FCC PART 15.407

TEST REPORT

For

Qolsys, Inc.

1900 The Alameda 4th Floor, San Jose, California 95126, United States

Tested Model: IQ Hub
FCC ID: 2AAJXQS-IQHUB

Report Type:	**Equipment Name:**
Original Report	IQ Hub

Report Number:	RSC191224001-0C
Date of Report Issue:	2019-12-31
Reviewed By:	Sula Huang
Prepared By:	Bay Area Compliance Laboratories Corp. (Chengdu) No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China Tel: +86-28-65525123 Fax: +86-28-65525125 www.baclcorp.com

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant	Qolsys, Inc.
Product	IQ Hub
Tested Model	IQ Hub
FCC ID	2AAJXQS-IQHUB
Frequency Range	5150~5250 MHz 5725~5850 MHz
Modulation Type	OFDM
Voltage Range	DC 3.7V rechargeable Li-ion battery or DC 12V from adapter
Measure approximately	196.4 mm (L) x 155 mm (W) x 25.6 mm (H)
Sample serial number	191224001/01 (assigned by the BACL, Chengdu)
Sample/EUT Status	The test sample was in good condition and received: 2019-12-24

Note: Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

Objective

This type approval report is prepared on behalf of **Qolsys, Inc.** in accordance with Part 2-Subpart J, Part 15-Subparts A, C and E of the Federal Communications Commission rules.

The tests were performed in order to determine compliance with FCC Part 15, section subpart C, 15.203, 15.205, 15.207, 15.209 and Subpart E, 15.407 rules.

Related Submittal(s)/Grant(s)

FCC Part 15C DXX submissions with FCC ID: 2AAJXQS-IQHUB
FCC Part 15C DTS submissions with FCC ID: 2AAJXQS-IQHUB

Measurement Uncertainty

Item			Uncertainty
AC power line conducted emission			2.24 dB
Radiated Emission(Field Strength)	30MHz-200MHz	H	4.47 dB
		V	4.73 dB
	200MHz-1GHz	H	4.87 dB
		V	5.93 dB
	1GHz-6GHz		4.51 dB
	6GHz-18GHz		4.49 dB
	18GHz-40GHz		5.48 dB
Conducted RF Power			±0.61dB
Power Spectrum Density			±0.61dB
Occupied Bandwidth			±5%
Conducted Emission			±1.5dB
Humidity			±5%
Temperature			±1℃

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the corresponding inclusion factor K when the inclusion probability is about 95%.

Test Methodology

All measurements contained in this report were conducted with:

1. ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

2. KDB 789033 D02 General U-NII Test Procedures New Rules v02r01.

3. KDB 662911 D01 Multiple Transmitter Output v02r01.

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Chengdu) to collect test data is located No.5040, Huilongwan Plaza, No. 1, Shawan Road, Jinniu District, Chengdu, Sichuan, China.

Bay Area Compliance Laboratories Corp. (Chengdu) lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4324.01) and the FCC designation No. CN1186 under the FCC KDB 974614 D01. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The EUT was configured for testing in an engineering mode which was provided by the manufacturer.

The system supports 802.11a/n-ht20/n-ht40/ac20/ac40/ac80, the 802.11ac20/ac40 were reduced since the identical parameters with 802.11n-ht20/n-ht40.

For 5150~5250 MHz band, channels are provided to test as follows:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	44	5220
38	5190	46	5230
40	5200	48	5240
42	5210	/	/

For 802.11a, 802.11n-HT20: Channel 36, 40 and 48 were tested
For 802.11n-HT40: Channel 38, 46 were tested
For ac80: Channel 42 was tested

For 5725~5850 MHz band, channels are provided to test as follows:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	157	5785
151	5755	159	5795
153	5765	161	5805
155	5775	165	5825

For 802.11a, 802.11n-HT20: Channel 149, 157 and 165 were tested.
For 802.11n-HT40: Channel 151, 159 were tested.
For ac80: Channel 155 was tested.

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

EUT Exercise Software

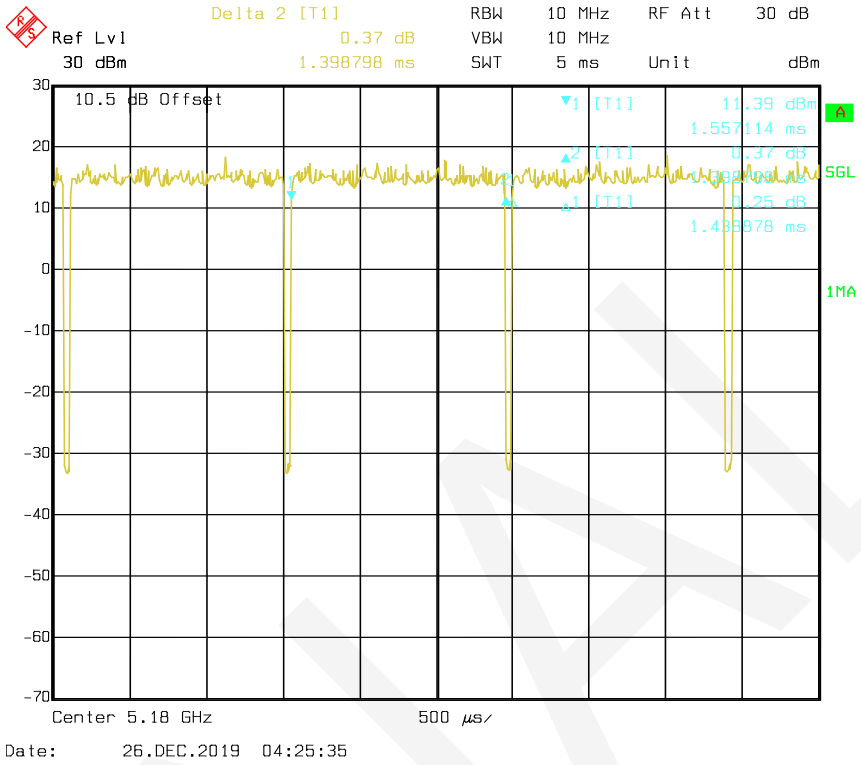
The software “RF Test Tool” was used for testing, which was provided by manufacturer.
The maximum power with maximum duty cycle was set as below:

Software				RF Test Tool	
UNII Band	**Mode**	**Channel**	**Frequency (MHz)**	**Data Rate**	**Power Level**
5150-5250MHz	802.11a	Low	5180	6 Mbps	Default
		Middle	5200	6 Mbps	Default
		High	5240	6 Mbps	Default
	802.11n-HT20	Low	5180	MCS0	Default
		Middle	5200	MCS0	Default
		High	5240	MCS0	Default
	802.11n-HT40	Low	5190	MCS0	Default
		High	5230	MCS0	Default
	802.11ac80	/	5210	MCS0	Default
5725-5850MHz	802.11a	Low	5745	6 Mbps	Default
		Middle	5785	6 Mbps	Default
		High	5825	6 Mbps	Default
	802.11n-HT20	Low	5745	MCS0	Default
		Middle	5785	MCS0	Default
		High	5825	MCS0	Default
	802.11n-HT40	Low	5755	MCS0	Default
		High	5795	MCS0	Default
	802.11ac80	/	5775	MCS0	Default

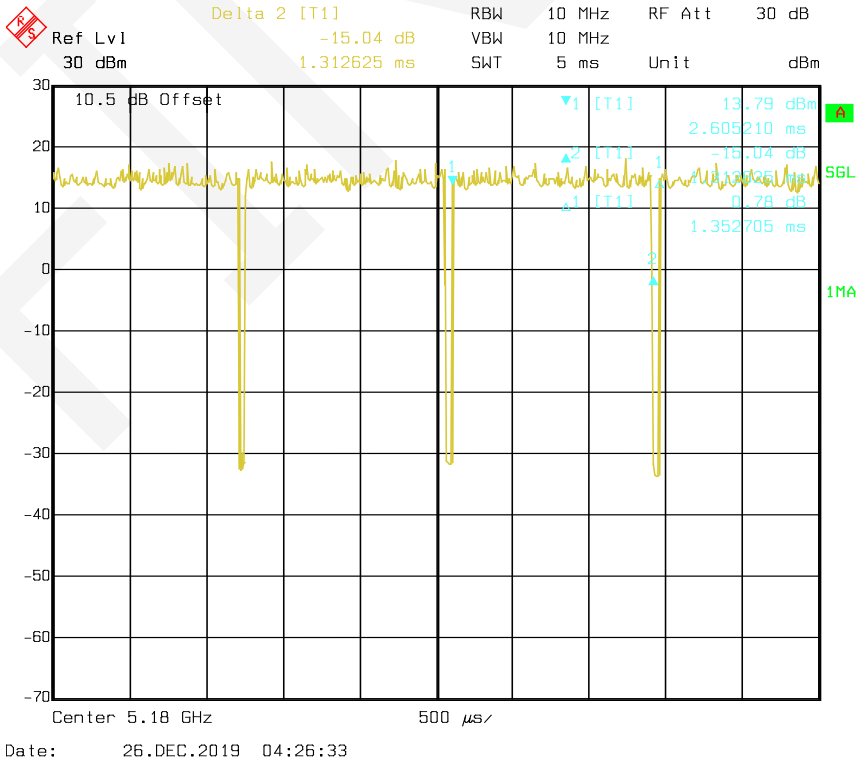
Duty Cycle information is below:

Mode	T_{on} (ms)	$T_{on}+T_{off}$ (ms)	Duty Cycle (%)	Duty Cycle Factor （dB)
802.11a	1.40	1.44	0.97	0.12
802.11n-HT20	1.31	1.35	0.97	0.13
802.11n-HT40	0.65	0.69	0.94	0.26
802.11ac80	0.33	0.37	0.89	0.50

802.11a



802.11n- HT20



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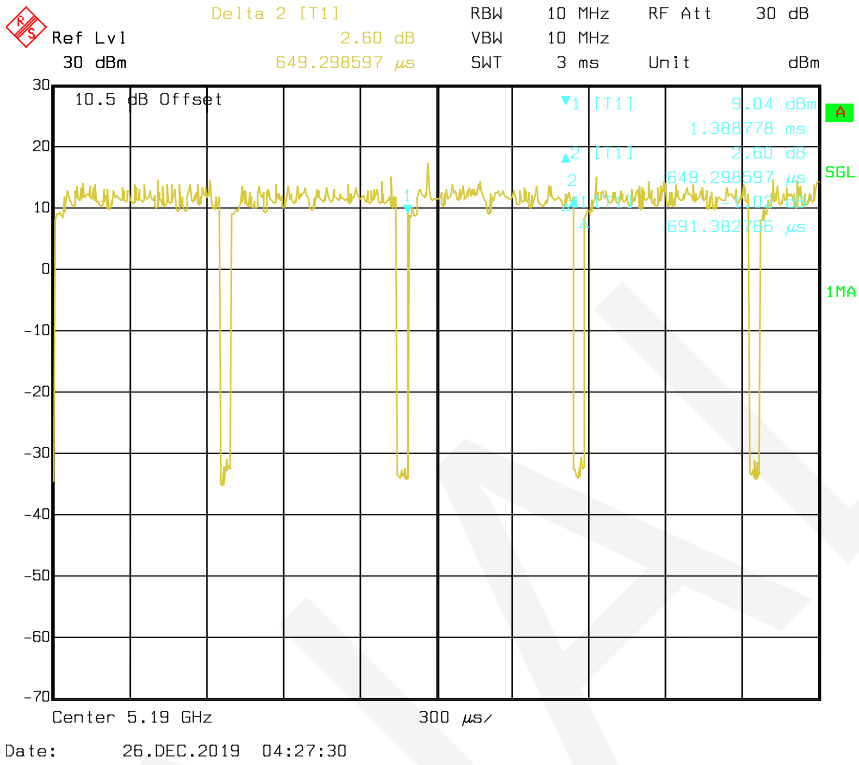
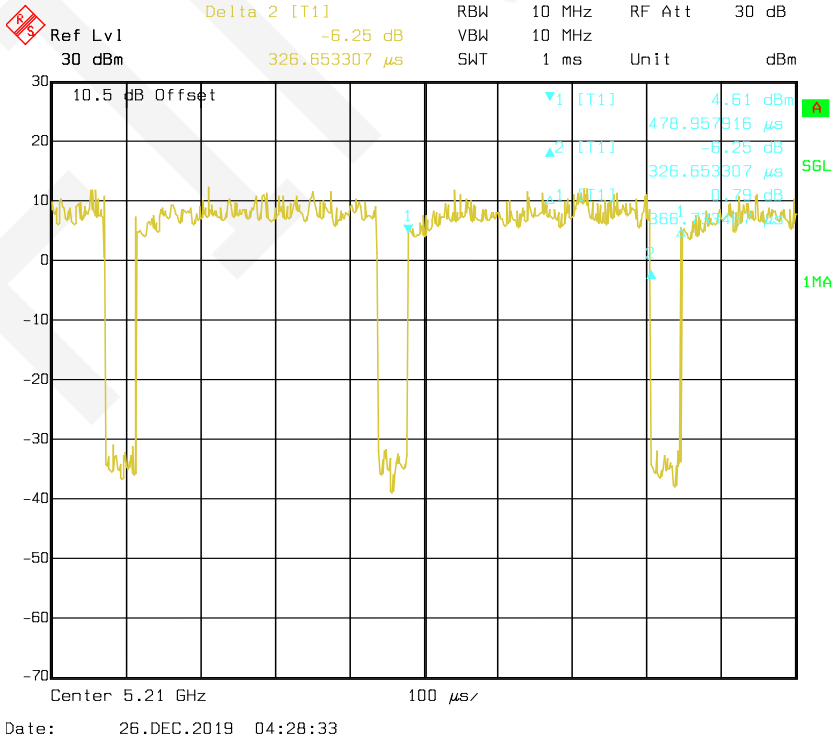


802.11ac80



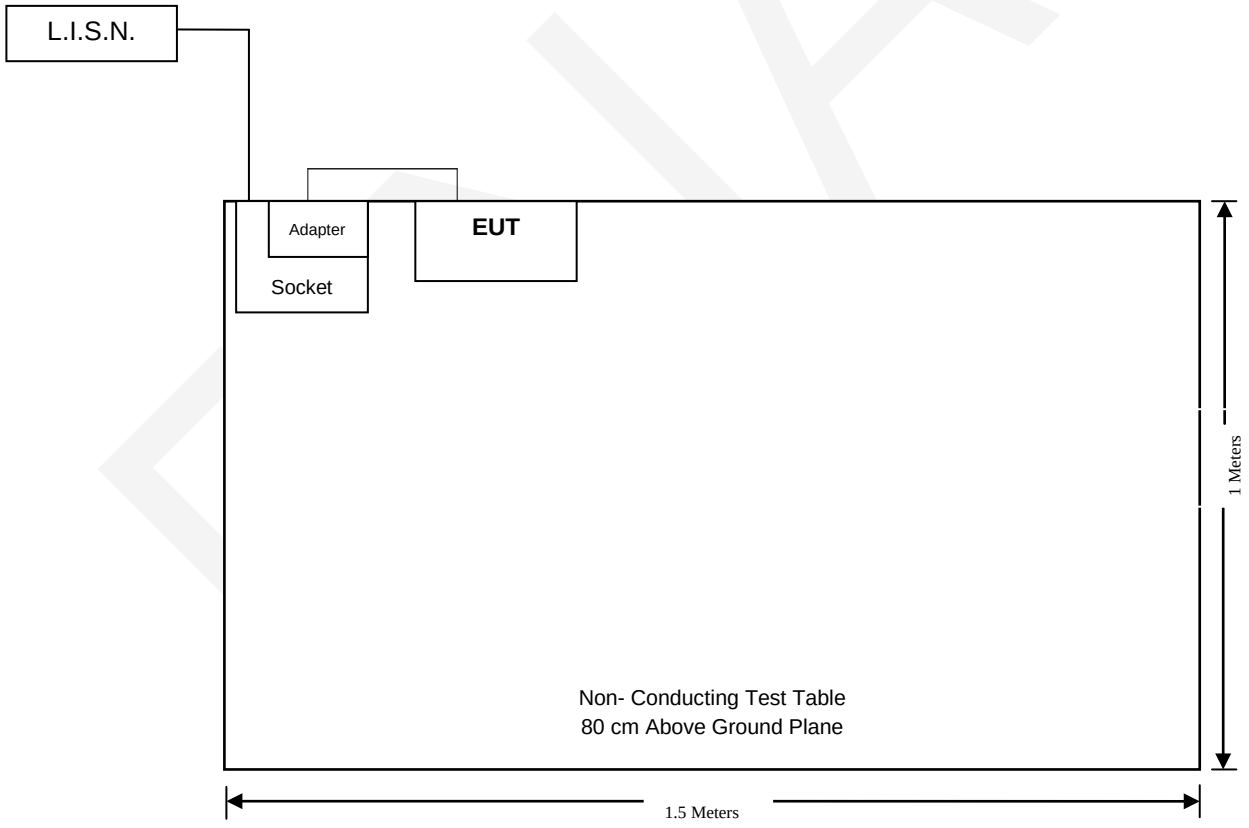
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
-	-	-	-

External I/O Cable

Cable Description	Length (m)	From	To
DC Power Cable	1.50	Adapter	EUT

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.407(f) & §1.1310 & §2.1091	Maximum Permissible exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.407(b)(6)& §15.207(a)	Conducted Emissions	Compliance
§15.205& §15.209 §15.407(b) (1), (4)(i), (6), (7)	Undesirable Emission & Restricted Bands	Compliance
§15.407(a) (1),(3) & (e)	26dB & 6dB Bandwidth	Compliance
§15.407(a)(1),(3)	Conducted Transmitter Output Power	Compliance
§15.407 (a)(1),(3),(5)	Power Spectral Density	Compliance

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

TEST EQUIPMENTS LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emission					
Rohde & Schwarz	EMI Test Receiver	ESCI	100028	2019-04-15	2020-04-14
ROHDE&SCHWARZ	L.I.S.N.	ENV216	3560.6550.16	2019-02-25	2020-02-24
HP	RF Limiter	11947A	3107A01270	2019-10-18	2020-10-17
MICRO-COAX	Conducted Cable	L-E003	000003	2019-08-05	2020-08-04
Rohde & Schwarz	EMC32	EMC32	V 8.52.0	NCR	NCR
Radiated Emission					
EMCT	Semi-Anechoic Chamber	966	001	2017-05-18	2020-05-17
SONOMA INSTRUMENT	Amplifier	310 N	186684	2019-09-06	2020-09-05
SUNOL SCIENCES	Broadband Antenna	JB3	A121808	2017-05-19	2020-05-18
INMET	Attenuator	18N-6dB	N/A	2019-10-17	2020-10-16
Rohde & Schwarz	EMI Test Receiver	ESR3	102456	2019-04-15	2020-04-14
Rohde & Schwarz	Spectrum Analyzer	FSU26	200835	2019-04-15	2020-04-14
EMCO	Horn Antenna	3115	2192	2019-09-25	2021-09-24
Mini-circuits	Pre-Amplifier	ZVA-183-S+	771001215	2019-07-24	2020-07-23
EM Electronics	RF Pre-Amplifier	EM18G40	060725	2019-07-24	2020-07-23
Rohde & Schwarz	EMI Test Receiver	ESIB 40	100215	2019-04-15	2020-04-14
A.H. Systems, Inc	Horn Antenna	SAS-574	510	2019-09-02	2021-09-01
Sinoscite.,Co Ltd	Reject Band Filter	BSF 5150-5850MN	0899V2	2019-11-10	2020-11-09
MICRO-TRONICS	High Pass Filter	HPM50111	G216	2019-11-10	2020-11-09
Unknown	RF Cable (Below 1GHz)	L-E005	000005	2019-09-06	2020-09-05
Unknown	RF Cable (Below 1GHz)	T-E128	000128	2019-10-17	2020-10-16
MICRO-COAX	Flexible microwave cable	T-E237	233522-001	2019-07-19	2020-07-18
Unknown	RF Cable (Above 1GHz)	T-E069	000069	2019-07-24	2020-07-23
Micro-coax	RF Cable (Above 1GHz)	T-E209	MFR 64639 2310	2019-07-19	2020-07-18
Rohde & Schwarz	EMC32	EMC32	V9.10.00	NCR	NCR

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Rohde & Schwarz	Spectrum Analyzer	FSEM30	100018	2019-04-15	2020-04-14
Agilent	USB power sensor	U2021XA	MY53320008	2019-01-17	2020-01-16
WEINSCHEL ENGINEERING	Attenuator	1A 10dB	AB1165	2019-08-05	2020-08-04
RF Superstore	DC Block	RF-530004	Unknown	2019-08-05	2020-08-04
Unknown	RF Cable	Unknown	000007	Each Time	Each Time

FCC §15.407 (f) & §1.1310 & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE

Applicable Standard

According to §15.407(f) and §1.1310 & §2.1091, systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

Limits for Maximum Permissible Exposure (MPE) (§1.1310, §2.1091)

(B) Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	**Electric Field Strength (V/m)**	**Magnetic Field Strength (A/m)**	**Power Density (mW/cm^2)**	**Averaging Time (minutes)**
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

f = frequency in MHz; * = Plane-wave equivalent power density;

According to §1.1310 and §2.1091 RF exposure is calculated.

Per 447498 D01 General RF Exposure Guidance v06**,** simultaneous transmission MPE test exclusion applies when the sum of the MPE for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0.

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = PG/4\pi R^2$$

Where:
S = power density (in appropriate units, e.g. mW/cm^2);
P = power input to the antenna (in appropriate units, e.g., mW);
G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm);

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Calculated Data:

(WiFi or BLE) + Z-wave + G-power (FCC ID: WP3PGMODEMLP) + WCDMA/LTE module (FCC ID: XMR201807EG91NA)

MPE evaluation for single transmission:

Mode	Frequency Range (MHz)	Antenna Gain		Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
WiFi	2412-2462	2.67	1.85	23.0	199.53	20	0.073	1.0
	5180-5240	1.02	1.26	13.0	19.95	20	0.005	1.0
	5745-5825	1.02	1.26	6.0	3.98	20	0.001	1.0
BLE	2402-2480	2.67	1.85	5.0	3.16	20	0.001	1.0
Power-G	912.75-919.106	0.43	1.10	13.5	22.39	20	0.005	0.61
Z-wave	908.4-916	0.50	1.12	-20.0	0.01	20	0.000	0.61
WCDMA Band 5	824-849	1.6	1.45	24.0	251.19	20	0.072	0.55
WCDMA Band 4	1710-1755	2.4	1.74	24.0	251.19	20	0.087	1.0
WCDMA Band 2	1850-1910	2.4	1.74	24.0	251.19	20	0.087	1.0
LTE Band 2	1850-1910	2.4	1.74	24.5	281.84	20	0.098	1.0
LTE Band 4	1710-1755	2.4	1.74	24.5	281.84	20	0.098	1.0
LTE Band 5	824-849	1.6	1.45	24.5	281.84	20	0.081	0.55
LTE Band 12	699-716	1.6	1.45	24.5	281.84	20	0.081	0.47
LTE Band 13	777-787	1.6	1.45	24.5	281.84	20	0.081	0.52

MPE evaluation for simultaneous transmission:

Note: 1. Wi-Fi & BLE can't transmit simultaneously.
2. Wi-Fi(2.4G) & Wi-Fi(5G) can't transmit simultaneously.
3. Wi-Fi &Z-wave&Power-G&WCDMA/LTE or BLE&Z-wave&Power-G&WCDMA/LTE can transmit simultaneously, MPE evaluation is as below formula:

PD1/Limit1+PD2/Limit2+……＜1, PD (Power Density)

The worst case is as below:

Max MPE of Wi-Fi(2.4G) + Max MPE of Power-G + Max MPE of LTE

= 0.073/1.0+0.005/0.61+0.081/0.47=0.254＜1.0

Result: MPE evaluation of single and simultaneous transmission meet the requirement of standard.

FCC §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.
Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Antenna Connector Construction

The EUT has one WiFi/Bluetooth LE antenna, one LTE antenna, one Z-wave antenna and one Power-G antenna, fulfill the requirement of this section. Please refer to the table below and EUT photo.

Antenna	Manufacturer	Model Number	Antenna Gain (Max)	Antenna Connector	Impedance	Antenna Type
WLAN/ Bluetooth LE	Taoglas	FXP838	2.67dBi(2400-2500MHz) 1.02dBi(5150-5850MHz)	IPEX	50 Ohm	PCB
LTE	Taoglas	FXUB79	1.6dBi (698-960MHz) 2.4dBi (1710-2700MHz)	IPEX	50 Ohm	PCB
Power-G	Taoglas	PC95	0.43dBi (902-928MHz)	IPEX	50 Ohm	PCB
Z-wave	Taoglas	FXP291	0.5dBi (902-928MHz)	IPEX	50 Ohm	PCB

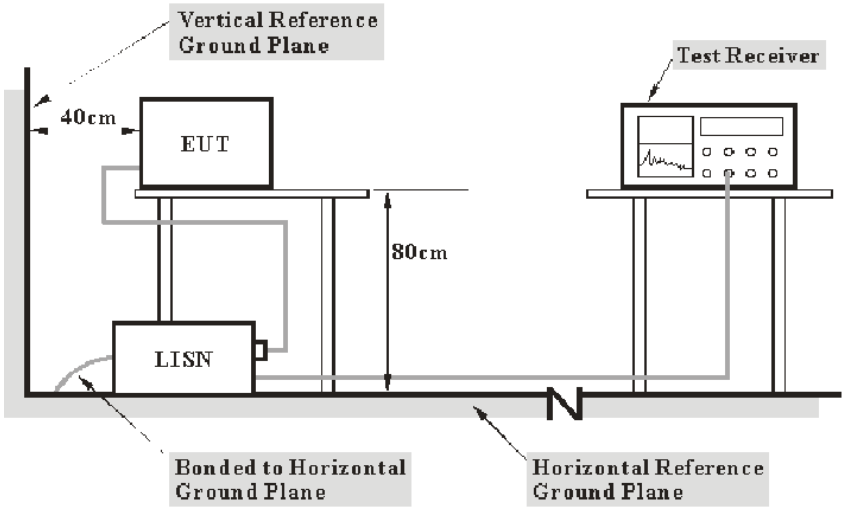
Result: Compliance.

