

FCC PART 15.407

TEST REPORT

For

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	R/C QUADCOPTER
Tested Model	SP510
Multiple Models	SP510 Plus, SP720, SP730, SP750, SP760, SP770, SP780, SP800, SP820
Model Difference	Refer to the DoS letter
Frequency Range	5G Wi-Fi: 5150-5250 MHz
Maximum Conducted Average Output Power	16.02dBm (802.11a), 17.82dBm(802.11n20), 17.21dBm(802.11n40)
Modulation Technique	OFDM
Antenna Specification*	1.5dBi(It is provided by the applicant)
Voltage Range	DC 7.4V from battery
Date of Test	2020-07-02 to 2020-07-20
Sample serial number	RSZ200623007-RF-S1(Assigned by BACL, Shenzhen)
Received date	2020-06-23
Sample/EUT Status	Good condition

Objective

This type approval report is 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.

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 EUT has two antennas but only support the SISO mode. It can operate in 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
39	5190	46	5230
40	5200	48	5240

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

“sureCRT”* software was used. The software and power level was provided by the applicant.

U-NII	Mode	Frequency (MHz)	Rate	Power Level*
5150 – 5250MHz	802.11 a	5180	6 Mbps	80
		5200	6 Mbps	80
		5240	6 Mbps	80
	802.11 n20	5180	MCS0	95
		5200	MCS0	95
		5240	MCS0	95
	802.11 n40	5190	MCS0	100
		5230	MCS0	100

Pre-scan with all the data rates, the above data rate is the worst case.

Duty cycle

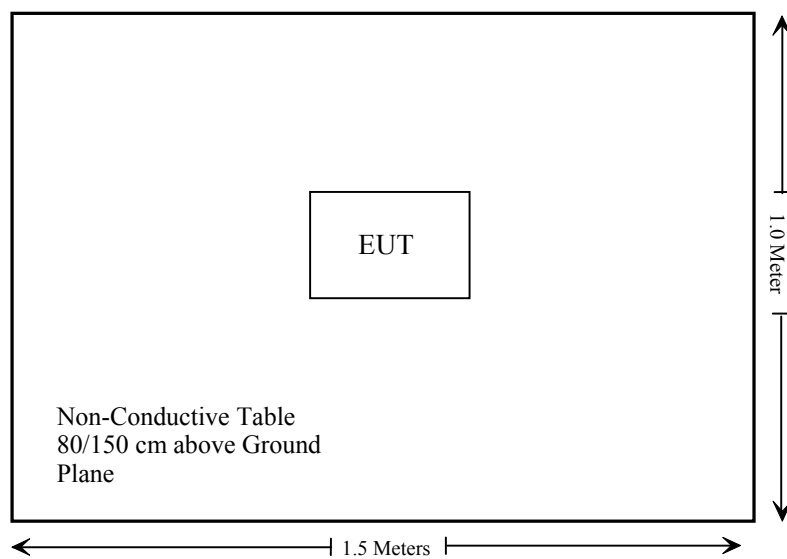
Please see the Appendix E.

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

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	Not Applicable
§15.205& §15.209 &§15.407(b) (1), (7)	Undesirable Emission& Restricted Bands	Compliance
§15.407(a)(5)	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 is powered by battery when 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
Unknown	Cable 2	RF Cable 2	F-03-EM197	2019/11/29	2020/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2019/7/22	2020/7/21
COM-POWER	Pre-amplifier	PA-122	181919	2019/11/29	2020/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2019/11/29	2020/11/28
Sunol Sciences	Horn Antenna	DRH-118	A052604	2017/12/22	2020/12/21
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
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	2020/7/10	2021/7/9
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

* **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 15.247 (i) and subpart 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/cm²)	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)

Frequency (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm²)	MPE Limit (mW/cm²)
	(dBi)	(numeric)	(dBm)	(mW)			
5150-5250	1.5	1.41	18.0	63.10	20	0.018	1.0

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 internal antennas arrangement for 5G Wi-Fi which was permanently attached and the antenna gain is 1.5dBi, fulfill the requirement of this section. Please refer to the EUT photos.

Result: Compliance.

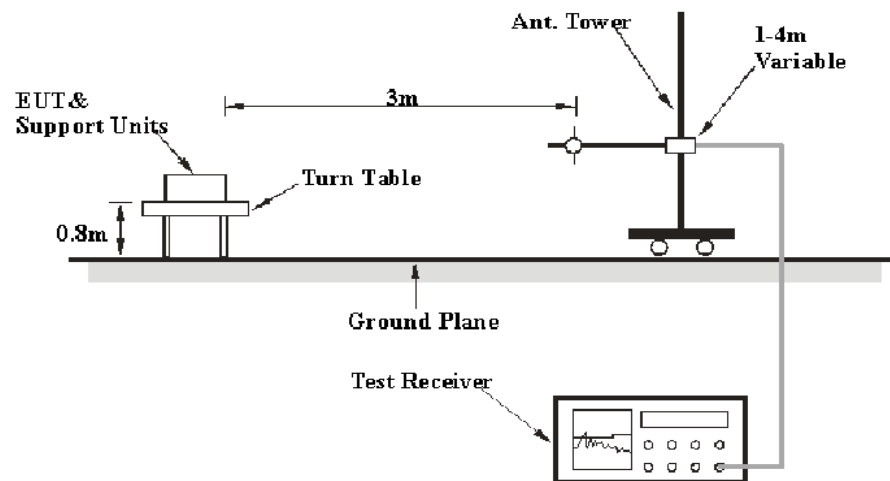
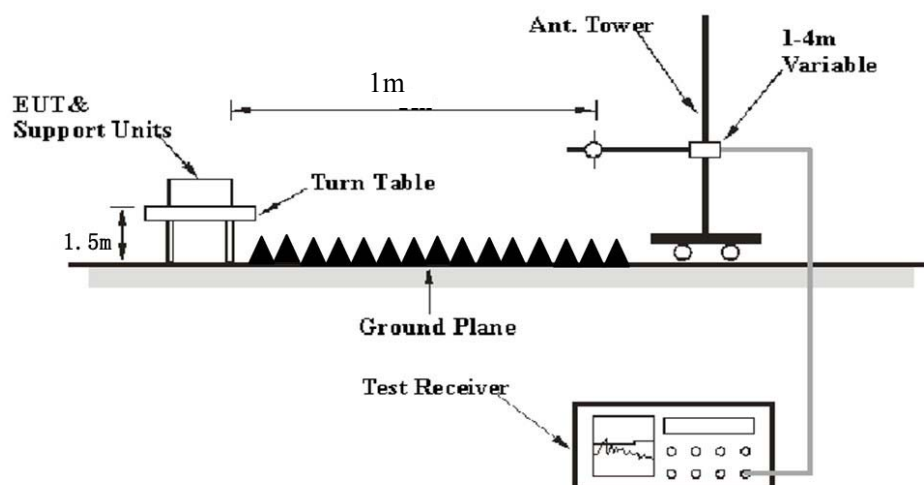
§15.205 & §15.209 & §15.407(B) (1) – UNDESIRABLE EMISSION**Applicable Standard**

FCC §15.407 (b) (1); §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.

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:

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

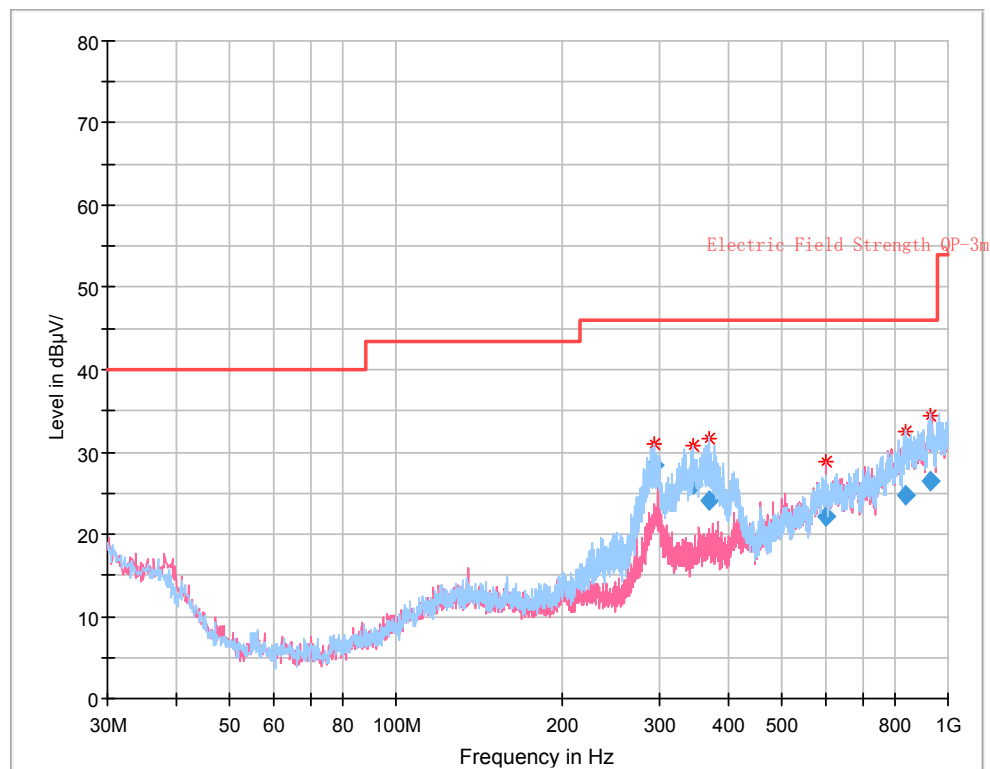
Test Data**Environmental Conditions**

Temperature:	28 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Holland Yang on 2020-07-02 for below 1GHz and Leven Gan from 2020-07-02 to 2020-07-03 for above 1GHz.

EUT operation mode: Transmitting

30 MHz – 1 GHz: (worst case is 802.11n20 mode 5180 MHz antenna 2)



Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBμV/m)	Margin (dB)
293.357375	28.29	102.0	H	267.0	-11.1	46.00	17.71
346.017125	25.95	103.0	H	225.0	-10.8	46.00	20.05
369.620625	24.18	115.0	H	235.0	-10.6	46.00	21.82
600.035625	22.12	304.0	V	136.0	-1.6	46.00	23.88
835.991625	24.73	339.0	H	91.0	2.7	46.00	21.27
931.178500	26.40	154.0	H	209.0	4.8	46.00	19.60

1 ~ 40 GHz:

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

5150-5250 MHz:**Antenna 1:**

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									
5149.41	30.38	PK	174	1.2	H	38.36	68.74	83.5	14.76
5149.41	16.45	Ave.	174	1.2	H	38.36	54.81	63.5	8.69
5354.56	30.84	PK	328	2.4	H	39.09	69.93	83.5	13.57
5354.56	16.53	Ave.	328	2.4	H	39.09	55.62	63.5	7.88
10360.00	47.43	PK	277	2.1	H	17.42	64.85	77.7	12.85
5200 MHz									
10400.00	43.83	PK	127	1.1	H	17.52	61.35	77.7	16.35
5240 MHz									
5148.69	30.86	PK	146	2.4	H	38.36	69.22	83.5	14.28
5148.69	16.88	Ave.	146	2.4	H	38.36	55.24	63.5	8.26
5356.27	30.67	PK	82	2.1	H	39.09	69.76	83.5	13.74
5356.27	16.85	Ave.	82	2.1	H	39.09	55.94	63.5	7.56
10480.00	44.77	PK	61	1.0	H	17.25	62.02	77.7	15.68
802.11n20									
5180 MHz									
5148.63	31.12	PK	32	2.3	H	38.36	69.48	83.5	14.02
5148.63	17.04	Ave.	32	2.3	H	38.36	55.40	63.5	8.10
5355.36	30.91	PK	41	1.8	H	39.09	70.00	83.5	13.50
5355.36	16.55	Ave.	41	1.8	H	39.09	55.64	63.5	7.86
10360.00	49.99	PK	5	1.2	H	17.42	67.41	77.7	10.29
5200 MHz									
10400.00	46.22	PK	42	1.0	H	17.52	63.74	77.7	13.96
5240 MHz									
5149.66	31.14	PK	129	1.2	H	38.36	69.50	83.5	14.00
5149.66	17.03	Ave.	129	1.2	H	38.36	55.39	63.5	8.11
5352.75	30.94	PK	351	1.6	H	39.09	70.03	83.5	13.47
5352.75	16.92	Ave.	351	1.6	H	39.09	56.01	63.5	7.49
10480.00	46.24	PK	296	1.2	H	17.25	63.49	77.7	14.21

802.11n40 Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (5190 MHz)									
5147.86	30.88	PK	157	2.0	H	38.36	69.24	83.5	14.26
5147.86	16.84	Ave.	157	2.0	H	38.36	55.20	63.5	8.30
5353.37	31.01	PK	1	2.1	H	39.09	70.10	83.5	13.40
5353.37	16.77	Ave.	1	2.1	H	39.09	55.86	63.5	7.64
10380.00	43.23	PK	304	2.3	H	17.42	60.65	77.7	17.05
High Channel (5230 MHz)									
5148.93	30.76	PK	241	1.5	H	38.36	69.12	83.5	14.38
5148.93	16.80	Ave.	241	1.5	H	38.36	55.16	63.5	8.34
5357.41	30.64	PK	155	1.9	H	39.09	69.73	83.5	13.77
5357.41	16.74	Ave.	155	1.9	H	39.09	55.83	63.5	7.67
10460.00	43.66	PK	83	2.2	H	17.15	60.81	77.7	16.89

