FCC RF Test Report

APPLICANT	:	Motorola Mobility LLC
EQUIPMENT	:	Mobile Cellular Phone
BRAND NAME	:	Motorola
MODEL NAME	:	XT2221-1
FCC ID	:	IHDT56AE1
STANDARD	:	FCC Part 15 Subpart E §15.407
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure
TEST DATE(S)	:	Jan. 21, 2022 ~ Feb. 16, 2022

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia

Reviewed by: Jason Jia / Supervisor

Alexwang

Approved by: Alex Wang / Manager

ACCREDITED
Cert #5145.02

Sporton International Inc. (Kunshan)
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People's Republic of China

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR1D1023E	Rev. 01	Initial issue of report	Feb. 18, 2022

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	2.1049 & 15.403(i)	26dB & 99% Bandwidth	-	Report only	-
3.2	15.407(a)	Maximum Conducted Output Power	≤ 24 dBm	Pass	-
3.3	15.407(a)	Power Spectral Density	≤ 11 dBm	Pass	-
3.4	15.407(b)	Unwanted Emissions	15.407(b) & 15.209(a)	Pass	Under limit 3.08 dB at 5460.00 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 11.97 dB at 0.193 MHz
3.6	15.203 & 15.407(a)	Antenna Requirement	15.203 & 15.407(a)	Pass	-

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

1 General Description

1.1 Applicant

Motorola Mobility LLC
222 W,Merchandise Mart Plaza, Chicago IL 60654 USA

1.2 Manufacturer

Motorola Mobility LLC
222 W,Merchandise Mart Plaza, Chicago IL 60654 USA

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Cellular Phone
Brand Name	Motorola
Model Name	XT2221-1
FCC ID	IHDT56AE1
IMEI Code	Conducted:358026320083036/358026320083044 Conduction:358026320007456/358026320007464 Radiation: 358026320007456/358026320007464
HW Version	DVT2
SW Version	S1SR32.16
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	5180 MHz ~ 5240 MHz 5260 MHz ~ 5320 MHz 5500 MHz ~ 5720 MHz
Maximum Output Power to Antenna	**<5180 MHz ~ 5240 MHz>** 802.11a : 18.09 dBm / 0.0644 W 802.11n HT20 : 17.98 dBm / 0.0628 W 802.11n HT40 : 16.56 dBm / 0.0453 W 802.11ac VHT20 : 16.19 dBm / 0.0416 W 802.11ac VHT40 : 14.92 dBm / 0.0310 W 802.11ac VHT80 : 11.56 dBm / 0.0143 W **<5260 MHz ~ 5320 MHz>** 802.11a : 18.08 dBm / 0.0643 W 802.11n HT20 : 17.79 dBm / 0.0601 W 802.11n HT40 : 16.99 dBm / 0.0500 W 802.11ac VHT20 : 16.00 dBm / 0.0398 W 802.11ac VHT40 : 14.89 dBm / 0.0308 W 802.11ac VHT80 : 11.99 dBm / 0.0158 W **<5500 MHz ~ 5720 MHz >** 802.11a : 18.21 dBm / 0.0662 W 802.11n HT20 : 17.93 dBm / 0.0621 W 802.11n HT40 : 16.79 dBm / 0.0478 W 802.11ac VHT20 : 16.24 dBm / 0.0421 W 802.11ac VHT40 : 14.96 dBm / 0.0313 W 802.11ac VHT80 : 14.13 dBm / 0.0259 W
99% Occupied Bandwidth	**<5180 MHz ~ 5240 MHz>** 802.11a : 16.73 MHz 802.11n HT20 : 17.93 MHz 802.11n HT40 : 36.46 MHz 802.11ac VHT80 : 75.52 MHz **<5260 MHz ~ 5320 MHz>** 802.11a : 16.68 MHz 802.11n HT20 : 17.93 MHz 802.11n HT40 : 36.56 MHz 802.11ac VHT80 : 75.52 MHz **<5500 MHz ~ 5720 MHz >** 802.11a : 16.83 MHz 802.11n HT20 : 18.03 MHz 802.11n HT40 : 36.56 MHz 802.11ac VHT80 : 75.64 MHz
Antenna Type / Gain	**<5180 MHz ~ 5240 MHz>** PIFA Antenna with gain -3.10 dBi **<5260 MHz ~ 5320 MHz>** PIFA Antenna with gain -3.10 dBi **<5500 MHz ~ 5720 MHz>** PIFA Antenna with gain -2.20 dBi
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)

Note: Note: For 802.11n HT20 / ac VHT20 and 802.11n HT40 / ac VHT40 mode, the whole testing have assessed only 802.11n HT20/HT40 by referring to their maximum conducted power.

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Specification of Accessory

Specification of Accessory				
AC Adapter 1(US)	**Brand Name**	Motorola (Salcomp)	**Model Name**	MC-331
AC Adapter 1(EU)	**Brand Name**	Motorola (Salcomp)	**Model Name**	MC-332
AC Adapter 1(UK)	**Brand Name**	Motorola (Salcomp)	**Model Name**	MC-333
AC Adapter 1(IN)	**Brand Name**	Motorola (Salcomp)	**Model Name**	MC-334
AC Adapter 1(AU)	**Brand Name**	Motorola (Salcomp)	**Model Name**	MC-335
AC Adapter 1(AR)	**Brand Name**	Motorola (Salcomp)	**Model Name**	MC-336
AC Adapter 1(BR)	**Brand Name**	Motorola (Salcomp)	**Model Name**	MC-337
AC Adapter 1(Chile)	**Brand Name**	Motorola (Salcomp)	**Model Name**	MC-339
AC Adapter 2(US)	**Brand Name**	Motorola (Acbel)	**Model Name**	MC-331
AC Adapter 2(EU)	**Brand Name**	Motorola (Acbel)	**Model Name**	MC-332
AC Adapter 2(UK)	**Brand Name**	Motorola (Acbel)	**Model Name**	MC-333
AC Adapter 3(US)	**Brand Name**	Motorola (Aohai)	**Model Name**	MC-331
AC Adapter 3(EU)	**Brand Name**	Motorola (Aohai)	**Model Name**	MC-332
AC Adapter 3(UK)	**Brand Name**	Motorola (Aohai)	**Model Name**	MC-333
Battery	**Brand Name**	Motorola (Sunwoda)	**Model Name**	NE50
Earphone 1	**Brand Name**	Motorola (NEW LEADER)	**Model Name**	NLD-EM313A-09SF
Earphone 2	**Brand Name**	Motorola (NEW LEADER)	**Model Name**	NLD-EM313A-19SF
Earphone 3	**Brand Name**	Motorola (LYAND ACOUSTIC)	**Model Name**	LYM239-76C-006
Earphone 4	**Brand Name**	Motorola (LYAND ACOUSTIC)	**Model Name**	LYM528-76C-001
USB Cable 1	**Brand Name**	Motorola (Saibao)	**Model Name**	SHQ-A110A
USB Cable 2	**Brand Name**	Motorola (Chuantuo)	**Model Name**	K235

