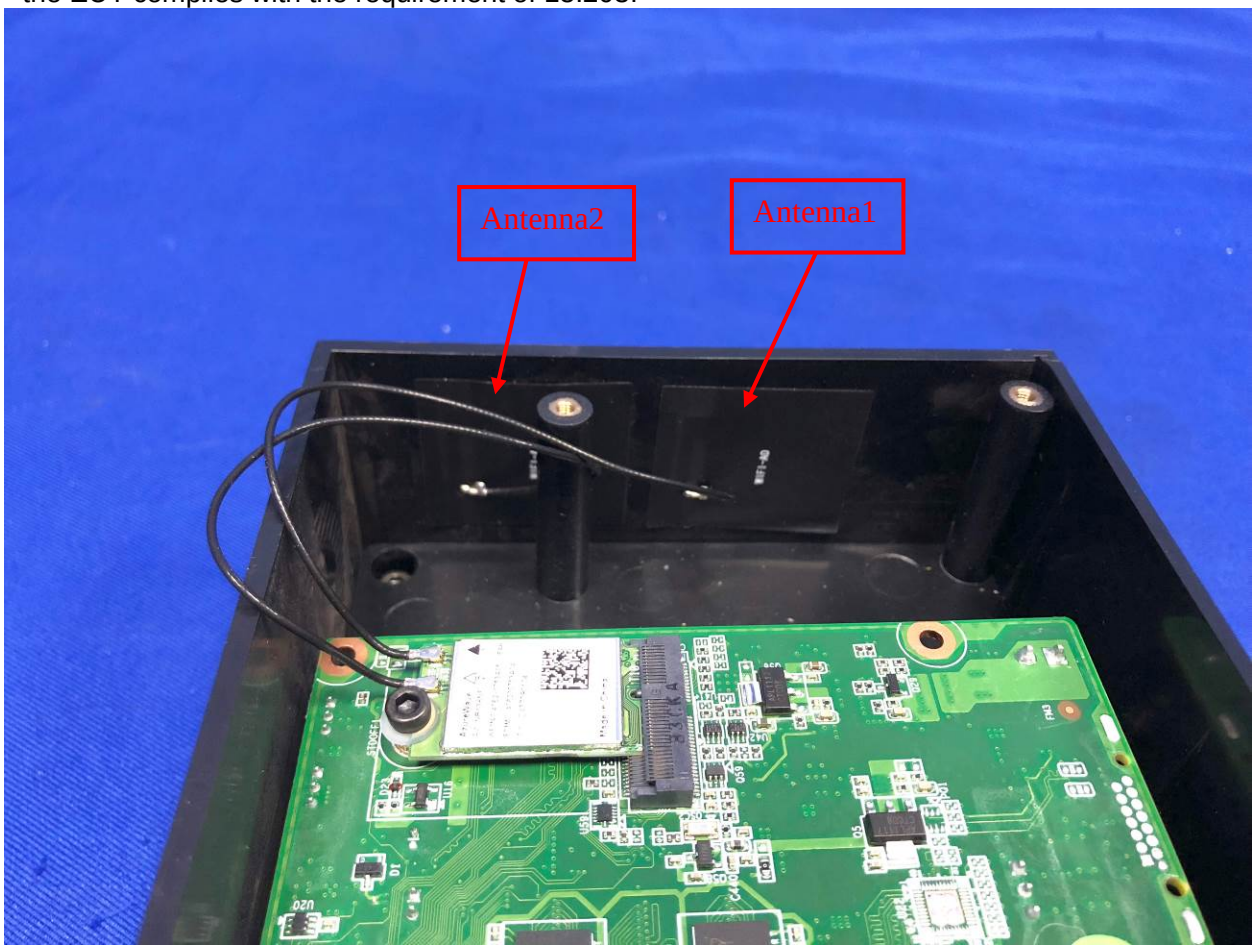
3.7 ANTENNA DESCRIPTION

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(FPC Antenna for WLAN)
* the EUT complies with the requirement of 15.203.



4 INSTRUMENT CALIBRATION

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

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4.1 MEASUREMENT EQUIPMENT USED

Conducted Emissions Test Site					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Data**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY44020154	2017-9-4	2018-9-3
Spectrum Analyzer	RS	FSU26	200789	2017-7-20	2018-7-19
Power meter	Anritsu	ML2495A	1445010	2018-4-26	2019-4-25
Power sensor	Anritsu	MA2411B	1339220	2018-4-26	2019-4-25
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
Cable	N/A	Cable-05	N/A	2018-4-24	2019-4-23
Cable	N/A	Cable-06	N/A	2018-4-24	2019-4-23
6dB Attenuator	N/A	N/A	N/A	2018-4-24	2019-4-23
Temp. / Humidity Gauge	Anymetre	TH603	CCS007	2017-10-24	2018-10-23
Test Software			EZ-EMC		

Conducted Emission					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
EMI TEST RECEIVER	R&S	ESCI	100781	2018-2-26	2019-2-25
V (V-LISN)	SCHWARZBECK	NNLK 8129	8129-143	2017-10-29	2018-10-28
TWO-LINE V-NETWORK	R&S	ENV216	101604	2017-10-29	2018-10-28
Pulse LIMITER	R&S	ESH3-Z2	100524	2017-12-27	2018-12-26
Cable	Thermax	Cable-02	14	2017-12-27	2018-12-26
Test Software			EZ-EMC		

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977 Chamber					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Data**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY44020154	2017-9-4	2018-9-3
Spectrum Analyzer	RS	FSU26	200789	2017-7-20	2018-7-19
EMI Test Receiver	R&S	ESCI	101378	2017-12-26	2018-12-25
Amplifier	COM-POWER	PAM-840A	461332	2017-11-29	2018-11-28
Amplifier	MITEQ	JS41-00101800-32-10P	1675713	2017-7-20	2018-7-19
Broad-Band Horn Antenna	SCHWARZBECK	BBHA 9170	9170-515	2018-2-27	2019-2-26
Bilog Antenna	SCHAFFNER	CBL6143	5078	2017-11-5	2018-11-4
Loop Antenna	COM-POWER	AL-130R	10160008	2018-5-8	2019-5-7
Horn-antenna	SCHWARZBECK	9120D	D:266	2018-2-26	2019-2-25
Horn-antenna	SCHWARZBECK	9120D	D:267	2017-11-5	2018-11-4
Turn Table	CT	CT123	4165	N.C.R	N.C.R
Antenna Tower	CT	CTERG23	3256	N.C.R	N.C.R
Controller	CT	CT1OO	95637	N.C.R	N.C.R
Cable	REBES MICROWAVE	Cable-93	N/A	2017-10-29	2018-10-28
Cable	REBES MICROWAVE	Cable-94	N/A	2017-10-29	2018-10-28
Cable	REBES MICROWAVE	Cable-95	N/A	2017-10-29	2018-10-28
Cable	N/A	Cable-03	N/A	2018-4-24	2019-4-23
Cable	N/A	Cable-04	N/A	2018-4-24	2019-4-23
2.4G Filter	N/A	N/A	N/A	2018-4-24	2019-4-23
Filter 5150MHz-5350MHz	N/A	N/A	N/A	2018-4-24	2019-4-23
Filter 5725MHz-5850MHz	N/A	N/A	N/A	2018-4-24	2019-4-23
Test Software			EZ-EMC		

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

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4.2 MEASUREMENT UNCERTAINTY

For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR 100 028-1 [2] and shall correspond to an expansion factor (coverage factor) k = 1,96 or k = 2 (which provide confidence levels of respectively 95 % and 95,45 % in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).

Table 6 is based on such expansion factors.

Table 6: Maximum measurement uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.129dB
Unwanted Emissions, conducted	±2.406dB
RF Power density, conducted	±2.379dB
Conducted emissions	±2.582dB
All emissions, radiated (Below 1GHz)	±4.725dB
All emissions, radiated (Above 1GHz)	± 4.818dB
Temperature	±0.3dB
Supply voltages	±0.2%

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5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at
☒ **No.10Weiye Rd., Innovation park, Eco&Tec, Development Zone, Kunshan City, Jiangsu, China.**
The sites are constructed in conformance with the requirements of ANSI C63.10:2013 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

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 preselectors and quasi-peak detectors are used to perform radiated measurements.

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

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

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

5.3 TABLE OF ACCREDITATIONS AND LISTINGS

FCC –Designation Number: CN1172.

Compliance Certification Services Inc. Kun shan Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Designation Number: CN1172.

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5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	A2LA	47 CFR FCC, Part 15,Subpart B (using ANSI 63.4 :2009 and ANSI C63.4:2014);ICES-003; 47 CFR FCC, Part 18(using MP-5:1986);ICES-001;VCCI - V3; VCCI-CISPR-32(up to 6GHz);VCCI 32-1;CNS 13438(up to 6GHz); CNS 13439; CNS 13803; CISPR 11; EN 55011; CISPR 13; EN 55013; CISPR 22; EN 55022; AS/NZS CISPR 22;CISPR32;EN55032; AS/NZS CISPR 32;EN55014-1(excluding clicks);CISPR 14-1(excluding clicks);EN55015;CISPR 15; IEC 61000-3-2; EN 61000-3-2; AS/NZS 61000.3.2 IEC 61000-3-3; EN 61000-3-3; AS/NZS 61000.3.3 IEC 61000-4-2; EN 61000-4-2; AS/NZS 61000.4.2 IEC 61000-4-3; EN 61000-4-3; AS/NZS 61000.4.3 IEC 61000-4-4; EN 61000-4-4; AS/NZS 61000.4.4 IEC 61000-4-5; EN 61000-4-5; AS/NZS 61000.4.5 IEC 61000-4-6; EN 61000-4-6; AS/NZS 61000.4.6 IEC 61000-4-8; EN 61000-4-8; AS/NZS 61000.4.8 IEC 61000-4-11; EN 61000-4-11; AS/NZS 61000.4.11 EN 61000-6-1; EN 61000-6-2; EN 61000-6-3 (excluding discontinuous interference); EN 61000-6-4; IEC 61000-6-1; IEC 61000-6-2; IEC 61000-6-3 (excluding discontinuous interference); IEC 61000-6-4; AS/NZS 61000.6.1; AS/NZS 61000.6.2; AS/NZS 61000.6.3 (excluding discontinuous interference); AS/NZS 61000.6.4; EN 55024; CISPR 24; AS/NZS CISPR 24; EN 61547; IEC 61547; EN 60601-1-2; IEC 60601-1-2; EN 50130-4; EN 55014-2; CISPR 14-2; EN 62040-2; IEC 62040-2; EN 61204-3; IEC 61204-3; EN 50121-1; EN 50121-3-2; EN 50121-4; EN 50121-5; EN 50155 (clauses 5.4 and 5.5); EN 61326-1; IEC 61326-1; EN 50083-2; EN 300 386; EN 301 489-1 (excluding Section 9.6); EN 301 489-3; EN 301 489-7; EN 301 489-17; EN 301 489-19; EN 301 489-24; EN 301 489-25; EN 301 489-34 FCC Part 15, Subparts 15C, 15E (KDB 905462 D03 (v01r02))(using ANSI C63.4:2009, ANSI C63.4:2014 and ANSI C63.10:2013) FCC Parts 22E, 24E (using ANSI/TIA-603-D) RSS-132; RSS-133; RSS-210; RSS-247 (excluding DFS testing) EN 300 220-1; EN 300 220-2; EN 300 328; EN 300 330-1; EN 300 330-2; EN 300 440-1; EN 300 440-2; EN 301 893 (excluding DFS testing); EN 301 511(clauses 4.2.12 to 4.2.19, and 5.2.12 to	ACCREDITED TESTING CERT #2541.01

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		5.2.19); EN 301 908-1 (clauses 4.2.2, 4.2.3, 5.3.1, and 5.3.2); EN 301 908-2 (clauses 4.2.4, 4.2.10, 5.3.3, and 5.3.9) AS/NZS 4268 IEEE Std 1528:2013; EN 50360; EN 50566; EN 62479; EN 50383; EN 50385; EN 62311; IEC 62209-1; EN 62209-1; IEC 62209-2; EN 62209-2; CNS 14958-1; CNS 14959; RSS-102; ACMA Radio Communications (Electromagnetic Radiation – Human Exposure) Standard 2014	
USA	FCC	3/10 meter Sites to perform FCC Part 15/18 measurements	CN1172
Japan	VCCI	3/10 meter Sites and conducted test sites to perform radiated/conducted measurements	VCCI R-1600 C-1707 G-216

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6 SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Setup photo for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

No.	Equipment	Model No.	Serial No.
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.

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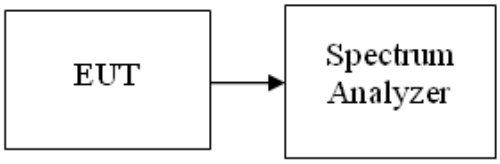
7 FCC PART 15 REQUIREMENTS

7.1 6 DB BANDWIDTH MEASUREMENT

LIMIT

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.725-5.85 GHz.

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 =100KHz, VBW≥ 3RBW, Detector = Peak. Trace mode = max hold.
4. Measure the maximum width of the emission that is 6 dB down from the peak of the emission.
5. Measure and record the results in the test report.

TEST RESULTS

No non-compliance noted

Test Data

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Test mode: IEEE 802.11a mode/ Chain 1

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5745	16.410	0.5
Mid	5785	16.346	0.5
High	5825	16.410	0.5

Test mode: IEEE 802.11a mode/ Chain 2

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5745	16.410	0.5
Mid	5785	16.410	0.5
High	5825	16.410	0.5

Test mode: IEEE 802.11an HT20 mode/ Chain 1

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5745	16.859	0.5
Mid	5785	16.923	0.5
High	5825	16.859	0.5

Test mode: IEEE 802.11an HT20 mode/ Chain 2

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5745	17.051	0.5
Mid	5785	16.923	0.5
High	5825	16.987	0.5

Test mode: IEEE 802.11an HT40 mode/ Chain 1

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5755	36.538	0.5
High	5795	36.538	0.5

Test mode: IEEE 802.11an HT40 mode/ Chain 2

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	FCC 6 dB Bandwidth Min. Limit (MHz)
Low	5755	36.538	0.5
High	5795	36.538	0.5

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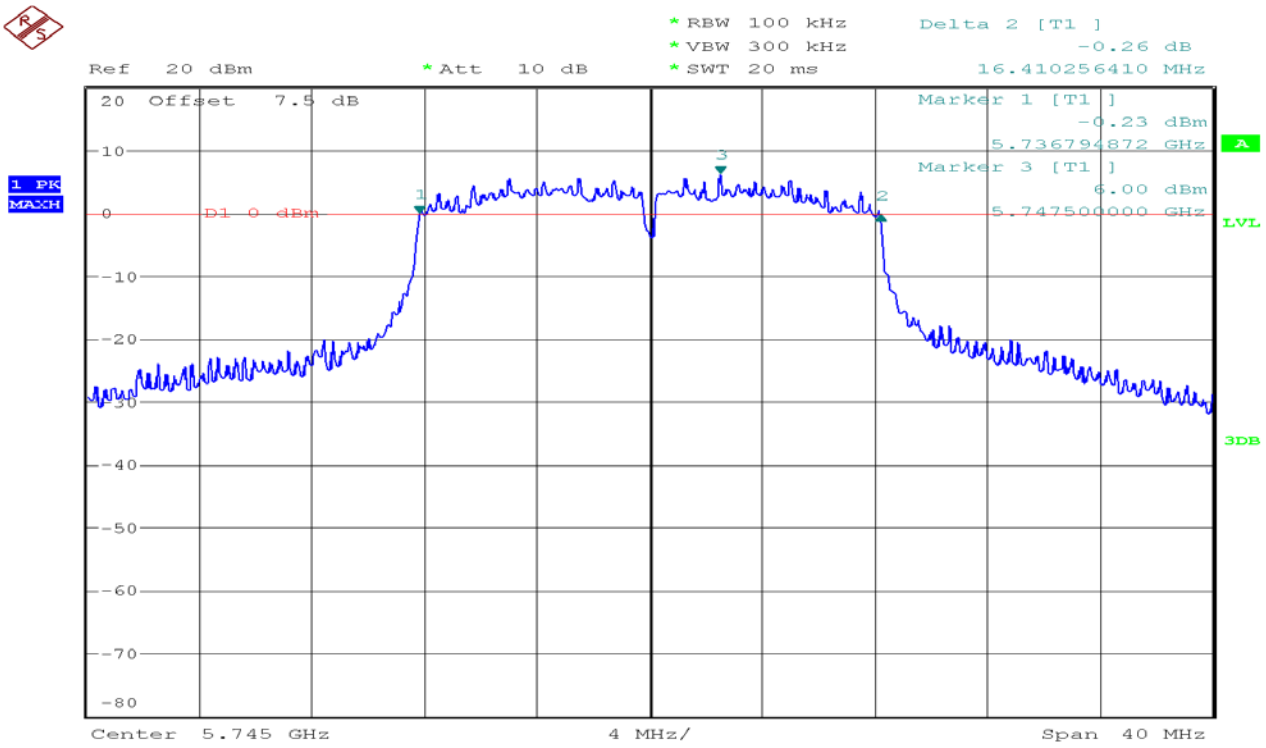
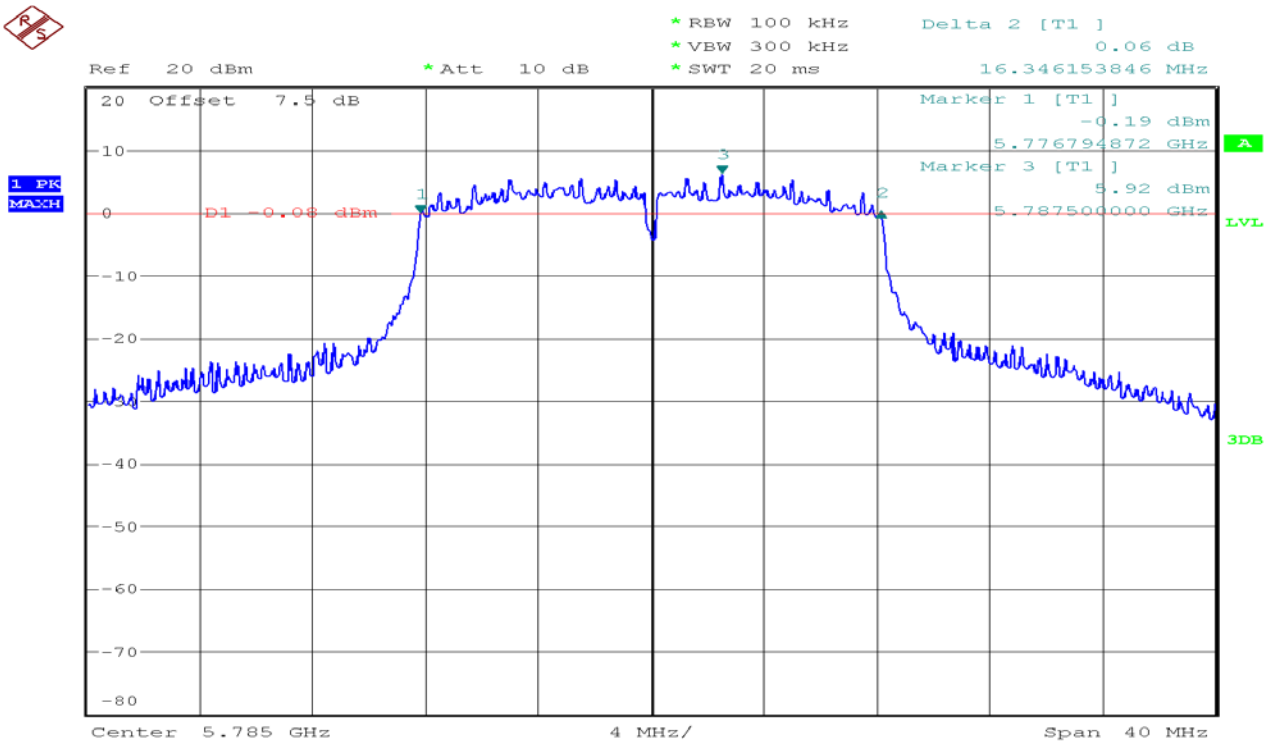
Test Plot

IEEE 802.11a mode/Chain 1:

6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



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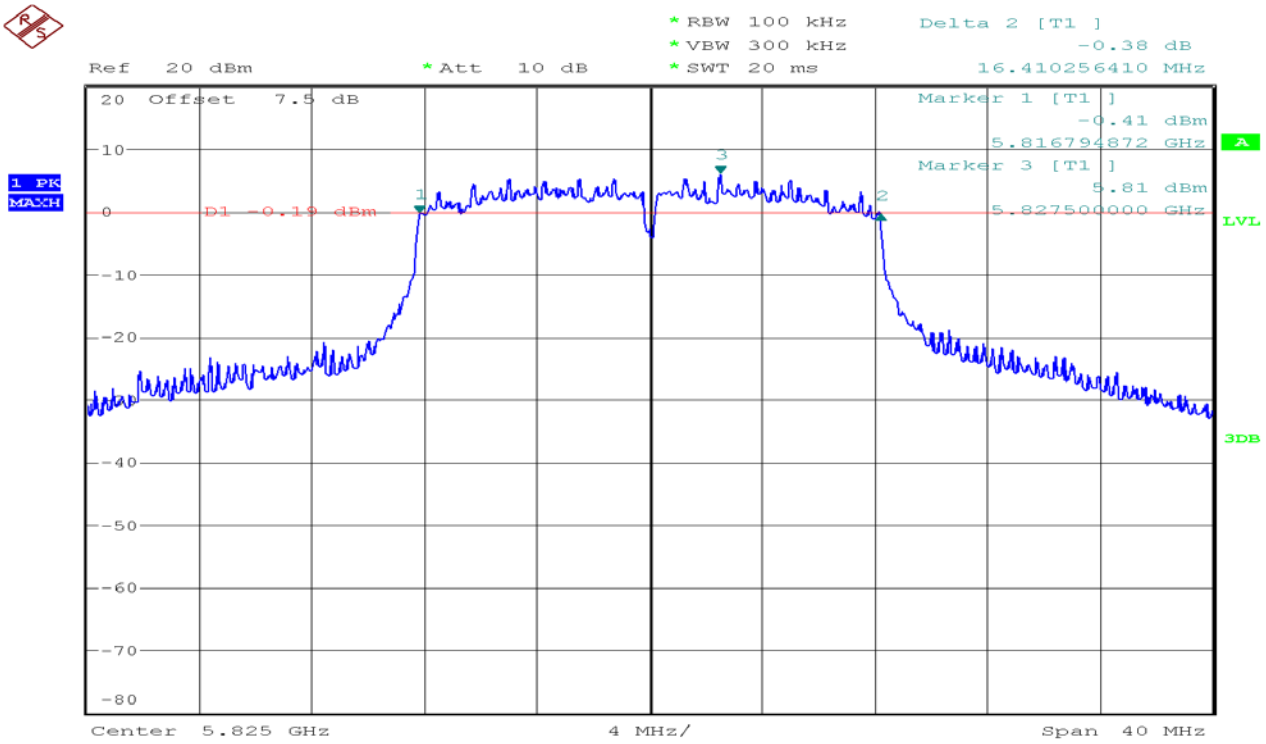
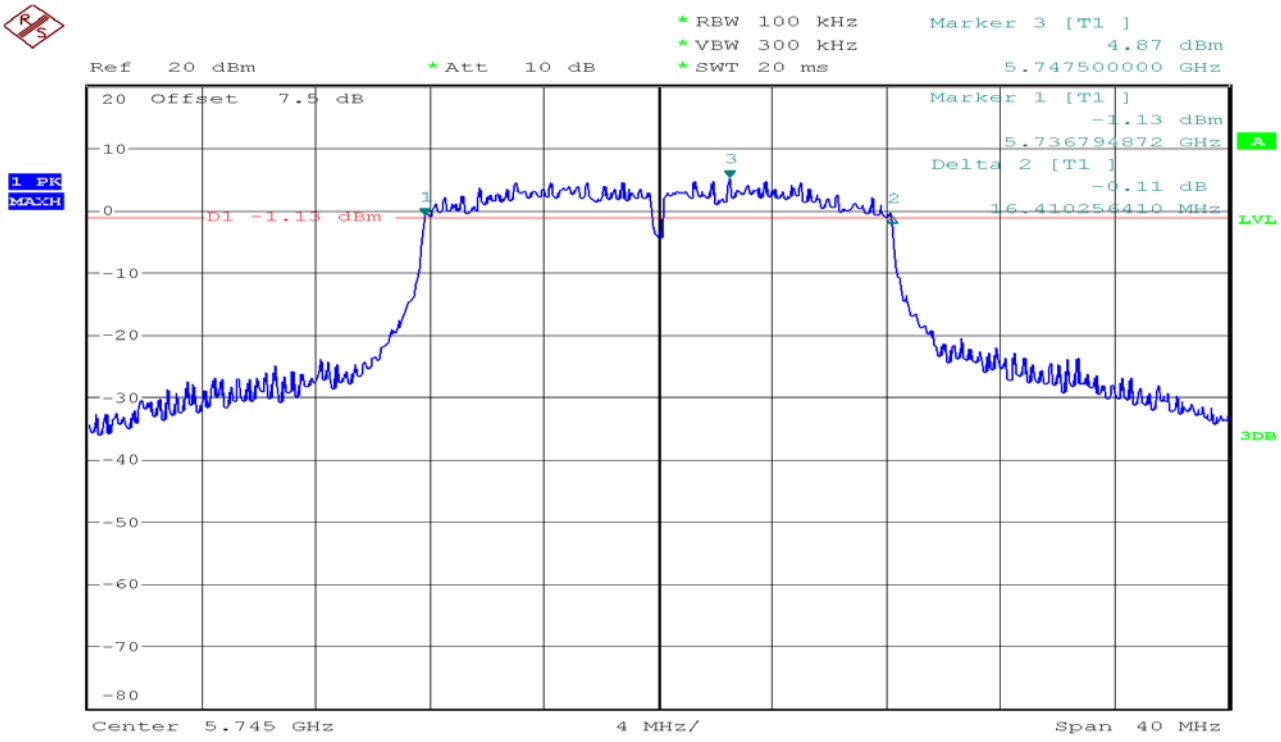
6dB Bandwidth (CH High)



IEEE 802.11a mode/Chain 2:

6dB Bandwidth (CH Low)



