TESTING LABORATORY
CERTIFICATE # 4821.01

FCC PART 15.407

TEST REPORT

For

Grandstream Networks, Inc.

126 Brookline Ave., 3rd Floor Boston, MA 02215, USA

FCC ID: YZZGWN7605LR

Report Type:	**Product Type:**
Class II Permissive Change	Outdoor Long-Range Wi-Fi Access Point

Report Number:	RSZ200312009-00A1
Report Date:	2020-05-20
Reviewed By:	Jimmy Xiao RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	Outdoor Long-Range Wi-Fi Access Point
Model	GWN7605LR
Frequency Range	5G Wi-Fi: 5250-5350 MHz; 5470-5725 MHz
Average Output Power	5250-5350 MHz: 18.42dBm (802.11a), 18.26dBm(802.11n20), 19.88dBm(802.11n40), 18.14dBm (802.11ac20), 19.74dBm(802.11 ac40), 16.52dBm(802.11 ac80) 5470-5725 MHz 17.86dBm (802.11a), 18.55dBm(802.11n20), 20.24dBm(802.11n40), 18.61dBm (802.11ac20), 20.07dBm(802.11 ac40), 18.23dBm(802.11 ac80)
Modulation Technique	Wi-Fi: OFDM
Antenna Specification	3.5 dBi
Voltage Range	DC 48V from POE
Date of Test	2020/03/15~2020/04/16
Sample serial number	RSZ200312009-RFA1-S1 (Assigned by BACL, Shenzhen)
Received date	2020-03-12
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.

This is a CIIPC application of the device, the difference between the original device and the current one described as following:

Adding DFS bands (5250-5350MHz & 5470-5725MHz.) by software, no any other hardware change or modification to the device.

Based on above difference, add the test for the DFS band.

Related Submittal(s)/Grant(s)

FCC original certified on 05/08/2020, FCC ID: YZZGWN7605LR.

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

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℃
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 5250-5350MHz Band, 7 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	60	5300
54	5270	62	5310
56	5280	64	5320
58	5290	/	/

For 5470-5725MHz Band, 18 channels are provided to testing:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	124	5620
102	5510	126	5630
104	5520	128	5640
106	5530	132	5660
108	5540	134	5670
110	5550	136	5680
112	5560	140	5700
116	5580	/	/
118	5590	/	/
120	5600	/	/
122	5610	/	/

Note: 802.11a/n20/n40/ac20/ac40/ac80 all support SISO&MIMO mode, the pre-scan result for MIMO mode is the worst, so just test MIMO mode.

EUT Exercise Software

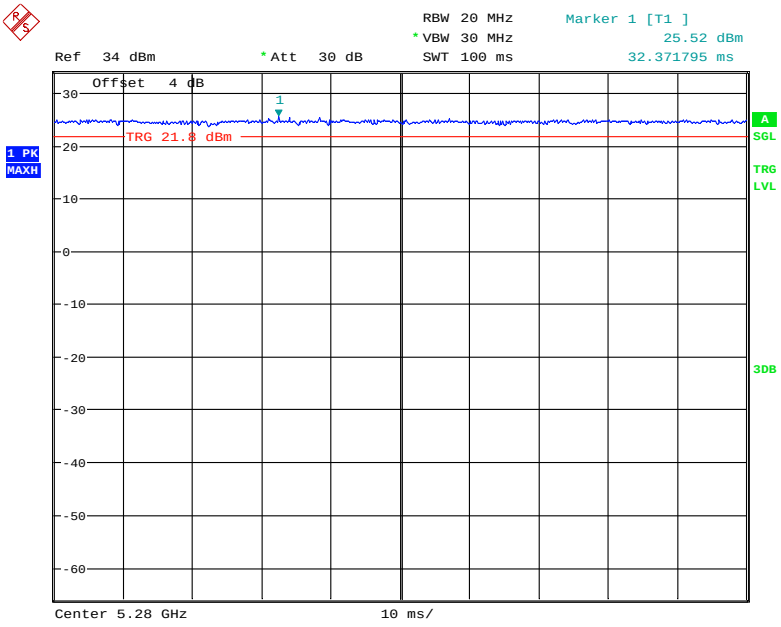
"Putty, QATool" was used in the test. Test frequencies and power level were configured (Ant 0&1) used the same power level) as below:

U-NII	Mode	Frequency (MHz)	Rate (Mbps)	Power Level
5250 – 5350MHz	802.11 a	5260	6	14.5
		5280	6	14.5
		5320	6	14.5
	802.11 n20	5260	MCS0	15.5
		5280	MCS0	15.5
		5320	MCS0	15.5
	802.11 n40	5270	MCS0	17.5
		5310	MCS0	17.5
	802.11 ac20	5260	MCS0	15.5
		5280	MCS0	15.5
		5320	MCS0	15.5
	802.11 ac40	5270	MCS0	17.5
		5310	MCS0	17.5
	802.11 ac80	5290	MCS0	15.5
5470 – 5725MHz	802.11 a	5500	6	13
		5580	6	14
		5700	6	13
	802.11 n20	5500	MCS0	15
		5580	MCS0	15
		5700	MCS0	16
	802.11 n40	5510	MCS0	16
		5550	MCS0	17.5
		5670	MCS0	17.5
	802.11 ac20	5500	MCS0	15
		5580	MCS0	15
		5700	MCS0	16
	802.11 ac40	5510	MCS0	16.5
		5550	MCS0	17.5
		5670	MCS0	17.5
	802.11 ac80	5530	MCS0	14.5
		5610	MCS0	17.5

Note: the above data rate was the worst case according to the output power test.

Duty cycle
5250-5350 MHz

802.11a mode



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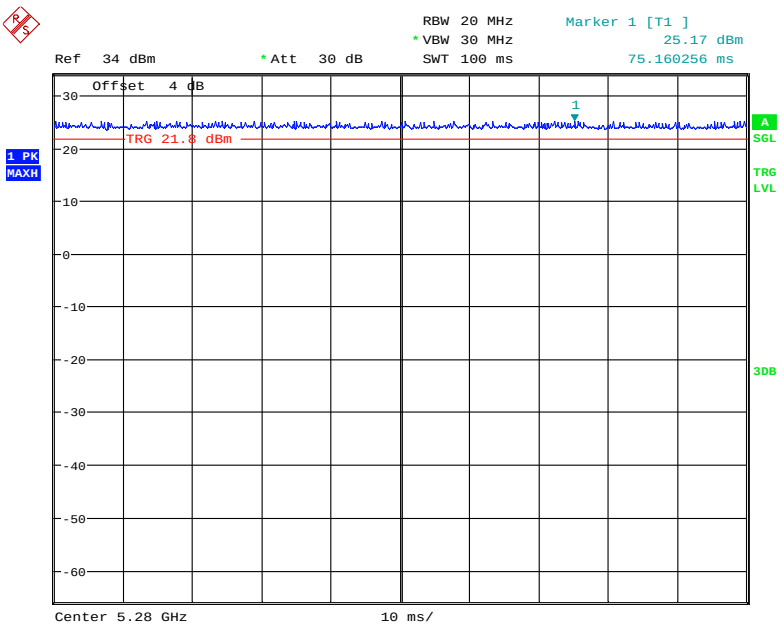
802.11n20 mode



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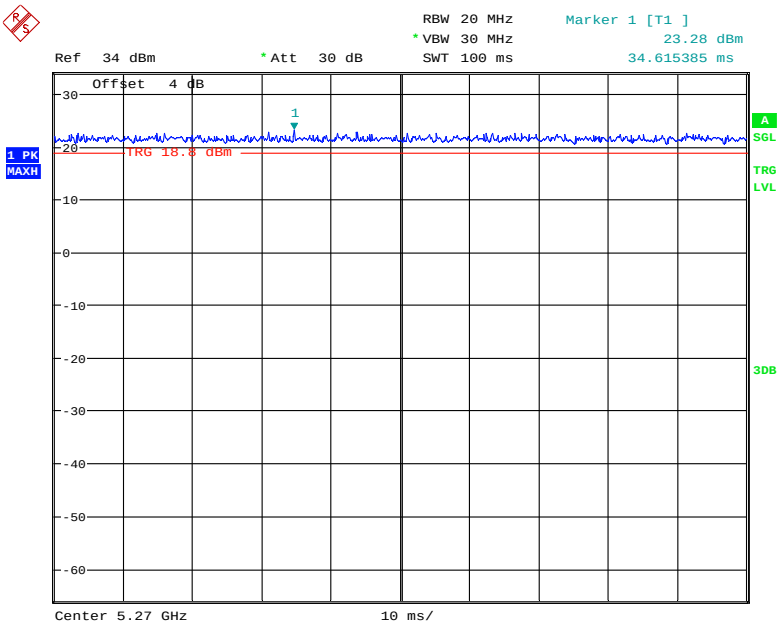
802.11n40 mode



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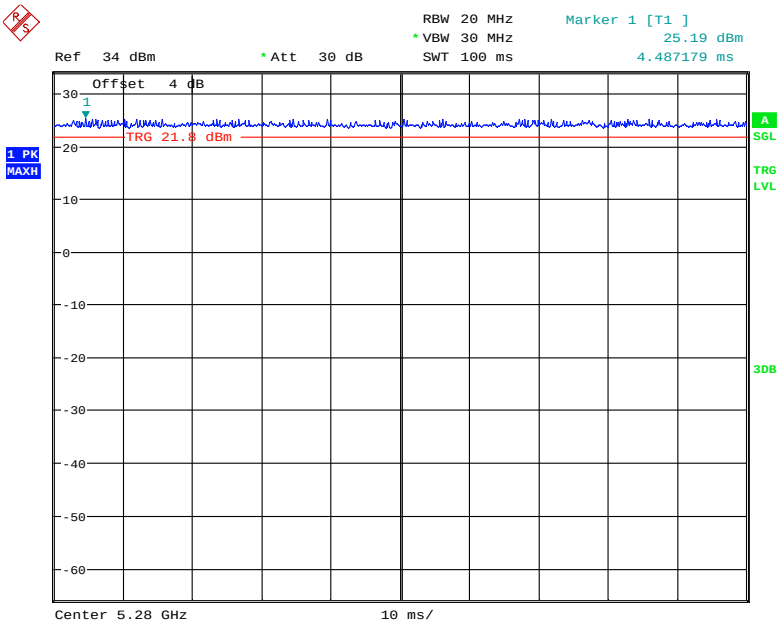
802.11ac20 Mode



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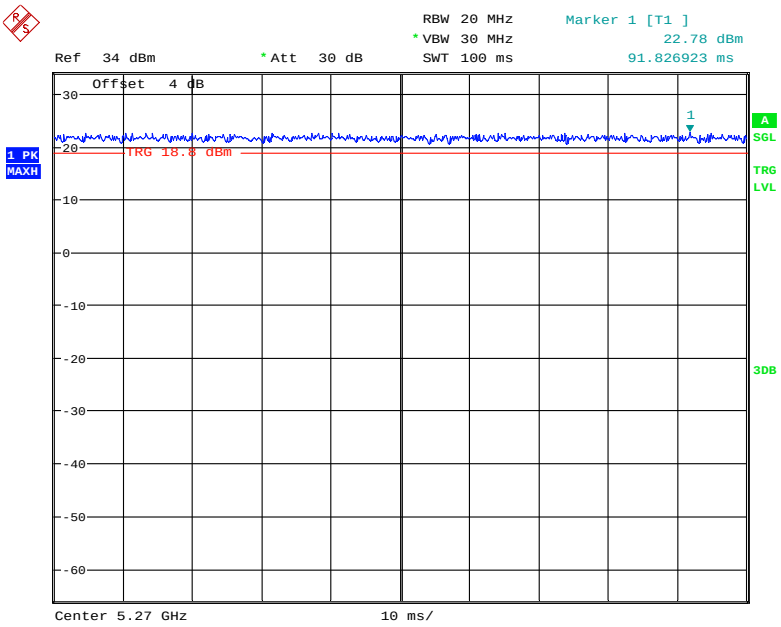
802.11ac40 Mode



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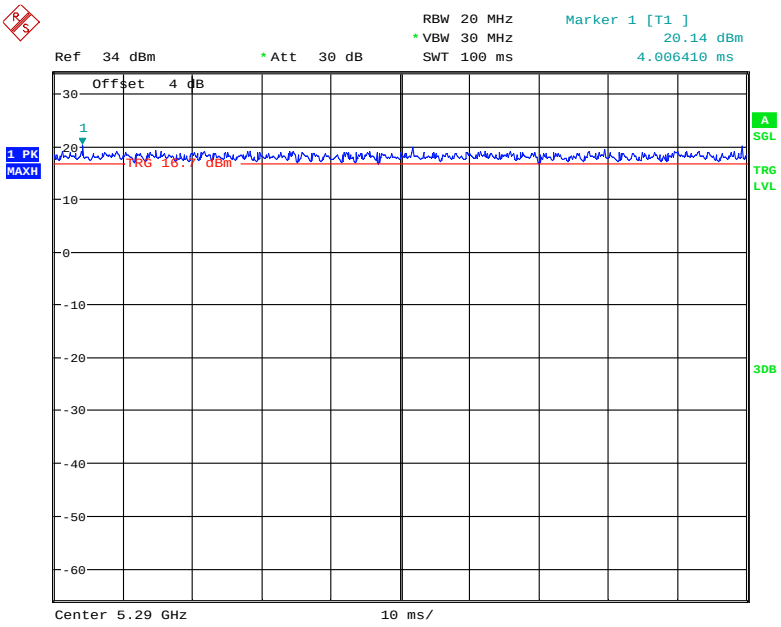
802.11ac80 Mode



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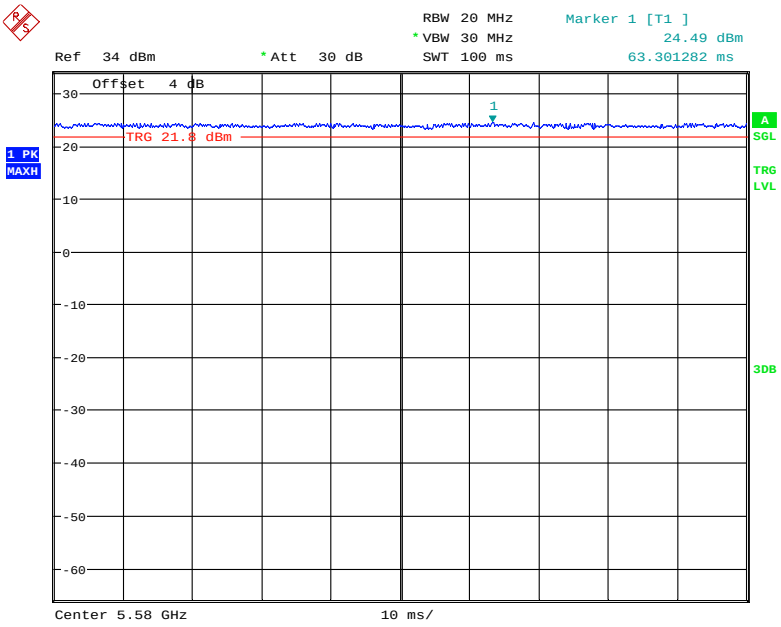
Mode	Duty Cycle (%)	T(ms)	1/T(kHz)	VBW Setting	10log(1/x)
802.11a	100	-	-	10Hz	-
802.11n20	100	-	-	10Hz	-
802.11n40	100	-	-	10Hz	-
802.11ac20	100	-	-	10Hz	-
802.11ac40	100	-	-	10Hz	-
802.11ac80	100	-	-	10Hz	-

5470-5725 MHz

802.11a mode



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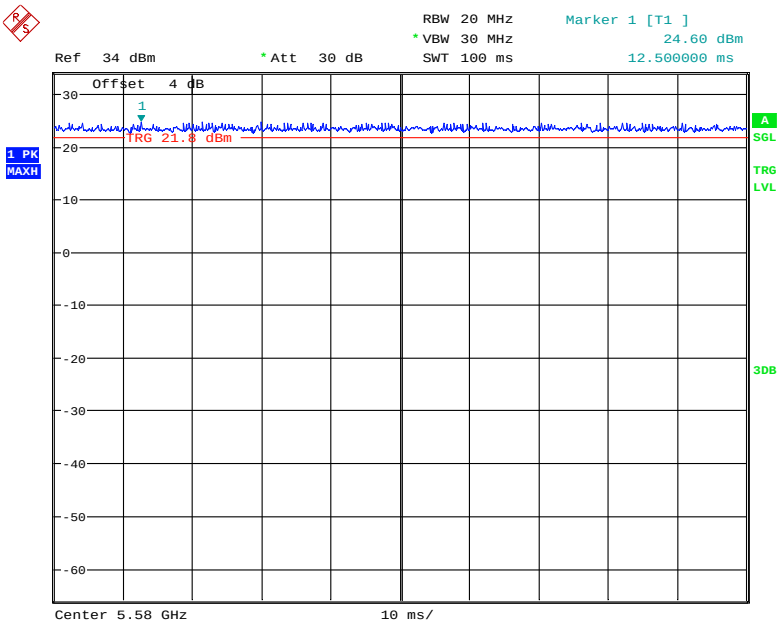
802.11n20 mode



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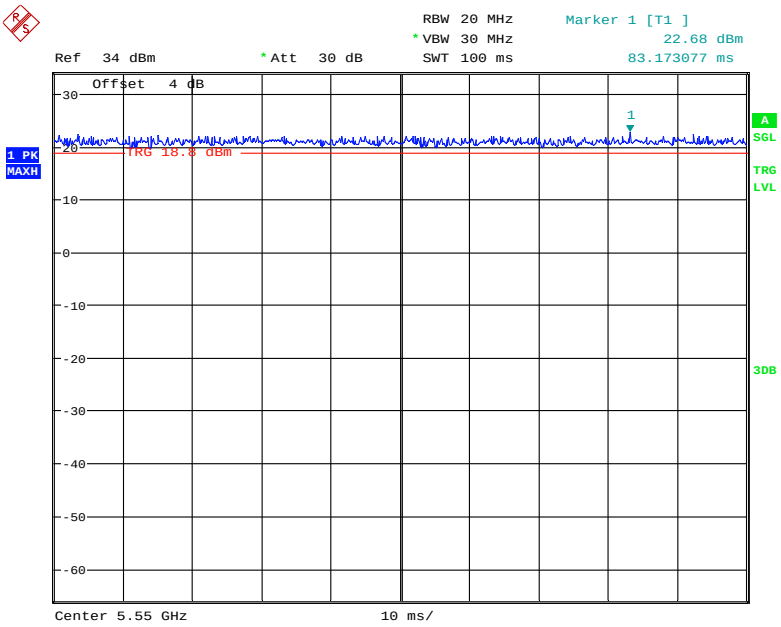
802.11n40 mode



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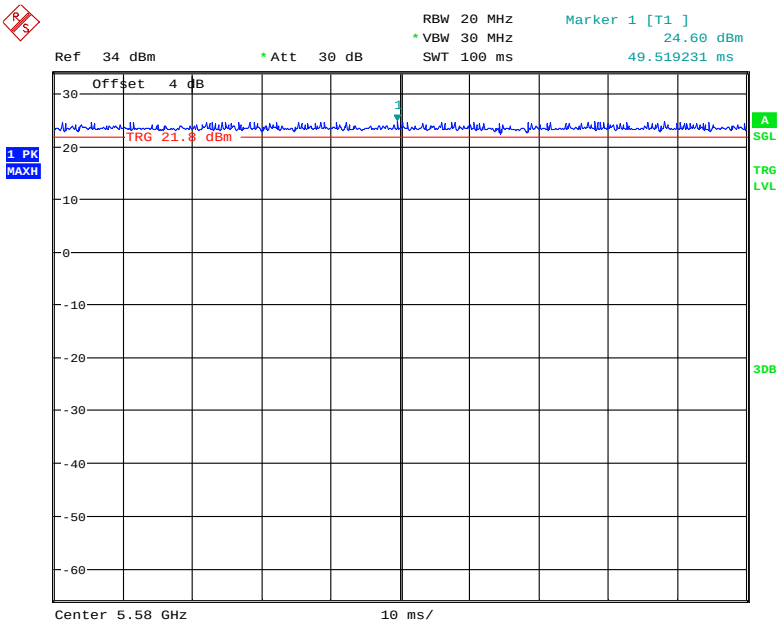
802.11ac20 Mode



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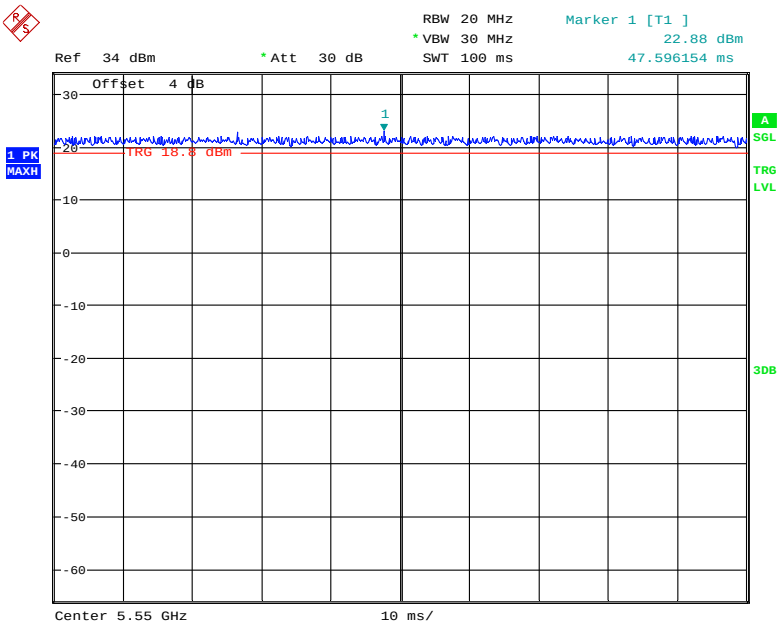
802.11ac40 Mode



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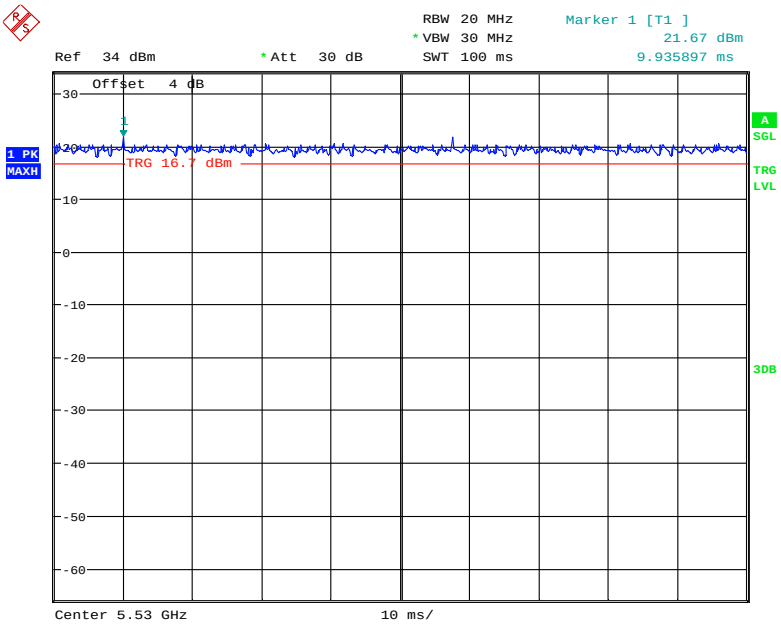
802.11ac80 Mode



Date: 26.MAR.2020 23:28:03

Mode	Duty Cycle (%)	T(ms)	1/T(kHz)	VBW Setting	10log(1/x)
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.

Support Equipment List and Details

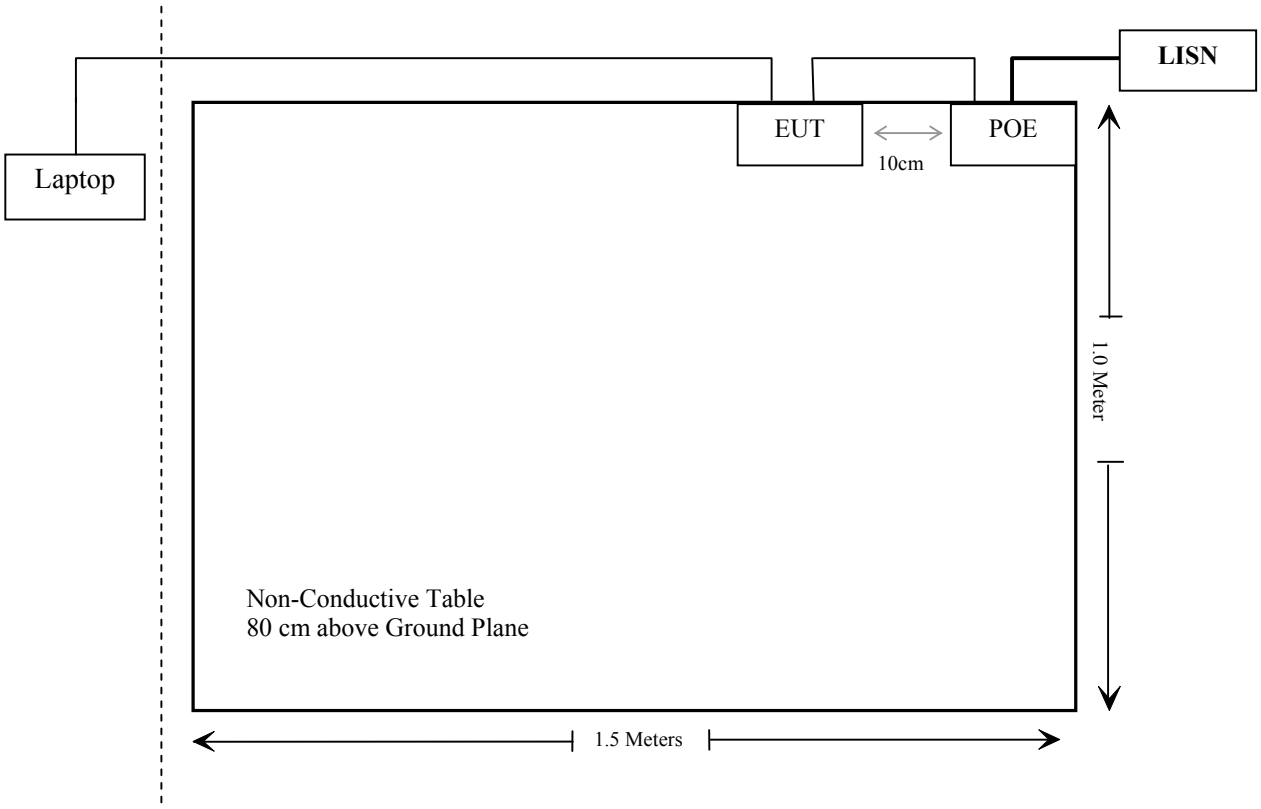
Manufacturer	Description	Model	Serial Number
Unknown	POE	VX-Pl1000GB	Pl1000
HP	Laptop	Compaq CQ45	5CG33407QL

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) (2), (3), (6),(7)	Undesirable Emission& Restricted Bands	Compliance
§15.407(a) (1)	26 dB Emission Bandwidth	Compliance
§15.407(a) (2)	Conducted Transmitter Output Power	Compliance
§15.407 (a) (2)	Power Spectral Density	Compliance

DFS report please refere to RSZ200312010-00 issued by Bay Area Compliance Laboratories Corp. (Dongguan).

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	2020/1/22	2021/1/21
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	2020/07/21
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
Insulted 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
SNSD	Band Reject filter	BSF2402-2480MN-0898-001	2.4G filter	2019/4/20	2020/4/20
Ducommun Technolagies	Horn antenna	ARH-4223-02	1007726-02 1304	2017/12/6	2020/12/5
Ducommun Technologies	Horn Antenna	ARH-2823-02	1007726-03	2017/12/6	2020/12/5

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Agilent	USB Wideband Power Sensor	U2021XA	MY54250003	2019/7/10	2020/7/9
Rohde & Schwarz	SPECTRUM ANALYZER	FSU26	200120	2020/3/2	2021/3/1
WEINSCHEL	3dB Attenuator	Unknown	F-03-EM121	2019/11/29	2020/11/28
Unknown	RF Cable	Unknown	2301 276	2019/11/29	2020/11/28

*** 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/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:

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

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	3.5	2.24	30	1000	20	0.446	1
5250-5350	6.5	4.47	20	100	20	0.089	1
5470-5725	6.5	4.47	21	125.89	20	0.112	1
5150-5250	6.5	4.47	19	79.43	20	0.071	1
5725-5850	6.5	4.47	21	125.89	20	0.112	1

Note: 1. the tune up conducted power was declared by the applicant
2. the 2.4G Wi-Fi can transmit at the same time with the 5G Wi-Fi.
3. For the 5G Wi-Fi, as it can support the beam-forming fucnitoin, so the antenna gain should add the 10lg2, 3.5dBi+10lg2=6.5dBi.
4. Please refer to the DTS report of the original FCC ID for the 2.4G Wi-Fi output power.
5. Simultaneous transmitting consideration:

The ratio=MPE_{DTS}/limit+MPE_{NII}/limit=0.446+0.112=0.558＜1.0, so simultaneous exposure is not required.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

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 external antennas which use non-standard antenna connectors. The antenna gain is 3.5dBi, fulfill the requirement of this section. Please refer to the EUT photos.

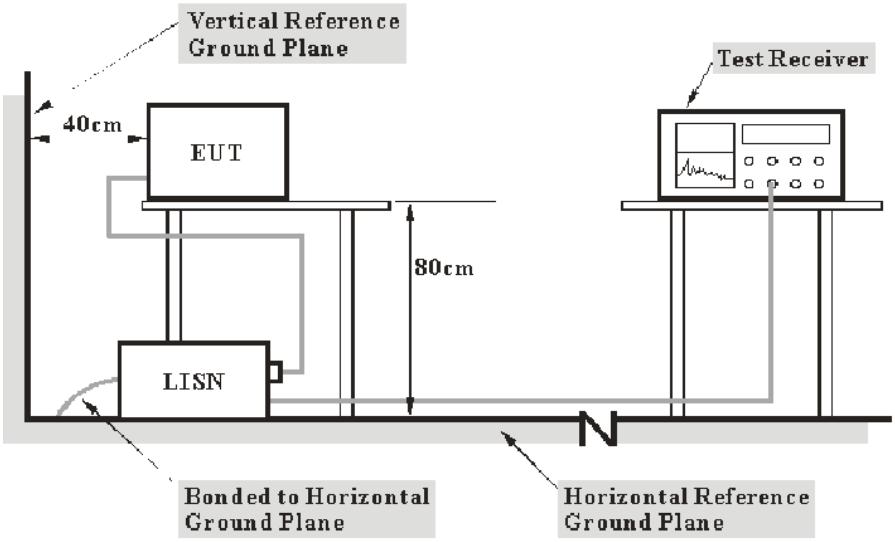
Result: Compliance.