1.7 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	**Sporton Site No.**	**FCC Designation No.**	**FCC Test Firm Registration No.**
	CO01-KS 03CH04-KS TH01-KS	CN1257	314309

1.8 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH04-KS	AUDIX	E3	6.2009-8-24a
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.9 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR Part 15 Subpart E
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report.

b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5180-5240 MHz U-NII-1	36	5180	44	5220
	38*	5190	46*	5230
	40	5200	48	5240
	42#	5210		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5260-5320 MHz U-NII-2A	52	5260	60	5300
	54*	5270	62*	5310
	56	5280	64	5320
	58#	5290		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5500- 5720 MHz MHz U-NII-2C	100	5500	112	5560
	102*	5510	116	5580
	104	5520	132	5660
	106#	5530	134*	5670
	108	5540	136	5680
	110*	5550	140	5700

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
TDWR Channel	118*	5590	124	5620
	120	5600	126*	5630
	122#	5610	128	5640

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
Straddle Channel	138#	5690	144	5720
	142*	5710		

Note:

1. The above Frequency and Channel in "*" were 802.11n HT40 and 802.11ac VHT40.
2. The above Frequency and Channel in "#" were 802.11ac VHT80.

2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11a	6 Mbps
802.11n HT20	MCS0
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0

Test Cases	
AC Conducted Emission	Mode 1 : GSM850 Idle + Bluetooth Link + WLAN(5G)Link + USB Cable 1(Charging from Adapter 1) +Earphone1
Remark: For Radiated Test Cases, The tests were performance with Adapter 1, Earphone 1, USB Cable 1	

Simultaneous transmission
802.11n HT40 CH102(5510MHz)+GSM 850

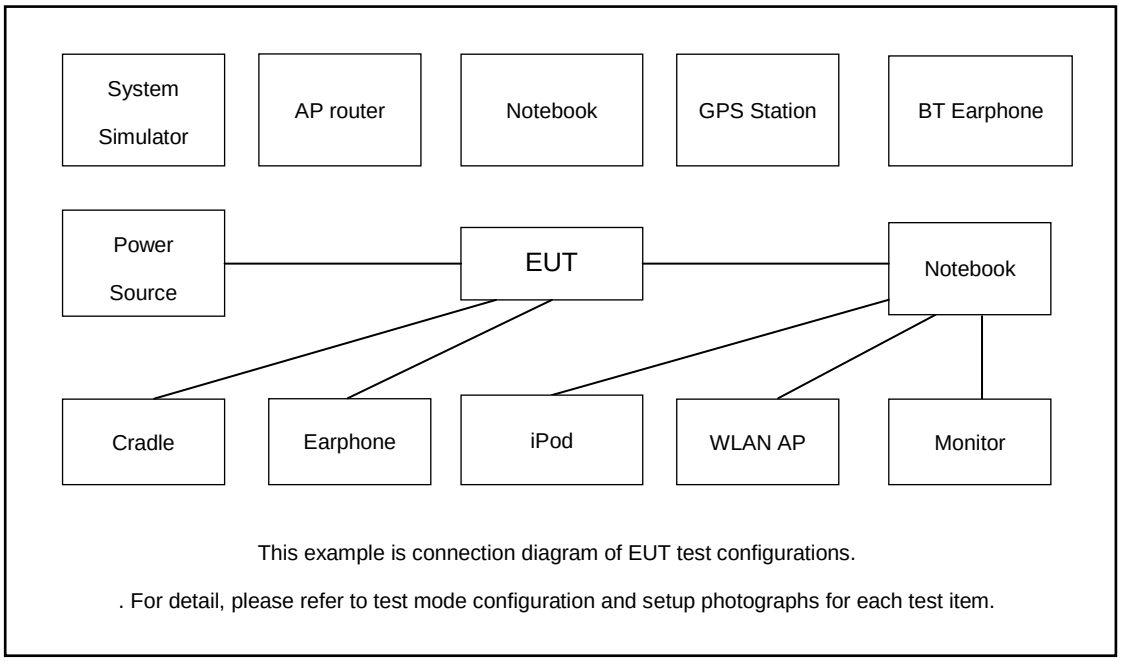
Ch. #		U-NII-1 : 5180-5240 MHz	U-NII-2A : 5260-5320 MHz	U-NII-2C : 5500- 5720 MHz
		802.11a	802.11a	802.11a
L	Low	36	52	100
M	Middle	44	60	116
H	High	48	64	140
Straddle		-	-	144

Ch. #		U-NII-1 : 5180-5240 MHz	U-NII-2A : 5260-5320 MHz	U-NII-2C : 5500- 5720 MHz
		802.11n HT20	802.11n HT20	802.11n HT20
L	Low	36	52	100
M	Middle	44	60	116
H	High	48	64	140
Straddle		-	-	144

Ch. #		U-NII-1 : 5180-5240 MHz	U-NII-2A : 5260-5320 MHz	U-NII-2C : 5500- 5720 MHz
		802.11n HT40	802.11n HT40	802.11n HT40
L	Low	38	54	102
M	Middle	-	-	110
H	High	46	62	134
Straddle		-	-	142

Ch. #		U-NII-1 : 5180-5240 MHz	U-NII-2A : 5260-5320 MHz	U-NII-2C : 5500- 5720 MHz
		802.11ac VHT80	802.11ac VHT80	802.11ac VHT80
L	Low	-	-	106
M	Middle	42	58	-
H	High	-	-	122
Straddle		-	-	138

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	LTE Base Station	Anritus	MT8821C	N/A	N/A	Unshielded,1.8m
2.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
3.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
4.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A
5.	Earphone	Motorola	N/A	N/A	N/A	N/A
6.	Adapter	N/A	N/A	N/A	N/A	N/A
7.	SD Card	Kingston	8GB	N/A	N/A	N/A

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuous transmit/receive.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example :

The spectrum analyzer offset is derived from RF cable loss.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 7.0dB.

Offset(dB) = RF cable loss(dB).

=7.0 (dB)

3 Test Result

3.1 26dB & 99% Occupied Bandwidth Measurement

3.1.1 Description of 26dB & 99% Occupied Bandwidth

This section is for reporting purpose only.

There is no restriction limits for bandwidth.