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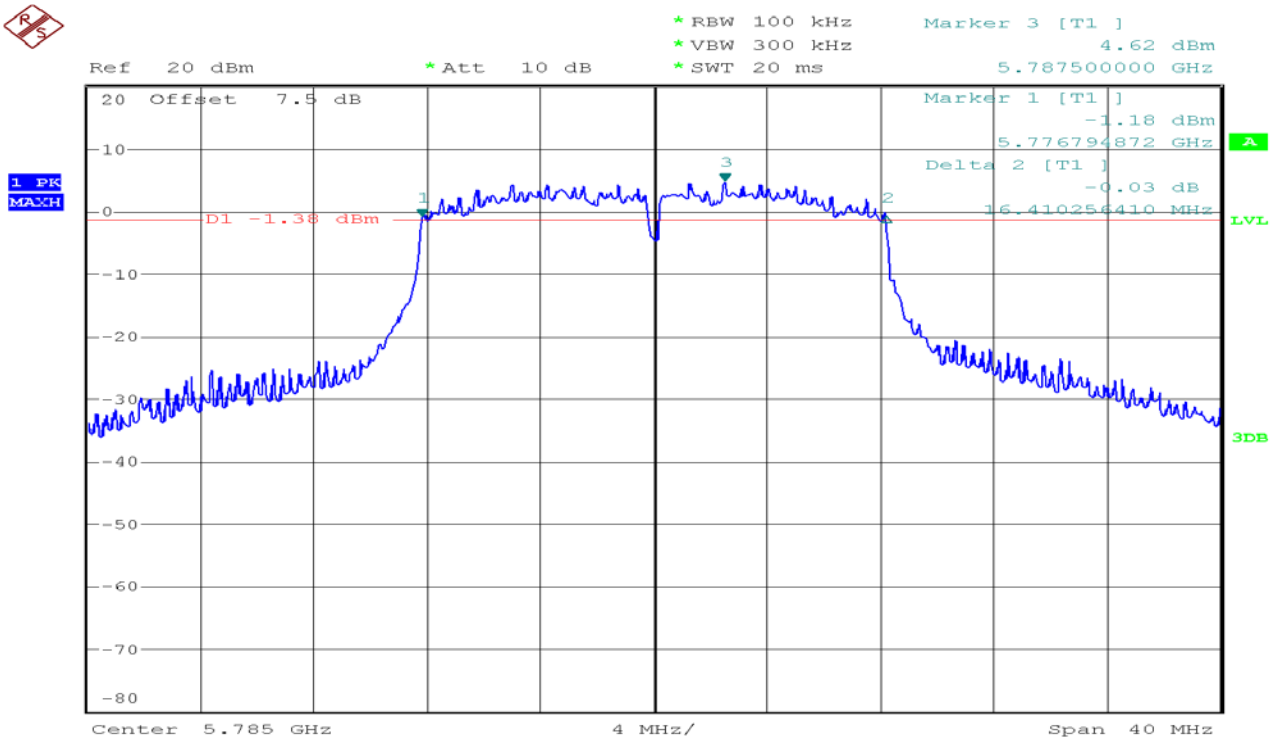
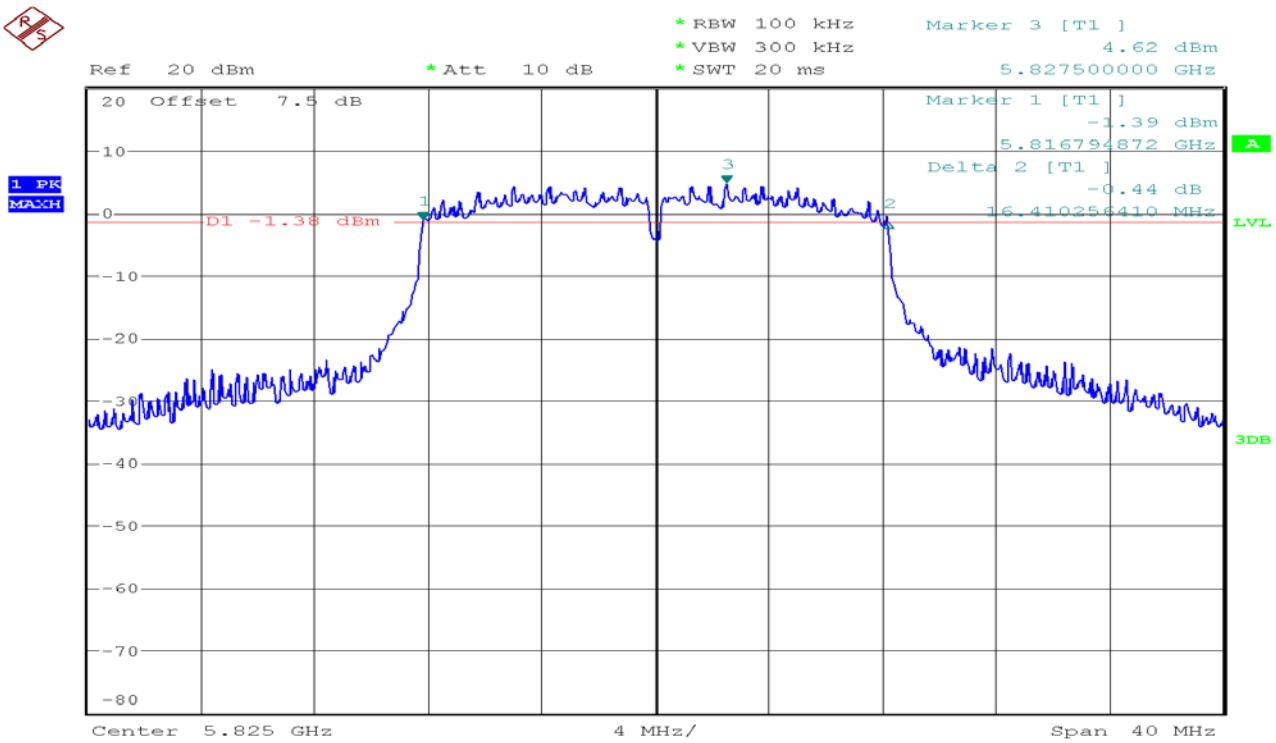
6dB Bandwidth (CH Mid)



6dB Bandwidth (CH High)



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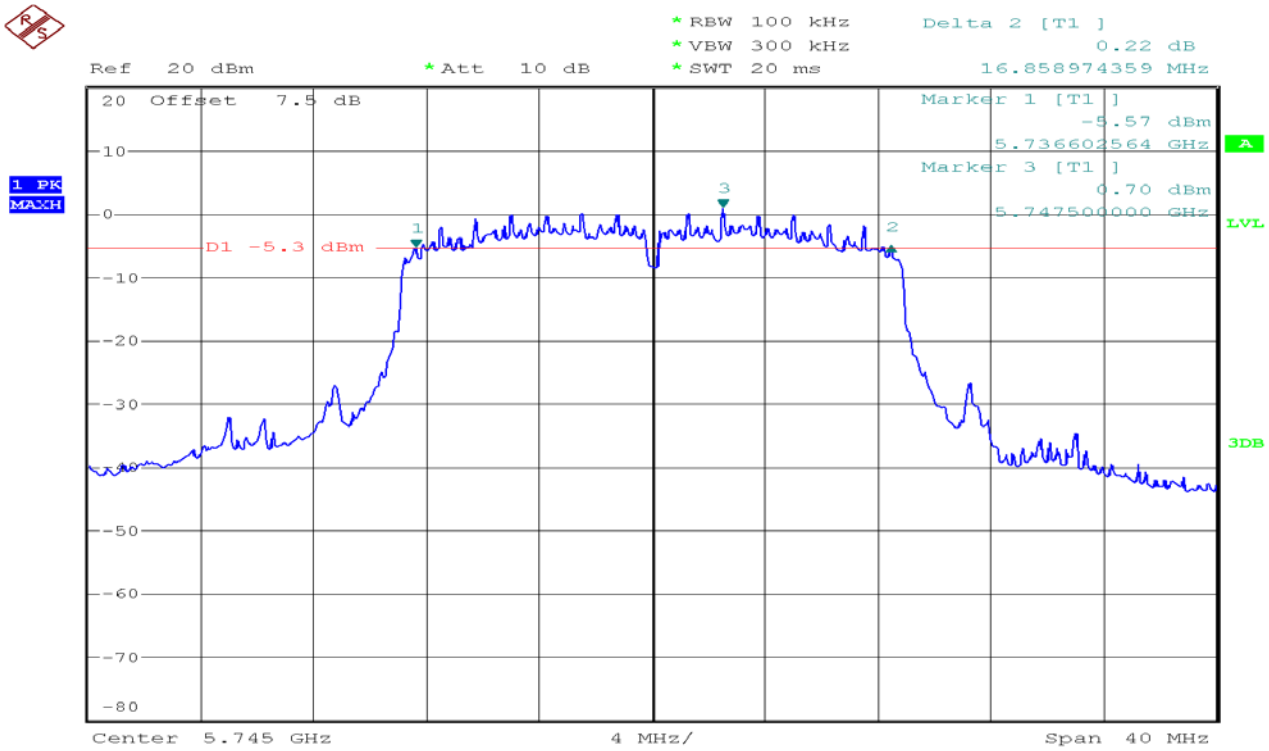
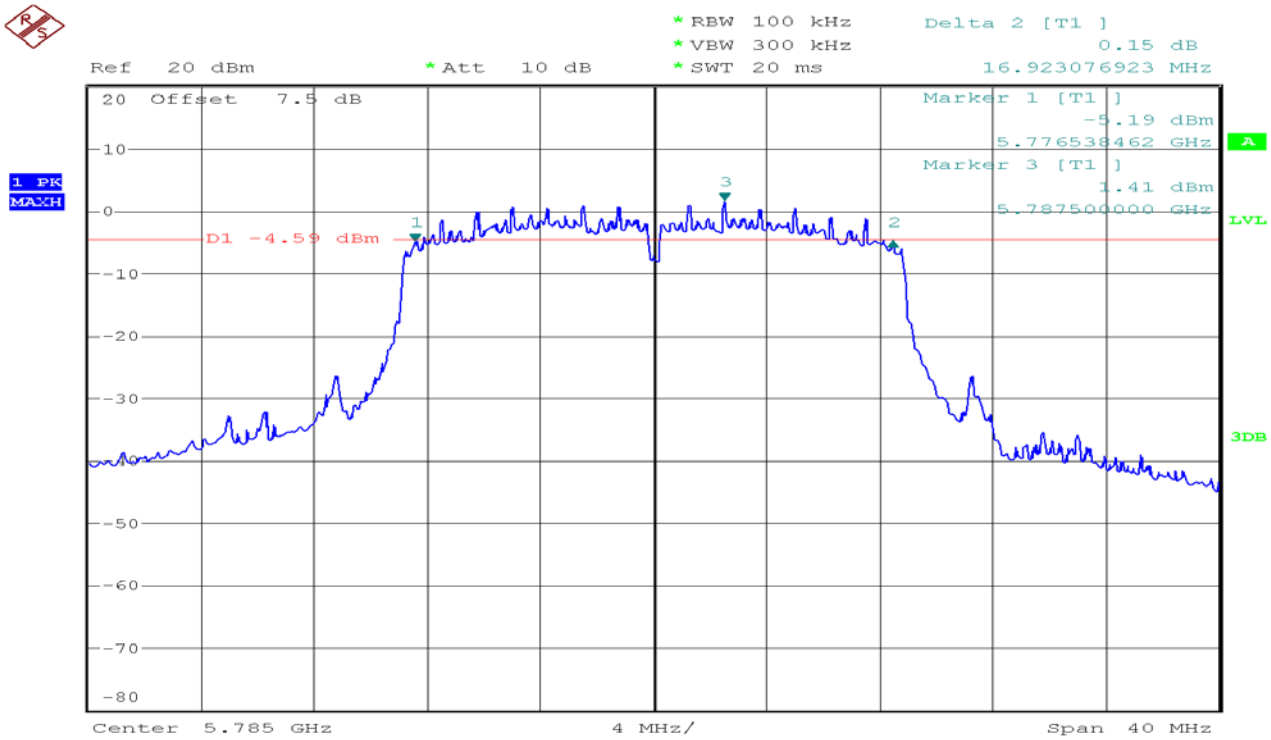
IEEE 802.11an HT20 mode/Chain 1:

6dB Bandwidth (CH Low)



6dB Bandwidth (CH Mid)



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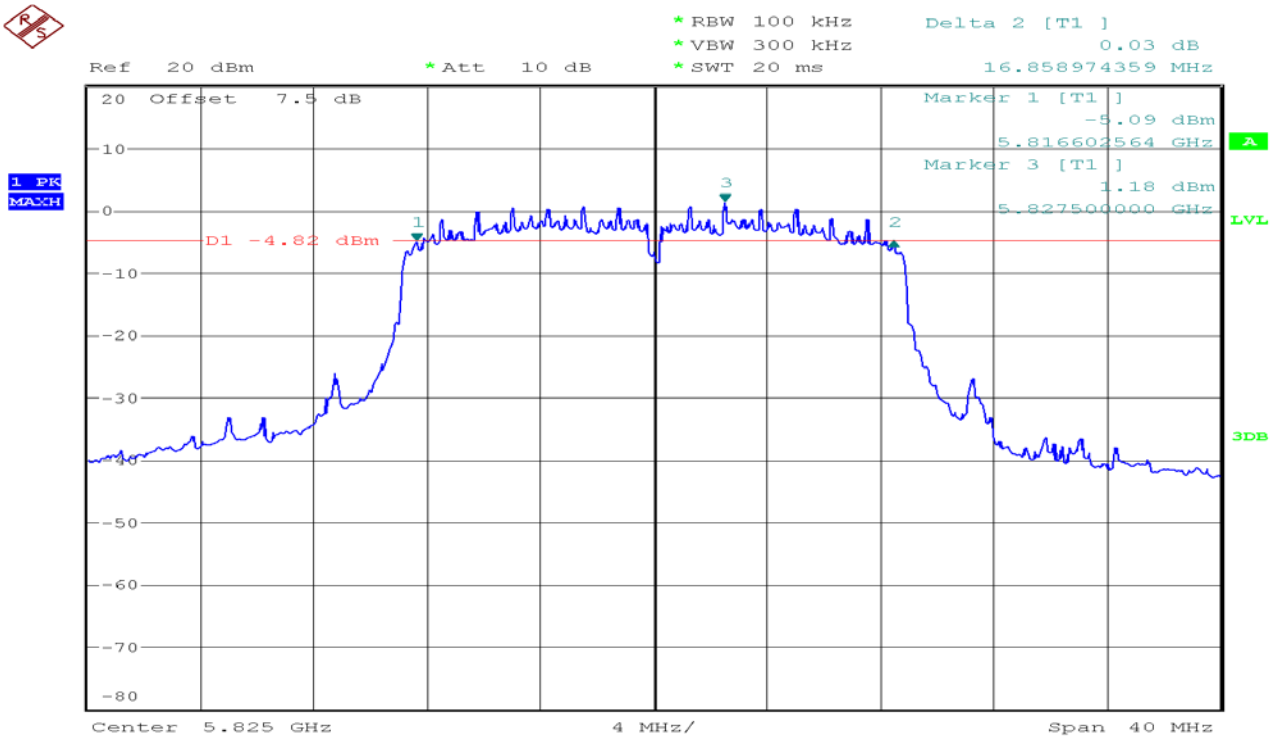
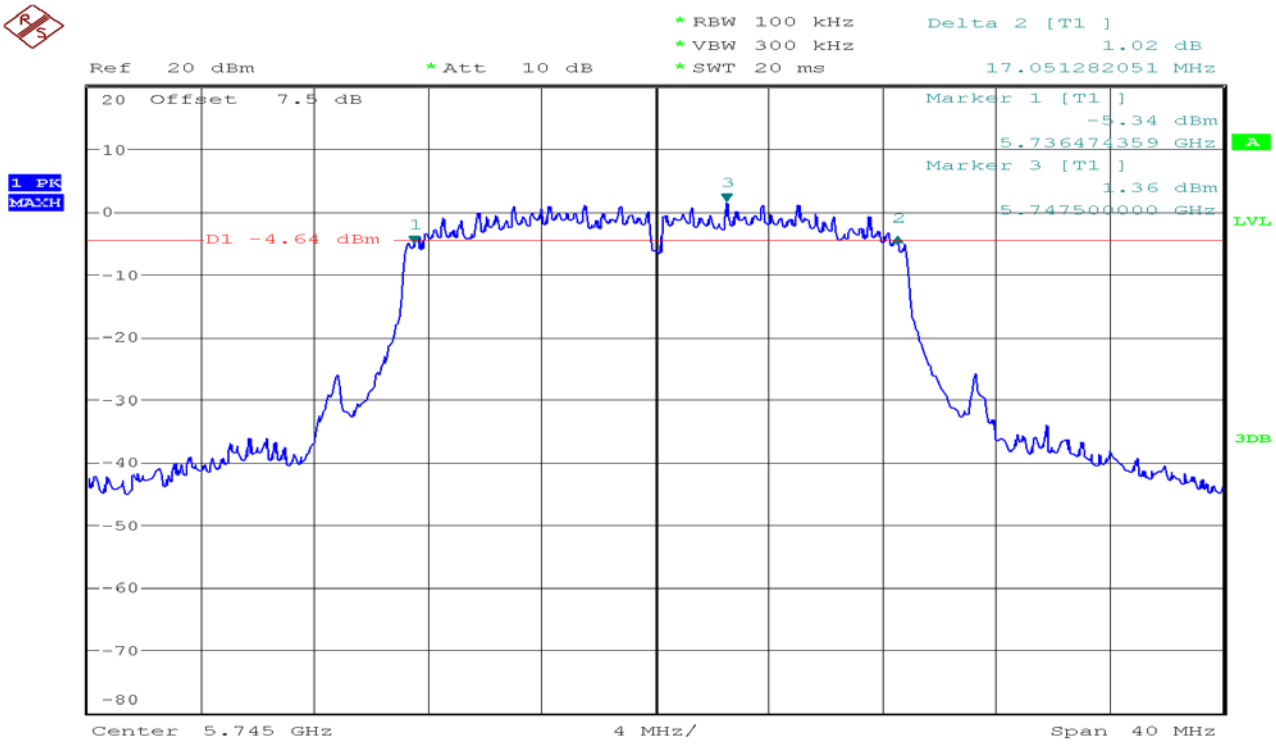
6dB Bandwidth (CH High)



IEEE 802.11an HT20 mode/Chain 2:

6dB Bandwidth (CH Low)



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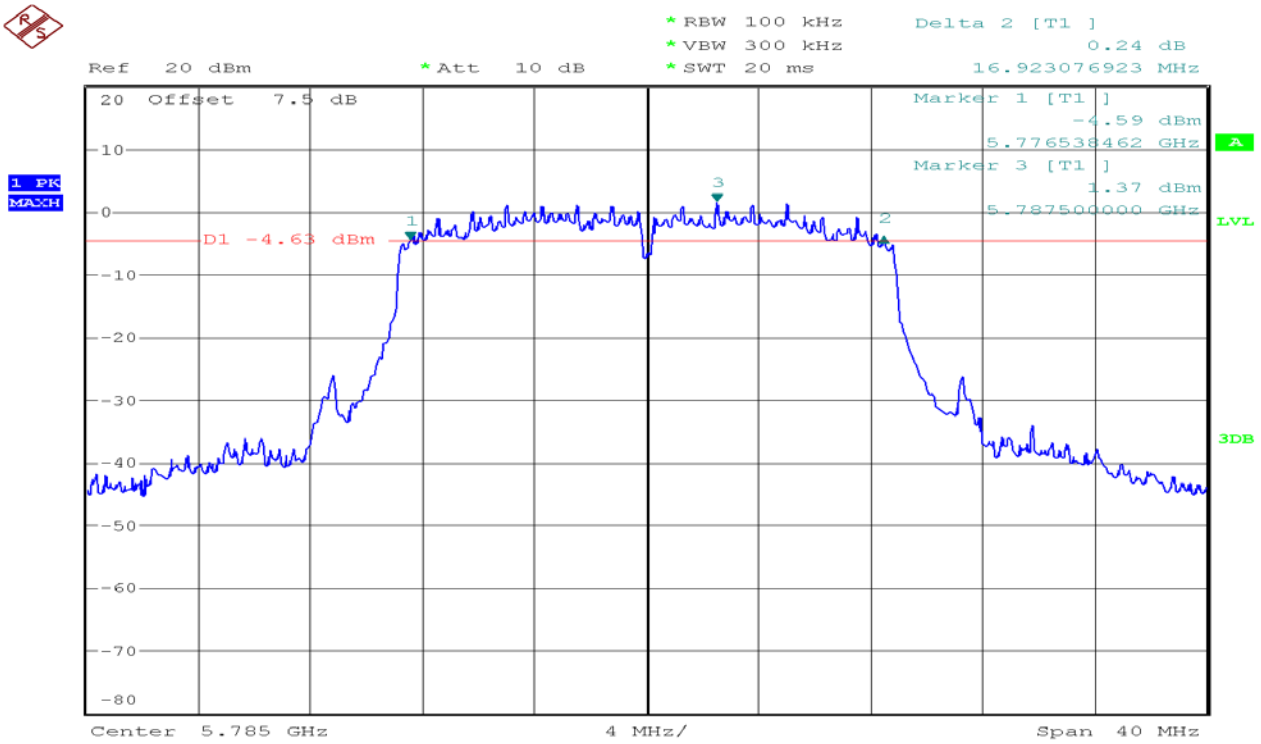
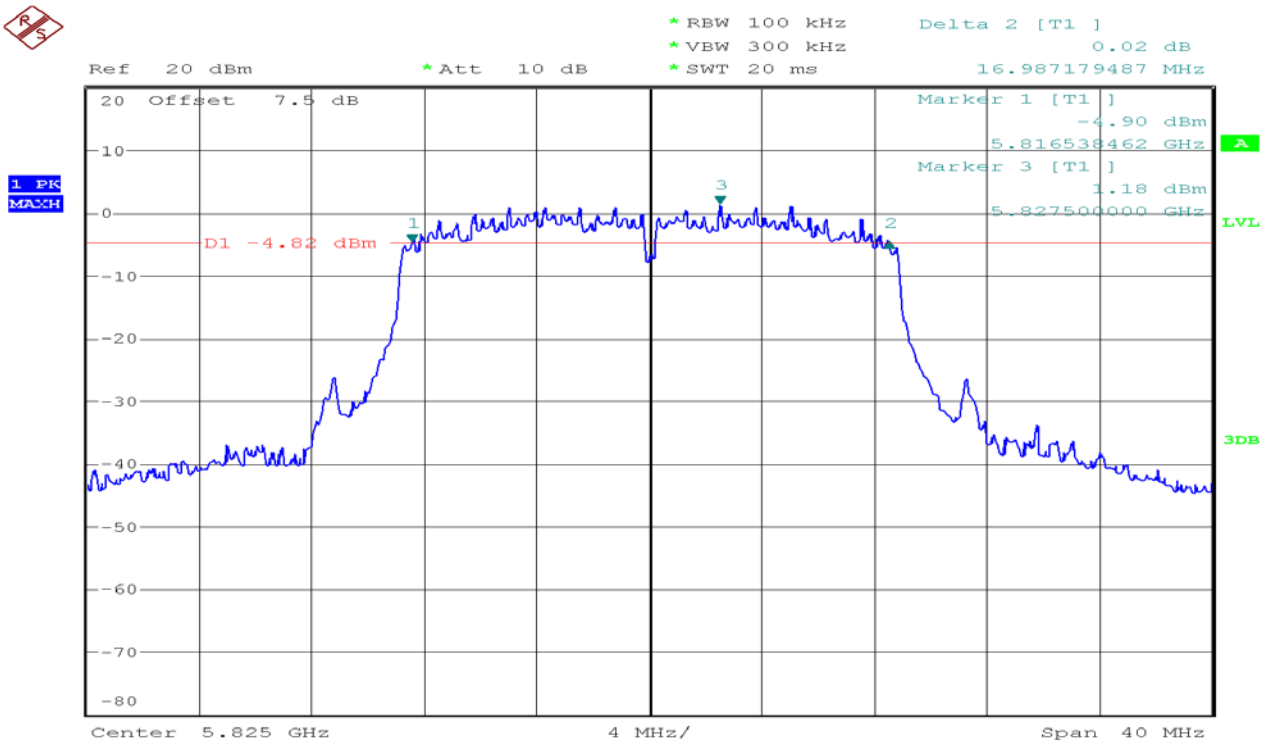
6dB Bandwidth (CH Mid)



6dB Bandwidth (CH High)



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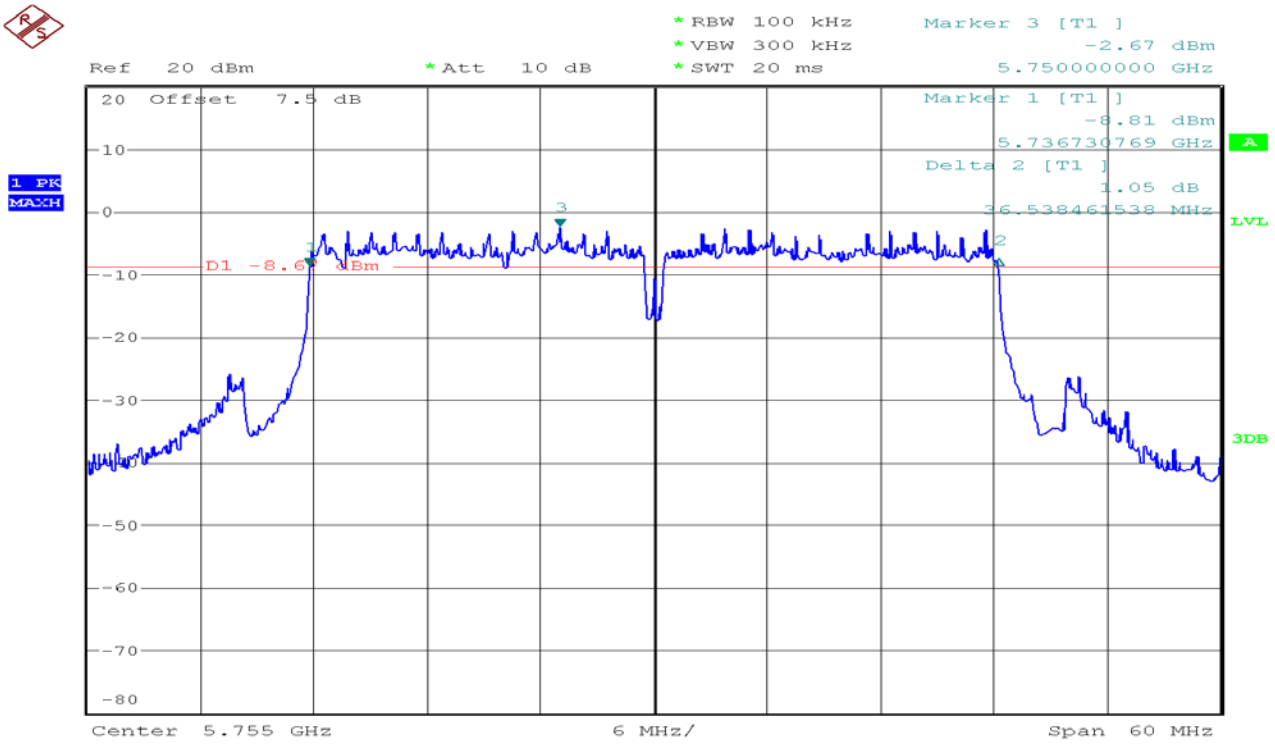
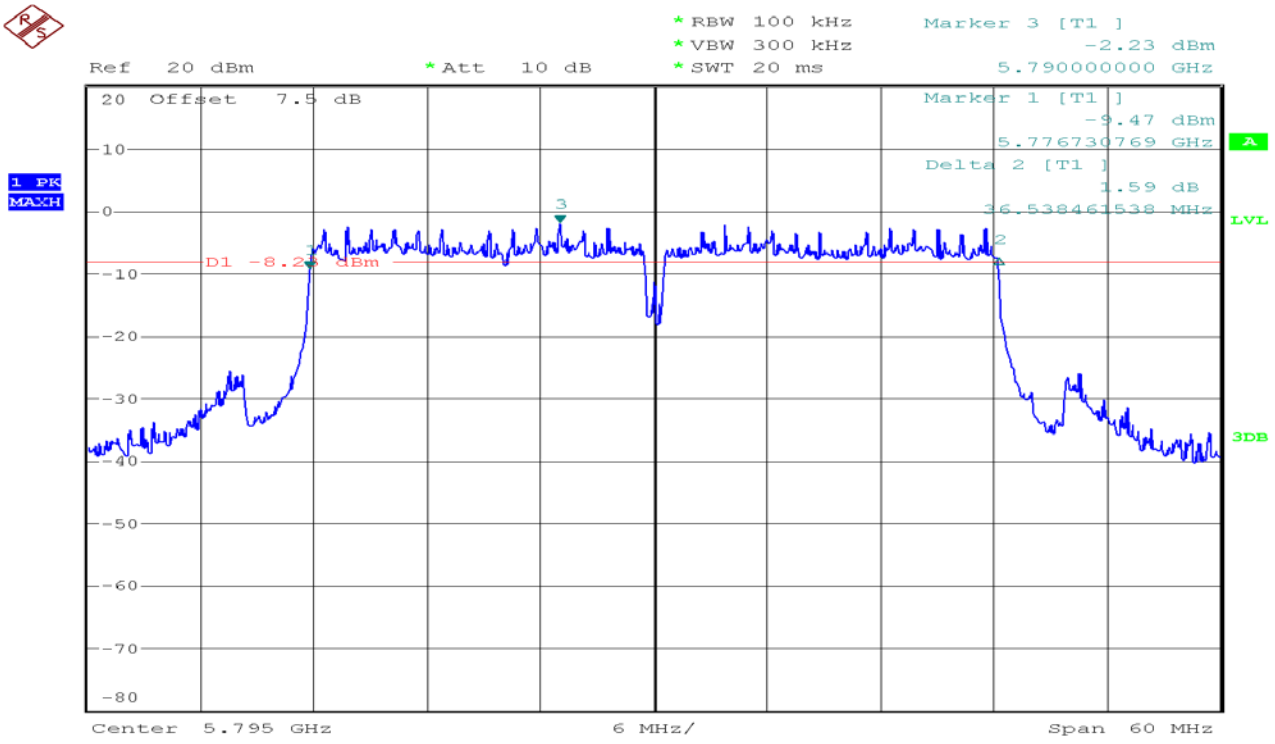
IEEE 802.11an HT40 mode/Chain 1:

6dB Bandwidth (CH Low)



6dB Bandwidth (CH High)



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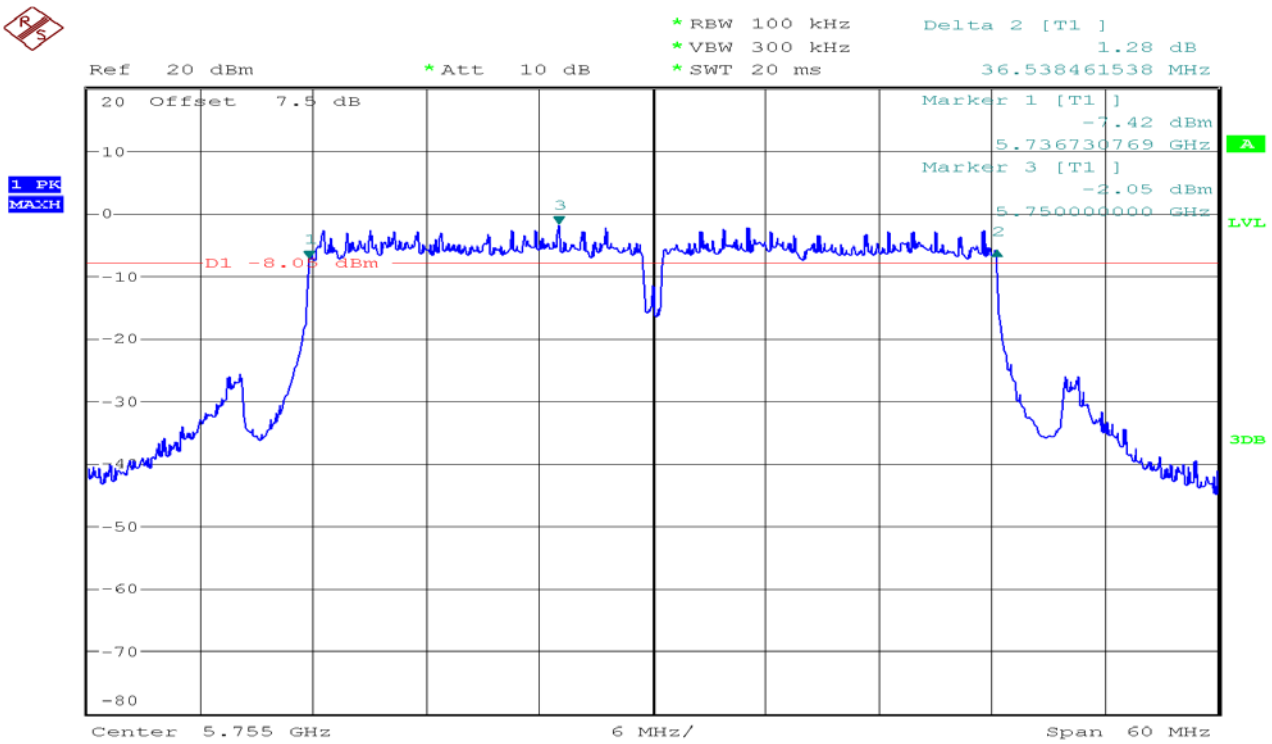
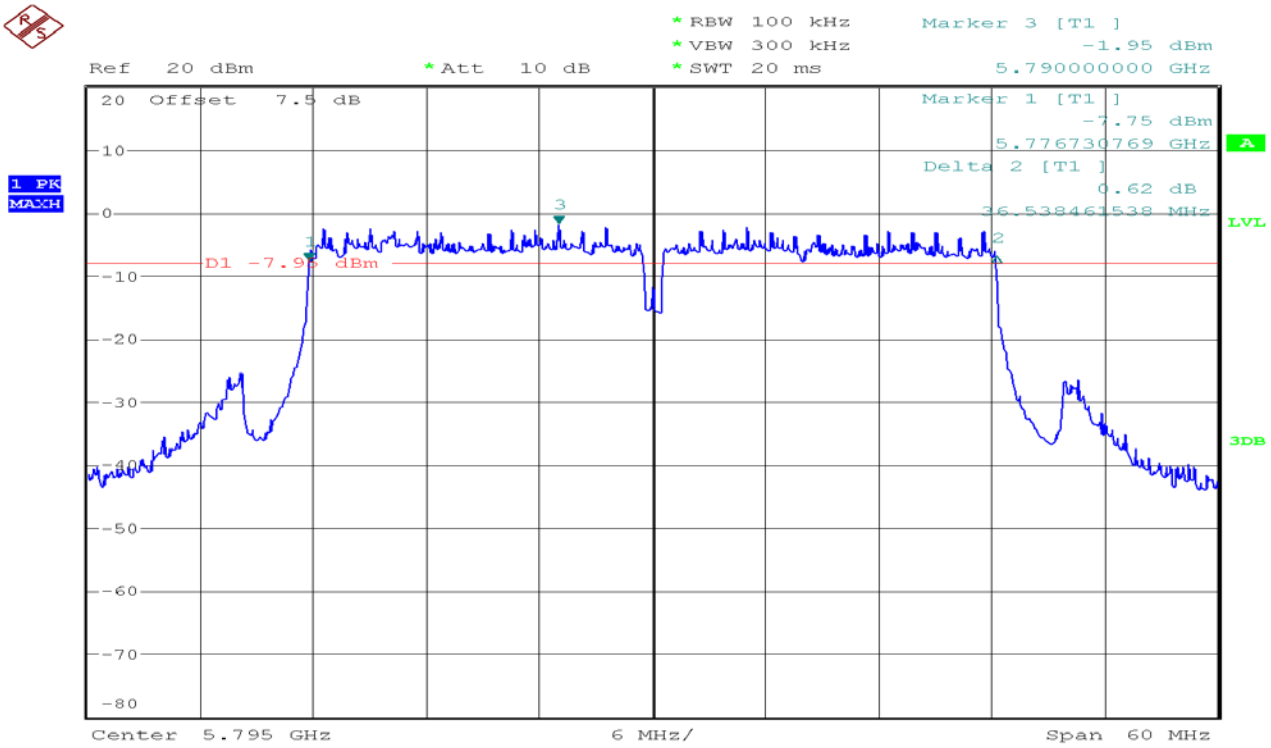
IEEE 802.11an HT40 mode/Chain 2:

6dB Bandwidth (CH Low)



6dB Bandwidth (CH High)



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7.2 MAXIMUM CONDUCTED OUTPUT POWER

LIMIT

According to §15.407(a),

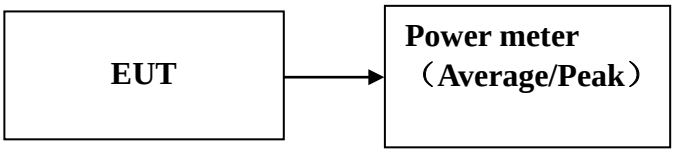
For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Directional Gain= 7.27dBi>6dBi

Limit=30dBm-(7.27-6) dB=28.73dBm

Test Configuration



The EUT was connected to a spectrum analyzer through a 50Ω RF cable.

TEST PROCEDURE

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02.Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, 10 log(1/x), where x is the duty cycle.

TEST RESULTS

No non-compliance noted

Test Data

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Test mode: IEEE 802.11a mode

5725~5850MHz

Channel	Frequency (MHz)	Chain 1 Average Output Power (dBm)	Chain 2 Average Output Power (dBm)	Limit (dBm)
Low	5745	15.41	15.07	30.00
Mid	5785	15.28	15.05	30.00
High	5825	15.48	14.91	30.00

Test mode: IEEE 802.11an HT20 mode
5725~5850MHz

Channel	Frequency (MHz)	Chain 1 Average Output Power (dBm)	Chain 2 Average Output Power (dBm)	Total Maximum Conducted Average Output Power (dBm)	Limit (dBm)
Low	5745	10.65	12.18	14.49	28.73
Mid	5785	10.64	11.81	14.27	28.73
High	5825	10.73	12.02	14.43	28.73

Test mode: IEEE 802.11an HT40 mode
5725~5850MHz

Channel	Frequency (MHz)	Chain 1 Average Output Power (dBm)	Chain 2 Average Output Power (dBm)	Total Maximum Conducted Average Output Power (dBm)	Limit (dBm)
Low	5755	10.43	11.59	14.06	28.73
High	5795	10.55	11.29	13.95	28.73

***Remark**: 1.*Total Output Power (dBm) = 10*LOG(10^(Chain 1 Output Power / 10)+10^(Chain 2 *Output Power /10))*
2.Duty factor has been offset with cable loss

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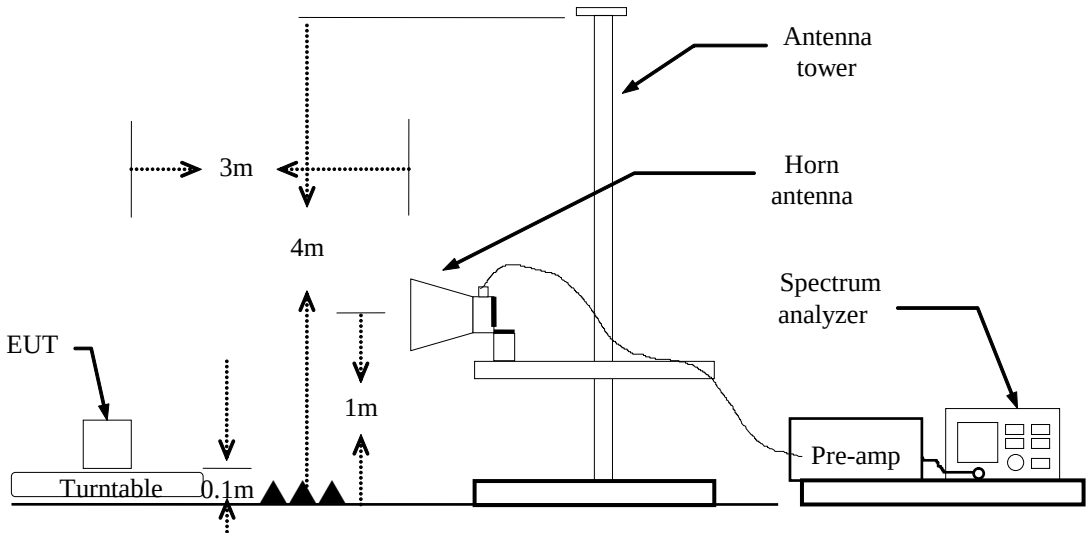
7.3 BAND EDGES MEASUREMENT

LIMIT

According to §15.407(b)(4)(i),
(1) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.
(2) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Test Configuration



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.1m 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=VBW=1MHz / Sweep=AUTO
   (b) AVERAGE: RBW=1MHz / Sweep=AUTO

   VBW=10Hz,when duty cycle is no less than 98 percent.

   VBW≧1/T,when duty cycle is less than 98 percent,where T is the minimum

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transmission duration over which the transmitter is on and is transmitting at its maximun power control level for the tested mode of operation.

5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

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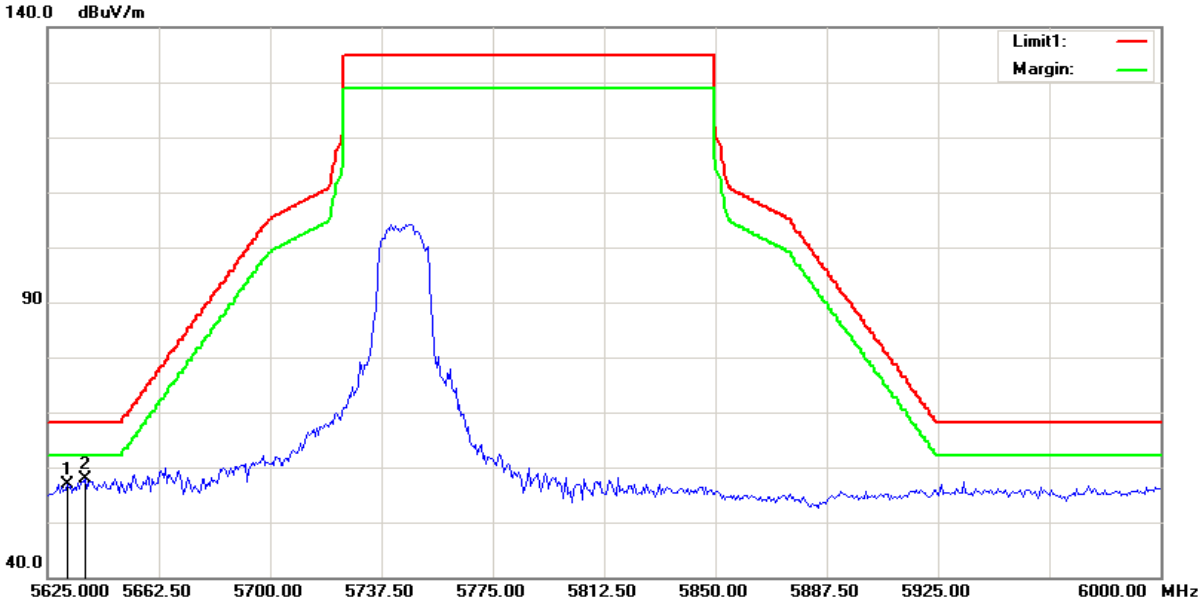
TEST RESULTS

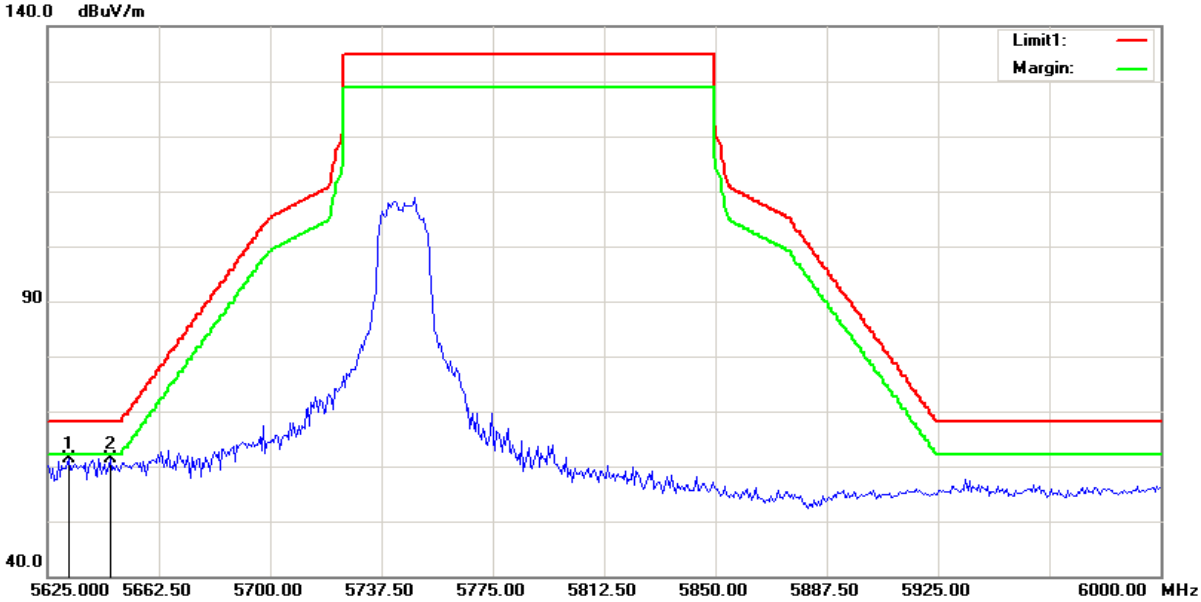
Band Edges (IEEE 802.11a mode ch low)

Polarity: Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5631.611	56.69	0.24	56.93	68.20	-11.27	100	265	peak
2	5637.620	57.59	0.24	57.83	68.20	-10.37	100	229	peak

Polarity: Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5632.212	61.24	0.24	61.48	68.20	-6.72	100	331	peak
2	5646.034	61.21	0.25	61.46	68.20	-6.74	100	329	peak

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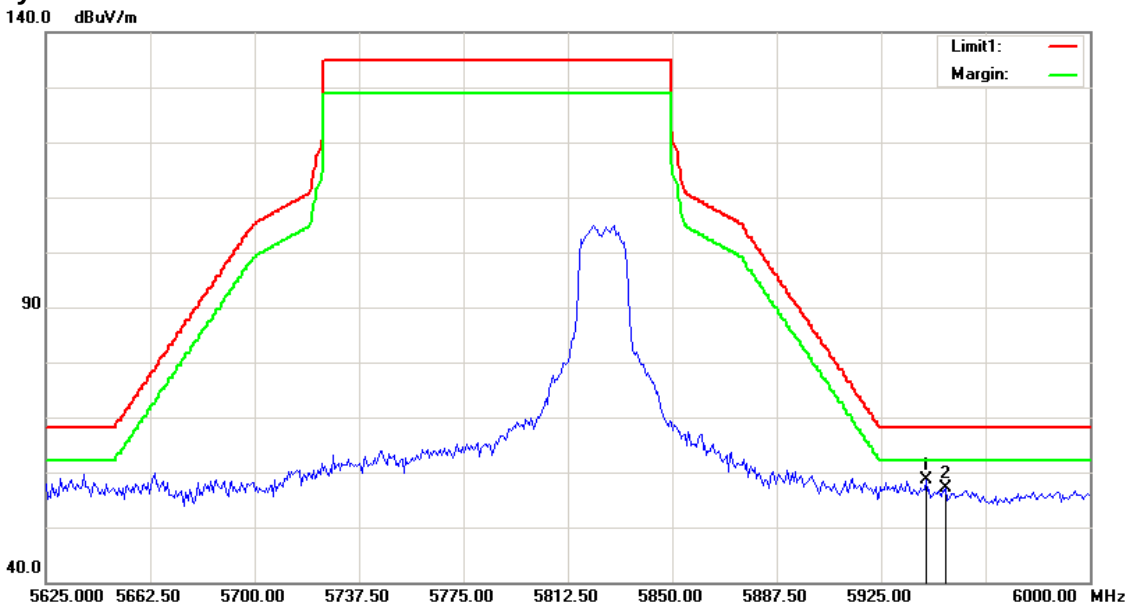
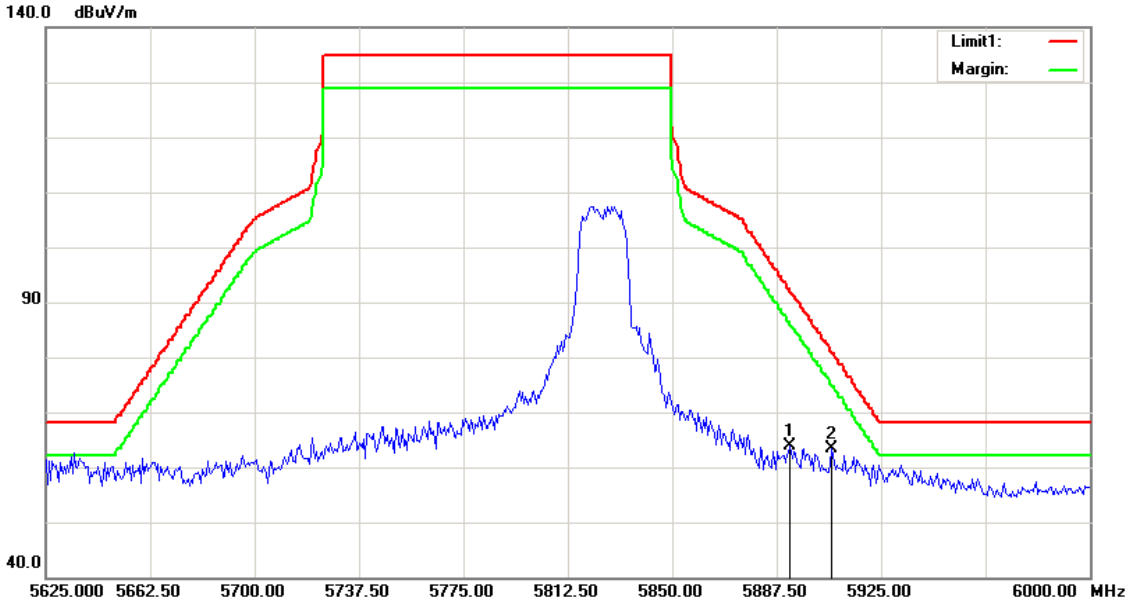
Band Edges (IEEE 802.11a mode ch high)

Polarity: Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5941.106	58.23	0.32	58.55	68.20	-9.65	100	269	peak
2	5948.317	56.84	0.32	57.16	68.20	-11.04	200	239	peak

Polarity: Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5892.428	63.58	0.30	63.88	92.30	-28.42	100	333	peak
2	5907.452	63.05	0.31	63.36	81.19	-17.83	100	337	peak

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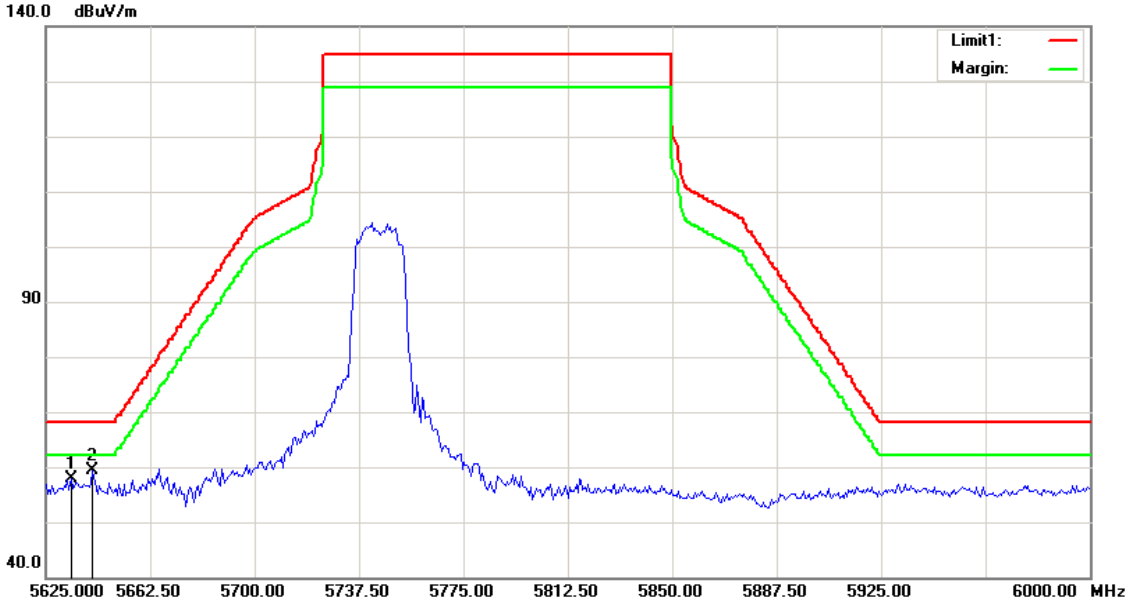
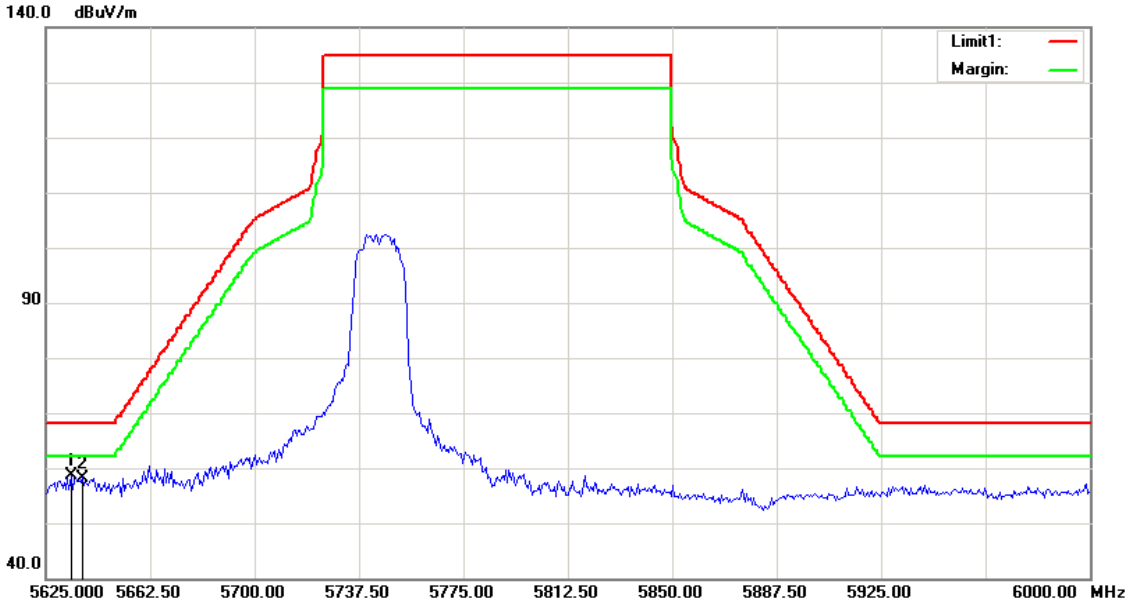
Band Edges (IEEE 802.11an HT20 mode ch low)

Polarity: Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5634.014	57.69	0.24	57.93	68.20	-10.27	200	255	peak
2	5641.827	59.14	0.24	59.38	68.20	-8.82	100	266	peak

Polarity: Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5634.014	58.42	0.24	58.66	68.20	-9.54	100	343	peak
2	5638.221	58.01	0.24	58.25	68.20	-9.95	100	329	peak

