



FCC PART 15.407 TEST REPORT

For

Grandstream Networks, Inc.

126 Brookline Ave, 3rd Floor, Boston, Massachusetts, United States

FCC ID: YZZGWN7605

Report Type:

Original Report

Product Type:

802.11ac Wave-2 2×2:2 Wi-Fi
Access Point

Report Number: RSZ200102001-00C

Report Date: 2020-03-18

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	802.11ac Wave-2 2×2:2 Wi-Fi Access Point
Model	GWN7605
Frequency Range	5G Wi-Fi: 5150-5250 MHz; 5725-5850 MHz
Maximum Conducted Average Output Power	5150-5250 MHz: 19.41dBm (802.11a), 18.41dBm(802.11n20), 17.71 dBm(802.11n40) 18.40dBm (802.11ac20), 17.72dBm(802.11 ac40), 9.59dBm(802.11 ac80) 5725-5850 MHz: 19.92dBm (802.11a), 18.97dBm(802.11n20), 18.41 dBm(802.11n40) 18.90dBm (802.11ac20), 18.38dBm(802.11 ac40), 16.88dBm(802.11 ac80)
Modulation Technique	OFDM
Antenna Specification	4.0 dBi
Voltage Range	DC 48V from POE
Date of Test	2020-01-14 to 2020-02-20
Sample serial number	RSZ200102001-RF-S1(Assigned by BACL, Shenzhen)
Received date	2020-01-02
Sample/EUT Status	Good condition

Objective

This type approval report is prepared on behalf of *Grandstream Networks, Inc.* in accordance with Part 2-Subpart J, Part 15-Subparts A and E of the Federal Communication Commissions rules.

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

Related Submittal(s)/Grant(s)

FCC Part 15.247 DTS and FCC Part 15B JAB submissions with FCC ID: YZZGWN7605.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices. And KDB789033 D02 General U-NII Test Procedures New Rules v02r01.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter		Uncertainty
Occupied Channel Bandwidth		±5%
RF Output Power with Power meter		±0.73dB
RF conducted test with spectrum		±1.6dB
AC Power Lines Conducted Emissions		±1.95dB
Emissions, Radiated	Below 1GHz	±4.75dB
	Above 1GHz	±4.88dB
Temperature		±1 °C
Humidity		±6%
Supply voltages		±0.4%

Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The device supports Beamforming and non-beamforming mode for 5G Wi-Fi. And these two modes share the same power declared by the applicant.

The EUT has two antennas for 5G Wi-Fi, it can operate in 802.11a/n20/n40/ac20/ac40/ac80 modes.

For 5150-5250MHz Band, 7 channels are provided to testing:

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

For 802.11a, 802.1120, 802.11ac20 channel 36, 40, 48 were tested; For 802.11n40, 802.11ac40 channel 38, 46 were tested; For 802.11ac80, channel 42 was tested.

For 5725-5850MHz Band, 8 channels are provided to testing:

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, 802.1120, 802.11ac20 channel 149, 157, 165 were tested; For 802.11n40, 802.11ac40 channel 151, 159 were tested; For 802.11ac80, channel 155 was tested.

The device supports SISO and MIMO mode, per pre-test, MIMO 2TX mode was the worst and reported.

EUT Exercise Software

“Putty, QATool” exercise software was used.

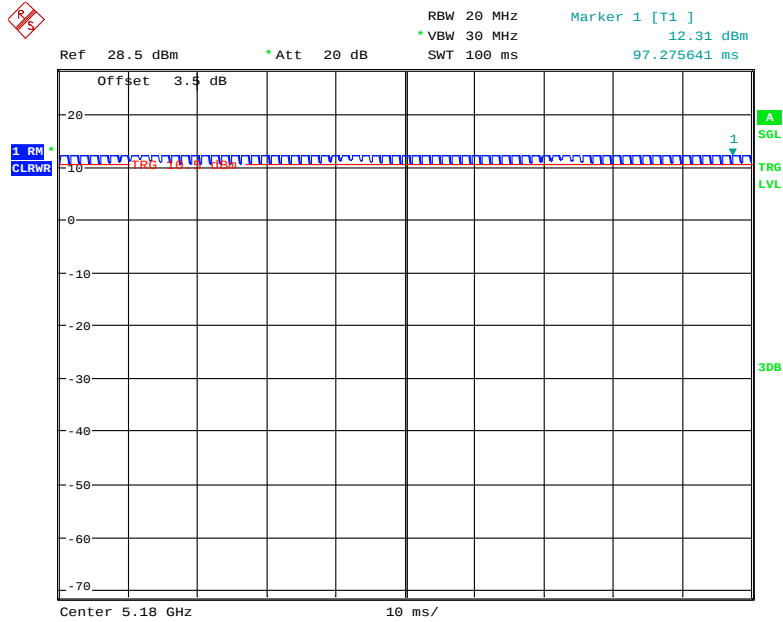
Test frequencies and power level were configured as below:

U-NII	Mode	Frequency (MHz)	Rate (Mbps)	Power Level
5150 – 5250MHz	802.11 a	5180	6	20
		5200	6	23.5
		5240	6	23.5
	802.11 n20	5180	MCS0	21.5
		5200	MCS0	23.5
		5240	MCS0	23.5
	802.11 n40	5190	MCS0	16
		5230	MCS0	23.5
	802.11 ac20	5180	MCS0	21
		5200	MCS0	23.5
		5240	MCS0	23.5
	802.11 ac40	5190	MCS0	16
		5230	MCS0	23.5
	802.11 ac8	5210	MCS0	16
5725 – 5850MHz	802.11 a	5745	6	24.5
		5785	6	24.5
		5825	6	24.5
	802.11 n20	5745	MCS0	24.5
		5785	MCS0	24.5
		5825	MCS0	24.5
	802.11 n40	5755	MCS0	24.5
		5795	MCS0	24.5
	802.11 ac20	5745	MCS0	24.5
		5785	MCS0	24.5
		5825	MCS0	24.5
	802.11 ac40	5755	MCS0	24.5
		5795	MCS0	24.5
	802.11 ac80	5775	MCS0	24.5

Note: The two antenna ports share the same power level.

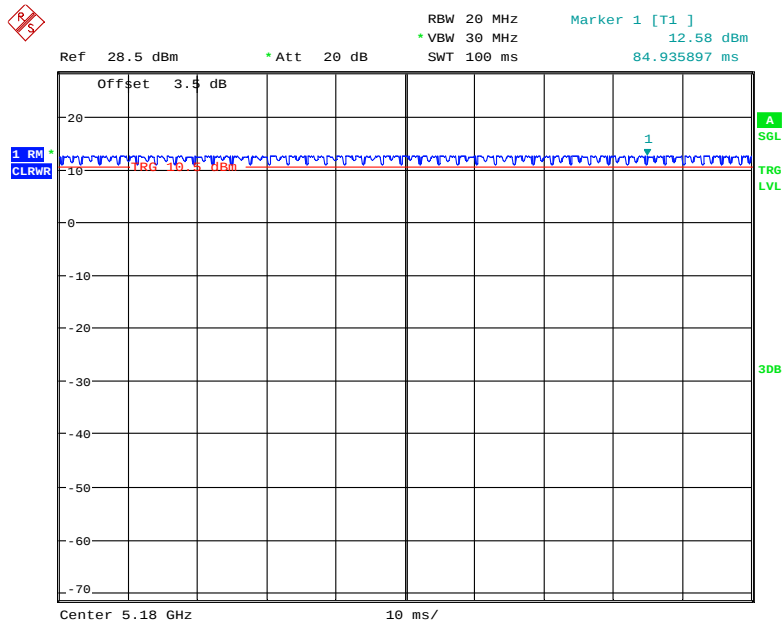
Duty cycle
5150-5250 MHz

802.11a mode



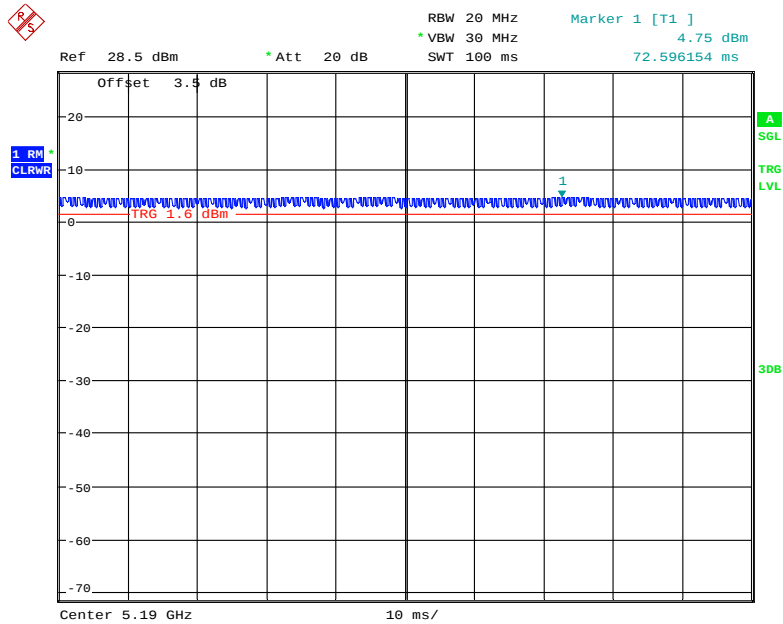
Date: 20.FEB.2020 17:06:36

802.11n20 mode



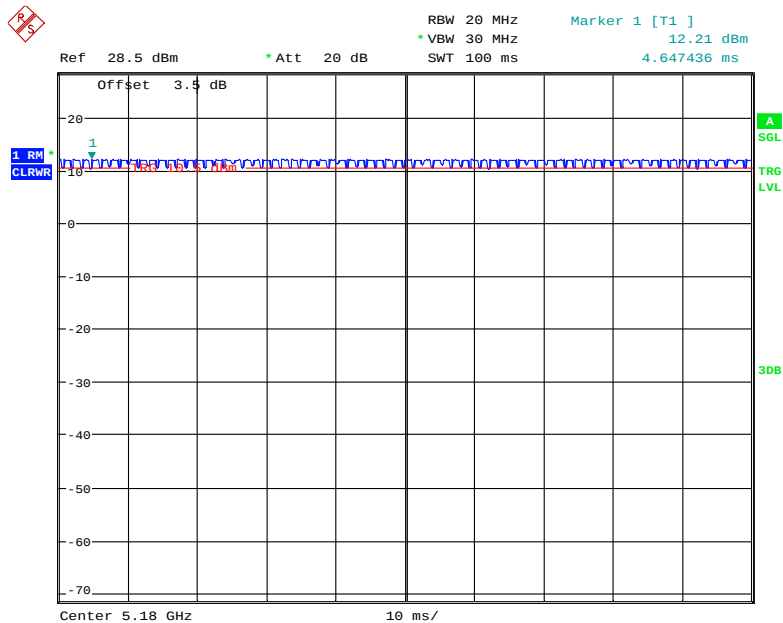
Date: 20.FEB.2020 17:05:58

802.11n40 mode



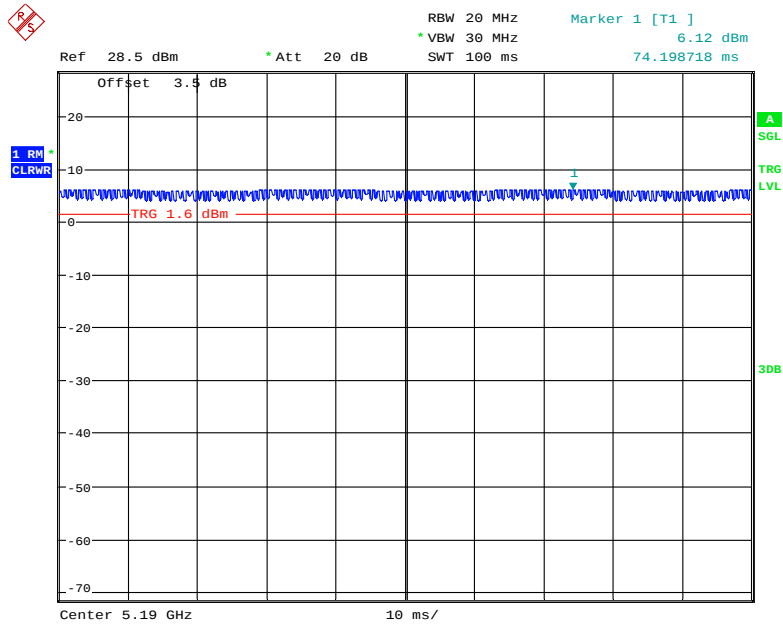
Date: 20.FEB.2020 17:05:24

802.11ac20 Mode



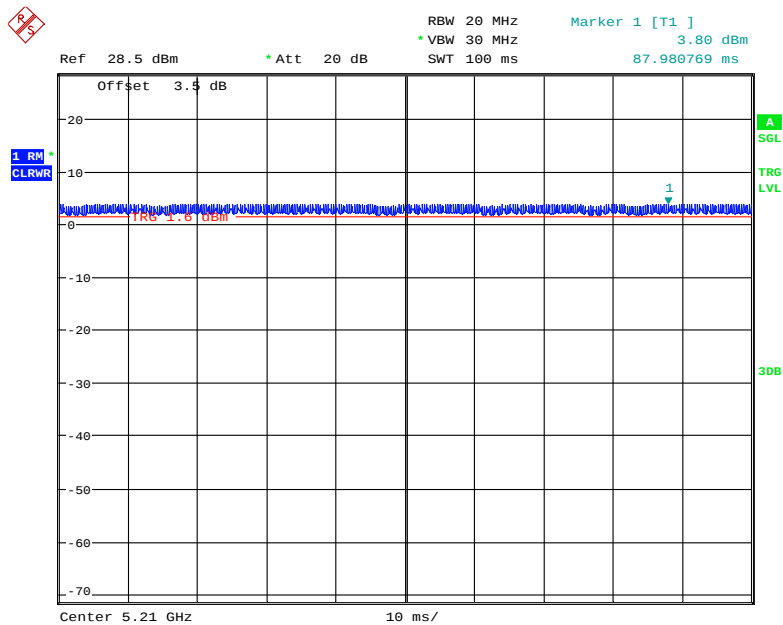
Date: 20.FEB.2020 17:06:19

802.11ac40 Mode



Date: 20.FEB.2020 17:04:54

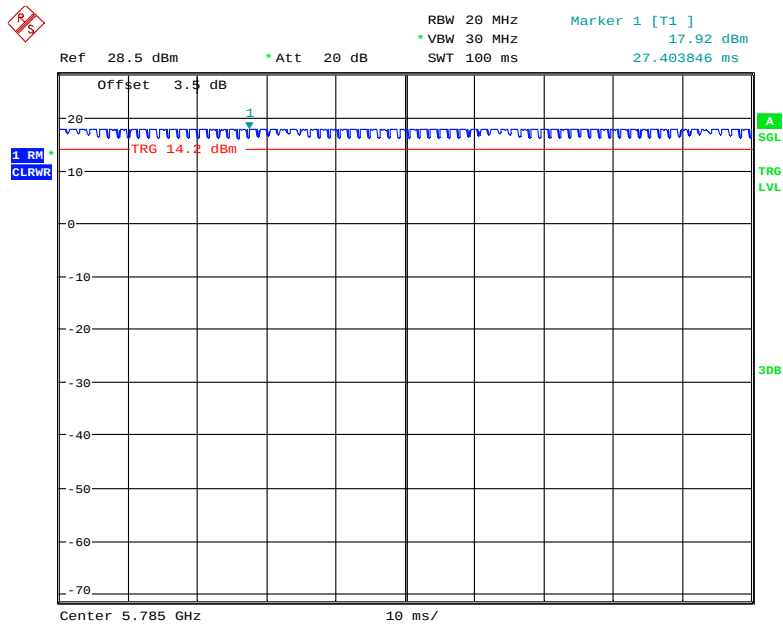
802.11ac80 Mode



Date: 20.FEB.2020 17:04:16

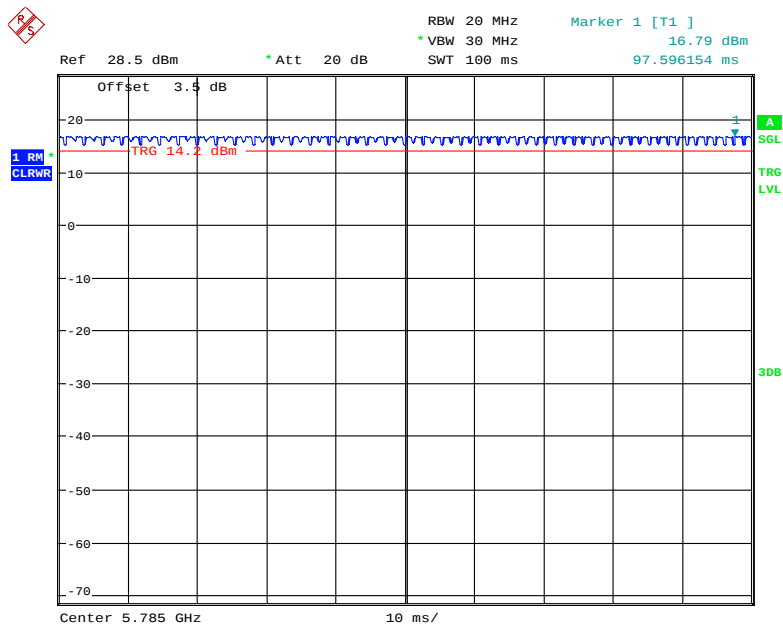
5725 – 5850MHz

802.11a mode



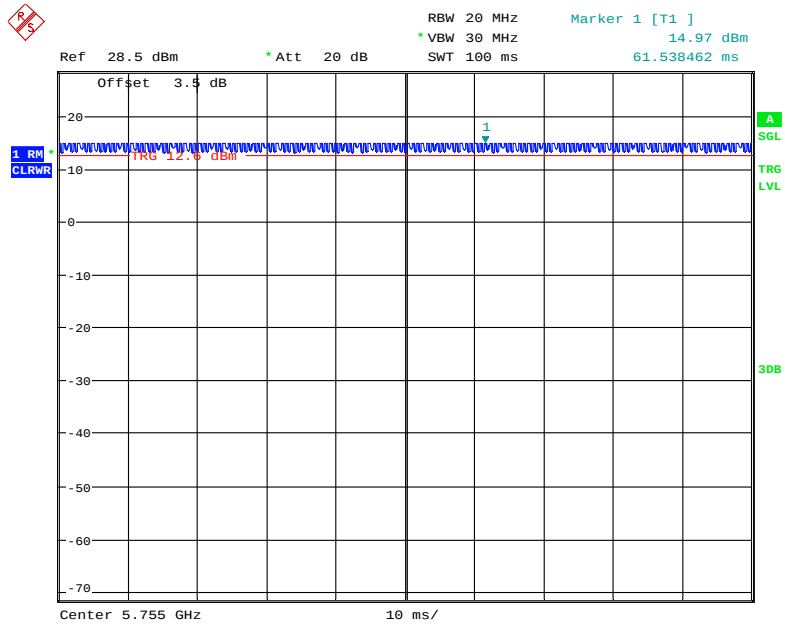
Date: 20.FEB.2020 18:03:06

802.11n20 mode



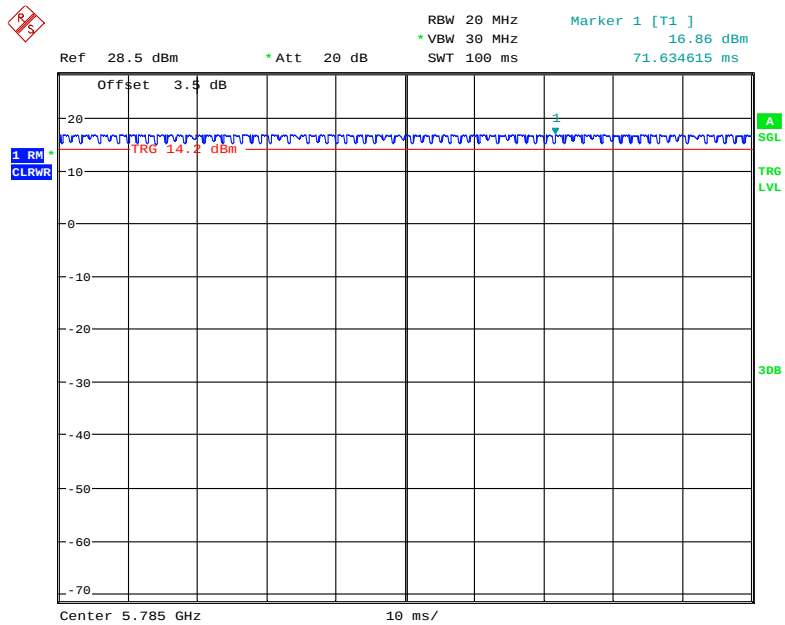
Date: 20.FEB.2020 18:03:20

802.11n40 mode



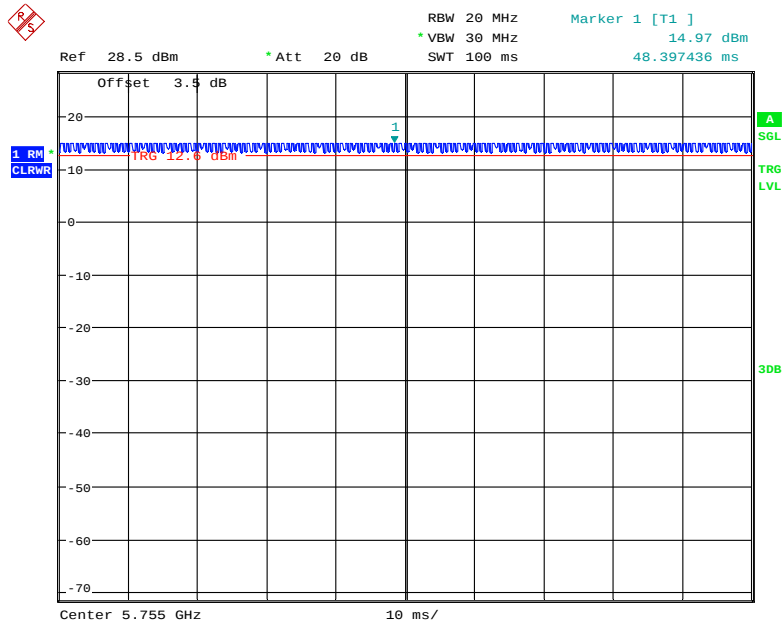
Date: 20.FEB.2020 18:05:12

802.11ac20 Mode



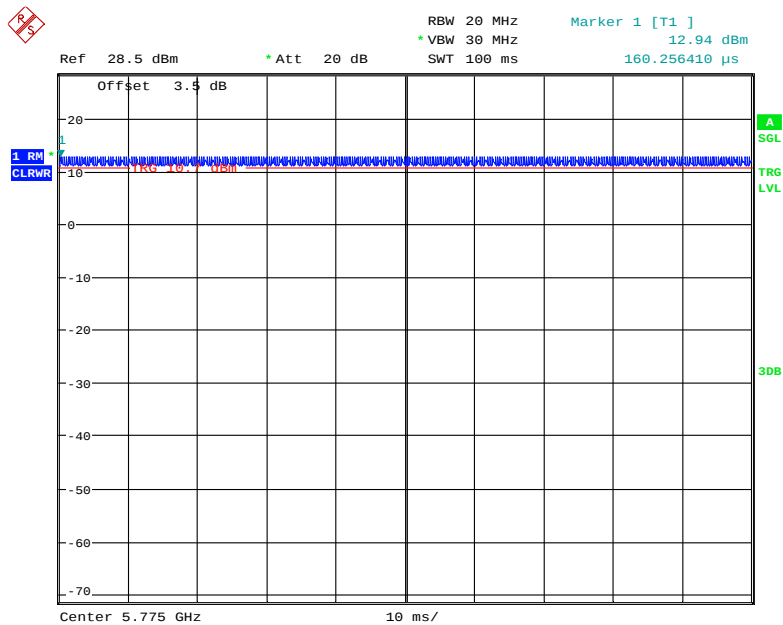
Date: 20.FEB.2020 18:03:35

802.11ac40 Mode



Date: 20.FEB.2020 18:04:31

802.11ac80Mode



Date: 20.FEB.2020 18:07:14

Mode	Duty Cycle (%)	T(ms)	1/T(kHz)	VBW Setting
802.11a	100	-	-	10Hz
802.11n20	100	-	-	10Hz
802.11n40	100	-	-	10Hz
802.11ac20	100	-	-	10Hz
802.11ac40	100	-	-	10Hz
802.11ac80	100	-	-	10Hz

Equipment Modifications

No modification was made to the EUT tested.

External I/O Cable

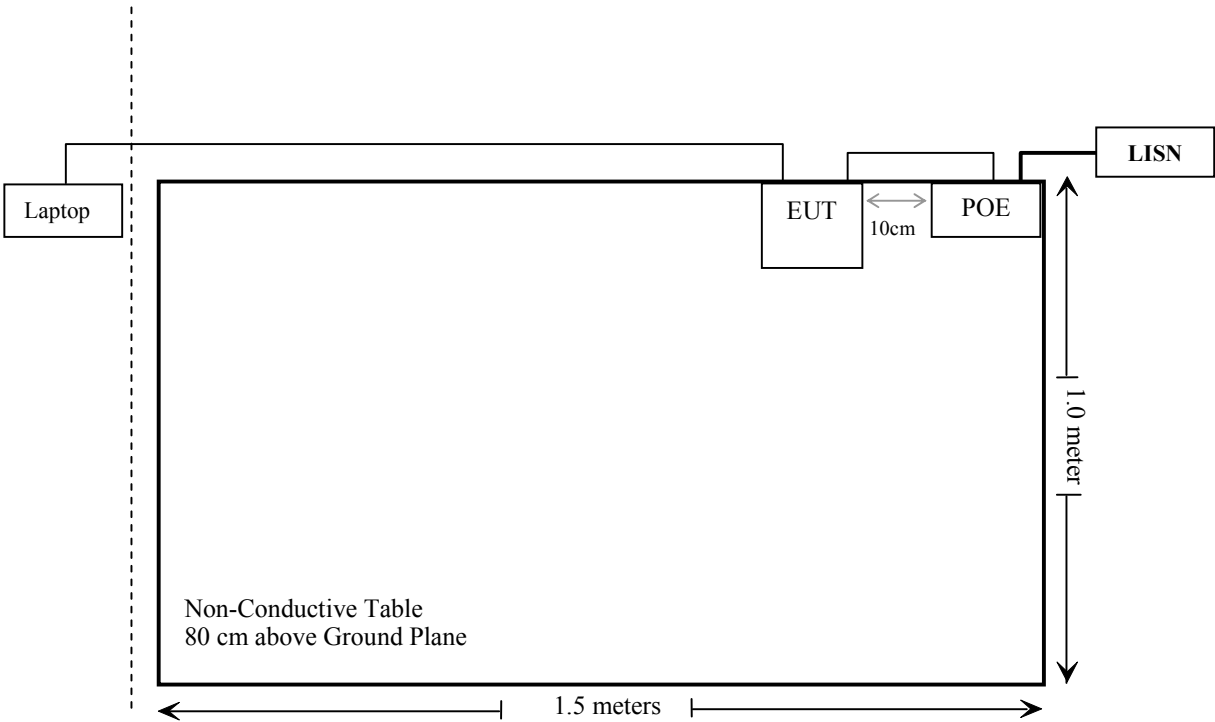
Manufacturer	Description	Model	Serial Number
Unknown	POE	VX-P11000GB	Unknown
HP	Laptop	Compaq CQ45	5CG33407QL

External I/O Cable

Cable Description	Length (m)	From/Port	To
Unshielded detachable AC Cable	1.0	LISN	POE
Unshielded detachable RJ45 Cable	1.2	POE	EUT
Unshielded detachable RJ45 Cable	8.0	EUT	Laptop

Block Diagram of Test Setup

For conducted emission:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 (b) (1) & §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),(7)	Undesirable Emission& Restricted Bands	Compliance
§15.407(a) (1), (5),(e)	26 dB Emission Bandwidth & 6dB Bandwidth	Compliance
§15.407(a)(1),(3)	Conducted Transmitter Output Power	Compliance
§15.407 (a)(1),(3)	Power Spectral Density	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2019/7/9	2020/7/8
Rohde & Schwarz	LISN	ENV216	101613	2019/1/25	2020/1/24
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2019/11/29	2020/11/28
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2019/11/29	2020/11/28
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2019/7/9	2020/7/8
Sonoma instrument	Pre-amplifier	310 N	186238	2019/4/20	2020/4/20
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017/12/22	2020/12/21
Unknown	Cable 2	RF Cable 2	F-03-EM197	2019/11/29	2020/11/28
Unknown	Cable	Chamber Cable 1	F-03-EM236	2019/11/29	2020/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2019/7/22	2020/7/21
COM-POWER	Pre-amplifier	PA-122	181919	2019/11/29	2020/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2019/11/29	2020/11/28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
Insulated Wire Inc.	RF Cable	SPS-2503-3150	02222010	2019/11/29	2020/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2019/11/29	2020/11/28
Ducommun technologies	RF Cable	RG-214	1	2019-11-12	2020-11-12
Ducommun technologies	RF Cable	RG-214	2	2019-11-12	2020-11-12
SNSD	Band Reject filter	BSF5150-5850MN-0899-004	5G filter	2019/4/20	2020/4/20
Ducommun Technologies	Horn antenna	ARH-4223-02	1007726-021304	2017/12/6	2020/12/5
Ducommun Technologies	Horn Antenna	ARH-2823-02	1007726-03	2017/12/6	2020/12/5
RF Conducted Test					
Agilent	USB Wideband Power Sensor	U2021XA	MY54250003	2019/7/10	2020/7/9
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2019/3/2	2020/7/21
WEINSCHL	3dB Attenuator	Unknown	Unknown	2019/11/29	2021/3/1

Ducommun technologies	RF Cable	RG-214	3	Each Time
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* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

§1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Applicable Standard

According to subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

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/f ²)	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

Result

Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm²)

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:

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

Frequency (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm ²)	MPE Limit (mW/cm ²)
	(dBi)	(numeric)	(dBm)	(mW)			
2412-2462	3.0	2.0	24	251.2	20	0.10	1
5150-5250	4.0	2.5	20	100.0	20	0.05	1
5725-5850	4.0	2.5	20	100.0	20	0.05	1

Note:

- 1) To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.
- 2) 2.4GHz or 5GHz Wi-Fi can transmit simultaneously for this device.
- 3) Simultaneous transmitting consideration:

The ratio= $MPE_{DTS}/limit + MPE_{NII}/limit = 0.10 + 0.05 = 0.15 < 1.0$, so simultaneous exposure is not required.

Result: Compliance

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.

And according to FCC 47 CFR section 15.407 (a), if the transmitting antennas of directional gain greater than 6dBi are used, the transmit power and power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has two internal antennas arrangement for 5G Wi-Fi, which was permanently attached and the antenna gain is 4.0dBi, fulfill the requirement of this section. Please refer to the EUT photos.

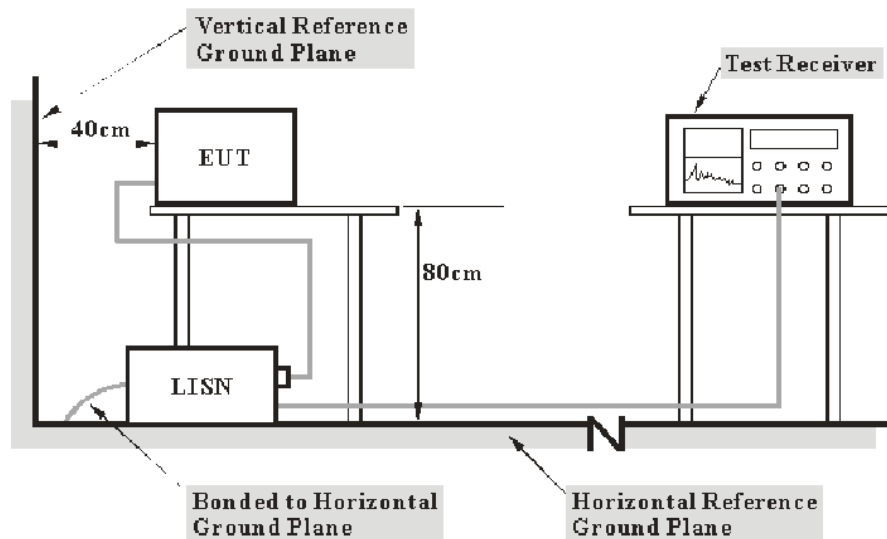
Result: Compliance.