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

Test Data

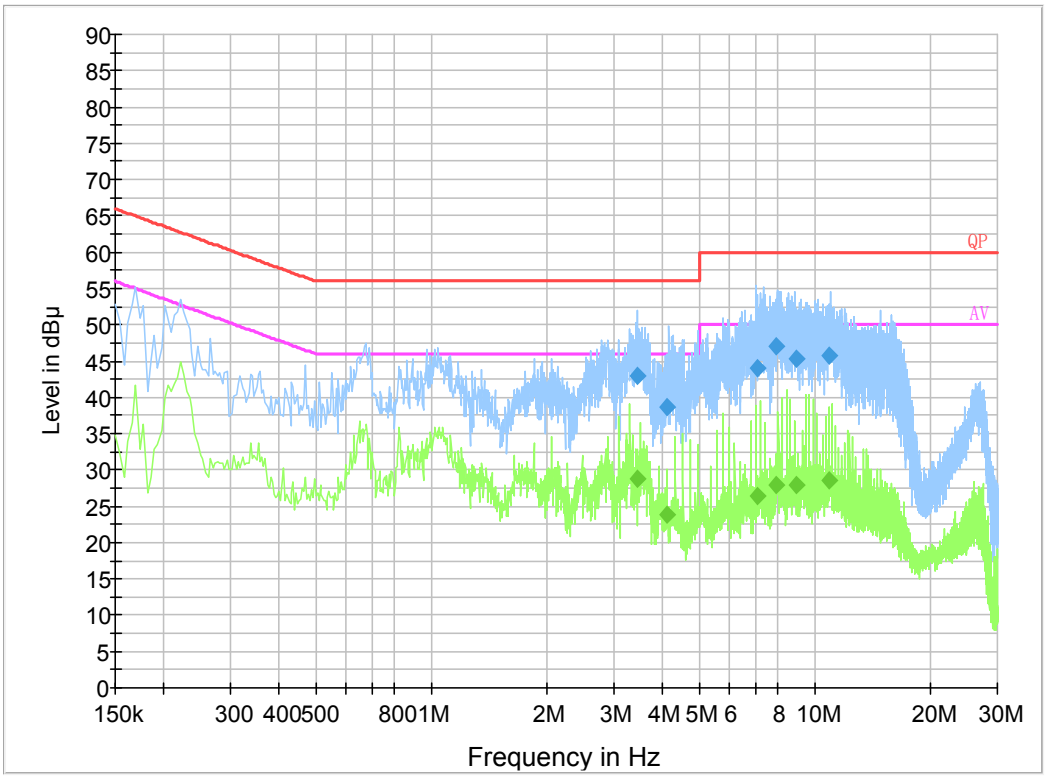
Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	65 %
ATM Pressure:	101.0 kPa

The testing was performed by Haiguo Li on 2020-03-15.

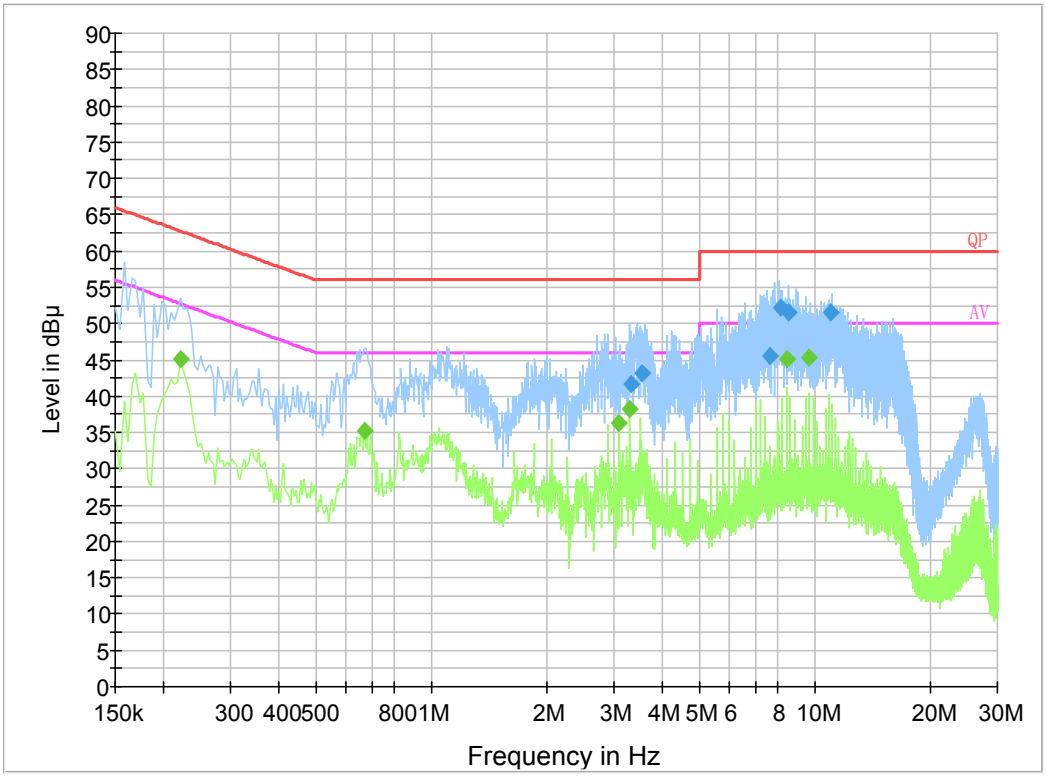
EUT operation mode: Transmitting (worst case is 802.11a mode, 5700MHz)

AC 120 V/60 Hz, Line:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
3.446130	43.0	19.9	56.0	13.0	QP
4.135330	38.6	19.9	56.0	17.4	QP
7.124430	44.0	19.9	60.0	16.0	QP
7.918330	47.0	19.9	60.0	13.0	QP
8.957250	45.4	20.0	60.0	14.6	QP
10.960670	45.8	20.0	60.0	14.2	QP
3.446130	28.7	19.9	46.0	17.3	Ave.
4.135330	23.9	19.9	46.0	22.1	Ave.
7.124430	26.4	19.9	50.0	23.6	Ave.
7.918330	28.0	19.9	50.0	22.0	Ave.
8.957250	28.0	20.0	50.0	22.0	Ave.
10.960670	28.6	20.0	50.0	21.4	Ave.

AC 120 V/60 Hz, Neutral:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
3.332530	41.7	19.9	56.0	14.3	QP
3.555910	43.1	19.9	56.0	12.9	QP
7.617350	45.5	19.9	60.0	14.5	QP
8.160950	52.3	19.9	60.0	7.7	QP
8.573510	51.5	19.9	60.0	8.5	QP
11.043770	51.6	20.0	60.0	8.4	QP
0.222000	45.2	19.8	52.7	7.5	Ave.
0.670000	35.3	19.8	46.0	10.7	Ave.
3.098000	36.4	19.9	46.0	9.6	Ave.
3.302000	38.2	19.9	46.0	7.8	Ave.
8.462000	45.1	19.9	50.0	4.9	Ave.
9.702000	45.4	20.0	50.0	4.6	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) (2), (3), (6),(7) – UNDESIRABLE EMISSION

Applicable Standard

FCC §15.407 (b) (2), (3), (6), (7); §15.209; §15.205;

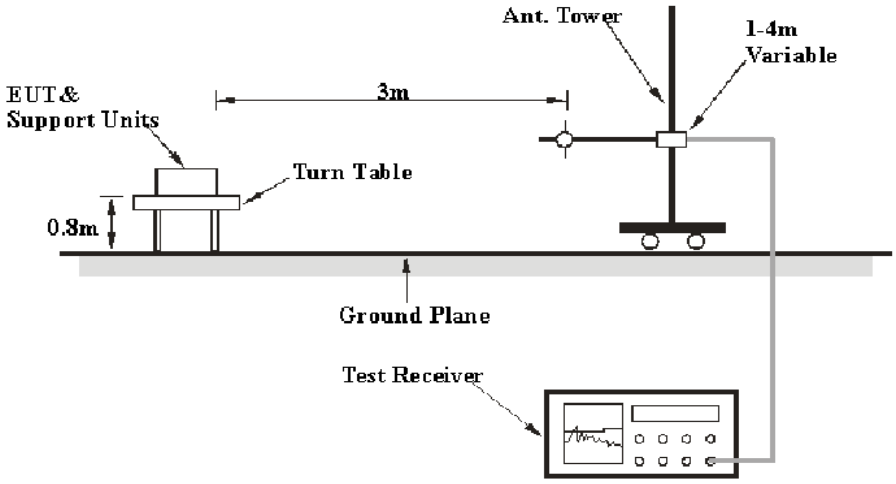
(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 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.
Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

KDB 789033 D02 General UNII Test Procedures New Rules v02r01, clause G),
E [dBμV/m] = EIRP [dBm] + 95.2, for d = 3 meters.

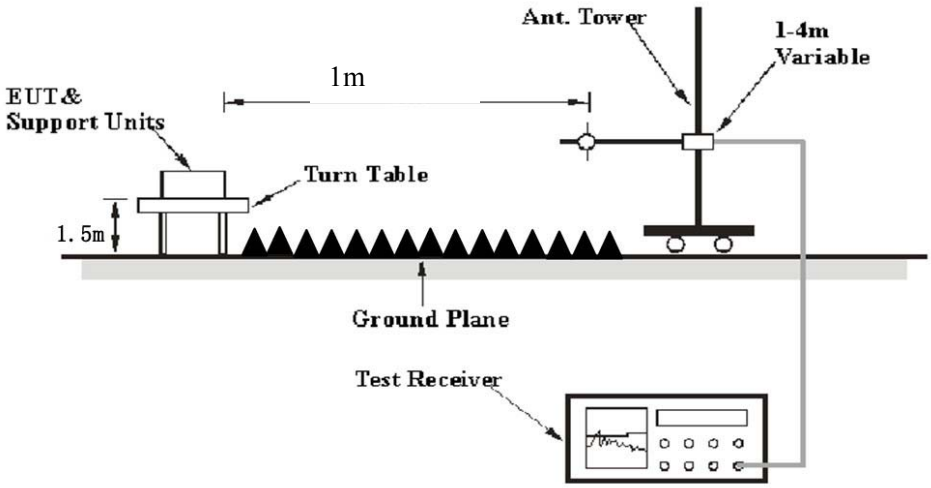
The general limit of -27 dBm EIRP (= 68.2 dBμV/m) is applied for unwanted emission of U-NII devices.
However, compliance with unwanted emissions in restricted bands may need to be considered, *e.g.,* some harmonics may land in the restricted bands below 5.15 GHz and above 5.35 GHz (refer
The general limit of -27 dBm EIRP (= 68.2 dBμV/m) is applied for unwanted emission of U-NII devices.
However, compliance with unwanted emissions in restricted bands may need to be considered, *e.g.,* some harmonics may land in the restricted bands below 5.15 GHz and above 5.35 GHz (refer to § 15.205 for restricted bands) that have average and peak limits specified in §§ 15.209 and 15.35(b), respectively.
Although the peak limit of 74 dBμV/m (20 dB above 54 dBμV/m) in the restricted band appears to be higher than 68.2 dBμV/m, the lower average limit of 54 dBμV/m in the restricted bands needs to be complied to

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.

According to ANSI C63.10-2013,9.4: For field strength measurements made at other than the distance at which the applicable limit is specified,extrapolate the measured field strength to the field strength at the distance specified by the limit using an inverse distance correction factor (20 dB/decade of distance). In some cases, a different distance correction factor may be required;

$$E_{\mathrm{SpecLimit}} = E_{\mathrm{Meas}} + 20\log\left(\frac{d_{\mathrm{Meas}}}{d_{\mathrm{SpecLimit}}}\right)$$

where

$E_{\mathrm{SpecLimit}}$ is the field strength of the emission at the distance specified by the limit, in dBμV/m
E_{Meas} is the field strength of the emission at the measurement distance, in dBμV/m
d_{Meas} is the measurement distance, in m
$d_{\mathrm{SpecLimit}}$ is the distance specified by the limit, in m

So the extrapolation factor of 1m is 20*log(1/3)= -9.5 dB

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 = Meter Reading + Antenna Factor + Cable Loss - 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 E, section 15.205, 15.209 and 15.407 rules.

Test Data

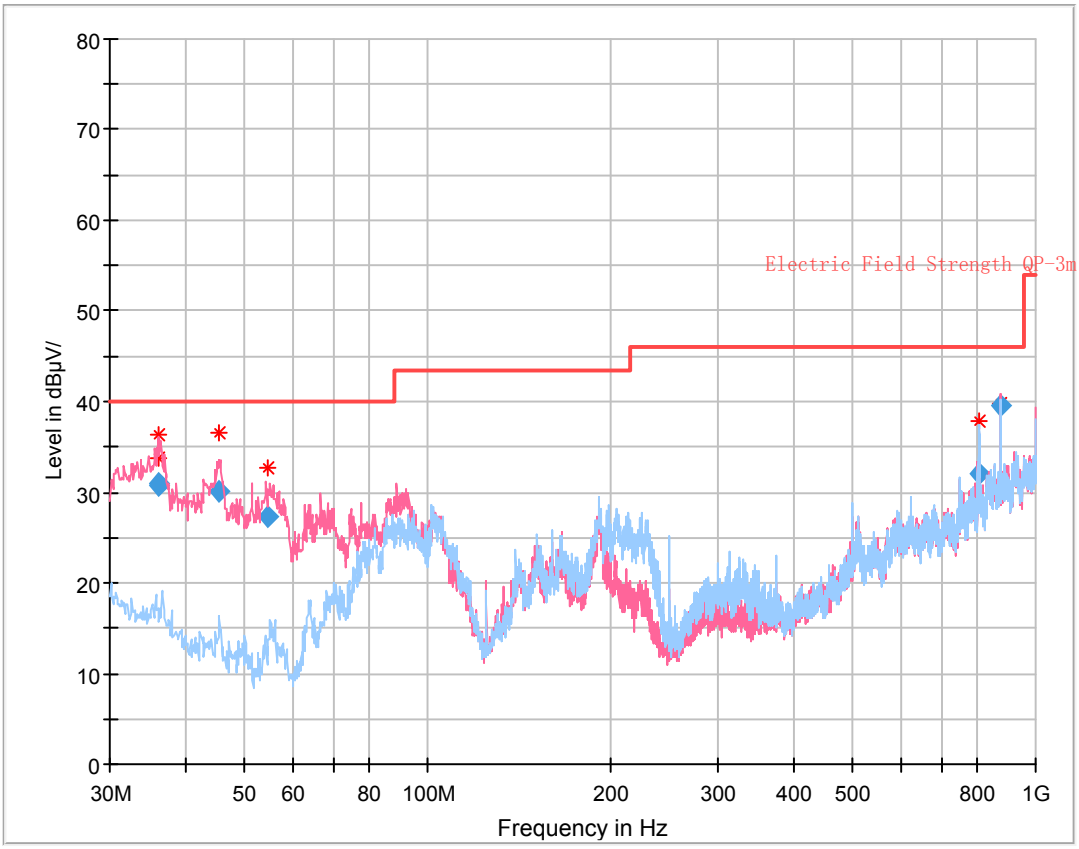
Environmental Conditions

Temperature:	22~25 ℃
Relative Humidity:	50~56 %
ATM Pressure:	101.0 kPa

The testing was performed by Zero Yan on 2020-04-13 for below 1G and by Leo Huang on 2020-03-20 for above 1G.

EUT operation mode: Transmitting

30 MHz – 1 GHz: *(worst case is 802.11a mode 5700MHz)*



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
36.033875	30.96	109.0	V	157.0	-11.2	40.00	9.04
36.182500	30.75	142.0	V	123.0	-11.3	40.00	9.25
45.214625	30.11	102.0	V	62.0	-17.4	40.00	9.89
54.473000	27.21	112.0	V	19.0	-19.9	40.00	12.79
805.519375	31.95	134.0	H	63.0	2.0	46.00	14.05
874.981375	39.56	102.0	V	340.0	3.6	46.00	6.44

1G ~ 40 GHz:

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

5250-5350 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									
5260 MHz									
5147.68	32.17	PK	241	1.6	V	38.36	70.53	83.5	12.97
5147.68	16.82	Ave.	241	1.6	V	38.36	55.18	63.5	8.32
5364.81	31.66	PK	118	1.8	V	39.09	70.75	83.5	12.75
5364.81	16.67	Ave.	118	1.8	V	39.09	55.76	63.5	7.74
10520.00	43.96	PK	222	1.9	V	17.25	61.21	77.7	16.49
5280 MHz									
10560.00	43.35	PK	20	2.3	V	17.91	61.26	77.7	16.44
5320 MHz									
5149.44	32.49	PK	231	1.6	V	38.36	70.85	83.5	12.65
5149.44	17.25	Ave.	231	1.6	V	38.36	55.61	63.5	7.89
5352.47	35.77	PK	119	2.1	V	39.09	74.86	83.5	8.64
5352.47	19.44	Ave.	119	2.1	V	39.09	58.53	63.5	4.97
10640.00	45.68	PK	330	1.5	V	18.01	63.69	83.5	19.81
10640.00	29.07	AV	330	1.5	V	18.01	47.08	63.5	16.42
802.11n20									
5260 MHz									
5148.67	31.36	PK	114	1.8	V	38.36	69.72	83.5	13.78
5148.67	16.65	Ave.	114	1.8	V	38.36	55.01	63.5	8.49
5356.85	31.53	PK	284	2.2	V	39.09	70.62	83.5	12.88
5356.85	16.78	Ave.	284	2.2	V	39.09	55.87	63.5	7.63
10520.00	41.45	PK	127	1.3	V	17.25	58.70	77.7	19.00
5280 MHz									
10560.00	41.54	PK	142	2.4	V	17.91	59.45	77.7	18.25
5320 MHz									
5149.63	31.52	PK	168	1.0	V	38.36	69.88	83.5	13.62
5149.63	16.58	Ave.	168	1.0	V	38.36	54.94	63.5	8.56
5350.40	32.51	PK	216	1.3	V	39.09	71.60	83.5	11.90
5350.40	17.91	Ave.	216	1.3	V	39.09	57.00	63.5	6.50
10640.00	45.83	PK	22	1.7	V	18.01	63.84	83.5	19.66
10640.00	29.54	Ave.	22	1.7	V	18.01	47.55	63.5	15.95

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									
5270 MHz									
5148.36	31.53	PK	34	2.0	V	38.36	69.89	83.5	13.61
5148.36	16.75	Ave.	34	2.0	V	38.36	55.11	63.5	8.39
5359.66	31.61	PK	154	1.1	V	39.09	70.70	83.5	12.80
5359.66	16.53	Ave.	154	1.1	V	39.09	55.62	63.5	7.88
10540.00	41.63	PK	328	1.3	V	17.25	58.88	77.7	18.82
5310 MHz									
5148.96	31.43	PK	119	2.5	V	38.36	69.79	83.5	13.71
5148.96	16.82	Ave.	119	2.5	V	38.36	55.18	63.5	8.32
5350.56	38.76	PK	163	2.3	V	39.09	77.85	83.5	5.65
5350.56	22.04	Ave.	163	2.3	V	39.09	61.13	63.5	2.37
10620.00	41.14	PK	62	1.2	V	18.01	59.15	83.5	24.35
10620.00	26.53	Ave.	62	1.2	V	18.01	44.54	63.5	18.96
802.11ac20									
5260 MHz									
5149.35	31.48	PK	343	2.3	V	38.36	69.84	83.5	13.66
5149.35	16.73	Ave.	343	2.3	V	38.36	55.09	63.5	8.41
5350.72	33.92	PK	338	1.5	V	39.09	73.01	83.5	10.49
5350.72	18.40	Ave.	338	1.5	V	39.09	57.49	63.5	6.01
10520.00	41.57	PK	318	1.7	V	17.25	58.82	77.7	18.88
5280 MHz									
10560.00	41.65	PK	206	2.3	V	17.91	59.56	77.7	18.14
5320 MHz									
5148.97	31.26	PK	216	1.0	V	38.36	69.62	83.5	13.88
5148.97	16.84	Ave.	216	1.0	V	38.36	55.20	63.5	8.30
5351.22	31.49	PK	39	1.4	V	39.09	70.58	83.5	12.92
5351.22	16.73	Ave.	39	1.4	V	39.09	55.82	63.5	7.68
10640.00	41.54	PK	320	2.2	V	18.01	59.55	83.5	23.95
10640.00	26.87	Ave.	320	2.2	V	18.01	44.88	63.5	18.62

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)
802.11ac40									
5270 MHz									
5149.67	32.16	PK	4	1.5	V	38.36	70.52	83.5	12.98
5149.67	16.88	Ave.	4	1.5	V	38.36	55.24	63.5	8.26
5352.63	31.76	PK	68	2.4	V	39.09	70.85	83.5	12.65
5352.63	16.83	Ave.	68	2.4	V	39.09	55.92	63.5	7.58
10540.00	42.36	PK	214	2.5	V	17.25	59.61	77.7	18.09
5310 MHz									
5148.68	32.14	PK	260	1.2	V	38.36	70.50	83.5	13.00
5148.68	16.75	Ave.	260	1.2	V	38.36	55.11	63.5	8.39
5350.56	41.11	PK	79	1.0	V	39.09	80.20	83.5	3.30
5350.56	23.13	Ave.	79	1.0	V	39.09	62.22	63.5	1.28
10620.00	42.01	PK	74	1.6	V	18.01	60.02	83.5	23.48
10620.00	26.89	Ave.	74	1.6	V	18.01	44.90	63.5	18.60
802.11ac80									
5290 MHz									
5149.83	33.26	PK	302	1.3	V	38.36	71.62	83.5	11.88
5149.83	16.58	Ave.	302	1.3	V	38.36	54.94	63.5	8.56
5352.15	39.27	PK	101	1.2	V	39.09	78.36	83.5	5.14
5352.15	23.27	Ave.	101	1.2	V	39.09	62.36	63.5	1.14
10580.00	41.59	PK	337	2.1	V	17.91	59.50	77.7	18.20

5470-5725 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									
5500 MHz									
5469.91	36.32	PK	296	1.4	V	39.37	75.69	77.7	2.01
5727.14	32.75	PK	45	2.4	V	39.49	72.24	77.7	5.46
11000.00	44.22	PK	53	1.5	V	17.66	61.88	83.5	21.62
11000.00	26.56	Ave.	53	1.5	V	17.66	44.22	63.5	19.28
5580 MHz									
11160.00	44.81	PK	273	1.3	V	17.39	62.20	83.5	21.30
11160.00	29.52	Ave.	273	1.3	V	17.39	46.91	63.5	16.59
5700 MHz									
5469.17	31.75	PK	244	2.0	V	39.37	71.12	77.7	6.58
5725.27	36.54	PK	305	1.6	V	39.49	76.03	77.7	1.67
11400.00	40.6	PK	64	1.9	V	17.73	58.33	83.5	25.17
11400.00	27.69	Ave.	64	1.9	V	17.73	45.42	63.5	18.08
802.11n20									
5500 MHz									
5468.72	31.75	PK	26	2.4	V	39.37	71.12	77.7	6.58
5725.68	31.13	PK	32	1.6	V	39.49	70.62	77.7	7.08
11000.00	41.35	PK	75	1.3	V	17.66	59.01	83.5	24.49
11000.00	28.06	Ave.	75	1.3	V	17.66	45.72	63.5	17.78
5580 MHz									
11160.00	41.21	PK	250	2.0	V	17.39	58.60	83.5	24.90
11160.00	26.66	Ave.	250	2.0	V	17.39	44.05	63.5	19.45
5700 MHz									
5468.33	32.54	PK	127	1.8	V	39.37	71.91	77.7	5.79
5725.68	36.61	PK	278	1.5	V	39.49	76.10	77.7	1.60
11400.00	41.55	PK	321	1.6	V	17.73	59.28	83.5	24.22
11400.00	28.16	Ave.	321	1.6	V	17.73	45.89	63.5	17.61

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									
5510 MHz									
5469.39	36.79	PK	265	1.8	V	39.37	76.16	77.7	1.54
5728.31	32.18	PK	147	1.5	V	39.49	71.67	77.7	6.03
11020.00	41.23	PK	158	2.3	V	17.26	58.49	83.5	25.01
11020.00	27.64	Ave.	158	2.3	V	17.26	44.90	63.5	18.60
5550 MHz									
11100.00	41.54	PK	119	1.1	V	16.52	58.06	83.5	25.44
11100.00	27.13	Ave.	119	1.1	V	16.52	43.65	63.5	19.85
5670 MHz									
5465.37	30.71	PK	344	1.4	V	39.37	70.08	77.7	7.62
5727.44	35.11	PK	323	1.2	V	39.49	74.60	77.7	3.10
11340.00	40.97	PK	192	2.2	V	17.43	58.40	83.5	25.10
11340.00	27.23	Ave.	192	2.2	V	17.43	44.66	63.5	18.84
802.11ac20									
5500 MHz									
5469.91	34.60	PK	271	2.0	V	39.37	73.97	77.7	3.73
5732.22	32.21	PK	123	2.3	V	39.49	71.70	77.7	6.00
11000.00	42.46	PK	339	1.5	V	17.66	60.12	83.5	23.38
11000.00	27.26	Ave.	339	1.5	V	17.66	44.92	63.5	18.58
5580 MHz									
11160.00	42.47	PK	155	2.4	V	17.39	59.86	83.5	23.64
11160.00	27.36	Ave.	155	2.4	V	17.39	44.75	63.5	18.75
5700 MHz									
5466.55	32.41	PK	168	2.3	V	39.37	71.78	77.7	5.92
5727.44	36.01	PK	88	1.3	V	39.49	75.50	77.7	2.20
11400.00	43.23	PK	170	1.9	V	17.73	60.96	83.5	22.54
11400.00	28.12	Ave.	170	1.9	V	17.73	45.85	63.5	17.65

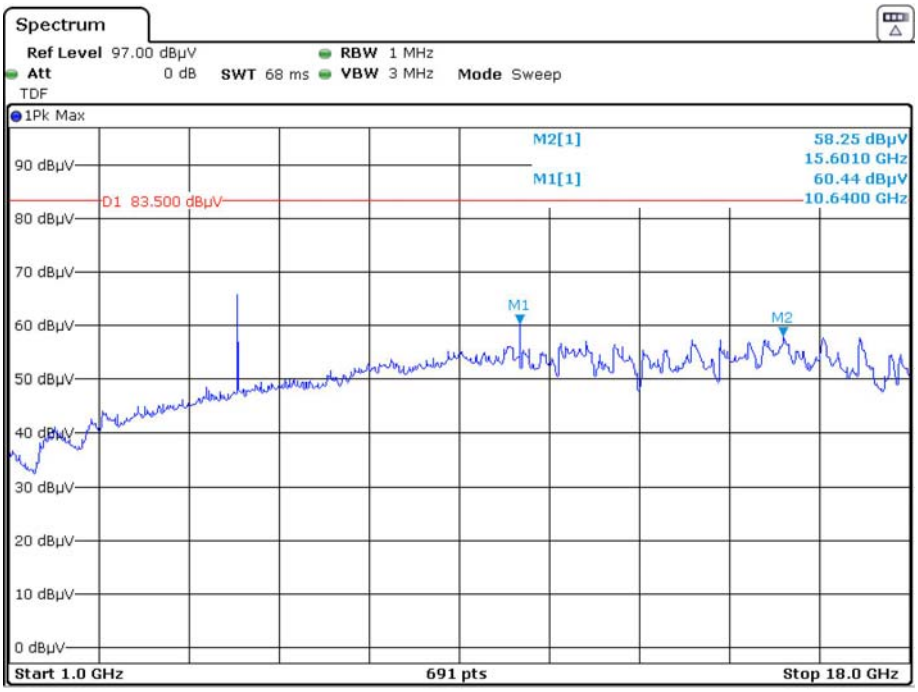
Frequency (MHz)	Receiver		Turntable	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	FCC Part 15.407/205/209	
	Reading (dBµV)	PK/QP/Ave.	Degree	Height (m)	Polar (H / V)			Limit (dBµV/m)	Margin (dB)
802.11ac40									
5510 MHz									
5469.57	37.02	PK	294	2.2	V	39.37	76.39	77.7	1.31
5726.47	33.15	PK	224	1.6	V	39.49	72.64	77.7	5.06
11020.00	40.26	PK	279	2.4	V	17.66	57.92	83.5	25.58
11020.00	27.45	Ave.	279	2.4	V	17.66	45.11	63.5	18.39
5550 MHz									
11100.00	41.43	PK	22	1.6	V	16.72	58.15	83.5	25.35
11100.00	27.75	Ave.	22	1.6	V	16.72	44.47	63.5	19.03
5670 MHz									
5469.87	32.34	PK	118	1.7	V	39.37	71.71	77.7	5.99
5725.71	35.45	PK	200	2.2	V	39.49	74.94	77.7	2.76
11340.00	40.95	PK	160	1.1	V	17.43	58.38	83.5	25.12
11340.00	27.46	Ave.	160	1.1	V	17.43	44.89	63.5	18.61
802.11ac80									
5530 MHz									
5462.79	35.80	PK	138	1.5	V	39.37	75.17	77.7	2.53
5725.42	32.22	PK	73	2.3	V	39.49	71.71	77.7	5.99
11060.00	40.97	PK	44	1.2	V	16.72	57.69	83.5	25.81
11060.00	26.73	Ave.	44	1.2	V	16.72	43.45	63.5	20.05
5610 MHz									
5468.88	32.66	PK	186	2.0	V	39.37	72.03	77.7	5.67
5725.97	35.87	PK	309	1.7	V	39.49	75.36	77.7	2.34
11220.00	41.85	PK	206	1.3	V	17.39	59.24	83.5	24.26
11220.00	27.89	Ave.	206	1.3	V	17.39	45.28	63.5	18.22

2.4G Wi-Fi (802.11b mode, 2412MHz) & 5G Wi-Fi (802.11a mode, 5320MHz) simultaneous transmission:

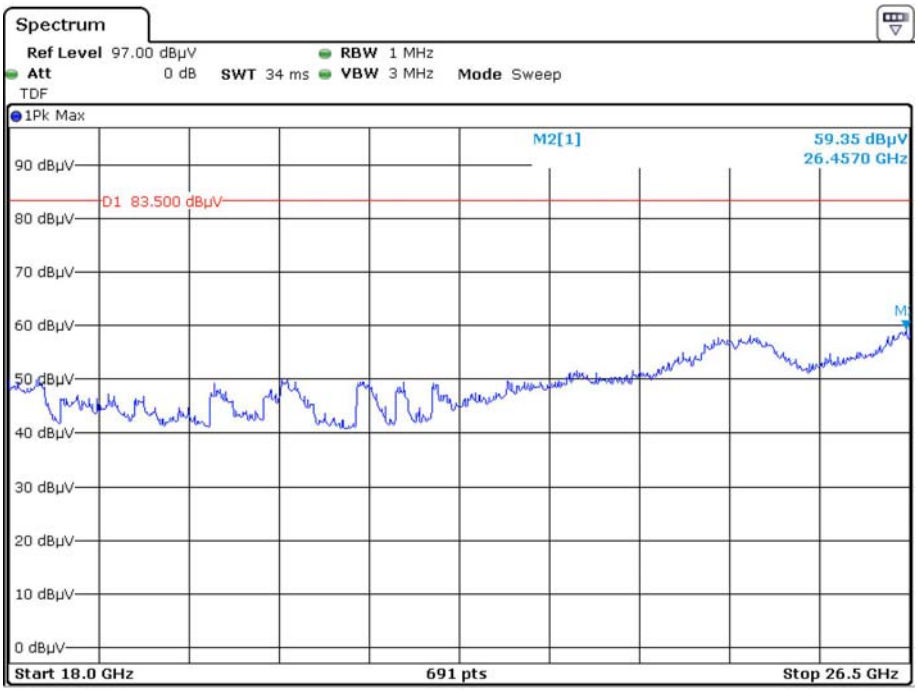
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Test Distance (m)
	Reading (dBµV)	PK/QP/Ave.		Height (m)	Polar (H/V)					
874.99	34.02	QP	340	1.1	H	3.6	37.62	46	8.38	3
874.99	35.61	QP	340	1.1	V	3.6	39.21	46	6.79	3
4824.00	44.33	PK	228	1.9	V	6.28	50.61	74	23.39	3
4824.00	28.91	Ave.	228	1.9	V	6.28	35.19	54	18.81	3
10640.00	45.26	PK	328	1.5	V	18.01	63.27	83.5	20.23	1
10640.00	30.81	Ave.	328	1.5	V	18.01	48.82	63.5	14.68	1

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.

