



FCC PART 15.407

TEST REPORT

For

Shenzhen VanTop Technology & Innovation Co., Ltd.

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FCC ID: 2AQ3A-SP600NQ0520

Report Type: Original Report	Product Type: R/C QUADCOPTER
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	R/C QUADCOPTER
Model	SP600N
Multiple Models	SP520, SP530, SP550, SP610, SP620, SP700, SP7100, SP7300, SP7500, A10, A16, A18, A20, Hummer 3S, Hummer 6S, Hummer 9S
Model Differences	Refer to the DOS letter
Frequency Range	5G Wi-Fi: 5150-5250 MHz
Conducted Average Output Power	5150-5250 MHz: 11.51dBm (802.11a), 11.28dBm(802.11n20), 10.26 dBm(802.11n40)
Modulation Technique	OFDM
Antenna Specification	2*2MIMO 1.7dBi
Voltage Range	DC 7.6V from battery
Date of Test	2020-04-27 to 2020-05-16
Sample serial number	RSZ200416816-RF-S1(Assigned by BACL, Shenzhen)
Received date	2020-04-16
Sample/EUT Status	Good condition

Objective

This type approval report is prepared on behalf of Shenzhen VanTop Technology & Innovation Co., Ltd. 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, 15.209 and 15.407 rules.

Related Submittal(s)/Grant(s)

Part of system submission with FCC ID: 2AQ3A-SP600NR2420

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 system was configured for testing in an engineering mode, which was provided by manufacturer.

The device support 802.11a/n20/n40 modes.

For 5150-5250MHz Band, 6 channels are provided to testing:

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

EUT Exercise Software

“secure CRT” 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	12
		5200	6	12
		5240	6	12
	802.11 n20	5180	MCS0	12
		5200	MCS0	12
		5240	MCS0	12
	802.11 n40	5190	MCS0	12
		5230	MCS0	12

Duty cycle

Test Result: Compliant. Please refer to the APPENDIX.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

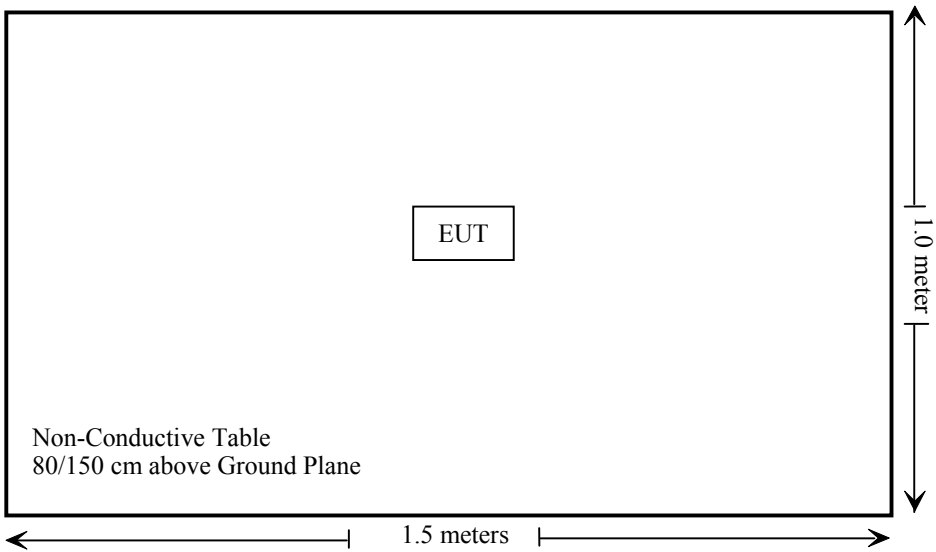
Manufacturer	Description	Model	Serial Number
/	/	/	/

External I/O Cable

Cable Description	Length (m)	From/Port	To
/	/	/	/

Block Diagram of Test Setup

For conducted emission:



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§1.1307 , §2.1091	Maximum Permissible exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.407(b)(6)& §15.207(a)	Conducted Emissions	Not Applicable
§15.205& §15.209 &§15.407(b) (1), (6),(7)	Undesirable Emission& Restricted Bands	Compliance
§15.407(a) (1)	26 dB Emission Bandwidth	Compliance
§15.407(a)(1)	Conducted Transmitter Output Power	Compliance
§15.407 (a)(1)	Power Spectral Density	Compliance

Not Applicable: The EUT will not connected to the public utility (AC) power line on normal operation.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
R&S	EMI Test Receiver	ESR3	102455	2019/7/9	2020/7/8
Sonoma instrument	Pre-amplifier	310 N	186238	2020/4/20	2021/4/20
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017/12/22	2020/12/21
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
SNSD	Band Reject filter	BSF5150-5850MN-0899-004	5G filter	2020/4/20	2021/4/20
Ducommun Technologies	Horn antenna	ARH-4223-02	1007726-02 1304	2017/12/6	2020/12/5
Ducommun Technologies	Horn antenna	ARH-2823-02	1007726-02 1302	2017/12/6	2020/12/5
RF Conducted Test					
Tonscend Corporation	RF control Unit	JS0806-2	19D8060154	2019/7/10	2020/7/9
Rohde & Schwarz	Signal and Spectrum Analyzer	FSV40	101473	2019/7/22	2020/7/21
Unknown	RF Cable	Unknown	2301 276	2019/11/29	2020/11/28
Ducommun technologies	RF Cable	RG-214	3	Each Time	

* **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).

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

Applicable Standard

According to subpart 15.247 (i) and subpart 1.1307 (b), 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)			
5150-5250	1.7	1.48	12	15.85	20	0.005	1

Note: 1. the tune up conducted power was declared by the applicant

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 intergral antenna arrangement for 5G Wi-Fi, which was permanently attached and the antenna gain is 1.7 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

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

FCC §15.407 (b) (1), (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:

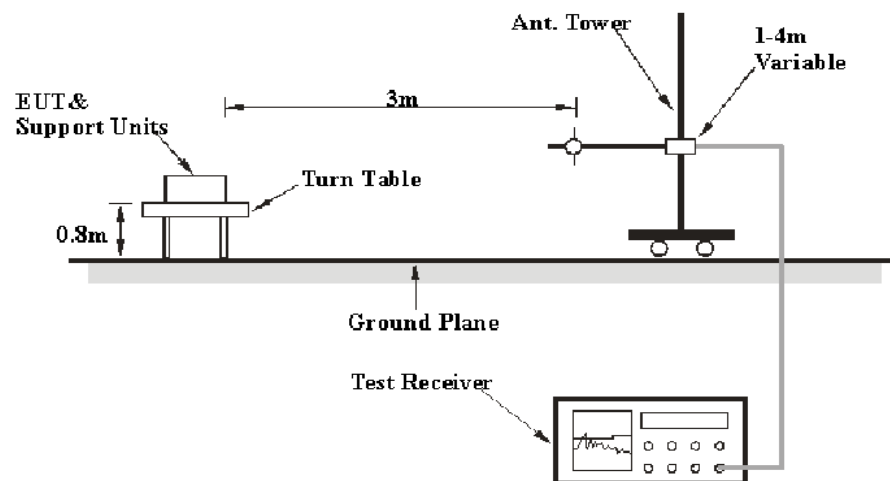
(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

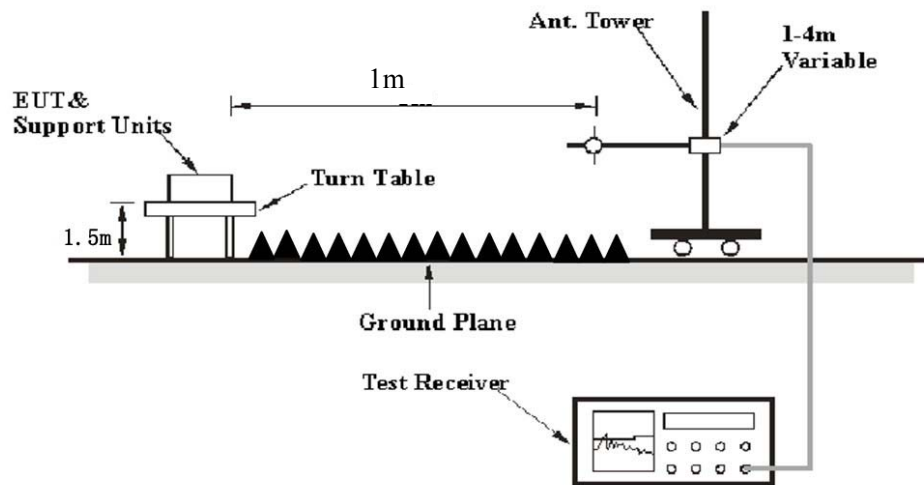
Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

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

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

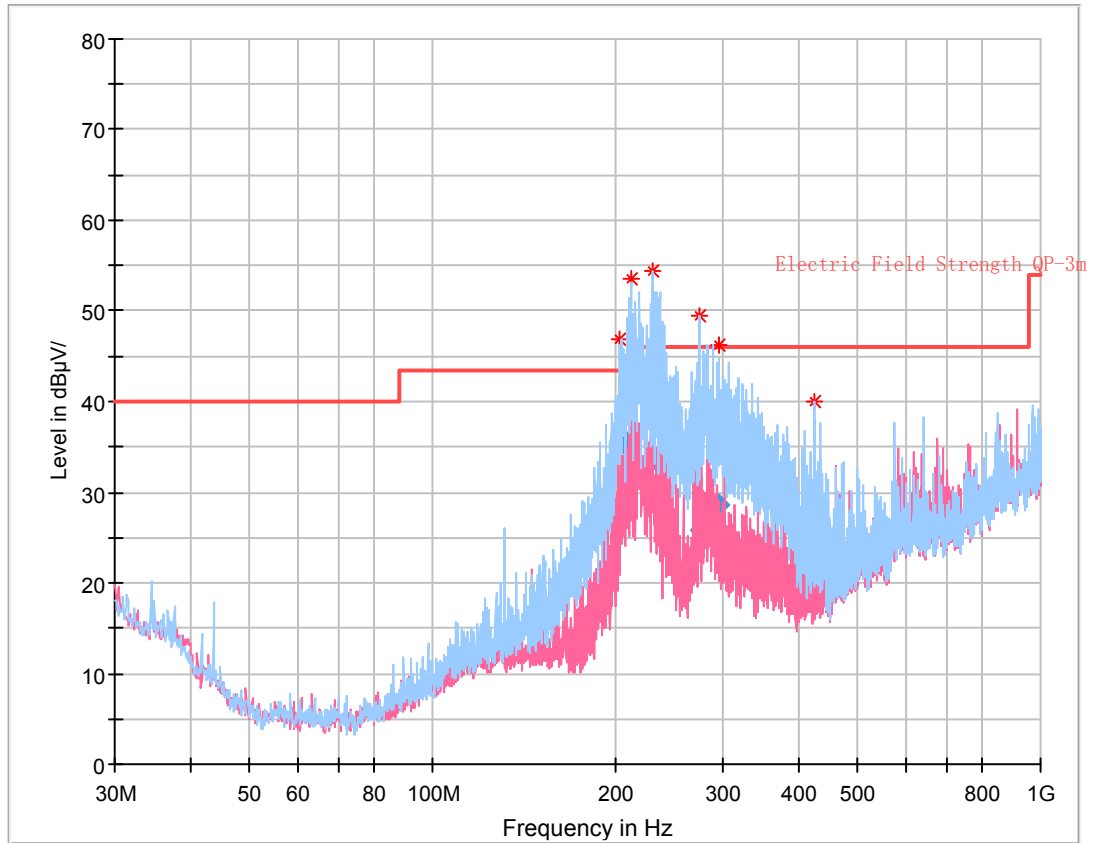
Environmental Conditions

Temperature:	23 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Holland Yang on 2020-04-27 for below 1G and Leo Huang from 2020-05-04 to 2020-05-16 for above 1G.