Antenna 2:

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									
5148.92	31.21	PK	120	1.3	H	38.36	69.57	83.5	13.93
5148.92	16.92	Ave.	120	1.3	H	38.36	55.28	63.5	8.22
5352.45	30.86	PK	341	1.2	H	39.09	69.95	83.5	13.55
5352.45	16.76	Ave.	341	1.2	H	39.09	55.85	63.5	7.65
10360.00	47.38	PK	273	2.5	H	17.42	64.80	77.7	12.90
5200 MHz									
10400.00	44.01	PK	344	1.9	H	17.52	61.53	77.7	16.17
5240 MHz									
5147.68	31.52	PK	278	1.6	H	38.36	69.88	83.5	13.62
5147.68	17.03	Ave.	278	1.6	H	38.36	55.39	63.5	8.11
5354.36	30.82	PK	116	1.4	H	39.09	69.91	83.5	13.59
5354.36	16.81	Ave.	116	1.4	H	39.09	55.90	63.5	7.60
10480.00	44.82	PK	106	2.4	H	17.25	62.07	77.7	15.63
802.11n20									
5180 MHz									
5149.62	30.86	PK	351	2.0	H	38.36	69.22	83.5	14.28
5149.62	16.89	Ave.	351	2.0	H	38.36	55.25	63.5	8.25
5353.17	30.54	PK	104	1.1	H	39.09	69.63	83.5	13.87
5353.17	16.83	Ave.	104	1.1	H	39.09	55.92	63.5	7.58
10360.00	49.89	PK	179	1.2	H	17.42	67.31	77.7	10.39
5200 MHz									
10400.00	46.53	PK	186	1.1	H	17.52	64.05	77.7	13.65
5240 MHz									
5148.85	31.13	PK	238	1.9	H	38.36	69.49	83.5	14.01
5148.85	17.07	Ave.	238	1.9	H	38.36	55.43	63.5	8.07
5351.47	30.91	PK	267	1.1	H	39.09	70.00	83.5	13.50
5351.47	16.85	Ave.	267	1.1	H	39.09	55.94	63.5	7.56
10480.00	46.47	PK	130	1.7	H	17.25	63.72	77.7	13.98

802.11n40 Mode:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)				
Low Channel (5190 MHz)									
5148.26	31.16	PK	86	1.1	H	38.36	69.52	83.5	13.98
5148.26	16.97	Ave.	86	1.1	H	38.36	55.33	63.5	8.17
5352.39	31.10	PK	168	2.4	H	39.09	70.19	83.5	13.31
5352.39	16.84	Ave.	168	2.4	H	39.09	55.93	63.5	7.57
10380.00	43.72	PK	308	1.4	H	17.42	61.14	77.7	16.56
High Channel (5230 MHz)									
5149.85	30.62	PK	34	1.5	H	38.36	68.98	83.5	14.52
5149.85	16.79	Ave.	34	1.5	H	38.36	55.15	63.5	8.35
5351.55	30.58	PK	338	1.6	H	39.09	69.67	83.5	13.83
5351.55	16.77	Ave.	338	1.6	H	39.09	55.86	63.5	7.64
10460.00	43.83	PK	87	2.0	H	17.15	60.98	77.7	16.72

Note:

Corrected Amplitude = Corrected Factor + Reading

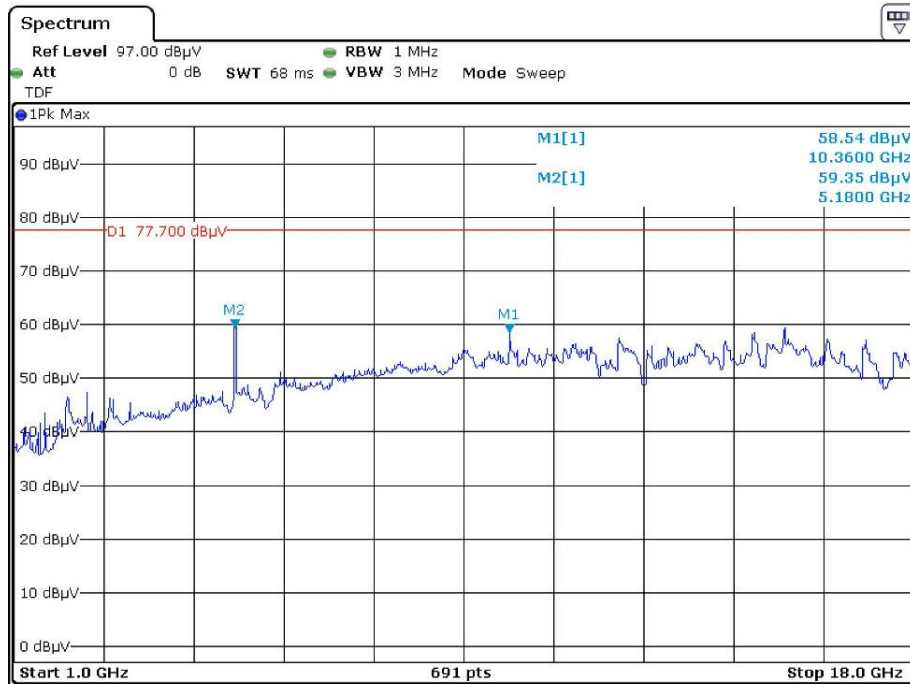
Corrected Factor=Antenna factor (RX) + Cable Loss – Amplifier Factor

Margin = Limit- Corr. Amplitude

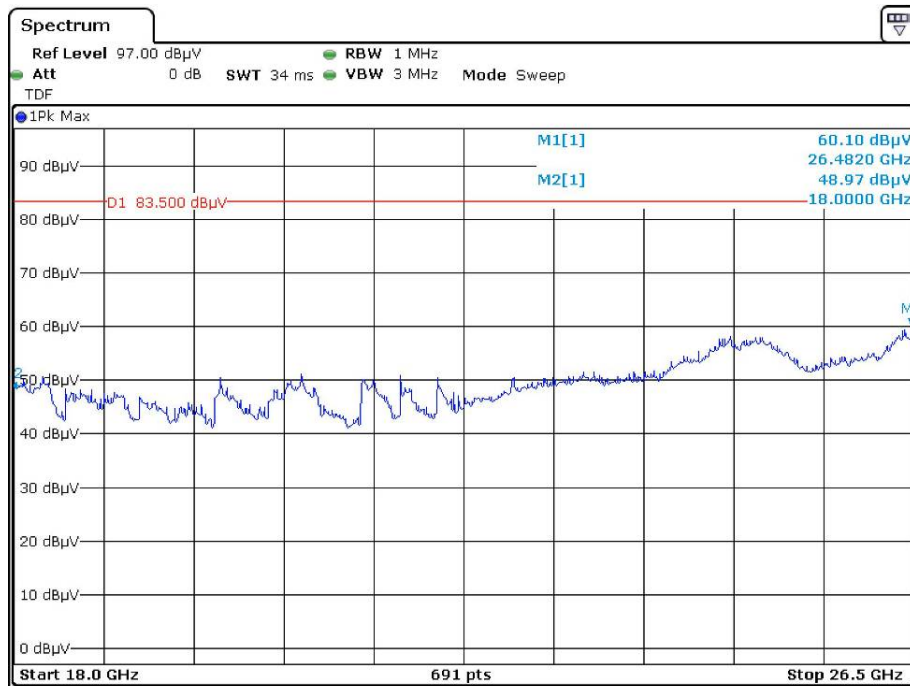
All other spurious emissions are 20 dB below the limit or are on the system noise floor level.