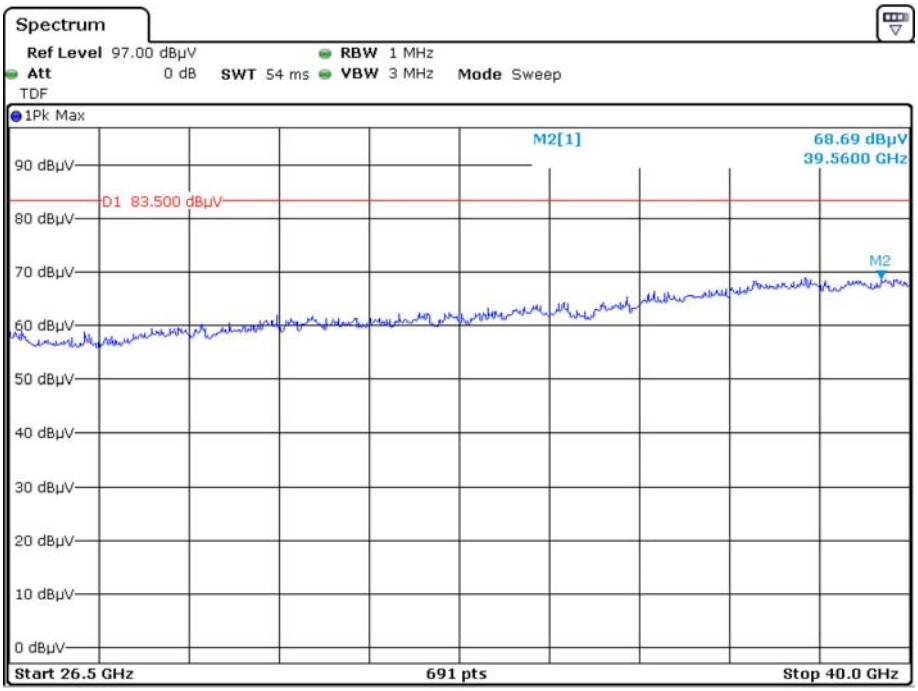
Pre-scan with 802.11a 5320MHz, for Peak
Horizontal



Date: 20.MAR.2020 16:39:14

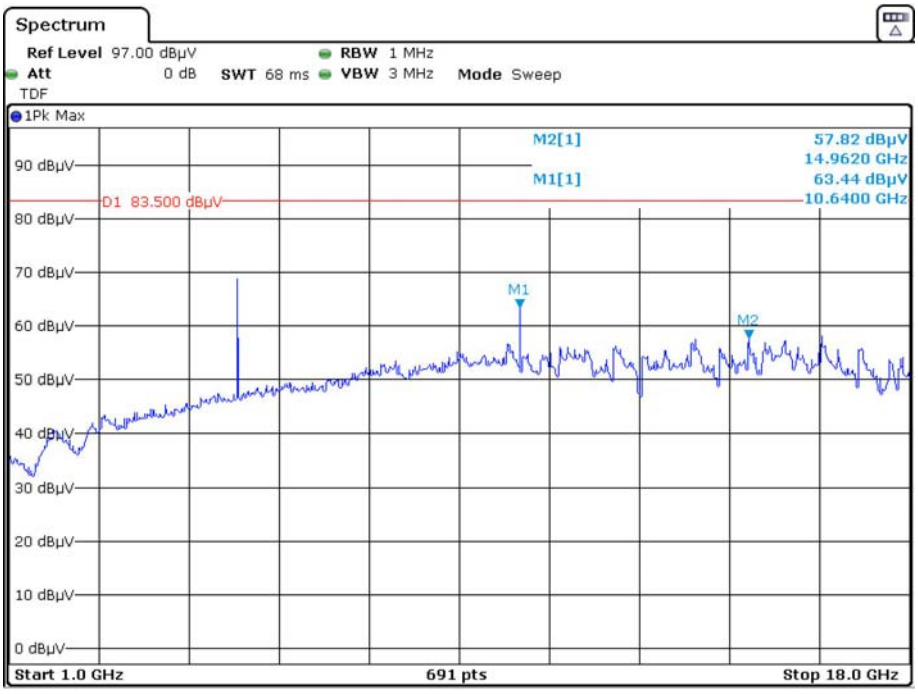


Date: 20.MAR.2020 17:26:59

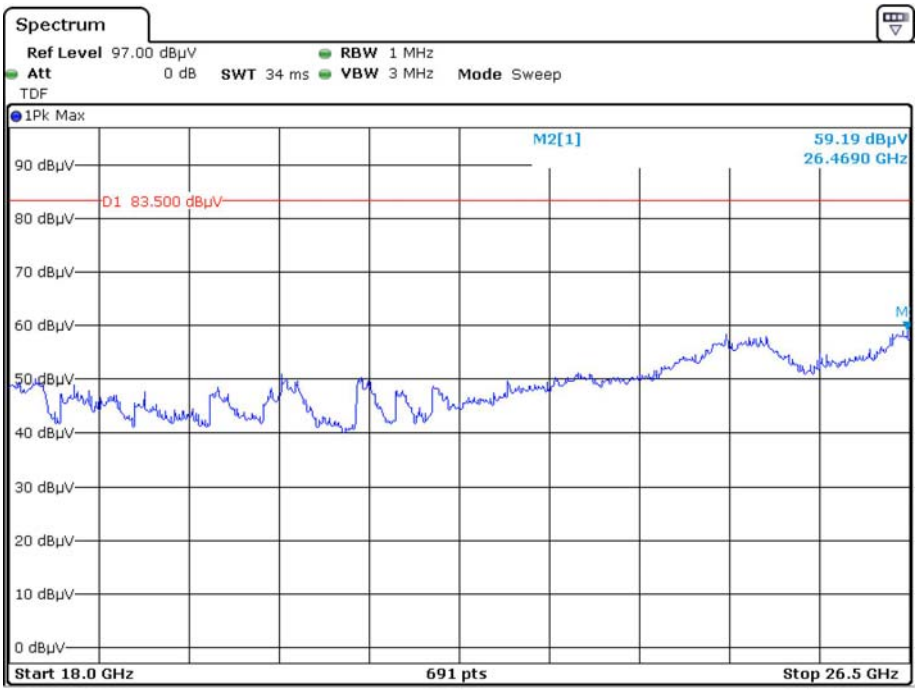


Date: 20.MAR.2020 18:11:56

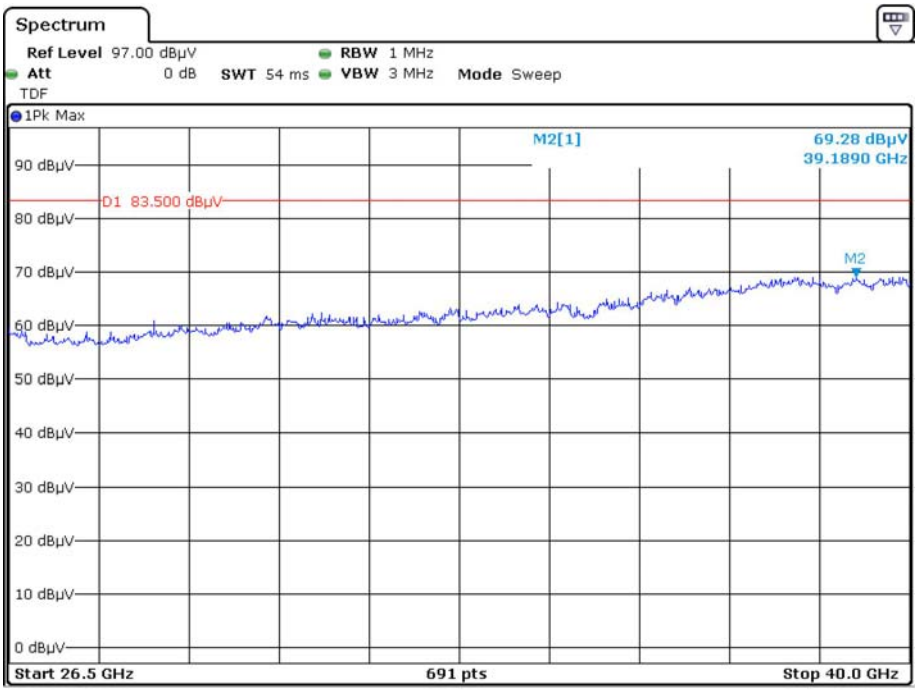
Vertical



Date: 20.MAR.2020 16:33:31

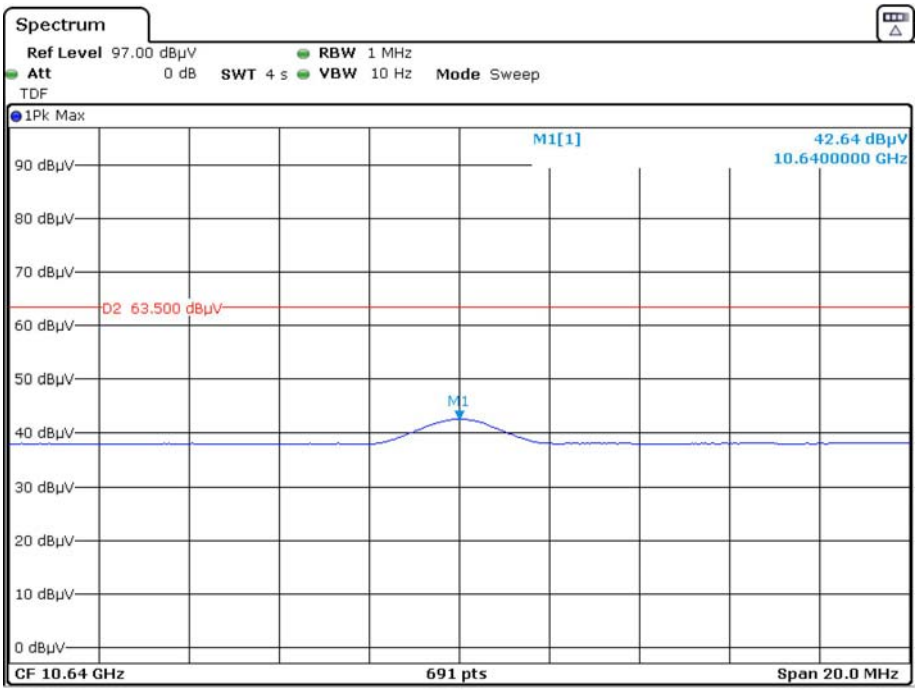


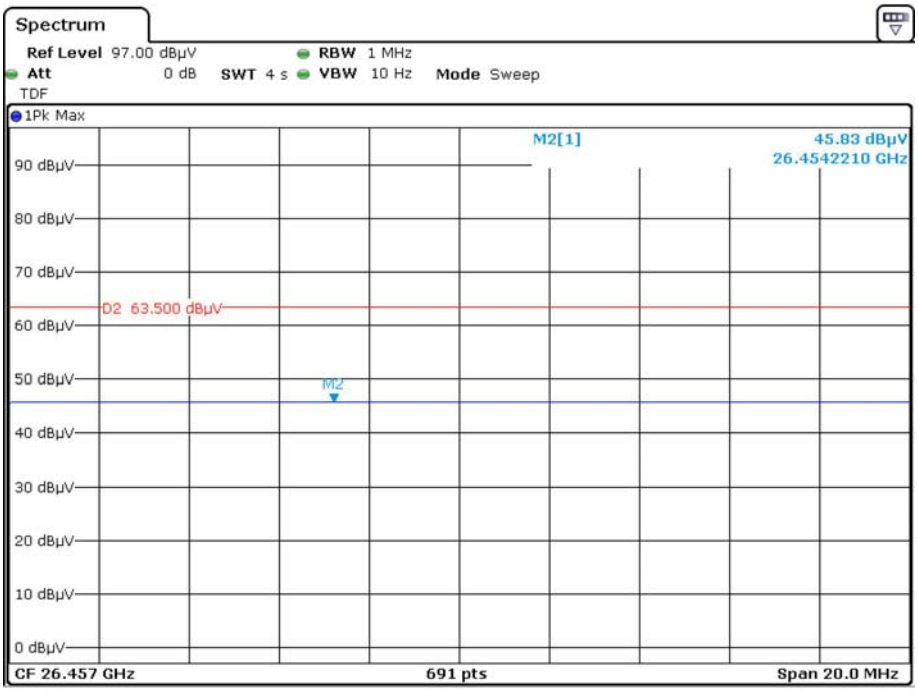
Date: 20.MAR.2020 17:32:07

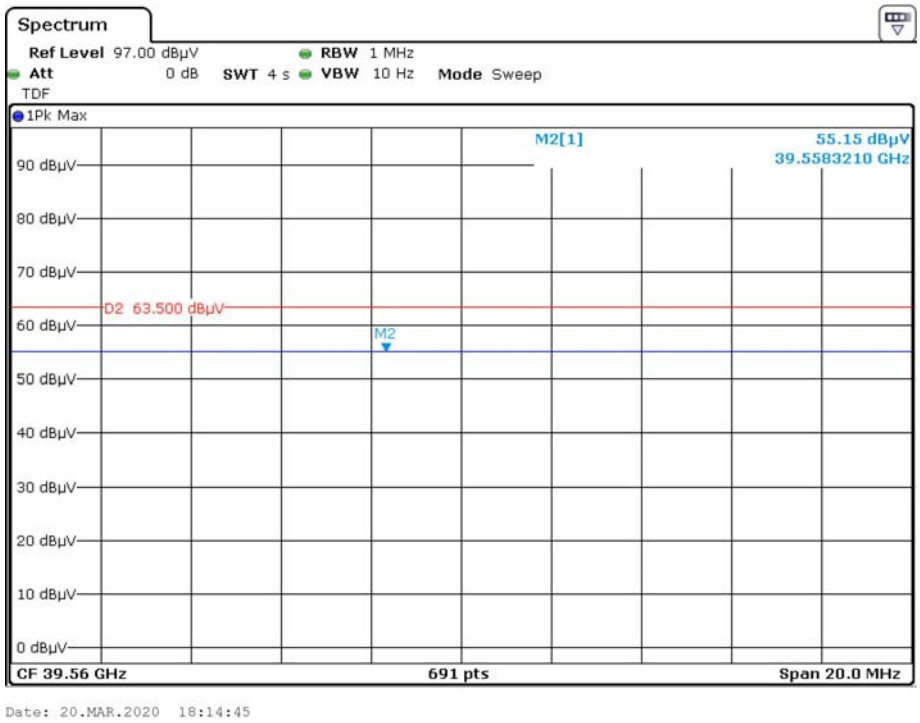


Date: 20.MAR.2020 18:06:40

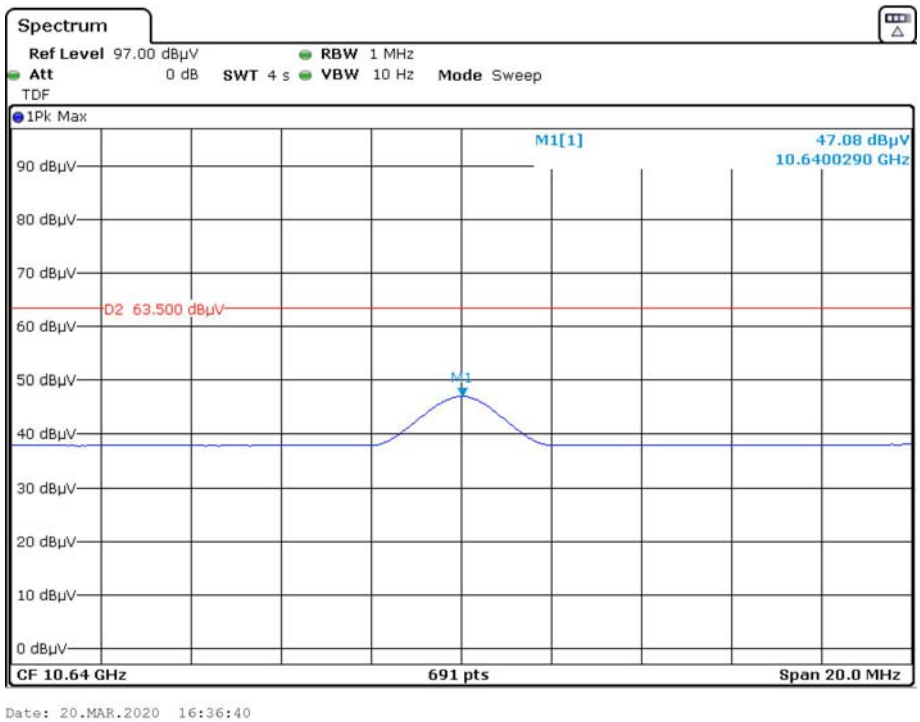
Pre-scan with 802.11a 5320MHz, for Average
Horizontal

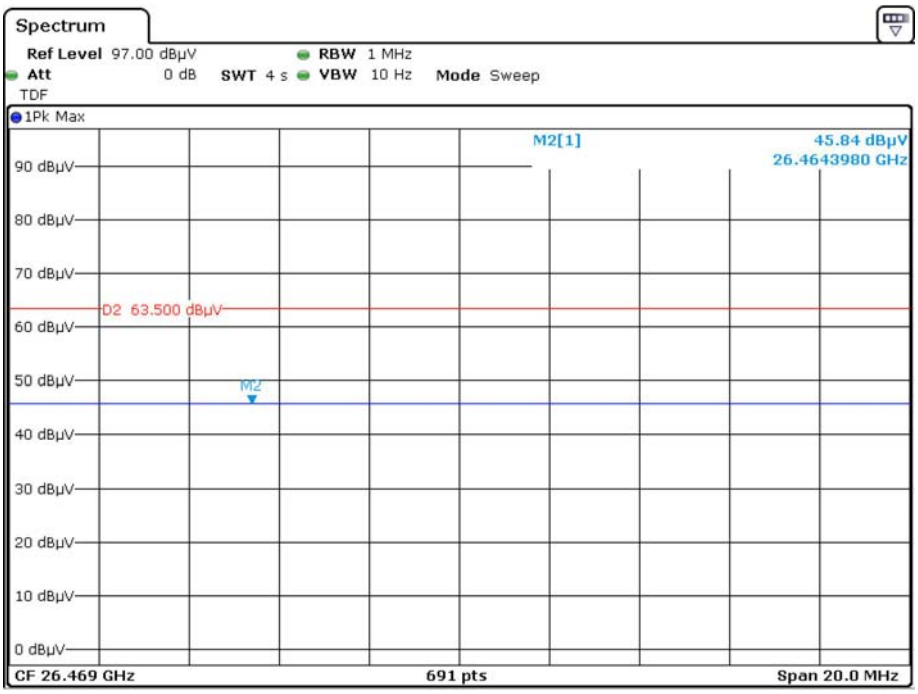




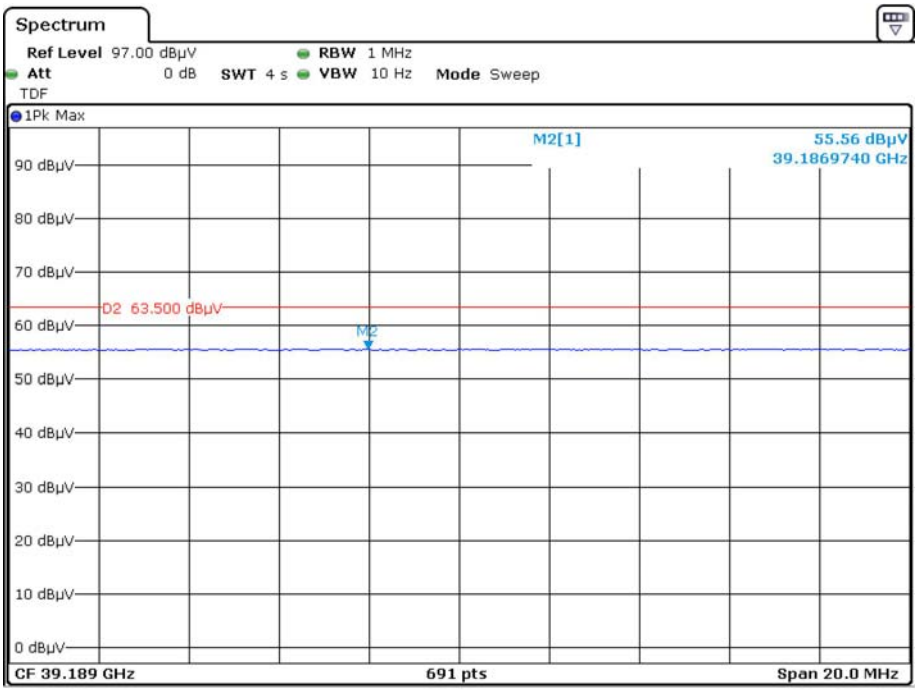

Spectrum
Ref Level 97.00 dBµV
RBW 1 MHz
Att 0 dB
SWT 4 s
VBW 10 Hz
Mode Sweep
TDF
1Pk Max
M2[1]
55.15 dBµV
39.5583210 GHz
90 dBµV
80 dBµV
70 dBµV
D2 63.500 dBµV
60 dBµV
M2
50 dBµV
40 dBµV
30 dBµV
20 dBµV
10 dBµV
0 dBµV
CF 39.56 GHz
691 pts
Span 20.0 MHz
Date: 20.MAR.2020 18:14:45

Vertical


Spectrum
Ref Level 97.00 dBµV
RBW 1 MHz
Att 0 dB
SWT 4 s
VBW 10 Hz
Mode Sweep
TDF
1Pk Max
M1[1]
47.08 dBµV
10.6400290 GHz
90 dBµV
80 dBµV
70 dBµV
D2 63.500 dBµV
60 dBµV
50 dBµV
M1
40 dBµV
30 dBµV
20 dBµV
10 dBµV
0 dBµV
CF 10.64 GHz
691 pts
Span 20.0 MHz
Date: 20.MAR.2020 16:36:40



Date: 20.MAR.2020 17:35:36



Date: 20.MAR.2020 18:09:13

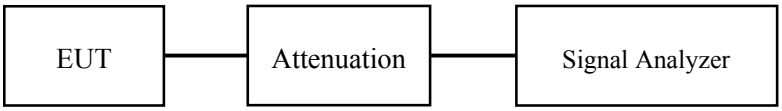
FCC §15.407(a) (1) – 26 dB EMISSION BANDWIDTH

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.

Test Procedure

1. Emission Bandwidth (EBW)
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) 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%.



Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by George Zhong from 2020-03-26 to 2020-03-27.

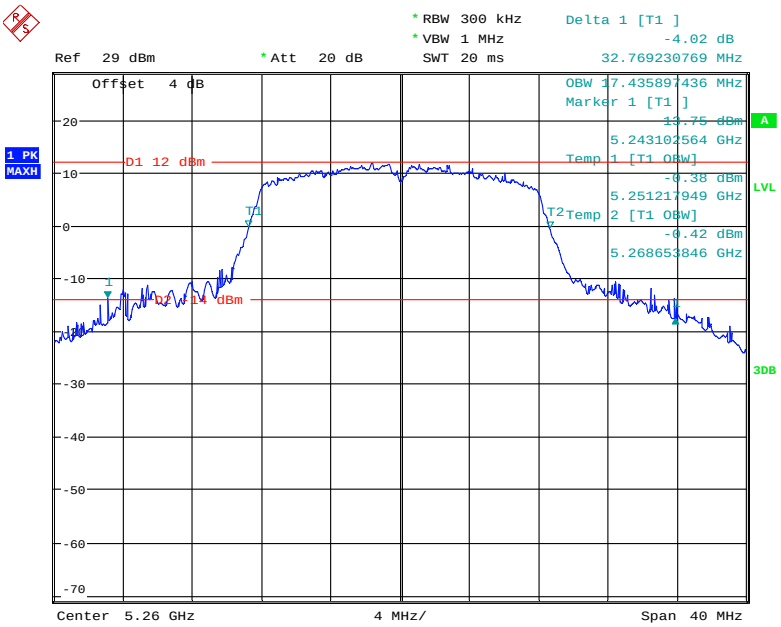
EUT operation mode: Transmitting (Antenna 0 was the worst case)

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

5250 MHz - 5350 MHz:

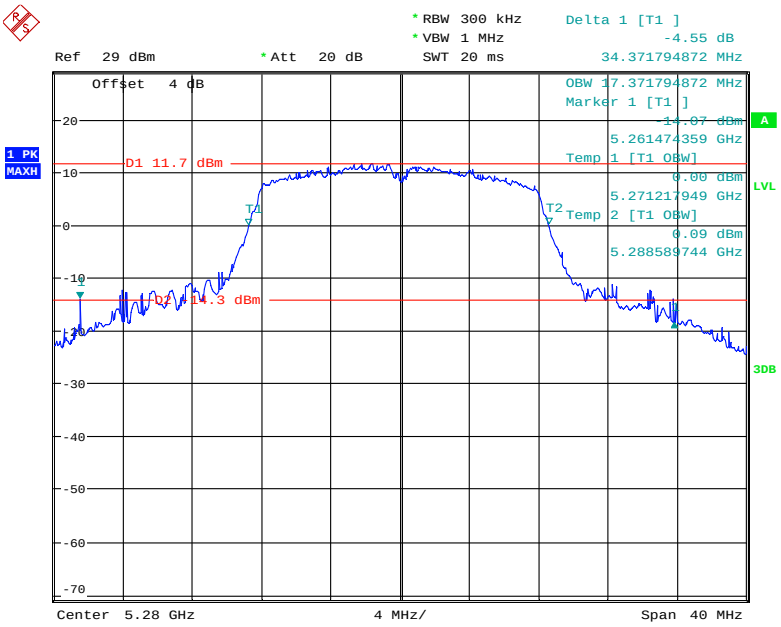
Frequency (MHz)	Antenna Port	26dB Bandwidth (MHz)	99% Bandwidth (MHz)
802.11a			
5260	Chain 0	32.77	17.44
5280	Chain 0	34.37	17.37
5320	Chain 0	23.81	16.99
802.11n20			
5260	Chain 0	27.74	18.01
5280	Chain 0	27.94	17.95
5320	Chain 0	27.68	17.95
802.11n40			
5270	Chain 0	49.74	36.54
5310	Chain 0	47.00	36.41
802.11ac20			
5260	Chain 0	27.74	18.01
5280	Chain 0	27.81	17.95
5320	Chain 0	23.45	17.95
802.11ac40			
5270	Chain 0	44.95	36.41
5310	Chain 0	43.54	36.41
802.11ac80			
5290	Chain 0	82.05	75.38