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

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

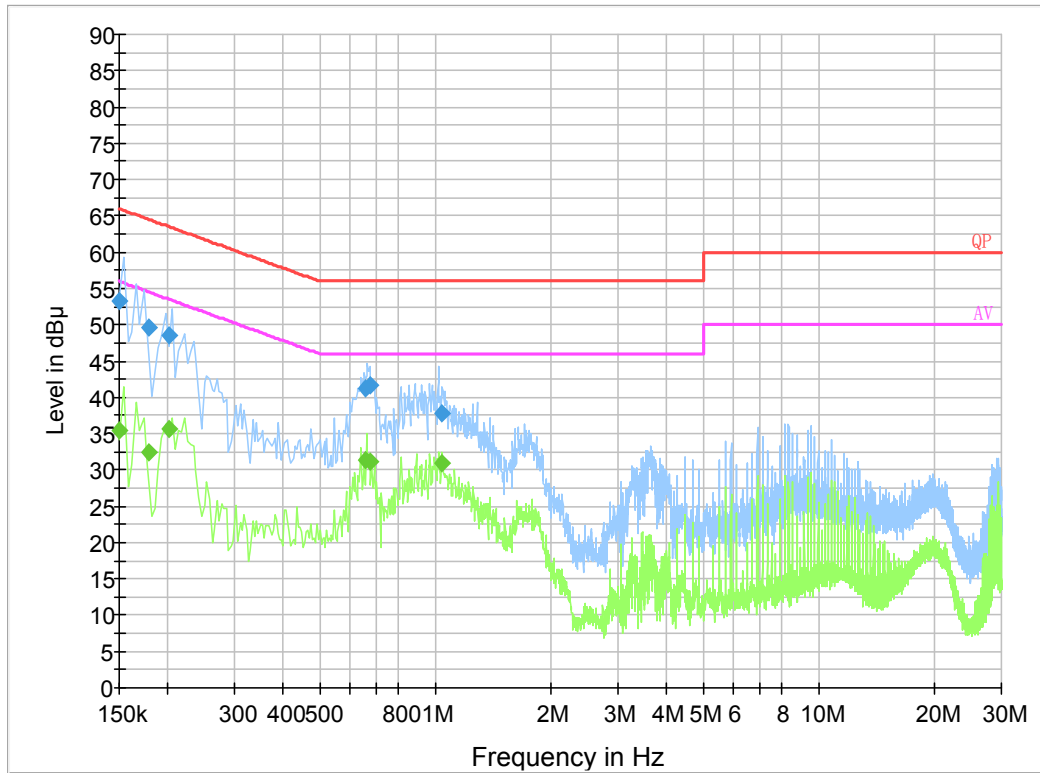
According to the EUT complied with the FCC Part 15.207.

Test Data**Environmental Conditions**

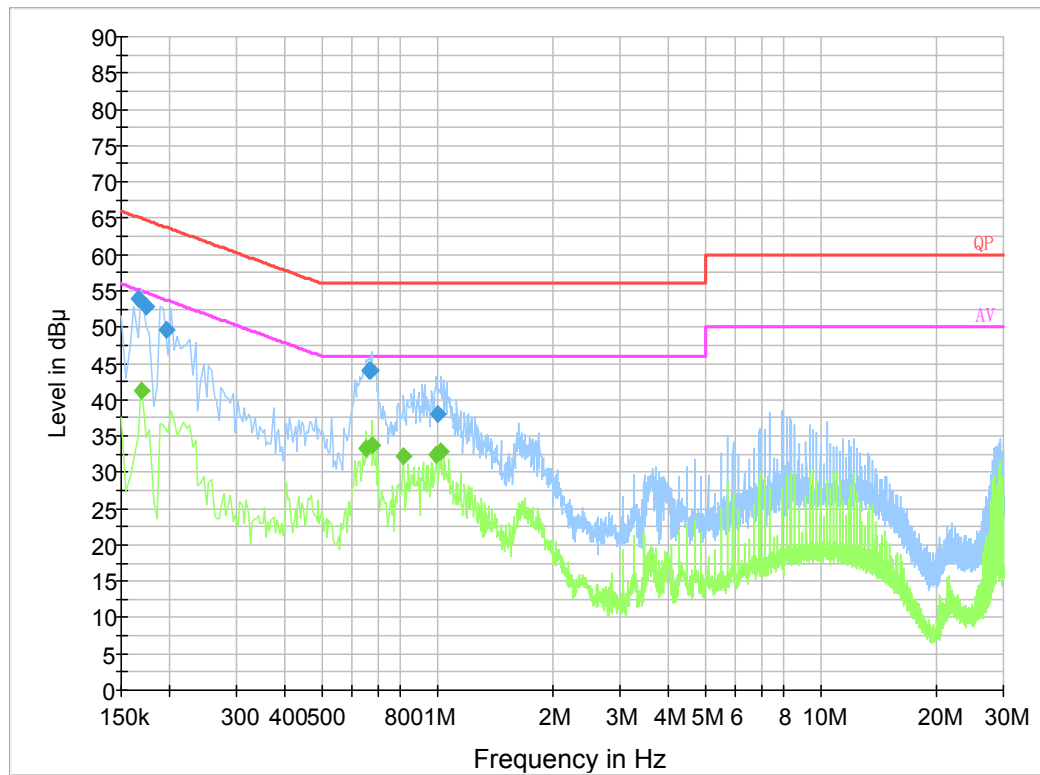
Temperature:	25 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li on 2020-01-14.

EUT operation mode: Transmitting (worst case is 802.11a mode 5180 MHz)

AC 120V/60 Hz, Line:

Frequency (MHz)	Corrected Amplitude (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/Ave./QP)
0.150000	53.3	19.8	66.0	12.7	QP
0.178500	49.7	19.9	64.6	14.9	QP
0.201500	48.5	19.8	63.5	15.0	QP
0.656190	41.3	19.8	56.0	14.7	QP
0.675990	41.7	19.8	56.0	14.3	QP
1.037330	37.9	19.9	56.0	18.1	QP
0.150000	35.4	19.8	56.0	20.6	Ave.
0.178500	32.4	19.9	54.6	22.2	Ave.
0.201500	35.6	19.8	53.5	17.9	Ave.
0.656190	31.4	19.8	46.0	14.6	Ave.
0.675990	31.2	19.8	46.0	14.8	Ave.
1.037330	30.9	19.9	46.0	15.1	Ave.

AC120V, 60 Hz, Neutral:

Frequency (MHz)	Corrected Amplitude (dBμV)	Correction Factor (dB)	Limit (dBμV)	Margin (dB)	Detector (PK/Ave./QP)
0.165500	53.9	19.8	65.2	11.3	QP
0.174500	52.9	19.8	64.7	11.8	QP
0.197500	49.7	19.8	63.7	14.0	QP
0.663810	44.0	19.8	56.0	12.0	QP
0.671890	44.0	19.8	56.0	12.0	QP
0.999030	38.0	19.8	56.0	18.0	QP
0.170000	41.2	19.9	55.0	13.8	Ave.
0.654000	33.3	19.8	46.0	12.7	Ave.
0.674000	33.8	19.8	46.0	12.2	Ave.
0.814000	32.1	19.8	46.0	13.9	Ave.
0.998000	32.4	19.8	46.0	13.6	Ave.
1.022000	32.9	19.8	46.0	13.1	Ave.

Note:

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

§15.205 & §15.209 & §15.407(B) (1), (4), (6), (7) – UNDESIRABLE EMISSION**Applicable Standard**

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

(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.

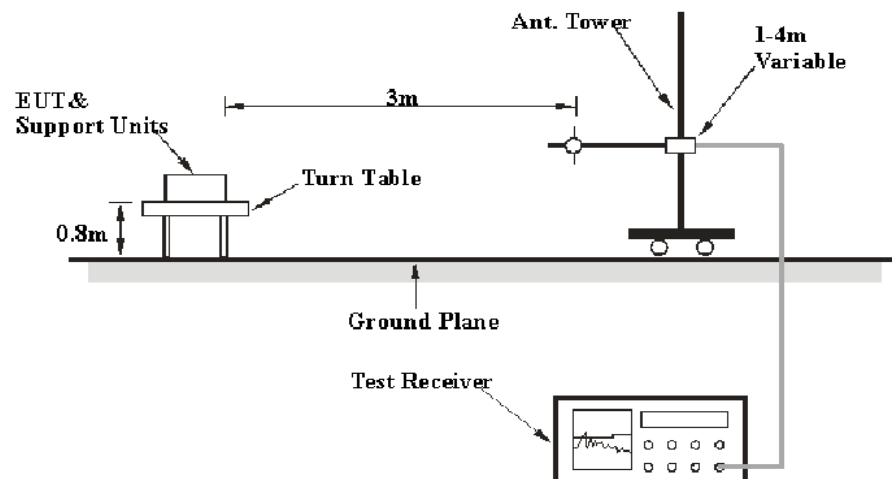
(4) For transmitters operating in the 5.725-5.85 GHz band:

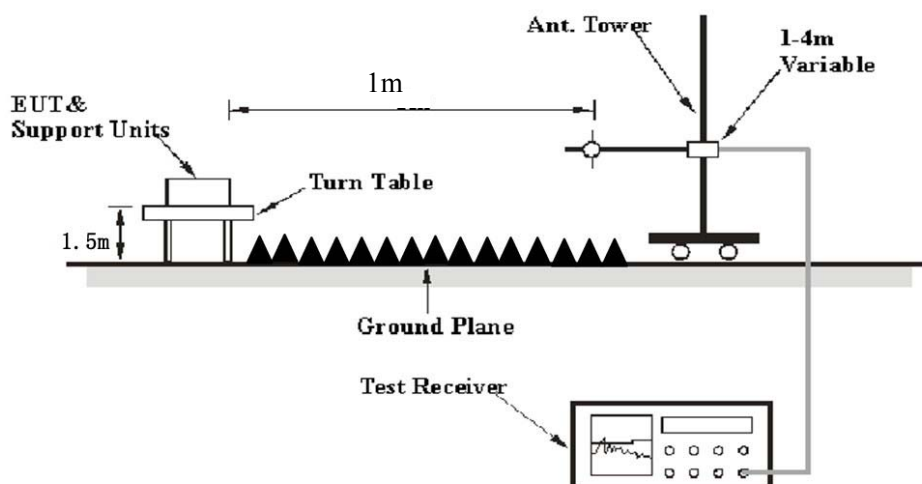
(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the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

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

EUT Setup

Below 1 GHz:



Above 1 GHz:

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with 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.

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 & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1 MHz	3 MHz	/	PK
	1MHz	10 Hz ^{Note 1}	/	Average
	1MHz	> 1/T ^{Note 2}	/	Average

Note 1: when duty cycle is no less than 98%

Note 2: when duty cycle is less than 98%

Test Procedure**Radiated Spurious Emission**

During the radiated emission test, the adapter was connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all the 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 1GHz.

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:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

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

Test Data

Environmental Conditions

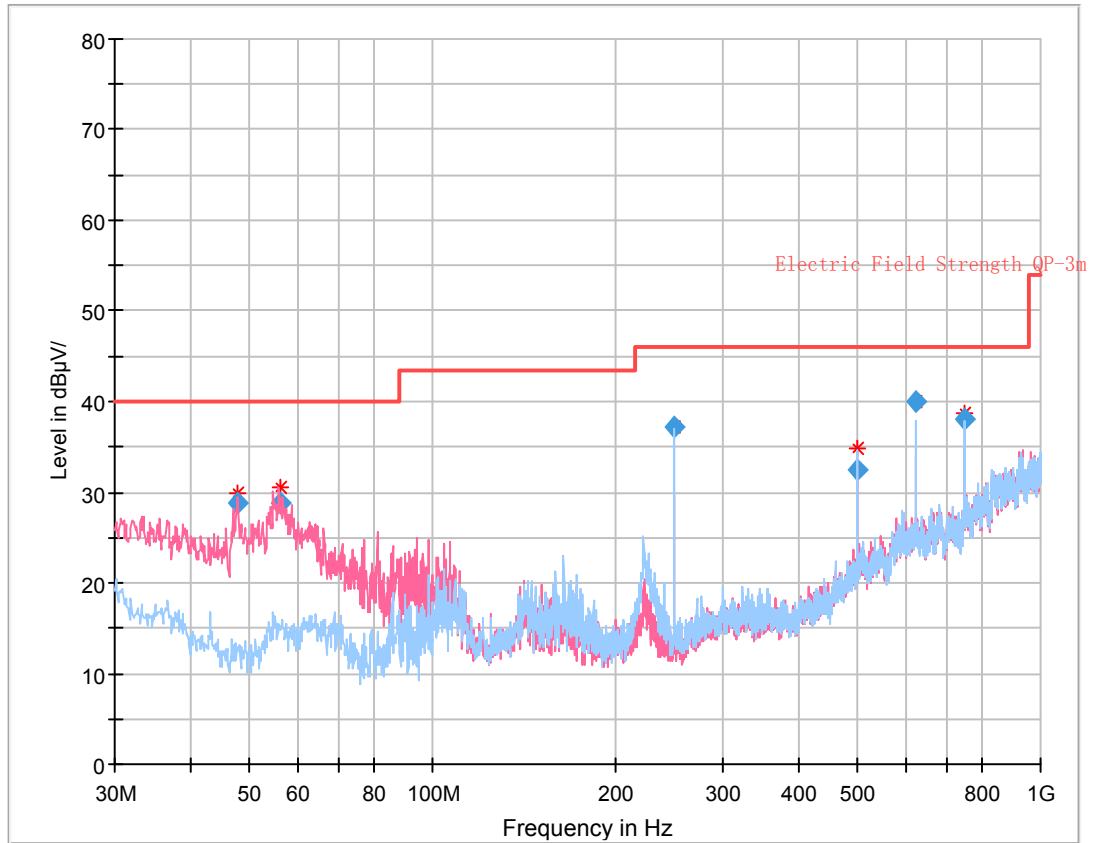
Temperature:	22 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Zero Yan on 2020-01-16 for below 1G and Alan He on 2020-02-17 to 2020-02-19 for above 1G.

EUT operation mode: Transmitting

Note: Non-Beam Forming mode share the same power with the Beam Forming mode. Pre-scan the two modes, the Beam Forming mode was the worst case, so only reported the data for this mode as below:

30 MHz – 1 GHz: (worst case is 802.11a mode 5180 MHz)



Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
47.813625	28.77	110.0	V	13.0	-18.6	40.00	11.23
55.992000	28.77	109.0	V	323.0	-20.0	40.00	11.23
250.010375	37.27	118.0	H	115.0	-14.1	46.00	8.73
500.031625	32.53	192.0	H	0.0	-5.2	46.00	13.47
625.022750	39.99	124.0	H	161.0	-1.6	46.00	6.01
749.999875	37.97	108.0	H	217.0	-0.4	46.00	8.03

1 ~ 40 GHz:

Note: The test distance is 1m, so the correct factor from 3m to 1m is $20\log(3/1)=9.5\text{dB}$ which was added into the final limit.

5150-5250 MHz:

Frequency (MHz)	Receiver		Turntable	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.407/205/209	
	Reading (dBμV)	PK/QP/Ave.	Degree	Height (m)	Polar (H / V)			Limit (dBμV/m)	Margin (dB)
802.11a									
5180 MHz									
5148.00	44.01	PK	65	2.4	H	38.36	82.37	83.5	1.13
5148.00	21.66	Ave.	65	2.4	H	38.36	60.02	63.5	3.48
5362.66	32.04	PK	289	1.8	H	39.09	71.13	83.5	12.37
5362.66	17.08	Ave.	289	1.8	H	39.09	56.17	63.5	7.33
10360.00	54.85	PK	215	1.6	H	17.42	72.27	77.7	5.43
5200 MHz									
10400.00	55.42	PK	24	1.2	H	17.52	72.94	77.7	4.76
5240 MHz									
5150.00	27.13	PK	185	2.2	H	41.43	68.56	83.5	14.94
5150.00	13.80	Ave.	185	2.2	H	41.43	55.23	63.5	8.27
5350.00	24.79	PK	61	2.4	H	42.06	66.85	83.5	16.65
5350.00	13.89	Ave.	61	2.4	H	42.06	55.95	63.5	7.55
10480.00	56.57	PK	219	1.5	H	17.25	73.82	77.7	3.88
802.11n20									
5180 MHz									
5149.67	42.98	PK	285	1.6	H	38.36	81.34	83.5	2.16
5149.67	22.93	Ave.	285	1.6	H	38.36	61.29	63.5	2.21
5409.62	31.37	PK	110	1.2	H	39.19	70.56	83.5	12.94
5409.62	16.95	Ave.	110	1.2	H	39.19	56.14	63.5	7.36
10360.00	51.84	PK	224	2.4	H	17.42	69.26	77.7	8.44
5200 MHz									
10400.00	54.41	PK	327	1.3	H	17.52	71.93	77.7	5.77
5240 MHz									
5149.67	31.69	PK	38	2.0	H	38.36	70.05	83.5	13.45
5149.67	16.91	Ave.	38	2.0	H	38.36	55.27	63.5	8.23
5409.62	30.68	PK	113	2.0	H	39.19	69.87	83.5	13.63
5409.62	17.71	Ave.	113	2.0	H	39.19	56.90	63.5	6.60
10480.00	56.40	PK	246	1.5	H	17.25	73.65	77.7	4.05

Frequency (MHz)	Receiver		Turntable	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.407/205/209	
	Reading (dBμV)	PK/QP/Ave.	Degree	Height (m)	Polar (H / V)			Limit (dBμV/m)	Margin (dB)
802.11n40									
5190 MHz									
5145.33	43.19	PK	344	1.2	H	38.36	81.55	83.5	1.95
5145.33	19.39	Ave.	344	1.2	H	38.36	57.75	63.5	5.75
5420.60	32.07	PK	4	1.3	H	39.19	71.26	83.5	12.24
5420.60	16.97	Ave.	4	1.3	H	39.19	56.16	63.5	7.34
10380.00	39.79	PK	28	2.0	H	17.42	57.21	77.7	20.49
5230 MHz									
5147.79	41.01	PK	285	1.0	H	38.36	79.37	83.5	4.13
5147.79	18.18	Ave.	285	1.0	H	38.36	56.54	63.5	6.96
5352.63	35.36	PK	356	1.7	H	39.09	74.45	83.5	9.05
5352.63	16.93	Ave.	356	1.7	H	39.09	56.02	63.5	7.48
10460.00	52.32	PK	34	2.1	H	17.15	69.47	77.7	8.23
802.11ac20									
5180 MHz									
5149.60	43.34	PK	170	1.8	H	38.36	81.70	83.5	1.80
5149.60	21.03	Ave.	170	1.8	H	38.36	59.39	63.5	4.11
5371.25	30.88	PK	139	1.1	H	39.09	69.97	83.5	13.53
5371.25	17.07	Ave.	139	1.1	H	39.09	56.16	63.5	7.34
10360.00	52.40	PK	280	2.0	H	17.42	69.82	77.7	7.88
5200 MHz									
10400.00	53.48	PK	120	1.8	H	17.52	71.00	77.7	6.70
5240 MHz									
5141.57	32.52	PK	157	1.3	H	38.36	70.88	83.5	12.62
5141.57	17.62	Ave.	157	1.3	H	38.36	55.98	63.5	7.52
5394.33	31.54	PK	143	1.8	H	39.19	70.73	83.5	12.77
5394.33	17.38	Ave.	143	1.8	H	39.19	56.57	63.5	6.93
10480.00	53.65	PK	38	1.9	H	17.25	70.90	77.7	6.80
802.11ac40									
5190 MHz									
5148.30	43.95	PK	115	1.3	H	38.36	82.31	83.5	1.19
5148.30	18.46	Ave.	115	1.3	H	38.36	56.82	63.5	6.68
5424.90	31.29	PK	347	1.6	H	39.19	70.48	83.5	13.02
5424.90	16.94	Ave.	347	1.6	H	39.19	56.13	63.5	7.37
10380.00	45.31	PK	177	2.4	H	17.42	62.73	77.7	14.97
5230 MHz									
5147.65	40.87	PK	187	2.3	H	38.36	79.23	83.5	4.27
5147.65	19.18	Ave.	187	2.3	H	38.36	57.54	63.5	5.96
5357.40	35.91	PK	190	1.0	H	39.09	75.00	83.5	8.50
5357.40	17.37	Ave.	190	1.0	H	39.09	56.46	63.5	7.04
10460.00	53.79	PK	175	2.2	H	17.15	70.94	77.7	6.76

Frequency (MHz)	Receiver		Turntable	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.407/205/209	
	Reading (dBμV)	PK/QP/Ave.	Degree	Height (m)	Polar (H / V)			Limit (dBμV/m)	Margin (dB)
802.11ac80									
5210 MHz									
5146.93	43.35	PK	249	1.4	H	38.36	81.71	83.5	1.79
5146.93	20.29	Ave.	249	1.4	H	38.36	58.65	63.5	4.85
5360.27	35.60	PK	283	2.2	H	39.09	74.69	83.5	8.81
5360.27	16.95	Ave.	283	2.2	H	39.09	56.04	63.5	7.46
10420.00	43.18	PK	164	2.2	H	17.52	60.70	77.7	17.00

5725-5850 MHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.407/205/209	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11a									
5745 MHz									
5697.50	43.50	PK	133	1.4	H	39.49	82.99	112.85	29.86
5717.53	55.86	PK	228	1.0	H	39.49	95.35	119.6	24.25
5721.30	58.27	PK	24	1.3	H	55.25	113.52	125.75	12.23
11490.00	52.67	PK	133	1.7	H	17.47	70.14	83.5	13.36
11490.00	39.30	Ave.	133	1.7	H	17.47	56.77	63.5	6.73
5785 MHz									
11570.00	53.63	PK	21	1.4	H	17.51	71.14	83.5	12.36
11570.00	39.21	Ave.	21	1.4	H	17.51	56.72	63.5	6.78
5825 MHz									
5852.62	43.50	PK	345	2.4	H	39.87	83.37	125.73	42.36
5858.37	49.01	PK	345	2.4	H	39.87	88.88	119.36	30.48
5878.87	40.90	PK	279	1.7	H	39.87	80.77	111.84	31.07
11650.00	53.61	PK	32	1.3	H	16.18	69.79	83.5	13.71
11650.00	40.04	Ave.	32	1.3	H	16.18	56.22	63.5	7.28
802.11n20									
5745 MHz									
5696.85	39.01	PK	4	2.3	H	39.49	78.50	112.37	33.87
5717.50	47.55	PK	4	2.3	H	39.49	87.04	119.67	32.63
5720.41	56.92	PK	15	1.8	H	39.87	96.79	131.45	34.66
11490.00	50.20	PK	254	2.0	H	17.47	67.67	83.5	15.83
11490.00	35.15	Ave.	254	2.0	H	17.47	52.62	63.5	10.88
5785 MHz									
11570.00	51.49	PK	18	1.8	H	17.51	69.00	83.5	14.50
11570.00	36.54	Ave.	18	1.8	H	17.51	54.05	63.5	9.45
5825 MHz									
5850.75	48.70	PK	293	2.2	H	39.87	88.57	129.99	41.42
5859.15	47.28	PK	293	2.2	H	39.87	87.15	119.14	31.99
5875.18	37.97	PK	20	2.1	H	39.87	77.84	114.57	36.73
11650.00	52.93	PK	31	2.2	H	16.18	69.11	83.5	14.39
11650.00	38.02	Ave.	31	2.2	H	16.18	54.20	63.5	9.30

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	FCC Part 15.407/205/209	
	Reading (dBµV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBµV/m)	Margin (dB)
802.11n40									
5755 MHz									
5697.14	43.88	PK	295	2.4	H	39.49	83.37	112.58	29.21
5719.99	53.93	PK	295	2.4	H	39.49	93.42	120.3	26.88
5720.49	56.03	PK	331	2.1	H	39.49	95.52	121.42	25.90
11510.00	48.97	PK	349	1.5	H	17.47	66.44	83.5	17.06
11510.00	33.82	Ave.	349	1.5	H	17.47	51.29	63.5	12.21
5795 MHz									
5851.68	42.07	PK	349	2.0	H	39.87	81.94	127.87	45.93
5856.80	40.83	PK	349	2.0	H	39.87	80.70	119.8	39.10
5876.99	37.28	PK	147	2.2	H	39.87	77.15	113.23	36.08
11590.00	49.54	PK	259	2.4	H	17.51	67.05	83.5	16.45
11590.00	34.82	Ave.	259	2.4	H	17.51	52.33	63.5	11.17
802.11ac20									
5745 MHz									
5697.43	38.54	PK	148	1.9	H	39.49	78.03	112.8	34.77
5714.86	48.56	PK	148	1.9	H	39.49	88.05	118.86	30.81
5724.42	55.57	PK	18	2.2	H	39.49	95.06	130.38	35.32
11490.00	49.46	PK	312	1.0	H	17.47	66.93	83.5	16.57
11490.00	34.80	Ave.	312	1.0	H	17.47	52.27	63.5	11.23
5785 MHz									
11570.00	51.59	PK	119	2.4	H	17.51	69.10	83.5	14.40
11570.00	37.11	Ave.	119	2.4	H	17.51	54.62	63.5	8.88
5825 MHz									
5850.10	49.09	PK	136	2.0	H	39.87	88.96	131.47	42.51
5855.42	46.08	PK	136	2.0	H	39.87	85.95	120.18	34.23
5875.10	37.69	PK	202	1.0	H	39.87	77.56	114.63	37.07
11650.00	52.77	PK	244	1.0	H	16.18	68.95	83.5	14.55
11650.00	37.60	Ave.	244	1.0	H	16.18	53.78	63.5	9.72

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	FCC Part 15.407/205/209	
	Reading (dBµV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBµV/m)	Margin (dB)
802.11ac40									
5755 MHz									
5698.52	45.31	PK	250	1.7	H	39.49	84.80	113.6	28.80
5716.40	56.26	PK	250	1.7	H	39.49	95.75	112.09	16.34
5723.92	59.35	PK	277	2.5	H	39.49	98.84	129.24	30.40
11510.00	50.96	PK	180	1.2	H	17.47	68.43	83.5	15.07
11510.00	34.33	Ave.	180	1.2	H	17.47	51.80	63.5	11.70
5795 MHz									
5851.86	46.56	PK	0	2.2	H	39.87	86.43	127.46	41.03
5862.45	44.65	PK	0	2.2	H	39.87	84.52	118.21	33.69
5878.30	38.90	PK	224	2.0	H	39.87	78.77	112.26	33.49
11590.00	50.95	PK	230	1.3	H	17.51	68.46	83.5	15.04
11590.00	34.45	Ave.	230	1.3	H	17.51	51.96	63.5	11.54
802.11ac80									
5775 MHz									
5699.53	52.41	PK	206	2.0	H	39.49	91.90	114.4	22.50
5713.68	55.01	PK	206	2.0	H	39.49	94.50	118.53	24.03
5723.84	55.89	PK	87	1.9	H	39.49	95.38	129.06	33.68
5850.30	48.41	PK	221	1.4	H	39.87	88.28	131.02	42.74
5855.80	46.36	PK	221	1.4	H	39.87	86.23	120.08	33.85
5878.87	42.81	PK	314	1.8	H	39.87	82.68	118.84	36.16
11550.00	49.97	PK	322	1.2	H	17.51	67.48	83.5	16.02
11550.00	29.62	Ave.	322	1.2	H	17.51	47.13	63.5	16.37

Note:

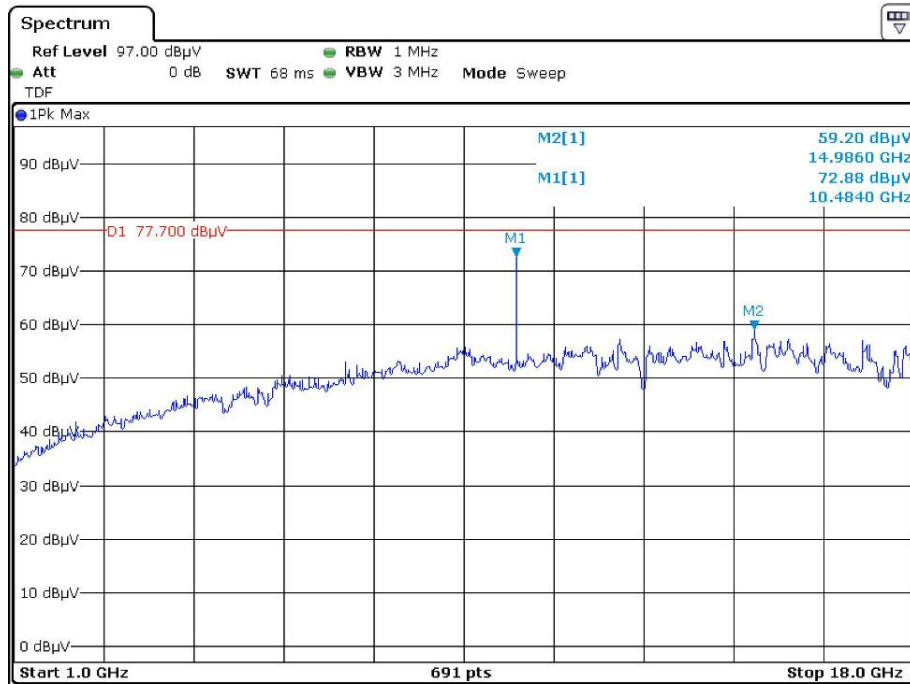
Corrected Amplitude = Corrected Factor + Reading

Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor

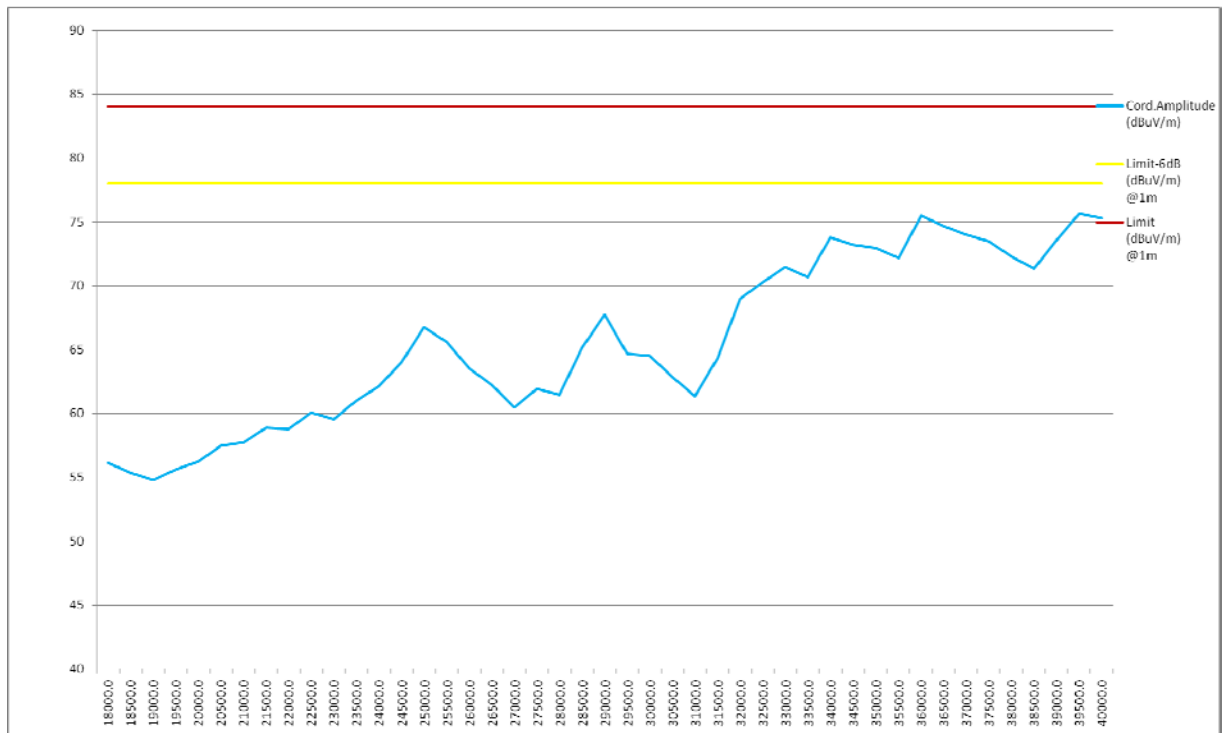
Margin = Limit- Corr. Amplitude

All other spurious emissions are 20 dB below the limit or are on the system noise floor level.