Peak

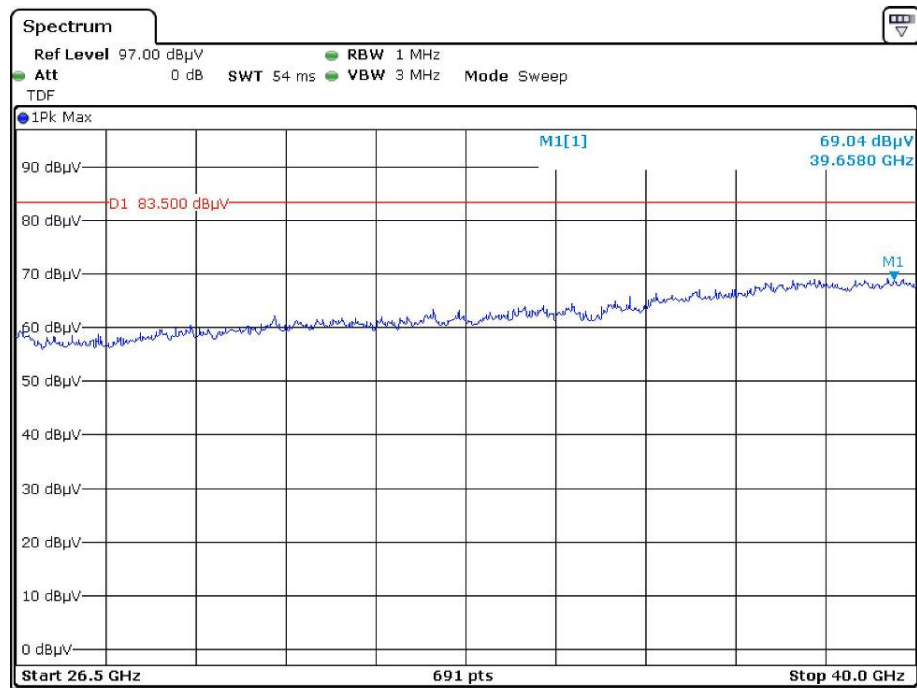
Pre-scan with 802.11n20 5180 MHz

Horizontal

Date: 2.JUL.2020 22:50:33

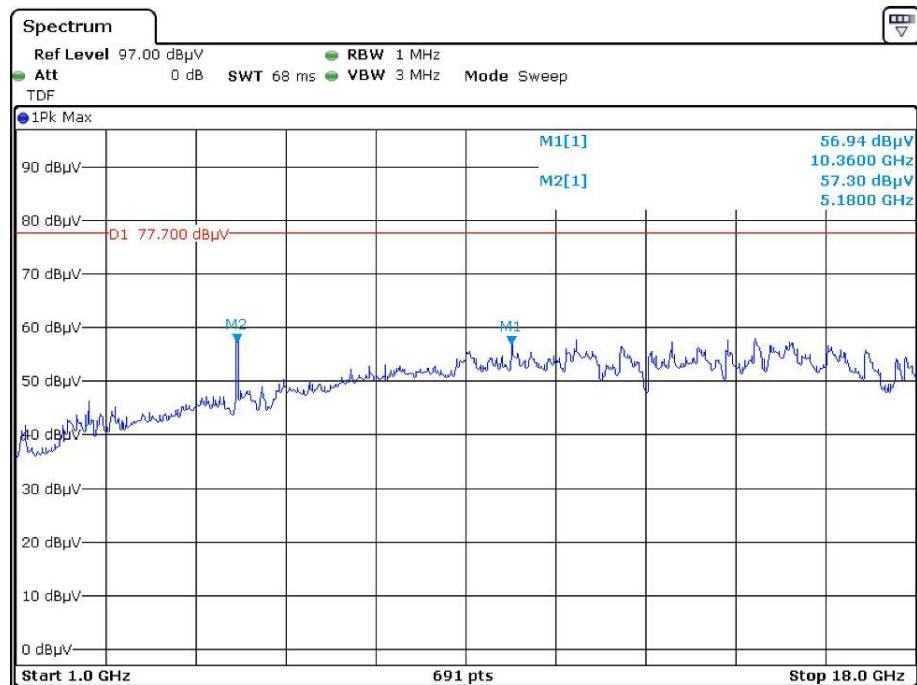


Date: 2.JUL.2020 23:27:49

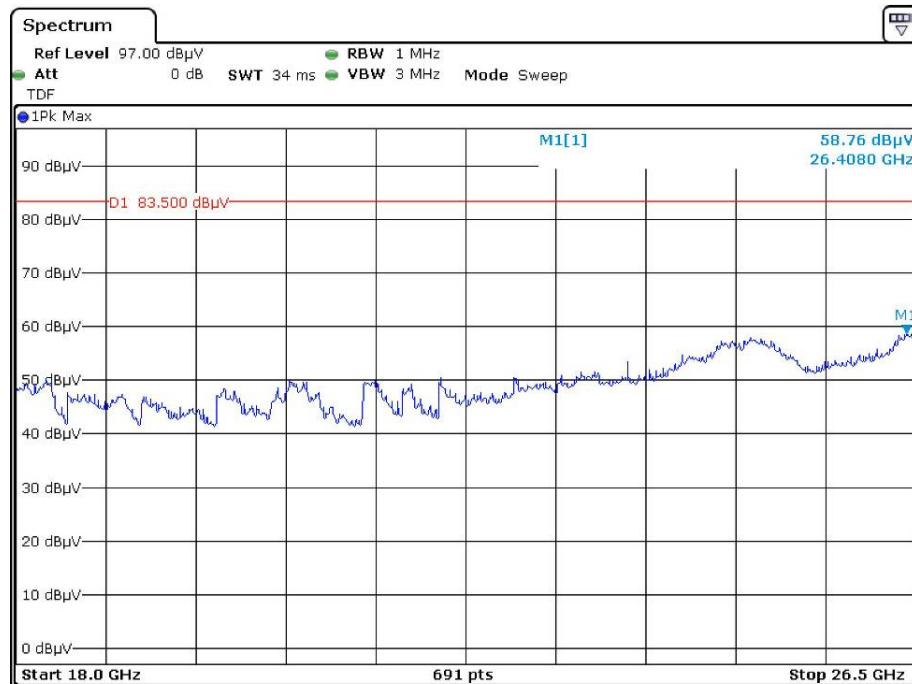


Date: 3.JUL.2020 00:33:02

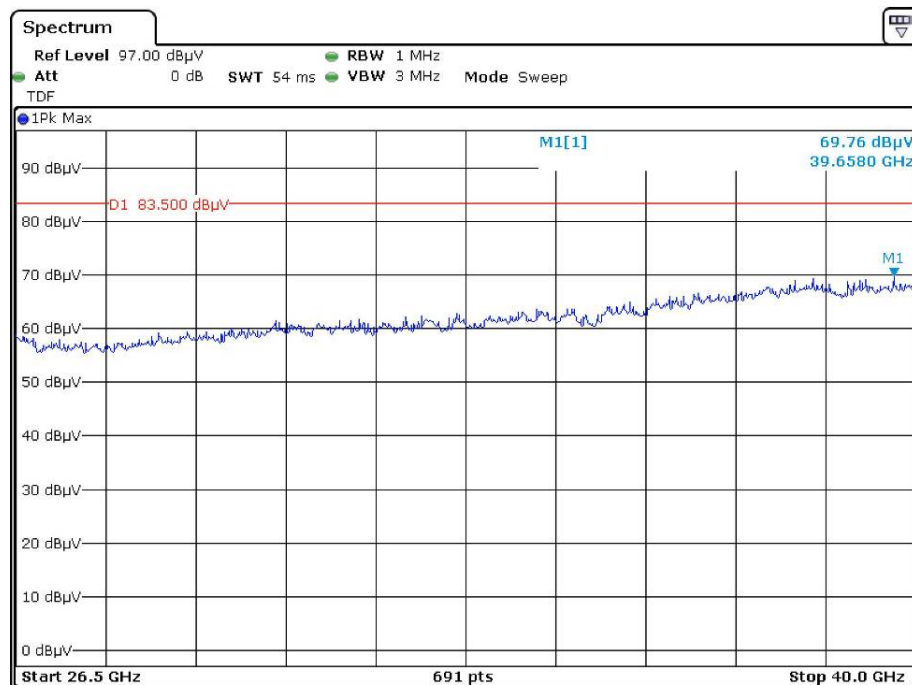
Vertical



Date: 2.JUL.2020 22:55:55

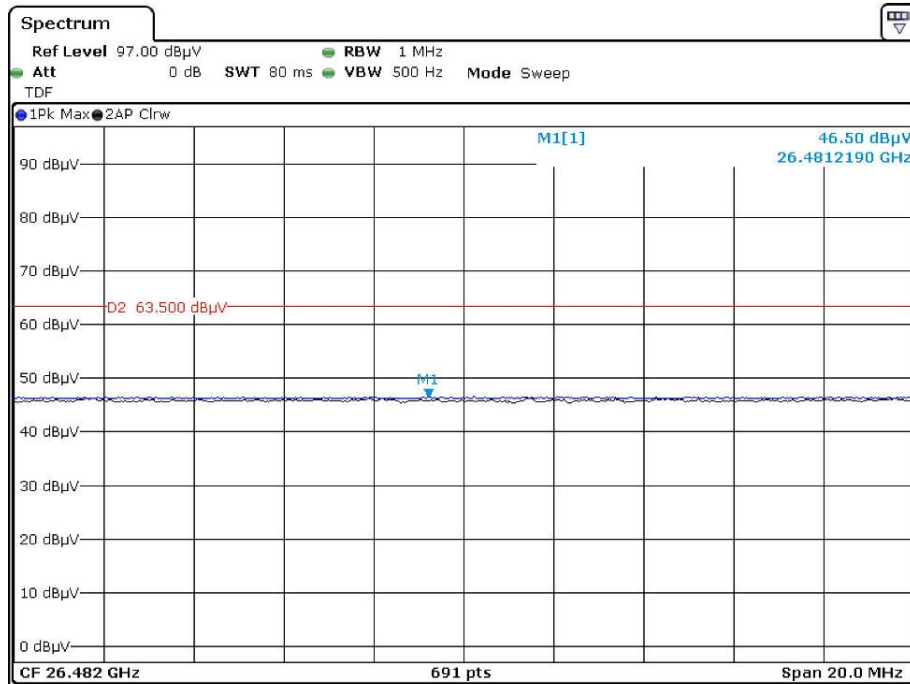


Date: 2.JUL.2020 23:36:03

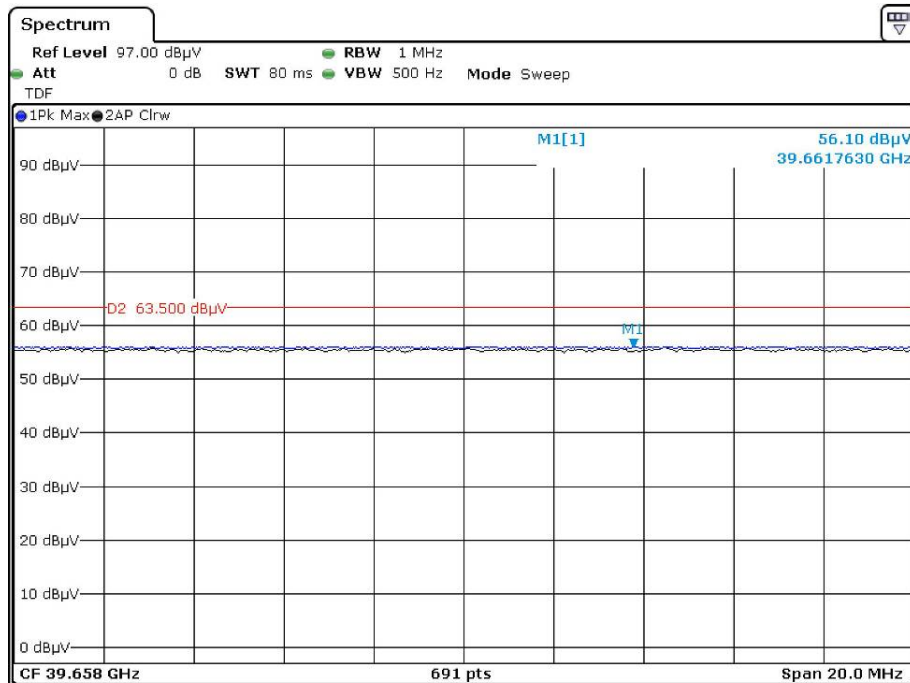


Date: 3.JUL.2020 00:39:52

Average Horizontal

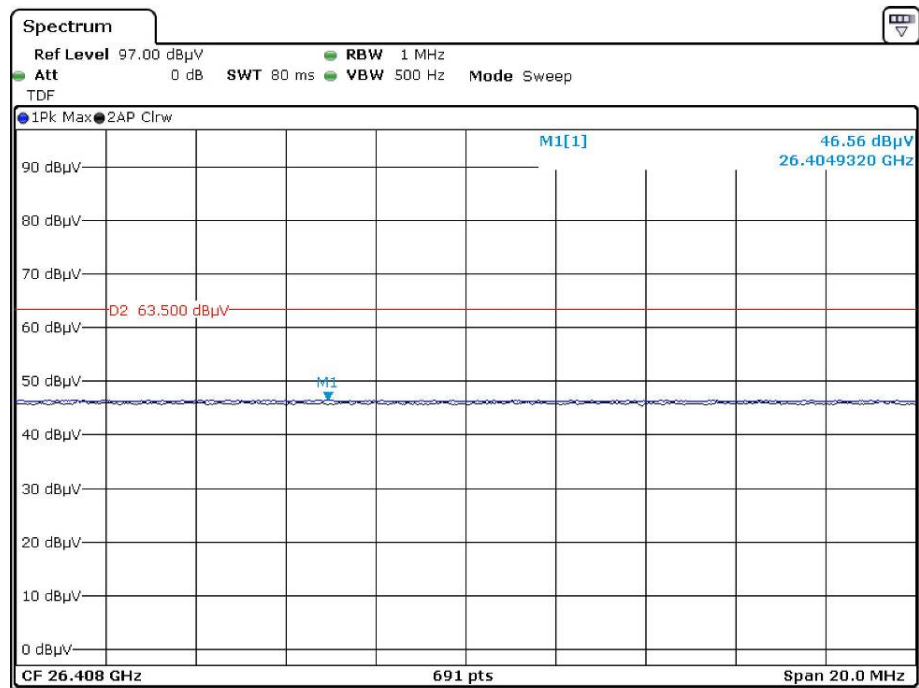


Date: 2.JUL.2020 23:32:04

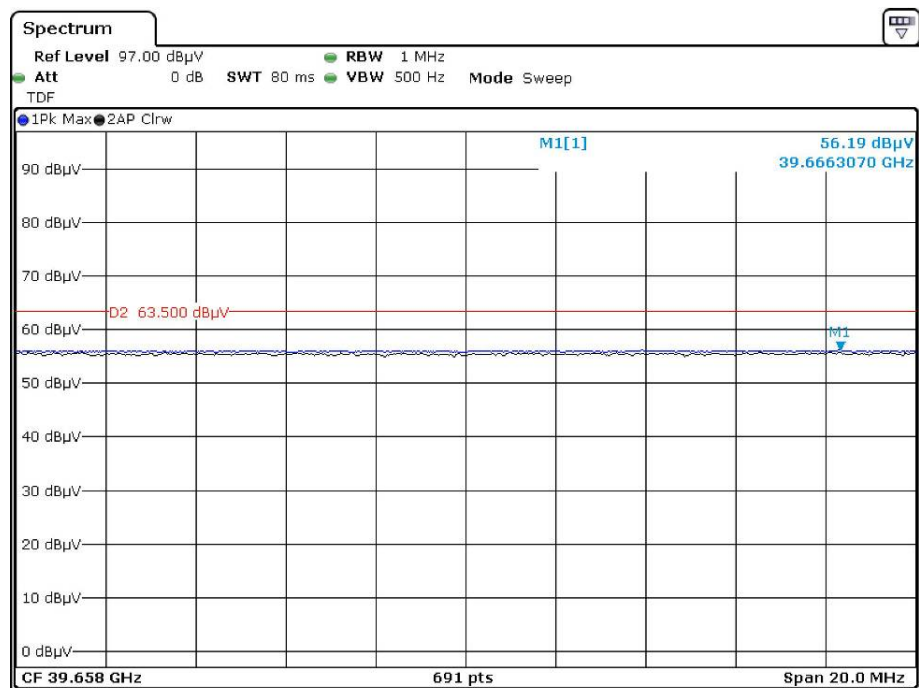


Date: 3.JUL.2020 00:36:35

Vertical



Date: 2.JUL.2020 23:39:34



Date: 3.JUL.2020 00:43:16

FCC §15.407(a) (5) – 26 dB EMISSION BANDWIDTH

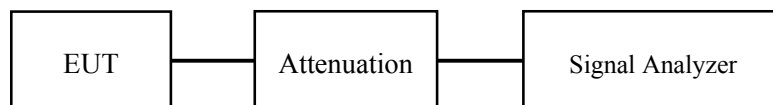
Applicable Standard

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 °C
Relative Humidity:	54 %
ATM Pressure:	101.0 kPa

The testing was performed by Gavin Guo on 2020-07-10.

EUT operation mode: Transmitting

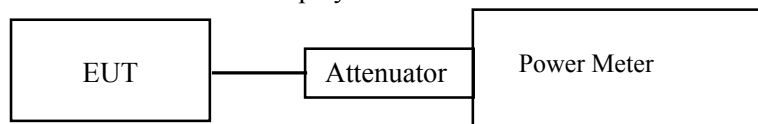
Test Result Compliant. Please refer to the Appendix.

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

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:	54 %
ATM Pressure:	101.0 kPa

The testing was performed by Gavin Guo on 2020-07-10.

EUT operation mode: Transmitting

Test Result Compliant. Please refer to the Appendix.

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

Applicable Standard

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

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:	54 %
ATM Pressure:	101.0 kPa

The testing was performed by Gavin Guo on 2020-07-10.

EUT operation mode: Transmitting

Test Result Compliant. Please refer to the Appendix.

