FCC 47 CFR PART15 SUBPART E

For

Prepared by

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-RPW1

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

TEL: 86-512-57355888

FAX: 86-512-57370818

TESTING CERT #2541.01

Note: *This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc. This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document. The client should not use it to claim product endorsement by A2LA or any government agencies. The test results in the report only apply to the tested sample.*

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 26 DB EMISSION BANDWIDTH 19
7.2 99% EMISSION BANDWIDTH 29
7.3 MAXIMUM CONDUCTED OUTPUT POWER 39
7.4 BAND EDGES MEASUREMENT 41
7.5 MAXIMUM POWER SPECTRAL DENSITY 47
7.6 FREQUENCY STABILITY MEASUREMENT 57
7.7 RADIATED UNDESIRABLE EMISSION 59
7.8 POWERLINE CONDUCTED EMISSIONS 72

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	June 24, 2018	C180502R01-RPW1	ALL	N/A
Update	June 29, 2018	C180629R01-RPW1	P1; P4	Modify Applicant's and Manufacturer's address
01	July 9, 2018	C180629R01-RPW1	P5; P6; P8; P39；P59	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-RPW1	P5; P39-40; P47-48	Modify Directional gain

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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 :	Band	Mode	Frequency Range(MHz)	Number of Channels
	Band I UNII-I	IEEE802.11a mode	5150 MHz~5250 MHz	4
		IEEE802.11an HT20 mode		4
		IEEE802.11an HT40 mode		2
Average Transmit Power :	IEEE802.11a mode: 15.36dBm IEEE802.11an HT20 mode: 14.79dBm IEEE802.11an HT40 mode: 14.41dBm			
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)			
Antenna Specification:			Gain(dBi)	
			Band I	
	Antenna 1		4.27	
	Antenna 2		4.27	
	Directional gain		7.28	
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.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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 0.490-0.510MHz.

[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.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

3.5 DESCRIPTION OF TEST MODES

Description	Modulation Technology	Modulation Type
26dB Bandwidth and 99% 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
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 (5180MHz),Channel (5200MHz) and Channel (5240MHz) with 54Mbps data rate were chosen for full testing.

IEEE 802.11an HT20 mode:

Channel (5180MHz),Channel (5200MHz) and Channel (5240MHz) with MCS15 data rate were chosen for full testing.

IEEE 802.11an HT40 mode:

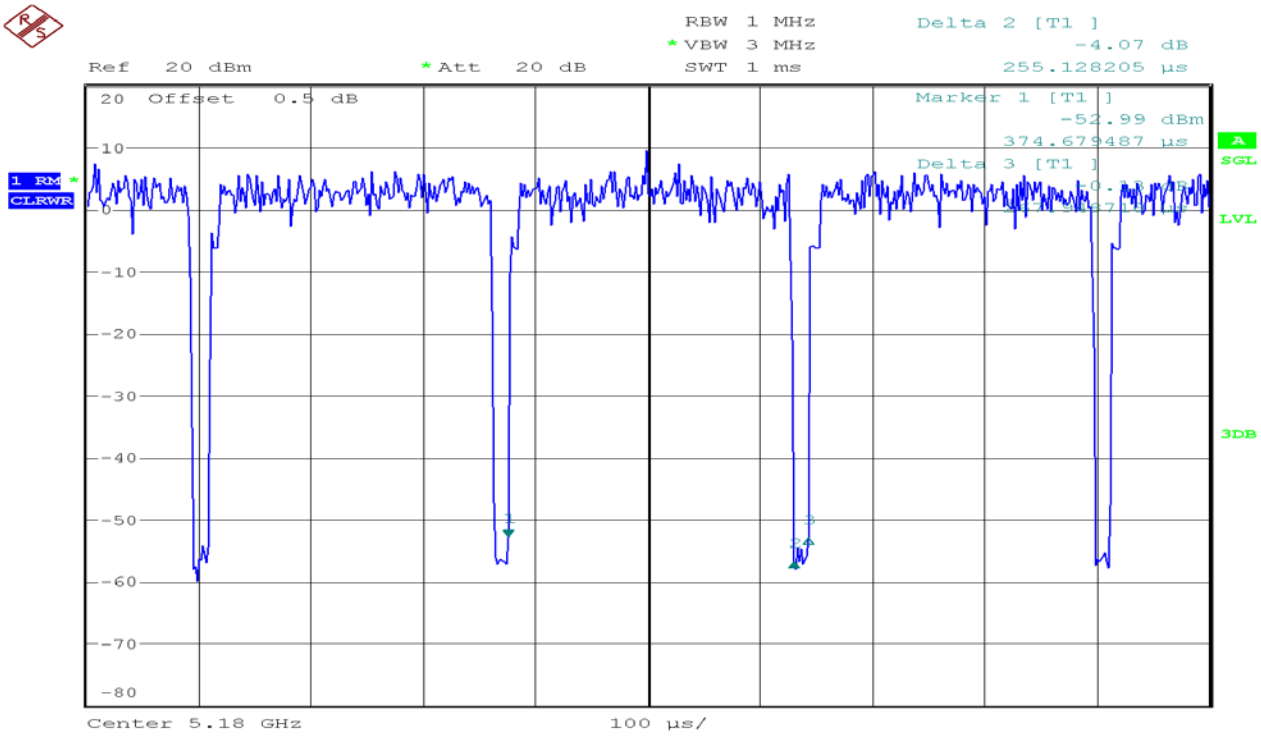
Channel (5190MHz) and Channel (5230MHz) with MCS15 data rate were chosen for full testing.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

3.6 DUTY CYCLE

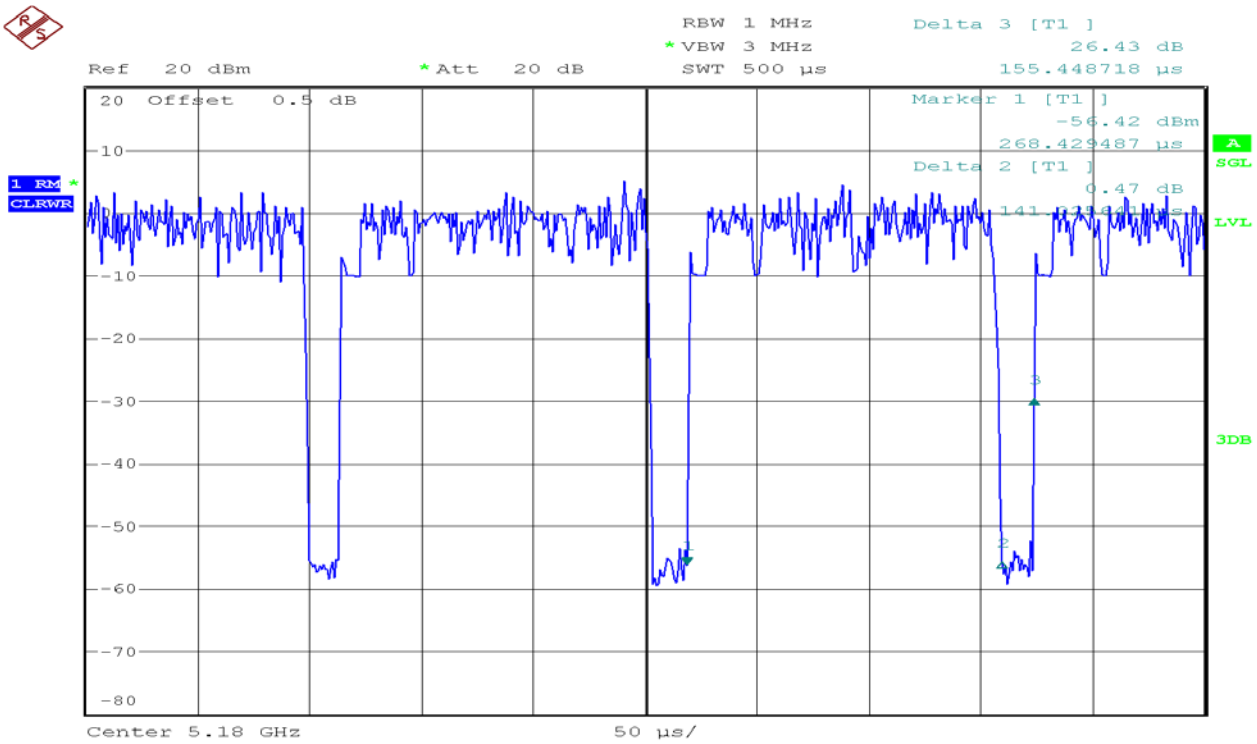
Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
IEEE 802.11 a	95.15	0.255	3.92	5KHz
IEEE 802.11an HT20	90.97	0.141	7.09	10KHz
IEEE 802.11an HT40	85.05	0.091	10.99	20KHz

IEEE 802.11 a

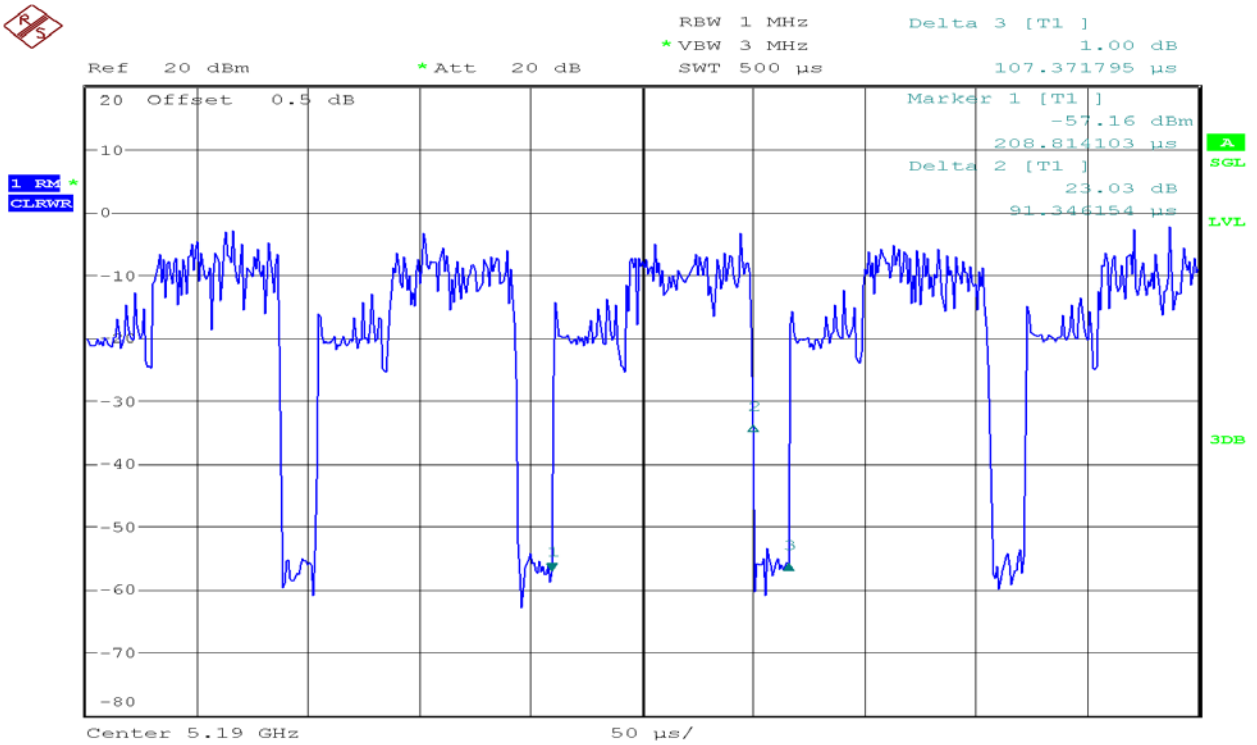


This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

IEEE 802.11an HT20



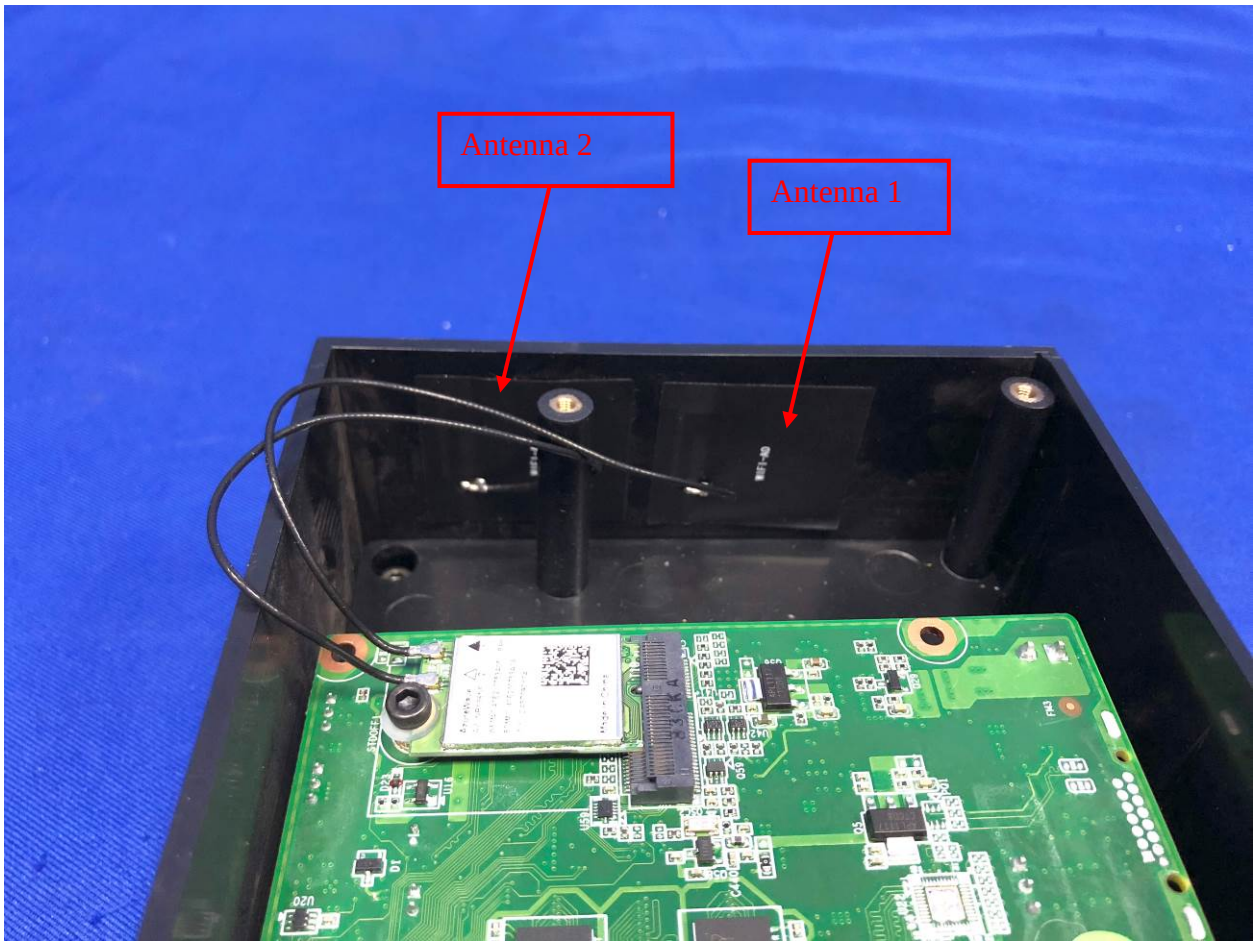
IEEE 802.11an HT40



This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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		

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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.*

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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%

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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 5.2.19); EN 301 908-1 (clauses 4.2.2, 4.2.3, 5.3.1, and 5.3.2);	ACCREDITED TESTING CERT #2541.01

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

		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

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

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

7 FCC PART 15 REQUIREMENTS

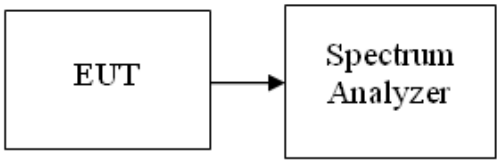
7.1 26 DB EMISSION BANDWIDTH

LIMIT

According to §15.403(i), for purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

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 = approximately 1% of the emission bandwidth, VBW > RBW, Detector = Peak ,Span >26dB bandwidth, and Sweep = auto ,Trace mode = max hold.
4. Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
5. Repeat until all the rest channels were investigated.

TEST RESULTS

No non-compliance noted

Test Data

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Test mode: IEEE 802.11a mode/ Chain 1

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	22.564
Mid	5200	22.436
High	5240	22.756

Test mode: IEEE 802.11a mode/ Chain 2

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	29.103
Mid	5200	25.833
High	5240	25.833

Test mode: IEEE 802.11an HT20MHz mode/ Chain 1

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	20.705
Mid	5200	20.641
High	5240	22.756

Test mode: IEEE 802.11an HT20MHz mode/ Chain 2

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5180	23.173
Mid	5200	22.949
High	5240	22.756

Test mode: IEEE 802.11an HT40MHz mode/ Chain 1

Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5190	45.673
High	5230	45.192

Test mode: IEEE 802.11an HT40MHz mode/ Chain 2

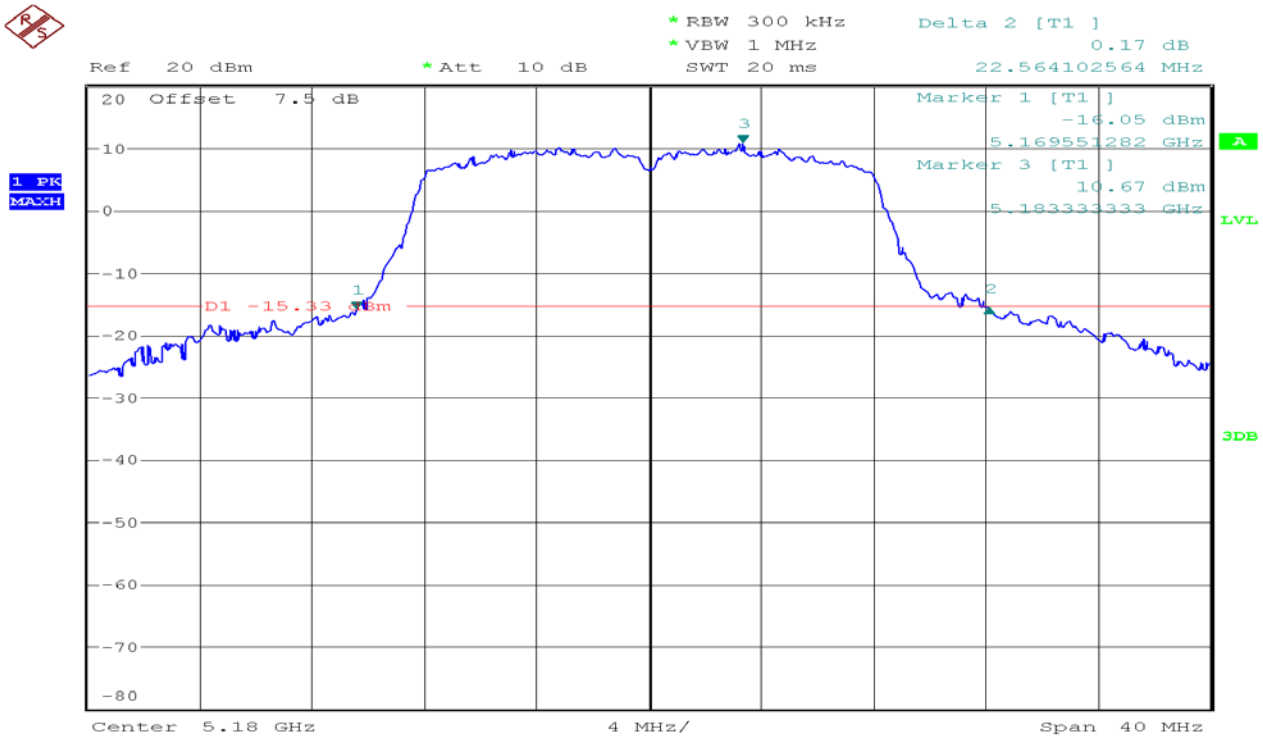
Channel	Frequency (MHz)	Bandwidth (B) (MHz)
Low	5190	46.731
High	5230	45.962

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

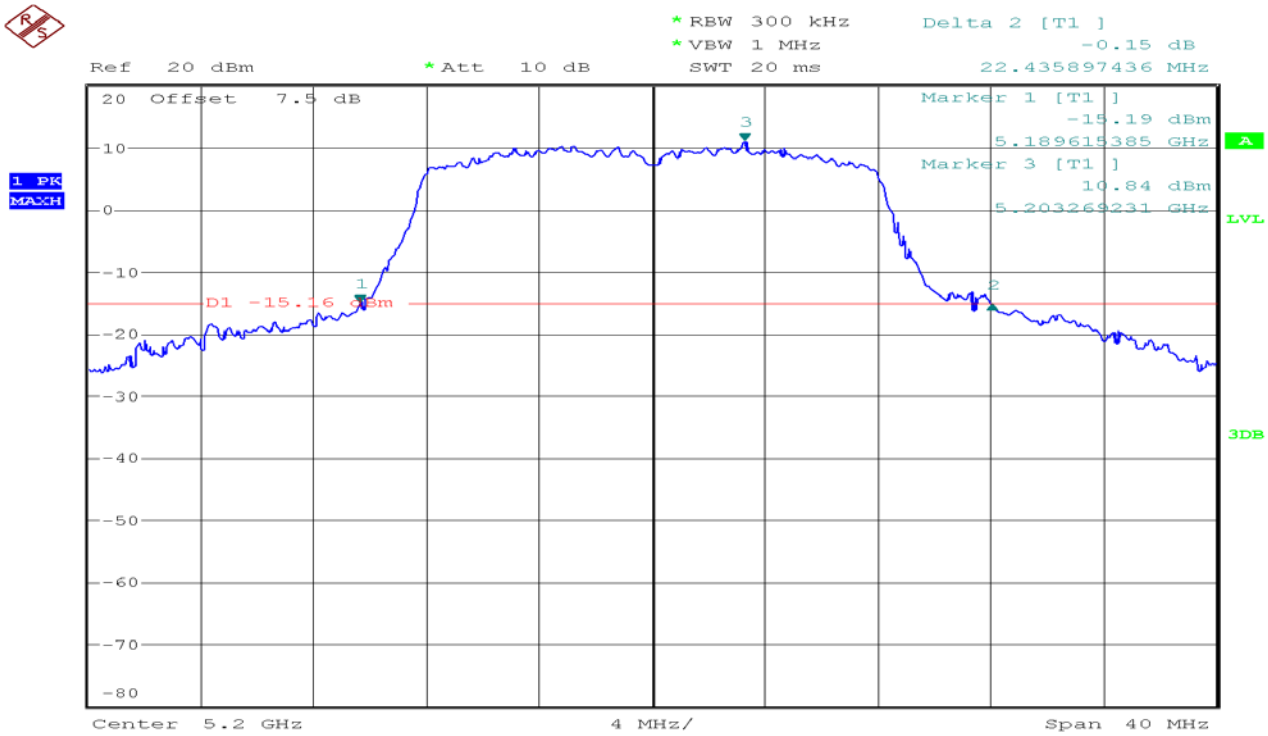
Test Plot

IEEE 802.11a mode/Chain 1:

CH Low

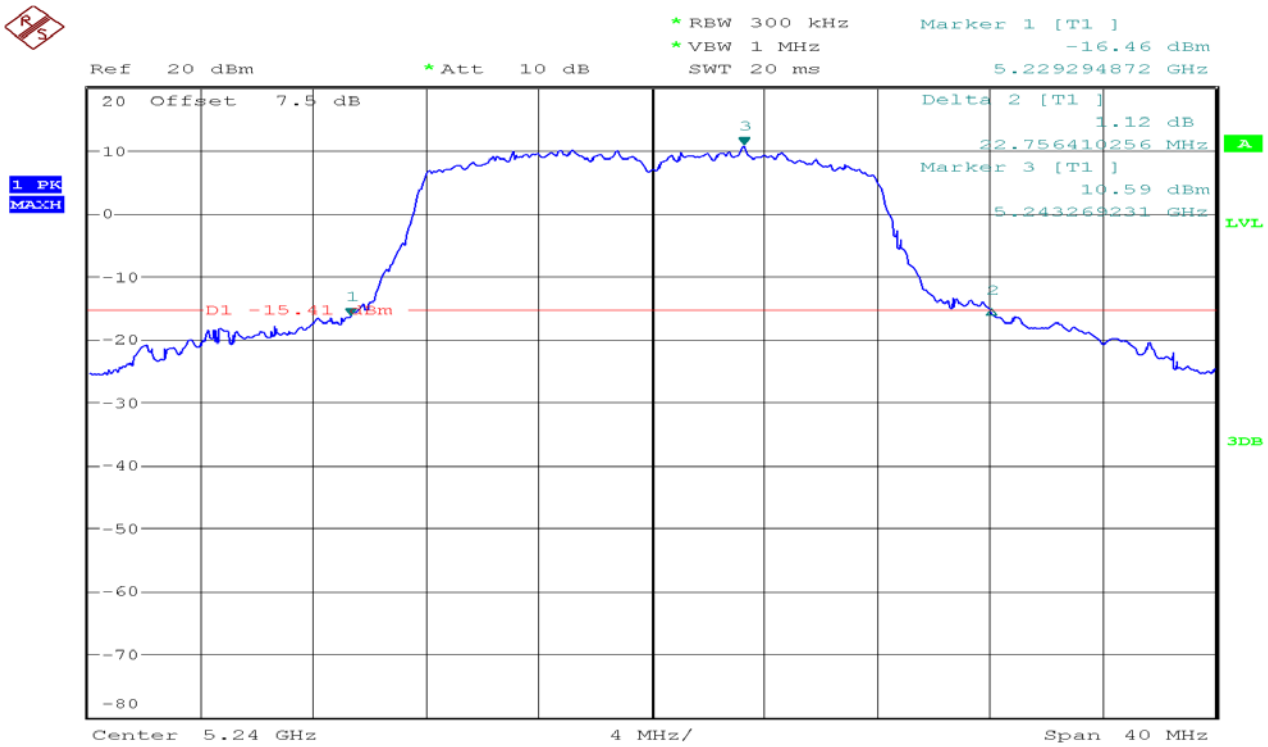


CH Mid



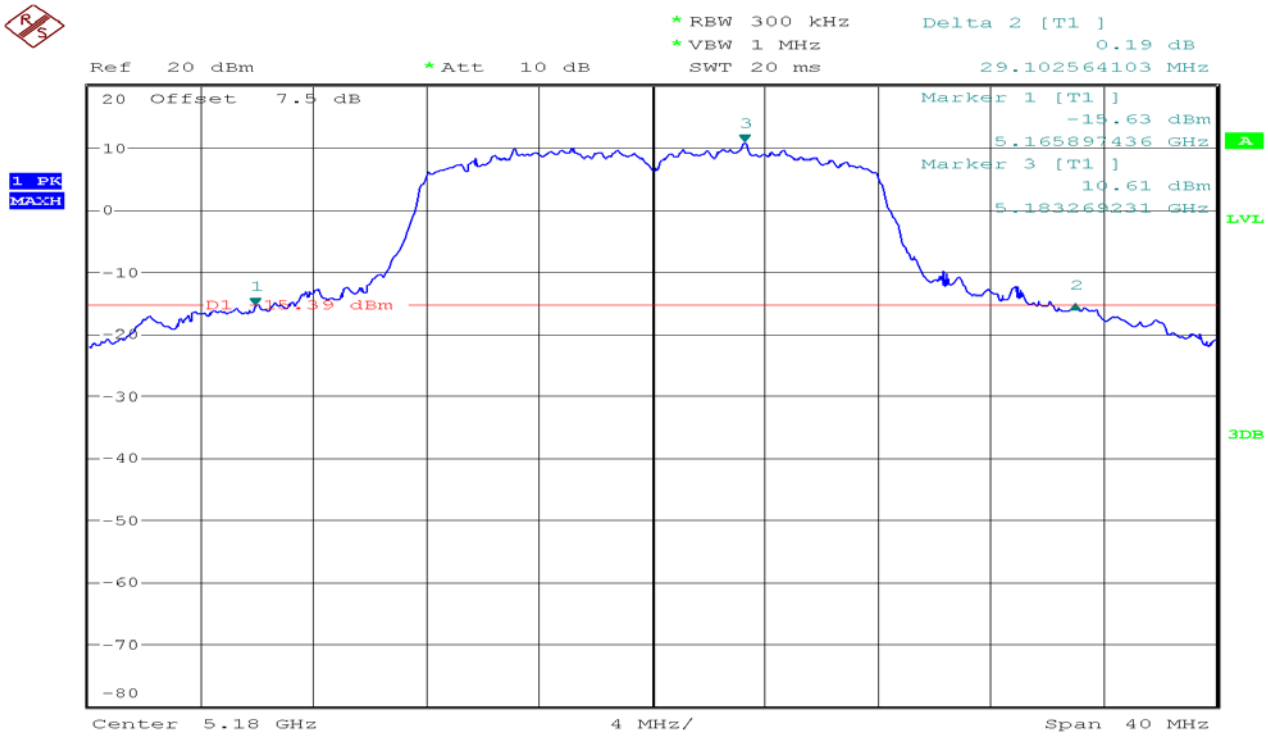
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH High



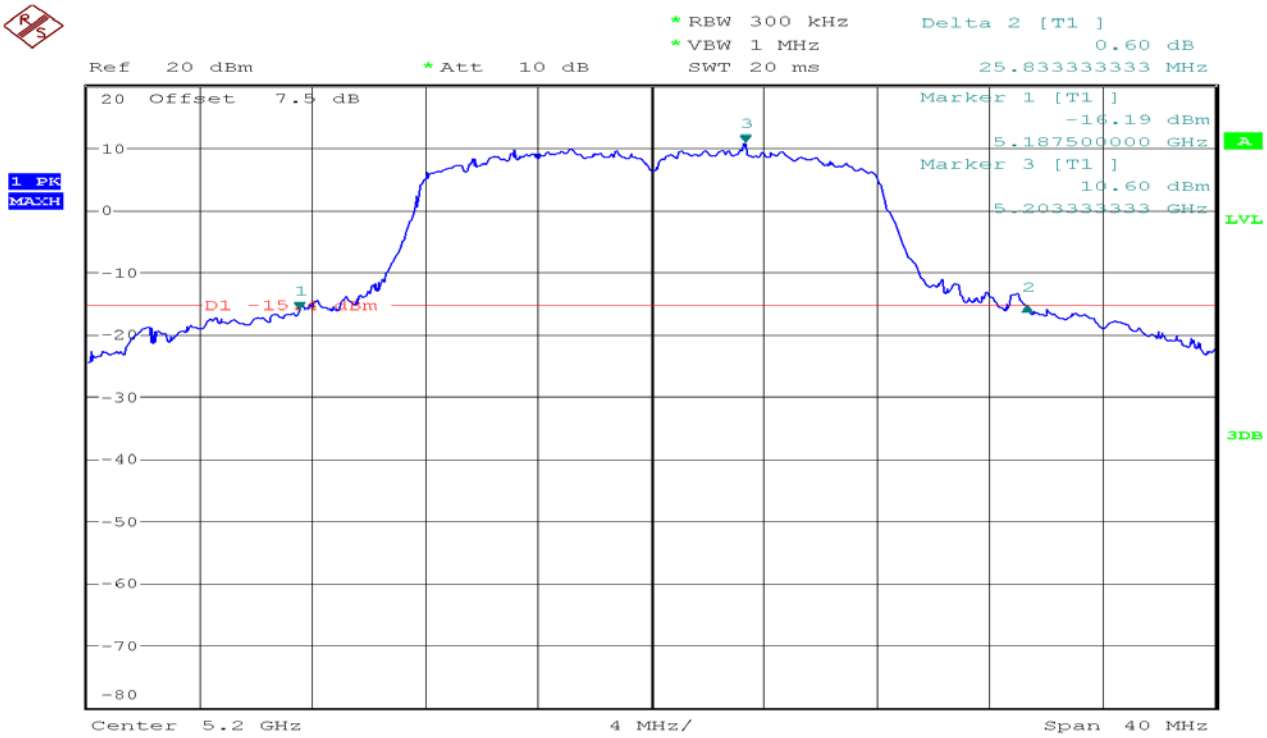
IEEE 802.11a mode/Chain 2:

CH Low

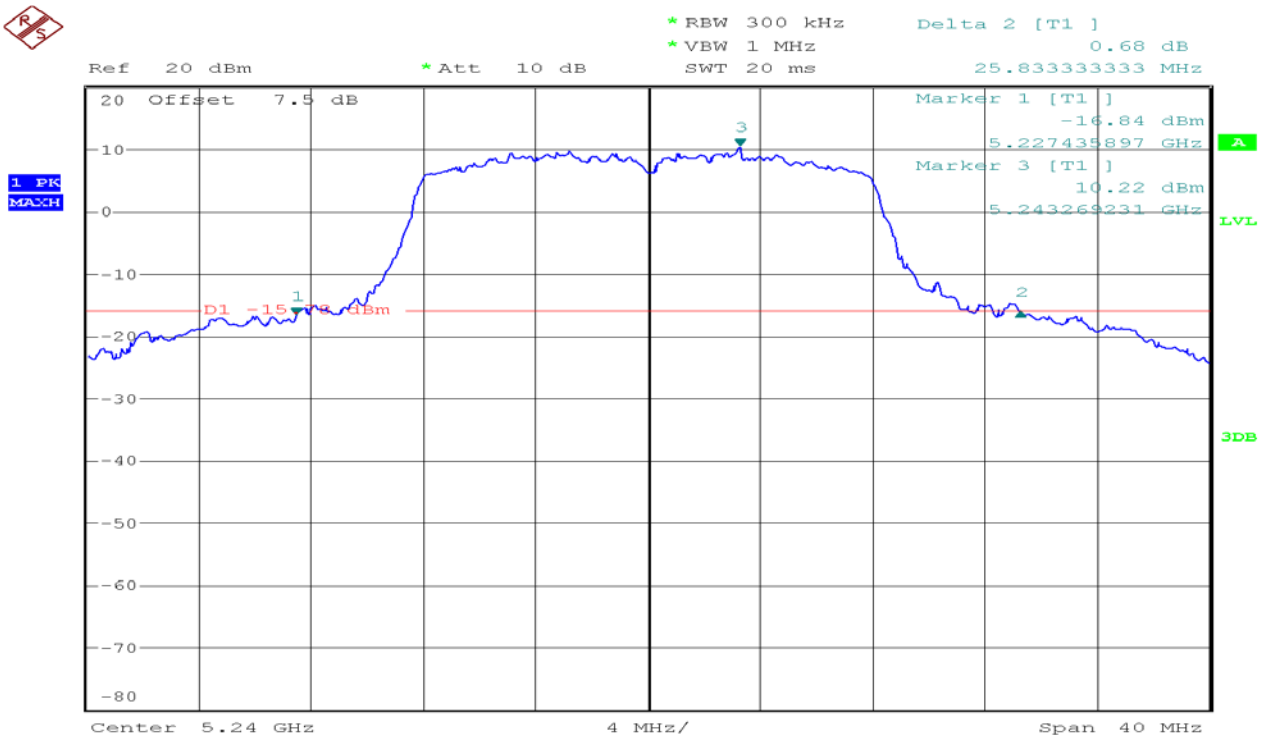


This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH Mid



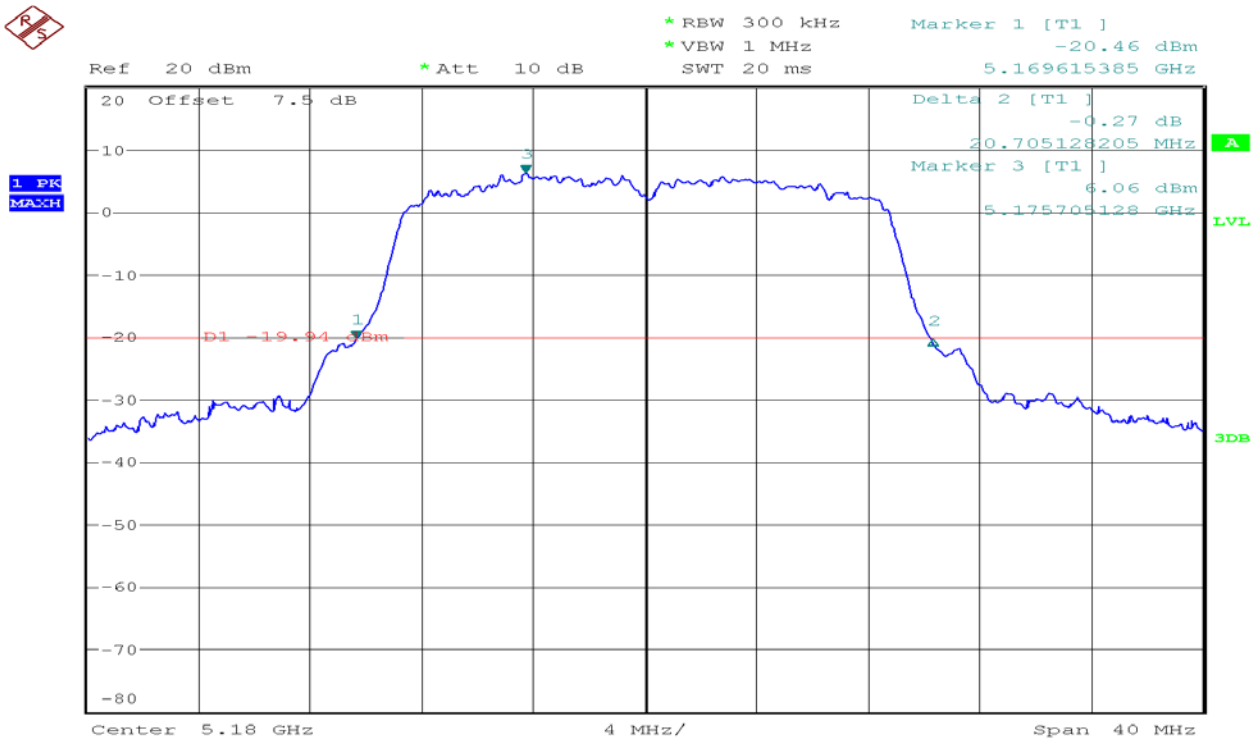
CH High



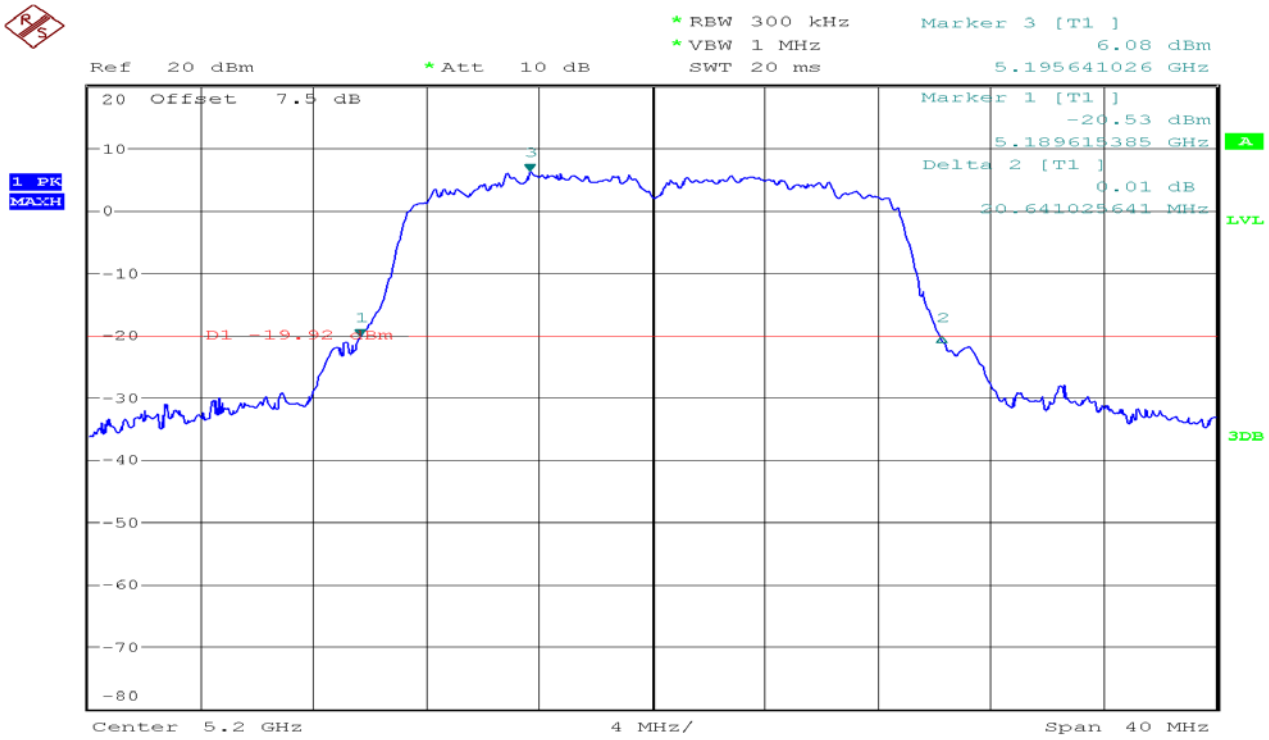
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

IEEE 802.11an HT20 mode/Chain 1:

CH Low

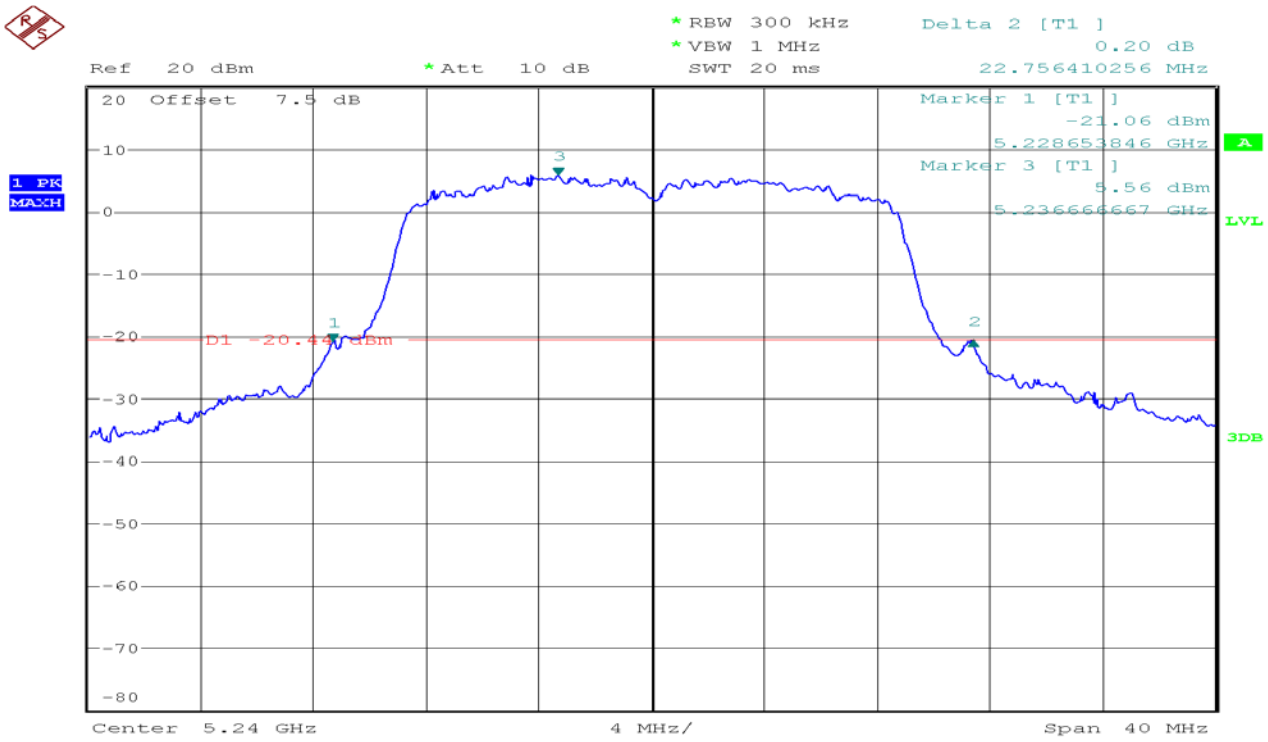


CH Mid



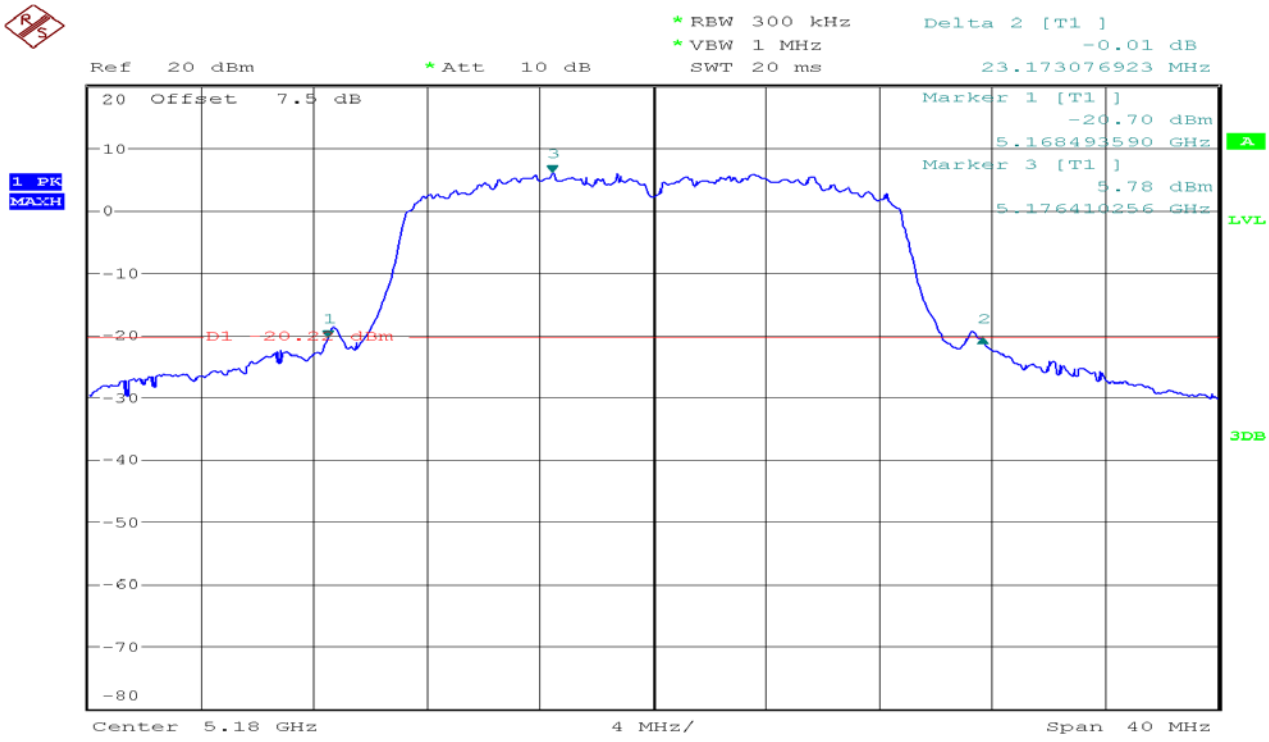
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH High



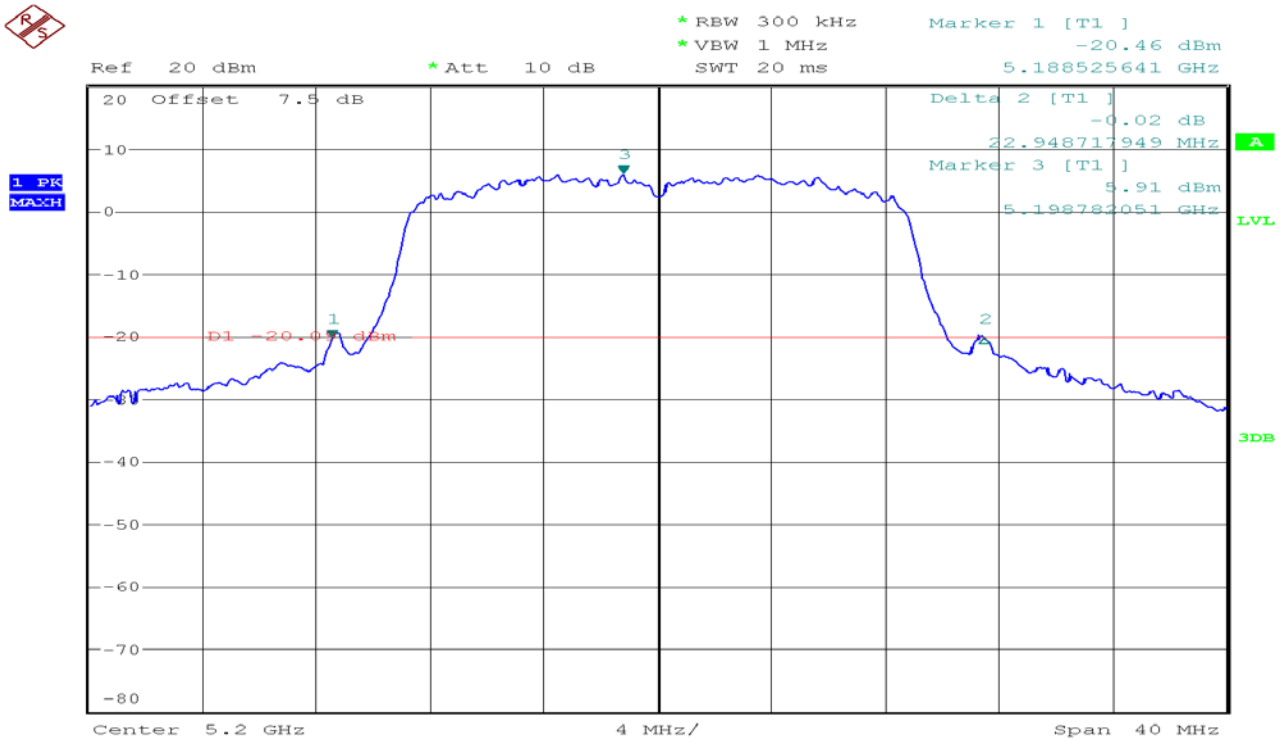
IEEE 802.11an HT20 mode/Chain 2:

CH Low

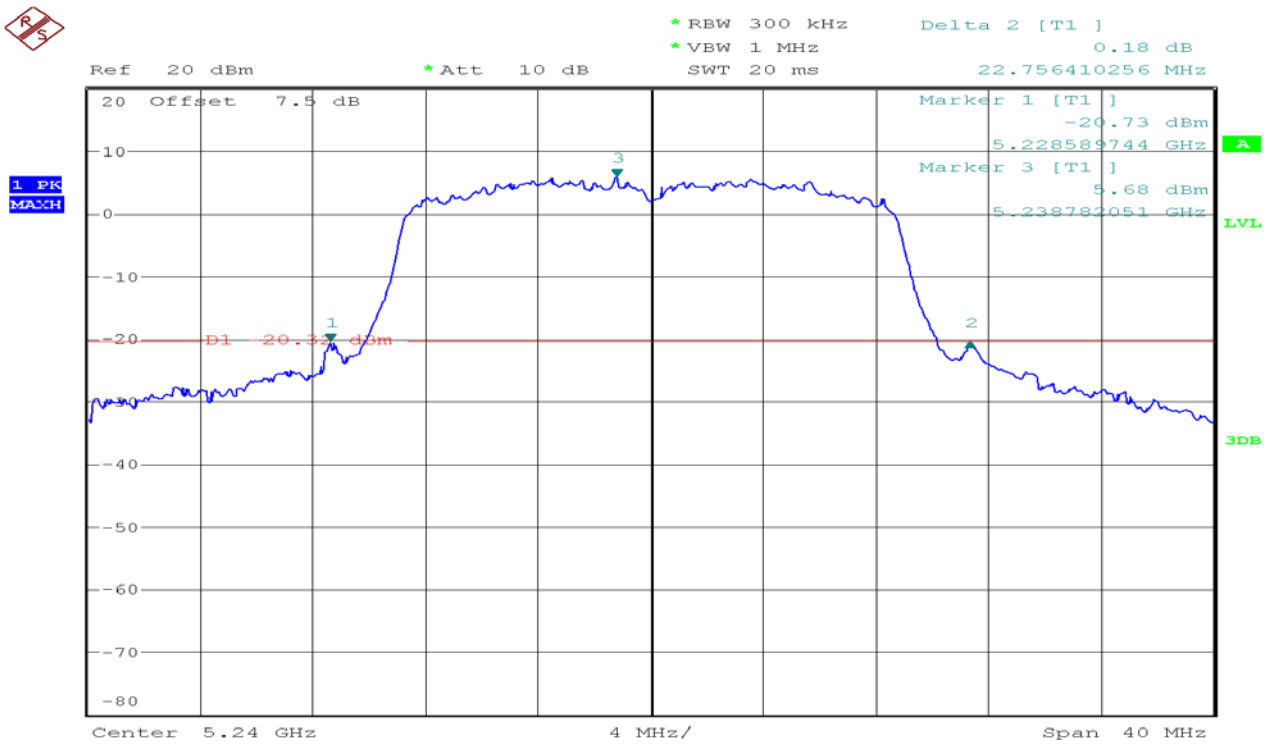


This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH Mid



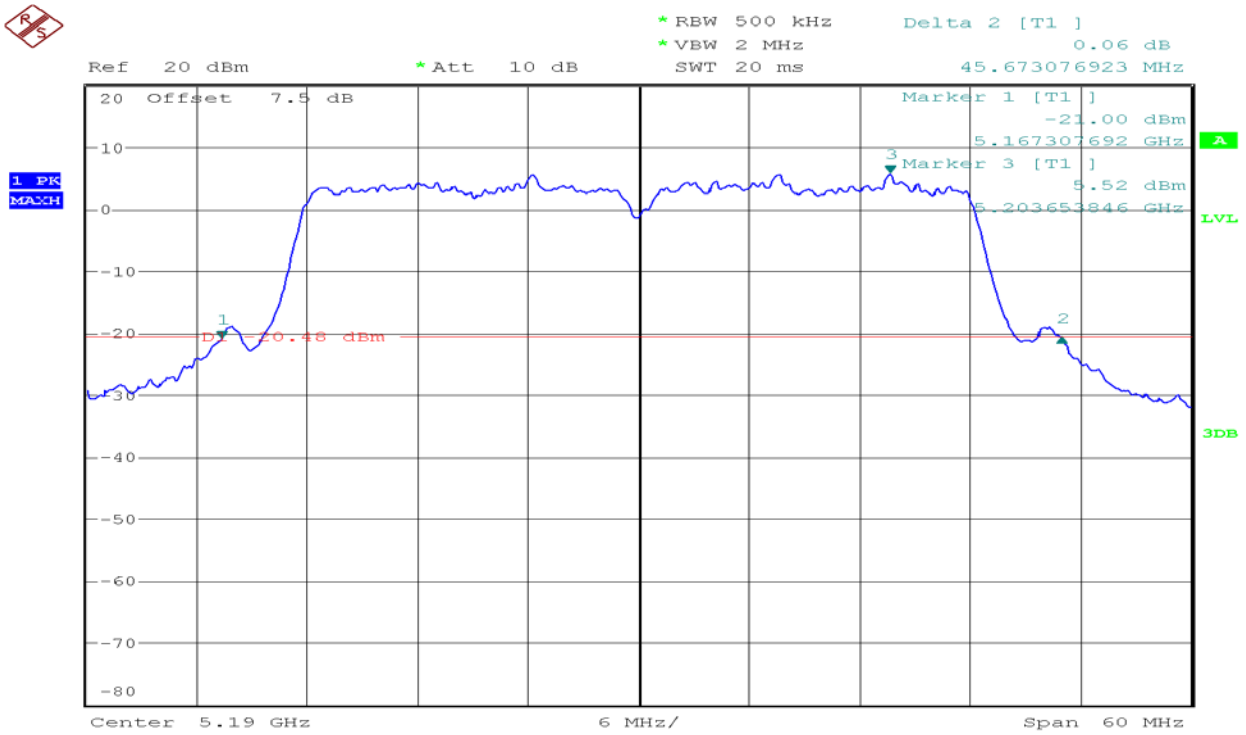
CH High



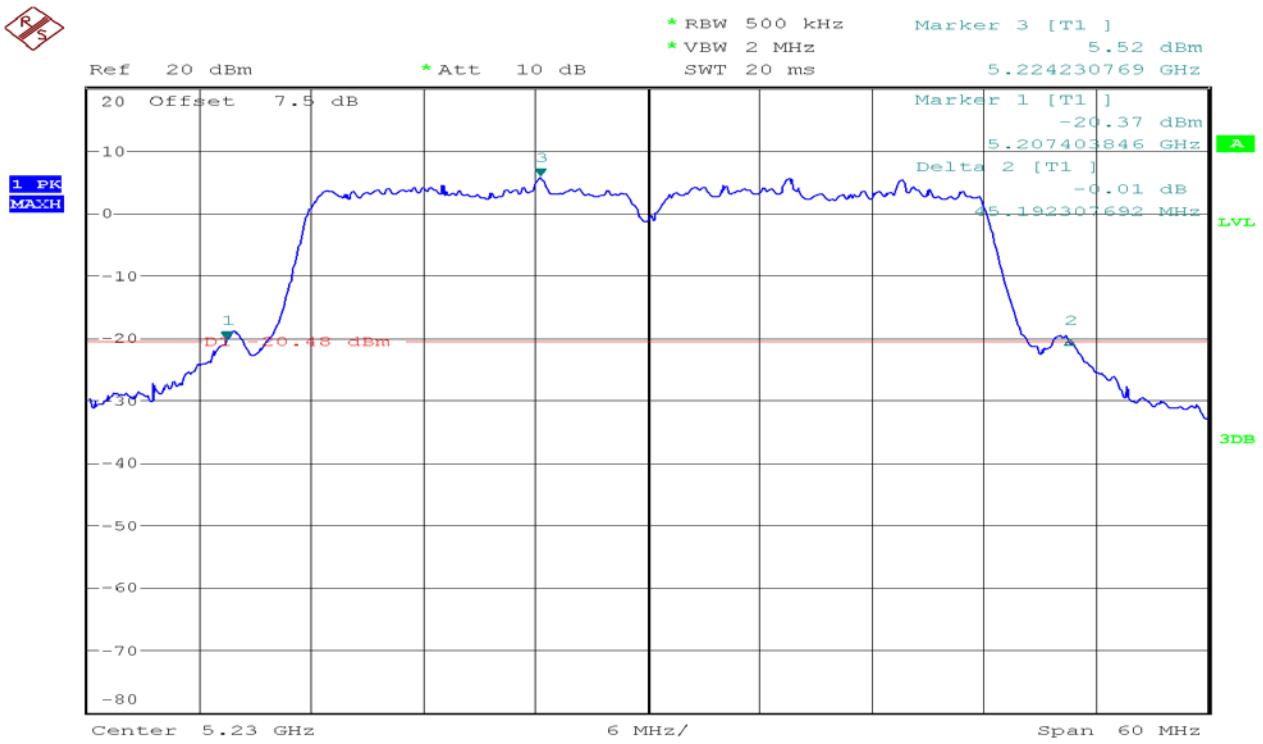
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

IEEE 802.11an HT40 mode/Chain 1:

CH Low



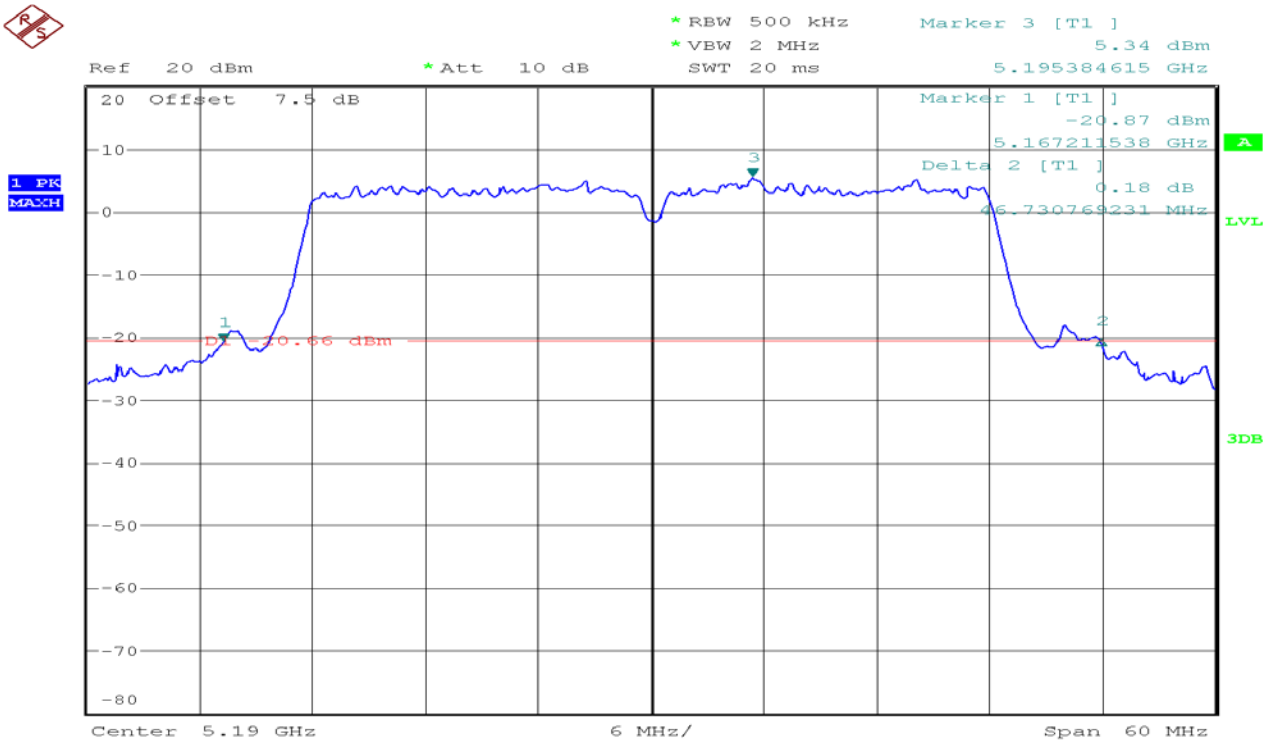
CH High



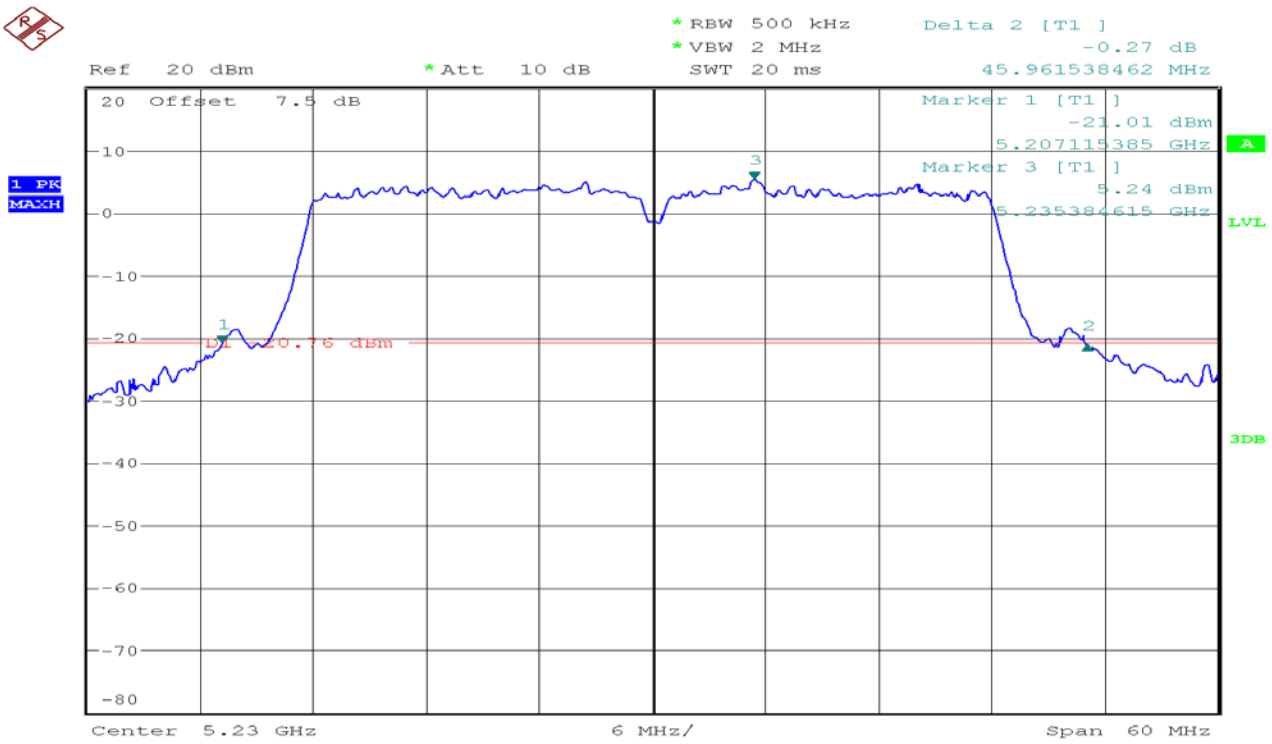
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

IEEE 802.11an HT40 mode/Chain 2:

CH Low



CH High



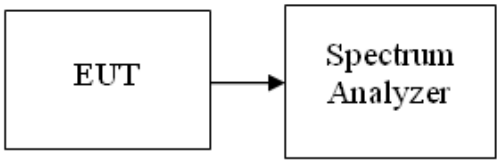
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

7.2 99% EMISSION BANDWIDTH

LIMIT

None; for reporting purposes only.