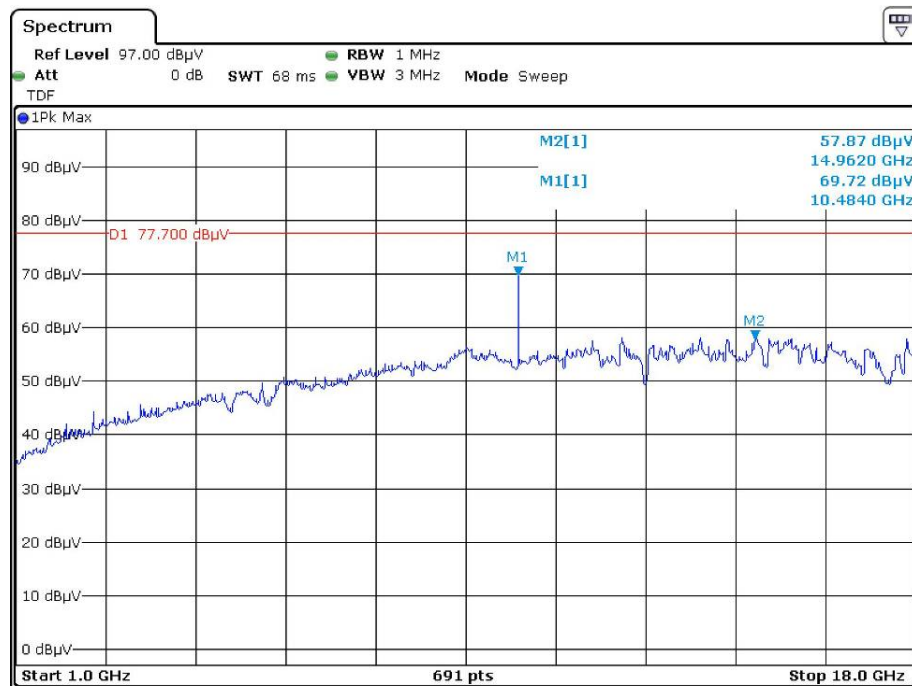
Peak
Pre-scan with 802.11a 5240MHz
Horizontal



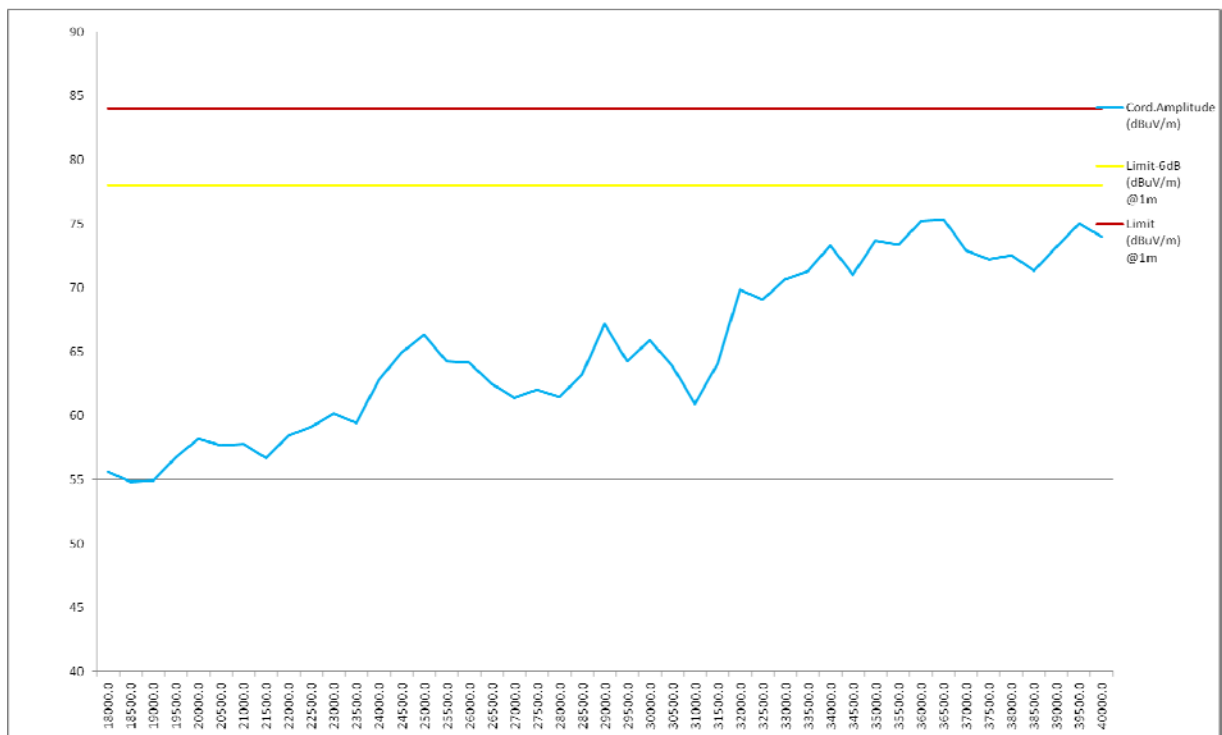
Date: 19.FEB.2020 15:01:38



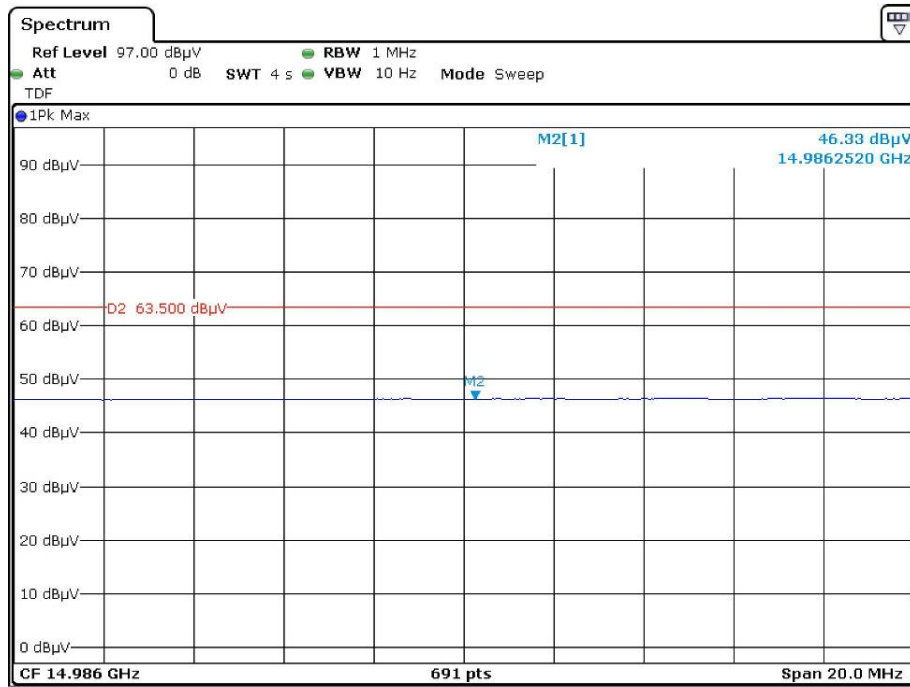
Vertical



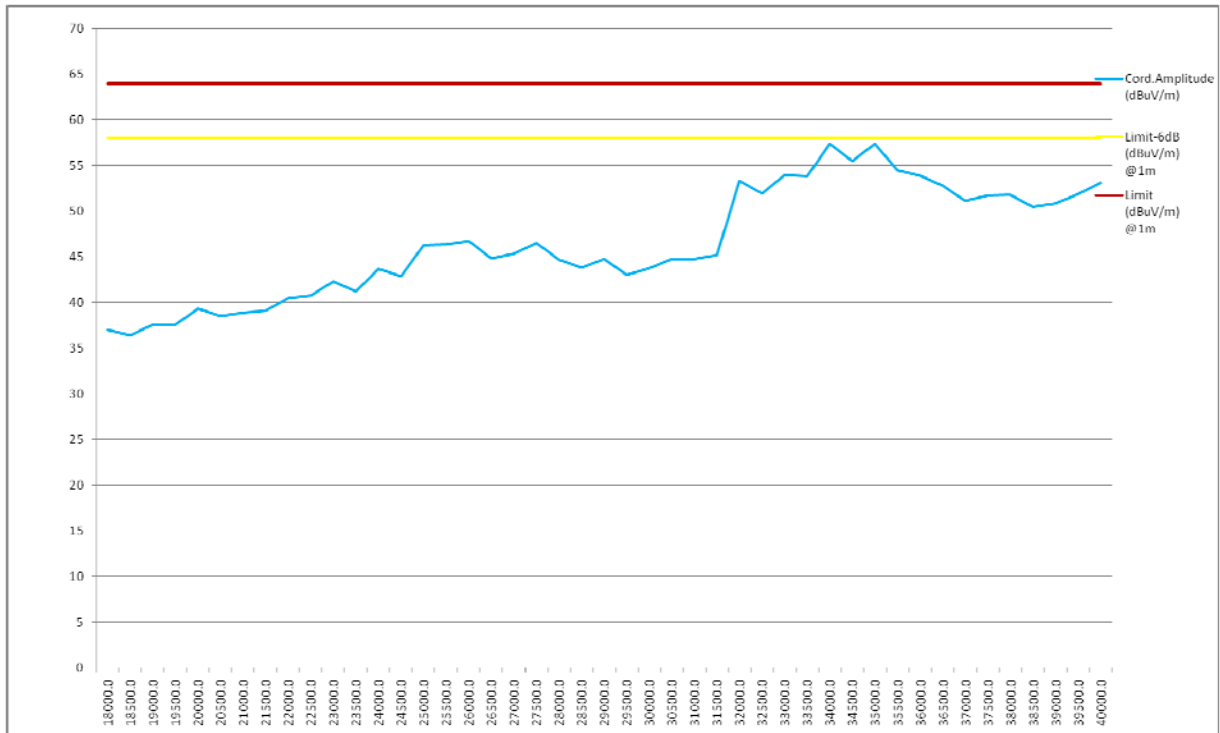
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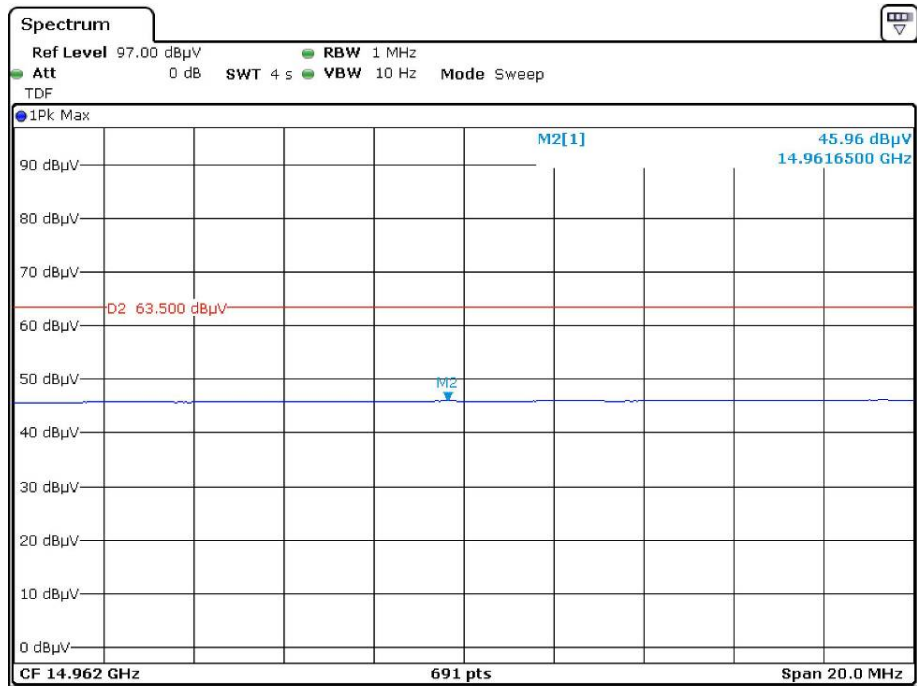
Average Horizontal



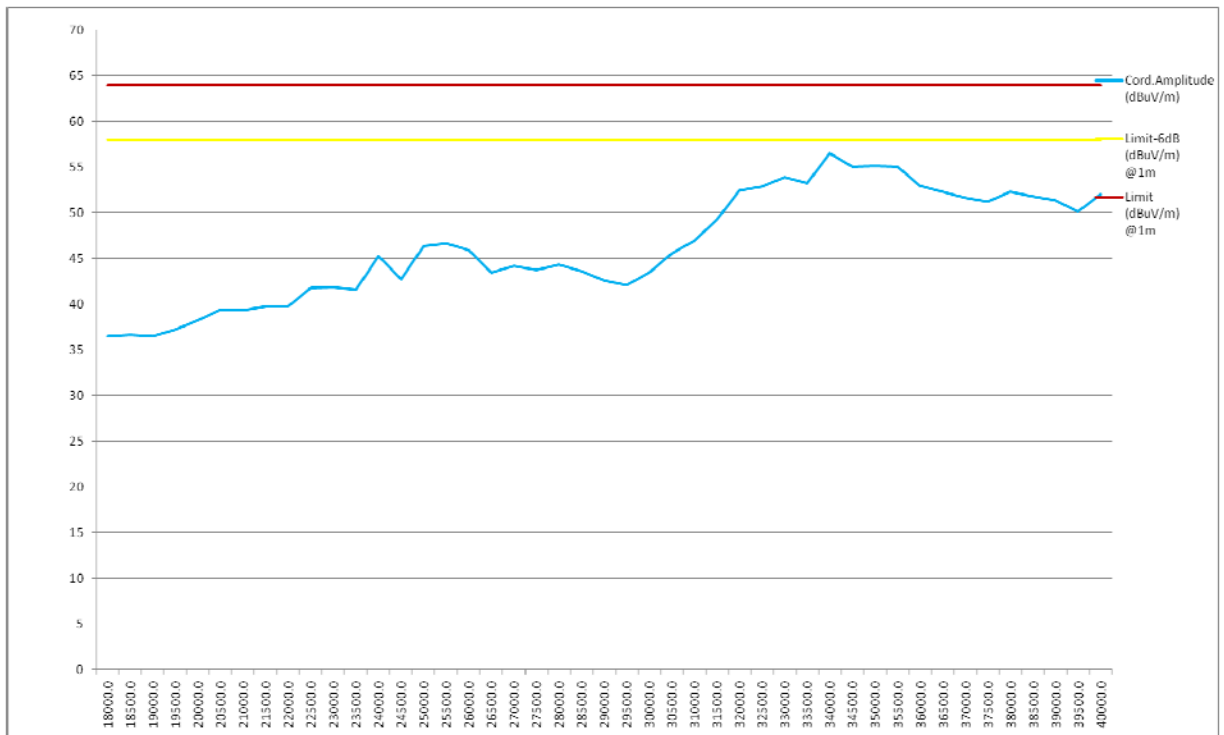
Date: 19.FEB.2020 15:08:04



Vertical



Date: 19.FEB.2020 15:20:19



FCC §15.407(a) (1) – 26 dB & 6dB EMISSION BANDWIDTH

Applicable Standard

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.

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

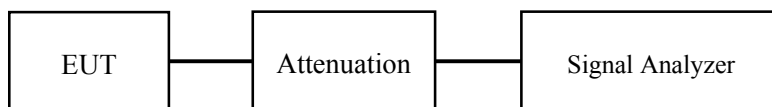
1. Emission Bandwidth (EBW)

- 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%.

2. Minimum Emission Bandwidth for the band 5.725-5.85 GHz

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ 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.



Test Data

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by George Zhong on 2020-02-20.

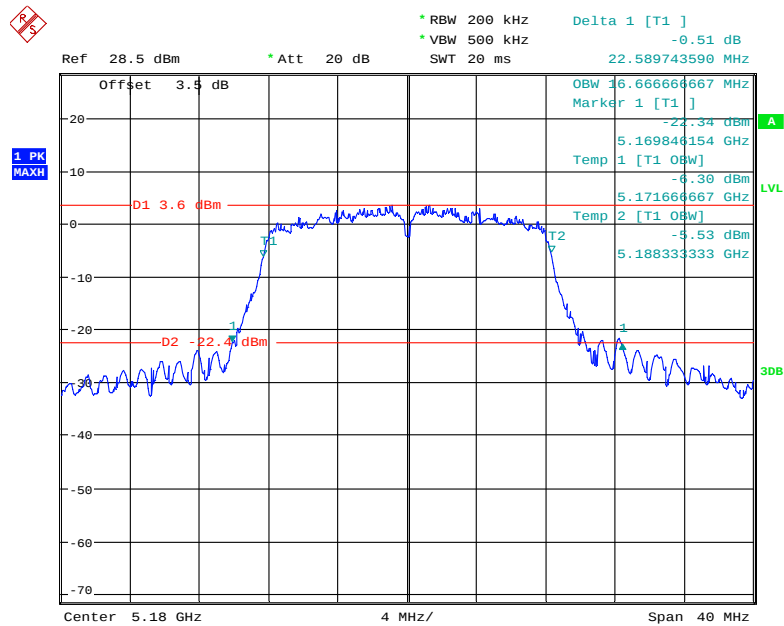
EUT operation mode: Transmitting (Test at the antenna 0)

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

5150 MHz - 5250 MHz:

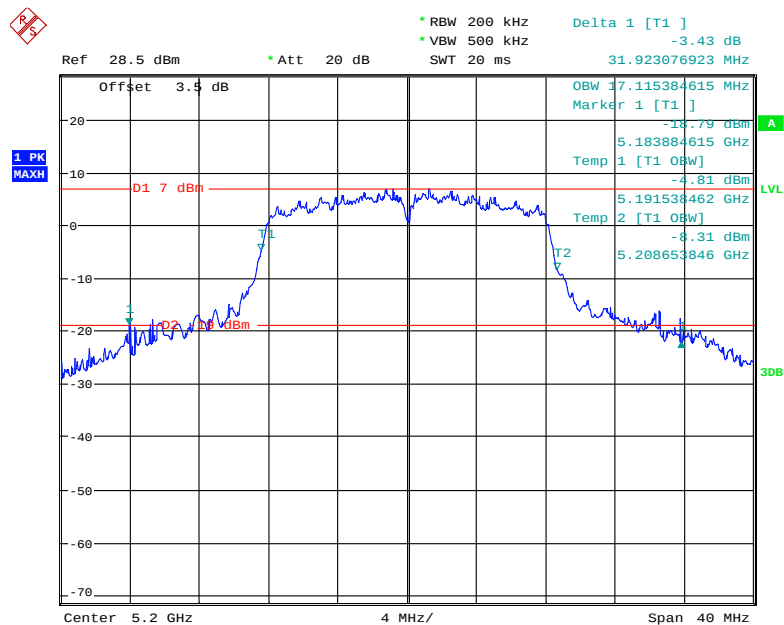
Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Remark
802.11a			No transmitted signal in the 99% bandwidth extends into the U-NII-2A band
5180	22.59	16.67	
5200	31.92	17.12	
5240	30.26	17.18	
802.11n20			
5180	20.35	17.63	
5200	25.77	17.76	
5240	25.71	17.82	
802.11n40			
5190	40.77	36.28	
5230	65.31	36.54	
802.11ac20			
5180	20.28	17.63	
5200	25.45	17.82	
5240	25.71	17.82	
802.11ac40			
5190	40.90	36.28	
5230	63.90	36.67	
11ac80			
5210	81.79	75.38	

802.11a mode, 26 dB Emissions & 99% Occupied Bandwidth, 5180 MHz



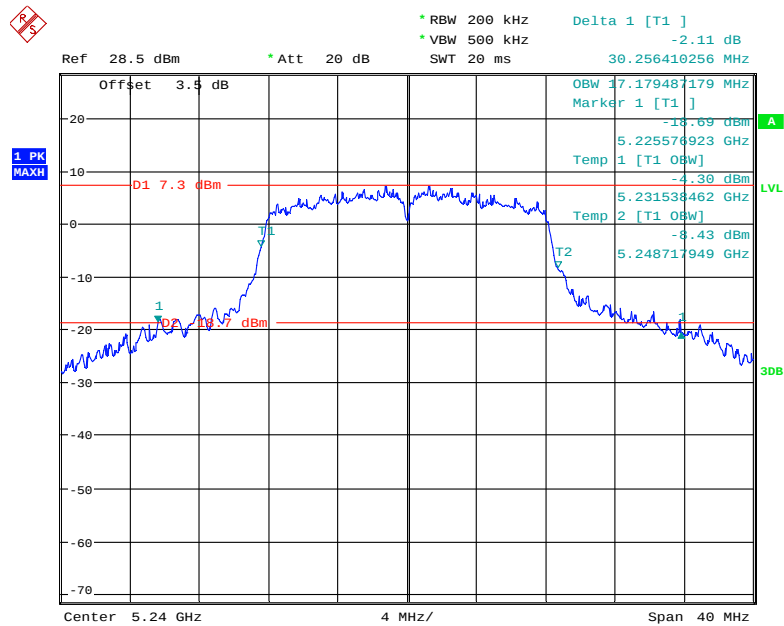
Date: 20.FEB.2020 16:49:29

802.11a mode, 26 dB Emissions & 99% Occupied Bandwidth, 5200 MHz



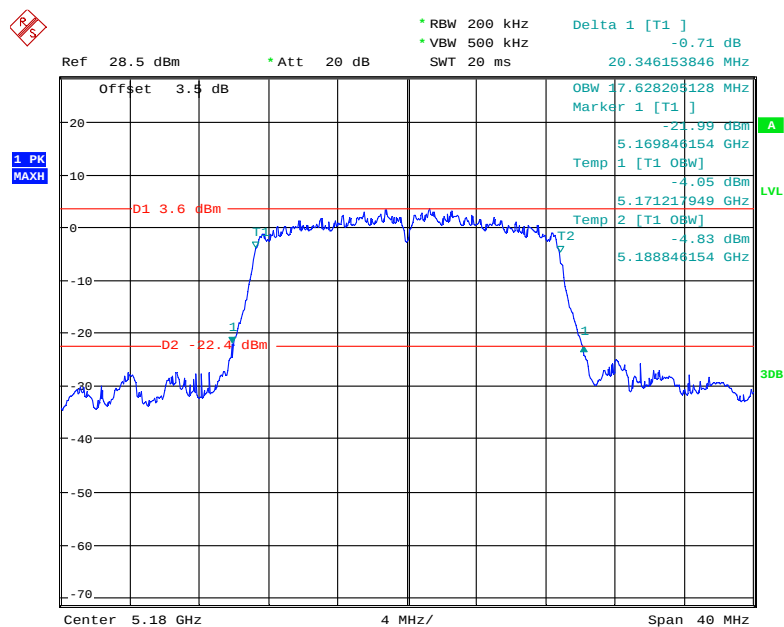
Date: 20.FEB.2020 16:44:23

802.11a mode, 26 dB Emissions & 99% Occupied Bandwidth, 5240 MHz

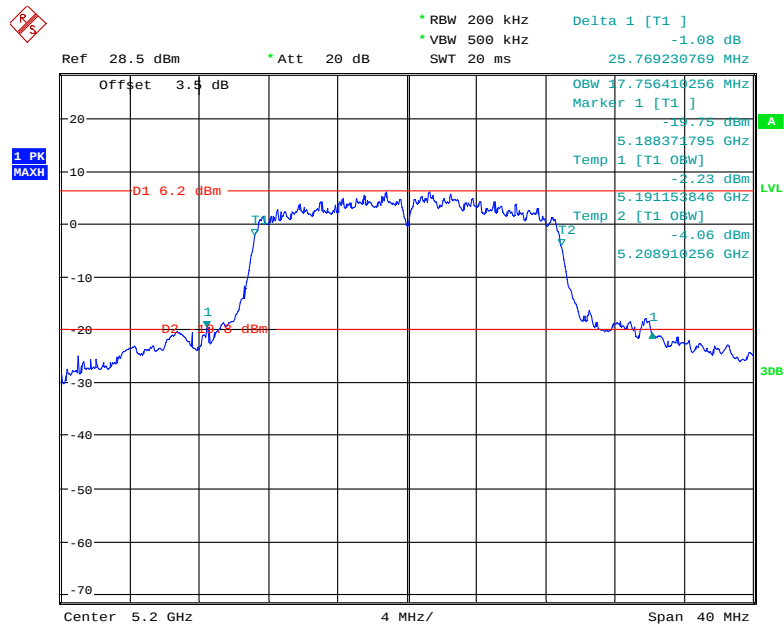


Date: 20.FEB.2020 16:42:45

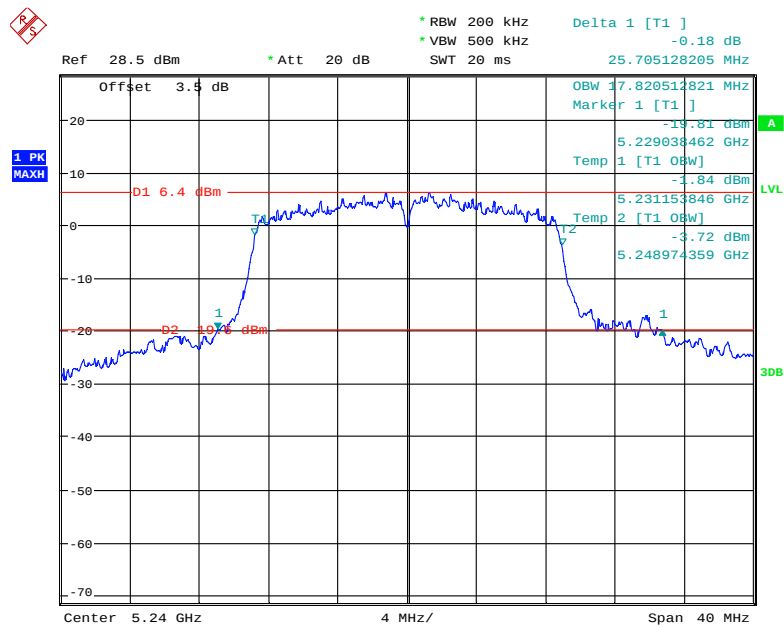
802.11n20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5180 MHz



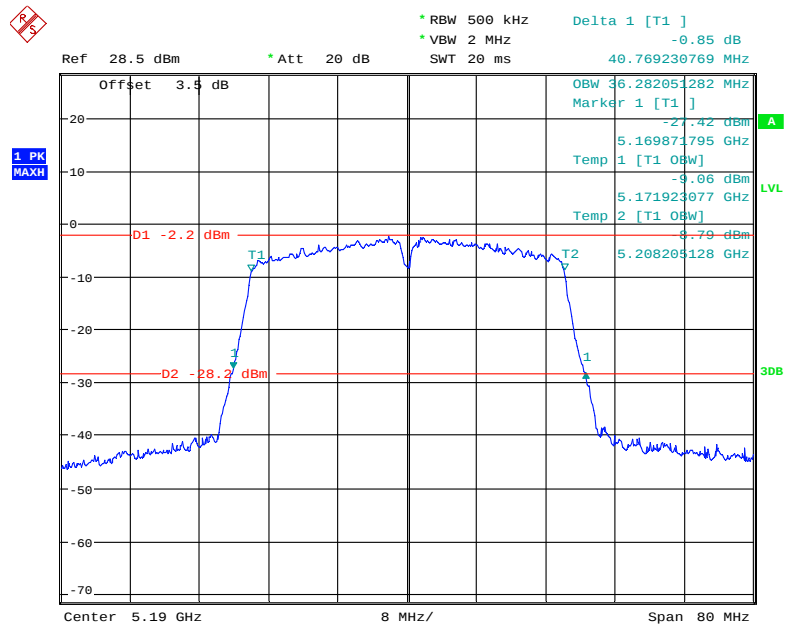
Date: 20.FEB.2020 16:48:28

802.11n20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5200 MHz

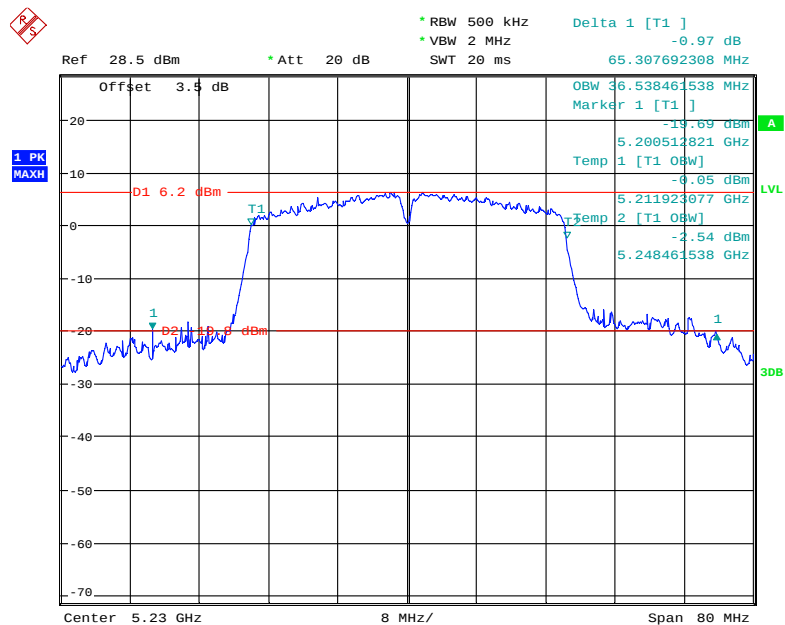
Date: 20.FEB.2020 16:45:26

802.11n20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5240 MHz

Date: 20.FEB.2020 16:40:57

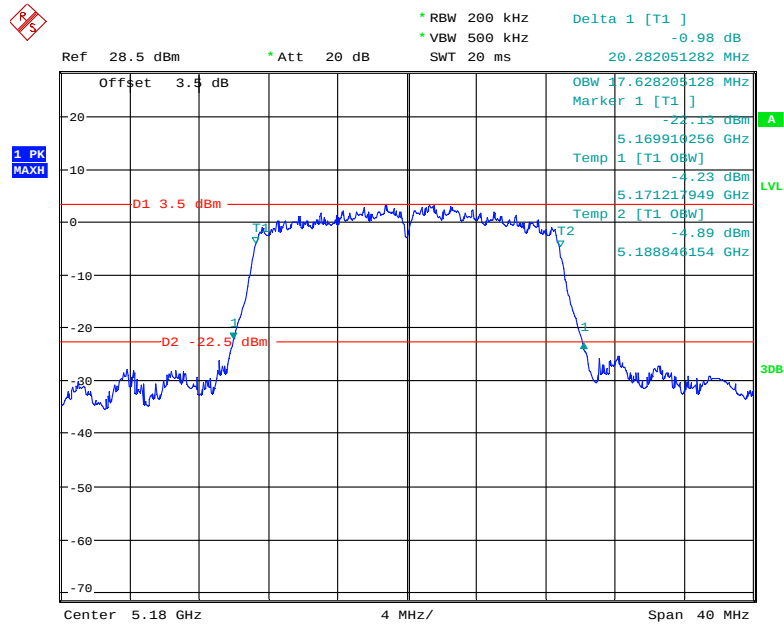
802.11n40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5190 MHz