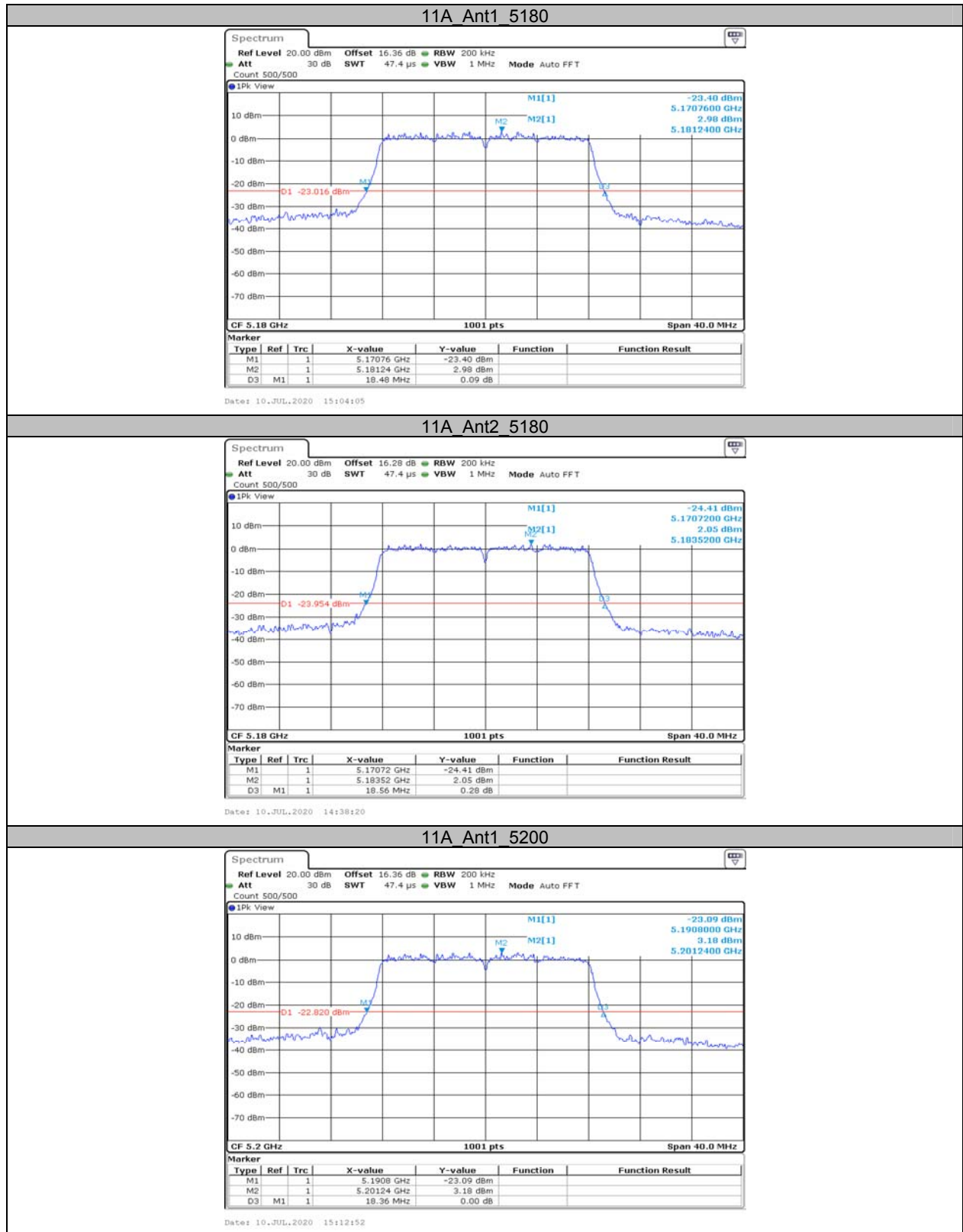
APPENDIX

Appendix A: Emission Bandwidth

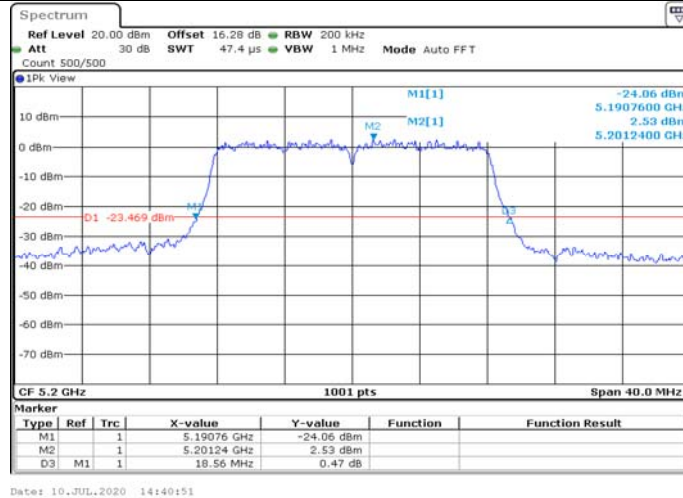
Test Result

TestMode	Antenna	Channel	26db EBW [MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	18.480	---	PASS
	Ant2	5180	18.560	---	PASS
	Ant1	5200	18.360	---	PASS
	Ant2	5200	18.560	---	PASS
	Ant1	5240	18.440	---	PASS
	Ant2	5240	18.760	---	PASS
11N20SISO	Ant1	5180	19.400	---	PASS
	Ant2	5180	19.640	---	PASS
	Ant1	5200	19.440	---	PASS
	Ant2	5200	19.600	---	PASS
	Ant1	5240	19.520	---	PASS
	Ant2	5240	19.320	---	PASS
11N40SISO	Ant1	5190	51.120	---	PASS
	Ant2	5190	47.520	---	PASS
	Ant1	5230	53.120	---	PASS
	Ant2	5230	50.000	---	PASS