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

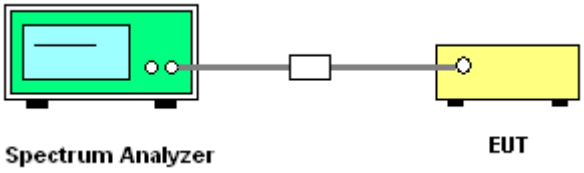
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section C) Emission bandwidth
2. Set RBW = approximately 1% of the emission bandwidth.
3. Set the VBW > RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 26 dB down from the peak 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%.
7. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1% to 5% of the OBW and set the Video bandwidth (VBW) ≥ 3 * RBW.
8. Measure and record the results in the test report.

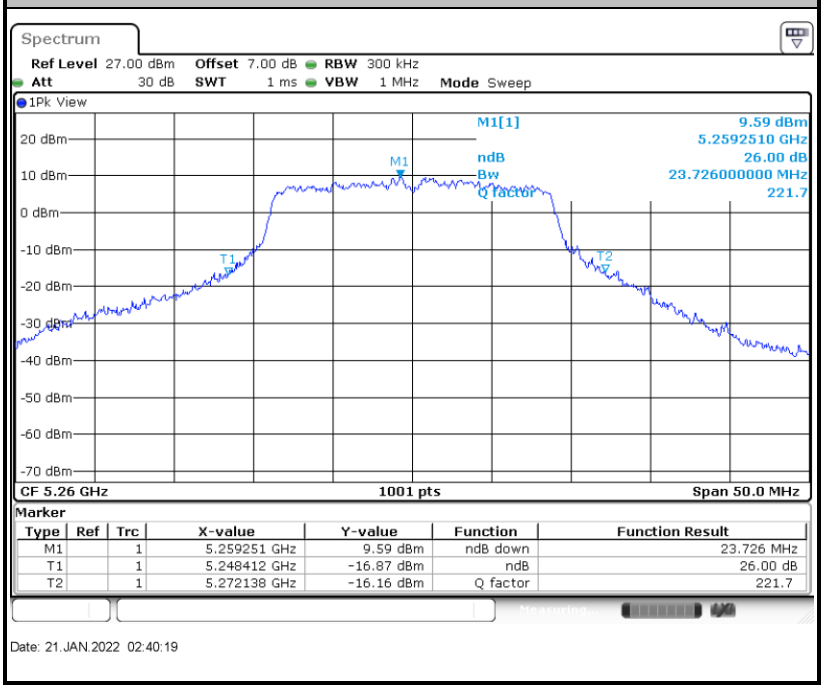
3.1.4 Test Setup



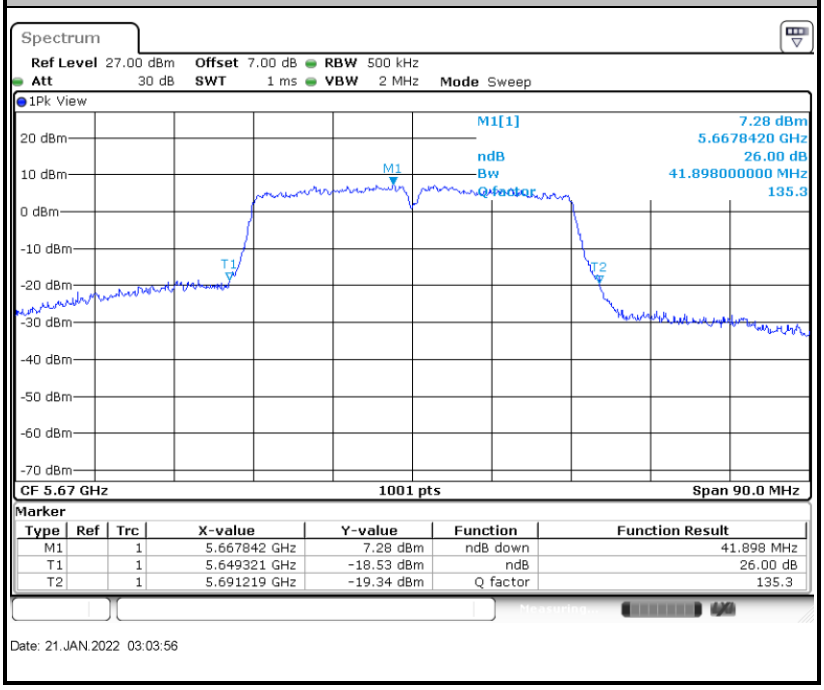
3.1.5 Test Result of 26dB & 99% Occupied Bandwidth

Please refer to Appendix A.