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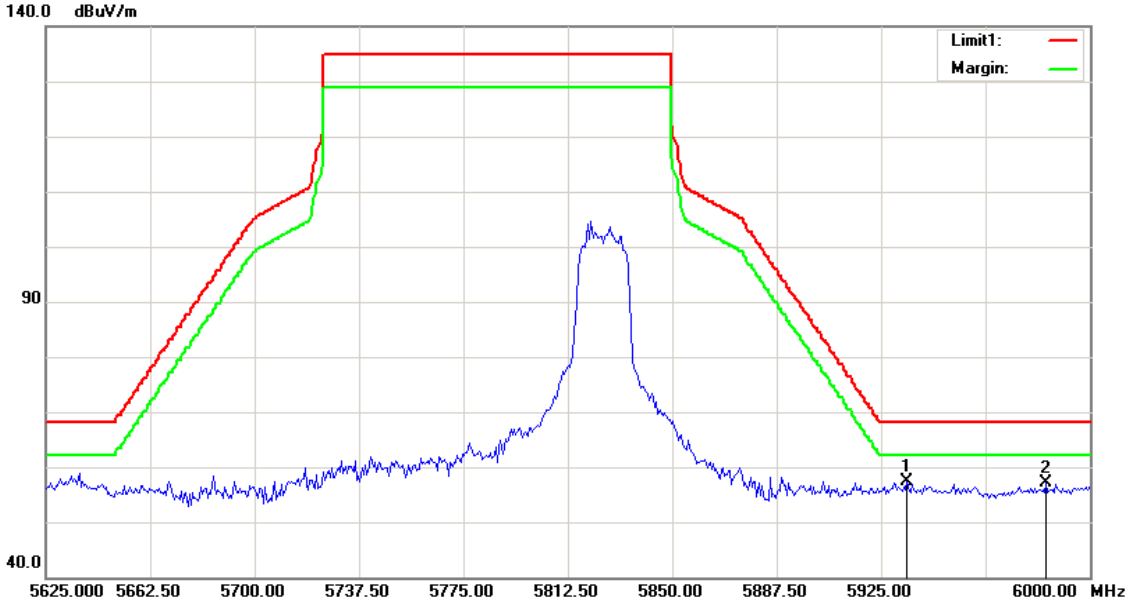
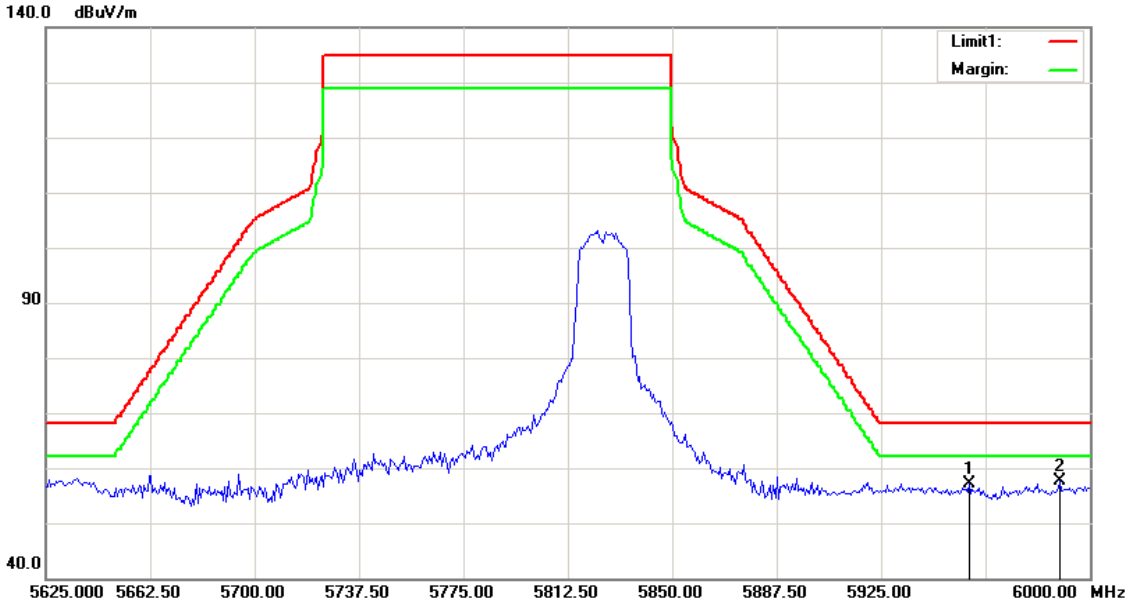
Band Edges (IEEE 802.11an HT20 mode ch high)

Polarity: Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5934.495	57.02	0.31	57.33	68.20	-10.87	100	333	peak
2	5984.375	56.86	0.33	57.19	68.20	-11.01	200	110	peak

Polarity: Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5956.731	56.72	0.32	57.04	68.20	-11.16	200	298	peak
2	5989.183	57.24	0.33	57.57	68.20	-10.63	200	360	peak

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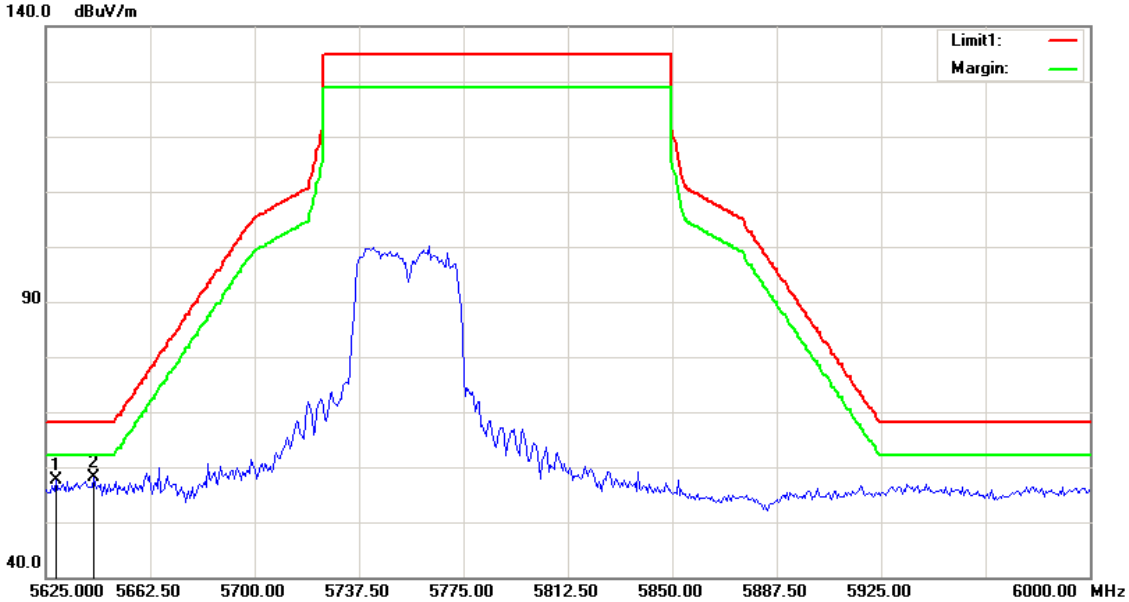
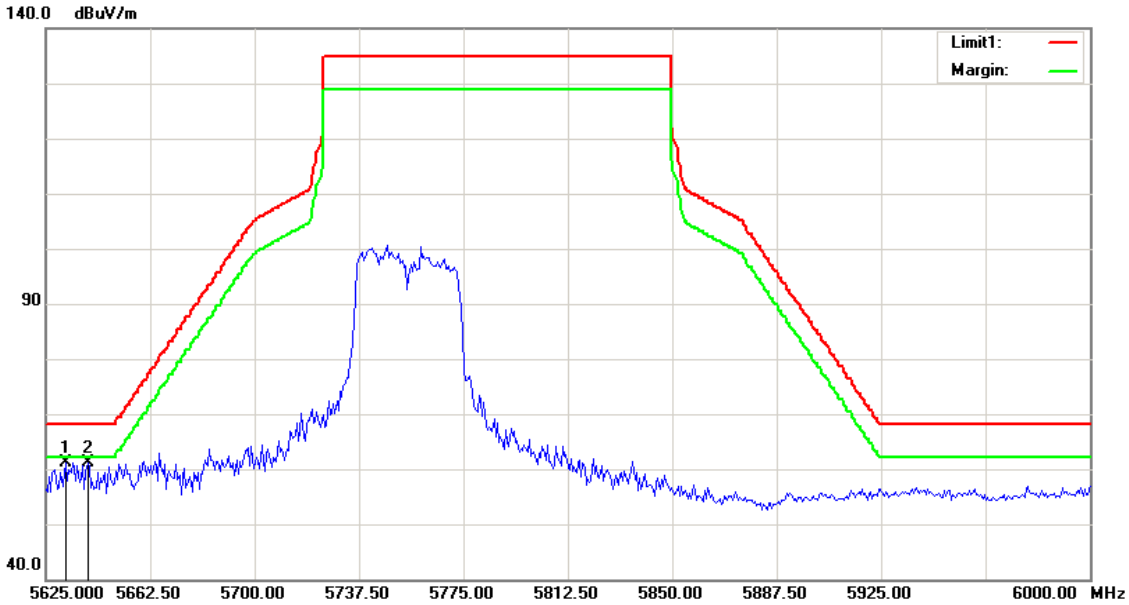
Band Edges (IEEE 802.11an HT40 mode ch low)

Polarity: Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5628.606	57.48	0.24	57.72	68.20	-10.48	200	99	peak
2	5642.428	57.97	0.24	58.21	68.20	-9.99	100	272	peak

Polarity: Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5632.212	60.84	0.24	61.08	68.20	-7.12	100	335	peak
2	5640.024	60.98	0.24	61.22	68.20	-6.98	100	335	peak

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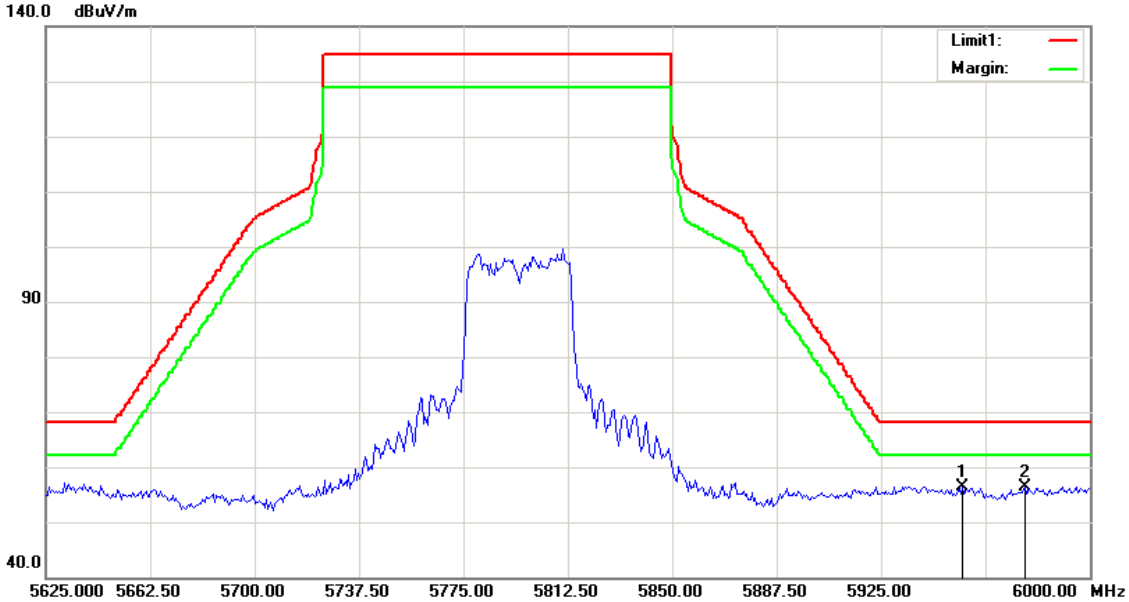
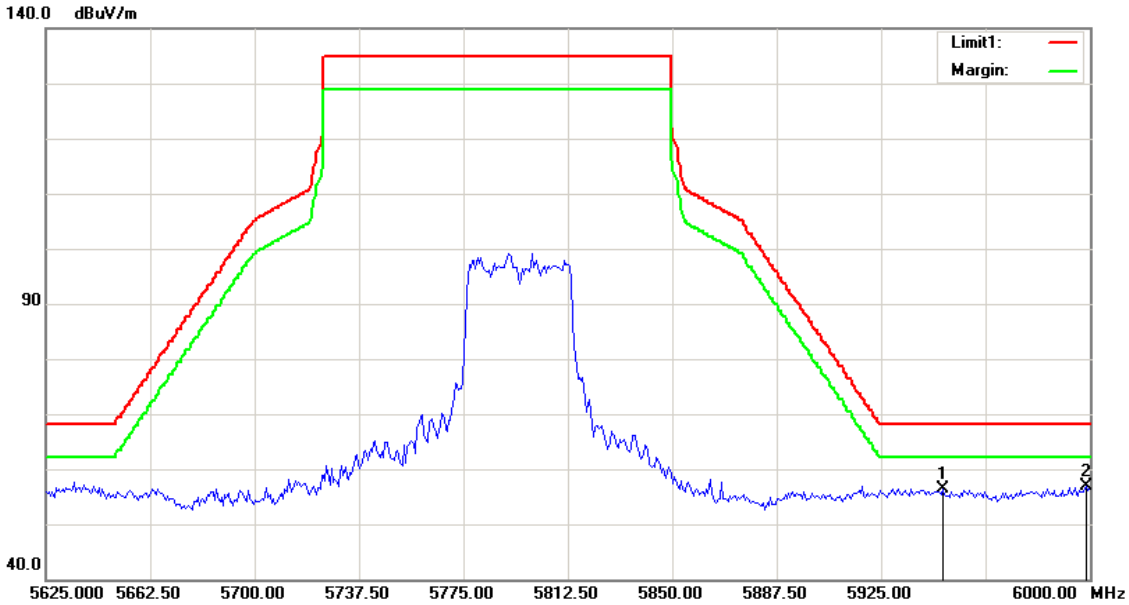
Band Edges (IEEE 802.11an HT40 mode ch high)

Polarity: Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5954.327	56.18	0.32	56.50	68.20	-11.70	200	135	peak
2	5976.563	56.17	0.32	56.49	68.20	-11.71	100	139	peak

Polarity: Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5947.115	56.04	0.32	56.36	68.20	-11.84	100	185	peak
2	5998.798	56.62	0.33	56.95	68.20	-11.25	300	81	peak

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7.4 POWER SPECTRAL DENSITY

LIMIT

According to §15.407(a),

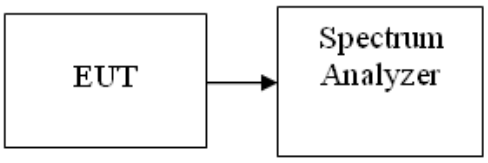
For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6dBi are used, both the maximum *transmit power and the* maximum *power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.*

Directional Gain= 7.27dBi>6dBi

Limit=30dBm-(7.27-6) dB=28.73dBm

Test Configuration



TEST PROCEDURE

1. The testing follows Method SA-2 of FCC KDB 789033 D02 General UNII Test Procedures v02r01.
2. Measure the duty cycle, Set span to encompass the entire emission bandwidth (EBW) of the signal. Set RBW = 500 kHz. Set VBW ≥ 1 MHz. Number of points in sweep ≥ 2 Span / RBW. Sweep time = auto. Detector = RMS, Trace average at least 100 traces in power averaging mode.. Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.
3. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
4. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Method (1): Measure and sum the spectra across the outputs. The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

TEST RESULTS

No non-compliance noted

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Test Data

Test mode: IEEE 802.11a mode

5725~5850MHz

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Limit (dBm)	Result
Low	5745	3.77	4.38	30.00	PASS
Mid	5785	3.77	4.30	30.00	PASS
High	5825	3.84	3.84	30.00	PASS

Test mode: IEEE 802.11an HT20 mode

5725~5850MHz

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
Low	5745	-0.48	0.10	2.83	28.73	PASS
Mid	5785	-0.48	0.09	2.82	28.73	PASS
High	5825	-0.83	-0.13	2.54	28.73	PASS

Test mode: IEEE 802.11an HT40 mode

5725~5850MHz

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
Low	5755	-3.95	-3.49	-0.70	28.73	PASS
High	5795	-4.29	-3.40	-0.81	28.73	PASS

Remark: 1.Total PPSD(dBm) = 10*LOG(10^(Chain 1 PPSD / 10)+10^(Chain 2 PPSD /10))

2.Duty factor has been offset with cable loss

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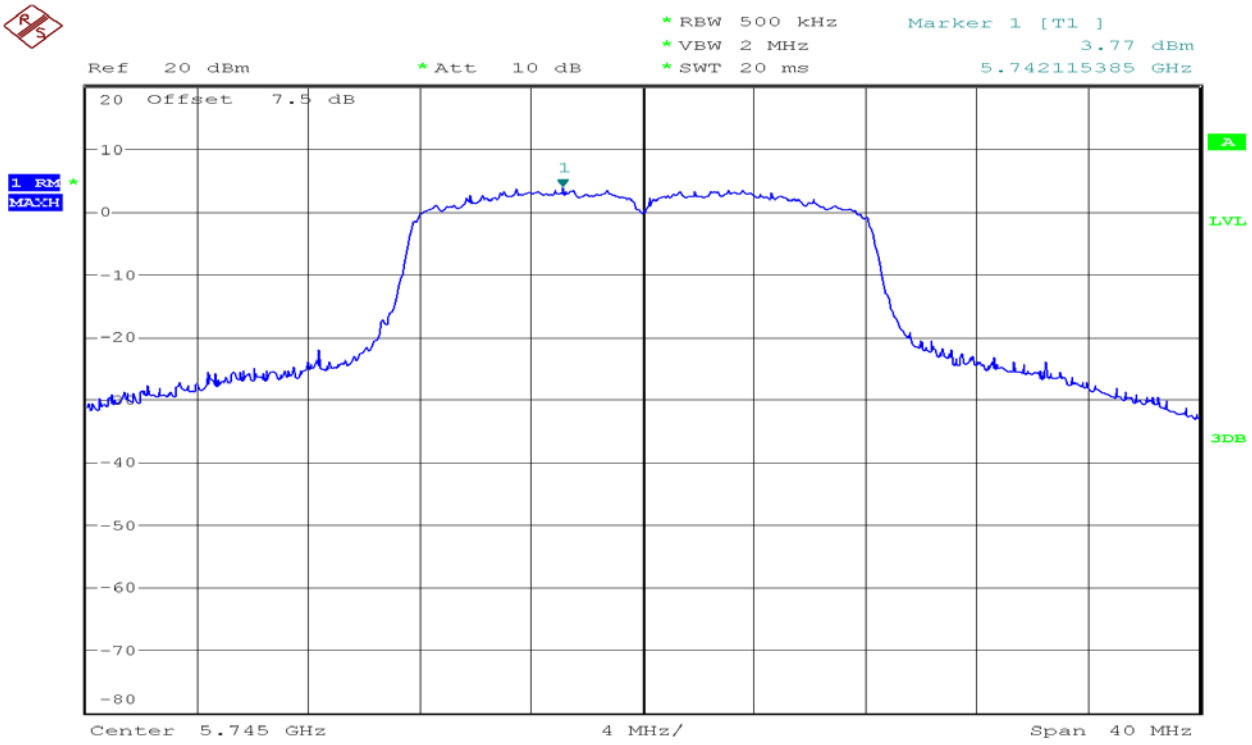
Test Plot

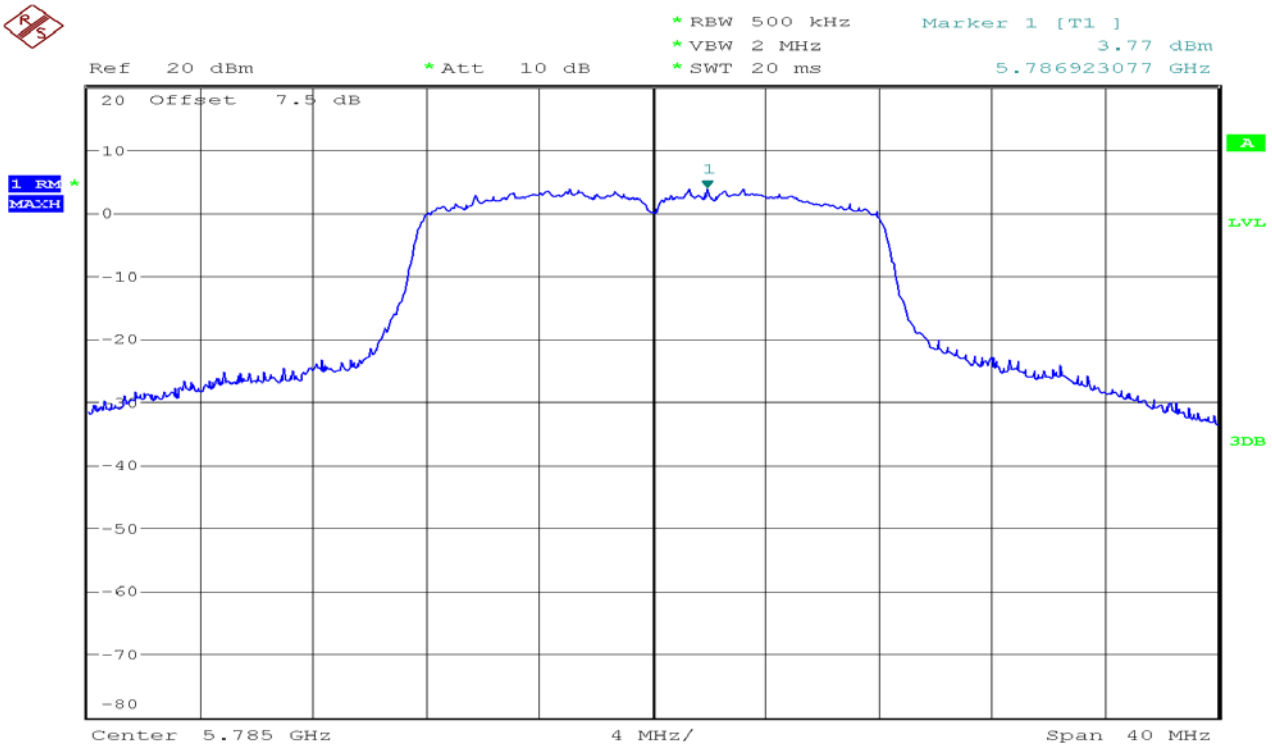
IEEE 802.11a mode/Chain 1

5725~5850MHz

CH Low



CH Mid



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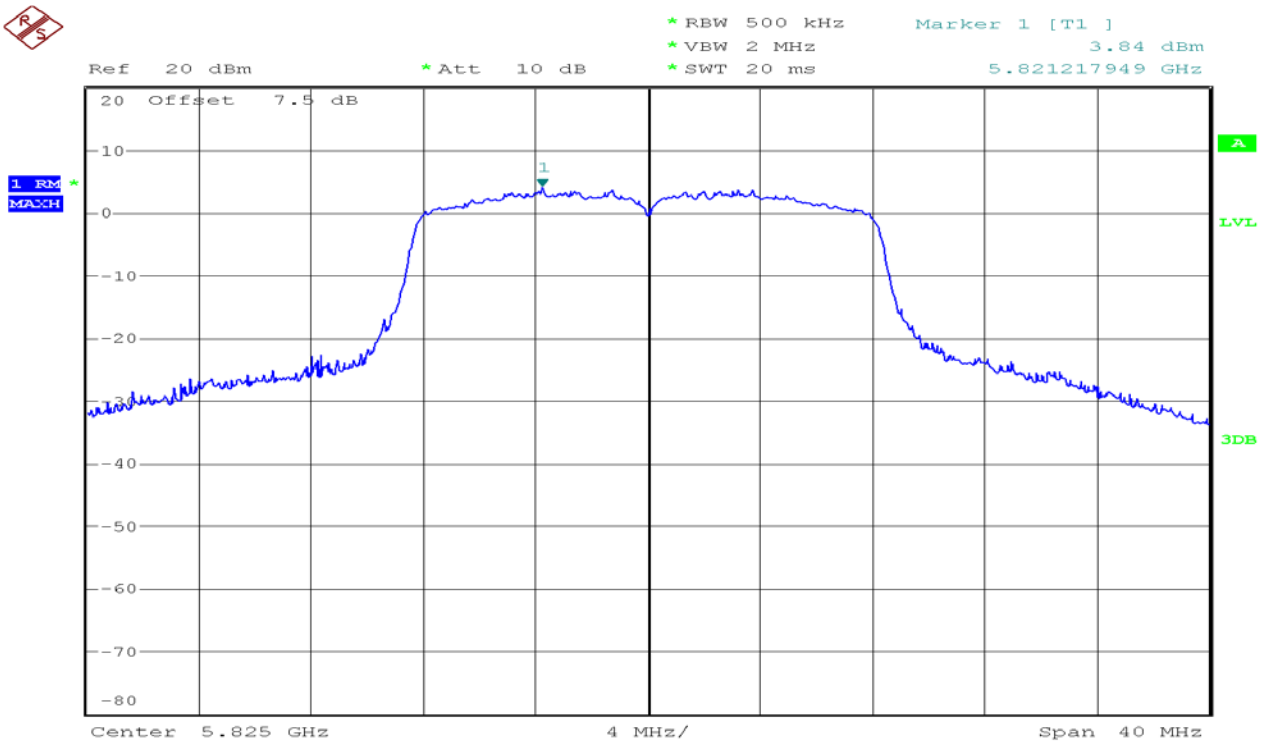
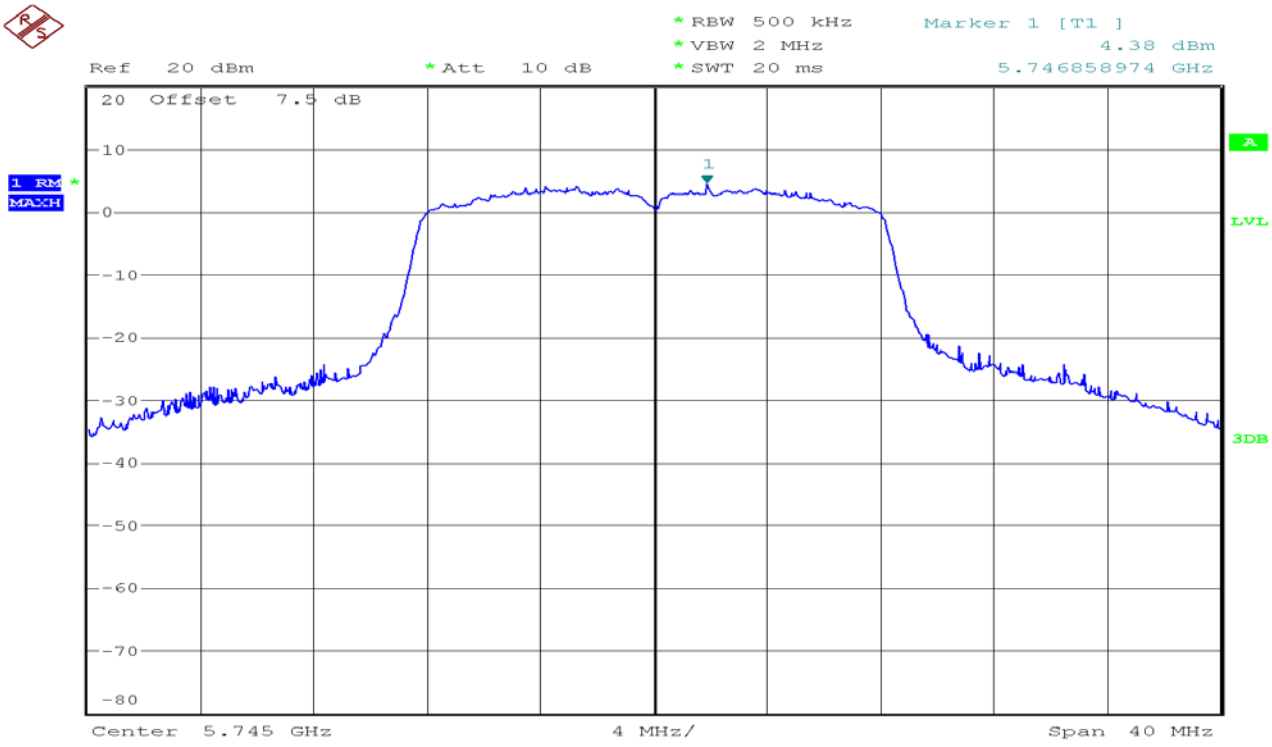
CH High