Test Configuration



Test Procedure

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW $\geqslant$ 3 · RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).

TEST RESULTS

No non-compliance noted

Test Data

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Test mode: IEEE 802.11a mode/ Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	16.731
Mid	5200	16.731
High	5240	16.667

Test mode: IEEE 802.11a mode/ Chain 2

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	17.308
Mid	5200	16.859
High	5240	16.859

Test mode: IEEE 802.11an HT20MHz mode/ Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	17.564
Mid	5200	17.564
High	5240	17.564

Test mode: IEEE 802.11an HT20MHz mode/ Chain 2

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	17.628
Mid	5200	17.564
High	5240	17.564

Test mode: IEEE 802.11an HT40MHz mode / Chain 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5190	36.635
High	5230	36.538

Test mode: IEEE 802.11an HT40MHz mode / Chain 2

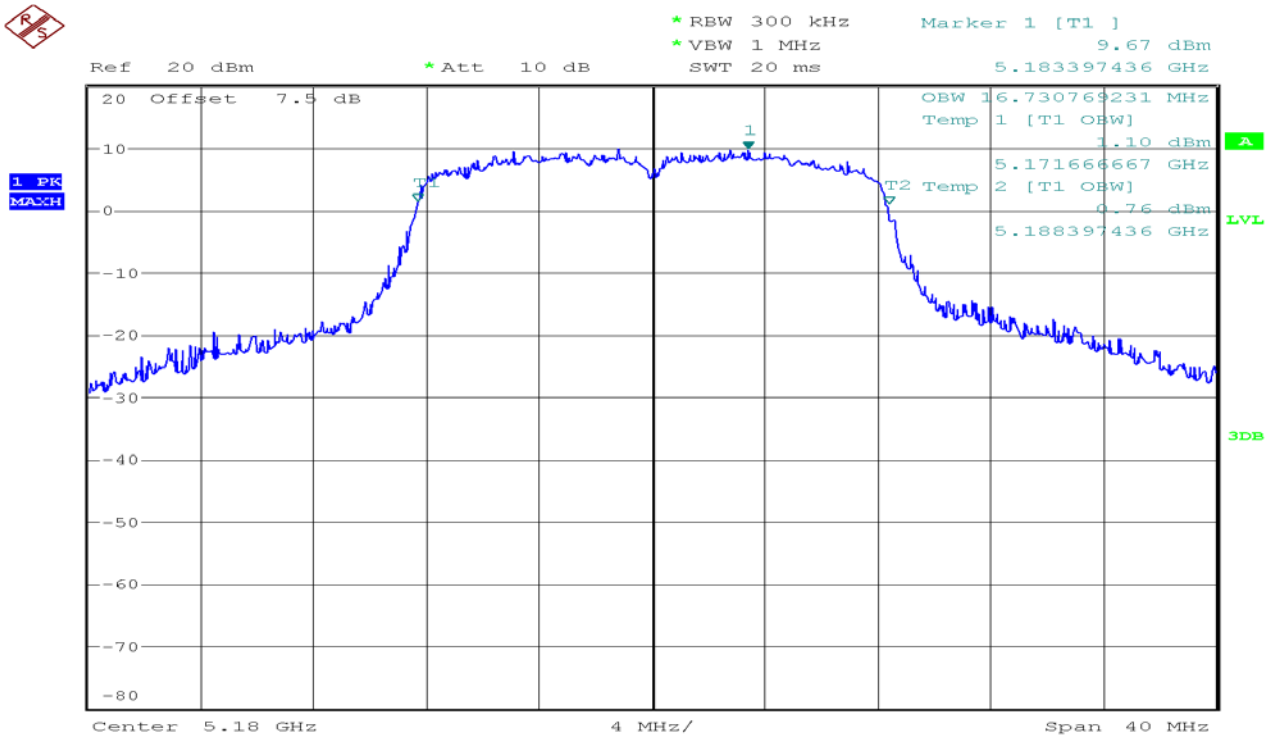
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5190	36.442
High	5230	36.538

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

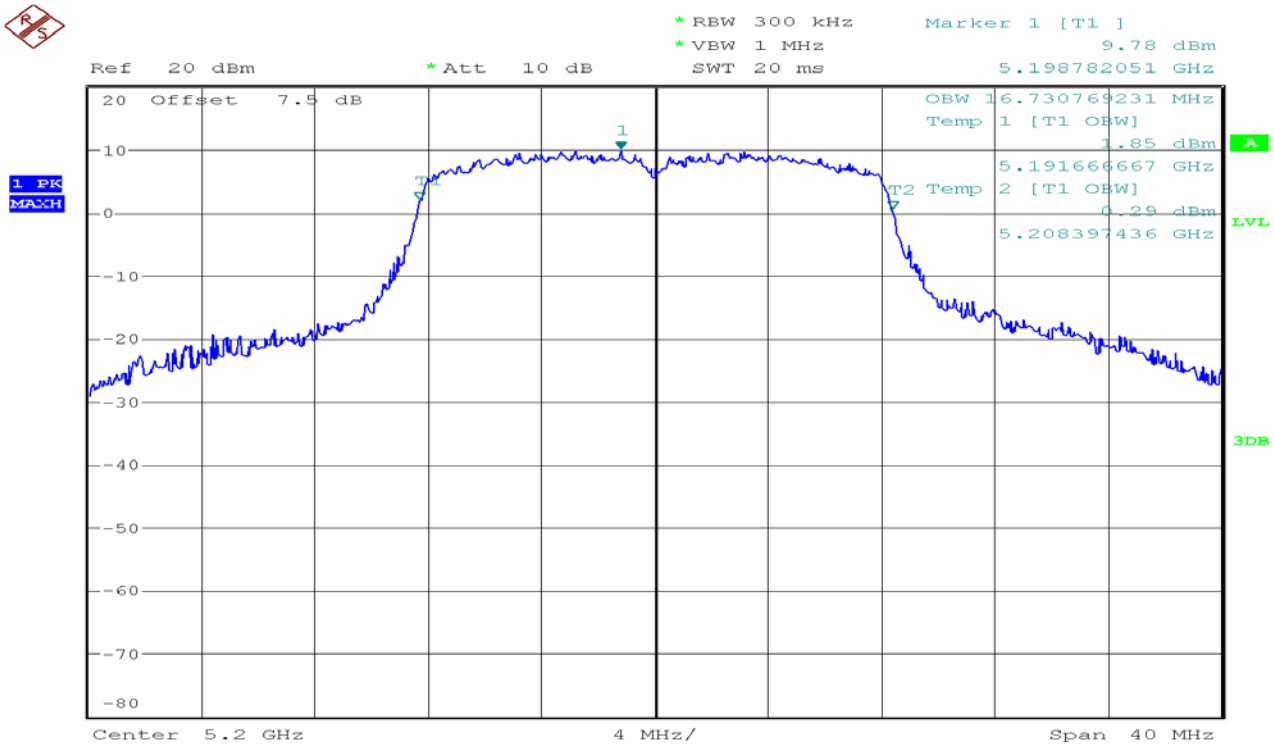
Test Plot

IEEE 802.11a mode/Chain 1:

CH Low

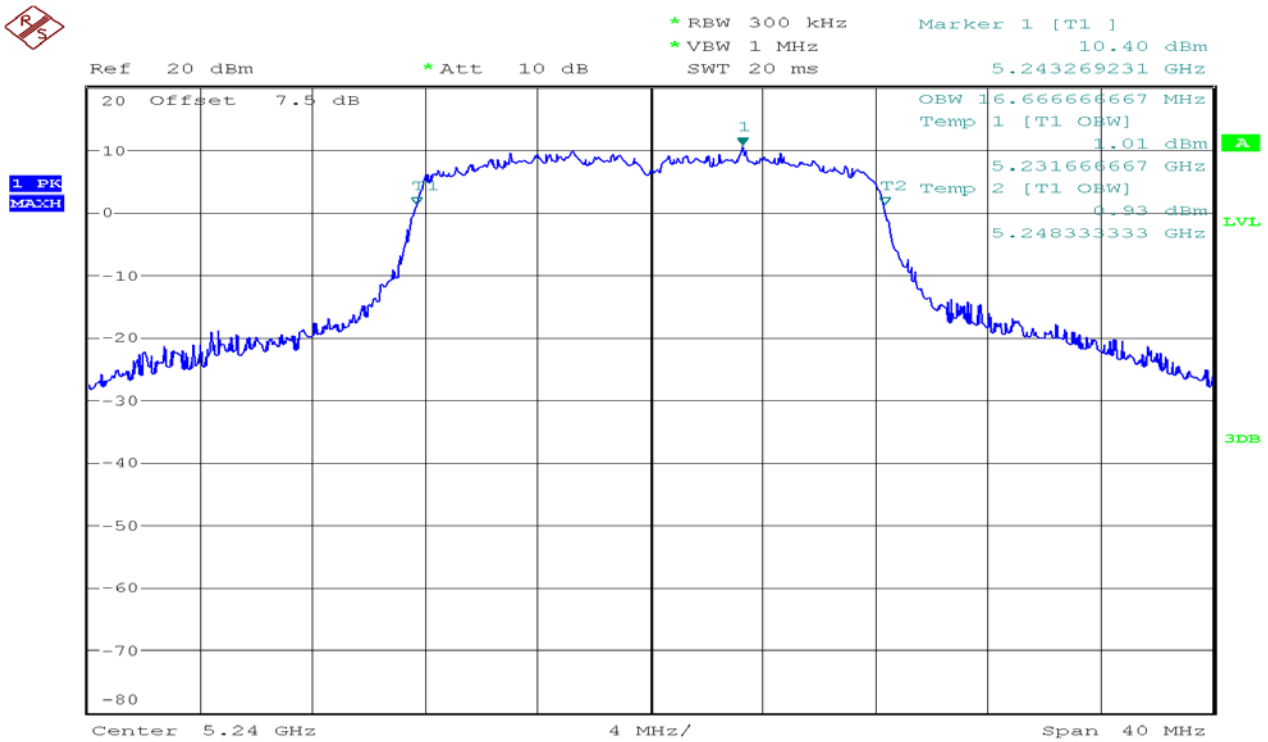


CH Mid



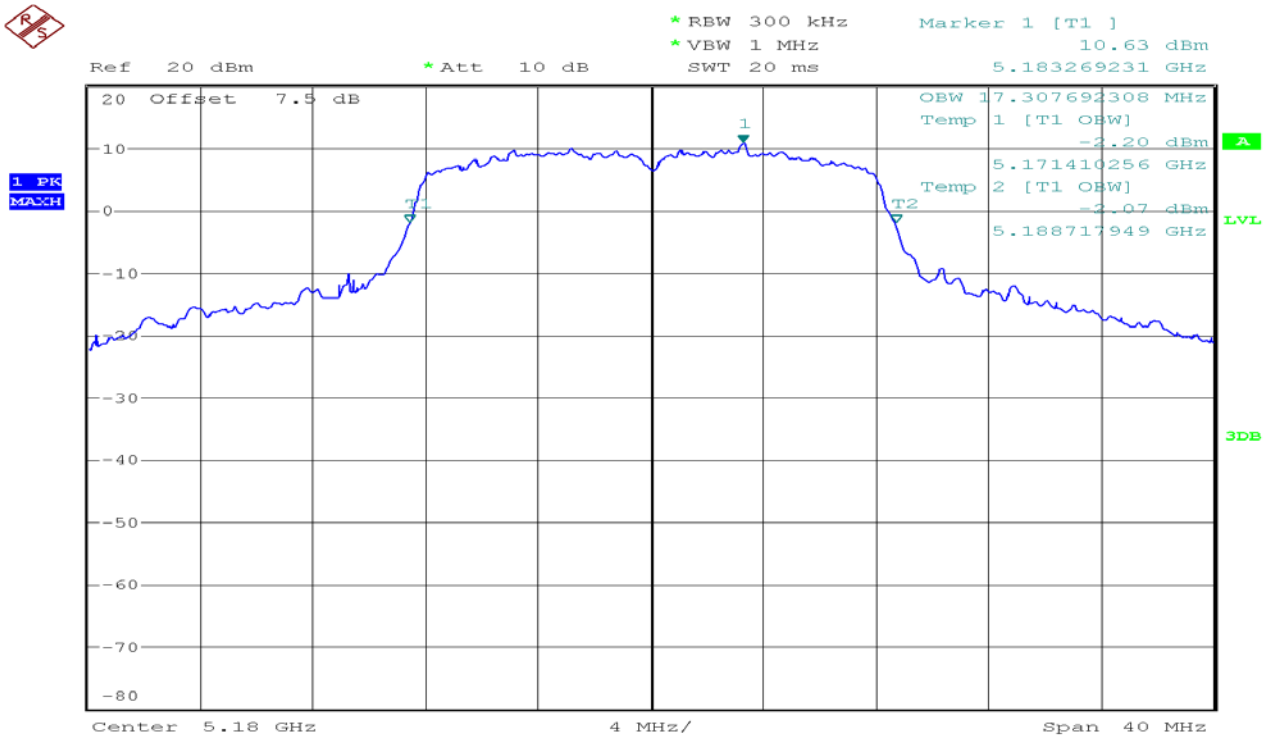
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH High



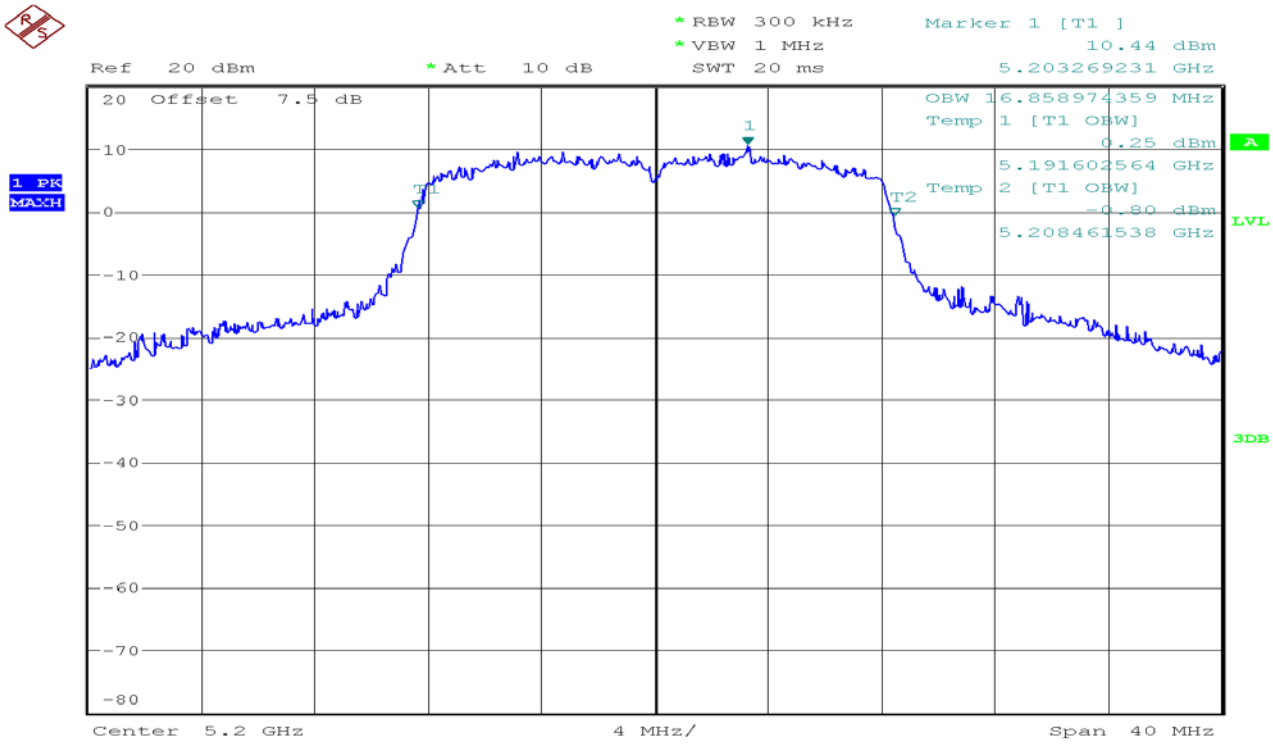
IEEE 802.11a mode/Chain 2:

CH Low

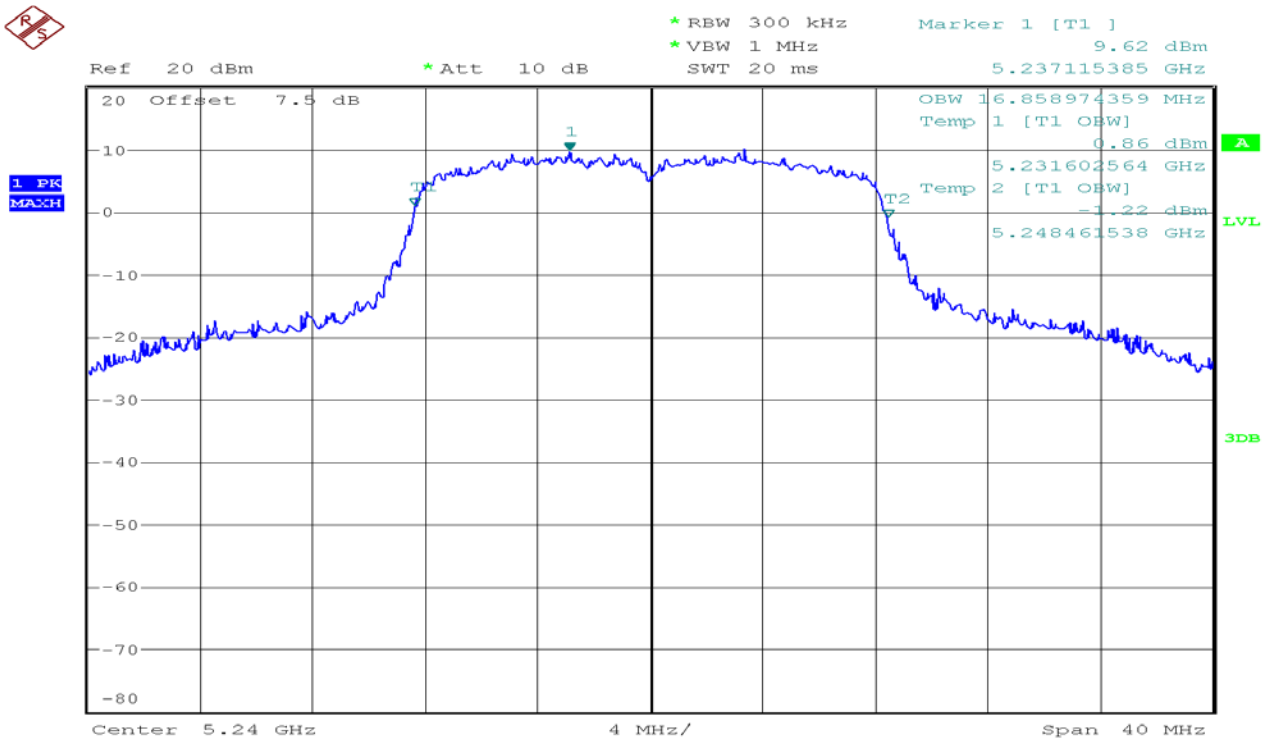


This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH Mid



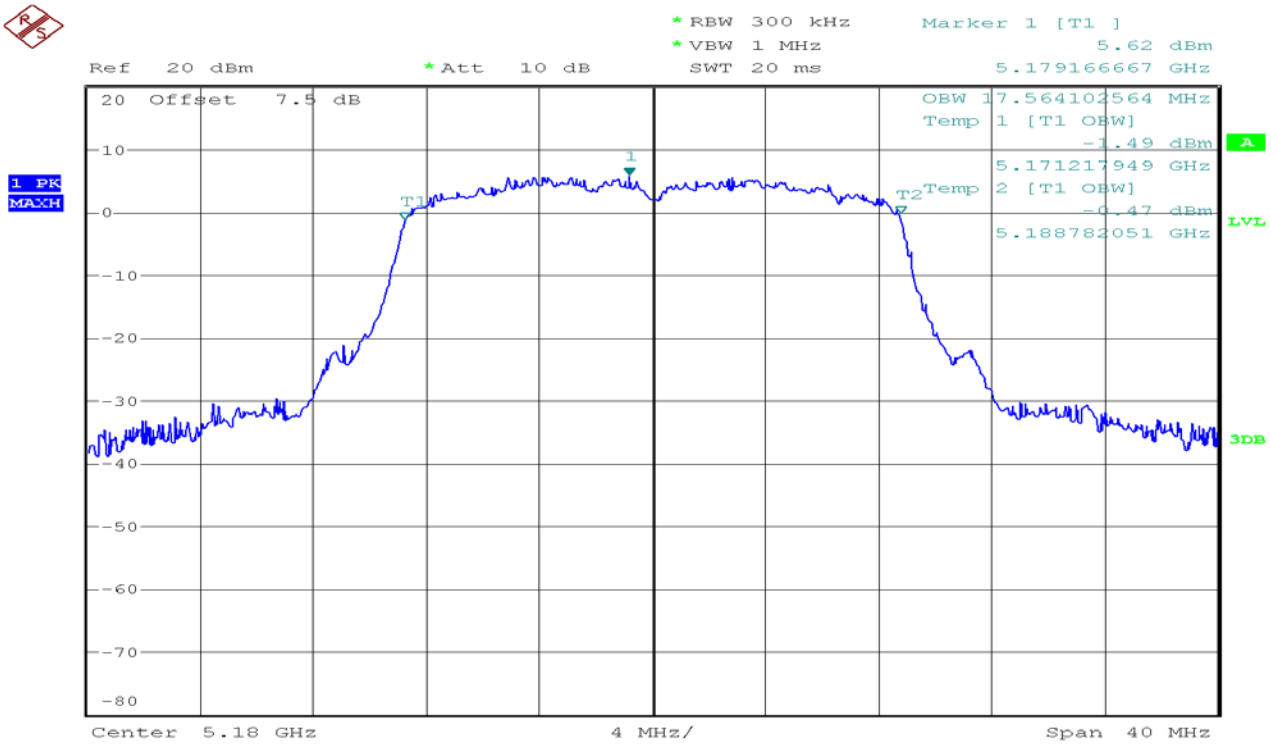
CH High



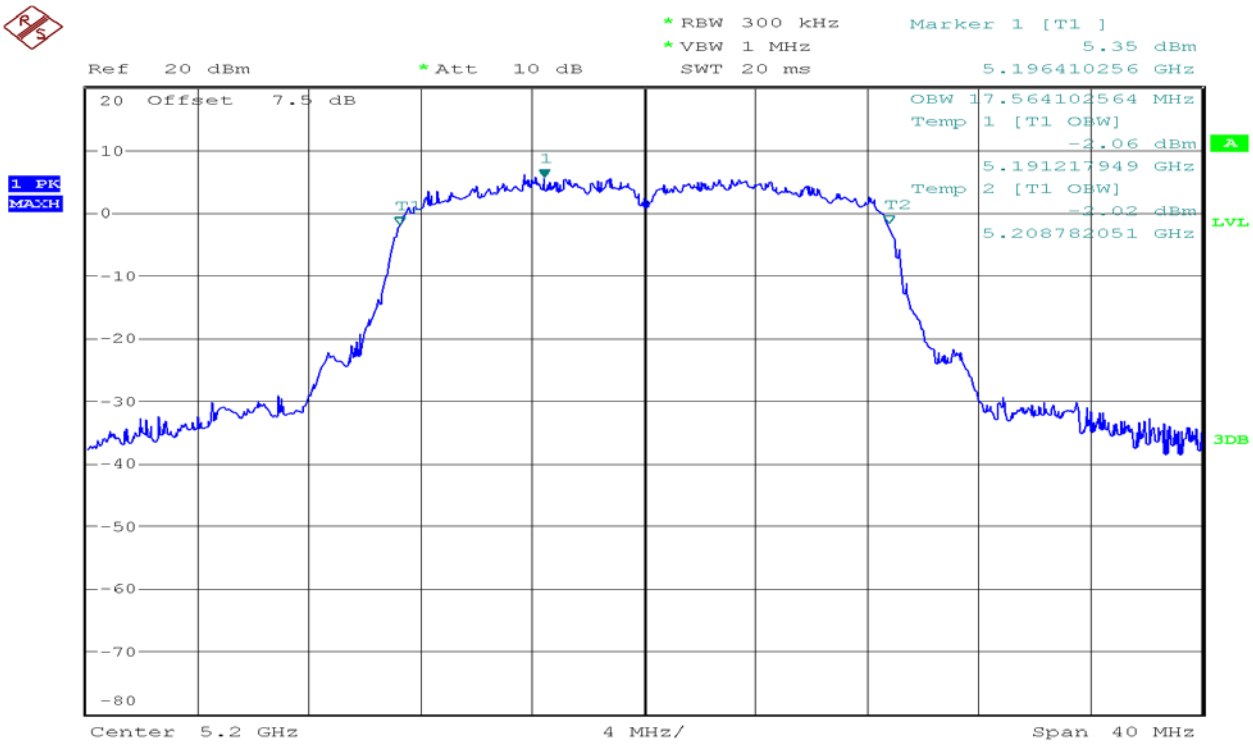
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

IEEE 802.11an HT20 mode/Chain 1:

CH Low

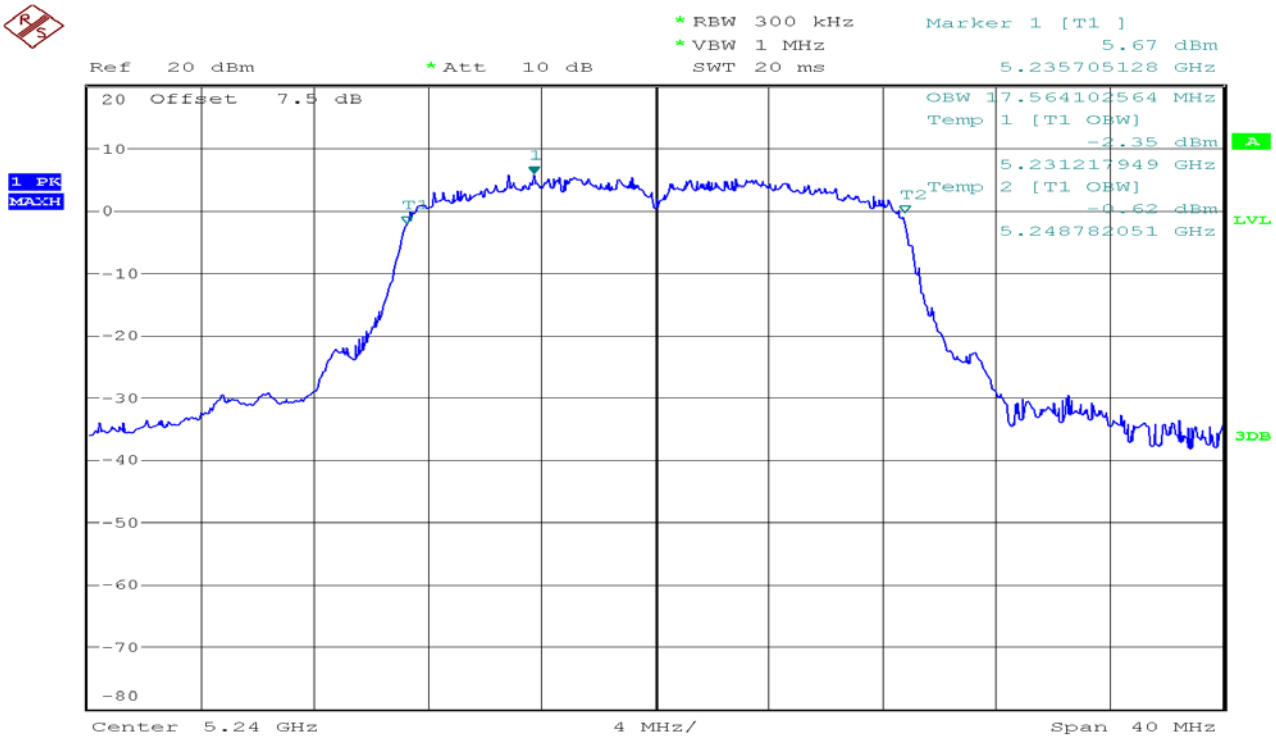


CH Mid



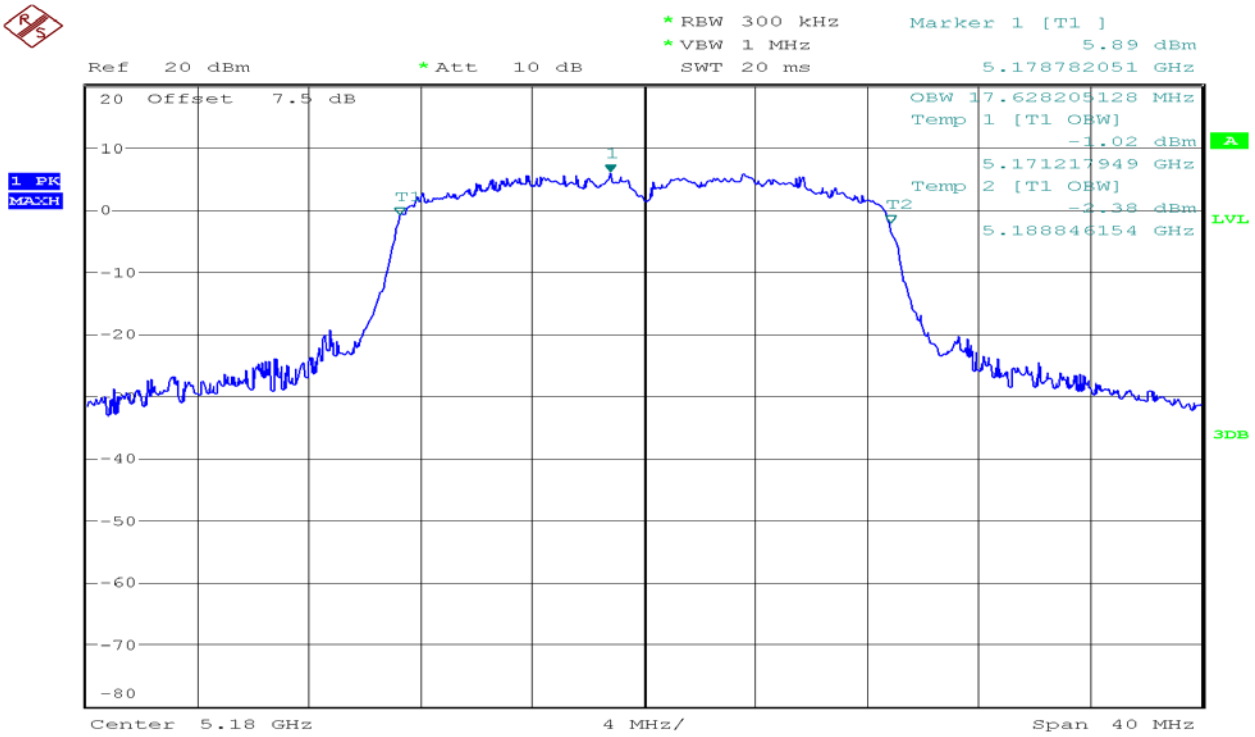
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH High