FCC §15.407 (b) (6) §15.207 (a) – CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207, §15.407(b) (6)

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$V_C = V_R + A_C + VDF$
$C_f = A_C + VDF$

Herein,
V_C (cord. Reading): corrected voltage amplitude
V_R: reading voltage amplitude
A_c: attenuation caused by cable loss
VDF: voltage division factor of AMN
C_f: Correction Factor

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Procedure

During the conducted emission test, the adapter was connected to the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Test Data

Environmental Conditions

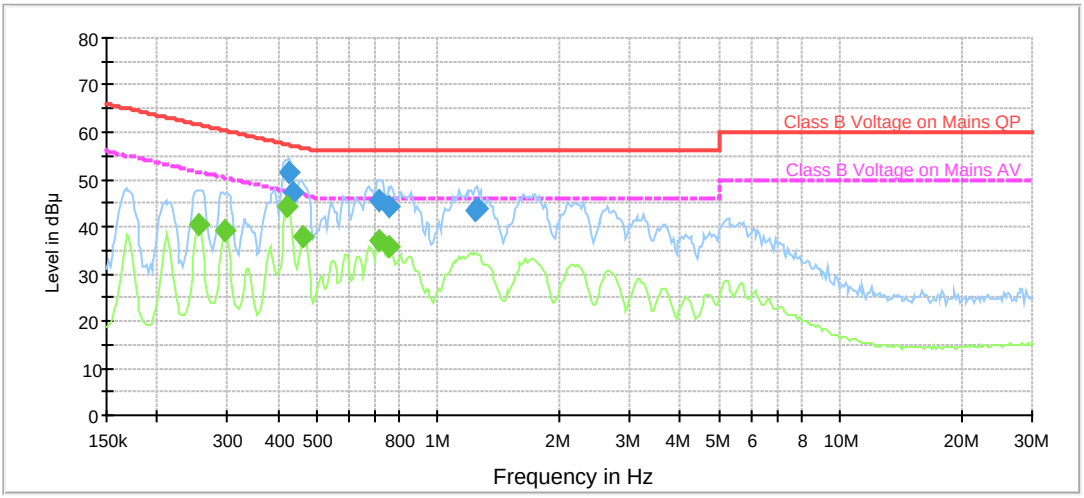
Temperature:	17 °C
Relative Humidity:	52 %
ATM Pressure:	96.2 kPa

The testing was performed by Eric Xiao on 2019-12-25.

Test Mode: Transmitting

5150-5250MHz band: 802.11n20-high channel - worst case

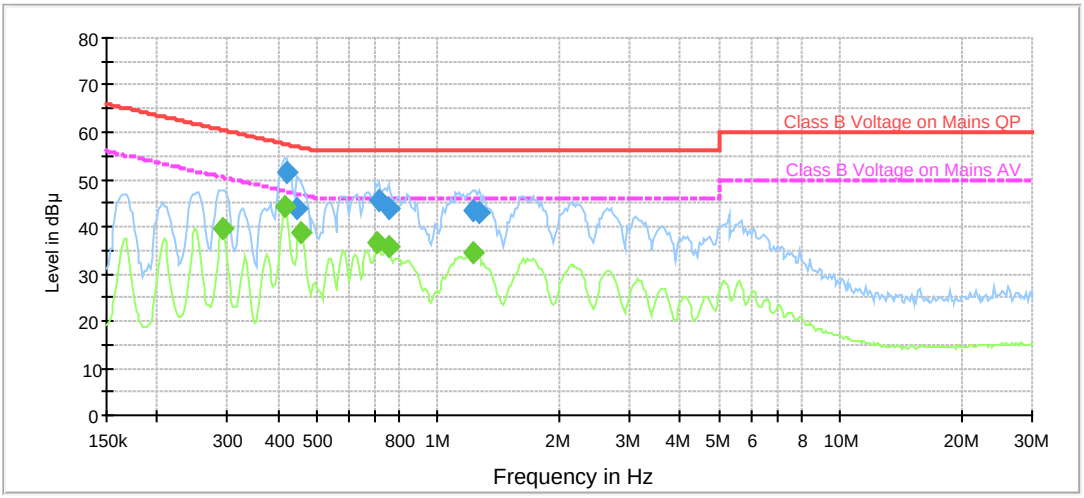
AC120V/60Hz, Line



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.426418	51.5	200.0	9.000	L1	19.6	5.8	57.3
0.434989	47.0	200.0	9.000	L1	19.6	10.2	57.2
0.715397	45.7	200.0	9.000	L1	19.6	10.3	56.0
0.751890	44.5	200.0	9.000	L1	19.6	11.5	56.0
1.236582	43.6	200.0	9.000	L1	19.6	12.4	56.0
1.248947	43.7	200.0	9.000	L1	19.6	12.3	56.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.254170	40.3	200.0	9.000	L1	19.6	11.3	51.6
0.295084	39.0	200.0	9.000	L1	19.6	11.4	50.4
0.422196	44.1	200.0	9.000	L1	19.6	3.3	47.4
0.461750	37.9	200.0	9.000	L1	19.6	8.8	46.7
0.715397	37.0	200.0	9.000	L1	19.6	9.0	46.0
0.759409	35.6	200.0	9.000	L1	19.6	10.4	46.0

AC120V/60Hz, Neutral



Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.422196	51.5	200.0	9.000	N	19.6	5.9	57.4
0.443733	44.0	200.0	9.000	N	19.6	13.0	57.0
0.715397	45.3	200.0	9.000	N	19.7	10.7	56.0
0.751890	44.0	200.0	9.000	N	19.7	12.0	56.0
1.224338	43.6	200.0	9.000	N	19.7	12.4	56.0
1.261437	43.1	200.0	9.000	N	19.7	12.9	56.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.292162	39.5	200.0	9.000	N	19.6	11.0	50.5
0.418016	44.2	200.0	9.000	N	19.6	3.3	47.5
0.457178	38.9	200.0	9.000	N	19.6	7.8	46.7
0.708314	36.8	200.0	9.000	N	19.7	9.2	46.0
0.751890	35.8	200.0	9.000	N	19.7	10.2	46.0
1.224338	34.6	200.0	9.000	N	19.7	11.4	46.0

Note:
1) Corrected Amplitude = Reading + Correction Factor
2) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter
3) Margin = Limit – Corrected Amplitude

FCC §15.209, §15.205 & §15.407(b) (1) (4)(i) (6) (7) – UNDESIRABLE EMISSION, RESTRICTED BANDS

Applicable Standard

FCC §15.407 (b) (1) (4)(i), (6), (7); §15.209; §15.205

FCC 15.407 (b)

Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

(i) 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.

(ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(7) The provisions of §15.205 apply to intentional radiators operating under this section.

(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, emission shall be computed as:
E[dBuV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

1) For 75 MHz above or below the band edge, a level of -27 dBm/MHz (68.2dBμV/m) was applied.

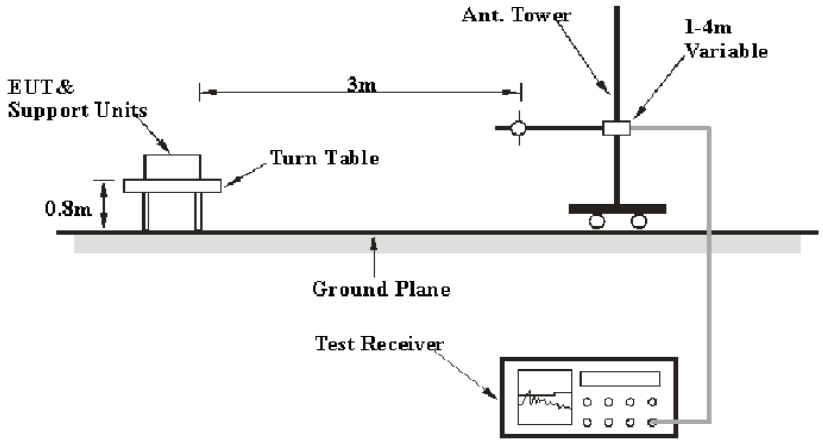
2) For 25MHz-75 MHz above or below the band edge, a level of 10 dBm/MHz (105.2dBμV/m) was applied.

3) For 5MHz-25 MHz above or below the band edge, a level of 15.6 dBm/MHz (110.8dBμV/m) was applied.

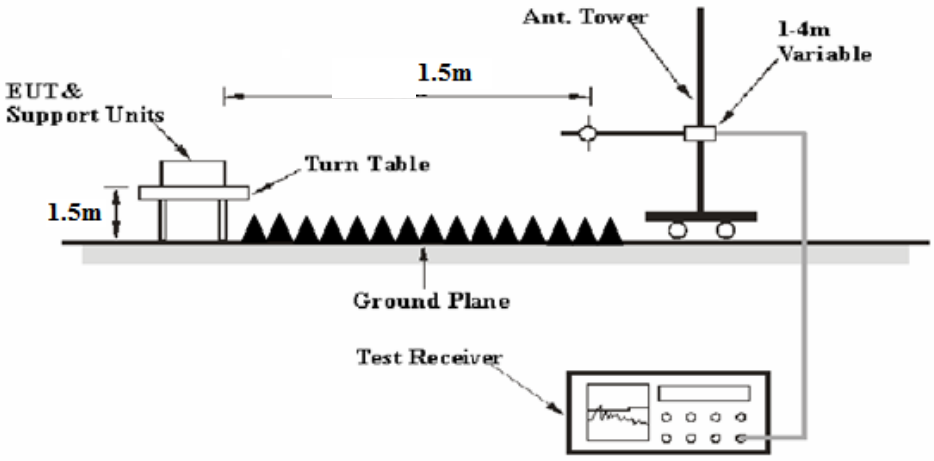
4) For 0 MHz-5 MHz above or below the band edge, a level of 27 dBm/MHz (122.2dBμV/m) was applied.

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission tests were performed in the 3 meters semi-anechoic chamber, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209 and FCC 15.407 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz.

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	3 MHz	/	AV

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1GHz, peak and Average detection modes for frequencies above 1 GHz.

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, emission shall be computed as: E [dBμV/m] = EIRP[dBm] + 95.2, for d = 3 meters.

According to C63.10, the above 1G test result shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade from 3m to 1.5m
Distance extrapolation factor =20 log (specific distance [3m]/test distance [1.5m]) dB
Extrapolation result = Corrected Amplitude (dBμV/m) - distance extrapolation factor (6dB)

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Amplitude = Receiver Reading + Cable loss + Antenna Factor – Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit-Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, Section 15.205 and 15.209, Subpart E, Section 15.407.

Test Data

Environmental Conditions

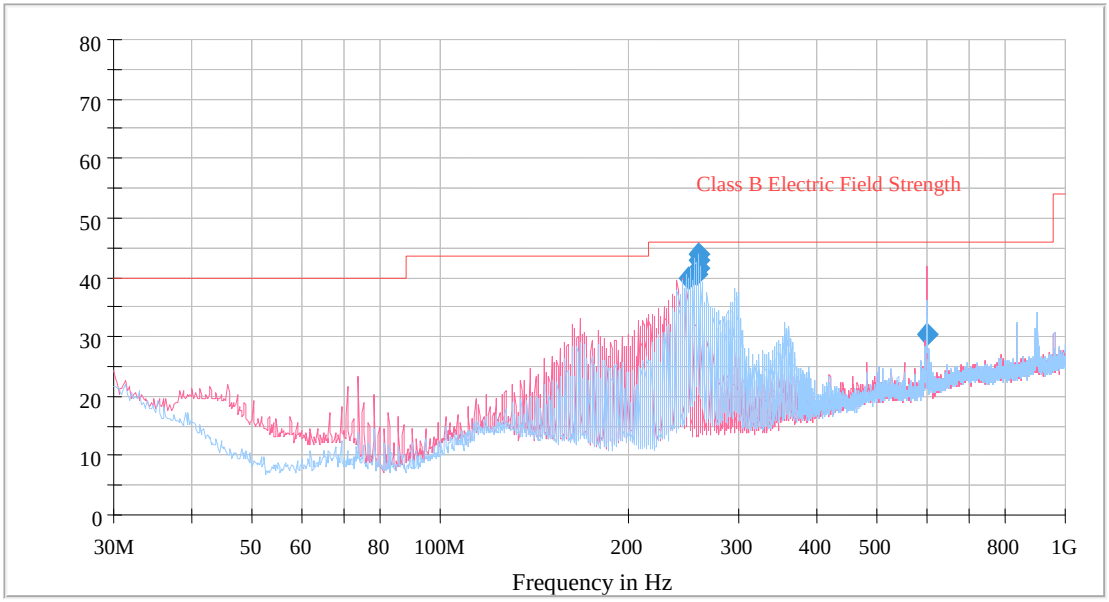
Temperature:	18 °C
Relative Humidity:	53 %
ATM Pressure:	95.8 kPa

The testing was performed by Eric Xiao on 2019-12-29.

Test mode: Transmitting

1) 30 MHz to 1 GHz:

5150-5250MHz band: 802.11n20-high channel - worst case



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
249.933200	39.87	46.00	6.13	200.0	120.000	128.0	H	0.0	-12.8
257.280000	40.52	46.00	5.48	200.0	120.000	123.0	H	14.0	-12.4
258.789600	42.75	46.00	3.25	200.0	120.000	122.0	H	11.0	-12.3
258.817800	43.85	46.00	2.15	200.0	120.000	124.0	H	10.0	-12.3
258.854500	41.49	46.00	4.51	200.0	120.000	123.0	H	18.0	-12.3
599.959700	30.54	46.00	15.46	200.0	120.000	166.0	V	353.0	-5.7

2) 1GHz-40GHz

(Note: Above 1GHz was performed at distance 1.5m)

For 5150-5250 MHz:

For 802.11a mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Extrapolation Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Measurement (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5180 MHz										
5180	68.91	PK	H	33.75	5.29	0.00	107.95	101.95	N/A	N/A
5180	59.67	AV	H	33.75	5.29	0.00	98.71	92.71	N/A	N/A
5150	35.00	PK	H	33.71	5.27	0.00	73.98	67.98	74.00	6.02
5150	19.96	AV	H	33.71	5.27	0.00	58.94	52.94	54.00	1.06
1799	63.15	PK	H	27.97	3.08	41.78	52.42	46.42	74.00	27.58
1799	41.36	AV	H	27.97	3.08	41.78	30.63	24.63	54.00	29.37
2700	58.36	PK	H	29.48	3.76	42.14	49.46	43.46	74.00	30.54
2700	41.69	AV	H	29.48	3.76	42.14	32.79	26.79	54.00	27.21
10360	41.63	PK	H	38.31	7.66	43.97	43.63	37.63	68.20	30.57
Frequency: 5200 MHz										
5200	69.13	PK	H	33.78	5.31	0.00	108.22	102.22	N/A	N/A
5200	60.58	AV	H	33.78	5.31	0.00	99.67	93.67	N/A	N/A
1799	63.02	PK	H	27.97	3.08	41.78	52.29	46.29	74.00	27.71
1799	41.27	AV	H	27.97	3.08	41.78	30.54	24.54	54.00	29.46
2700	57.54	PK	H	29.48	3.76	42.14	48.64	42.64	74.00	31.36
2700	41.53	AV	H	29.48	3.76	42.14	32.63	26.63	54.00	27.37
10400	41.26	PK	H	38.28	7.68	43.98	43.24	37.24	68.20	30.96
Frequency: 5240 MHz										
5240	69.87	PK	H	33.84	5.34	0.00	109.05	103.05	N/A	N/A
5240	61.02	AV	H	33.84	5.34	0.00	100.20	94.20	N/A	N/A
5350	28.63	PK	H	33.99	5.42	0.00	68.04	62.04	74.00	11.96
5350	17.52	AV	H	33.99	5.42	0.00	56.93	50.93	54.00	3.07
1799	63.00	PK	H	27.97	3.08	41.78	52.27	46.27	74.00	27.73
1799	41.30	AV	H	27.97	3.08	41.78	30.57	24.57	54.00	29.43
2700	57.32	PK	H	29.48	3.76	42.14	48.42	42.42	74.00	31.58
2700	41.42	AV	H	29.48	3.76	42.14	32.52	26.52	54.00	27.48
10480	41.05	PK	H	38.22	7.70	44.00	42.97	36.97	68.20	31.23

For 802.11n-HT20 mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Extrapolation Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Measurement (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5180 MHz										
5180	69.52	PK	H	33.75	5.29	0.00	108.56	102.56	N/A	N/A
5180	61.12	AV	H	33.75	5.29	0.00	100.16	94.16	N/A	N/A
5150	39.52	PK	H	33.71	5.27	0.00	78.50	72.50	74.00	1.50
5150	20.15	AV	H	33.71	5.27	0.00	59.13	53.13	54.00	0.87
1799	62.66	PK	H	27.97	3.08	41.78	51.93	45.93	74.00	28.07
1799	40.52	AV	H	27.97	3.08	41.78	29.79	23.79	54.00	30.21
2700	57.51	PK	H	29.48	3.76	42.14	48.61	42.61	74.00	31.39
2700	40.75	AV	H	29.48	3.76	42.14	31.85	25.85	54.00	28.15
10360	40.89	PK	H	38.31	7.66	43.97	42.89	36.89	68.20	31.31
Frequency: 5200 MHz										
5200	70.35	PK	H	33.78	5.31	0.00	109.44	103.44	N/A	N/A
5200	61.34	AV	H	33.78	5.31	0.00	100.43	94.43	N/A	N/A
1799	62.72	PK	H	27.97	3.08	41.78	51.99	45.99	74.00	28.01
1799	40.91	AV	H	27.97	3.08	41.78	30.18	24.18	54.00	29.82
2700	57.28	PK	H	29.48	3.76	42.14	48.38	42.38	74.00	31.62
2700	41.48	AV	H	29.48	3.76	42.14	32.58	26.58	54.00	27.42
10400	41.14	PK	H	38.28	7.68	43.98	43.12	37.12	68.20	31.08
Frequency: 5240 MHz										
5240	70.88	PK	H	33.84	5.34	0.00	110.06	104.06	N/A	N/A
5240	61.87	AV	H	33.84	5.34	0.00	101.05	95.05	N/A	N/A
5350	29.63	PK	H	33.99	5.42	0.00	69.04	63.04	74.00	10.96
5350	18.05	AV	H	33.99	5.42	0.00	57.46	51.46	54.00	2.54
1799	63.92	PK	H	27.97	3.08	41.78	53.19	47.19	74.00	26.81
1799	41.22	AV	H	27.97	3.08	41.78	30.49	24.49	54.00	29.51
2700	57.97	PK	H	29.48	3.76	42.14	49.07	43.07	74.00	30.93
2700	41.24	AV	H	29.48	3.76	42.14	32.34	26.34	54.00	27.66
10480	41.44	PK	H	38.22	7.70	44.00	43.36	37.36	68.20	30.84

For 802.11n-HT40 mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Extrapolation Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Measurement (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5190 MHz										
5190	66.22	PK	H	33.77	5.30	0.00	105.29	99.29	N/A	N/A
5190	56.63	AV	H	33.77	5.30	0.00	95.70	89.70	N/A	N/A
5150	39.34	PK	H	33.71	5.27	0.00	78.32	72.32	74.00	1.68
5150	20.21	AV	H	33.71	5.27	0.00	59.19	53.19	54.00	0.81
1799	64.11	PK	H	27.97	3.08	41.78	53.38	47.38	74.00	26.62
1799	40.38	AV	H	27.97	3.08	41.78	29.65	23.65	54.00	30.35
2700	57.72	PK	H	29.48	3.76	42.14	48.82	42.82	74.00	31.18
2700	41.62	AV	H	29.48	3.76	42.14	32.72	26.72	54.00	27.28
10380	40.7	PK	H	38.30	7.67	43.98	42.69	36.69	68.20	31.51
Frequency: 5230 MHz										
5230	67.43	PK	H	33.82	5.33	0.00	106.58	100.58	N/A	N/A
5230	57.49	AV	H	33.82	5.33	0.00	96.64	90.64	N/A	N/A
5350	29.64	PK	H	33.99	5.42	0.00	69.05	63.05	74.00	10.95
5350	19.58	AV	H	33.99	5.42	0.00	58.99	52.99	54.00	1.01
1799	63.54	PK	H	27.97	3.08	41.78	52.81	46.81	74.00	27.19
1799	40.37	AV	H	27.97	3.08	41.78	29.64	23.64	54.00	30.36
2700	57.37	PK	H	29.48	3.76	42.14	48.47	42.47	74.00	31.53
2700	41.33	AV	H	29.48	3.76	42.14	32.43	26.43	54.00	27.57
10460	41.43	PK	H	38.23	7.70	43.99	43.37	37.37	68.20	30.83

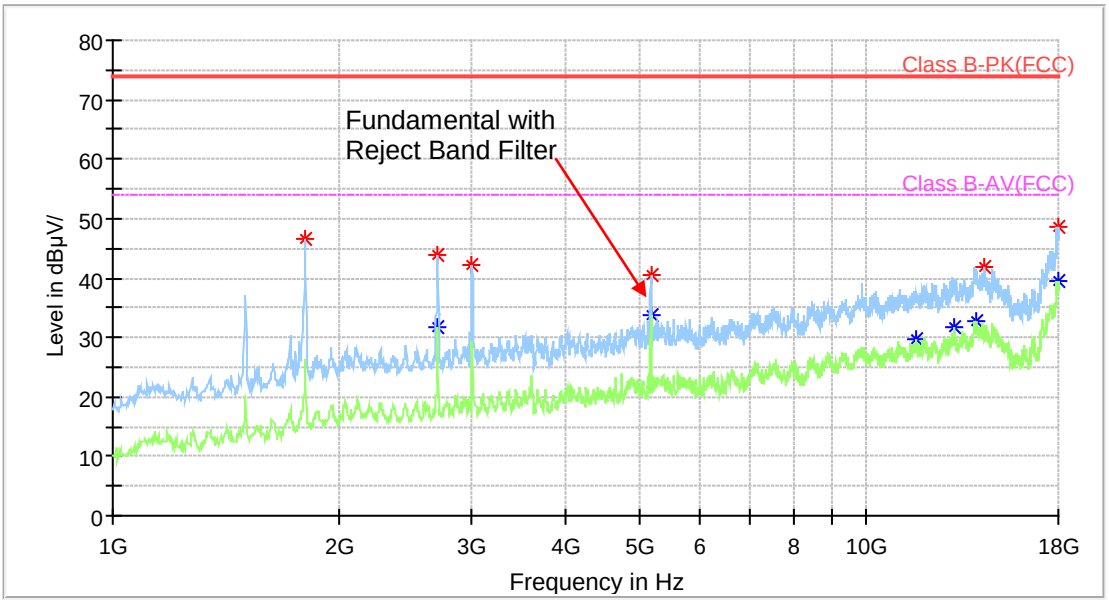
For 802.11ac80 mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Extrapolation Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Measurement (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5210 MHz										
5210	64.87	PK	H	33.79	5.32	0.00	103.98	97.98	N/A	N/A
5210	54.86	AV	H	33.79	5.32	0.00	93.97	87.97	N/A	N/A
5150	37.91	PK	H	33.71	5.27	0.00	76.89	70.89	74.00	3.11
5150	20.58	AV	H	33.71	5.27	0.00	59.56	53.56	54.00	0.44
5350	27.28	PK	H	33.99	5.42	0.00	66.69	60.69	74.00	13.31
5350	15.96	AV	H	33.99	5.42	0.00	55.37	49.37	54.00	4.63
10420	32.65	PK	H	38.26	7.68	43.98	34.61	28.61	54.00	25.39
1799	62.62	PK	H	27.97	3.08	41.78	51.89	45.89	74.00	28.11
1799	40.53	AV	H	27.97	3.08	41.78	29.80	23.80	54.00	30.20
2700	57.85	PK	H	29.48	3.76	42.14	48.95	42.95	74.00	31.05
2700	41.59	AV	H	29.48	3.76	42.14	32.69	26.69	54.00	27.31

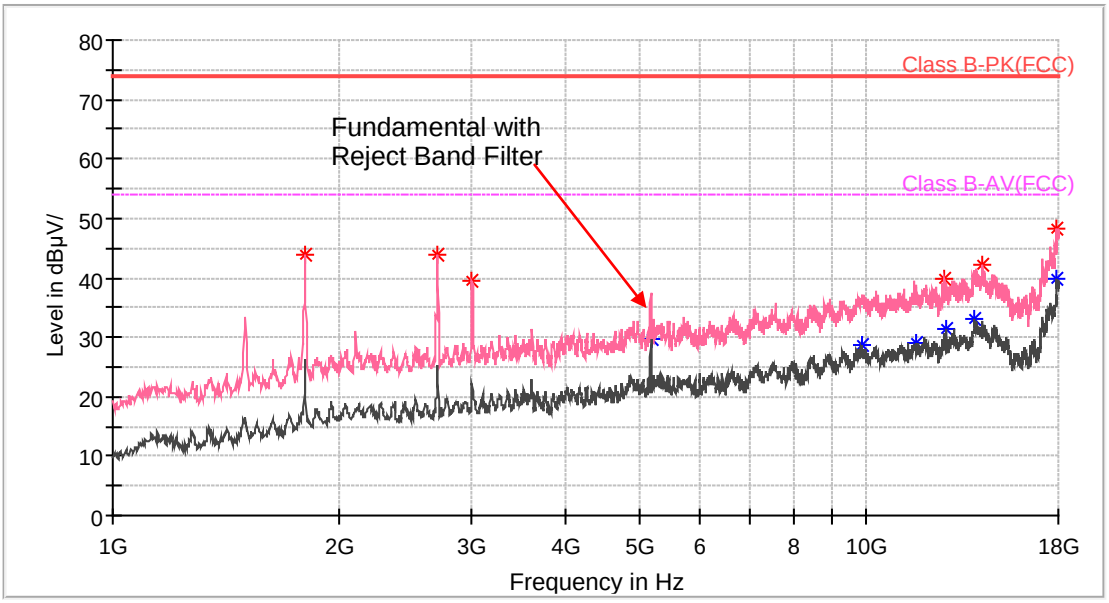
Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Margin = Limit- Corr. Amplitude

Please refer to the below pre-scan plot of worst case:

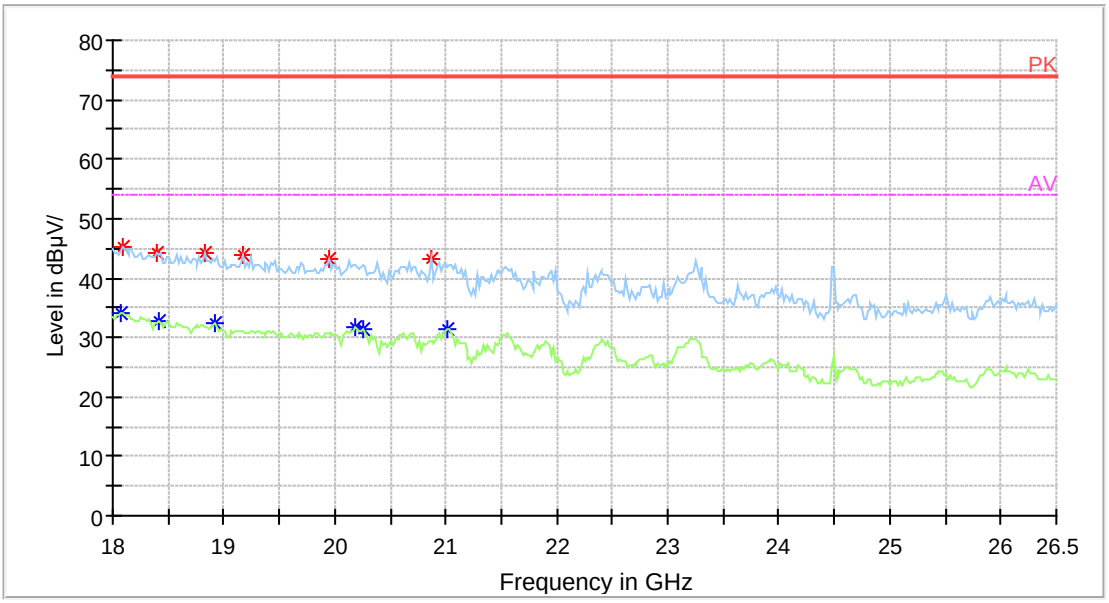
802.11ac80 Mode_Horizontal_1GHz-18GHz



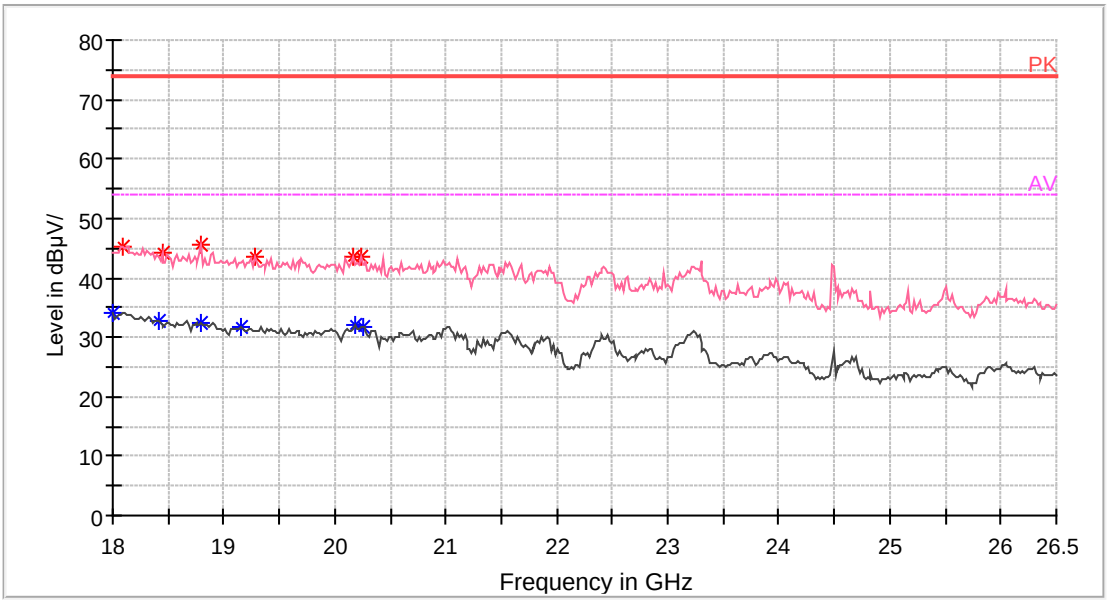
802.11ac80 Mode _Vertical_1GHz-18GHz



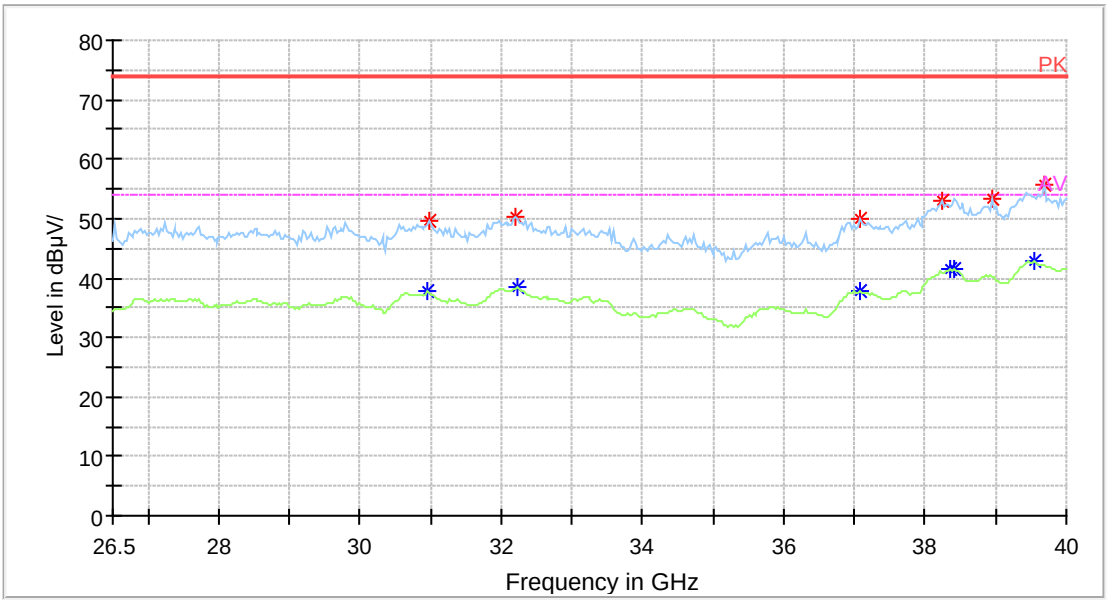
802.11ac80 Mode _Horizontal_18GHz-26.5GHz



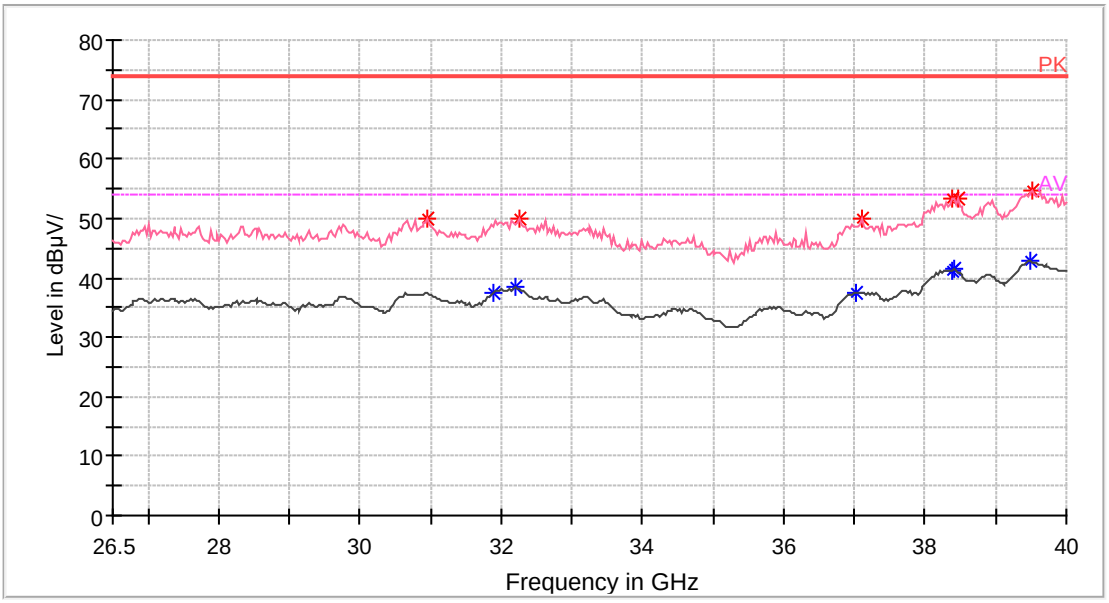
802.11ac80 Mode _Vertical_18GHz-26.5GHz



802.11ac80 Mode _Horizontal_26.5GHz-40GHz



802.11ac80 Mode _Vertical_26.5GHz-40GHz



For 5725-5850 MHz

For 802.11a mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Extrapolation Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Measurement (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5745 MHz										
5745	72.82	PK	H	34.75	4.81	0.00	112.38	106.38	N/A	N/A
5745	63.41	AV	H	34.75	4.81	0.00	102.97	96.97	N/A	N/A
5650	25.34	PK	H	34.73	4.76	0.00	64.83	58.83	68.20	9.37
5700	24.28	PK	H	34.74	4.79	0.00	63.81	57.81	105.20	47.39
5720	24.97	PK	H	34.74	4.80	0.00	64.51	58.51	110.80	52.29
5725	27.39	PK	H	34.75	4.80	0.00	66.94	60.94	122.20	61.26
2700	63.65	PK	H	29.64	3.25	44.13	52.41	46.41	74.00	27.59
2700	45.61	AV	H	29.64	3.25	44.13	34.37	28.37	54.00	25.63
2850	62.36	PK	H	30.12	3.33	44.20	51.61	45.61	74.00	28.39
2850	42.63	AV	H	30.12	3.33	44.20	31.88	25.88	54.00	28.12
11490	41.16	PK	H	38.90	6.89	44.64	42.31	36.31	74.00	37.69
11490	33.64	AV	H	38.90	6.89	44.64	34.79	28.79	54.00	25.21
Frequency: 5785 MHz										
5785	71.60	PK	H	34.76	4.83	0.00	111.19	105.19	N/A	N/A
5785	62.15	AV	H	34.76	4.83	0.00	101.74	95.74	N/A	N/A
5650	26.41	PK	H	34.73	4.76	0.00	65.90	59.90	68.20	8.30
5700	23.57	PK	H	34.74	4.79	0.00	63.10	57.10	105.20	48.10
5720	25.04	PK	H	34.74	4.80	0.00	64.58	58.58	110.80	52.22
5725	26.99	PK	H	34.75	4.80	0.00	66.54	60.54	122.20	61.66
2700	63.26	PK	H	29.64	3.25	44.13	52.02	46.02	74.00	27.98
2700	44.91	AV	H	29.64	3.25	44.13	33.67	27.67	54.00	26.33
2850	61.45	PK	H	30.12	3.33	44.20	50.70	44.70	74.00	29.30
2850	41.74	AV	H	30.12	3.33	44.20	30.99	24.99	54.00	29.01
11570	40.26	PK	H	38.91	6.91	44.46	41.62	35.62	74.00	38.38
11570	33.31	AV	H	38.91	6.91	44.46	34.67	28.67	54.00	25.33
Frequency: 5825 MHz										
5825	70.36	PK	H	34.77	4.85	0.00	109.98	103.98	N/A	N/A
5825	61.87	AV	H	34.77	4.85	0.00	101.49	95.49	N/A	N/A
5850	26.23	PK	H	34.77	4.86	0.00	65.86	59.86	122.20	62.34
5855	24.58	PK	H	34.77	4.86	0.00	64.21	58.21	110.80	52.59
5875	26.08	PK	H	34.78	4.87	0.00	65.73	59.73	105.20	45.47
5925	24.13	PK	H	34.79	4.89	0.00	63.81	57.81	68.20	10.39
2700	62.92	PK	H	29.64	3.25	44.13	51.68	45.68	74.00	28.32
2700	45.25	AV	H	29.64	3.25	44.13	34.01	28.01	54.00	25.99
2850	61.54	PK	H	30.12	3.33	44.20	50.79	44.79	74.00	29.21
2850	42.34	AV	H	30.12	3.33	44.20	31.59	25.59	54.00	28.41
11650	40.57	PK	H	38.93	6.94	44.27	42.17	36.17	74.00	37.83
11650	32.67	AV	H	38.93	6.94	44.27	34.27	28.27	54.00	25.73

For 802.11n-HT20 mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Extrapolation Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Measurement (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5745 MHz										
5745	70.47	PK	H	34.75	4.81	0.00	110.03	104.03	N/A	N/A
5745	62.84	AV	H	34.75	4.81	0.00	102.40	96.40	N/A	N/A
5650	25.33	PK	H	34.73	4.76	0.00	64.82	58.82	68.20	9.38
5700	26.21	PK	H	34.74	4.79	0.00	65.74	59.74	105.20	45.46
5720	27.29	PK	H	34.74	4.80	0.00	66.83	60.83	110.80	49.97
5725	28.51	PK	H	34.75	4.80	0.00	68.06	62.06	122.20	60.14
2700	64.04	PK	H	29.64	3.25	44.13	52.80	46.80	74.00	27.20
2700	45.05	AV	H	29.64	3.25	44.13	33.81	27.81	54.00	26.19
2850	61.93	PK	H	30.12	3.33	44.20	51.18	45.18	74.00	28.82
2850	41.89	AV	H	30.12	3.33	44.20	31.14	25.14	54.00	28.86
11490	40.57	PK	H	38.90	6.89	44.64	41.72	35.72	74.00	38.28
11490	32.75	AV	H	38.90	6.89	44.64	33.90	27.90	54.00	26.10
Frequency: 5785 MHz										
5785	70.32	PK	H	34.76	4.83	0.00	109.91	103.91	N/A	N/A
5785	62.66	AV	H	34.76	4.83	0.00	102.25	96.25	N/A	N/A
2700	62.71	PK	H	29.64	3.25	44.13	51.47	45.47	74.00	28.53
2700	45.56	AV	H	29.64	3.25	44.13	34.32	28.32	54.00	25.68
2850	61.61	PK	H	30.12	3.33	44.20	50.86	44.86	74.00	29.14
2850	42.1	AV	H	30.12	3.33	44.20	31.35	25.35	54.00	28.65
11570	40.48	PK	H	38.91	6.91	44.46	41.84	35.84	74.00	38.16
11570	33.30	AV	H	38.91	6.91	44.46	34.66	28.66	54.00	25.34
Frequency: 5825 MHz										
5825	69.38	PK	H	34.77	4.85	0.00	109.00	103.00	N/A	N/A
5825	61.63	AV	H	34.77	4.85	0.00	101.25	95.25	N/A	N/A
5850	25.16	PK	H	34.77	4.86	0.00	64.79	58.79	122.20	63.41
5855	26.66	PK	H	34.77	4.86	0.00	66.29	60.29	110.80	50.51
5875	27.45	PK	H	34.78	4.87	0.00	67.10	61.10	105.20	44.10
5925	28.79	PK	H	34.79	4.89	0.00	68.47	62.47	68.20	5.73
2700	62.73	PK	H	29.64	3.25	44.13	51.49	45.49	74.00	28.51
2700	44.99	AV	H	29.64	3.25	44.13	33.75	27.75	54.00	26.25
2850	62.18	PK	H	30.12	3.33	44.20	51.43	45.43	74.00	28.57
2850	42.34	AV	H	30.12	3.33	44.20	31.59	25.59	54.00	28.41
11650	41.04	PK	H	38.93	6.94	44.27	42.64	36.64	74.00	37.36
11650	32.8	AV	H	38.93	6.94	44.27	34.40	28.40	54.00	25.60

For 802.11n-HT40 mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBµV/m)	Extrapolation Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
	Reading (dBµV)	Measurement (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5755 MHz										
5755	66.92	PK	H	34.75	4.81	0.00	106.48	100.48	N/A	N/A
5755	58.96	AV	H	34.75	4.81	0.00	98.52	92.52	N/A	N/A
5650	25.17	PK	H	34.73	4.76	0.00	64.66	58.66	68.20	9.54
5700	26.00	PK	H	34.74	4.79	0.00	65.53	59.53	105.20	45.67
5720	27.66	PK	H	34.74	4.80	0.00	67.20	61.20	110.80	49.60
5725	28.66	PK	H	34.75	4.80	0.00	68.21	62.21	122.20	59.99
2700	64.63	PK	H	29.64	3.25	44.13	53.39	47.39	74.00	26.61
2700	45.2	AV	H	29.64	3.25	44.13	33.96	27.96	54.00	26.04
2850	61.76	PK	H	30.12	3.33	44.20	51.01	45.01	74.00	28.99
2850	42.33	AV	H	30.12	3.33	44.20	31.58	25.58	54.00	28.42
11510	41.15	PK	H	38.90	6.89	44.61	42.33	36.33	74.00	37.67
11510	33.16	AV	H	38.90	6.89	44.61	34.34	28.34	54.00	25.66
Frequency: 5795 MHz										
5795	65.15	PK	H	34.76	4.83	0.00	104.74	98.74	N/A	N/A
5795	57.36	AV	H	34.76	4.83	0.00	96.95	90.95	N/A	N/A
5850	23.88	PK	H	34.77	4.86	0.00	63.51	57.51	122.20	64.69
5855	26.79	PK	H	34.77	4.86	0.00	66.42	60.42	110.80	50.38
5875	27.43	PK	H	34.78	4.87	0.00	67.08	61.08	105.20	44.12
5925	28.96	PK	H	34.79	4.89	0.00	68.64	62.64	68.20	5.56
2700	63.89	PK	H	29.64	3.25	44.13	52.65	46.65	74.00	27.35
2700	44.65	AV	H	29.64	3.25	44.13	33.41	27.41	54.00	26.59
2850	61.4	PK	H	30.12	3.33	44.20	50.65	44.65	74.00	29.35
2850	42.02	AV	H	30.12	3.33	44.20	31.27	25.27	54.00	28.73
11590	41.08	PK	H	38.92	6.92	44.41	42.51	36.51	74.00	37.49
11590	33.64	AV	H	38.92	6.92	44.41	35.07	29.07	54.00	24.93

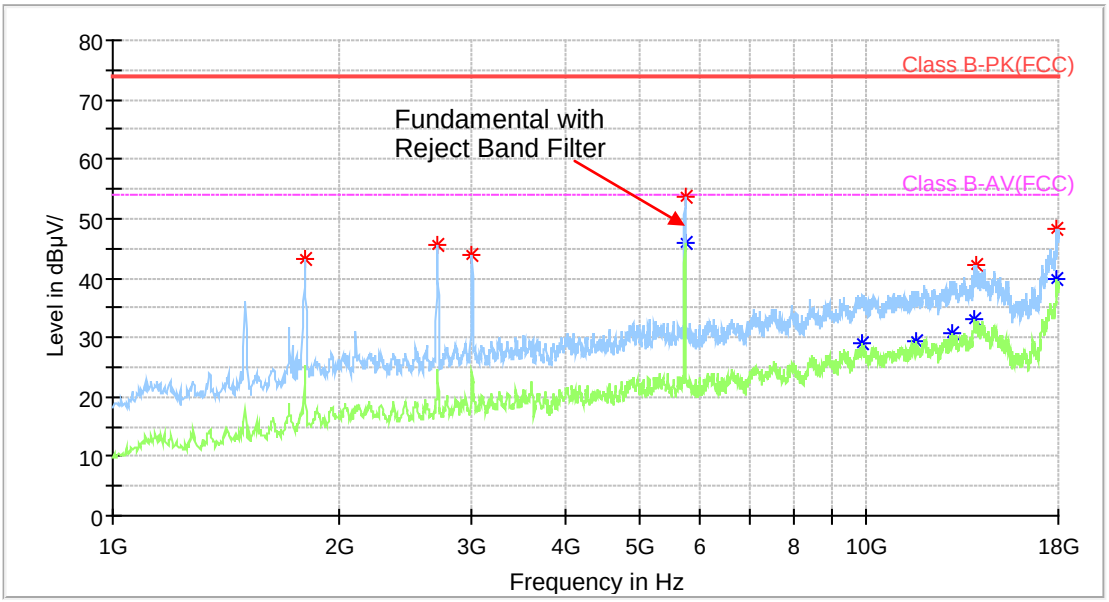
For 802.11ac80 mode

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dBμV/m)	Extrapolation Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	Measurement (PK /AV)	Polar (H/V)	Factor (dB/m)						
Frequency: 5775 MHz										
5775	66.75	PK	H	34.76	4.82	0.00	106.33	100.33	N/A	N/A
5775	58.41	AV	H	34.76	4.82	0.00	97.99	91.99	N/A	N/A
5650	26.43	PK	H	34.73	4.76	0.00	65.92	59.92	68.20	7.78
5700	26.89	PK	H	34.74	4.79	0.00	66.42	60.42	105.20	44.25
5720	27.41	PK	H	34.74	4.80	0.00	66.95	60.95	110.80	49.69
5725	27.56	PK	H	34.75	4.80	0.00	67.11	61.11	122.20	61.09
5850	26.21	PK	H	34.77	4.86	0.00	65.84	59.84	122.20	62.36
5855	26.16	PK	H	34.77	4.86	0.00	65.79	59.79	110.80	52.43
5875	24.72	PK	H	34.78	4.87	0.00	64.37	58.37	105.20	45.88
5925	25.64	PK	H	34.79	4.89	0.00	65.32	59.32	68.20	32.22
2700	63.29	PK	H	29.64	3.25	44.13	52.05	46.05	74.00	27.95
2700	44.93	AV	H	29.64	3.25	44.13	33.69	27.69	54.00	26.31
2850	62.04	PK	H	30.12	3.33	44.20	51.29	45.29	74.00	28.71
2850	42.58	AV	H	30.12	3.33	44.20	31.83	25.83	54.00	28.17
11550	40.67	PK	H	38.91	6.91	44.51	41.98	35.98	74.00	45.15
11550	33.54	AV	H	38.91	6.91	44.51	34.85	28.85	54.00	25.15

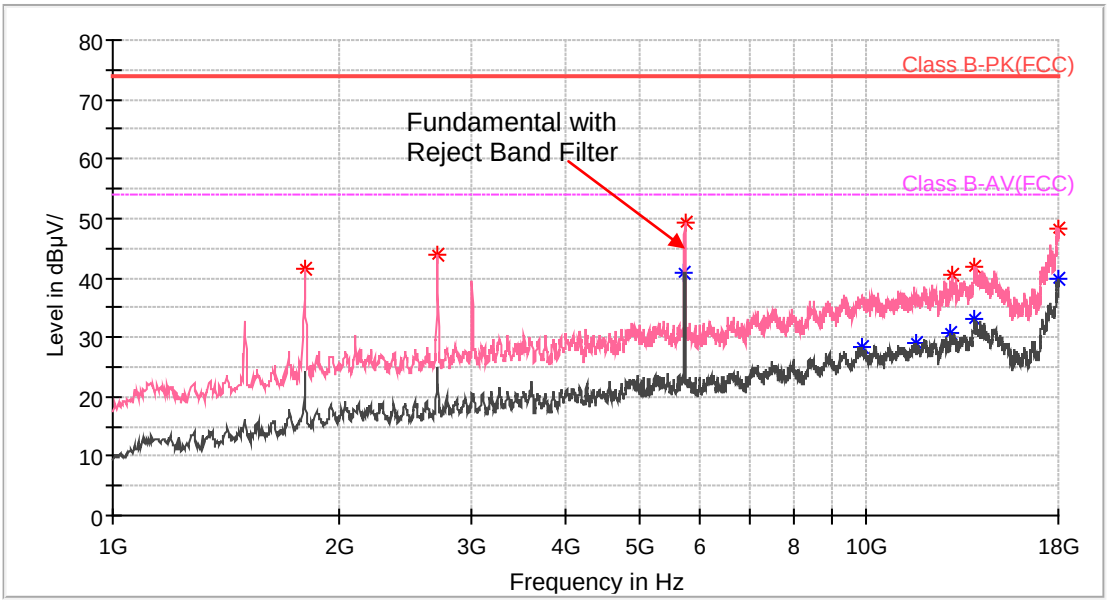
Note:
Corrected Amplitude = Corrected Factor + Reading
Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor
Margin = Limit- Corr. Amplitude

Please refer to the below pre-scan plot of worst case:

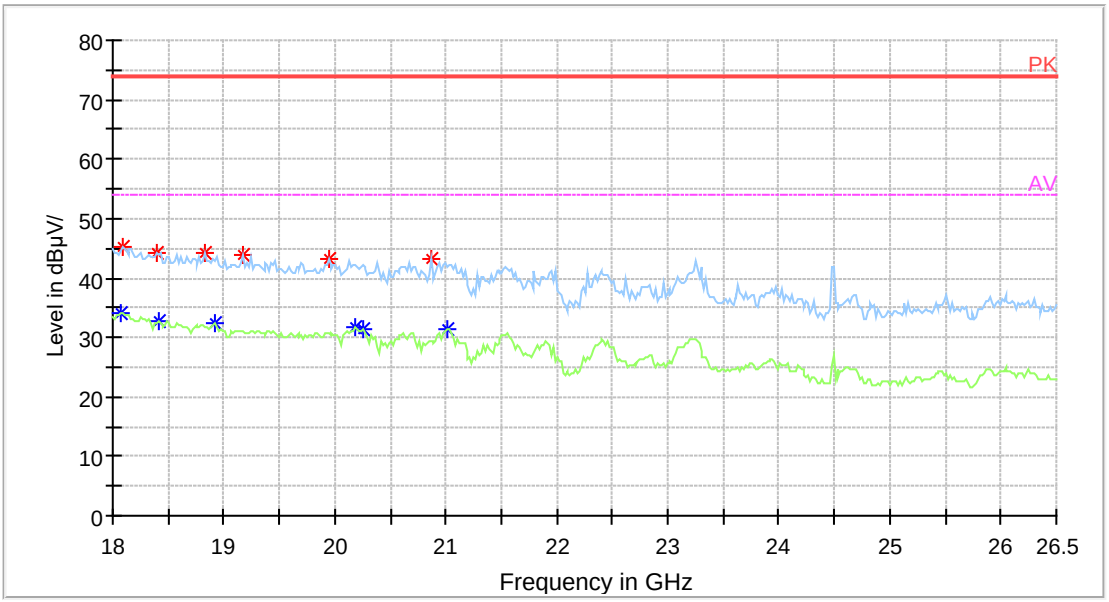
802.11n-HT40 Mode _Horizontal_1GHz-18GHz