EUT operation mode: Transmitting

30 MHz – 1 GHz: (worst case is 802.11a mode 5240 MHz)



Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
203.023750	34.95	192.0	H	174.0	-13.9	43.50	8.55
211.753750	35.83	109.0	H	146.0	-13.9	43.50	7.67
229.536375	33.50	111.0	H	217.0	-14.0	46.00	12.50
274.251500	25.89	142.0	H	303.0	-12.4	46.00	20.11
295.199875	28.70	154.0	H	173.0	-10.9	46.00	17.30
425.126250	18.42	114.0	H	305.0	-9.3	46.00	27.58

30 MHz ~ 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									
5148.81	31.70	PK	274	2.2	H	38.36	70.06	83.5	13.44
5148.81	16.93	Ave.	274	2.2	H	38.36	55.29	63.5	8.21
5351.26	29.87	PK	173	2.4	H	39.09	68.96	83.5	14.54
5351.26	16.21	Ave.	173	2.4	H	39.09	55.30	63.5	8.20
10360.00	56.81	PK	187	2.3	H	17.42	74.23	77.7	3.47
5200 MHz									
10400.00	58.33	PK	106	1.7	H	17.52	75.85	77.7	1.85
5240 MHz									
5148.61	30.42	PK	146	2.2	H	38.36	68.78	83.5	14.72
5148.61	16.37	Ave.	146	2.2	H	38.36	54.73	63.5	8.77
5350.83	30.22	PK	212	1.4	H	39.09	69.31	83.5	14.19
5350.83	16.41	Ave.	212	1.4	H	39.09	55.50	63.5	8.00
10480.00	59.01	PK	36	1.6	H	17.25	76.26	77.7	1.44

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)
802.11n20									
5180 MHz									
5149.36	30.90	PK	85	1.7	H	38.36	69.26	83.5	14.24
5149.36	16.62	Ave.	85	1.7	H	38.36	54.98	63.5	8.52
5351.43	30.13	PK	201	1.7	H	39.09	69.22	83.5	14.28
5351.43	16.31	Ave.	201	1.7	H	39.09	55.40	63.5	8.10
10360.00	56.82	PK	127	2.3	H	17.42	74.24	77.7	3.46
5200 MHz									
10400.00	56.93	PK	219	1.6	H	17.52	74.45	77.7	3.25
5240 MHz									
5148.37	30.22	PK	169	1.1	H	38.36	68.58	83.5	14.92
5148.37	16.35	Ave.	169	1.1	H	38.36	54.71	63.5	8.79
5350.60	30.31	PK	123	1.9	H	39.09	69.40	83.5	14.10
5350.60	16.29	Ave.	123	1.9	H	39.09	55.38	63.5	8.12
10480.00	58.94	PK	184	1.2	H	17.25	76.19	77.7	1.51

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									
5148.59	43.20	PK	239	2.3	H	38.36	81.56	83.5	1.94
5148.59	23.57	Ave.	239	2.3	H	38.36	61.93	63.5	1.57
5352.37	30.29	PK	243	1.9	H	39.09	69.38	83.5	14.12
5352.37	16.33	Ave.	243	1.9	H	39.09	55.42	63.5	8.08
10380.00	53.94	PK	209	1.7	H	17.42	71.36	77.7	6.34
5230 MHz									
5148.63	30.47	PK	83	1.4	H	38.36	68.83	83.5	14.67
5148.63	16.55	Ave.	83	1.4	H	38.36	54.91	63.5	8.59
5350.29	30.55	PK	113	1.1	H	39.09	69.64	83.5	13.86
5350.29	16.62	Ave.	113	1.1	H	39.09	55.71	63.5	7.79
10460.00	57.74	PK	163	1.7	H	17.15	74.89	77.7	2.81

Note:

Corrected Amplitude = Corrected Factor + Reading

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

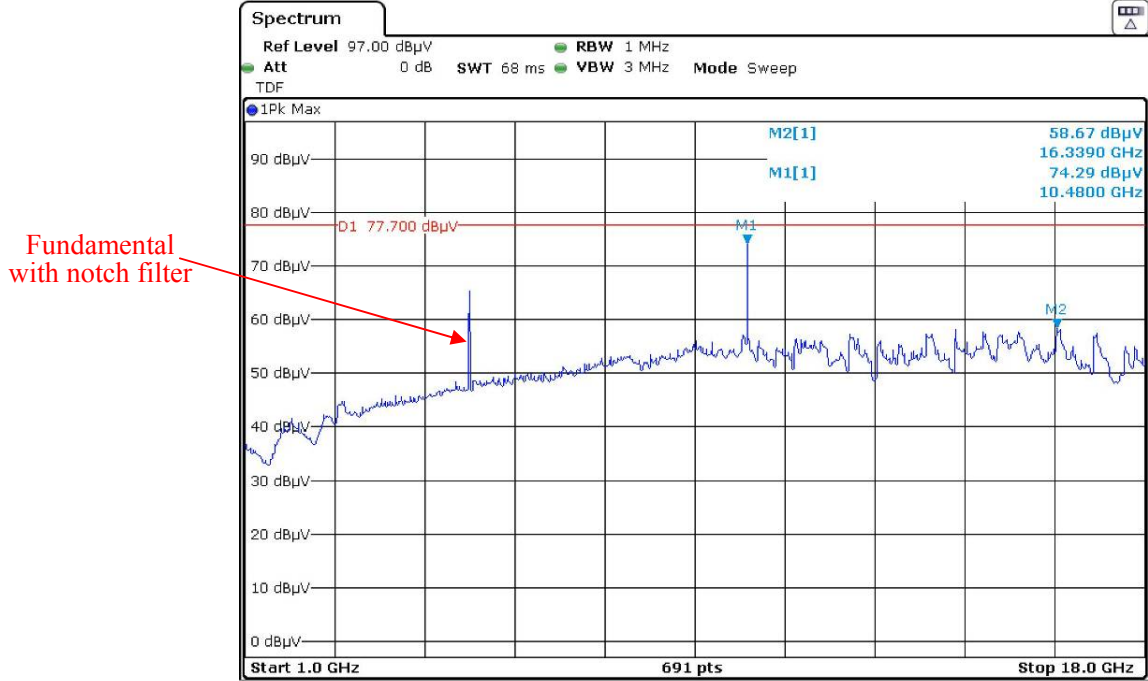
Margin = Limit- Corr. Amplitude

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

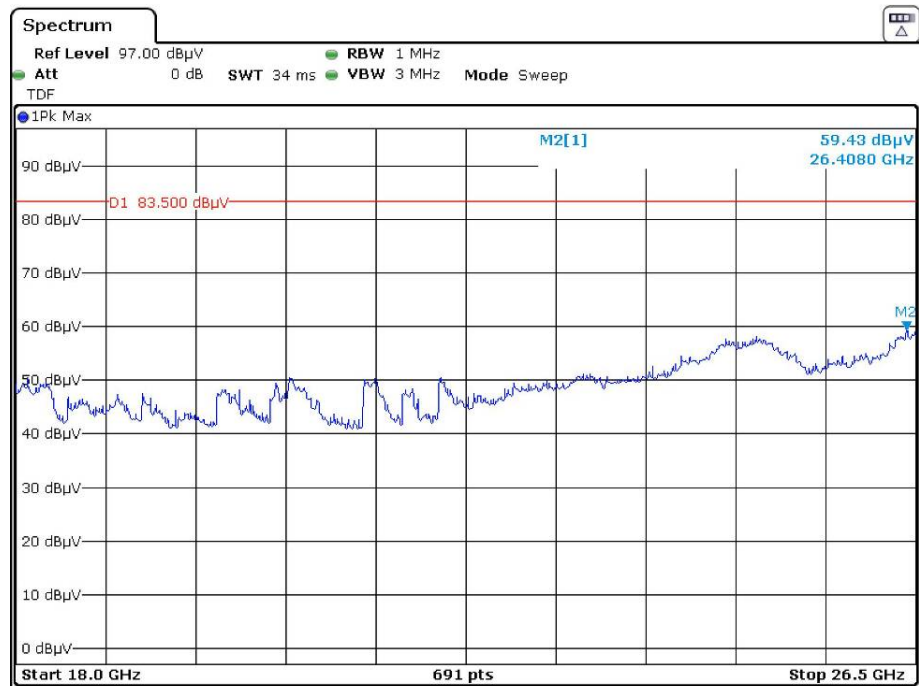
Peak

Pre-scan with 802.11a high channel

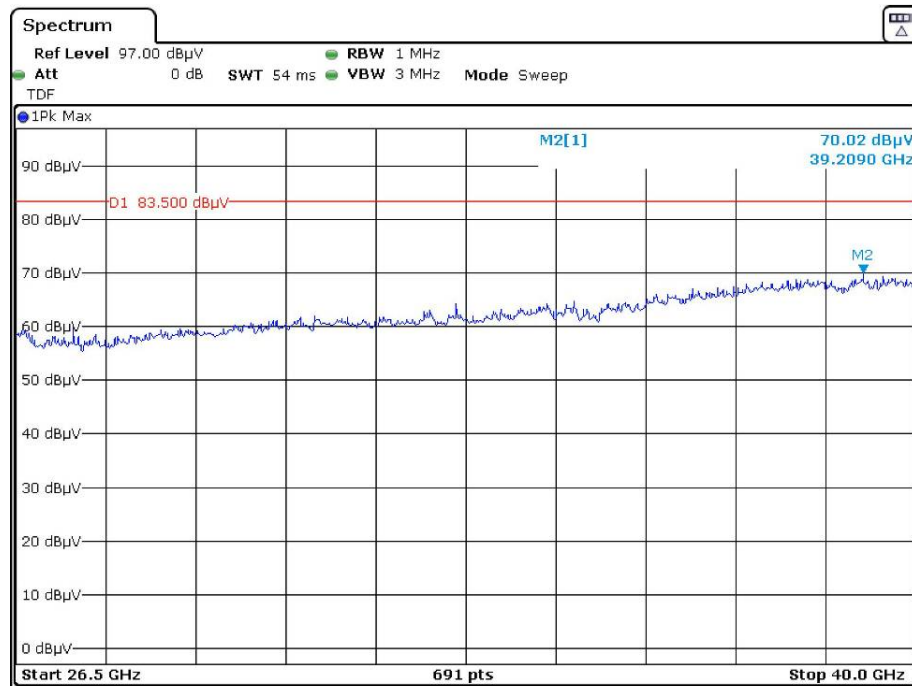
Horizontal



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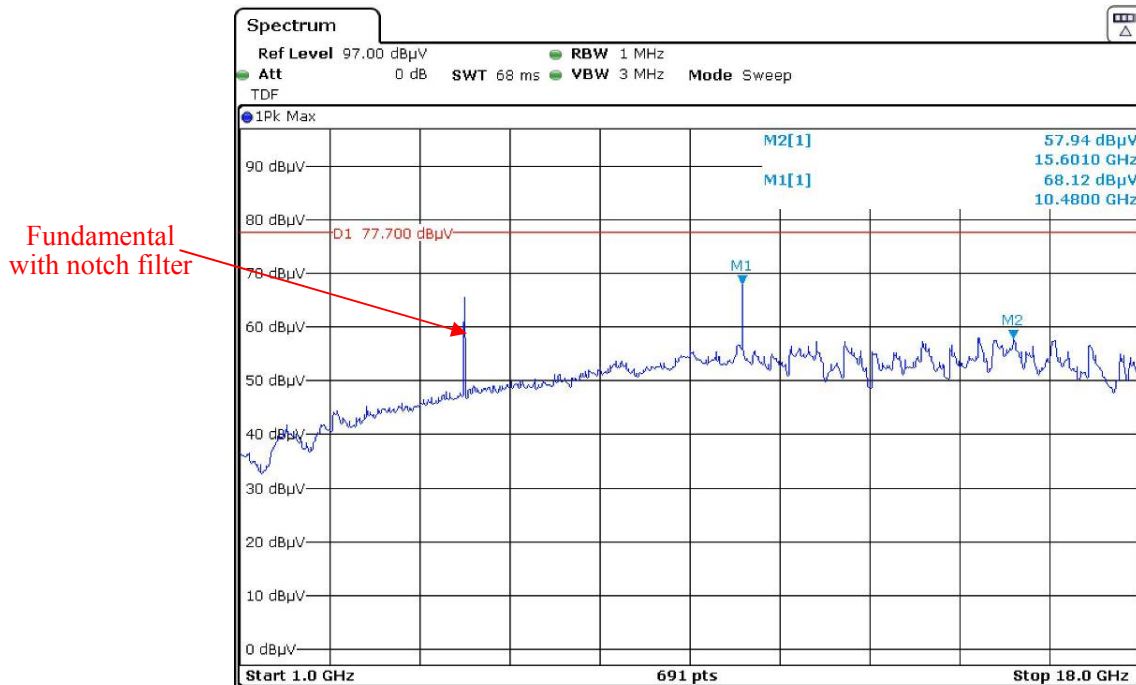