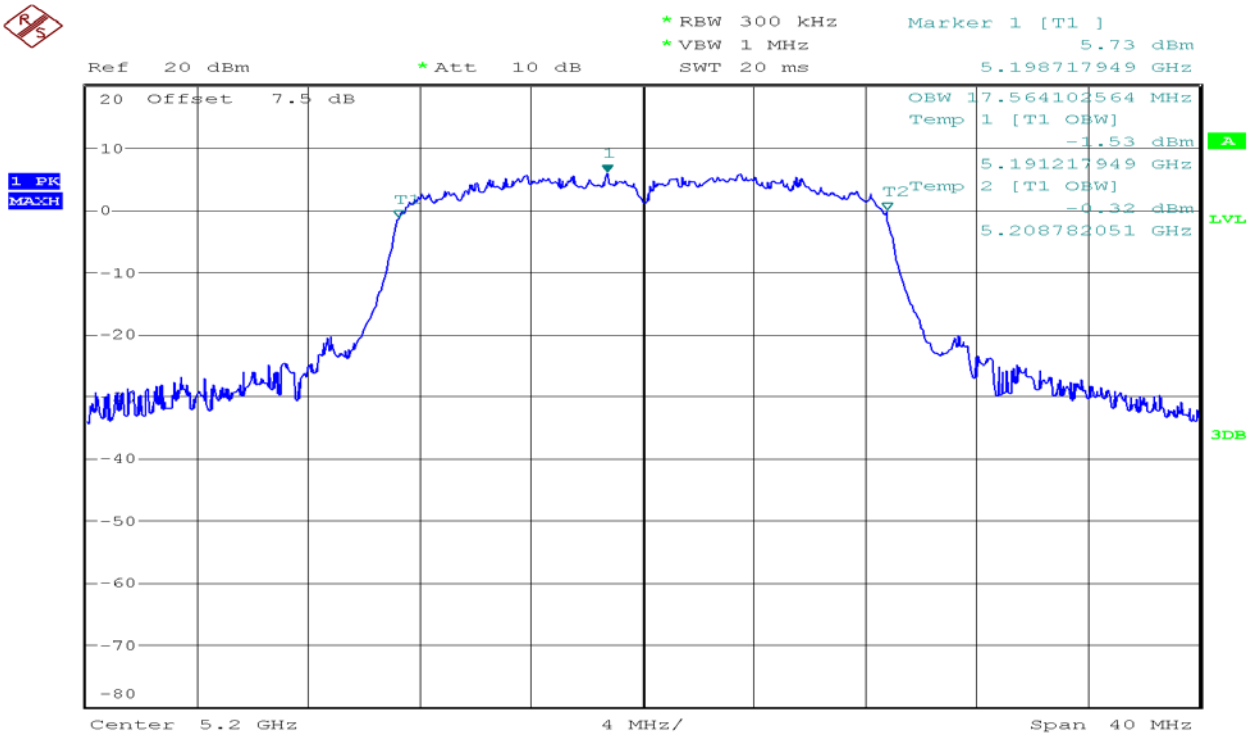
IEEE 802.11an HT20 mode/Chain 2:

CH Low

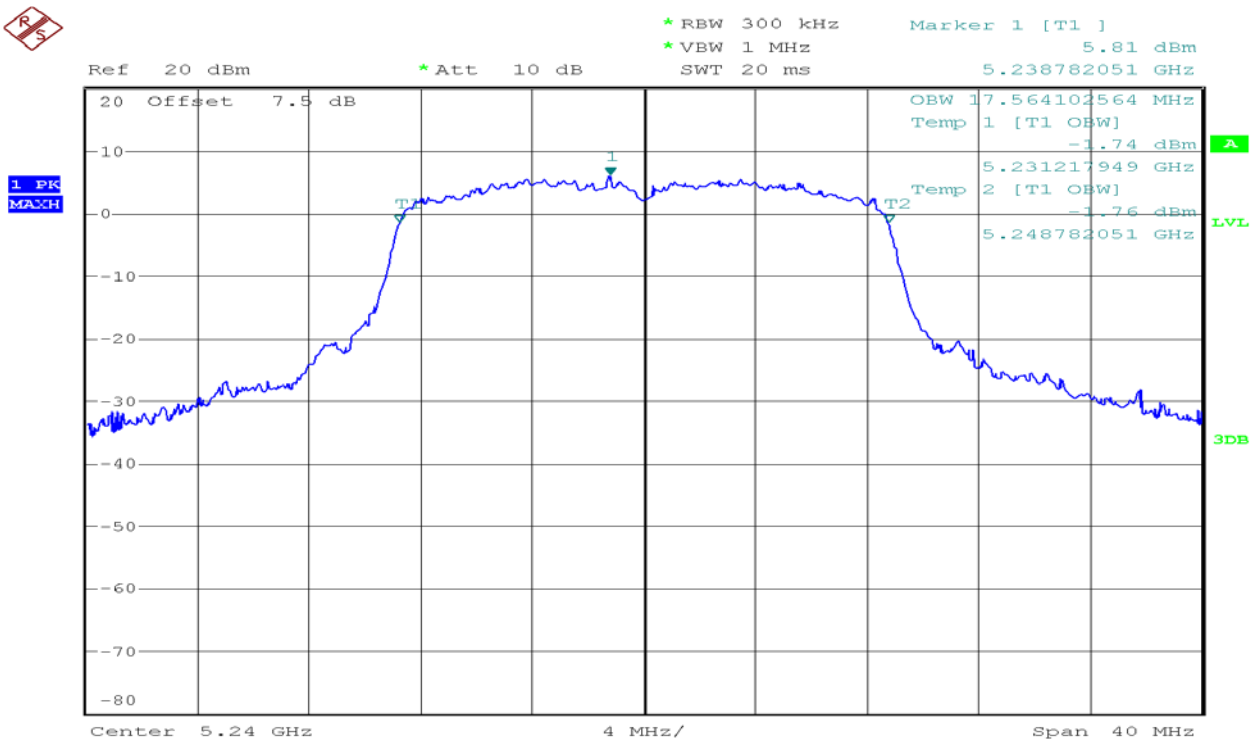


This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH Mid



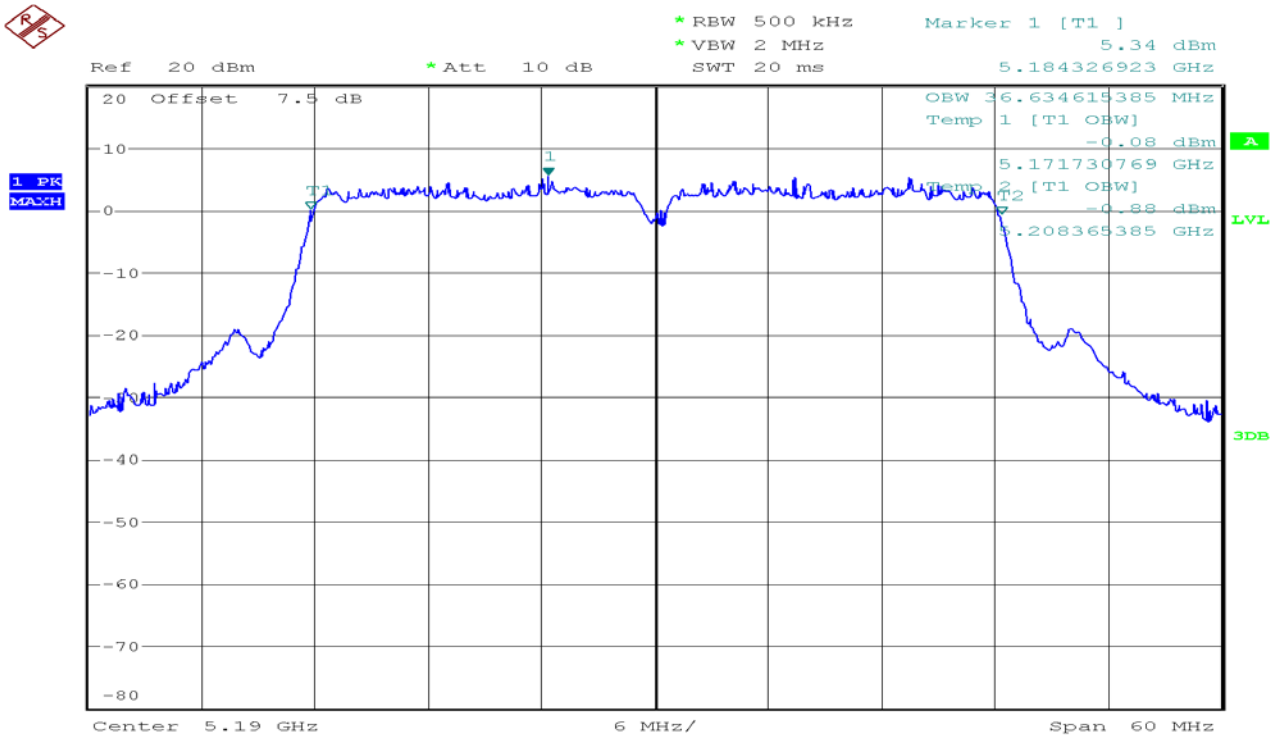
CH High



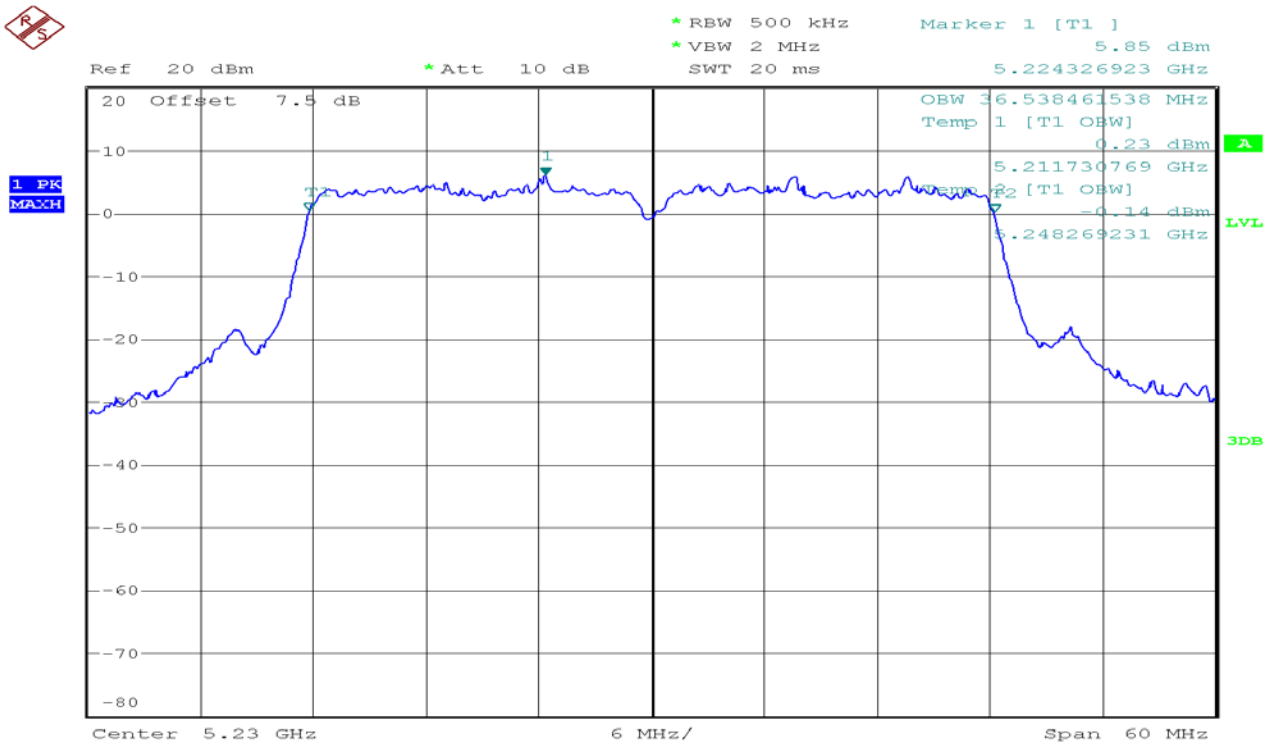
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

IEEE 802.11an HT40 mode/Chain 1:

CH Low



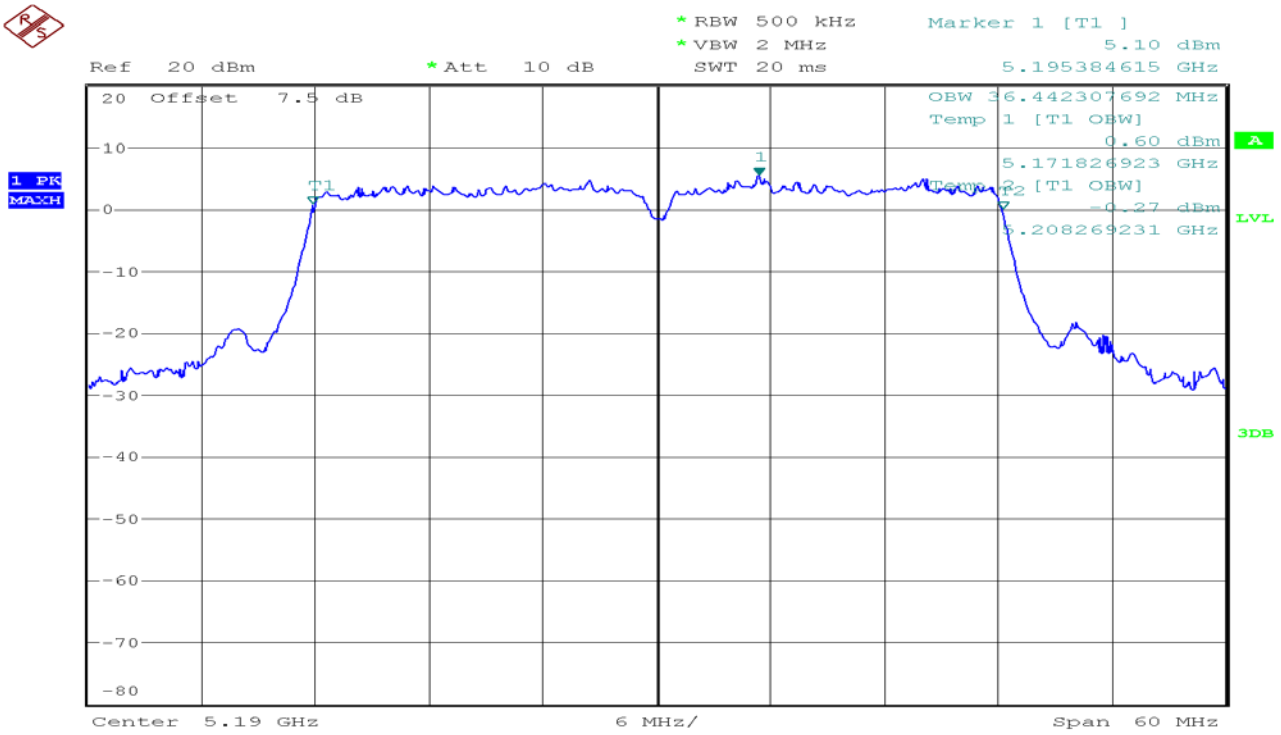
CH High



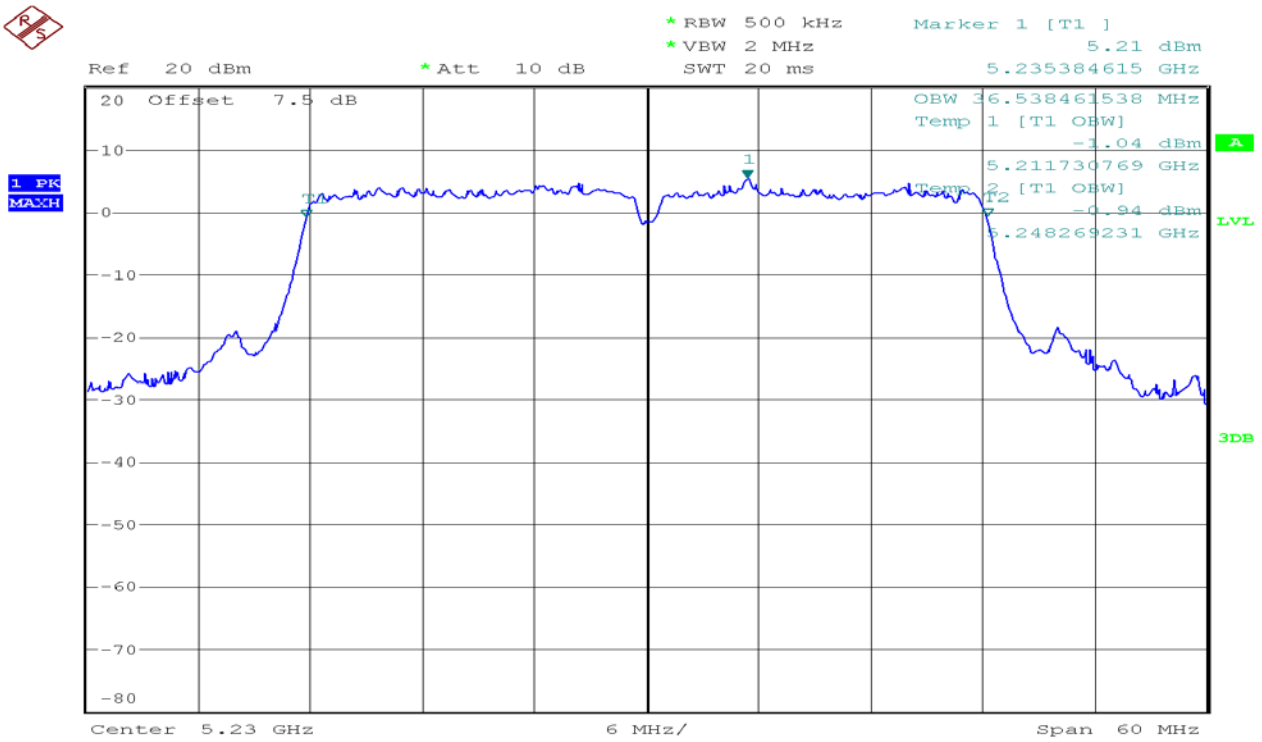
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

IEEE 802.11an HT40 mode/Chain 2:

CH Low



CH High



This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

7.3 MAXIMUM CONDUCTED OUTPUT POWER

LIMIT

The peak power shall not exceed the limit as follow:

According to §15.407(a),

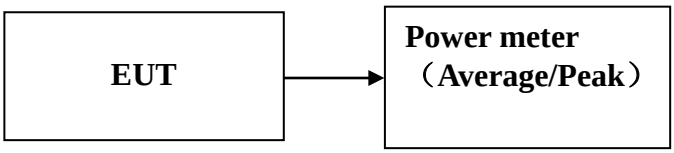
(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

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=7.28dBi>6dBi

Limit=24dBm-(7.28-6) dB=22.72dBm

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 RESULTS

No non-compliance noted

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Test Data

Test mode: IEEE 802.11a mode

Channel	Frequency (MHz)	Chain 1 Average Output Power (dBm)	Chain 2 Average Output Power (dBm)	Limit (dBm)
Low	5180	15.36	15.08	24.00
Mid	5200	15.33	15.15	24.00
High	5240	15.20	15.32	24.00

Test mode: IEEE 802.11an HT20MHz mode

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	5180	11.89	11.50	14.71	22.72
Mid	5200	11.87	11.68	14.79	22.72
High	5240	11.89	11.58	14.75	22.72

Test mode: IEEE 802.11an HT40MHz mode

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	5190	11.38	11.33	14.37	22.72
High	5230	11.48	11.31	14.41	22.72

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

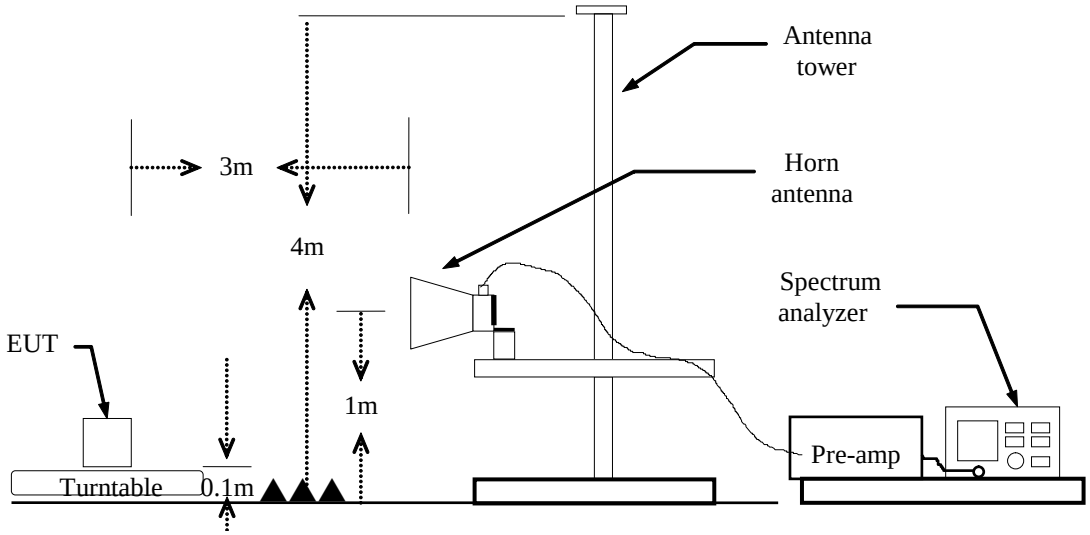
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

7.4 BAND EDGES MEASUREMENT

LIMIT

According to §15.407(b),
(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.

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

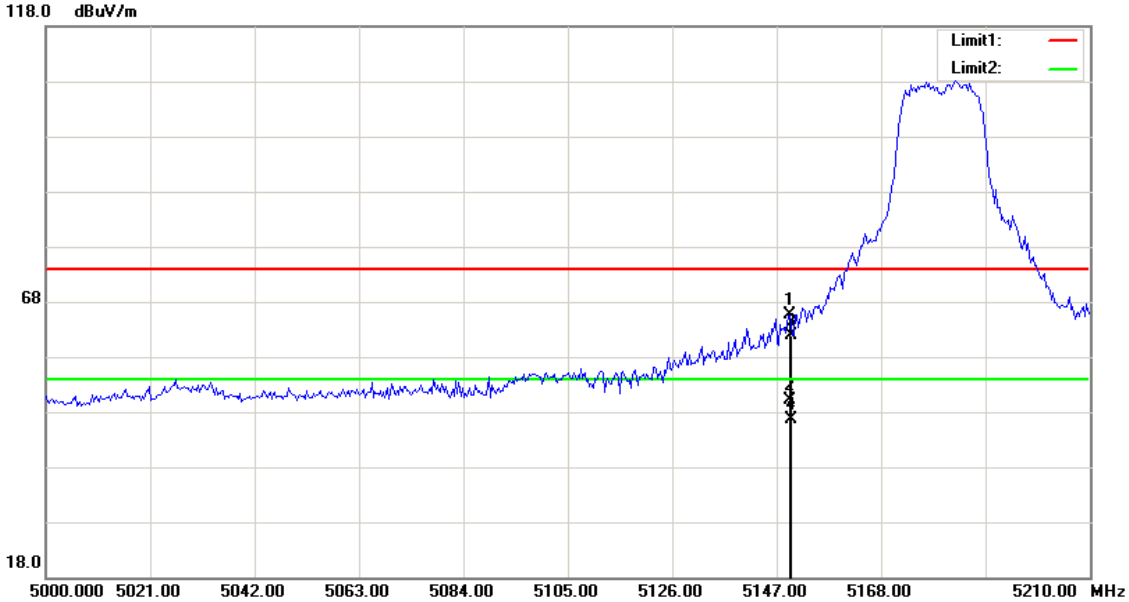
TEST RESULTS

Refer to attach spectrum analyzer data chart.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Band Edges (IEEE 802.11a mode)

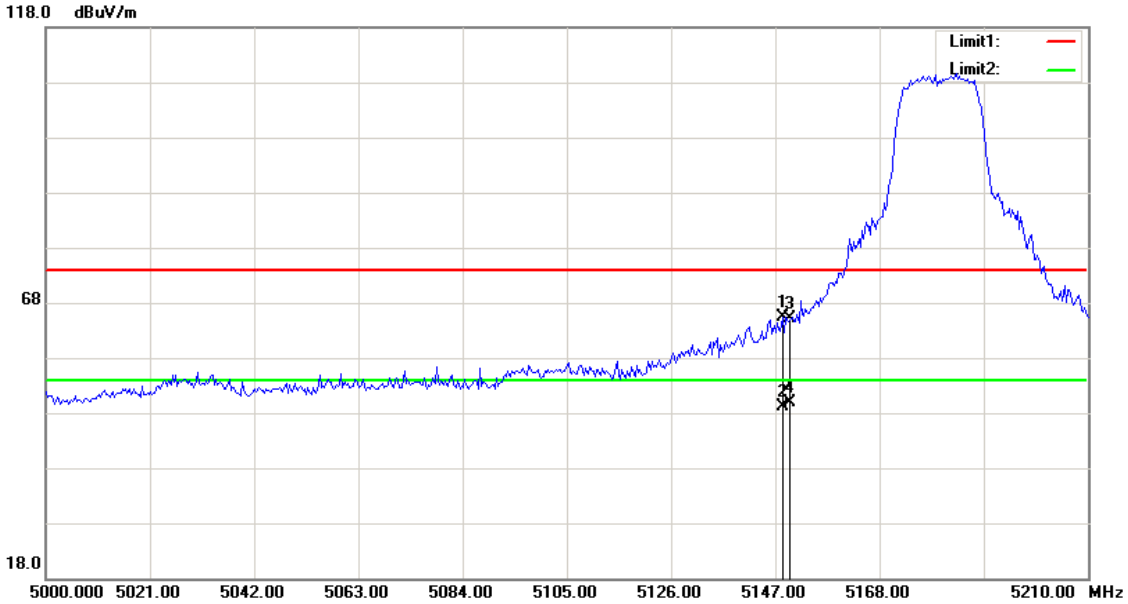
Polarity: Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5149.760	65.29	0.32	65.61	74.00	-8.39	100	270	peak
2	5149.760	49.72	0.32	50.04	54.00	-3.96	100	275	AVG
3	5150.000	61.64	0.32	61.96	74.00	-12.04	200	277	peak
4	5150.000	46.21	0.32	46.53	54.00	-7.47	100	237	AVG

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Polarity: Horizontal

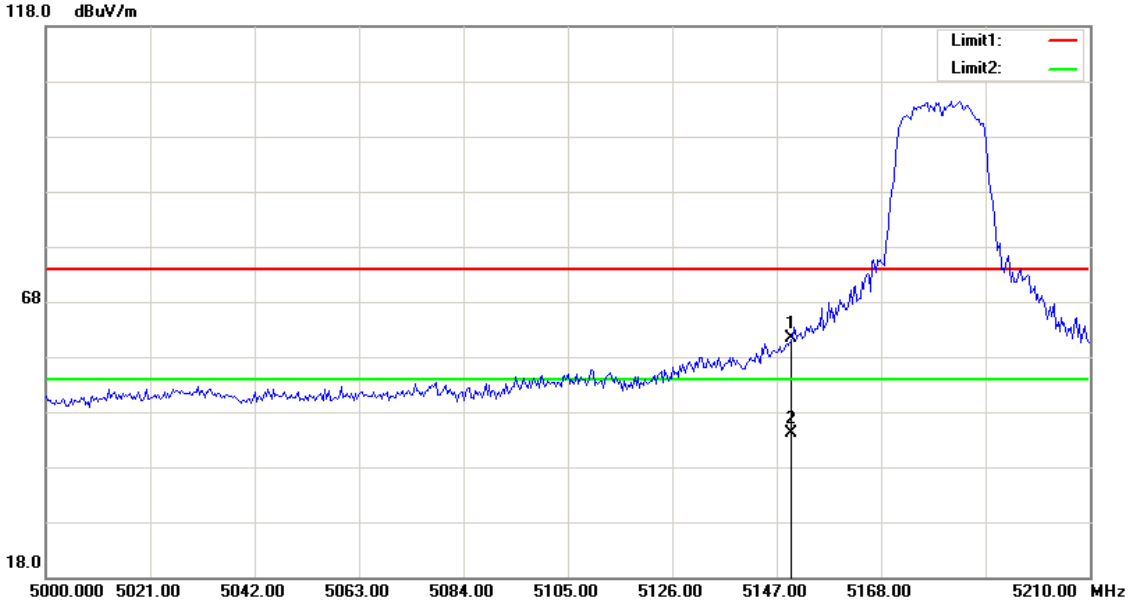


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	5148.413	65.04	0.32	65.36	74.00	-8.64	100	336	peak
2	5148.413	48.72	0.32	49.04	54.00	-4.96	100	336	AVG
3	5150.000	64.74	0.32	65.06	74.00	-8.94	200	334	peak
4	5150.000	49.56	0.32	49.88	54.00	-4.12	100	337	AVG