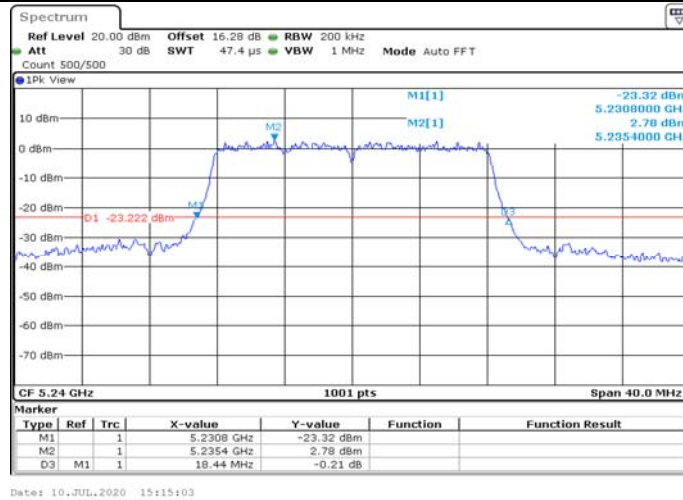
Test Graphs



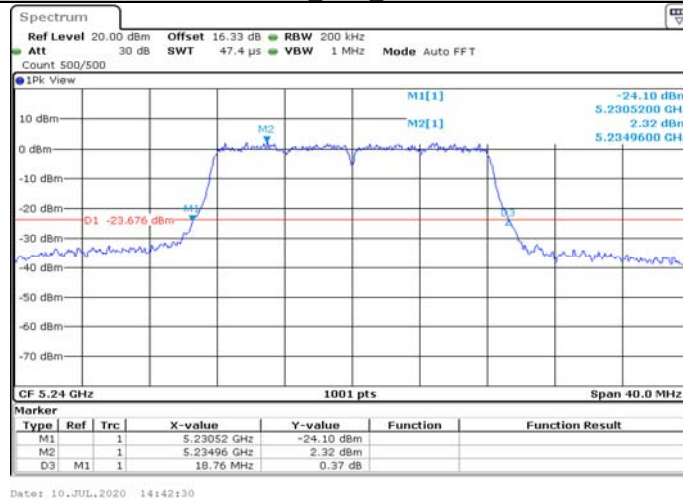
11A_Ant2_5200



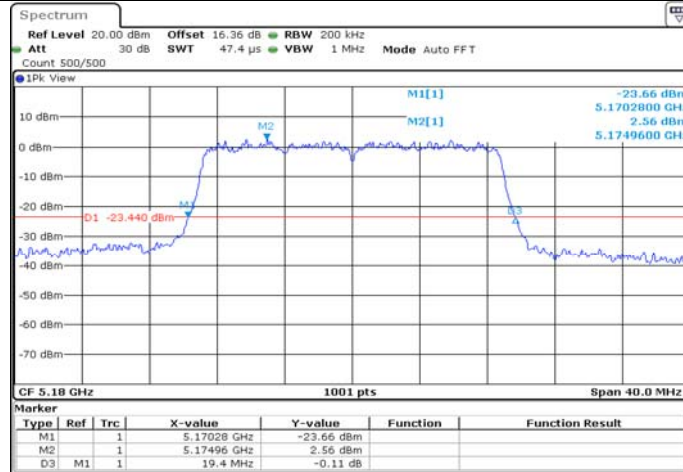
11A_Ant1_5240



11A_Ant2_5240

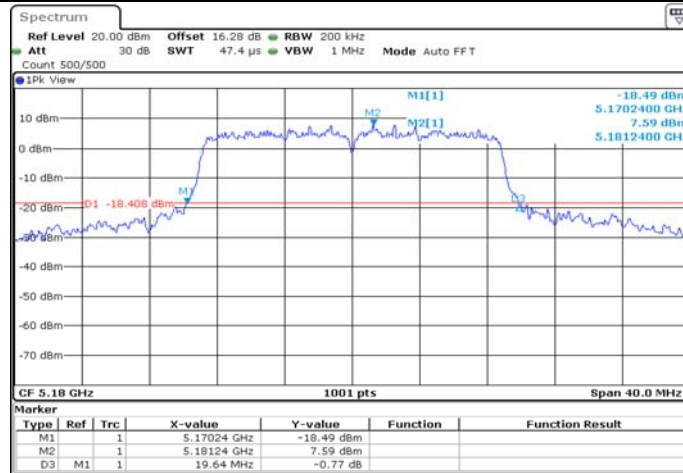


11N20SISO Ant1 5180



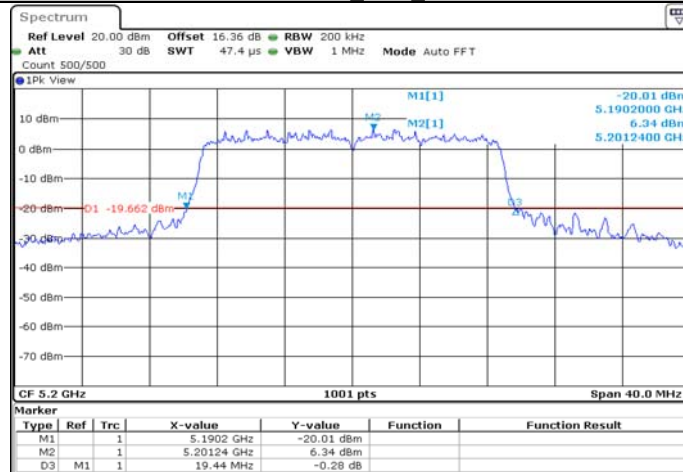
Date: 10_JUL_2020 14:49:40

11N20SISO Ant2 5180



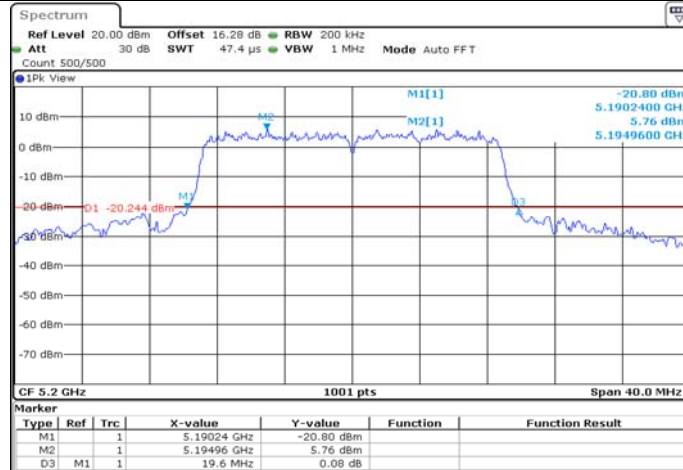
Date: 10_JUL_2020 13:19:26

11N20SISO Ant1 5200



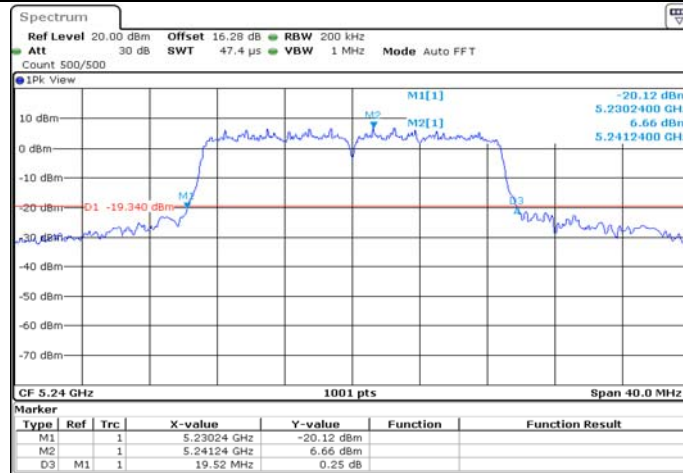
Date: 10_JUL_2020 14:52:44

11N20SISO Ant2 5200



Date: 10_JUL_2020 14:28:43

11N20SISO Ant1 5240



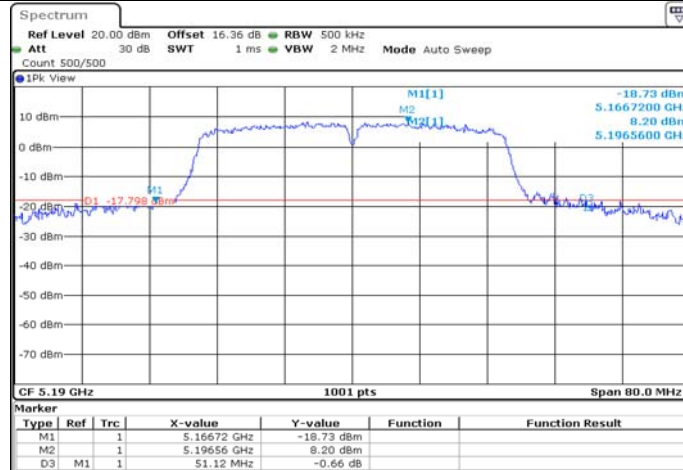
Date: 10_JUL_2020 14:54:26

11N20SISO Ant2 5240



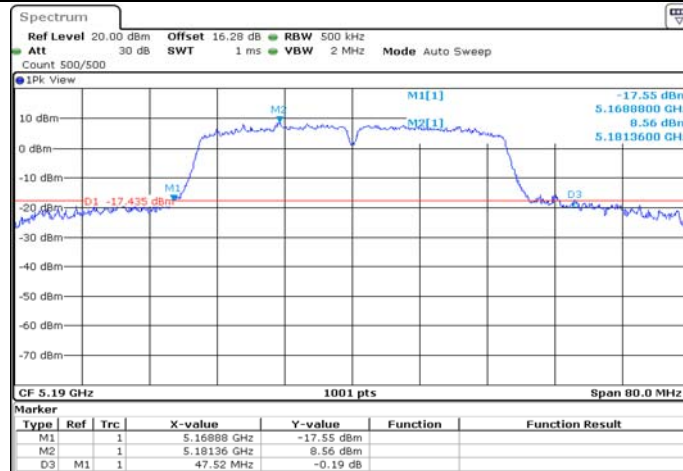
Date: 10_JUL_2020 14:30:52

11N40SISO Ant1 5190



Date: 10.JUL.2020 14:58:42

11N40SISO Ant2 5190

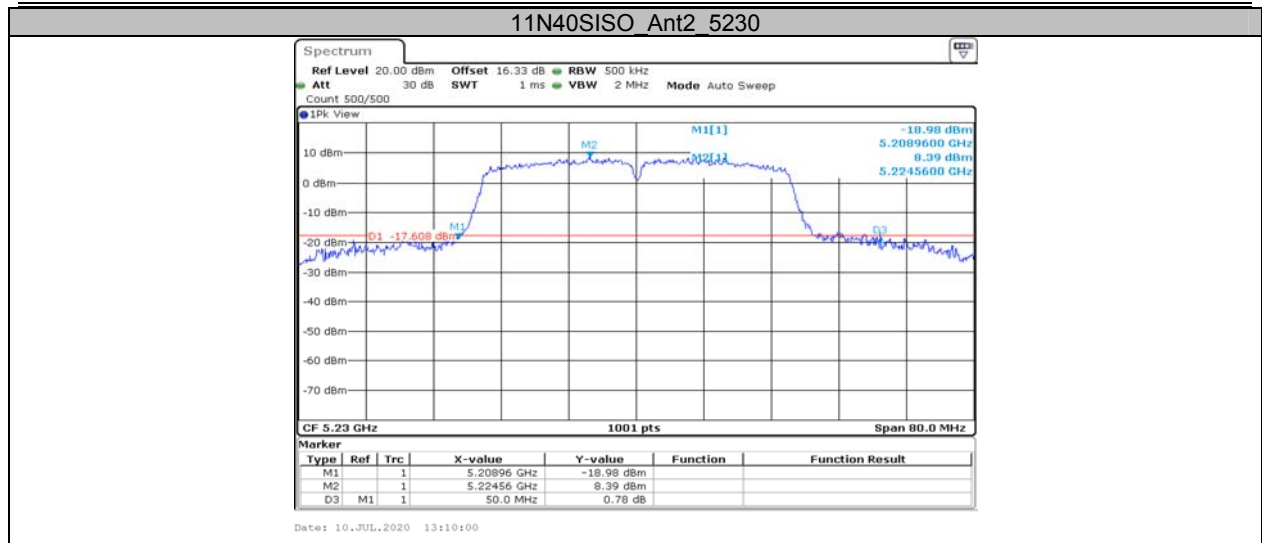


Date: 10.JUL.2020 13:13:16

11N40SISO Ant1 5230



Date: 10.JUL.2020 15:00:38

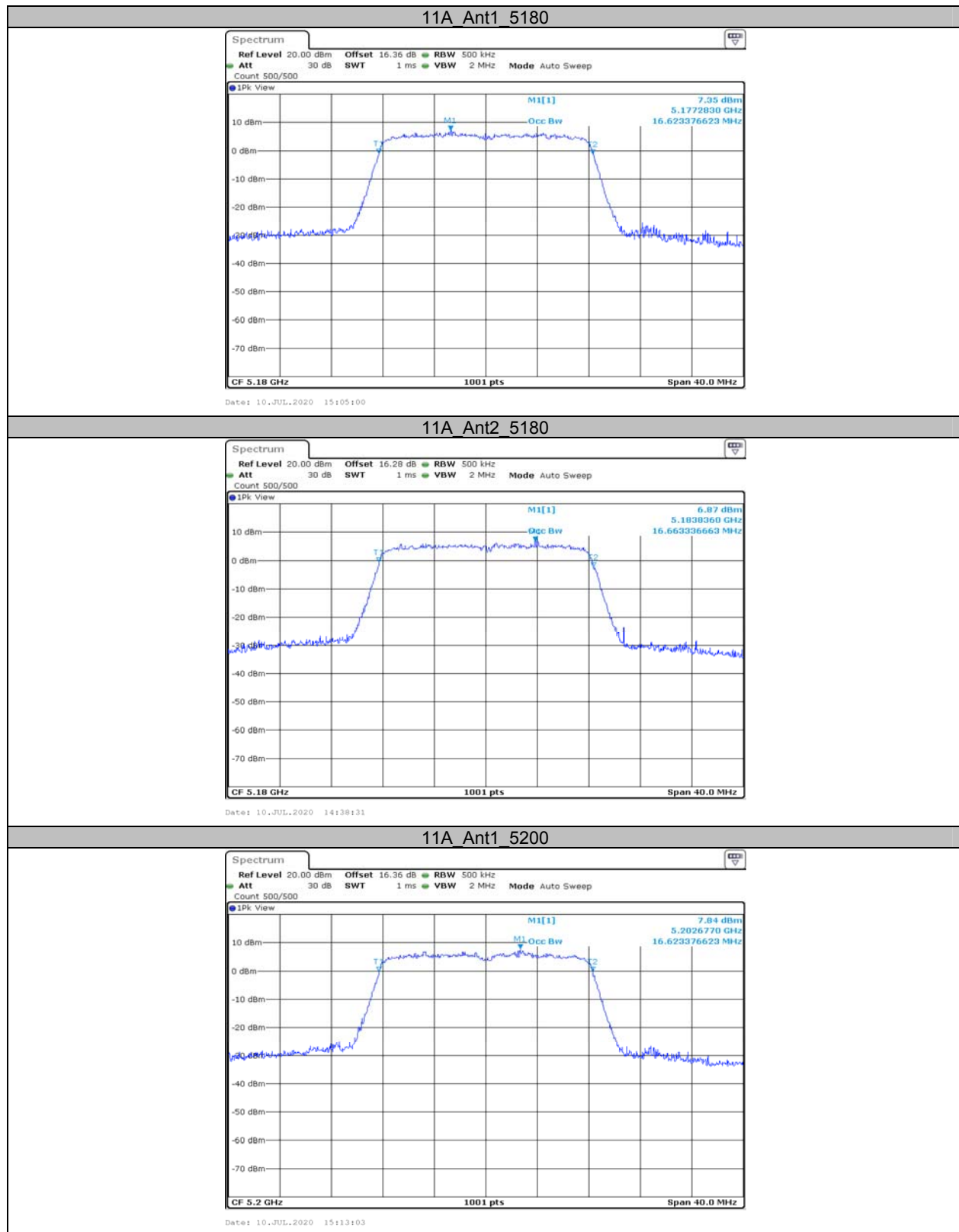


Appendix B: Occupied channel bandwidth**Test Result**

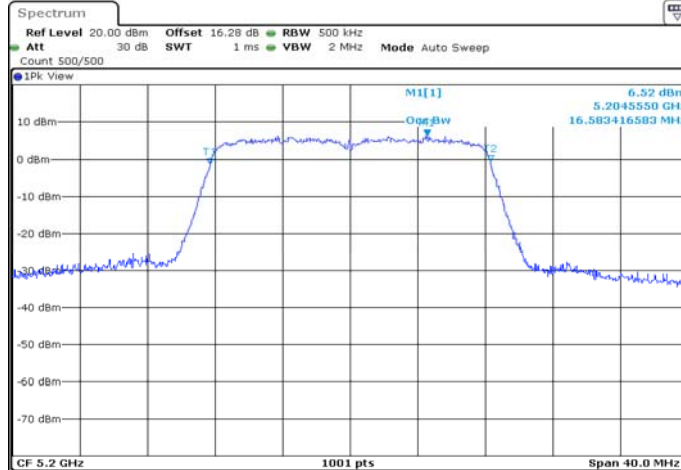
TestMode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	16.623	---	PASS
	Ant2	5180	16.663	---	PASS
	Ant1	5200	16.623	---	PASS
	Ant2	5200	16.583	---	PASS
	Ant1	5240	16.583	---	PASS
	Ant2	5240	16.583	---	PASS
11N20SISO	Ant1	5180	17.702	---	PASS
	Ant2	5180	17.862	---	PASS
	Ant1	5200	17.742	---	PASS
	Ant2	5200	17.782	---	PASS
	Ant1	5240	17.782	---	PASS
	Ant2	5240	17.782	---	PASS
11N40SISO	Ant1	5190	36.683	---	PASS
	Ant2	5190	36.523	---	PASS
	Ant1	5230	36.763	---	PASS
	Ant2	5230	36.683	---	PASS