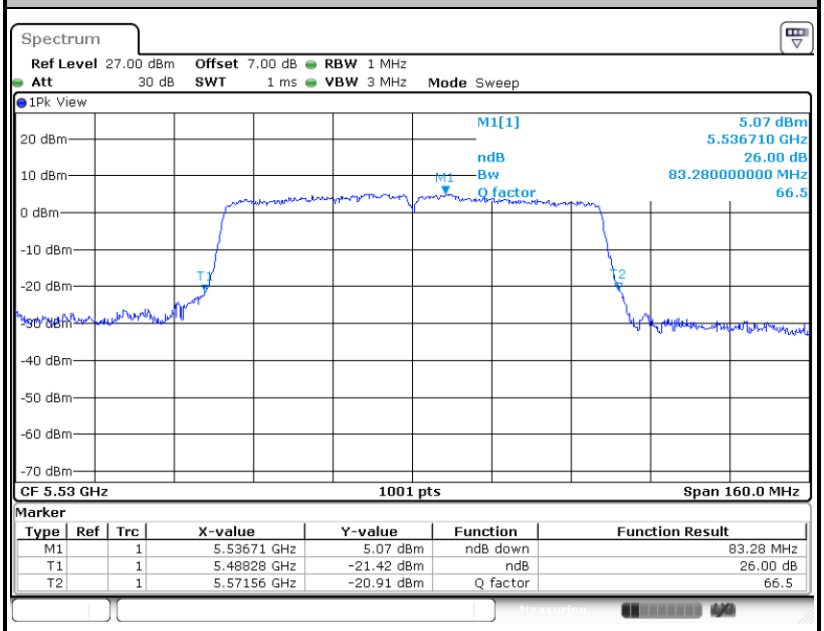
Maximum 26dB Bandwidth for 20M BW



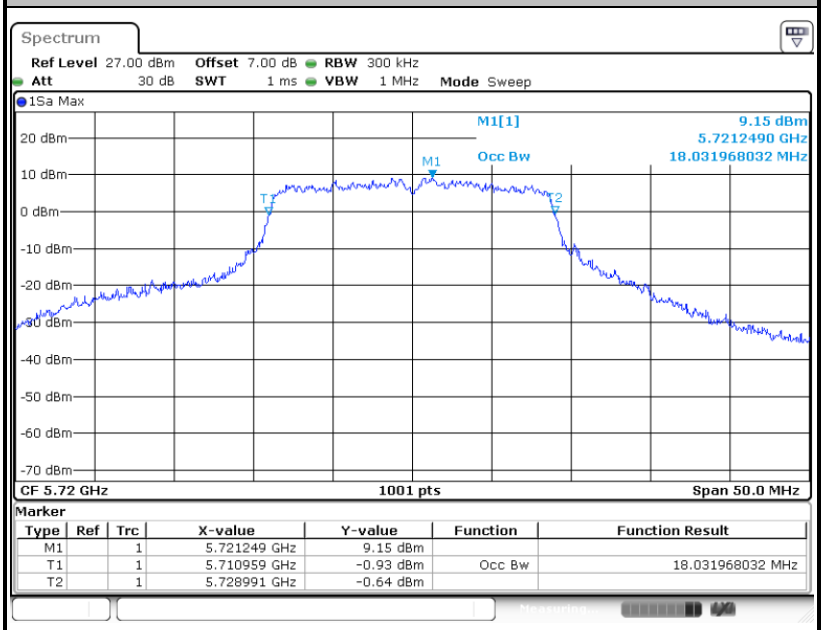
Maximum 26dB Bandwidth for 40M BW



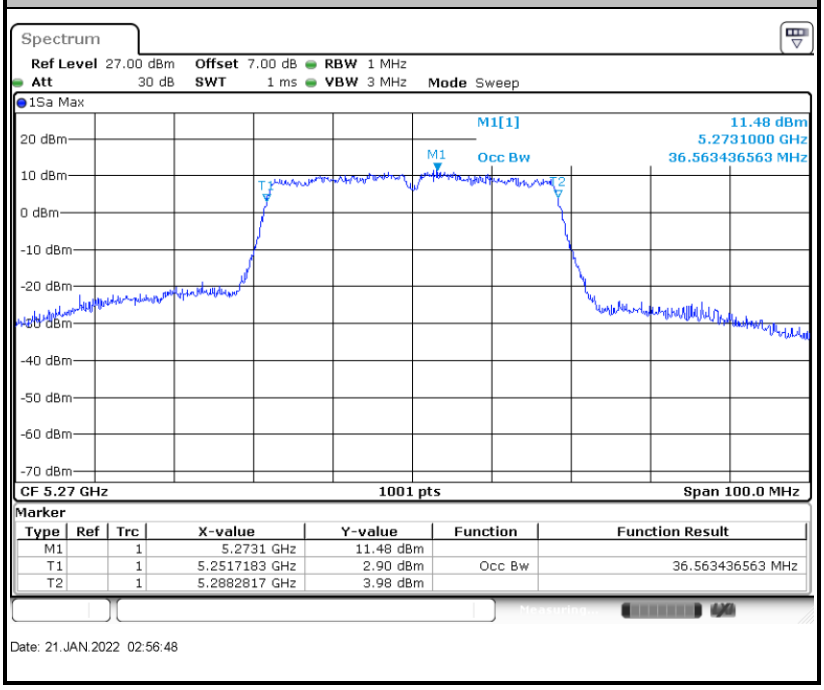
Maximum 26dB Bandwidth for 80M BW



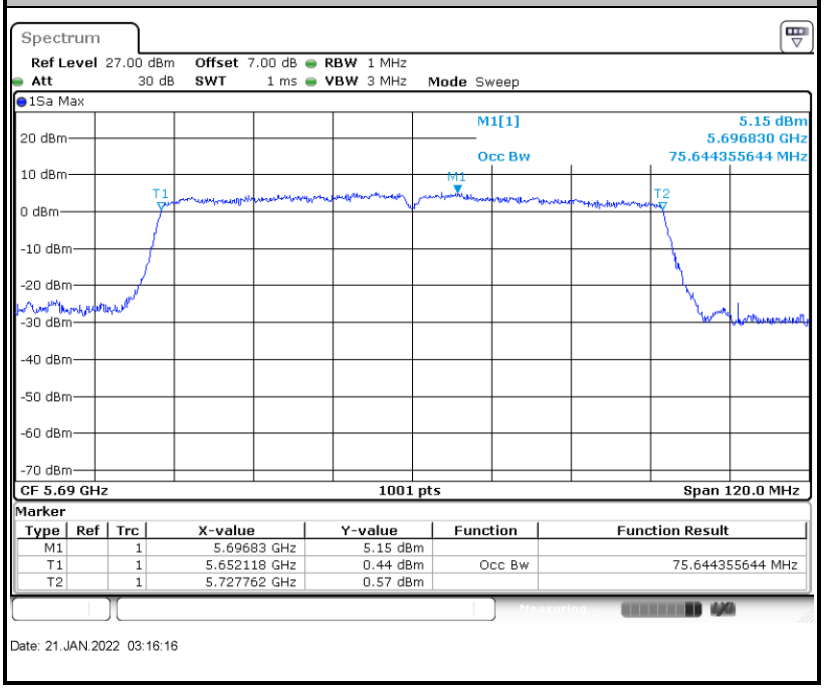
Maximum 99% Occupied Bandwidth for 20M BW



Maximum 99% Occupied Bandwidth for 40M BW



Maximum 99% Occupied Bandwidth for 80M BW



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Maximum Conducted Output Power Measurement

3.2.1 Limit of Maximum Conducted Output Power

<FCC 14-30 CFR 15.407>

For mobile and portable 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.

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

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note that U-NII-2 band, devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

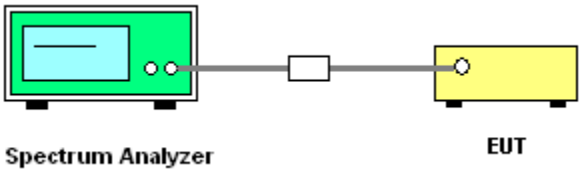
The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

Method PM (Measurement using an RF average power meter):

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, 10 log(1/x), where x is the duty cycle.

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

3.2.4 Test Setup



3.2.5 Test Result of Maximum Conducted Output Power

Please refer to Appendix A.

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

<FCC 14-30 CFR 15.407>

For mobile and portable client devices in the 5.15–5.25 GHz band, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.

For the 5.25–5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section F) Maximum power spectral density.

 # Method SA-2 #

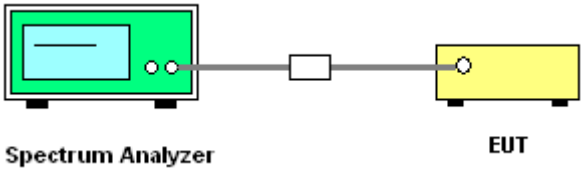
(trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 1 MHz.
- Set VBW ≥ 3 MHz.
- Number of points in sweep ≥ 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times. For example, add 10 log(1/0.25) = 6

dB if the duty cycle is 25 percent.

1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.