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Band Edges (IEEE 802.11an HT20 mode)

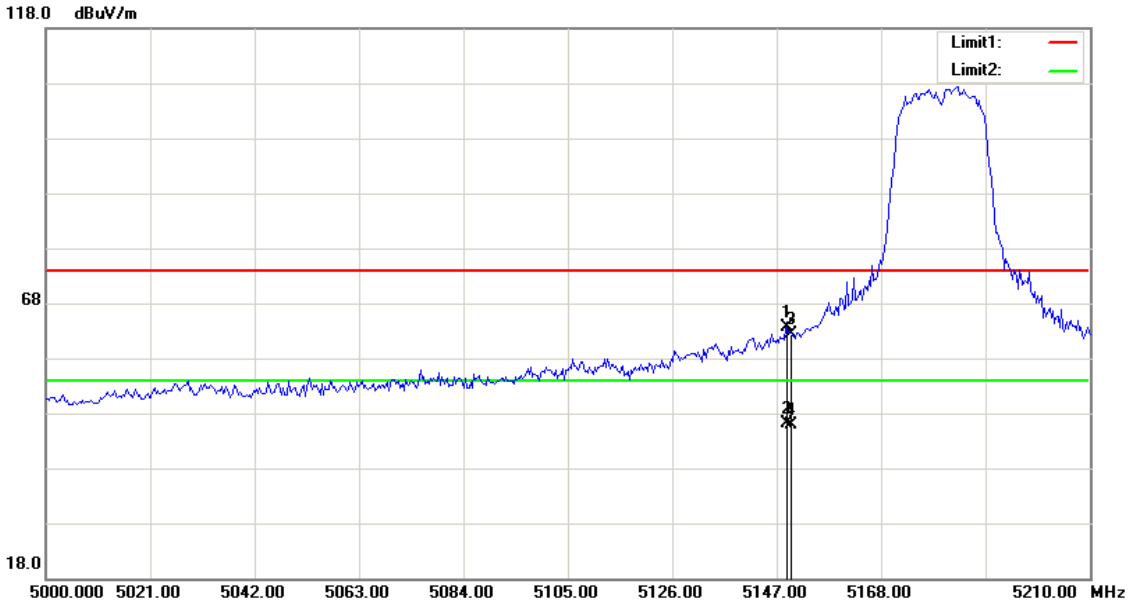
Polarity: Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5150.000	61.03	0.32	61.35	74.00	-12.65	200	98	peak
2	5150.000	43.91	0.32	44.23	54.00	-9.77	100	102	AVG

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Polarity: Horizontal

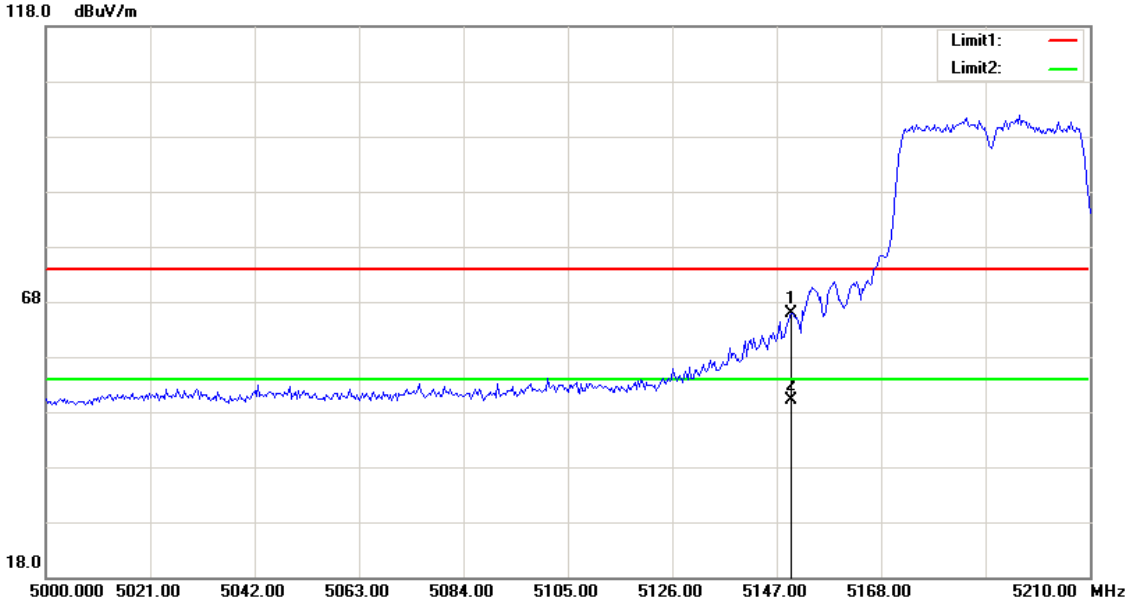


No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	5149.087	63.19	0.32	63.51	74.00	-10.49	100	0	peak
2	5149.087	45.82	0.32	46.14	54.00	-7.86	100	0	AVG
3	5150.000	61.98	0.32	62.30	74.00	-11.70	100	358	peak
4	5150.000	45.60	0.32	45.92	54.00	-8.08	100	360	AVG

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

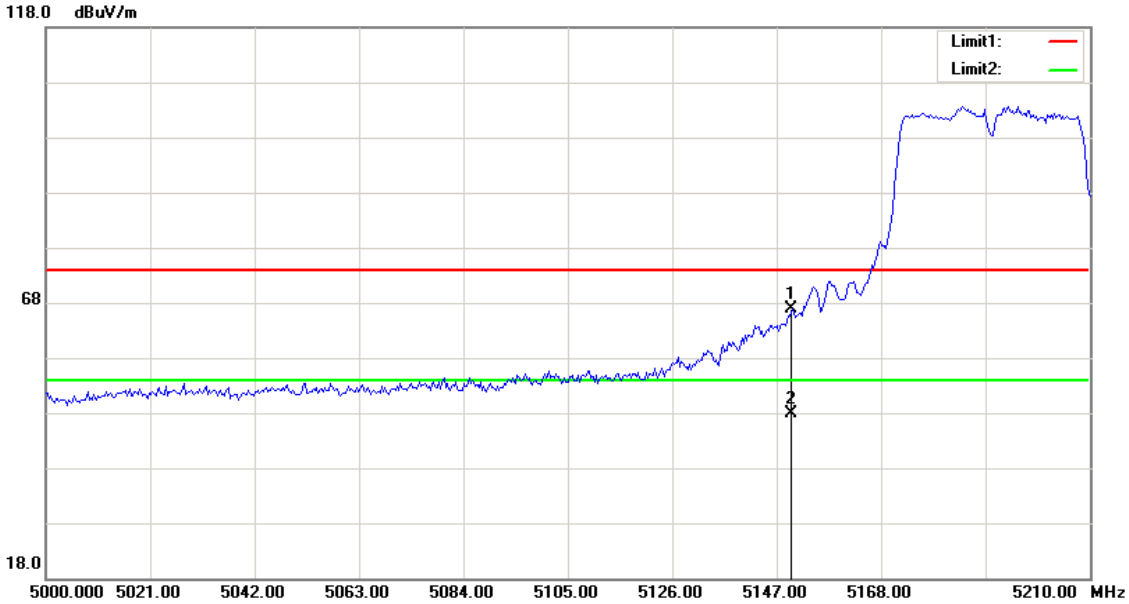
Band Edges (IEEE 802.11an HT40 mode)

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	5150.000	65.46	0.32	65.78	74.00	-8.22	200	96	peak
2	5150.000	49.78	0.32	50.10	54.00	-3.90	100	93	AVG

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	5150.000	66.60	0.32	66.92	74.00	-7.08	200	326	peak
2	5150.000	47.61	0.32	47.93	54.00	-6.07	100	325	AVG

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

7.5 MAXIMUM POWER SPECTRAL DENSITY

LIMIT

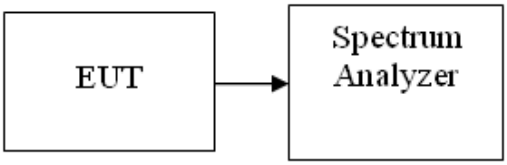
According to §15.407(a),

For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Directional Gain=7.28dBi>6dBi

Limit=11dBm-(7.28-6) dB=9.72dBm

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 = 1MHz, VBW = 3MHz, Span must be greater than 26dB bandwidth, adjust as necessary, Sweep= auto, Detector RMS
3. Record the max. reading.

TEST RESULTS

No non-compliance noted

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Test Data

Test mode: IEEE 802.11a mode

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Limit (dBm)	Result
Low	5180	6.99	6.91	11.00	PASS
Mid	5200	7.17	6.97	11.00	PASS
High	5240	6.89	6.82	11.00	PASS

Test mode: IEEE 802.11an HT20MHz mode

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
Low	5180	2.79	3.10	5.96	9.72	PASS
Mid	5200	3.09	3.26	6.19	9.72	PASS
High	5240	2.55	2.81	5.69	9.72	PASS

Test mode: IEEE 802.11an HT40MHz mode

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Result
Low	5190	-0.61	-0.42	2.50	9.72	PASS
High	5230	-0.41	-0.28	2.67	9.72	PASS

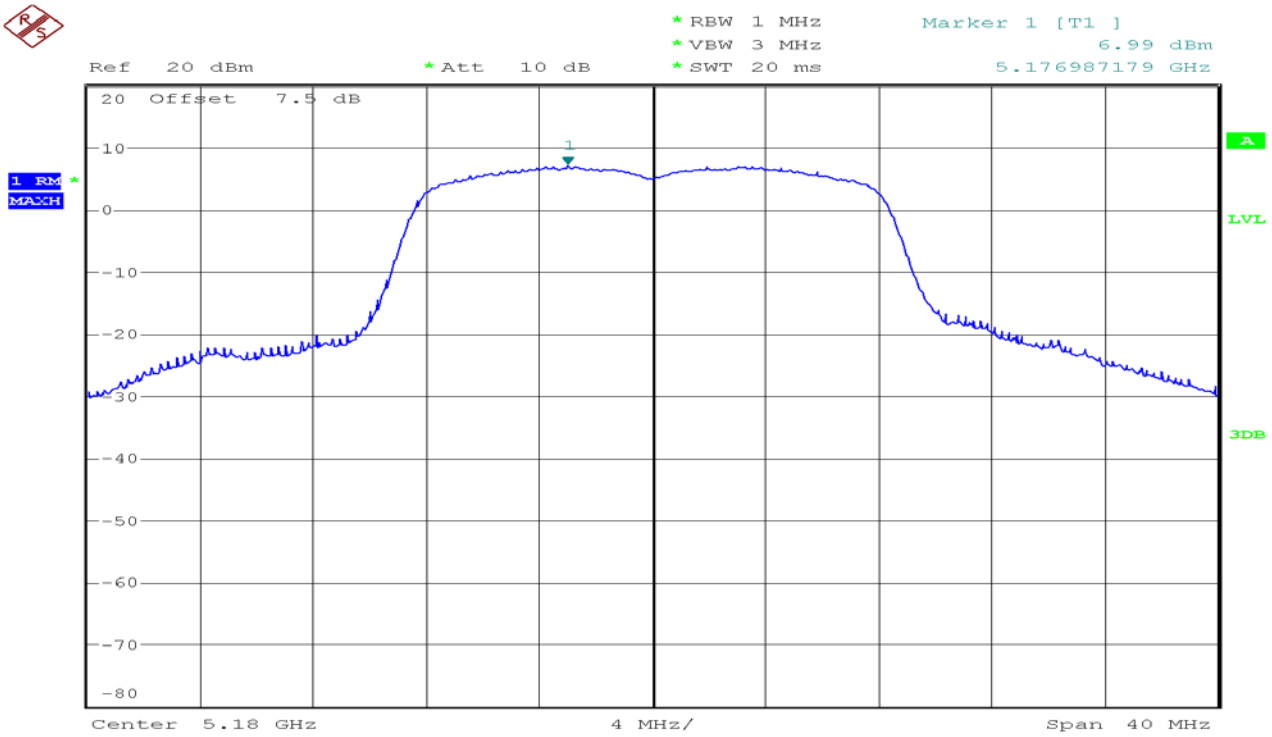
***Remark**: 1.*Total PPSD(dBm) = 10*LOG(10^(Chain 1 PPSD / 10)+10^(Chain 2 PPSD /10))

2.Duty factor has been offset with cable loss

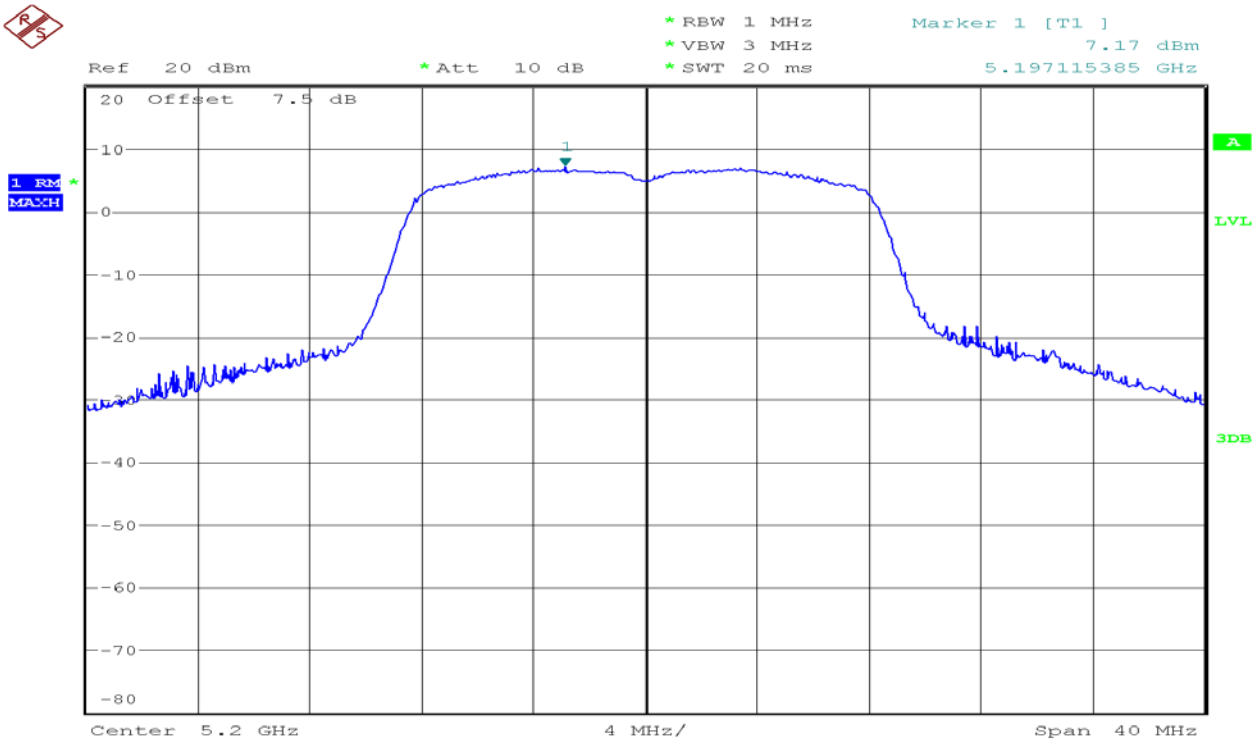
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Test Plot
IEEE 802.11a mode/Chain 1:

CH Low

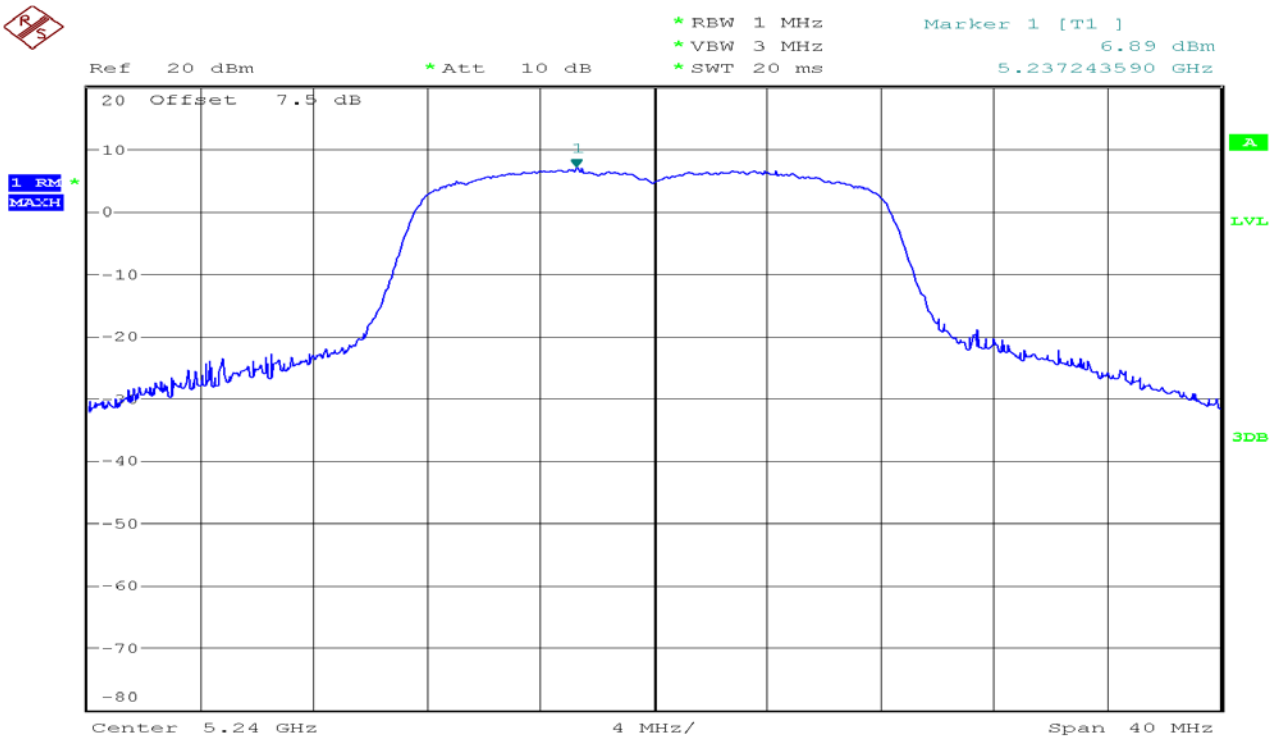


CH Mid



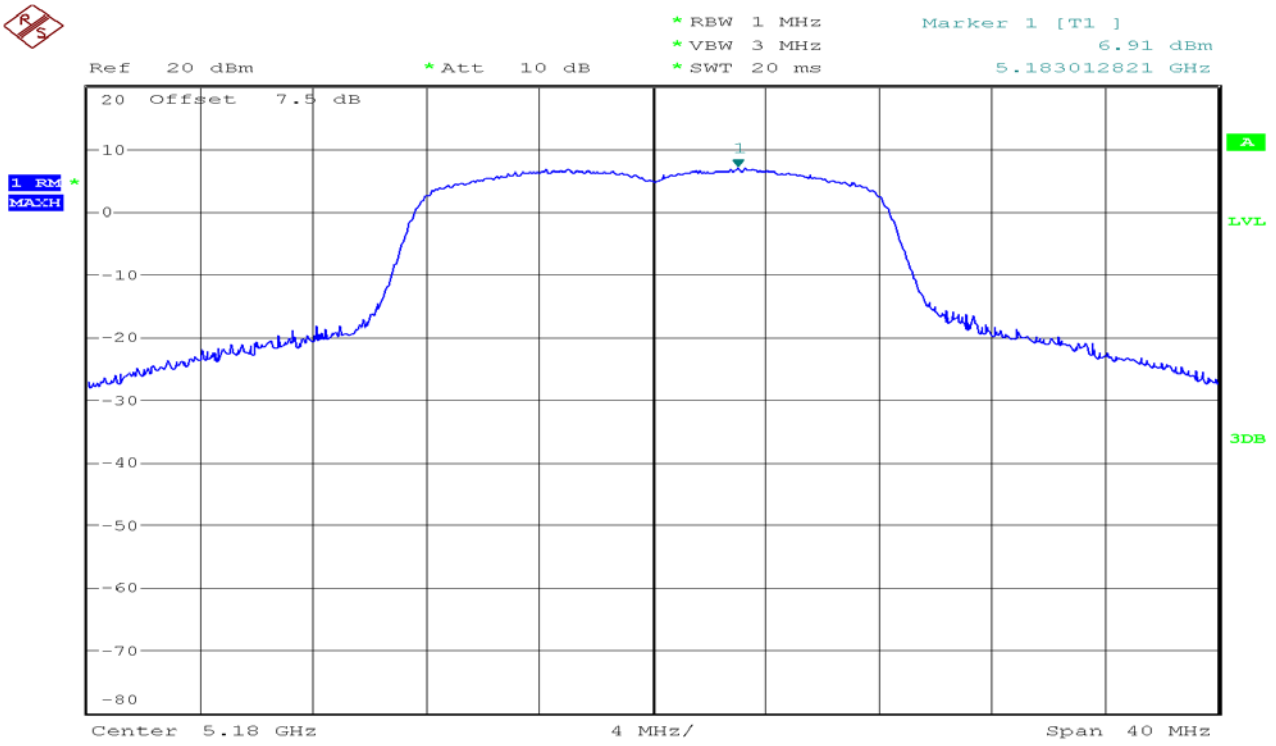
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH High



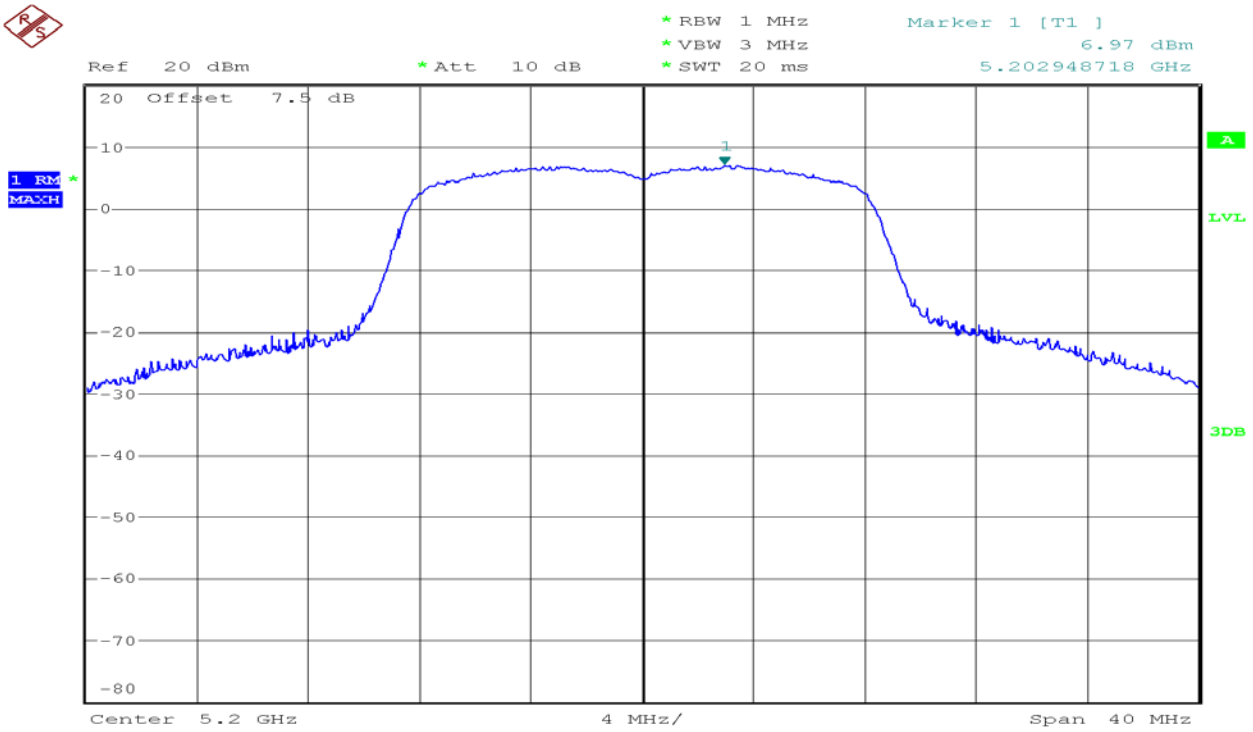
IEEE 802.11a mode/Chain 2:

CH Low

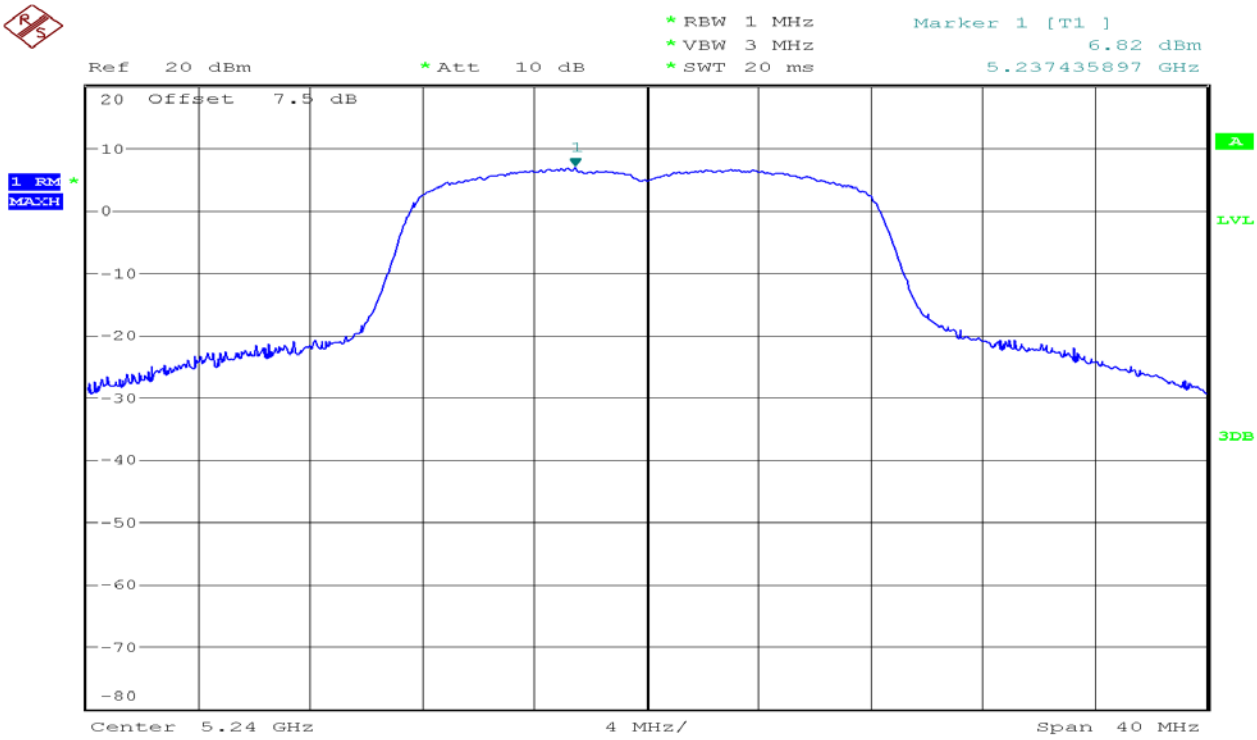


This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH Mid



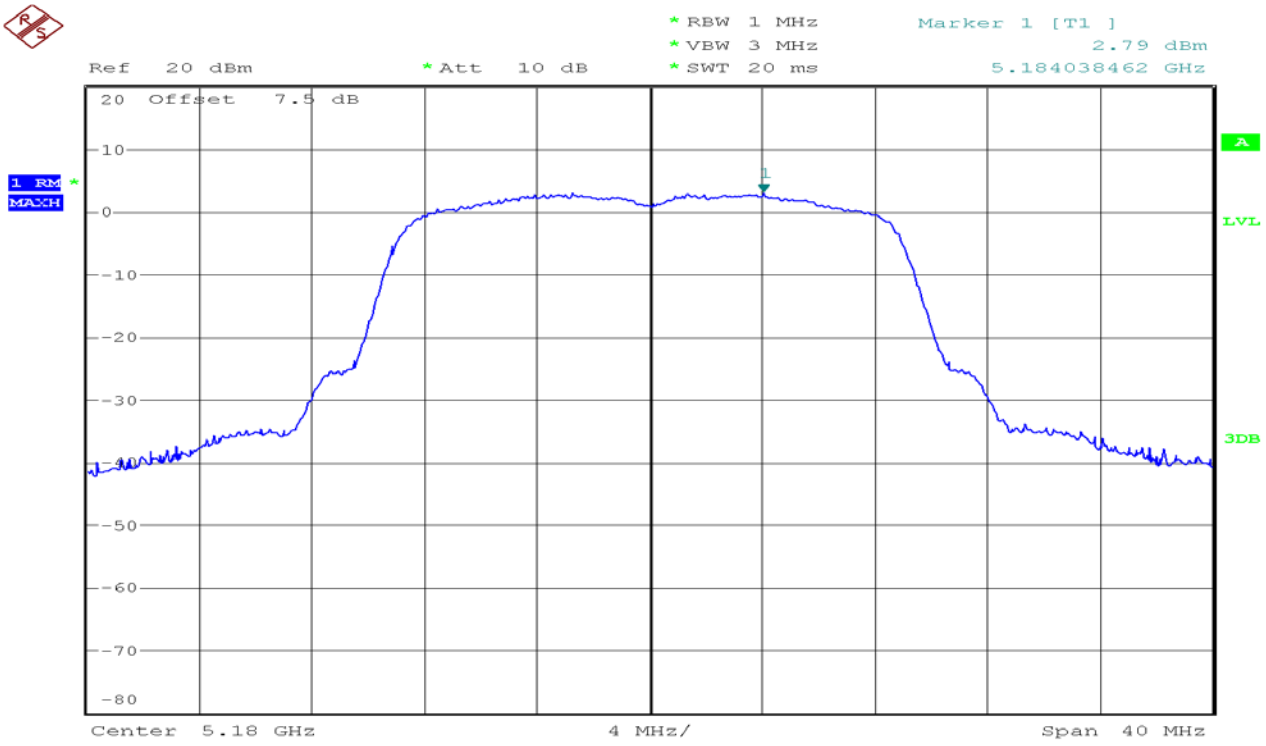
CH High



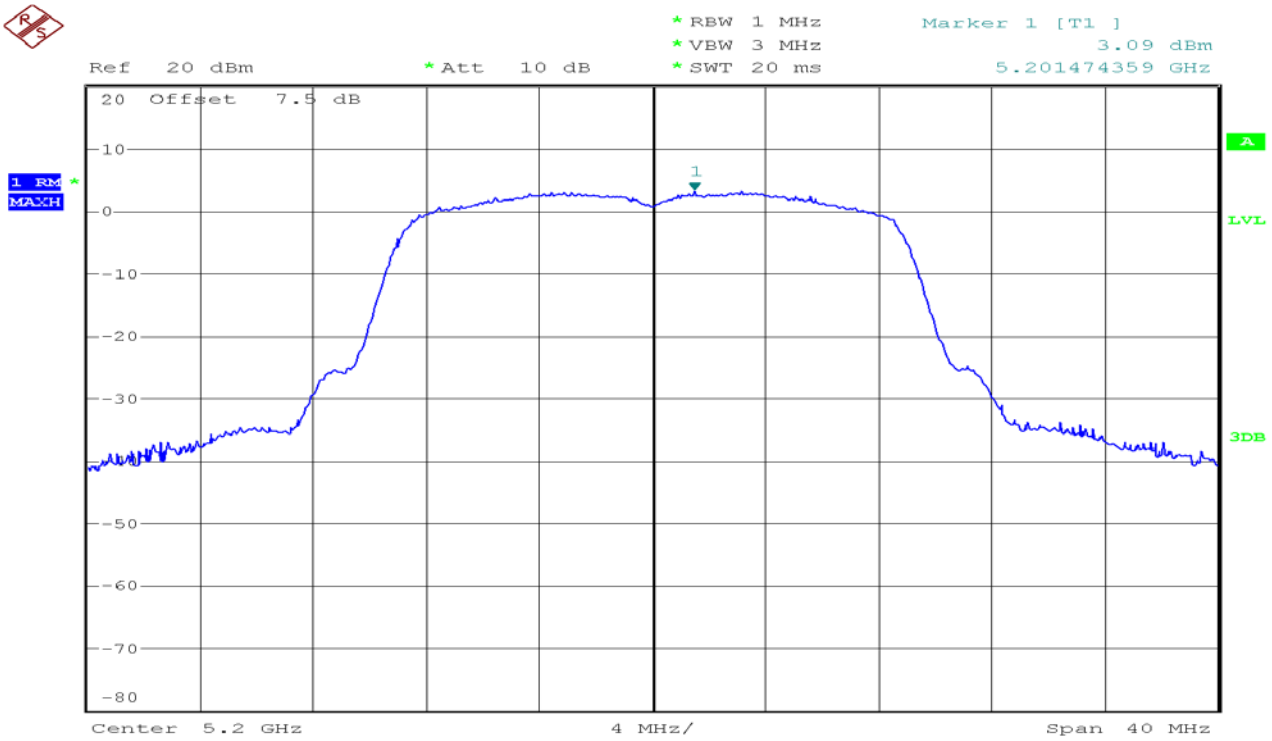
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