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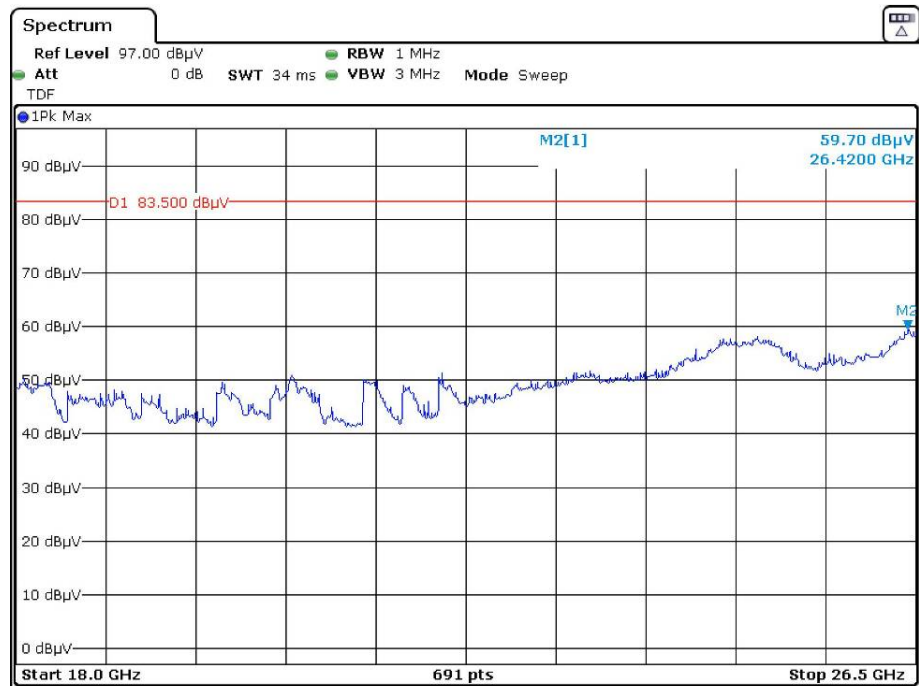


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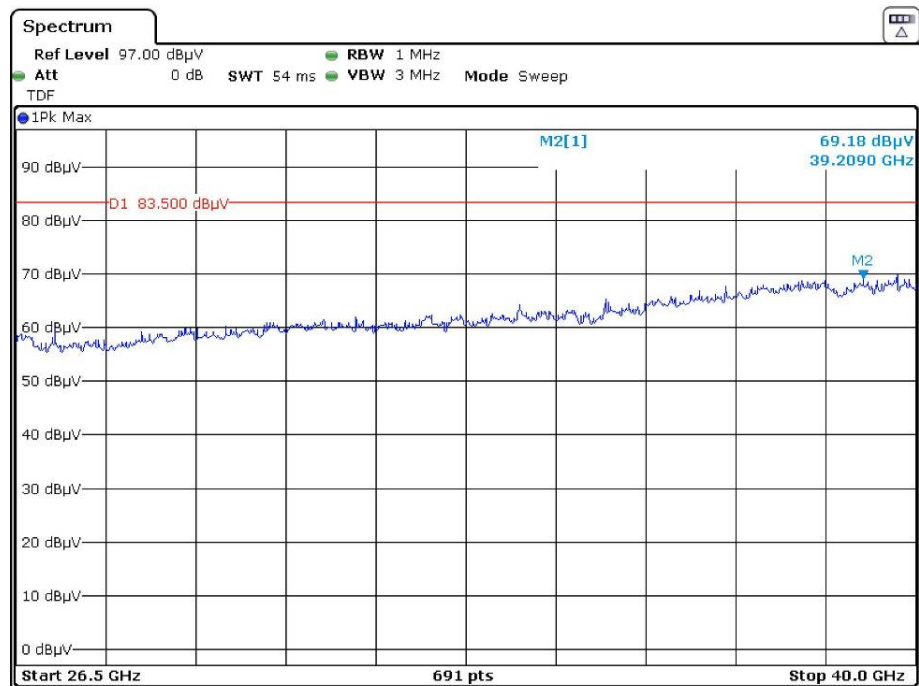
Vertical



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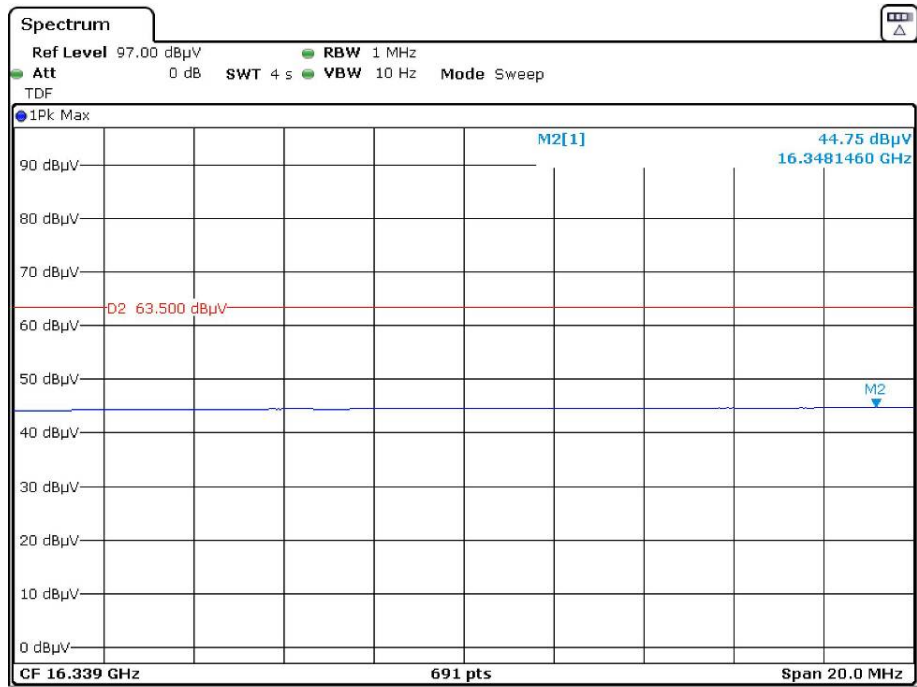


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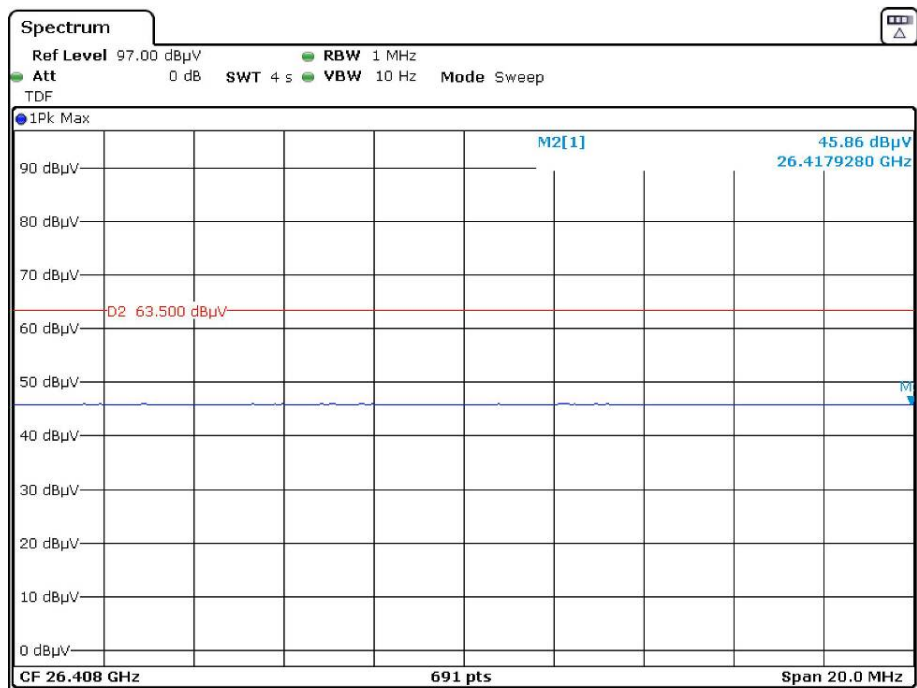


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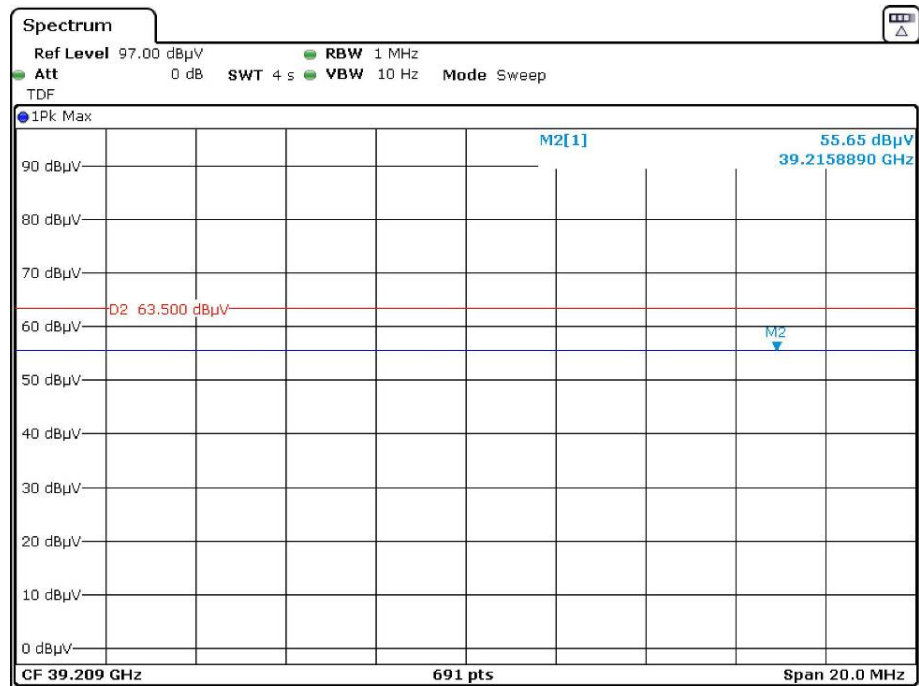
Average Horizontal