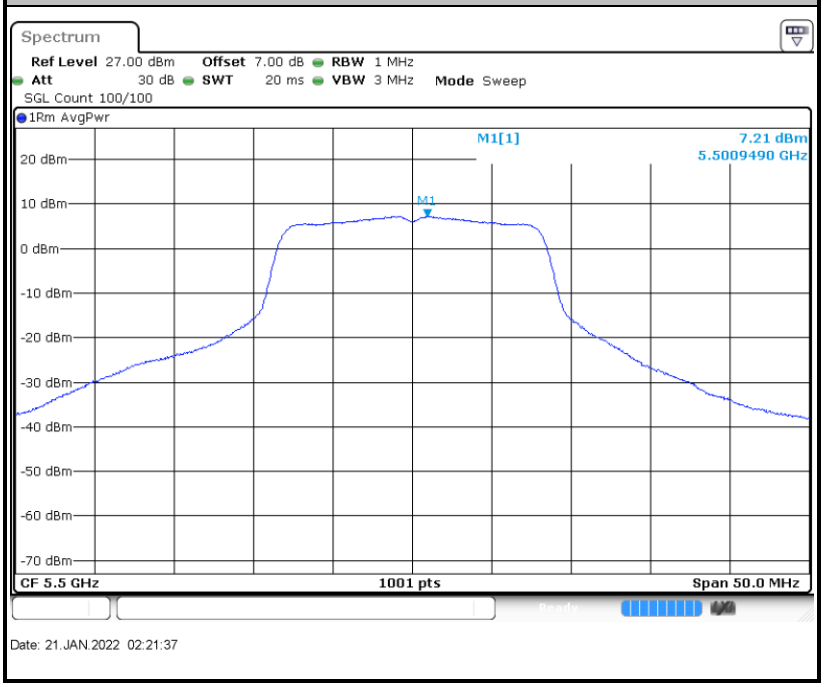
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/MHz)



Note: Average Power Density (dB) = Measured value+ Duty Factor

3.4 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.4.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5725 MHz band: all emissions outside of the 5470-5725 MHz band shall not exceed an EIRP of -27 dBm/MHz.

(2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.2

Note: The following formula is used to convert the EIRP to field strength.

$$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.7$$

where

EIRP is the equivalent isotropically radiated power, in dBm

E_{Meas} is the field strength of the emission at the measurement distance, in dBμV/m

d_{Meas} is the measurement distance, in m

(3) ANSI C63.10-2013 clause 12.7.3 note 97

As specified by regulatory requirements, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit. However, an out-of-band emission that complies with both the average and peak general regulatory limits is not required to satisfy the peak emission limit.

3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.

   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz

   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz

   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

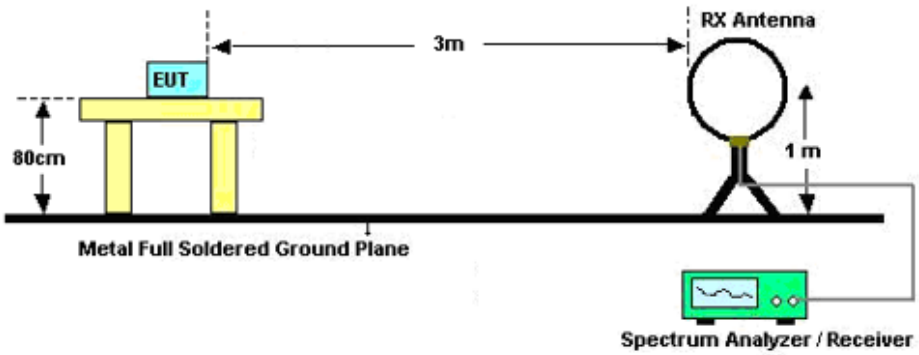
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

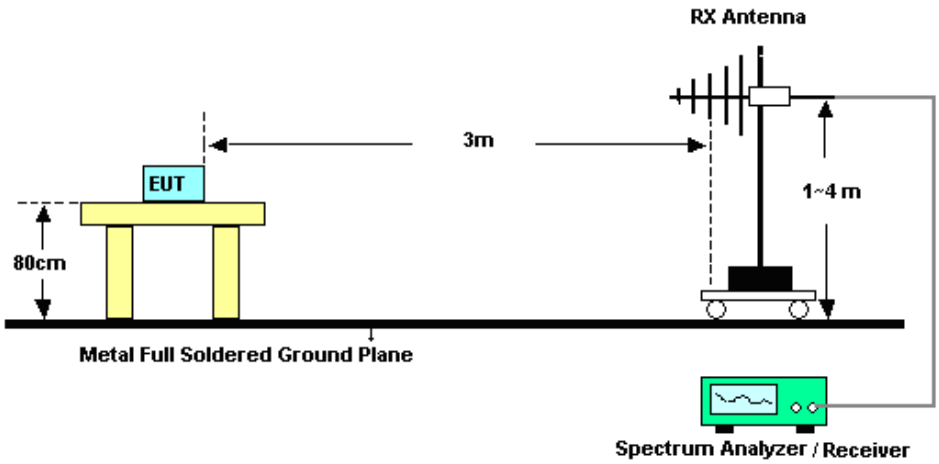
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.4.4 Test Setup

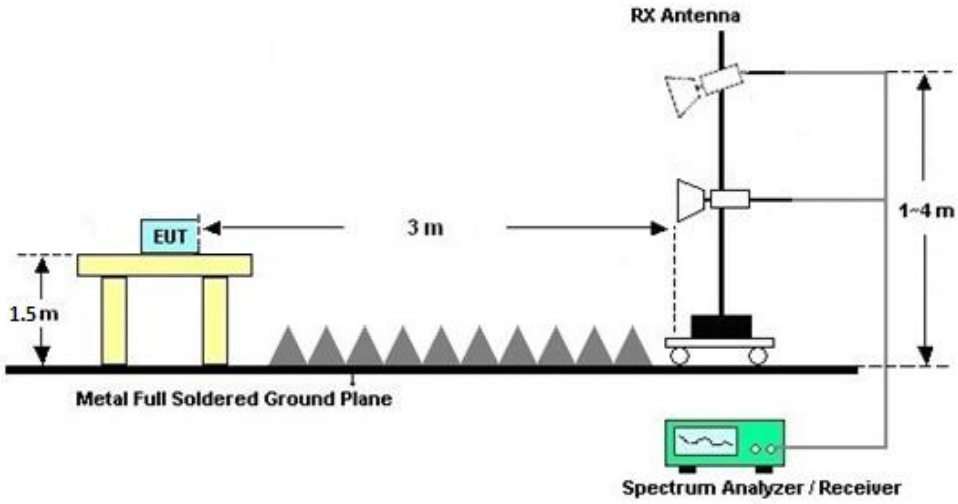
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.4.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

3.4.7 Duty Cycle

Please refer to Appendix D.

3.4.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.

3.5 AC Conducted Emission Measurement

3.5.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

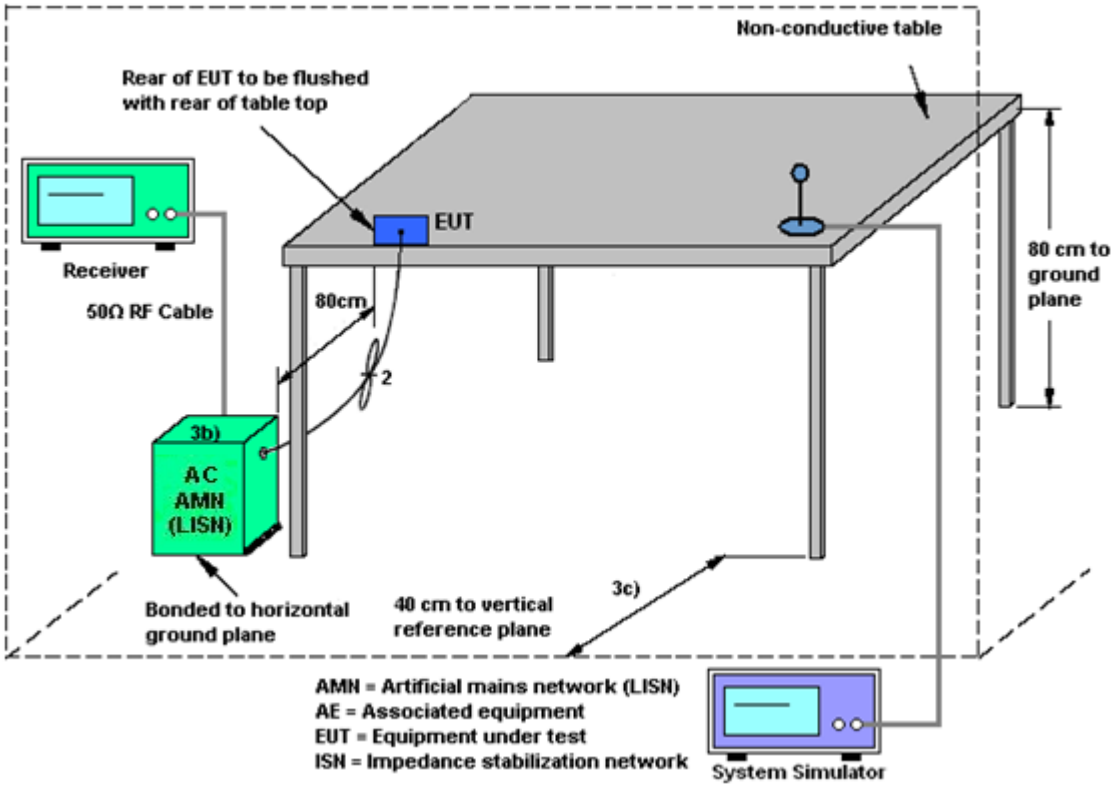
3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.5.4 Test Setup



3.5.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.6 Antenna Requirements

3.6.1 Standard Applicable

If transmitting antenna directional gain is greater than 6 dBi, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.6.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101040	10Hz~40GHz	Oct. 14, 2021	Jan. 21, 2022	Oct. 13, 2022	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 07, 2022	Jan. 21, 2022	Jan. 06, 2023	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 07, 2022	Jan. 21, 2022	Jan. 06, 2023	Conducted (TH01-KS)
Temperature &humidity chamber	Hongzhan	LP-150U	H2014011440	-40~+150°C 20%~95%RH	Jul. 12, 2021	Jan. 21, 2022	Jul. 11, 2022	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY57290151	3Hz~8.5GHz;Max 30dBm	Jul. 12, 2021	Feb. 16, 2022	Jul. 11, 2022	Radiation (03CH04-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150244	10Hz-44G,MAX 30dB	Apr. 13, 2021	Feb. 16, 2022	Apr. 12, 2022	Radiation (03CH04-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 30, 2021	Feb. 16, 2022	Oct. 29, 2022	Radiation (03CH04-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz-1GHz	May 30, 2021	Feb. 16, 2022	May 29, 2022	Radiation (03CH05-KS)
Horn Antenna	Schwarzbeck	BBHA9120D	1356	1GHz~18GHz	Apr. 18, 2021	Feb. 16, 2022	Apr. 17, 2022	Radiation (03CH04-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 05, 2022	Feb. 16, 2022	Jan. 04, 2023	Radiation (03CH04-KS)
Amplifier	Burgeon	BPA-530	102219	0.01MHz ~3000MHz	Nov. 01, 2021	Feb. 16, 2022	Oct. 31, 2022	Radiation (03CH04-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 05, 2022	Feb. 16, 2022	Jan. 04, 2023	Radiation (03CH04-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	1Ghz-18Ghz	Jul. 30, 2021	Feb. 16, 2022	Jul. 29, 2022	Radiation (03CH04-KS)
Amplifier	Keysight	83017A	MY57280106	500MHz~26.5GHz	Oct. 12, 2021	Feb. 16, 2022	Oct. 11, 2022	Radiation (03CH04-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Feb. 16, 2022	NCR	Radiation (03CH04-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Feb. 16, 2022	NCR	Radiation (03CH04-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Feb. 16, 2022	NCR	Radiation (03CH04-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 21, 2021	Jan. 22, 2022	Apr. 20, 2022	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 14, 2021	Jan. 22, 2022	Oct. 13, 2022	Conduction (CO01-KS)
AC LISN	R&S	ENV216	100334	9kHz~30MHz	Oct. 14, 2021	Jan. 22, 2022	Oct. 13, 2022	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 14, 2021	Jan. 22, 2022	Oct. 13, 2022	Conduction (CO01-KS)

NCR: No Calibration Required

5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.94dB**

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.0dB**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.1dB**

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.1dB**

THE END

Appendix A. Conducted Test Results

A1. Conducted Test Results

Test Engineer:	Jacob Zhang	Temperature:	21~25	°C
Test Date:	2022/1/21	Relative Humidity:	51~54	%

Report Number : FR1D1023E

TEST RESULTS DATA
26dB and 99% OBW

U-NII-1 single antenna								
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)		26 dB Bandwidth (MHz)	
					Ant 1	Ant 2	Ant 1	Ant 2
11a	6Mbps	1	36	5180	16.68	-	21.68	-
11a	6Mbps	1	44	5220	16.68	-	22.03	-
11a	6Mbps	1	48	5240	16.73	-	22.43	-
HT20	MCS0	1	36	5180	17.83	-	22.93	-
HT20	MCS0	1	44	5220	17.83	-	23.38	-
HT20	MCS0	1	48	5240	17.93	-	23.48	-
HT40	MCS0	1	38	5190	36.46	-	41.18	-
HT40	MCS0	1	46	5230	36.46	-	41.00	-
VHT80	MCS0	1	42	5210	75.52	-	83.12	-