IEEE 802.11an HT20 mode/Chain 1:

CH Low

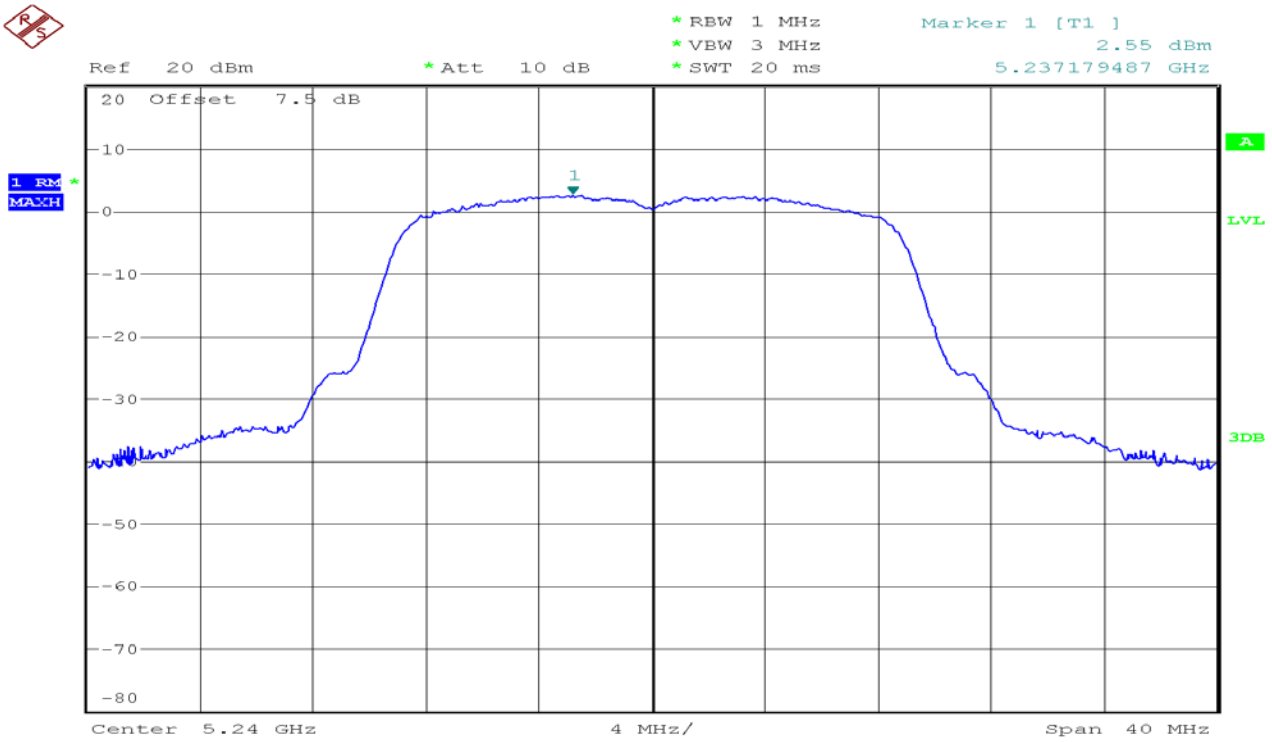


CH Mid



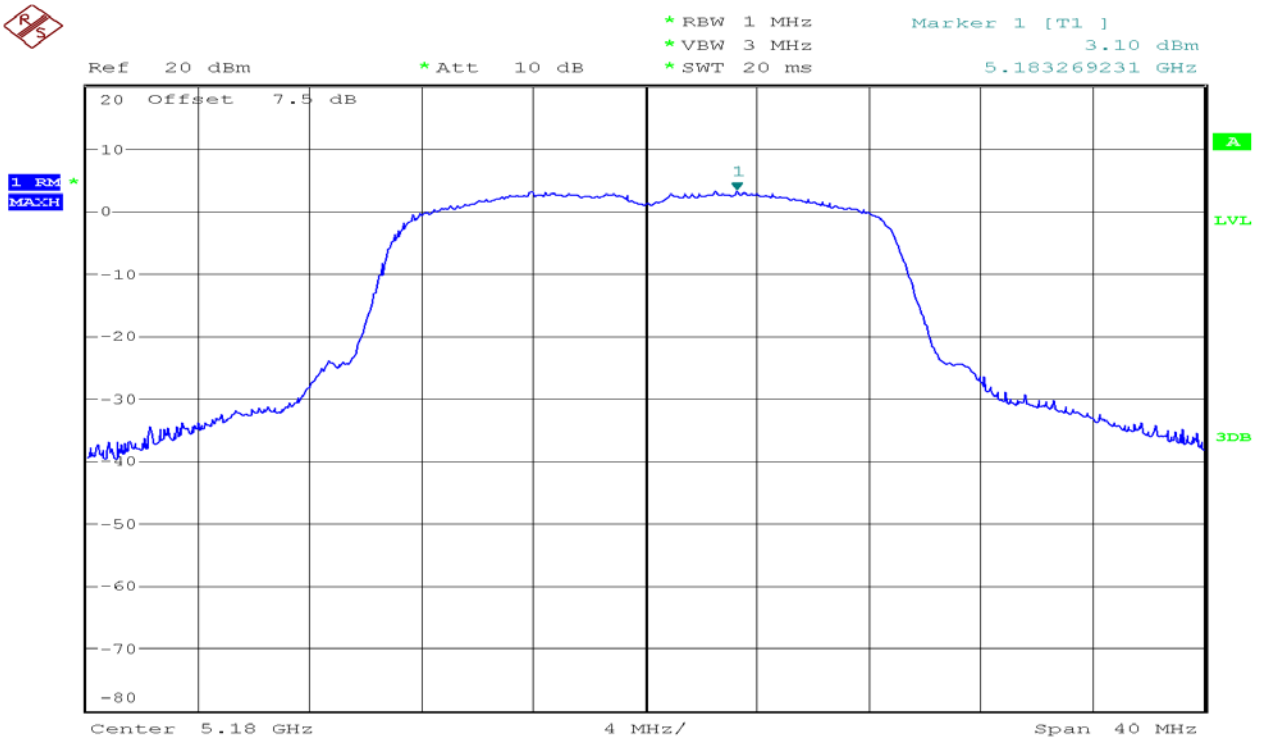
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH High



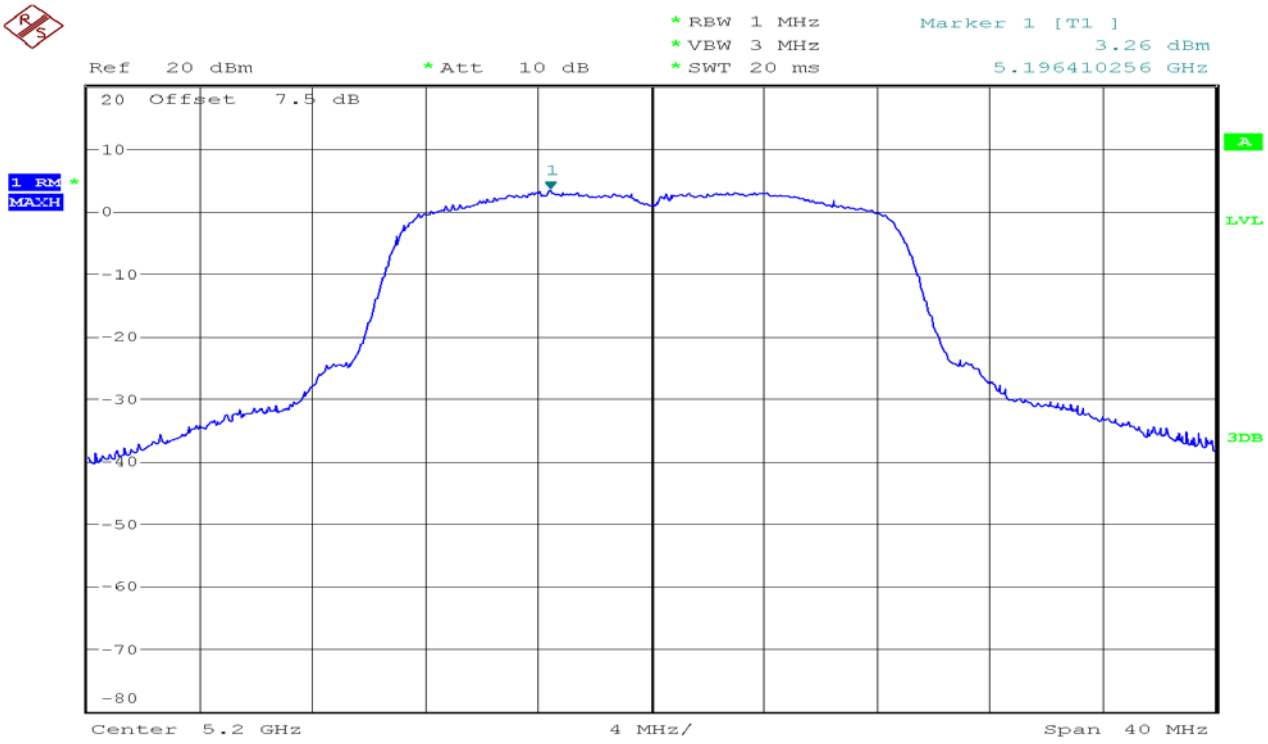
IEEE 802.11an HT20 mode/Chain 2:

CH Low

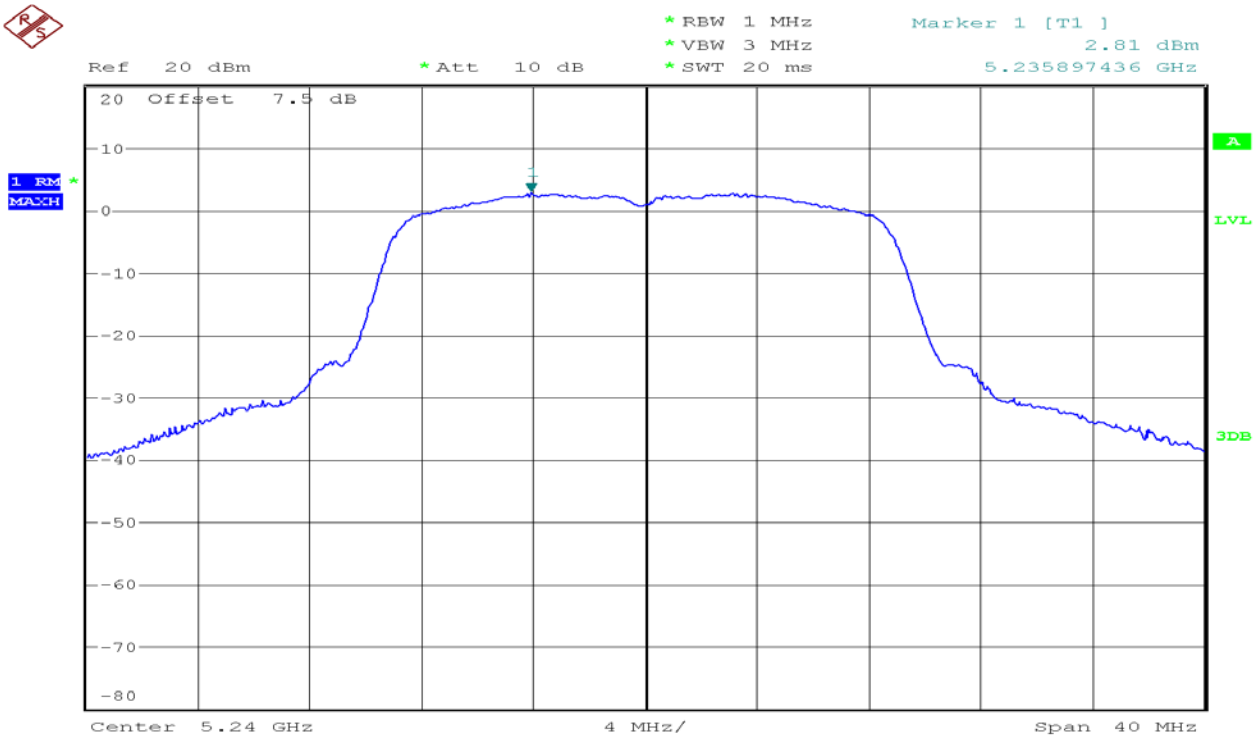


This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

CH Mid



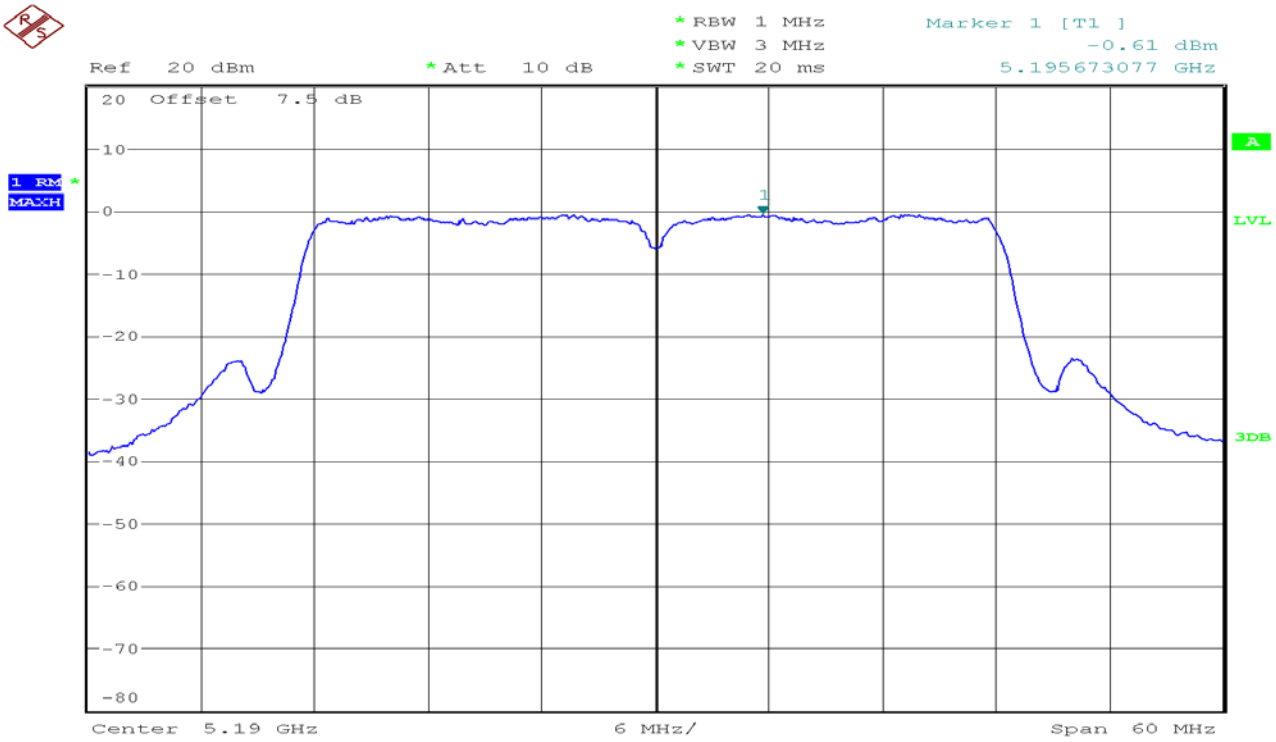
CH High



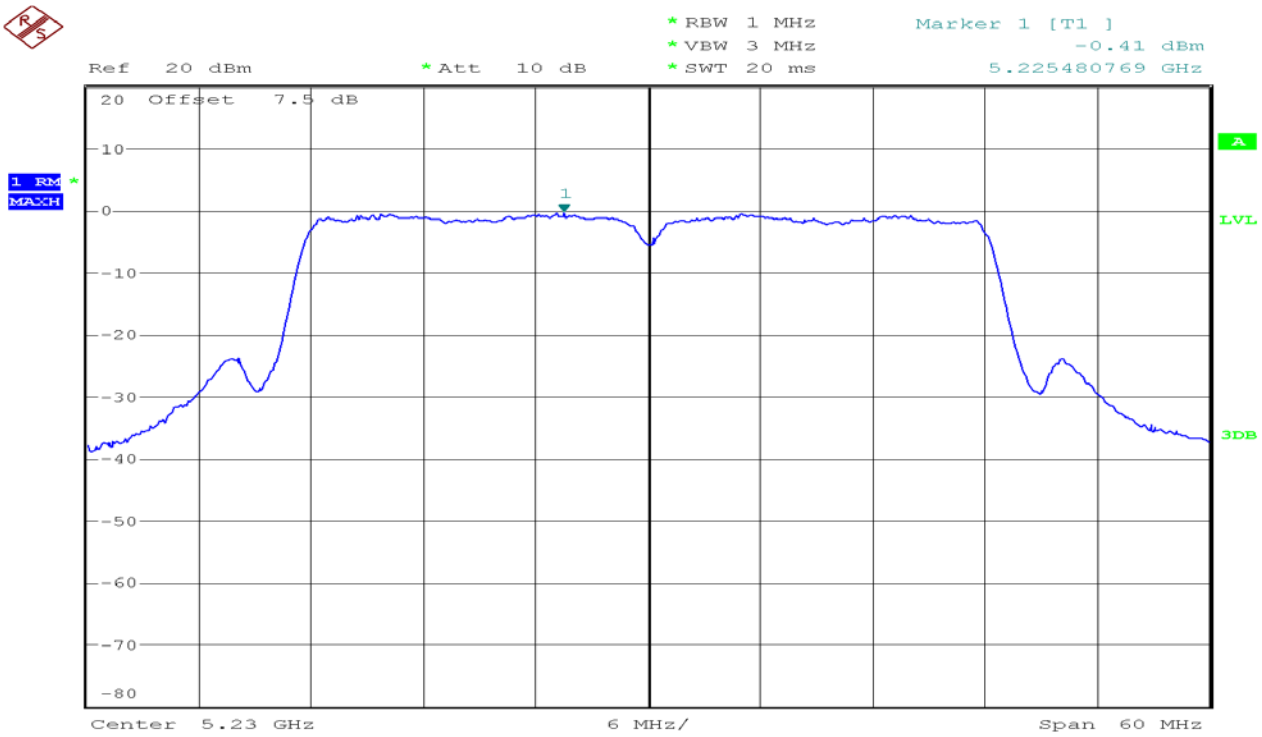
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

IEEE 802.11an HT40 mode/Chain 1:

CH Low



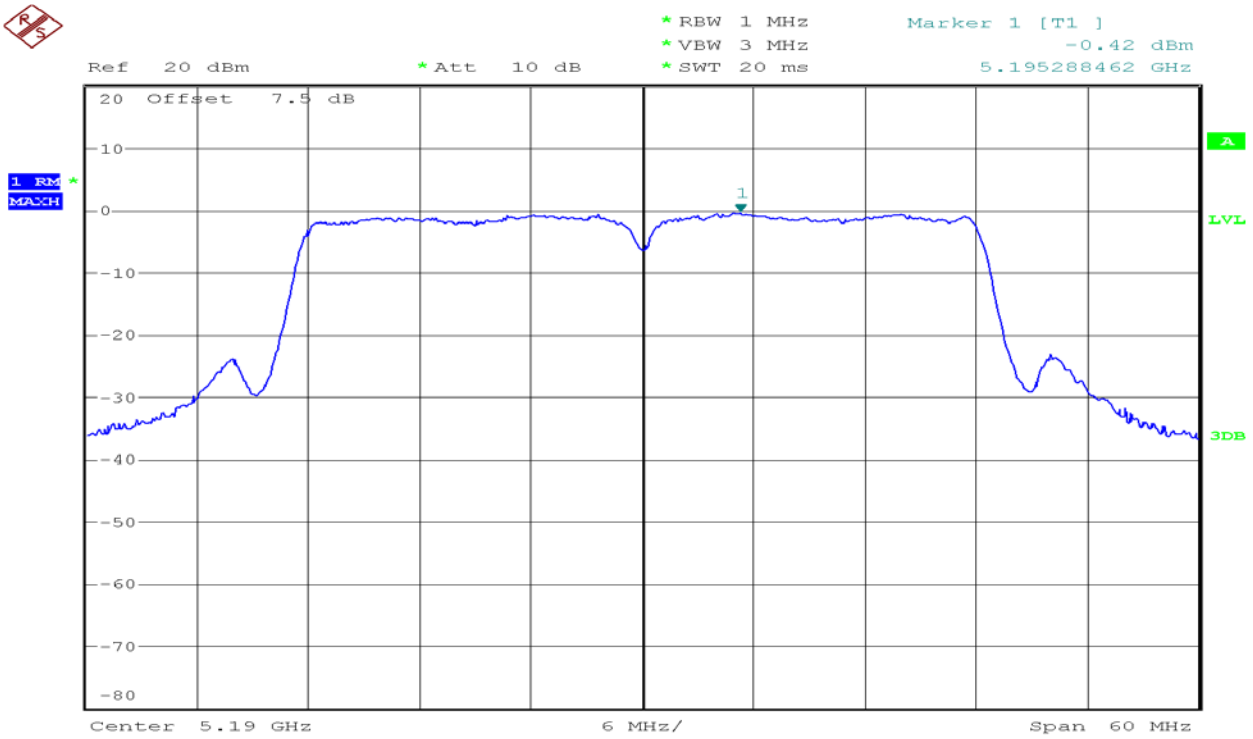
CH High



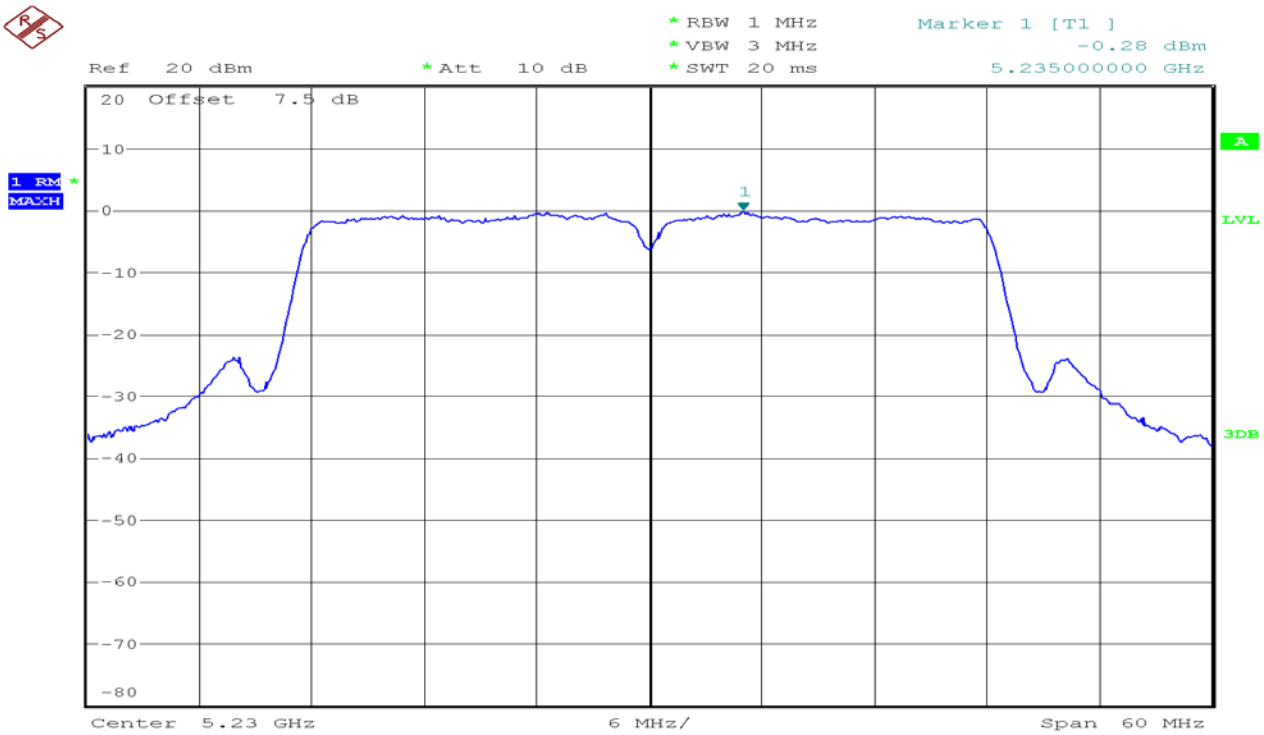
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

IEEE 802.11an HT40 mode/Chain 2:

CH Low



CH High



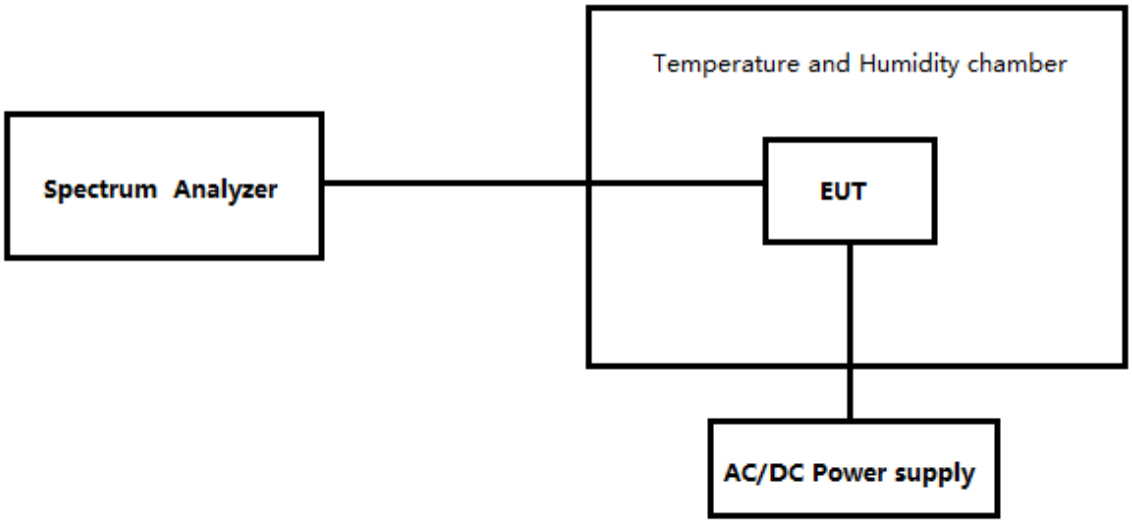
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

7.6 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.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

TEST RESULTS

U-NII-1-(5150MHz-5250MHz)					
Freq.(MHz)	Center Frequency (MHz)	Frequency Deviation (MHz)	Frequency Stability (ppm)	Temperature (°C)	Voltage (V)
5180	5179.991628	0.008	1.62	25	V_{min}
5180	5179.982354	0.018	3.41	25	V_{max}
5180	5179.992634	0.007	1.42	25	V_{nor}
5180	5180.036421	0.036	7.03	-20	V_{nor}
5180	5180.070163	0.070	13.54	80	V_{nor}

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

7.7 RADIATED UNDESIRABLE EMISSION

LIMIT

Radiated emissions from 9 kHz to 40 GHz 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 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.
   For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.
   For transmitters operating in the 5470-5600 MHz and 5650-5725MHz band: all emissions outside of the 5470-5600 MHz and 5650-5725MHz band shall not exceed an EIRP of -27 dBm/MHz.
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 §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.*

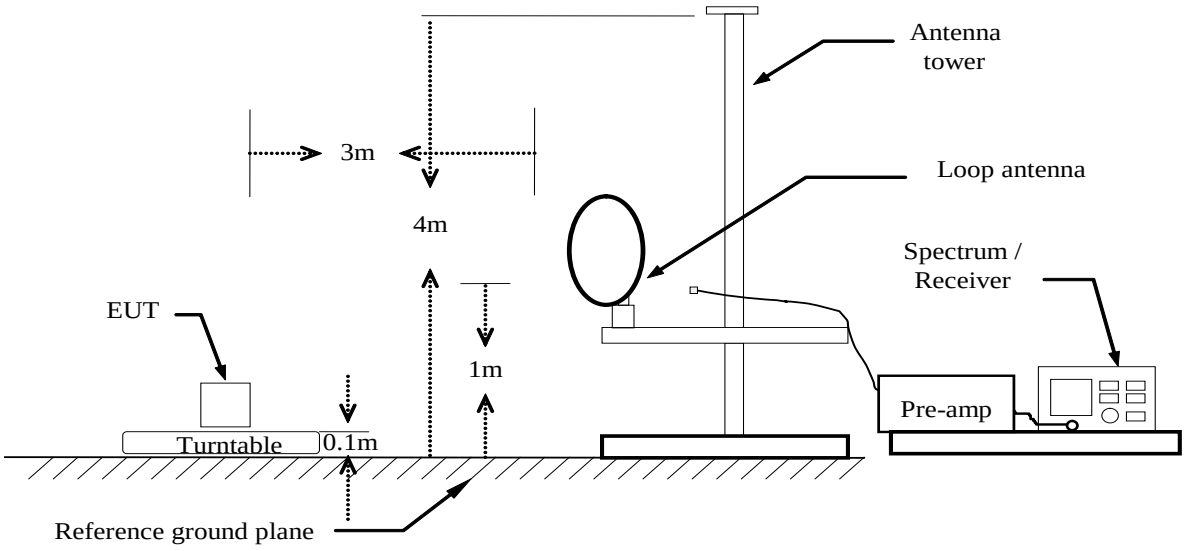
4. In the emission table above, the tighter limit applies at the band edges.