802.11a mode, 26 dB Emissions & 99% Occupied Bandwidth, 5260 MHz



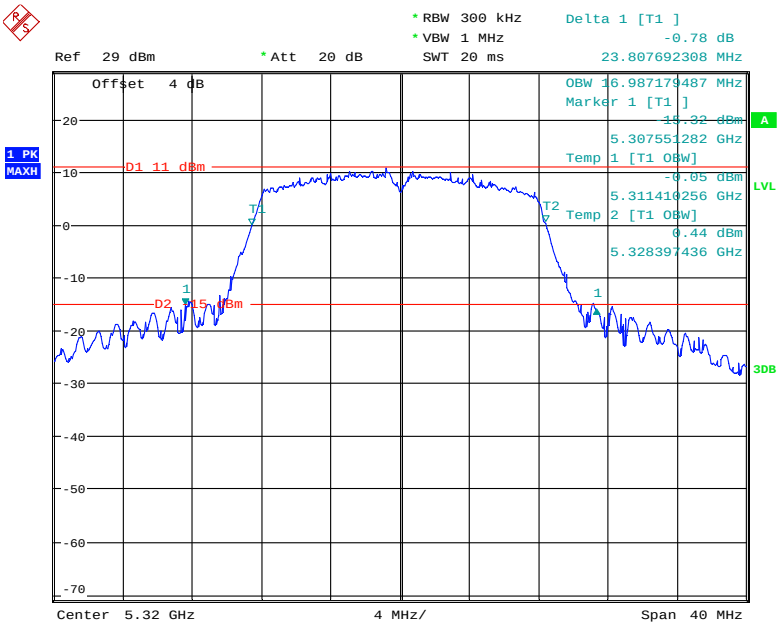
Date: 27.MAR.2020 00:27:11

802.11a mode, 26 dB Emissions & 99% Occupied Bandwidth, 5280 MHz



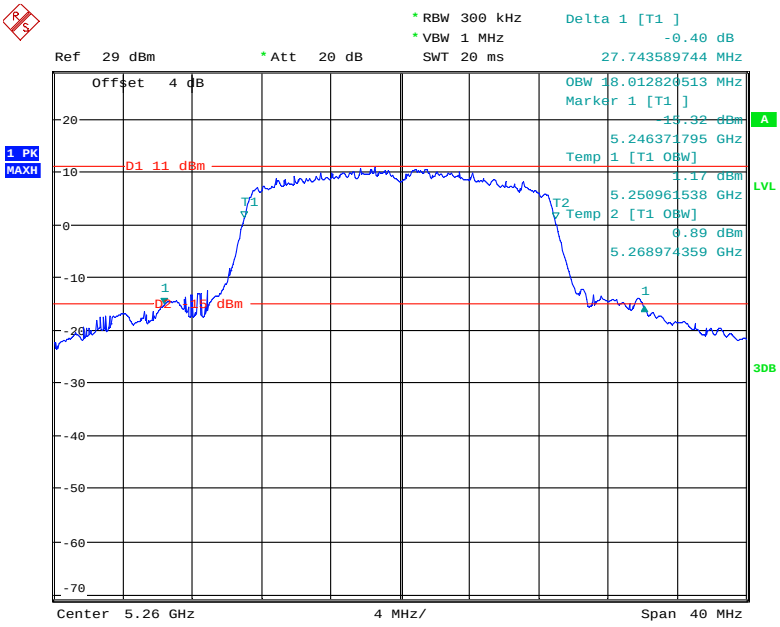
Date: 27.MAR.2020 00:35:27

802.11a mode, 26 dB Emissions & 99% Occupied Bandwidth, 5320 MHz



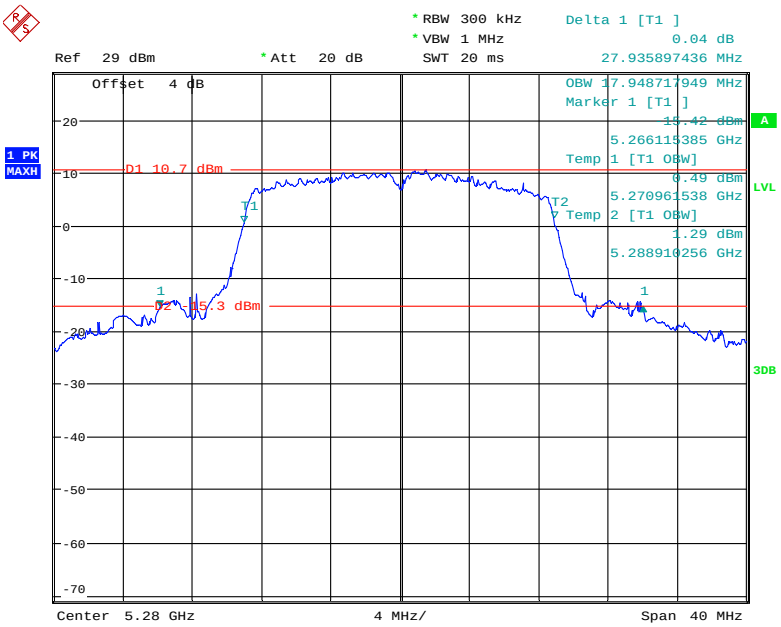
Date: 27.MAR.2020 00:36:46

802.11n20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5260 MHz



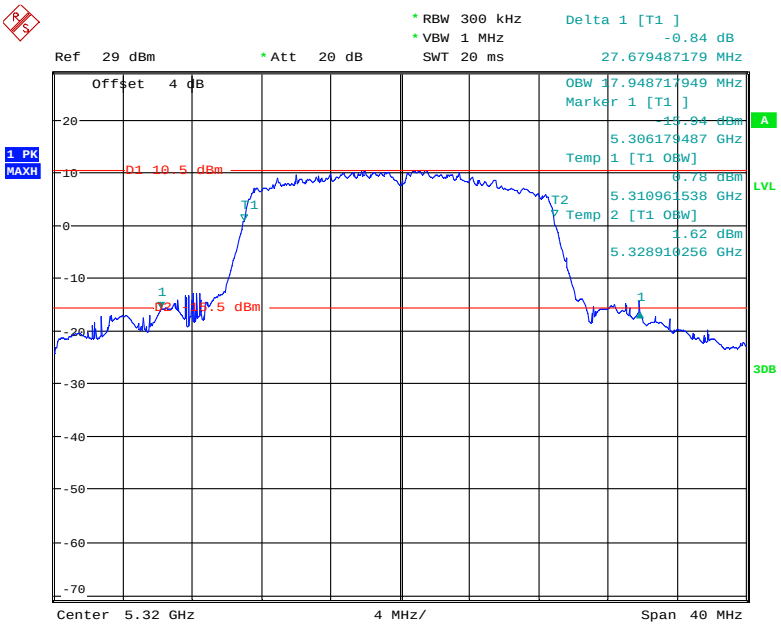
Date: 27.MAR.2020 00:29:39

802.11n20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5280 MHz



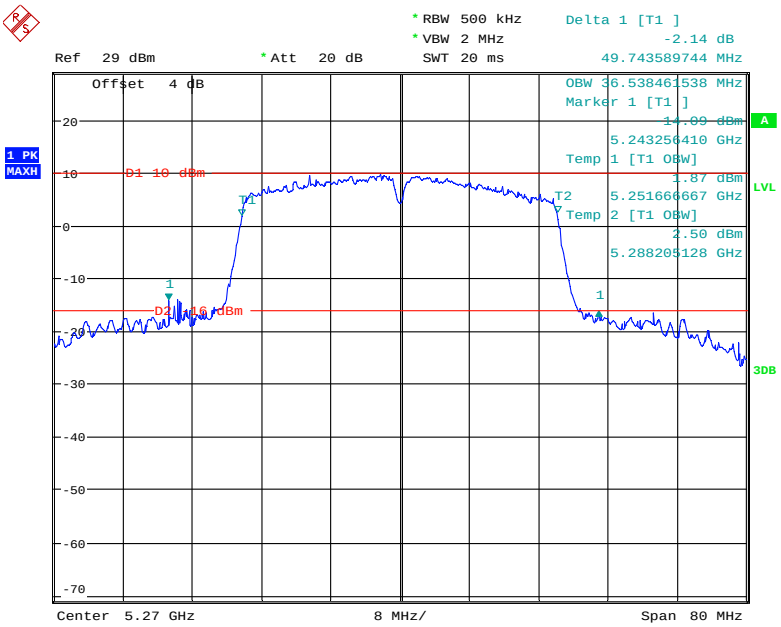
Date: 27.MAR.2020 00:34:05

802.11n20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5320 MHz



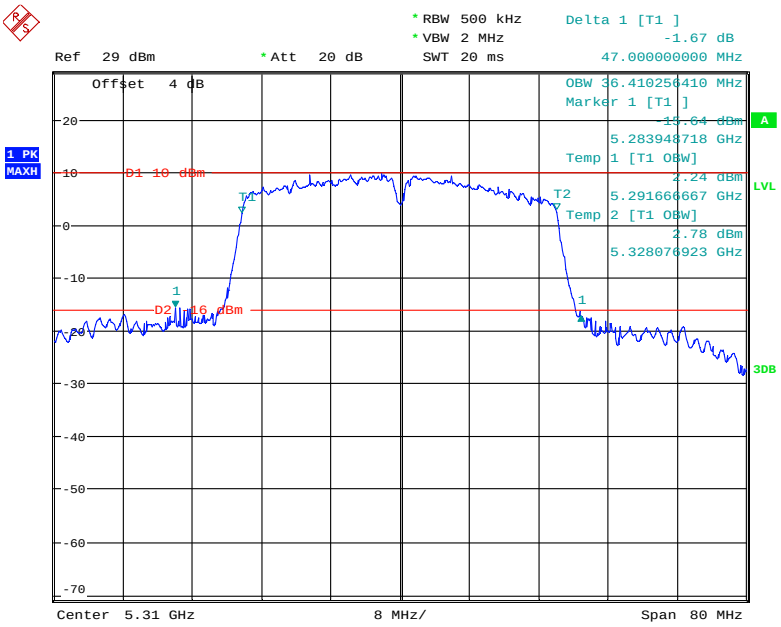
Date: 27.MAR.2020 00:38:04

802.11n40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5270 MHz



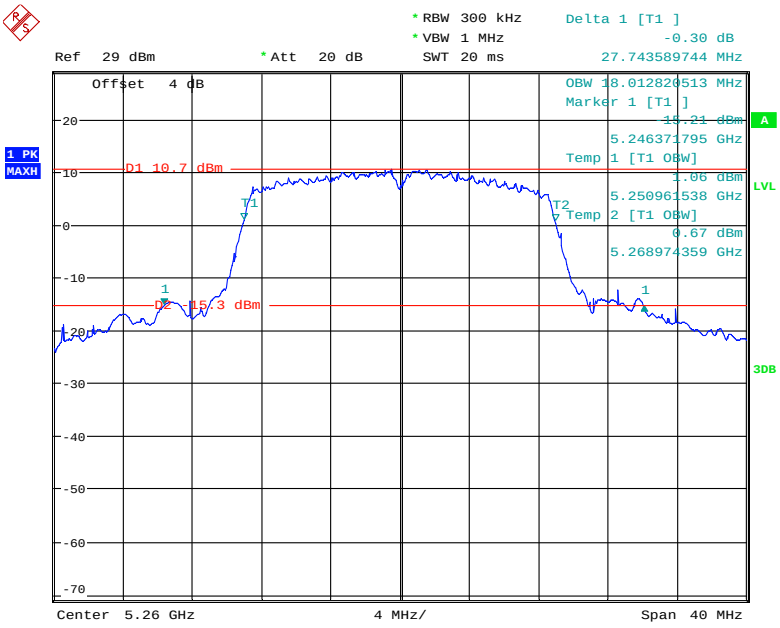
Date: 26.MAR.2020 23:49:37

802.11n40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5310 MHz



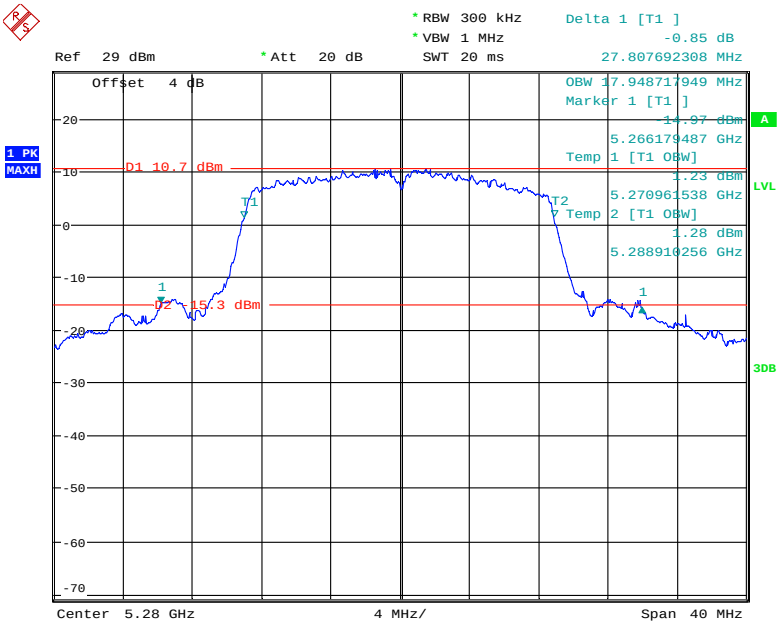
Date: 26.MAR.2020 23:50:29

802.11ac20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5260 MHz



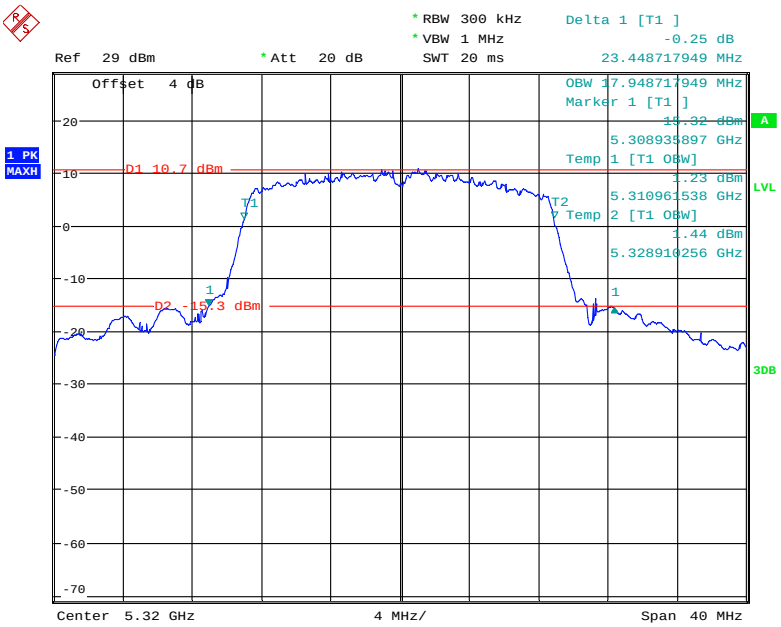
Date: 27.MAR.2020 00:31:14

802.11ac20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5280 MHz



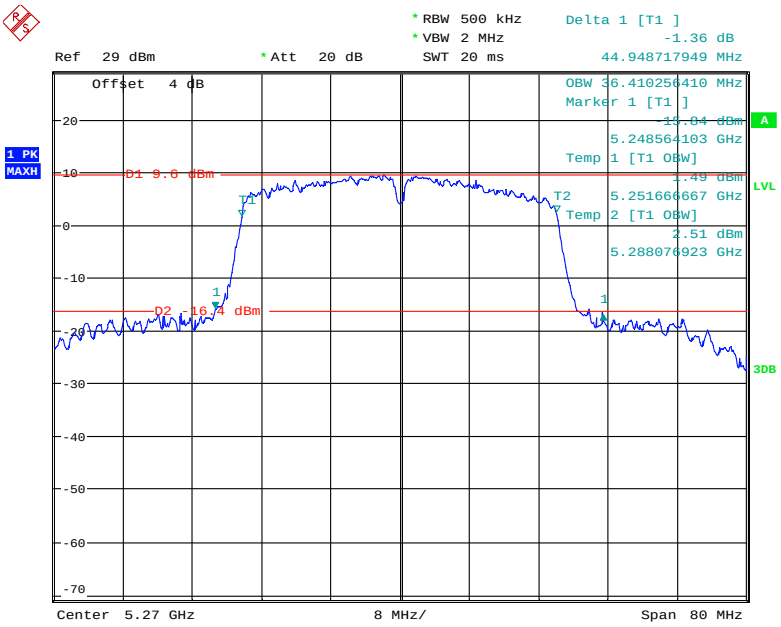
Date: 27.MAR.2020 00:33:16

802.11ac20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5320 MHz



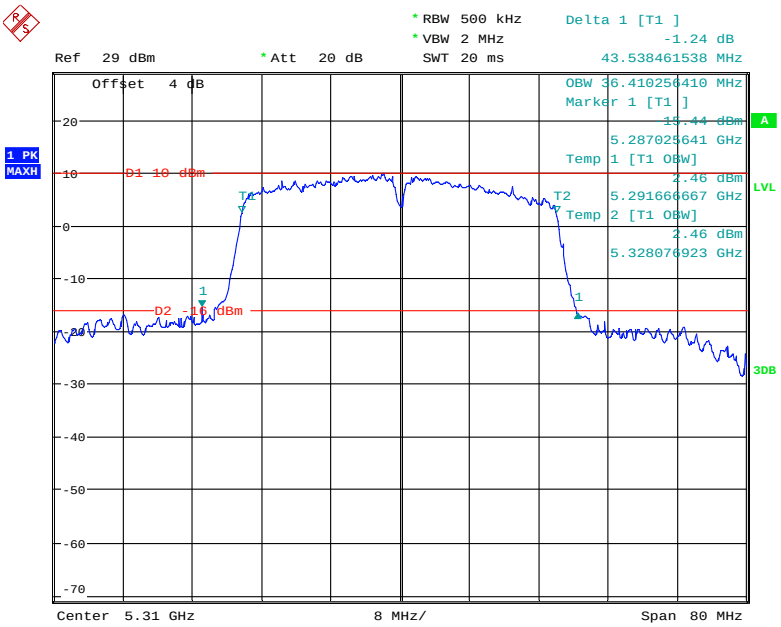
Date: 27.MAR.2020 00:39:07

802.11ac40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5270 MHz



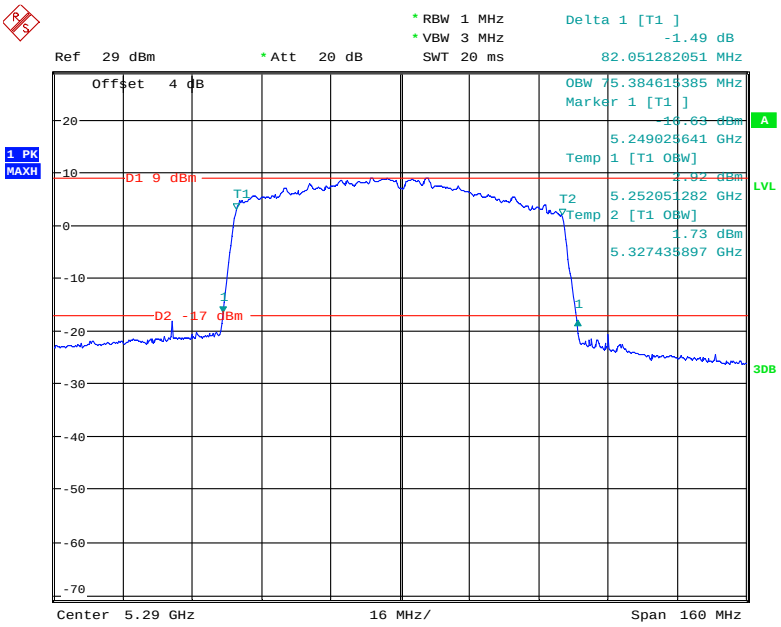
Date: 26.MAR.2020 23:47:51

802.11ac40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5310 MHz



Date: 26.MAR.2020 23:51:21

802.11ac80 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5290 MHz

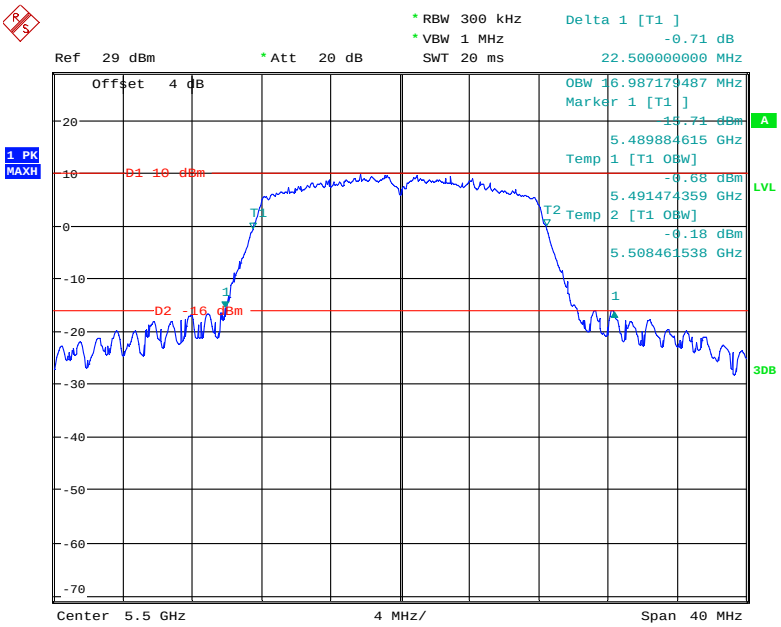


Date: 26.MAR.2020 23:52:51

5470 MHz – 5725 MHz:

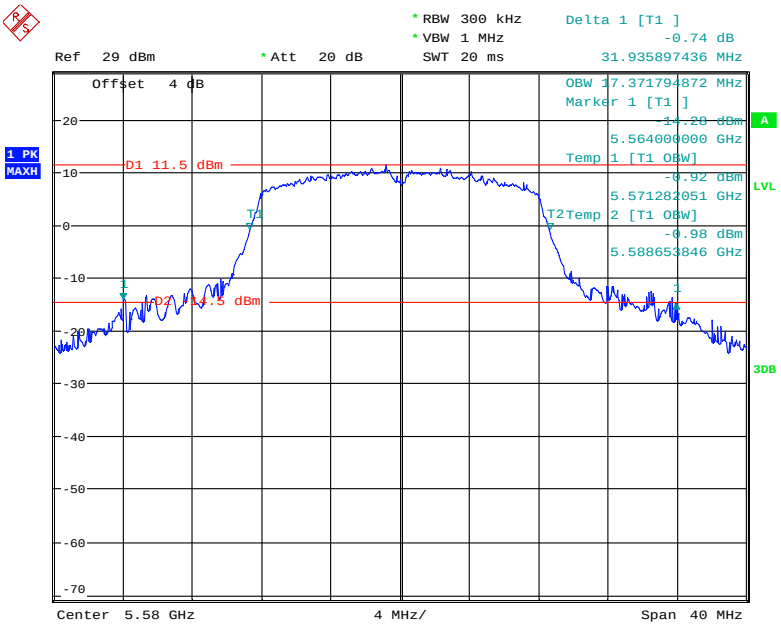
Frequency (MHz)	Antenna Port	26dB bandwidth (MHz)	99% Bandwidth (MHz)
802.11a			
5500	Chain 0	22.50	16.99
5580	Chain 0	31.94	17.37
5700	Chain 0	30.62	17.18
802.11n20			
5500	Chain 0	28.23	17.88
5580	Chain 0	27.83	18.01
5700	Chain 0	33.37	18.40
802.11n40			
5510	Chain 0	42.95	36.41
5550	Chain 0	47.69	36.41
5670	Chain 0	67.08	36.92
802.11ac20			
5500	Chain 0	26.18	17.95
5580	Chain 0	27.83	18.01
5700	Chain 0	34.27	18.53
802.11ac40			
5510	Chain 0	46.15	36.41
5550	Chain 0	46.15	36.41
5670	Chain 0	67.33	36.92
802.11ac80			
5530	Chain 0	82.05	75.38
5610	Chain 0	124.31	75.90

