FCC PART 15.407

TEST REPORT

For

Colorlight Cloud Tech Ltd

Room 3801(37-39F), Tower A, Building 8, Block C, Phase 3, Vanke Cloud City, Xili Community, Xili Street, Nanshan District, Shenzhen, China

FCC ID: 2AVV2C390CLT

Report Type:	**Product Type:**
Original Report	LED Player

Report Number: RSZ200811008-00B

Report Date: 2021-03-11

Reviewed By: Jacob Kong, RF Engineer

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Note: This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

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TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Product	LED Player
Tested Model	C3 Pro
Frequency Range	5G Wi-Fi: 5150-5250 MHz
Maximum Average Transmit Power	5150-5250 MHz 16.81dBm (802.11a), 17.62dBm(802.11n20), 18.35dBm(802.11n40), 16.19dBm(802.11ac20), 17.56dBm (802.11ac40), 16.34dBm (802.11ac80)
Modulation Technique	Wi-Fi: OFDM
Antenna Specification*	External Antenna: 4.5dBi(provided by the applicant)
Voltage Range	DC 12V from adapter
Date of Test	2020-08-20 to 2021-03-11
Sample number	RSZ200811008-RF-S1 for RF conducted test & RSZ200811008-RF-S2 for CE&RE test(Assigned by BACL, Shenzhen)
Received date	2020-08-11
Sample/EUT Status	Good condition
Adapter information	Model:KS39DU-1200200WU Input: AC 100-240V, 50/60Hz, 2.0A Output: DC 12V, 2.0A

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, 15.207, 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

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

Measurement Uncertainty

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

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

Test Facility

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

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

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

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

The device support 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	/	/

Equipment Modifications

No modification was made to the EUT tested.

EUT Exercise Software

“Ampek RFTesttool,VER:5.3”* software was use to the EUT tested .

The device was tested with the worst case was performed as below:

U-NII	Mode	Channel Number	Frequency (MHz)	Rate (Mbps)	Power Level*
5150 – 5250MHz	802.11 a	CH36	5180	6	85
		CH40	5200	6	85
		CH48	5240	6	85
	802.11 n20	CH36	5180	MCS0	89
		CH40	5200	MCS0	89
		CH48	5240	MCS0	75
	802.11 ac20	CH36	5180	MCS0	89
		CH40	5200	MCS0	80
		CH48	5240	MCS0	80
	802.11 n40	CH38	5190	MCS0	80
		CH46	5230	MCS0	80
	802.11 ac40	CH38	5190	MCS0	89
		CH46	5230	MCS0	80
	802.11 ac80	CH42	5210	MCS0	81

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.

The software and power level was provided by the applicant.

Duty cycle:

Test Result: Pass. Please refer to the Appendix.

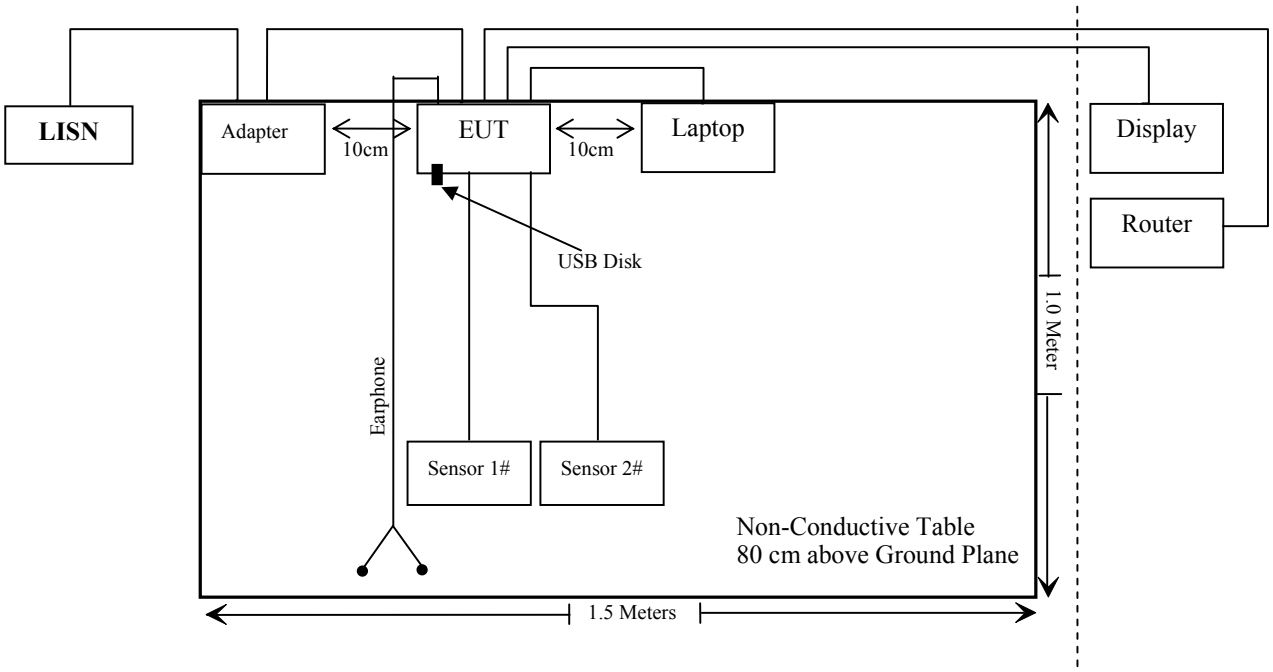
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
SHENZHEN LAMP DISPLAY TECHNOLOGY CO.,LTD	Display	LTV-SU4316	15345021
HIKVISION	Router	DS-3WR03-E	10021642429
DELL	Laptop	Latitude E5430	11429208685
DELL	Laptop	Inspiron 15-3543	DT7MH52
Colorlight	Sensor 1#	Brightness Sensor	03021518
Colorlight	Sensor 2#	Sensor	21518390
Un-known	Earphone	Un-known	Earphone
Sandisk	USB Disk	SDCZ73-064G-Z35	2145498

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Un-Detachable AC Cable	1.1	Adapter	LISN
Un-shielding Un-Detachable DC Cable	1.2	Adapter	EUT
Un-Shielding Detachable RJ45 Cable	8.0	EUT	Display
Un-Shielding Detachable RJ45 Cable	8.0	EUT	Router
Un-shielding Detachable USB Cable	1.2	EUT	Laptop
Un-shielding Detachable Audio Cable	1.2	EUT	Earphone
Un-shielding Detachable RJ11 Cable*2	2.5	EUT	Sensor

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i), §2.1091	Maximum Permissible Exposure(MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.407(b)(8) & §15.207(a)	Conducted Emissions	Compliance
§15.205 & §15.209 &§15.407(b) (1),(7)	Undesirable Emission& Restricted Bands	Compliance
§15.407(a) (1)	26 dB Emission Bandwidth & 99% Occupied Bandwidth	Compliance
§15.407(a) (1)	Conducted Transmitter Output Power	Compliance
§15.407 (a) (1)	Power Spectral Density	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	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 (30MHz-1GHz)					
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 (1GHz-40GHz)					
Rohde & Schwarz	Spectrum Analyzer	FSV40-N	102259	2020/08/04	2021/08/03
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	2020/04/20	2021/04/20
Ducommun Technolagies	Horn antenna	ARH-4223-02	1007726-02 1304	2017/12/06	2020/12/05
Ducommun Technolagies	Horn antenna	ARH-2823-02	1007726-01 1302	2017/12/06	2020/12/05
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	2019/11/29	2020/11/28
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).

FCC §15.247 (i) & §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/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)

Frequency (MHz)	Antenna Gain		Tune up conducted power		Evaluation Distance (cm)	Power Density (mW/cm^2)	MPE Limit (mW/cm^2)
	(dBi)	(numeric)	(dBm)	(mW)			
5150-5250	4.5	2.82	18.5	70.79	20	0.04	1

Note: the 2.4GHz wifi connot transmit with 5GHz wifi at same time

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 one enternal antenna with unique antenna connector and the antenna gain is 4.5 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

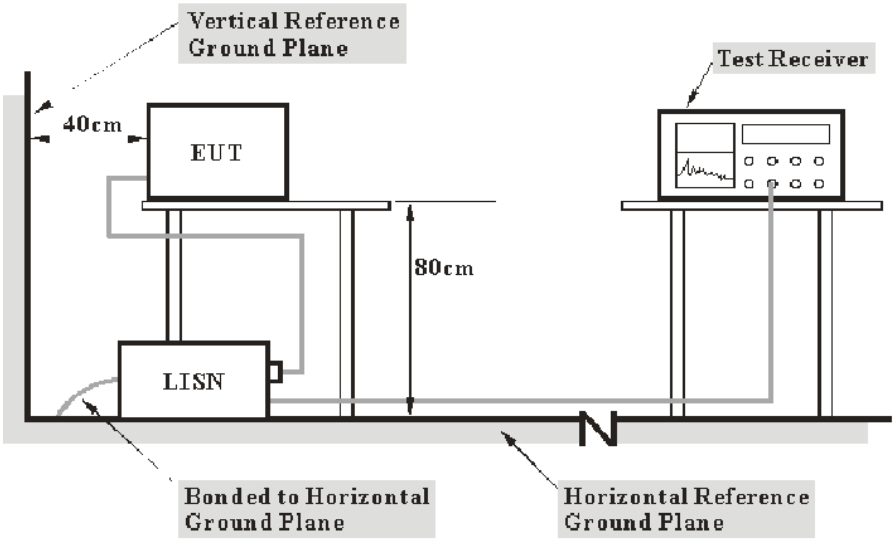
Result: Pass.

FCC §15.407 (b) (8) §15.207 (a) – CONDUCTED EMISSIONS

Applicable Standard

FCC §15.207, §15.407(b) (8)

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.

The adapter was connected to a 120 VAC/60 Hz power source.

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

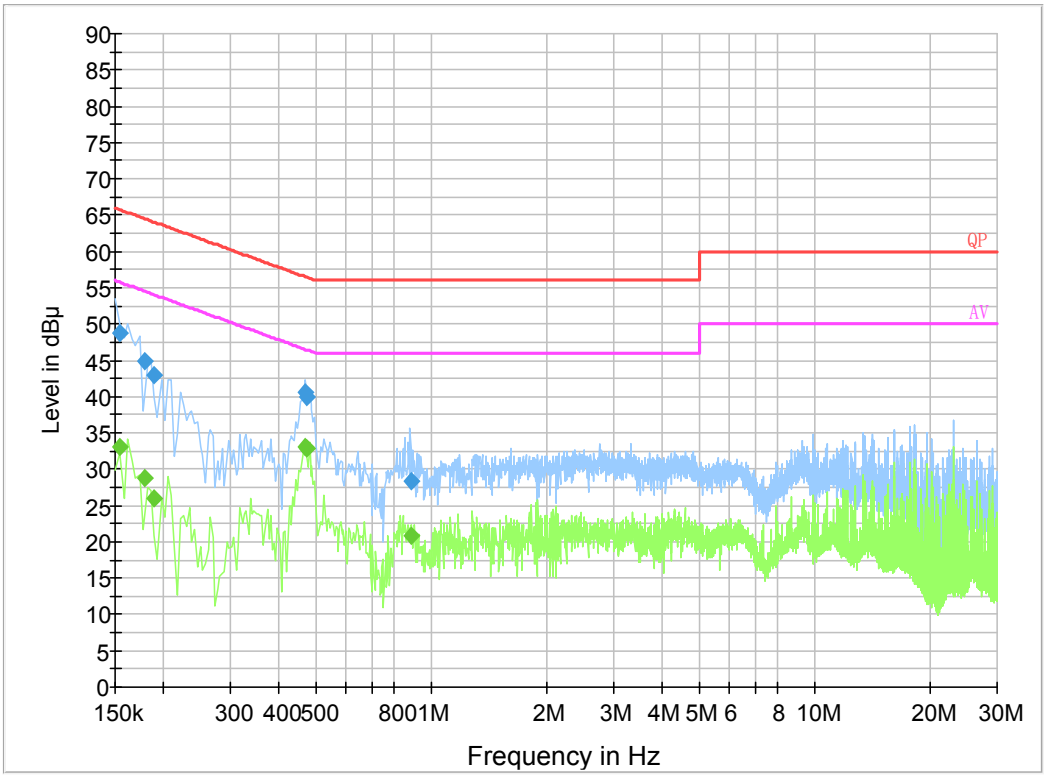
Environmental Conditions

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

The testing was performed by Haiguo Li on 2021-02-24.

EUT operation mode: WIFI Transmitting (worst case is 802.11n40 mode 5230 MHz)

AC 120V/60 Hz, Line:



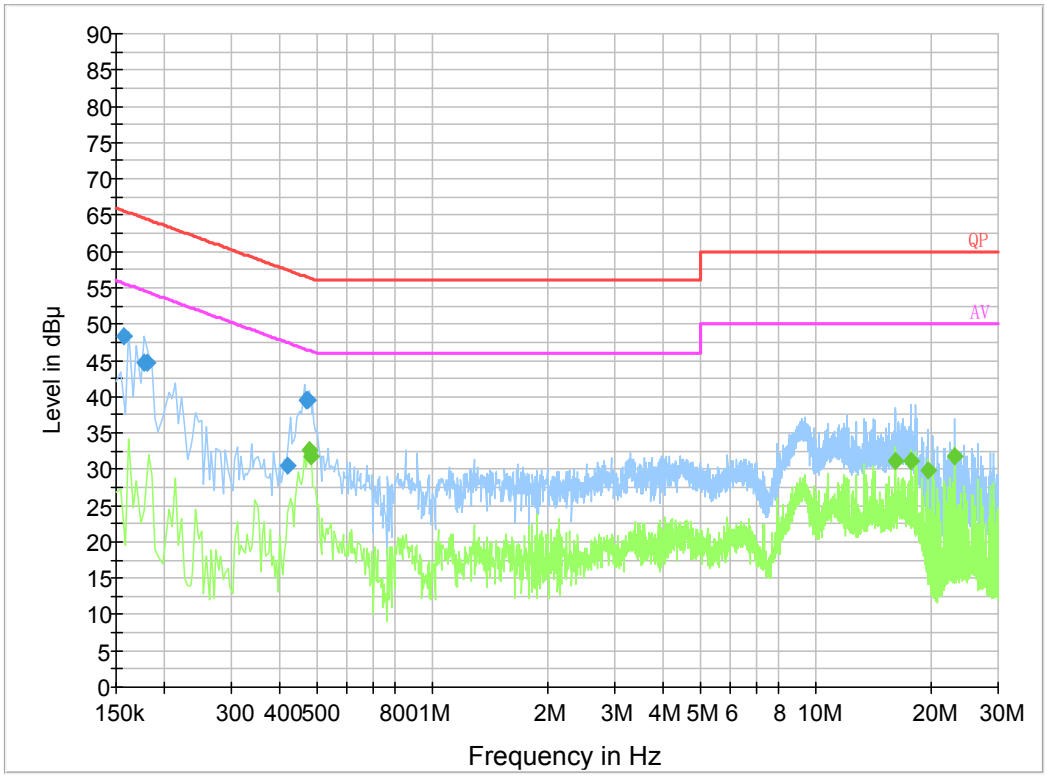
Final Result 1

Frequency (MHz)	QuasiPeak (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.154500	48.8	9.000	L1	19.8	17.0	65.8
0.178500	44.9	9.000	L1	19.9	19.7	64.6
0.189500	42.9	9.000	L1	19.8	21.2	64.1
0.470950	40.5	9.000	L1	19.8	16.0	56.5
0.474770	39.9	9.000	L1	19.8	16.5	56.4
0.888770	28.5	9.000	L1	19.8	27.5	56.0

Final Result 2

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.154500	33.1	9.000	L1	19.8	22.7	55.8
0.178500	28.9	9.000	L1	19.9	25.7	54.6
0.189500	26.0	9.000	L1	19.8	28.1	54.1
0.470950	33.1	9.000	L1	19.8	13.4	46.5
0.474770	32.9	9.000	L1	19.8	13.5	46.4
0.888770	20.9	9.000	L1	19.8	25.1	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)
0.157500	48.2	9.000	N	19.8	17.4	65.6
0.177500	44.7	9.000	N	19.8	19.9	64.6
0.181500	44.6	9.000	N	19.8	19.8	64.4
0.419610	30.5	9.000	N	19.8	27.0	57.5
0.471010	39.5	9.000	N	19.8	17.0	56.5
0.474770	39.5	9.000	N	19.8	16.9	56.4

Final Result 2

Frequency (MHz)	Average (dB µ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB µ V)
0.478000	32.6	9.000	N	19.8	13.8	46.4
0.482000	31.7	9.000	N	19.8	14.6	46.3
16.230000	31.2	9.000	N	20.1	18.8	50.0
17.694000	31.2	9.000	N	20.2	18.8	50.0
19.710000	29.9	9.000	N	20.4	20.1	50.0
23.130000	31.8	9.000	N	20.3	18.2	50.0

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

Applicable Standard

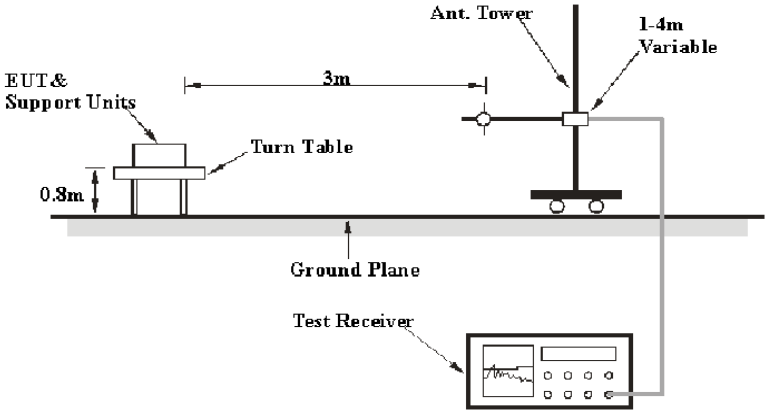
FCC §15.407 (b) (1), (7); §15.209; §15.205;

(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.

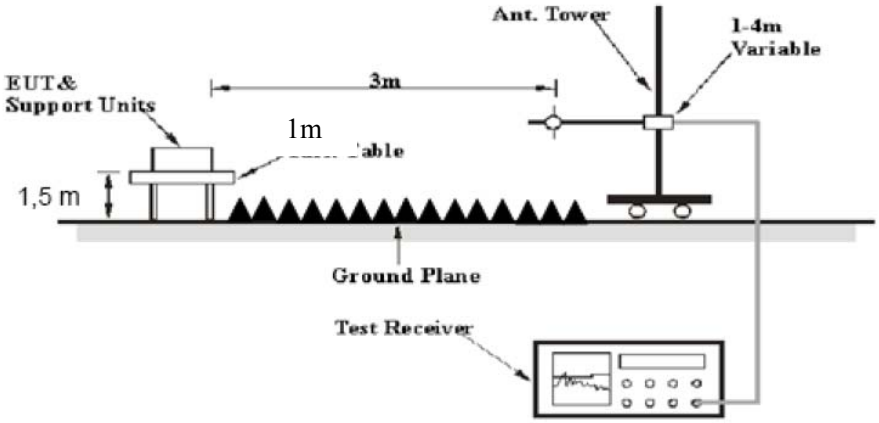
KDB 789033 D02 General UNII Test Procedures New Rules v02r01, clause G),
E[dBμV/m] = EIRP[dBm] - 20 log (d[m]) + 104.77, where E = field strength and d = distance at which field strength limit is specified.
For FCC §15.407 (b) (1) , d=1m, non-Restricted bands limit=-27-20*log(1)+104.77=77.7 dBμV/m

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

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: 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

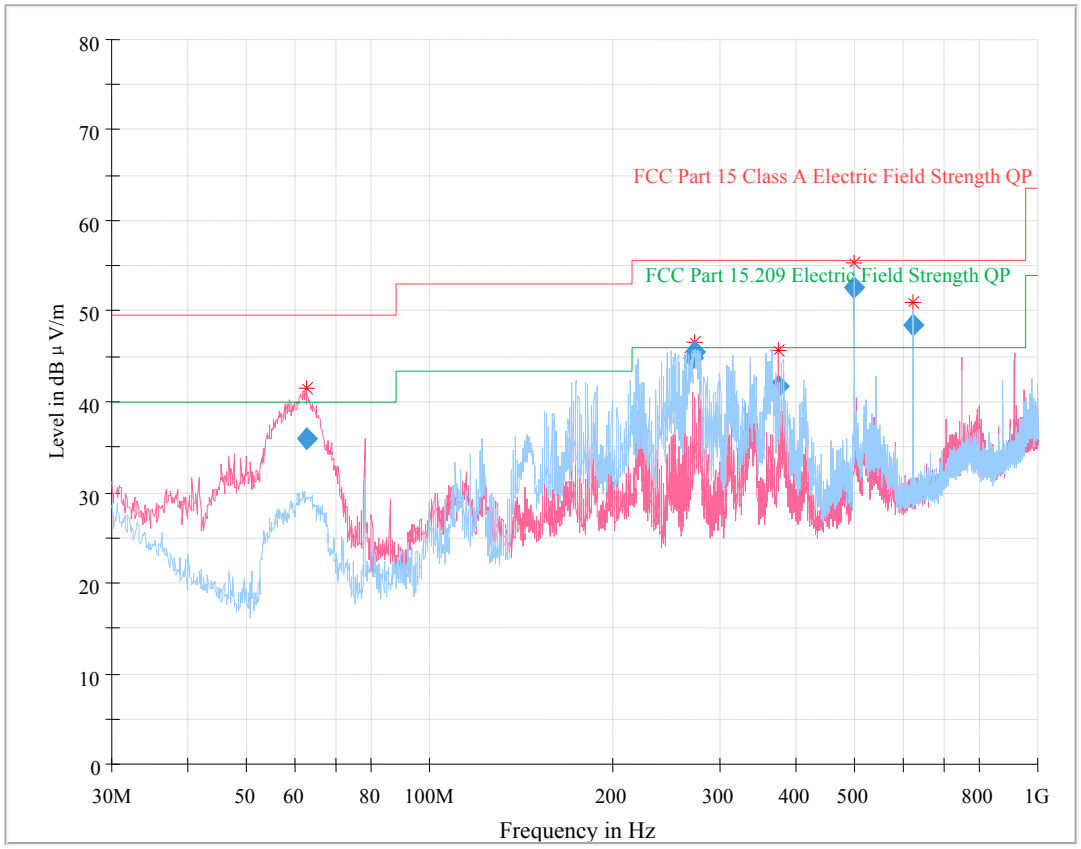
Environmental Conditions

Temperature:	23~25 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0~101.2 kPa

The testing was performed by Kilroy Deng on 2021-02-24 for below 1GHz and Leven Gan on 2020-08-21 for above 1GHz.

EUT operation mode: Transmitting

30 MHz – 1 GHz: *(worst case is 802.11n40 mode 5230 MHz)*



Final_Result

Frequency (MHz)	QuasiPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
62.541500	35.91	40.00	4.09	124.0	V	13.0	-10.4
271.190875	44.98	46.00	1.02	116.0	H	287.0	-5.0
273.391625	45.39	46.00	0.61	131.0	H	294.0	-4.9
374.982875	41.72	46.00	4.28	215.0	V	355.0	-2.1
500.019000	52.62	46.00	-6.62*	185.0	H	247.0	1.0
625.012000	47.83	46.00	-1.83*	175.0	H	127.0	3.3

Note*: The above plot represents the worst case for all supported operating modes, there were no spurious emission in the range 30MHz -1GHz over the limit in §15.209 caused by radio, the emission list at above table was investigated and was not caused by the radio, the emission was present when the radio was not transmitting. Those emissions comply with the FCC Part 15, Subpart B-Unintentional radiators §15.109(b) limit set for Class A digital device as the EUT is a Class A equipment according the user manual.

1000MHz ~ 40 GHz:

5150-5250MHz:

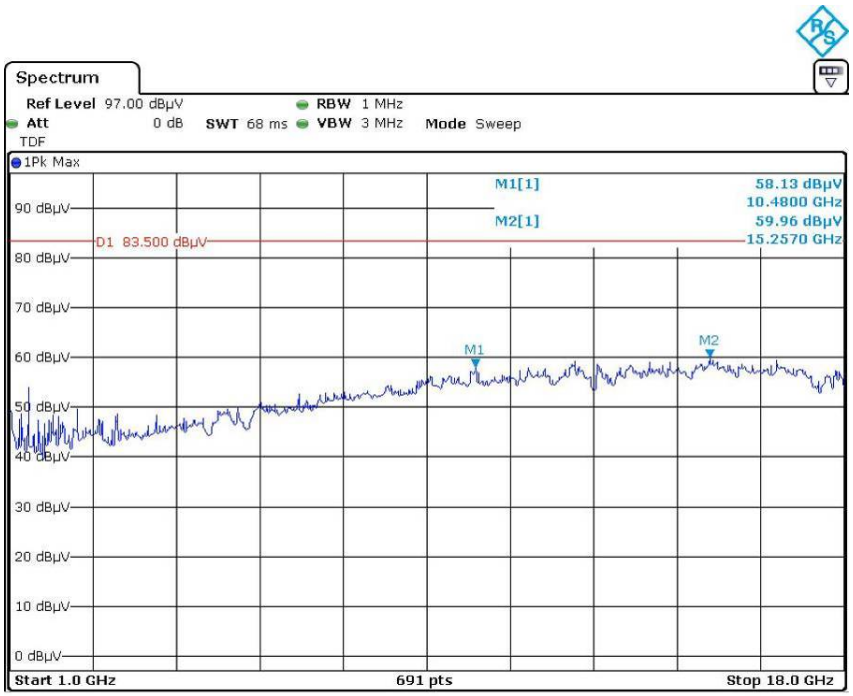
Frequency (MHz)	Receiver		Turntable	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	FCC Part 15.407	
	Reading (dBµV)	PK/QP/Ave.	Degree	Height (m)	Polar (H / V)			Limit (dBµV/m)	Margin (dB)
802.11A									
5180 MHz									
5148.91	32.59	PK	251	1.6	V	38.36	70.95	83.5	12.55
5148.91	17.30	Ave.	251	1.6	V	38.36	55.66	63.5	7.84
5351.04	31.30	PK	193	2.4	V	39.09	70.39	83.5	13.11
5351.04	17.17	Ave.	193	2.4	V	39.09	56.26	63.5	7.24
10360.00	44.64	PK	217	1.4	V	17.42	62.06	77.7	15.64
5200 MHz									
10400.00	45.12	PK	145	1.3	H	17.52	62.64	77.7	15.06
5240 MHz									
5148.67	32.10	PK	86	2.3	V	38.36	70.46	83.5	13.04
5148.67	17.60	Ave.	86	2.3	V	38.36	55.96	63.5	7.54
5350.52	32.47	PK	213	1.6	V	39.09	71.56	83.5	11.94
5350.52	17.79	Ave.	213	1.6	V	39.09	56.88	63.5	6.62
10480.00	49.02	PK	18	2.0	V	17.25	66.27	77.7	11.43
802.11N20									
5180MHz									
5149.50	33.02	PK	80	1.1	V	38.36	71.38	83.5	12.12
5149.50	17.92	Ave.	80	1.1	V	38.36	56.28	63.5	7.22
5350.44	31.70	PK	81	1.8	V	39.09	70.79	83.5	12.71
5350.44	17.53	Ave.	81	1.8	V	39.09	56.62	63.5	6.88
10360.00	45.91	PK	314	1.6	V	17.48	63.39	77.7	14.31
5200 MHz									
10400.00	46.98	PK	307	2.3	H	17.58	64.56	77.7	13.14
5240 MHz									
5147.86	31.24	PK	119	1.9	V	38.36	69.60	83.5	13.90
5147.86	17.33	Ave.	119	1.9	V	38.36	55.69	63.5	7.81
5351.01	32.54	PK	40	1.8	V	39.09	71.63	83.5	11.87
5351.01	17.47	Ave.	40	1.8	V	39.09	56.56	63.5	6.94
10480.00	47.61	PK	191	1.5	V	16.98	64.59	77.7	13.11

Frequency (MHz)	Receiver		Turntable	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBµV/m)	FCC Part 15.407	
	Reading (dBµV)	PK/QP/Ave.	Degree	Height (m)	Polar (H / V)			Limit (dBµV/m)	Margin (dB)
802.11N40									
5190 MHz									
5148.18	34.82	PK	295	2.1	V	38.36	73.18	83.5	10.32
5148.18	21.52	Ave.	295	2.1	V	38.36	59.88	63.5	3.62
5351.26	32.24	PK	2	1.3	V	39.09	71.33	83.5	12.17
5351.26	17.87	Ave.	2	1.3	V	39.09	56.96	63.5	6.54
10380.00	45.32	PK	192	1.8	V	17.42	62.74	77.7	14.96
5230 MHz									
5149.62	31.21	PK	140	1.5	V	38.36	69.57	83.5	13.93
5149.62	18.25	Ave.	140	1.5	V	38.36	56.61	63.5	6.89
5351.83	31.64	PK	175	1.3	V	39.09	70.73	83.5	12.77
5351.83	18.38	Ave.	175	1.3	V	39.09	57.47	63.5	6.03
10460.00	44.53	PK	323	1.2	V	17.15	61.68	77.7	16.02
802.11AC20									
5180 MHz									
5148.81	31.81	PK	359	1.1	V	38.36	70.17	83.5	13.33
5148.81	18.56	Ave.	359	1.1	V	38.36	56.92	63.5	6.58
5350.47	31.21	PK	77	2.0	V	39.09	70.30	83.5	13.20
5350.47	18.30	Ave.	77	2.0	V	39.09	57.39	63.5	6.11
10360.00	46.23	PK	115	1.4	V	17.42	63.65	77.7	14.05
5200 MHz									
10400.00	47.81	PK	23	1.6	V	17.52	65.33	77.7	12.37
5240MHz									
5148.52	31.78	PK	30	2.3	V	38.36	70.14	83.5	13.36
5148.52	18.41	Ave.	30	2.3	V	38.36	56.77	63.5	6.73
5351.11	32.41	PK	230	1.4	V	39.09	71.50	83.5	12.00
5351.11	18.57	Ave.	230	1.4	V	39.09	57.66	63.5	5.84
10480.00	48.68	PK	301	1.1	V	17.25	65.93	77.7	11.77

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBμV/m)	FCC Part 15.407	
	Reading (dBμV)	PK/QP/Ave.		Height (m)	Polar (H/V)			Limit (dBμV/m)	Margin (dB)
802.11AC40									
5190 MHz									
5148.47	36.82	PK	247	1.9	V	38.36	75.18	83.5	8.32
5148.47	20.35	Ave.	247	1.9	V	38.36	58.71	63.5	4.79
5352.12	32.24	PK	149	1.5	V	39.09	71.33	83.5	12.17
5352.12	18.81	Ave.	149	1.5	V	39.09	57.90	63.5	5.60
10380.00	45.67	PK	317	1.9	V	17.42	63.09	77.7	14.61
5230 MHz									
5148.78	31.45	PK	104	1.3	V	38.36	69.81	83.5	13.69
5148.78	18.64	Ave.	104	1.3	V	38.36	57.00	63.5	6.50
5351.24	31.77	PK	151	2.3	V	39.09	70.86	83.5	12.64
5351.24	18.70	Ave.	151	2.3	V	39.09	57.79	63.5	5.71
10460.00	44.63	PK	251	2.2	V	17.15	61.78	77.7	15.92
802.11AC80									
5210 MHz									
5148.21	33.33	PK	45	1.1	V	38.36	71.69	83.5	11.81
5148.21	19.54	Ave.	45	1.1	V	38.36	57.90	63.5	5.60
5350.45	32.14	PK	138	2.0	V	39.09	71.23	83.5	12.27
5350.45	18.82	Ave.	138	2.0	V	39.09	57.91	63.5	5.59
10420.00	42.49	PK	183	1.3	V	17.52	60.01	77.7	17.69

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.
Test at 1m distance for above 1GHz.

Peak
Pre-scan with 802.11a 5240MHz
Horizontal



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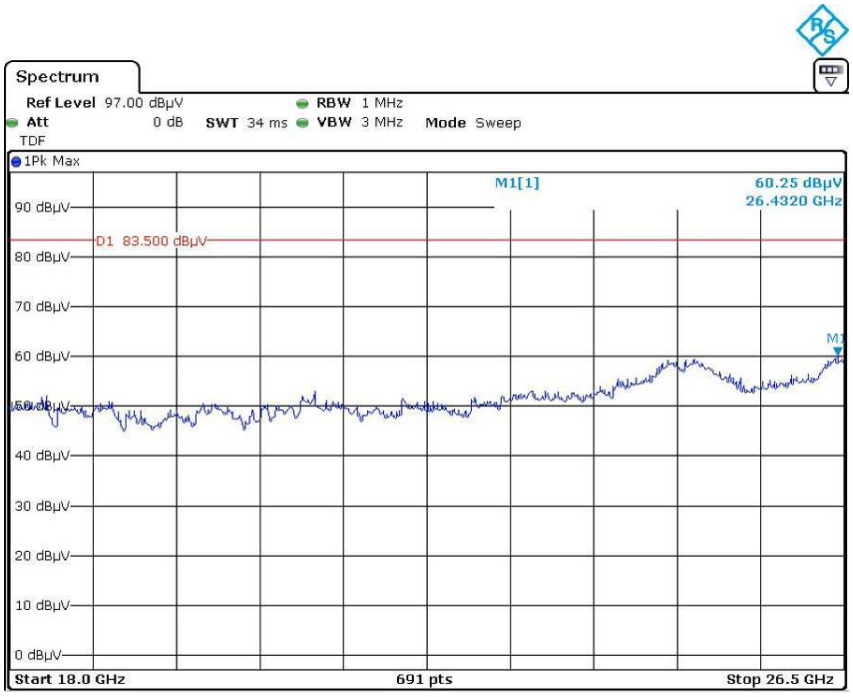

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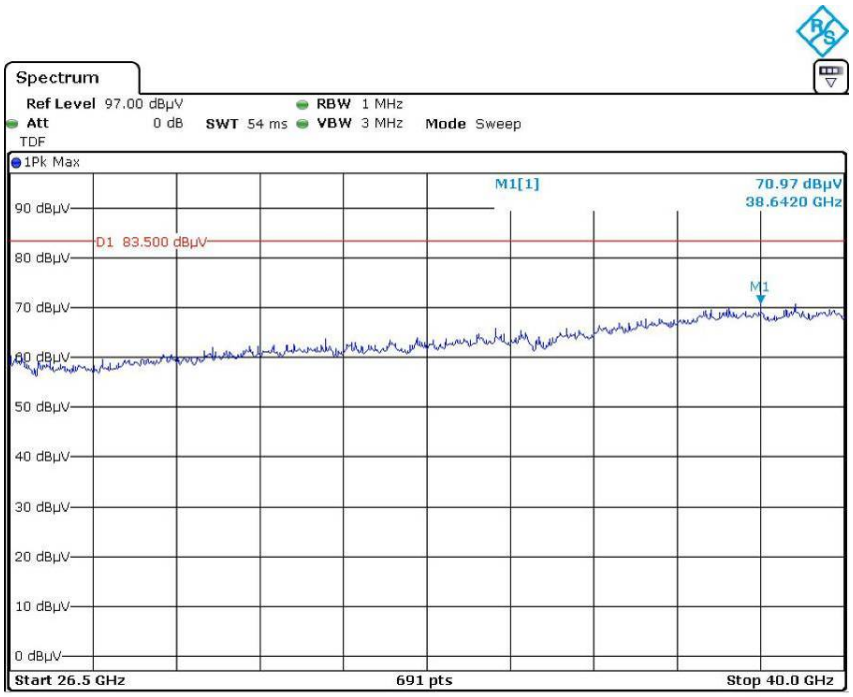

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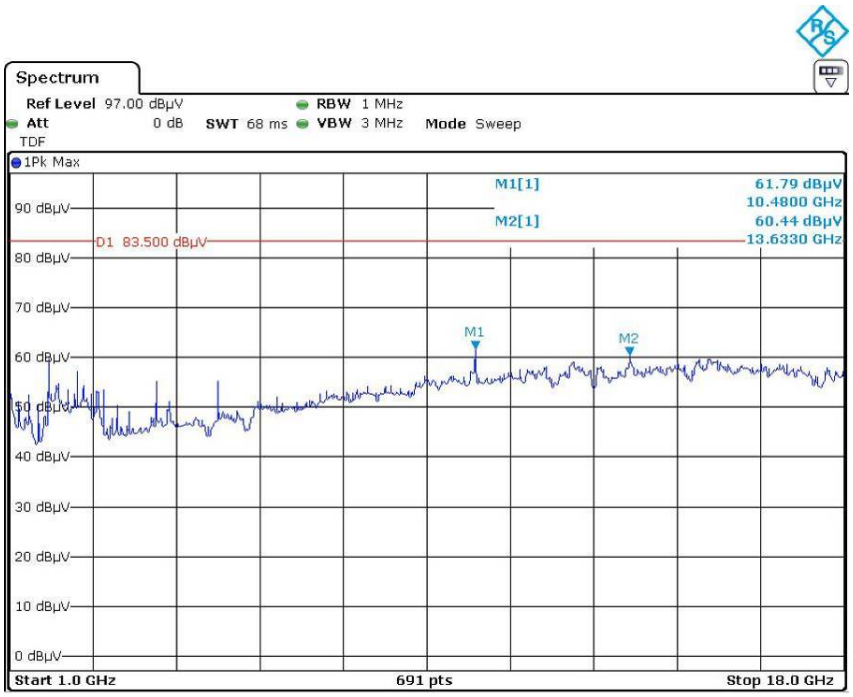
Vertical



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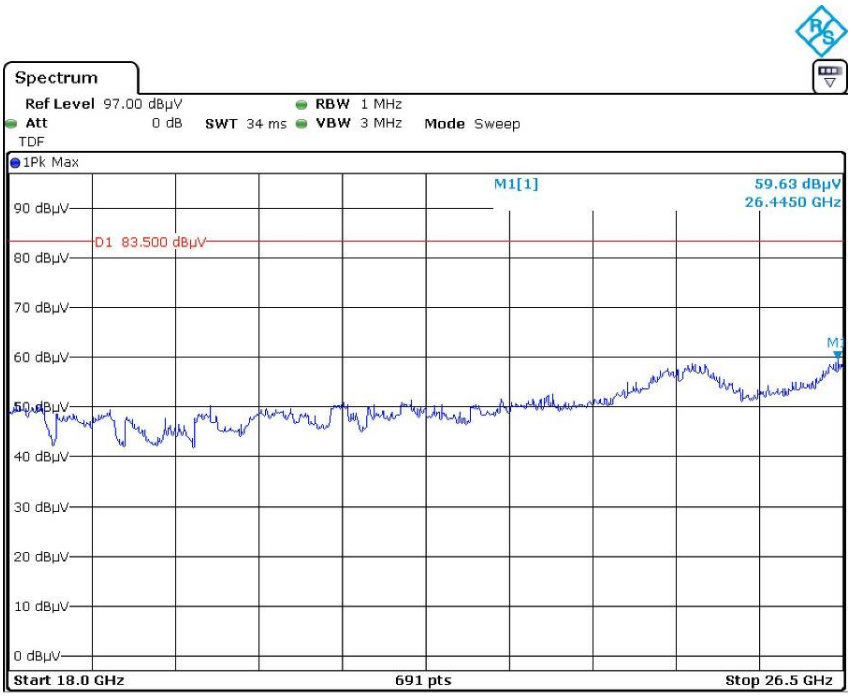

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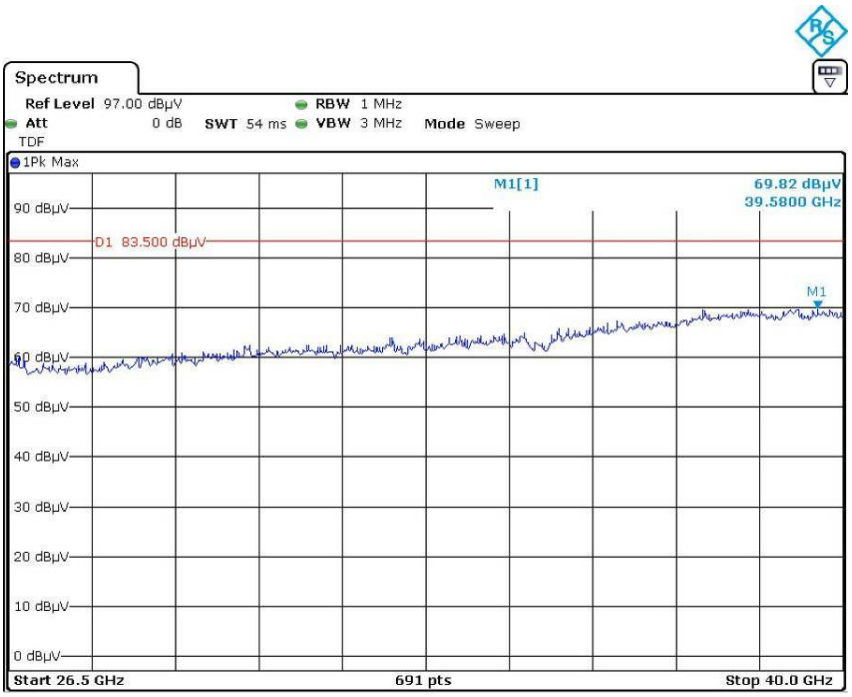
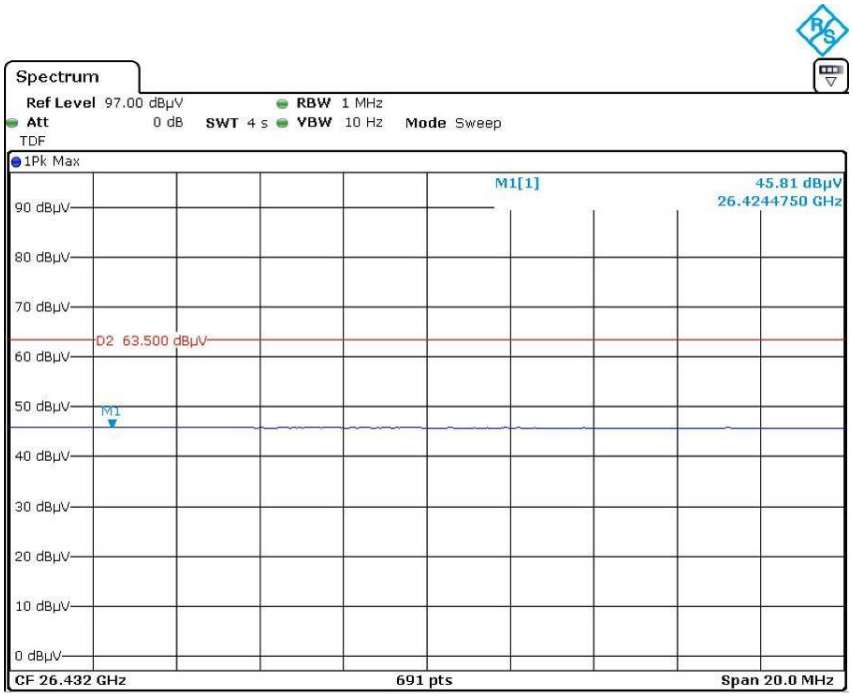


Date: 21.AUG.2020 21:16:09

Average
Horizontal



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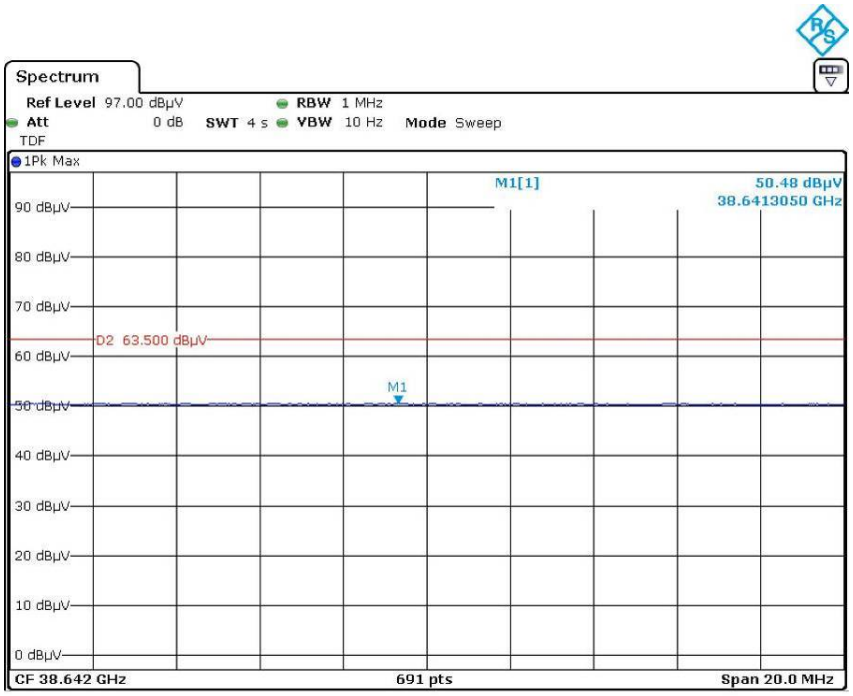

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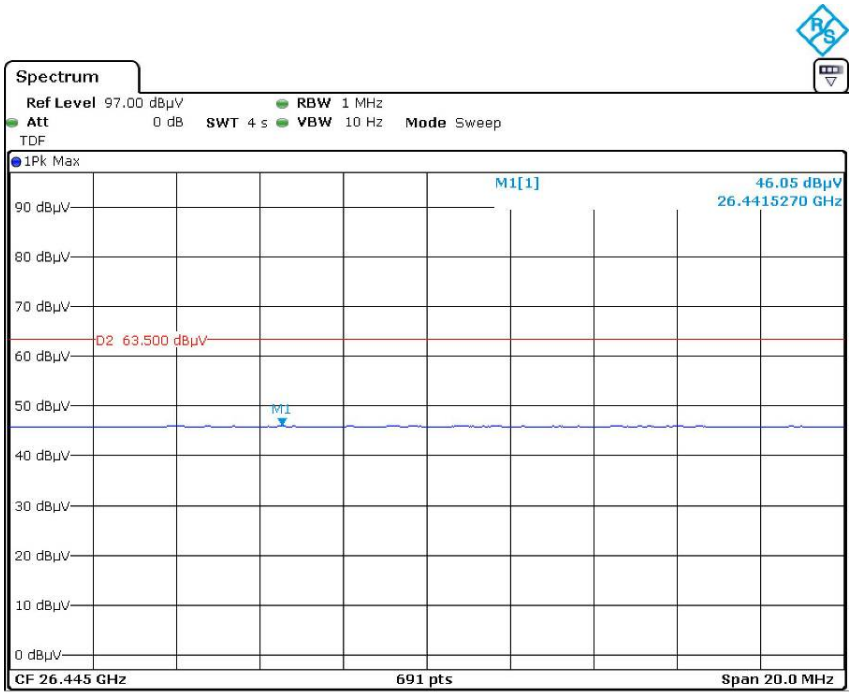
Vertical



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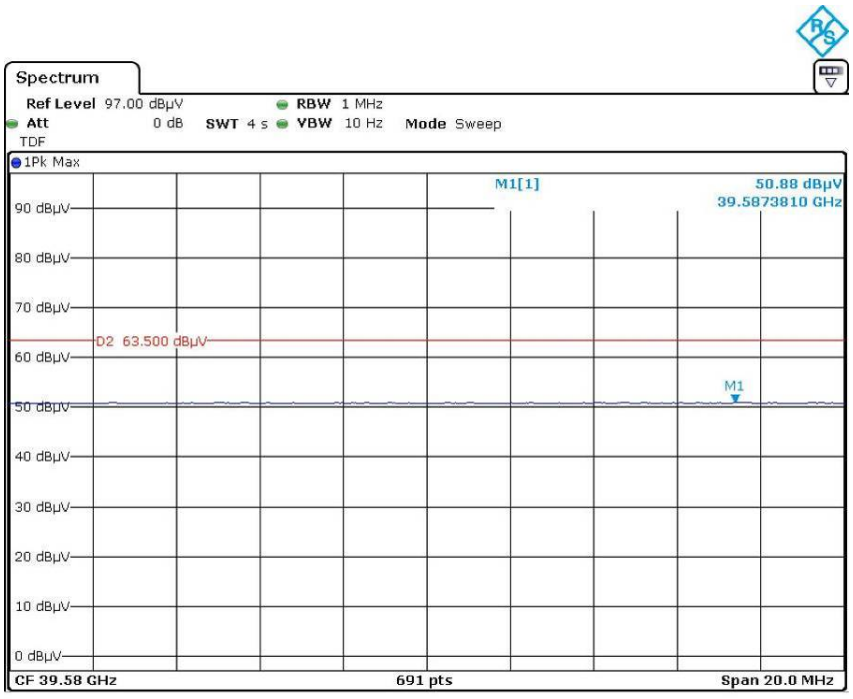


Date: 21.AUG.2020 21:19:41

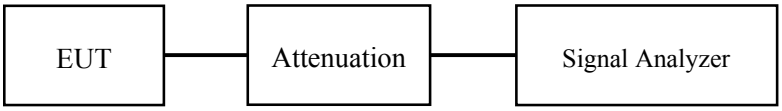
FCC §15.407(a) (1) – 26 dB EMISSION BANDWIDTH & 99% OCCUPIED BANDWIDTH

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) &99% Occupied Bandwidth (OBW)
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 for EBW, and use the 99% power bandwidth function of the instrument to measure the OBW. 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:	24 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao from 2020-09-03 to 2021-03-11.

EUT operation mode: Transmitting

Test Result: Pass.

Please refer to the Appendix

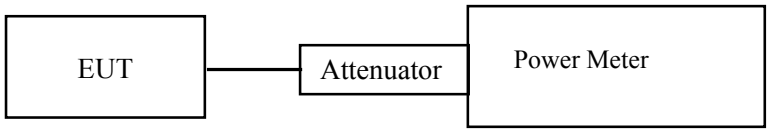
FCC §15.407(a) (1) – CONDUCTED TRANSMITTER OUTPUT POWER

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:	24 ℃
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao on 2020-09-03.

EUT operation mode: Transmitting

Test Result: Pass.

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 ≥ 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:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Bravos Zhao from 2020-09-03 to 2021-03-10.

EUT operation mode: Transmitting

Test Result: Pass.

Please refer to the Appendix

APPENDIX

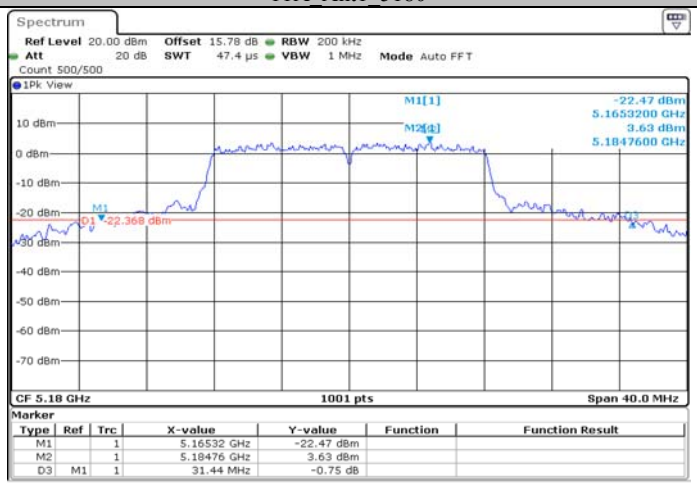
AppendixA1:EmissionBandwidth

Test Result

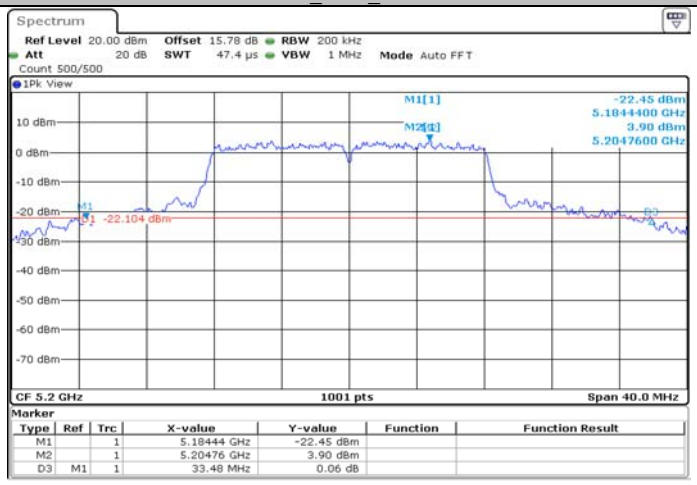
Test Mode	Antenna	Channel	26db EBW [MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	31.44	---	PASS
		5200	33.48	---	PASS
		5240	34.48	---	PASS
11N20SISO	Ant1	5180	36.84	---	PASS
		5200	37.76	---	PASS
		5240	38.08	---	PASS
11N40SISO	Ant1	5190	53.00	---	PASS
		5230	49.70	---	PASS
11AC20SISO	Ant1	5180	30.52	---	PASS
		5200	33.72	---	PASS
		5240	35.28	---	PASS
11AC40SISO	Ant1	5190	53.80	---	PASS
		5230	60.88	---	PASS
11AC80SISO	Ant1	5210	125.12	---	PASS

Test Graphs

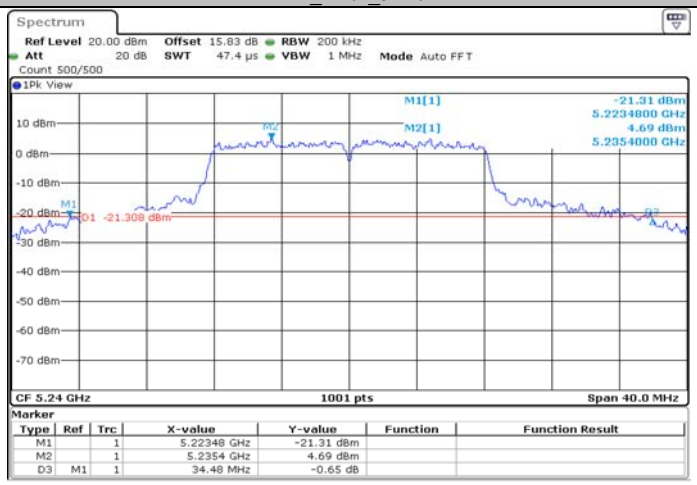
11A_Ant1_5180



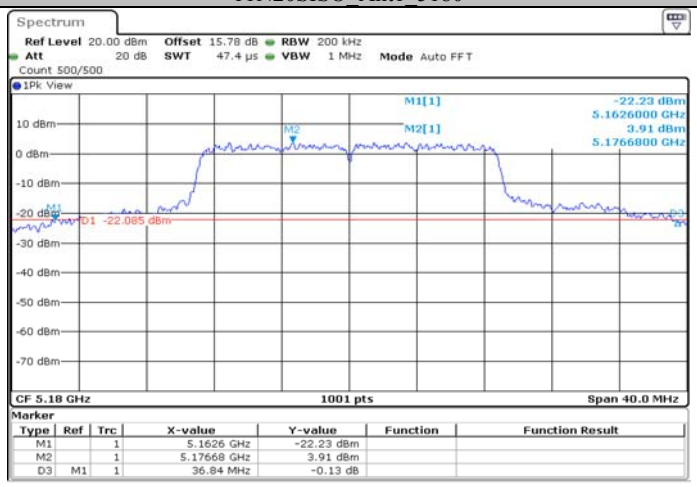
11A_Ant1_5200



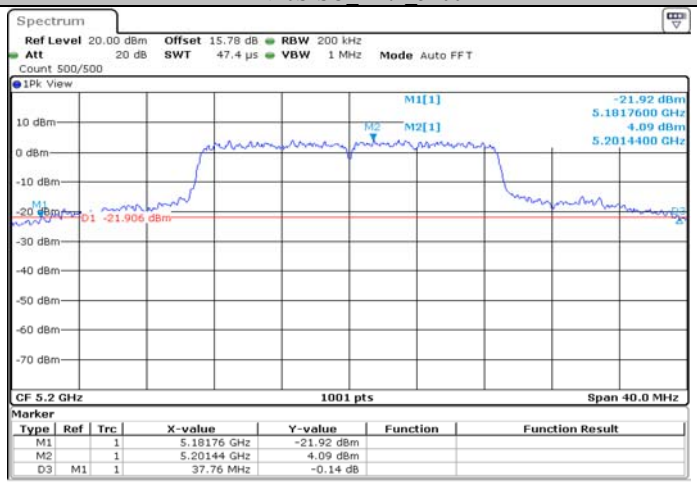
11A_Ant1_5240



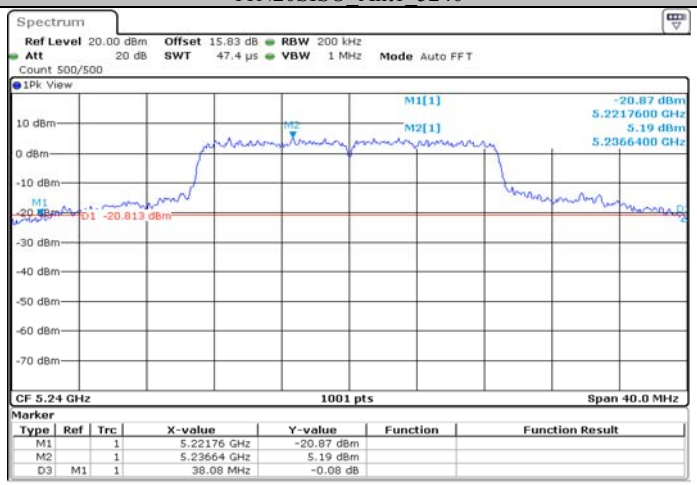
11N20SISO_Ant1_5180



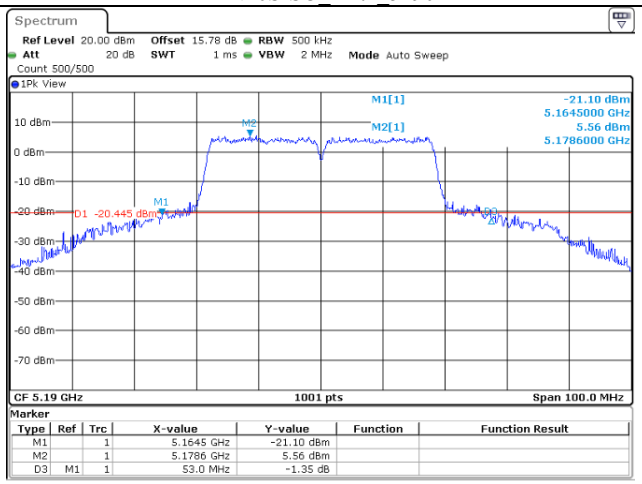
11N20SISO_Ant1_5200



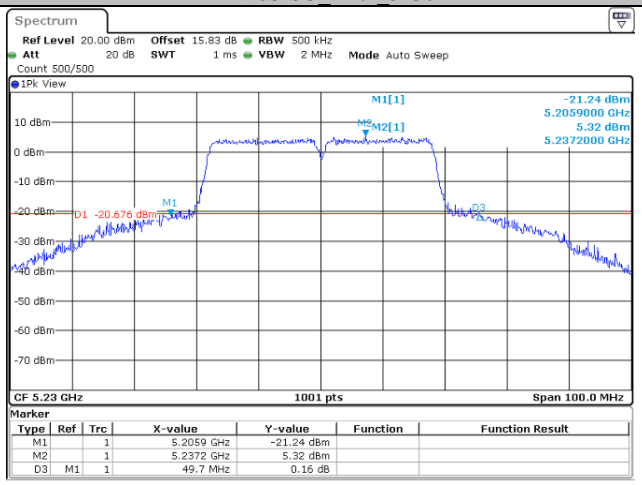
11N20SISO_Ant1_5240



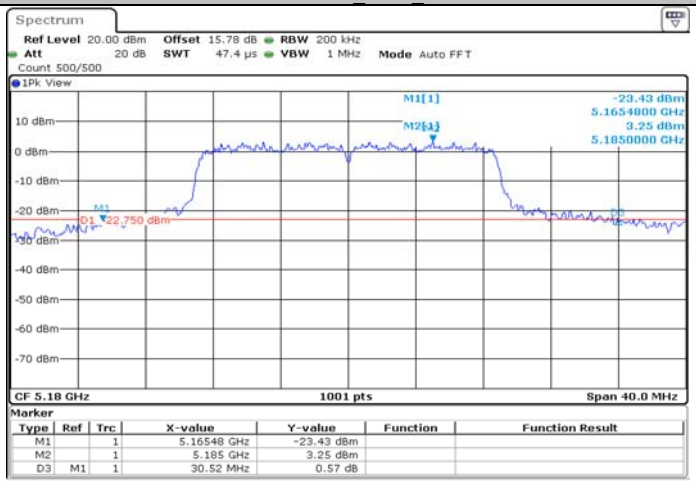
11N40SISO_Ant1_5190



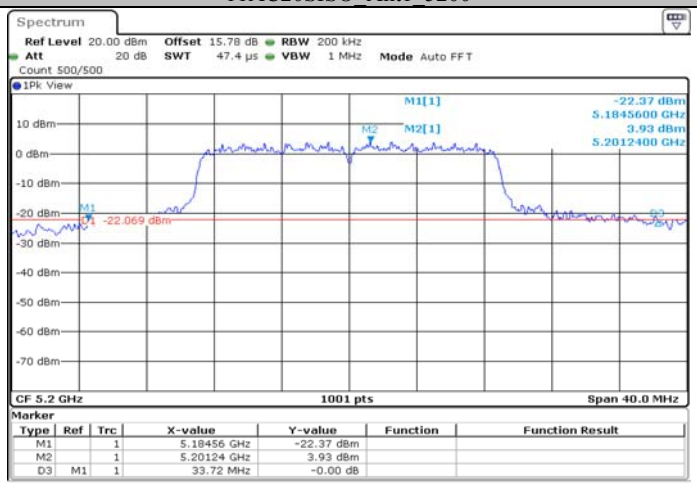
11N40SISO_Ant1_5230



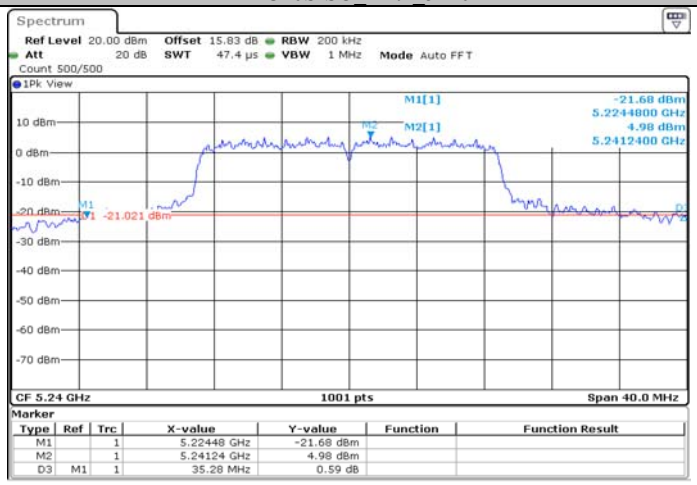
11AC20SISO_Ant1_5180



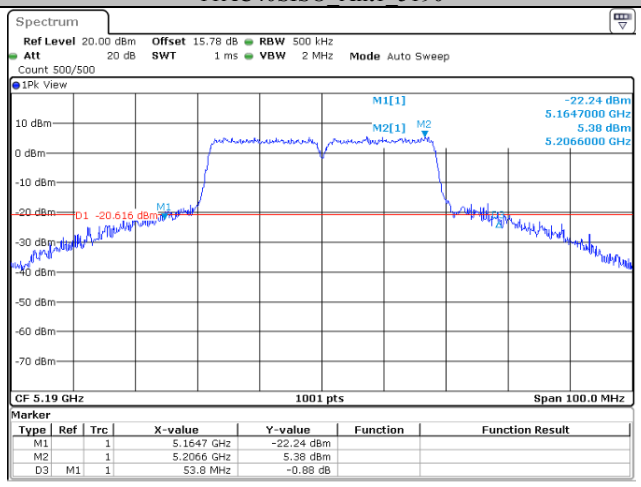
11AC20SISO_Ant1_5200



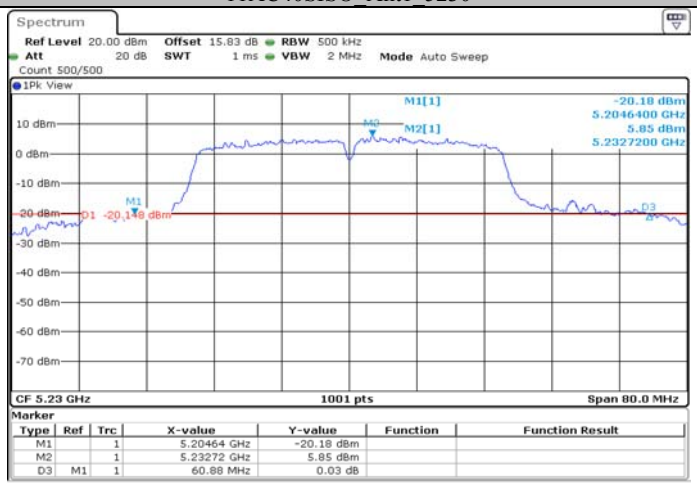
11AC20SISO_Ant1_5240



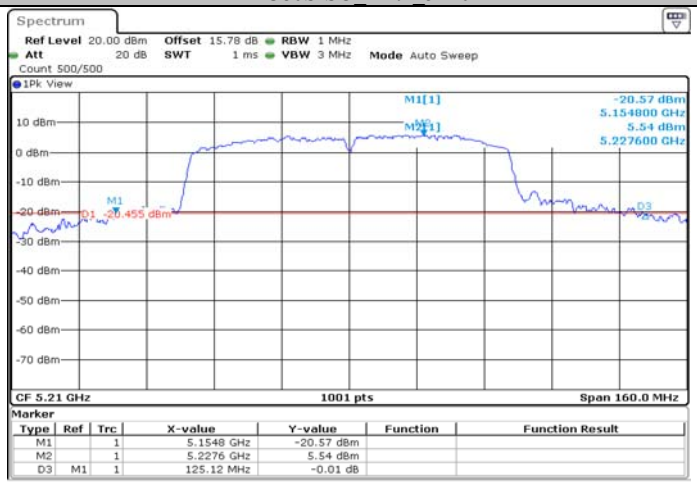
11AC40SISO_Ant1_5190



11AC40SISO_Ant1_5230



11AC80SISO_Ant1_5210



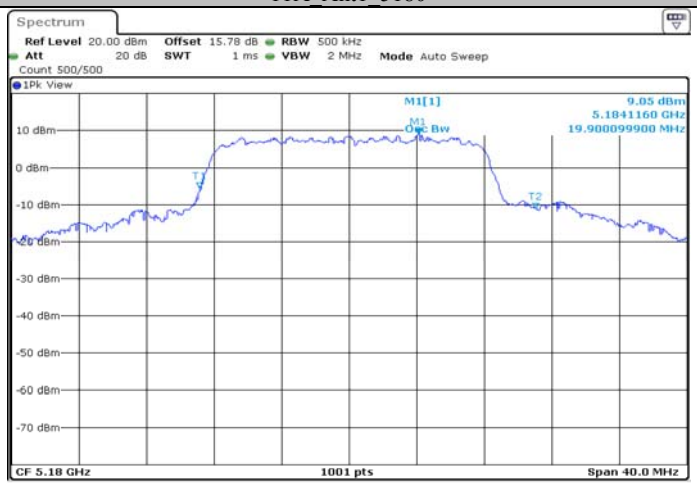
AppendixA2: Occupied channel bandwidth

Test Result

Test Mode	Antenna	Channel	OCB [MHz]	Limit[MHz]	Verdict
11A	Ant1	5180	19.900	---	PASS
		5200	20.699	---	PASS
		5240	17.343	---	PASS
11N20SISO	Ant1	5180	21.818	---	PASS
		5200	22.977	---	PASS
		5240	18.541	---	PASS
11N40SISO	Ant1	5190	45.235	---	PASS
		5230	37.642	---	PASS
11AC20SISO	Ant1	5180	18.462	---	PASS
		5200	18.741	---	PASS
		5240	19.061	---	PASS
11AC40SISO	Ant1	5190	41.399	---	PASS
		5230	37.802	---	PASS
11AC80SISO	Ant1	5210	76.244	---	PASS

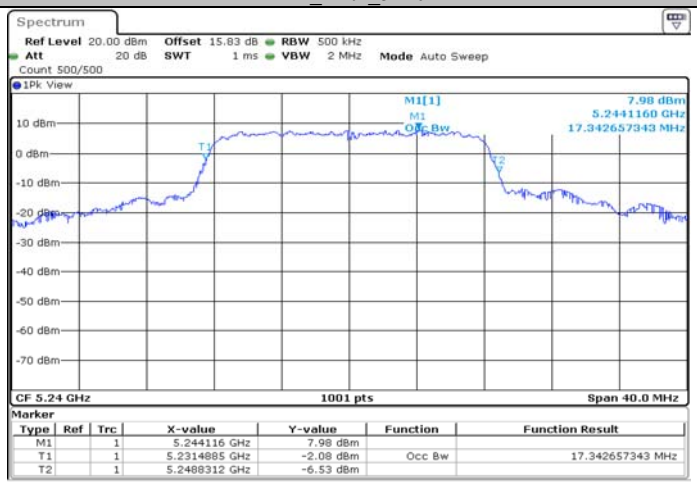
Test Graphs

11A_Ant1_5180

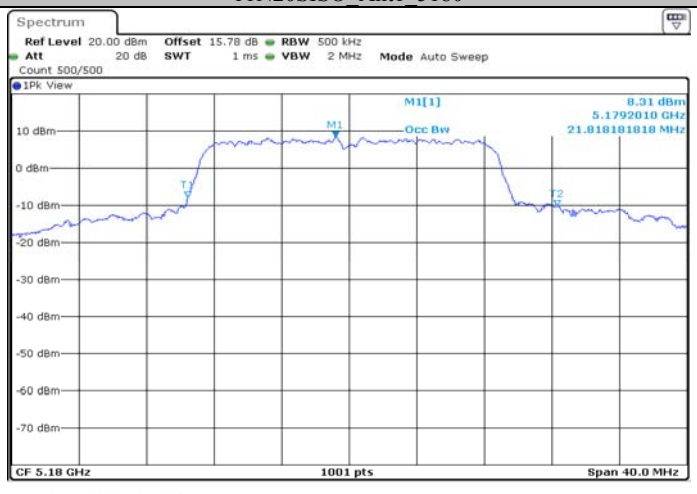


11A_Ant1_5200

11A_Ant1_5240

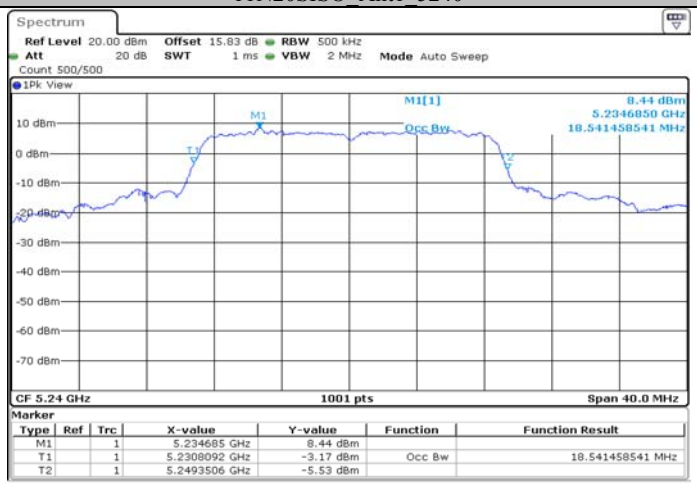


11N20SISO_Ant1_5180



11N20SISO_Ant1_5200

11N20SISO_Ant1_5240



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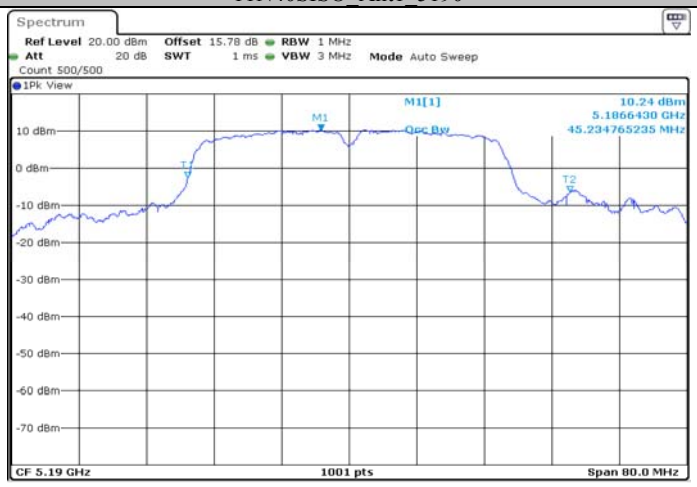
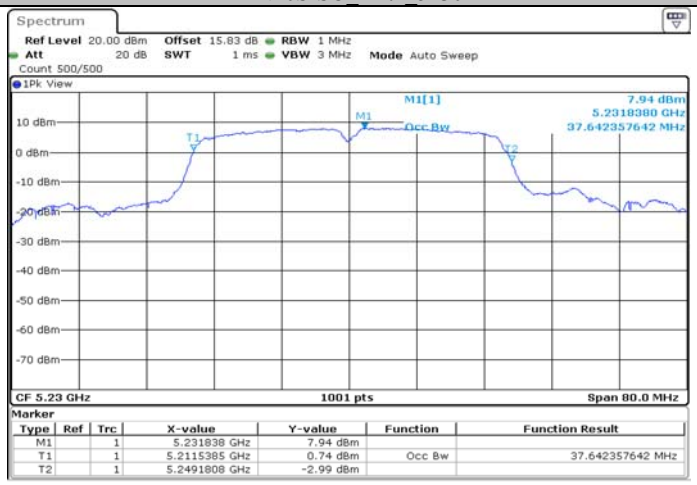
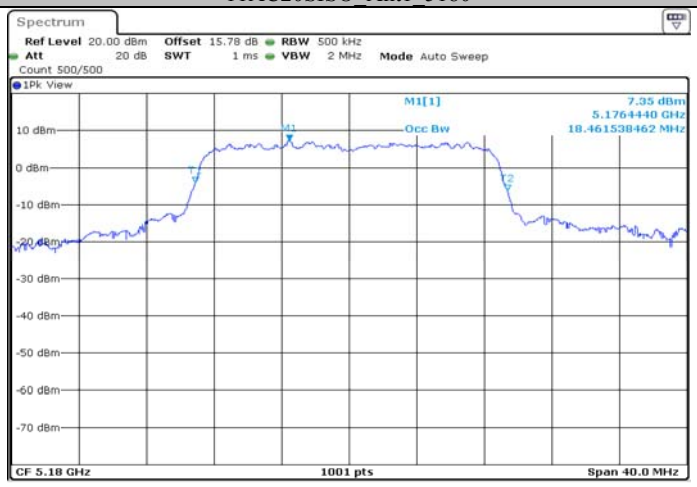


11N40SISO_Ant1_5230

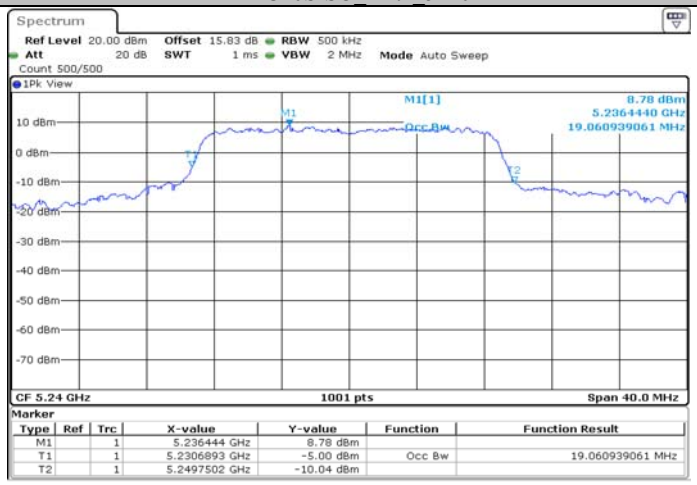


11AC20SISO_Ant1_5180

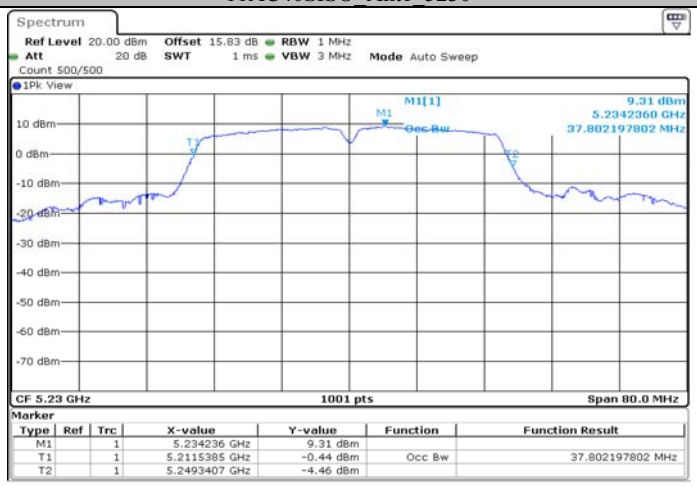


11AC20SISO_Ant1_5200

11AC20SISO_Ant1_5240



11AC40SISO_Ant1_5190

11AC40SISO_Ant1_5230


11AC80SISO_Ant1_5210


AppendixB: Maximum conducted average output power

Test Result

Test Mode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11A	Ant1	5180	15.52	<=23.98	PASS
		5200	16.16	<=23.98	PASS
		5240	16.81	<=23.98	PASS
11N20SISO	Ant1	5180	16.64	<=23.98	PASS
		5200	17.00	<=23.98	PASS
		5240	17.62	<=23.98	PASS
11N40SISO	Ant1	5190	17.82	<=23.98	PASS
		5230	18.35	<=23.98	PASS
11AC20SISO	Ant1	5180	15.13	<=23.98	PASS
		5200	15.68	<=23.98	PASS
		5240	16.19	<=23.98	PASS
11AC40SISO	Ant1	5190	17.56	<=23.98	PASS
		5230	16.05	<=23.98	PASS
11AC80SISO	Ant1	5210	16.34	<=23.98	PASS

Note: EUT is client.

AppendixC: Maximum power spectral density

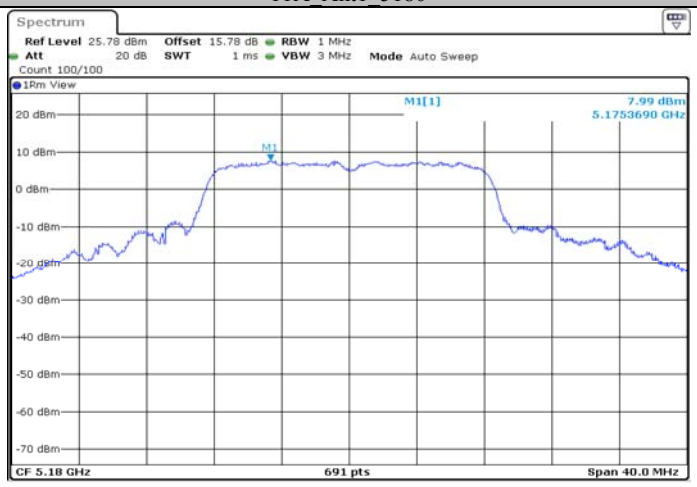
Test Result

Test Mode	Antenna	Channel	Result [dBm/MHz]	Limit[dBm/MHz]	Verdict
11A	Ant1	5180	7.99	<=11	PASS
		5200	8.15	<=11	PASS
		5240	9.02	<=11	PASS
11N20SISO	Ant1	5180	8.45	<=11	PASS
		5200	8.93	<=11	PASS
		5240	9.72	<=11	PASS
11N40SISO	Ant1	5190	9.07	<=11	PASS
		5230	9.76	<=11	PASS
11AC20SISO	Ant1	5180	8.52	<=11	PASS
		5200	9.06	<=11	PASS
		5240	9.79	<=11	PASS
11AC40SISO	Ant1	5190	8.89	<=11	PASS
		5230	7.93	<=11	PASS
11AC80SISO	Ant1	5210	4.48	<=11	PASS

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

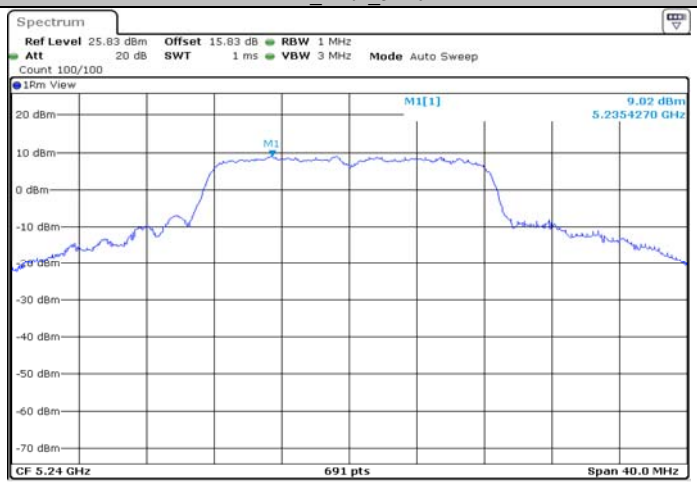
Test Graphs

11A_Ant1_5180

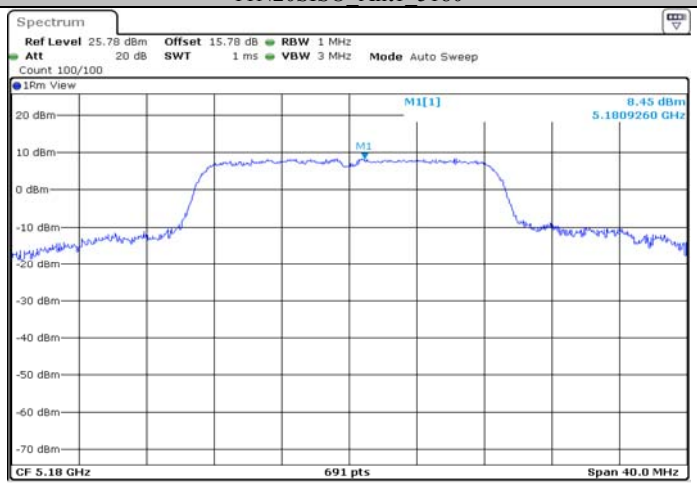


11A_Ant1_5200

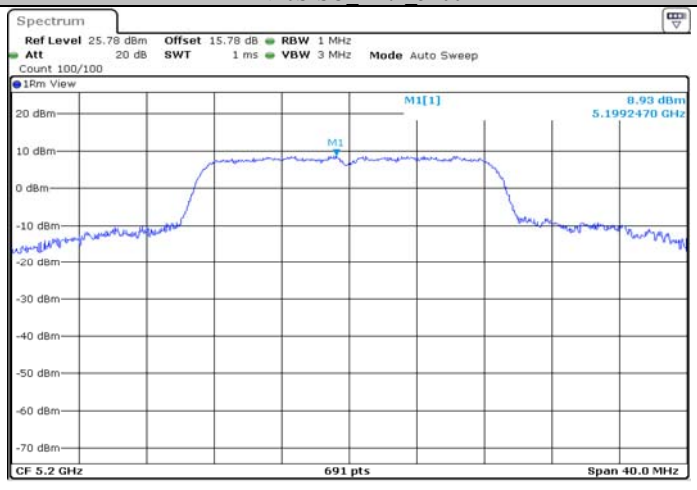
11A_Ant1_5240



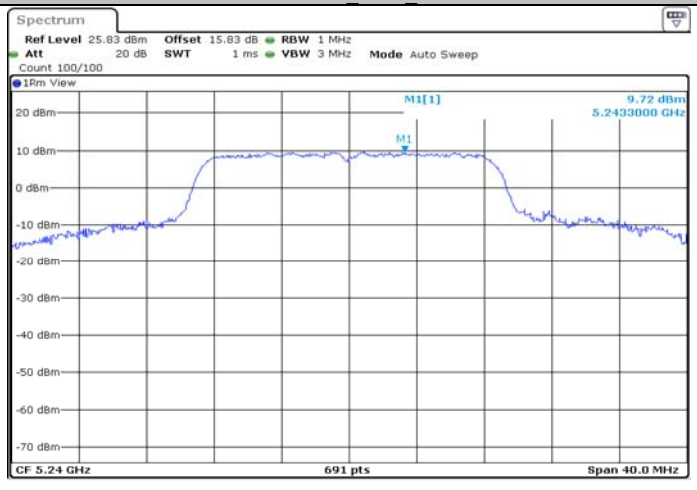
11N20SISO_Ant1_5180



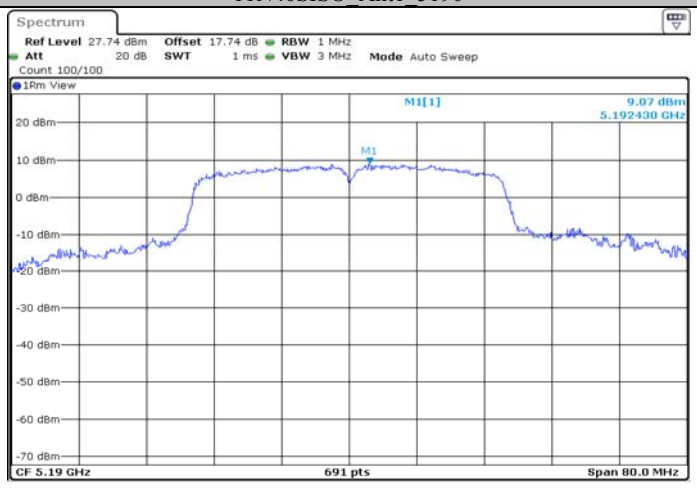
11N20SISO_Ant1_5200



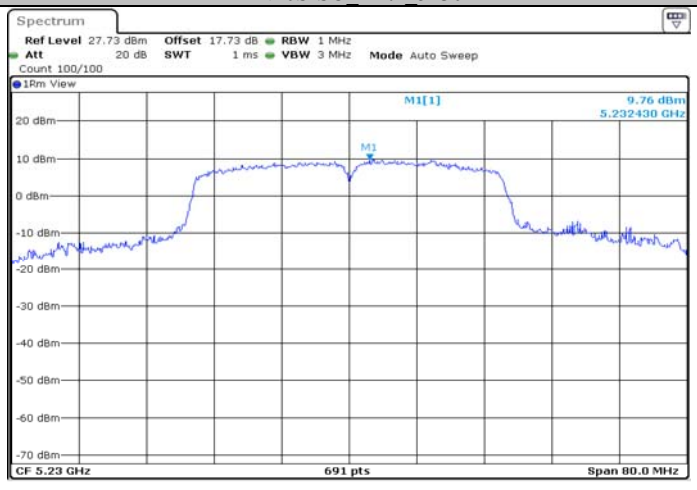
11N20SISO_Ant1_5240



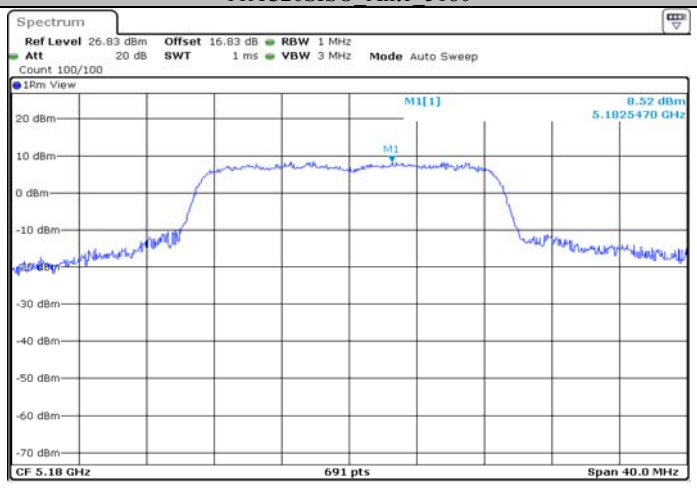
11N40SISO_Ant1_5190



11N40SISO_Ant1_5230



11AC20SISO_Ant1_5180



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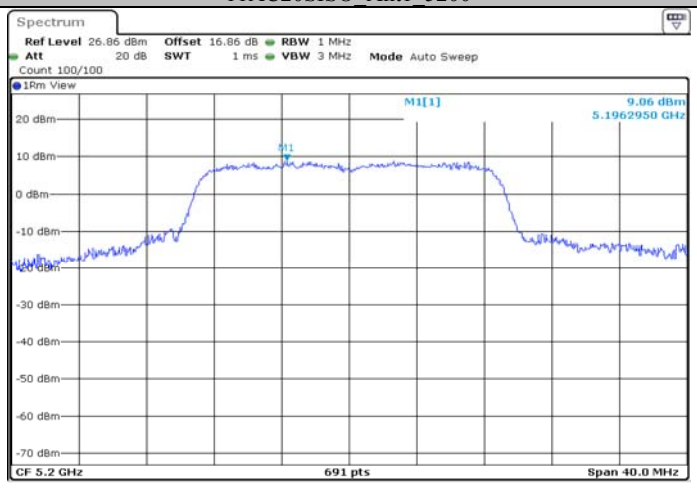

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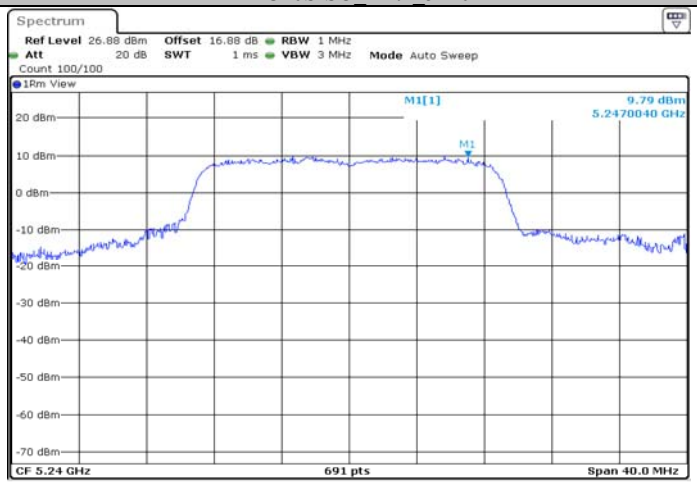
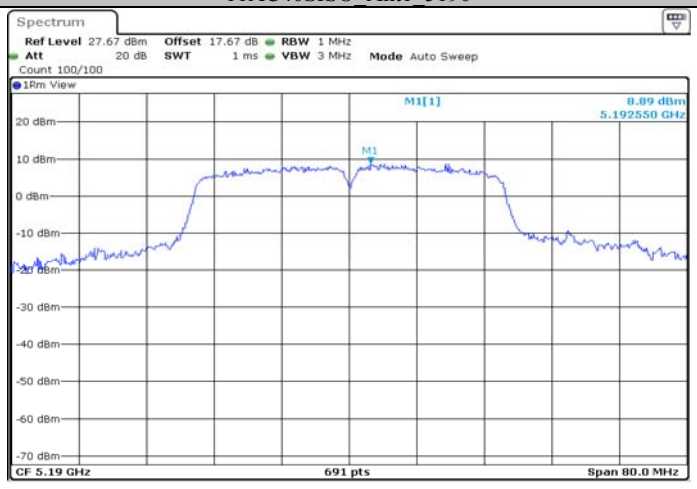


11AC40SISO_Ant1_5190



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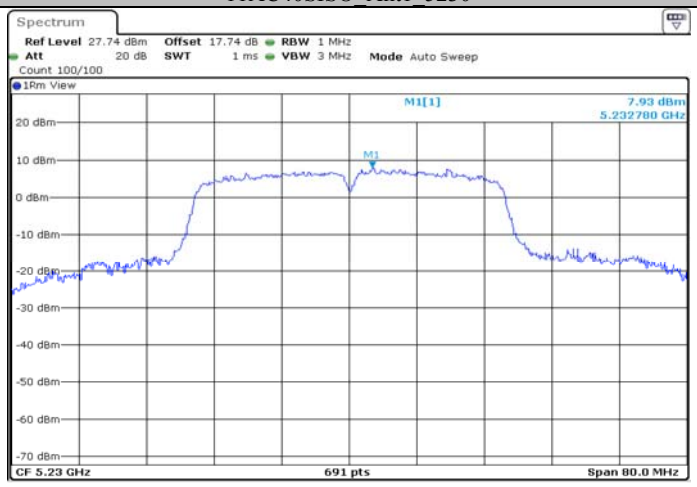
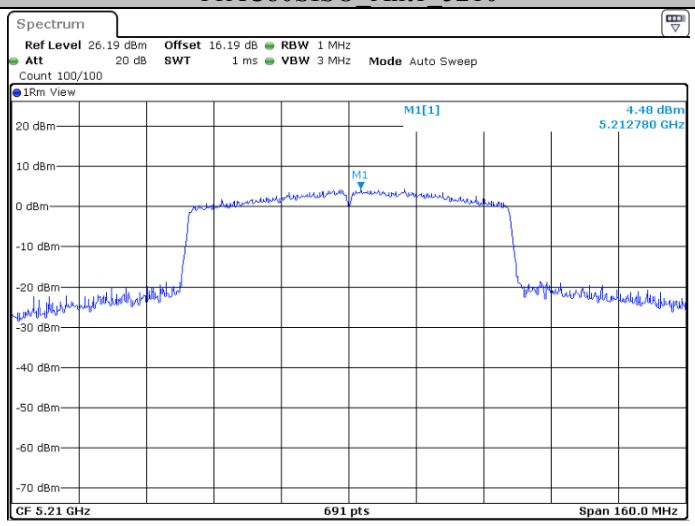

11AC80SISO_Ant1_5210


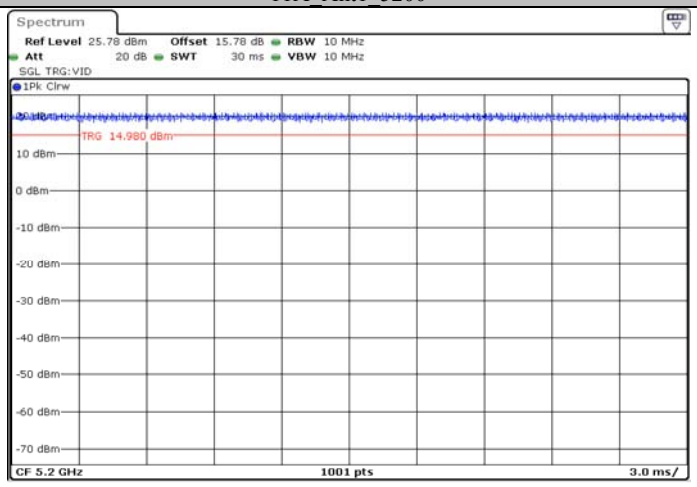
AppendixH: Duty Cycle

Test Result

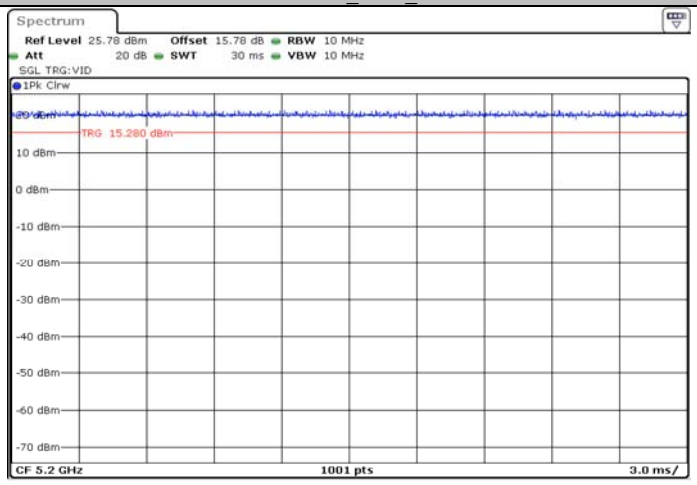
Test Mode	Antenna	Channel	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
11A	Ant1	5200	30.00	30.00	100.00
11N20SISO	Ant1	5200	30.00	30.00	100.00
11N40SISO	Ant1	5190	0.91	1.43	63.64
11AC20SISO	Ant1	5200	1.87	2.40	77.92
11AC40SISO	Ant1	5190	0.91	1.43	63.64
11AC80SISO	Ant1	5210	0.43	0.96	44.79

Test Graphs

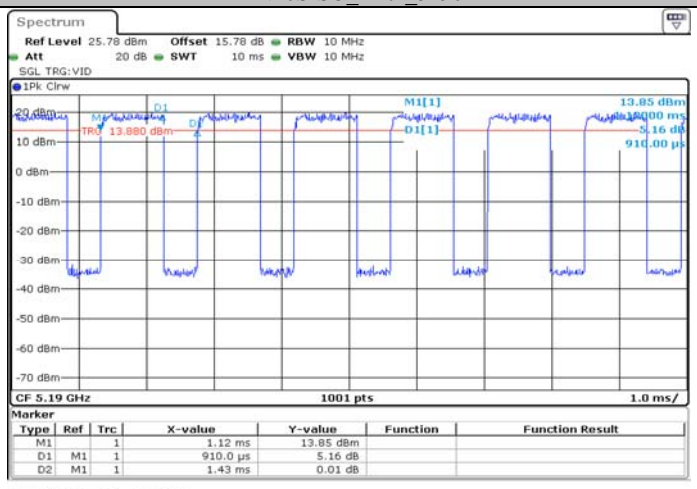
11A_Ant1_5200



11N20SISO_Ant1_5200



11N40SISO_Ant1_5190



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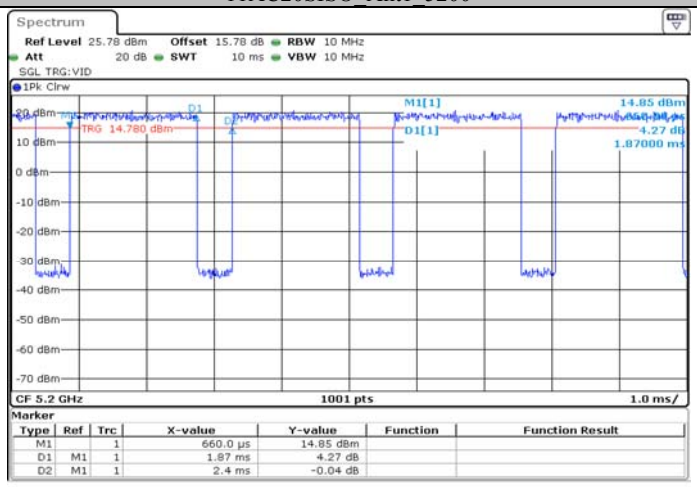
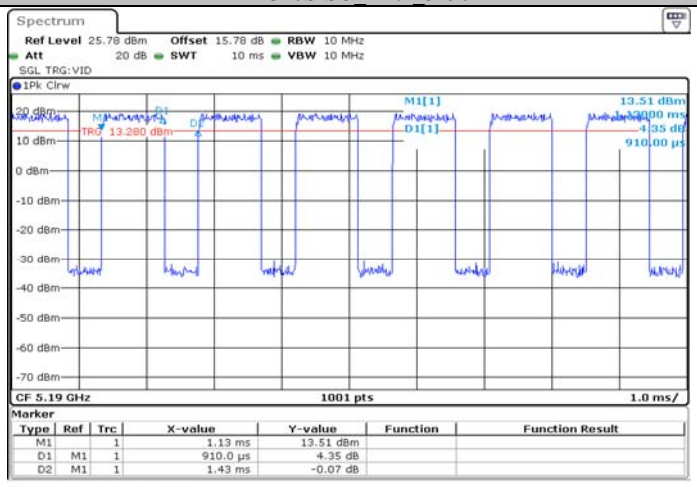
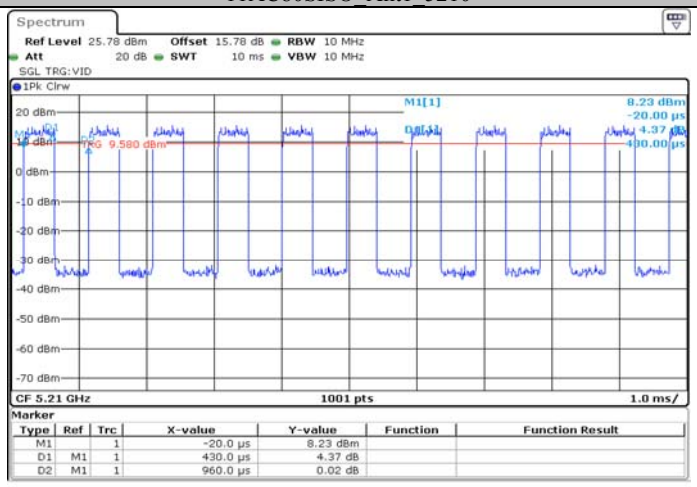


11AC40SISO_Ant1_5190



11AC80SISO_Ant1_5210



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