Report Number : FR1D1023E

TEST RESULTS DATA
Average Power Table

FCC U-NII-1 single antenna													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power with duty factor (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)			Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	36	5180	18.09	-		24.00	-	-3.10	-		Pass
11a	6Mbps	1	44	5220	17.86	-		24.00	-	-3.10	-		Pass
11a	6Mbps	1	48	5240	17.56	-		24.00	-	-3.10	-		Pass
HT20	MCS0	1	36	5180	17.98	-		24.00	-	-3.10	-		Pass
HT20	MCS0	1	44	5220	17.70	-		24.00	-	-3.10	-		Pass
HT20	MCS0	1	48	5240	17.57	-		24.00	-	-3.10	-		Pass
HT40	MCS0	1	38	5190	14.77	-		24.00	-	-3.10	-		Pass
HT40	MCS0	1	46	5230	16.56	-		24.00	-	-3.10	-		Pass
VHT20	MCS0	1	36	5180	16.19	-		24.00	-	-3.10	-		Pass
VHT20	MCS0	1	44	5220	15.95	-		24.00	-	-3.10	-		Pass
VHT20	MCS0	1	48	5240	15.71	-		24.00	-	-3.10	-		Pass
VHT40	MCS0	1	38	5190	14.27	-		24.00	-	-3.10	-		Pass
VHT40	MCS0	1	46	5230	14.92	-		24.00	-	-3.10	-		Pass
VHT80	MCS0	1	42	5210	11.56	-		24.00	-	-3.10	-		Pass

Report Number : FR1D1023E

TEST RESULTS DATA
Power Spectral Density

FCC U-NII-1 single antenna													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Power Density (dBm/MHz)			Average PSD Limit (dBm/MHz)		DG (dBi)			Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	36	5180	6.92	-		11.00	-	-3.10	-		Pass
11a	6Mbps	1	44	5220	6.91	-		11.00	-	-3.10	-		Pass
11a	6Mbps	1	48	5240	6.57	-		11.00	-	-3.10	-		Pass
HT20	MCS0	1	36	5180	6.46	-		11.00	-	-3.10	-		Pass
HT20	MCS0	1	44	5220	6.03	-		11.00	-	-3.10	-		Pass
HT20	MCS0	1	48	5240	6.12	-		11.00	-	-3.10	-		Pass
HT40	MCS0	1	38	5190	0.86	-		11.00	-	-3.10	-		Pass
HT40	MCS0	1	46	5230	1.77	-		11.00	-	-3.10	-		Pass
VHT80	MCS0	1	42	5210	-5.58	-		11.00	-	-3.10	-		Pass

Report Number : FR1D1023E

TEST RESULTS DATA
26dB and 99% OBW

U-NII-2A single antenna											
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)		26 dB Bandwidth (MHz)		FCC 26dB Bandwidth Power Limit (dBm)		Note
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	52	5260	16.68	-	22.43	-	23.98	-	
11a	6Mbps	1	60	5300	16.68	-	21.98	-	23.98	-	
11a	6Mbps	1	64	5320	16.68	-	21.88	-	23.98	-	
HT20	MCS0	1	52	5260	17.93	-	23.73	-	23.98	-	
HT20	MCS0	1	60	5300	17.93	-	23.48	-	23.98	-	
HT20	MCS0	1	64	5320	17.88	-	23.03	-	23.98	-	
HT40	MCS0	1	54	5270	36.56	-	40.91	-	23.98	-	
HT40	MCS0	1	62	5310	36.46	-	41.36	-	23.98	-	
VHT80	MCS0	1	58	5290	75.52	-	83.12	-	23.98	-	

Report Number : FR1D1023E

TEST RESULTS DATA
Average Power Table

FCC U-NII-2A single antenna													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power with duty factor (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		EIRP Power Limit (dBm)	Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	52	5260	18.08	-		23.98	-	-3.10	-	26.99	Pass
11a	6Mbps	1	60	5300	17.79	-		23.98	-	-3.10	-	26.99	Pass
11a	6Mbps	1	64	5320	17.63	-		23.98	-	-3.10	-	26.99	Pass
HT20	MCS0	1	52	5260	17.79	-		23.98	-	-3.10	-	26.99	Pass
HT20	MCS0	1	60	5300	17.58	-		23.98	-	-3.10	-	26.99	Pass
HT20	MCS0	1	64	5320	17.31	-		23.98	-	-3.10	-	26.99	Pass
HT40	MCS0	1	54	5270	16.99	-		23.98	-	-3.10	-	26.99	Pass
HT40	MCS0	1	62	5310	14.68	-		23.98	-	-3.10	-	26.99	Pass
VHT20	MCS0	1	52	5260	16.00	-		23.98	-	-3.10	-	26.99	Pass
VHT20	MCS0	1	60	5300	15.64	-		23.98	-	-3.10	-	26.99	Pass
VHT20	MCS0	1	64	5320	15.78	-		23.98	-	-3.10	-	26.99	Pass
VHT40	MCS0	1	54	5270	14.89	-		23.98	-	-3.10	-	26.99	Pass
VHT40	MCS0	1	62	5310	14.66	-		23.98	-	-3.10	-	26.99	Pass
VHT80	MCS0	1	58	5290	11.99	-		23.98	-	-3.10	-	26.99	Pass

Report Number : FR1D1023E

TEST RESULTS DATA
Power Spectral Density

U-NII-2A single antenna													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Power Density (dBm/MHz)			Average PSD Limit (dBm/MHz)		DG (dBi)			Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	52	5260	6.83	-		11.00	-	-3.10	-		Pass
11a	6Mbps	1	60	5300	6.33	-		11.00	-	-3.10	-		Pass
11a	6Mbps	1	64	5320	6.19	-		11.00	-	-3.10	-		Pass
HT20	MCS0	1	52	5260	6.50	-		11.00	-	-3.10	-		Pass
HT20	MCS0	1	60	5300	5.89	-		11.00	-	-3.10	-		Pass
HT20	MCS0	1	64	5320	5.78	-		11.00	-	-3.10	-		Pass
HT40	MCS0	1	54	5270	2.52	-		11.00	-	-3.10	-		Pass
HT40	MCS0	1	62	5310	0.31	-		11.00	-	-3.10	-		Pass
VHT80	MCS0	1	58	5290	-5.18	-		11.00	-	-3.10	-		Pass