Date: 16.MAY.2020 15:07:31

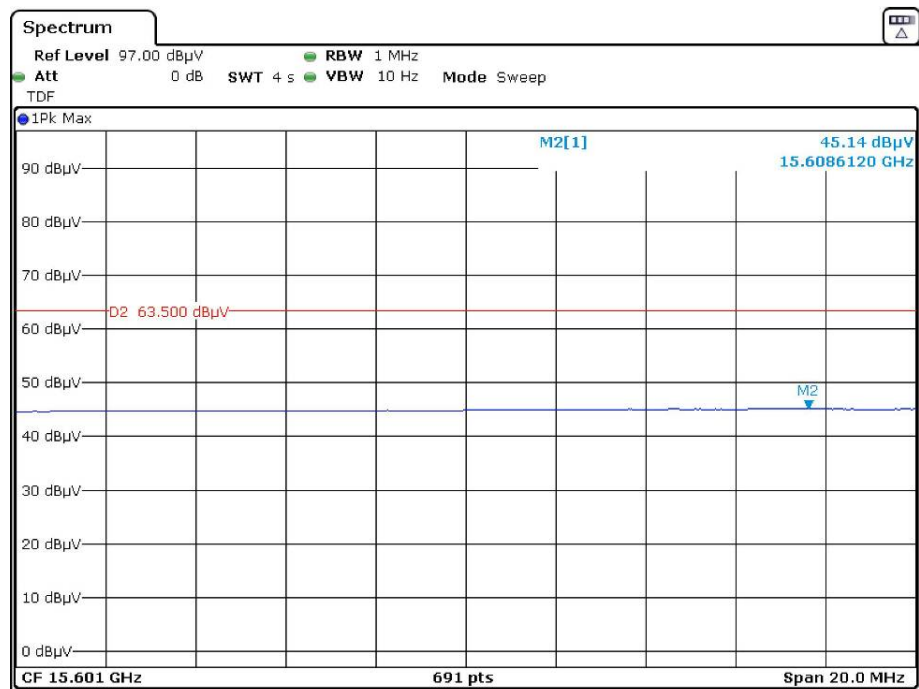


Date: 16.MAY.2020 15:55:57

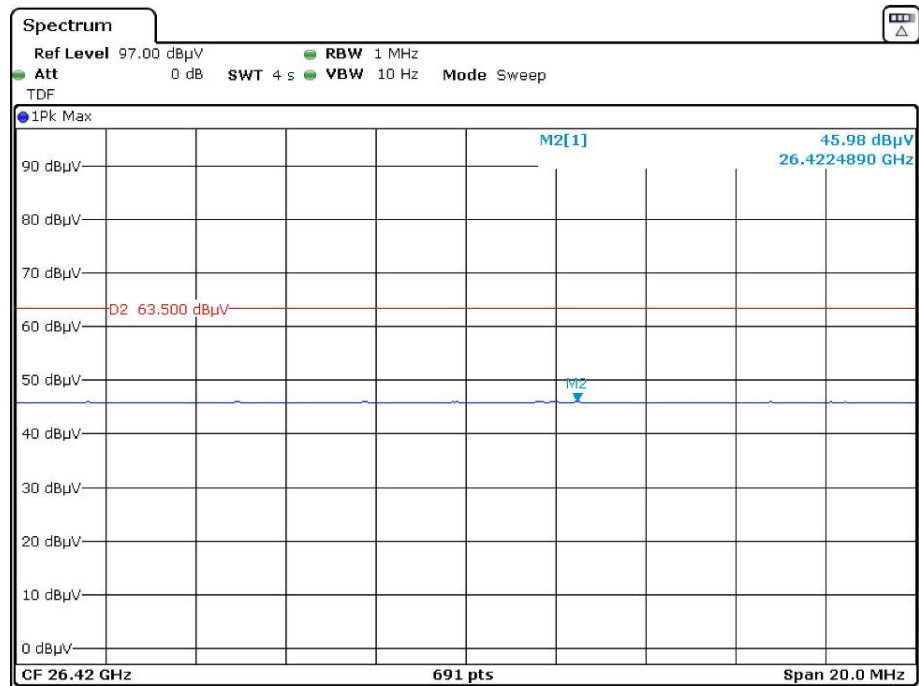


Date: 16.MAY.2020 16:32:09

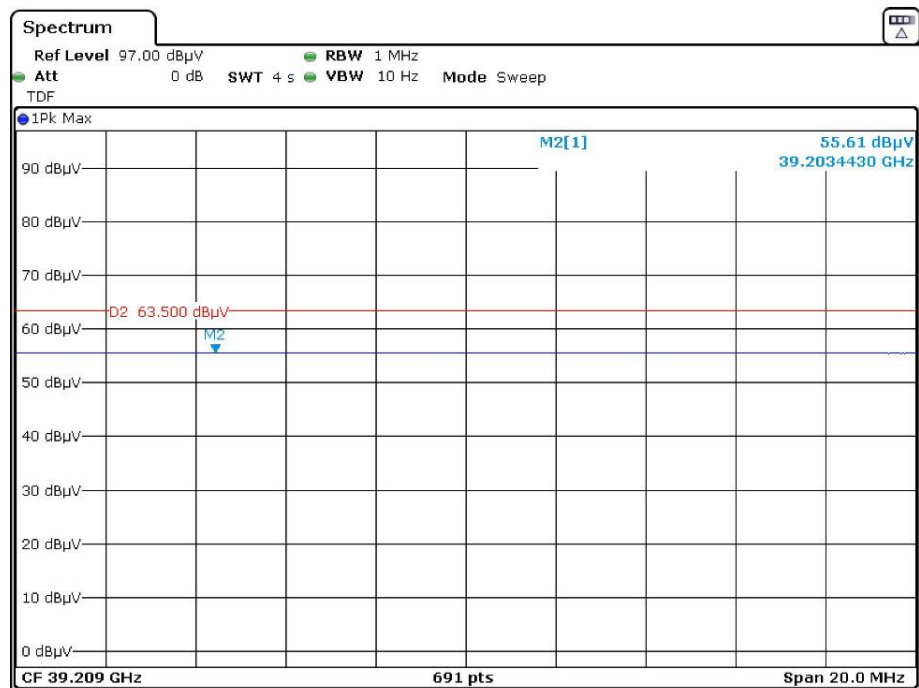
Vertical



Date: 16.MAY.2020 15:13:55



Date: 16.MAY.2020 15:48:40



Date: 16.MAY.2020 16:38:38

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

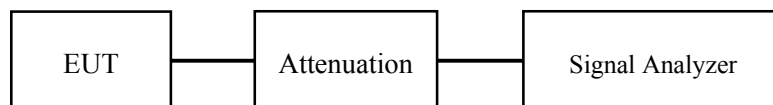
Applicable Standard

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)

- 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%.



Test Data

Environmental Conditions

Temperature:	25~26 °C
Relative Humidity:	50~56 %
ATM Pressure:	100.0~101.0 kPa

The testing was performed by Cary Guan on 2020-05-13.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the APPENDIX.

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

Applicable Standard

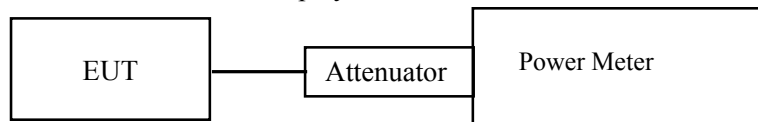
For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz 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. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

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.

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 Cary Guan on 2020-05-13.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the APPENDIX.

FCC §15.407(a) (1) - 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.

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 kPa

The testing was performed by Cary Guan on 2020-05-13.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the APPENDIX.

APPENDIX

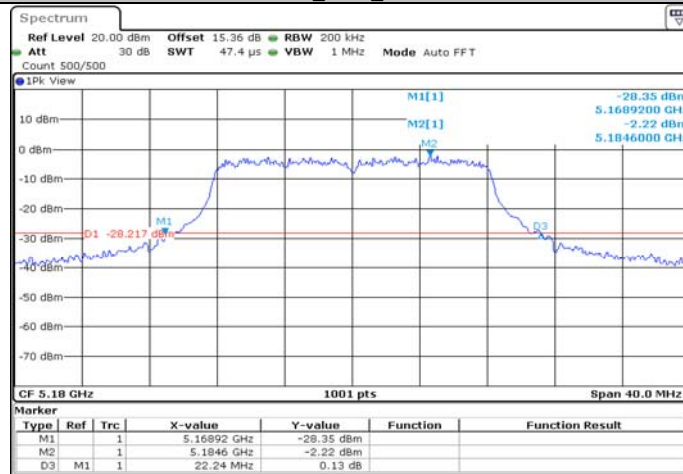
Appendix A: Emission Bandwidth

Test Result

TestMode	Antenna	Channel	26db EBW [MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	22.240	---	PASS
	Ant1	5200	21.440	---	PASS
	Ant1	5240	21.720	---	PASS
11N20	Ant1	5180	22.640	---	PASS
	Ant1	5200	22.400	---	PASS
	Ant1	5240	22.160	---	PASS
11N40	Ant1	5190	48.560	---	PASS
	Ant1	5230	50.080	---	PASS

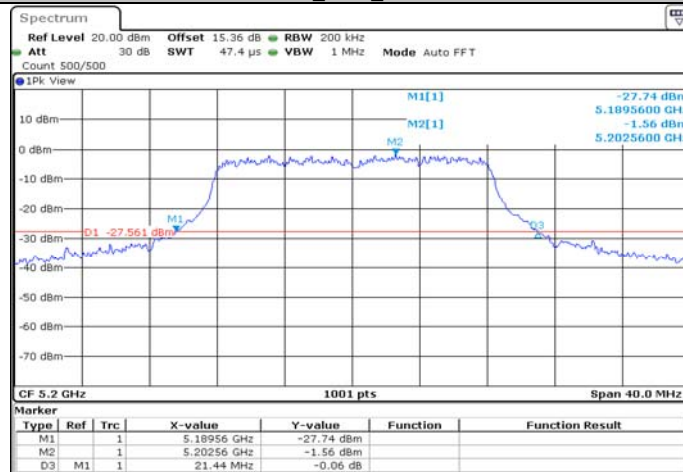
Test Graphs

11A_Ant1_5180



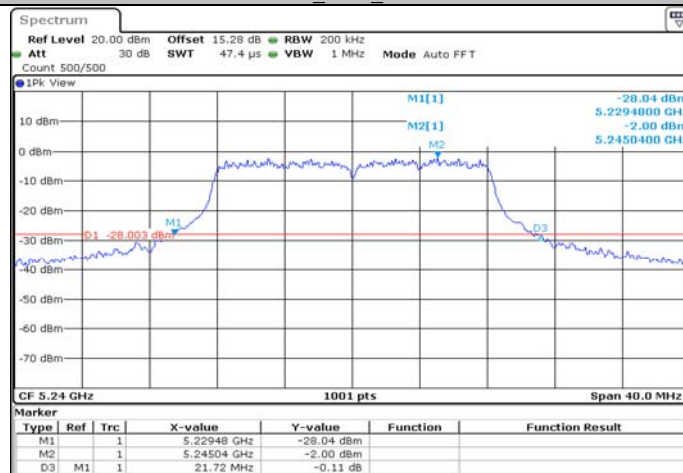
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11A_Ant1_5200



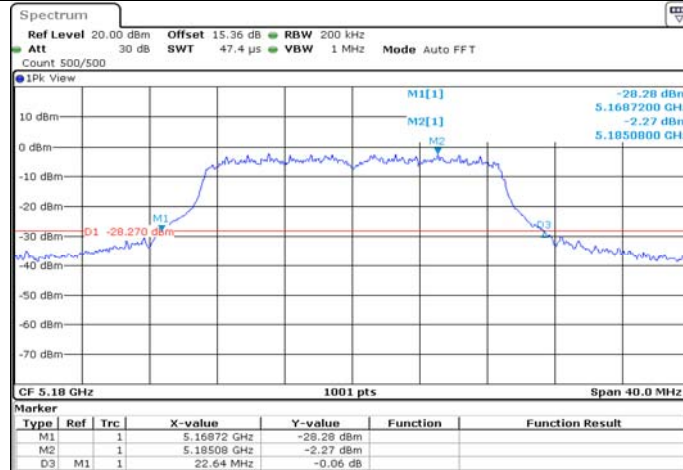
Date: 13.MAY.2020 18:21:05

11A_Ant1_5240



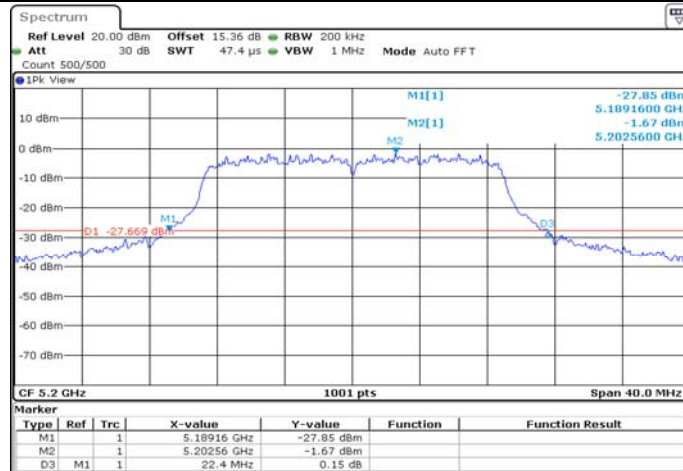
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11N20_Ant1_5180



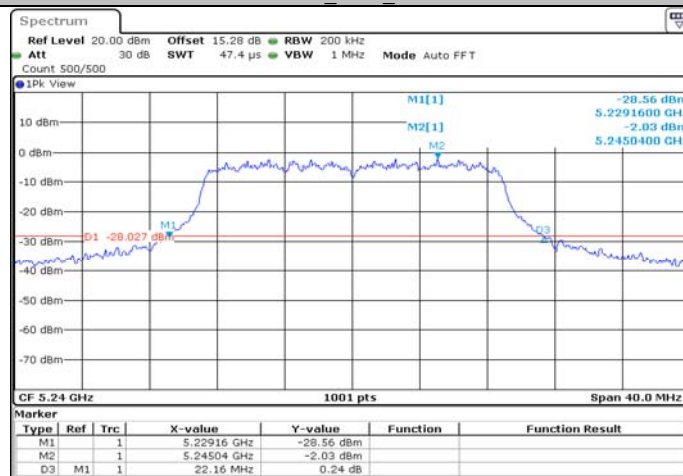
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11N20_Ant1_5200