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

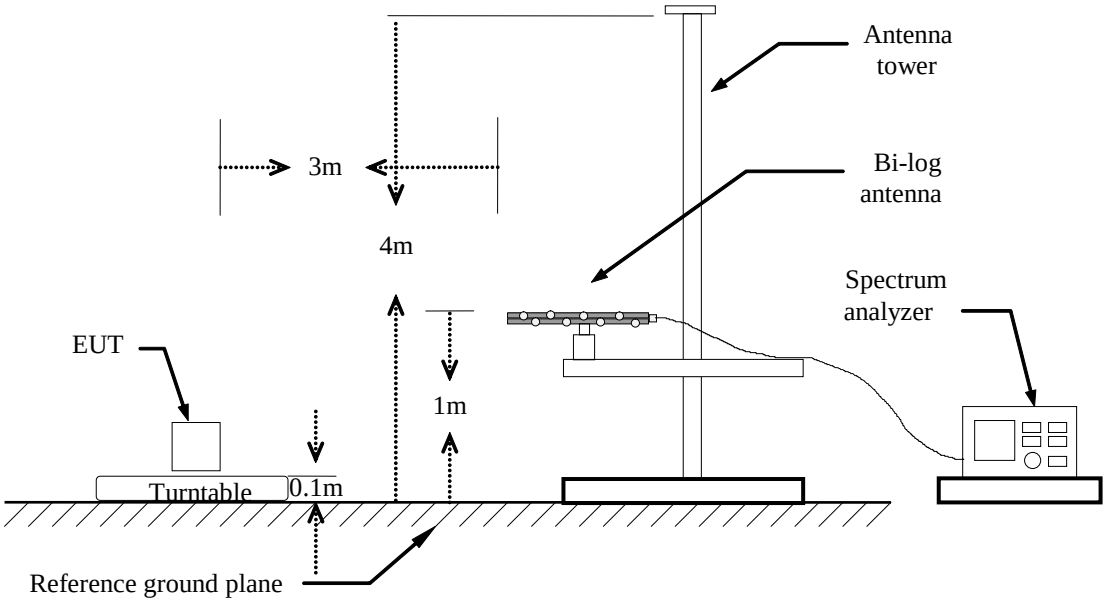
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Test Configuration

Below 30MHz

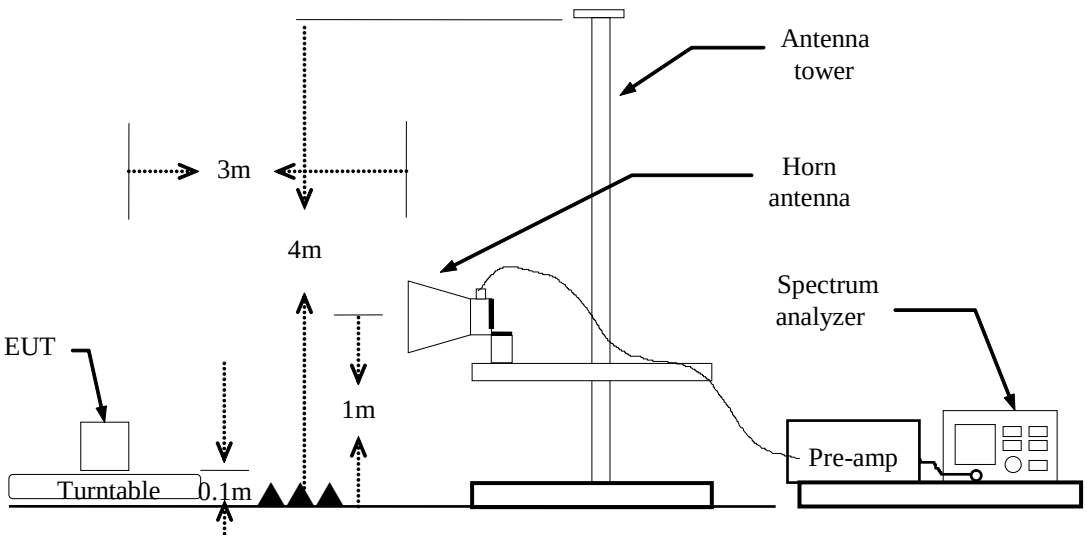


Below 1 GHz



This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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.

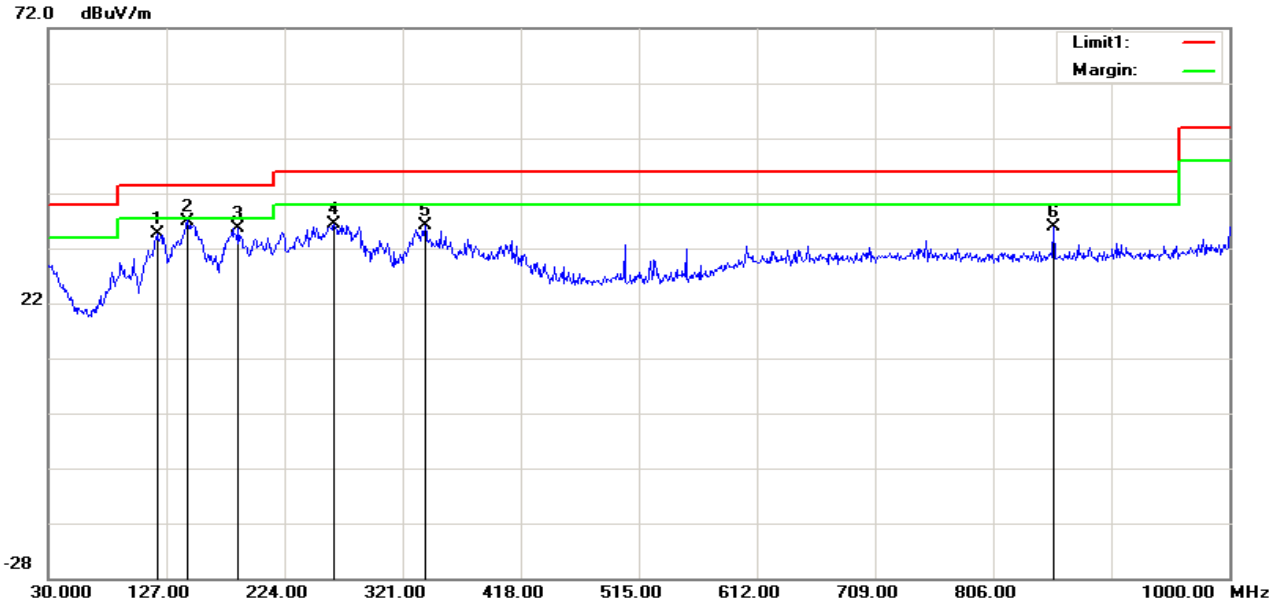
This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

TEST RESULTS

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

30MHz-1GHz

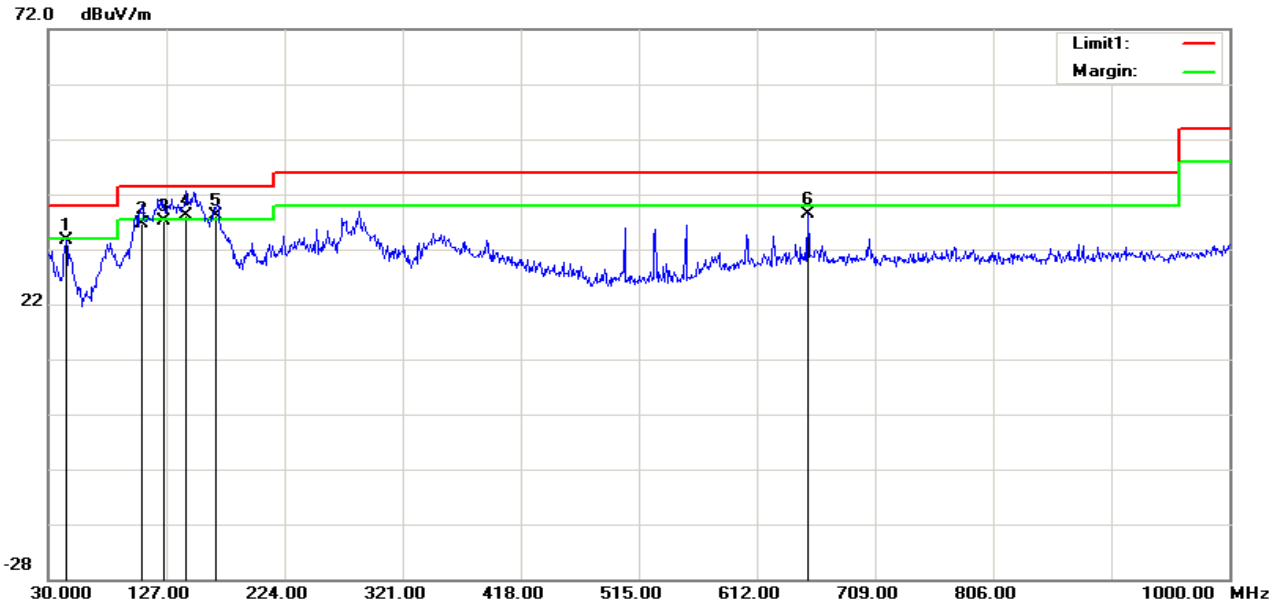
Operation Mode:	Normal Link	**Test Date:**	2018-6-20
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Hor.



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

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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:

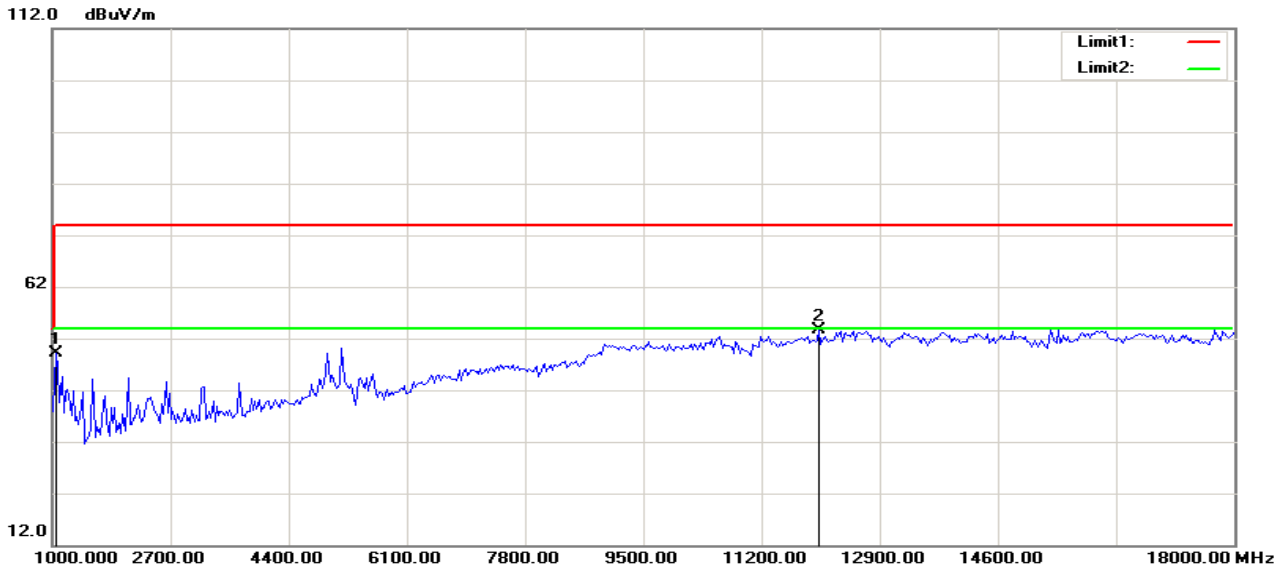
1. Measuring frequencies from 30 MHz to the 1GHz.(no emission found from the lowest internal used/generated frequency to 30MHz)
2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the 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).

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

Above 1 GHz

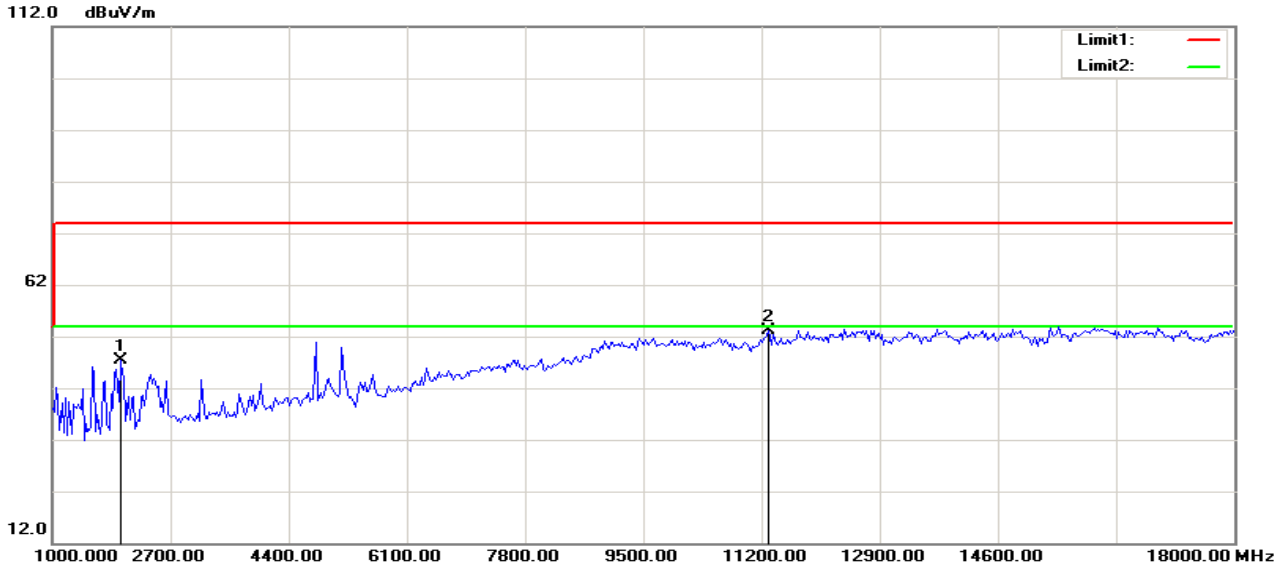
Operation Mode:	Tx / IEEE 802.11a mode CH Low	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1054.487	60.66	-11.52	49.14	74.00	-24.86	100	215	peak
2	12033.654	39.91	13.66	53.57	74.00	-20.43	100	91	peak

Vertical

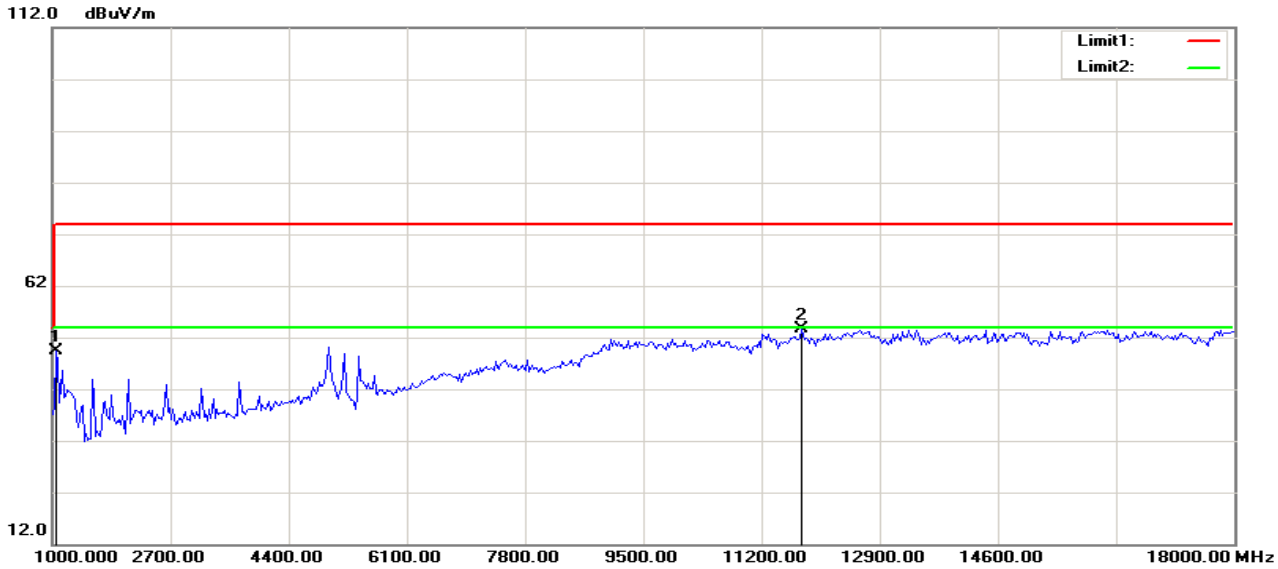


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1980.769	56.25	-8.90	47.35	74.00	-26.65	100	175	peak
2	11298.077	40.25	12.87	53.12	74.00	-20.88	100	184	peak

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

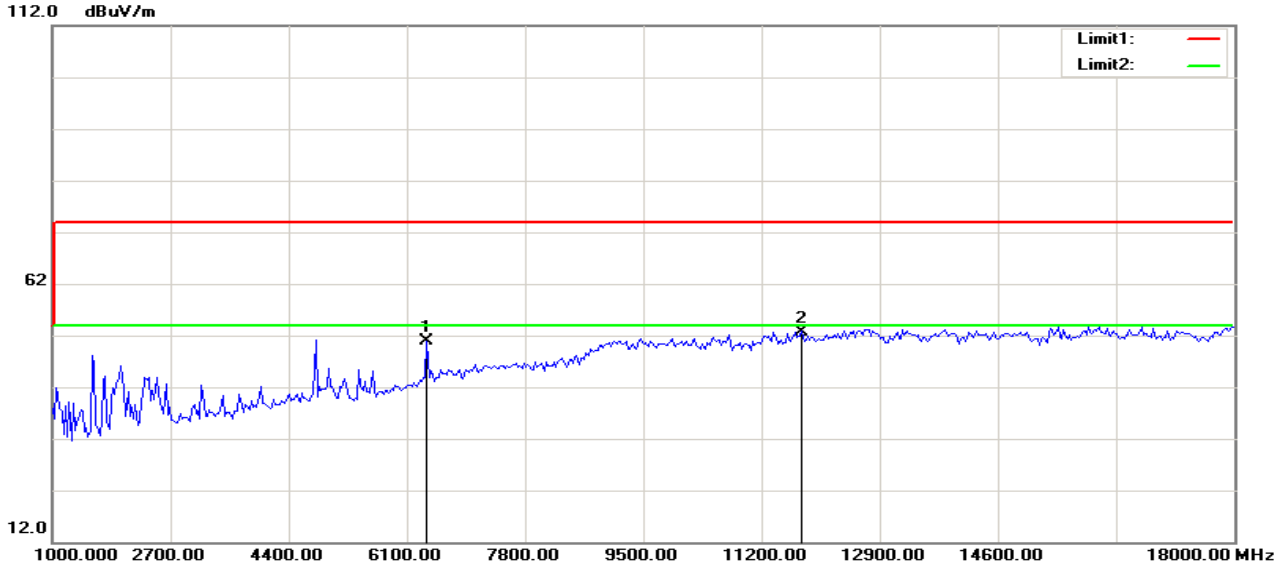
Operation Mode:	Tx / IEEE 802.11a mode CH Mid	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1054.487	60.99	-11.52	49.47	74.00	-24.53	100	200	peak
2	11788.461	40.03	13.54	53.57	74.00	-20.43	100	270	peak

Vertical

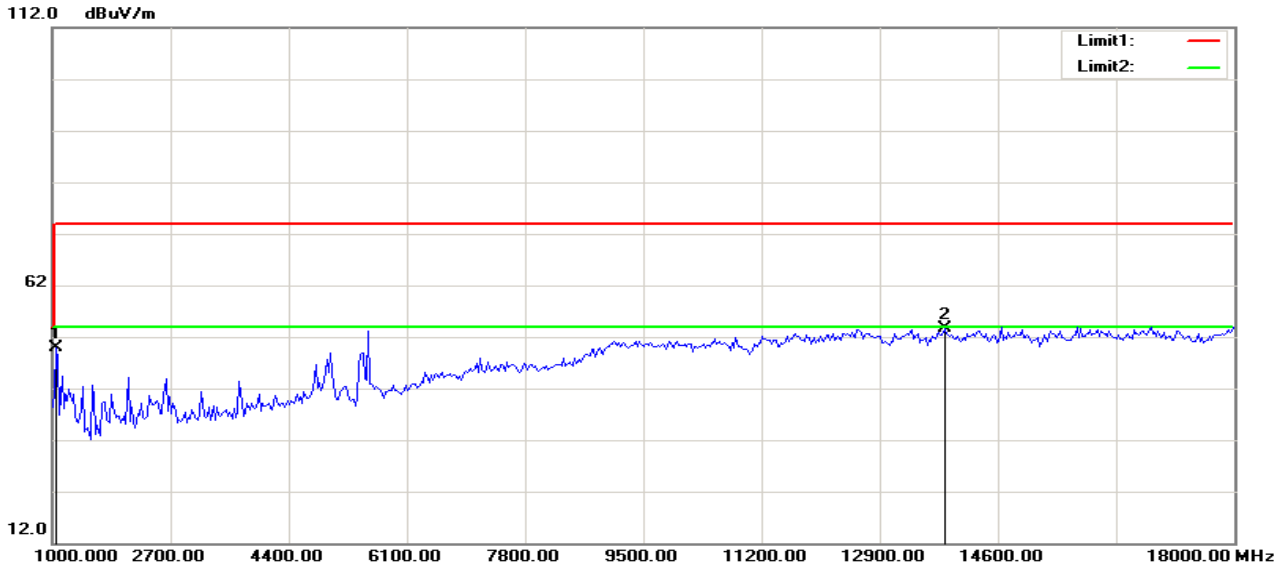


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	6394.231	48.34	2.53	50.87	74.00	-23.13	100	189	peak
2	11788.461	39.21	13.54	52.75	74.00	-21.25	100	338	peak

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

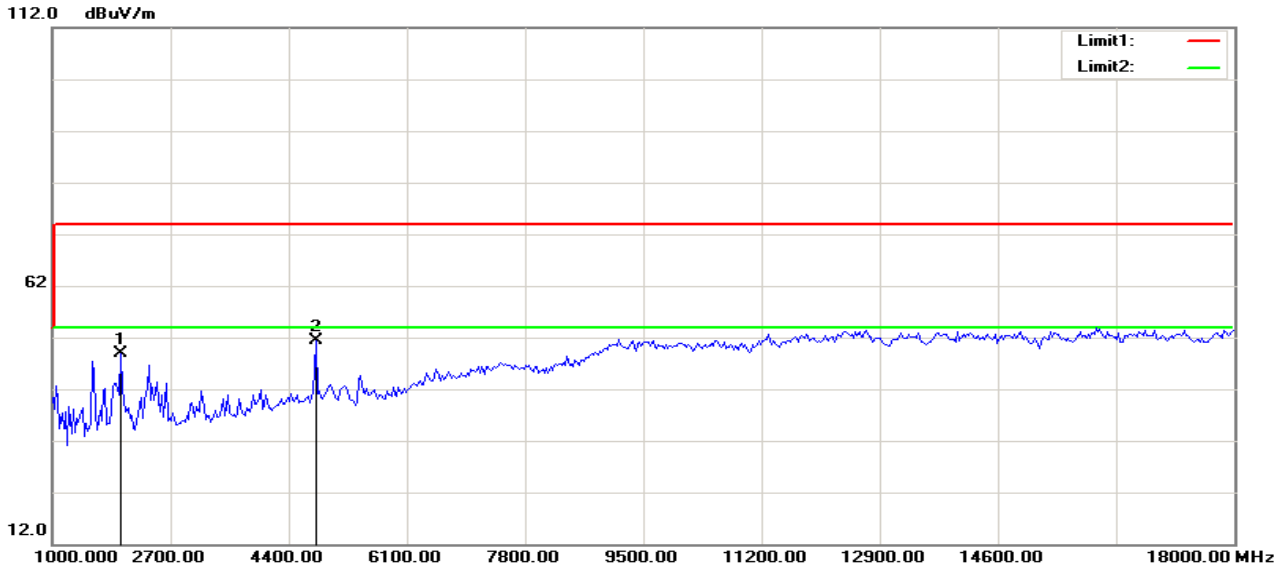
Operation Mode:	Tx / IEEE 802.11a mode CH High	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	1054.487	61.29	-11.52	49.77	74.00	-24.23	100	208	peak
2	13831.731	38.63	14.99	53.62	74.00	-20.38	100	254	peak

Vertical

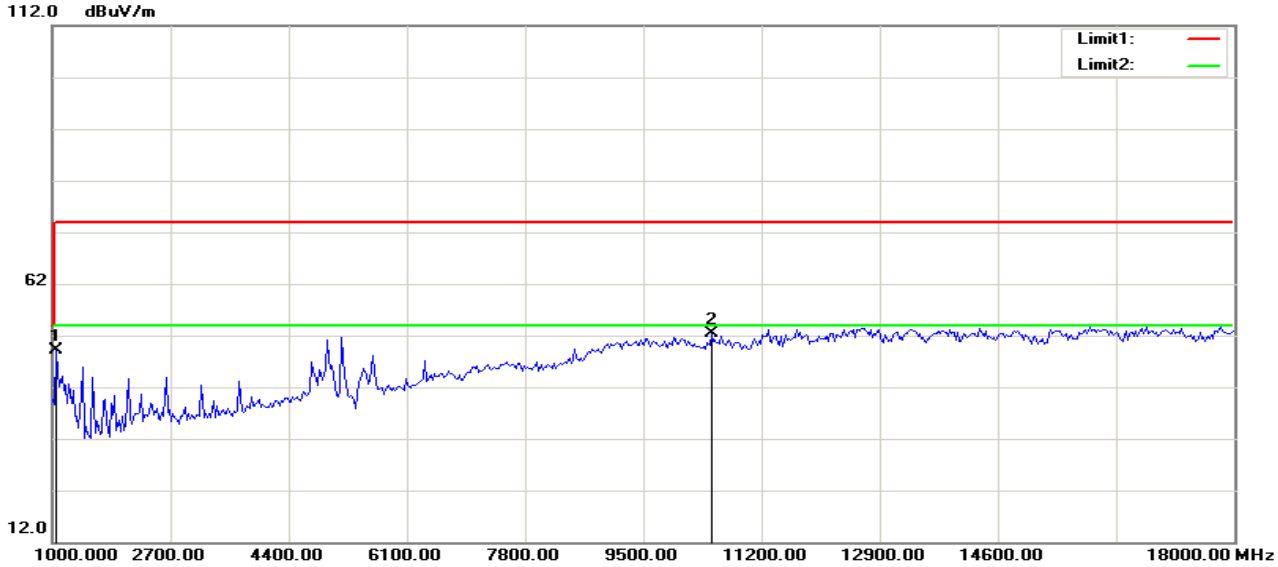


No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	1980.769	57.79	-8.90	48.89	74.00	-25.11	100	169	peak
2	4786.859	51.92	-0.43	51.49	74.00	-22.51	100	284	peak

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

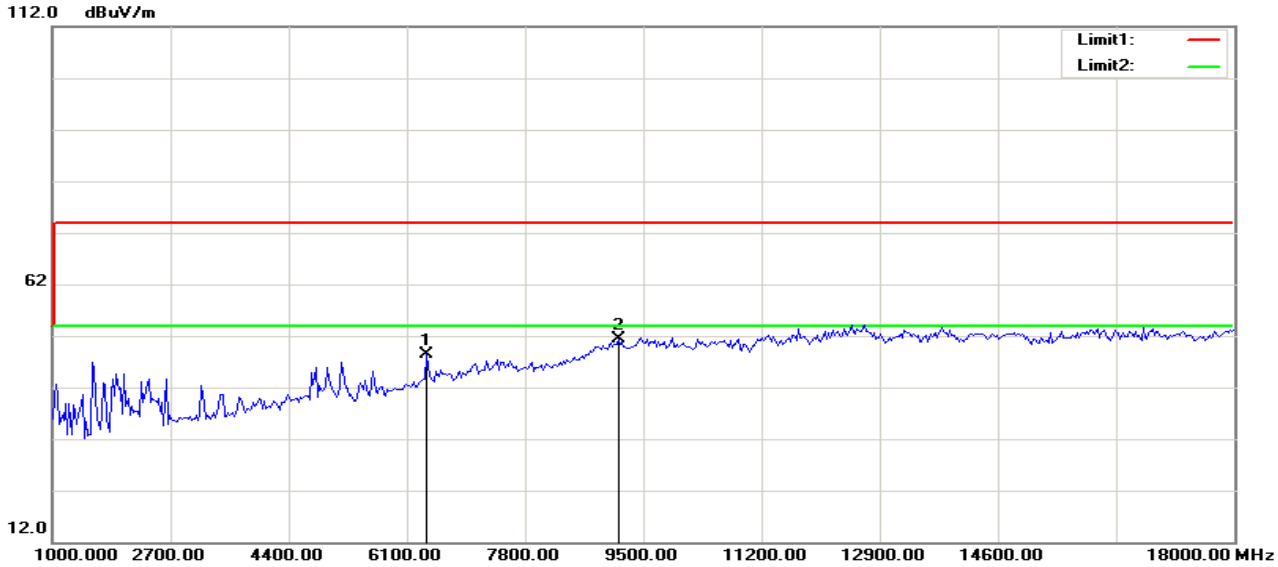
Operation Mode:	TX / IEEE 802.11an HT20 mode /CH Low	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	1054.487	60.57	-11.52	49.05	74.00	-24.95	100	211	peak
2	10480.769	40.43	11.88	52.31	74.00	-21.69	100	39	peak

Vertical

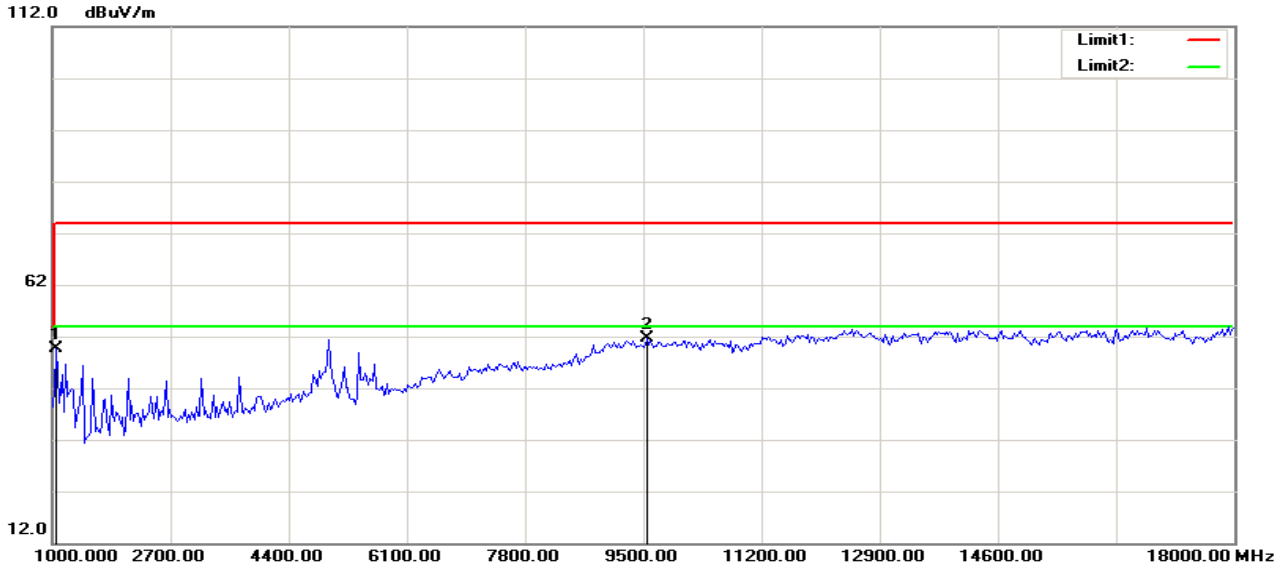


No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	6394.231	45.76	2.53	48.29	74.00	-25.71	100	198	peak
2	9145.833	40.78	10.51	51.29	74.00	-22.71	100	328	peak