<u>IEEE 802.11a mode/Chain 2</u>
5725~5850MHz
CH Low



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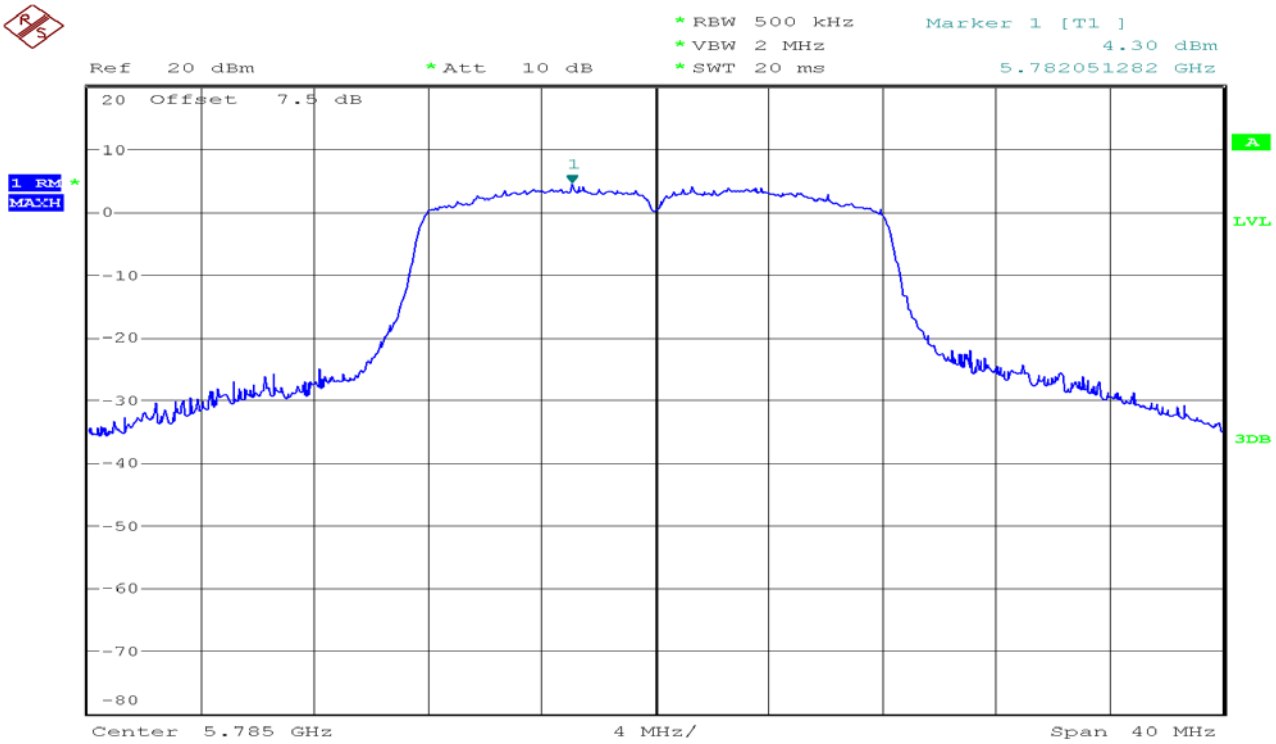
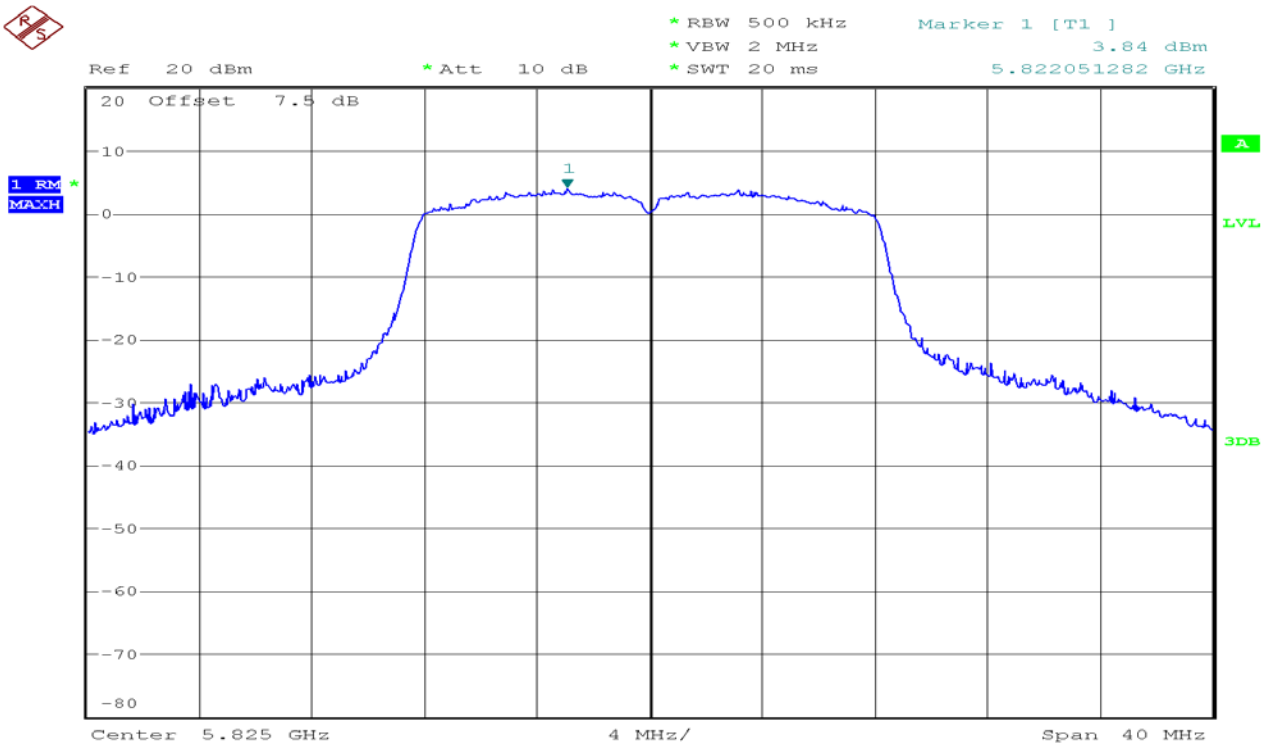
CH Mid



CH High



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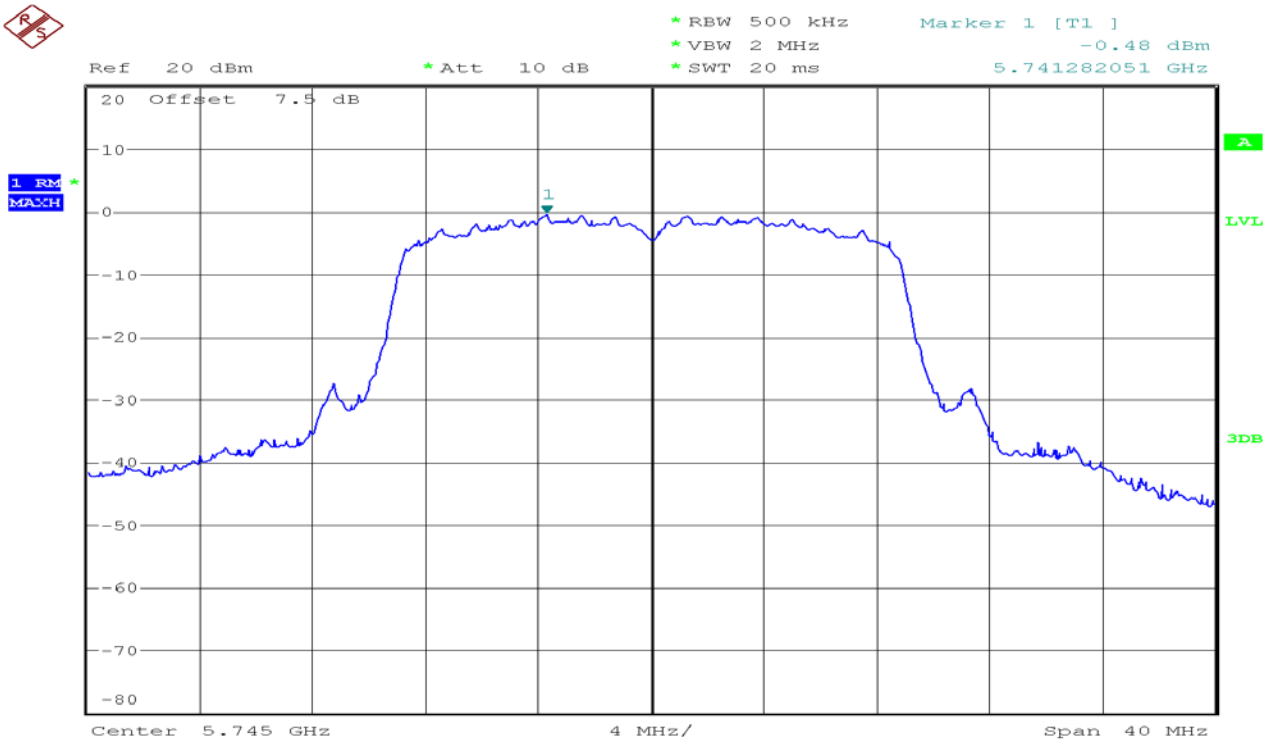
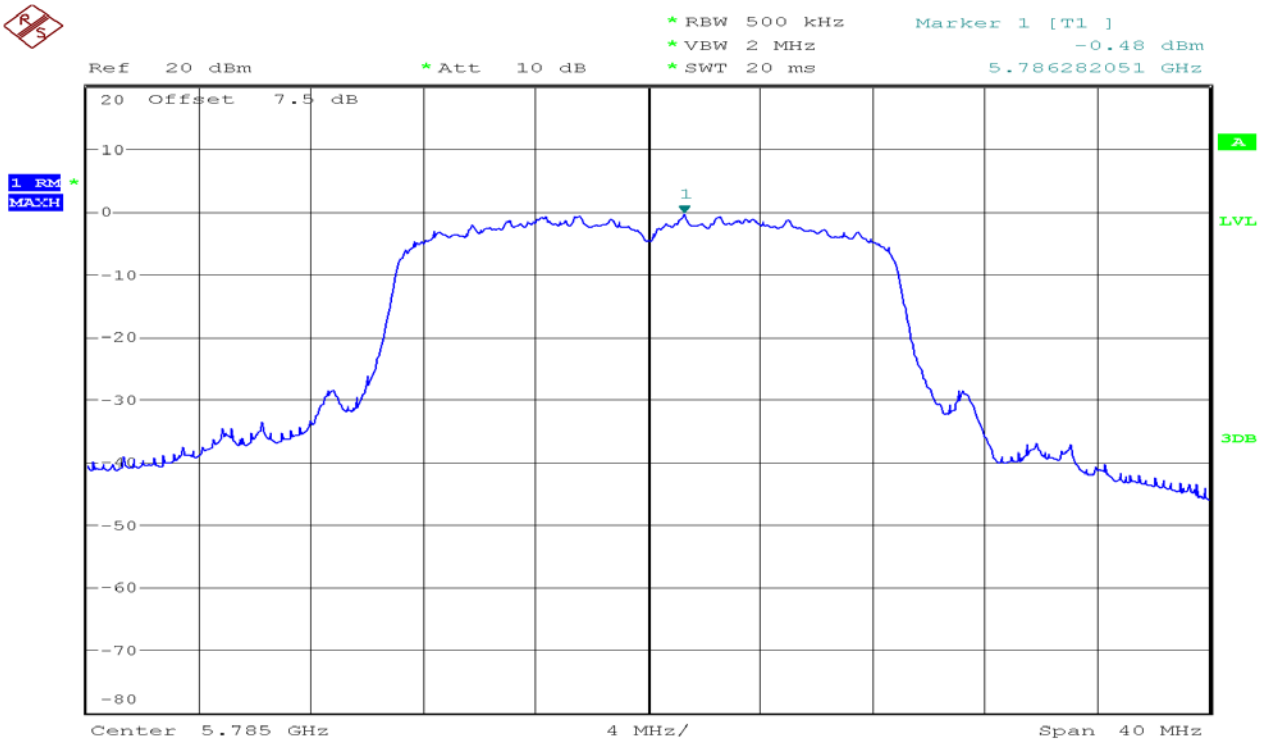
IEEE 802.11an HT20 mode/Chain 1
5725~5850MHz

CH Low



CH Mid



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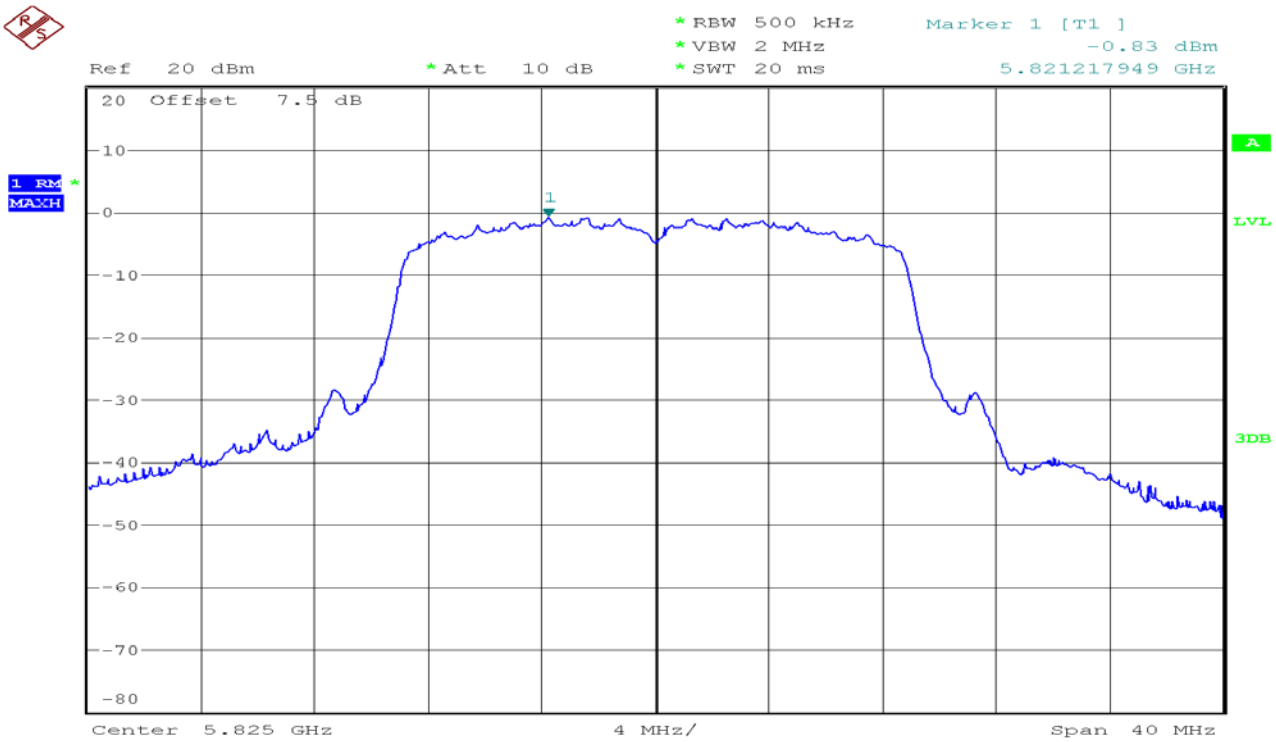
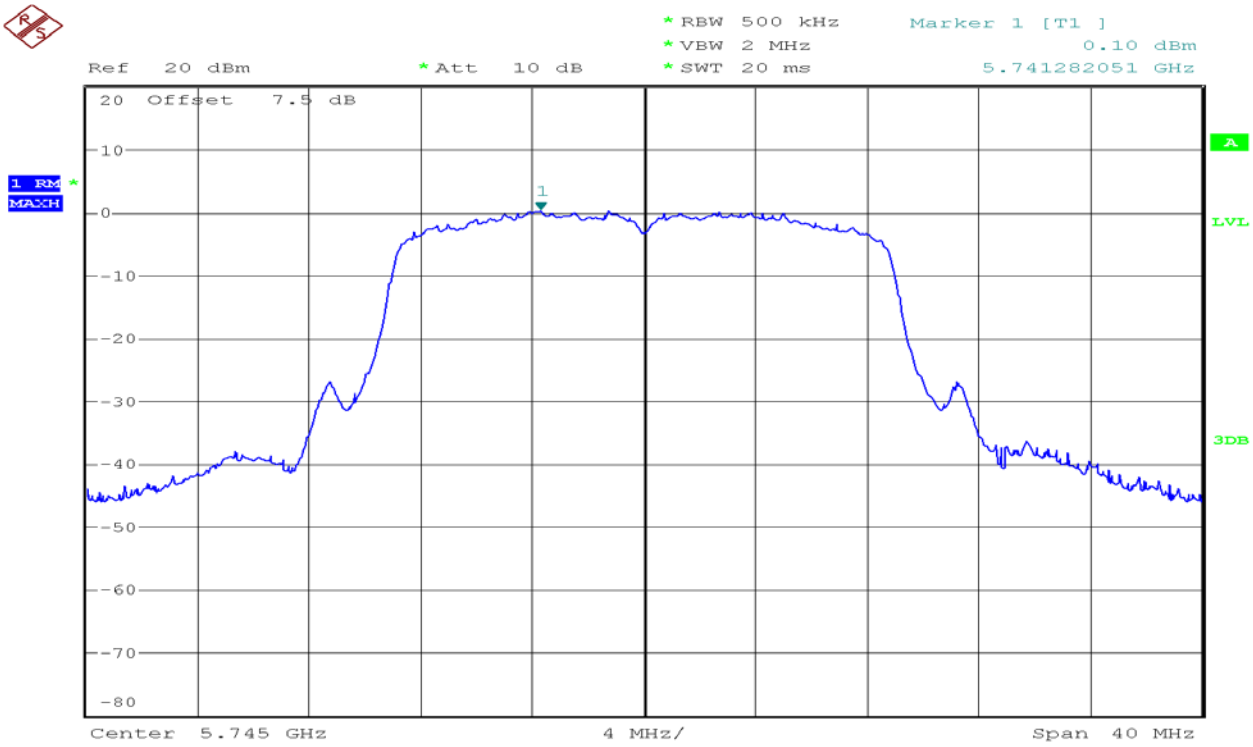
CH High



<u>IEEE 802.11an HT20 mode/Chain 2</u>
5725~5850MHz
CH Low



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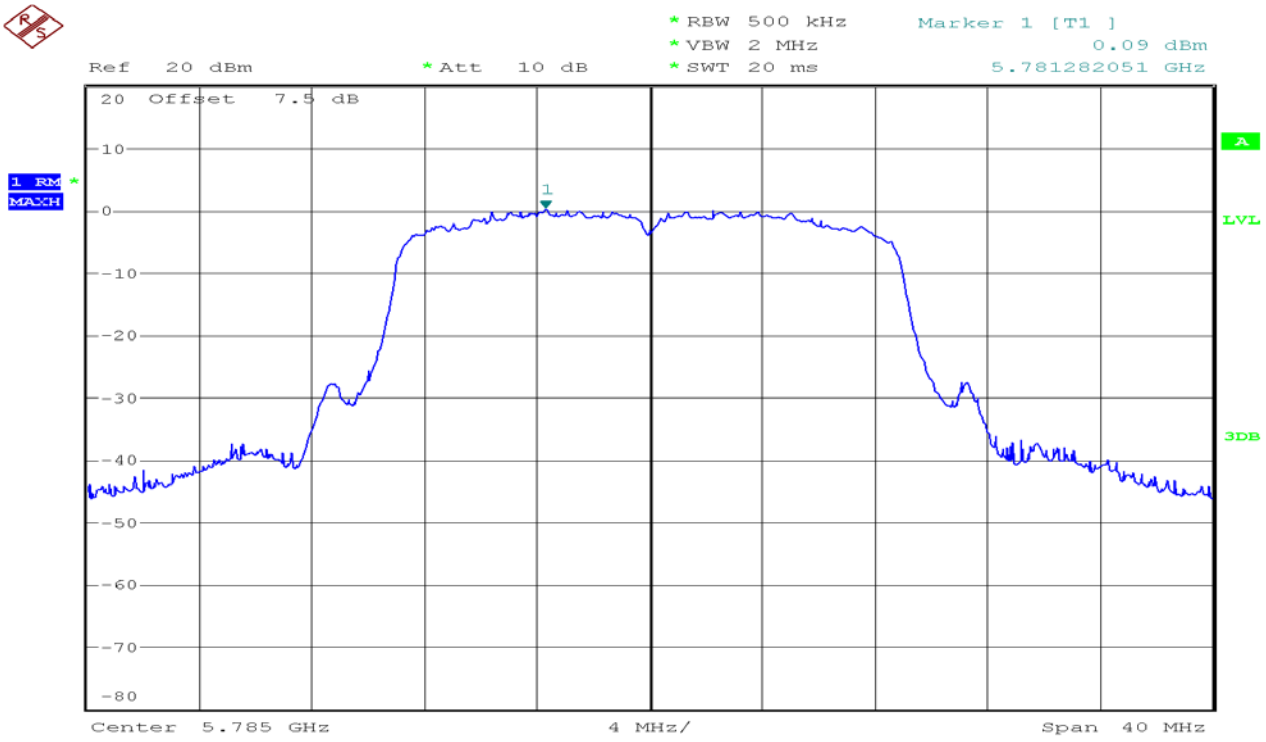
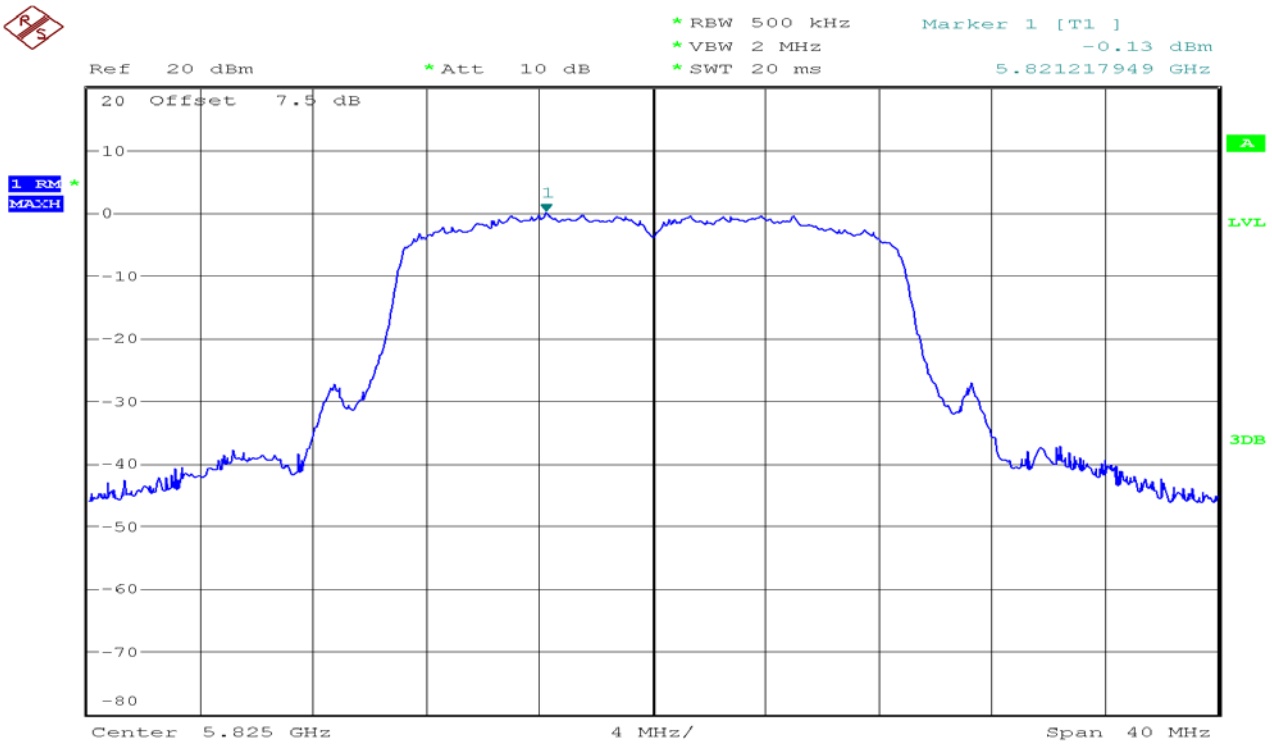
CH Mid



CH High



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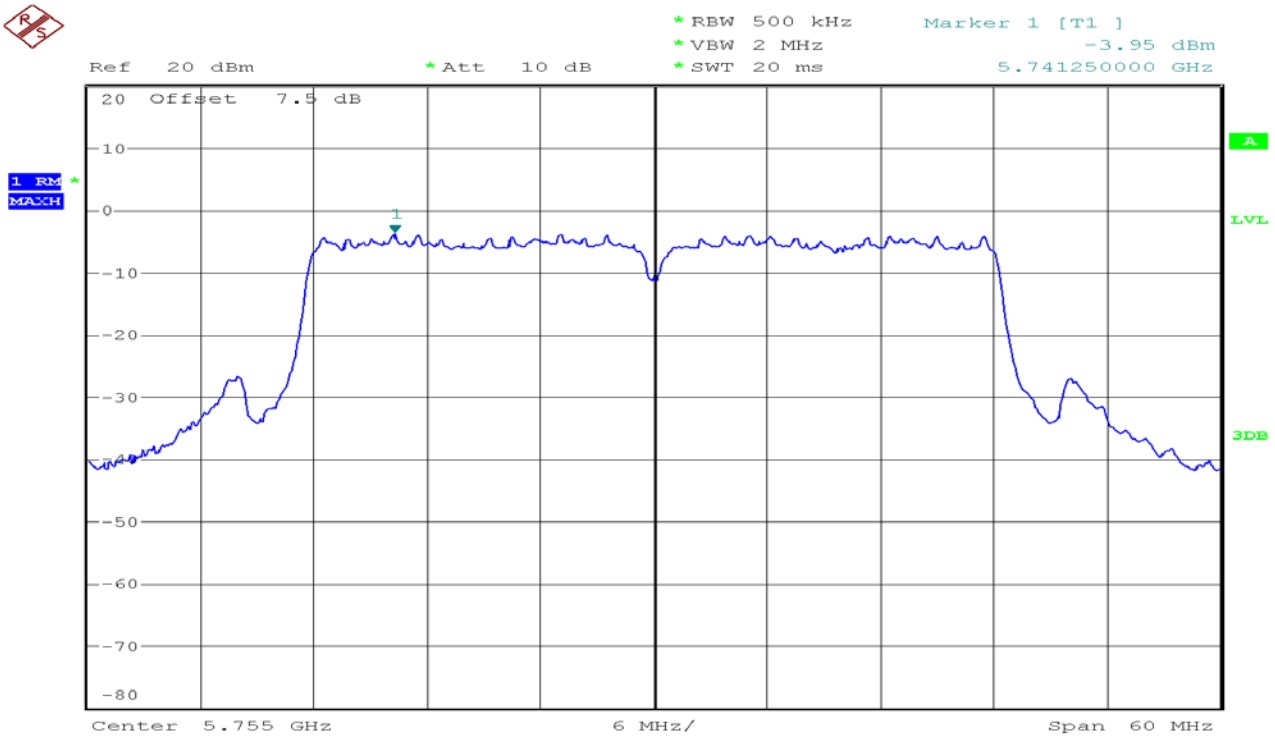
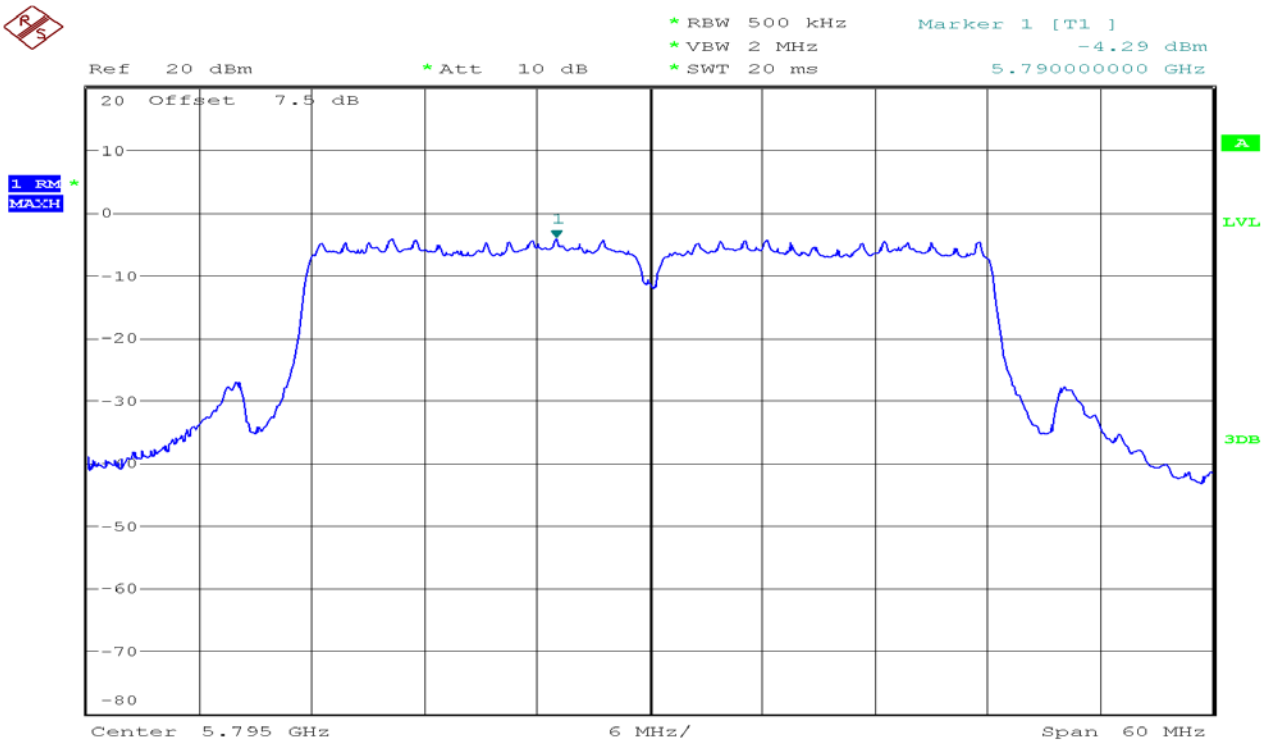
IEEE 802.11an HT40 mode/Chain 1
5725~5850MHz

CH Low



CH High



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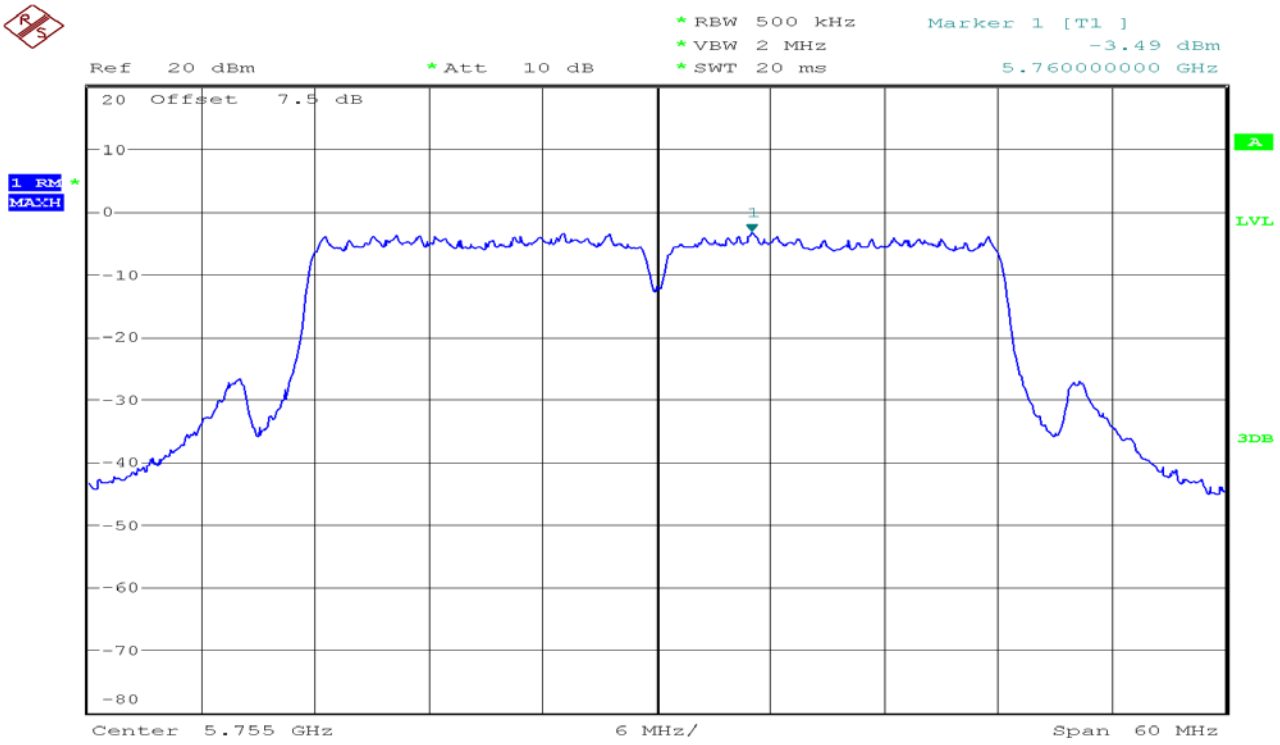
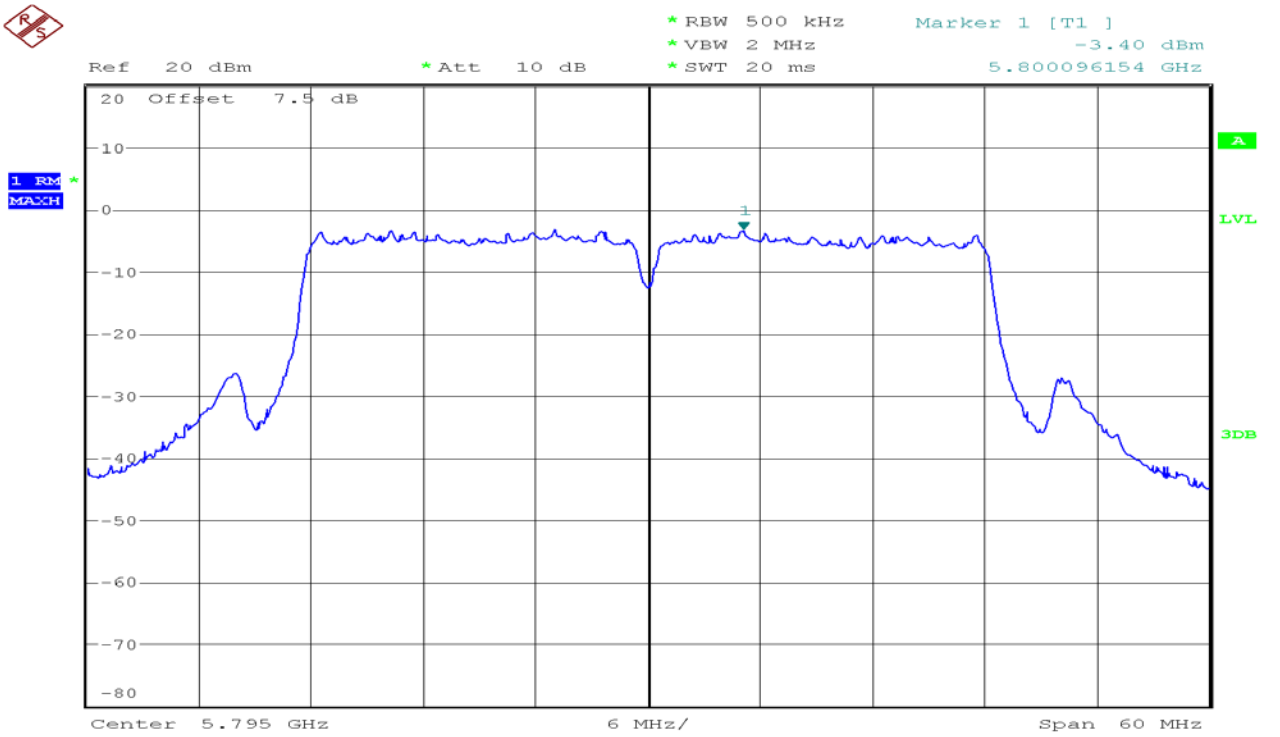
IEEE 802.11an HT40 mode/Chain 2
5725~5850MHz

CH Low



CH High



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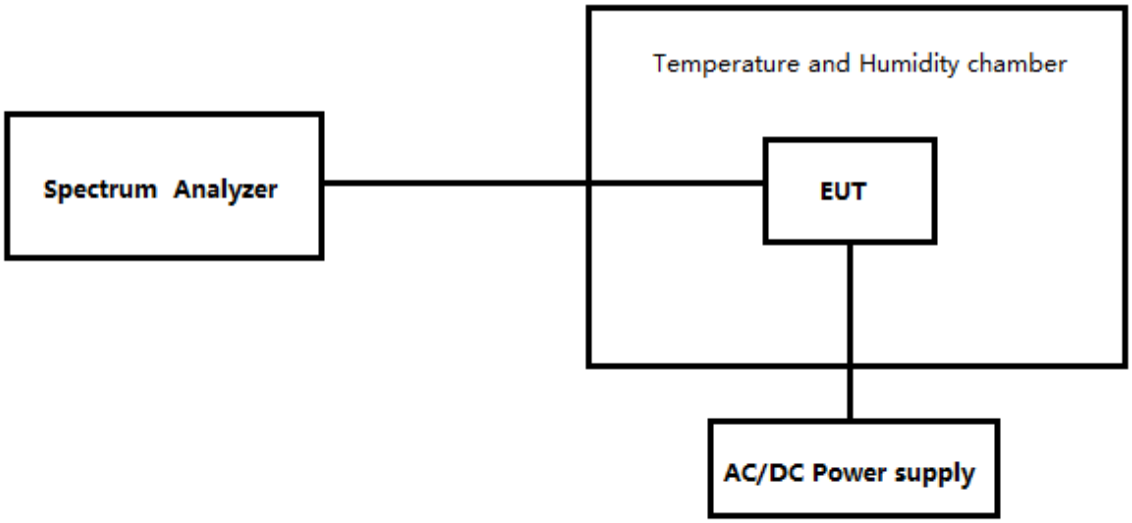
7.5 FREQUENCY STABILITY MEASUREMENT

LIMIT

According to §15.407(g),Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

TEST CONFIGURATION



TEST PROCEDURE

1. To ensure emission at the band edge is maintained within the authorized band, those values shall be measured by radiation emissions at upper and lower frequency points, and finally compensated by frequency deviation as procedures below.
2. The EUT was operated at the maximum output power, and connected to the spectrum analyzer, which is set to maximum hold function and peak detector. The peak value of the power envelope was measured and noted. The upper and lower frequency points were respectively measured relatively 10dB lower than the measured peak value.
3. The frequency deviation was calculated by adding the upper frequency point and the lower frequency point divided by two. Those detailed values of frequency deviation are provided in table below.

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TEST RESULTS

U-NII-3-(5725MHz-5850MHz)					
Freq.(MHz)	Center Frequency (MHz)	Frequency Deviation (MHz)	Frequency Stability (ppm)	Temperature (°C)	Voltage (V)
5745	5744.982	0.018	3.13	25	V_{min}
5745	5744.991	0.009	1.57	25	V_{max}
5745	5744.996	0.004	0.70	25	V_{nor}
5745	5745.042	0.042	7.33	-20	V_{nor}
5745	5745.064	0.064	11.09	80	V_{nor}

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7.6 RADIATED UNDESIRABLE EMISSION

LIMIT

Radiated emissions from 9 kHz to 40GHz were measured according to the methods defines in ANSI C63.10-2013. The EUT was placed above the ground plane, 0.1 meter for frequency below 1GHz and 0.1 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. For transmitters operating in the 5725-5850 MHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz (78.3dBμV/m); for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz (68.3dBμV/m).
2. KDB789033 v02 G)2)c) As specified in 15.407(b), emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in 15.407(b)(4)). However, an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.
3. According to APPENDIX A Final Rules of FCC-16-24A1,For transmitters operating in the 5.725-5.85 GHz band:
   All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
4. 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.*

5. 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)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

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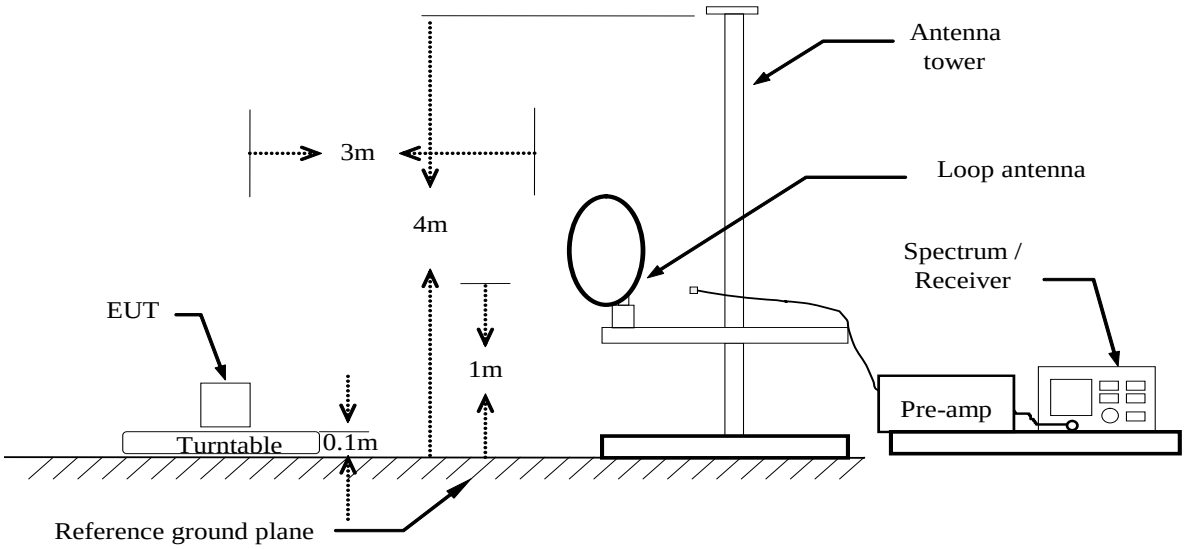
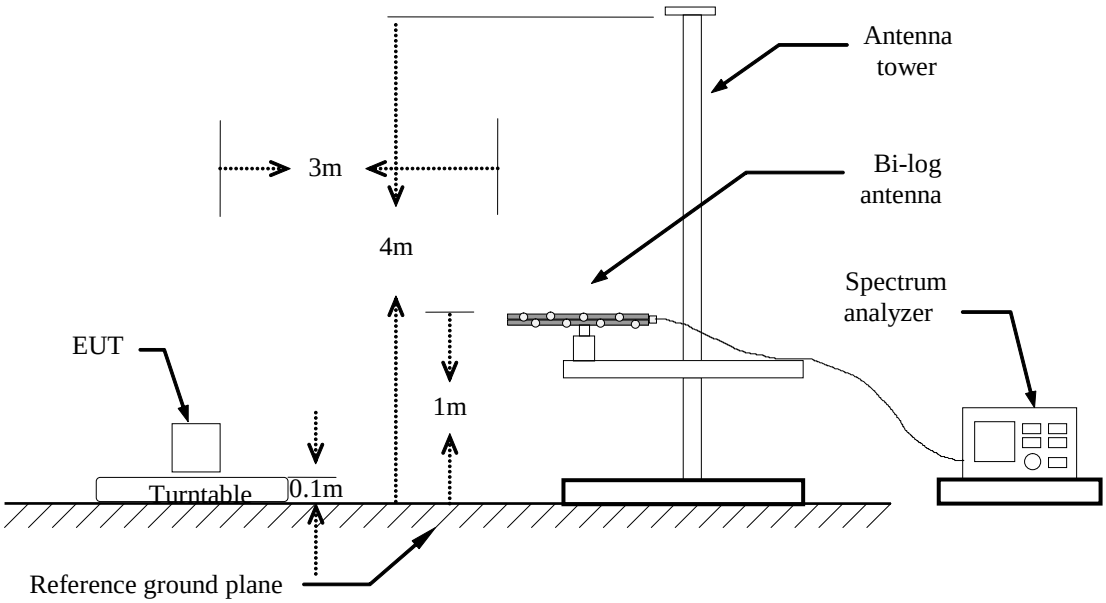
Test Configuration

Below 30MHz



Below 1 GHz



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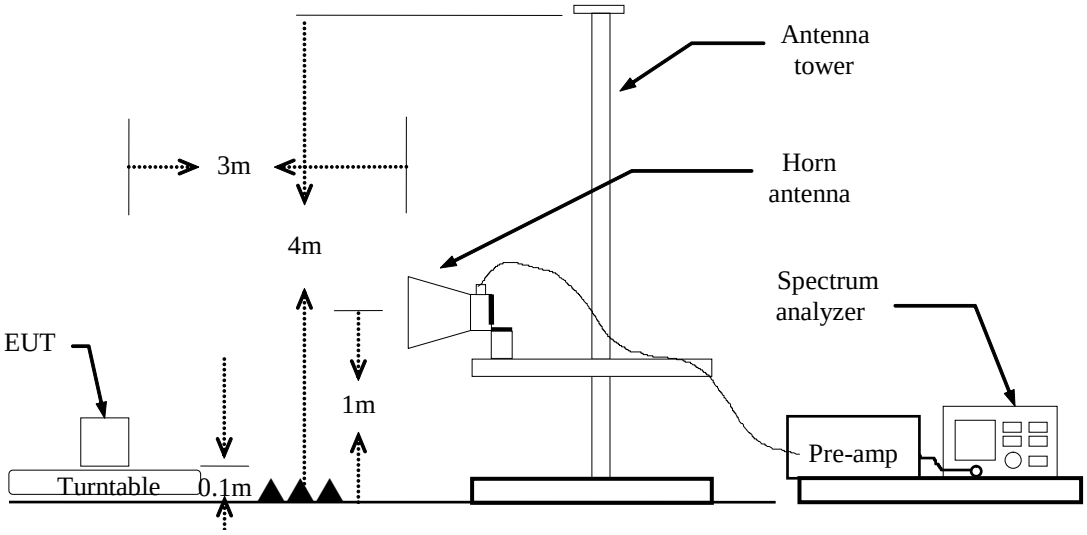
Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable above ground plane, which is 0.1 meter for frequency below 1GHz and 0.1 meter for frequency above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:

Below 1GHz:

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

Above 1GHz:

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

(b) AVERAGE: RBW=1MHz / Sweep=AUTO

VBW=10Hz,when duty cycle is no less than 98 percent.

VBW≧1/T,when duty cycle is less than 98 percent,where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximun power control level for the tested mode of operation.

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

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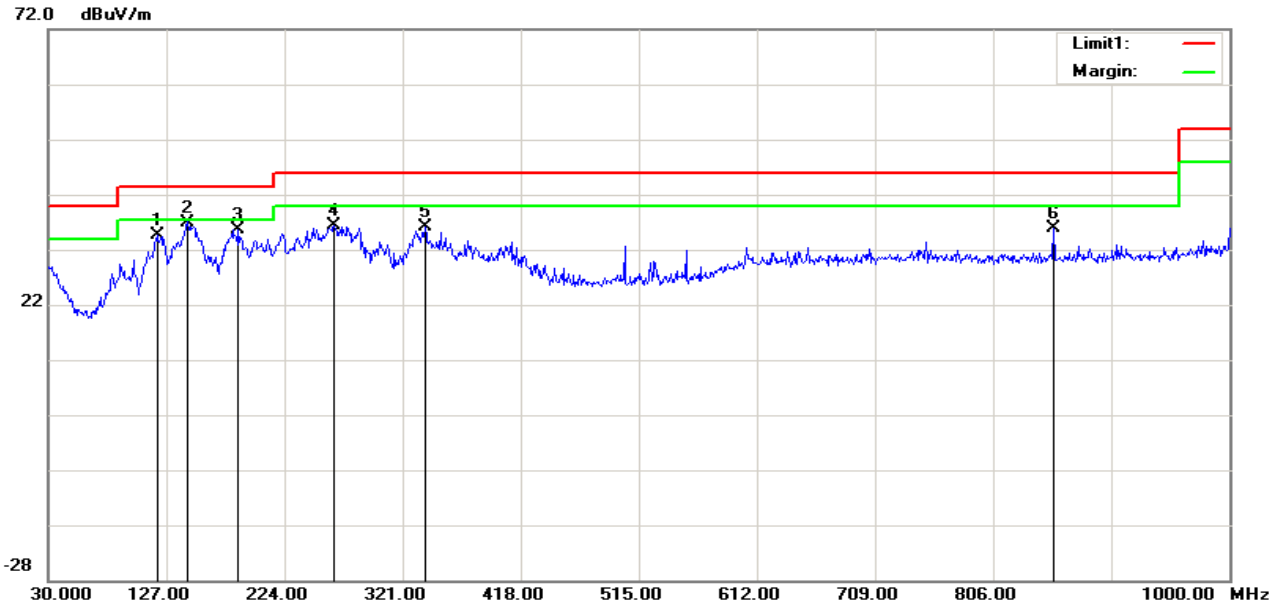
Test Result of Radiated Emission

Below 30MHz

Below 30MHz and above 18GHz. The measured value have enough margin over 20dB than the limit, therefore they are not reported.

30MHz-1GHz

Operation Mode:	Normal Link	**Test Date:**	2018-6-20
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Hor.



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	119.2400	20.71	13.90	34.61	43.50	-8.89	200	236	peak
2	144.4600	22.74	14.26	37.00	43.50	-6.50	200	199	peak
3	186.1700	21.01	14.57	35.58	43.50	-7.92	200	112	peak
4	264.7400	20.57	15.70	36.27	46.00	-9.73	100	244	peak
5	339.4300	17.80	18.38	36.18	46.00	-9.82	100	43	peak
6	855.4700	9.89	26.02	35.91	46.00	-10.09	100	24	peak

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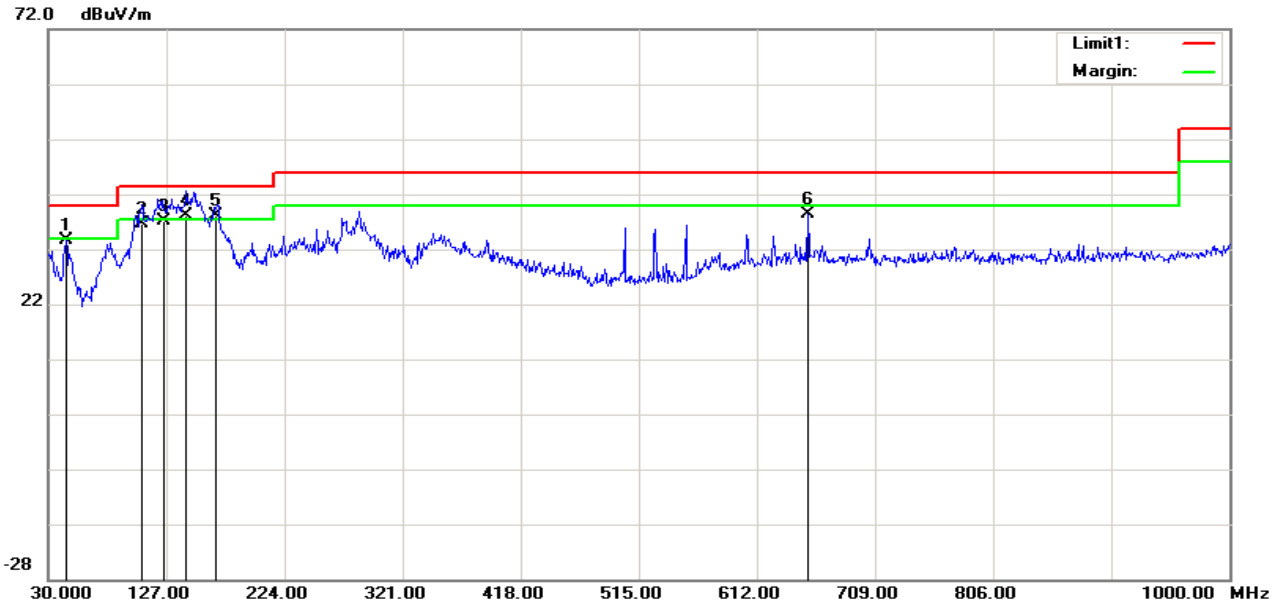
Operation Mode:	Normal Link	**Test Date:**	2018-6-20
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver.



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	44.5500	14.96	18.58	33.54	40.00	-6.46	100	228	peak
2	106.6930	22.93	13.73	36.66	43.50	-6.84	100	137	QP
3	124.5560	23.18	13.98	37.16	43.50	-6.34	100	124	QP
4	143.5750	23.92	14.25	38.17	43.50	-5.33	100	119	QP
5	168.0010	23.77	14.46	38.23	43.50	-5.27	100	74	QP
6	653.7100	12.98	25.41	38.39	46.00	-7.61	100	32	peak

Remark:

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

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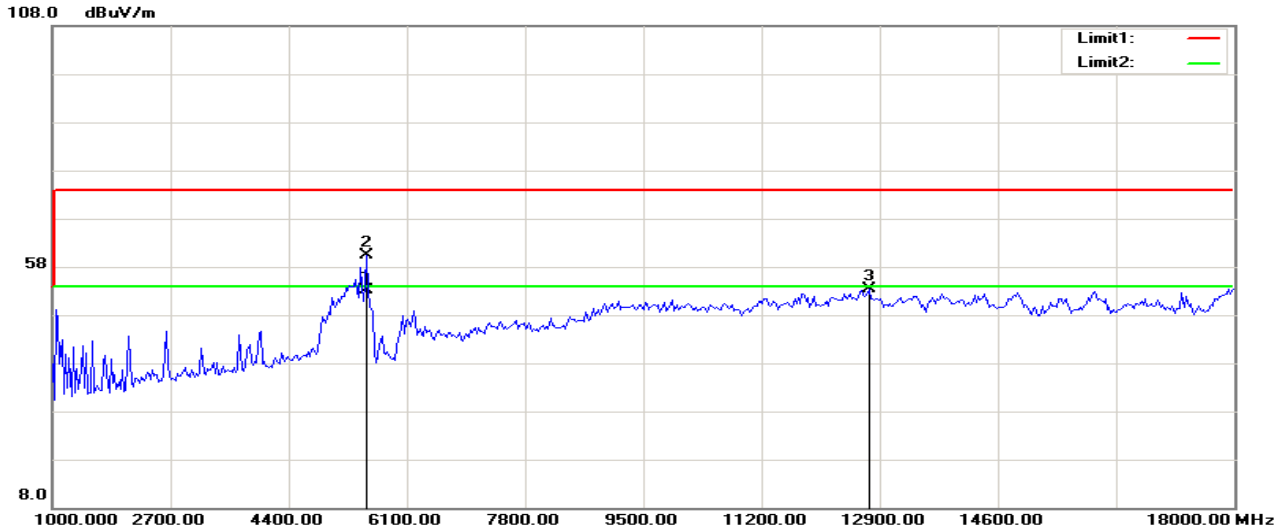
Above 1 GHz

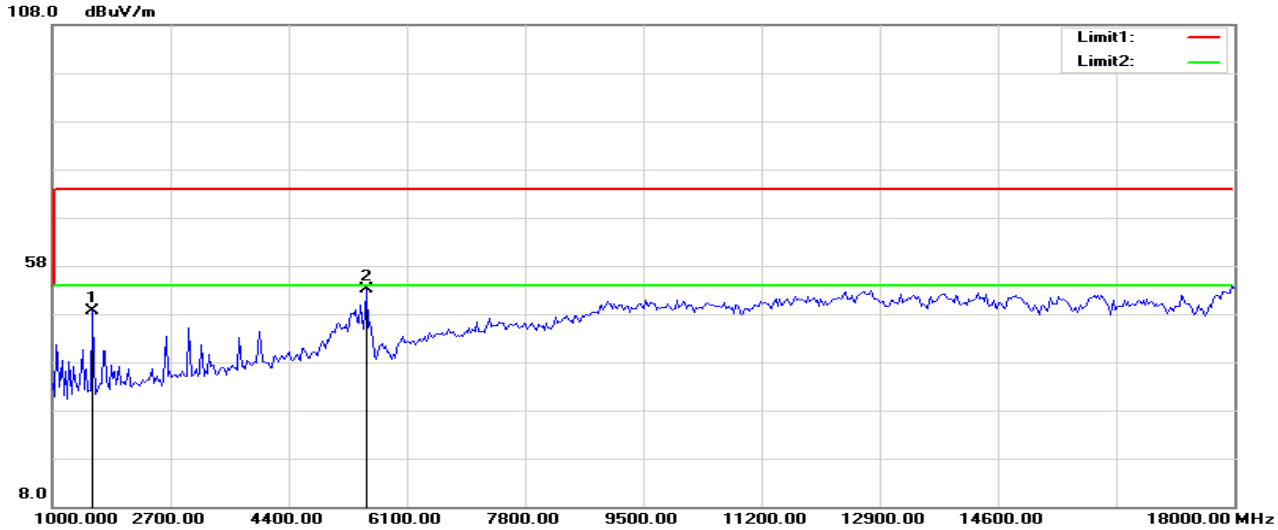
Operation Mode:	Tx / IEEE 802.11a mode CH Low	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5522.301	52.85	0.22	53.07	54.00	-0.93	100	123	AVG
2	5522.436	60.06	0.22	60.28	74.00	-13.72	100	172	peak
3	12741.987	38.18	15.11	53.29	74.00	-20.71	100	200	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1572.115	58.37	-9.85	48.52	74.00	-25.48	100	303	peak
2	5522.436	52.90	0.22	53.12	74.00	-20.88	100	198	peak

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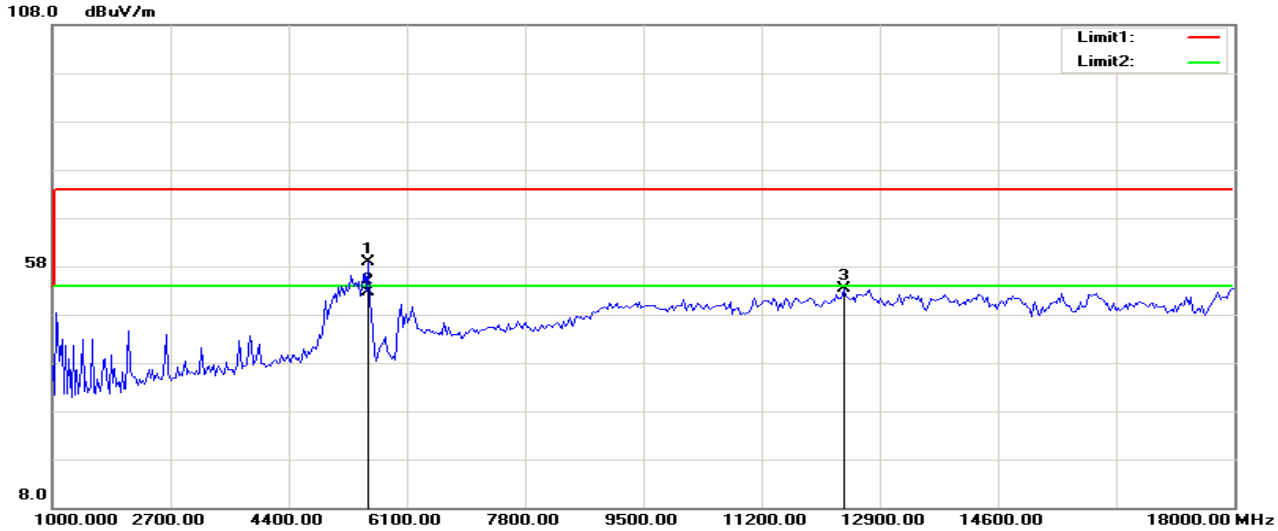
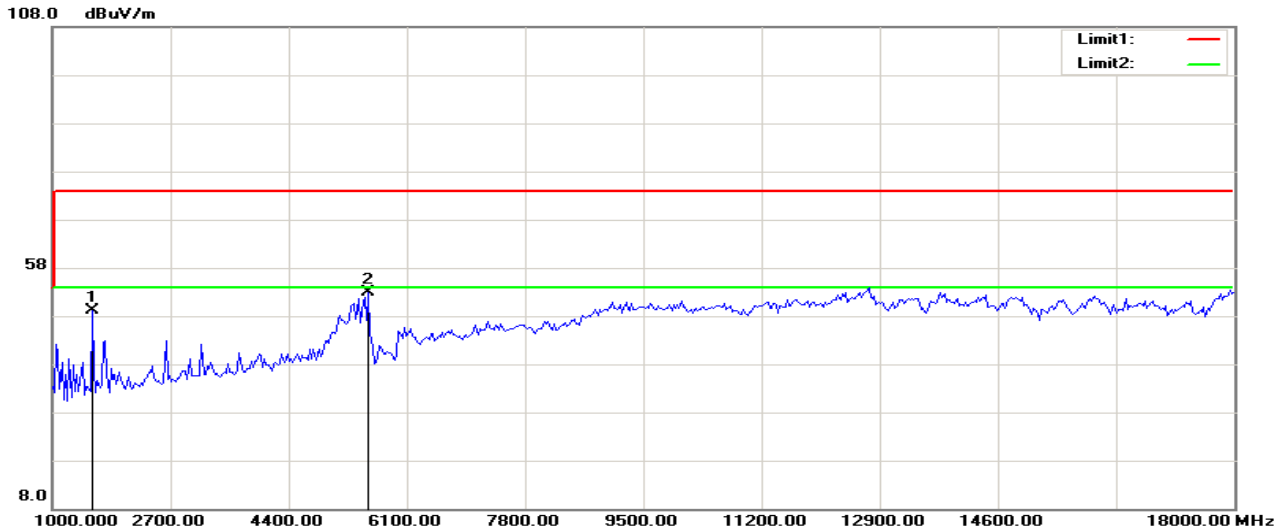
Operation Mode:	Tx / IEEE 802.11a mode CH Mid	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5549.680	58.69	0.22	58.91	74.00	-15.09	100	164	peak
2	5549.866	52.30	0.22	52.52	54.00	-1.48	100	161	AVG
3	12387.820	38.16	15.21	53.37	74.00	-20.63	100	229	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1572.115	58.91	-9.85	49.06	74.00	-24.94	100	307	peak
2	5549.680	52.70	0.22	52.92	74.00	-21.08	100	303	peak

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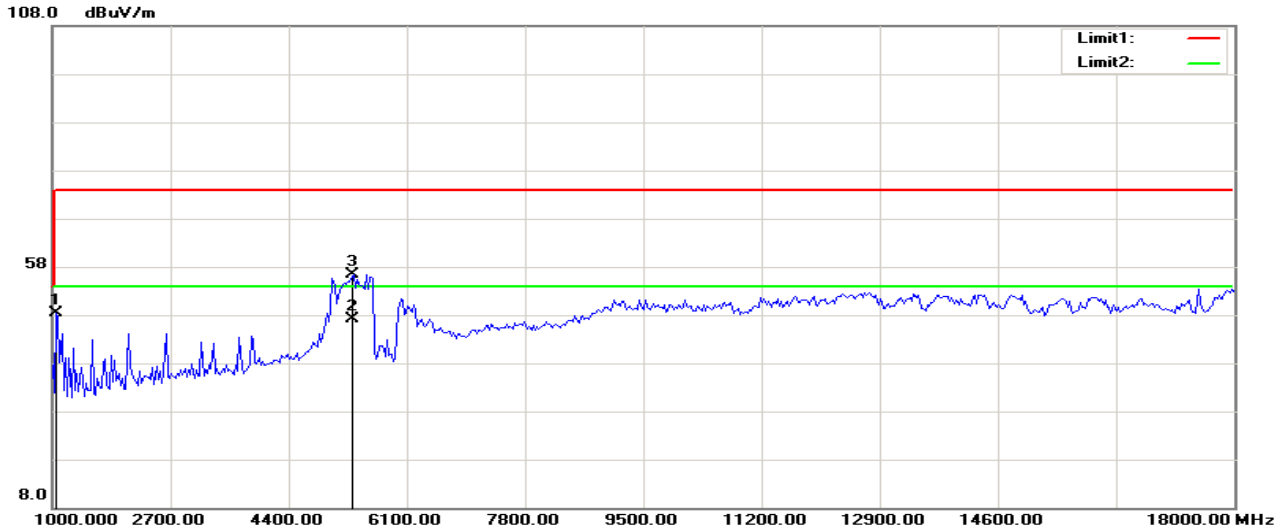
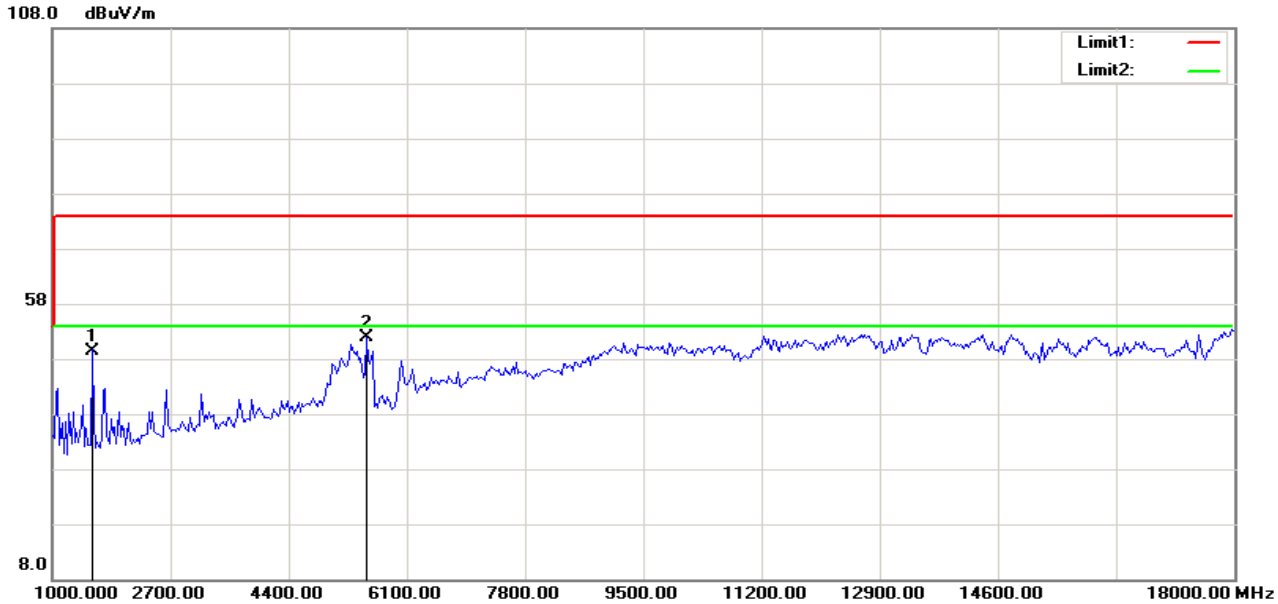
Operation Mode:	Tx / IEEE 802.11a mode CH High	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1054.487	59.86	-11.52	48.34	74.00	-25.66	100	212	peak
2	5326.539	46.79	0.27	47.06	54.00	-6.94	100	165	AVG
3	5326.731	56.05	0.27	56.32	74.00	-17.68	100	178	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1572.115	59.35	-9.85	49.50	74.00	-24.50	100	309	peak
2	5522.436	51.69	0.22	51.91	74.00	-22.09	100	259	peak

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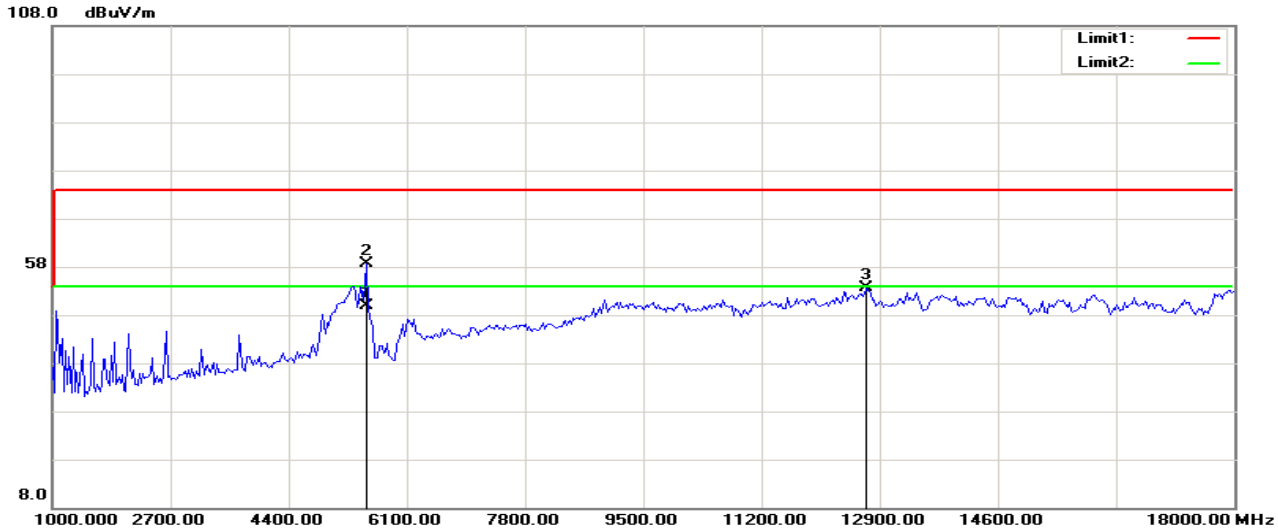
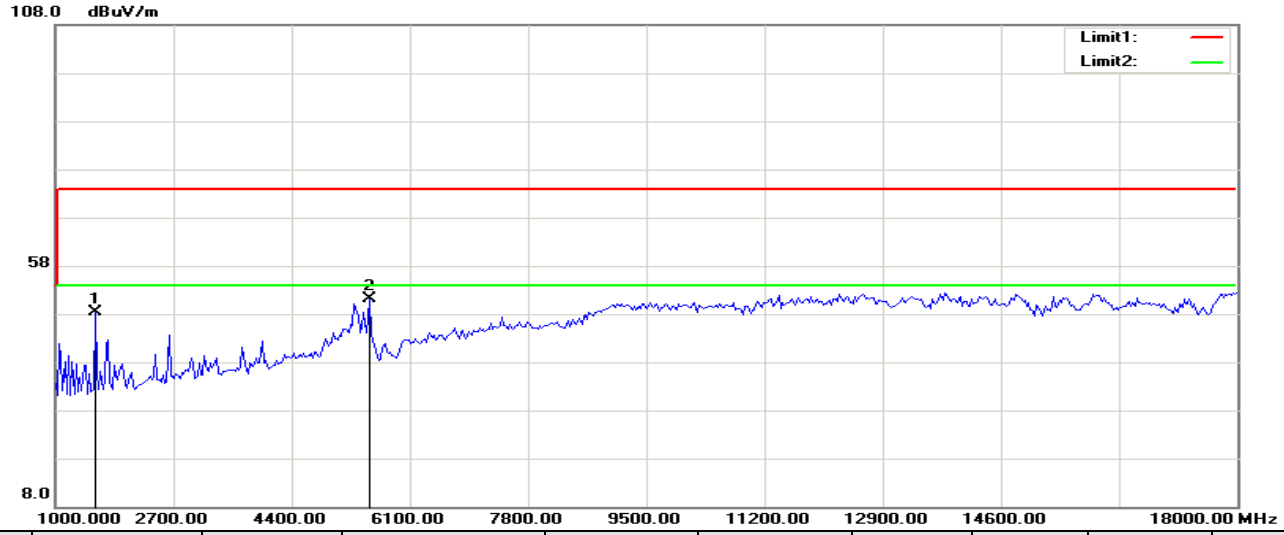
Operation Mode:	TX / IEEE 802.11an HT20 mode /CH Low	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5522.346	49.65	0.22	49.87	54.00	-4.13	100	183	AVG
2	5522.436	58.43	0.22	58.65	74.00	-15.35	100	174	peak
3	12714.744	38.37	15.18	53.55	74.00	-20.45	100	202	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1572.115	58.12	-9.85	48.27	74.00	-25.73	100	304	peak
2	5522.436	50.94	0.22	51.16	74.00	-22.84	100	296	peak

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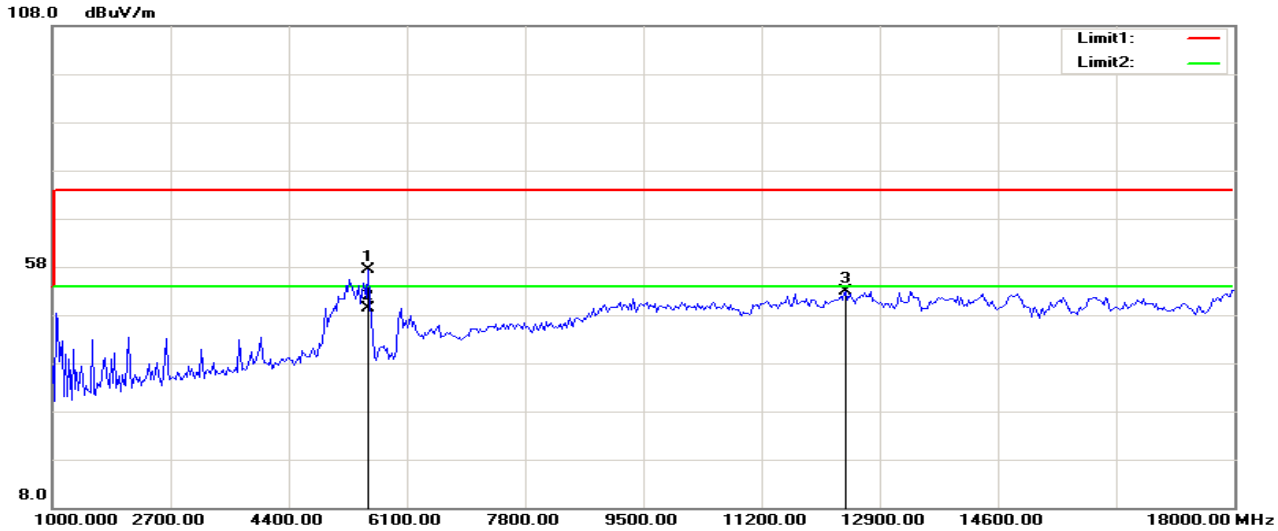
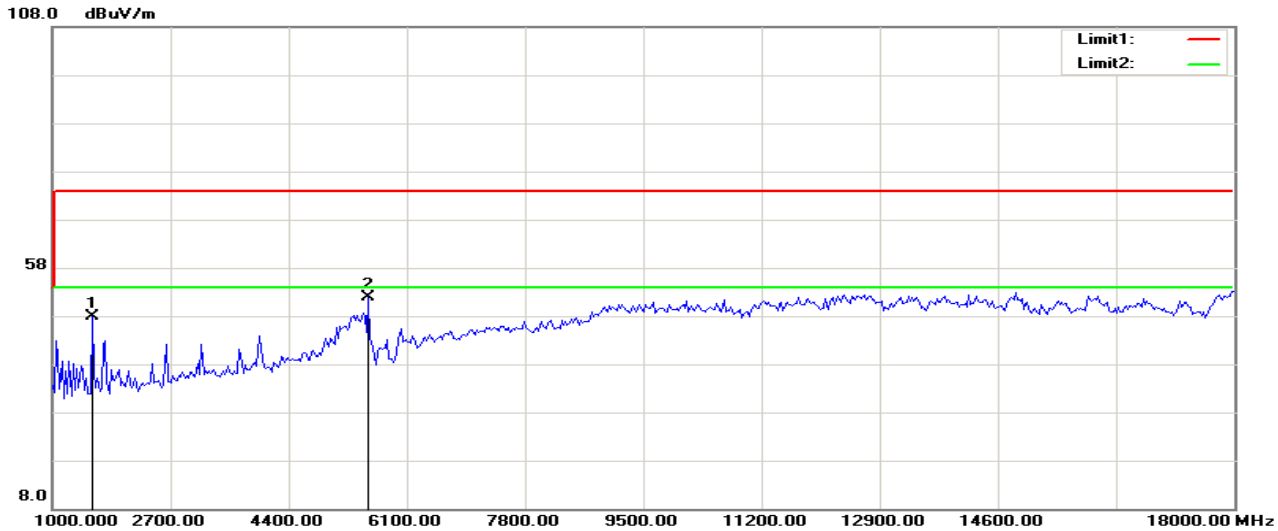
Operation Mode:	TX / IEEE 802.11an HT20 mode /CH Mid	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5549.680	57.10	0.22	57.32	74.00	-16.68	100	170	peak
2	5549.994	49.27	0.22	49.49	54.00	-4.51	100	61	AVG
3	12415.064	37.52	15.33	52.85	74.00	-21.15	100	21	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1572.115	57.79	-9.85	47.94	74.00	-26.06	100	313	peak
2	5549.680	51.69	0.22	51.91	74.00	-22.09	100	197	peak

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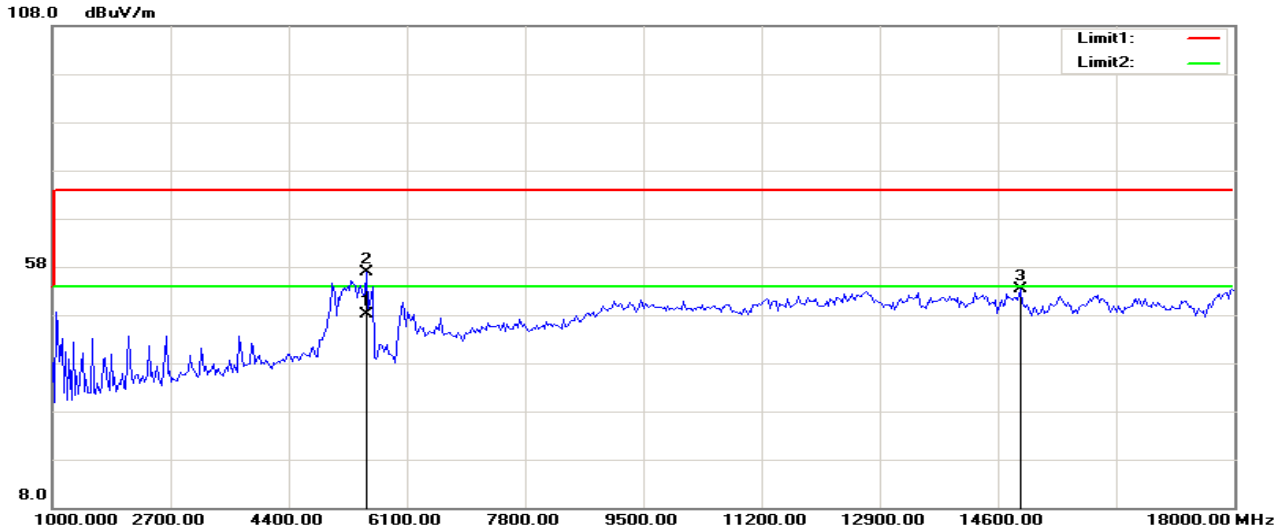
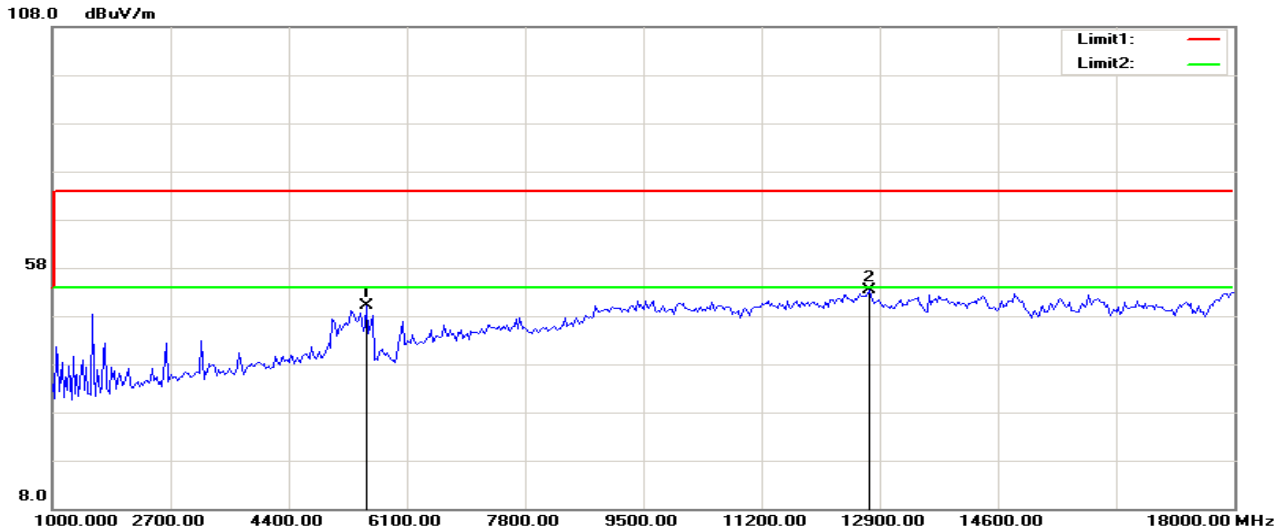
Operation Mode:	TX / IEEE 802.11an HT20 mode /CH High	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5521.122	47.81	0.22	48.03	54.00	-5.97	100	176	AVG
2	5522.436	56.76	0.22	56.98	74.00	-17.02	100	172	peak
3	14921.474	36.87	16.40	53.27	74.00	-20.73	100	0	peak

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5522.436	49.88	0.22	50.10	74.00	-23.90	100	263	peak
2	12741.987	38.19	15.11	53.30	74.00	-20.70	100	12	peak

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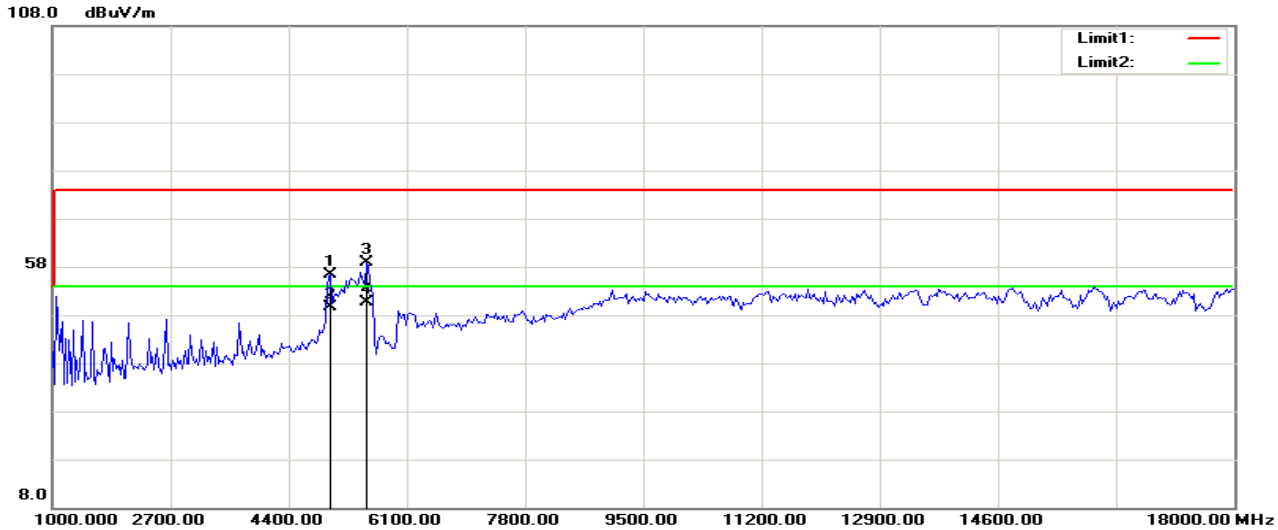
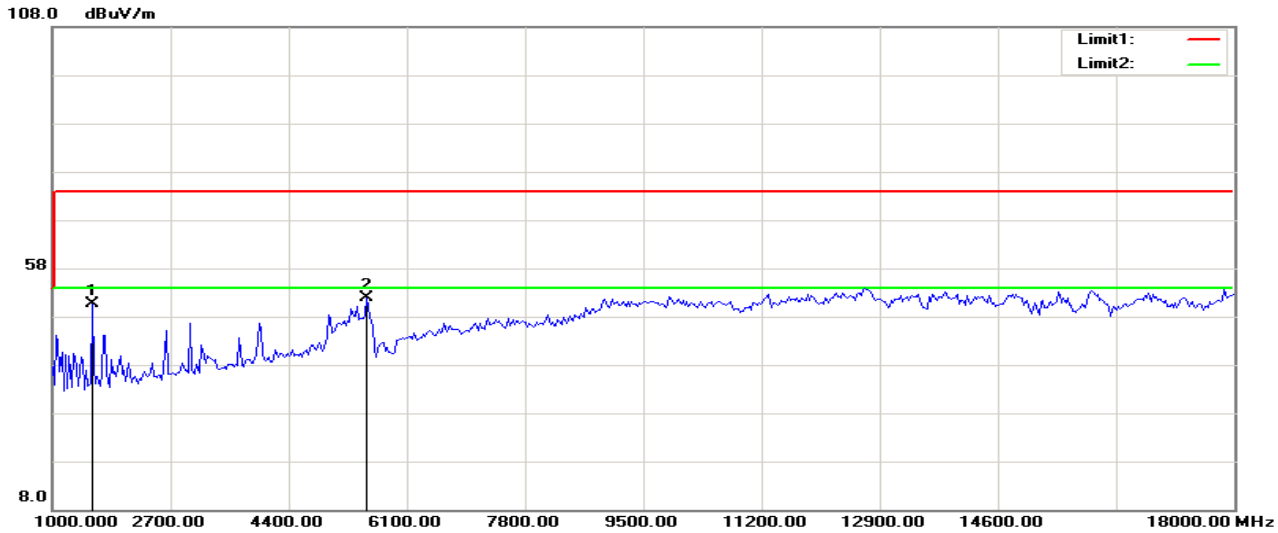
Operation Mode:	TX / IEEE 802.11an HT40 mode /CH Low	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5004.808	55.94	0.37	56.31	74.00	-17.69	100	149	peak
2	5004.808	49.15	0.37	49.52	54.00	-4.48	164	147	AVG
3	5522.436	58.61	0.22	58.83	74.00	-15.17	100	170	peak
4	5522.436	50.42	0.22	50.64	54.00	-3.36	100	167	AVG

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1572.115	60.48	-9.85	50.63	74.00	-23.37	100	307	peak
2	5522.436	51.73	0.22	51.95	74.00	-22.05	100	259	peak

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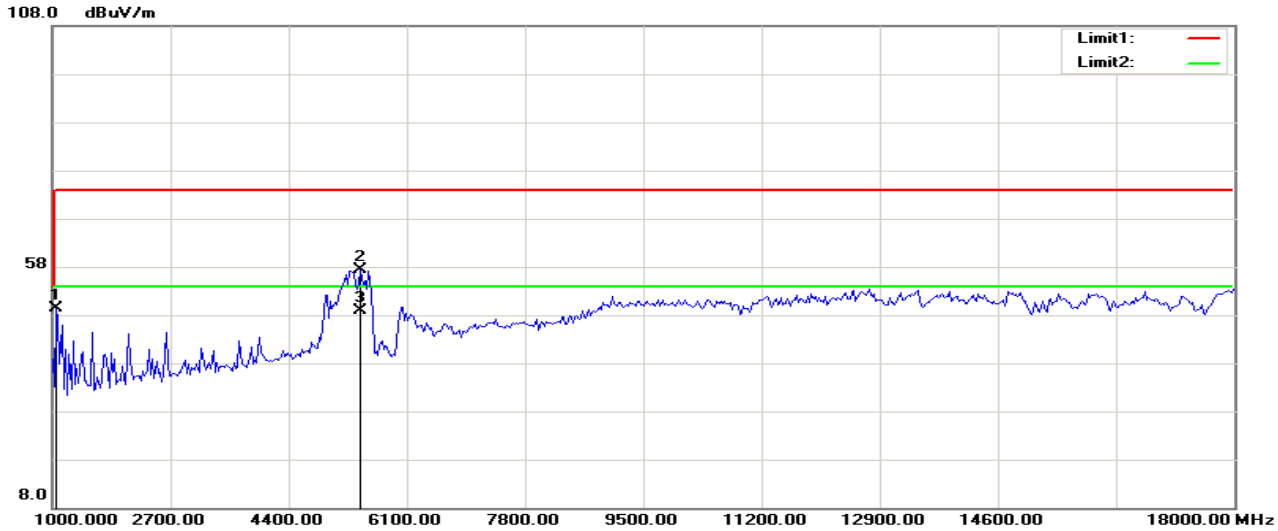
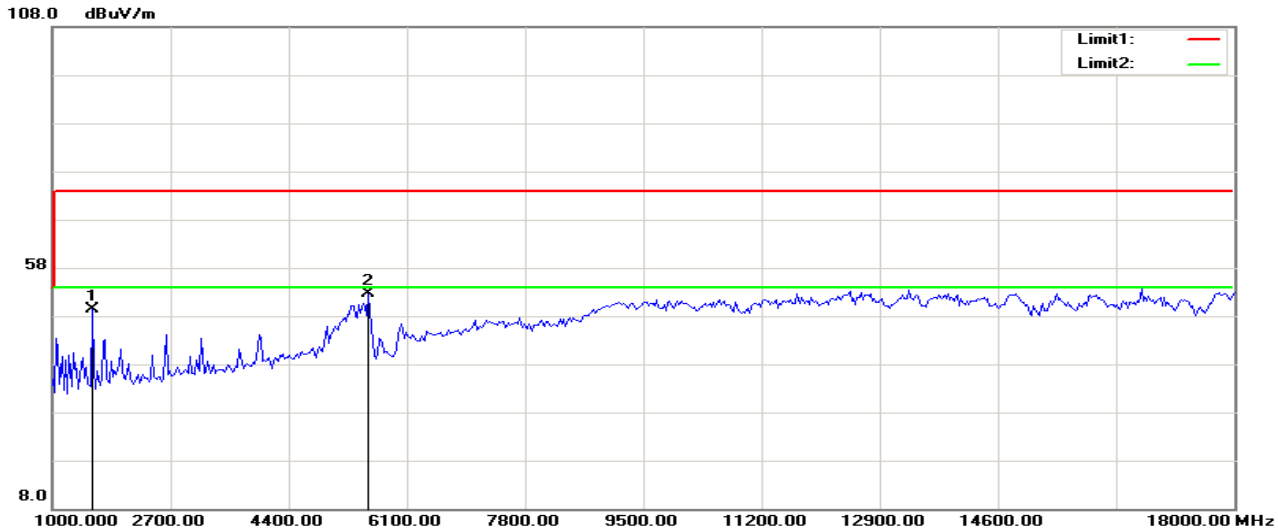
Operation Mode:	TX / IEEE 802.11an HT40 mode /CH High	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1054.487	60.93	-11.52	49.41	74.00	-24.59	100	209	peak
2	5440.705	57.05	0.23	57.28	74.00	-16.72	100	173	peak
3	5440.705	48.59	0.23	48.82	54.00	-5.18	100	175	AVG

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1572.115	59.29	-9.85	49.44	74.00	-24.56	100	309	peak
2	5549.680	52.47	0.22	52.69	74.00	-21.31	100	267	peak

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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.*
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 3 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).*

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7.7 POWERLINE CONDUCTED EMISSIONS

LIMIT

For equipment 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.

Frequency Range (MHz)	Limits (dBµV)	
	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 Setup photo for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.1m 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.

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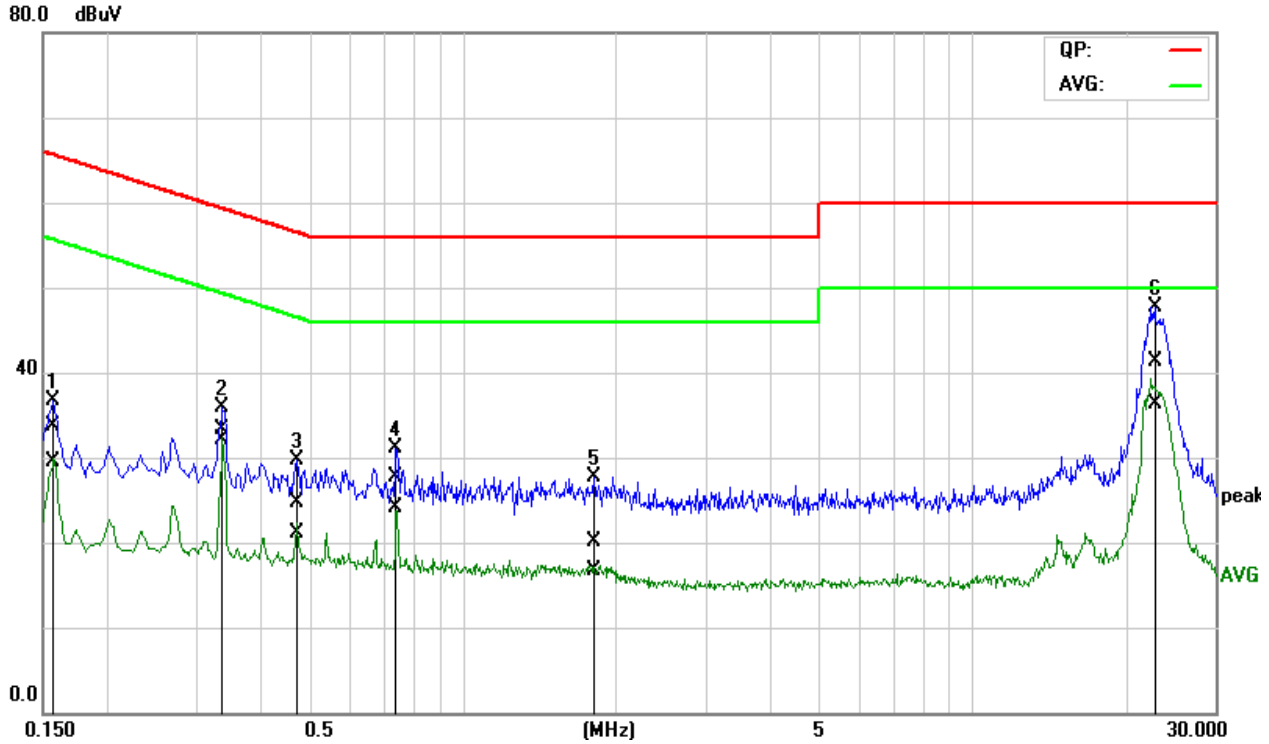
Test Data

Job No.:	C180629R01	Date:	2018/5/11
Model No.:	Pro2 Plus	Time:	16:00:46
Standard:	FCC Class B	Temp.(C)/Hum.(%):	22(C)/48%
Test item:	Conduction test	Test By:	Lily.Wang
Line:	L1	Test Voltage:	AC 120V/60Hz
Model:		Description:	

L1



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.1578	14.34	10.07	19.43	33.77	29.50	65.57	55.58	-31.80	-26.08	Pass
2	0.3372	13.87	12.60	19.48	33.35	32.08	59.27	49.27	-25.92	-17.19	Pass
3	0.4724	5.29	1.68	19.49	24.78	21.17	56.47	46.47	-31.69	-25.30	Pass
4	0.7429	8.22	4.55	19.54	27.76	24.09	56.00	46.00	-28.24	-21.91	Pass
5	1.7873	0.51	-2.97	19.58	20.09	16.61	56.00	46.00	-35.91	-29.39	Pass
6*	22.8031	21.30	16.22	20.08	41.38	36.30	60.00	50.00	-18.62	-13.70	Pass

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

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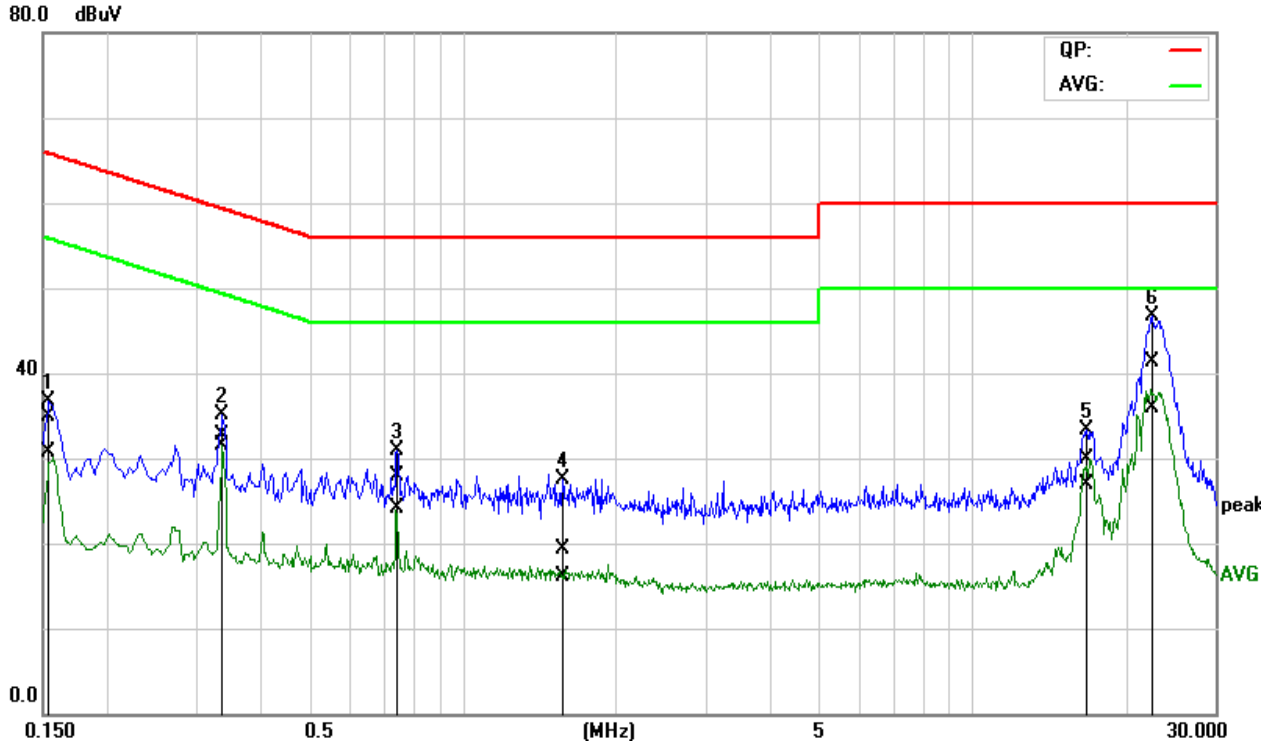
Job No.:	C180629R01	Date:	2018/5/11
Model No.:	Pro2 Plus	Time:	16:07:40
Standard:	FCC Class B	Temp.(C)/Hum.(%):	22(C)/48%
Test item:	Conduction test	Test By:	Lily.Wang
Line:	L2	Test Voltage:	AC 120V/60Hz
Model:		Description:	

L2



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.1554	15.41	11.19	19.43	34.84	30.62	65.70	55.71	-30.86	-25.09	Pass
2	0.3378	13.31	11.93	19.48	32.79	31.41	59.26	49.26	-26.47	-17.85	Pass
3	0.7433	8.27	4.55	19.54	27.81	24.09	56.00	46.00	-28.19	-21.91	Pass
4	1.5708	-0.18	-3.46	19.58	19.40	16.12	56.00	46.00	-36.60	-29.88	Pass
5	16.7850	9.89	6.75	20.06	29.95	26.81	60.00	50.00	-30.05	-23.19	Pass
6*	22.6590	21.20	15.87	20.08	41.28	35.95	60.00	50.00	-18.72	-14.05	Pass

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

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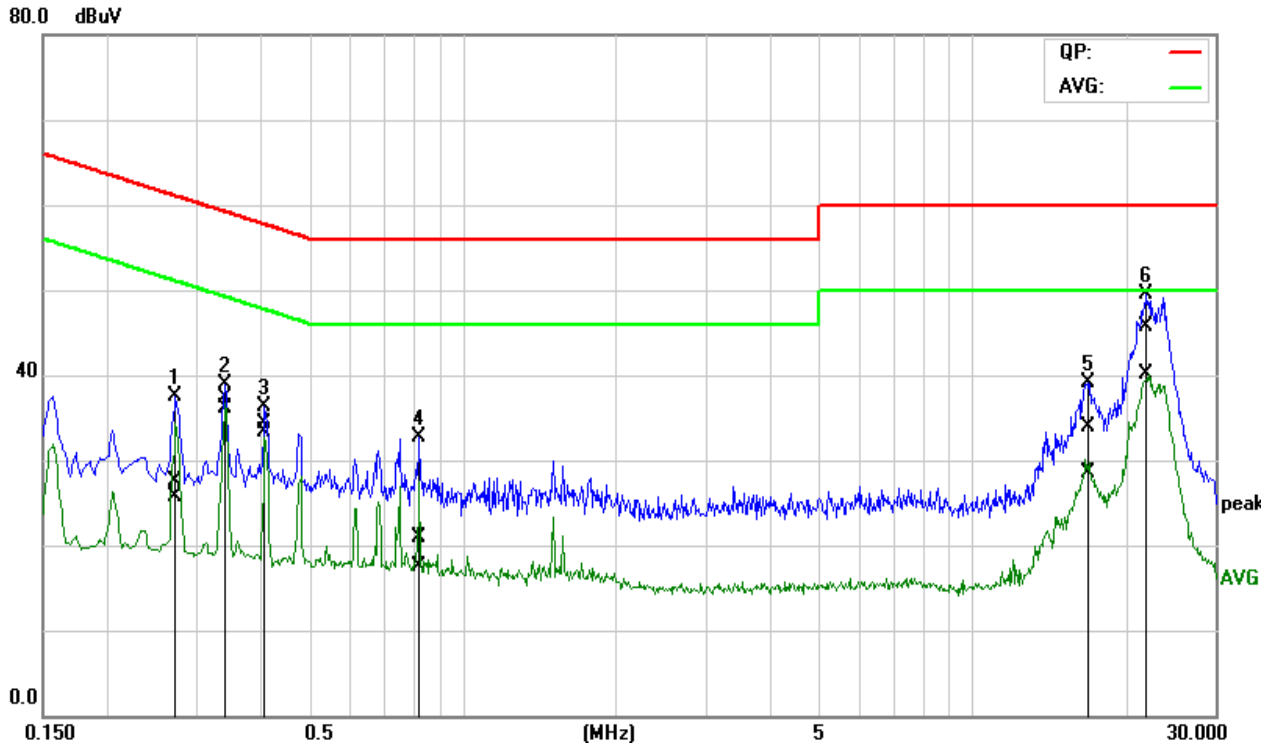
Job No.:	C180629R01	Date:	2018/5/11
Model No.:	Pro2 Plus	Time:	14:09:46
Standard:	FCC Class B	Temp.(C)/Hum.(%):	22(C)/48%
Test item:	Conduction test	Test By:	Lily.Wang
Line:	L1	Test Voltage:	AC 240V/60Hz
Model:		Description:	

L1



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.2741	8.03	6.31	19.46	27.49	25.77	60.99	50.99	-33.50	-25.22	Pass
2	0.3409	17.74	16.73	19.47	37.21	36.20	59.18	49.18	-21.97	-12.98	Pass
3	0.4099	14.83	13.82	19.47	34.30	33.29	57.65	47.65	-23.35	-14.36	Pass
4	0.8277	1.28	-1.98	19.54	20.82	17.56	56.00	46.00	-35.18	-28.44	Pass
5	16.9635	14.00	8.41	20.00	34.00	28.41	60.00	50.00	-26.00	-21.59	Pass
6*	21.9846	25.66	20.18	20.02	45.68	40.20	60.00	50.00	-14.32	-9.80	Pass

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

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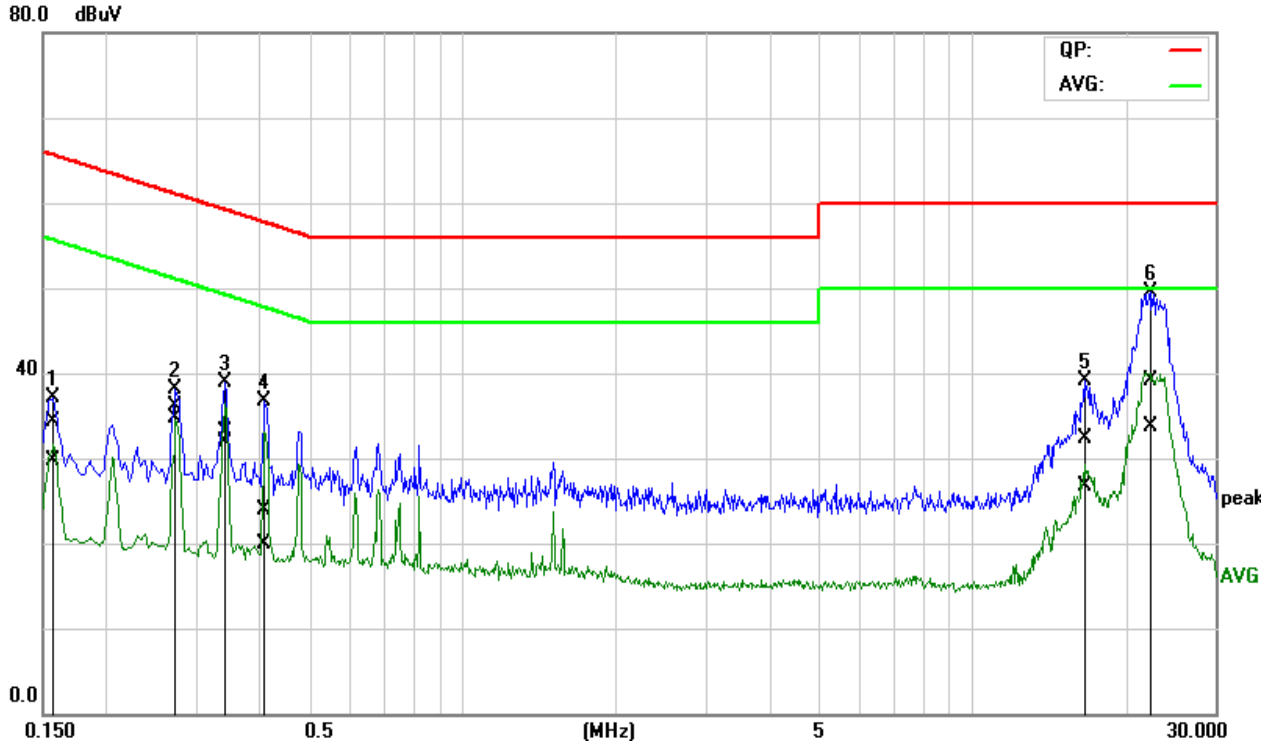
Job No.:	C180629R01	Date:	2018/5/11
Model No.:	Pro2 Plus	Time:	14:16:17
Standard:	FCC Class B	Temp.(C)/Hum.(%):	22(C)/48%
Test item:	Conduction test	Test By:	Lily.Wang
Line:	L2	Test Voltage:	AC 240V/60Hz
Model:		Description:	

L2



No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.1558	14.79	10.28	19.42	34.21	29.70	65.68	55.68	-31.47	-25.98	Pass
2*	0.2748	16.64	15.17	19.46	36.10	34.63	60.97	50.97	-24.87	-16.34	Pass
3	0.3373	13.71	12.53	19.47	33.18	32.00	59.27	49.27	-26.09	-17.27	Pass
4	0.4082	4.38	0.37	19.47	23.85	19.84	57.68	47.68	-33.83	-27.84	Pass
5	16.6281	12.40	6.77	20.00	32.40	26.77	60.00	50.00	-27.60	-23.23	Pass
6	22.3402	19.15	13.63	20.03	39.18	33.66	60.00	50.00	-20.82	-16.34	Pass

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

*R*emark:

1.The measuring frequencies range between 0.15 MHz and 30 MHz.

2.The emissions measured in the frequency range between 0.15 MHz and 30MHz were made with an instrument using Quasi-peak detector and Average detector.

3.“---” denotes the emission level was or more than 2dB below the Average limit, and no re-check was made.

4.The IF bandwidth of SPA between 0.15MHz and 30MHz was 10KHz. The IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz.

END OF REPORT

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