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

Test Graphs

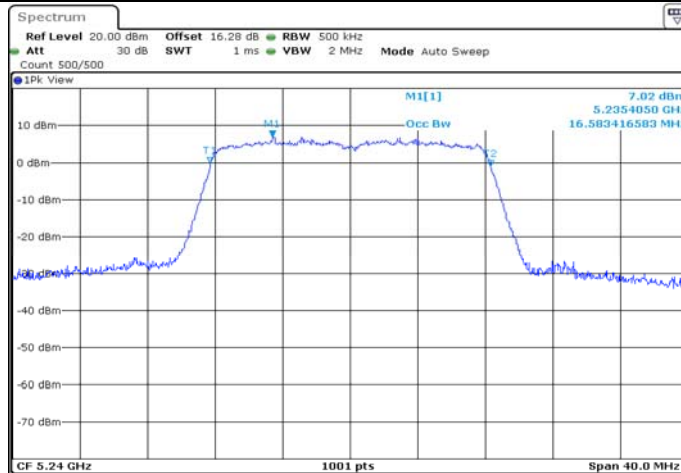


11A_Ant2_5200



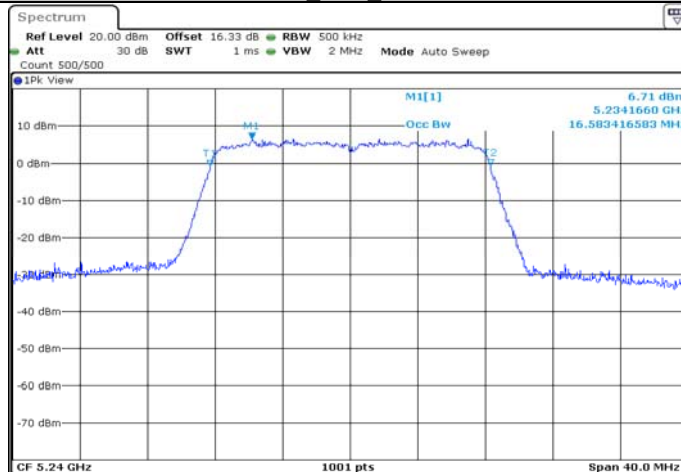
Date: 10.JUL.2020 14:41:02

11A_Ant1_5240



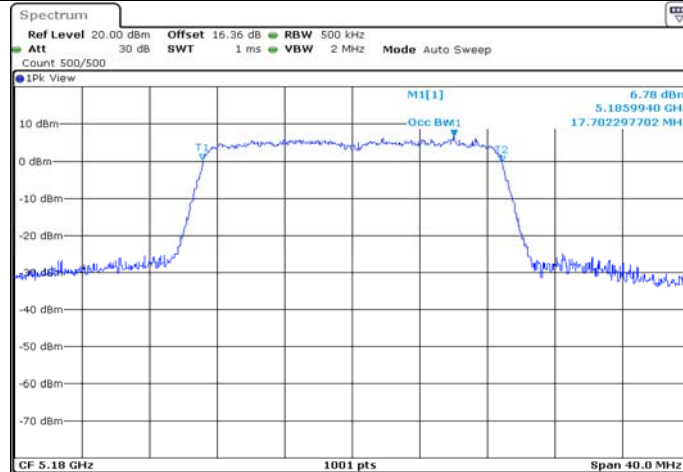
Date: 10.JUL.2020 15:15:14

11A_Ant2_5240



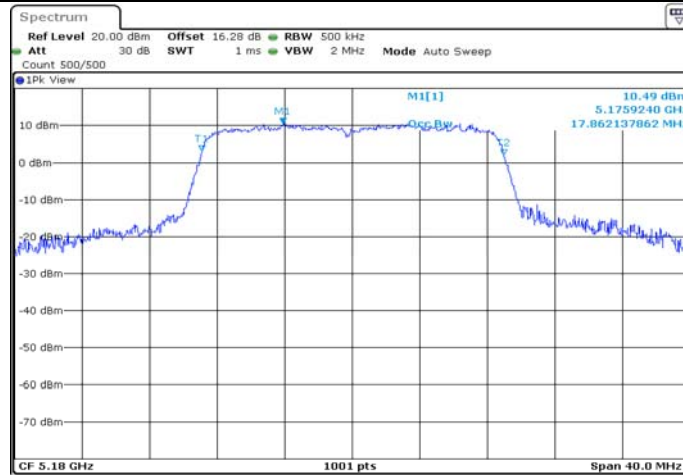
Date: 10.JUL.2020 14:42:41

11N20SISO_Ant1_5180



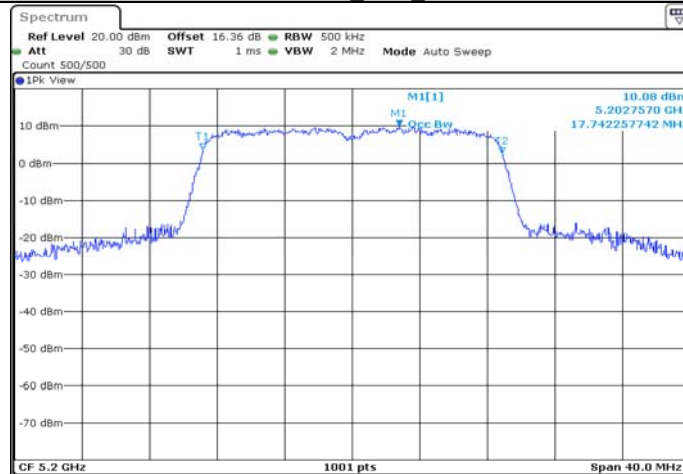
Date: 10.JUL.2020 14:49:51

11N20SISO_Ant2_5180



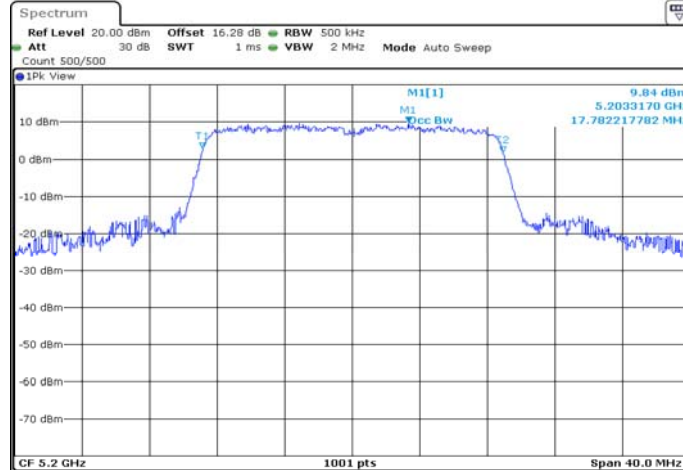
Date: 10.JUL.2020 13:19:38

11N20SISO_Ant1_5200

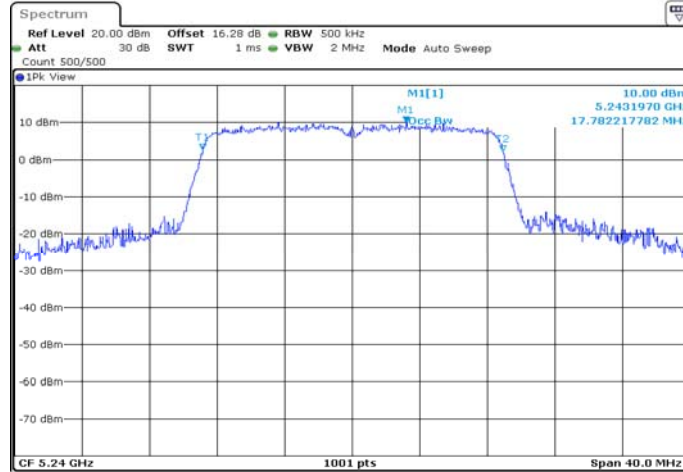


Date: 10.JUL.2020 14:52:56

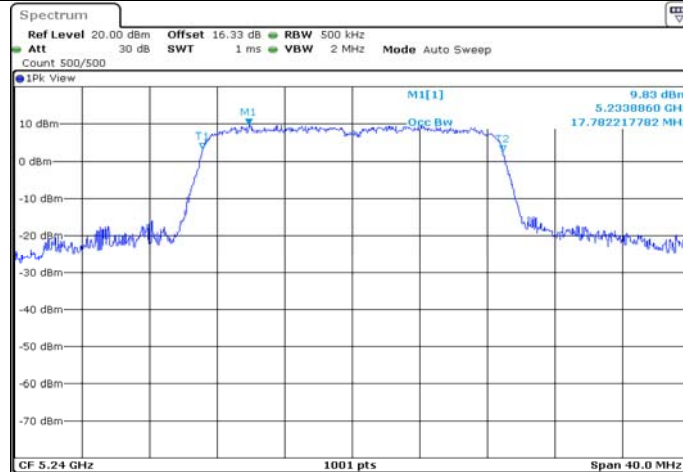
11N20SISO_Ant2_5200



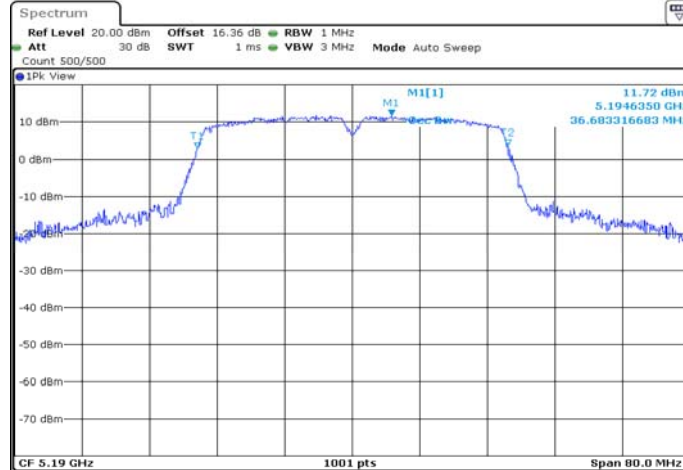
11N20SISO_Ant1_5240



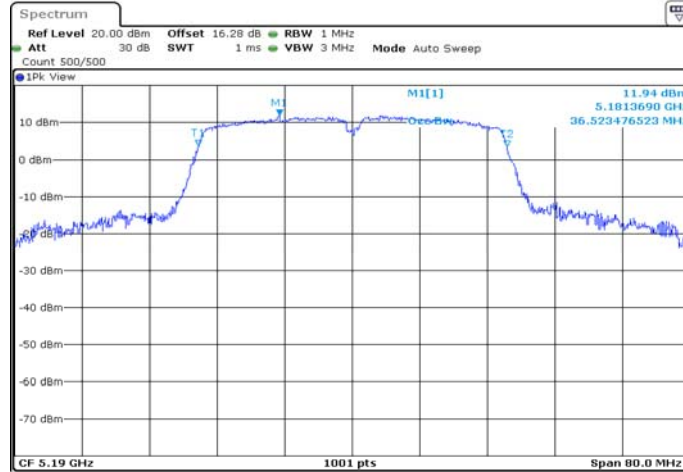
11N20SISO_Ant2_5240



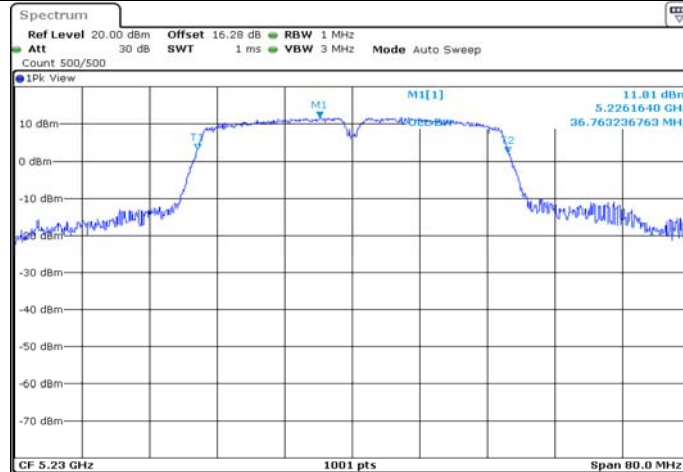
11N40SISO_Ant1_5190

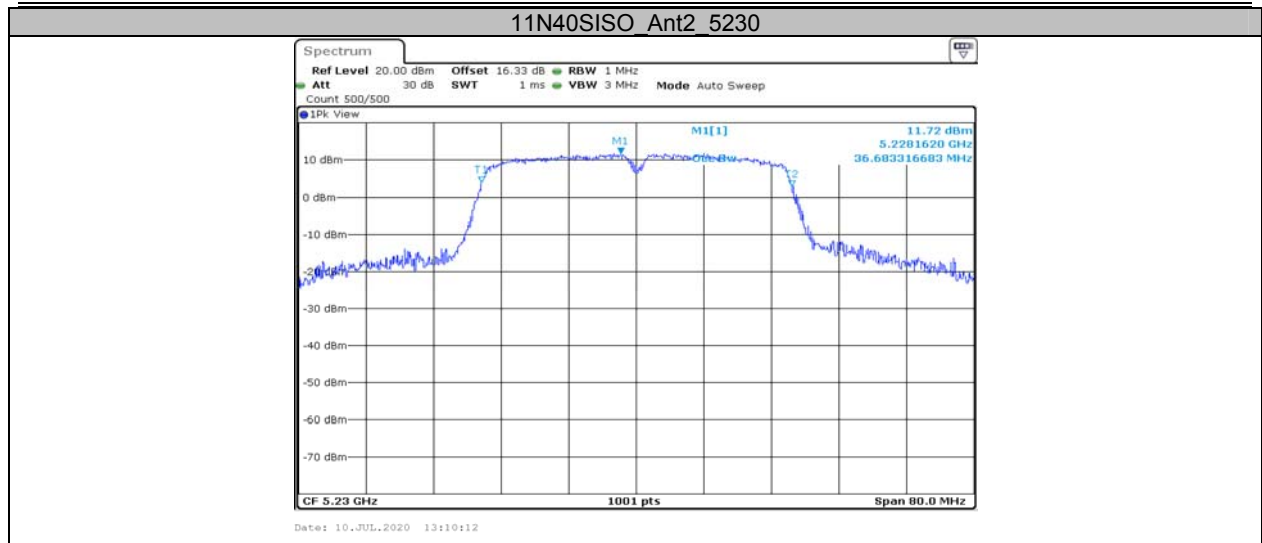


11N40SISO_Ant2_5190



11N40SISO_Ant1_5230





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

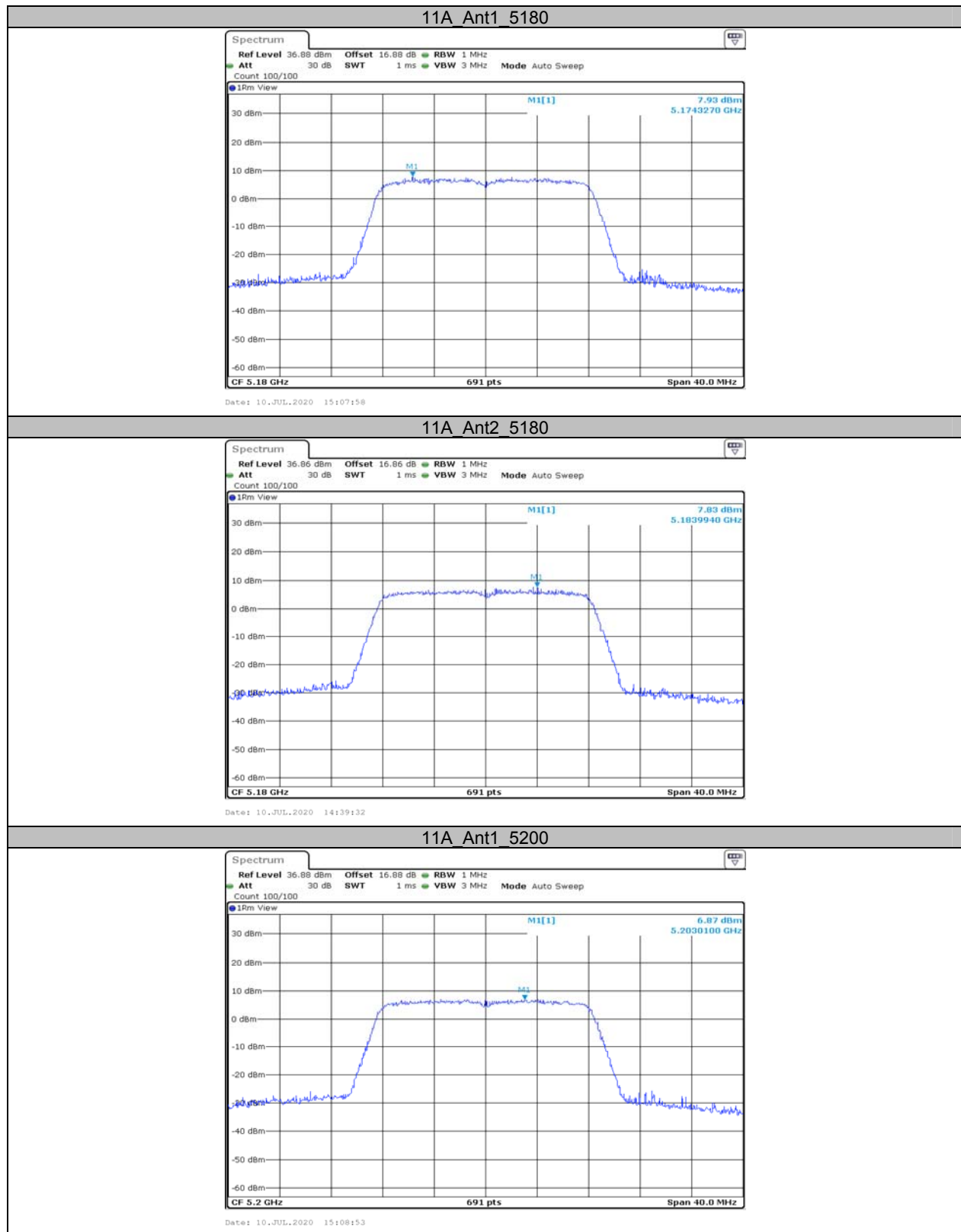
TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11A	Ant1	5180	15.58	<=23.98	PASS
	Ant2	5180	15.19	<=23.98	PASS
	Ant1	5200	16.02	<=23.98	PASS
	Ant2	5200	15.83	<=23.98	PASS
	Ant1	5240	15.83	<=23.98	PASS
	Ant2	5240	15.42	<=23.98	PASS
11N20SISO	Ant1	5180	15.21	<=23.98	PASS
	Ant2	5180	17.82	<=23.98	PASS
	Ant1	5200	17.56	<=23.98	PASS
	Ant2	5200	17.44	<=23.98	PASS
	Ant1	5240	17.61	<=23.98	PASS
	Ant2	5240	17.42	<=23.98	PASS
11N40SISO	Ant1	5190	16.98	<=23.98	PASS
	Ant2	5190	16.70	<=23.98	PASS
	Ant1	5230	17.21	<=23.98	PASS
	Ant2	5230	17.04	<=23.98	PASS

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

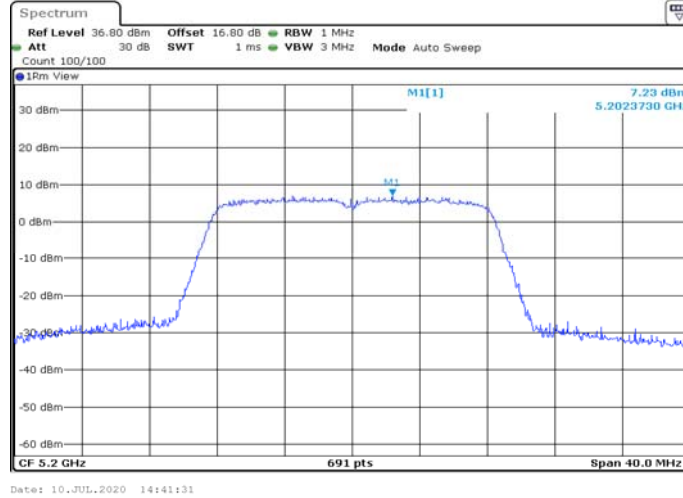
TestMode	Antenna	Channel	Result [dBm/MHz]	Limit[dBm/MHz]	Verdict
11A	Ant1	5180	7.93	<=11	PASS
	Ant2	5180	7.83	<=11	PASS
	Ant1	5200	6.87	<=11	PASS
	Ant2	5200	7.23	<=11	PASS
	Ant1	5240	7.24	<=11	PASS
	Ant2	5240	7.22	<=11	PASS
11N20SISO	Ant1	5180	8.13	<=11	PASS
	Ant2	5180	10.98	<=11	PASS
	Ant1	5200	10.63	<=11	PASS
	Ant2	5200	10.48	<=11	PASS
	Ant1	5240	10.7	<=11	PASS
	Ant2	5240	10.27	<=11	PASS
11N40SISO	Ant1	5190	9.34	<=11	PASS
	Ant2	5190	9.19	<=11	PASS
	Ant1	5230	9.86	<=11	PASS
	Ant2	5230	9.57	<=11	PASS