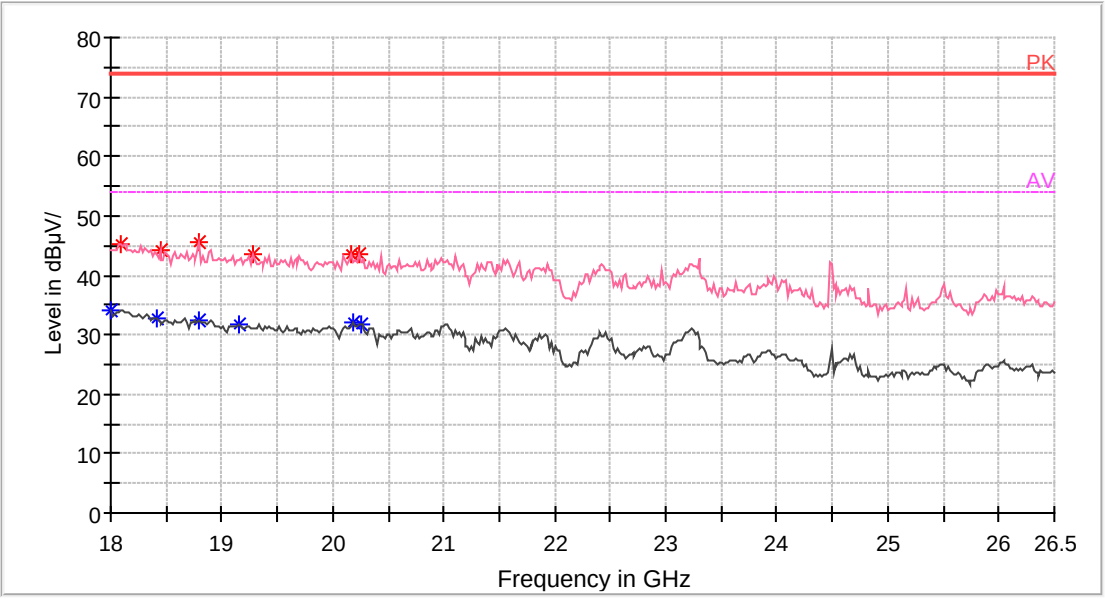
802.11n-HT40 Mode _Vertical_1GHz-18GHz



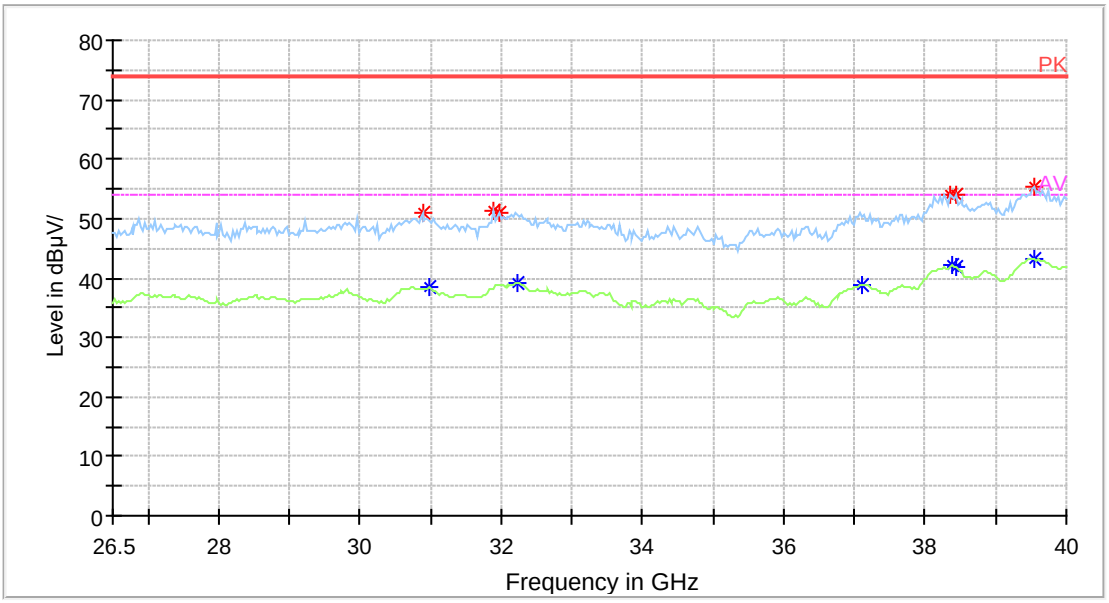
802.11n-HT40 Mode _Horizontal_18GHz-26.5GHz



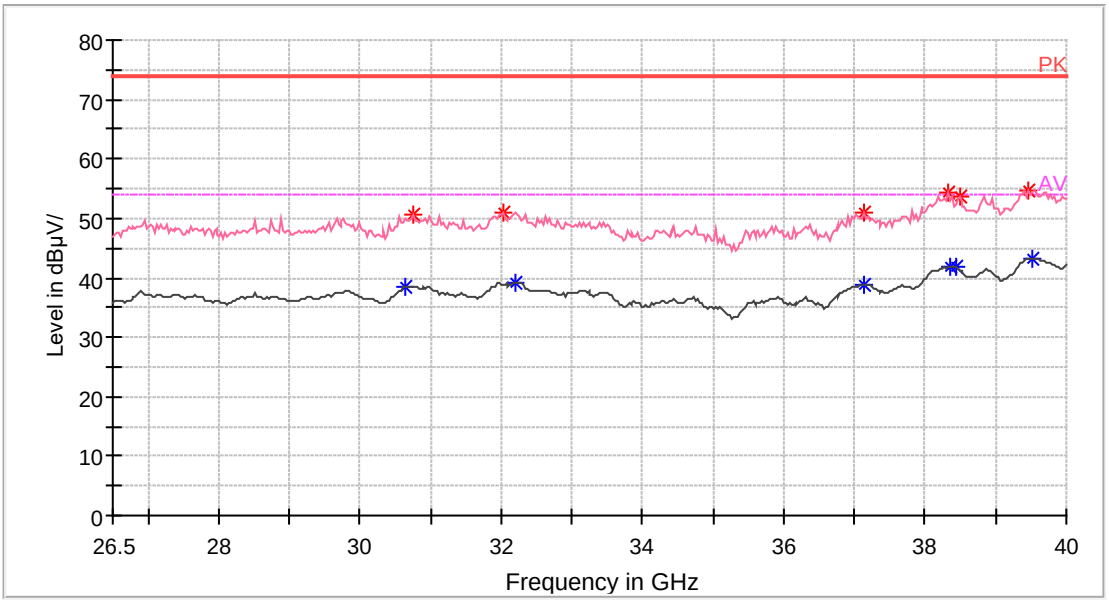
802.11n-HT40 Mode _Vertical_18GHz-26.5GHz



802.11n-HT40 Mode _Horizontal_26.5GHz-40GHz



802.11n-HT40 Mode _Vertical_26.5GHz-40GHz



FCC §15.407(a) (5) & (e) – 26dB & 6dB BANDWIDTH

Applicable Standard

(a)(5) The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

3.

(A) 26dB Bandwidth

Set RBW = approximately 1% of the emission bandwidth.
Set the VBW > RBW. Detector= Peak. Trace mode = max hold. 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%.

(B) 6dB Bandwidth

Set RBW = 100 kHz. Set the video bandwidth (VBW) ≥ 3 × RBW.
Detector = Peak. Trace mode = max hold. Sweep = auto couple. Allow the trace to stabilize. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

(C) 99% Occupied Bandwidth

The following procedure shall be used for measuring (99 %) power bandwidth:

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 ≥ 3 · RBW
5. Use the 99 % power bandwidth function of the instrument.

4. Repeat above procedures until all frequencies measured were complete.

Test Data

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	57 %
ATM Pressure:	95.9 kPa

The testing was performed by Eric Xiao on 2019-12-26.

Test Result: Pass. Please refer to the following tables and plots.

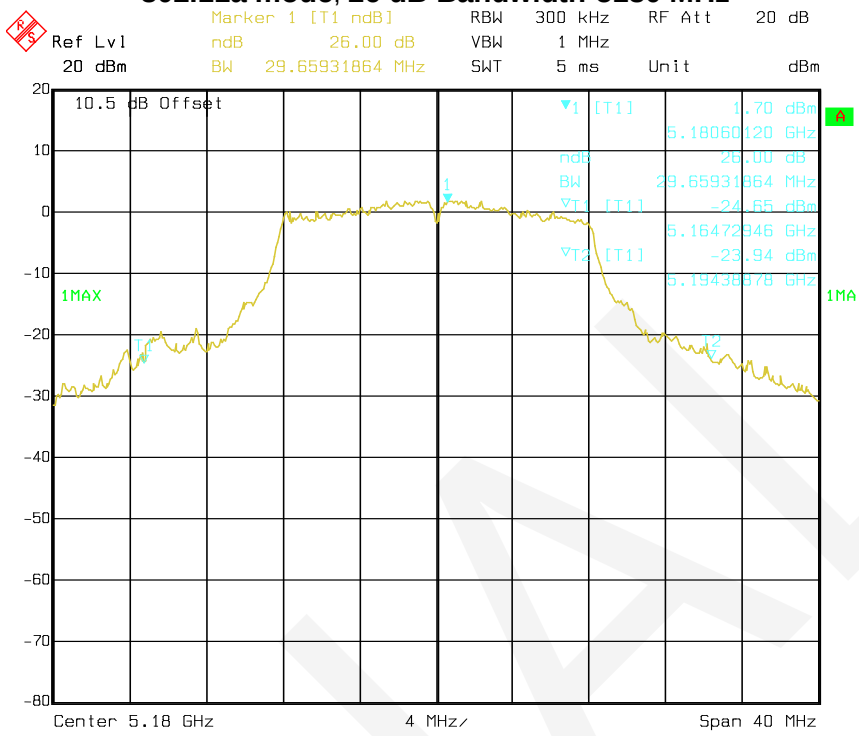
Test mode: Transmitting

For 5150-5250 MHz:

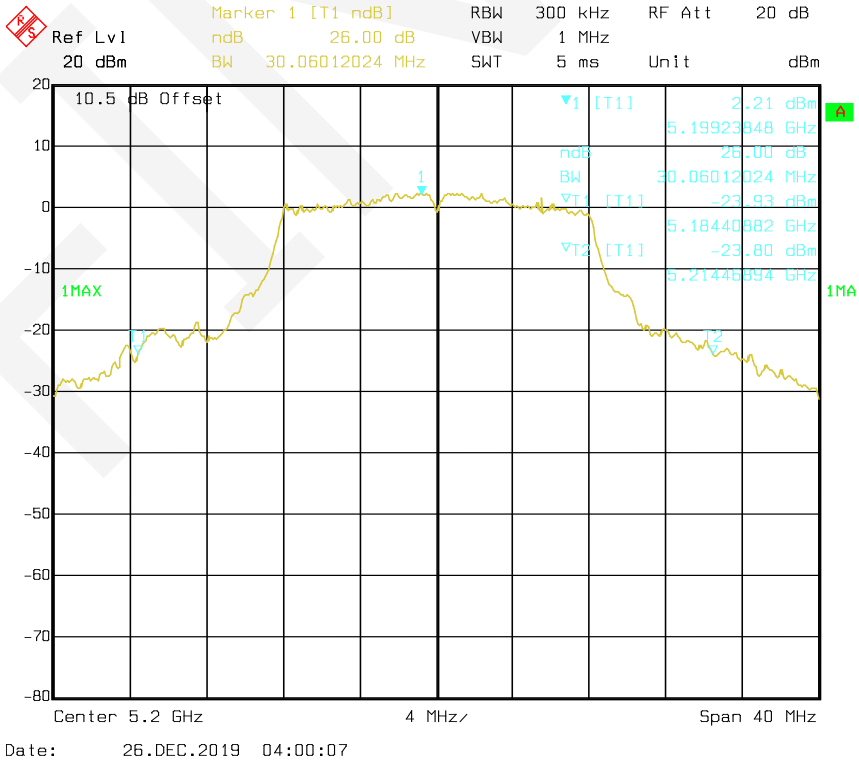
Mode	Channel	Frequency (MHz)	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11a	Low	5180	29.66	18.70
	Middle	5200	30.06	18.76
	High	5240	29.02	17.88
802.11n-HT20	Low	5180	27.17	18.76
	Middle	5200	28.70	18.68
	High	5240	27.49	18.76
802.11n-HT40	Low	5190	55.95	37.03
	High	5230	55.15	37.03
802.11ac80	/	5210	104.85	76.31

Note: the 99% Occupied Bandwidth doesn't extend U-NII-2A band 5250-5350MHz.

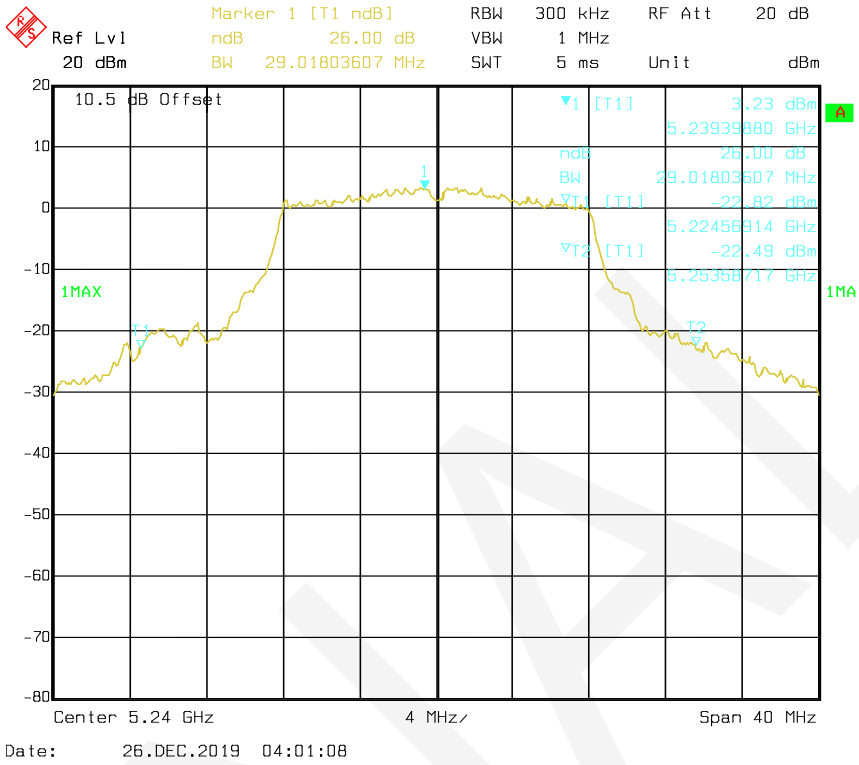
802.11a mode, 26 dB Bandwidth-5180 MHz



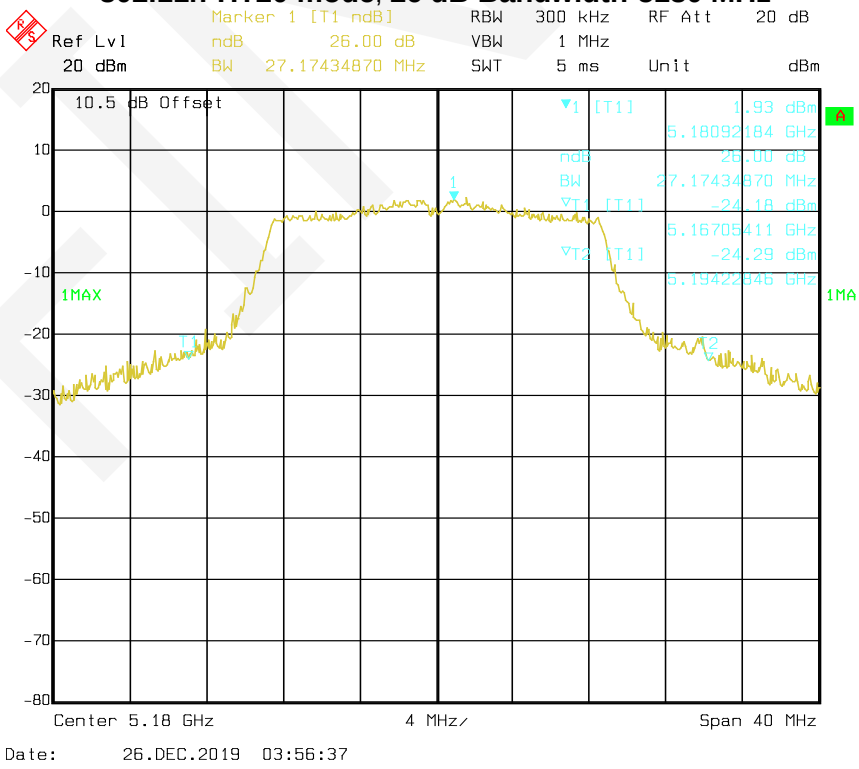
802.11a mode, 26 dB Bandwidth-5200 MHz



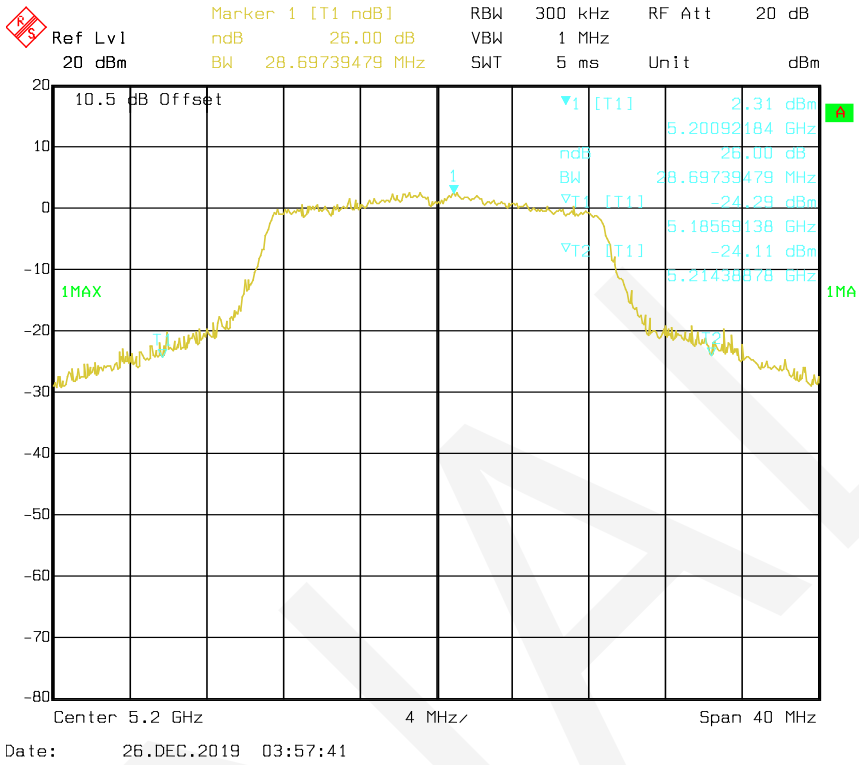
802.11a mode, 26 dB Bandwidth-5240 MHz



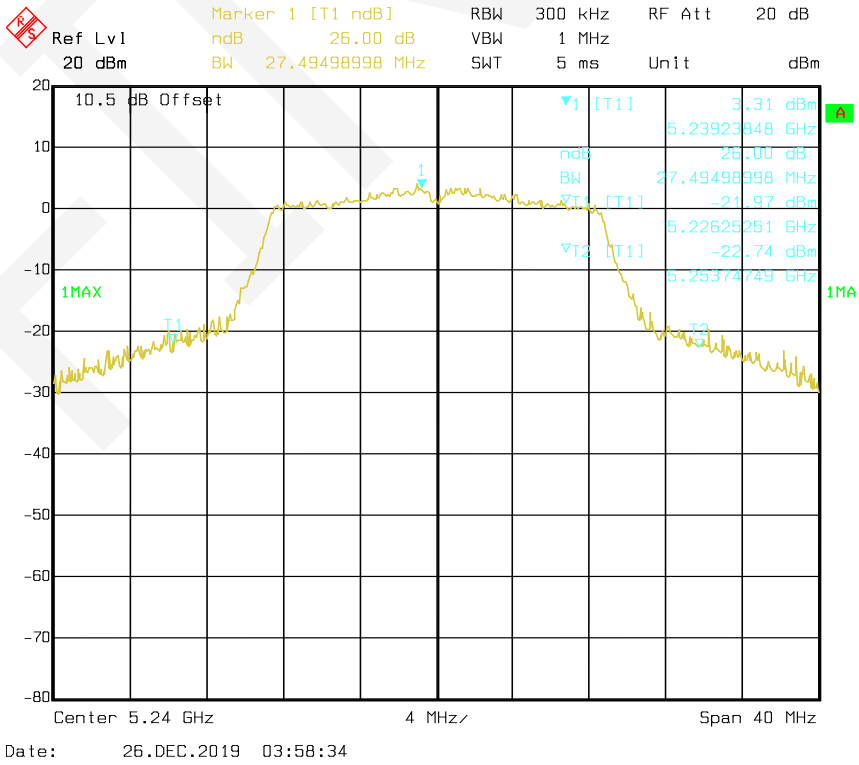
802.11n-HT20 mode, 26 dB Bandwidth-5180 MHz



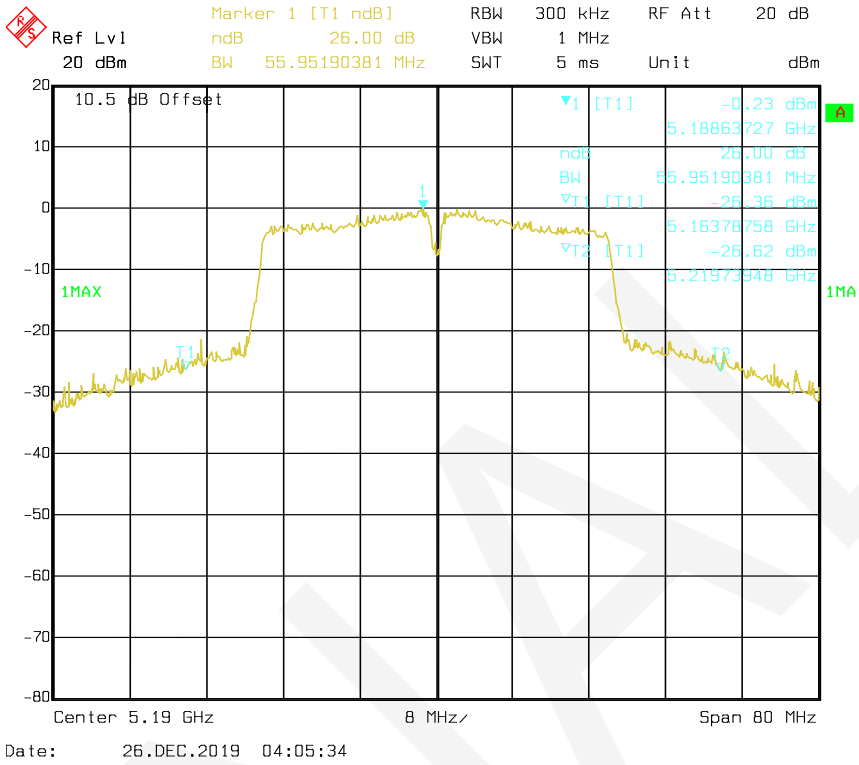
802.11n-HT20 mode, 26 dB Bandwidth-5200 MHz



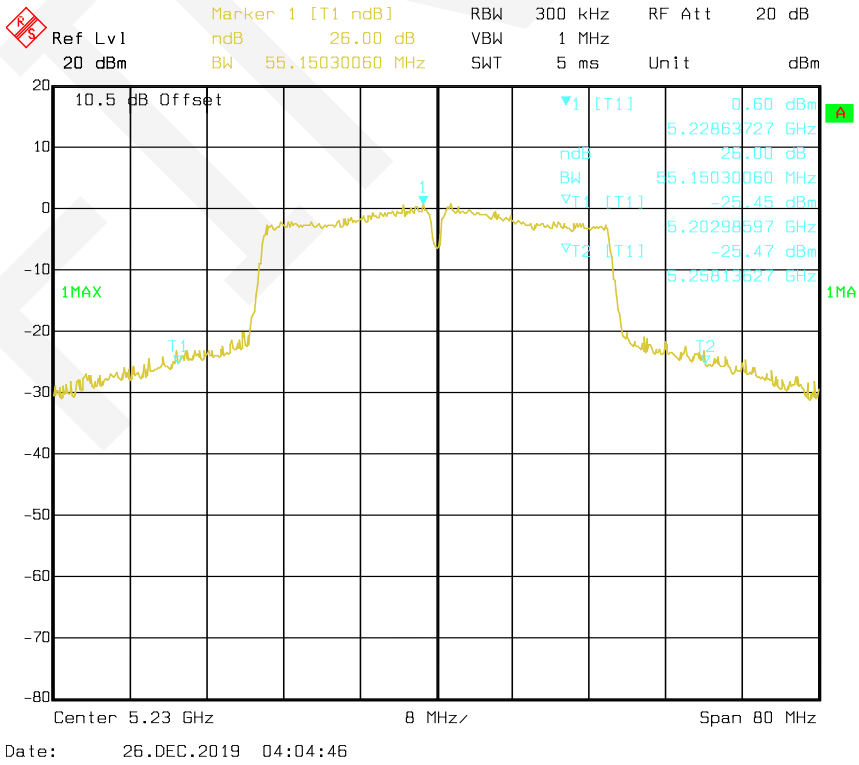
802.11n-HT20 mode, 26 dB Bandwidth-5240 MHz