Date: 20.FEB.2020 16:52:10

802.11n40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5230 MHz

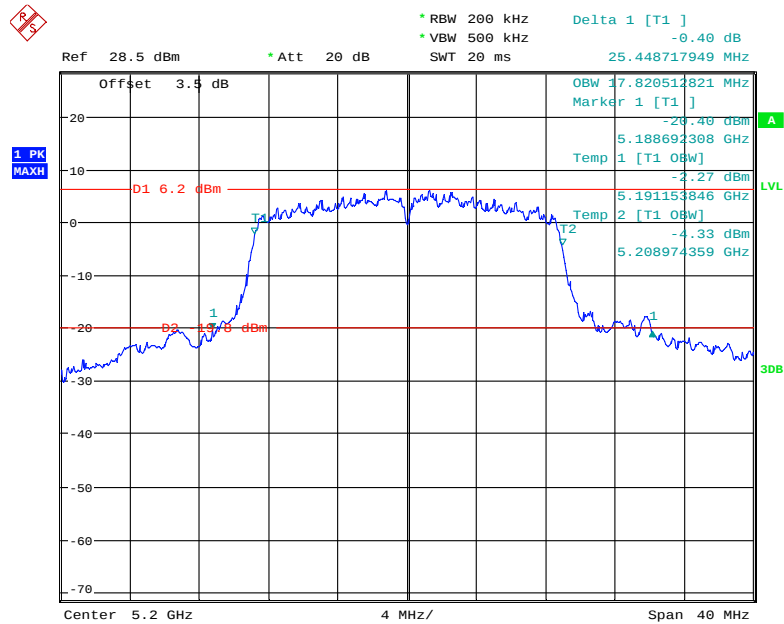
Date: 20.FEB.2020 16:56:00

802.11ac20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5180 MHz

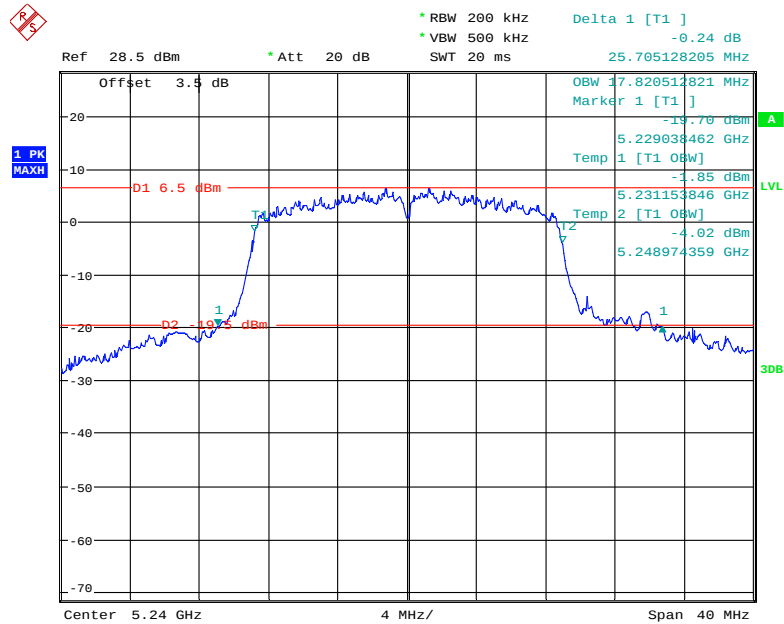


Date: 20.FEB.2020 16:47:32

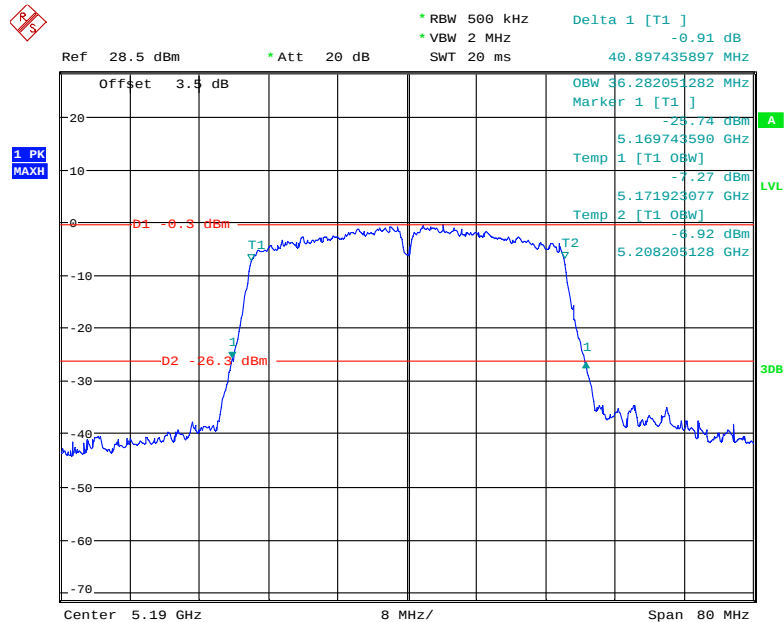
802.11ac20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5200 MHz



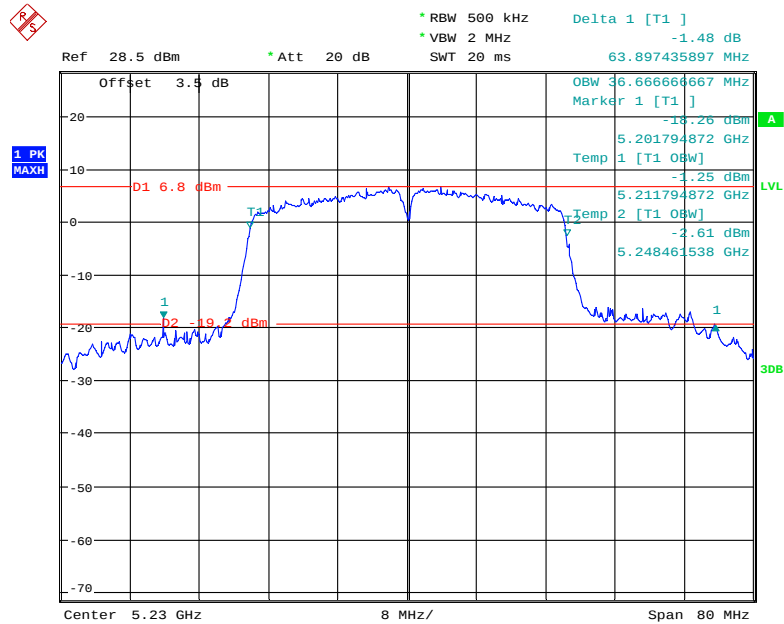
Date: 20.FEB.2020 16:46:28

802.11ac20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5240 MHz

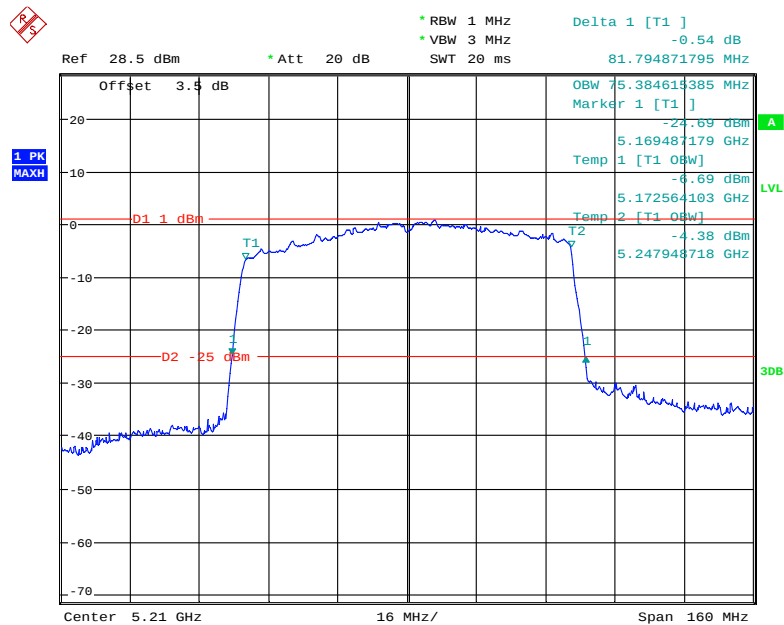
Date: 20.FEB.2020 16:39:54

802.11ac40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5190 MHz

Date: 20.FEB.2020 16:53:27

802.11ac40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5230 MHz

Date: 20.FEB.2020 16:55:14

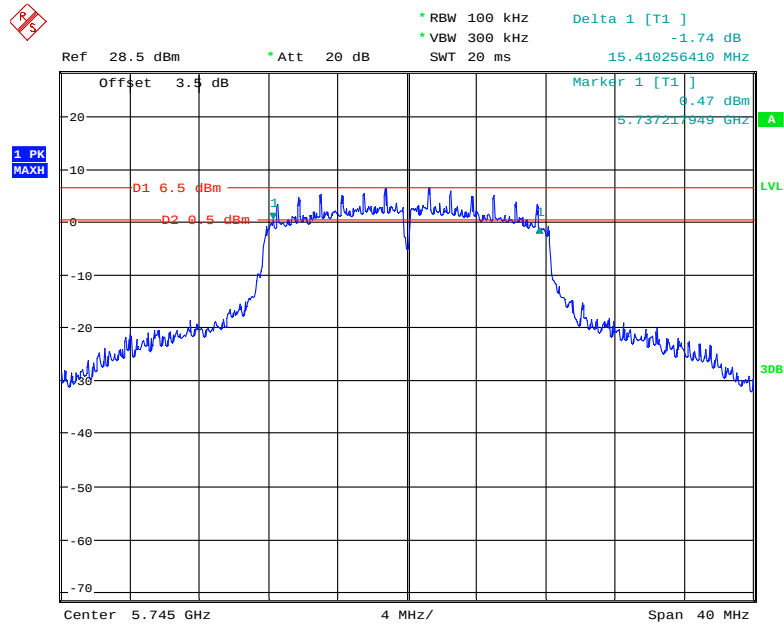
802.11ac80 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5230 MHz

Date: 20.FEB.2020 16:59:22

5725 MHz – 5850 MHz:

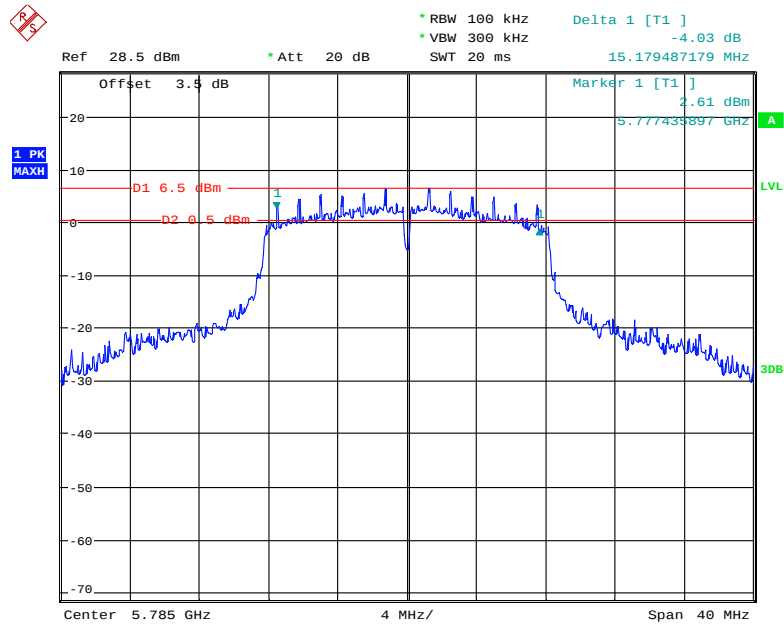
Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit (MHz)	Remark
802.11a				No transmitted signal in the 99% bandwidth extends into the U-NII-2C band
5745	15.41	17.88	0.5	
5785	15.18	17.69	0.5	
5825	15.18	17.82	0.5	
802.11n20				
5745	15.22	18.21	0.5	
5785	15.18	18.21	0.5	
5825	15.18	18.21	0.5	
802.11n40				
5755	35.26	36.67	0.5	
5795	35.26	36.67	0.5	
802.11ac20				
5745	15.22	18.21	0.5	
5785	15.18	18.21	0.5	
5825	15.18	18.27	0.5	
802.11ac40				
5755	35.26	36.67	0.5	
5795	35.26	36.67	0.5	
802.11ac80				
5775	75.64	75.90	0.5	