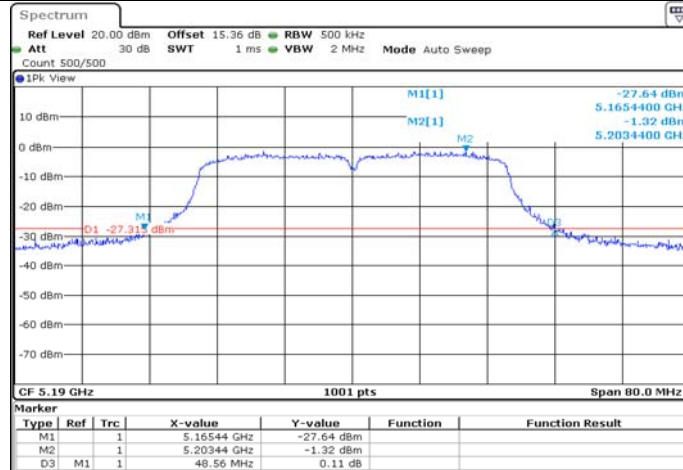
Date: 13.MAY.2020 18:30:10

11N20_Ant1_5240



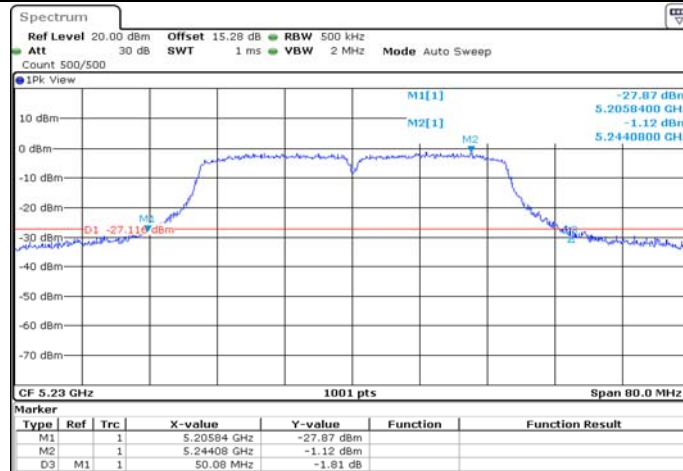
Date: 13.MAY.2020 18:32:35

11N40 Ant1 5190



Date: 13.MAY.2020 18:35:50

11N40 Ant1 5230



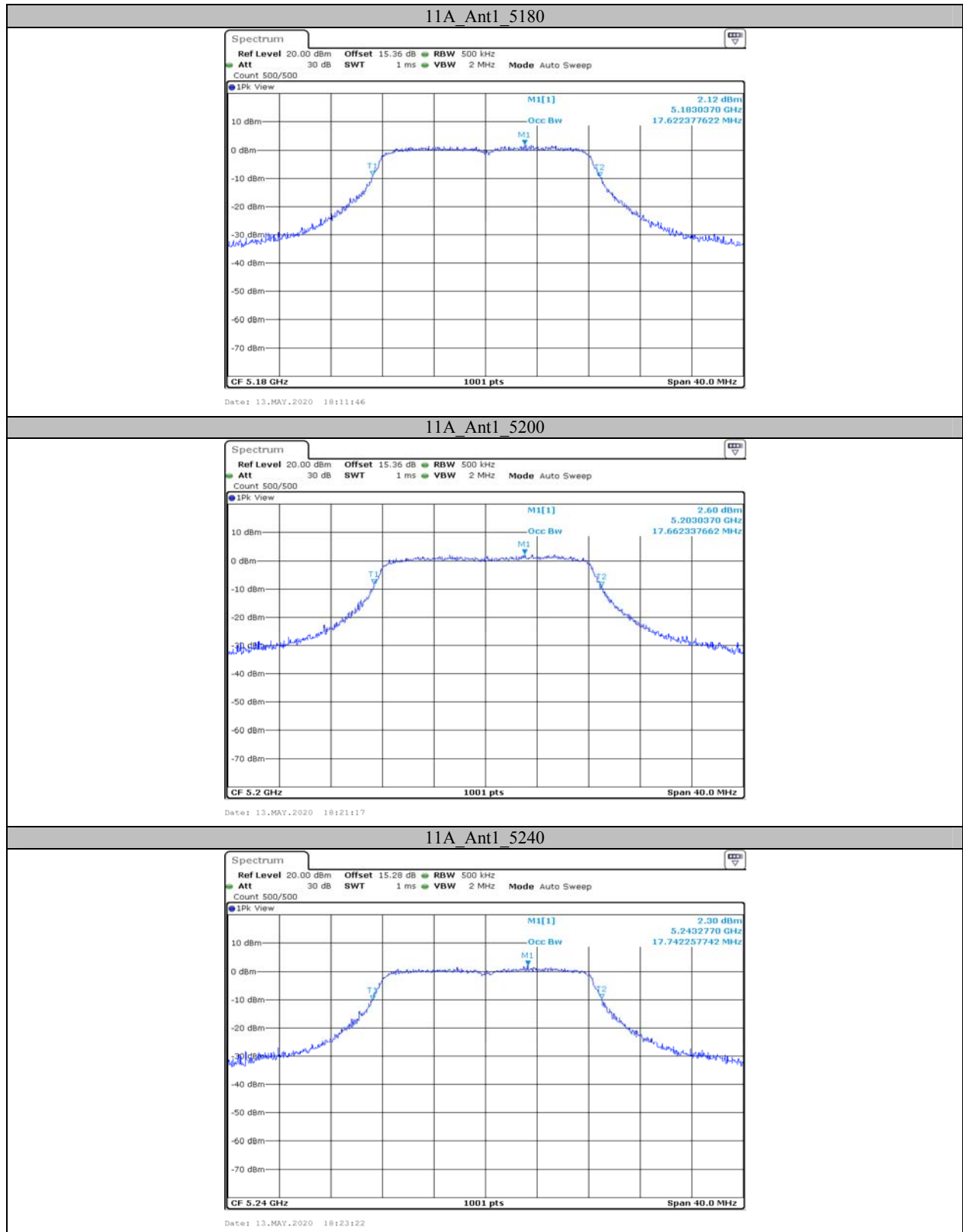
Date: 13.MAY.2020 18:38:22

Appendix B: Occupied channel bandwidth**Test Result**

TestMode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	17.622	---	PASS
	Ant1	5200	17.662	---	PASS
	Ant1	5240	17.742	---	PASS
11N20	Ant1	5180	18.581	---	PASS
	Ant1	5200	18.661	---	PASS
	Ant1	5240	18.661	---	PASS
11N40	Ant1	5190	37.483	---	PASS
	Ant1	5230	37.962	---	PASS

Note: No transmitted signal in the 99% bandwidth extends into the U-NII-2A and U-NII-2C band.

Test Graphs

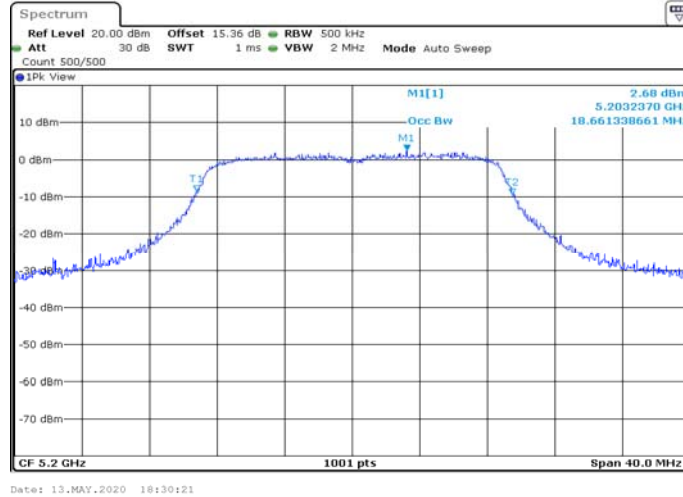


11N20_Ant1_5180



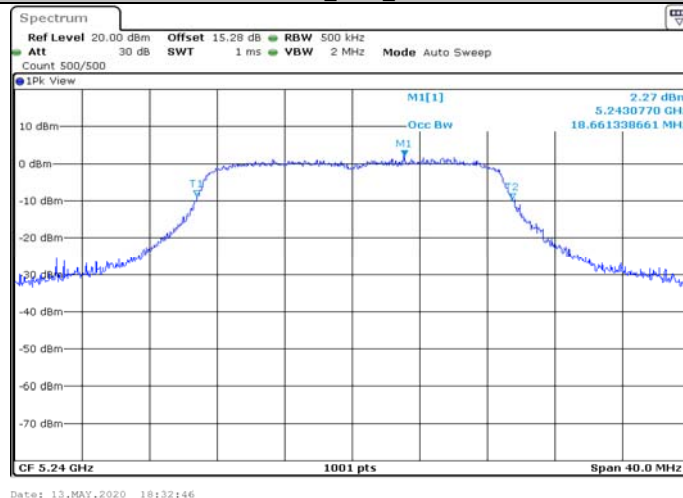
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11N20_Ant1_5200



Date: 13.MAY.2020 18:30:21

11N20_Ant1_5240



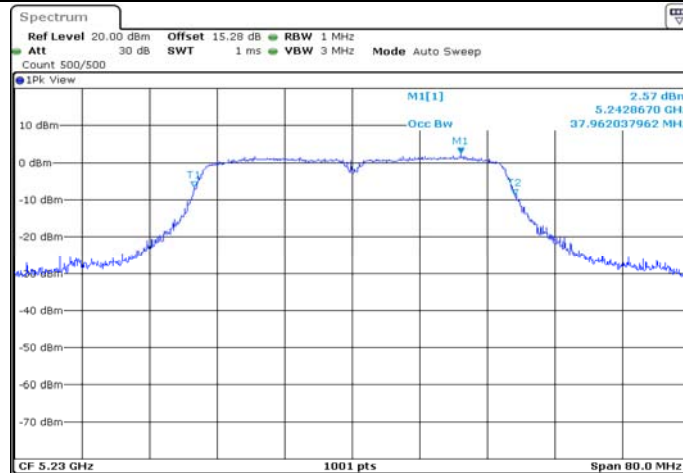
Date: 13.MAY.2020 18:32:46

11N40 Ant1 5190



Date: 13.MAY.2020 18:36:01

11N40 Ant1 5230



Date: 13.MAY.2020 18:38:34

Appendix C: Maximum conducted output power**Test Result**

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11A	Ant1	5180	7.51	<=30	PASS
	Ant2	5180	6.78	<=30	PASS
	total	5180	10.17	<=30	PASS
	Ant1	5200	7.94	<=30	PASS
	Ant2	5200	7.55	<=30	PASS
	total	5200	10.76	<=30	PASS
	Ant1	5240	7.57	<=30	PASS
	Ant2	5240	9.26	<=30	PASS
	total	5240	11.51	<=30	PASS
11N20	Ant1	5180	7.4	<=30	PASS
	Ant2	5180	8.99	<=30	PASS
	total	5180	11.28	<=30	PASS
	Ant1	5200	7.88	<=30	PASS
	Ant2	5200	7.42	<=30	PASS
	total	5200	10.67	<=30	PASS
	Ant1	5240	7.62	<=30	PASS
	Ant2	5240	7.15	<=30	PASS
	total	5240	10.4	<=30	PASS
11N40	Ant1	5190	7.08	<=30	PASS
	Ant2	5190	7.14	<=30	PASS
	total	5190	10.12	<=30	PASS
	Ant1	5230	7.3	<=30	PASS
	Ant2	5230	7.2	<=30	PASS
	total	5230	10.26	<=30	PASS

Note:

The product is a outdoor access point device.

The maximum antenna gain is 1.7dBi.

Directional gain = array gain + antenna gain

Array gain=0 for $N_{ANT} \leq 4$, so directional gain=1.7dBi<6dBi

The maximum conducted output power is 11.51dBm, the maximum e.i.r.p. is

11.51dBm+1.7dBi=13.21dBm<21dBm, so it's compliance with the requirement of FCC part 15.407

a (1)(i) : The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm)

Appendix D: Maximum power spectral density**Test Result**

TestMode	Antenna	Channel	Result [dBm/MHz]	Limit[dBm/MHz]	Verdict
11A	Ant1	5180	4.08	<=17	PASS
	Ant2	5180	3.26	<=17	PASS
	total	5180	6.7	<=17	PASS
	Ant1	5200	2.75	<=17	PASS
	Ant2	5200	3.54	<=17	PASS
	total	5200	6.17	<=17	PASS
	Ant1	5240	1.88	<=17	PASS
	Ant2	5240	3.19	<=17	PASS
11N20	total	5240	5.59	<=17	PASS
	Ant1	5180	2.02	<=17	PASS
	Ant2	5180	1.16	<=17	PASS
	total	5180	4.62	<=17	PASS
	Ant1	5200	2.28	<=17	PASS
	Ant2	5200	2.08	<=17	PASS
	total	5200	5.19	<=17	PASS
	Ant1	5240	2.59	<=17	PASS
11N40	Ant2	5240	0.32	<=17	PASS
	total	5240	4.61	<=17	PASS
	Ant1	5190	-1.27	<=17	PASS
	Ant2	5190	-3.19	<=17	PASS
	total	5190	0.89	<=17	PASS
	Ant1	5230	-1.23	<=17	PASS
	Ant2	5230	-2.67	<=17	PASS
	total	5230	1.12	<=17	PASS

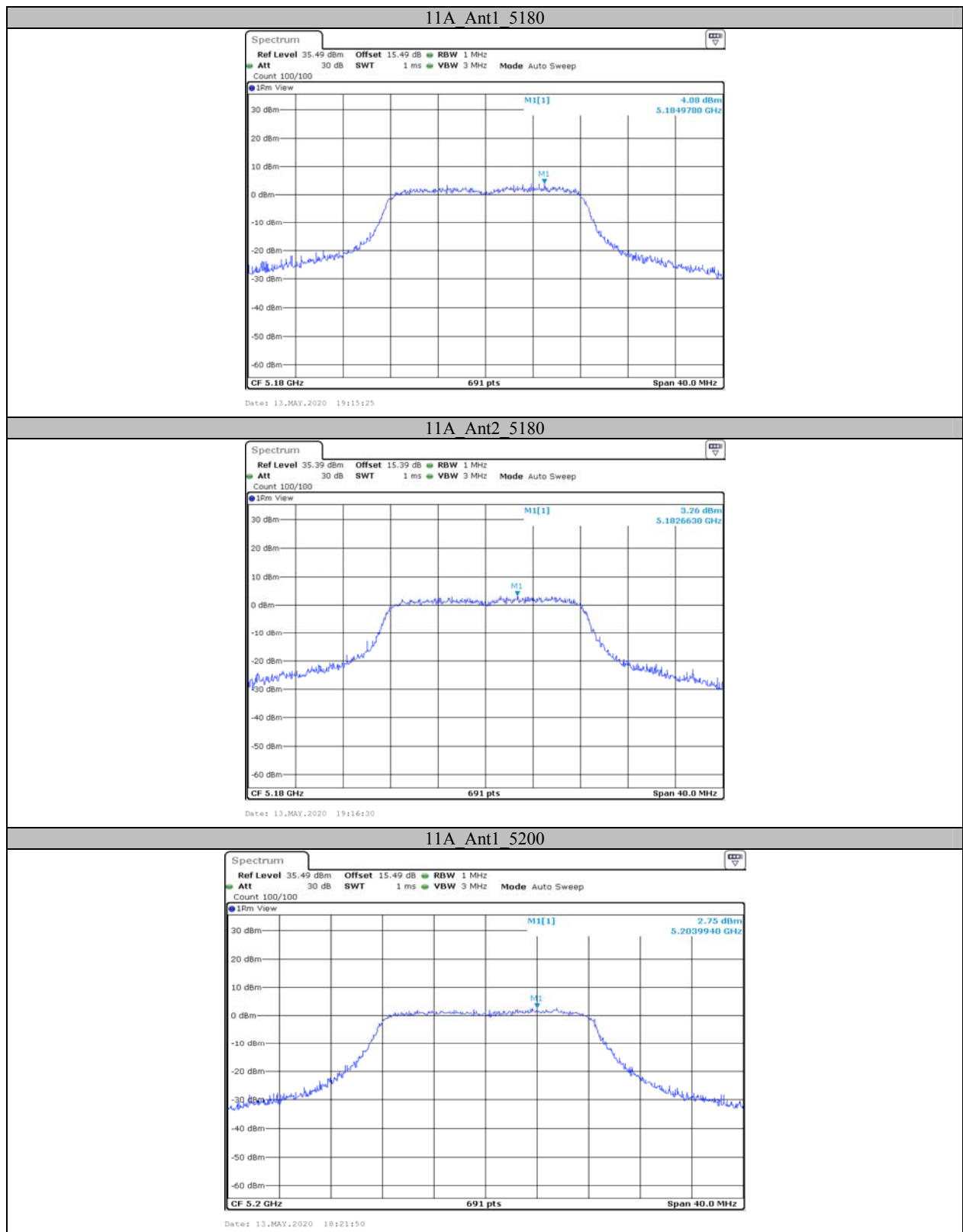
Note: The Duty Cycle Factor is compensated in the graph.

The product is a outdoor access point device.

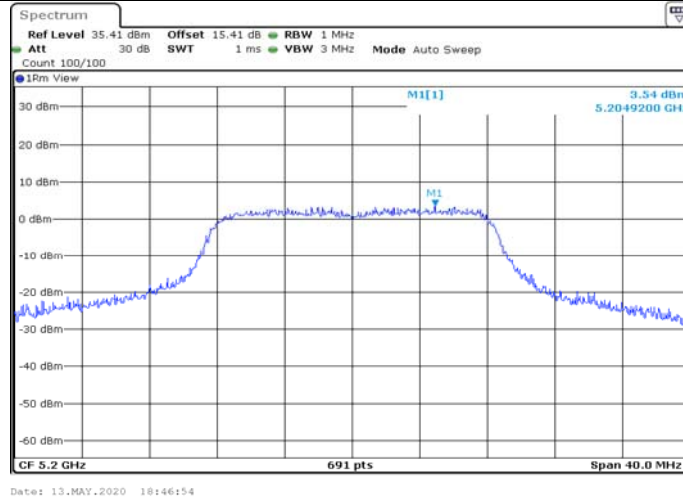
The maximum antenna gain is 1.7dBi.

Directional gain = array gain + antenna gain = $10 \cdot \log(N_{\text{ANT}}/N_{\text{SS}}) + 1.7\text{dBi} = 4.7\text{dBi} < 6\text{dBi}$

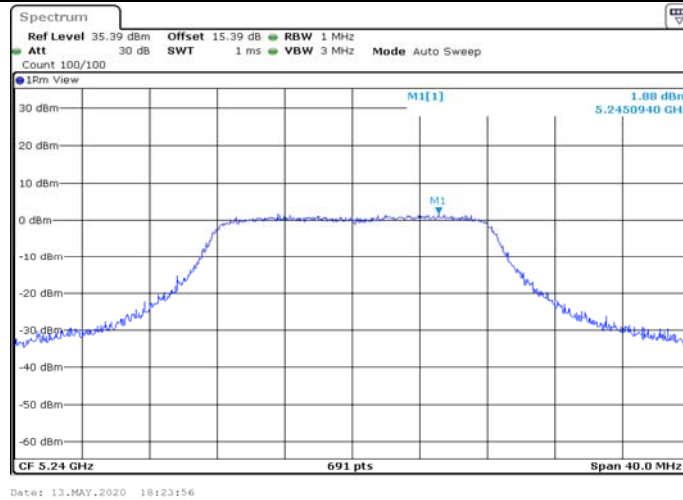
Test Graphs



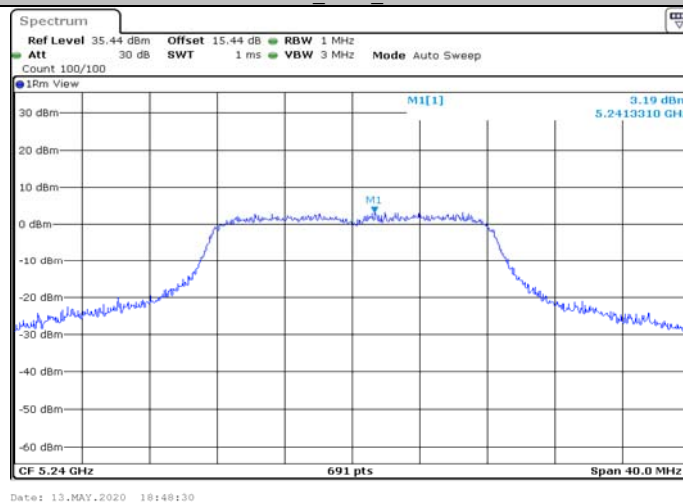
11A_Ant2_5200



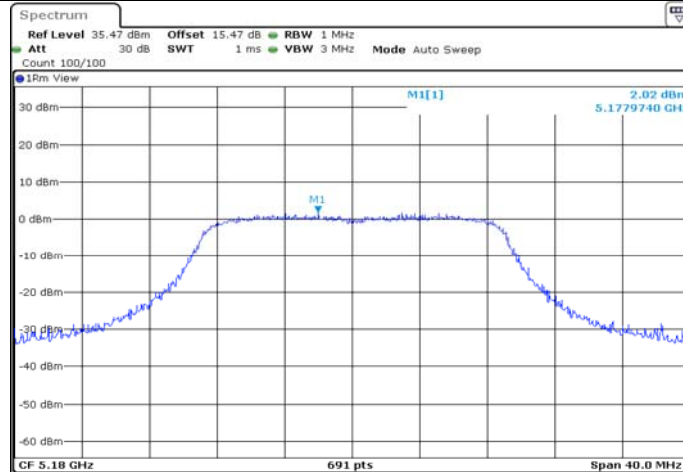
11A_Ant1_5240



11A_Ant2_5240

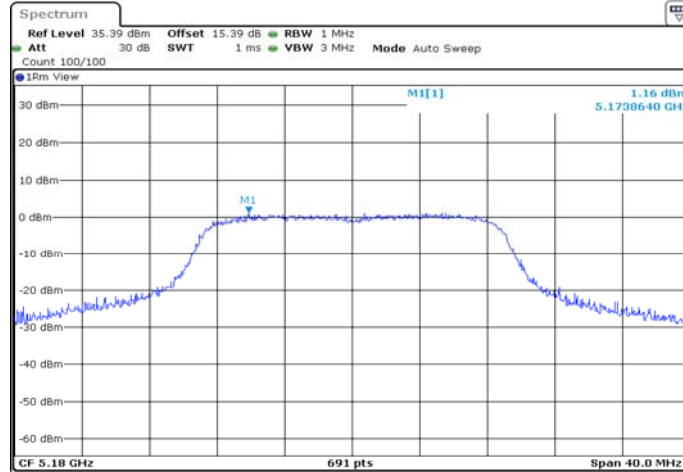


11N20_Ant1_5180



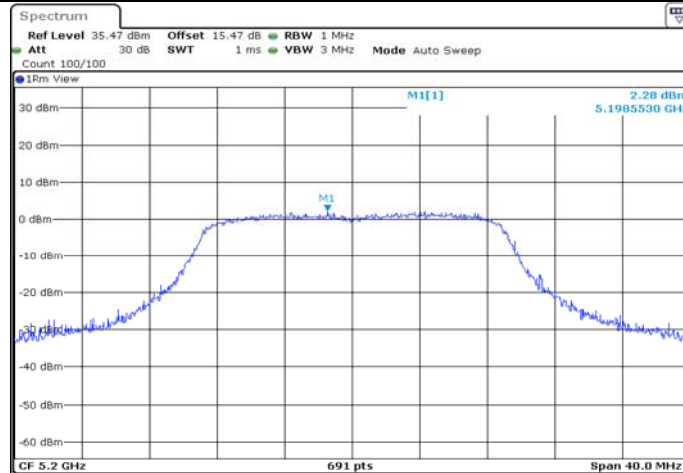
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11N20_Ant2_5180



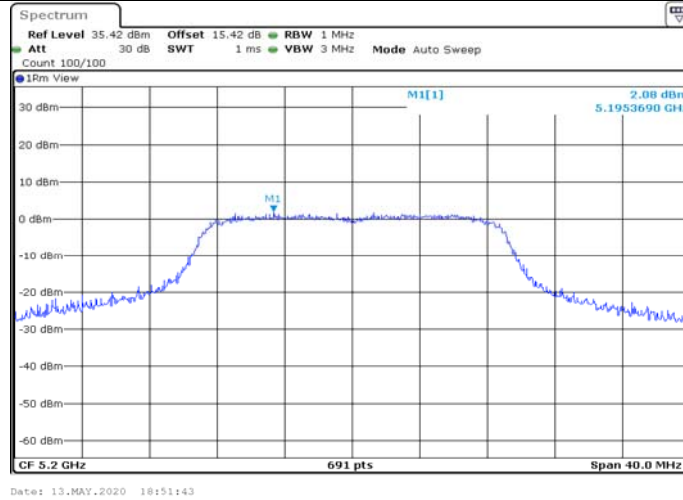
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11N20_Ant1_5200

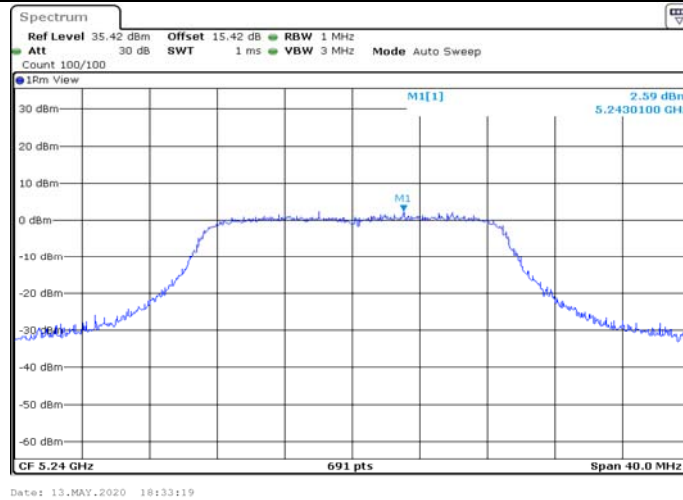


Date: 13.MAY.2020 18:30:54

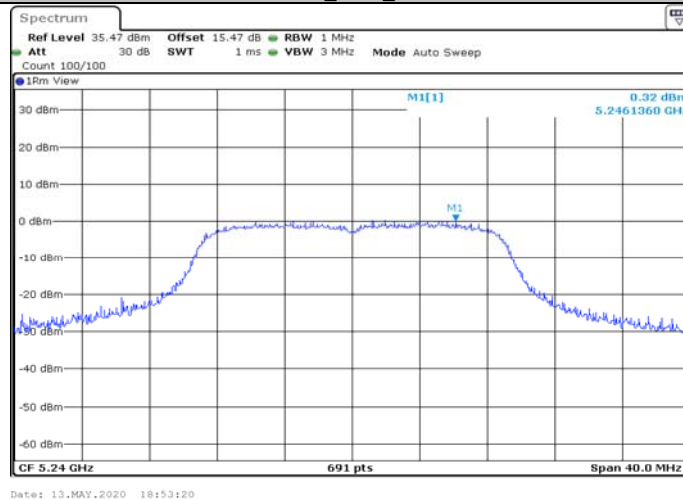
11N20_Ant2_5200



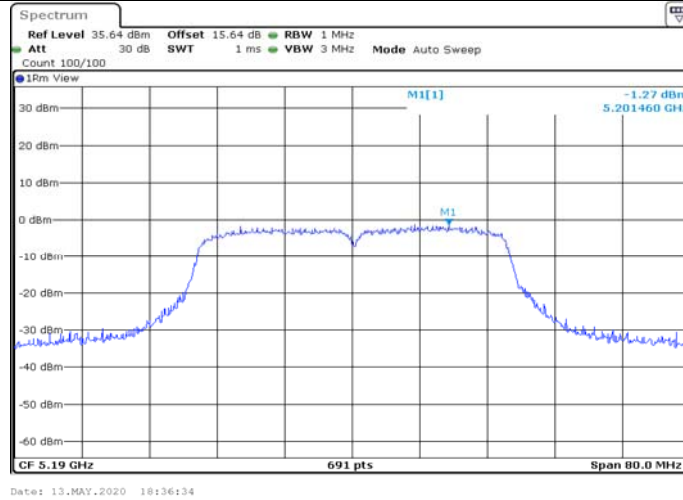
11N20_Ant1_5240



11N20_Ant2_5240

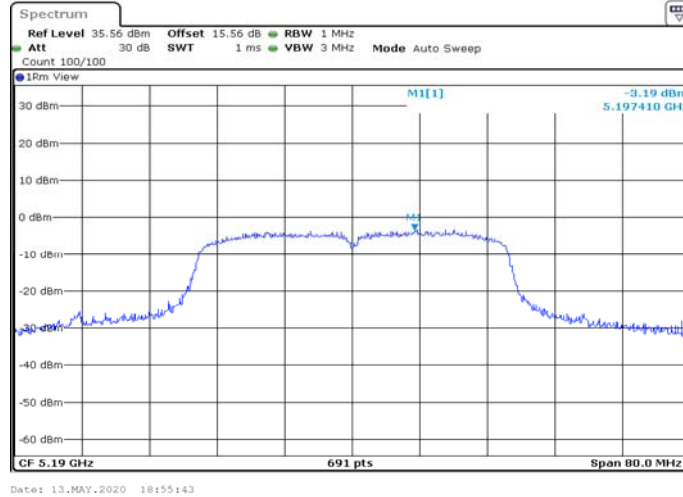


11N40_Ant1_5190



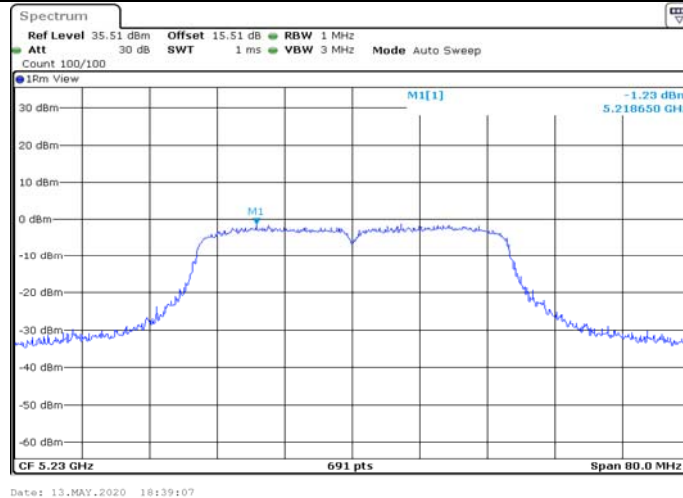
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11N40_Ant2_5190

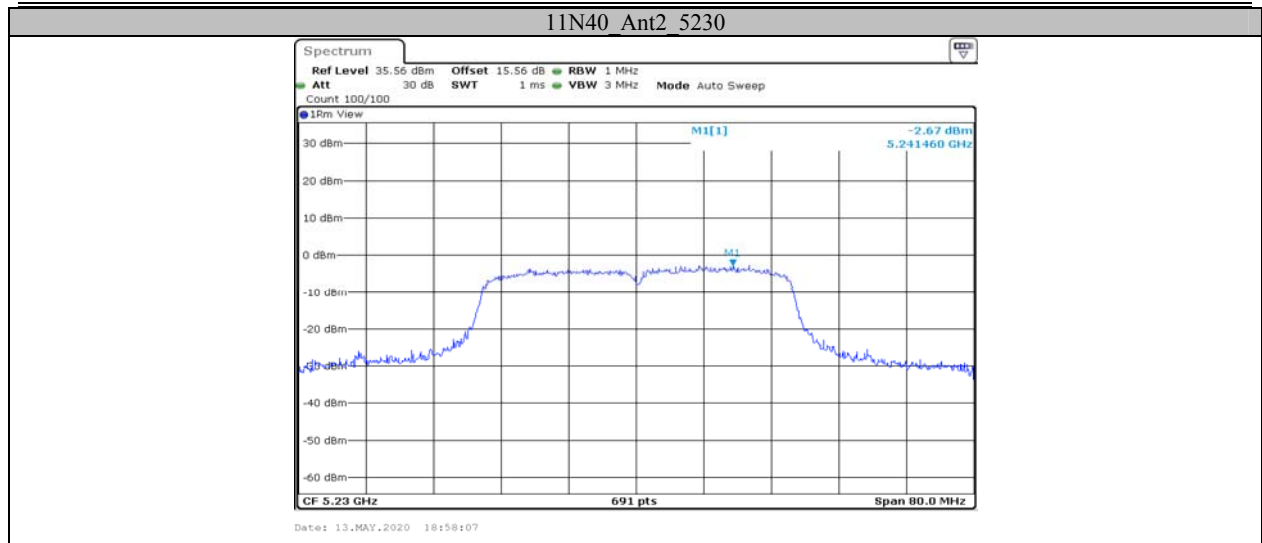


Date: 13.MAY.2020 18:55:43

11N40_Ant1_5230



Date: 13.MAY.2020 18:39:07

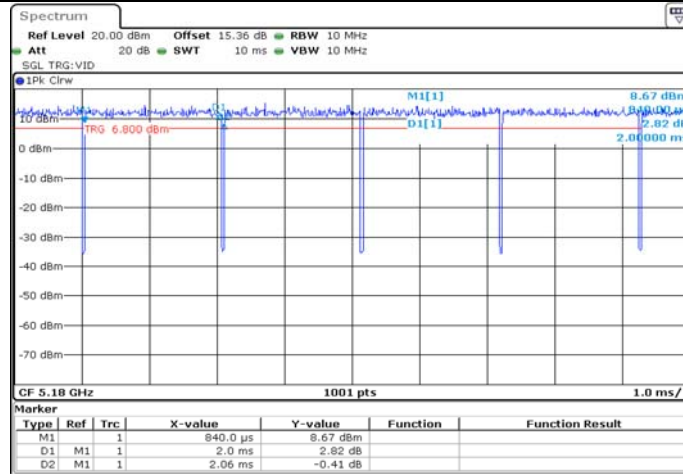


Appendix E: Duty Cycle**Test Result**

TestMode	Antenna	Channel	TransmissionDuration [ms]	Transmission Period [ms]	Duty Cycle [%]
11A	Ant1	5180	2.00	2.06	97.09
	Ant2	5180	2.01	2.06	97.57
	Ant1	5200	2.00	2.06	97.09
	Ant2	5200	2.00	2.06	97.09
	Ant1	5240	2.01	2.06	97.57
	Ant2	5240	2.01	2.06	97.57
11N20	Ant1	5180	1.87	1.92	97.40
	Ant2	5180	1.87	1.92	97.40
	Ant1	5200	1.87	1.92	97.40
	Ant2	5200	1.87	1.93	96.89
	Ant1	5240	1.86	1.92	96.87
	Ant2	5240	1.87	1.93	96.89
11N40	Ant1	5190	0.90	0.96	93.75
	Ant2	5190	0.91	0.97	93.81
	Ant1	5230	0.91	0.96	94.79
	Ant2	5230	0.91	0.96	94.79

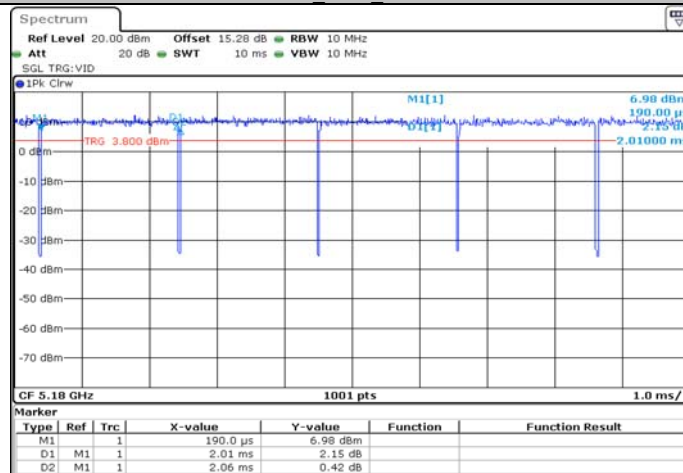
Test Graphs

11A Ant1 5180



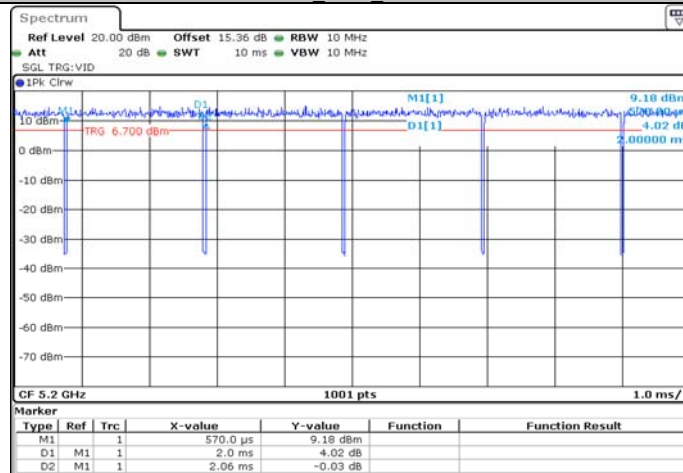
Date: 13.MAY.2020 18:12:00

11A Ant2 5180



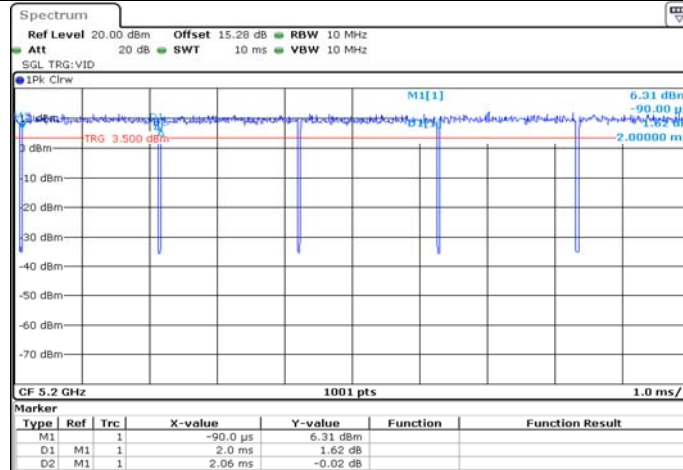
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11A Ant1 5200



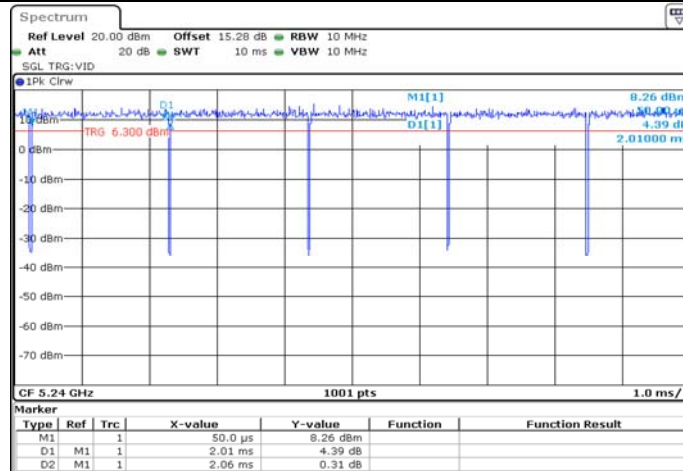
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11A_Ant2_5200