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

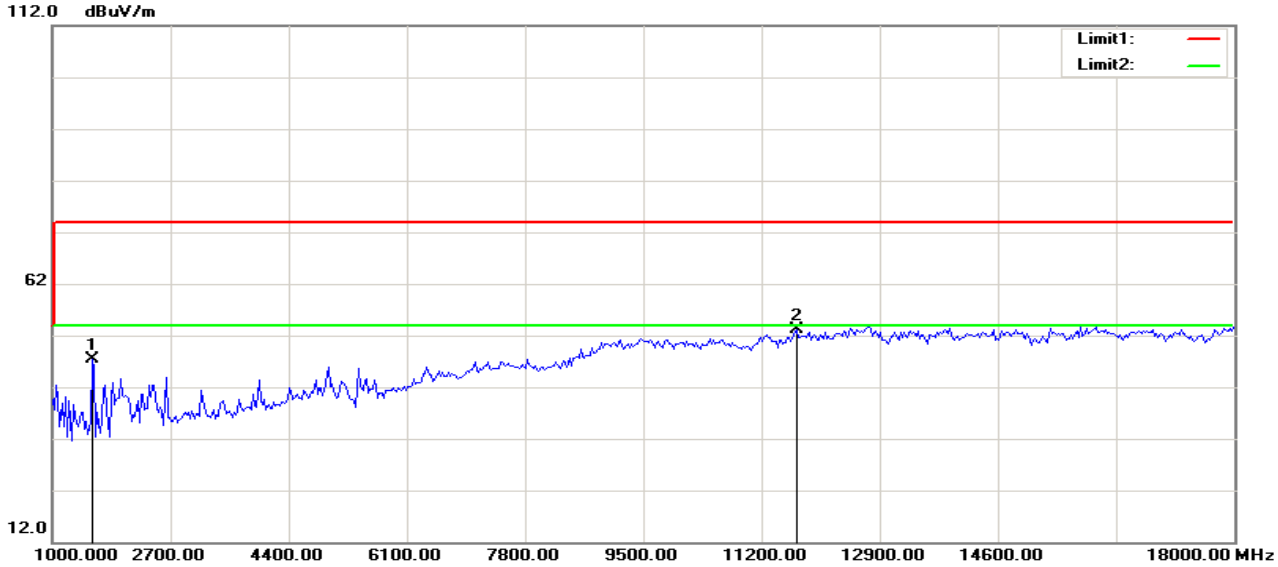
Operation Mode:	TX / IEEE 802.11an HT20 mode /CH Mid	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1054.487	61.17	-11.52	49.65	74.00	-24.35	100	212	peak
2	9554.487	40.23	11.28	51.51	74.00	-22.49	100	10	peak

Vertical

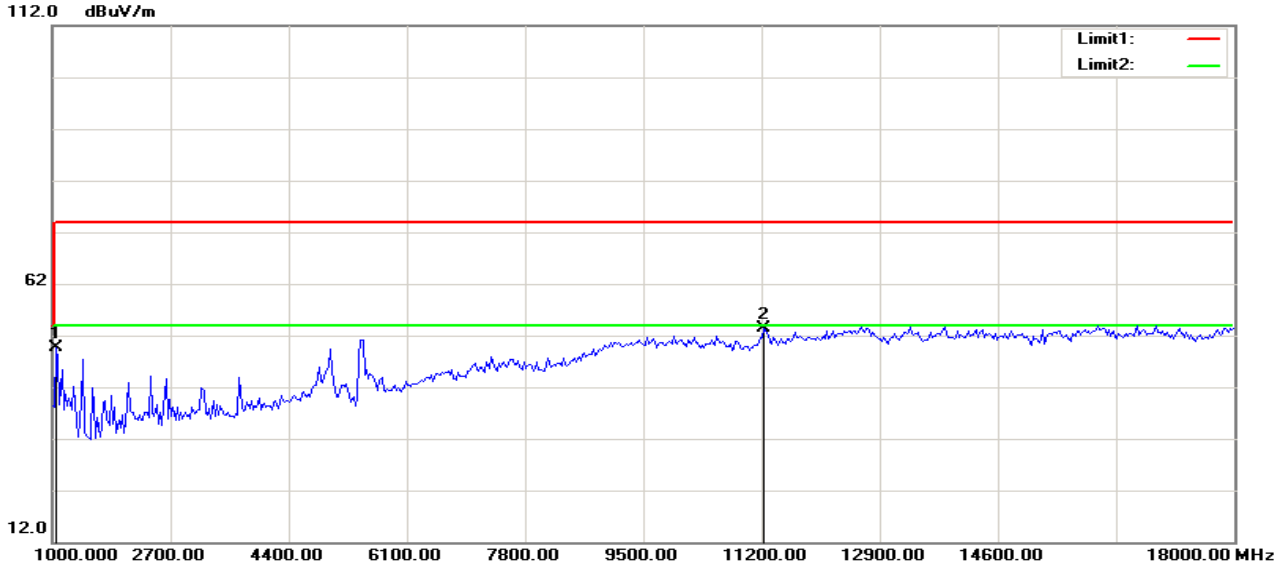


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1572.115	57.26	-9.85	47.41	74.00	-26.59	100	308	peak
2	11706.731	39.62	13.55	53.17	74.00	-20.83	100	299	peak

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

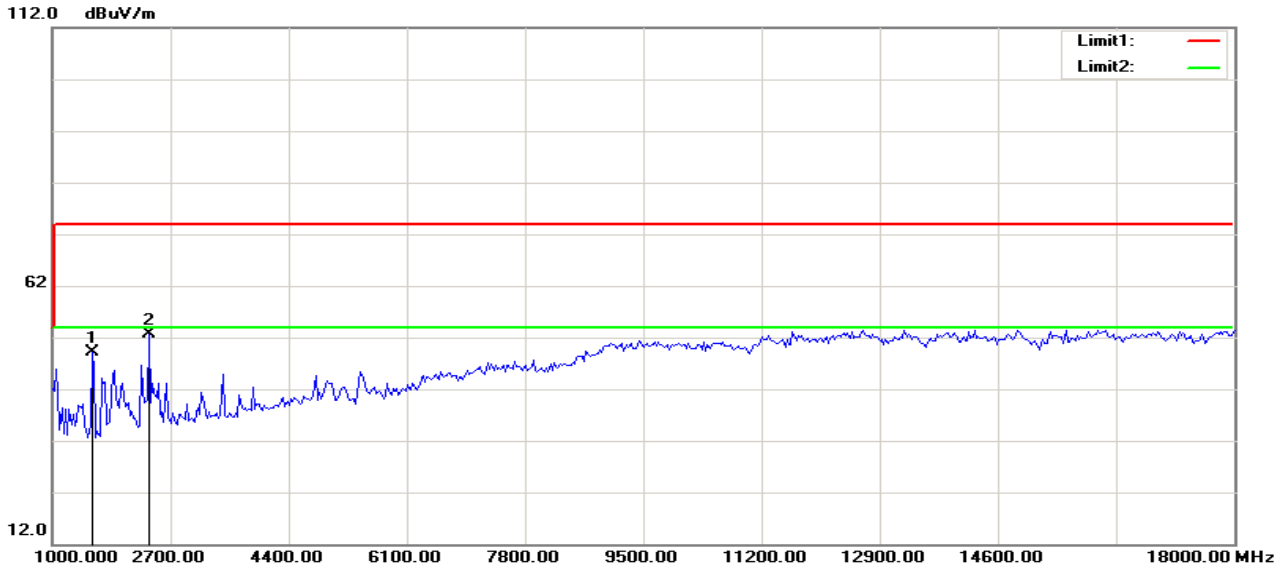
Operation Mode:	TX / IEEE 802.11an HT20 mode /CH High	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1054.487	61.11	-11.52	49.59	74.00	-24.41	100	194	peak
2	11243.590	40.70	12.68	53.38	74.00	-20.62	100	341	peak

Vertical

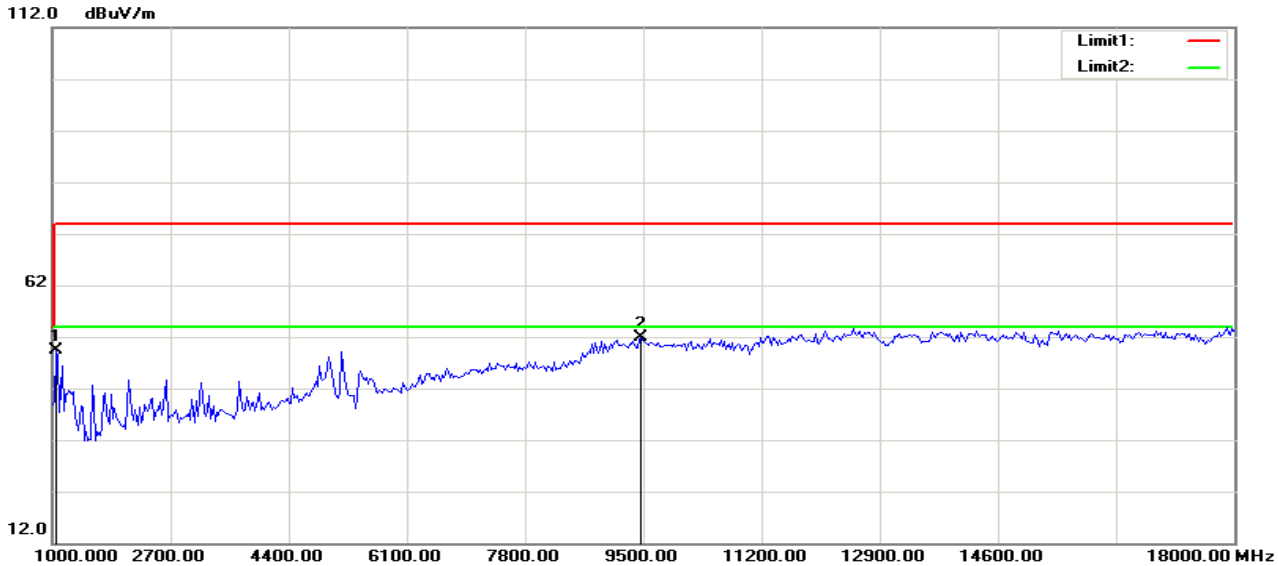


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (deg.)	Remark
1	1572.115	58.97	-9.85	49.12	74.00	-24.88	100	344	peak
2	2389.423	60.29	-7.57	52.72	74.00	-21.28	100	177	peak

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

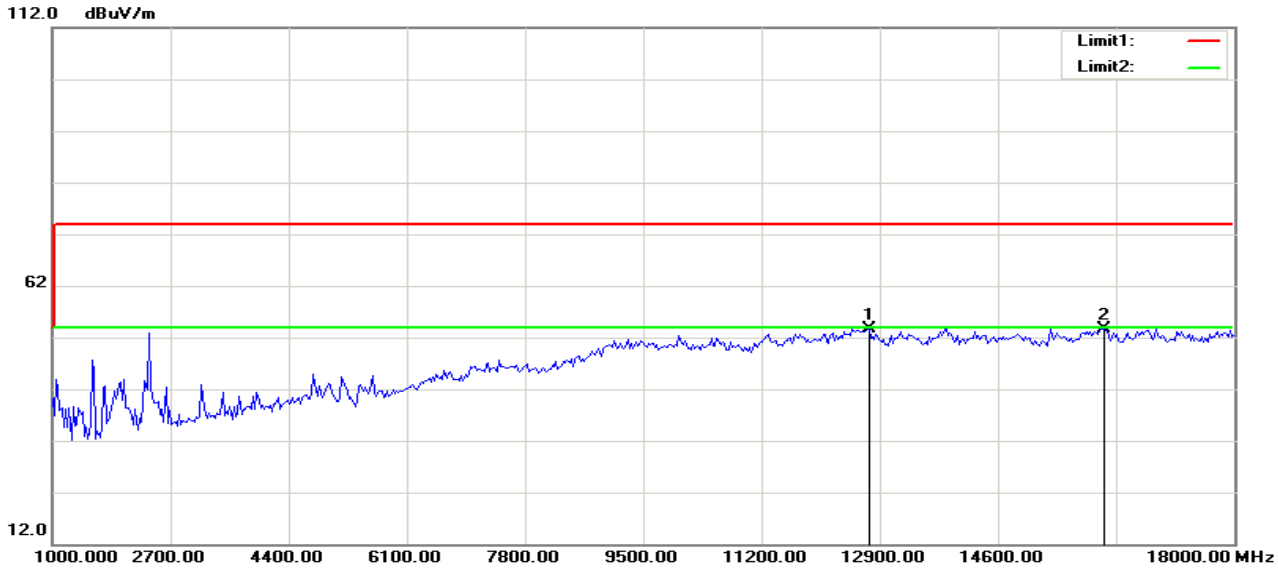
Operation Mode:	TX / IEEE 802.11an HT40 mode /CH Low	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	1054.487	60.81	-11.52	49.29	74.00	-24.71	100	198	peak
2	9472.756	40.73	11.21	51.94	74.00	-22.06	100	143	peak

Vertical

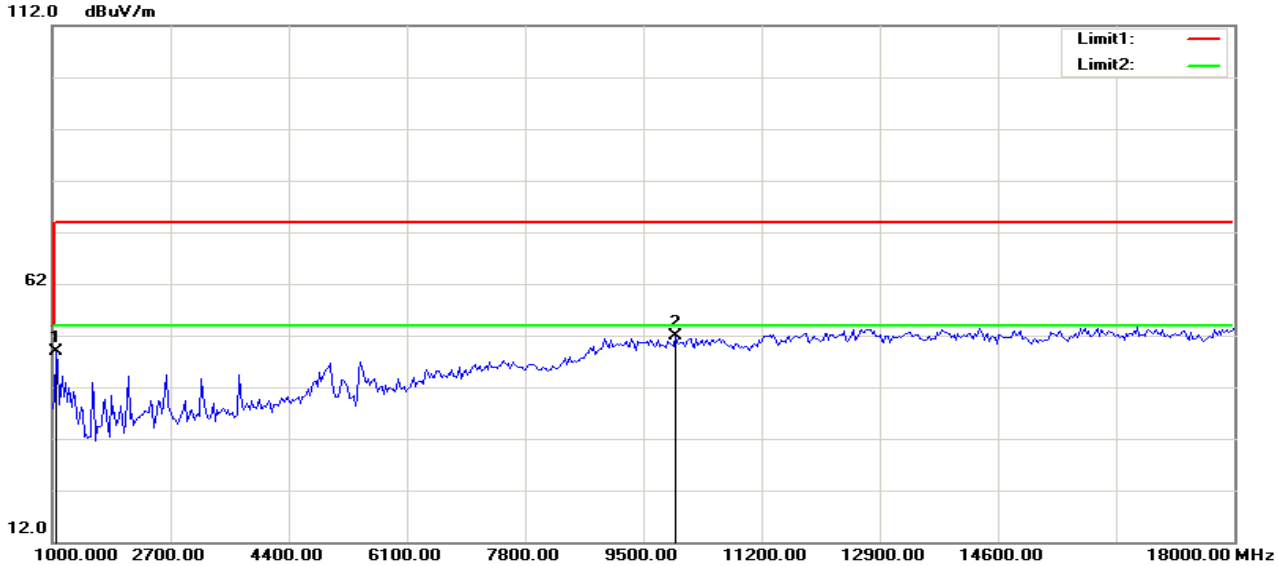


No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	12741.987	38.43	15.11	53.54	74.00	-20.46	100	268	peak
2	16120.192	35.96	17.77	53.73	74.00	-20.27	100	180	peak

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

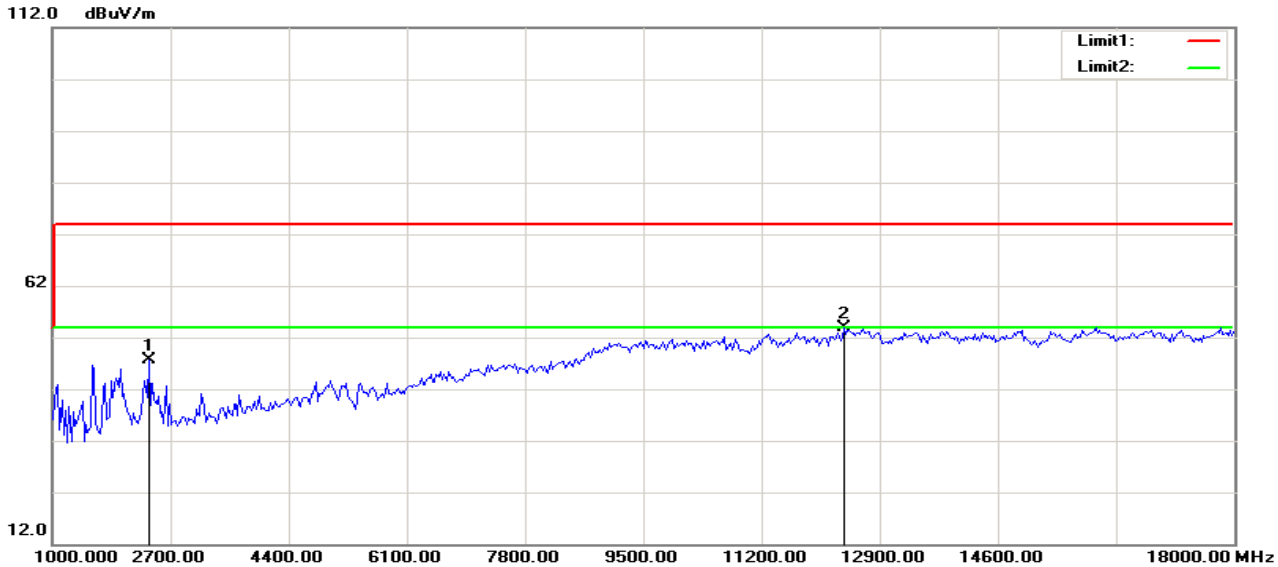
Operation Mode:	TX / IEEE 802.11an HT40 mode /CH High	**Test Date:**	2018-5-17
Temperature:	25°C	**Tested by:**	Lily.Wang
Humidity:	40% RH	**Polarity:**	Ver. / Hor.

Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	1054.487	60.45	-11.52	48.93	74.00	-25.07	100	203	peak
2	9963.141	40.49	11.37	51.86	74.00	-22.14	100	360	peak

Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Height	Degree	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg.)	
1	2389.423	55.08	-7.57	47.51	74.00	-26.49	100	177	peak
2	12387.820	38.63	15.21	53.84	74.00	-20.16	100	139	peak

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

7.8 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 µH/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 (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

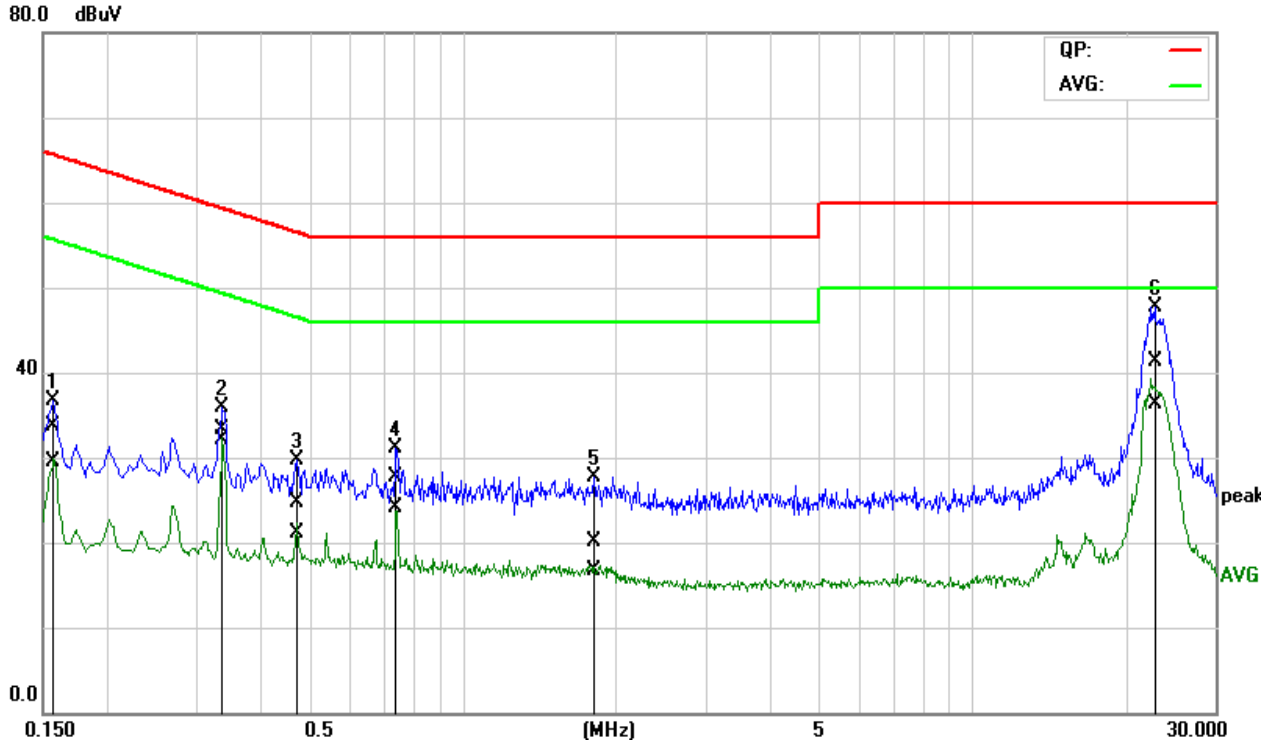
The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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



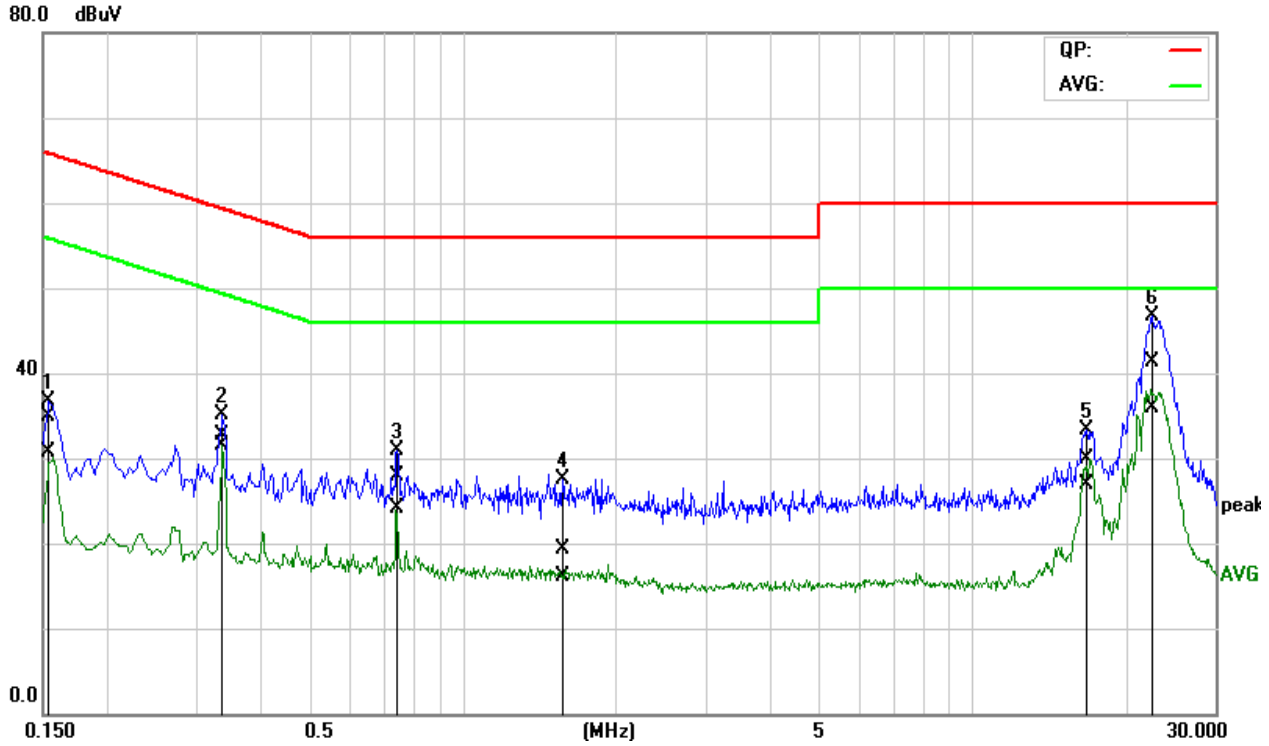
No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.1578	14.34	10.07	19.43	33.77	29.50	65.57	55.58	-31.80	-26.08	Pass
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).

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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



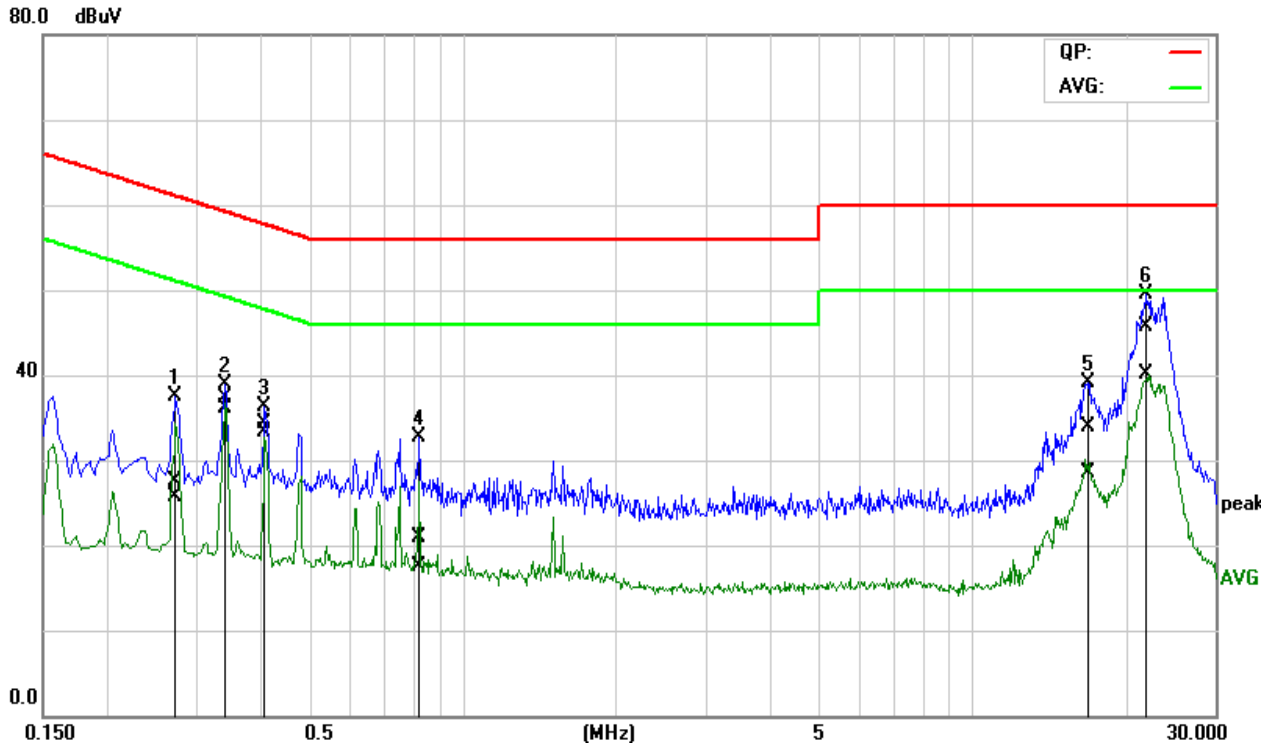
No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.1554	15.41	11.19	19.43	34.84	30.62	65.70	55.71	-30.86	-25.09	Pass
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).

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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



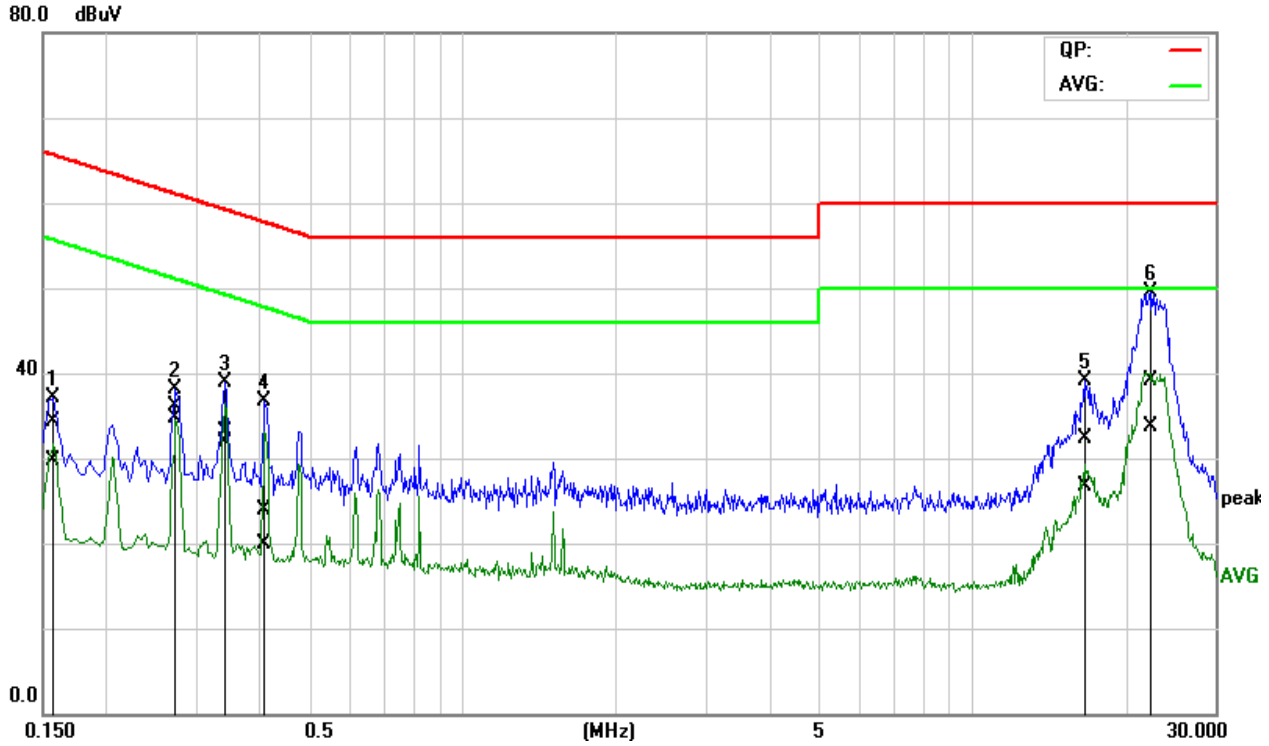
No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1	0.2741	8.03	6.31	19.46	27.49	25.77	60.99	50.99	-33.50	-25.22	Pass
2	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).

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.

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

This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc.