FCC PART 15.407

TEST REPORT

For

Xunison Ltd

25th Kilcarbery Business Park, Upper Nangor Road, Dublin 22, Ireland

FCC ID: 2AP2F-Q20S

Report Type:	Product Type:
Original Report	X-Brain

Report Number:	SZ6210322-07659E-RF-00A
Report Date:	2021-08-02
Reviewed By:	Jacob Kong RF Engineer
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	X-Brain
Tested Model	Q20S
Frequency Range	5G Wi-Fi: 5150-5250 MHz; 5725-5850 MHz
Maximum conducted average output power	5150-5250 MHz: 15.2dBm(802.11a), 15.3dBm(802.11n20), 19.1dBm(802.11n40) 15.4dBm(802.11ac20), 18.6dBm(802.11ac40), 18.6dBm(802.11ac80) 5725-5850 MHz: 19.1dBm(802.11a), 19.0dBm(802.11n20), 19.8dBm(802.11n40) 18.9dBm(802.11ac20), 19.8dBm(802.11ac40), 19.6dBm(802.11ac80)
Modulation Technique	OFDM
Antenna Specification*	3.5 dBi (It is provided by the applicant)
Voltage Range	DC 12V from adapter
Date of Test	2021-05-10 to 2021-07-23
Sample number	SZ6210322-07659E-RF -S1 (Assigned by BACL, Shenzhen)
Received date	2021-03-22
Sample/EUT Status	Good condition
Adapter information	Model: GRT-A30-120200UB Input: AC 100-240V ~ 50/60Hz, 1.0A Max Output: DC 12.0V, 2.0A

Objective

This test 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, 15.207, 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 KDB789033D02 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.
Each test item follows test standards and with no deviation.

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 5F(B-West) , 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, 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 can operate in 802.11a/n20/n40/ac20/ac40/ac80 modes.

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

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

For 802.11a, 802.11n20/ac20 mode: channel 36, 40, 48 were tested; For 802.11n40/ac40 mode: channel 38, 46 were tested. For 802.11ac80 mode, channel 42 was tested.

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

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

For 802.11a, 802.11n20/ac20 mode: channel 149, 157, 165 were tested; For 802.11n40/ac40 mode: channel 151, 159 were tested. For 802.11ac80 mode, channel 155 was tested.

EUT Exercise Software

"QRCT4"* software was use to the EUT tested. The software and power level was provided by the applicant.

Test frequencies and power level were configured as below:

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

Note 1: The worse-case data rates are determined to be as follows for each mode based upon investigations by measuring the output power and PSD across all data rated bandwidths, and modulations.
Note 2: The power level was provided by the applicant.
Note 3: EUT have four antennas for 5G Wi-Fi, two for 5.2G Wi-Fi and two for 5.8G Wi-Fi respectively, and support MIMO mode, the SISO/MIMO mode have same parameter setting, all test was performed in the worst case MIMO mode.

Duty cycle

Test Result: Pass. Please refer to the Appendix.

Equipment Modifications

No modification was made to the EUT tested.

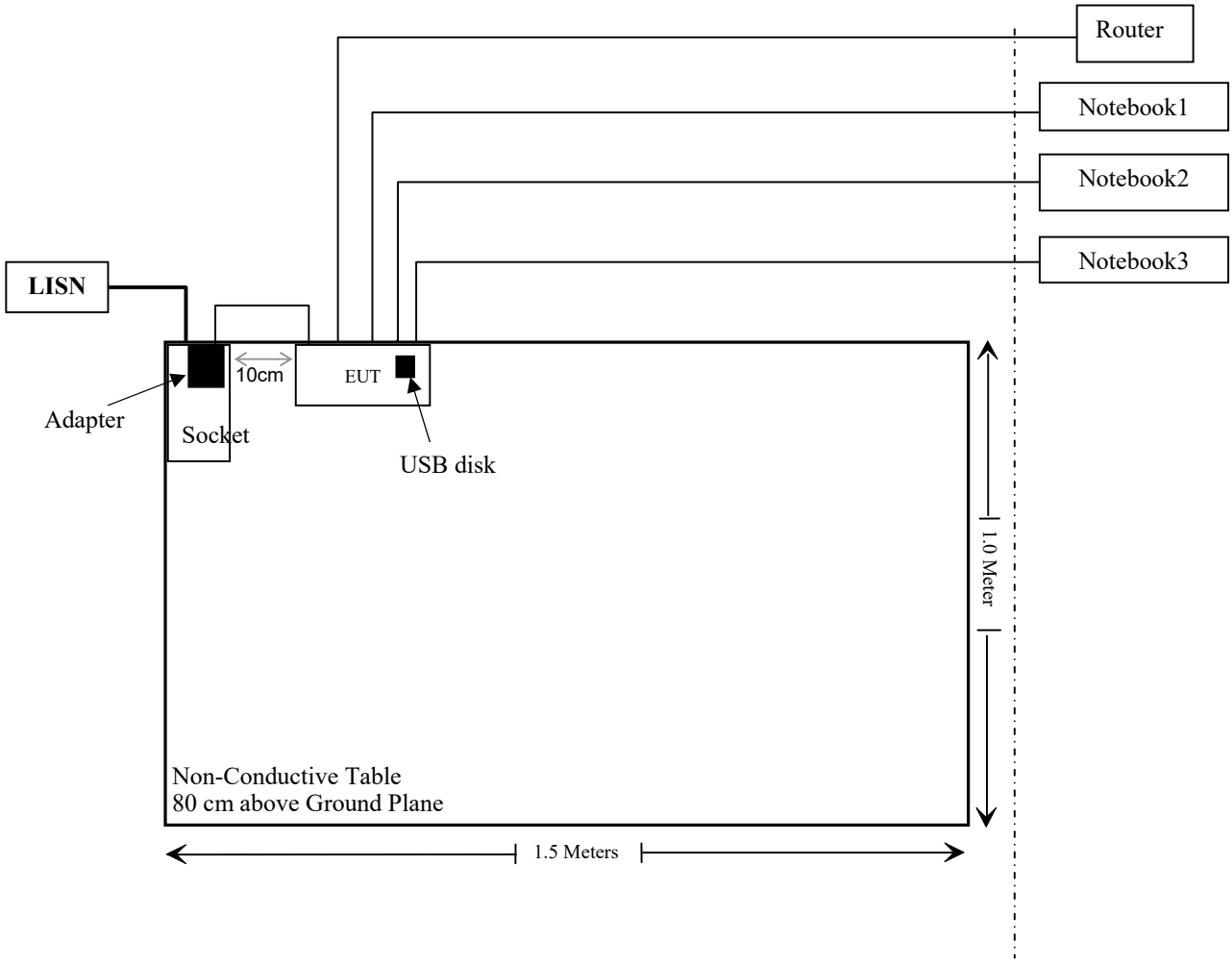
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
BULL	Socket	GN-212	A37209315081183
Kingston	USB disk	DTSE9H/16G	Kingston
Dell	Notebook1	Inspron15	Unknown
Dell	Notebook2	Latitude E5430	JG3NLV1
Dell	Notebook3	Latitude E5570	Unknown
HIKVISION	ROUTER	DS-3WR03-E	10021642429

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielded Un-detachable AC cable	1.0	Socket	main
Un-shielded Un-detachable DC cable	1.0	adapter	EUT
Un-shielded detachable RJ45 cable*3	4.0	EUT	NOTEBOOK
Un-shielded detachable RJ45 cable	4.0	EUT	Router

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§ 1.1307 , §2.1091	MAXIMUM PERMISSIBLE EXPOSURE (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.407(b)(6)& §15.207(a)	Conducted Emissions	Compliant
§15.205& §15.209 &§15.407(b) (1), (4),(7)	Undesirable Emission& Restricted Bands	Compliant
§15.407(a) (1), (5),(e)	26 dB Emission Bandwidth & 6dB Bandwidth	Compliant
§15.407(a)(1),(3)	Conducted Transmitter Output Power	Compliant
§15.407 (a)(1),(3)	Power Spectral Density	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2020/08/04	2021/08/03
Rohde & Schwarz	LISN	ENV216	101613	2020/08/04	2021/08/03
Rohde & Schwarz	Transient Limitor	ESH3Z2	DE25985	2020/11/29	2021/11/28
Unknown	CE Cable	CE Cable	UF A210B-1-0720-504504	2020/11/29	2021/11/28
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
Radiated Emission Test (Below 1G)					
R&S	EMI Test Receiver	ESR3	102455	2020/08/04	2021/08/03
Sonoma instrument	Pre-amplifier	310 N	186238	2020/08/04	2021/08/03
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2020/12/22	2023/12/21
Unknown	Cable 2	RF Cable 2	F-03-EM197	2020/11/29	2021/11/28
Unknown	Cable	Chamber Cable 1	F-03-EM236	2020/11/29	2021/11/28
Rohde & Schwarz	Auto test software	EMC 32	V9.10	NCR	NCR
Radiated Emission Test (Above 1G)					
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2020/08/04	2021/08/03
COM-POWER	Pre-amplifier	PA-122	181919	2020/11/29	2021/11/28
Quinstar	Amplifier	QLW-18405536-J0	15964001002	2020/11/28	2021/11/27
Sunol Sciences	Horn Antenna	3115	9107-3694	2021/01/15	2024/01/14
Insulted Wire Inc.	RF Cable	SPS-2503-3150	02222010	2020/11/29	2021/11/28
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2020/11/29	2021/11/28
Unknown	Signal Cable	RG-214	2	2020/11/29	2021/11/28
SNSD	Band Reject filter	BSF5150-5850MN-0899-004	5G filter	2021/04/20	2022/04/20
Ducommun Technolagies	Horn antenna	ARH-4223-02	1007726-02 1304	2020/12/06	2023/12/05
Ducommun Technolagies	Horn antenna	ARH-2823-02	1007726-02 1302	2020/12/06	2023/12/05

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RF Conducted Test					
Tonscend Corporation	RF control Unit	JS0806-2	19D8060154	2020/08/04	2021/08/03
Rohde & Schwarz	Signal and Spectrum Analyzer	FSV40	101473	2020/08/04	2021/08/03
Unknown	RF Cable	Unknown	2301 276	2020/11/29	2021/11/28

*** 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:

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

Mode	Frequency (MHz)	Antenna Gain		Max Tune-up Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
		(dBi)	(numeric)	(dBm)	(mW)			
ZigBee	2405-2480	0	1.00	19	79.43	20	0.016	1
2.4G Wi-Fi	2412-2462	4.5	2.82	25	316.23	20	0.177	1
5G Wi-Fi	5150-5350	3.5	2.24	20.0	100	20	0.045	1
	5725-5850	3.5	2.24	20.0	100	20	0.045	1

Note: 1. the tune up conducted power was declared by the applicant
2. the 2.4G Wi-Fi, 5.2G Wi-Fi, 5.8G Wi-Fi and ZigBee can transmit at the same time.

Simultaneous transmitting consideration:

The ratio=$MPE_{2.4GWi\text{-}Fi}$/limit+ $MPE_{5.2GWi\text{-}Fi}$/limit + $MPE_{5.8GWi\text{-}Fi}$/limit+ MPE_{ZigBee}/limit
=0.177/1+0.045/1+0.045/1+0.016/1=0.283＜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 5.2G Wi-Fi and two internal antennas arrangement for 5.8G Wi-Fi, which was permanently attached and the antenna gain is 3.5dBi, fulfill the requirement of this section. Please refer to the EUT photos.

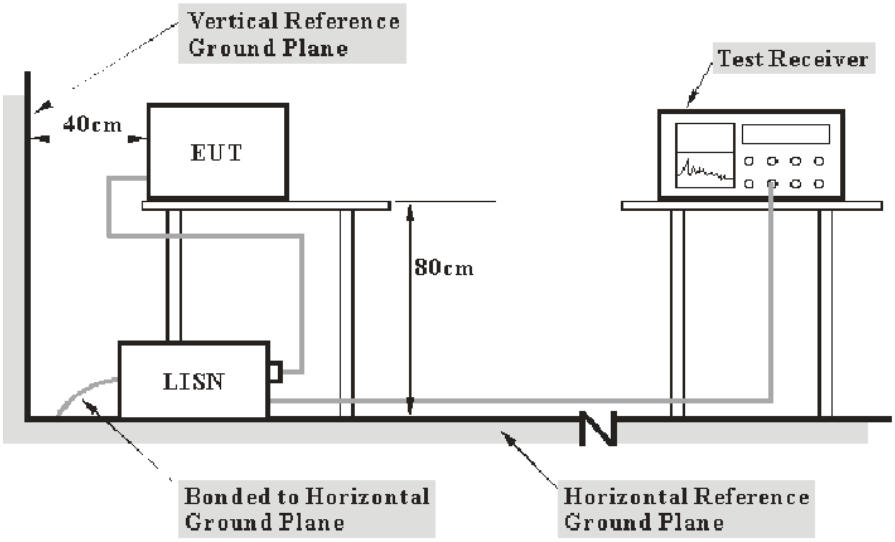
Result: Pass

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 Data

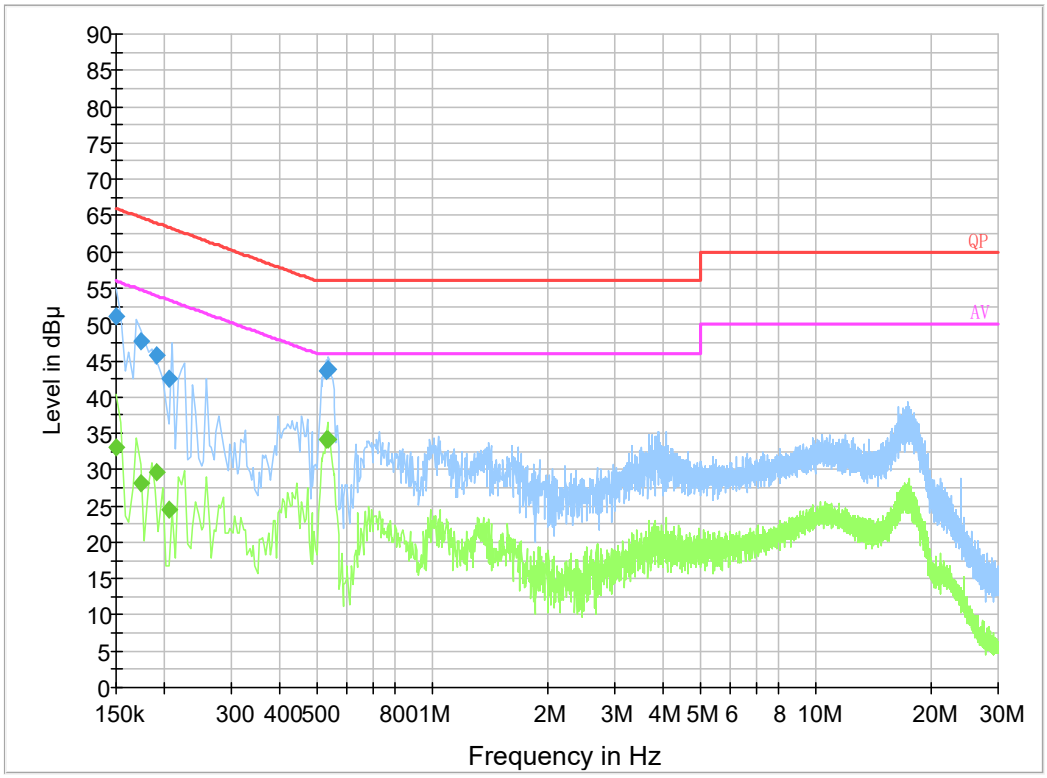
Environmental Conditions

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

The testing was performed by Haiguo Li on 2021-05-10.

EUT operation mode: Transmitting

AC 120V/60 Hz, Line:



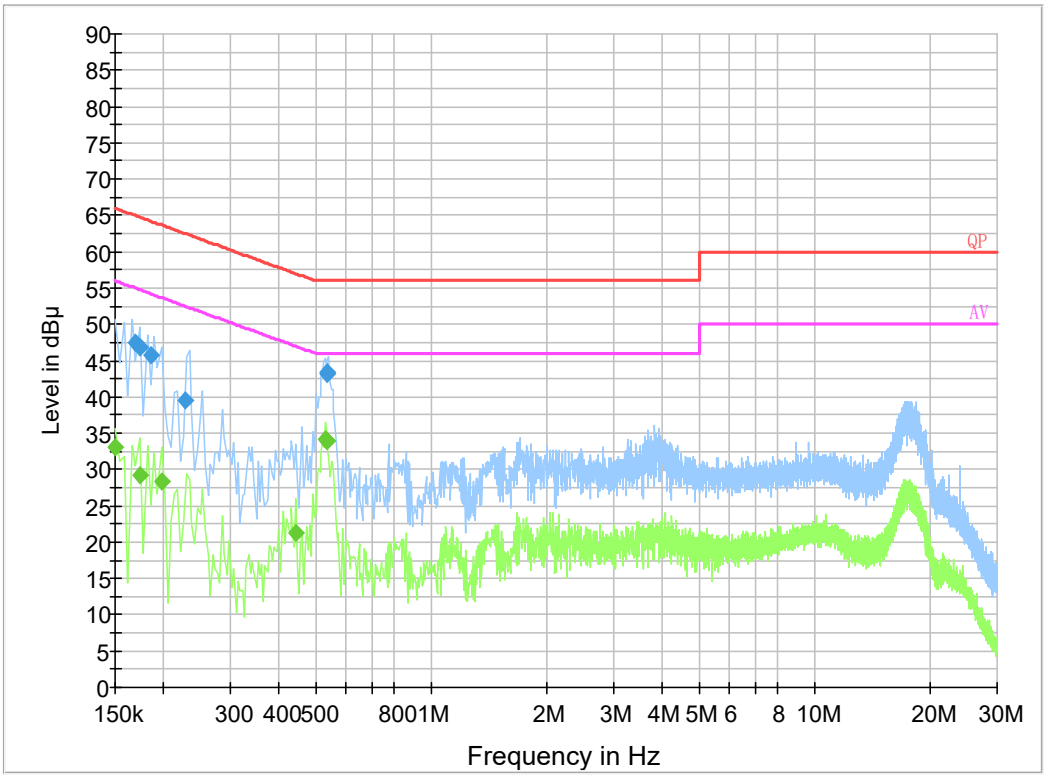
Final Result 1

Frequency (MHz)	QuasiPeak (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.150000	51.1	0.200	L1	19.8	14.9	66.0
0.173500	47.7	9.000	L1	19.9	17.1	64.8
0.190501	45.8	9.000	L1	19.8	18.2	64.0
0.205500	42.6	9.000	L1	19.8	20.8	63.4
0.530050	43.6	9.000	L1	19.8	12.4	56.0
0.533930	43.8	9.000	L1	19.8	12.2	56.0

Final Result 2

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.150000	33.1	9.000	L1	19.8	22.9	56.0
0.173500	28.1	9.000	L1	19.9	26.7	54.8
0.190501	29.5	9.000	L1	19.8	24.5	54.0
0.205500	24.5	9.000	L1	19.8	28.9	53.4
0.530050	34.2	9.000	L1	19.8	11.8	46.0
0.533930	34.2	9.000	L1	19.8	11.8	46.0

AC120V, 60 Hz, Neutral:



Final Result 1

Frequency (MHz)	QuasiPeak (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.169500	47.4	9.000	N	19.8	17.6	65.0
0.173500	46.9	9.000	N	19.8	17.9	64.8
0.185500	45.7	9.000	N	19.8	18.5	64.2
0.229500	39.6	9.000	N	19.8	22.9	62.5
0.534050	43.3	9.000	N	19.8	12.7	56.0
0.537870	43.4	9.000	N	19.8	12.6	56.0

Final Result 2

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.150000	33.2	9.000	N	19.8	22.8	56.0
0.174000	29.3	9.000	N	19.8	25.5	54.8
0.198000	28.3	9.000	N	19.8	25.4	53.7
0.446000	21.3	9.000	N	19.8	25.6	46.9
0.530000	34.1	9.000	N	19.8	11.9	46.0
0.538000	33.9	9.000	N	19.8	12.1	46.0

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

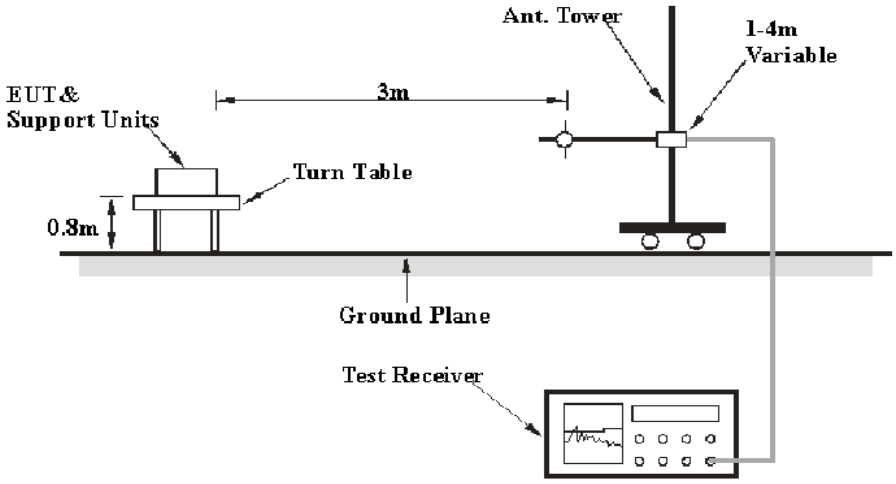
Applicable Standard

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

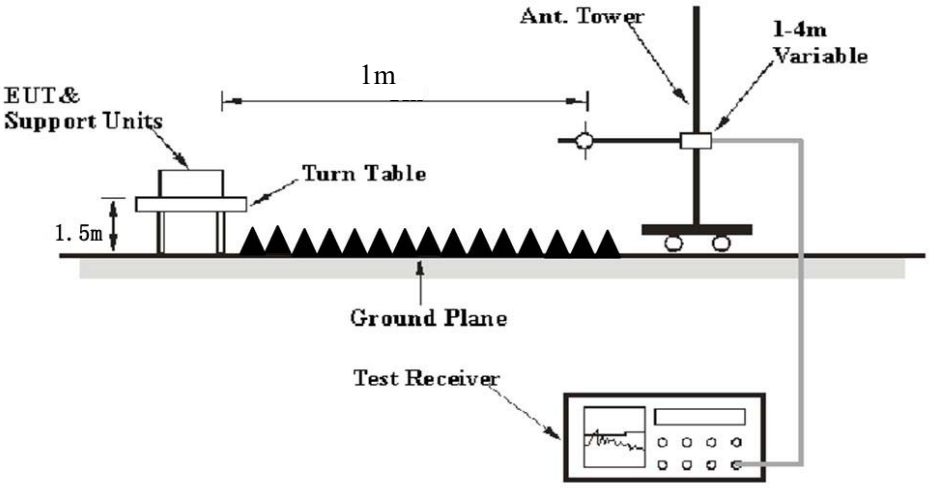
(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:
(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band:
(i) All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209.

EUT Setup

Below 1 GHz:



Above 1 GHz:



The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC 15.209 and FCC 15.407 limits.

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

EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 40 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

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

Note 1: when duty cycle is no less than 98%
Note 2: when duty cycle is less than 98%

Test Procedure

Radiated Spurious Emission

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

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

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

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 Data

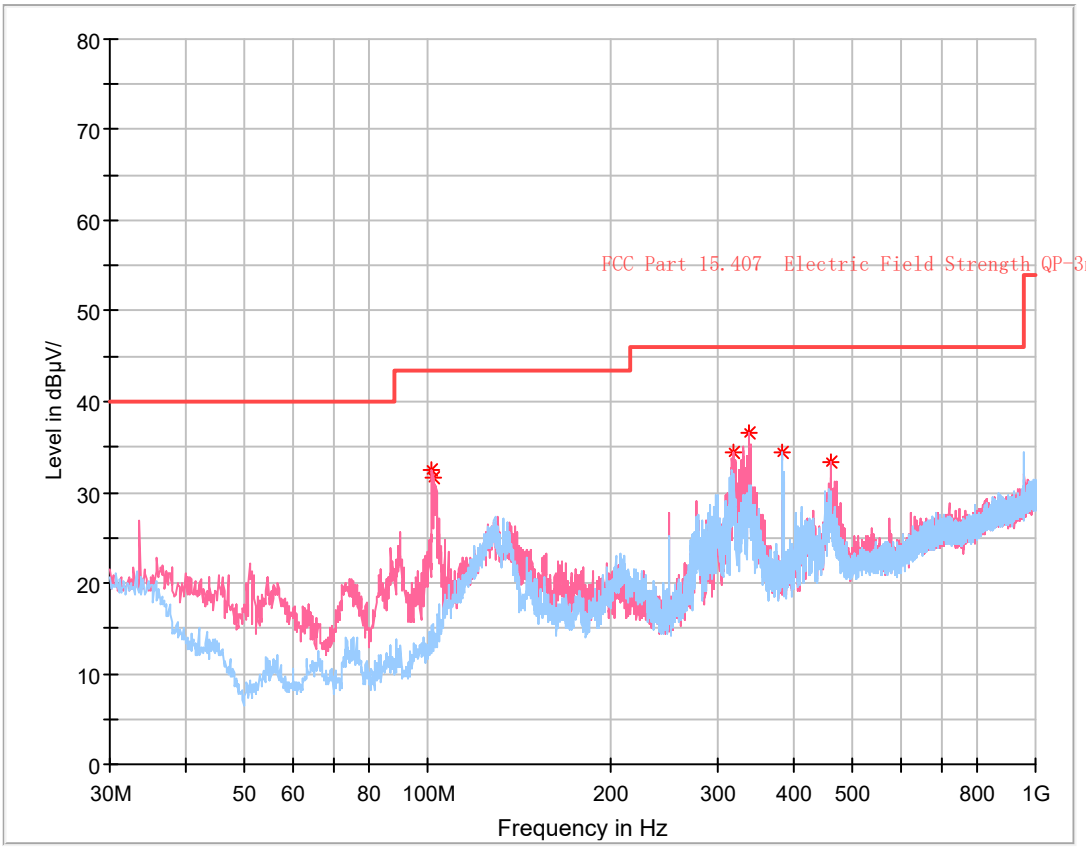
Environmental Conditions

Temperature:	25.9~ 28 ℃
Relative Humidity:	52~ 58 %
ATM Pressure:	101.0 kPa

The testing was performed by Zero Yan on 2021-05-10 for below 1GHz and Alan He on 2021-05-18 for above 1GHz.

EUT operation mode: Transmitting

30 MHz~1 GHz: *(the worst case is 802.11n40 Mode, 5755MHz)*



Critical_Freqs

Frequency (MHz)	MaxPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
101.780000	32.49	43.50	11.01	100.0	V	242.0	-13.3
102.386250	31.64	43.50	11.86	100.0	V	227.0	-13.1
319.302500	34.35	46.00	11.65	200.0	V	149.0	-9.5
338.581250	36.48	46.00	9.52	200.0	V	103.0	-9.1
383.201250	34.45	46.00	11.55	100.0	H	81.0	-7.8
459.952500	33.31	46.00	12.69	100.0	V	183.0	-5.5

1 ~ 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.

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									
5148.52	33.04	PK	113	1.8	V	38.36	71.40	83.5	12.10
5148.52	17.99	Ave.	113	1.8	V	38.36	56.35	63.5	7.15
5449.73	31.5	PK	323	2.0	V	39.29	70.79	83.5	12.71
5449.73	17.54	Ave.	323	2.0	V	39.29	56.83	63.5	6.67
10360.00	48.41	PK	14	1.4	V	17.42	65.83	77.7	11.87
5200 MHz									
10400.00	47.1	PK	267	1.9	V	17.52	64.62	77.7	13.08
5240 MHz									
5110.24	31.5	PK	158	2.3	V	38.26	69.76	83.5	13.74
5110.24	17.81	Ave.	158	2.3	V	38.26	56.07	63.5	7.43
5431.90	31.6	PK	175	1.1	V	39.29	70.89	83.5	12.61
5431.90	17.45	AV	175	1.1	V	39.29	56.74	63.5	6.76
10480.00	48.77	PK	38	1.1	V	17.25	66.02	77.7	11.68
802.11n20									
5180 MHz									
5148.30	32.18	PK	328	1.2	V	38.36	70.54	83.5	12.96
5148.30	17.52	Ave.	328	1.2	V	38.36	55.88	63.5	7.62
5360.43	31.24	PK	28	1.4	V	39.09	70.33	83.5	13.17
5360.43	17.5	Ave.	28	1.4	V	39.09	56.59	63.5	6.91
10360.00	50.69	PK	10	2.0	V	17.42	68.11	77.7	9.59
5200 MHz									
10400.00	51.38	PK	346	2.2	V	17.52	68.90	77.7	8.80
5240 MHz									
5144.90	31.88	PK	201	2.5	V	38.36	70.24	83.5	13.26
5144.90	17.4	Ave.	201	2.5	V	38.36	55.76	63.5	7.74
5360.43	31.17	PK	280	2.2	V	39.09	70.26	83.5	13.24
5360.43	16.89	Ave.	280	2.2	V	39.09	55.98	63.5	7.52
10480.00	49.84	PK	70	1.4	V	17.25	67.09	77.7	10.61

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									
5190 MHz									
5149.82	33.94	PK	161	2.5	V	38.36	72.30	83.5	11.20
5149.82	20.02	Ave.	161	2.5	V	38.36	58.38	63.5	5.12
5434.93	31.41	PK	312	2.5	V	39.29	70.70	83.5	12.80
5434.93	17.5	Ave.	312	2.5	V	39.29	56.79	63.5	6.71
10380.00	46.85	PK	183	1.2	V	17.42	64.27	77.7	13.43
5230 MHz									
5104.02	32.24	PK	144	2.3	V	38.26	70.50	83.5	13.00
5104.02	17.93	Ave.	144	2.3	V	38.26	56.19	63.5	7.31
5365.68	31.33	PK	244	2.5	V	39.09	70.42	83.5	13.08
5365.68	17.48	AV	244	2.5	V	39.09	56.57	63.5	6.93
10460.00	45.37	PK	164	1.8	V	17.15	62.52	77.7	15.18
802.11ac20									
5180 MHz									
5143.52	33.67	PK	232	1.3	V	38.36	72.03	83.5	11.47
5143.52	17.93	Ave.	232	1.3	V	38.36	56.29	63.5	7.21
5360.43	31.16	PK	159	1.3	V	39.09	70.25	83.5	13.25
5360.43	16.87	Ave.	159	1.3	V	39.09	55.96	63.5	7.54
10360.00	50.86	PK	152	1.1	V	17.42	68.28	77.7	9.42
5200 MHz									
10400.00	50.21	PK	296	2.3	V	17.52	67.73	77.7	9.97
5240 MHz									
5109.95	31.87	PK	326	2.1	V	38.26	70.13	83.5	13.37
5109.95	17.53	Ave.	326	2.1	V	38.26	55.79	63.5	7.71
5360.43	31.17	PK	337	2.5	V	39.09	70.26	83.5	13.24
5360.43	16.9	Ave.	337	2.5	V	39.09	55.99	63.5	7.51
10480.00	50.91	PK	21	1.4	V	17.25	68.16	77.7	9.54
802.11ac40									
5190 MHz									
5143.45	32.61	PK	168	1.9	V	38.36	70.97	83.5	12.53
5143.45	19.31	Ave.	168	1.9	V	38.36	57.67	63.5	5.83
5446.23	31.34	PK	242	1.7	V	39.29	70.63	83.5	12.87
5446.23	17.44	Ave.	242	1.7	V	39.29	56.73	63.5	6.77
10380.00	46.75	PK	317	1.3	V	17.42	64.17	77.7	13.53
5230 MHz									
5125.22	32.32	PK	224	1.0	V	38.36	70.68	83.5	12.82
5125.22	18.03	Ave.	224	1.0	V	38.36	56.39	63.5	7.11
5404.68	31.21	PK	58	1.8	V	39.19	70.40	83.5	13.10
5404.68	17.53	Ave.	58	1.8	V	39.19	56.72	63.5	6.78
10460.00	45.14	PK	215	2.4	V	17.15	62.29	77.7	15.41

Frequency (MHz)	Receiver		Turntable	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	FCC Part 15.407/205/209	
	Reading (dBµV)	PK/QP/Ave.	Degree	Height (m)	Polar (H / V)			Limit (dBµV/m)	Margin (dB)
802.11ac80									
5210MHz									
5133.61	36.86	PK	213	1.6	V	38.36	75.22	83.5	8.28
5133.61	23.29	Ave.	213	1.6	V	38.36	61.65	63.5	1.85
5437.95	31.42	PK	158	1.3	V	39.29	70.71	83.5	12.79
5437.95	17.87	Ave.	158	1.3	V	39.29	57.16	63.5	6.34
10420.00	44.15	PK	45	2.4	V	17.52	61.67	77.7	16.03

5725-5850 MHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.407/205/209	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11a									
5745 MHz									
5613.57	32.08	PK	114	1.0	H	39.46	71.54	77.7	6.16
5667.19	32.66	PK	266	2.2	H	39.49	72.15	129.19	57.04
5713.24	32.22	PK	70	1.7	H	39.49	71.71	118.41	46.70
5722.85	32.49	PK	332	1.6	H	39.49	71.98	126.8	54.82
11490.00	51.09	PK	189	2.3	H	17.47	68.56	83.5	14.94
11490.00	33.87	Ave.	189	2.3	H	17.47	51.34	63.5	12.16
5785 MHz									
11570.00	52.35	PK	237	1.5	H	17.51	69.86	83.5	13.64
11570.00	35.46	Ave.	237	1.5	H	17.51	52.97	63.5	10.53
5825 MHz									
5850.32	34.02	PK	264	1.7	H	39.87	73.89	130.97	57.08
5868.07	33.75	PK	338	2.0	H	39.87	73.62	116.64	43.02
5899.87	33.33	PK	158	2.0	H	39.87	73.20	96.3	23.10
5943.09	33.61	PK	110	1.7	H	39.97	73.58	77.7	4.12
11650.00	51.28	PK	321	1.2	H	16.18	67.46	83.5	16.04
11650.00	34.15	Ave.	321	1.2	H	16.18	50.33	63.5	13.17
802.11n20									
5745 MHz									
5645.12	32.18	PK	315	1.4	H	39.46	71.64	77.7	6.06
5674.86	33.56	PK	314	1.3	H	39.49	73.05	96.09	23.04
5706.41	33.90	PK	250	2.2	H	39.49	73.39	116.5	43.11
5724.03	36.14	PK	172	2.3	H	39.49	75.63	129.5	53.87
11490.00	50.85	PK	310	1.2	H	17.47	68.32	83.5	15.18
11490.00	30.82	Ave.	310	1.2	H	17.47	48.29	63.5	15.21
5785 MHz									
11570.00	51.39	PK	355	2.3	H	17.51	68.90	83.5	14.60
11570.00	31.16	Ave.	355	2.3	H	17.51	48.67	63.5	14.83
5825 MHz									
5852.25	32.94	PK	94	1.2	H	39.87	72.81	126.57	53.76
5873.12	34.04	PK	315	1.3	H	39.87	73.91	115.23	41.32
5901.58	34.48	PK	173	1.4	H	39.87	74.35	95.03	20.68
5931.06	33.63	PK	2	1.9	H	39.97	73.60	77.7	4.10
11650.00	52.24	PK	249	2.4	H	16.18	68.42	83.5	15.08
11650.00	31.55	Ave.	249	2.4	H	16.18	47.73	63.5	15.77

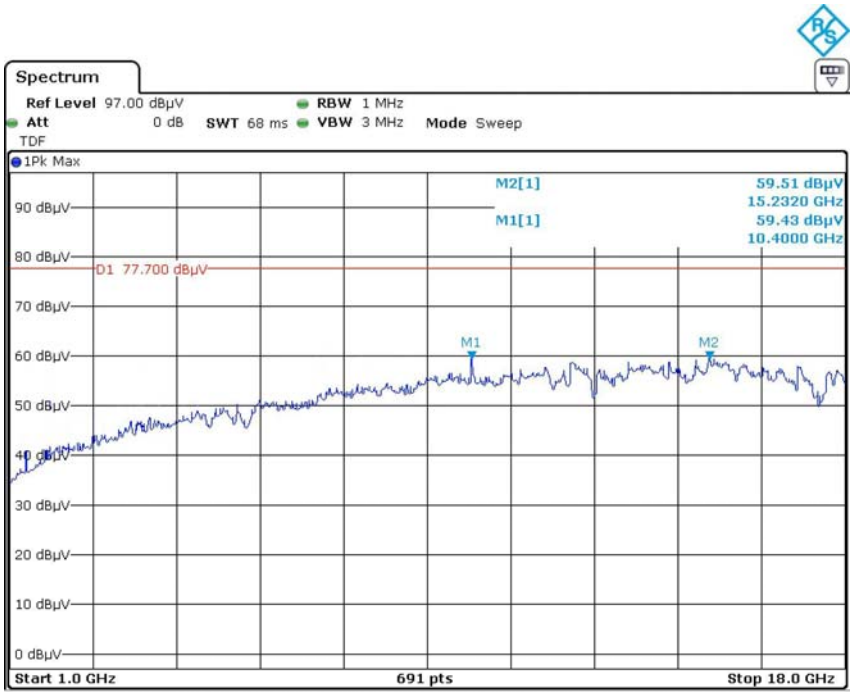
Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.407/205/209	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11n40									
5755 MHz									
5634.33	33.74	PK	91	1.8	H	39.46	73.20	77.7	4.50
5692.73	35.84	PK	354	1.8	H	39.49	75.33	109.32	33.99
5712.55	39.92	PK	103	1.3	H	39.49	79.41	118.21	38.80
5721.71	41.31	PK	327	2.5	H	39.49	80.80	124.2	43.40
11510.00	47.57	PK	24	1.9	H	17.47	65.04	83.5	18.46
11510.00	32.24	Ave.	24	1.9	H	17.47	49.71	63.5	13.79
5795 MHz									
5854.67	33.05	PK	356	1.4	H	39.87	72.92	121.05	48.13
5856.39	33.95	PK	80	1.3	H	39.87	73.82	119.91	46.09
5911.32	34.65	PK	79	1.5	H	39.87	74.52	87.82	13.30
5930.15	34.37	PK	40	1.6	H	39.97	74.34	77.7	3.36
11590.00	46.58	PK	200	1.4	H	17.51	64.09	83.5	19.41
11590.00	31.57	Ave.	200	1.4	H	17.51	49.08	63.5	14.42
802.11ac20									
5745 MHz									
5611.61	32.43	PK	323	1.4	H	39.46	71.89	77.7	5.81
5695.48	33.71	PK	283	1.3	H	39.49	73.20	111.35	38.15
5706.30	34.99	PK	37	2.5	H	39.49	74.48	116.46	41.98
5724.89	39.79	PK	126	1.8	H	39.49	79.28	131.45	52.17
11490.00	49.48	PK	257	1.7	H	17.47	66.95	83.5	16.55
11490.00	32.25	Ave.	257	1.7	H	17.47	49.72	63.5	13.78
5785 MHz									
11570.00	53.81	PK	196	2.5	H	17.51	71.32	83.5	12.18
11570.00	34.87	Ave.	196	2.5	H	17.51	52.38	63.5	11.12
5825 MHz									
5851.06	33.06	PK	127	1.3	H	39.87	72.93	129.28	56.35
5872.77	33.79	PK	20	2.2	H	39.87	73.66	115.32	41.66
5924.64	34.68	PK	268	1.5	H	39.97	74.65	77.97	3.32
5988.05	34.28	PK	279	2.2	H	39.84	74.12	77.7	3.58
11650.00	53.76	PK	160	2.0	H	16.18	69.94	83.5	13.56
11650.00	34.58	Ave.	160	2.0	H	16.18	50.76	63.5	12.74

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.407/205/209	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11ac40									
5755 MHz									
5647.29	33.52	PK	112	2.5	H	39.46	72.98	77.7	4.72
5694.39	35.21	PK	123	1.9	H	39.49	74.70	110.55	35.85
5718.02	38.84	PK	192	1.9	H	39.49	78.33	119.75	41.42
5724.50	34.64	PK	255	1.3	H	39.49	74.13	130.56	56.43
11510.00	46.78	PK	203	2.3	H	17.47	64.25	83.5	19.25
11510.00	32.4	Ave.	203	2.3	H	17.47	49.87	63.5	13.63
5795 MHz									
5852.04	34.9	PK	189	2.3	H	39.87	74.77	127.05	52.28
5858.9	34.03	PK	134	2.5	H	39.87	73.90	119.21	45.31
5883.21	33.77	PK	293	2.1	H	39.87	73.64	108.62	34.98
5927.33	34.1	PK	17	1.8	H	39.97	74.07	77.7	3.63
11590.00	46.79	PK	253	1.7	H	17.51	64.30	83.5	19.20
11590.00	31.24	Ave.	253	1.7	H	17.51	48.75	63.5	14.75
802.11ac80									
5775 MHz									
5648.08	35.05	PK	118	2.2	H	39.46	74.51	77.7	3.19
5692.15	39.89	PK	209	2.2	H	39.49	79.38	108.89	29.51
5710.72	43.56	PK	261	2.5	H	39.49	83.05	117.7	34.65
5724.49	42.36	PK	108	2.3	H	39.49	81.85	130.54	48.69
5850.88	37.13	PK	84	1.4	H	39.87	77.00	129.69	52.69
5856.26	35.63	PK	344	1.5	H	39.87	75.50	119.95	44.45
5898.12	34.36	PK	93	1.0	H	39.87	74.23	97.59	23.36
5930.37	34.21	PK	333	2.1	H	39.97	74.18	77.7	3.52
11550.00	43.89	PK	111	1.0	H	17.51	61.40	83.5	22.10
11550.00	30.59	Ave.	111	1.0	H	17.51	48.10	63.5	15.40

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 802.11 mode 5200MHz
Horizontal



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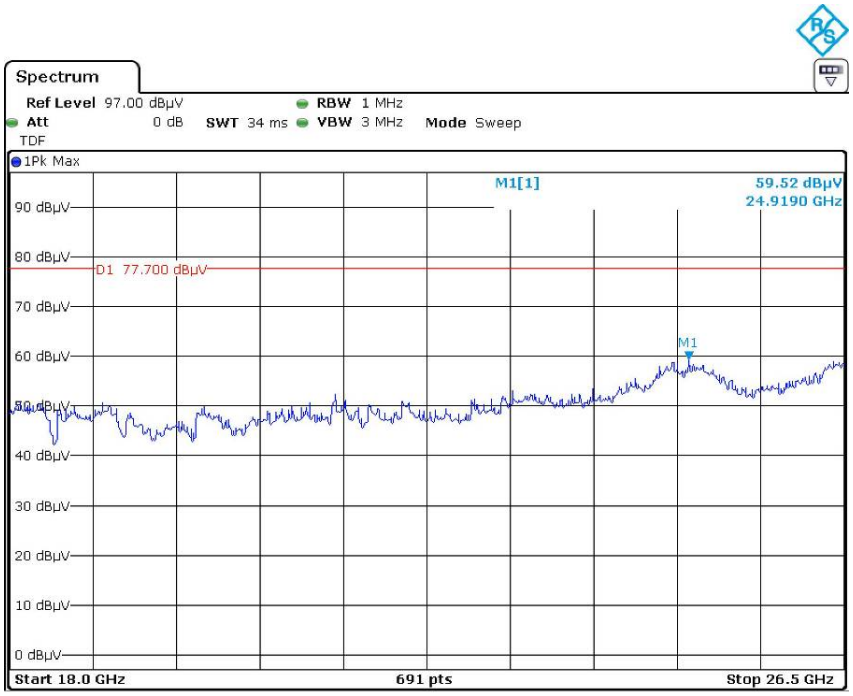

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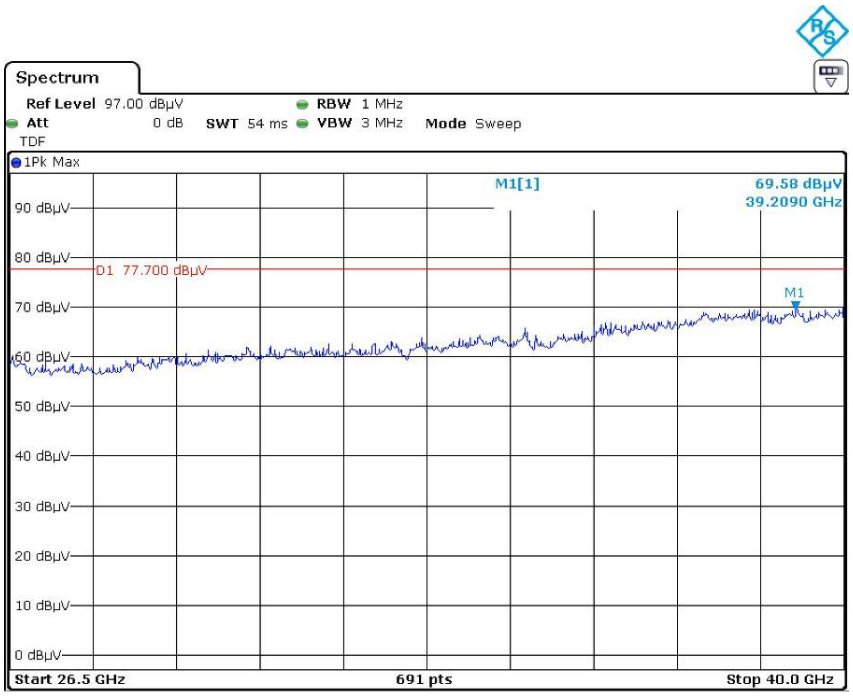

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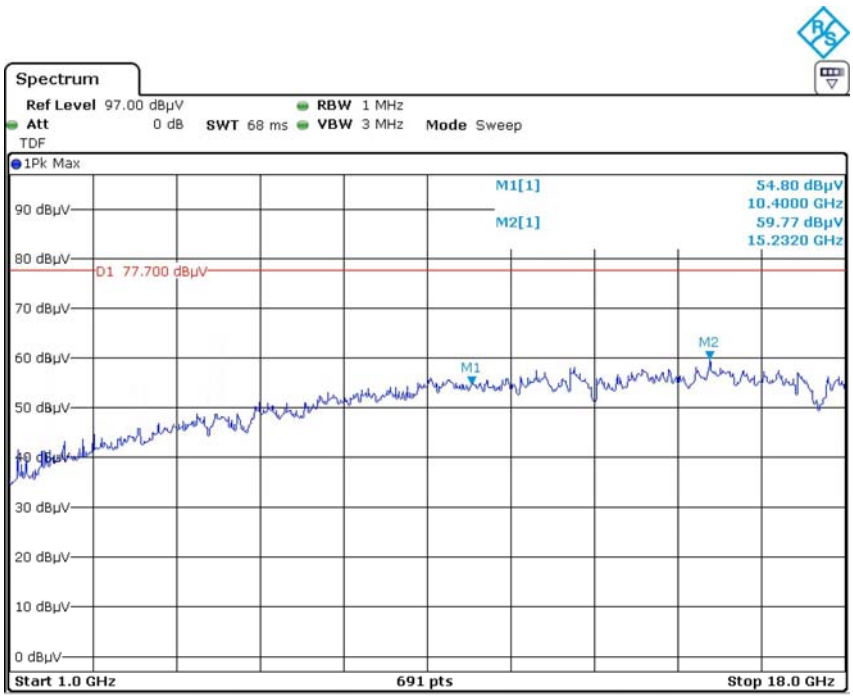
Vertical



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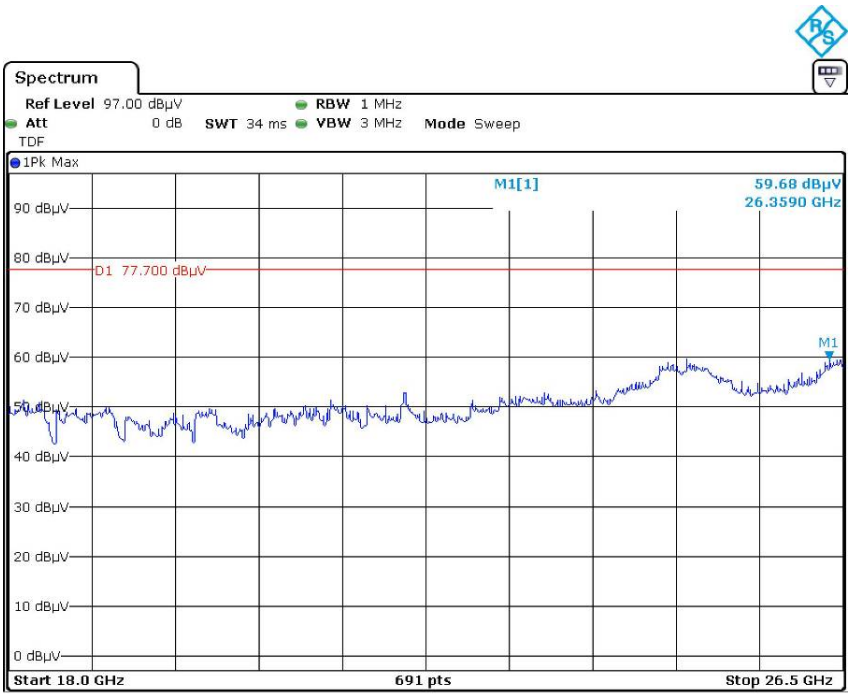

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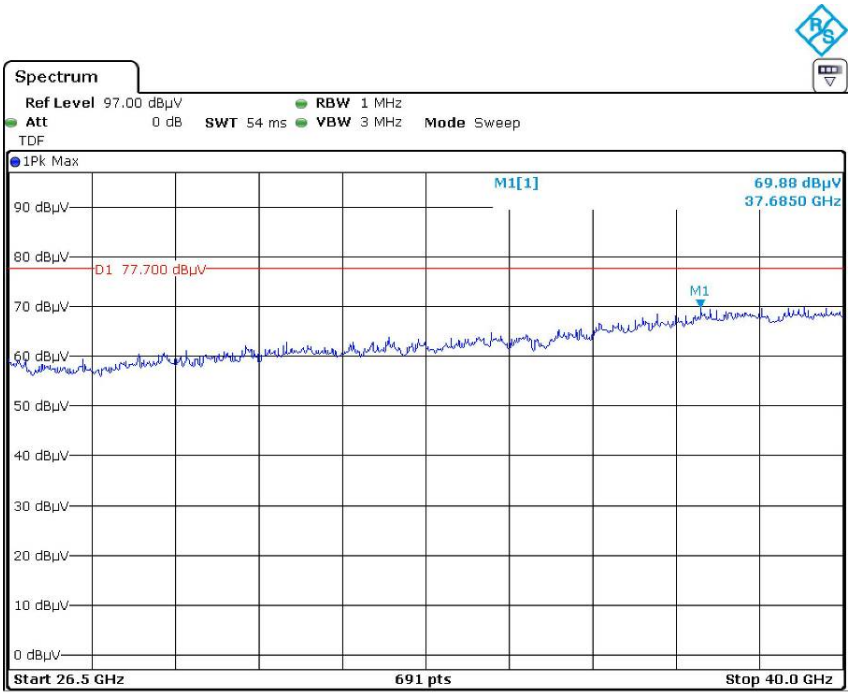

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FCC §15.407(a) (1) – 26 dB & 6dB EMISSION BANDWIDTH

Applicable Standard

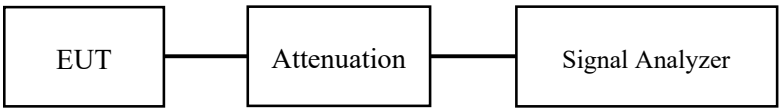
The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band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

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

Test Procedure

1. Emission Bandwidth (EBW)
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%.

2. **Minimum Emission Bandwidth for the band 5.725-5.85 GHz**
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao on 2021-05-27 and 2021-06-08.

EUT operation mode: Transmitting

Test Result: Pass

Note: the worst case ANT1 was tested.

Please refer to the Appendix

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

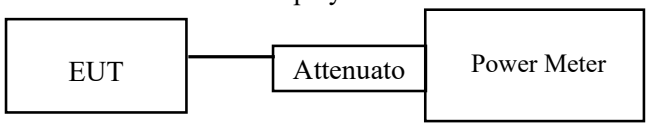
Applicable Standard

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

Test Procedure

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



Test Data

Environmental Conditions

Temperature:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao on 2021-05-27 and 2021-07-23.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the Appendix

FCC §15.407(a) (1) (3) - 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.

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

Test Procedure

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

a) Set RBW ≥ 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:	24 ℃
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao on 2021-06-07 and 2021-07-23.

EUT operation mode: Transmitting

Test Result: Pass

Please refer to the Appendix

APPENDIX

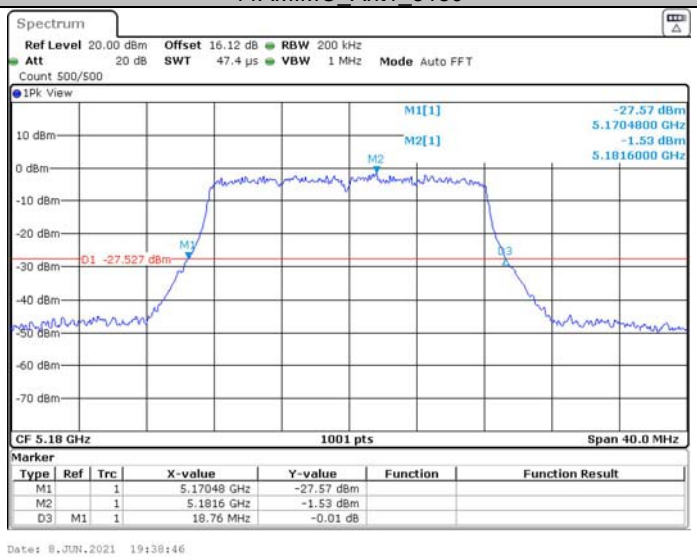
Appendix A1: Emission Bandwidth

Test Result

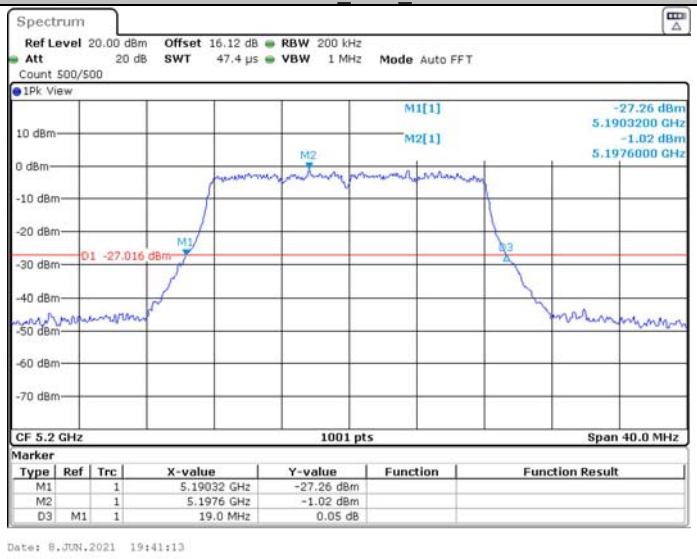
Test Mode	Antenna	Channel	26db EBW [MHz]	Limit[MHz]	Verdict
11AMIMO	Ant1	5180	18.760	---	PASS
	Ant1	5200	19.000	---	PASS
	Ant1	5240	19.000	---	PASS
11N20MIMO	Ant1	5180	19.640	---	PASS
	Ant1	5200	19.880	---	PASS
	Ant1	5240	20.080	---	PASS
11N40MIMO	Ant1	5190	39.680	---	PASS
	Ant1	5230	39.600	---	PASS
11AC20MIMO	Ant1	5180	20.040	---	PASS
	Ant1	5200	20.160	---	PASS
	Ant1	5240	19.880	---	PASS
11AC40MIMO	Ant1	5190	39.600	---	PASS
	Ant1	5230	39.520	---	PASS
11AC80MIMO	Ant1	5210	83.360	---	PASS

Test Graphs

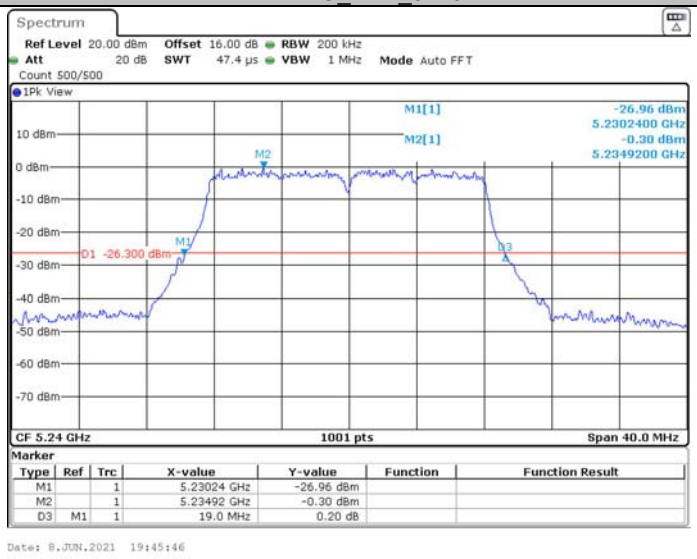
11AMIMO_Ant1_5180



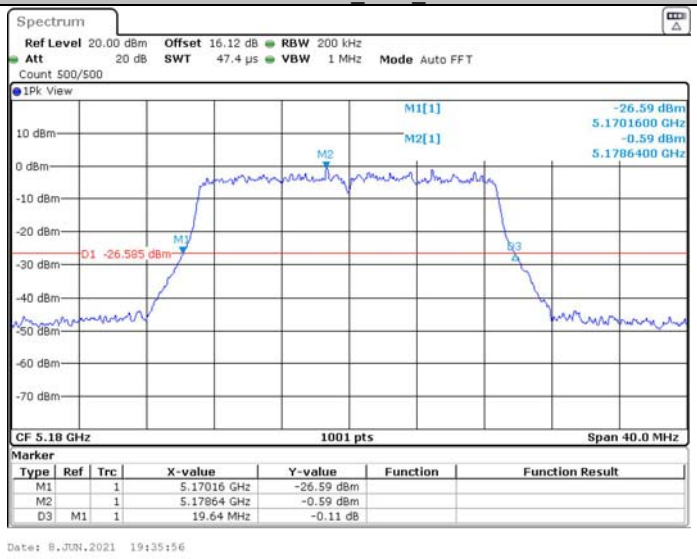
11AMIMO_Ant1_5200



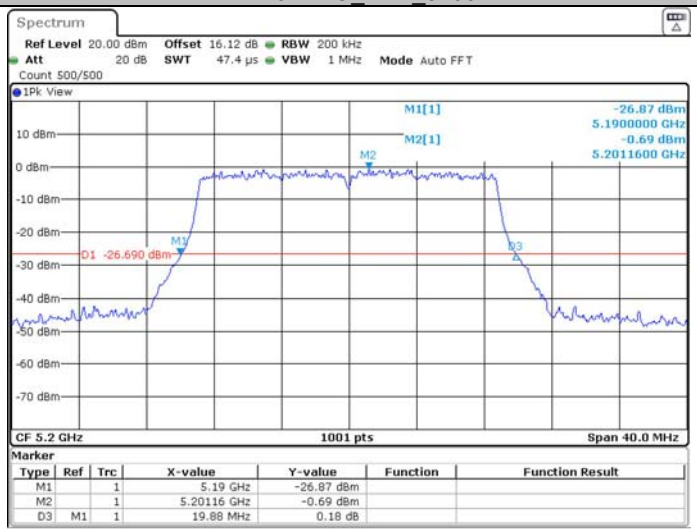
11AMIMO_Ant1_5240



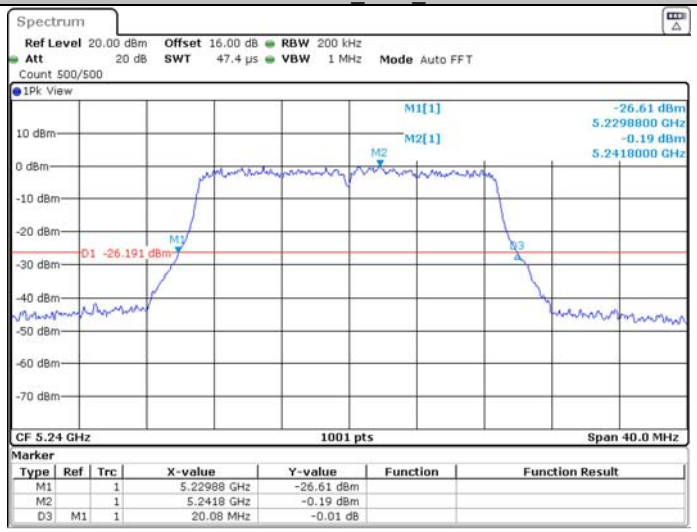
11N20MIMO_Ant1_5180



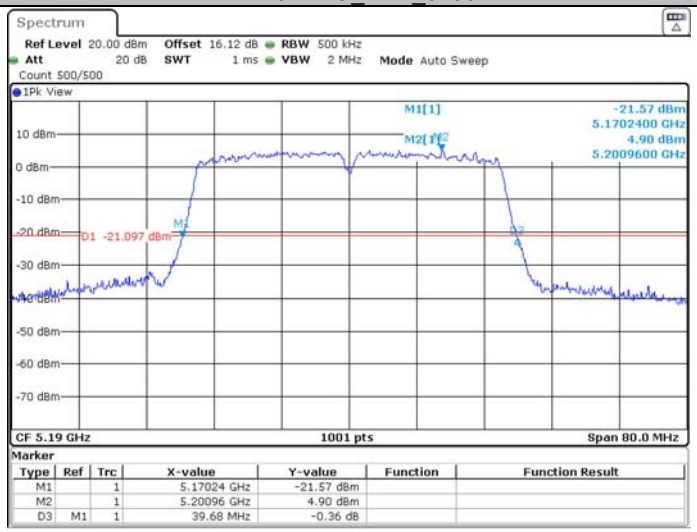
11N20MIMO_Ant1_5200



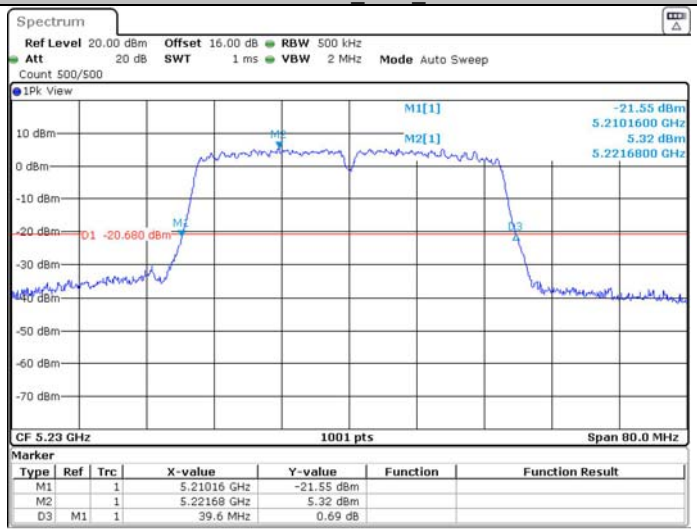
11N20MIMO_Ant1_5240



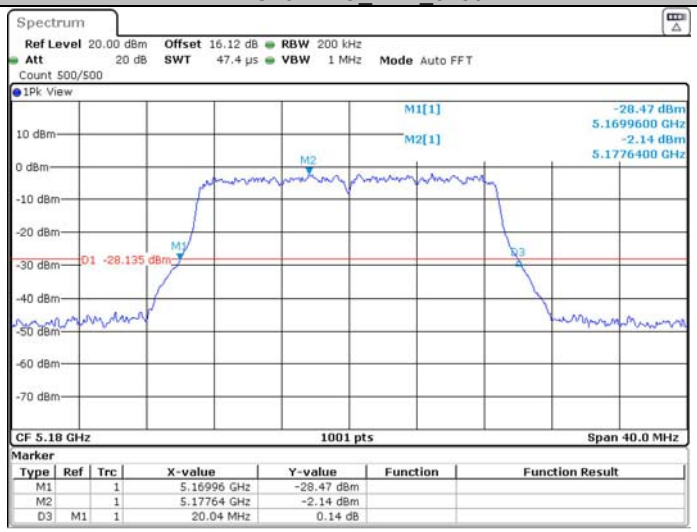
11N40MIMO_Ant1_5190



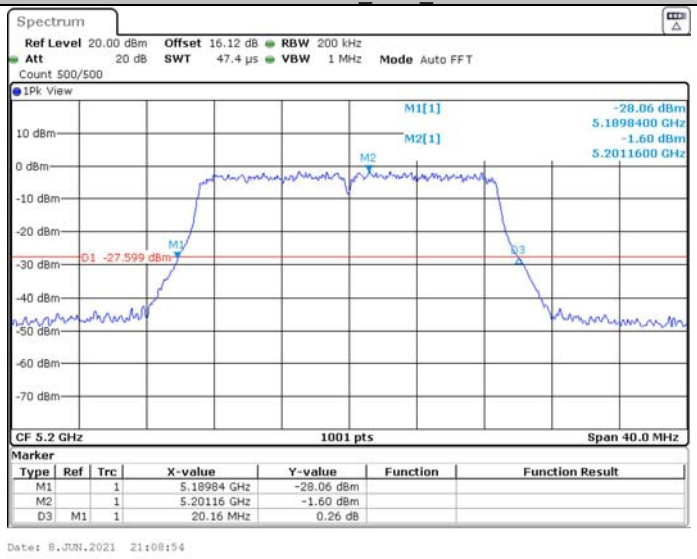
11N40MIMO_Ant1_5230



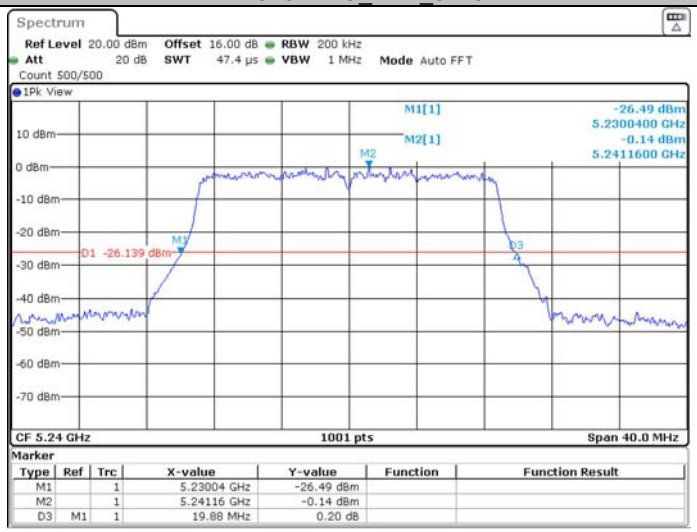
11AC20MIMO_Ant1_5180



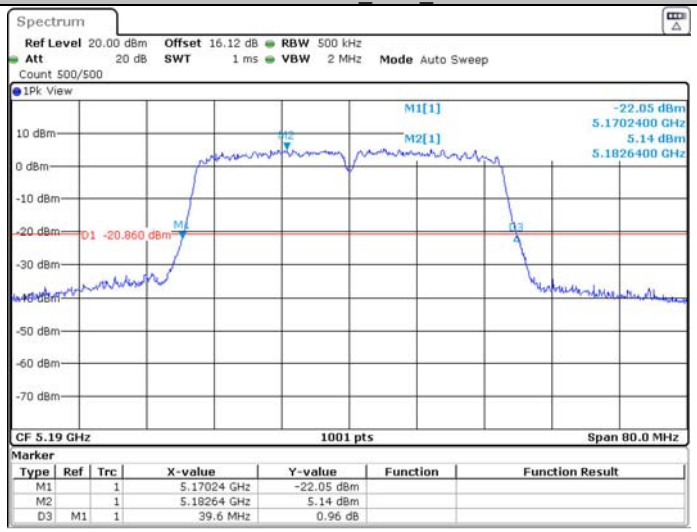
11AC20MIMO_Ant1_5200



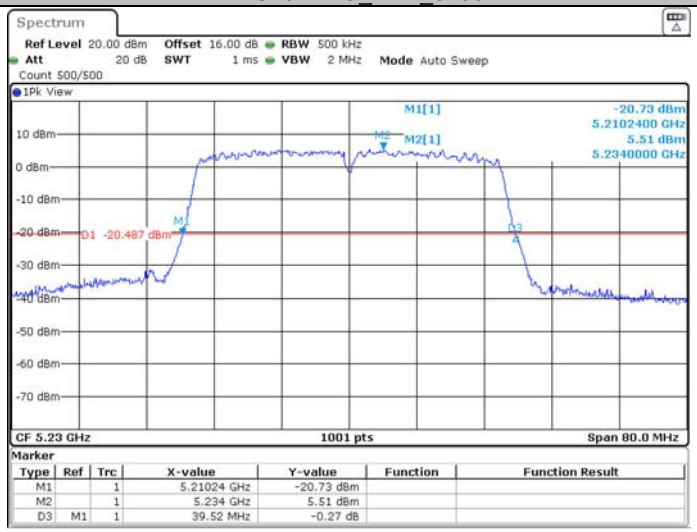
11AC20MIMO_Ant1_5240



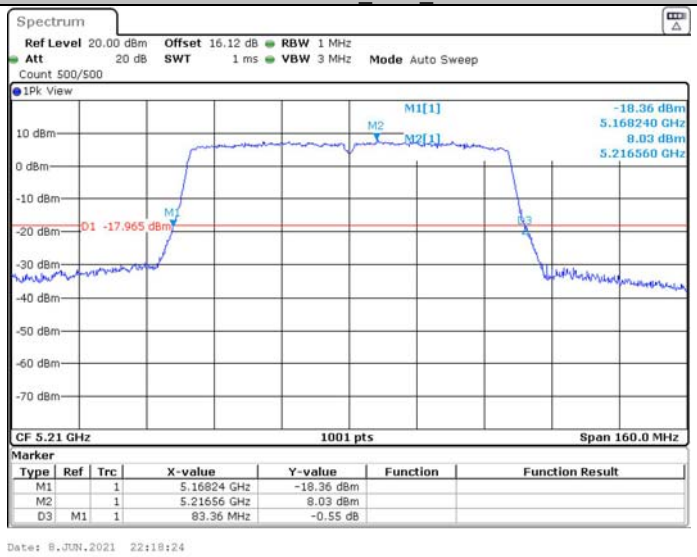
11AC40MIMO_Ant1_5190



11AC40MIMO_Ant1_5230



11AC80MIMO_Ant1_5210



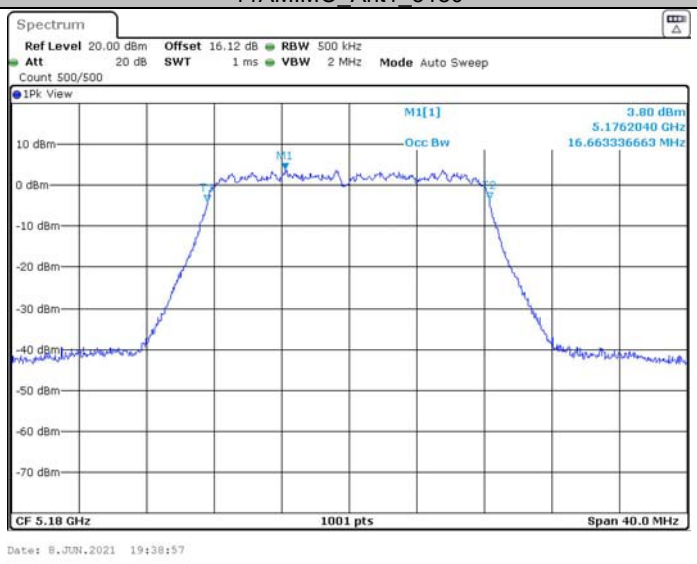
Appendix A2: Occupied channel bandwidth

Test Result

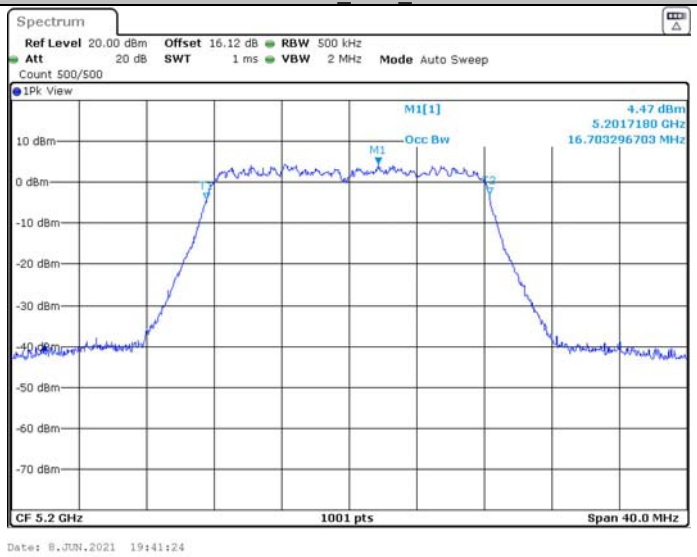
Test Mode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
11AMIMO	Ant1	5180	16.663	---	PASS
	Ant1	5200	16.703	---	PASS
	Ant1	5240	16.663	---	PASS
	Ant1	5745	16.663	---	PASS
	Ant1	5785	16.623	---	PASS
	Ant1	5825	16.623	---	PASS
11N20MIMO	Ant1	5180	17.782	---	PASS
	Ant1	5200	17.782	---	PASS
	Ant1	5240	17.742	---	PASS
	Ant1	5745	17.822	---	PASS
	Ant1	5785	17.742	---	PASS
	Ant1	5825	17.742	---	PASS
11N40MIMO	Ant1	5190	35.964	---	PASS
	Ant1	5230	35.964	---	PASS
	Ant1	5755	35.964	---	PASS
	Ant1	5795	35.964	---	PASS
11AC20MIMO	Ant1	5180	17.742	---	PASS
	Ant1	5200	17.742	---	PASS
	Ant1	5240	17.782	---	PASS
	Ant1	5745	17.702	---	PASS
	Ant1	5785	17.742	---	PASS
	Ant1	5825	17.822	---	PASS
11AC40MIMO	Ant1	5190	35.964	---	PASS
	Ant1	5230	35.964	---	PASS
	Ant1	5755	36.044	---	PASS
	Ant1	5795	35.964	---	PASS
11AC80MIMO	Ant1	5210	75.764	---	PASS
	Ant1	5775	75.924	---	PASS

Test Graphs

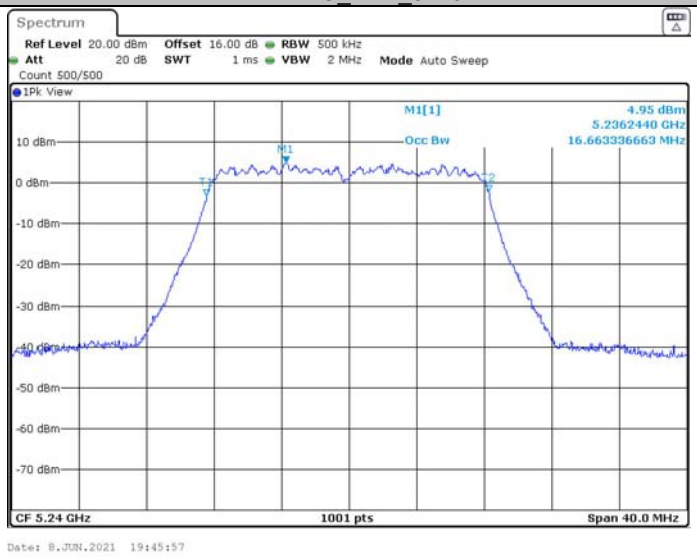
11AMIMO_Ant1_5180



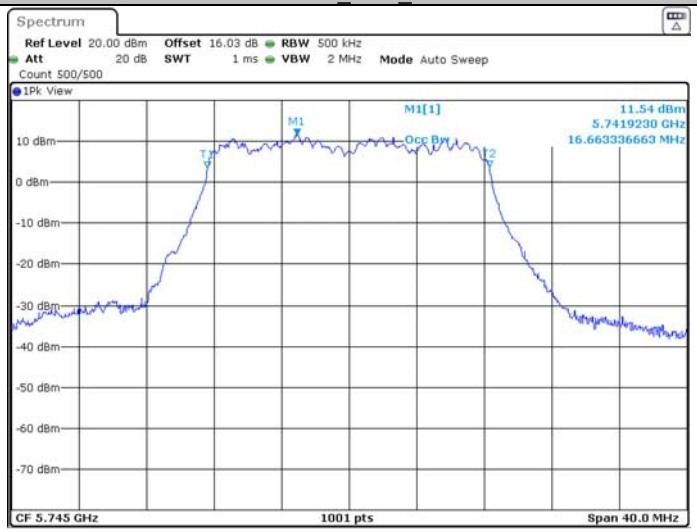
11AMIMO_Ant1_5200



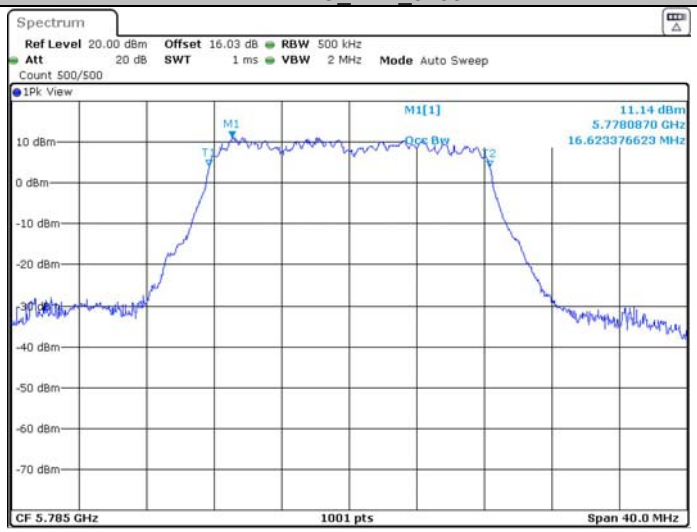
11AMIMO_Ant1_5240



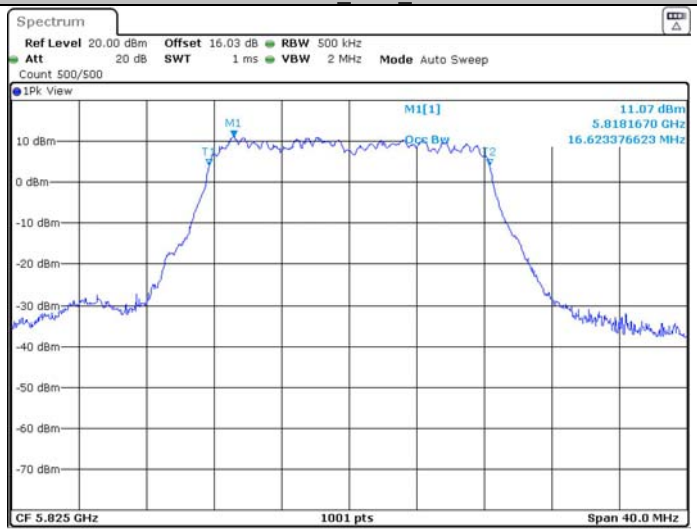
11AMIMO_Ant1_5745



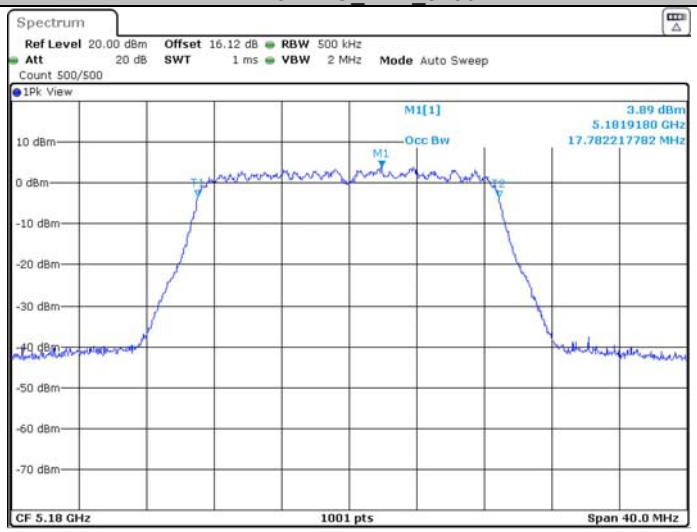
11AMIMO_Ant1_5785



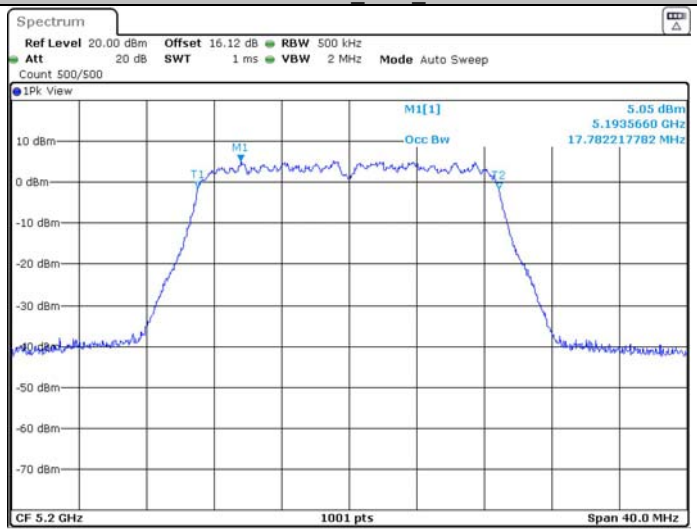
11AMIMO_Ant1_5825



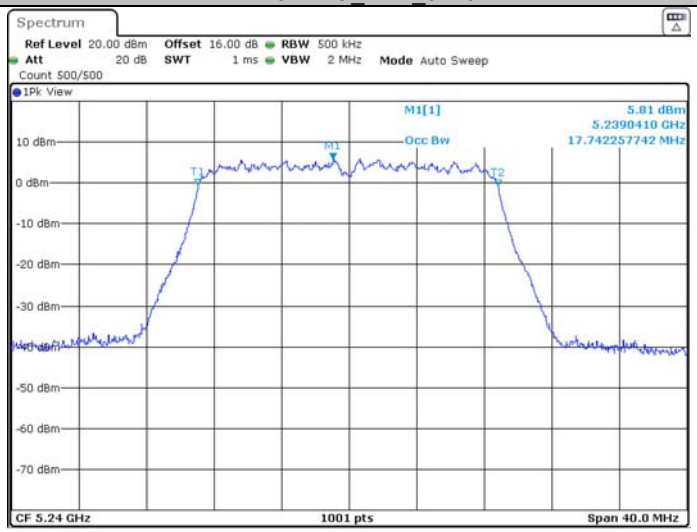
11N20MIMO_Ant1_5180



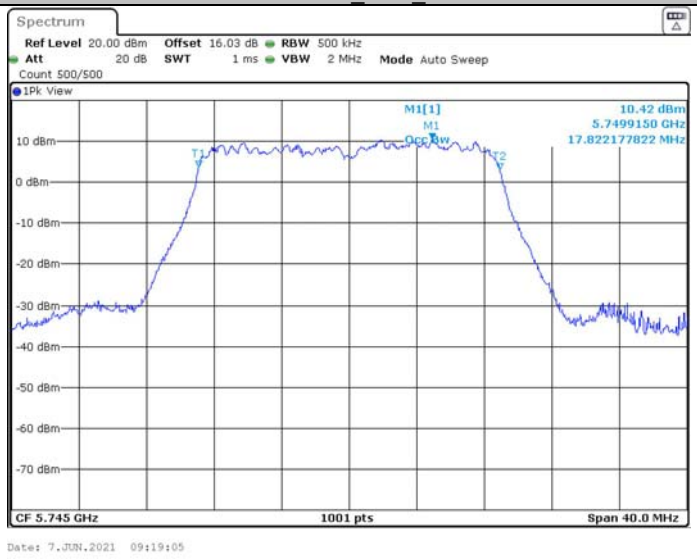
11N20MIMO_Ant1_5200



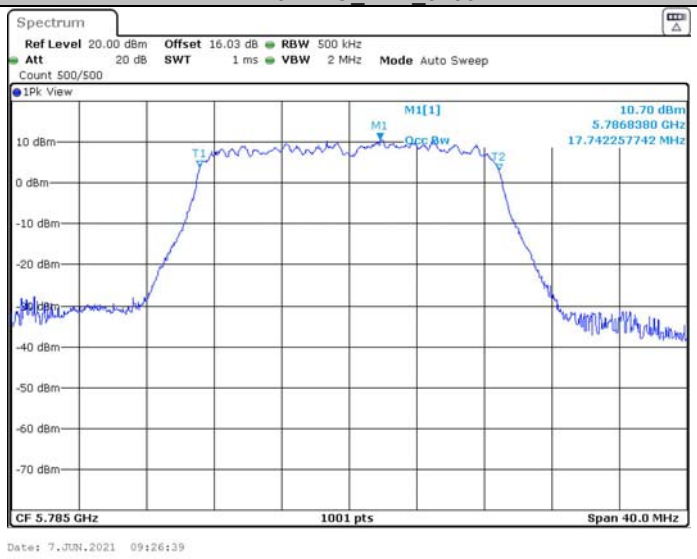
11N20MIMO_Ant1_5240



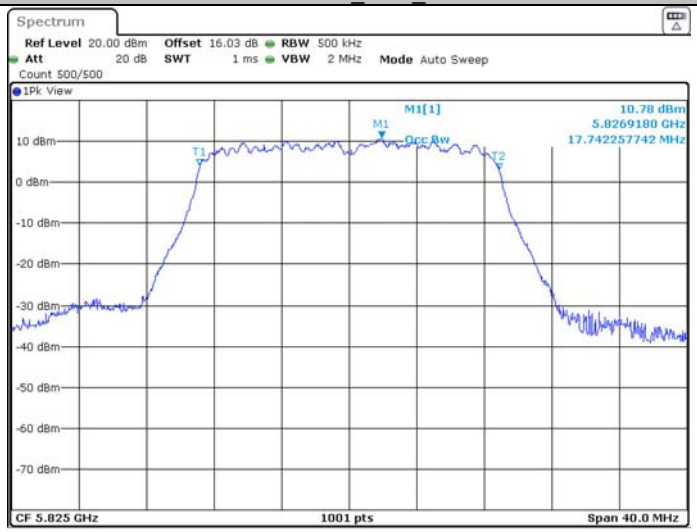
11N20MIMO_Ant1_5745



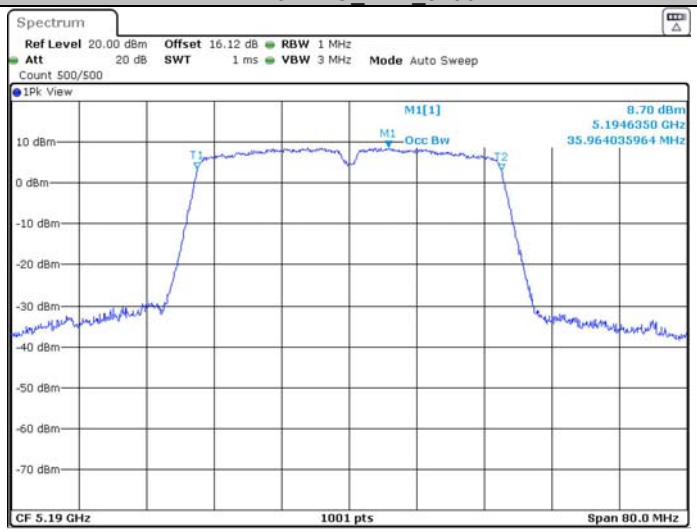
11N20MIMO_Ant1_5785



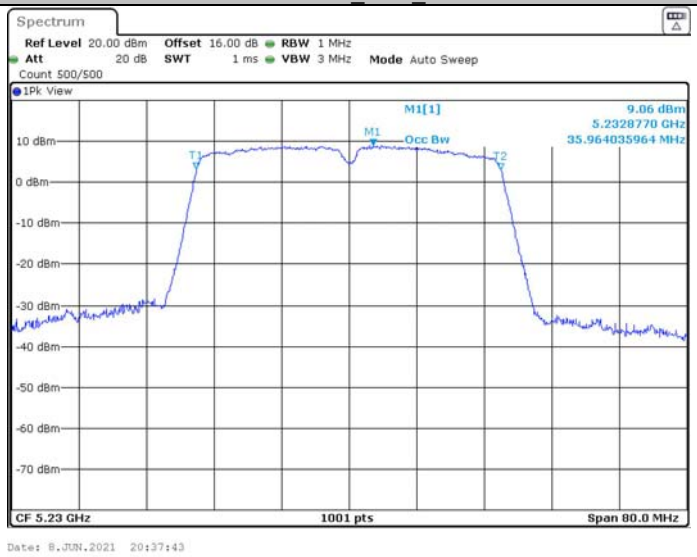
11N20MIMO_Ant1_5825



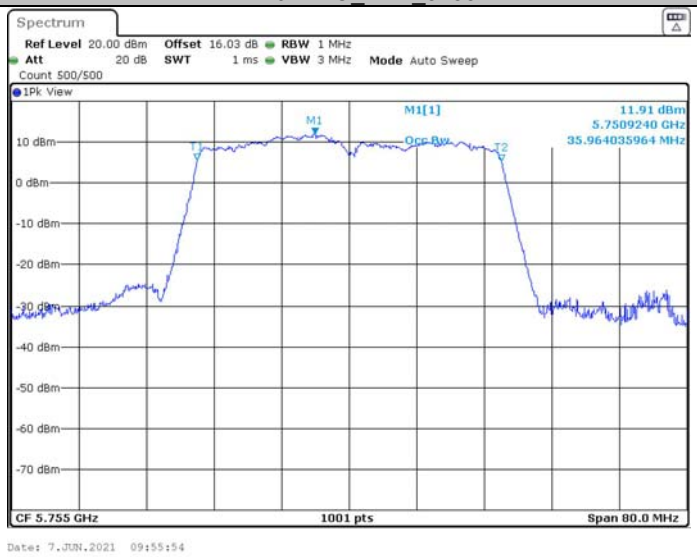
11N40MIMO_Ant1_5190



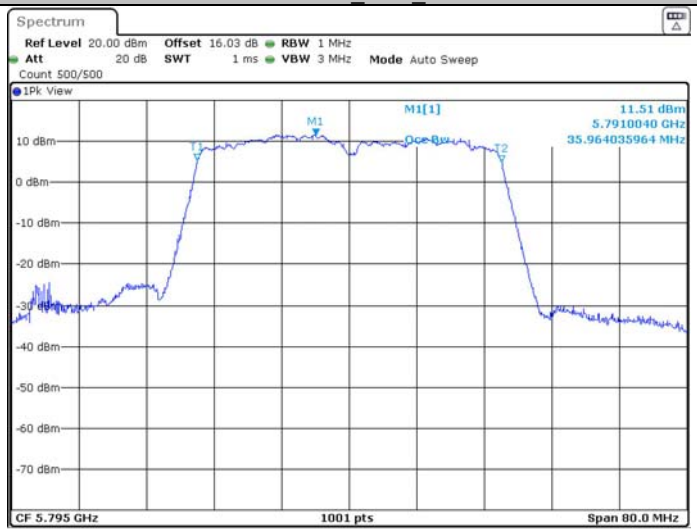
11N40MIMO_Ant1_5230



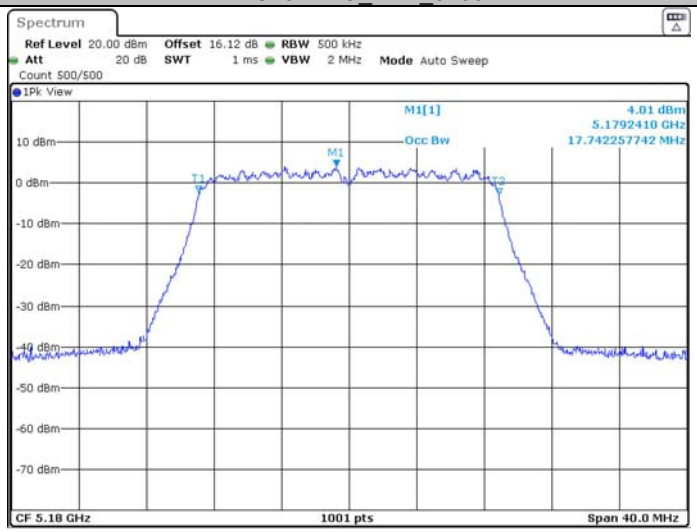
11N40MIMO_Ant1_5755



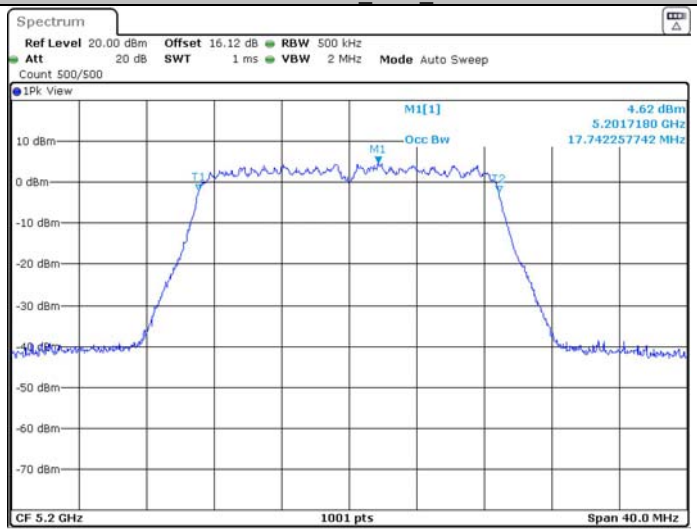
11N40MIMO_Ant1_5795



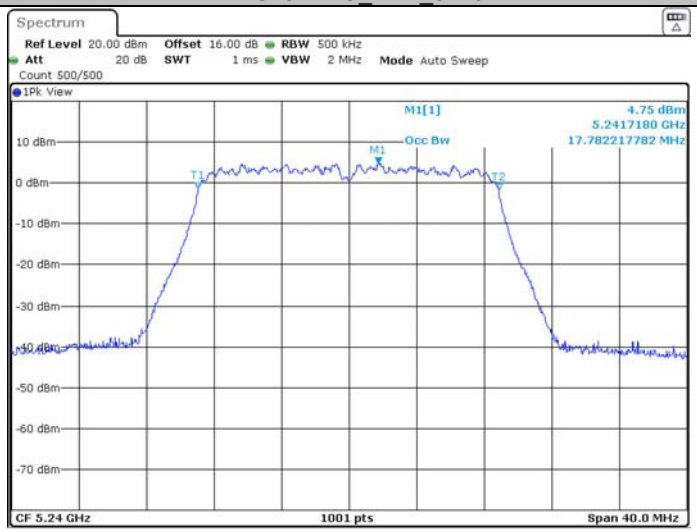
11AC20MIMO_Ant1_5180



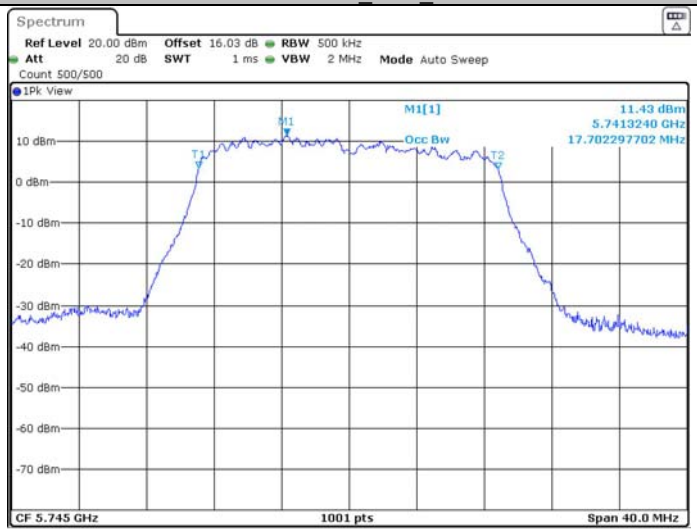
11AC20MIMO_Ant1_5200



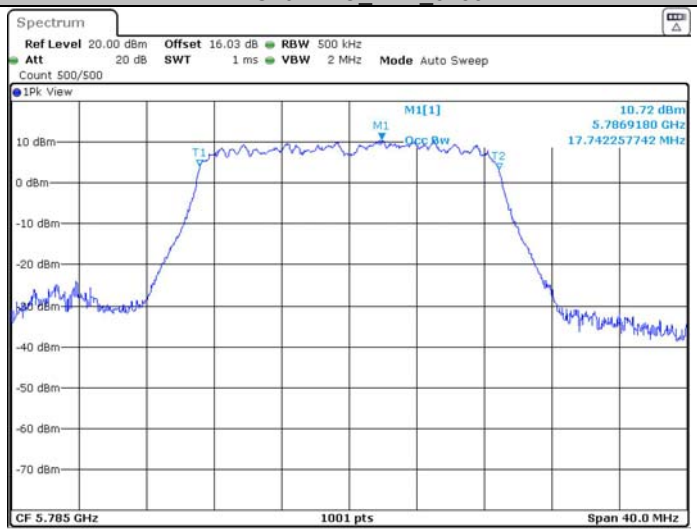
11AC20MIMO_Ant1_5240



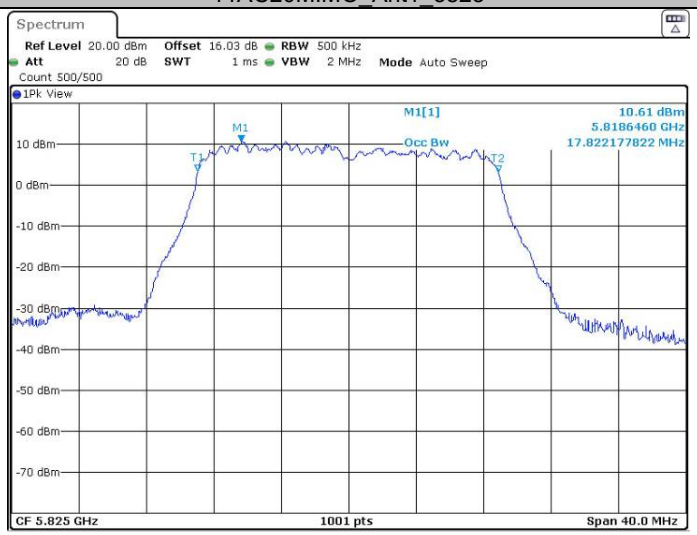
11AC20MIMO_Ant1_5745



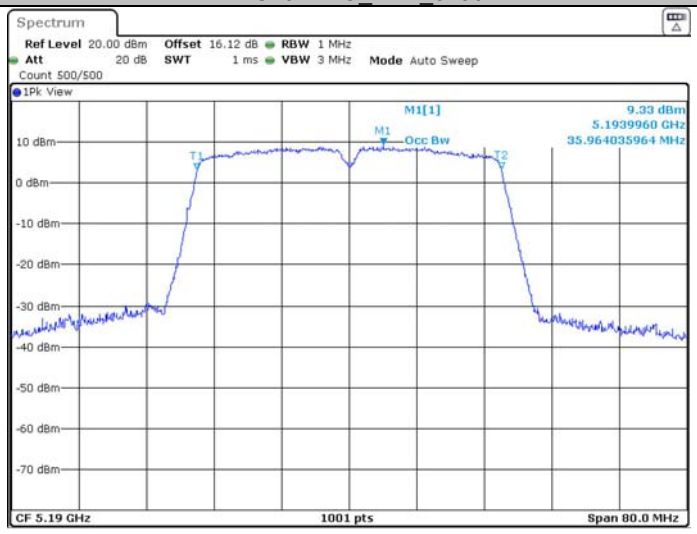
11AC20MIMO_Ant1_5785



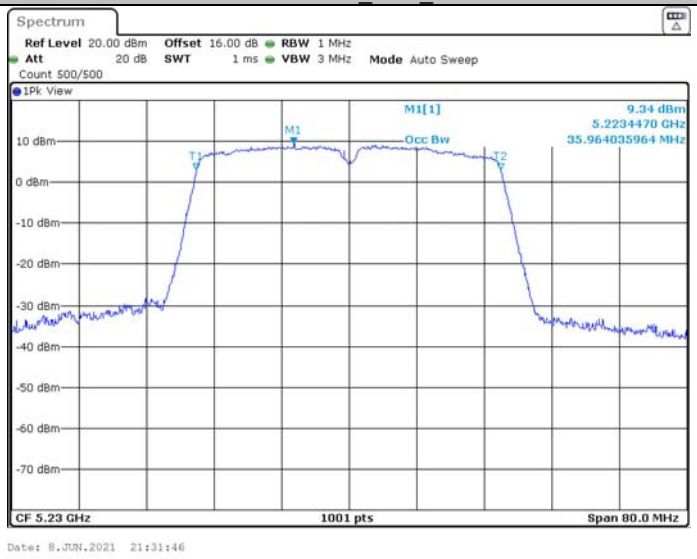
11AC20MIMO_Ant1_5825



11AC40MIMO_Ant1_5190



11AC40MIMO_Ant1_5230

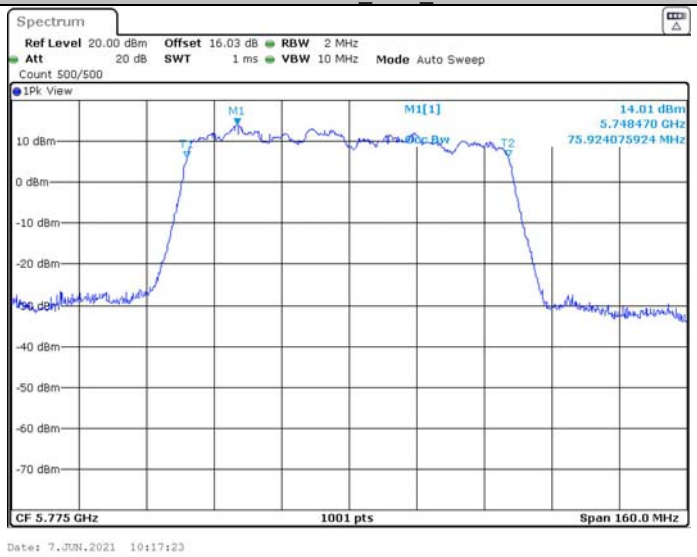


11AC40MIMO_Ant1_5755

11AC40MIMO_Ant1_5795

11AC80MIMO_Ant1_5210

11AC80MIMO_Ant1_5775



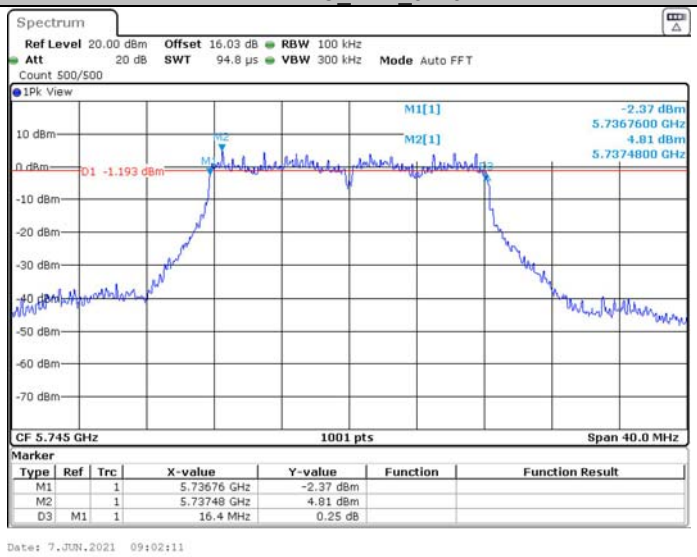
Appendix A3: Min emission bandwidth

Test Result

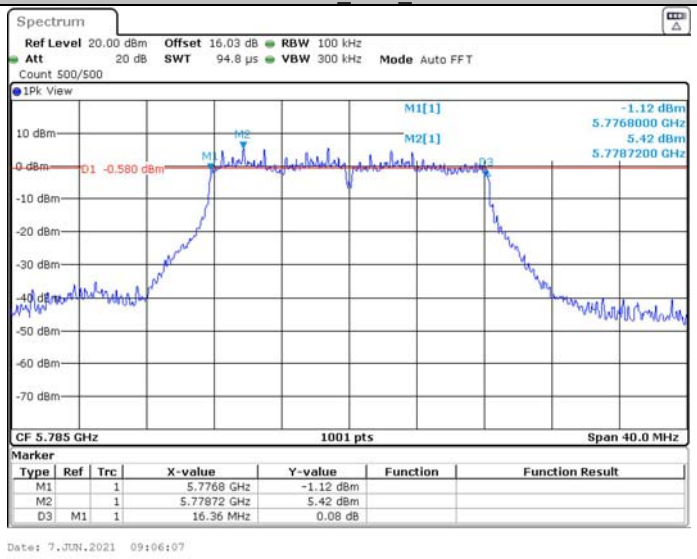
Test Mode	Antenna	Channel	6db EBW [MHz]	Limit[MHz]	Verdict
11AMIMO	Ant1	5745	16.400	0.5	PASS
		5785	16.360	0.5	PASS
		5825	16.400	0.5	PASS
11N20MIMO	Ant1	5745	17.240	0.5	PASS
		5785	17.640	0.5	PASS
		5825	16.600	0.5	PASS
11N40MIMO	Ant1	5755	35.200	0.5	PASS
		5795	35.280	0.5	PASS
11AC20MIMO	Ant1	5745	16.000	0.5	PASS
		5785	16.640	0.5	PASS
		5825	17.000	0.5	PASS
11AC40MIMO	Ant1	5755	35.200	0.5	PASS
		5795	35.280	0.5	PASS
11AC80MIMO	Ant1	5775	76.160	0.5	PASS

Test Graphs

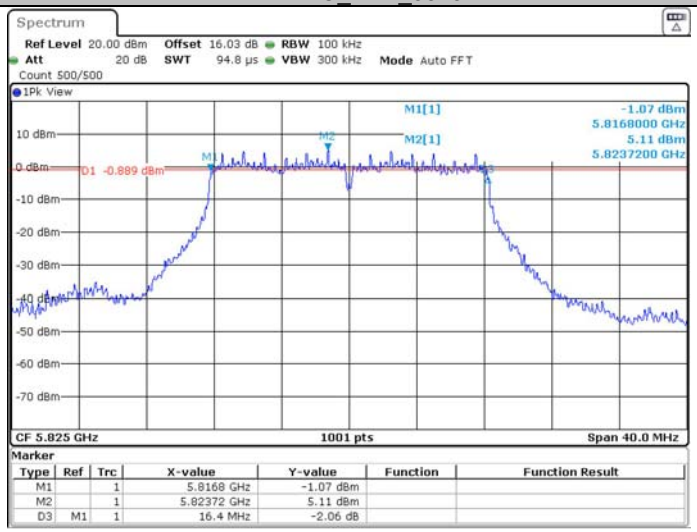
11AMIMO_Ant1_5745



11AMIMO_Ant1_5785



11AMIMO_Ant1_5825



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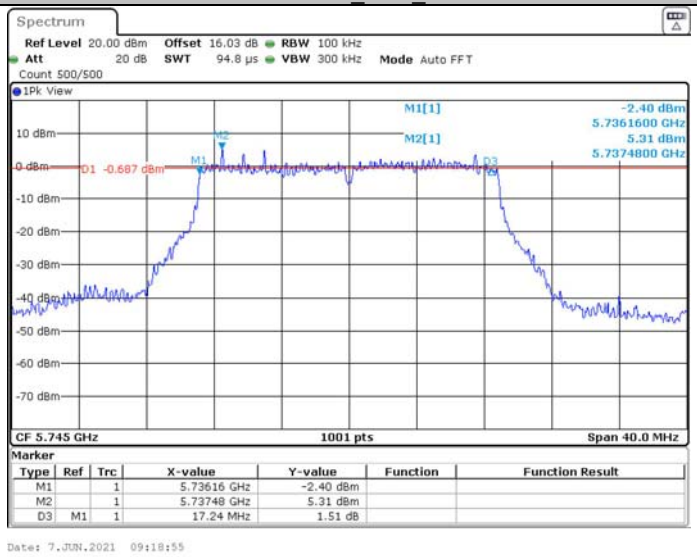

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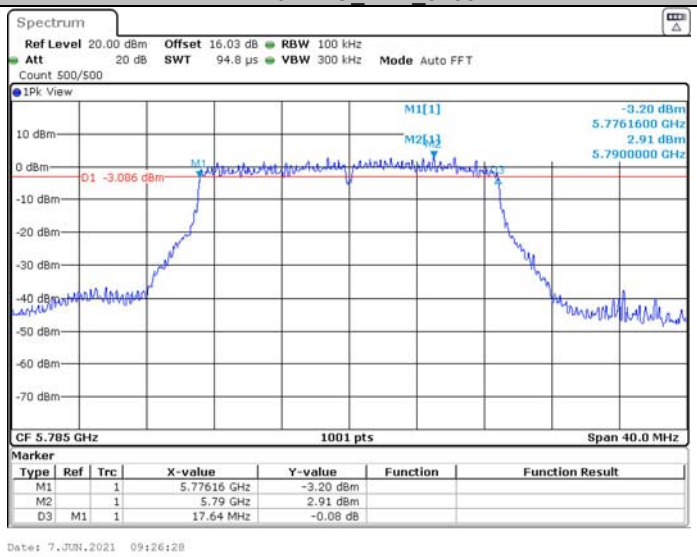

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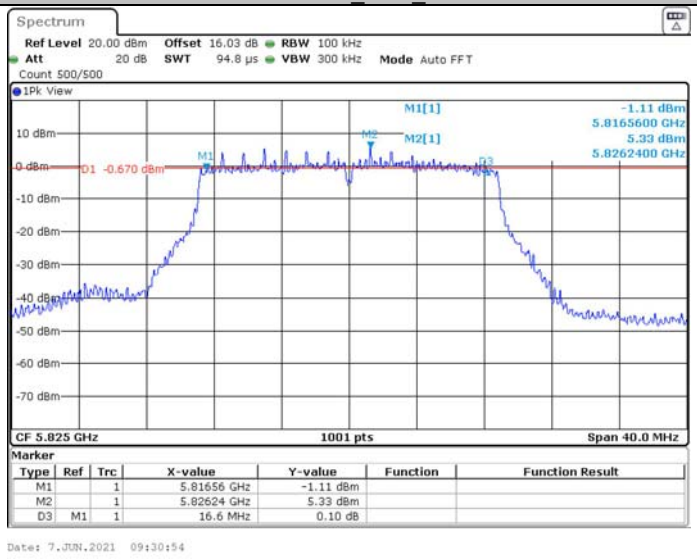

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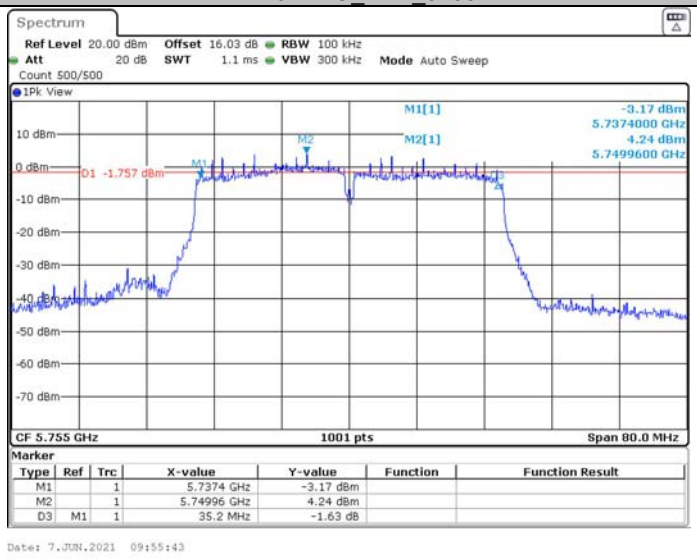

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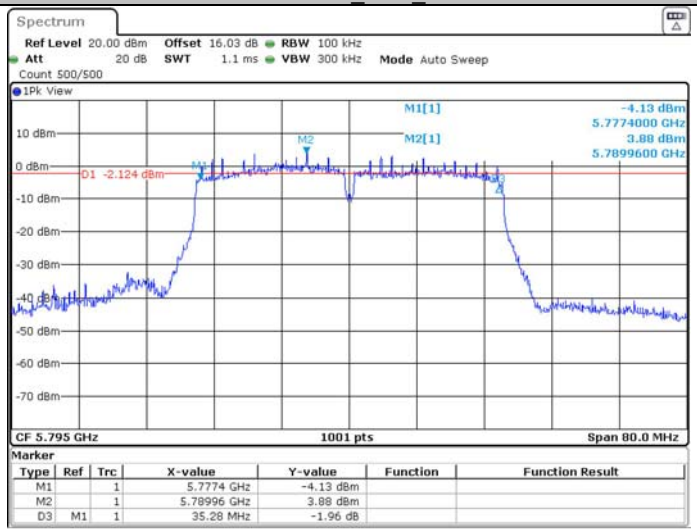
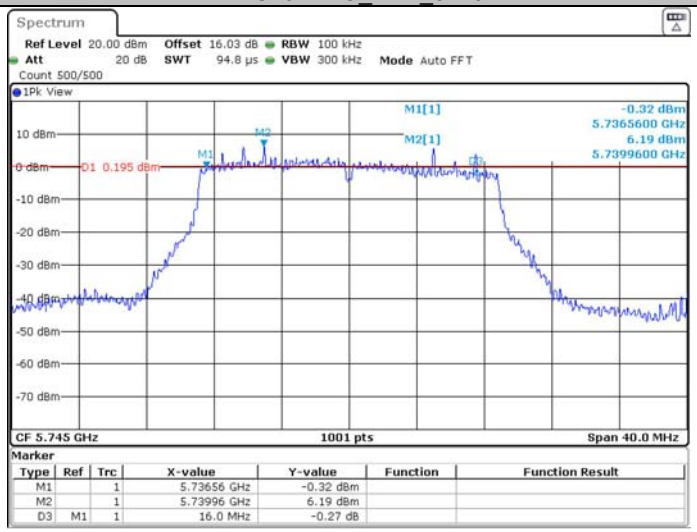
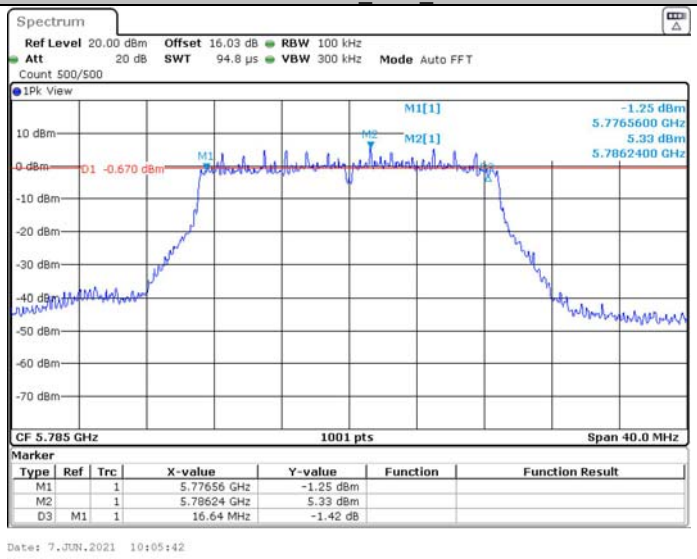


11AC20MIMO_Ant1_5745



11AC20MIMO_Ant1_5785



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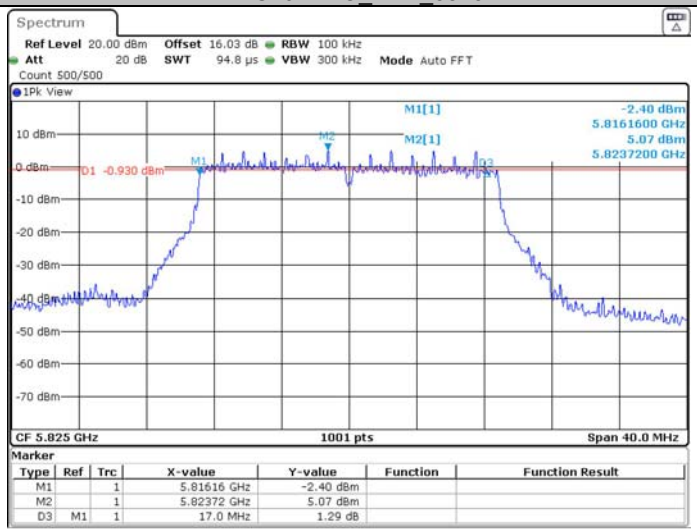
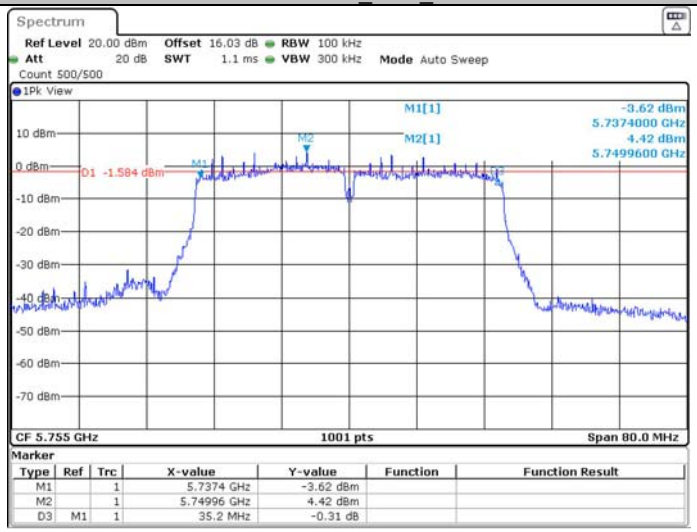
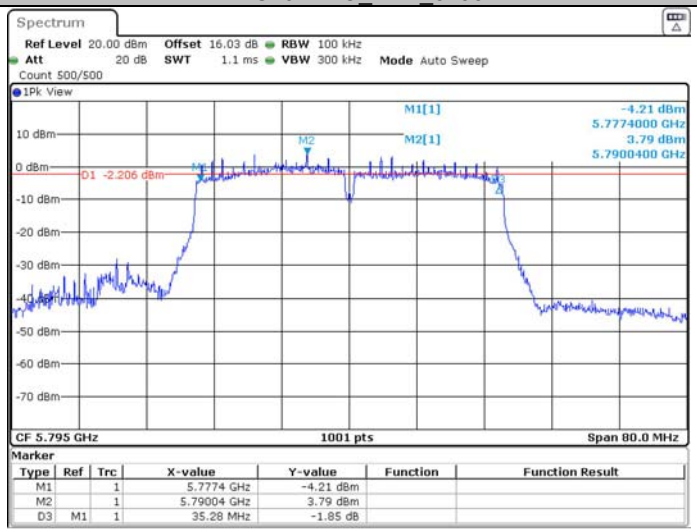


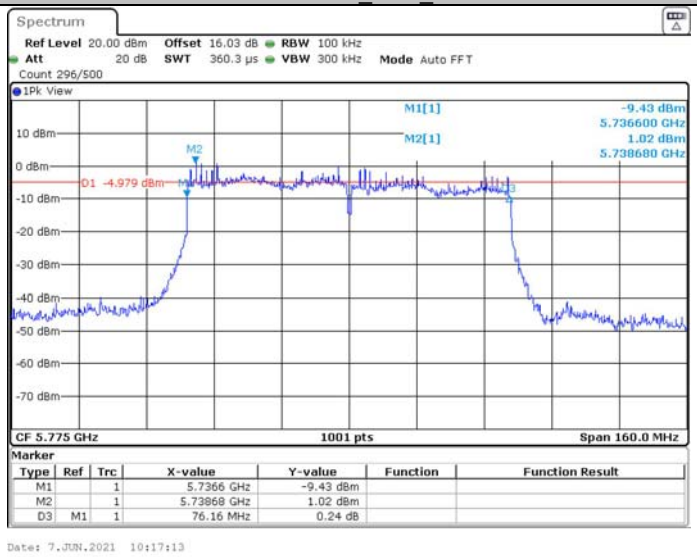
11AC40MIMO_Ant1_5755



11AC40MIMO_Ant1_5795



11AC80MIMO_Ant1_5775



Appendix B: Maximum conducted output power

Test Result

Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11AMIMO	Ant1	5180	10.62	≤30	PASS
	Ant2	5180	11.72	≤30	PASS
	total	5180	14.2	≤30	PASS
	Ant1	5200	12.98	≤30	PASS
	Ant2	5200	9.39	≤30	PASS
	total	5200	14.6	≤30	PASS
	Ant1	5240	11.69	≤30	PASS
	Ant2	5240	12.66	≤30	PASS
	total	5240	15.2	≤30	PASS
	Ant1	5745	15.57	≤30	PASS
	Ant2	5745	16.53	≤30	PASS
	total	5745	19.1	≤30	PASS
	Ant1	5785	15.54	≤30	PASS
	Ant2	5785	16.11	≤30	PASS
	total	5785	18.8	≤30	PASS
	Ant1	5825	15.57	≤30	PASS
	Ant2	5825	15.89	≤30	PASS
	total	5825	18.7	≤30	PASS
11N20MIMO	Ant1	5180	10.77	≤30	PASS
	Ant2	5180	12.17	≤30	PASS
	total	5180	14.5	≤30	PASS
	Ant1	5200	12.85	≤30	PASS
	Ant2	5200	8.53	≤30	PASS
	total	5200	14.2	≤30	PASS
	Ant1	5240	11.44	≤30	PASS
	Ant2	5240	12.96	≤30	PASS
	total	5240	15.3	≤30	PASS
	Ant1	5745	15.50	≤30	PASS
	Ant2	5745	16.40	≤30	PASS
	total	5745	19.0	≤30	PASS
	Ant1	5785	15.52	≤30	PASS
	Ant2	5785	16.03	≤30	PASS
	total	5785	18.8	≤30	PASS
	Ant1	5825	15.70	≤30	PASS
	Ant2	5825	15.74	≤30	PASS
	total	5825	18.7	≤30	PASS
11N40MIMO	Ant1	5190	15.12	≤30	PASS
	Ant2	5190	15.82	≤30	PASS
	total	5190	18.5	≤30	PASS
	Ant1	5230	16.06	≤30	PASS
	Ant2	5230	16.02	≤30	PASS
	total	5230	19.1	≤30	PASS
	Ant1	5755	16.44	≤30	PASS
	Ant2	5755	17.15	≤30	PASS
	total	5755	19.8	≤30	PASS
	Ant1	5795	16.54	≤30	PASS
	Ant2	5795	16.81	≤30	PASS
	total	5795	19.7	≤30	PASS
11AC20MIMO	Ant1	5180	12.11	≤30	PASS
	Ant2	5180	11.97	≤30	PASS
	total	5180	15.1	≤30	PASS
	Ant1	5200	13.21	≤30	PASS
	Ant2	5200	8.89	≤30	PASS
	total	5200	14.6	≤30	PASS
	Ant1	5240	11.36	≤30	PASS

	Ant2	5240	13.30	≤30	PASS
	total	5240	15.4	≤30	PASS
	Ant1	5745	15.78	≤30	PASS
	Ant2	5745	16.01	≤30	PASS
	total	5745	18.9	≤30	PASS
	Ant1	5785	15.64	≤30	PASS
	Ant2	5785	16.06	≤30	PASS
	total	5785	18.9	≤30	PASS
	Ant1	5825	15.47	≤30	PASS
	Ant2	5825	15.64	≤30	PASS
	total	5825	18.6	≤30	PASS
11AC40MIMO	Ant1	5190	16.04	≤30	PASS
	Ant2	5190	15.12	≤30	PASS
	total	5190	18.6	≤30	PASS
	Ant1	5230	15.04	≤30	PASS
	Ant2	5230	14.33	≤30	PASS
	total	5230	17.7	≤30	PASS
	Ant1	5755	16.44	≤30	PASS
	Ant2	5755	17.11	≤30	PASS
	total	5755	19.8	≤30	PASS
	Ant1	5795	16.52	≤30	PASS
	Ant2	5795	16.82	≤30	PASS
	total	5795	19.7	≤30	PASS
11AC80MIMO	Ant1	5210	15.50	≤30	PASS
	Ant2	5210	15.64	≤30	PASS
	total	5210	18.6	≤30	PASS
	Ant1	5775	16.38	≤30	PASS
	Ant2	5775	16.84	≤30	PASS
	total	5775	19.6	≤30	PASS

Note: the device employed Cyclic Delay Diversity (CDD) for MIMO mode,
Directional gain= G_{ANT} + Array gain
For Power measurement, Array gain=0dB for $N_{ANT} \leq 4$, So
Directional gain=3.5dBi<6dBi

The device is an indoor AP.

Appendix C: Maximum power spectral density

Test Result

Test Mode	Antenna	Channel	Result [dBm/MHz]	Limit[dBm/MHz]	Verdict
11AMIMO	Ant1	5180	6.19	≤16.5	PASS
	Ant2	5180	7.31	≤16.5	PASS
	total	5180	9.80	≤16.5	PASS
	Ant1	5200	7.91	≤16.5	PASS
	Ant2	5200	4.84	≤16.5	PASS
	total	5200	9.65	≤16.5	PASS
	Ant1	5240	6.6	≤16.5	PASS
	Ant2	5240	7.61	≤16.5	PASS
	total	5240	10.14	≤16.5	PASS
	Ant1	5745	10.29	<=29.5	PASS
	Ant2	5745	9.76	<=29.5	PASS
	total	5745	13.04	<=29.5	PASS
	Ant1	5785	9.91	<=29.5	PASS
	Ant2	5785	9.6	<=29.5	PASS
	total	5785	12.77	<=29.5	PASS
	Ant1	5825	10.13	<=29.5	PASS
	Ant2	5825	9.44	<=29.5	PASS
	total	5825	12.81	<=29.5	PASS
11N20MIMO	Ant1	5180	5.85	≤16.5	PASS
	Ant2	5180	6.82	≤16.5	PASS
	total	5180	9.37	≤16.5	PASS
	Ant1	5200	3.14	≤16.5	PASS
	Ant2	5200	4.44	≤16.5	PASS
	total	5200	6.85	≤16.5	PASS
	Ant1	5240	5.33	≤16.5	PASS
	Ant2	5240	6.96	≤16.5	PASS
	total	5240	9.23	≤16.5	PASS
	Ant1	5745	9.09	<=29.5	PASS
	Ant2	5745	10.02	<=29.5	PASS
	total	5745	12.59	<=29.5	PASS
	Ant1	5785	9.08	<=29.5	PASS
	Ant2	5785	9.5	<=29.5	PASS
	total	5785	12.31	<=29.5	PASS
	Ant1	5825	9.52	<=29.5	PASS
	Ant2	5825	9.41	<=29.5	PASS
	total	5825	12.48	<=29.5	PASS
11N40MIMO	Ant1	5190	6.26	≤16.5	PASS
	Ant2	5190	7.16	≤16.5	PASS
	total	5190	9.74	≤16.5	PASS
	Ant1	5230	7.36	≤16.5	PASS
	Ant2	5230	7.01	≤16.5	PASS
	total	5230	10.20	≤16.5	PASS
	Ant1	5755	7.51	<=29.5	PASS
	Ant2	5755	7.33	<=29.5	PASS
	total	5755	10.43	<=29.5	PASS
	Ant1	5795	7.4	<=29.5	PASS
	Ant2	5795	6.83	<=29.5	PASS
	total	5795	10.13	<=29.5	PASS
11AC20MIMO	Ant1	5180	6.01	≤16.5	PASS
	Ant2	5180	6.59	≤16.5	PASS
	total	5180	9.32	≤16.5	PASS
	Ant1	5200	7.97	≤16.5	PASS
	Ant2	5200	4.58	≤16.5	PASS
	total	5200	7.00	≤16.5	PASS
	Ant1	5240	5.88	≤16.5	PASS

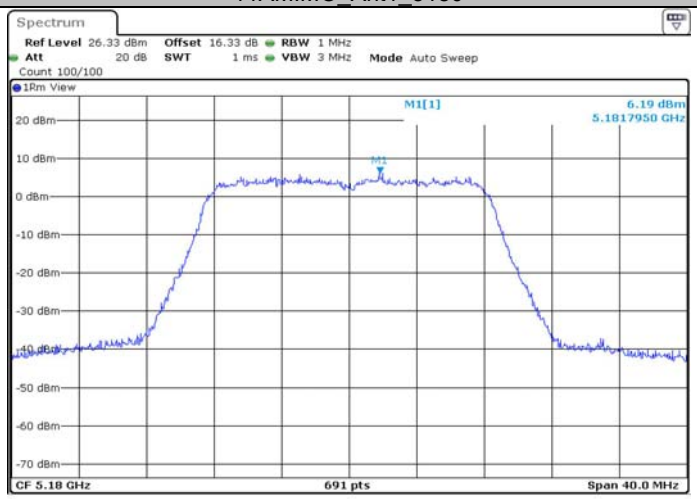
	Ant2	5240	7.49	≤16.5	PASS
	total	5240	9.77	≤16.5	PASS
	Ant1	5745	9.93	<=29.5	PASS
	Ant2	5745	8.92	<=29.5	PASS
	total	5745	12.46	<=29.5	PASS
	Ant1	5785	9.58	<=29.5	PASS
	Ant2	5785	9.46	<=29.5	PASS
	total	5785	12.53	<=29.5	PASS
	Ant1	5825	9.58	<=29.5	PASS
	Ant2	5825	8.82	<=29.5	PASS
	total	5825	12.23	<=29.5	PASS
11AC40MIMO	Ant1	5190	7.58	≤16.5	PASS
	Ant2	5190	5.48	≤16.5	PASS
	total	5190	9.67	≤16.5	PASS
	Ant1	5230	6.93	≤16.5	PASS
	Ant2	5230	4.54	≤16.5	PASS
	total	5230	8.91	≤16.5	PASS
	Ant1	5755	7.25	<=29.5	PASS
	Ant2	5755	7.54	<=29.5	PASS
	total	5755	10.41	<=29.5	PASS
	Ant1	5795	7.06	<=29.5	PASS
	Ant2	5795	6.7	<=29.5	PASS
	total	5795	9.89	<=29.5	PASS
11AC80MIMO	Ant1	5210	3.42	≤16.5	PASS
	Ant2	5210	5.04	≤16.5	PASS
	total	5210	7.32	≤16.5	PASS
	Ant1	5775	5.24	<=29.5	PASS
	Ant2	5775	3.75	<=29.5	PASS
	total	5775	7.57	<=29.5	PASS

Note: 1. The Result and Limit Unit is dBm/500 kHz in the band 5.725–5.85 GHz.
2. The Duty Cycle Factor is compensated in the graph.

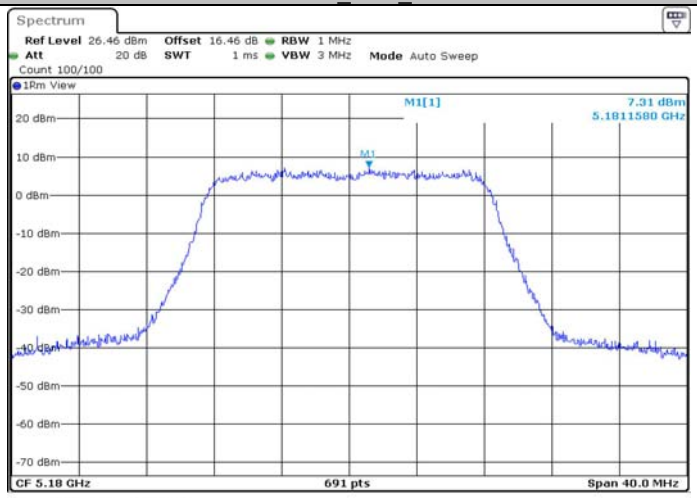
Note: the device employed Cyclic Delay Diversity (CDD) for MIMO mode,
Directional gain= G_{ANT} + Array gain
For power spectral density (PSD) measurement, Array gain=10log(N_{NAT})dB, So
Directional gain=3.5dBi+10log(2)dB=6.5dBi>6dBi
The limit should reduced 0.5dB which exceeds 6dBi

Test Graphs

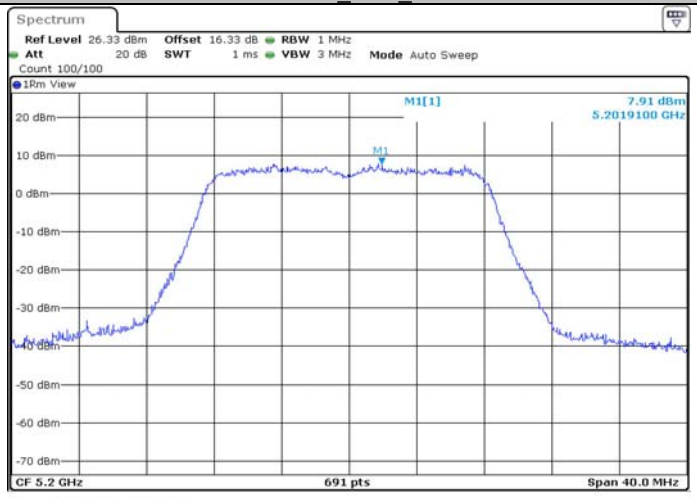
11AMIMO_Ant1_5180



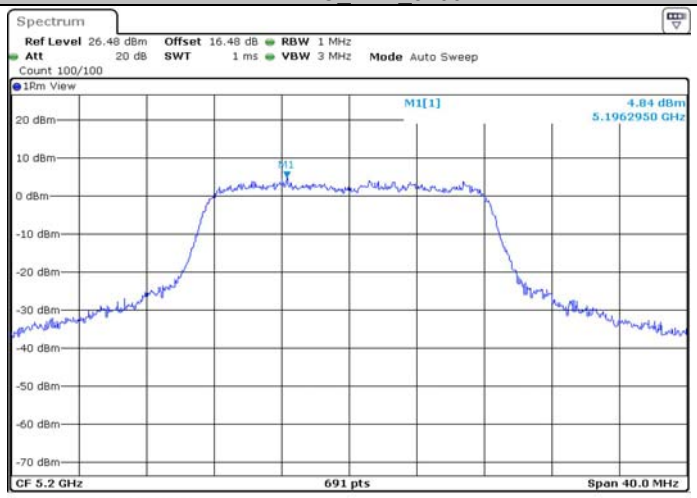
11AMIMO_Ant2_5180



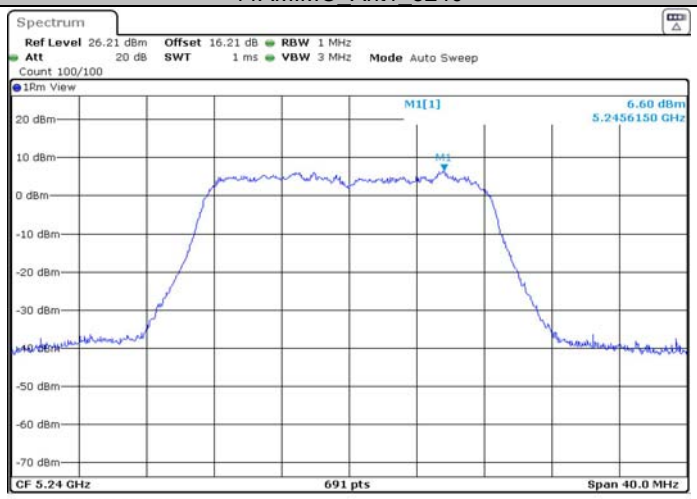
11AMIMO_Ant1_5200



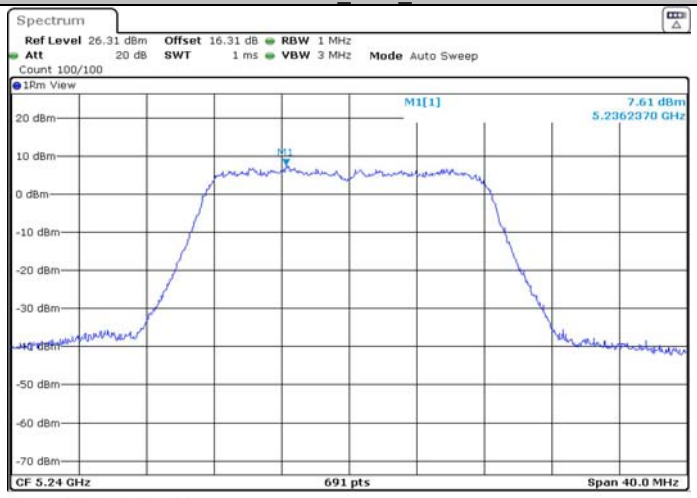
11AMIMO_Ant2_5200



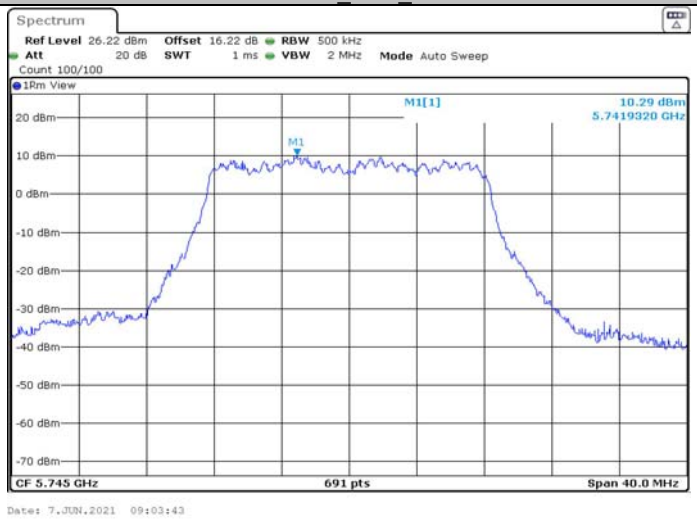
11AMIMO_Ant1_5240



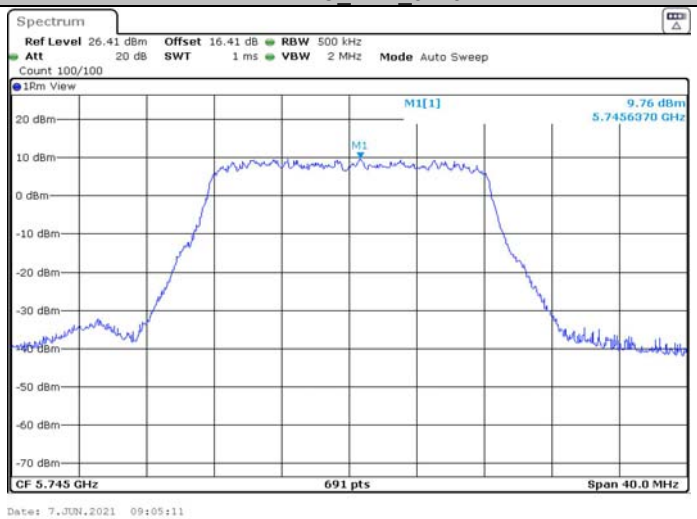
11AMIMO_Ant2_5240



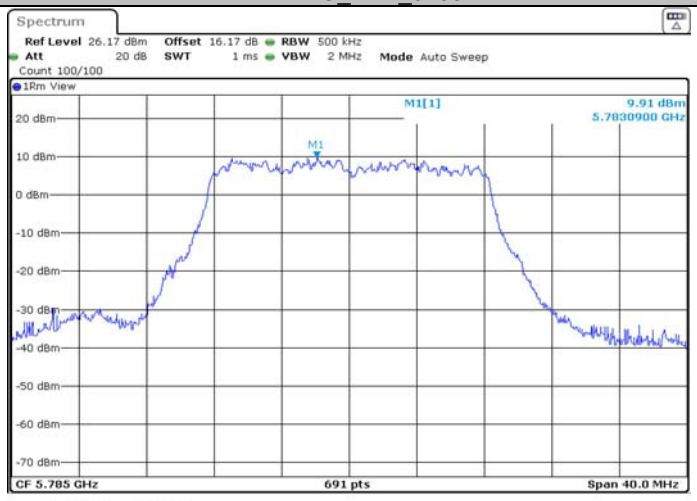
11AMIMO_Ant1_5745

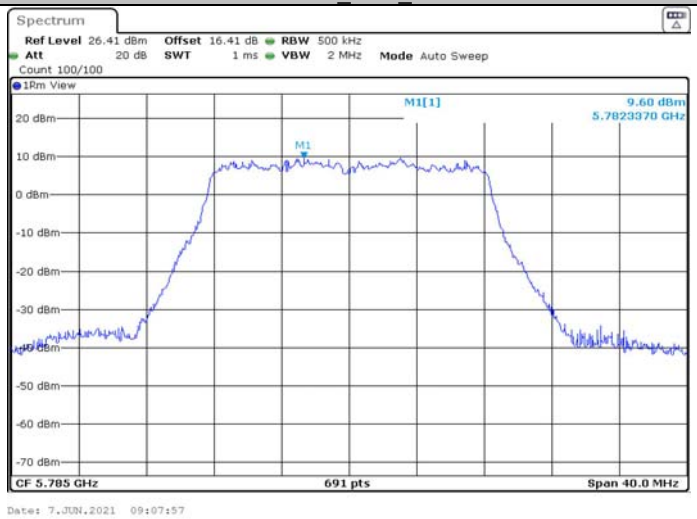


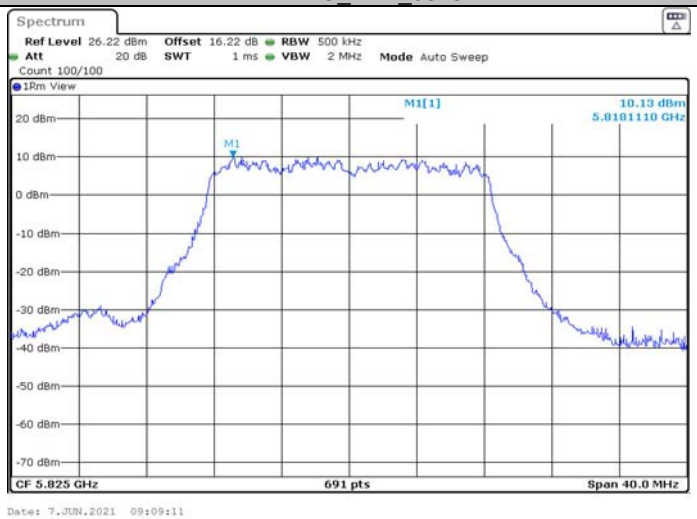
11AMIMO_Ant2_5745

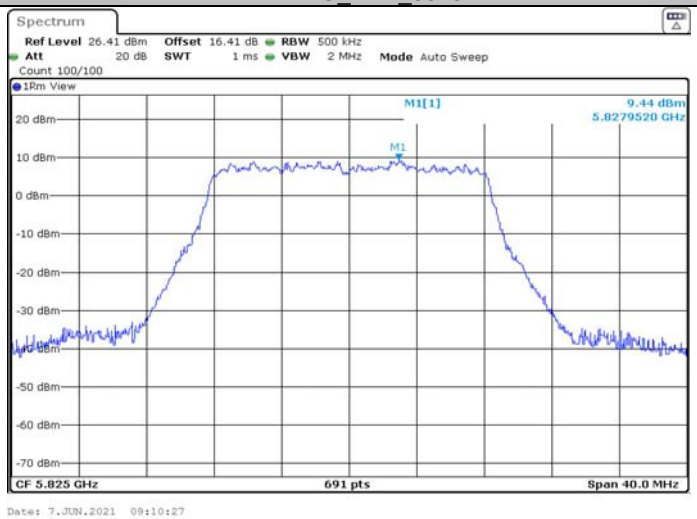


11AMIMO_Ant1_5785

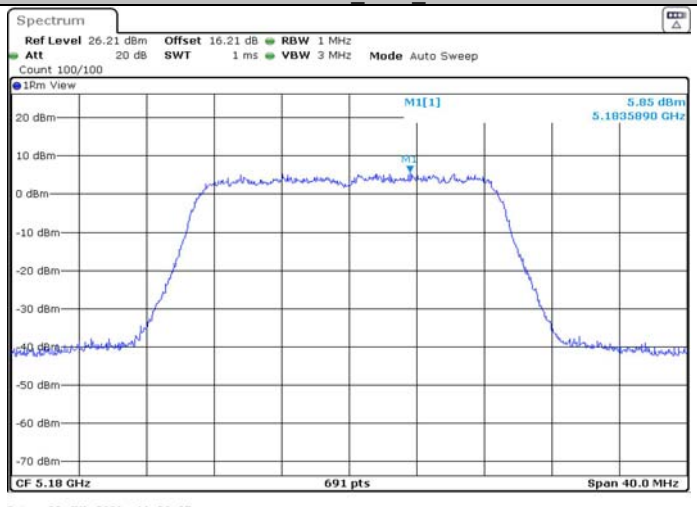


11AMIMO_Ant2_5785


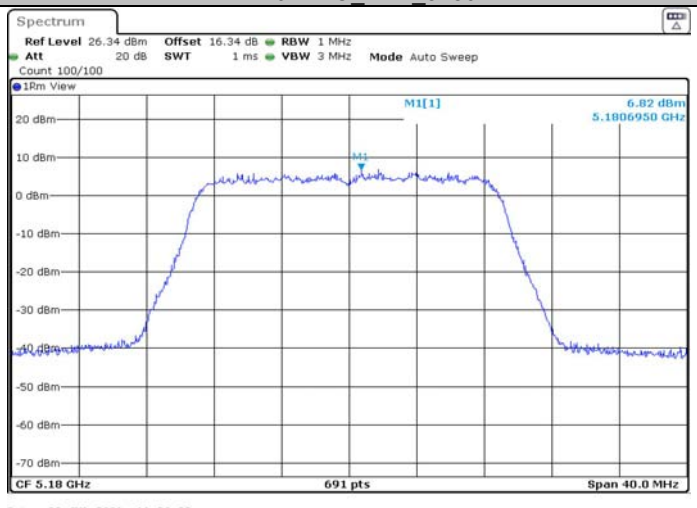
11AMIMO_Ant1_5825


11AMIMO_Ant2_5825


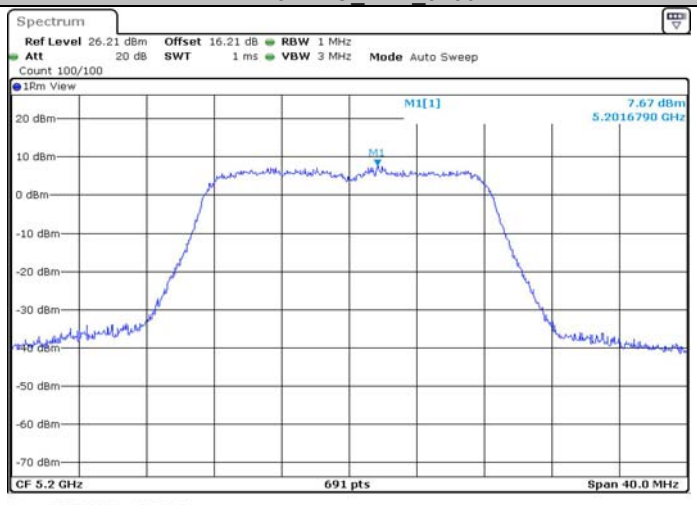
11N20MIMO_Ant1_5180

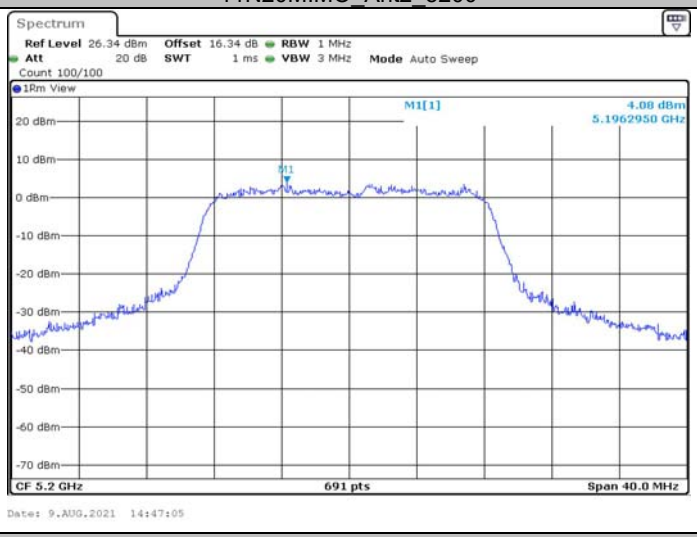


11N20MIMO_Ant2_5180



11N20MIMO_Ant1_5200

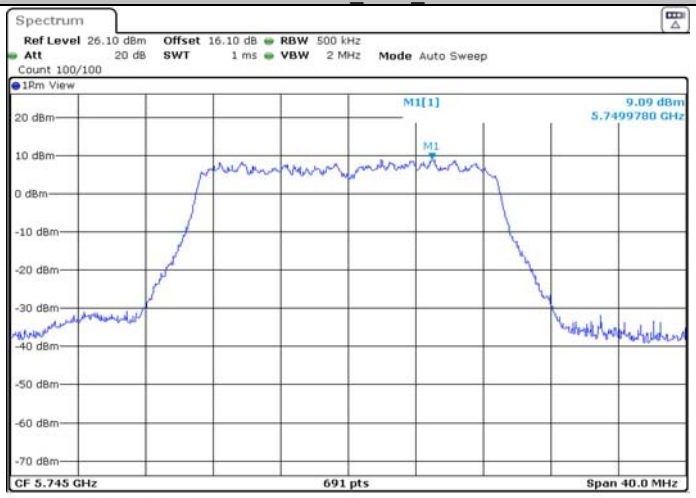


11N20MIMO_Ant2_5200


11N20MIMO_Ant1_5240


11N20MIMO_Ant2_5240

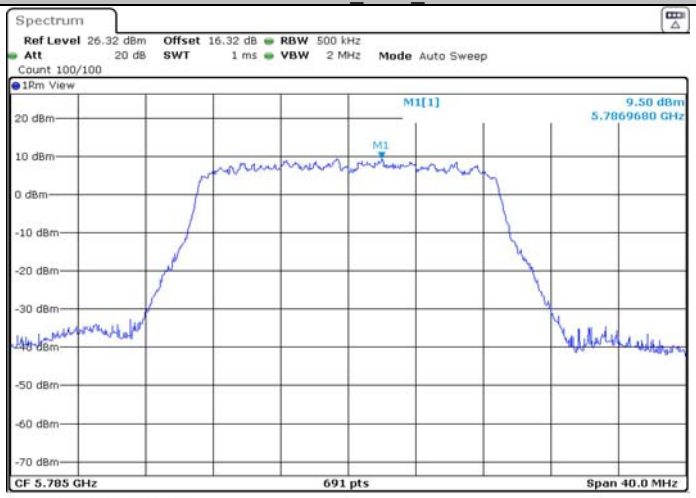

11N20MIMO_Ant1_5745



11N20MIMO_Ant2_5745

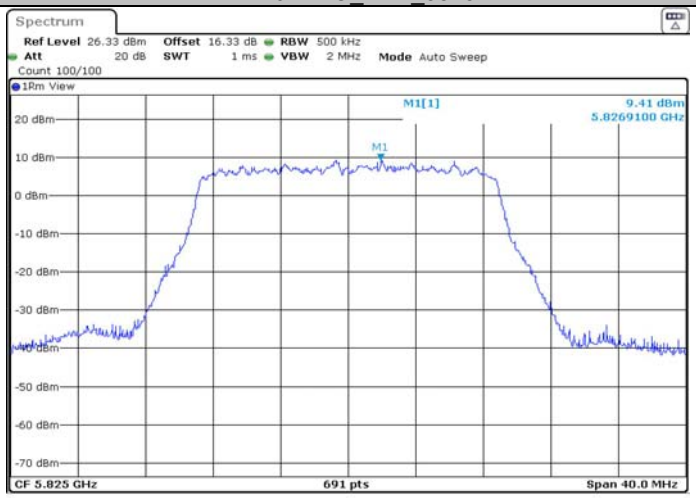
11N20MIMO_Ant1_5785

11N20MIMO_Ant2_5785

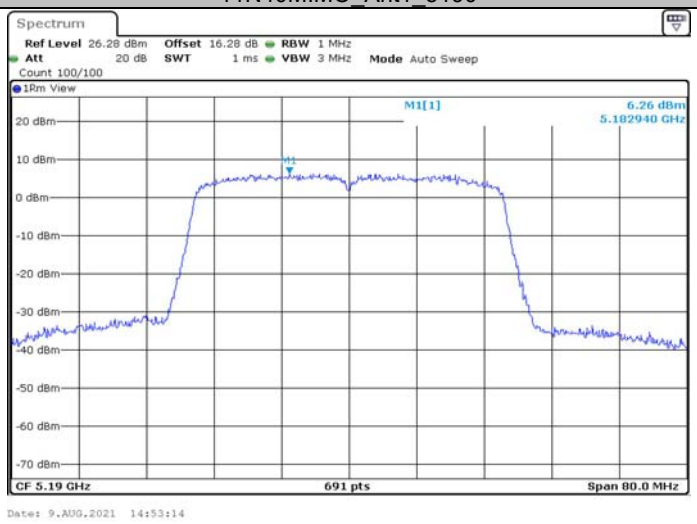


11N20MIMO_Ant1_5825

11N20MIMO_Ant2_5825



11N40MIMO_Ant1_5190



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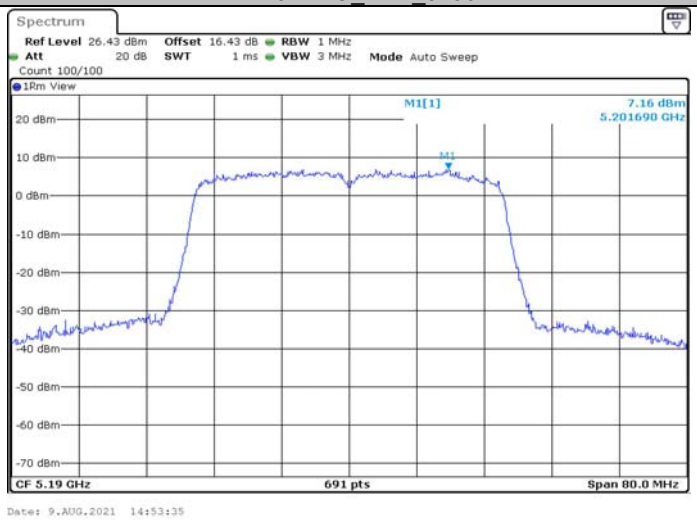
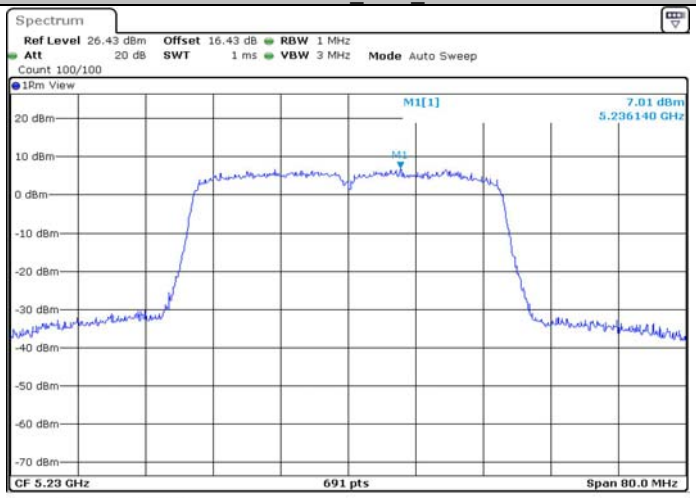
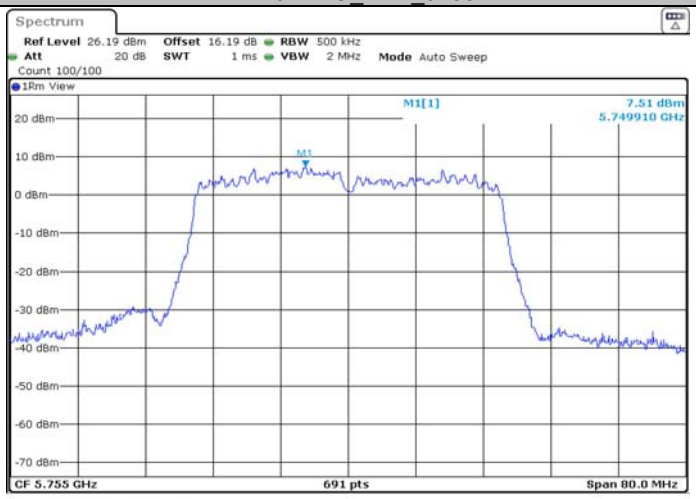


11N40MIMO_Ant1_5230

11N40MIMO_Ant2_5230



11N40MIMO_Ant1_5755



11N40MIMO_Ant2_5755

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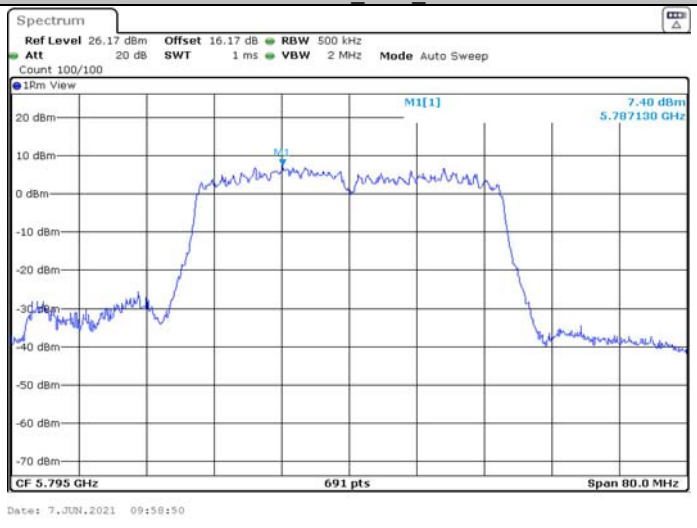

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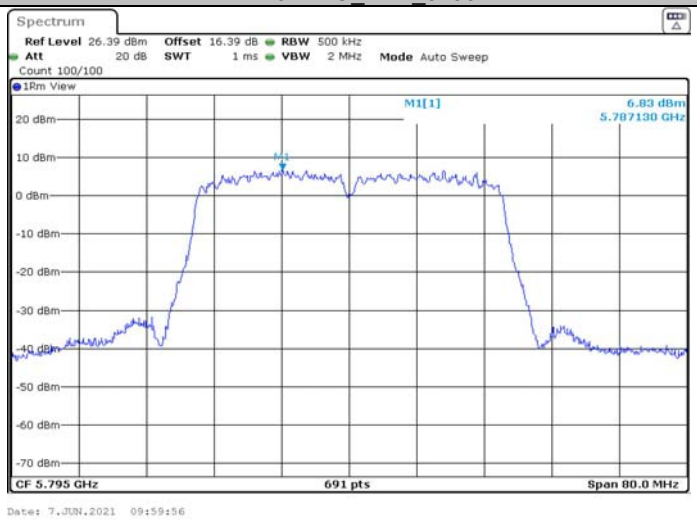
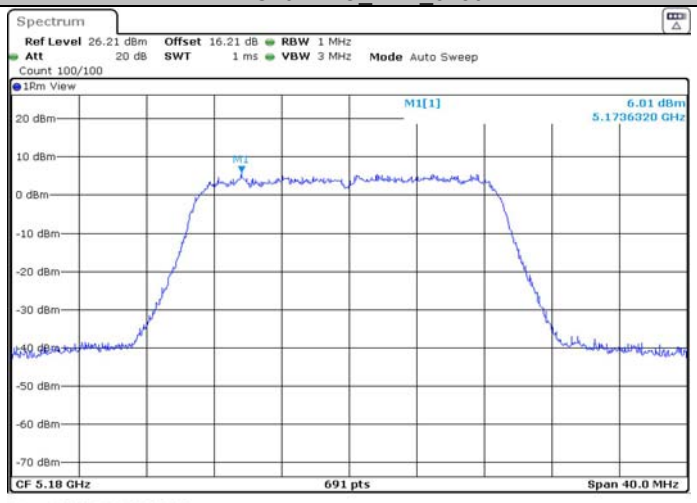


11AC20MIMO_Ant1_5180


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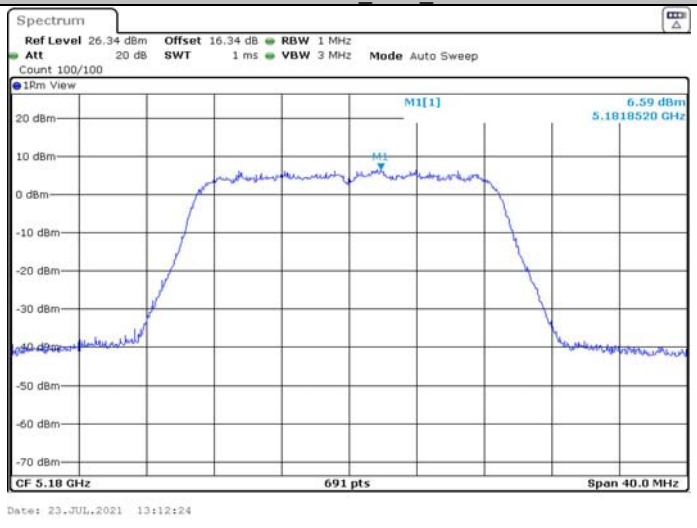

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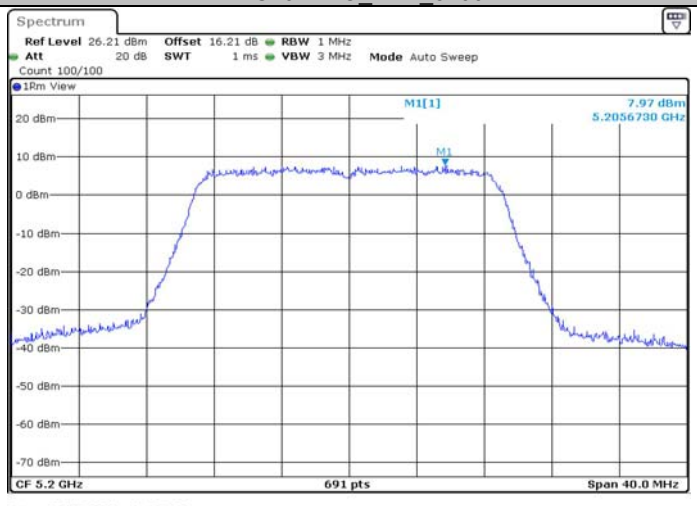

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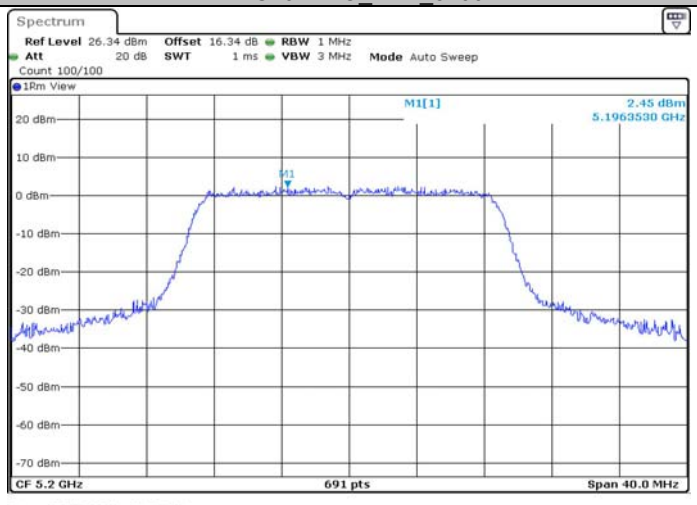

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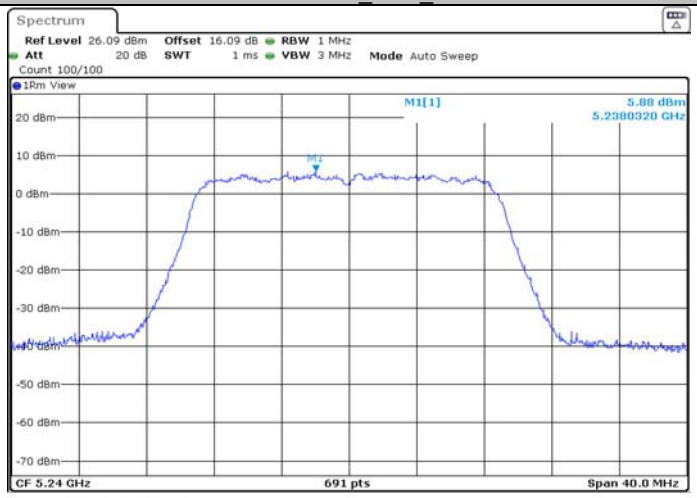
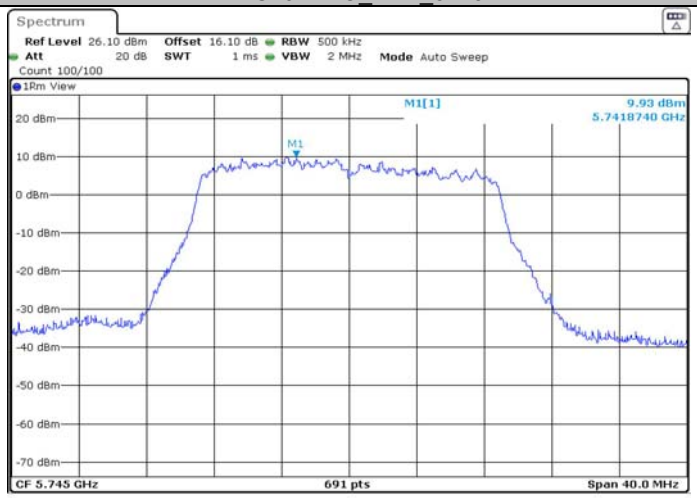


11AC20MIMO_Ant2_5240

11AC20MIMO_Ant1_5745



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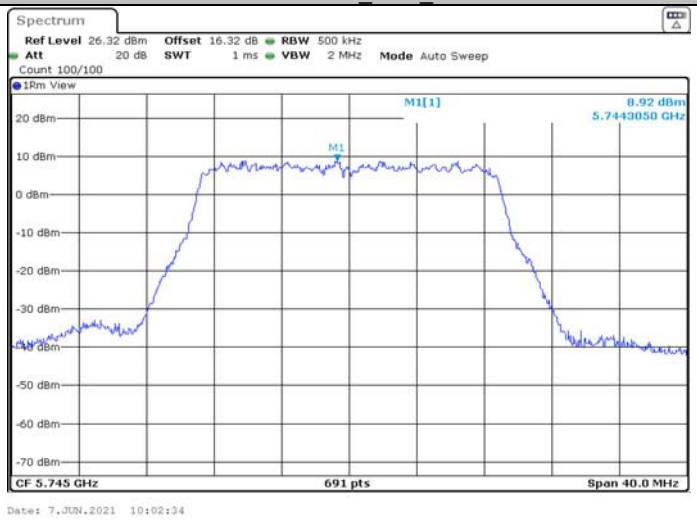

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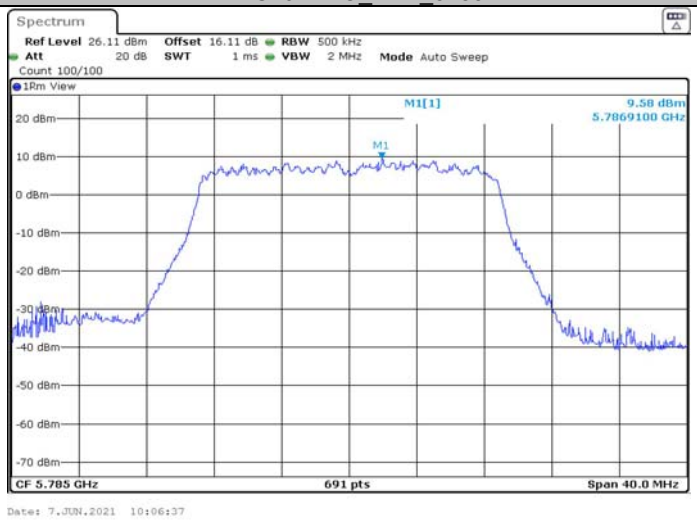

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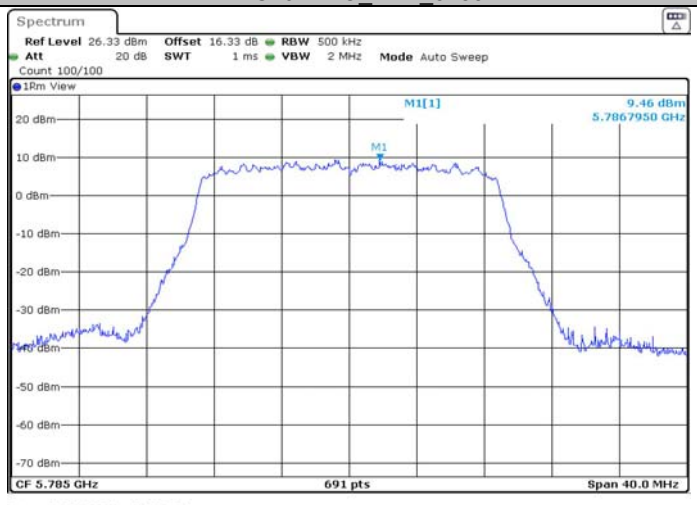

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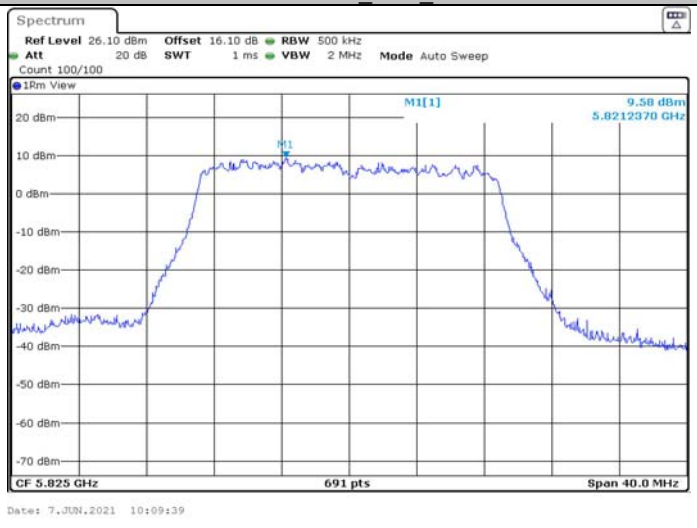

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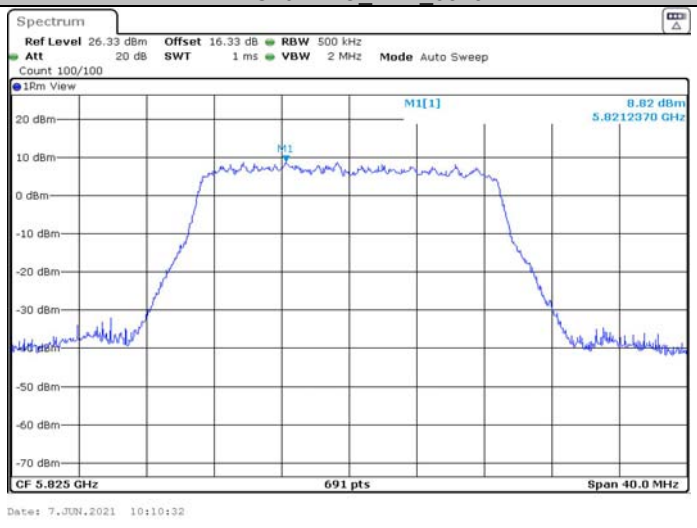
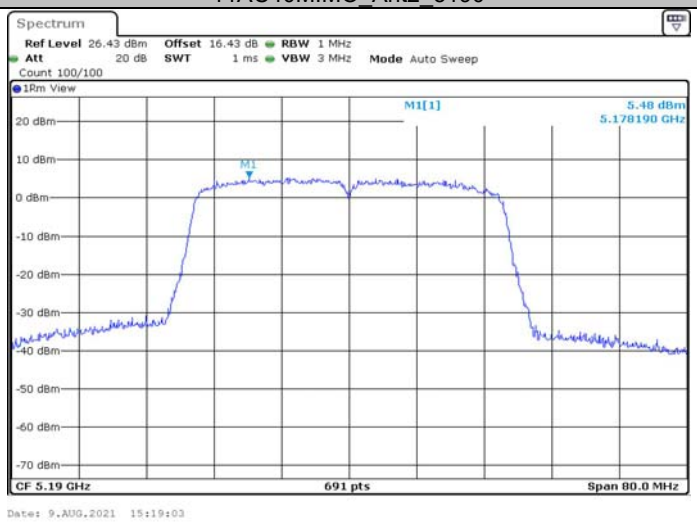


11AC40MIMO_Ant1_5190


11AC40MIMO_Ant2_5190

11AC40MIMO_Ant1_5230

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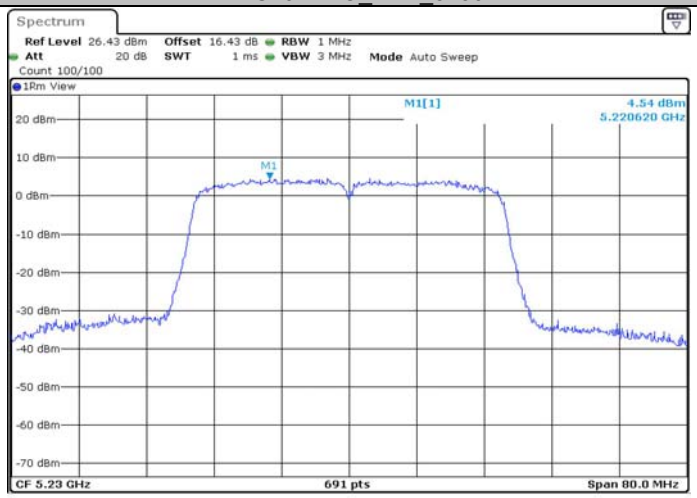

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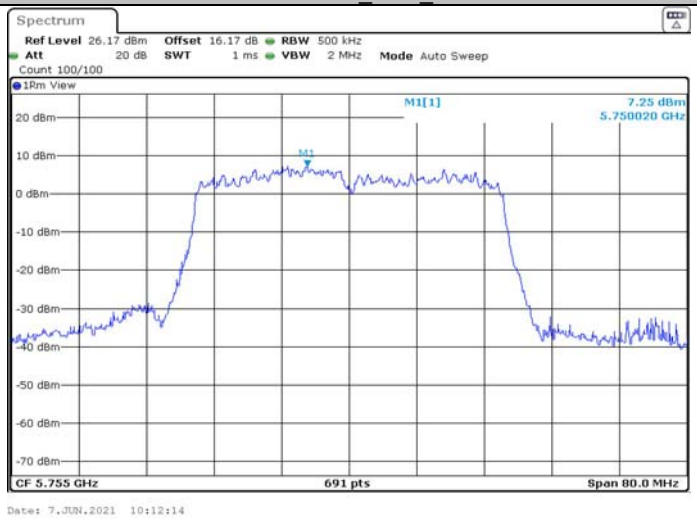

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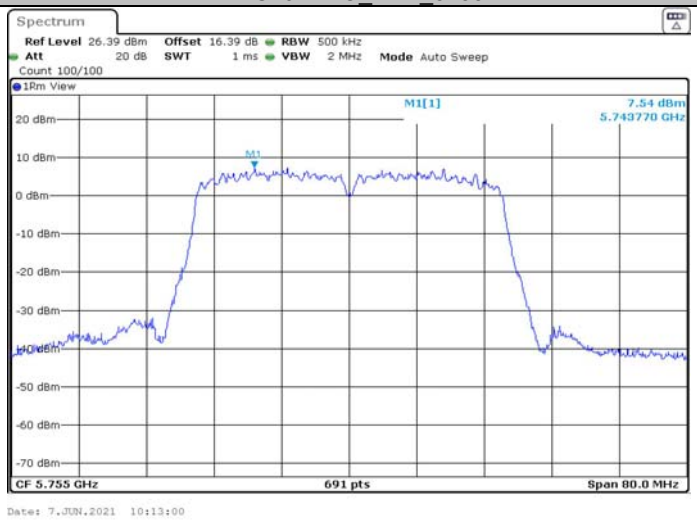

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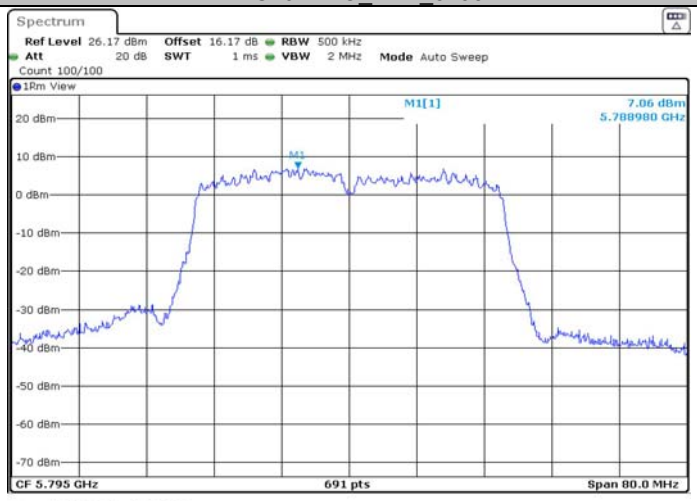

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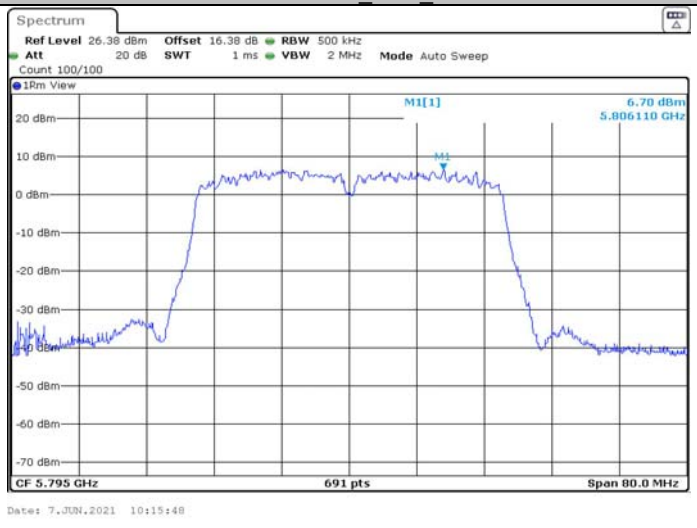
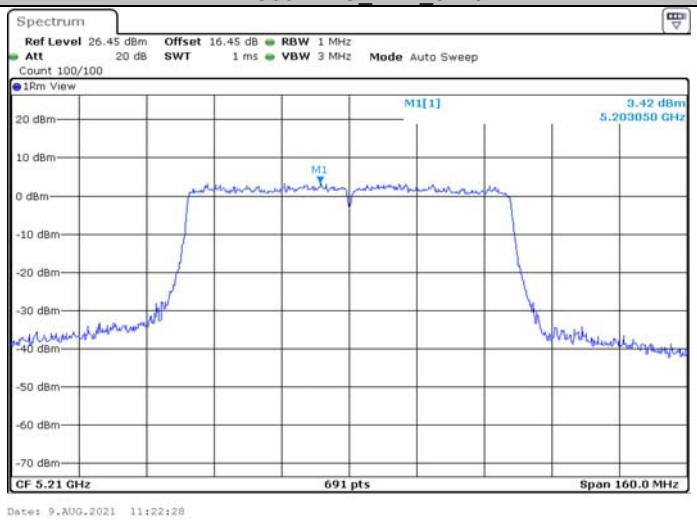
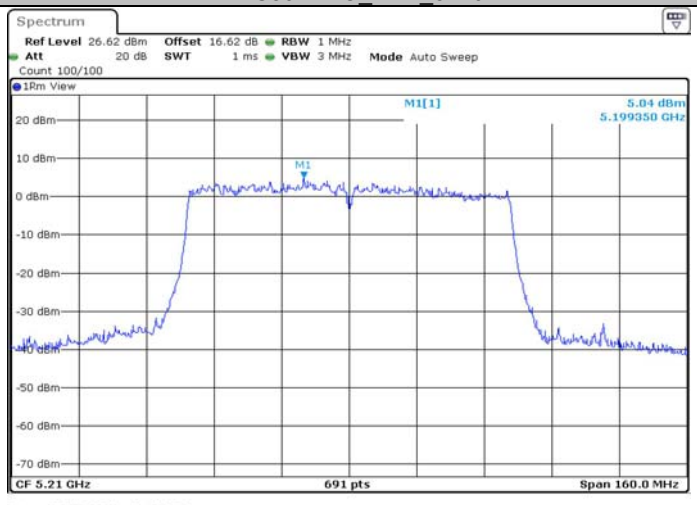


11AC80MIMO_Ant1_5210


11AC80MIMO_Ant2_5210


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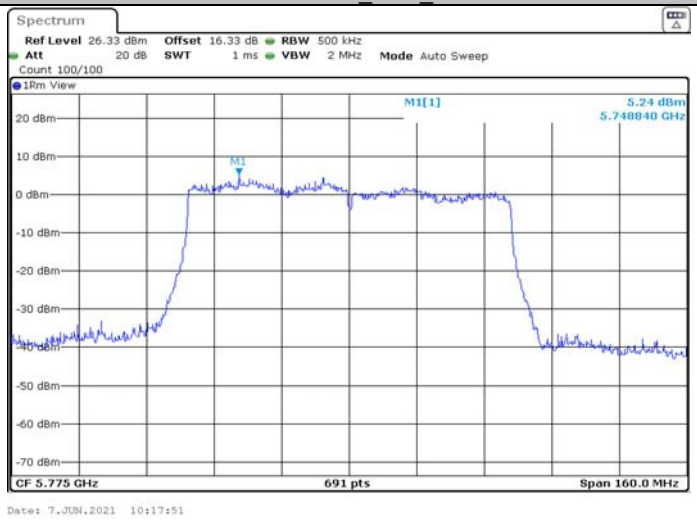
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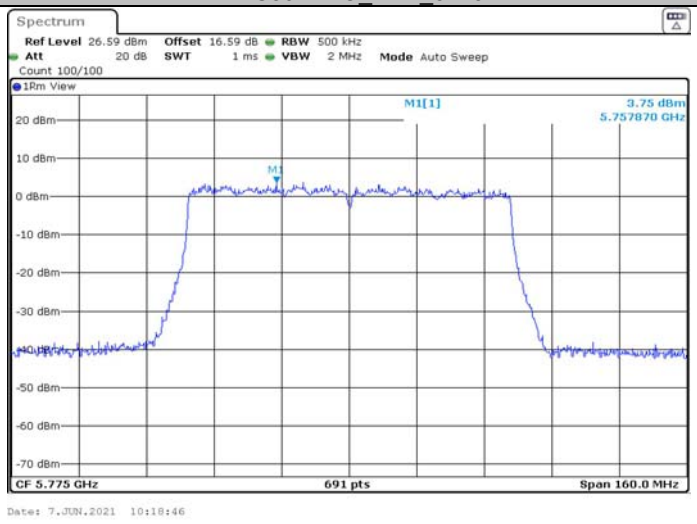


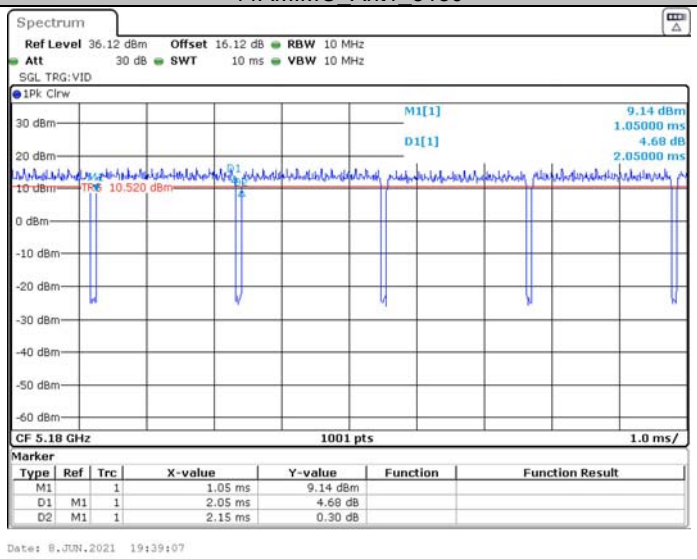
Appendix D: DutyCycle

Test Result

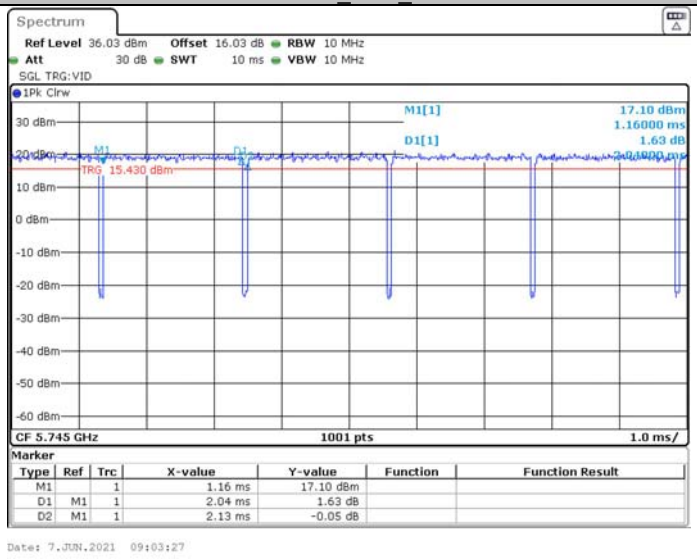
Test Mode	Antenna	Channel	TransmissionDuration [ms]	Transmission Period [ms]	Duty Cycle [%]
11AMIMO	Ant1	5180	2.05	2.15	95.35
	Ant1	5745	2.04	2.13	95.77
11N20MIMO	Ant1	5180	4.99	5.09	98.04
	Ant1	5745	4.99	5.07	98.42
11N40MIMO	Ant1	5190	2.41	2.50	96.40
	Ant1	5755	2.41	2.50	96.40
11AC20MIMO	Ant1	5180	5.00	5.10	98.04
	Ant1	5745	4.99	5.07	98.42
11AC40MIMO	Ant1	5190	2.42	2.51	96.41
	Ant1	5755	2.41	2.49	96.79
11AC80MIMO	Ant1	5210	1.13	1.22	92.62
	Ant1	5775	1.13	1.21	93.39

Test Graphs

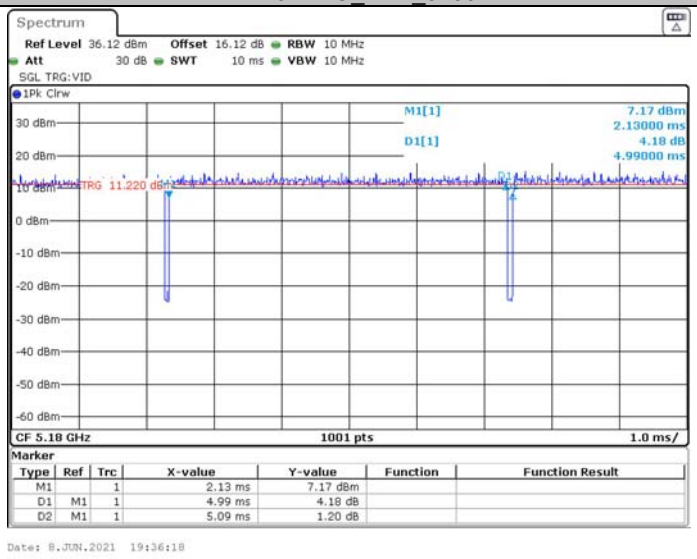
11AMIMO_Ant1_5180



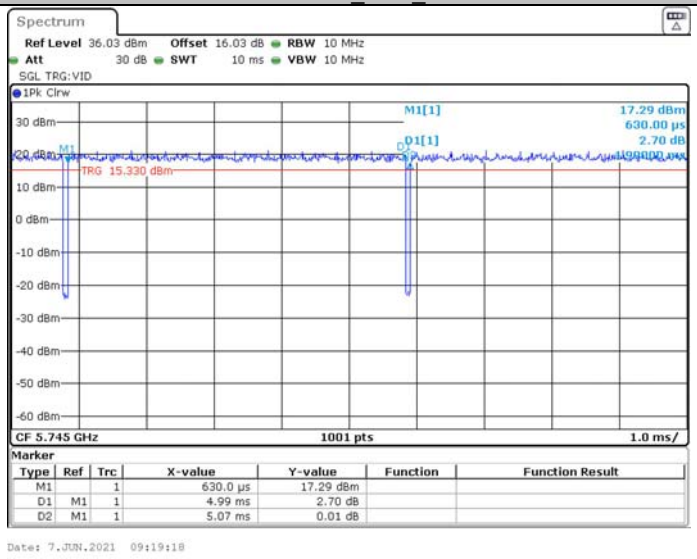
11AMIMO_Ant1_5745



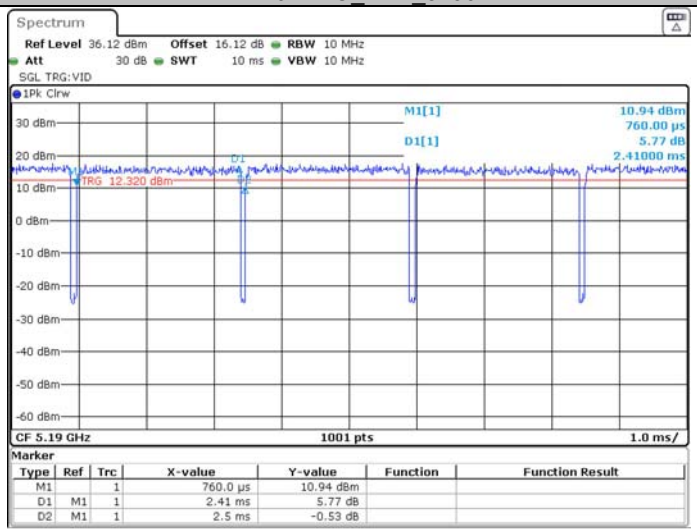
11N20MIMO_Ant1_5180



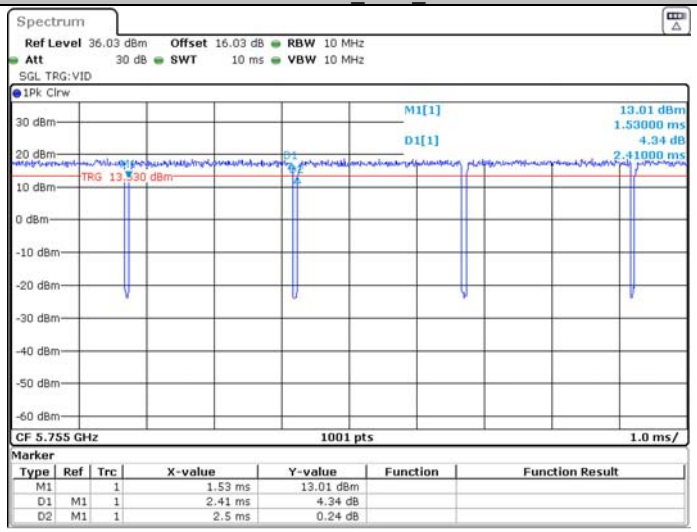
11N20MIMO_Ant1_5745



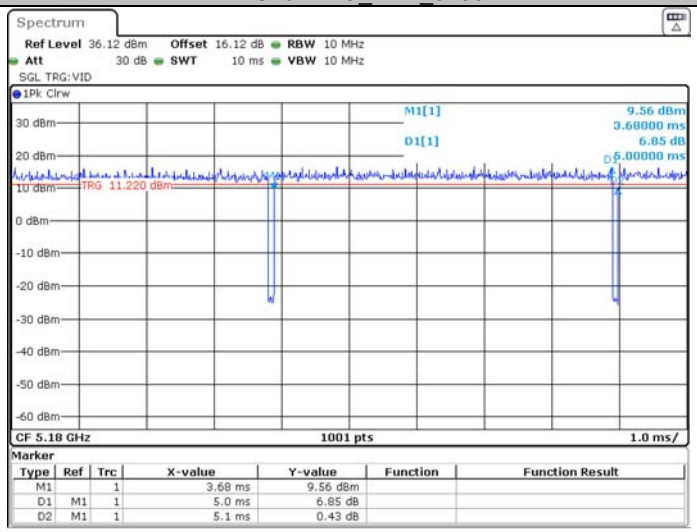
11N40MIMO_Ant1_5190



11N40MIMO_Ant1_5755



11AC20MIMO_Ant1_5180



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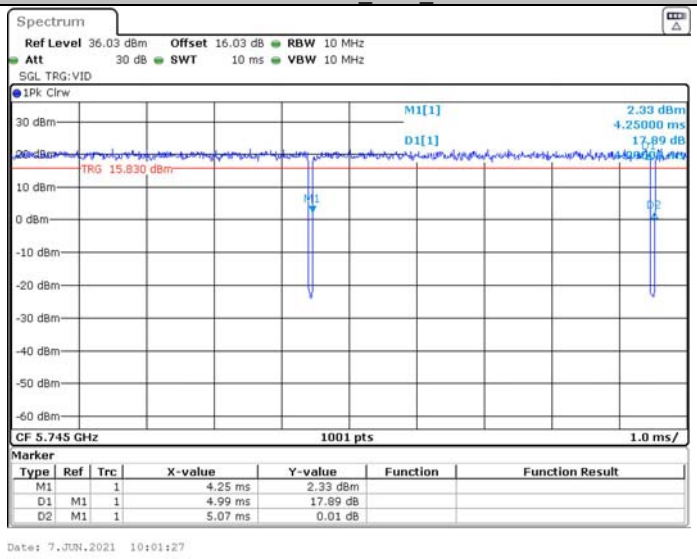
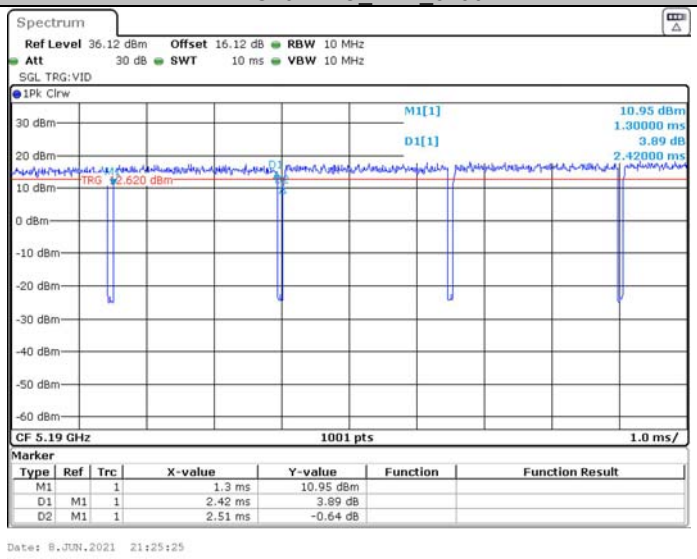


11AC40MIMO_Ant1_5190



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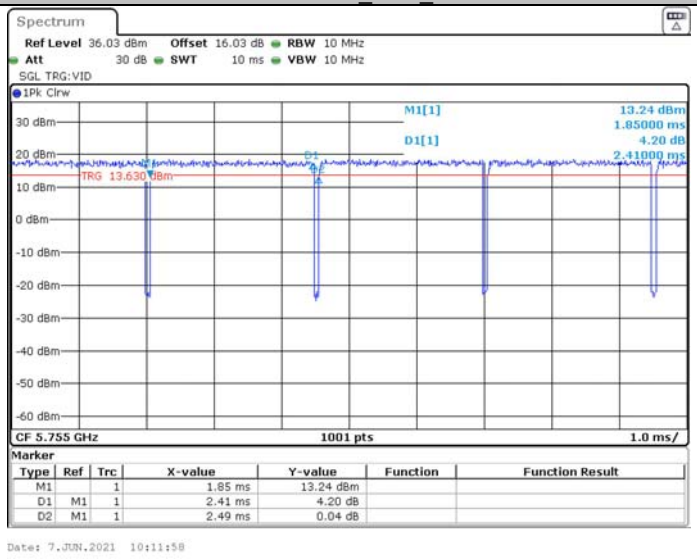
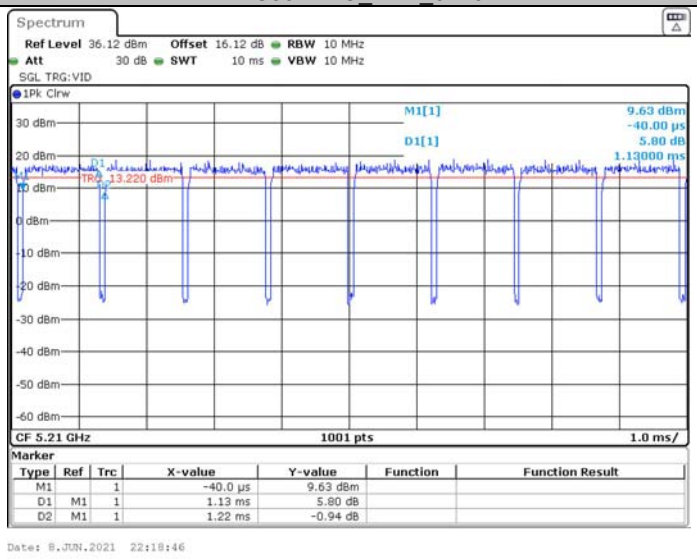
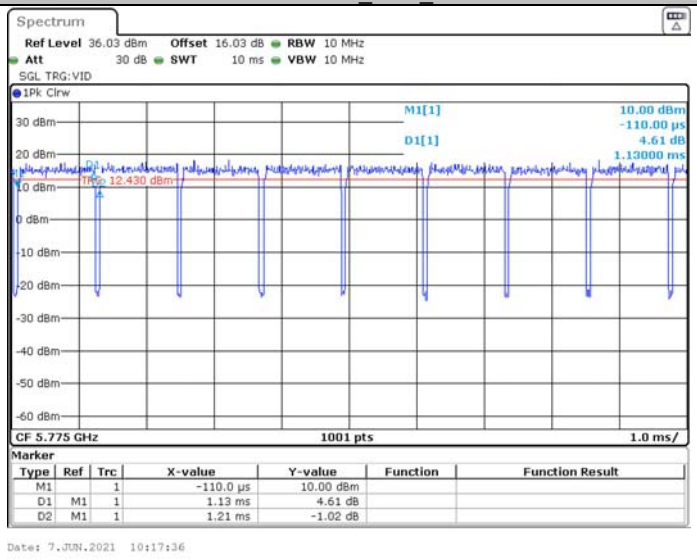


11AC80MIMO_Ant1_5210



11AC80MIMO_Ant1_5775



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