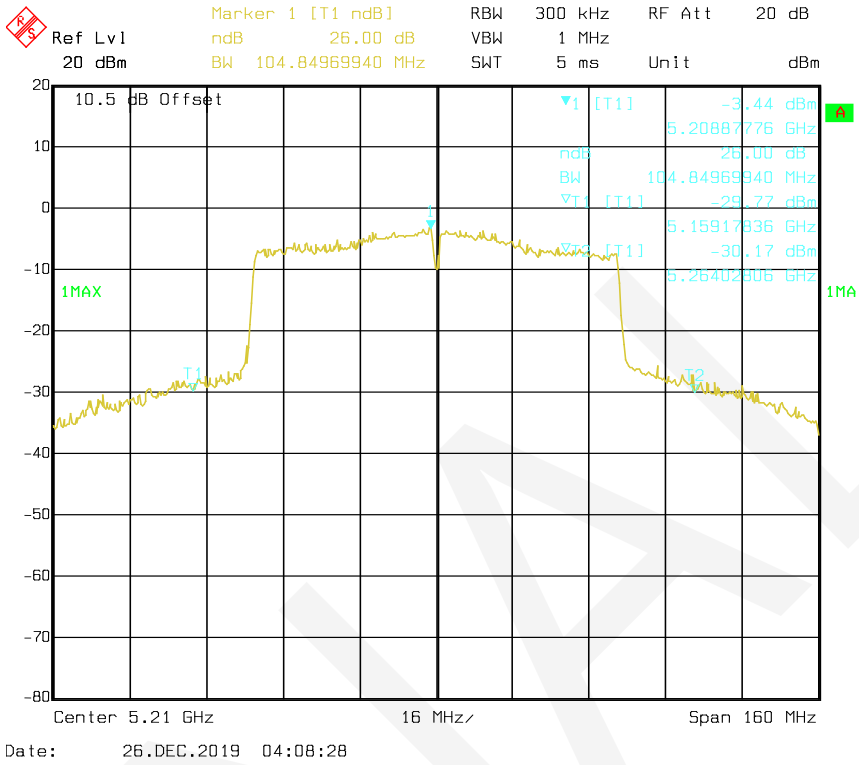
802.11n-HT40 mode, 26 dB Bandwidth-5190 MHz



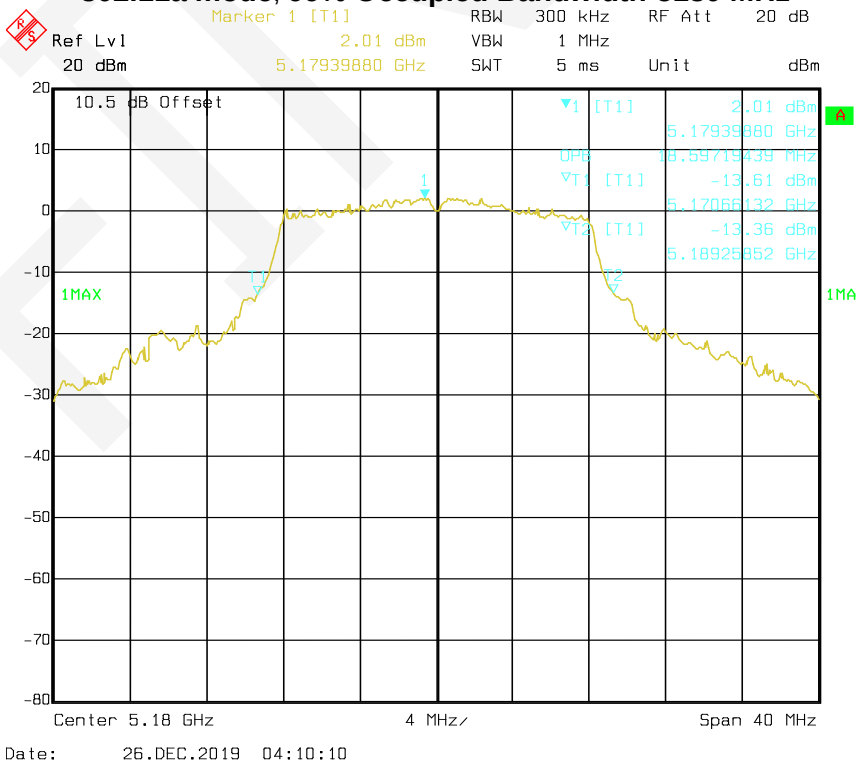
802.11n-HT40 mode, 26 dB Bandwidth-5230 MHz



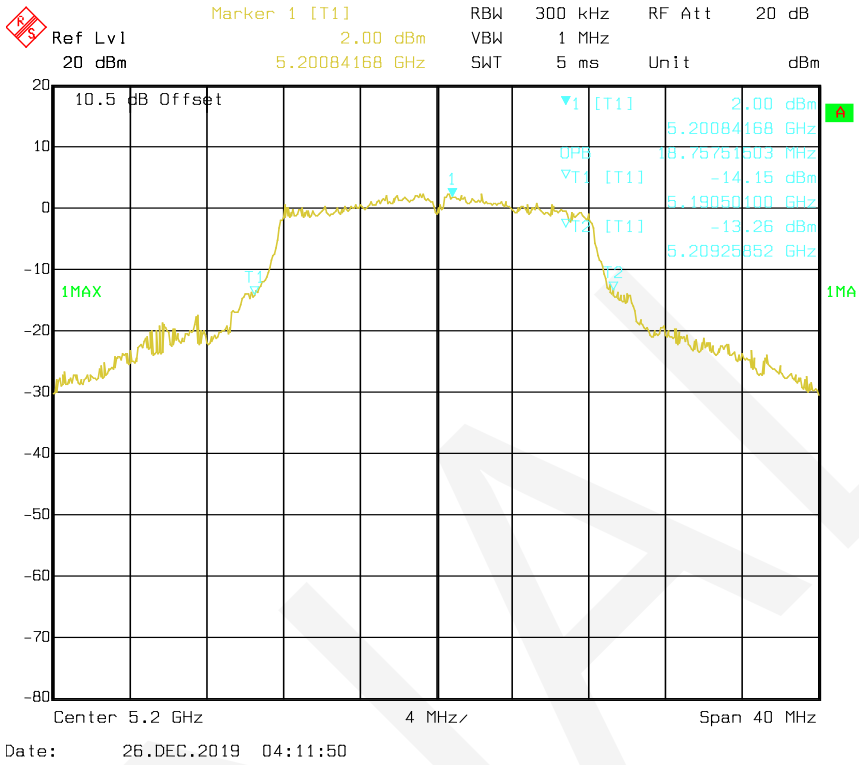
802.11ac80 mode, 26 dB Bandwidth-5210 MHz



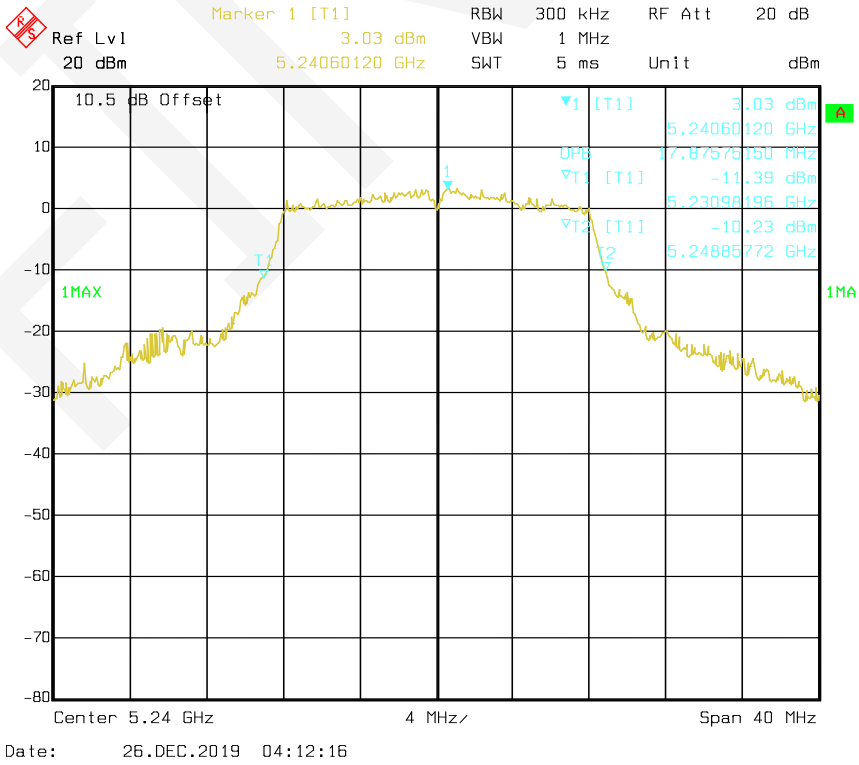
802.11a mode, 99% Occupied Bandwidth-5180 MHz



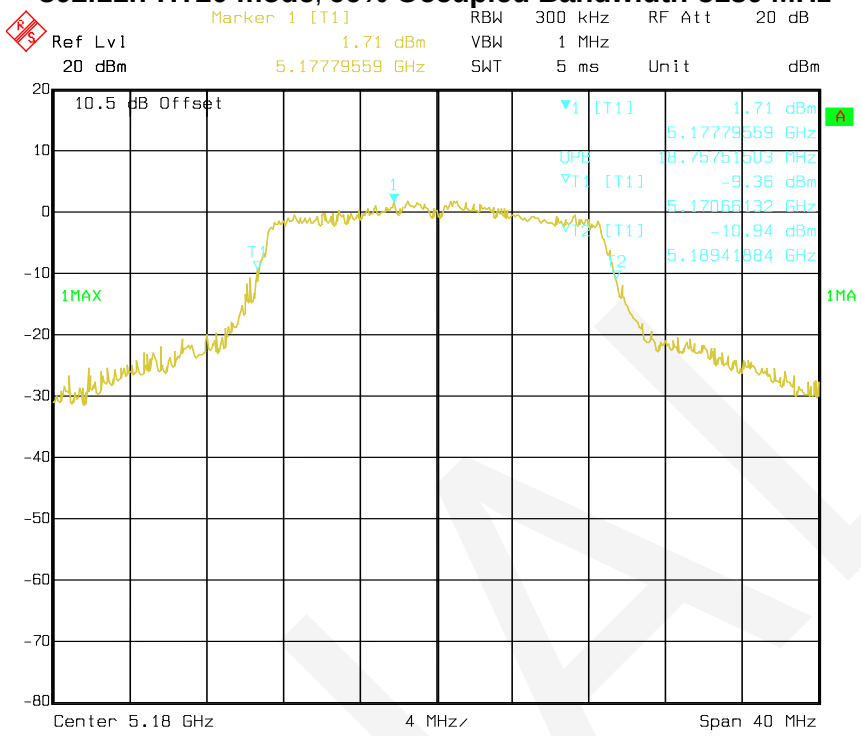
802.11a mode, 99% Occupied Bandwidth -5200 MHz



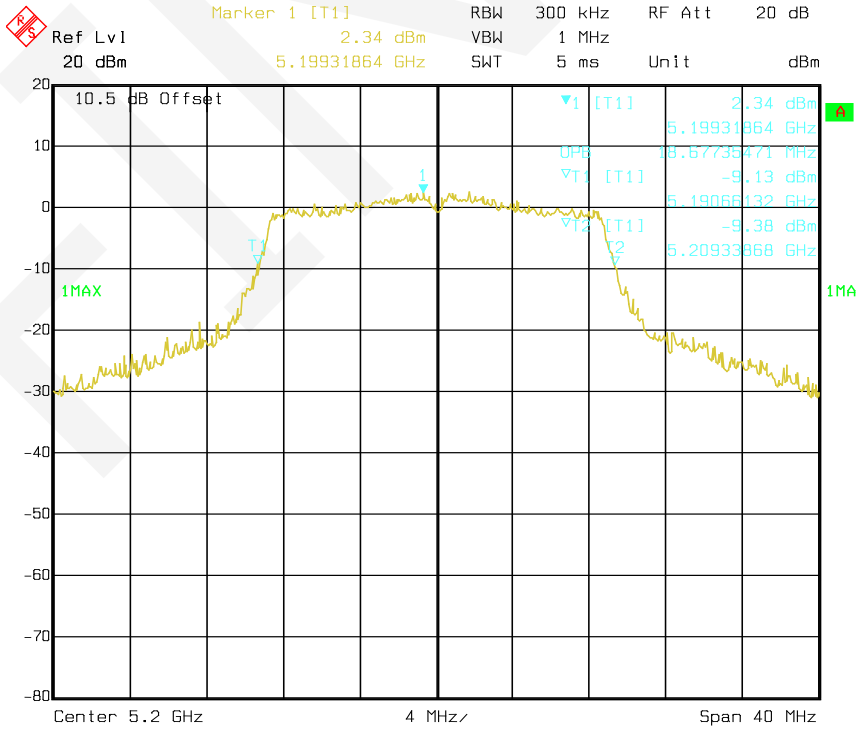
802.11a mode, 99% Occupied Bandwidth -5240 MHz



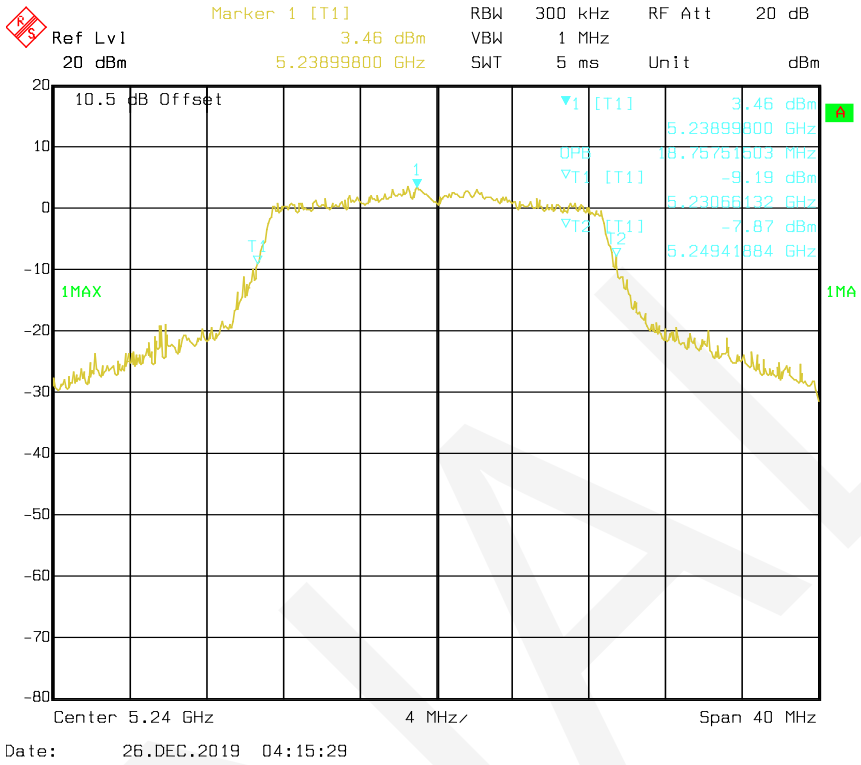
802.11n-HT20 mode, 99% Occupied Bandwidth-5180 MHz



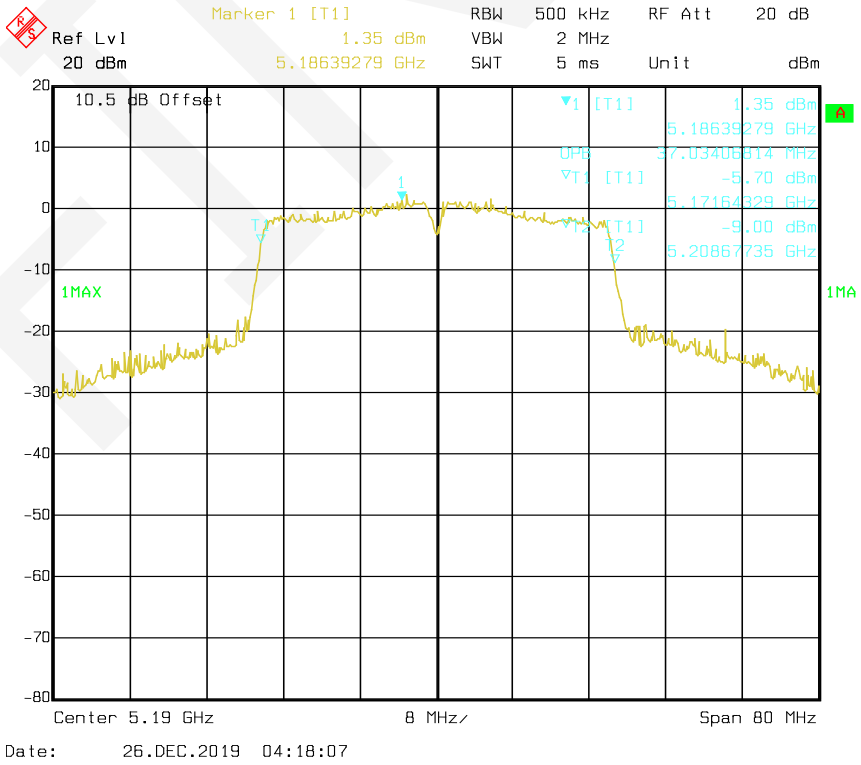
802.11n-HT20 mode, 99% Occupied Bandwidth -5200 MHz



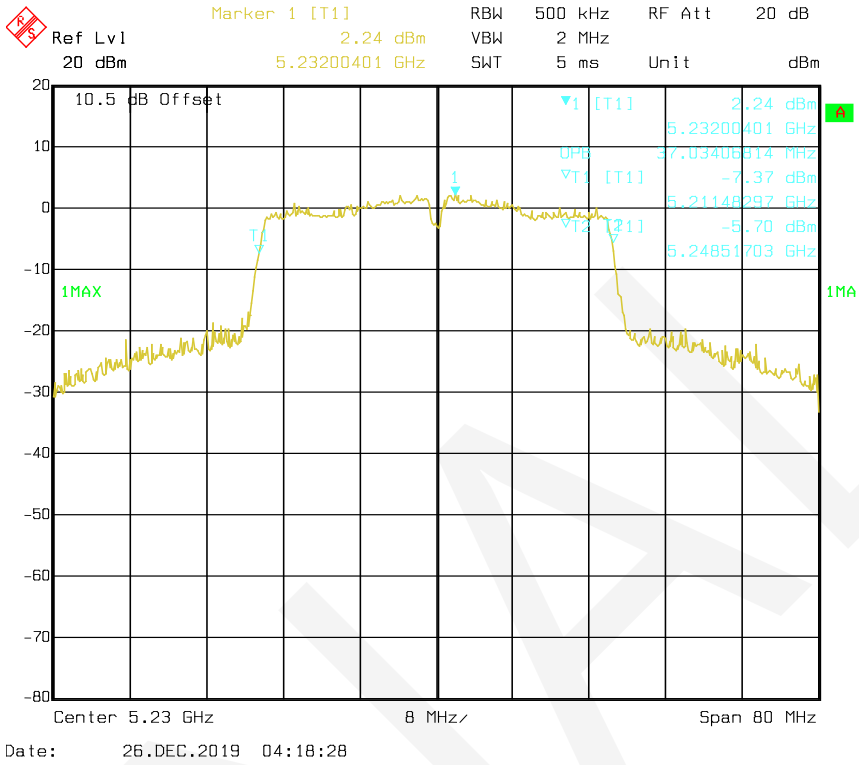
802.11n-HT20 mode, 99% Occupied Bandwidth -5240 MHz



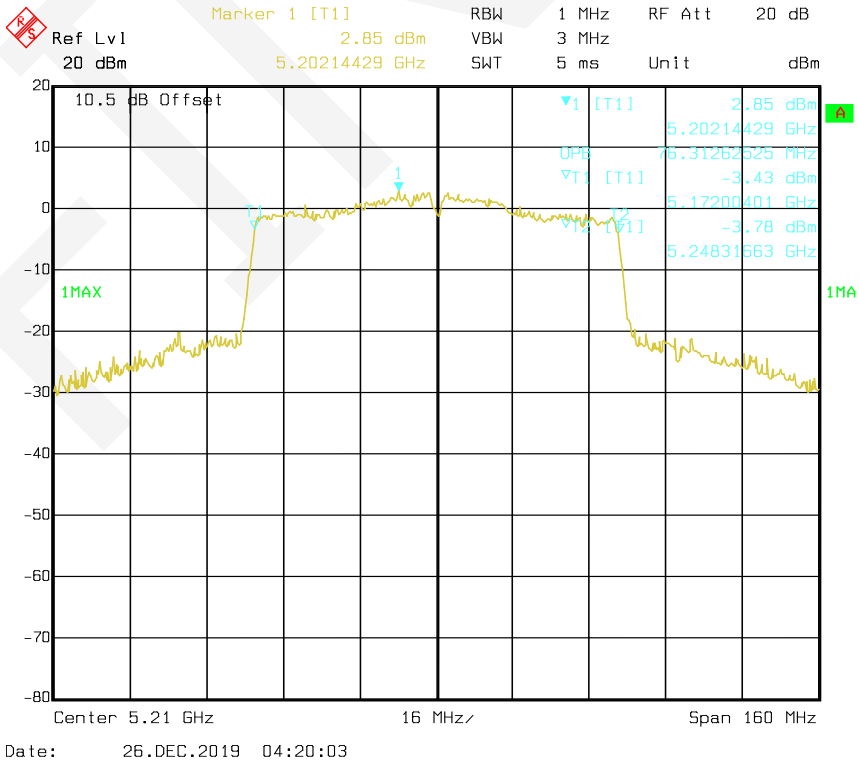
802.11n-HT40 mode, 99% Occupied Bandwidth-5190 MHz



802.11n-HT40 mode, 99% Occupied Bandwidth-5230 MHz



802.11ac80 mode, 99% Occupied Bandwidth-5210 MHz

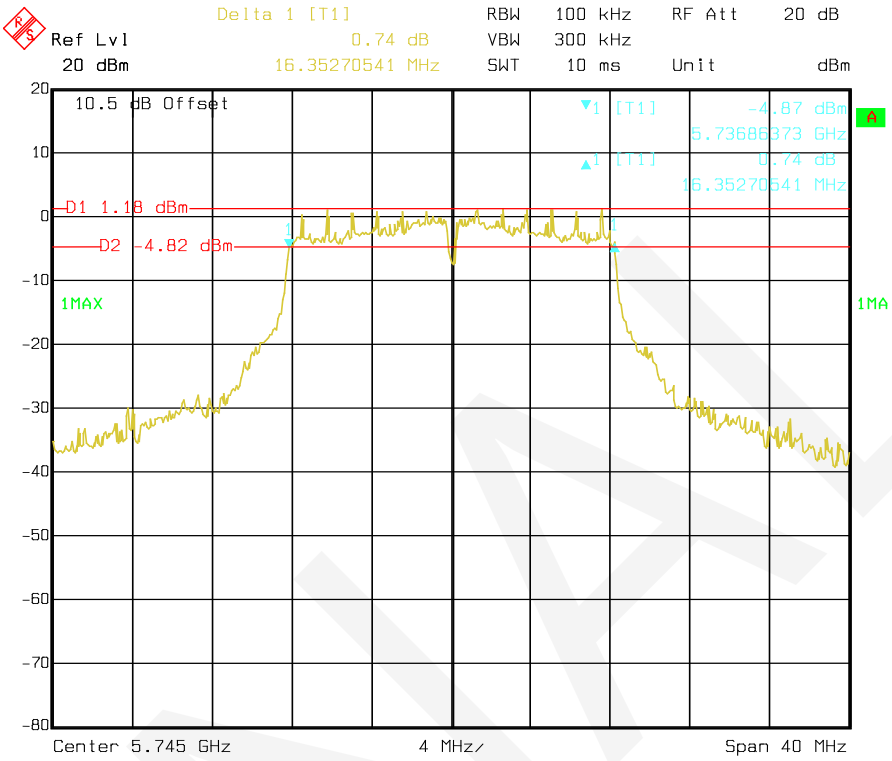


For 5725-5850 MHz:

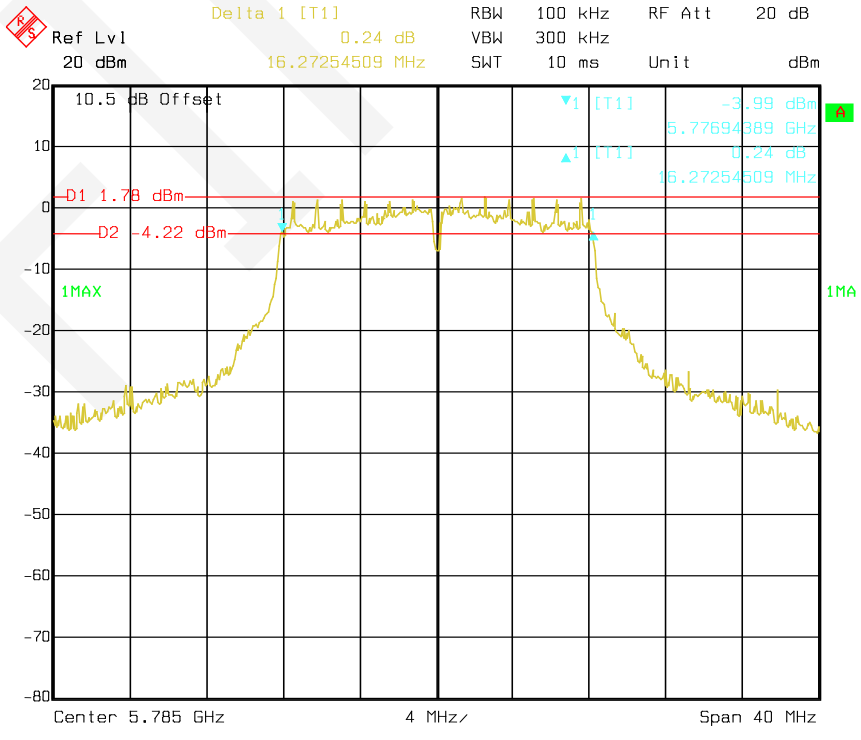
Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)
802.11a	Low	5745	16.35	17.39
	Middle	5785	16.27	17.64
	High	5825	16.35	17.64
802.11n-HT20	Low	5745	17.07	18.44
	Middle	5785	17.56	18.44
	High	5825	17.31	18.44
802.11n-HT40	Low	5755	36.07	36.71
	High	5795	36.07	36.87
802.11ac80	/	5775	75.99	76.31

Note: The 99% Occupied Bandwidth doesn't extend U-NII-2C band 5470-5725MHz.