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

Test Graphs

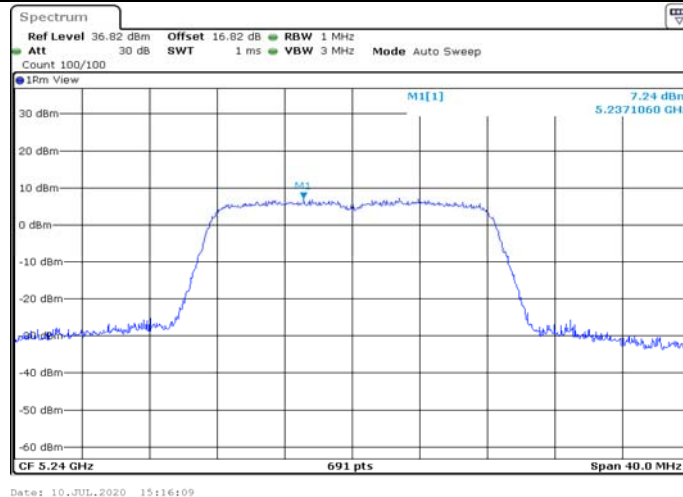


11A_Ant2_5200



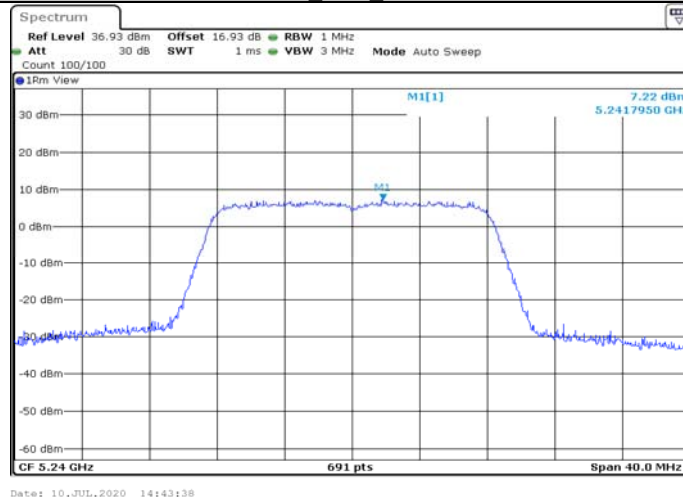
Date: 10.JUL.2020 14:41:31

11A_Ant1_5240



Date: 10.JUL.2020 15:16:09

11A_Ant2_5240

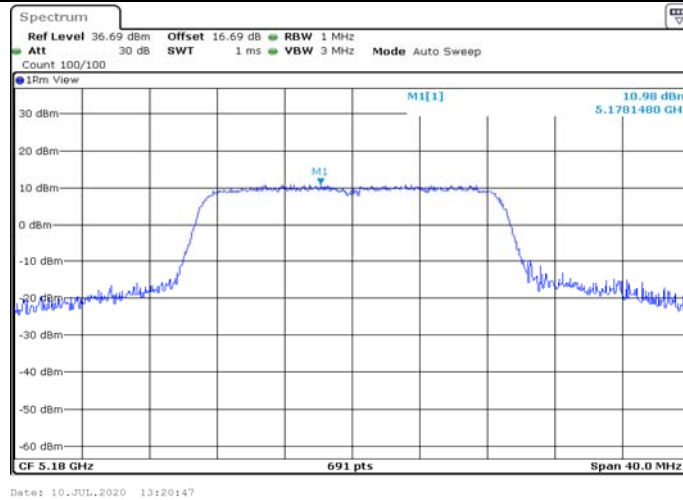


Date: 10.JUL.2020 14:43:38

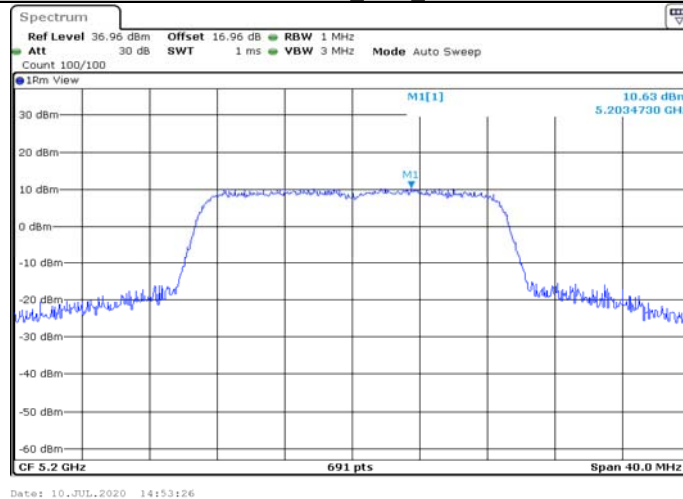
11N20SISO_Ant1_5180



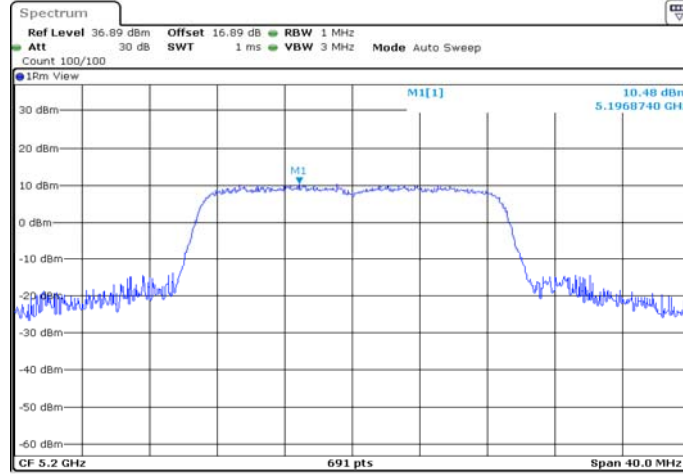
11N20SISO_Ant2_5180



11N20SISO_Ant1_5200

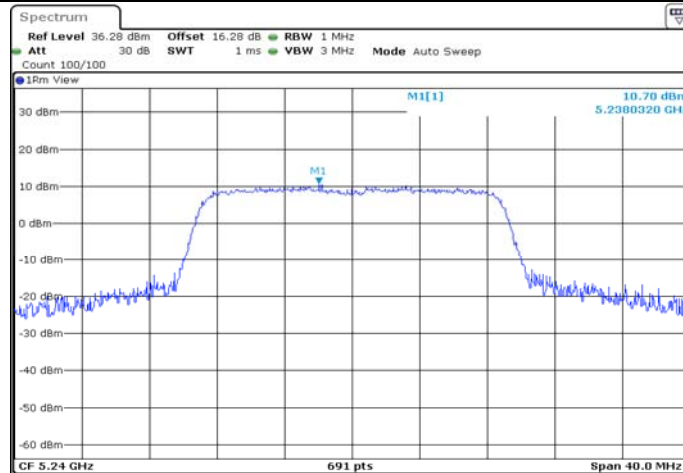


11N20SISO_Ant2_5200



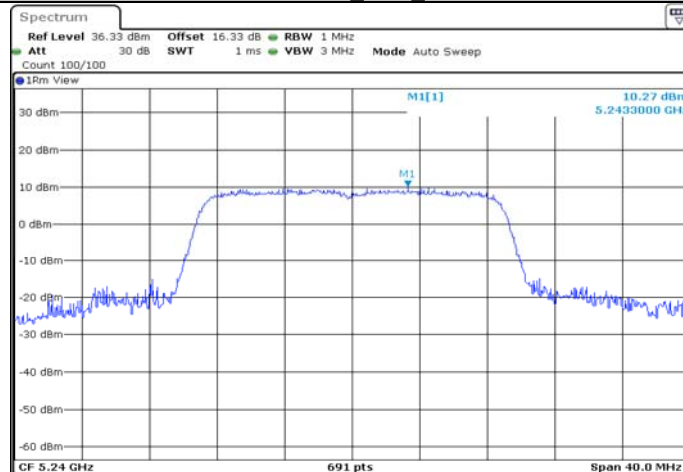
Date: 10.JUL.2020 14:29:26

11N20SISO_Ant1_5240



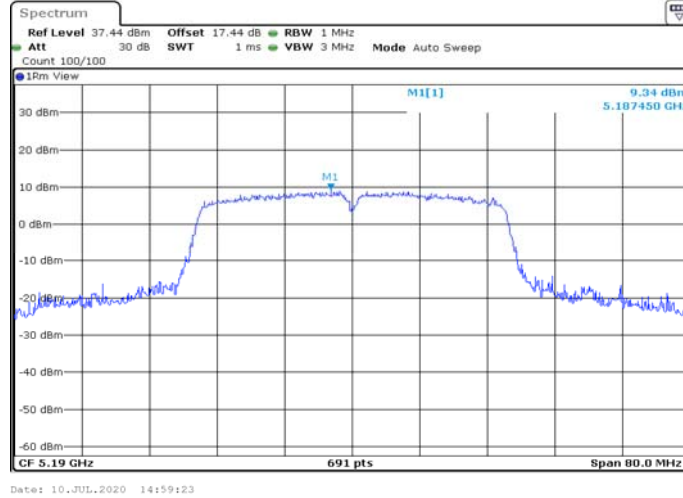
Date: 10.JUL.2020 14:57:00

11N20SISO_Ant2_5240

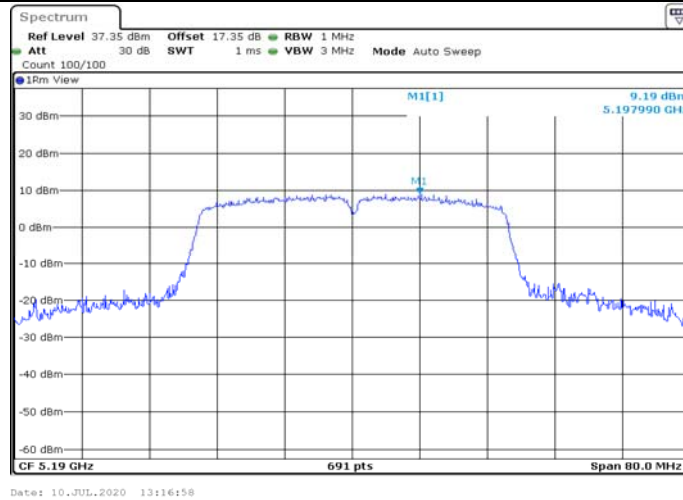