802.11a mode, 6dB Emission Bandwidth, 5745 MHz



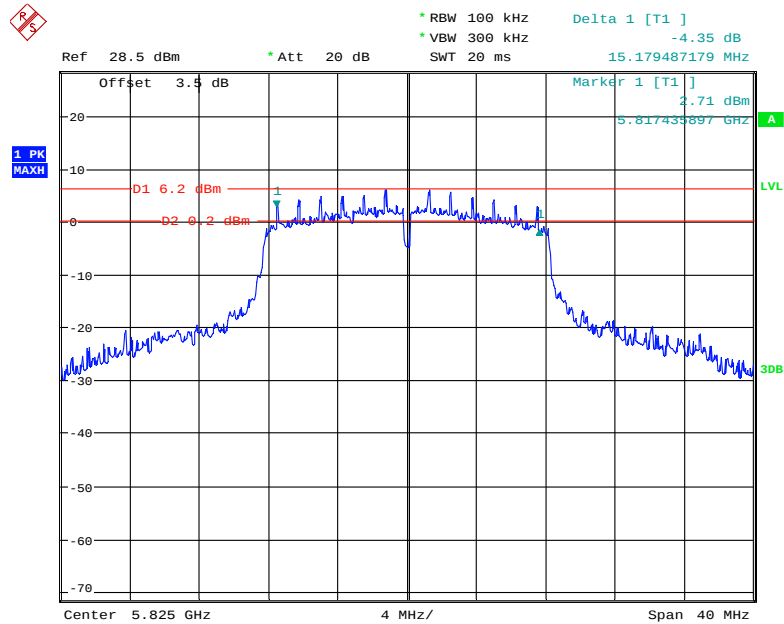
Date: 20.FEB.2020 20:05:01

802.11a mode, 6dB Emission Bandwidth, 5785 MHz



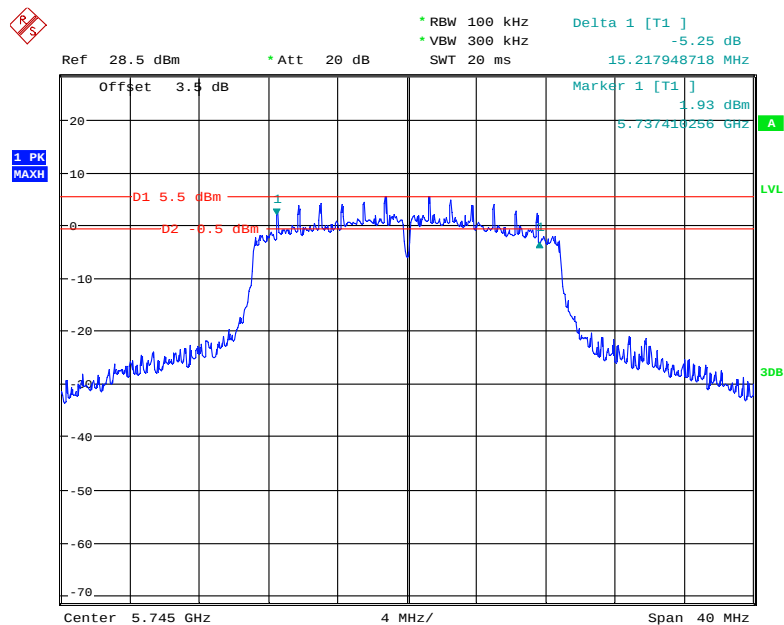
Date: 20.FEB.2020 20:12:41

802.11a mode, 6dB Emission Bandwidth, 5825 MHz



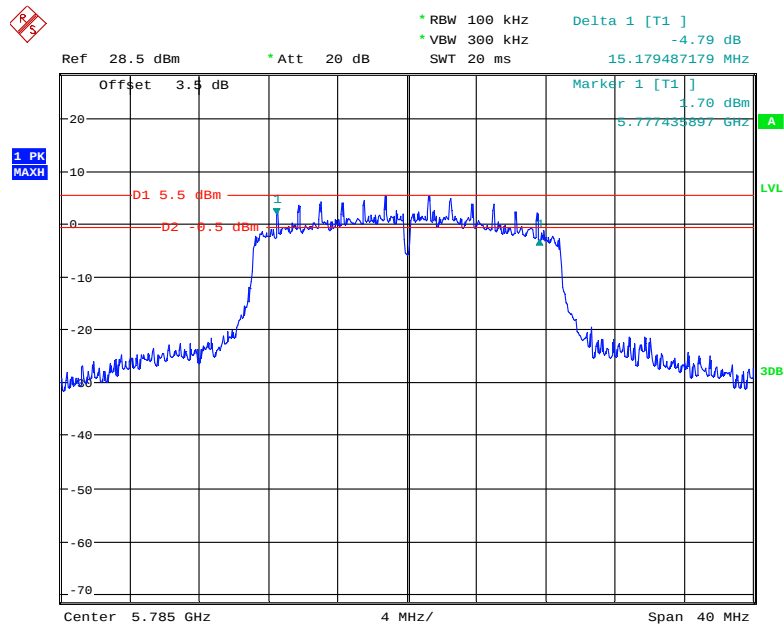
Date: 20.FEB.2020 20:14:29

802.11n20 mode, 6dB Emission Bandwidth, 5745 MHz



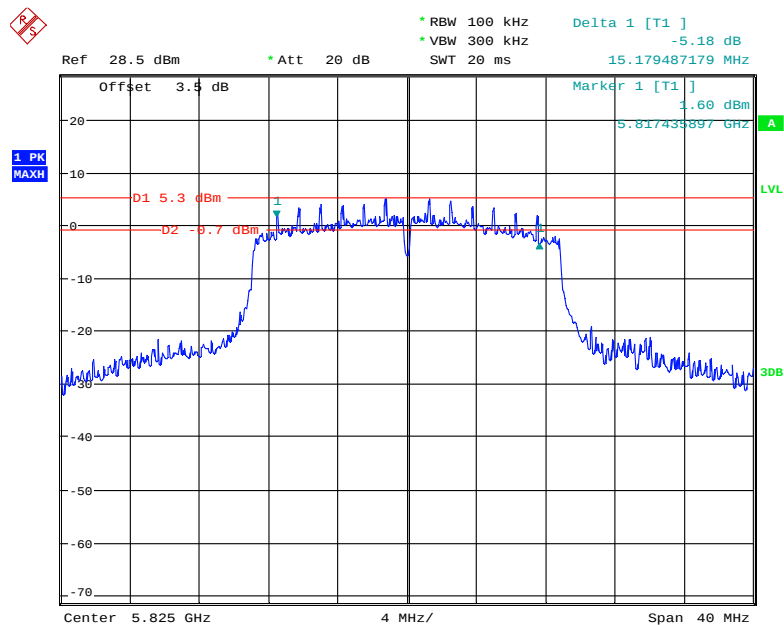
Date: 20.FEB.2020 20:06:43

802.11n20 mode, 6dB Emission Bandwidth, 5785 MHz



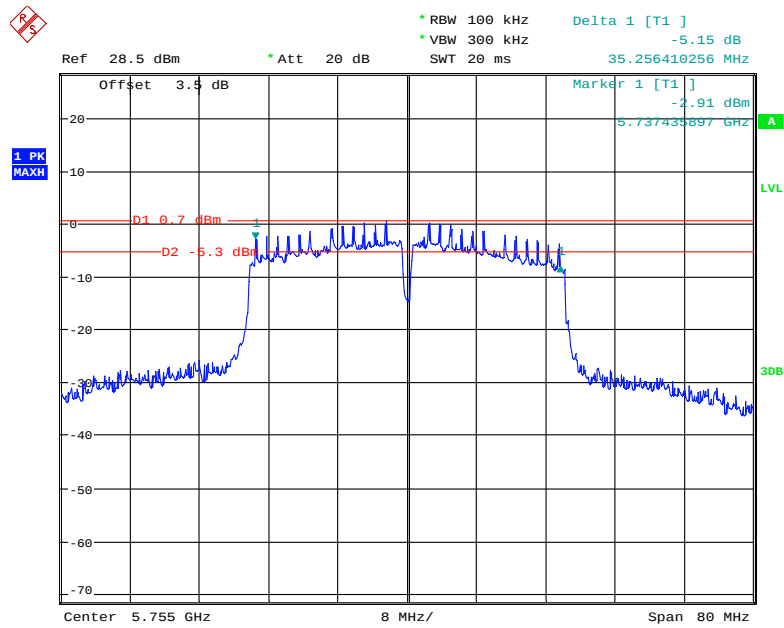
Date: 20.FEB.2020 20:10:45

802.11n20 mode, 6dB Emission Bandwidth, 5825 MHz



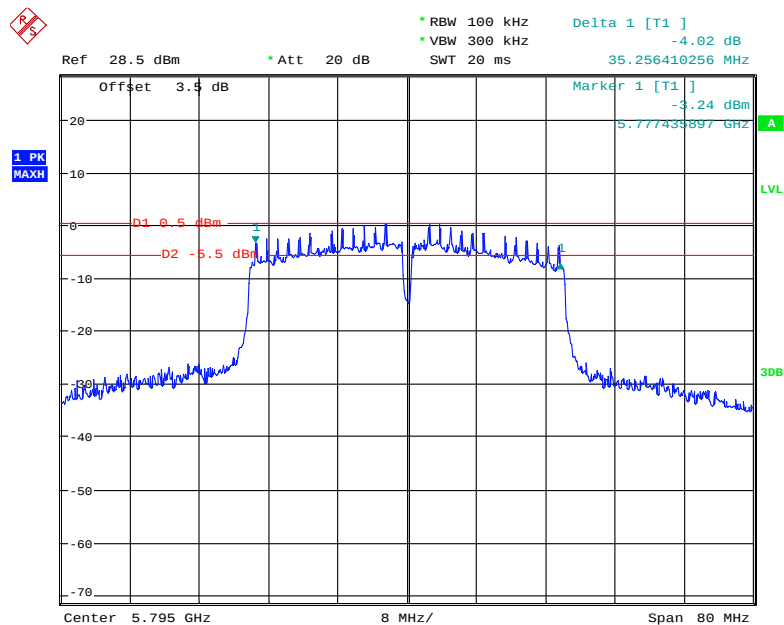
Date: 20.FEB.2020 20:16:18

802.11n40 mode, 6dB Emission Bandwidth, 5755 MHz



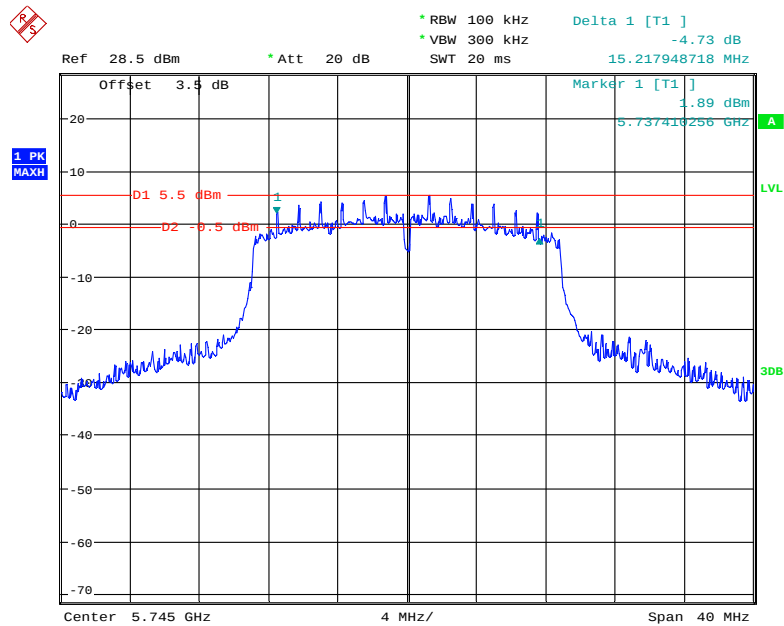
Date: 20.FEB.2020 18:16:01

802.11n40 mode, 6dB Emission Bandwidth, 5795 MHz



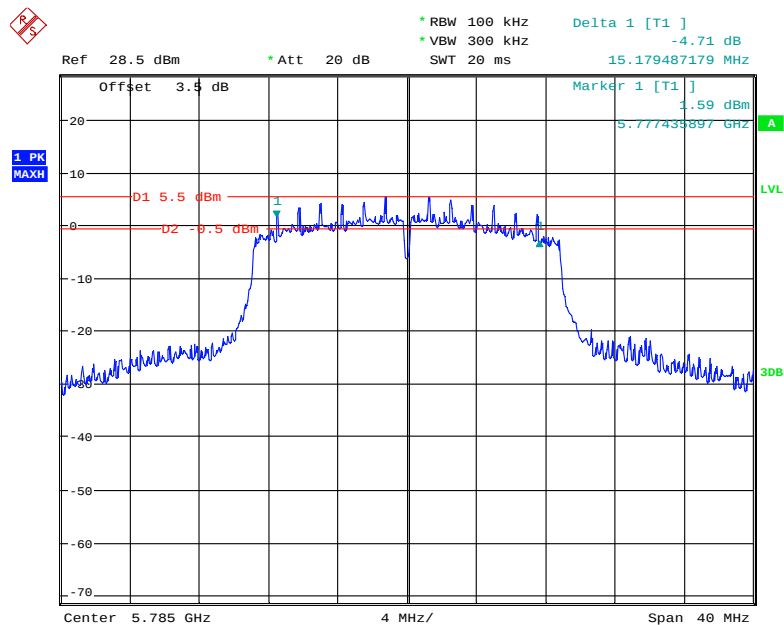
Date: 20.FEB.2020 18:33:42

802.11ac20 mode, 6dB Emission Bandwidth, 5745 MHz



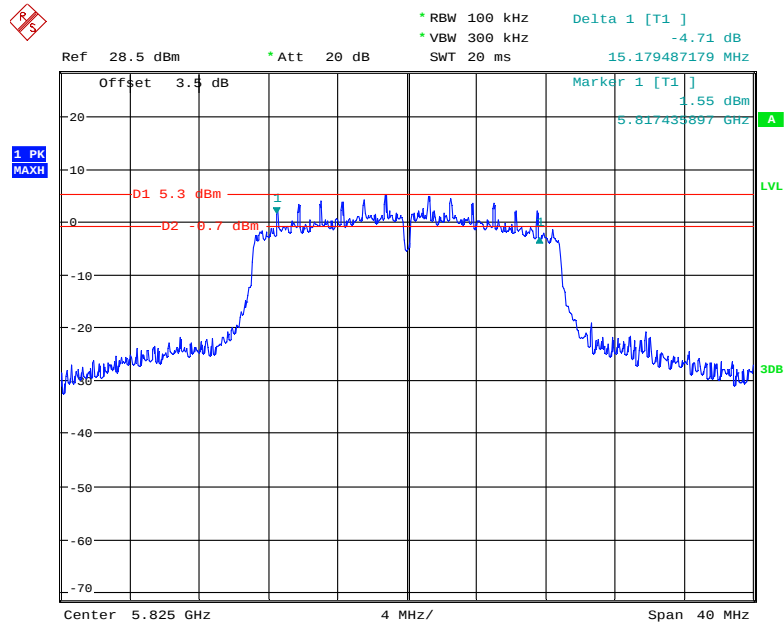
Date: 20.FEB.2020 20:07:39

802.11ac20 mode, 6dB Emission Bandwidth, 5785 MHz



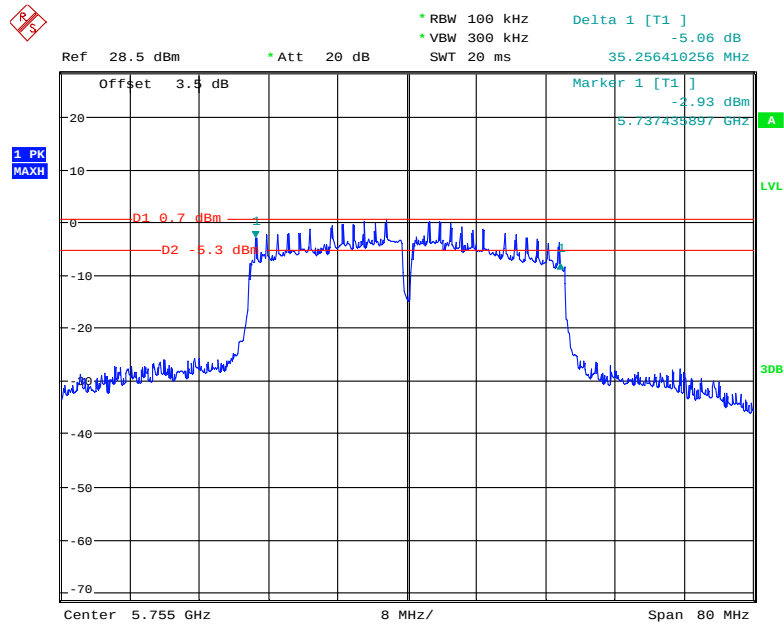
Date: 20.FEB.2020 20:08:59

802.11ac20 mode, 6dB Emission Bandwidth, 5825 MHz



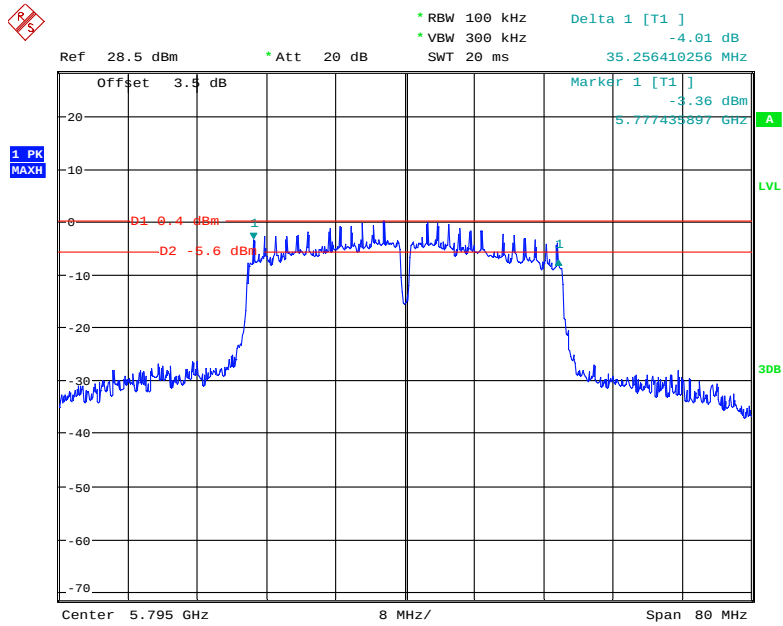
Date: 20.FEB.2020 20:18:42

802.11ac40 mode, 6dB Emission Bandwidth, 5755 MHz



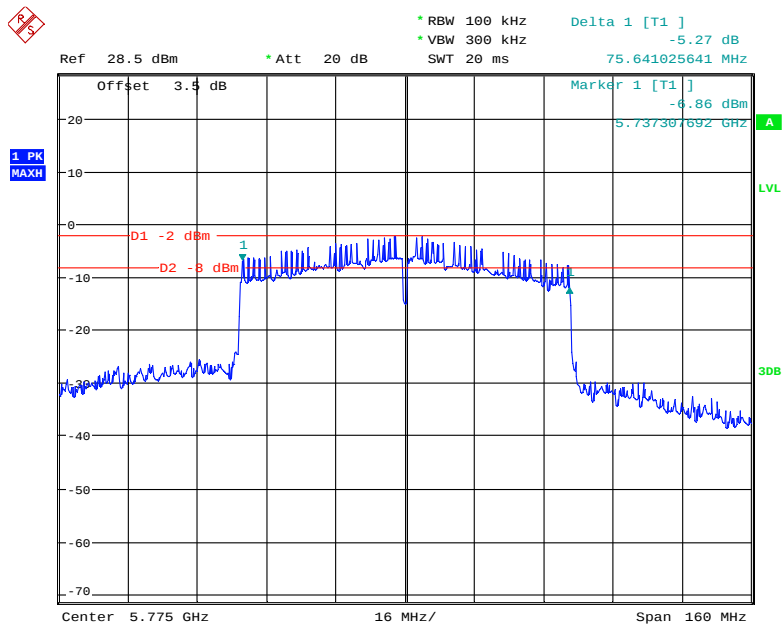
Date: 20.FEB.2020 18:14:52

802.11ac40 mode, 6dB Emission Bandwidth, 5795 MHz



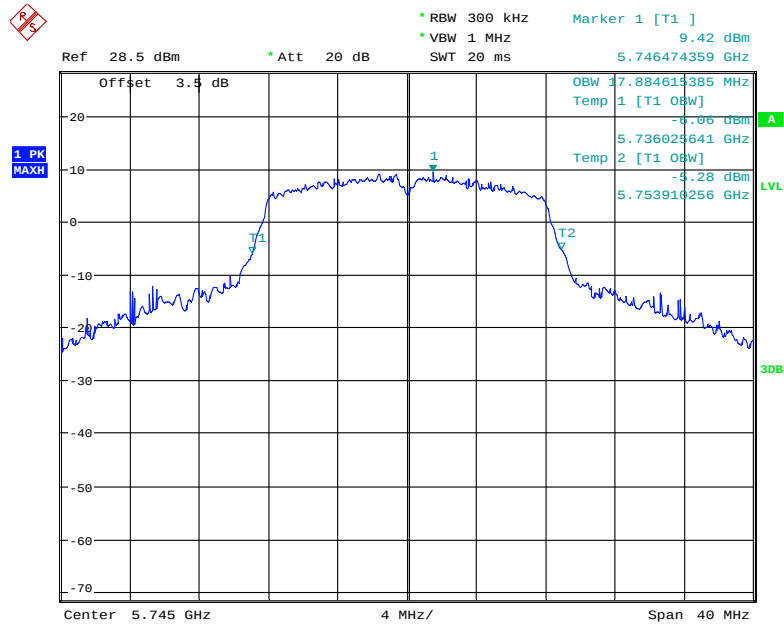
Date: 20.FEB.2020 18:34:38

802.11ac80 mode, 6dB Emission Bandwidth, 5775 MHz



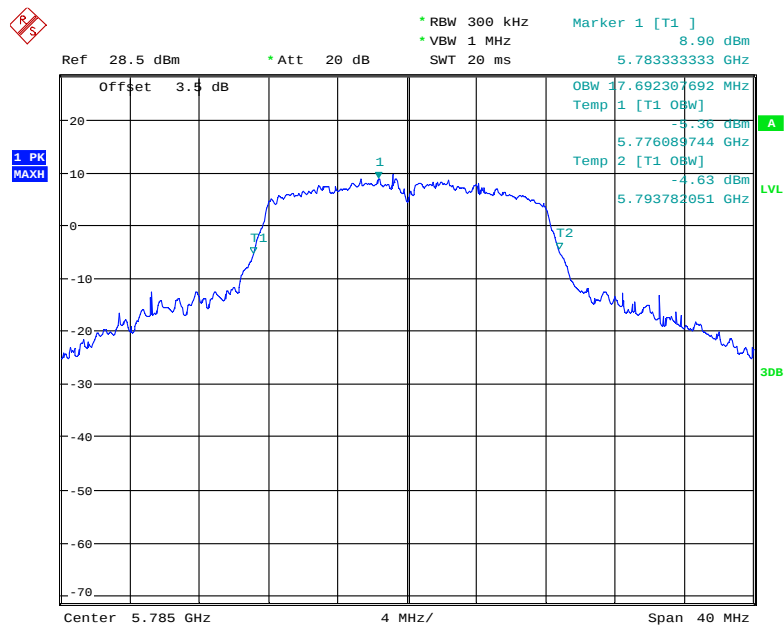
Date: 20.FEB.2020 18:12:51

802.11a mode, 99% Occupied Bandwidth, 5745 MHz



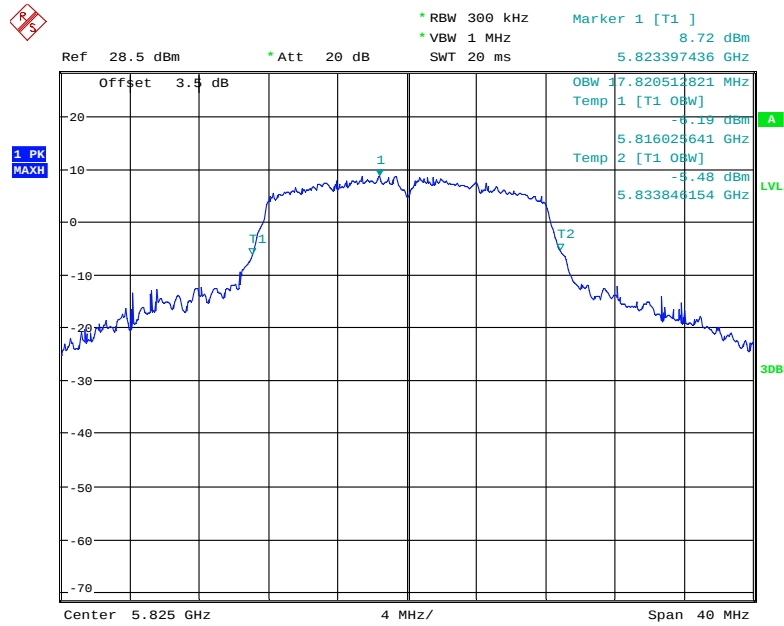
Date: 20.FEB.2020 20:28:46

802.11a mode, 99% Occupied Bandwidth, 5785 MHz



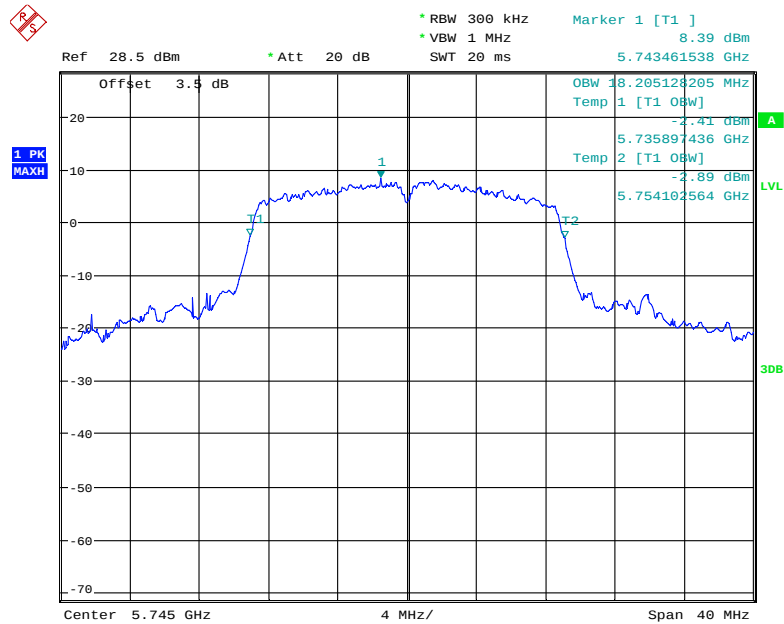
Date: 20.FEB.2020 20:23:36

802.11a mode, 99% Occupied Bandwidth, 5825 MHz



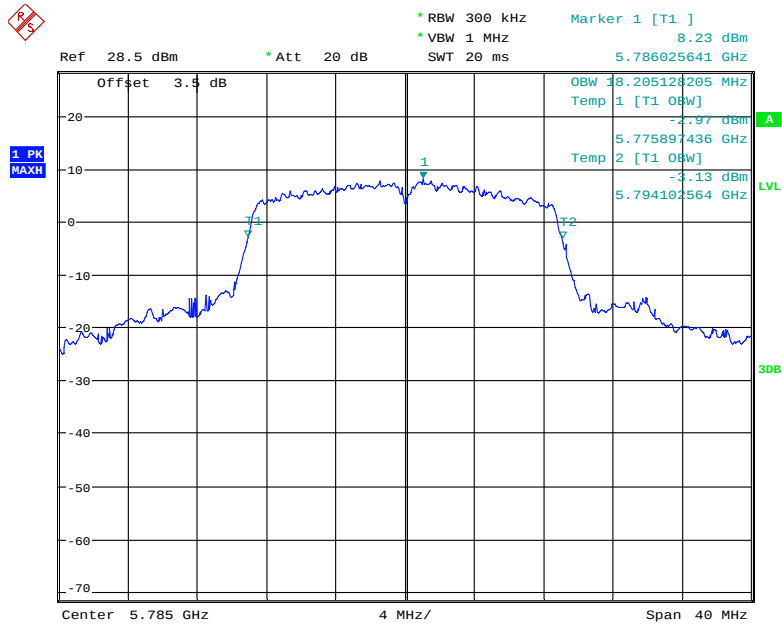
Date: 20.FEB.2020 20:29:58

802.11n20 mode, 99% Occupied Bandwidth, 5745 MHz



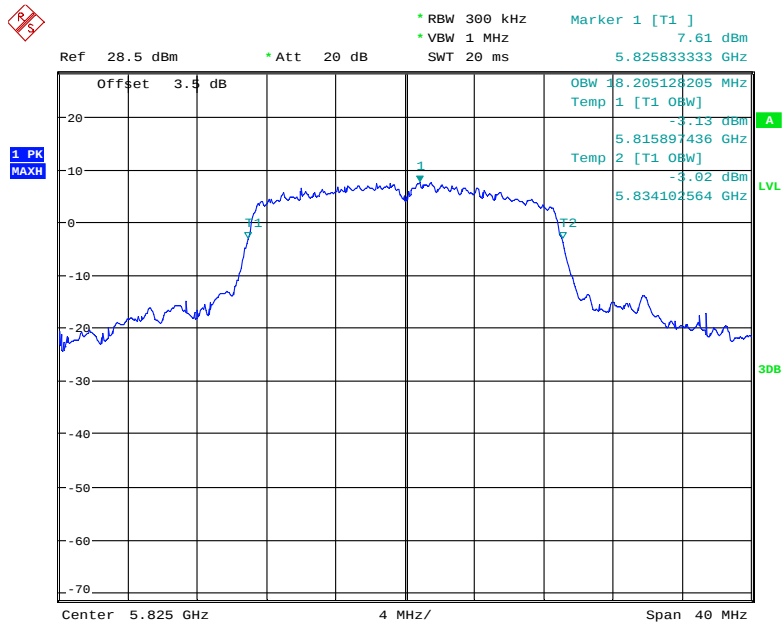
Date: 20.FEB.2020 20:27:51

802.11n20 mode, 99% Occupied Bandwidth, 5785 MHz



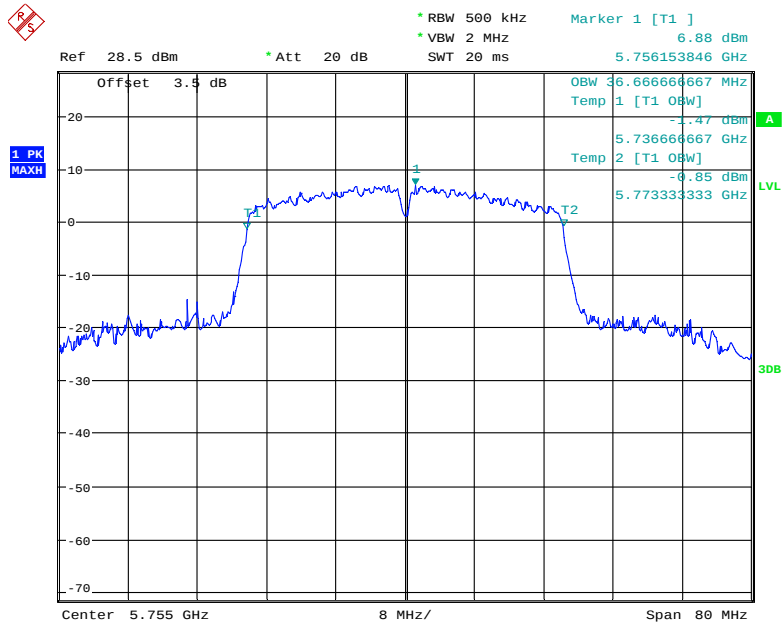
Date: 20.FEB.2020 20:24:42

802.11n20 mode, 99% Occupied Bandwidth, 5825 MHz



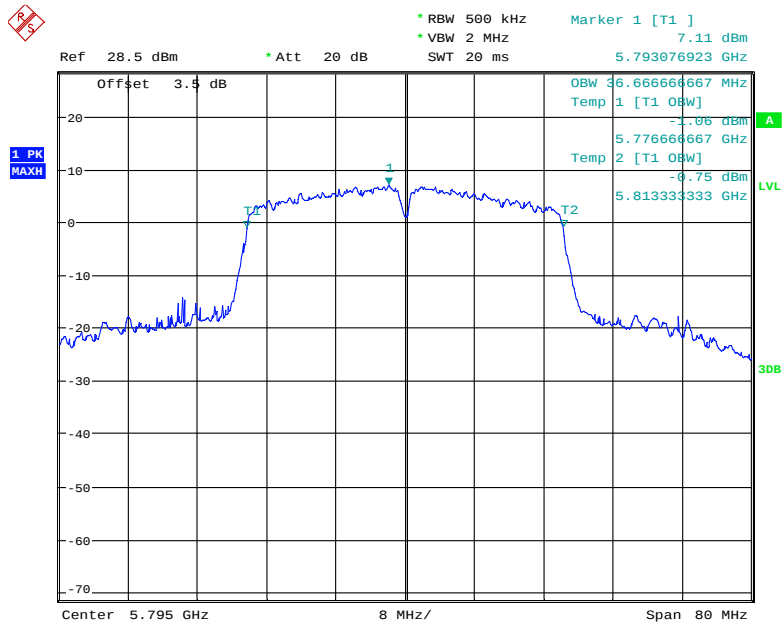
Date: 20.FEB.2020 20:30:45

802.11n40 mode, 99% Occupied Bandwidth, 5755 MHz



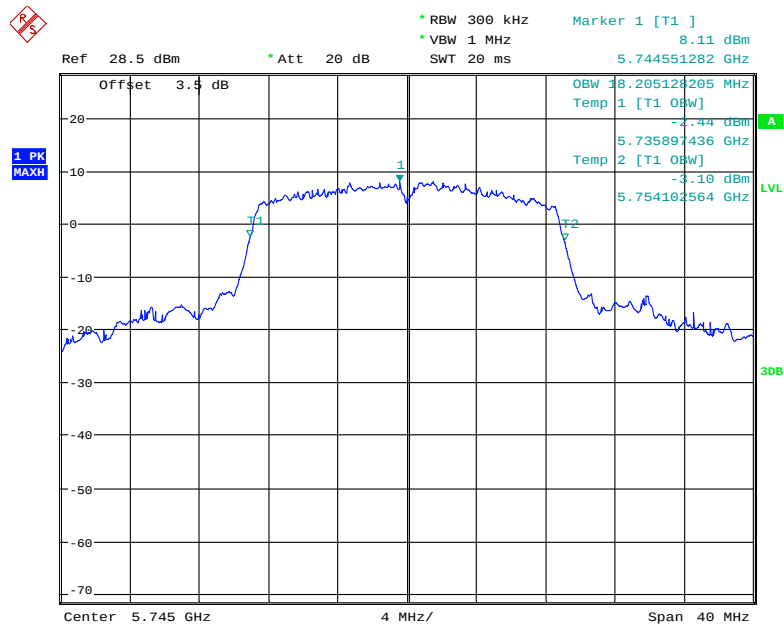
Date: 20.FEB.2020 20:31:51

802.11n40 mode, 99% Occupied Bandwidth, 5795 MHz



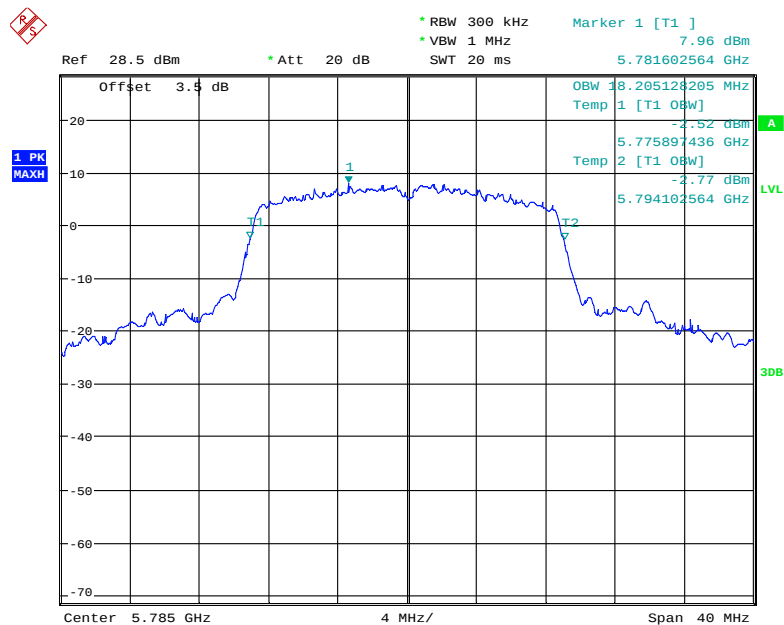
Date: 20.FEB.2020 20:36:02

802.11ac20 mode, 99% Occupied Bandwidth, 5745 MHz



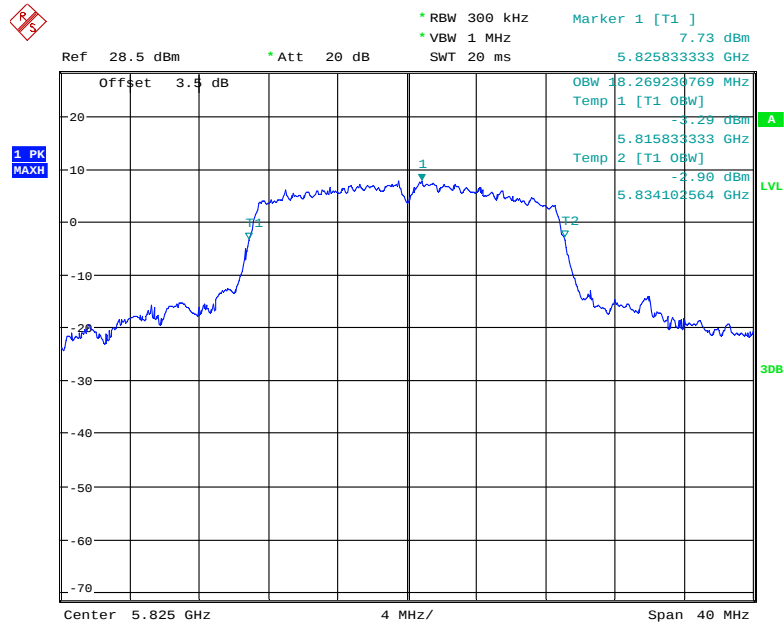
Date: 20.FEB.2020 20:27:07

802.11ac20 mode, 99% Occupied Bandwidth, 5785 MHz



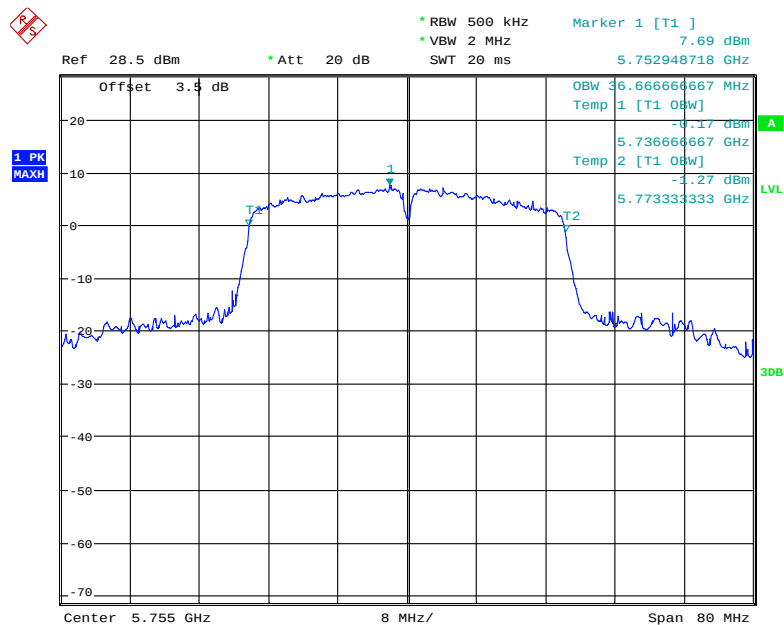
Date: 20.FEB.2020 20:26:03

802.11ac20 mode, 99% Occupied Bandwidth, 5825 MHz



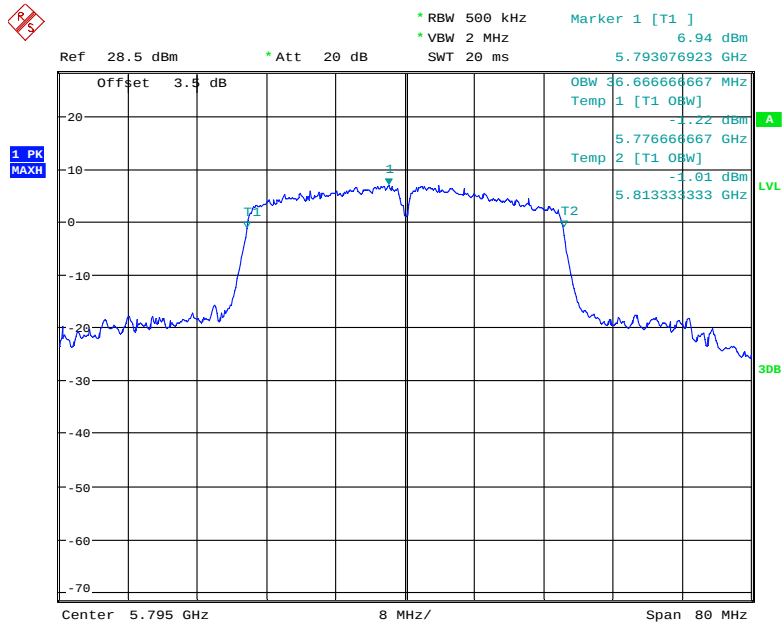
Date: 20.FEB.2020 20:20:34

802.11ac40 mode, 99% Occupied Bandwidth, 5755 MHz



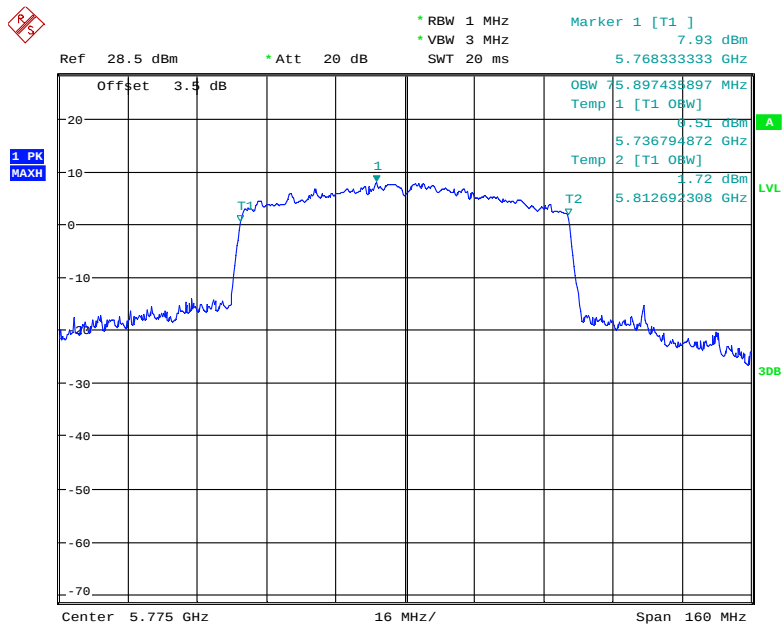
Date: 20.FEB.2020 20:33:44

802.11ac40 mode, 99% Occupied Bandwidth, 5795 MHz



Date: 20.FEB.2020 20:35:03

802.11ac80 mode, 99% Occupied Bandwidth, 5775 MHz



Date: 20.FEB.2020 20:38:04

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

Applicable Standard

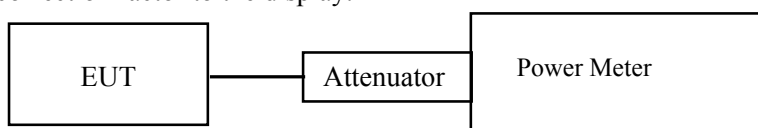
For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz 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.

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.

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.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by George Zhong on 2020-02-20.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the following tables.

5150 MHz – 5250 MHz

Frequency (MHz)	Antenna Port	Reading (dBm)	Cable Loss (dB)	Average Output Power (dBm)	Total Power (dBm)	Non-BF Limit (dBm)	BF Limit (dBm)
802.11a							
5180	0	11.73	1	12.73	16.27	30	29
	1	12.74	1	13.74			
5200	0	14.79	1	15.79	19.41		
	1	15.93	1	16.93			
5240	0	15.11	1	16.11	19.20		
	1	15.26	1	16.26			
802.11n20							
5180	0	11.61	1	12.61	16.41	30	29
	1	13.07	1	14.07			
5200	0	13.74	1	14.74	18.41		
	1	14.98	1	15.98			
5240	0	14.13	1	15.13	18.17		
	1	14.18	1	15.18			
802.11n40							
5190	0	5.85	1	6.85	10.30	30	29
	1	6.69	1	7.69			
5230	0	13.45	1	14.45	17.71		
	1	13.93	1	14.93			
802.11ac20							
5180	0	11.51	1	12.51	16.12	30	29
	1	12.63	1	13.63			
5200	0	13.86	1	14.86	18.40		
	1	14.86	1	15.86			
5240	0	14.26	1	15.26	18.24		
	1	14.19	1	15.19			
802.11ac40							
5190	0	6.27	1	7.27	10.99	30	29
	1	7.59	1	8.59			
5230	0	13.48	1	14.48	17.72		
	1	13.92	1	14.92			
802.11ac80							
5210	0	5.44	1	6.44	9.59	30	29
	1	5.71	1	6.71			

Note: For Beam-Forming mode:

(1) Directional gain = array gain + Ant gain = $10 \cdot \lg(N_{ant}/N_{ss}) + 4dBi = 7dBi > 6dBi$, So $Limit_{BF} = 30 - (7 - 6) = 29dBm$

(2) Non-Beam Forming mode share the same power with the Beam Forming mode.

5725 MHz – 5825 MHz:

Frequency (MHz)	Antenna Port	Reading (dBm)	Cable Loss (dB)	Average Output Power (dBm)	Total Power (dBm)	Non-BF Limit (dBm)	BF Limit (dBm)
802.11a							
5745	0	15.61	1	16.61	19.92	30	29
	1	16.19	1	17.19			
5785	0	15.62	1	16.62	19.70		
	1	15.75	1	16.75			
5825	0	15.39	1	16.39	19.31		
	1	15.20	1	16.20			
802.11n20							
5745	0	14.71	1	15.71	18.97	30	29
	1	15.20	1	16.20			
5785	0	14.51	1	15.51	18.69		
	1	14.85	1	15.85			
5825	0	14.38	1	15.38	18.24		
	1	14.07	1	15.07			
802.11n40							
5755	0	14.06	1	15.06	18.41	30	29
	1	14.72	1	15.72			
5795	0	14.03	1	15.03	18.11		
	1	14.17	1	15.17			
802.11ac20							
5745	0	14.71	1	15.71	18.90	30	29
	1	15.07	1	16.07			
5785	0	14.60	1	15.60	18.77		
	1	14.91	1	15.91			
5825	0	14.42	1	15.42	18.25		
	1	14.05	1	15.05			
802.11ac40							
5755	0	14.15	1	15.15	18.38	30	29
	1	14.57	1	15.57			
5795	0	14.00	1	15.00	18.14		
	1	14.25	1	15.25			
802.11ac80							
5775	0	12.59	1	13.59	16.88	30	29
	1	13.14	1	14.14			

Note: For Beam-Forming mode:

(1) Directional gain = array gain + Ant gain = $10 \cdot \lg(N_{ant}/N_{ss}) + 4dBi = 7dBi > 6dBi$, So $Limit_{BF} = 30 - (7 - 6) = 29dBm$

(2) Non-Beam Forming mode share the same power with the Beam Forming mode.

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

Applicable Standard

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 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.

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.

Test Procedure

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

- a) Set $RBW \geq 1/T$, where T is defined in section II.B.1.a).
- b) Set $VBW \geq 3 RBW$.
- c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add $10 \log (500 \text{ kHz}/RBW)$ to the measured result, whereas $RBW (< 500 \text{ kHz})$ is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
- d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add $10 \log (1\text{MHz}/RBW)$ to the measured result, whereas $RBW (< 1 \text{ MHz})$ is the reduced resolution bandwidth of spectrum analyzer set during measurement.
- e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Test Data**Environmental Conditions**

Temperature:	25 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by George Zhong on 2020-02-20.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the following tables and plots.

5150 MHz – 5250 MHz

Frequency (MHz)	Antenna Port	Reading (dBm/MHz)	Cable Loss (dB)	Power Spectral Density (dBm/MHz)	Total PSD (dBm/MHz)	Limit (dBm/MHz)
802.11a						
5180	0	3.04	1	4.04	7.69	16
	1	4.24	1	5.24		
5200	0	6.03	1	7.03	10.90	
	1	7.60	1	8.60		
5240	0	6.21	1	7.21	10.44	
	1	6.63	1	7.63		
802.11n20						
5180	0	2.99	1	3.99	7.88	16
	1	4.60	1	5.60		
5200	0	5.25	1	6.25	9.87	
	1	6.40	1	7.40		
5240	0	5.51	1	6.51	9.55	
	1	5.57	1	6.57		
802.11n40						
5190	0	-6.32	1	-5.32	-1.79	16
	1	-5.34	1	-4.34		
5230	0	2.44	1	3.44	6.60	
	1	2.73	1	3.73		
802.11ac20						
5180	0	2.72	1	3.72	7.42	16
	1	4.01	1	5.01		
5200	0	5.17	1	6.17	9.81	
	1	6.35	1	7.35		
5240	0	5.43	1	6.43	9.37	
	1	5.28	1	6.28		
802.11ac40						
5190	0	-4.75	1	-3.75	-0.06	16
	1	-3.48	1	-2.48		
5230	0	2.42	1	3.42	6.62	
	1	2.79	1	3.79		
802.11ac80						
5210	0	-7.25	1	-6.25	-3.04	16
	1	-6.86	1	-5.86		

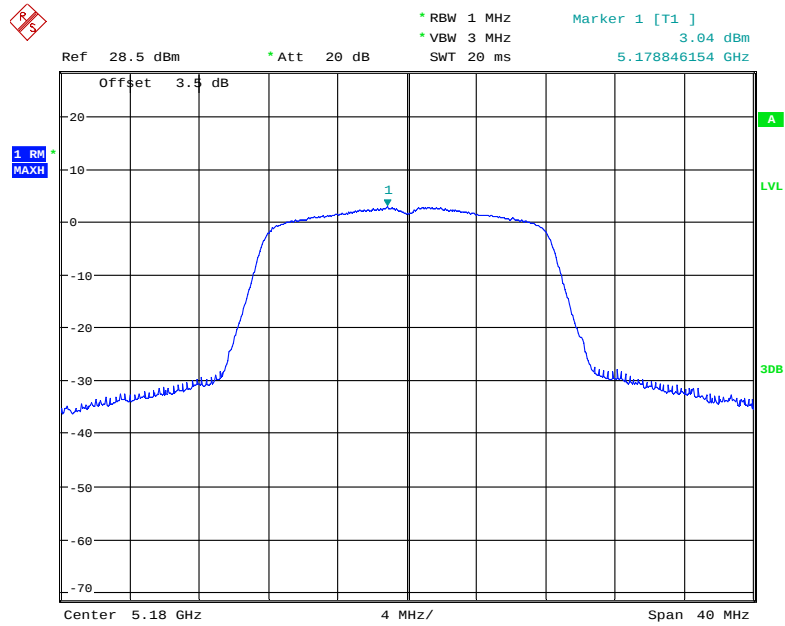
Note: For Beam-Forming mode:

(1) Directional gain = array gain + Ant gain = $10 \cdot \lg(N_{ant}/N_{ss}) + 4dBi = 7dBi > 6dBi$, So Limit = $17 - (7 - 6) = 16dBm/MHz$

(2) Non-Beam Forming mode share the same power with the Beam Forming mode.

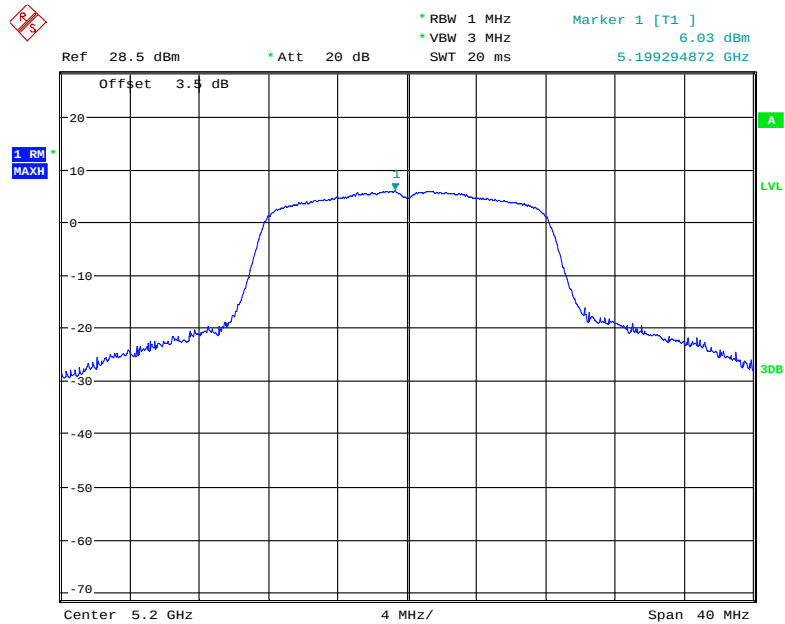
Antenna 0

802.11a mode, Power Spectral Density, 5180 MHz



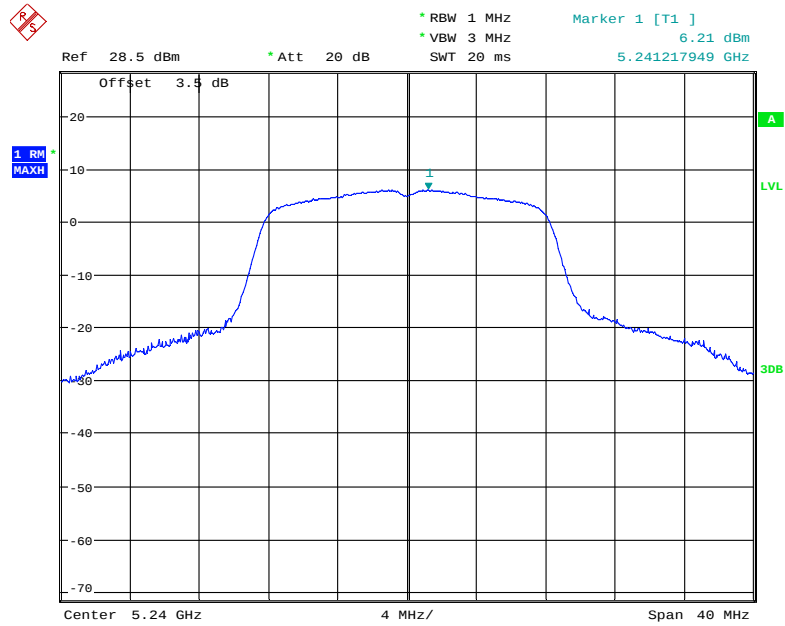
Date: 20.FEB.2020 17:07:43

802.11a mode, Power Spectral Density, 5200 MHz



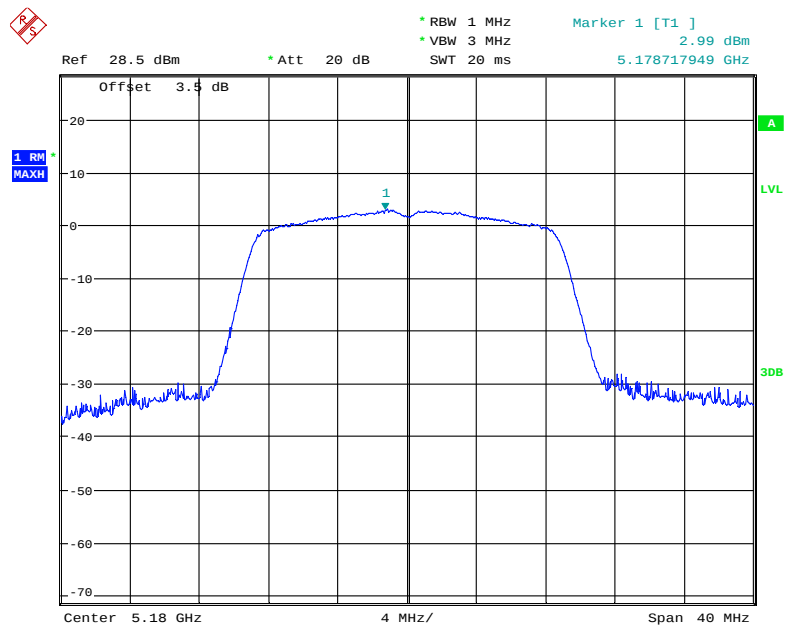
Date: 20.FEB.2020 17:09:52

802.11a mode, Power Spectral Density, 5240 MHz



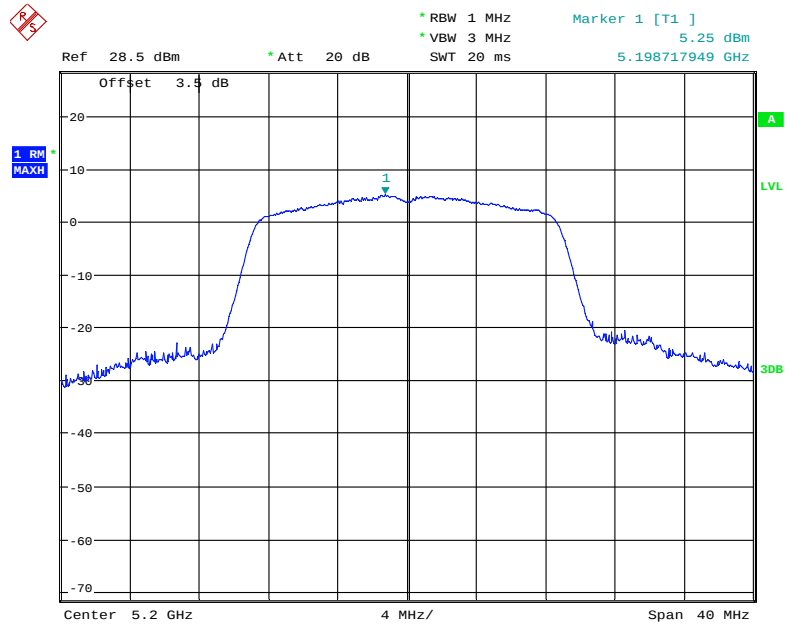
Date: 20.FEB.2020 17:10:16

802.11n20 mode, Power Spectral Density, 5180 MHz



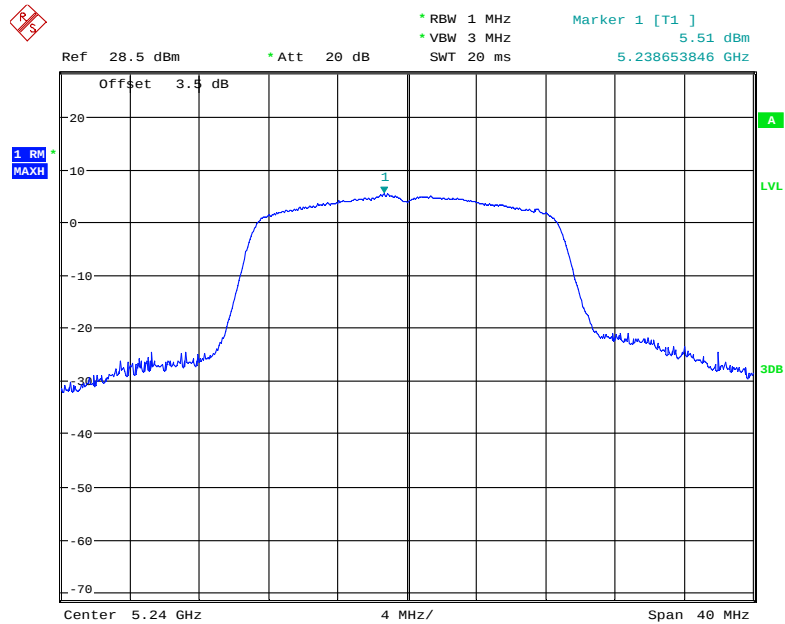
Date: 20.FEB.2020 17:08:14

802.11n20 mode, Power Spectral Density, 5200 MHz



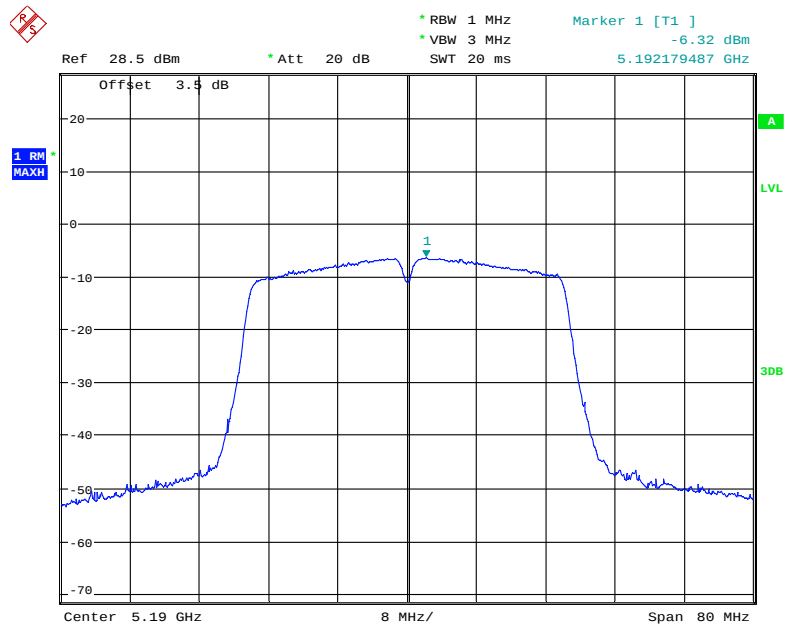
Date: 20.FEB.2020 17:09:30

802.11n20 mode, Power Spectral Density, 5240 MHz



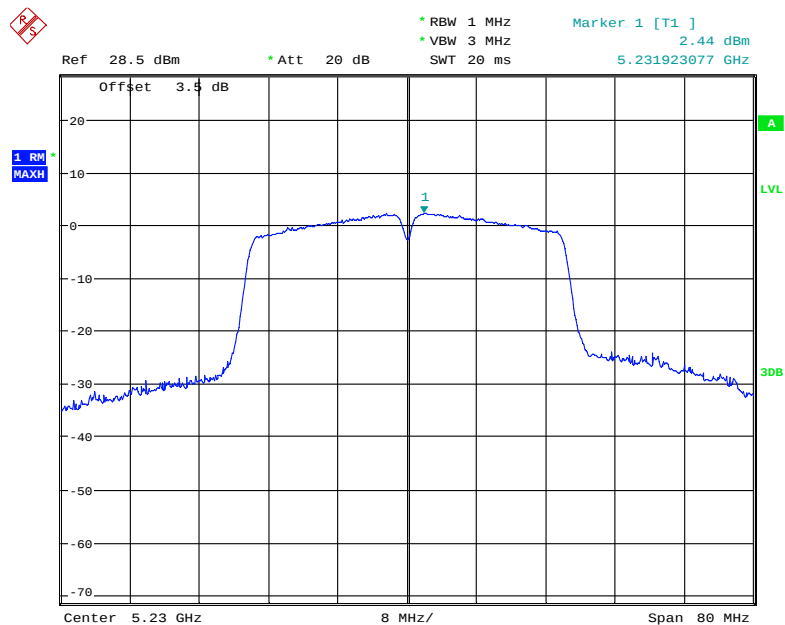
Date: 20.FEB.2020 17:10:36

802.11n40 mode, Power Spectral Density, 5190 MHz



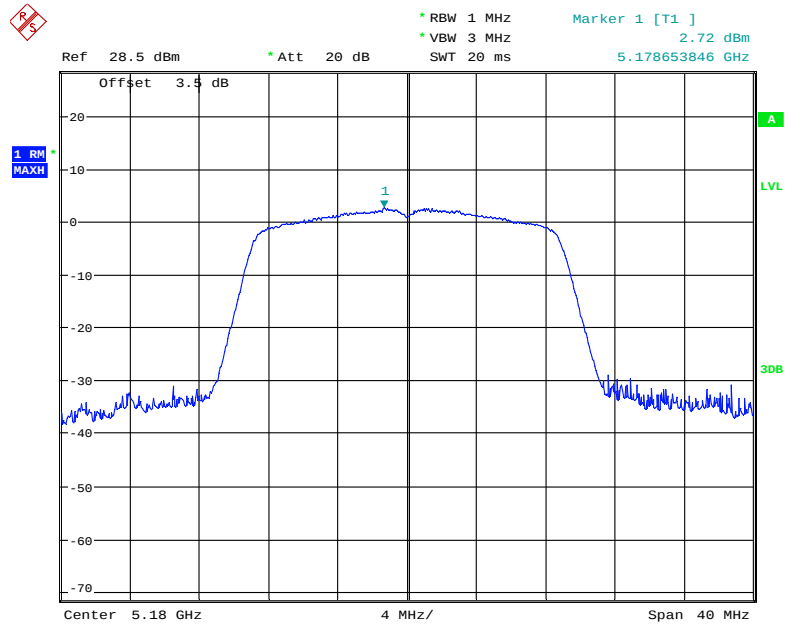
Date: 20.FEB.2020 17:12:10

802.11n40 mode, Power Spectral Density, 5230 MHz



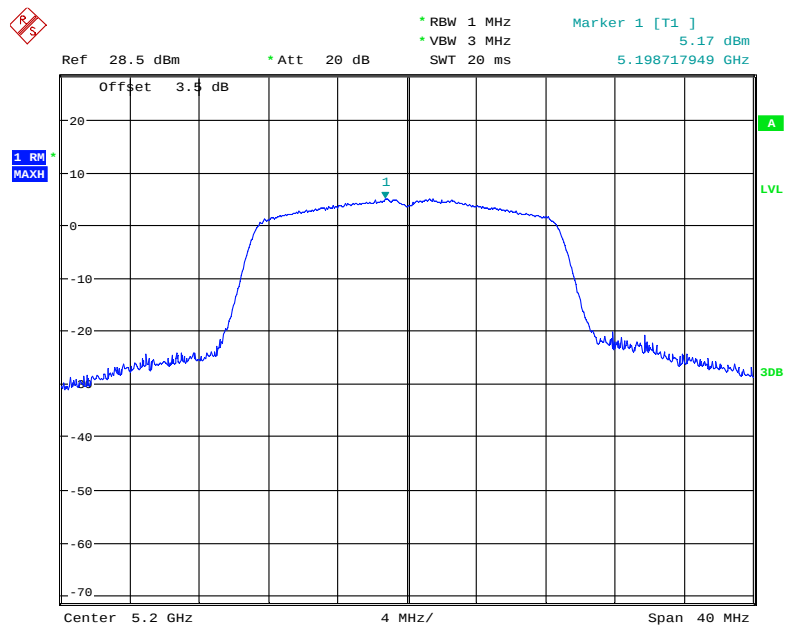
Date: 20.FEB.2020 17:14:31

802.11ac20 mode, Power Spectral Density, 5180 MHz



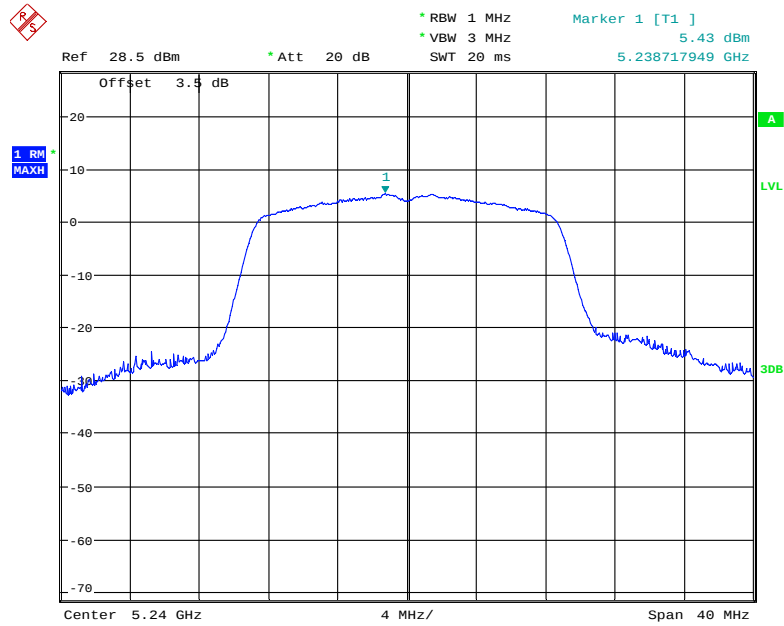
Date: 20.FEB.2020 17:08:36

802.11ac20 mode, Power Spectral Density, 5200 MHz



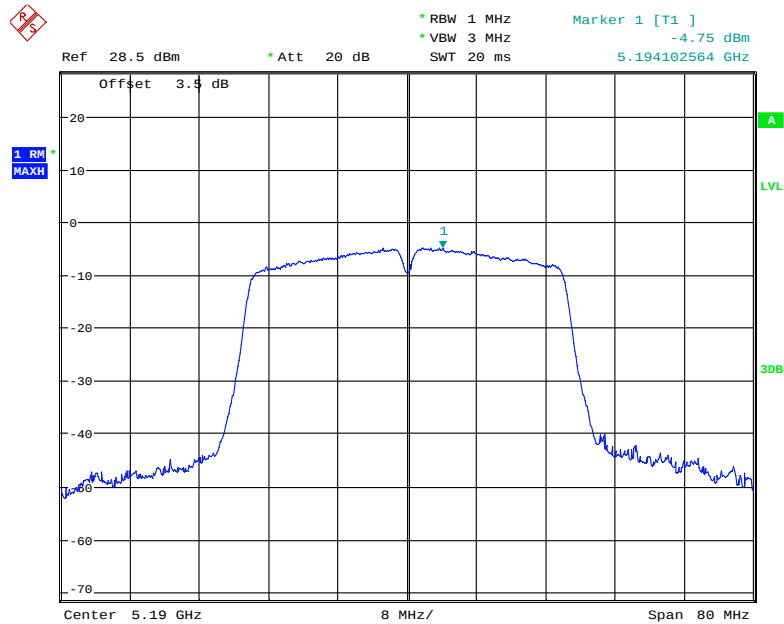
Date: 20.FEB.2020 17:09:08

802. 11ac20 mode, Power Spectral Density, 5240 MHz



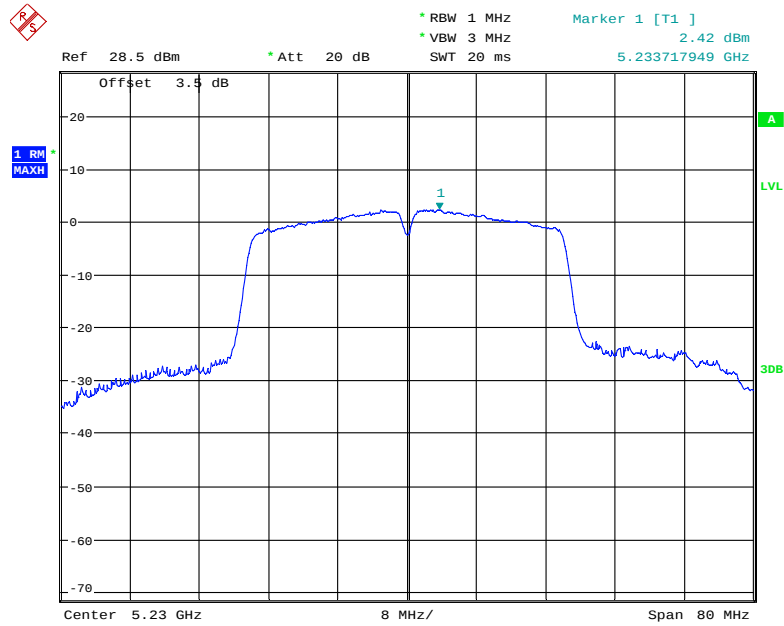
Date: 20.FEB.2020 17:10:55

802. 11ac40 mode, Power Spectral Density, 5190 MHz



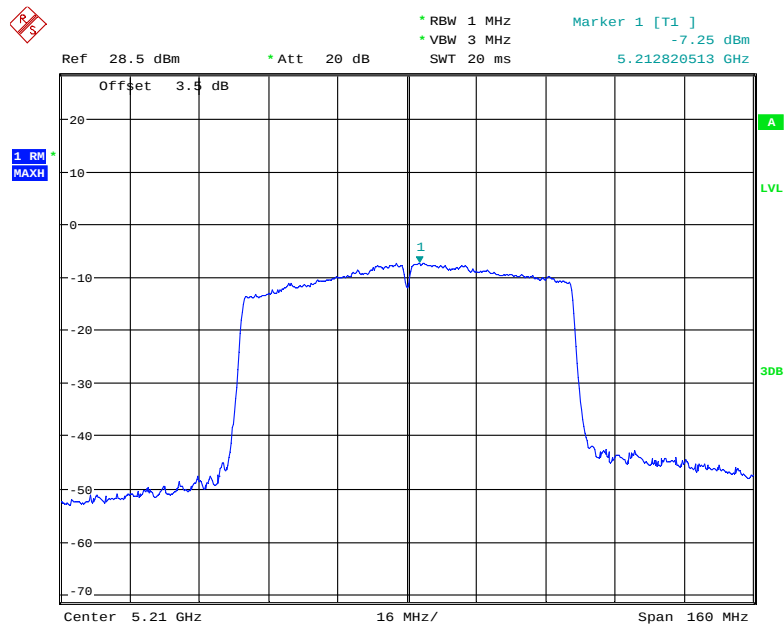
Date: 20.FEB.2020 17:12:36

802. 11ac40 mode, Power Spectral Density, 5230 MHz



Date: 20.FEB.2020 17:15:02

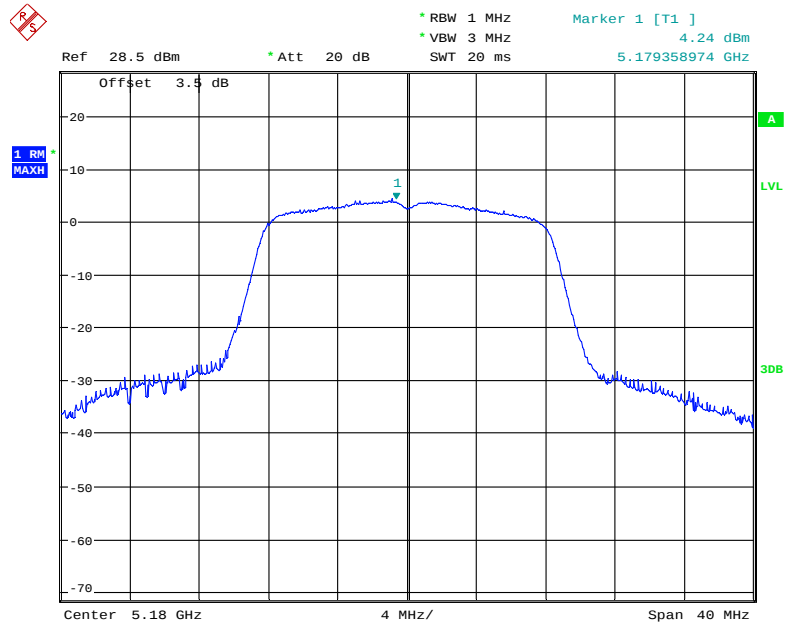
802. 11ac80 mode, Power Spectral Density, 5210 MHz



Date: 20.FEB.2020 17:16:08

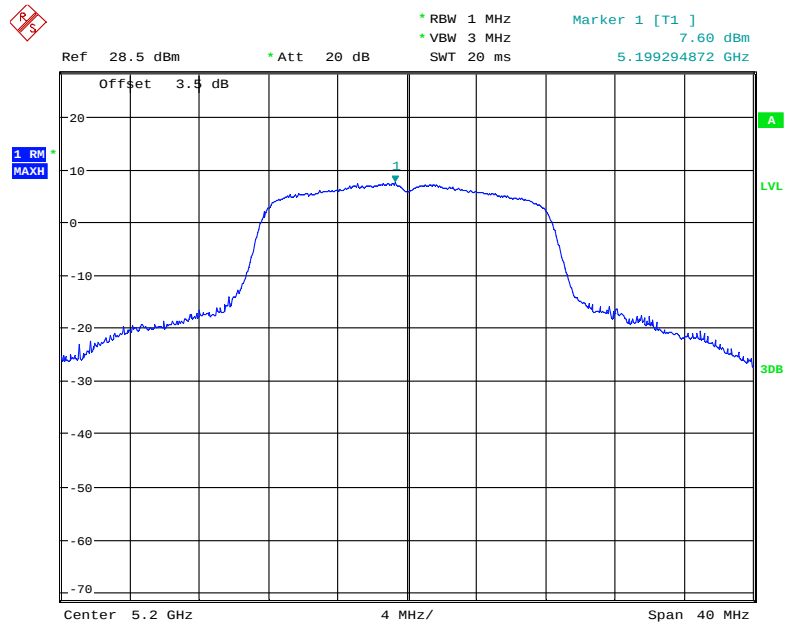
Antenna 1

802.11a mode, Power Spectral Density, 5180 MHz



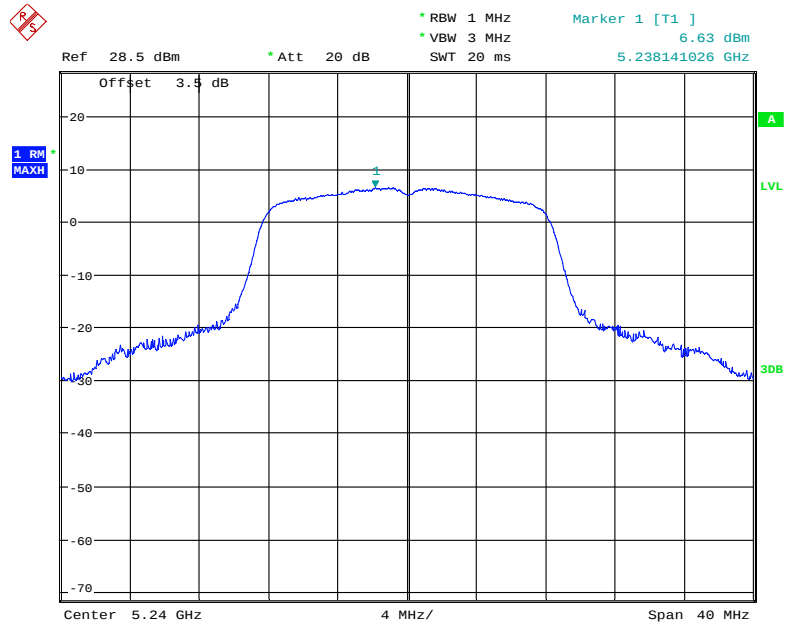
Date: 20.FEB.2020 17:48:45

802.11a mode, Power Spectral Density, 5200 MHz



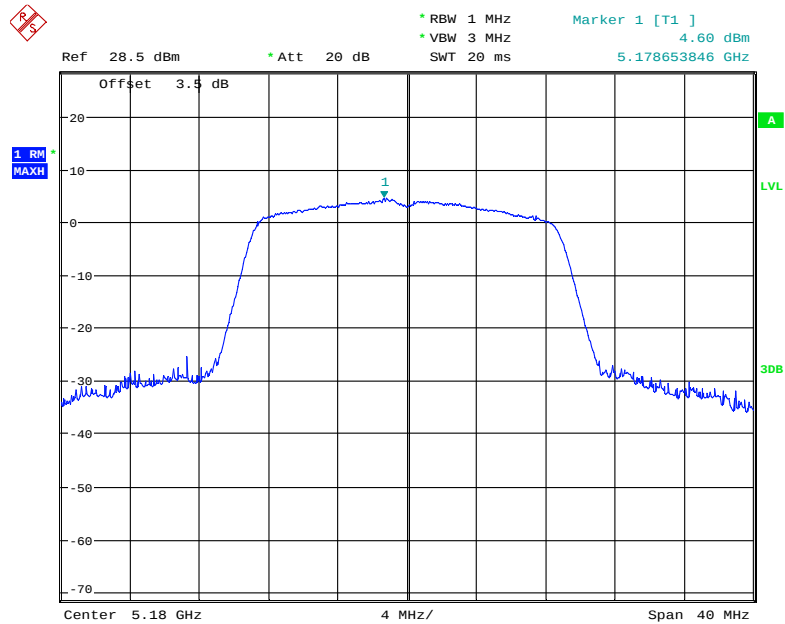
Date: 20.FEB.2020 17:51:33

802.11a mode, Power Spectral Density, 5240 MHz



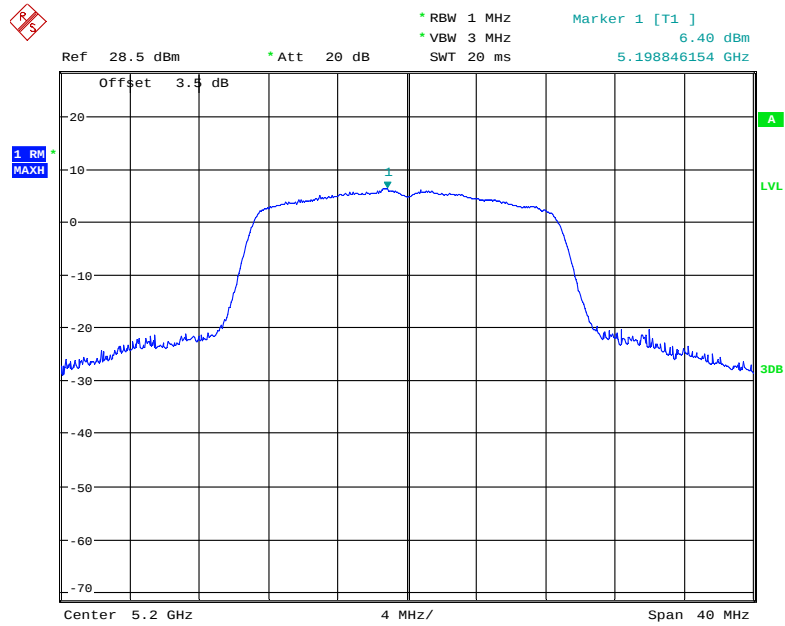
Date: 20.FEB.2020 17:51:55

802.11n20 mode, Power Spectral Density, 5180 MHz



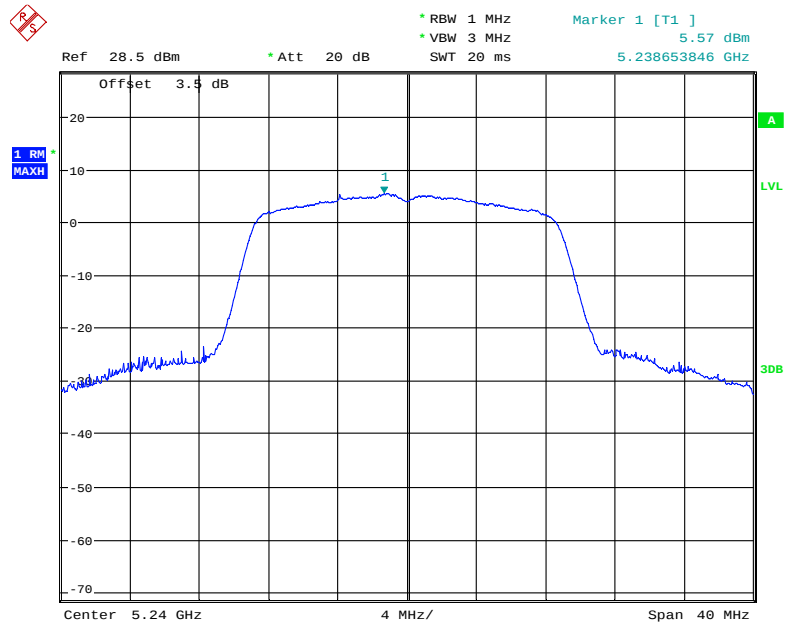
Date: 20.FEB.2020 17:49:25

802.11n20 mode, Power Spectral Density, 5200 MHz



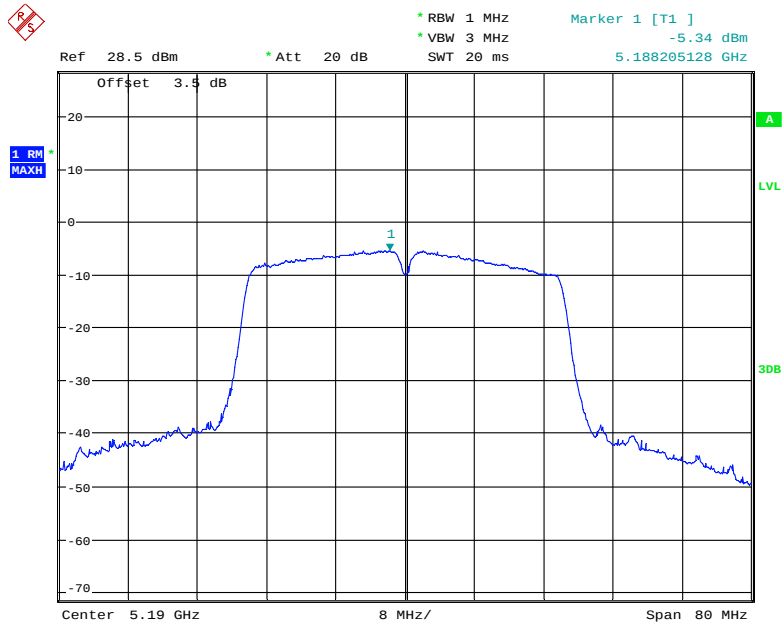
Date: 20.FEB.2020 17:50:59

802.11n20 mode, Power Spectral Density, 5240 MHz



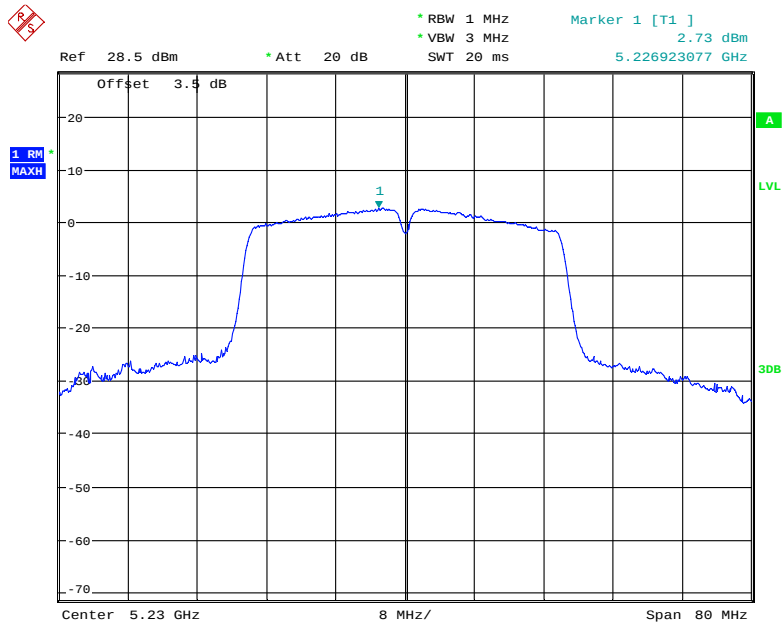
Date: 20.FEB.2020 17:52:25

802.11n40 mode, Power Spectral Density, 5190 MHz



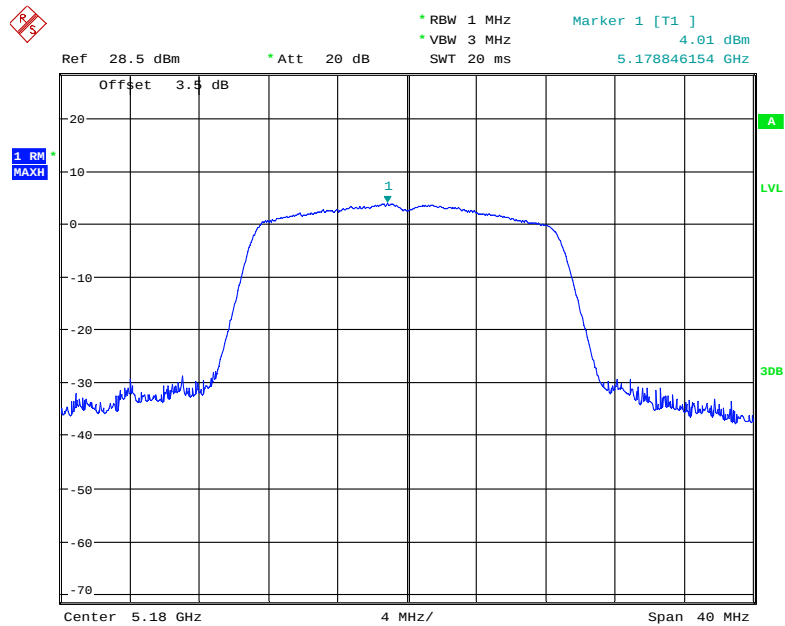
Date: 20.FEB.2020 17:36:56

802.11n40 mode, Power Spectral Density, 5230 MHz



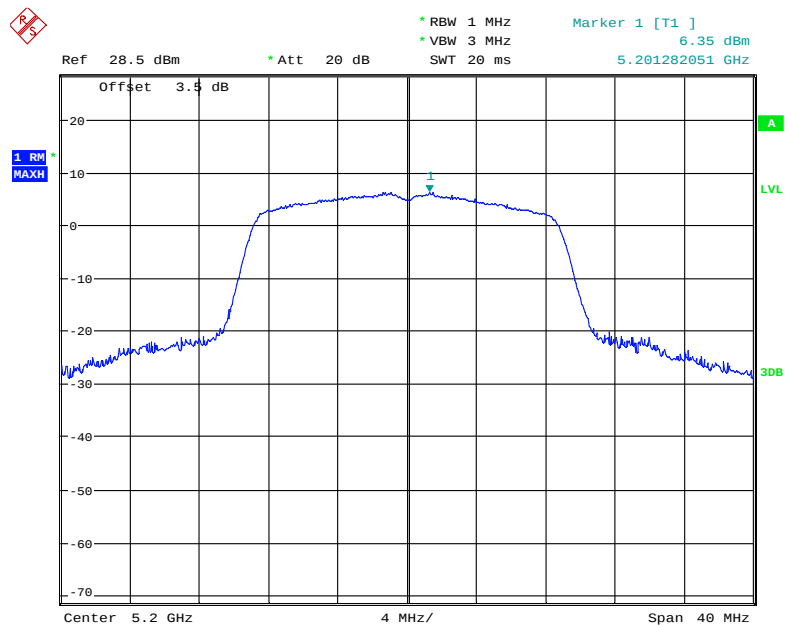
Date: 20.FEB.2020 17:36:07

802.11ac20 mode, Power Spectral Density, 5180 MHz



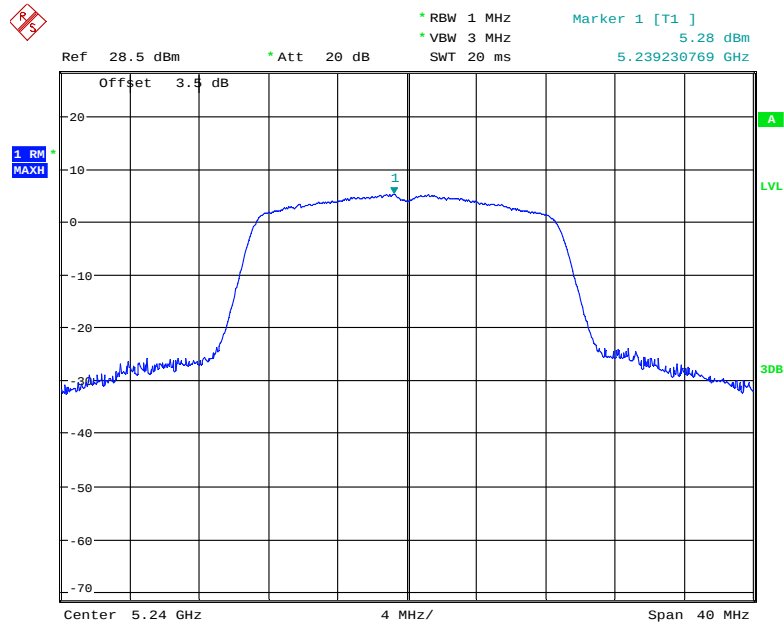
Date: 20.FEB.2020 17:50:01

802.11ac20 mode, Power Spectral Density, 5200 MHz



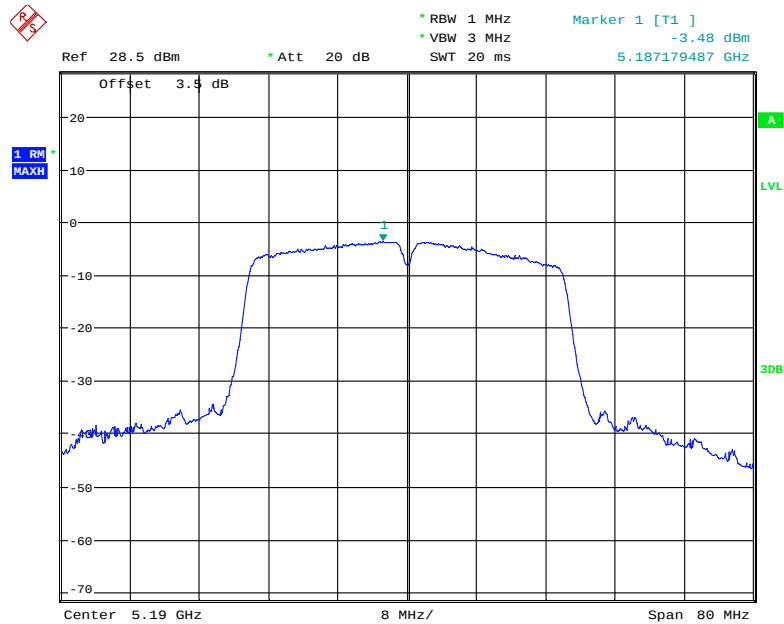
Date: 20.FEB.2020 17:50:36

802. 11ac20 mode, Power Spectral Density, 5240 MHz



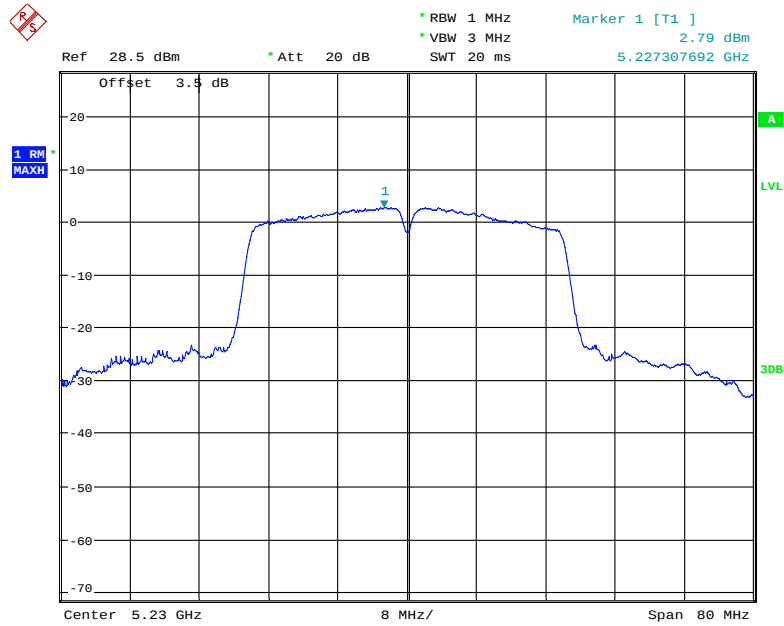
Date: 20.FEB.2020 17:52:44

802. 11ac40 mode, Power Spectral Density, 5190 MHz



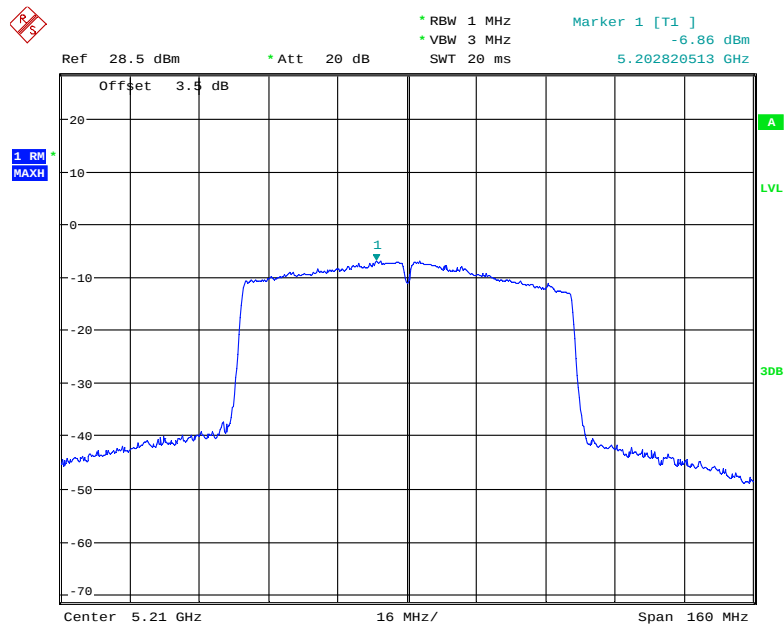
Date: 20.FEB.2020 17:37:36

802.11ac40 mode, Power Spectral Density, 5230 MHz



Date: 20.FEB.2020 17:35:14

802.11ac80 mode, Power Spectral Density, 5210 MHz



Date: 20.FEB.2020 17:38:46

5725 MHz – 5825 MHz:

Frequency (MHz)	Antenna Port	Reading (dBm/MHz)	Cable Loss (dB)	Correct Factor (dB)	Power Spectral Density (dBm/500kHz)	Total PSD (dBm/500kHz)	Limit (dBm/500kHz)
802.11a							
5745	0	6.90	1	-3	4.90	8.32	29
	1	7.68	1	-3	5.68		
5785	0	6.85	1	-3	4.85	8.06	
	1	7.25	1	-3	5.25		
5825	0	6.52	1	-3	4.52	7.68	
	1	6.81	1	-3	4.81		
802.11n20							
5745	0	6.32	1	-3	4.32	7.49	29
	1	6.64	1	-3	4.64		
5785	0	5.96	1	-3	3.96	7.13	
	1	6.27	1	-3	4.27		
5825	0	5.92	1	-3	3.92	6.78	
	1	5.62	1	-3	3.62		
802.11n40							
5755	0	3.09	1	-3	1.09	4.54	29
	1	3.93	1	-3	1.93		
5795	0	3.17	1	-3	1.17	4.15	
	1	3.10	1	-3	1.10		
802.11ac20							
5745	0	6.22	1	-3	4.22	7.25	29
	1	6.26	1	-3	4.26		
5785	0	5.94	1	-3	3.94	7.04	
	1	6.12	1	-3	4.12		
5825	0	6.01	1	-3	4.01	6.85	
	1	5.66	1	-3	3.66		
802.11ac40							
5755	0	2.99	1	-3	0.99	4.29	29
	1	3.56	1	-3	1.56		
5795	0	2.90	1	-3	0.90	3.98	
	1	3.04	1	-3	1.04		
802.11ac80							
5775	0	0.50	1	-3	-1.50	1.87	29
	1	1.19	1	-3	-0.81		

Note: For Beam-Forming mode:

(1) Directional gain = array gain + Ant gain = $10 \cdot \lg(N_{ant}/N_{ss}) + 4dBi = 7dBi > 6dBi$,

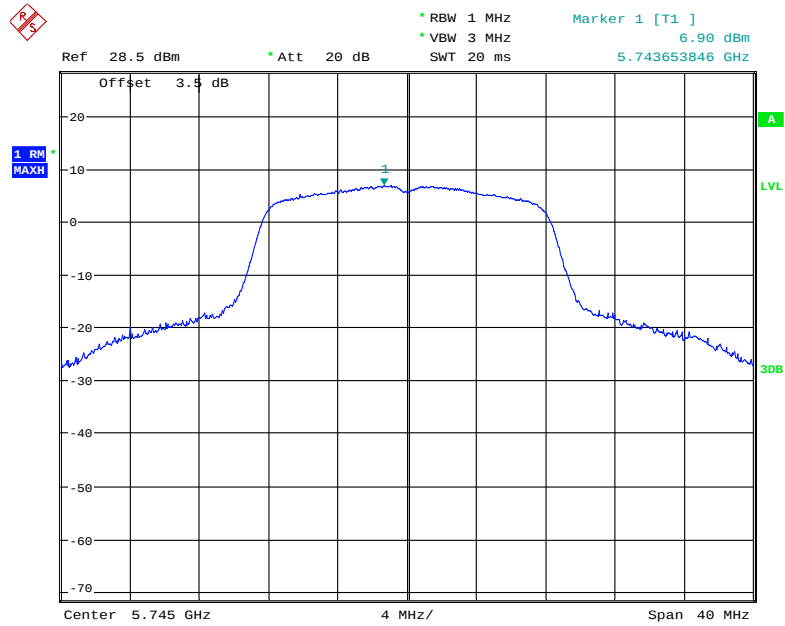
So $Limit_{BF} = 30 - (7 - 6) = 29dBm/500kHz$

(2) Non-Beam Forming mode share the same power with the Beam Forming mode.