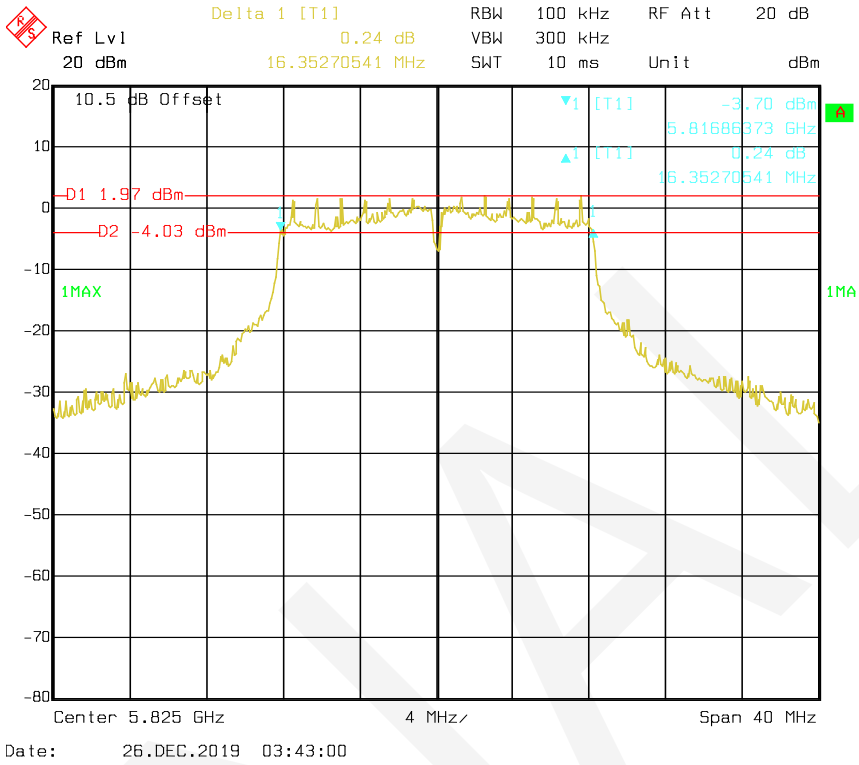
802.11a mode, 6 dB Bandwidth-5745 MHz



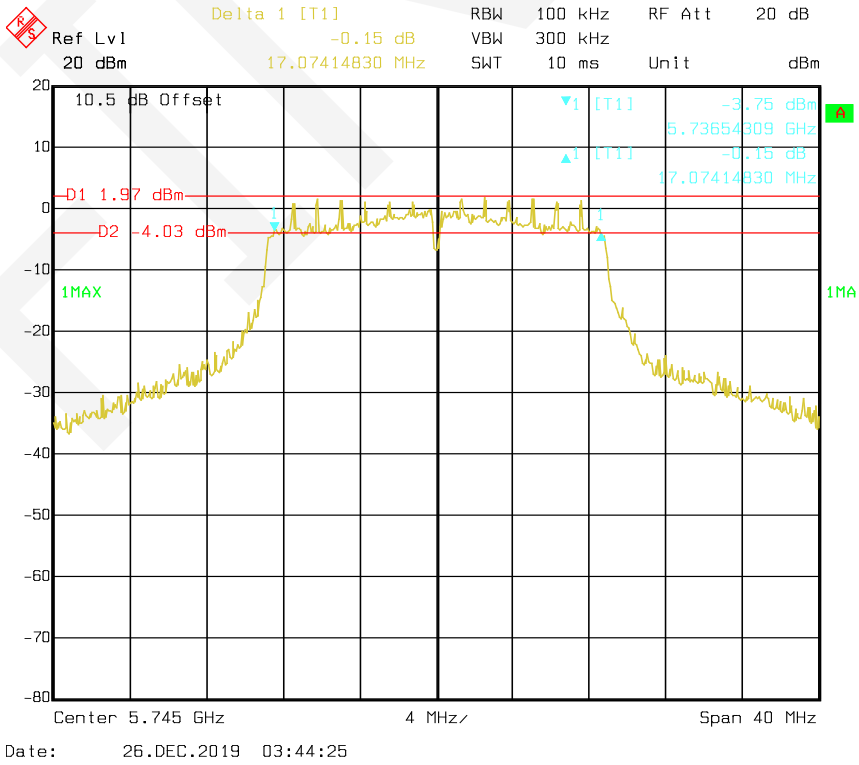
802.11a mode, 6 dB Bandwidth-5785 MHz



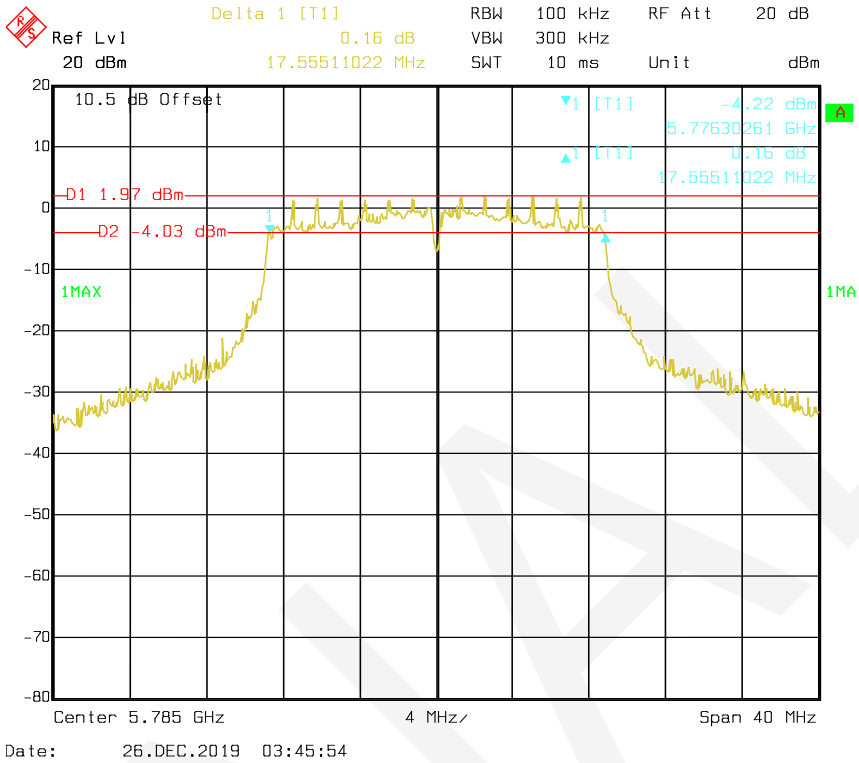
802.11a mode, 6 dB Bandwidth-5825 MHz



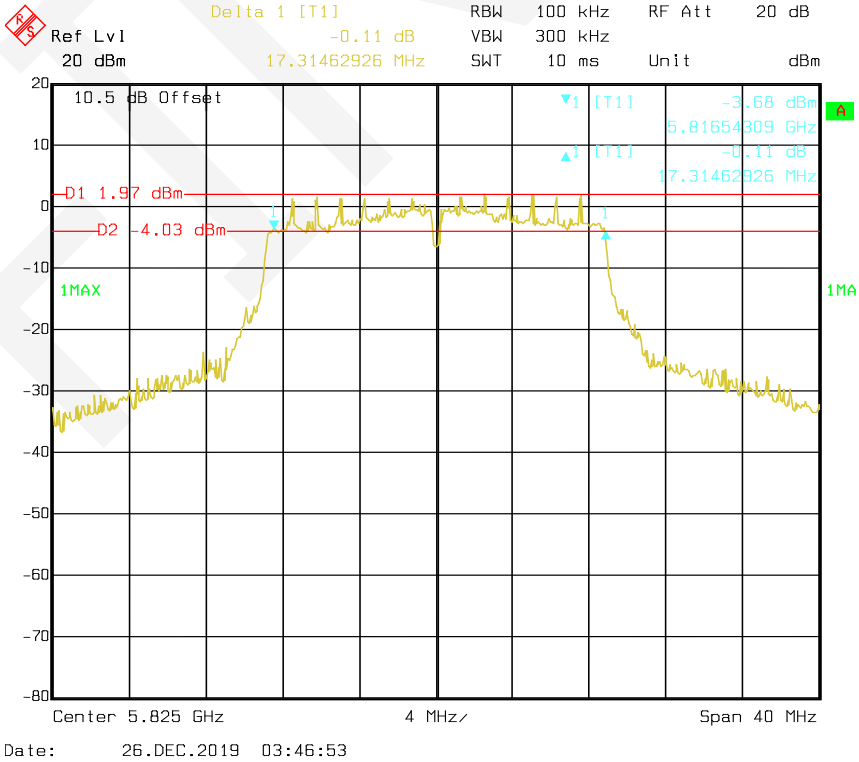
802.11n-HT20 mode, 6 dB Bandwidth-5745 MHz



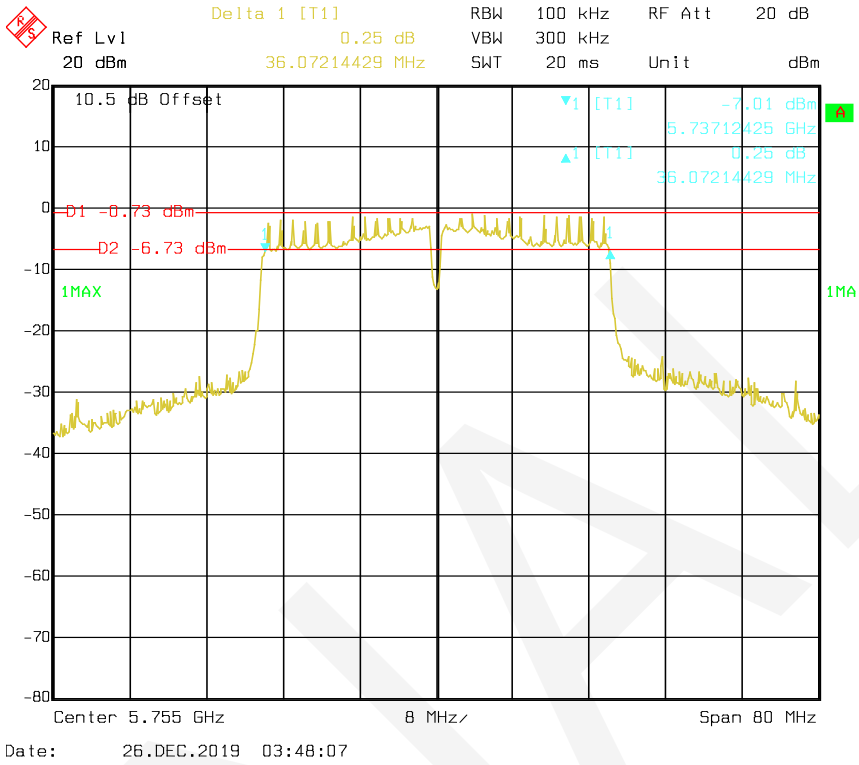
802.11n-HT20 mode, 6 dB Bandwidth-5785 MHz



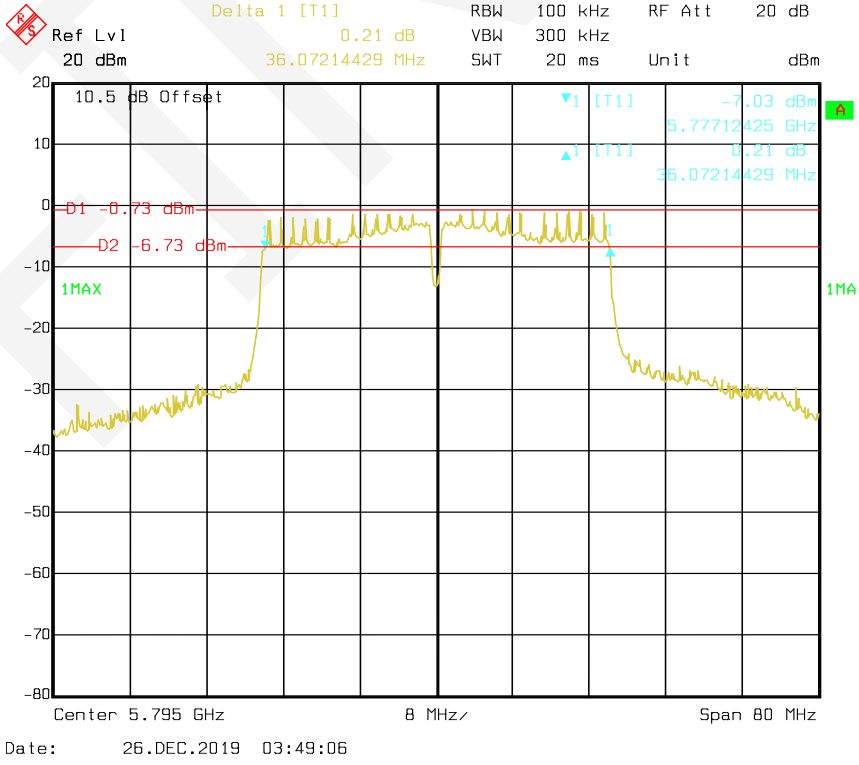
802.11n-HT20 mode, 6 dB Bandwidth-5825 MHz



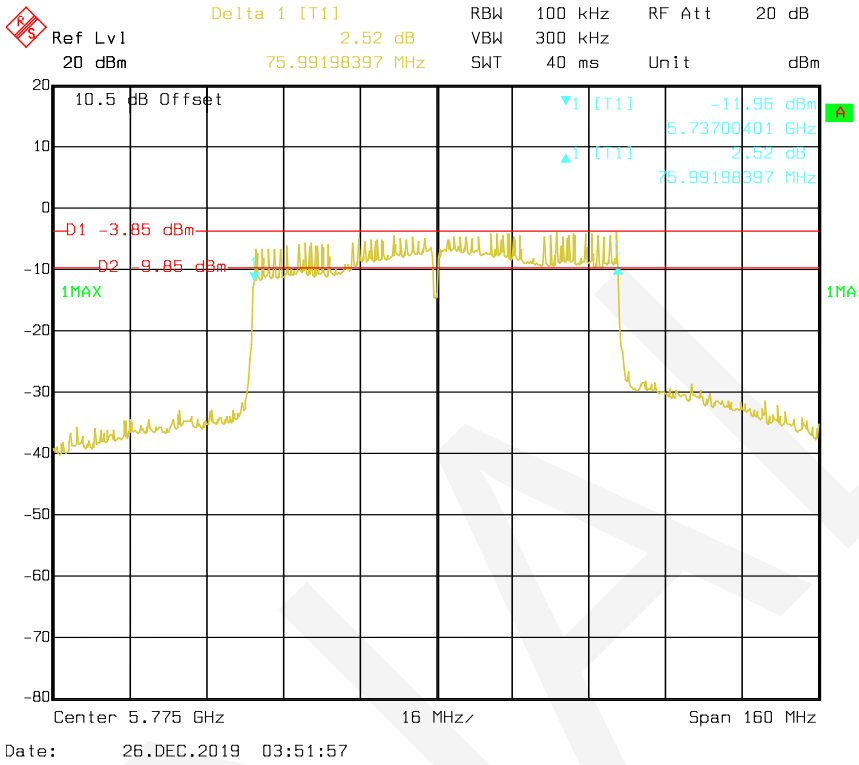
802.11n-HT40 mode, 6 dB Bandwidth-5755 MHz



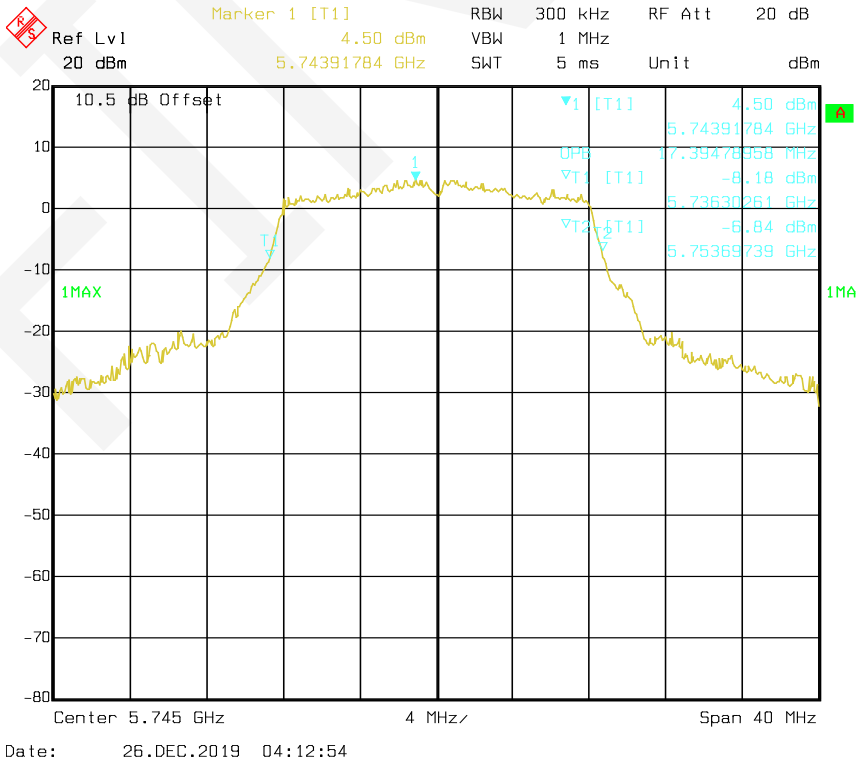
802.11n-HT40 mode, 6 dB Bandwidth-5795 MHz



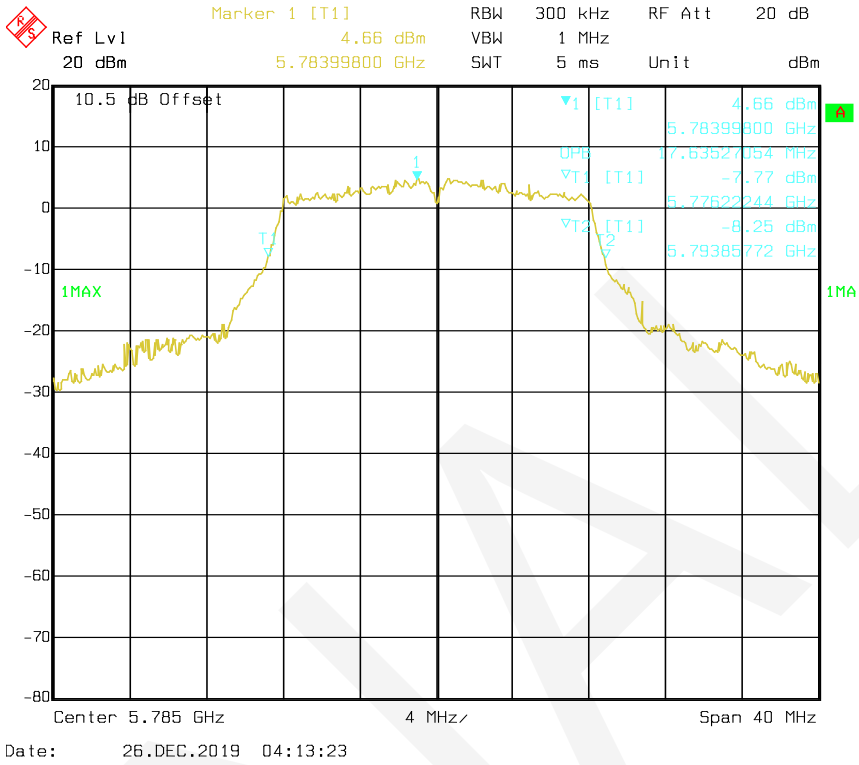
802.11ac80 mode, 6 dB Bandwidth-5775 MHz



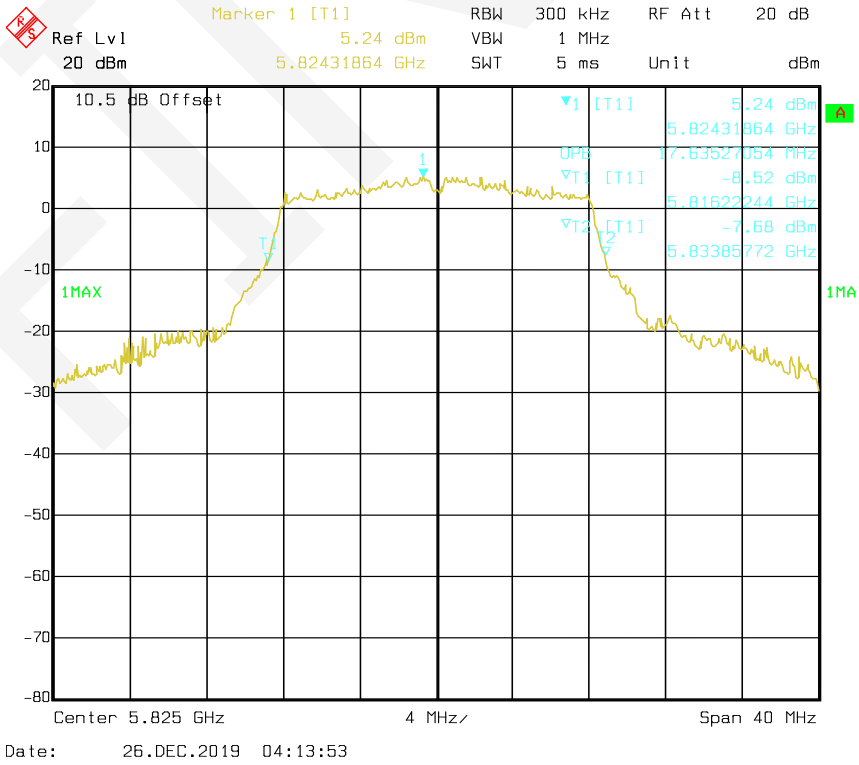
802.11a mode, 99% Occupied Bandwidth-5745 MHz



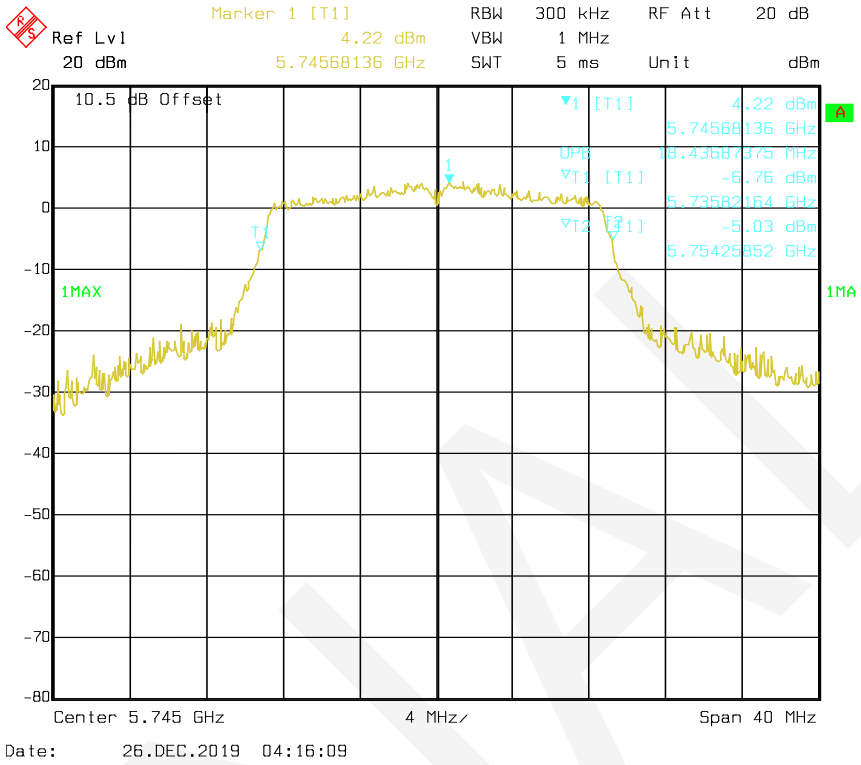
802.11a mode, 99% Occupied Bandwidth -5785 MHz



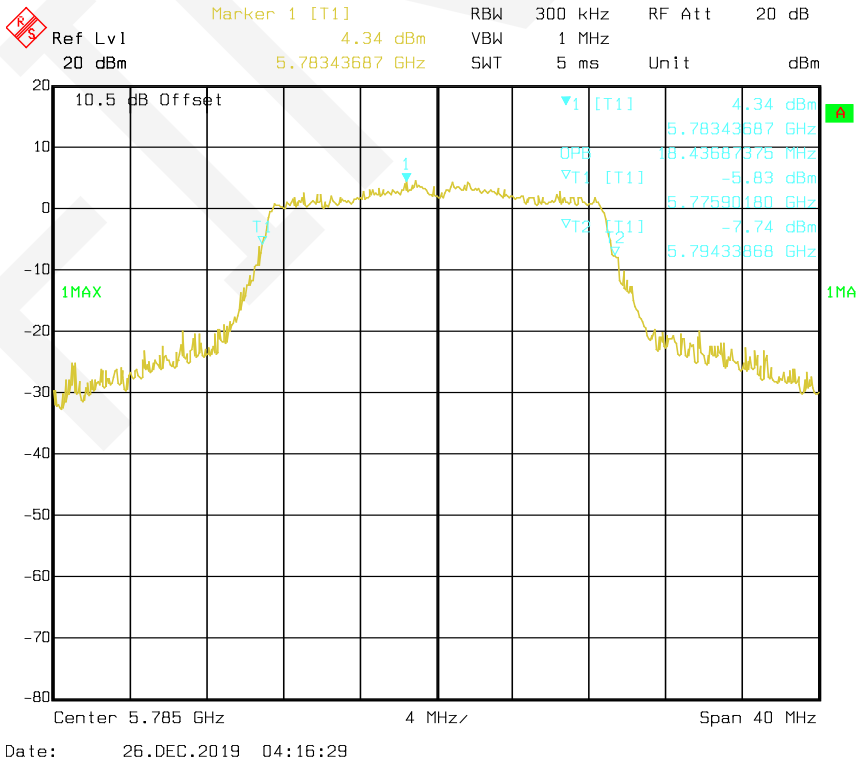
802.11a mode, 99% Occupied Bandwidth -5825 MHz



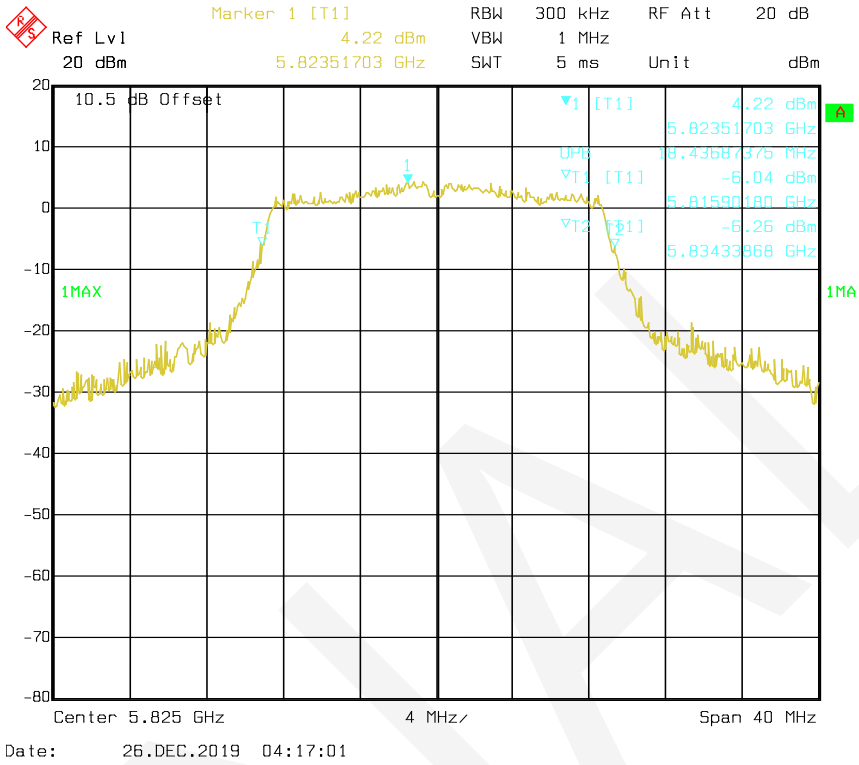
802.11n-HT20 mode, 99% Occupied Bandwidth-5745 MHz



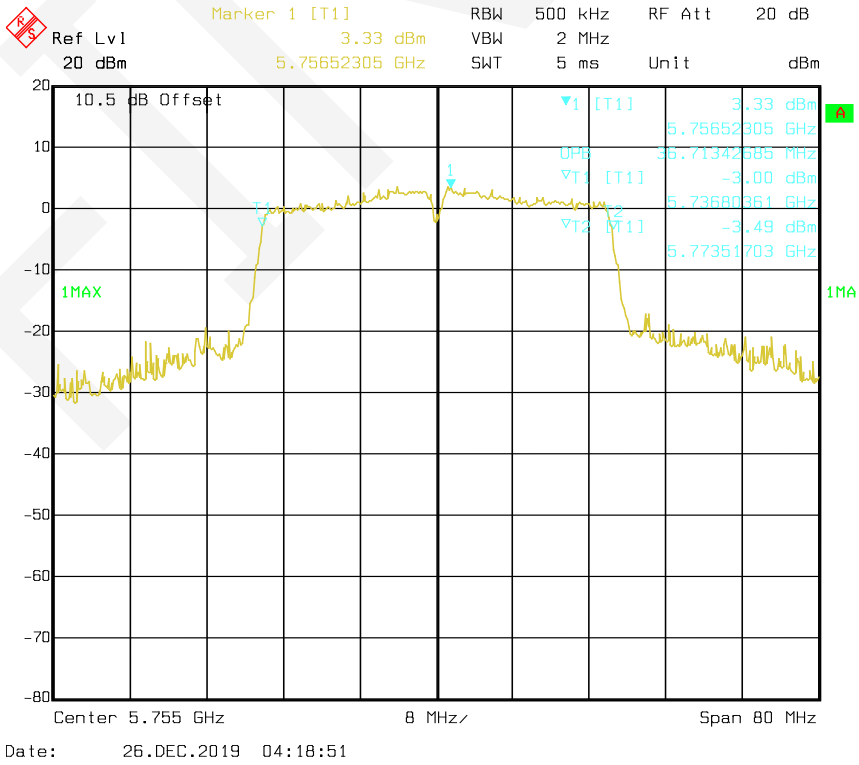
802.11n-HT20 mode, 99% Occupied Bandwidth-5785 MHz



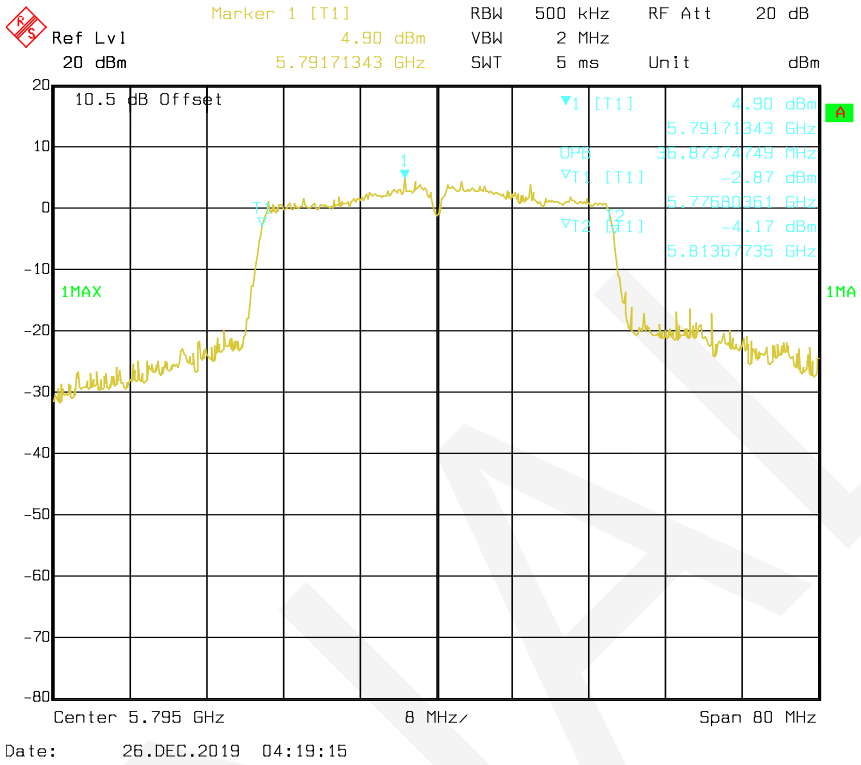
802.11n-HT20 mode, 99% Occupied Bandwidth-5825 MHz



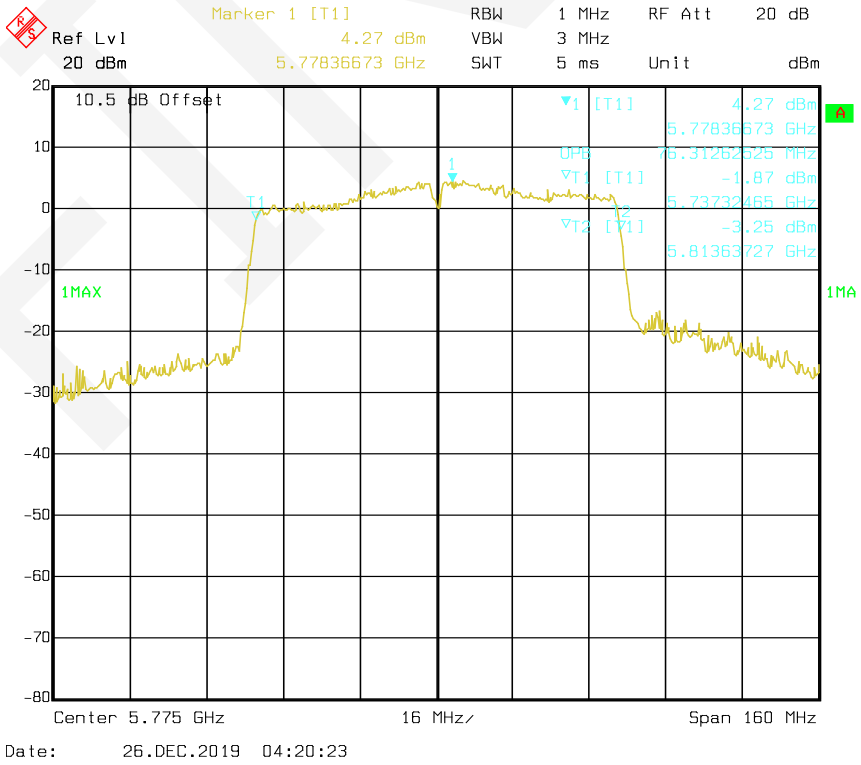
802.11n-HT40 mode, 99% Occupied Bandwidth-5755 MHz



802.11n-HT40 mode, 99% Occupied Bandwidth-5795 MHz



802.11ac80 mode, 99% Occupied Bandwidth-5775 MHz



FCC §15.407(a) (1)(IV), (3), (4) – CONDUCTED TRANSMITTER OUTPUT POWER

Applicable Standard

(a) Power limits:

(1) For the band 5.15-5.25 GHz.

(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. In addition, 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.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

NOTE TO PARAGRAPH (A)(3): The Commission strongly recommends that parties employing U-NII devices to provide critical communications services should determine if there are any nearby Government radar systems that could affect their operation.

(4) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

Test Procedure

According to 789033 D02 General UNII Test Procedures New Rules v02r01

Test Data

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	57 %
ATM Pressure:	95.9 kPa

The testing was performed by Eric Xiao on 2019-12-26.

Test Mode: Transmitting

For 5150-5250 MHz:

Mode	Channel	Frequency (MHz)	Conducted Average Output Power (dBm)	Limit (dBm)
802.11a	Low	5180	12.53	24
	Middle	5200	12.46	24
	High	5240	12.78	24
802.11n-HT20	Low	5180	12.11	24
	Middle	5200	12.25	24
	High	5240	12.43	24
802.11n-HT40	Low	5190	10.33	24
	High	5230	10.65	24
802.11ac 80	/	5210	11.30	24

Note: The Duty cycle Factor was corrected in result.

For 5725-5850 MHz:

Mode	Channel	Frequency (MHz)	Conducted Average Output Power (dBm)	Limit (dBm)
802.11a	Low	5745	5.81	30
	Middle	5785	4.31	30
	High	5825	3.91	30
802.11n-HT20	Low	5745	5.02	30
	Middle	5785	3.88	30
	High	5825	3.68	30
802.11n-HT40	Low	5755	4.67	30
	High	5795	3.72	30
802.11ac 80	/	5775	3.93	30

Note: The Duty cycle Factor was corrected in result.

FCC §15.407(a) (1) (iv) (3) (5) - POWER SPECTRAL DENSITY

Applicable Standard

(a) Power limits:

(1) For the band 5.15-5.25 GHz.

(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. In addition, 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.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz 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. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(5) The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

Test Procedure

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Test Data

Environmental Conditions

Temperature:	20 °C
Relative Humidity:	57 %
ATM Pressure:	95.9 kPa

The testing was performed by Eric Xiao on 2019-12-26.

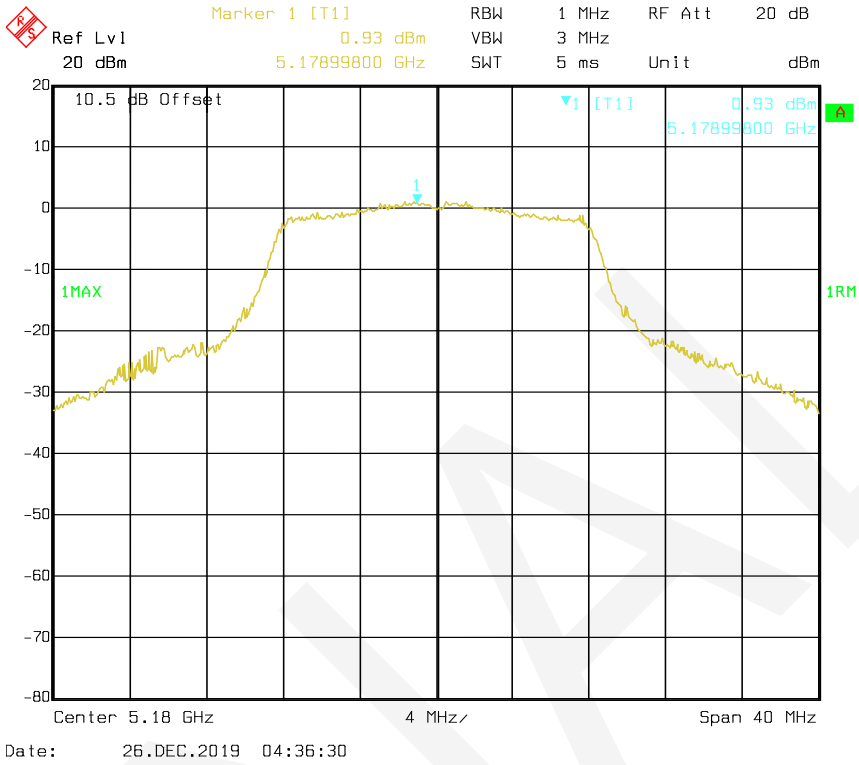
Test Mode: Transmitting

For 5150-5250 MHz:

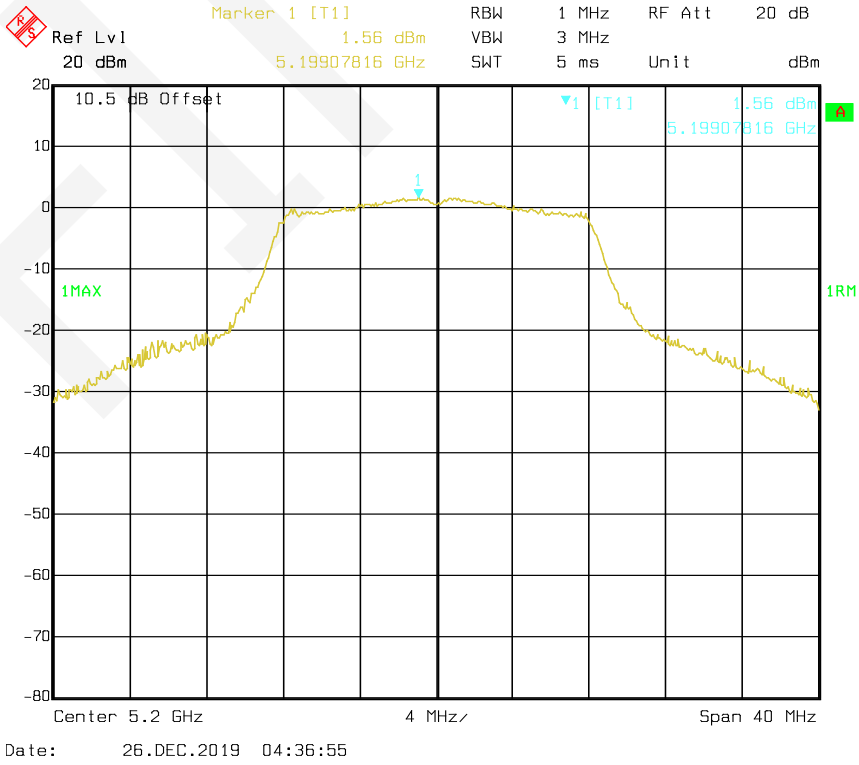
Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/MHz)	Limit (dBm/MHz)
802.11a	Low	5180	0.93	11
	Middle	5200	1.56	11
	High	5240	2.37	11
802.11n-HT20	Low	5180	0.96	11
	Middle	5200	0.98	11
	High	5240	2.15	11
802.11n-HT40	Low	5190	-1.77	11
	High	5230	-1.37	11
802.11ac80	/	5210	-5.03	11

Note: The Duty cycle Factor was corrected in result.

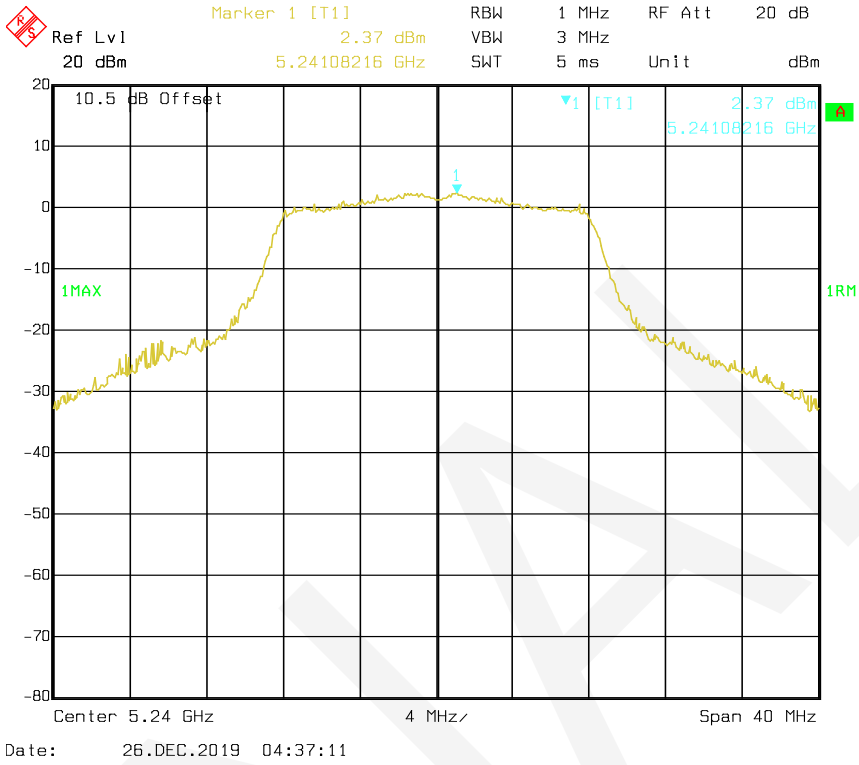
802.11a mode, Power Spectral Density-5180 MHz



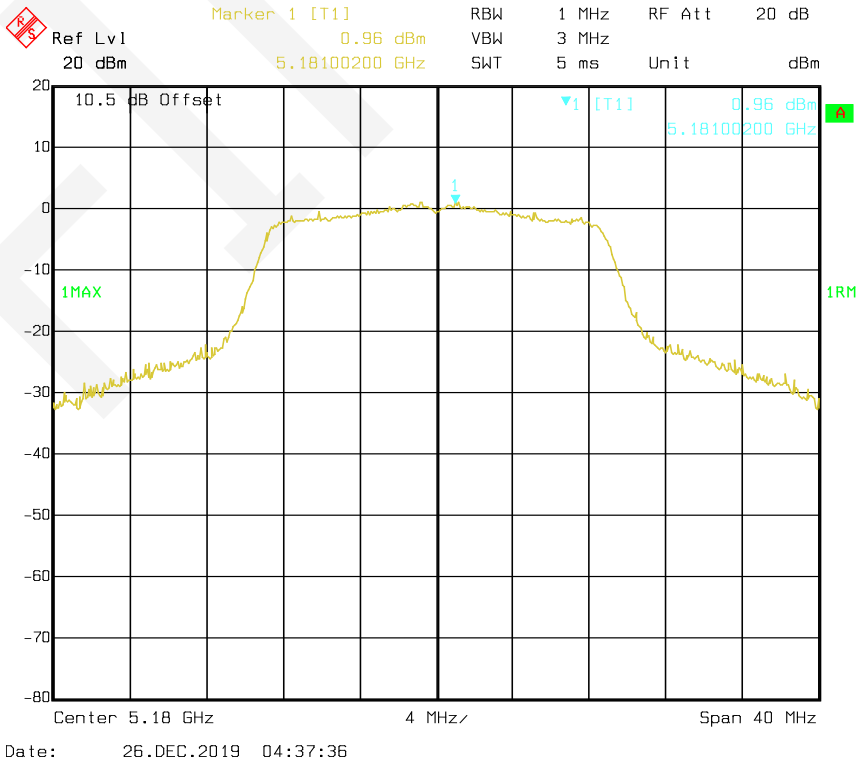
802.11a mode, Power Spectral Density-5200 MHz



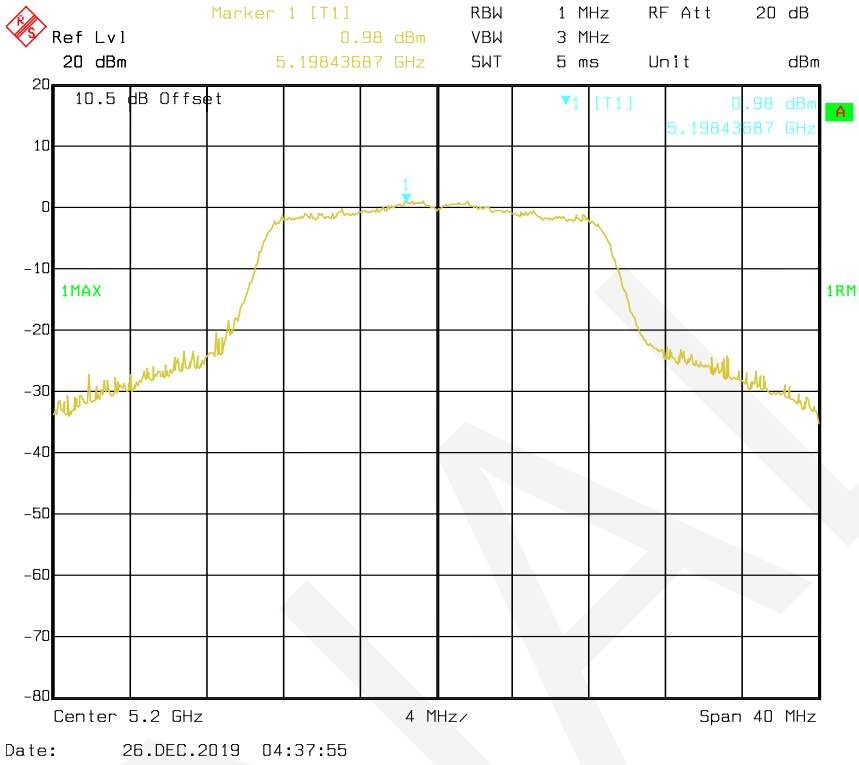
802.11a mode, Power Spectral Density-5240 MHz



802.11n-HT20 mode, Power Spectral Density-5180 MHz

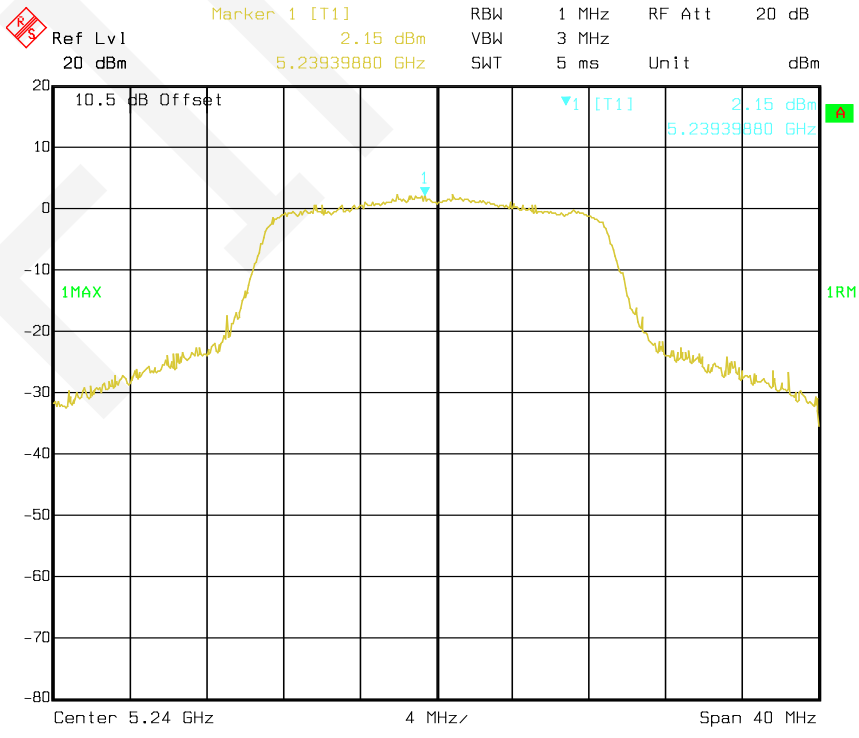


802.11n-HT20 mode, Power Spectral Density-5200 MHz



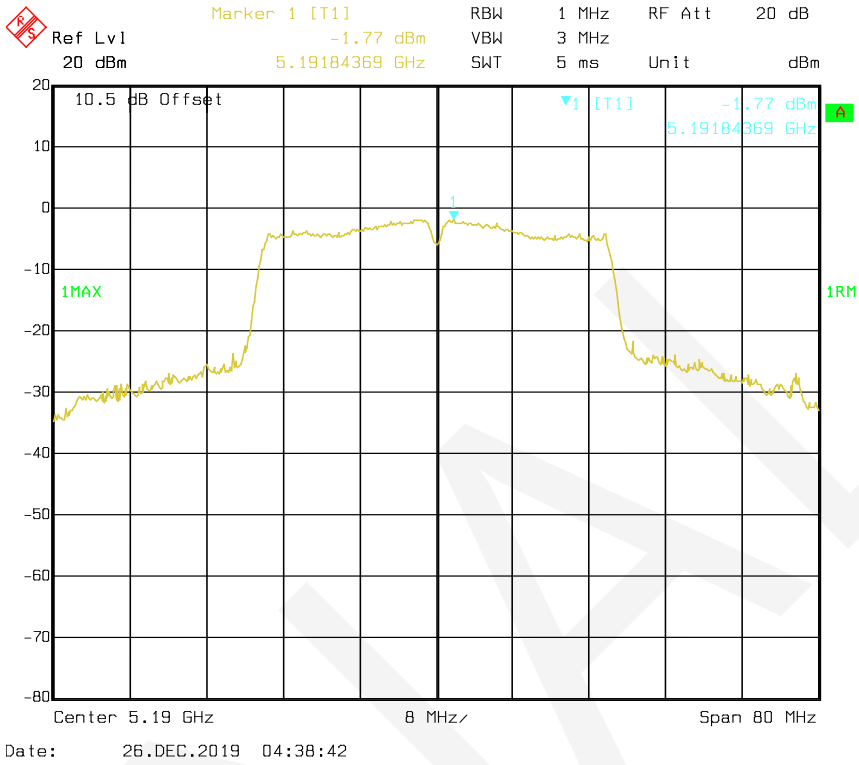
Date: 26.DEC.2019 04:37:55

802.11n-HT20 mode, Power Spectral Density-5240 MHz

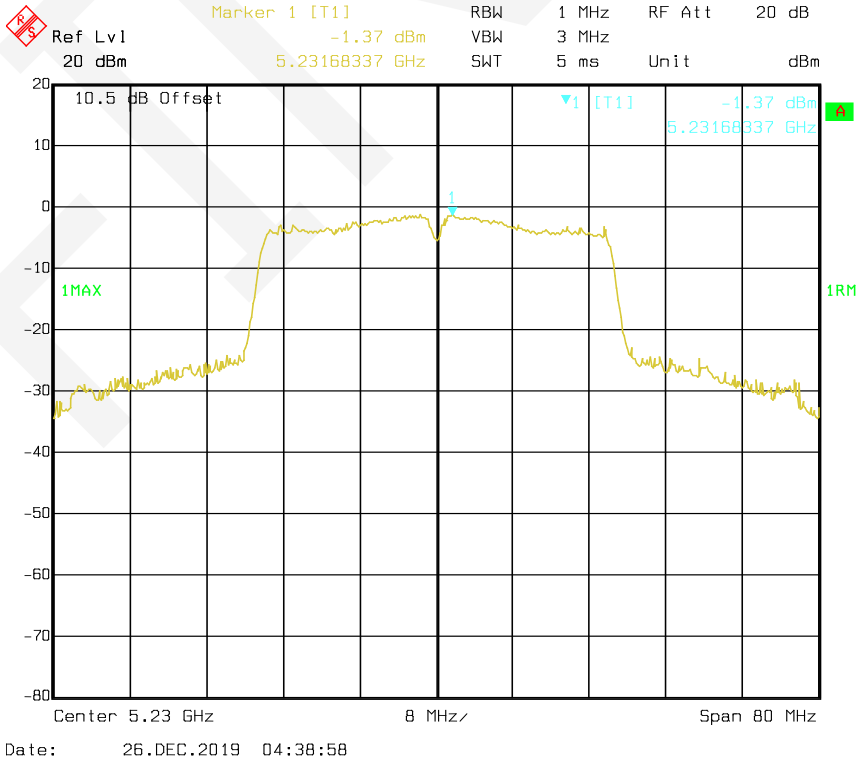


Date: 26.DEC.2019 04:38:12

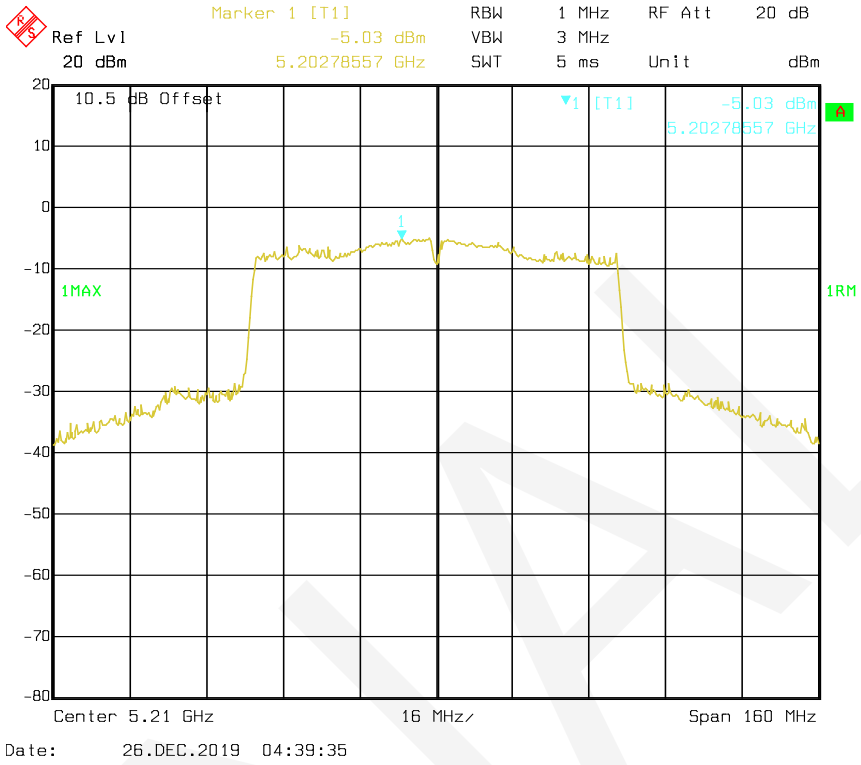
802.11n-HT40 mode, Power Spectral Density-5190 MHz



802.11n-HT40 mode, Power Spectral Density-5230 MHz



802.11ac 80 mode, Power Spectral Density-5210 MHz

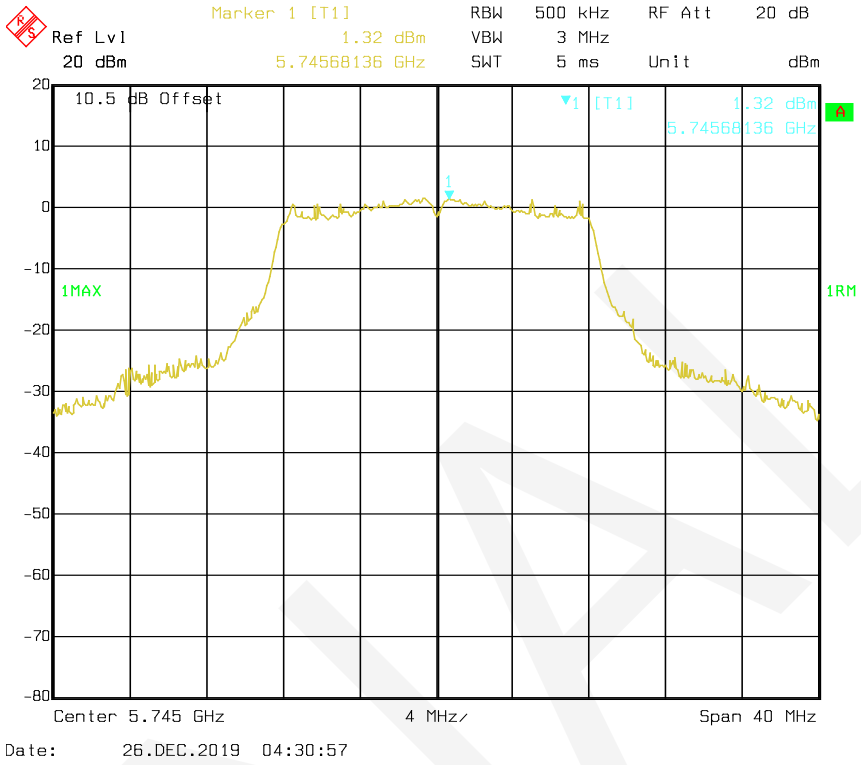


For 5725-5850 MHz:

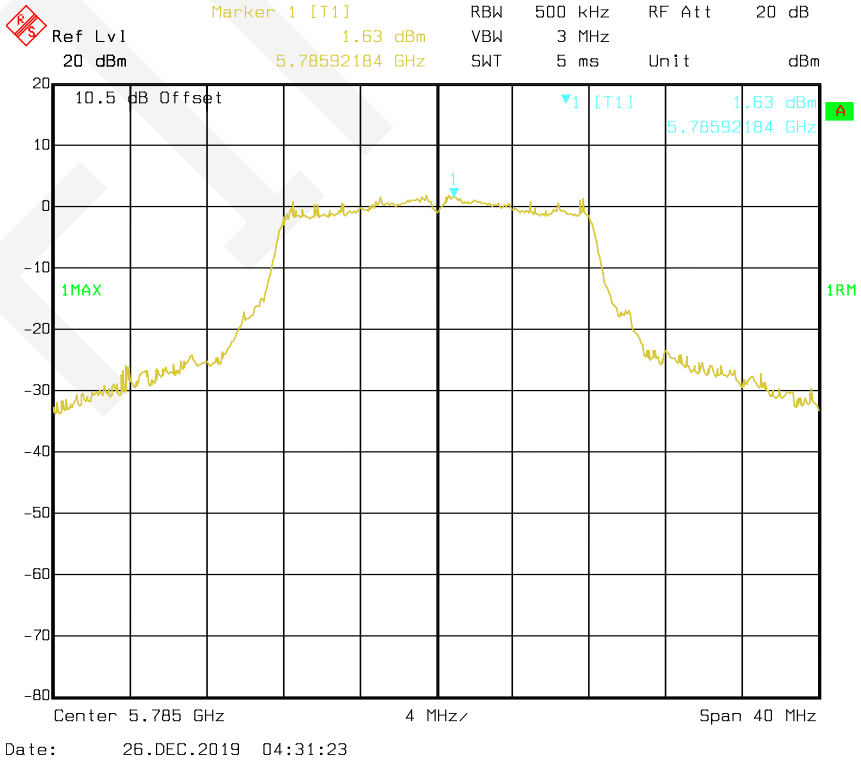
Mode	Channel	Frequency (MHz)	Power Spectral Density (dBm/500 kHz)	Limit (dBm/500 kHz)
802.11a	Low	5745	1.32	30
	Middle	5785	1.63	30
	High	5825	2.18	30
802.11n-HT20	Low	5745	1.13	30
	Middle	5785	1.50	30
	High	5825	1.43	30
802.11n-HT40	Low	5755	-1.44	30
	High	5795	-1.34	30
802.11ac80	/	5775	-4.36	30

Note: The Duty cycle Factor was corrected in result.

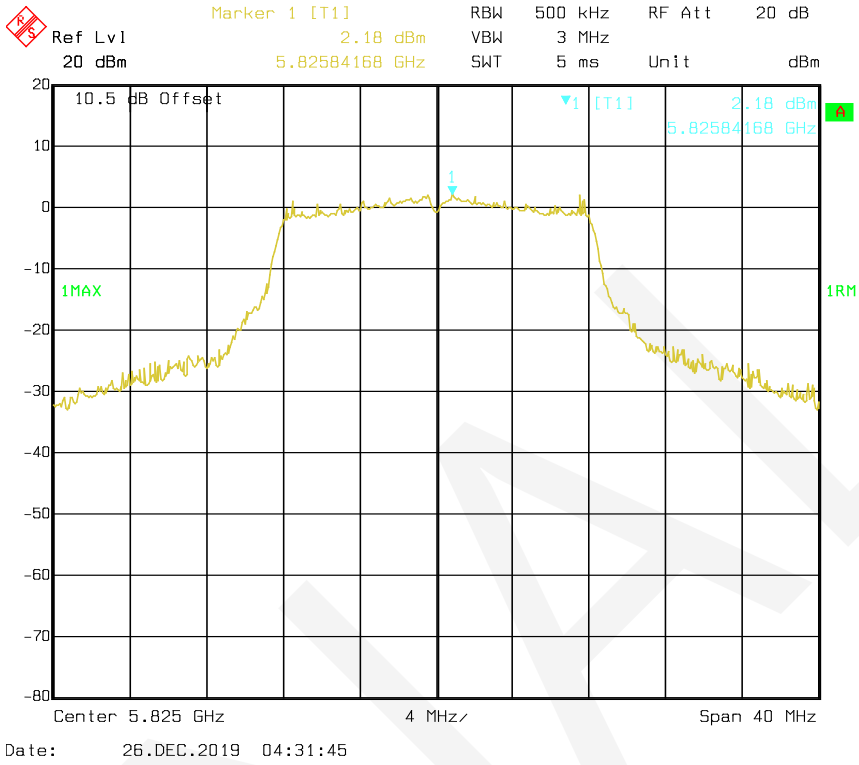
802.11a mode, Power Spectral Density-5745 MHz



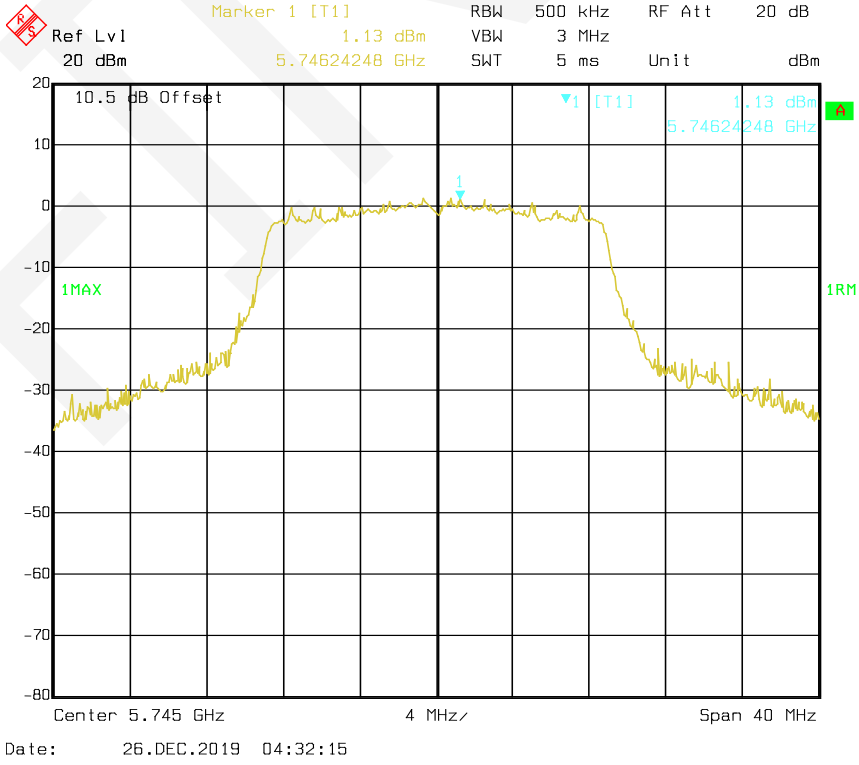
802.11a mode, Power Spectral Density-5785 MHz



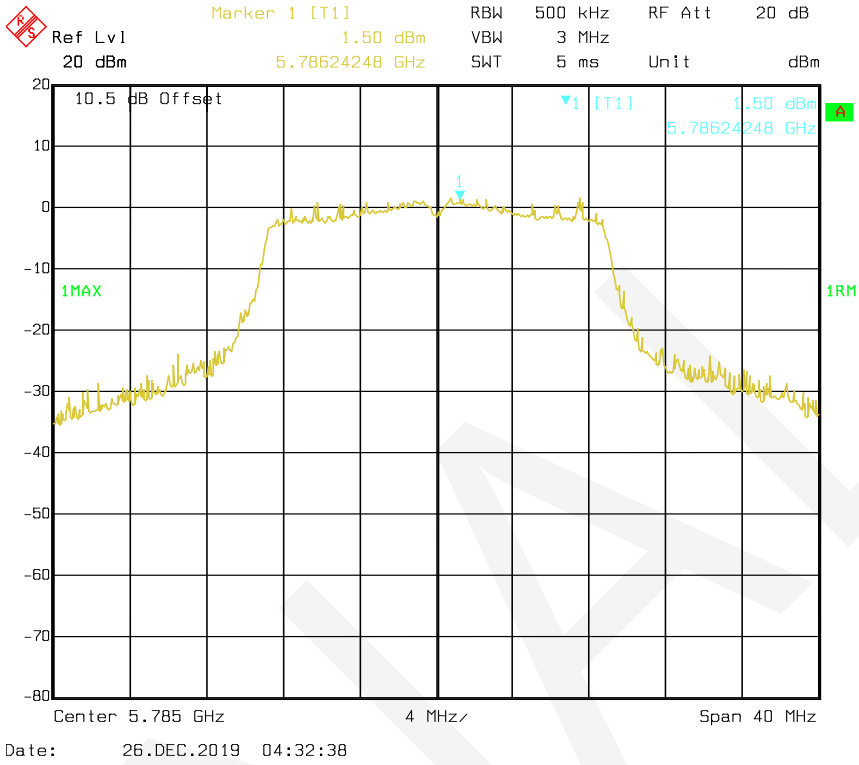
802.11a mode, Power Spectral Density-5825 MHz



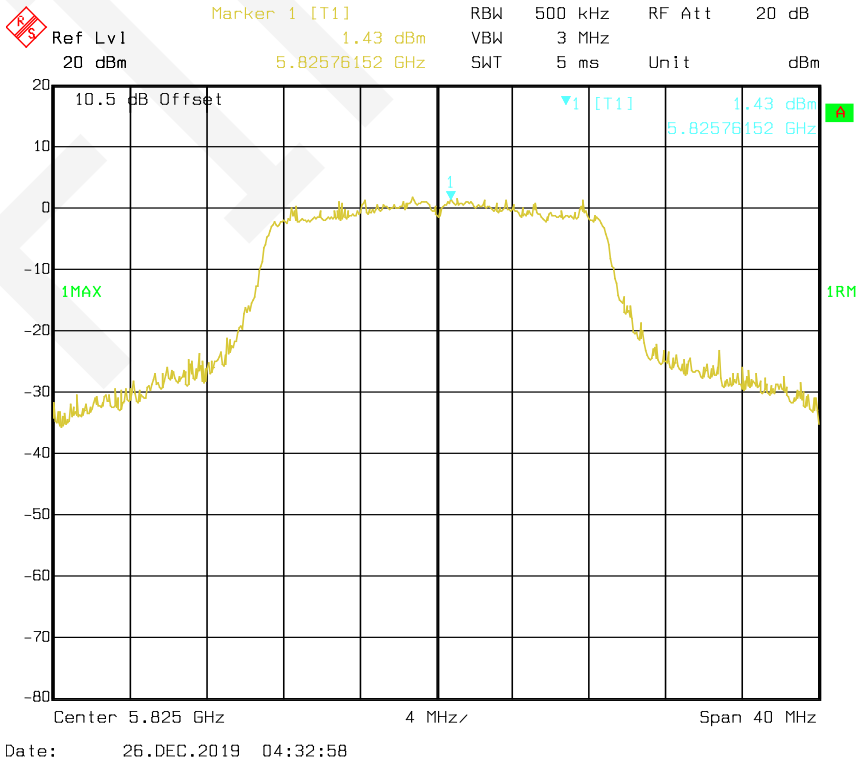
802.11n-HT20 mode, Power Spectral Density-5745 MHz



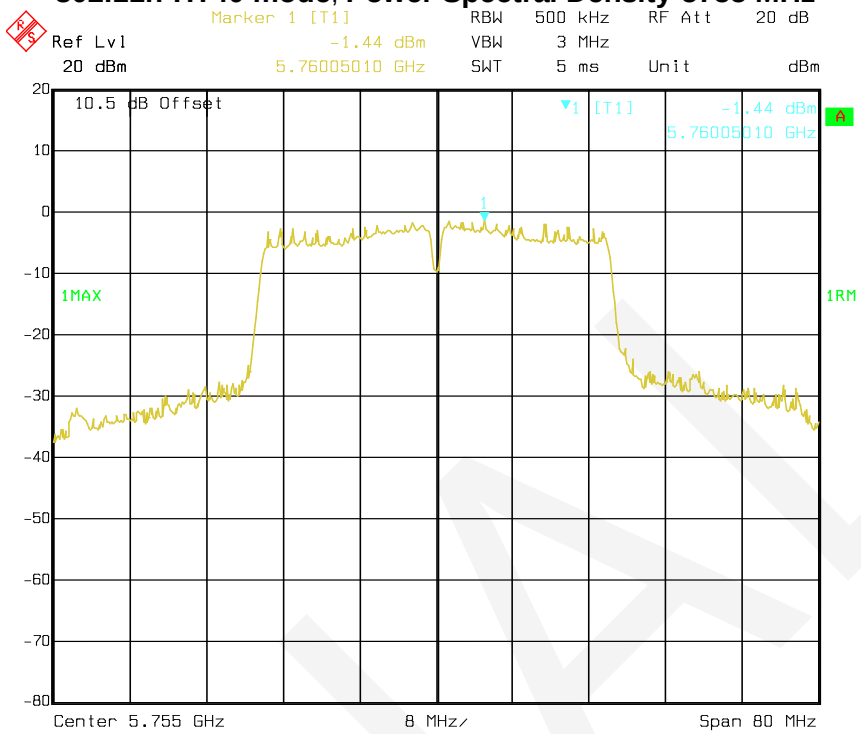
802.11n-HT20 mode, Power Spectral Density-5785 MHz



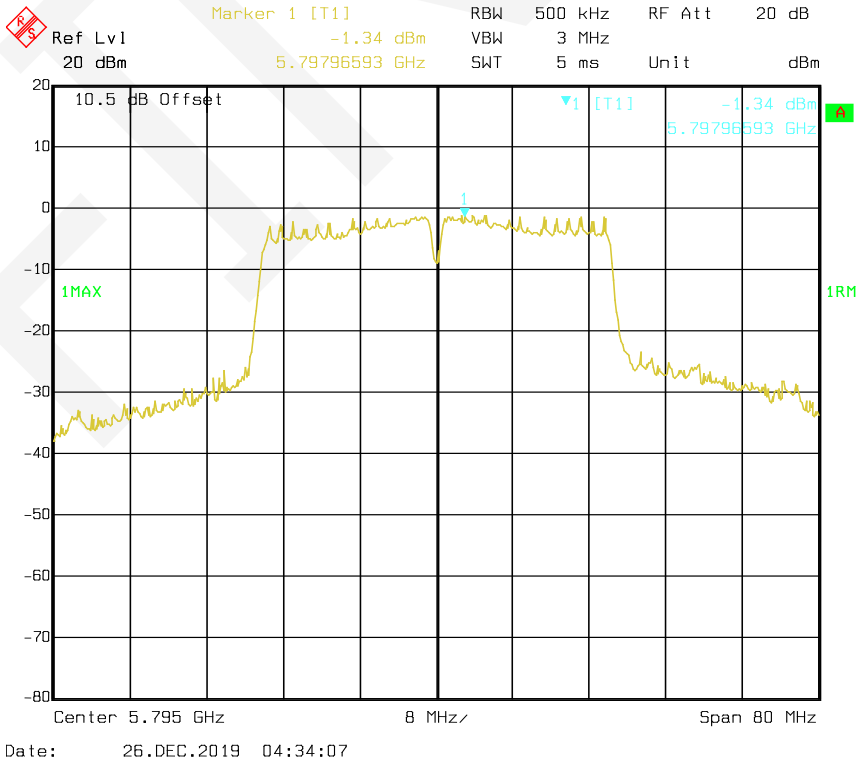
802.11n-HT20 mode, Power Spectral Density-5825 MHz



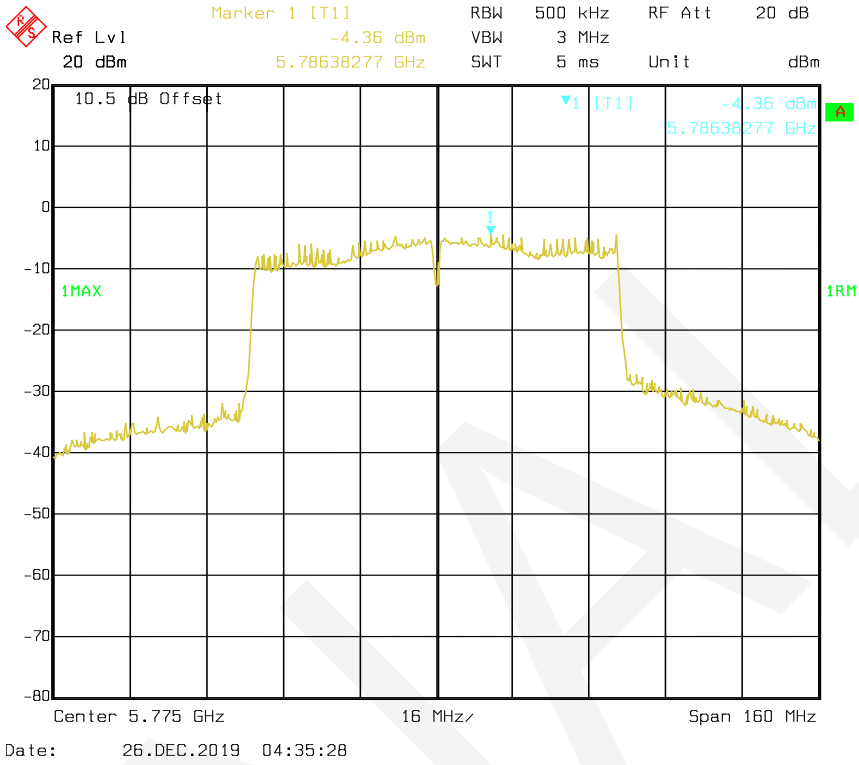
802.11n-HT40 mode, Power Spectral Density-5755 MHz



802.11n-HT40 mode, Power Spectral Density-5795 MHz



802.11ac80 mode, Power Spectral Density-5775 MHz



END OF REPORT