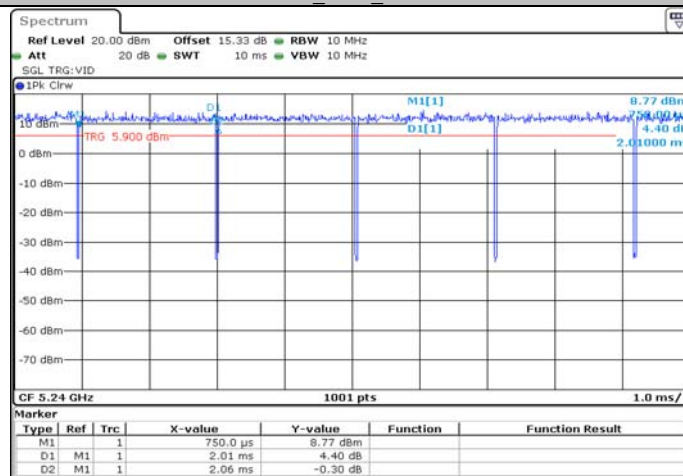
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11A_Ant1_5240



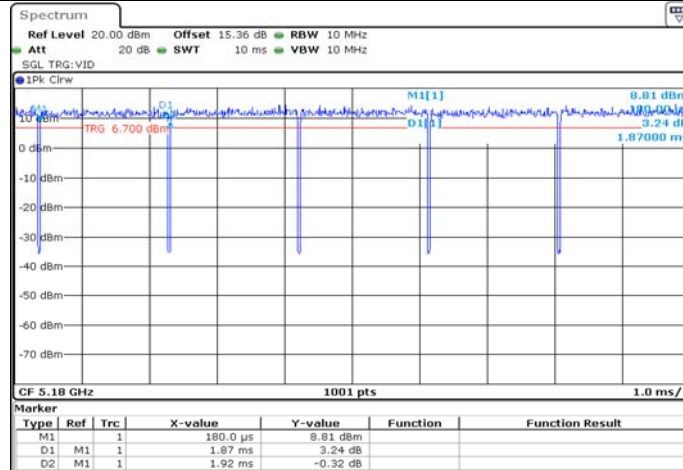
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11A_Ant2_5240



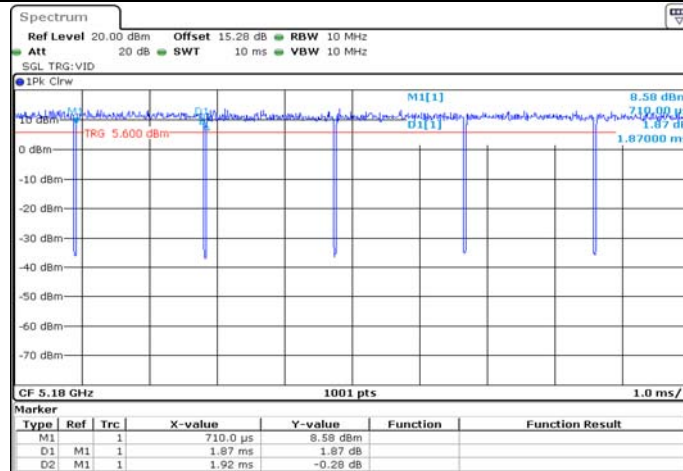
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11N20_Ant1_5180



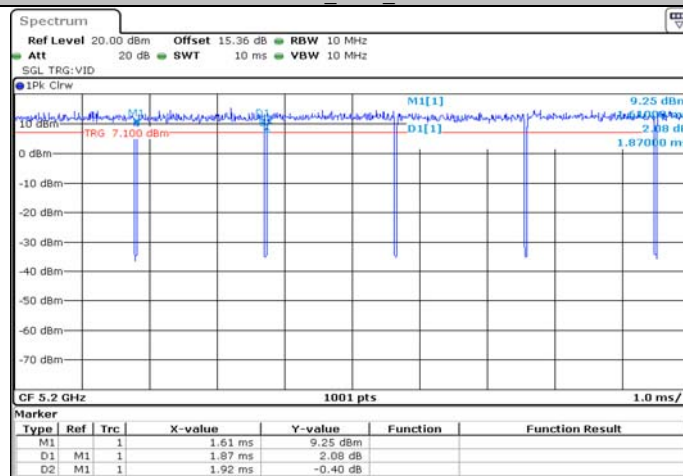
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11N20_Ant2_5180



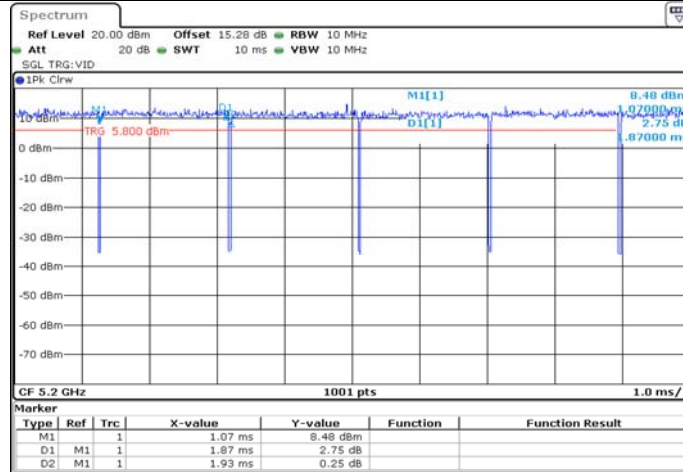
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11N20_Ant1_5200



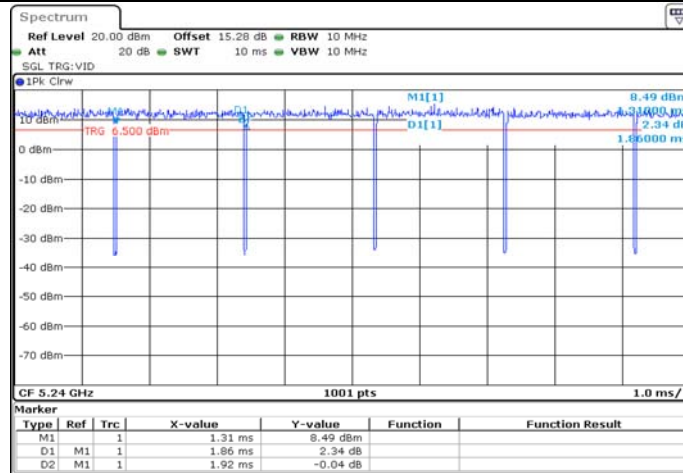
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11N20_Ant2_5200



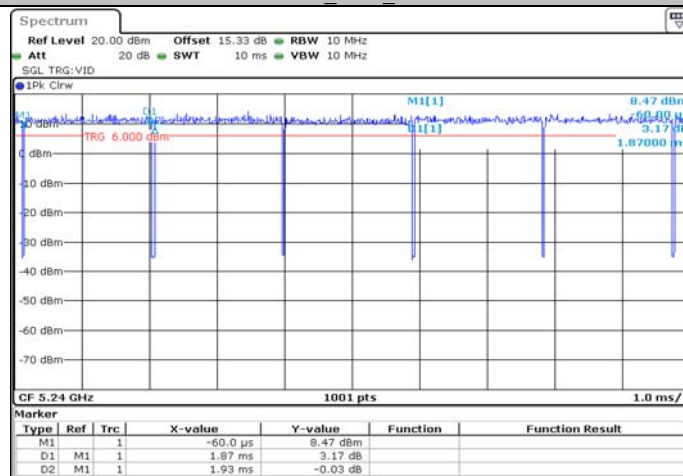
Date: 13.MAY.2020 18:51:24

11N20_Ant1_5240



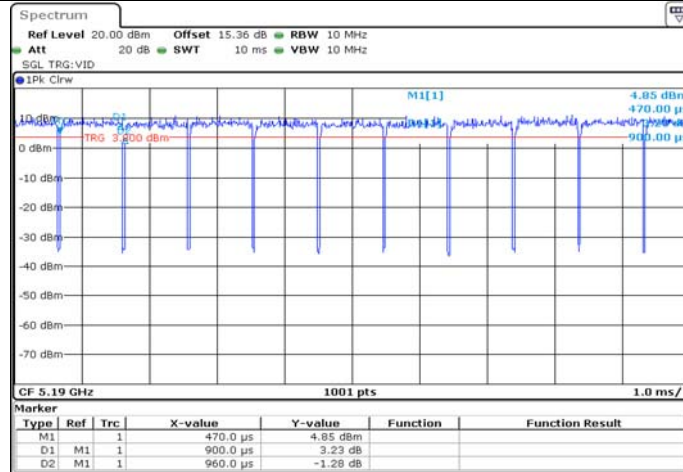
Date: 13.MAY.2020 18:53:00

11N20_Ant2_5240



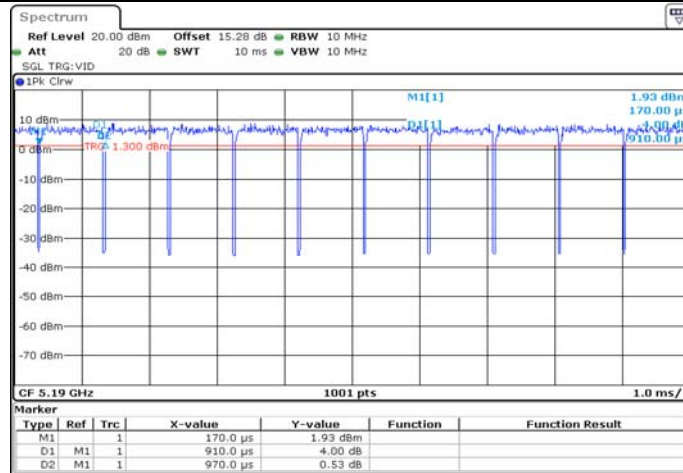
Date: 13.MAY.2020 18:53:01

11N40_Ant1_5190



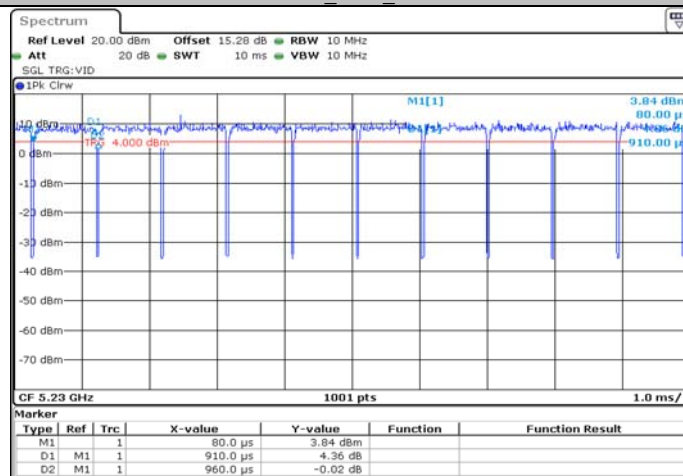
Date: 13.MAY.2020 18:36:15

11N40_Ant2_5190

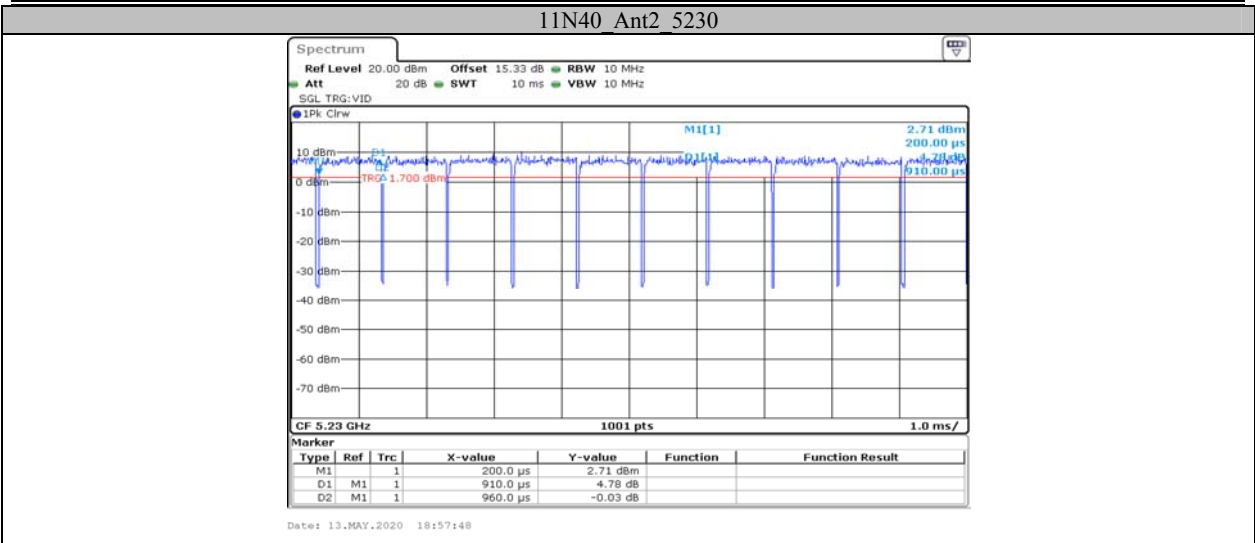


Date: 13.MAY.2020 18:55:24

11N40_Ant1_5230



Date: 13.MAY.2020 18:38:48



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