(3) The correct factor from RBW = 1M to 500kHz is $10 \lg(500/1000) = -3.0dB$

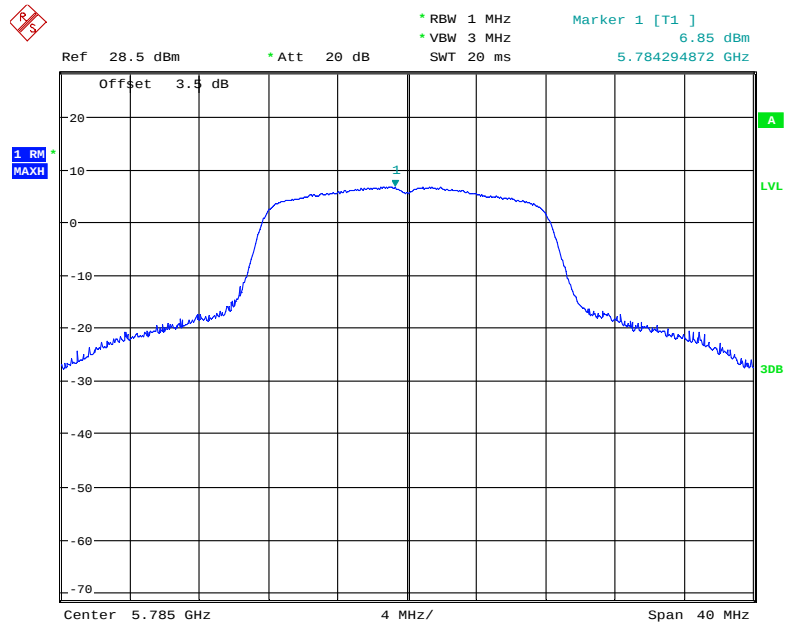
Antenna 0

802.11a mode, Power Spectral Density, 5745 MHz



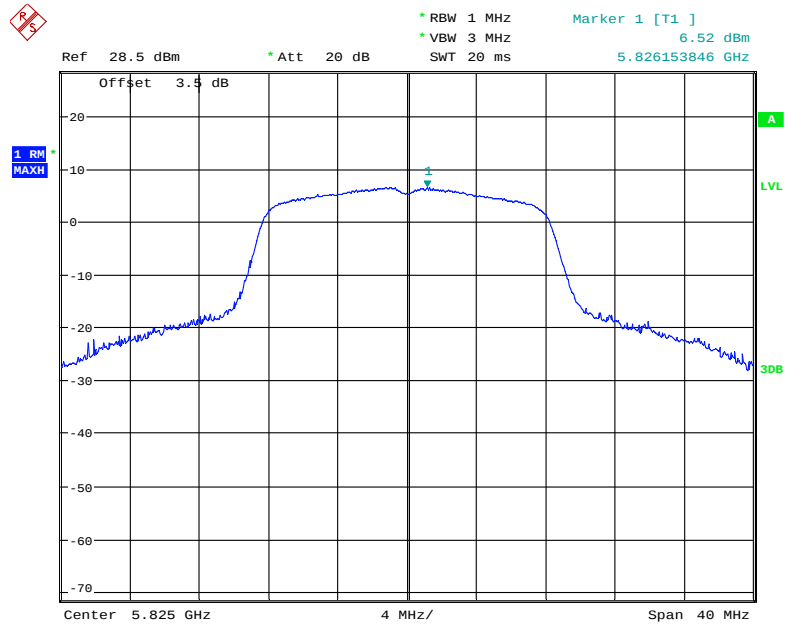
Date: 20.FEB.2020 20:52:21

802.11a mode, Power Spectral Density, 5785 MHz



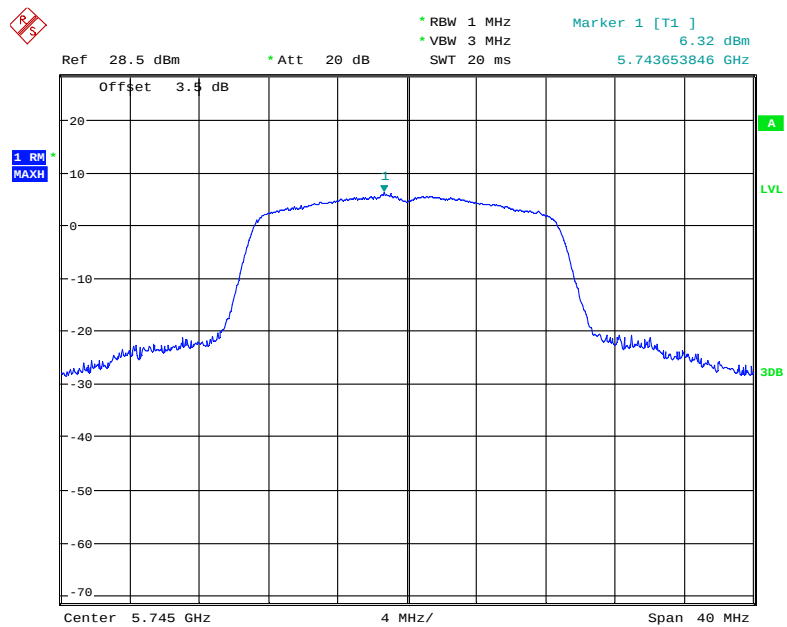
Date: 20.FEB.2020 20:54:14

802.11a mode, Power Spectral Density, 5825 MHz



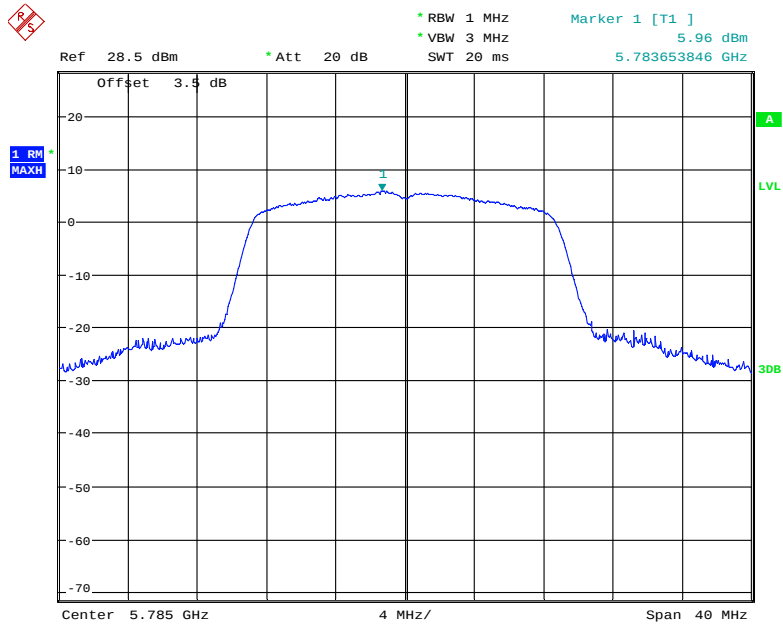
Date: 20.FEB.2020 20:54:40

802.11n20 mode, Power Spectral Density, 5745 MHz



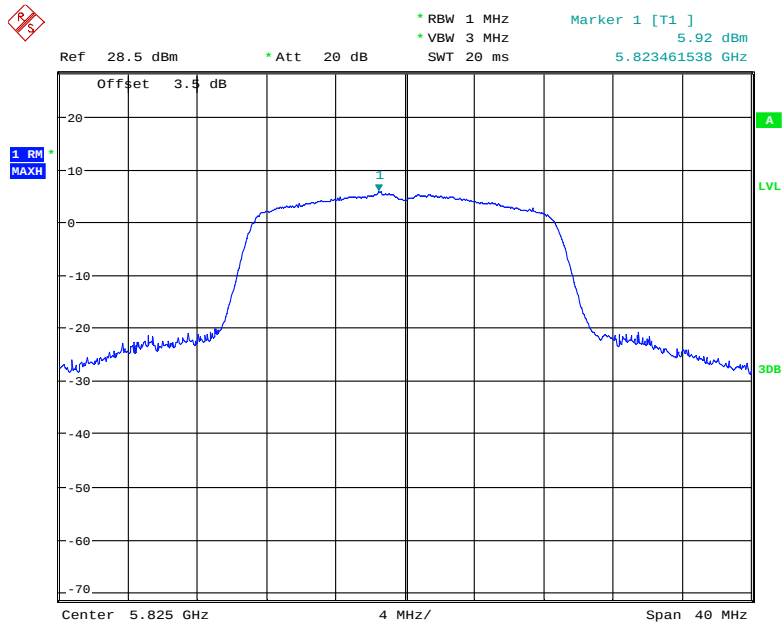
Date: 20.FEB.2020 20:52:49

802.11n20 mode, Power Spectral Density, 5785 MHz



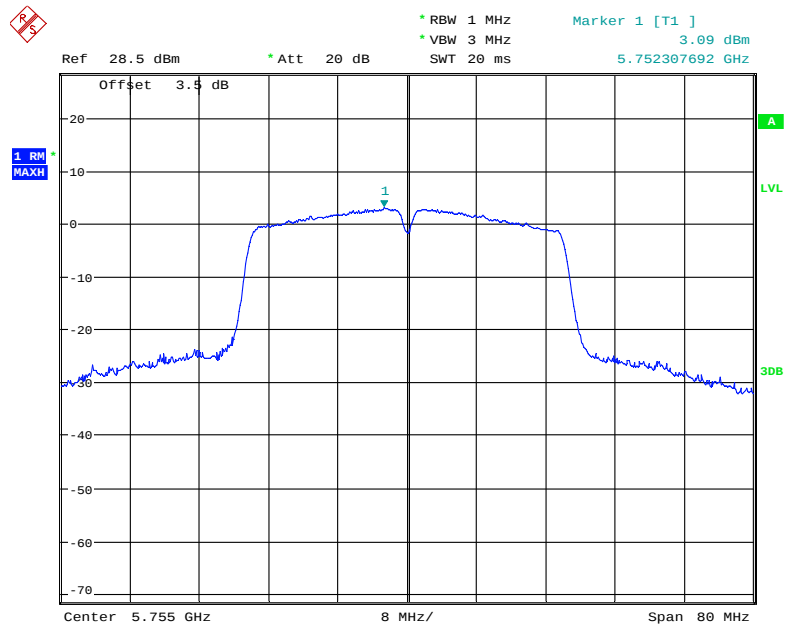
Date: 20.FEB.2020 20:53:57

802.11n20 mode, Power Spectral Density, 5825 MHz



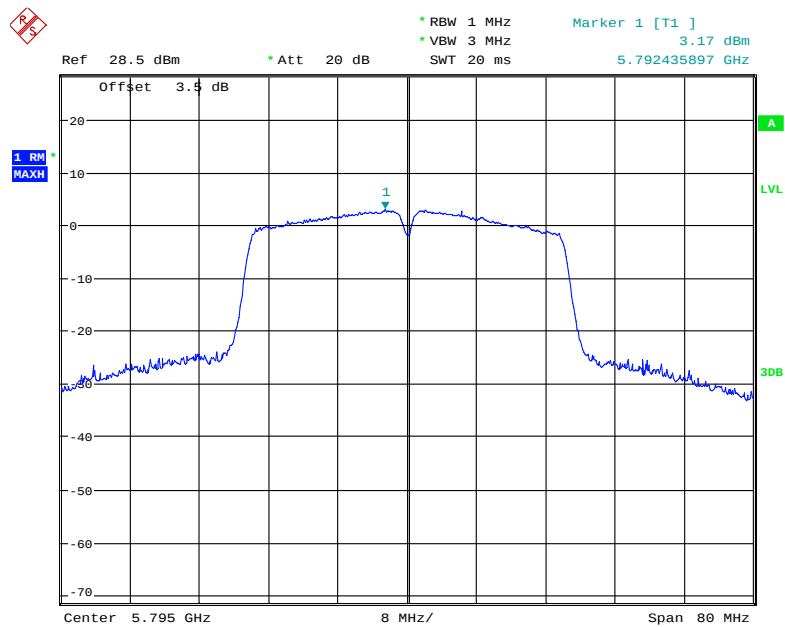
Date: 20.FEB.2020 20:54:58

802.11n40 mode, Power Spectral Density, 5755 MHz



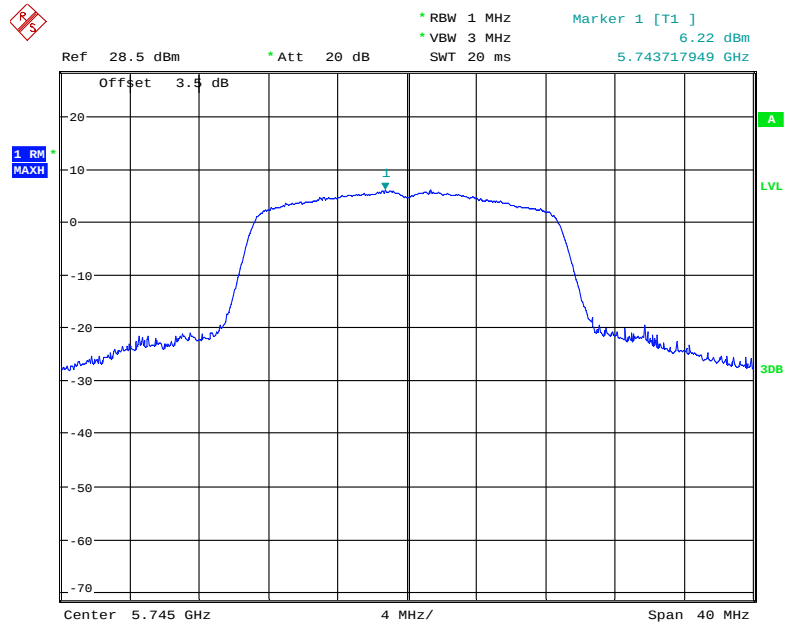
Date: 20.FEB.2020 20:50:28

802.11n40 mode, Power Spectral Density, 5795 MHz



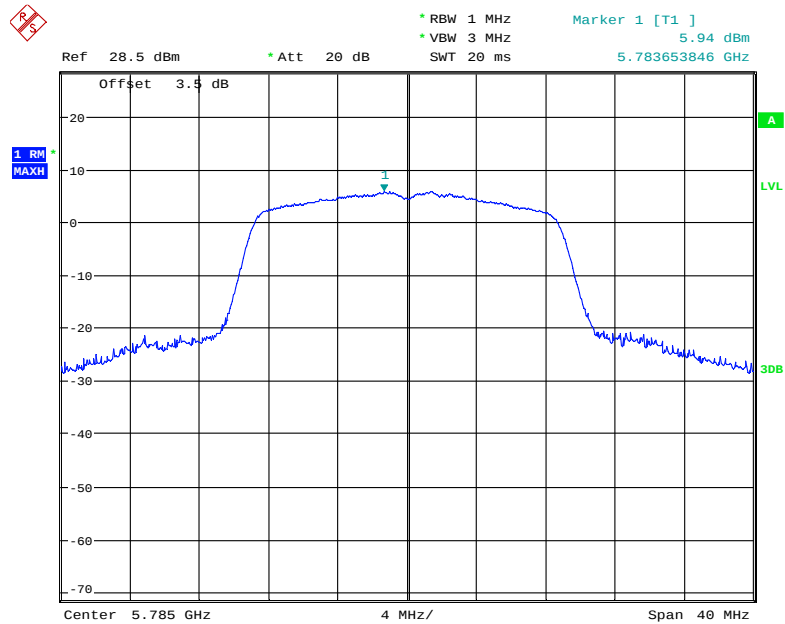
Date: 20.FEB.2020 20:50:11

802.11ac20 mode, Power Spectral Density, 5745 MHz



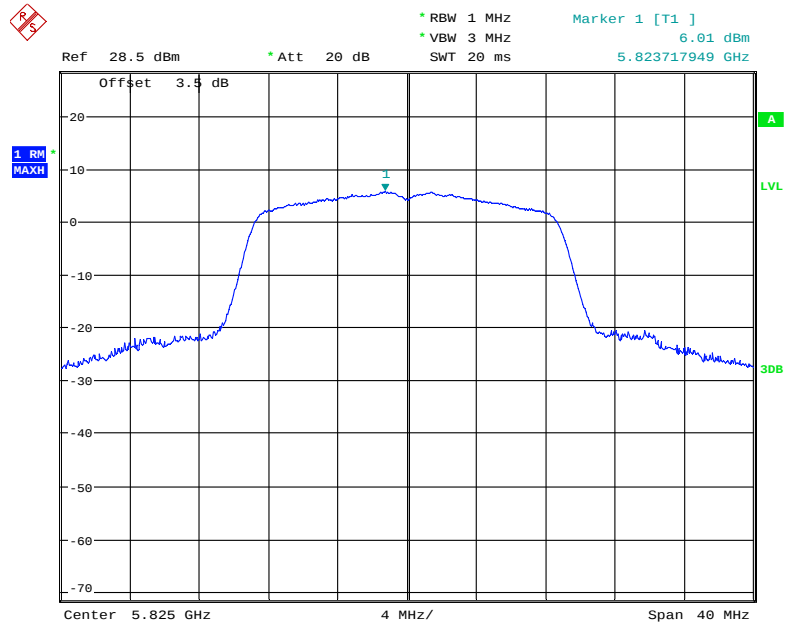
Date: 20.FEB.2020 20:53:12

802.11ac20 mode, Power Spectral Density, 5785 MHz



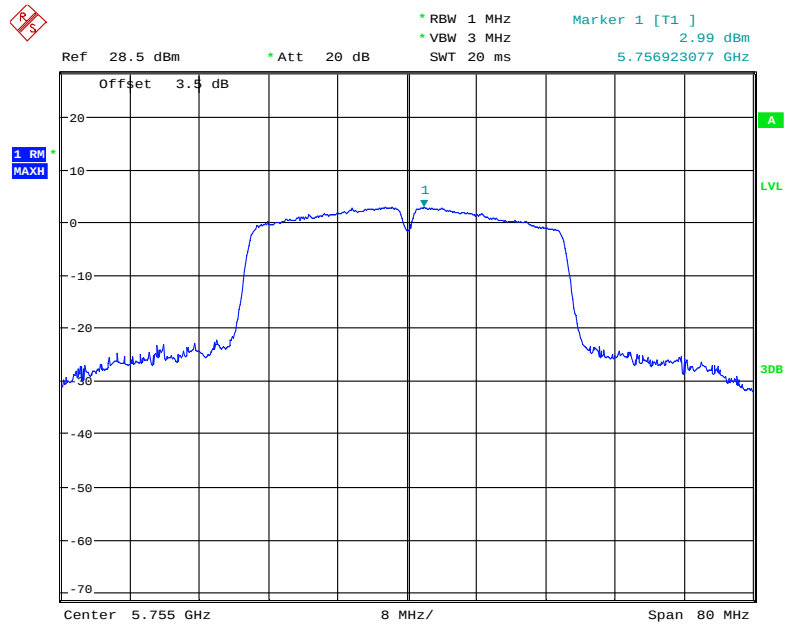
Date: 20.FEB.2020 20:53:37

802.11ac20 mode, Power Spectral Density, 5825 MHz



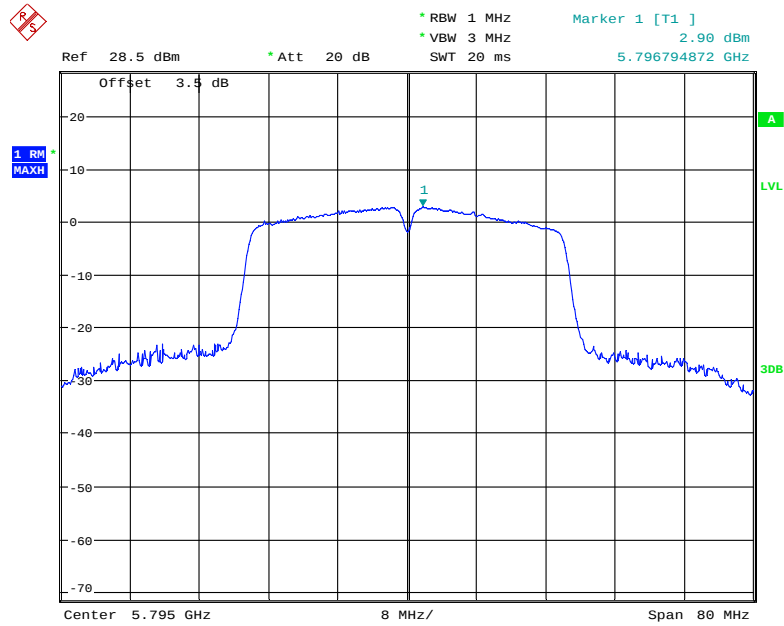
Date: 20.FEB.2020 20:55:27

802.11ac40 mode, Power Spectral Density, 5755 MHz



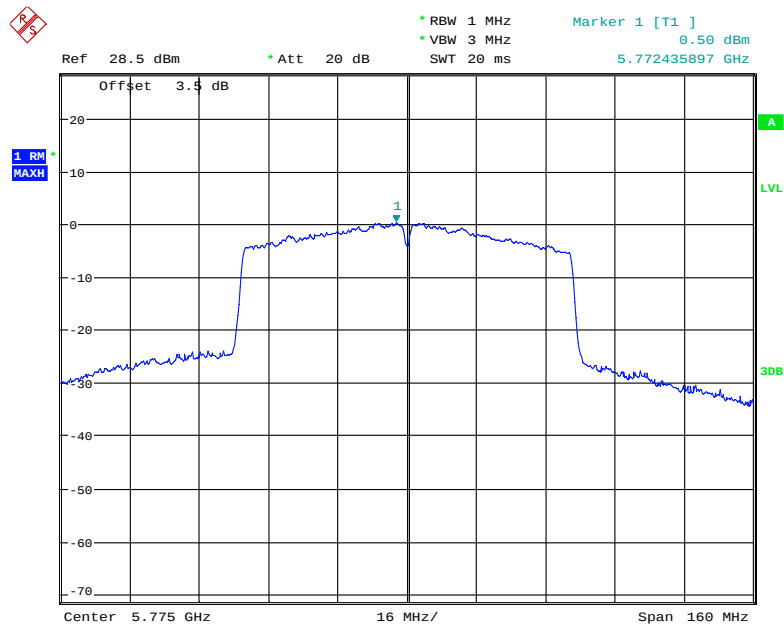
Date: 20.FEB.2020 20:50:48

802.11ac40 mode, Power Spectral Density, 5795 MHz



Date: 20.FEB.2020 20:49:52

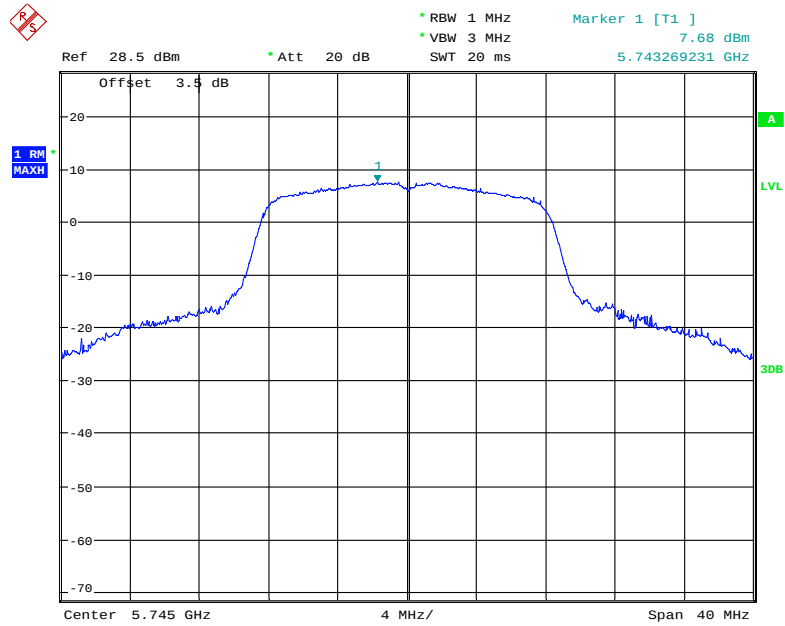
802.11ac80 mode, Power Spectral Density, 5775 MHz



Date: 20.FEB.2020 20:40:14

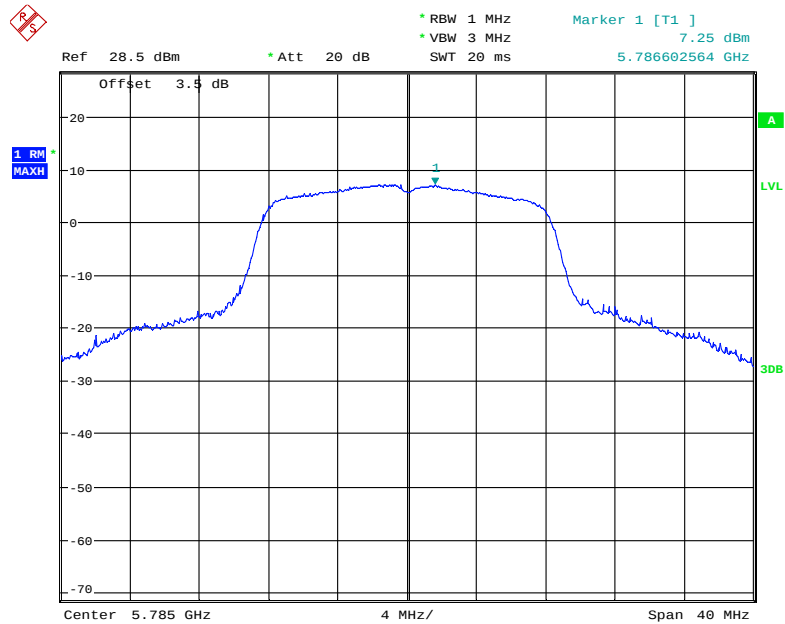
Antenna 1

802.11a mode, Power Spectral Density, 5745 MHz



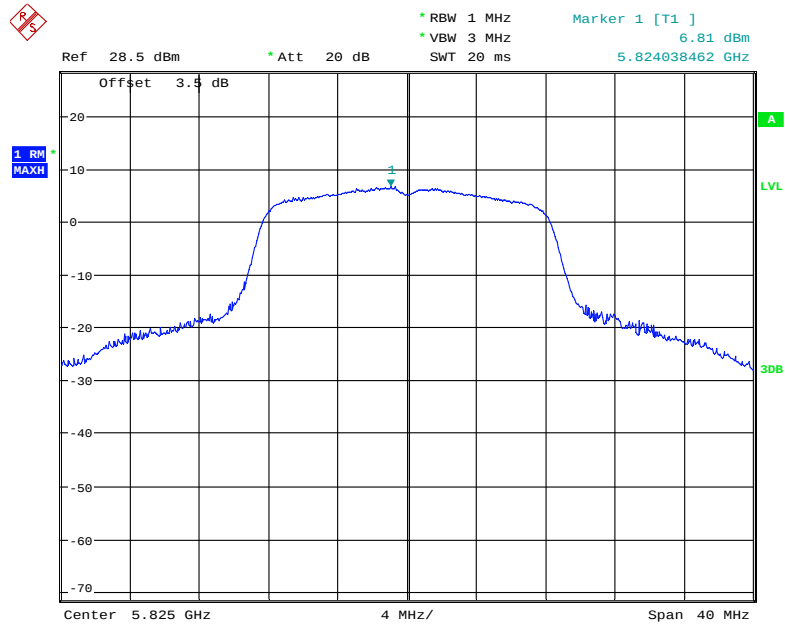
Date: 20.FEB.2020 21:07:41

802.11a mode, Power Spectral Density, 5785 MHz



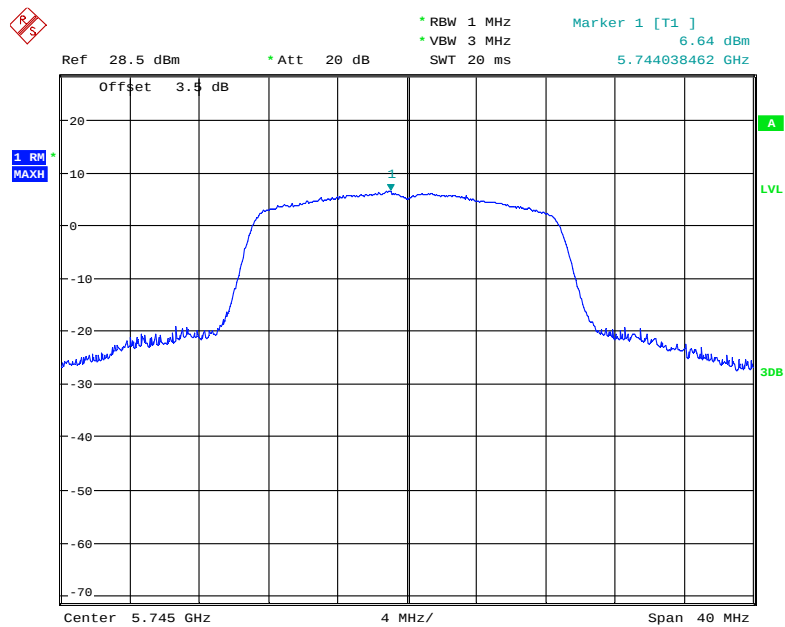
Date: 20.FEB.2020 21:05:42

802.11a mode, Power Spectral Density, 5825 MHz



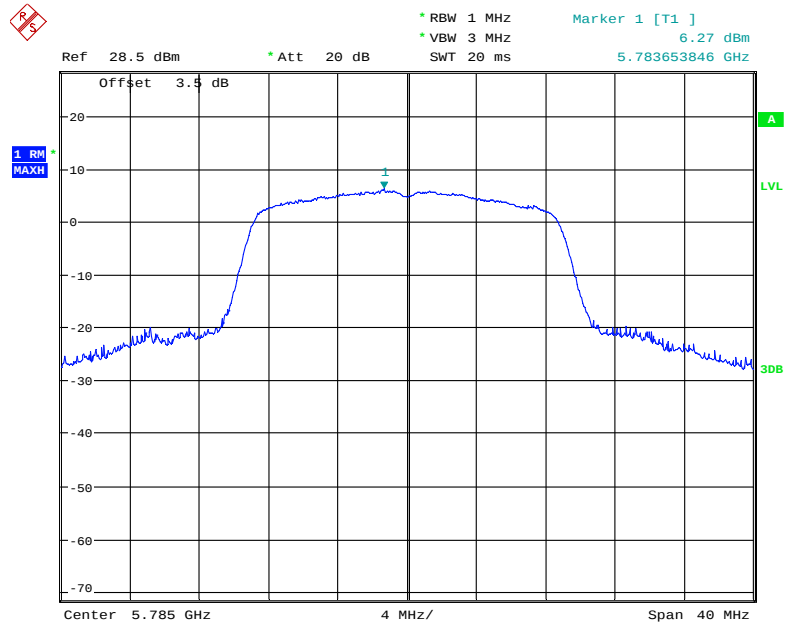
Date: 20.FEB.2020 21:05:21

802.11n20 mode, Power Spectral Density, 5745 MHz



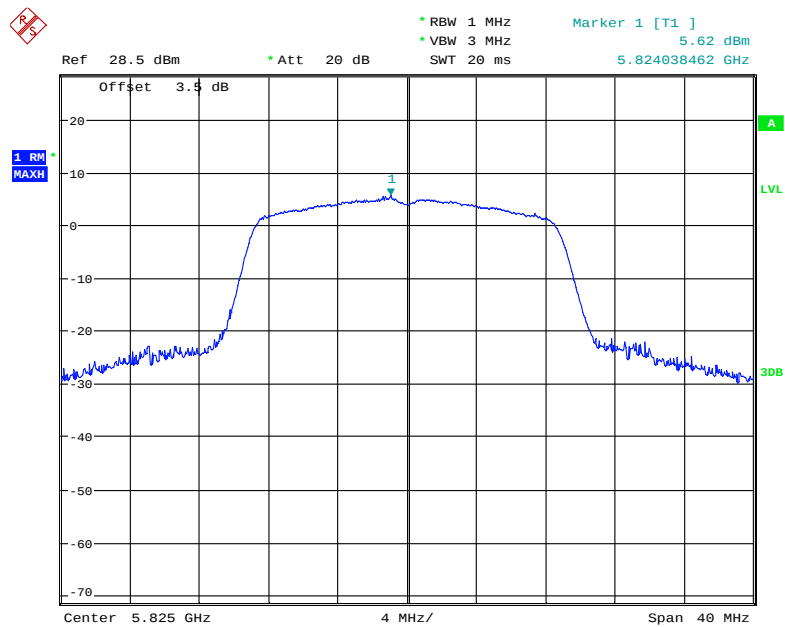
Date: 20.FEB.2020 21:07:16

802.11n20 mode, Power Spectral Density, 5785 MHz



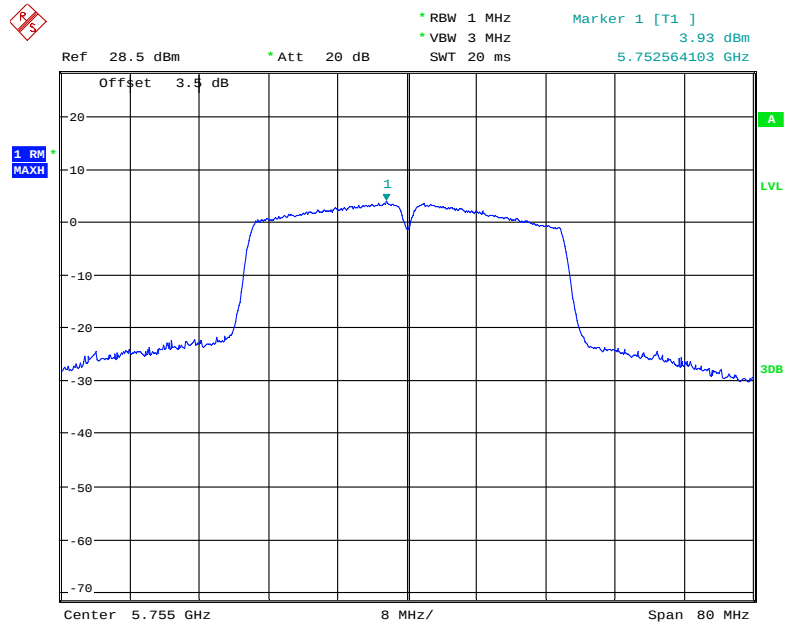
Date: 20.FEB.2020 21:06:01

802.11n20 mode, Power Spectral Density, 5825 MHz



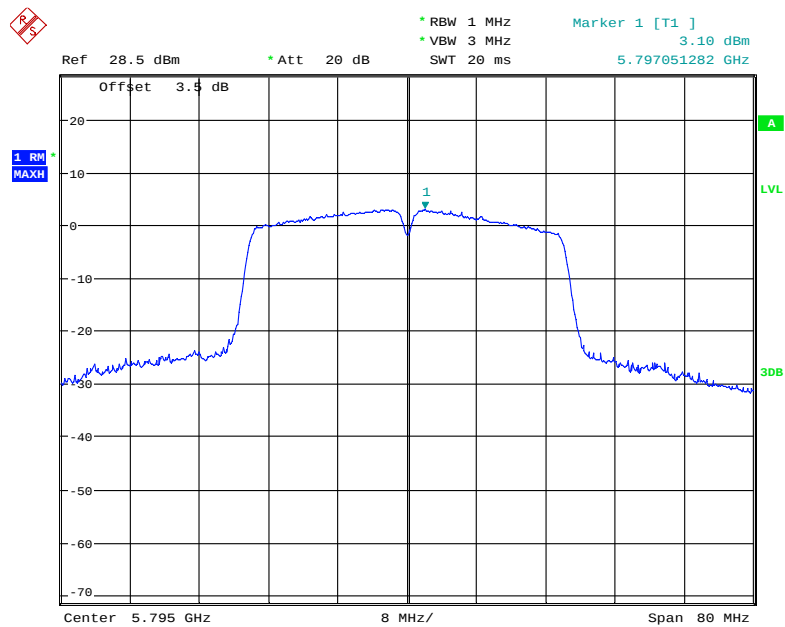
Date: 20.FEB.2020 21:04:58

802.11n40 mode, Power Spectral Density, 5755 MHz



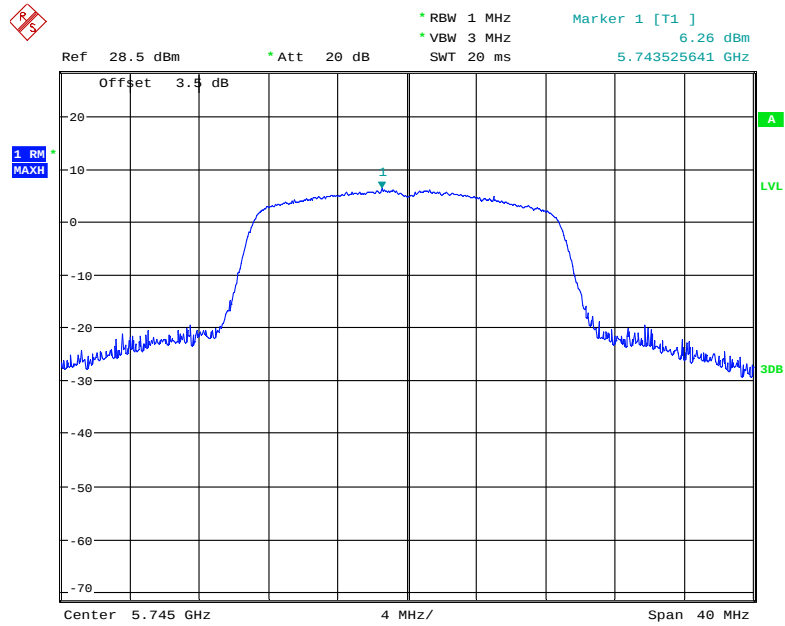
Date: 20.FEB.2020 20:44:48

802.11n40 mode, Power Spectral Density, 5795 MHz



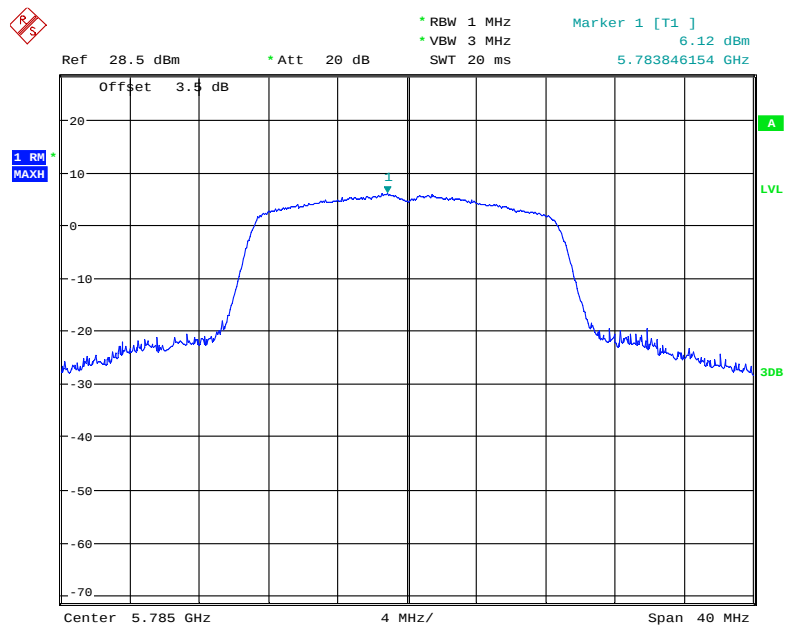
Date: 20.FEB.2020 20:45:43

802.11ac20 mode, Power Spectral Density, 5745 MHz



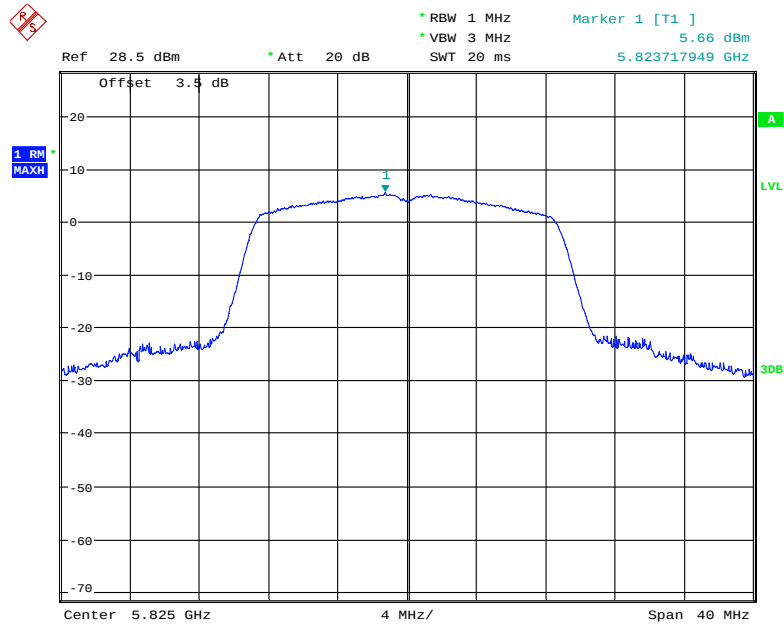
Date: 20.FEB.2020 21:06:54

802.11ac20 mode, Power Spectral Density, 5785 MHz



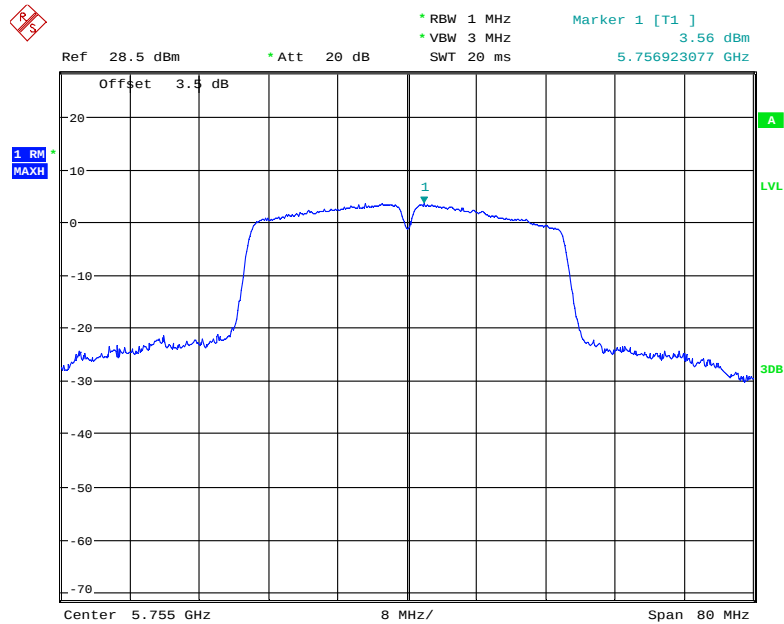
Date: 20.FEB.2020 21:06:20

802. 11ac20 mode, Power Spectral Density, 5825 MHz



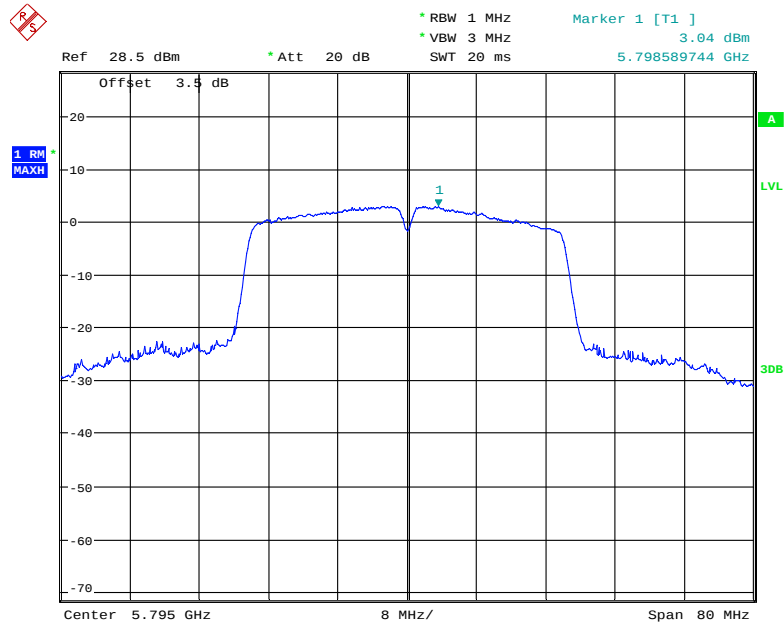
Date: 20.FEB.2020 21:04:19

802. 11ac40 mode, Power Spectral Density, 5755 MHz



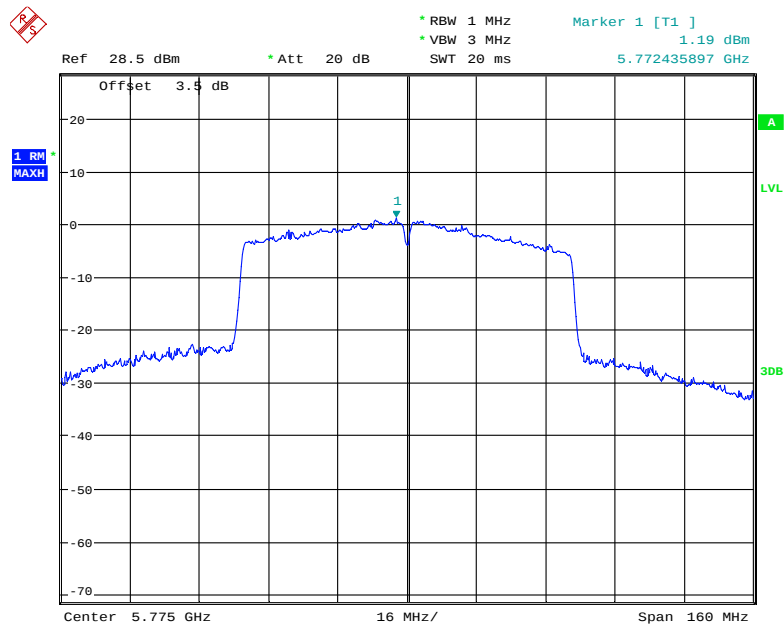
Date: 20.FEB.2020 20:44:24

802.11ac40 mode, Power Spectral Density, 5795 MHz



Date: 20.FEB.2020 20:46:03

802.11ac80 mode, Power Spectral Density, 5775 MHz



Date: 20.FEB.2020 20:43:28

***** END OF REPORT *****