802.11a mode, 26 dB Emissions & 99% Occupied Bandwidth, 5500 MHz



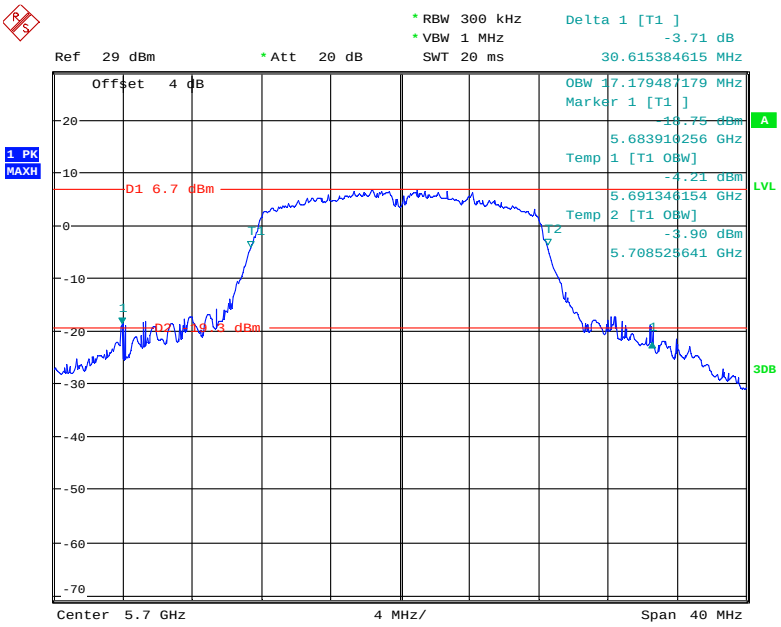
Date: 27.MAR.2020 00:12:18

802.11a mode, 26 dB Emissions & 99% Occupied Bandwidth, 5580 MHz



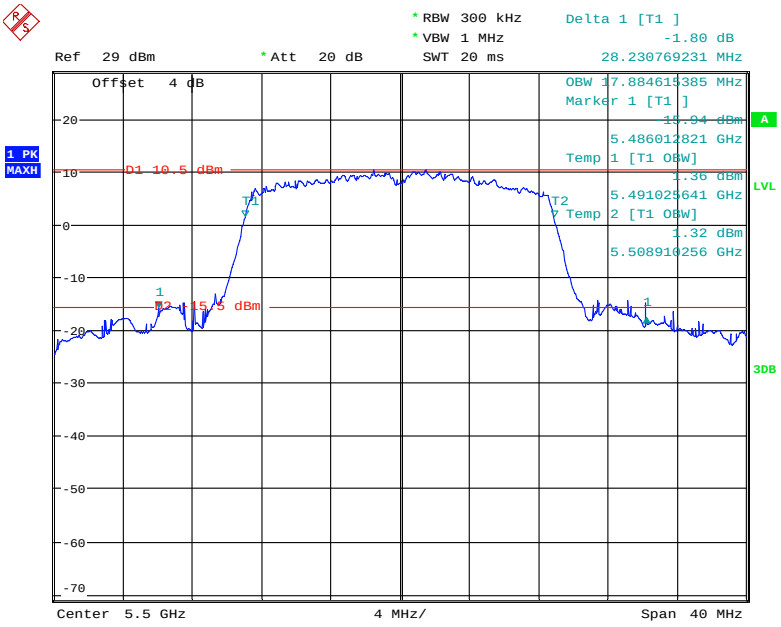
Date: 27.MAR.2020 00:14:49

802.11a mode, 26 dB Emissions & 99% Occupied Bandwidth, 5700 MHz



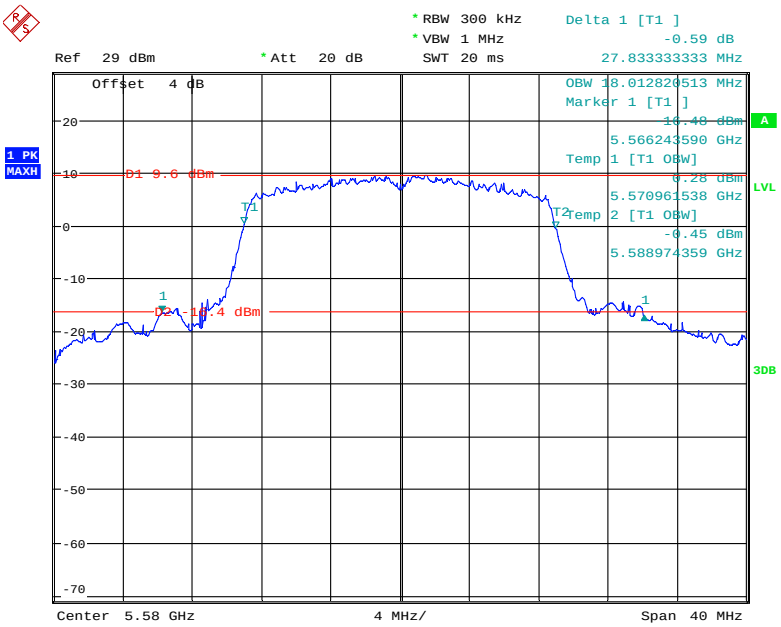
Date: 27.MAR.2020 00:24:23

802.11n20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5500 MHz



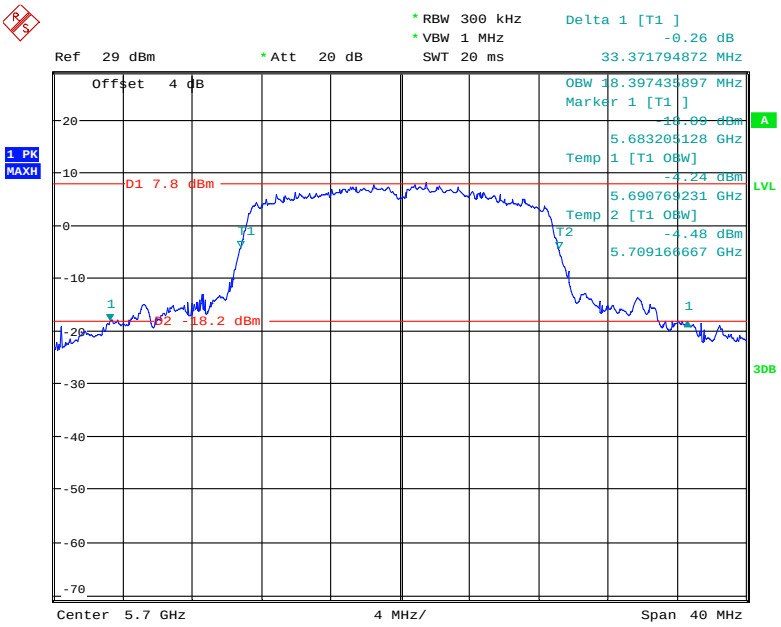
Date: 27.MAR.2020 00:10:30

802.11n20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5580 MHz



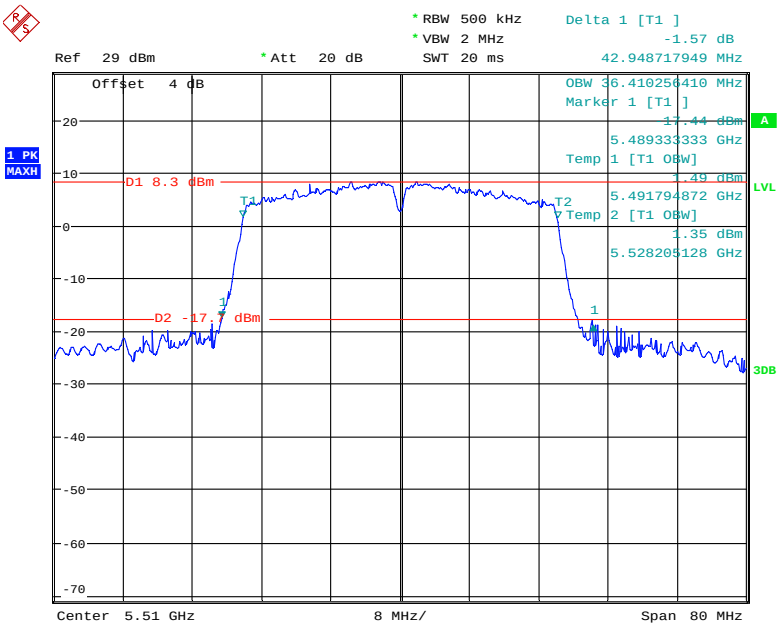
Date: 27.MAR.2020 00:16:28

802.11n20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5700 MHz



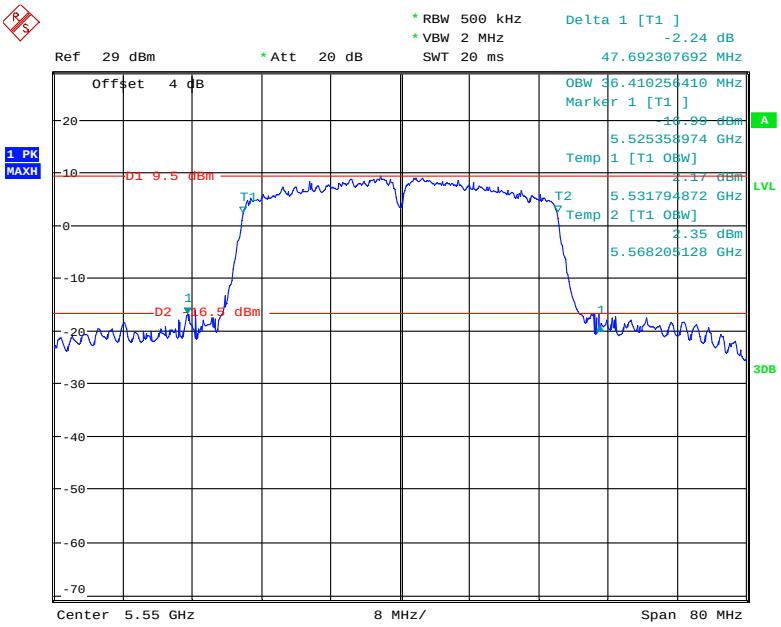
Date: 27.MAR.2020 00:22:52

802.11n40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5510 MHz



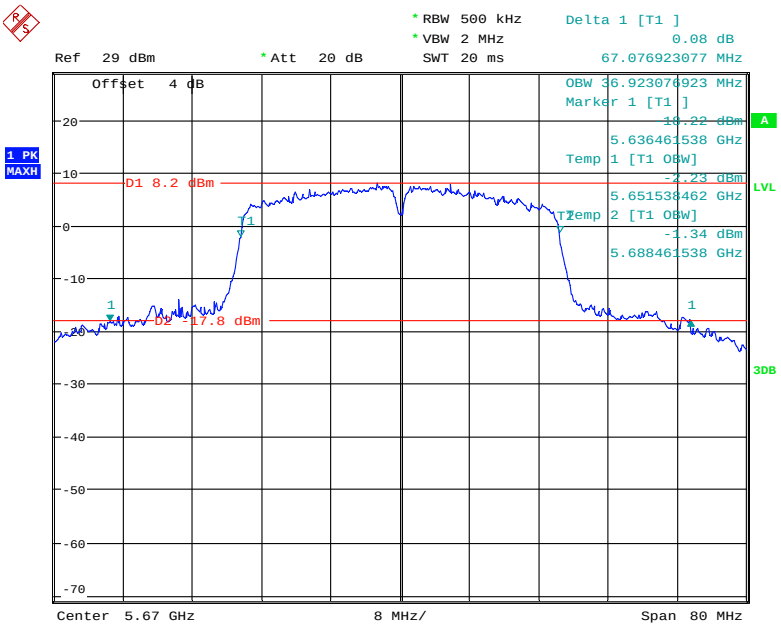
Date: 26.MAR.2020 23:56:39

802.11n40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5550 MHz



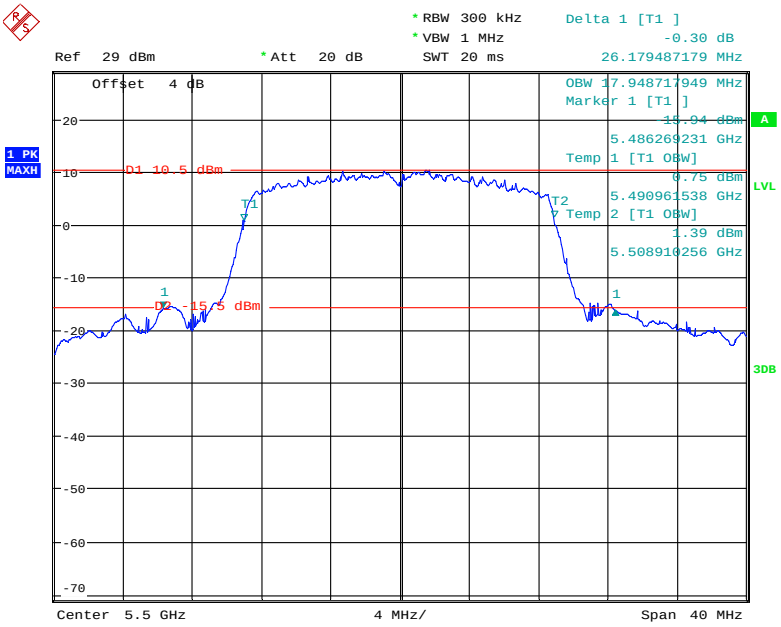
Date: 27.MAR.2020 00:00:51

802.11 n40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5670 MHz



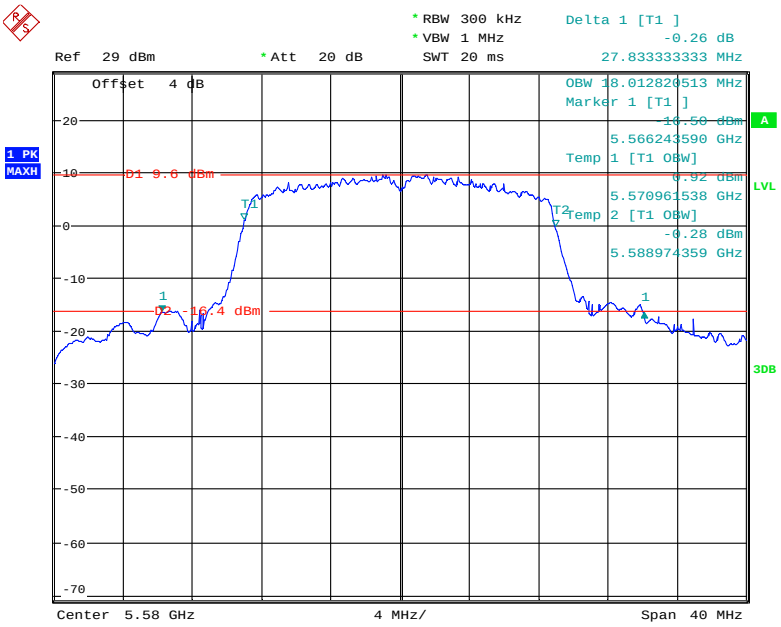
Date: 27.MAR.2020 00:04:09

802.11ac20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5500 MHz



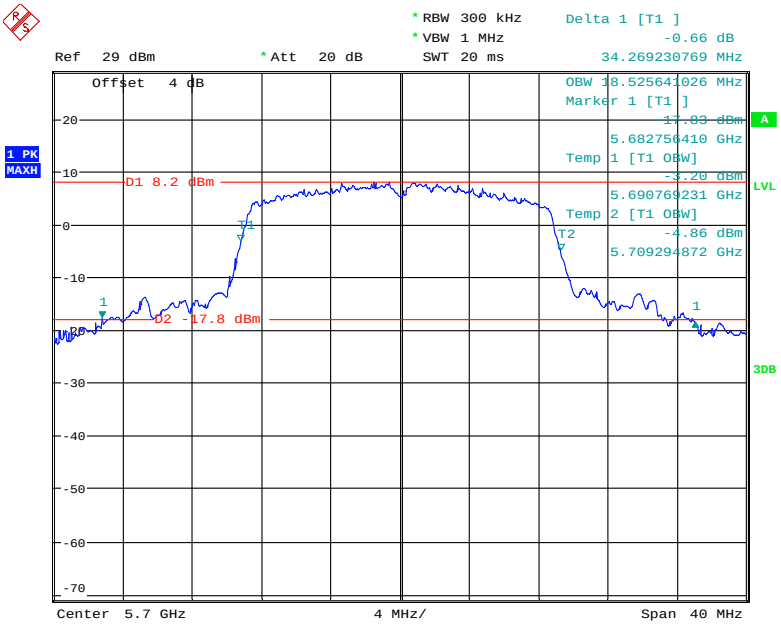
Date: 27.MAR.2020 00:08:29

802.11ac20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5580 MHz



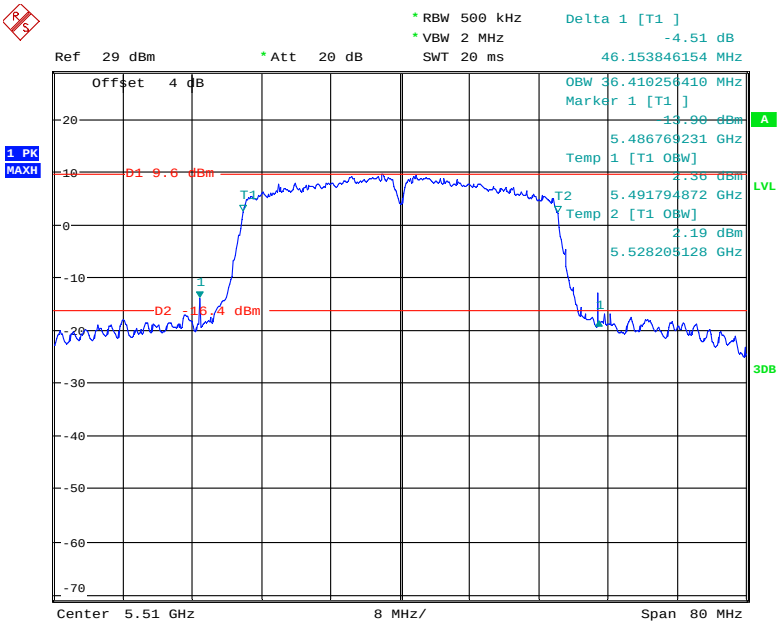
Date: 27.MAR.2020 00:17:25

802.11ac20 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5700 MHz



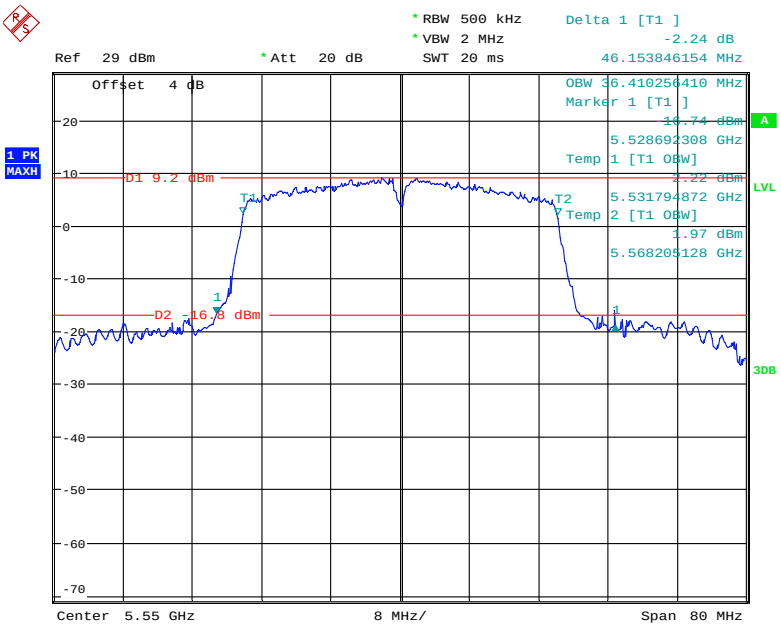
Date: 27.MAR.2020 00:19:49

802.11ac40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5510 MHz



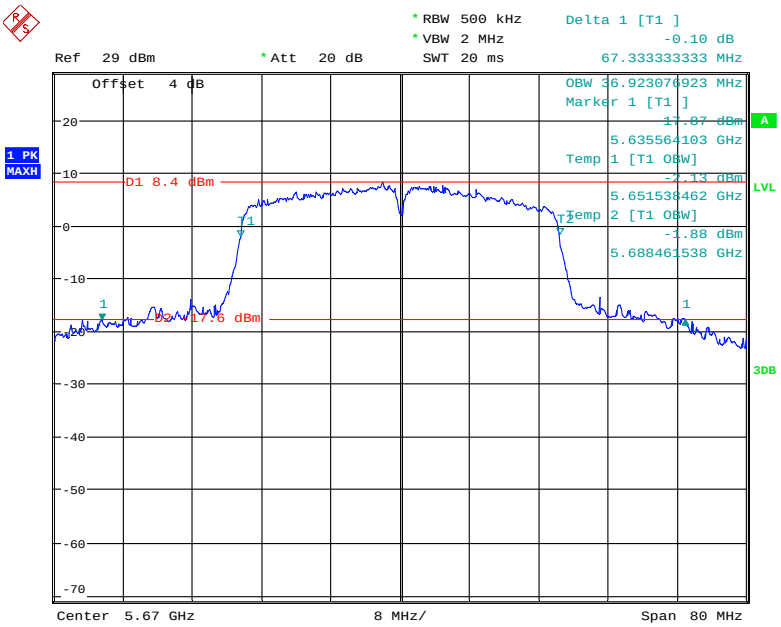
Date: 26.MAR.2020 23:57:55

802.11ac40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5550 MHz



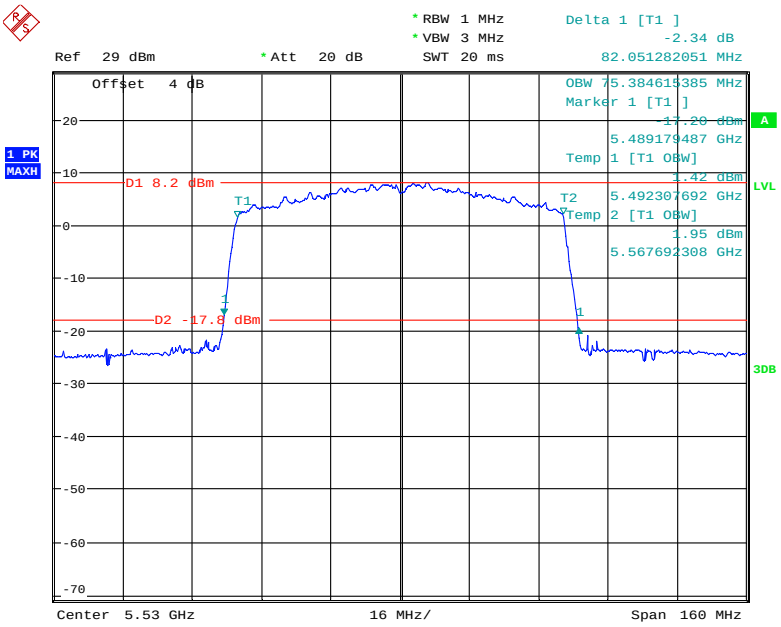
Date: 26.MAR.2020 23:59:40

802.11ac40 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5670 MHz



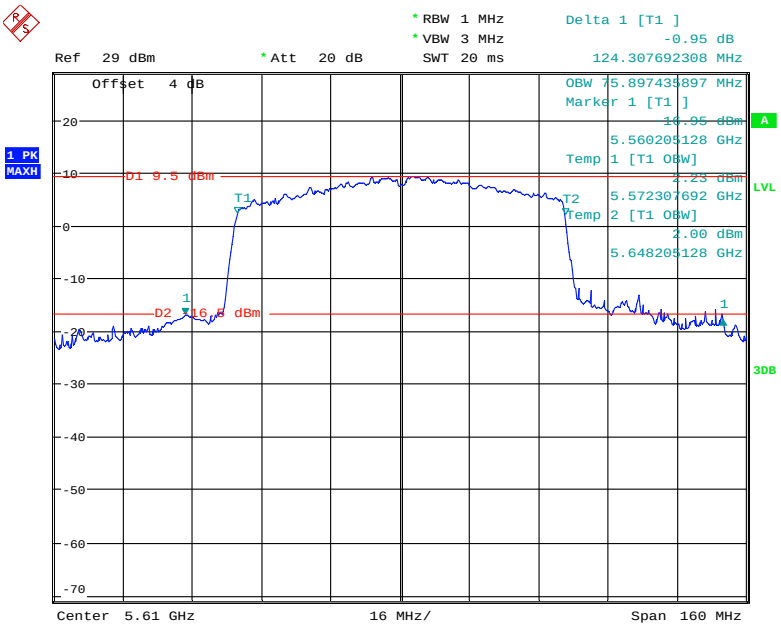
Date: 27.MAR.2020 00:05:49

802.11ac80 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5530 MHz



Date: 26.MAR.2020 23:31:24

802.11ac80 mode, 26 dB Emissions & 99% Occupied Bandwidth, 5610 MHz



Date: 26.MAR.2020 23:33:18

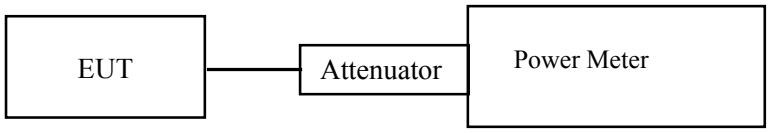
FCC §15.407(a) (2) – CONDUCTED TRANSMITTER OUTPUT POWER

Applicable Standard

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. 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.

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:	25~26 ℃
Relative Humidity:	52~55 %
ATM Pressure:	101.0 kPa

The testing was performed by George Zhong from 2020-03-27 to 2020-04-16.

EUT operation mode: Transmitting

For Beam-Forming mode:
Directional gain = Array gain+Ant gain=10*log(Nant/Nss)+3.5dBi=6.5dBi>6dBi,
So $Limit_{BF}$=24-(6.5-6)dBm=23.5dBm

Test Result: Pass

Please refer to the following tables.

5250 MHz – 5350 MHz:

Frequency (MHz)	Antenna Port	Average Output Power (dBm)	Total Power (dBm)	Non-BF Limit (dBm)	BF Limit (dBm)
802.11a					
5260	0	15.54	18.38	24	23.5
	1	15.19			
5280	0	15.58	18.42		
	1	15.23			
5320	0	15.54	18.31		
	1	15.04			
802.11n20					
5260	0	15.43	18.24	24	23.5
	1	15.02			
5280	0	15.39	18.26		
	1	15.11			
5320	0	15.23	18.11		
	1	14.97			
802.11n40					
5270	0	16.79	19.88	24	23.5
	1	16.94			
5310	0	16.40	19.35		
	1	16.27			
802.11ac20					
5260	0	15.35	18.14	24	23.5
	1	14.89			
5280	0	15.34	18.03		
	1	14.68			
5320	0	15.41	18.12		
	1	14.79			
802.11ac40					
5270	0	16.66	19.74	24	23.5
	1	16.79			
5310	0	16.46	19.47		
	1	16.46			
802.11ac80					
5290	0	13.64	16.52	24	23.5
	1	13.38			

5470 MHz – 5725 MHz:

Frequency (MHz)	Antenna Port	Average Output Power (dBm)	Total Power (dBm)	Non-BF Limit (dBm)	BF Limit (dBm)
802.11a					
5500	0	14.67	17.54	24	23.5
	1	14.38			
5580	0	15.02	17.86		
	1	14.68			
5700	0	14.86	17.57		
	1	14.23			
802.11n20					
5500	0	15.52	18.34	24	23.5
	1	15.13			
5580	0	15.56	18.31		
	1	15.03			
5700	0	15.74	18.55		
	1	15.34			
802.11n40					
5510	0	16.15	19.06	24	23.5
	1	15.94			
5550	0	17.43	20.24		
	1	17.01			
5670	0	17.42	20.15		
	1	16.84			
802.11ac20					
5500	0	15.43	18.33	24	23.5
	1	15.21			
5580	0	15.56	18.40		
	1	15.21			
5700	0	15.84	18.61		
	1	15.34			
802.11ac40					
5510	0	16.62	19.35	24	23.5
	1	16.03			
5550	0	17.12	20.06		
	1	16.98			
5670	0	17.23	20.07		
	1	16.89			
802.11ac80					
5530	0	13.70	16.51	24	23.5
	1	13.28			
5610	0	15.54	18.23		
	1	14.87			

FCC §15.407(a) (2) - POWER SPECTRAL DENSITY

Applicable Standard

(ii) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. 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.

Test Procedure

For devices operating in the bands 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 ≥ 1/T, where T is defined in section II.B.l.a).
b) Set VBW ≥ 3 RBW.
c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (< 500 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 (1MHz/RBW) to the measured result, whereas RBW (< 1 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:	25~26 ℃
Relative Humidity:	52~55 %
ATM Pressure:	101.0 kPa

The testing was performed by George Zhong from 2020-03-27 to 2020-04-16.

EUT operation mode: Transmitting

For Beam-Forming:
Directional gain = Array gain+Ant gain=10*log(Nant/Nss)+3.5dBi=6.5dBi>6dBi,
So $Limit_{BF}$=11-(6.5-6)dBm/MHz=10.5dBm/MHz

Test Result: Pass

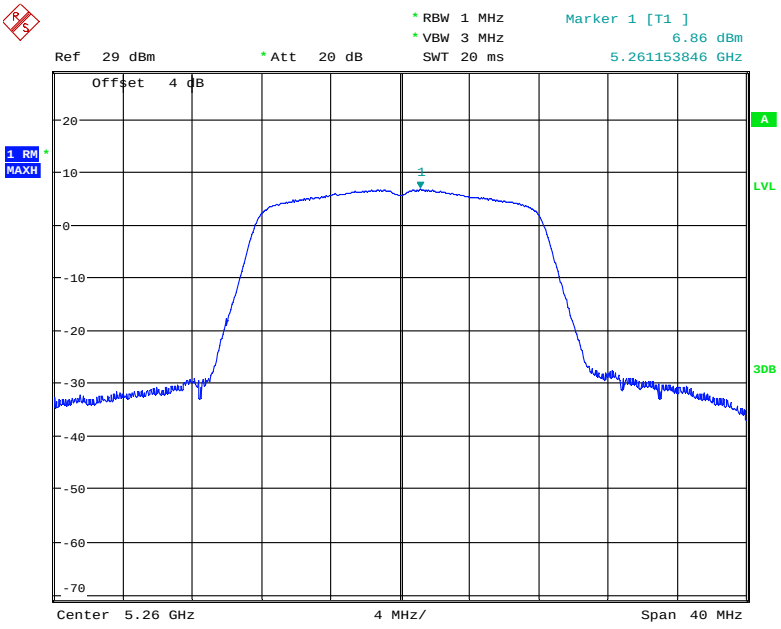
Please refer to the following tables and plots.

5250 MHz – 5350 MHz:

Frequency (MHz)	Antenna Port	Power Spectral Density (dBm/MHz)	Total Power Spectral (dBm/MHz)	Limit (dBm/MHz)
802.11a				
5260	0	6.86	9.58	10.5
	1	6.25		
5280	0	7.07	9.78	
	1	6.44		
5320	0	6.77	9.50	
	1	6.18		
802.11n20				
5260	0	6.80	9.60	10.5
	1	6.36		
5280	0	6.84	9.54	
	1	6.20		
5320	0	6.98	9.46	
	1	5.85		
802.11n40				
5270	0	5.61	8.55	10.5
	1	5.47		
5310	0	5.60	8.49	
	1	5.36		
802.11ac20				
5260	0	6.70	9.50	10.5
	1	6.27		
5280	0	6.74	9.49	
	1	6.20		
5320	0	6.88	9.41	
	1	5.85		
802.11ac40				
5270	0	5.64	8.62	10.5
	1	5.57		
5310	0	5.57	8.48	
	1	5.37		
802.11ac80				
5290	0	1.26	3.85	10.5
	1	0.37		

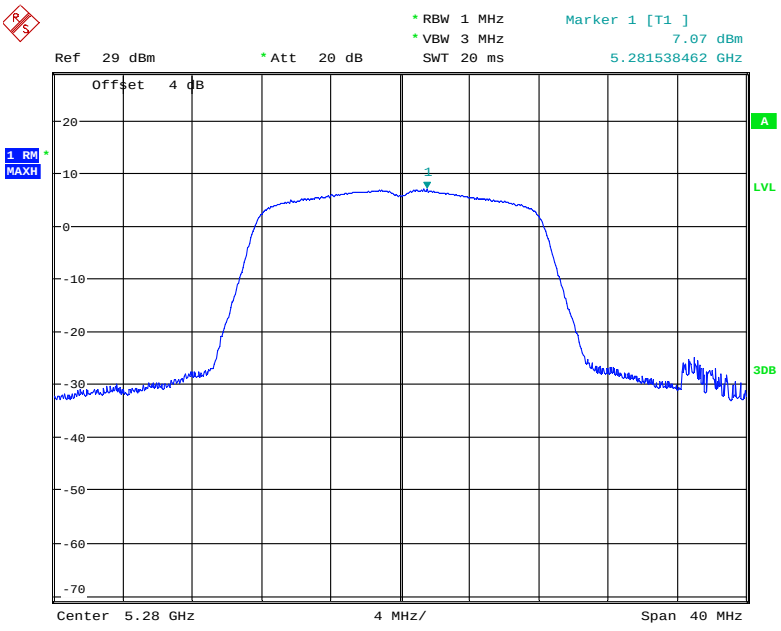
Antenna 0:

802.11a mode, Power Spectral Density, 5260 MHz



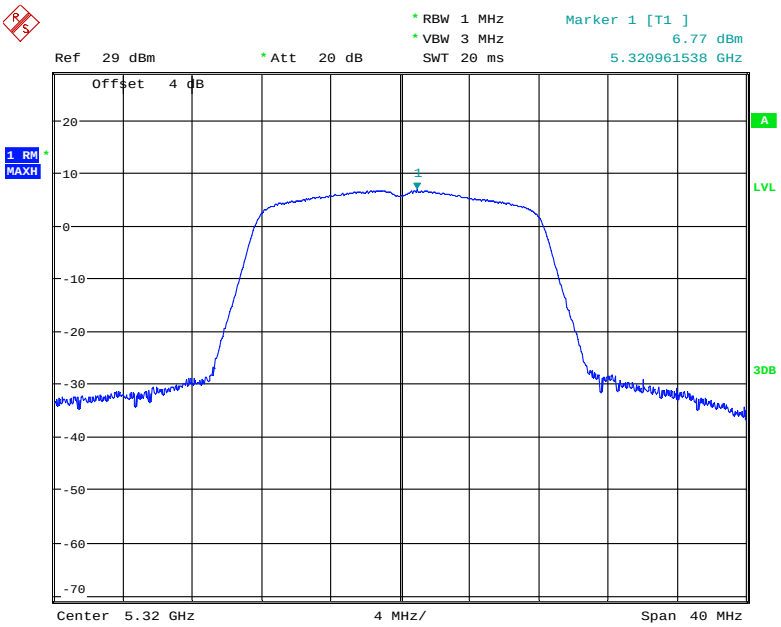
Date: 16.APR.2020 20:42:37

802.11a mode, Power Spectral Density, 5280 MHz



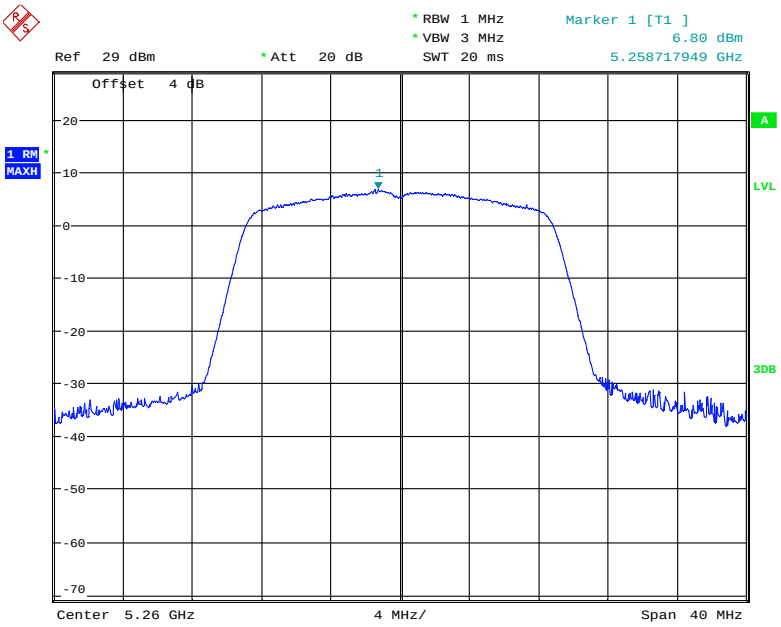
Date: 16.APR.2020 20:43:43

802.11a mode, Power Spectral Density, 5320 MHz



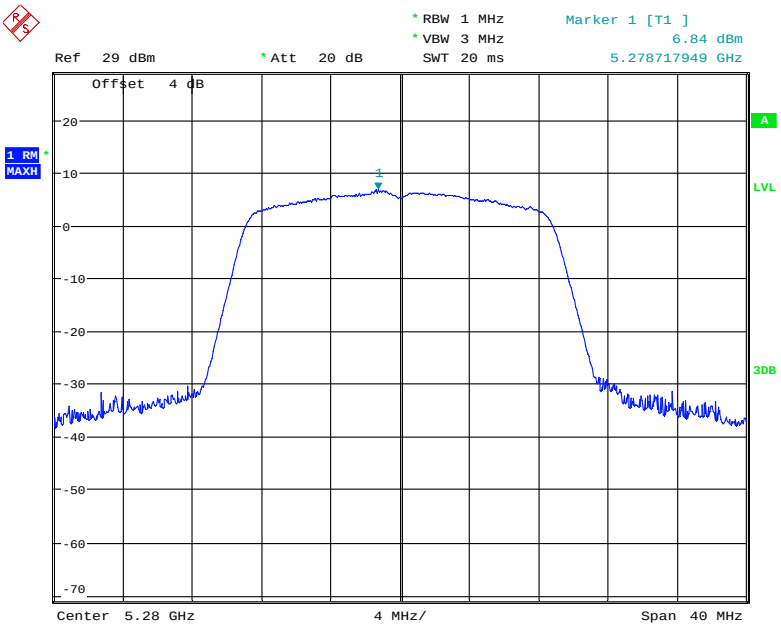
Date: 16.APR.2020 20:44:05

802.11n20 mode, Power Spectral Density, 5260 MHz



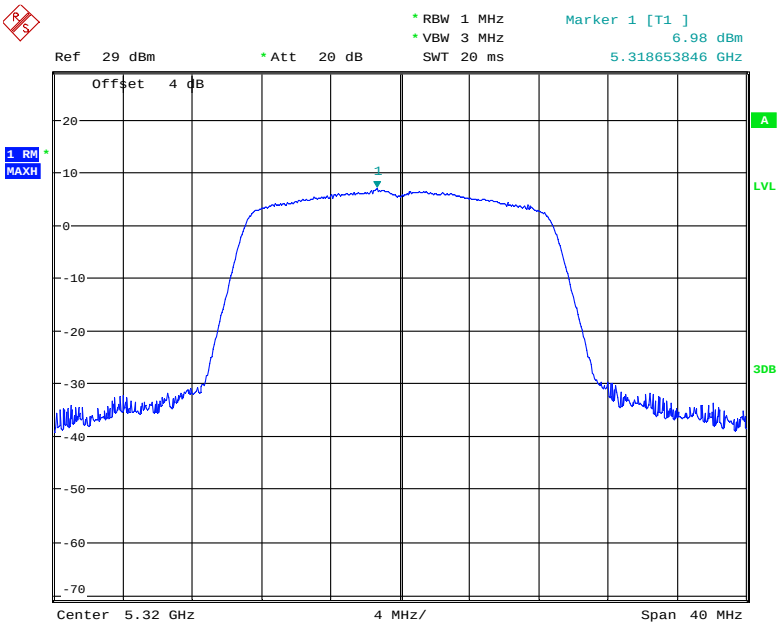
Date: 16.APR.2020 20:45:55

802.11n20 mode, Power Spectral Density, 5280 MHz



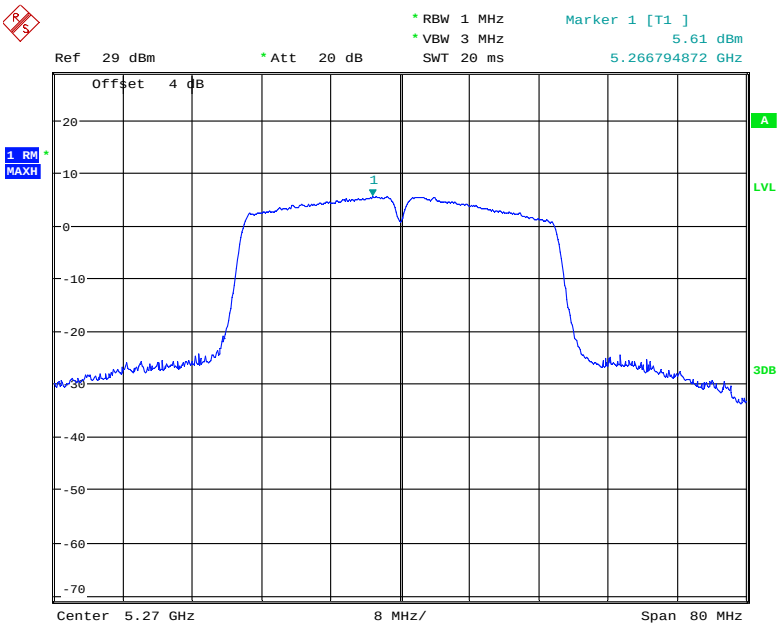
Date: 16.APR.2020 20:45:28

802.11n20 mode, Power Spectral Density, 5320 MHz



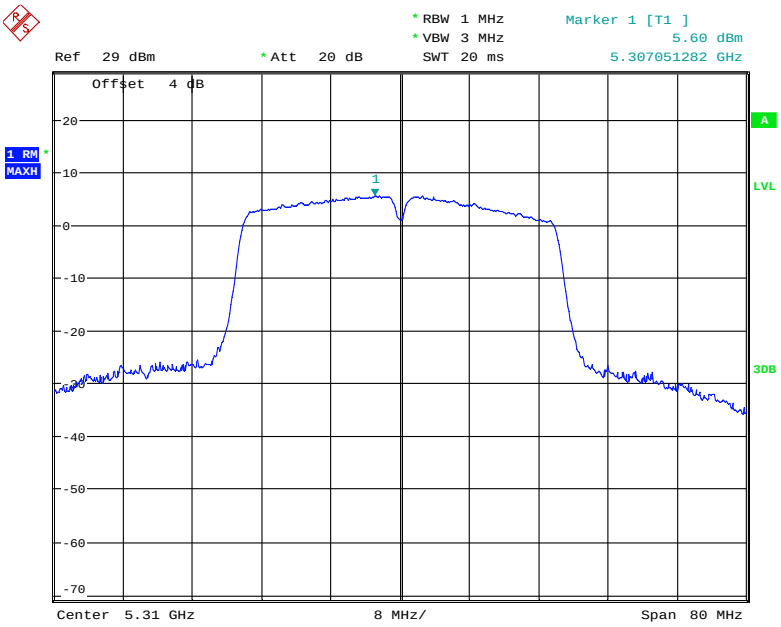
Date: 16.APR.2020 20:44:24

802.11n40 mode, Power Spectral Density, 5270 MHz



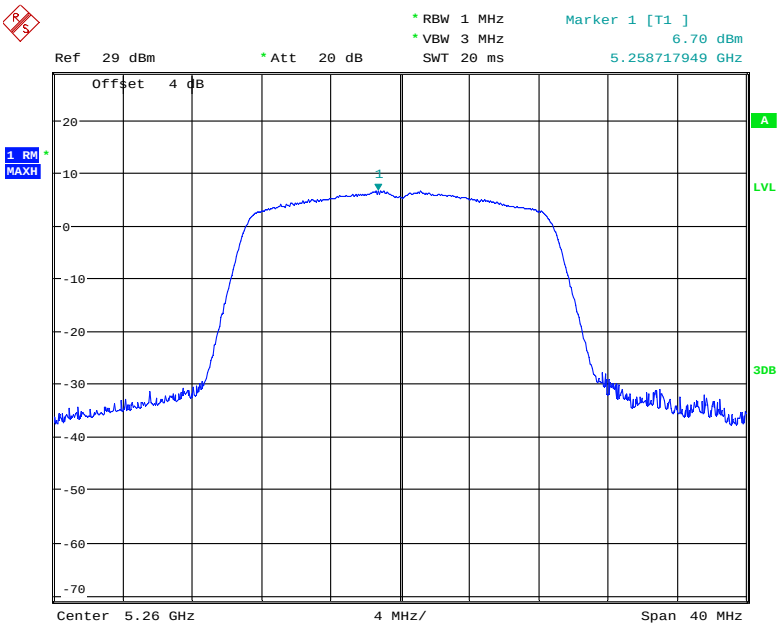
Date: 27.MAR.2020 20:18:35

802.11n40 mode, Power Spectral Density, 5310 MHz



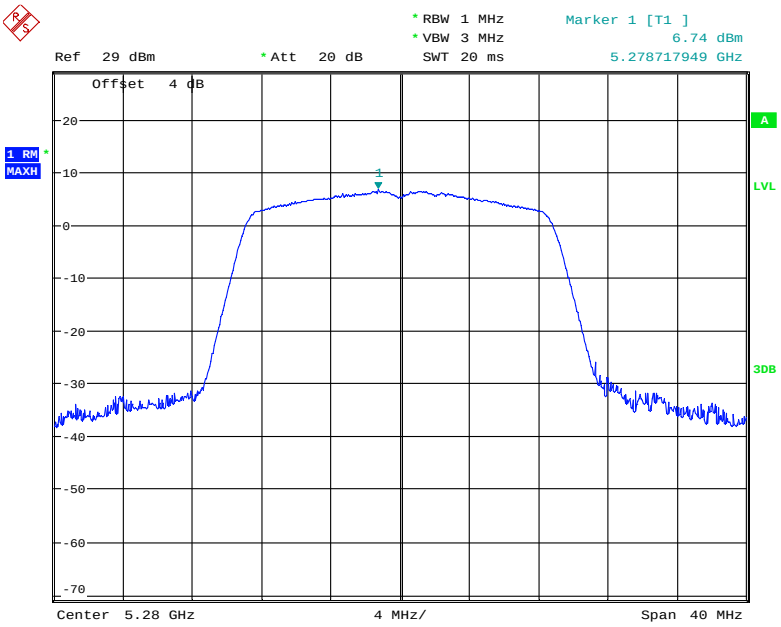
Date: 27.MAR.2020 20:18:50

802.11ac20 mode, Power Spectral Density, 5260 MHz



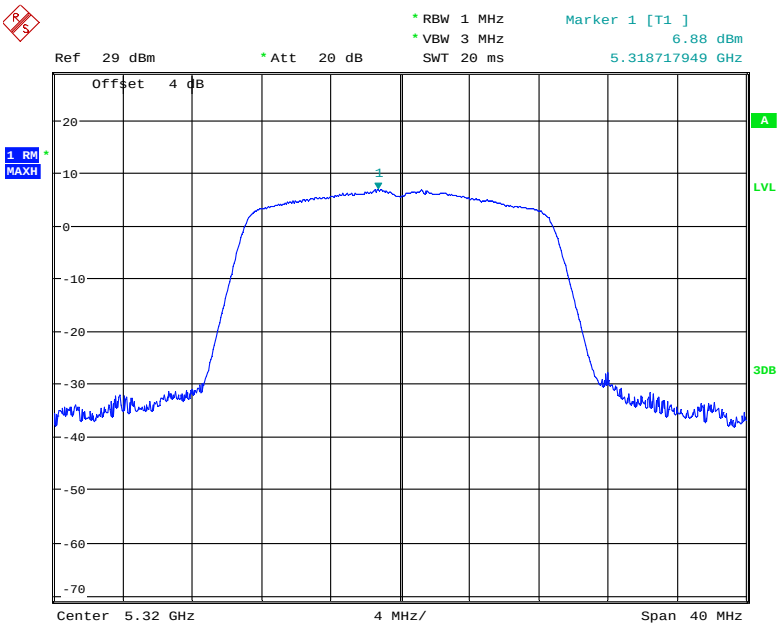
Date: 16.APR.2020 20:46:16

802. 11ac20 mode, Power Spectral Density, 5280 MHz



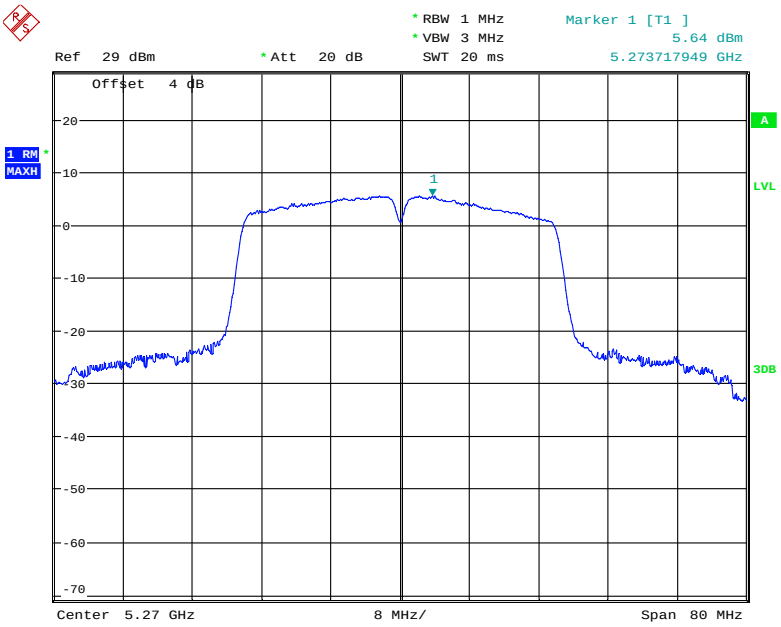
Date: 16.APR.2020 20:45:05

802. 11ac20 mode, Power Spectral Density, 5320 MHz



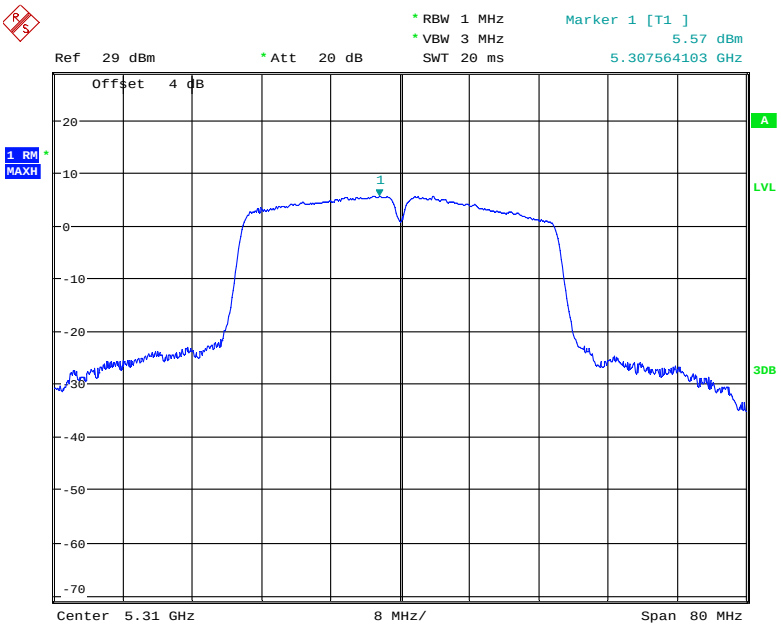
Date: 16.APR.2020 20:44:43

802. 11ac40 mode, Power Spectral Density, 5270 MHz



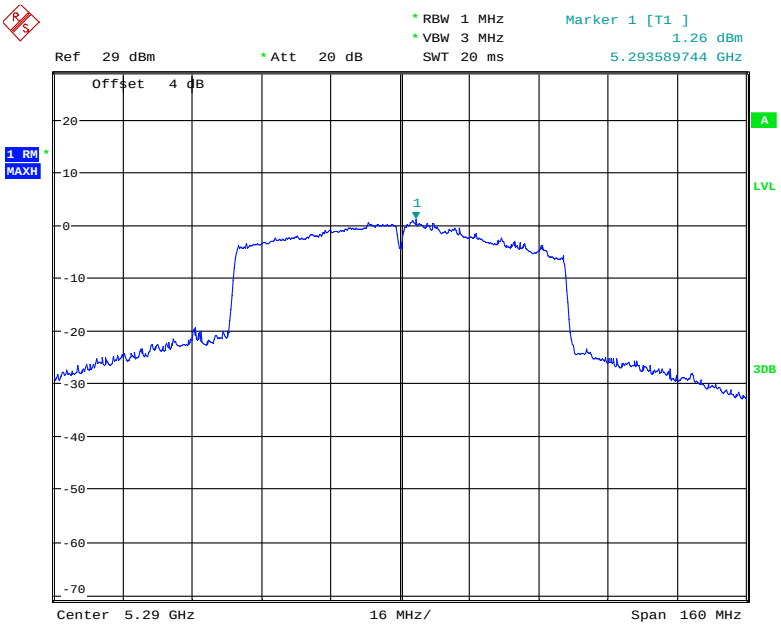
Date: 27.MAR.2020 20:17:38

802. 11ac40 mode, Power Spectral Density, 5310 MHz



Date: 27.MAR.2020 20:19:21

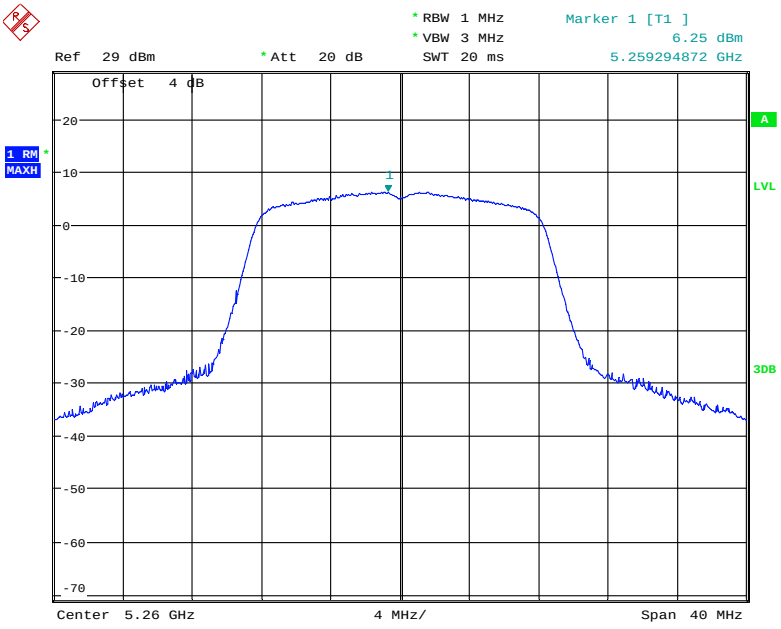
802. 11ac80 mode, Power Spectral Density, 5290 MHz



Date: 27.MAR.2020 20:16:59

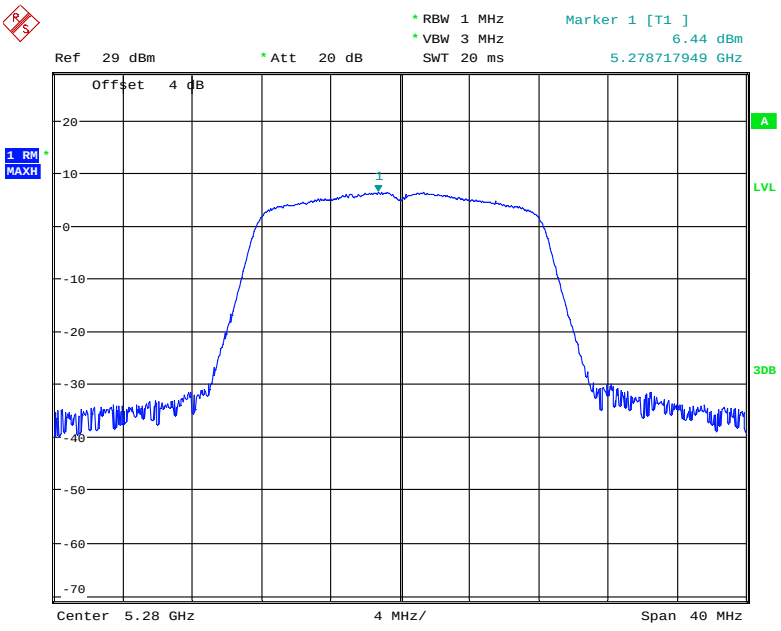
Antenna 1:

802.11a mode, Power Spectral Density, 5260 MHz



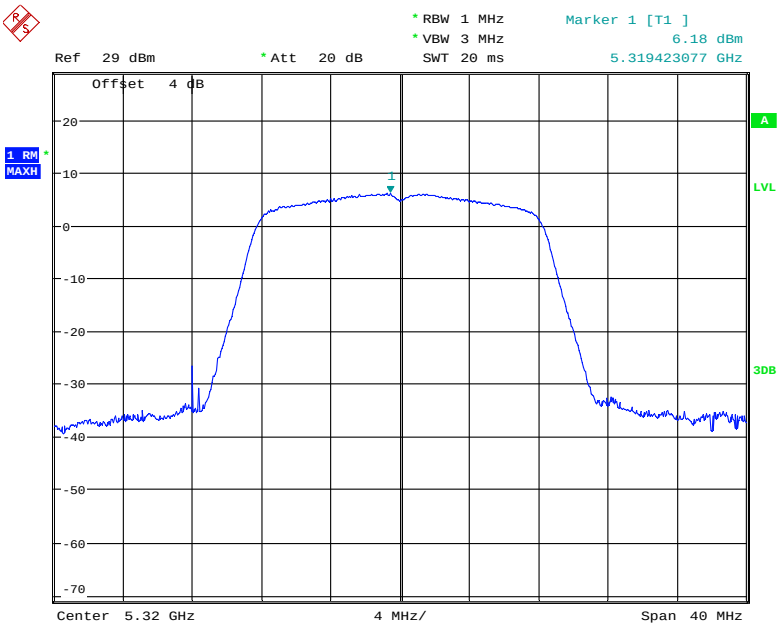
Date: 16.APR.2020 20:47:47

802.11a mode, Power Spectral Density, 5280 MHz



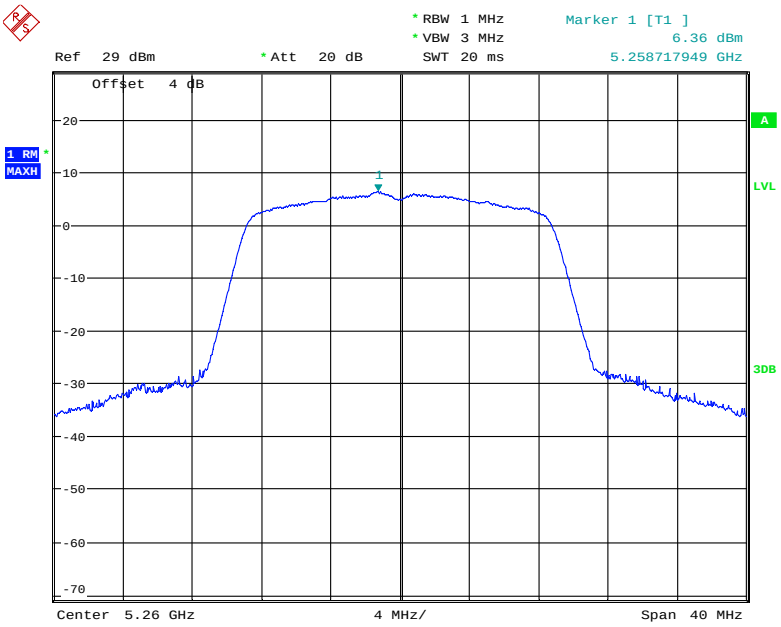
Date: 16.APR.2020 20:48:04

802.11a mode, Power Spectral Density, 5320 MHz



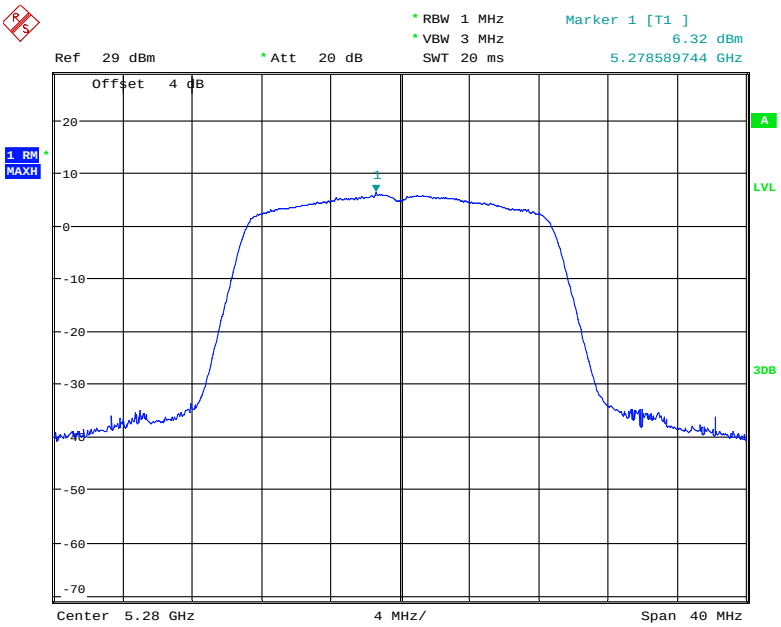
Date: 16.APR.2020 20:50:49

802.11n20 mode, Power Spectral Density, 5260 MHz



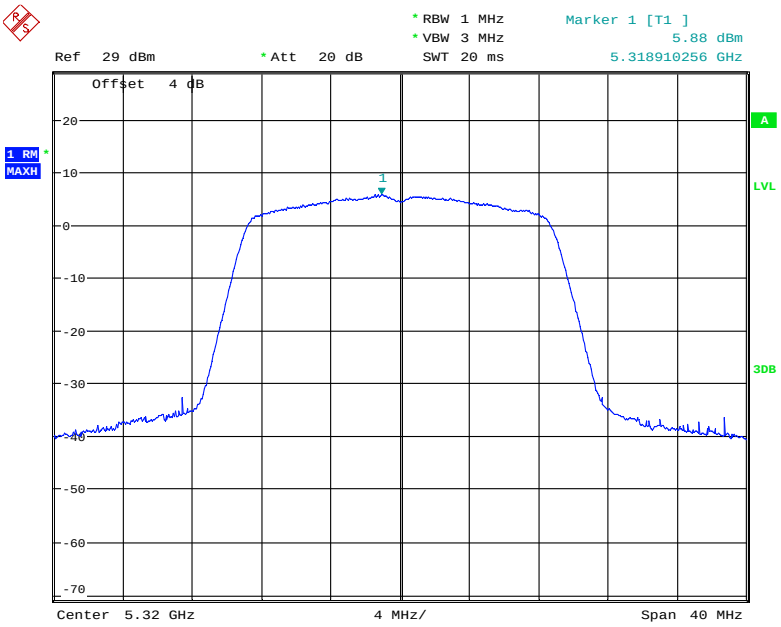
Date: 16.APR.2020 20:47:30

802.11n20 mode, Power Spectral Density, 5280 MHz



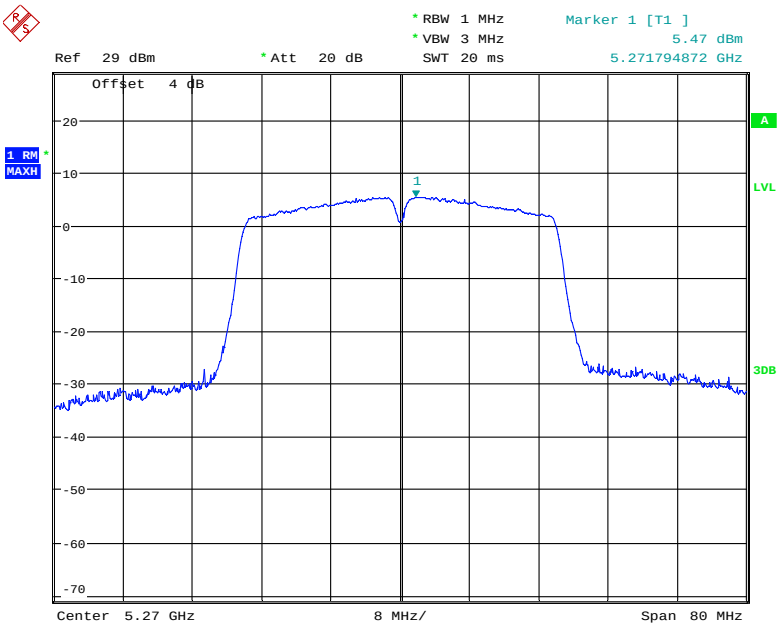
Date: 16.APR.2020 20:48:28

802.11n20 mode, Power Spectral Density, 5320 MHz



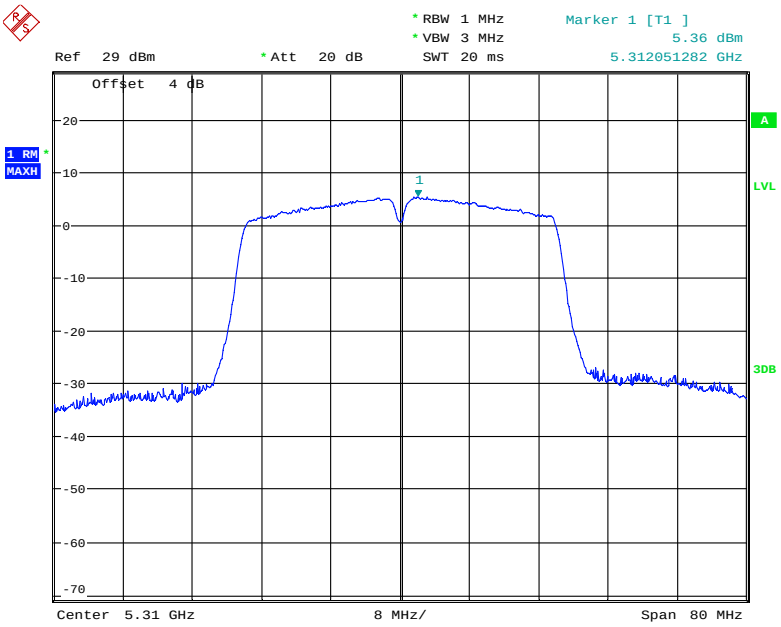
Date: 16.APR.2020 20:50:12

802.11n40 mode, Power Spectral Density, 5270 MHz



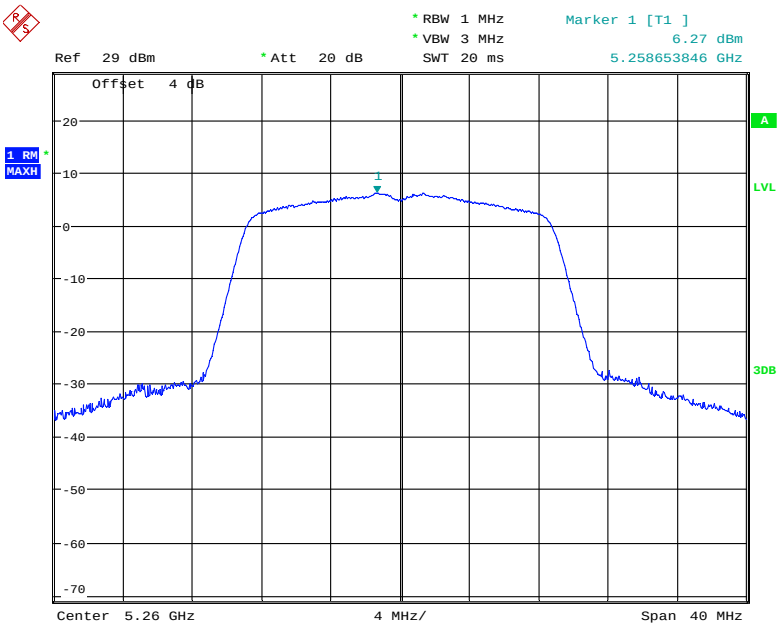
Date: 27.MAR.2020 20:13:55

802.11n40 mode, Power Spectral Density, 5310 MHz



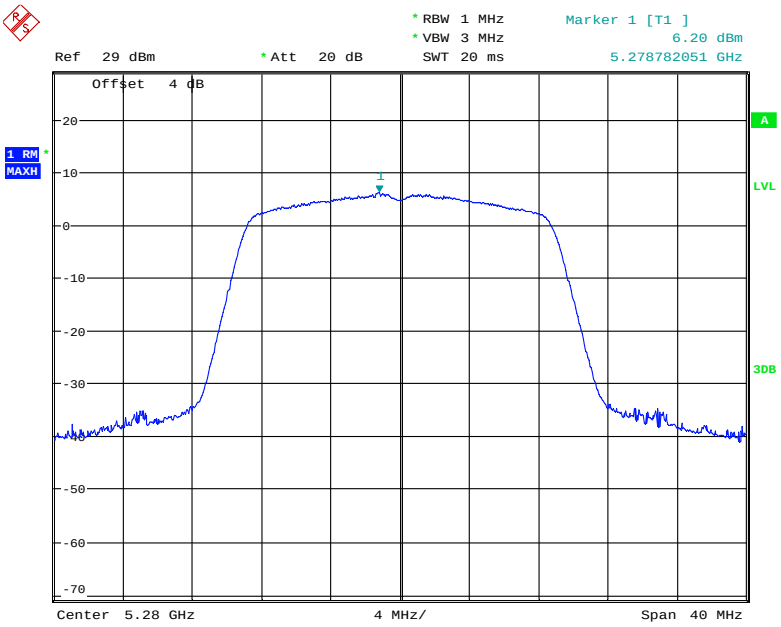
Date: 27.MAR.2020 20:15:07

802.11ac20 mode, Power Spectral Density, 5260 MHz



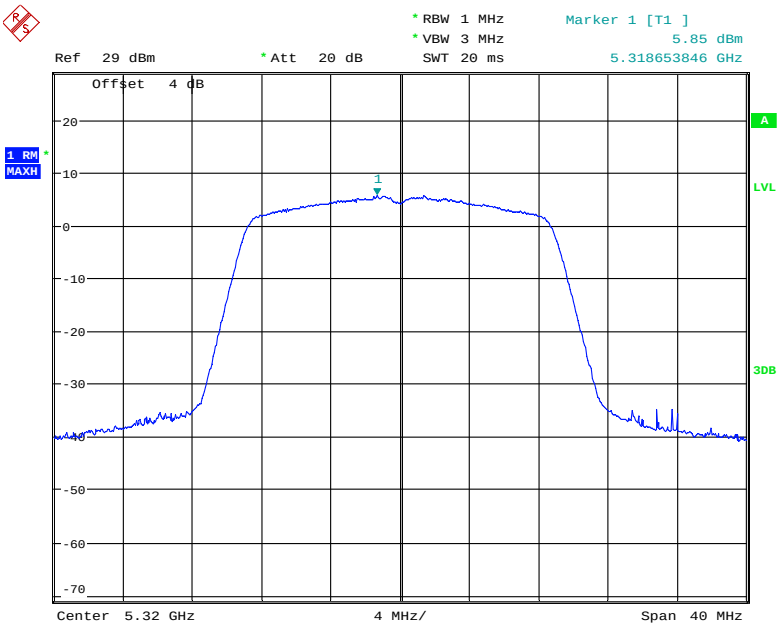
Date: 16.APR.2020 20:47:04

802. 11ac20 mode, Power Spectral Density, 5280 MHz



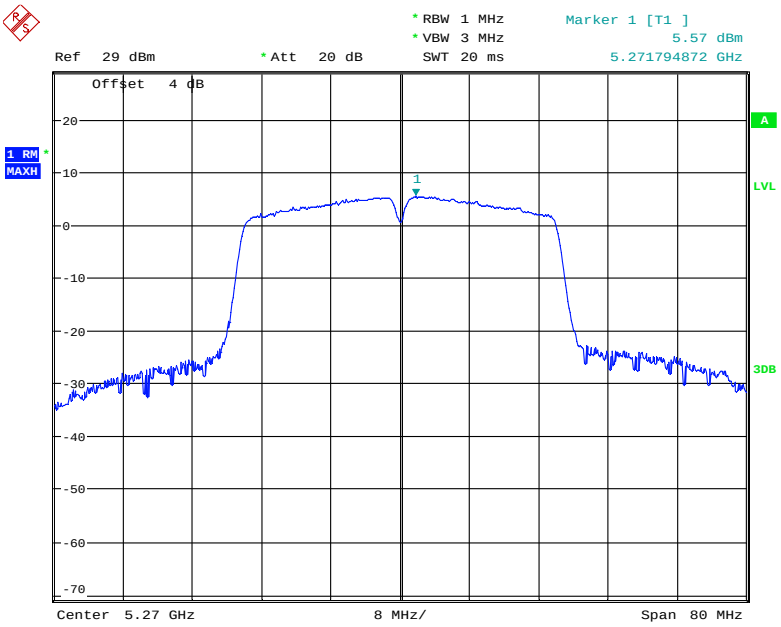
Date: 16.APR.2020 20:48:44

802. 11ac20 mode, Power Spectral Density, 5320 MHz



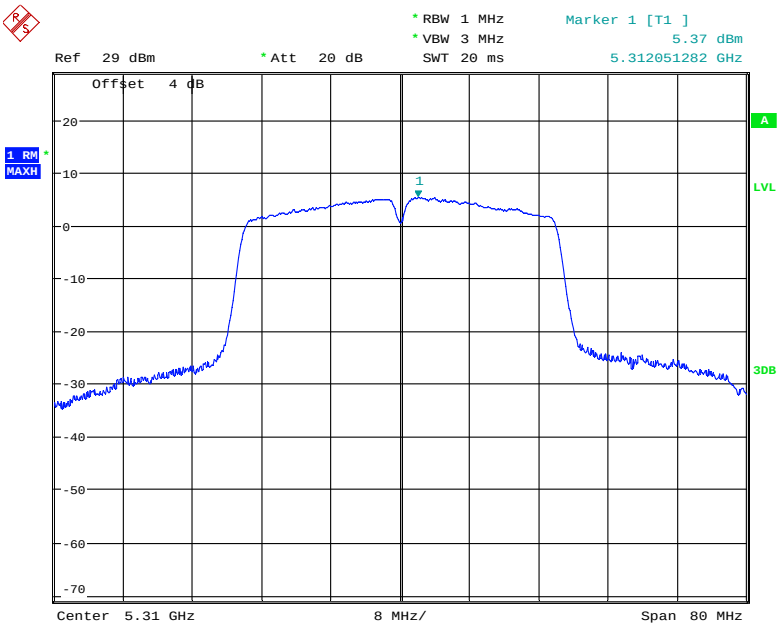
Date: 16.APR.2020 20:50:28

802. 11ac40 mode, Power Spectral Density, 5270 MHz



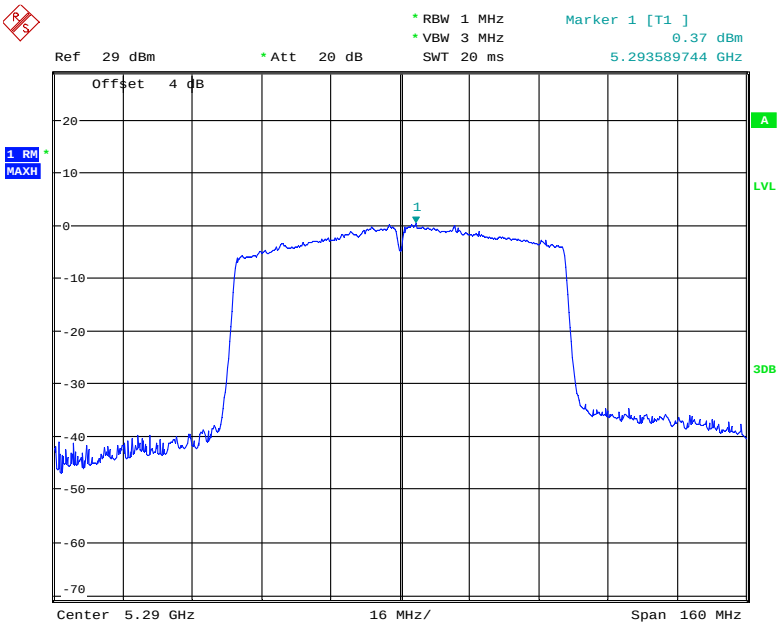
Date: 27.MAR.2020 20:14:22

802. 11ac40 mode, Power Spectral Density, 5310 MHz



Date: 27.MAR.2020 20:14:49

802. 11ac80 mode, Power Spectral Density, 5290 MHz



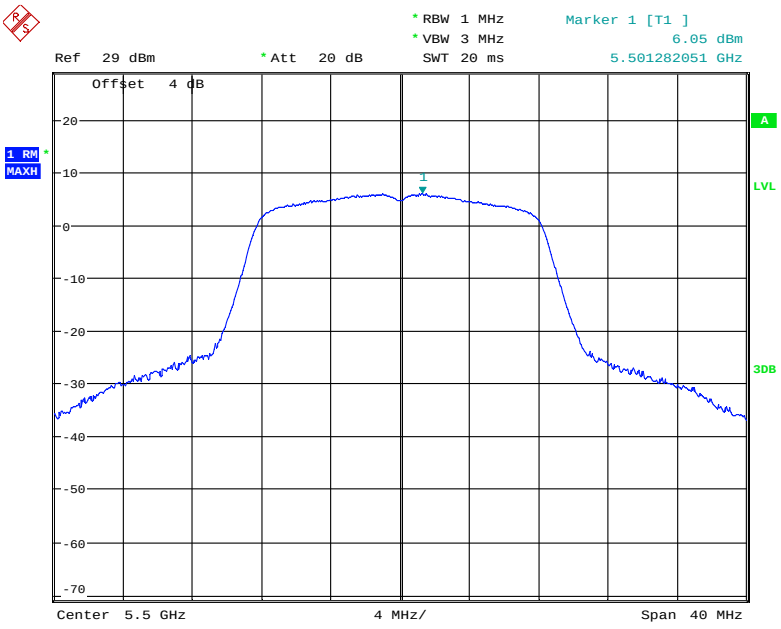
Date: 27.MAR.2020 20:16:03

5470 MHz – 5725 MHz:

Frequency (MHz)	Antenna Port	Power Spectral Density (dBm/MHz)	Total Power Spectral (dBm/MHz)	Limit (dBm/MHz)
802.11a				
5500	0	6.05	8.75	10.5
	1	5.41		
5580	0	7.01	9.61	
	1	6.14		
5700	0	5.34	8.12	
	1	4.86		
802.11n20				
5500	0	7.05	9.69	10.5
	1	6.28		
5580	0	7.09	9.79	
	1	6.44		
5700	0	7.19	9.73	
	1	6.19		
802.11n40				
5510	0	5.13	7.89	10.5
	1	4.62		
5550	0	6.32	9.00	
	1	5.63		
5670	0	5.72	8.53	
	1	5.31		
802.11ac20				
5500	0	7.24	9.76	10.5
	1	6.20		
5580	0	6.91	9.55	
	1	6.13		
5700	0	7.09	9.73	
	1	6.32		
802.11ac40				
5510	0	5.32	8.00	10.5
	1	4.63		
5550	0	6.28	8.94	
	1	5.55		
5670	0	5.73	8.48	
	1	5.19		
802.11ac80				
5530	0	0.82	3.72	10.5
	1	0.59		
5610	0	3.35	6.42	
	1	3.47		

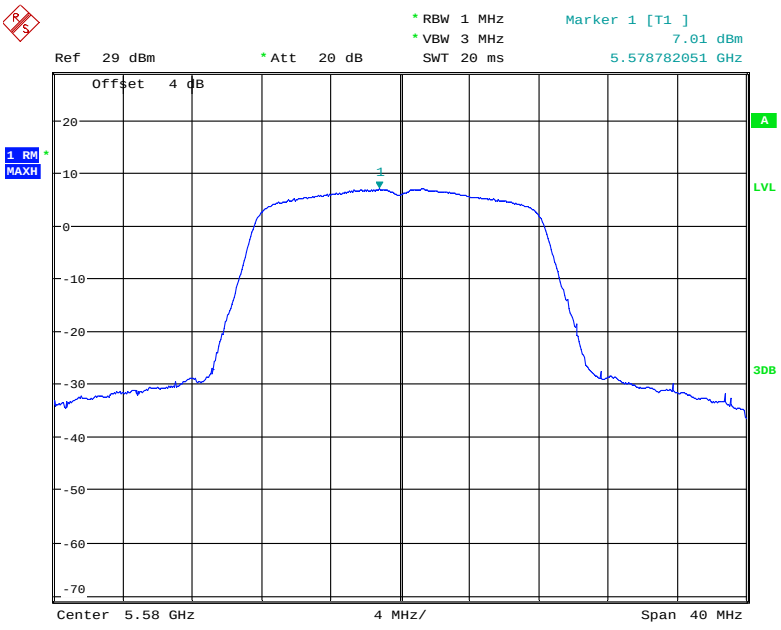
Antenna 0:

802.11a mode, Power Spectral Density, 5500 MHz



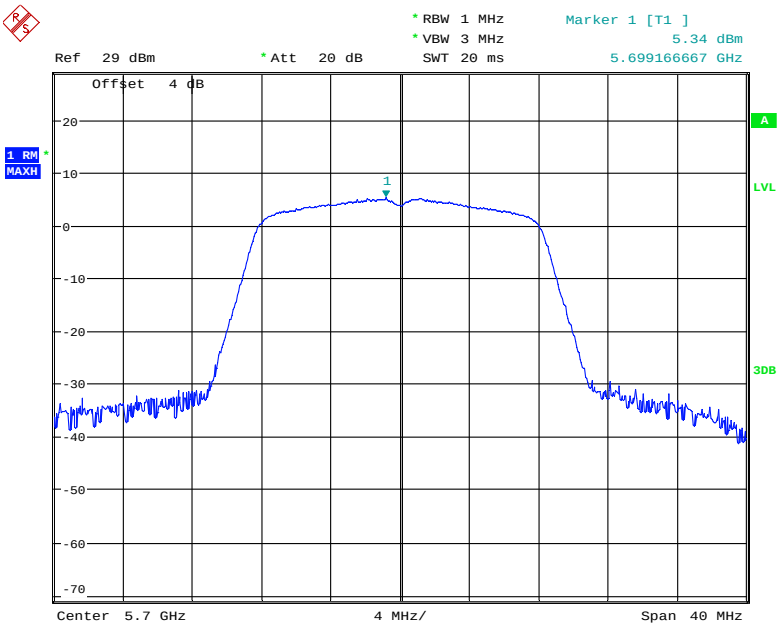
Date: 16.APR.2020 21:29:05

802.11a mode, Power Spectral Density, 5580 MHz



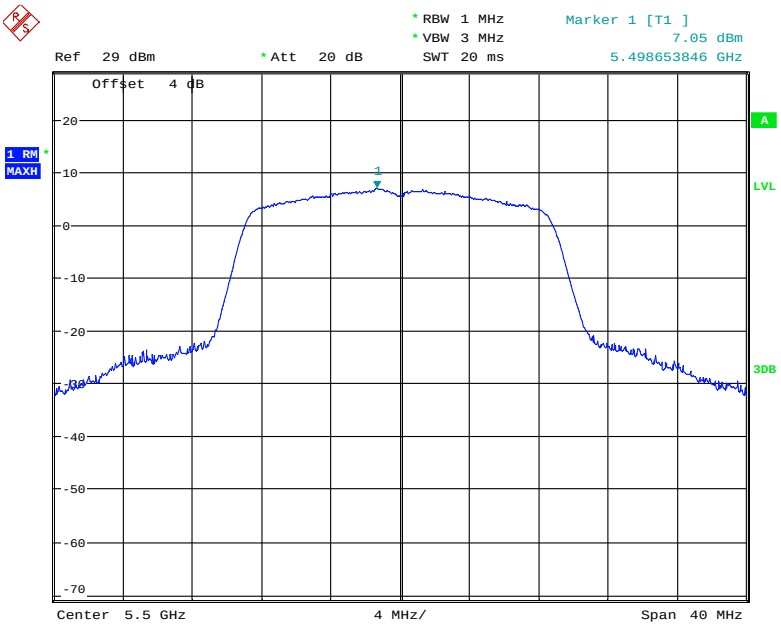
Date: 16.APR.2020 21:32:53

802.11a mode, Power Spectral Density, 5700 MHz



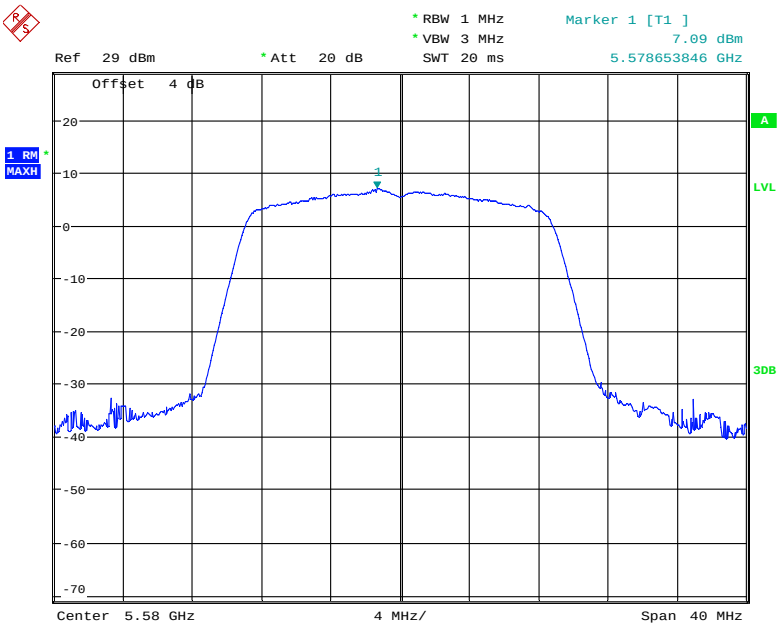
Date: 16.APR.2020 21:33:20

802.11n20 mode, Power Spectral Density, 5500 MHz



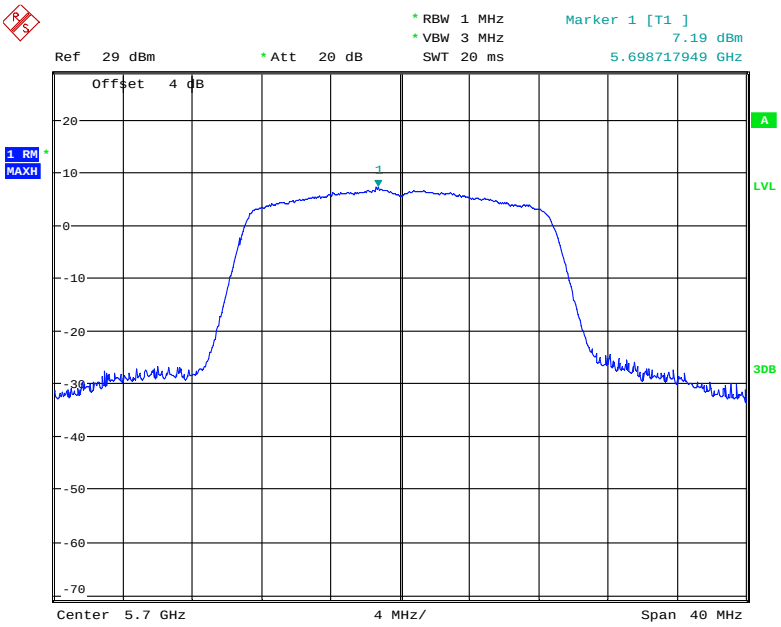
Date: 16.APR.2020 21:30:58

802.11n20 mode, Power Spectral Density, 5580 MHz



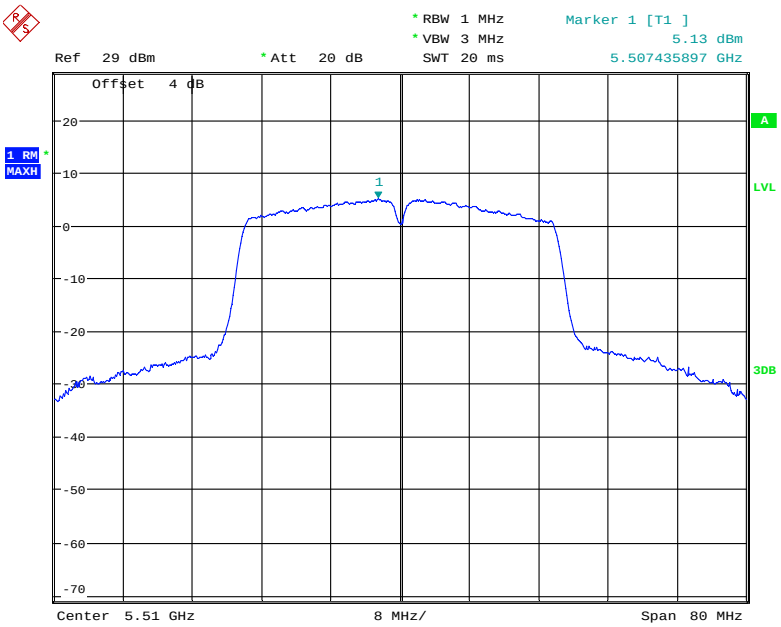
Date: 16.APR.2020 21:32:17

802.11n20 mode, Power Spectral Density, 5700 MHz



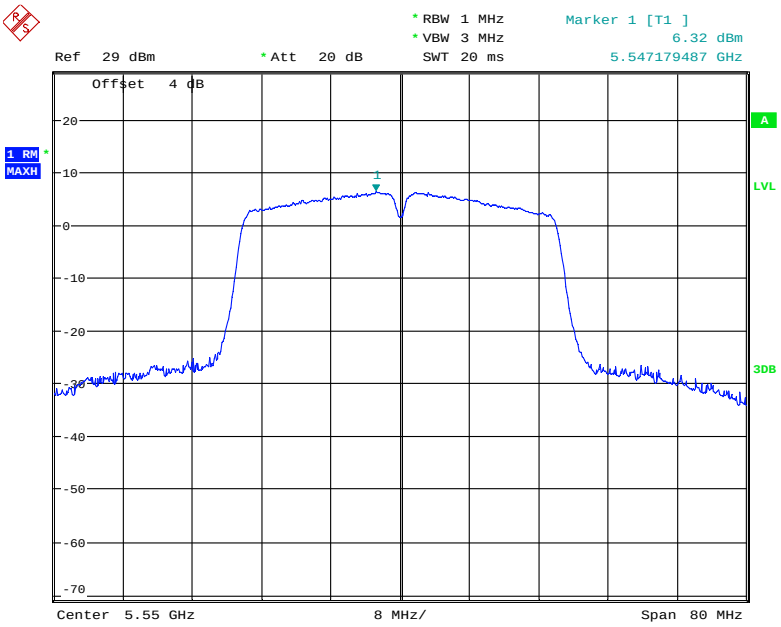
Date: 16.APR.2020 21:34:03

802.11n40 mode, Power Spectral Density, 5510 MHz



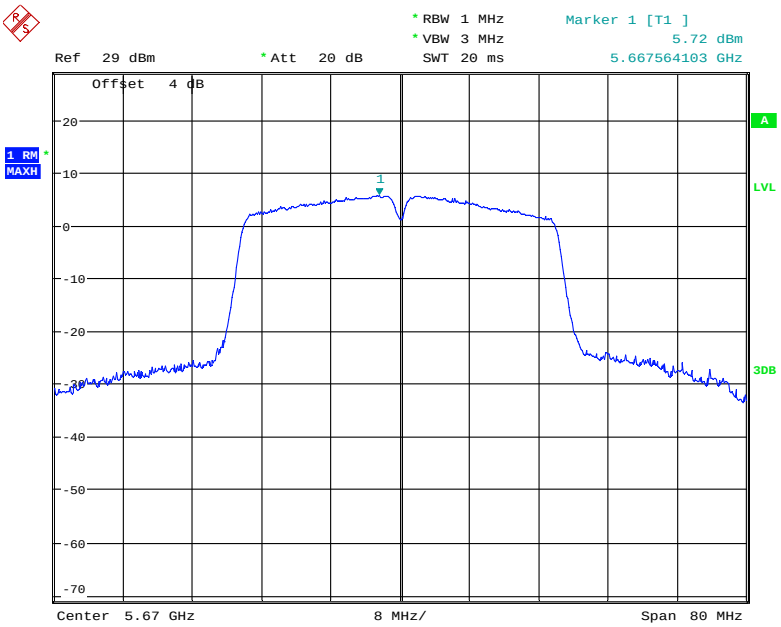
Date: 16.APR.2020 21:43:39

802.11n40 mode, Power Spectral Density, 5550 MHz



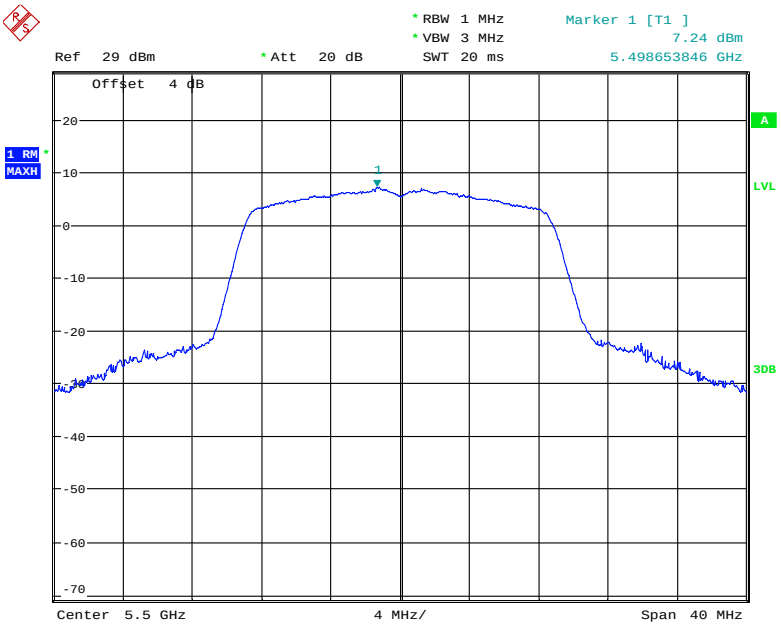
Date: 16.APR.2020 21:44:45

802.11n40 mode, Power Spectral Density, 5670 MHz



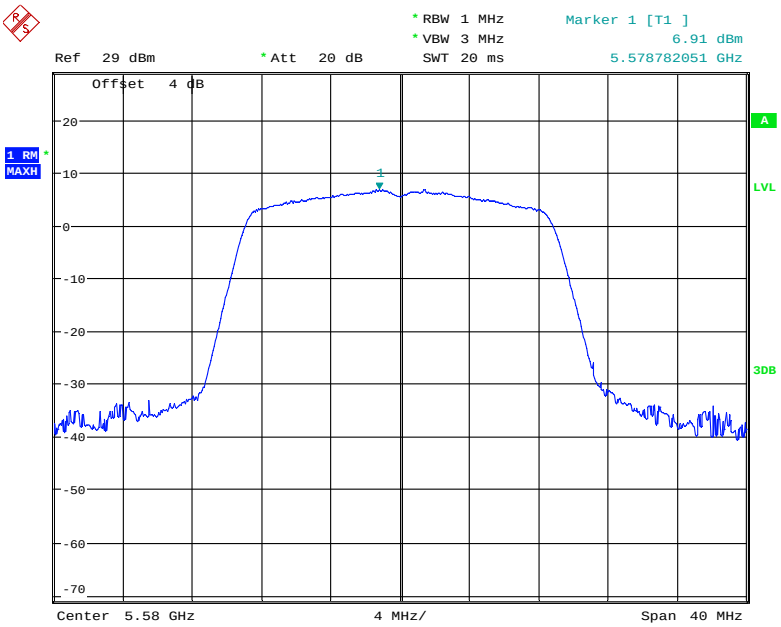
Date: 16.APR.2020 21:45:07

802.11ac20 mode, Power Spectral Density, 5500 MHz



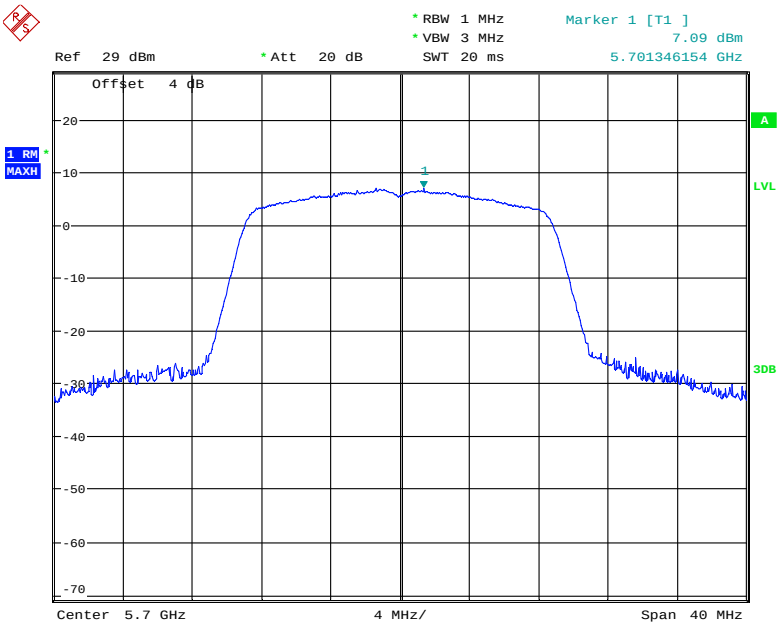
Date: 16.APR.2020 21:31:26

802. 11ac20 mode, Power Spectral Density, 5580 MHz



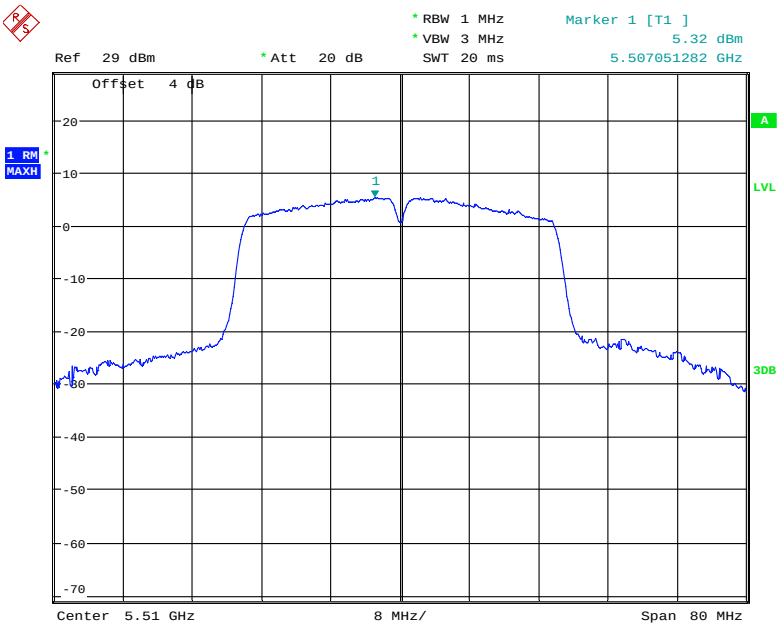
Date: 16.APR.2020 21:31:57

802. 11ac20 mode, Power Spectral Density, 5700 MHz



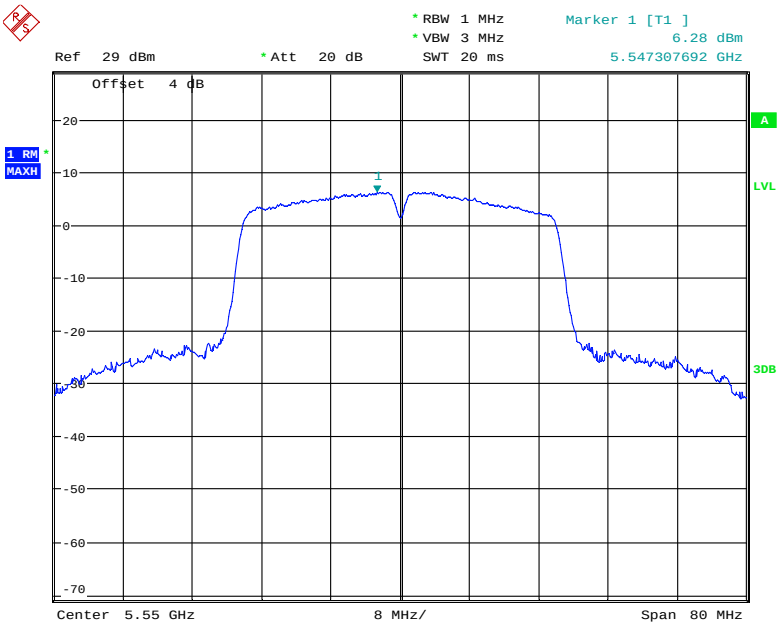
Date: 16.APR.2020 21:34:21

802. 11ac40 mode, Power Spectral Density, 5510 MHz



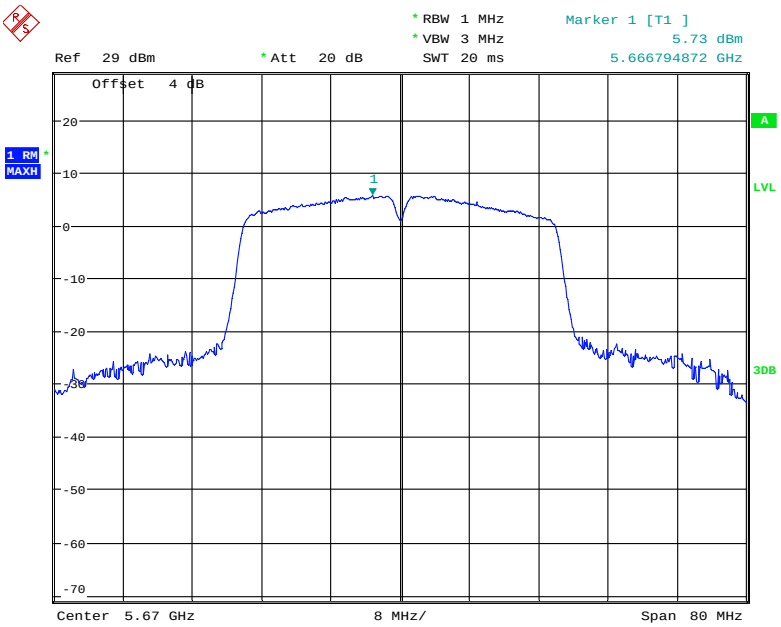
Date: 16.APR.2020 21:44:08

802. 11ac40 mode, Power Spectral Density, 5550 MHz



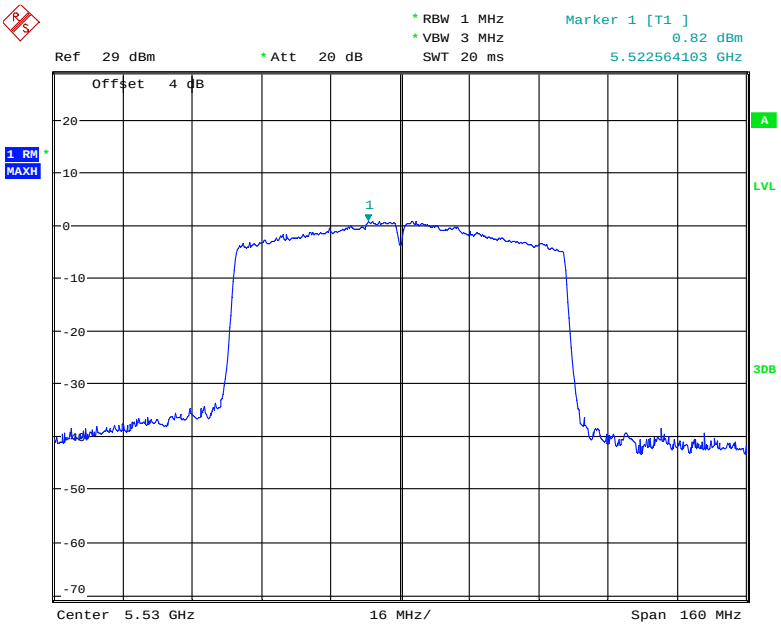
Date: 16.APR.2020 21:44:29

802. 11ac40 mode, Power Spectral Density, 5670 MHz



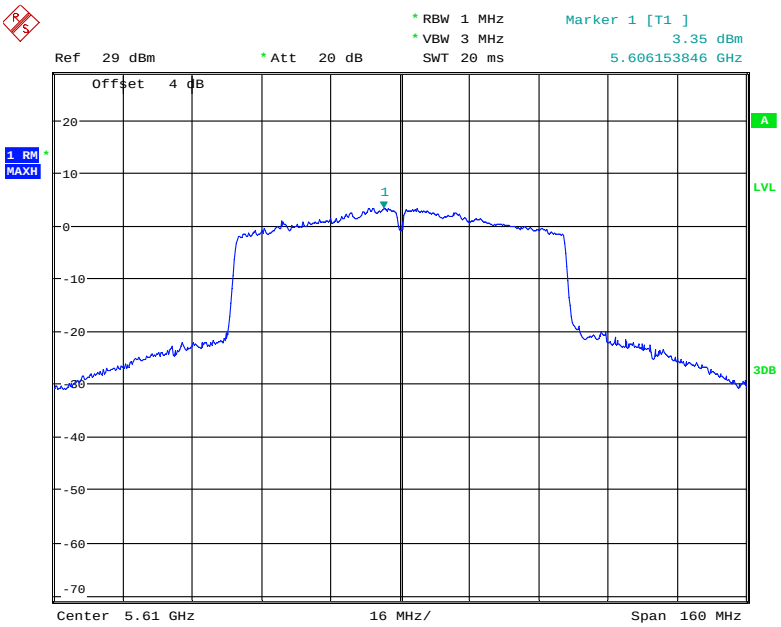
Date: 16.APR.2020 21:45:21

802. 11ac80 mode, Power Spectral Density, 5530 MHz



Date: 16.APR.2020 21:50:28

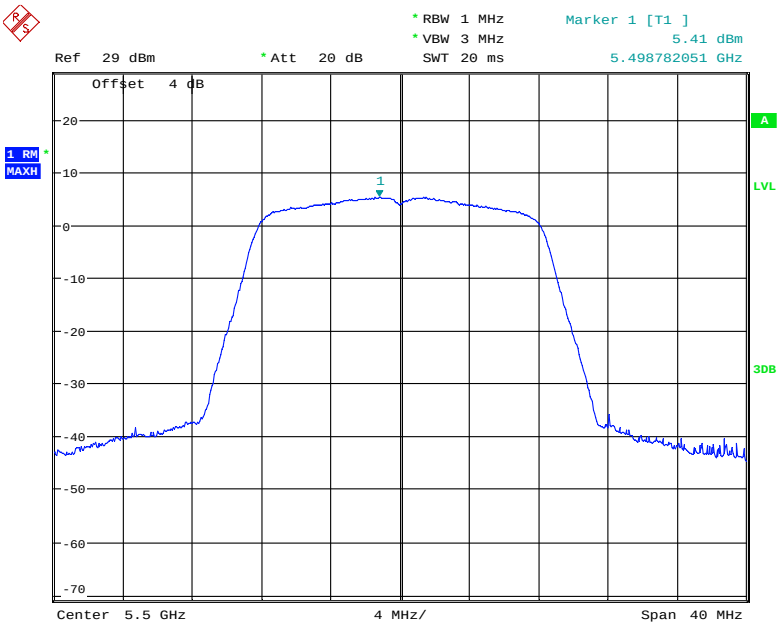
802. 11ac80 mode, Power Spectral Density, 5610 MHz