Date: 10.JUL.2020 14:32:12

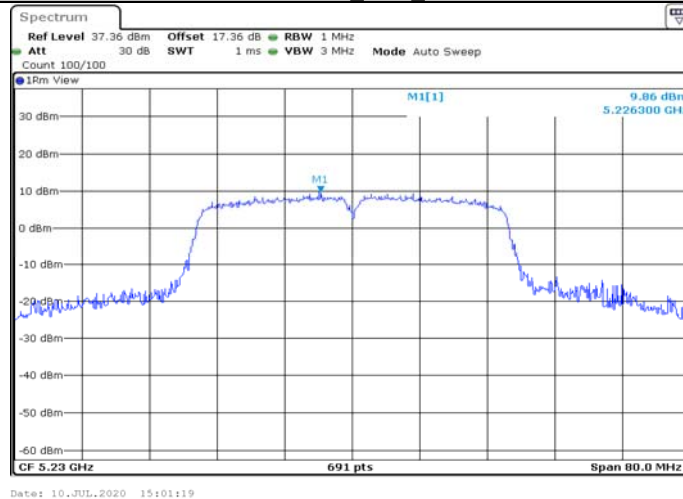
11N40SISO_Ant1_5190

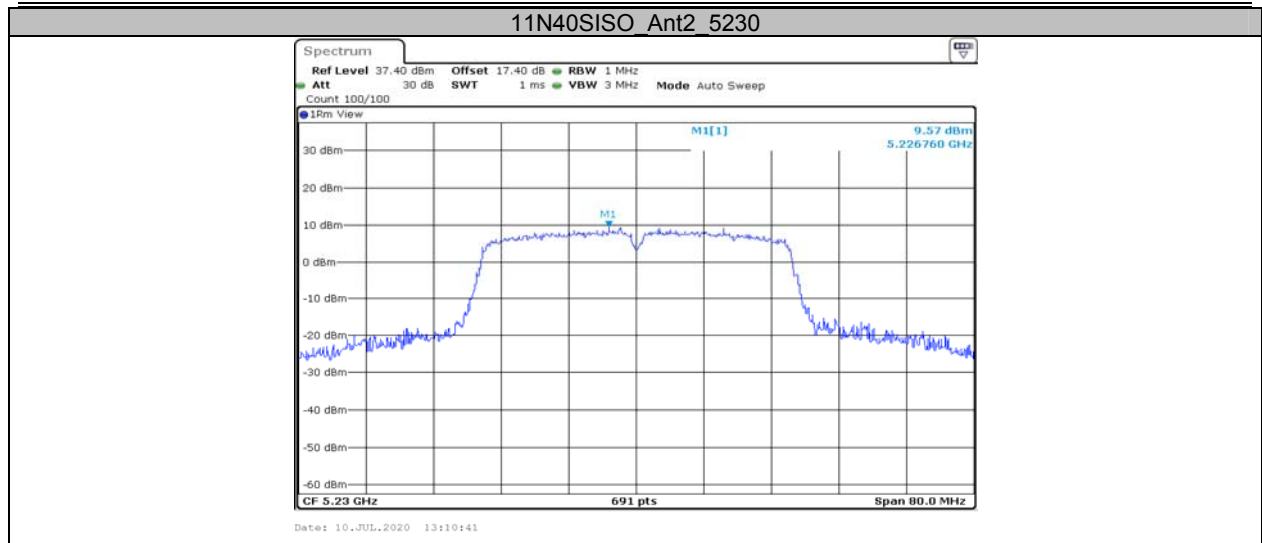


11N40SISO_Ant2_5190



11N40SISO_Ant1_5230

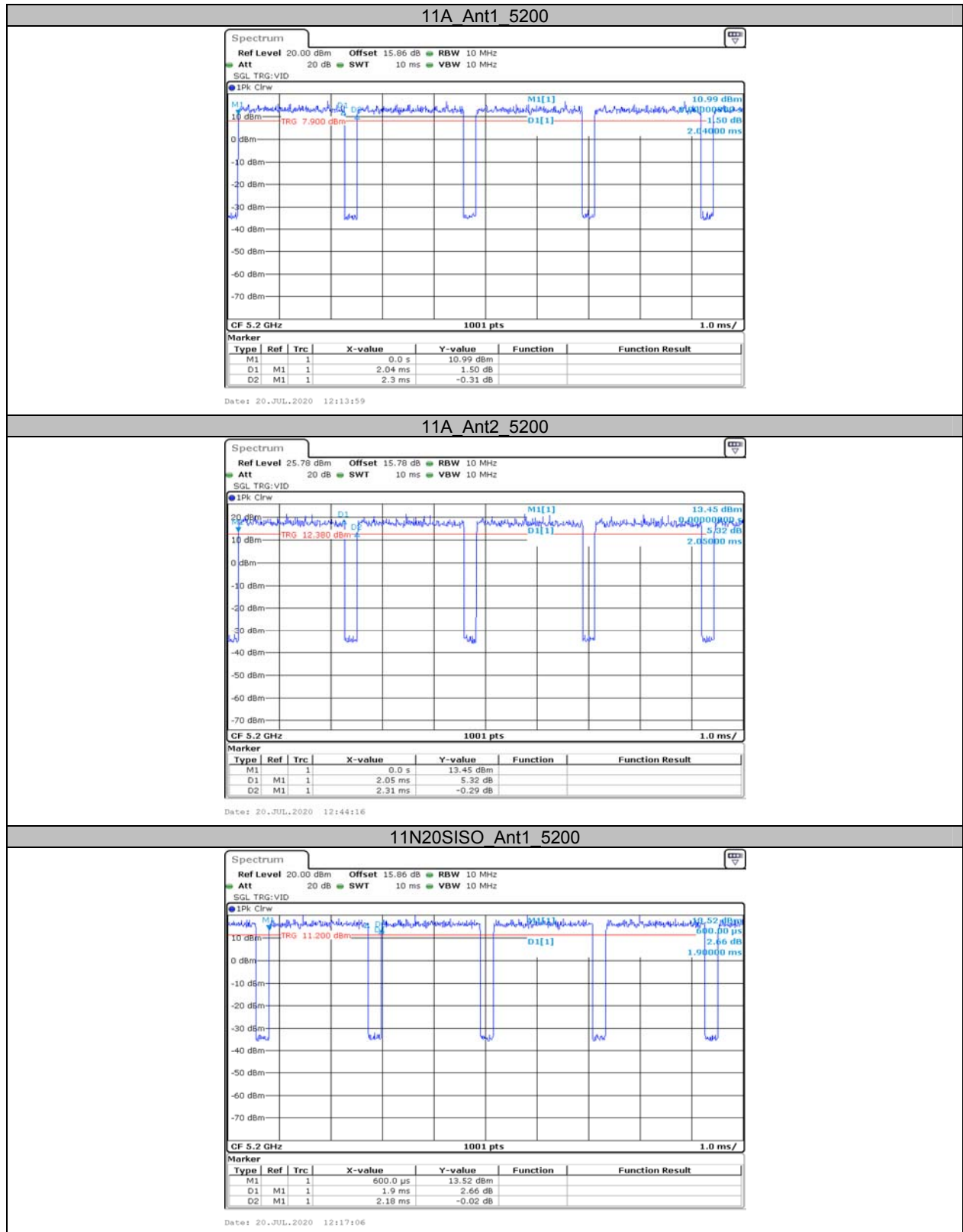




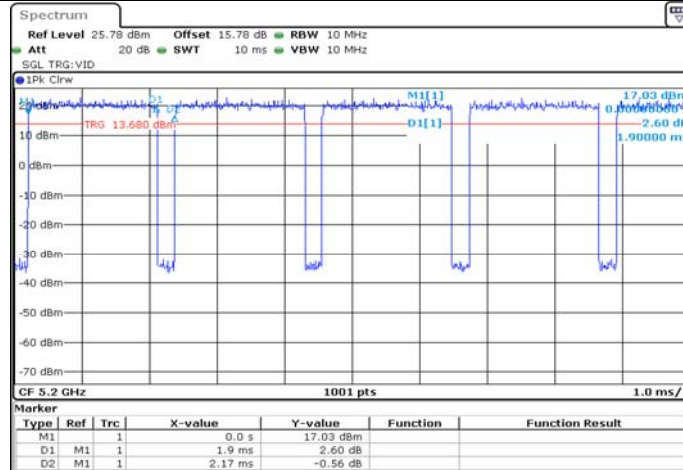
Appendix E: Duty Cycle**Test Result**

TestMode	Antenna	Channel	TransmissionDuration [ms]	Transmission Period [ms]	Duty Cycle [%]
11A	Ant1	5200	2.04	2.30	88.70
	Ant2	5200	2.05	2.31	88.74
11N20SISO	Ant1	5200	1.90	2.18	87.16
	Ant2	5200	1.90	2.17	87.56
11N40SISO	Ant1	5190	0.92	1.18	77.97
	Ant2	5190	0.93	1.19	78.15

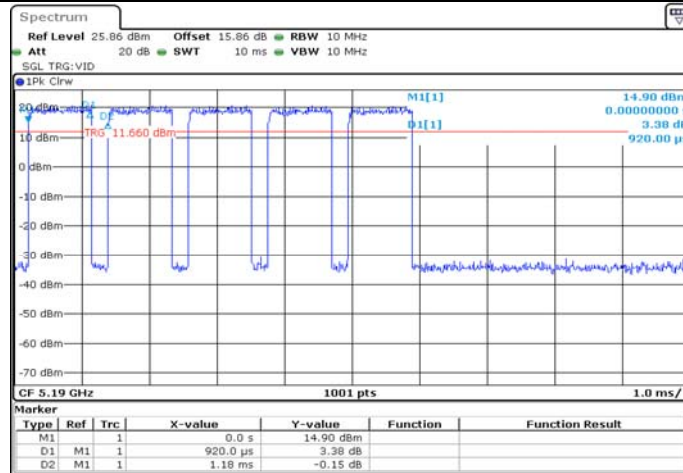
Test Graphs



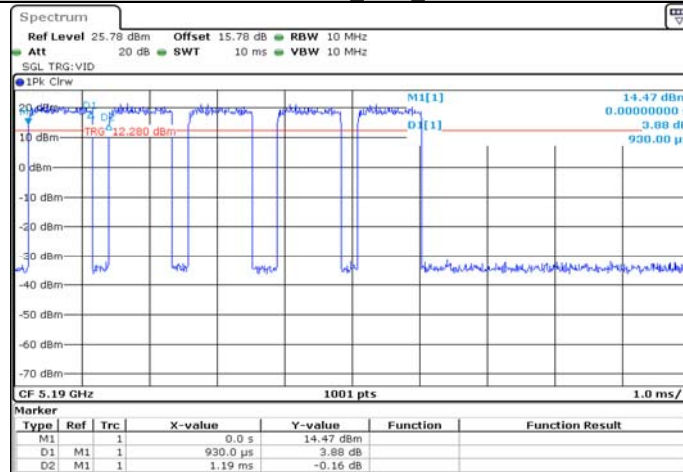
11N20SISO Ant2 5200



11N40SISO Ant1 5190



11N40SISO Ant2 5190



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