Date: 16.APR.2020 21:50:05

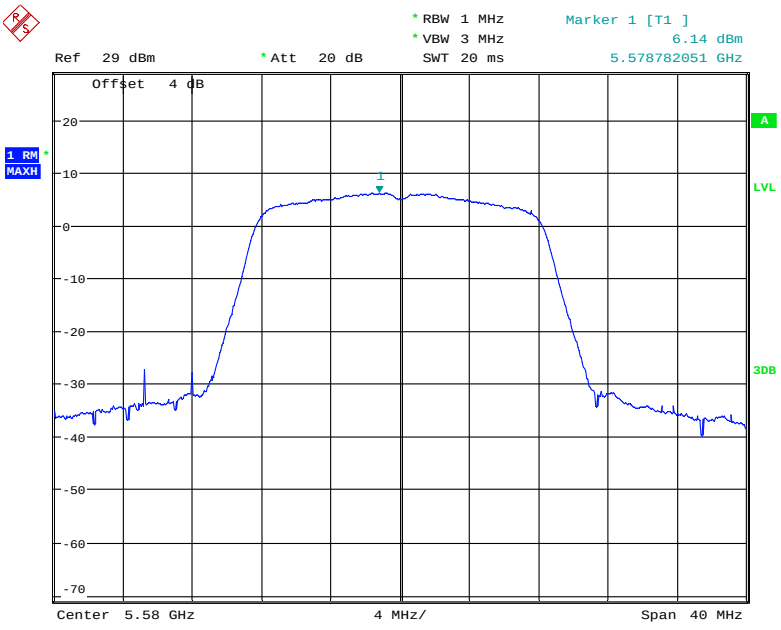
Antenna 1:

802.11a mode, Power Spectral Density, 5500 MHz



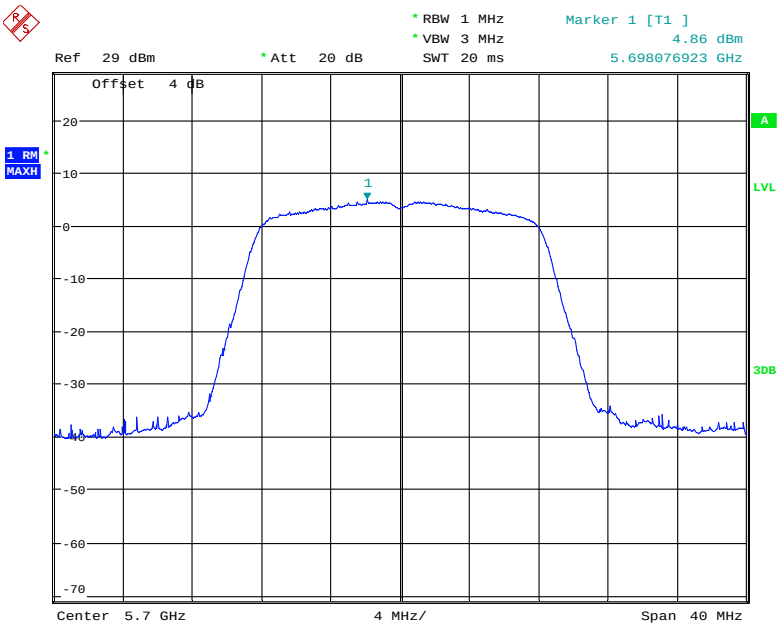
Date: 16.APR.2020 21:40:33

802.11a mode, Power Spectral Density, 5580 MHz



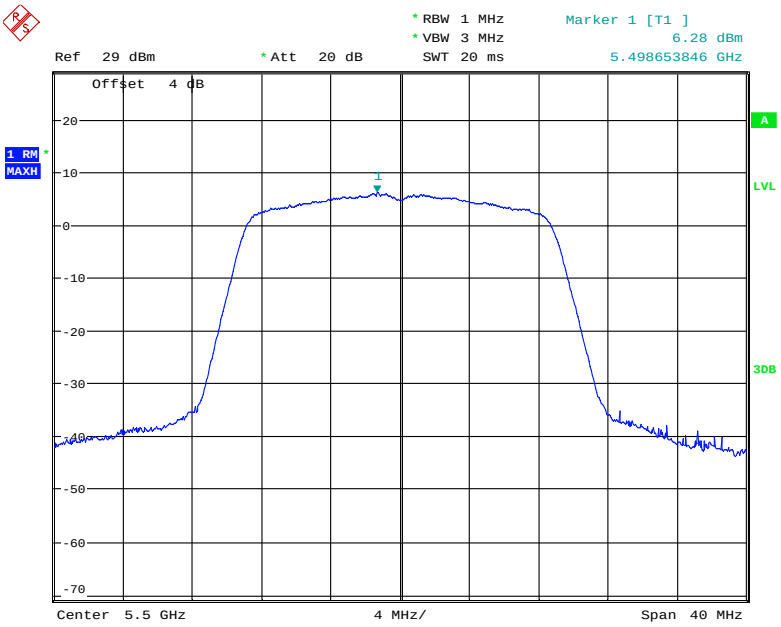
Date: 16.APR.2020 21:38:00

802.11a mode, Power Spectral Density, 5700 MHz



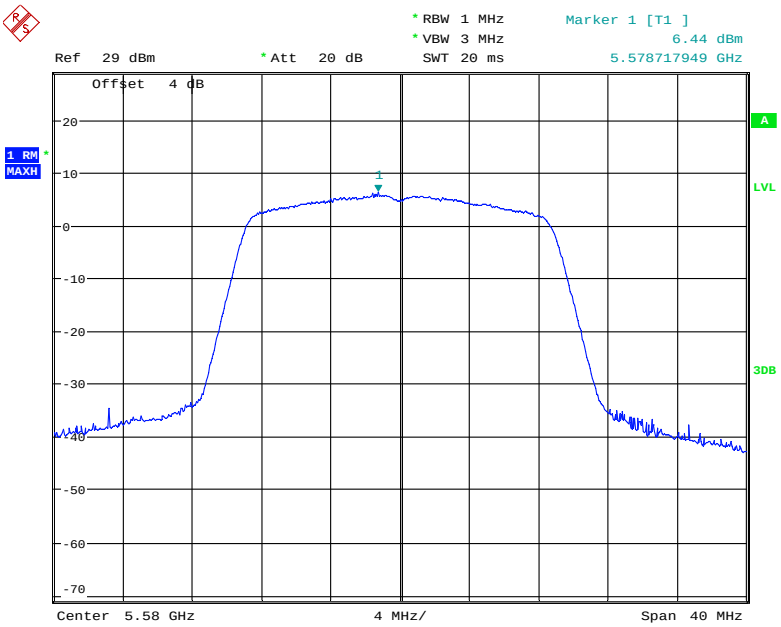
Date: 16.APR.2020 21:37:01

802.11n20 mode, Power Spectral Density, 5500 MHz



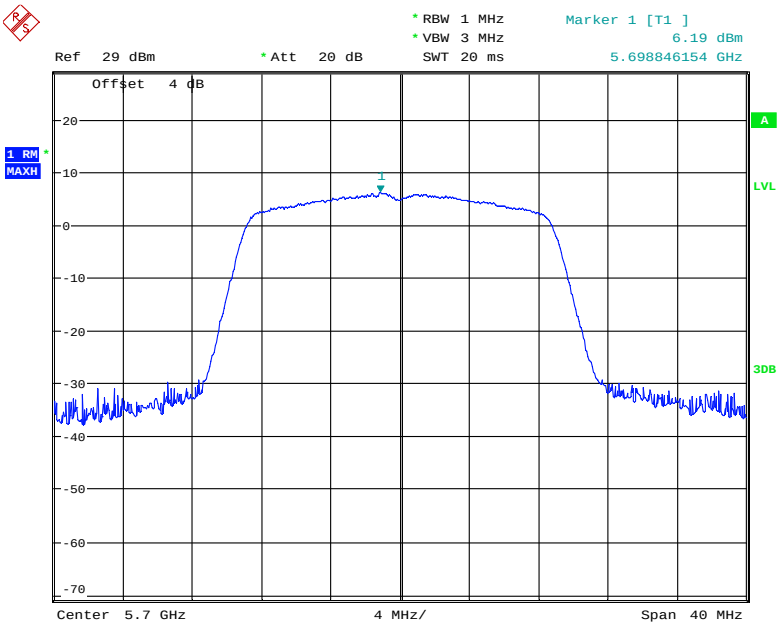
Date: 16.APR.2020 21:39:39

802.11n20 mode, Power Spectral Density, 5580 MHz



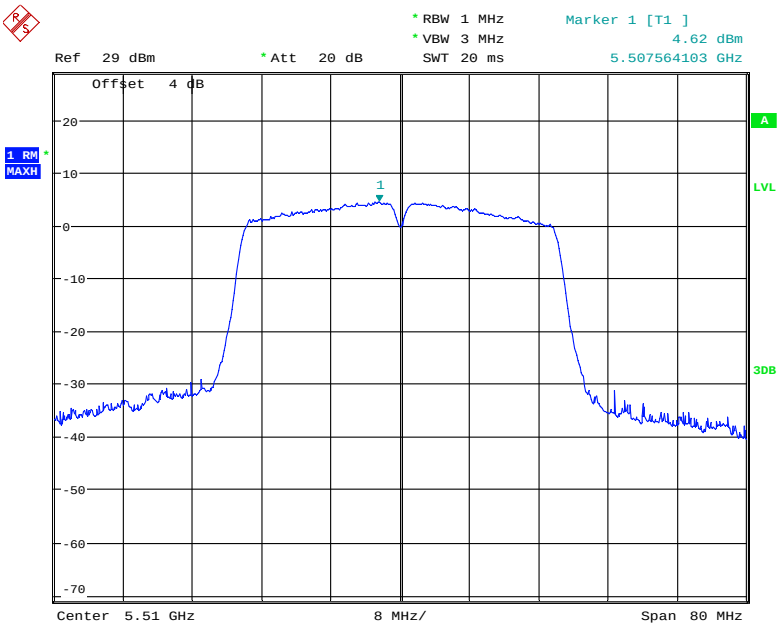
Date: 16.APR.2020 21:38:28

802.11n20 mode, Power Spectral Density, 5700 MHz



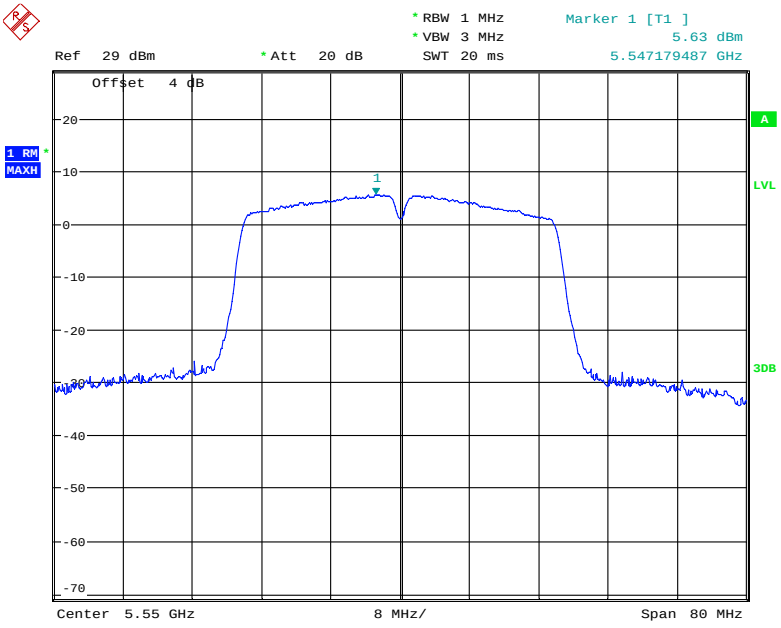
Date: 16.APR.2020 21:36:14

802.11n40 mode, Power Spectral Density, 5510 MHz



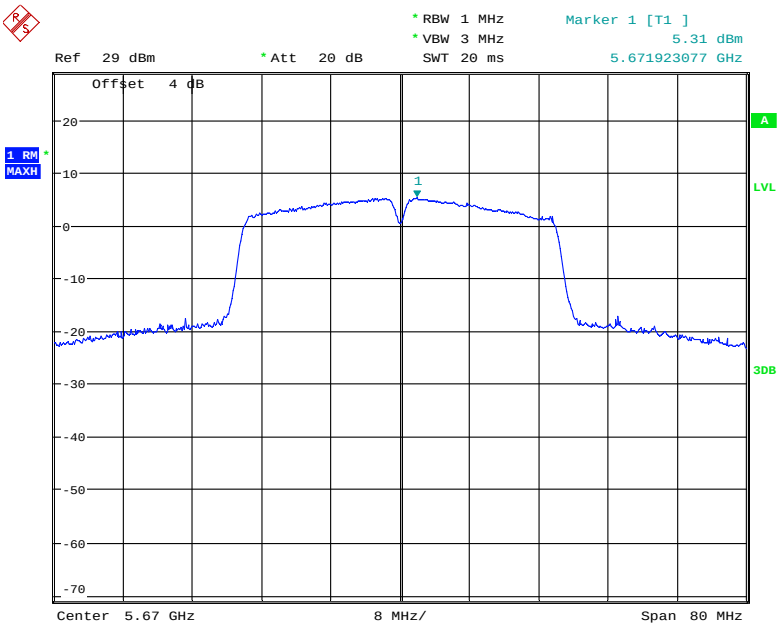
Date: 16.APR.2020 21:47:51

802.11n40 mode, Power Spectral Density, 5550 MHz



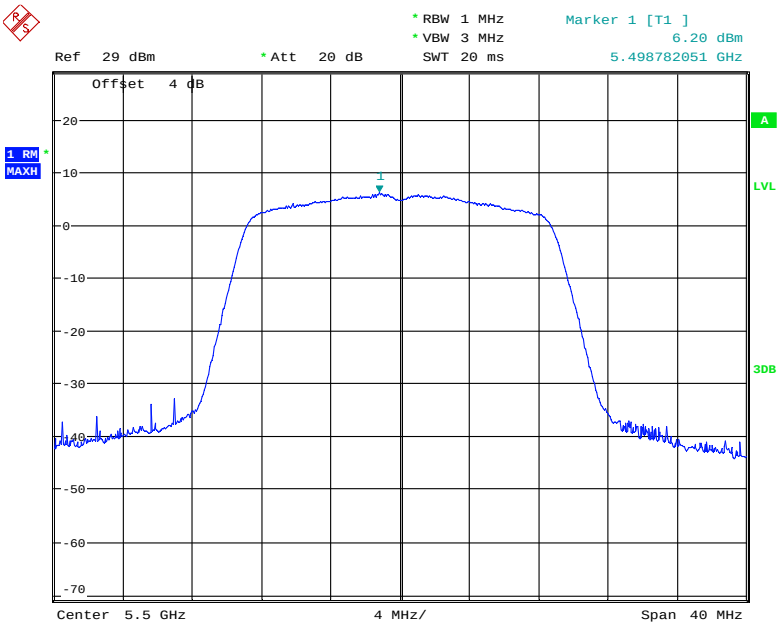
Date: 16.APR.2020 21:46:23

802.11n40 mode, Power Spectral Density, 5670 MHz



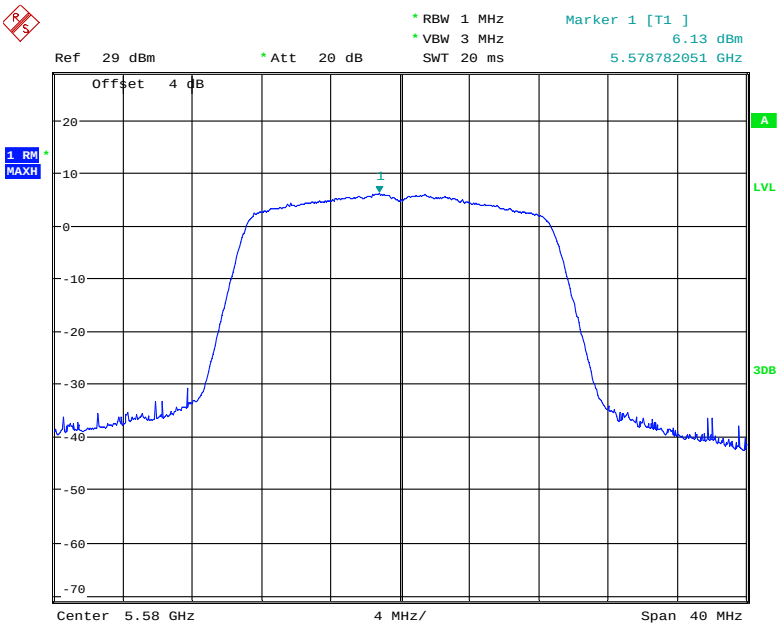
Date: 16.APR.2020 21:46:05

802.11ac20 mode, Power Spectral Density, 5500 MHz



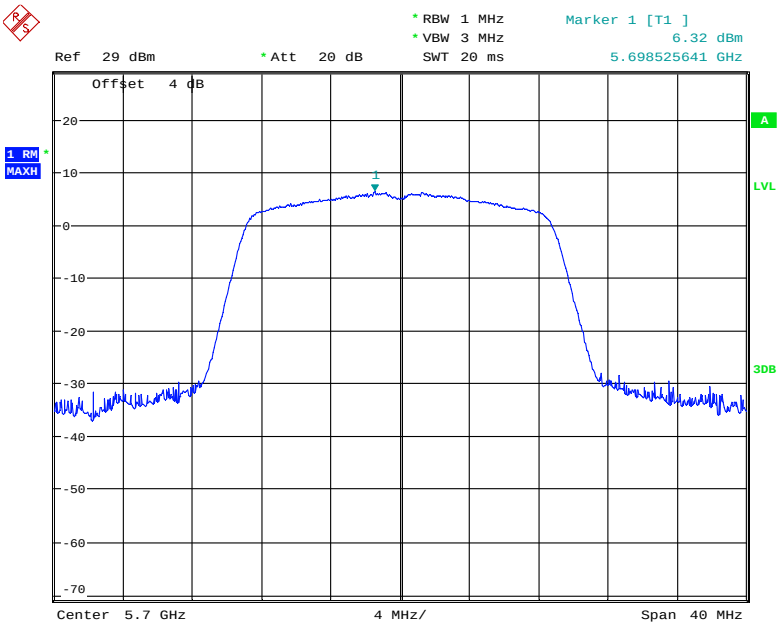
Date: 16.APR.2020 21:39:18

802. 11ac20 mode, Power Spectral Density, 5580 MHz



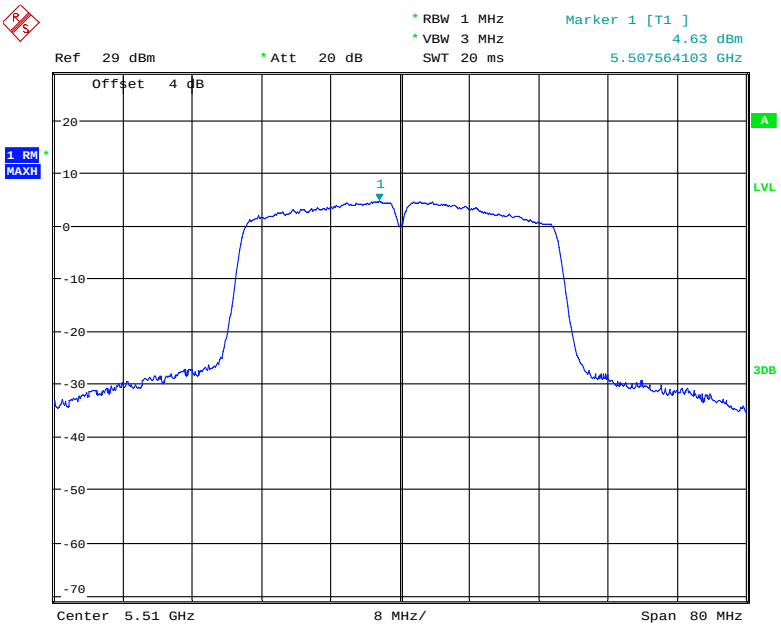
Date: 16.APR.2020 21:38:48

802. 11ac20 mode, Power Spectral Density, 5700 MHz



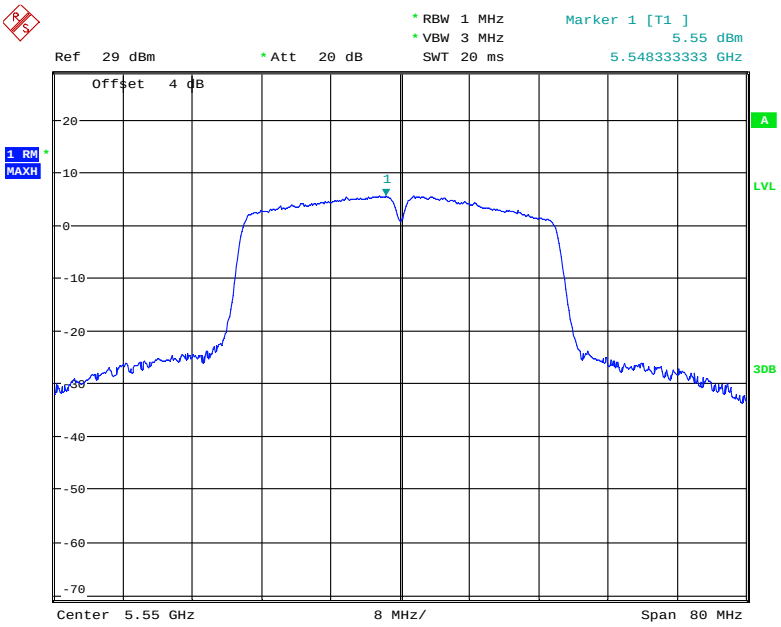
Date: 16.APR.2020 21:35:54

802. 11ac40 mode, Power Spectral Density, 5510 MHz



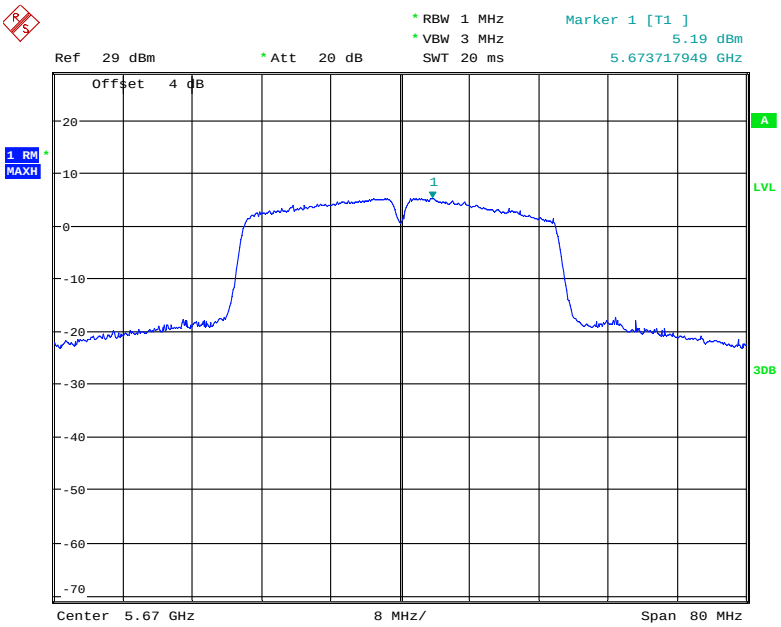
Date: 16.APR.2020 21:47:24

802. 11ac40 mode, Power Spectral Density, 5550 MHz



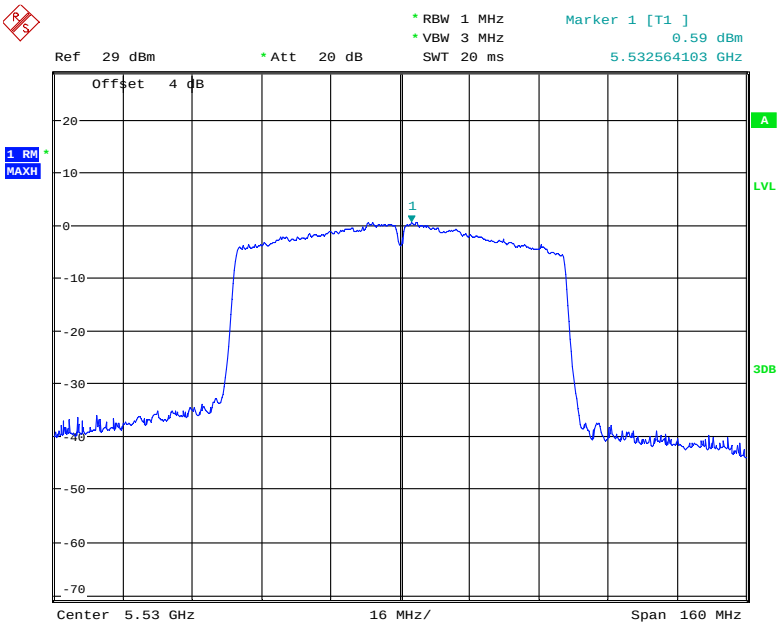
Date: 16.APR.2020 21:46:38

802. 11ac40 mode, Power Spectral Density, 5670 MHz



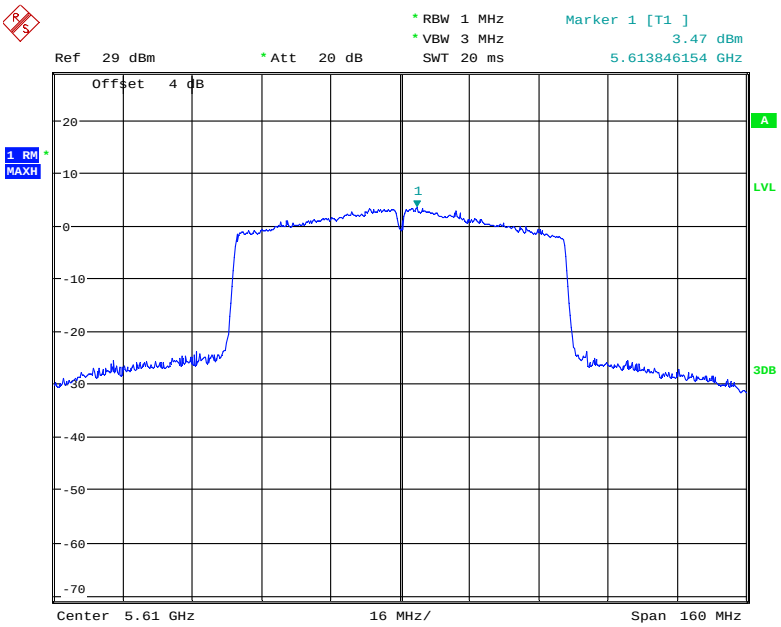
Date: 16.APR.2020 21:45:52

802. 11ac80 mode, Power Spectral Density, 5530 MHz



Date: 16.APR.2020 21:48:49

802. 11ac80 mode, Power Spectral Density, 5610 MHz



Date: 16.APR.2020 21:49:28

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