Report Number : FR1D1023E

TEST RESULTS DATA
26dB and 99% OBW

U-NII-2C single antenna												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth In U-NII 2C (MHz)		26 dB Bandwidth In U-NII 2C (MHz)		FCC 26dB Bandwidth Power Limit (dBm)		6 dB Bandwidth for Straddle Channel (MHz)	
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2
11a	6Mbps	1	100	5500	16.78	-	22.23	-	23.98	-	----	----
11a	6Mbps	1	116	5580	16.73	-	22.38	-	23.98	-	----	----
11a	6Mbps	1	140	5700	16.78	-	22.48	-	23.98	-	----	----
HT20	MCS0	1	100	5500	17.98	-	23.58	-	23.98	-	----	----
HT20	MCS0	1	116	5580	17.88	-	23.13	-	23.98	-	----	----
HT20	MCS0	1	140	5700	17.93	-	23.53	-	23.98	-	----	----
HT40	MCS0	1	102	5510	36.56	-	41.54	-	23.98	-	----	----
HT40	MCS0	1	110	5550	36.56	-	41.54	-	23.98	-	----	----
HT40	MCS0	1	134	5670	36.46	-	41.90	-	23.98	-	----	----
VHT80	MCS0	1	106	5530	75.64	-	83.28	-	23.98	-	----	----
VHT80	MCS0	1	122	5610	75.64	-	82.80	-	23.98	-	----	----

U-NII-2C straddle channel single antenna												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth In U-NII 2C (MHz)		26 dB Bandwidth In U-NII 2C (MHz)		FCC 26dB Bandwidth Power Limit (dBm)		6 dB Bandwidth for Straddle Channel (MHz)	
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2
11a	6Mbps	1	144	5720	16.83	-	22.98	-	23.98	-	-	-
HT20	MCS0	1	144	5720	18.03	-	23.53	-	23.98	-	-	-
HT40	MCS0	1	142	5710	36.56	-	41.72	-	23.98	-	-	-
VHT80	MCS0	1	138	5690	75.64	-	83.12	-	23.98	-	-	-

Report Number : FR1D1023E

TEST RESULTS DATA
Average Power Table

FCC U-NII-2C single antenna													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power with duty factor (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		EIRP Power Limit (dBm)	Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	100	5500	18.21	-		23.98	-	-2.20	-	26.99	Pass
11a	6Mbps	1	116	5580	17.80	-		23.98	-	-2.20	-	26.99	Pass
11a	6Mbps	1	140	5700	18.10	-		23.98	-	-2.20	-	26.99	Pass
HT20	MCS0	1	100	5500	17.93	-		23.98	-	-2.20	-	26.99	Pass
HT20	MCS0	1	116	5580	17.51	-		23.98	-	-2.20	-	26.99	Pass
HT20	MCS0	1	140	5700	17.89	-		23.98	-	-2.20	-	26.99	Pass
HT40	MCS0	1	102	5510	15.14	-		23.98	-	-2.20	-	26.99	Pass
HT40	MCS0	1	110	5550	16.60	-		23.98	-	-2.20	-	26.99	Pass
HT40	MCS0	1	134	5670	16.72	-		23.98	-	-2.20	-	26.99	Pass
VHT20	MCS0	1	100	5500	16.24	-		23.98	-	-2.20	-	26.99	Pass
VHT20	MCS0	1	116	5580	15.57	-		23.98	-	-2.20	-	26.99	Pass
VHT20	MCS0	1	140	5700	16.09	-		23.98	-	-2.20	-	26.99	Pass
VHT40	MCS0	1	102	5510	14.79	-		23.98	-	-2.20	-	26.99	Pass
VHT40	MCS0	1	110	5550	14.45	-		23.98	-	-2.20	-	26.99	Pass
VHT40	MCS0	1	134	5670	14.68	-		23.98	-	-2.20	-	26.99	Pass
VHT80	MCS0	1	106	5530	11.67	-		23.98	-	-2.20	-	26.99	Pass
VHT80	MCS0	1	122	5610	13.74	-		23.98	-	-2.20	-	26.99	Pass

FCC U-NII-2C straddle channel single antenna													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Conducted Power with duty factor (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		EIRP Power Limit (dBm)	Pass/Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	144	5720	18.02	-		23.98	-	-2.20	-	26.99	Pass
HT20	MCS0	1	144	5720	17.83	-		23.98	-	-2.20	-	26.99	Pass
HT40	MCS0	1	142	5710	16.79	-		23.98	-	-2.20	-	26.99	Pass
VHT20	MCS0	1	144	5720	16.03	-		23.98	-	-2.20	-	26.99	Pass
VHT40	MCS0	1	142	5710	14.96	-		23.98	-	-2.20	-	26.99	Pass
VHT80	MCS0	1	138	5690	14.13	-		23.98	-	-2.20	-	26.99	Pass

Report Number : FR1D1023E

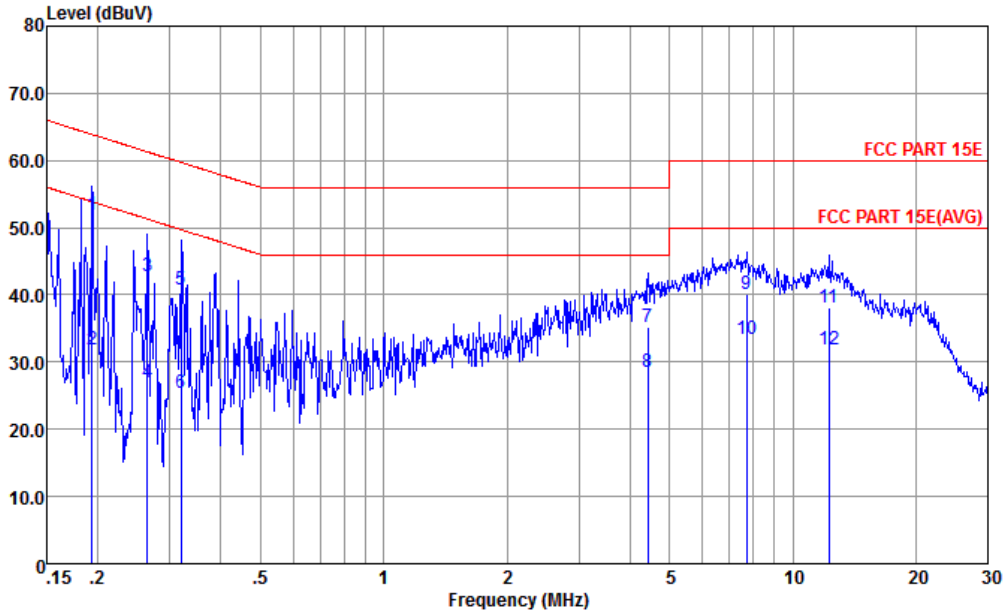
TEST RESULTS DATA
Power Spectral Density

U-NII-2C single antenna													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Power Density (dBm/MHz)			Average PSD Limit (dBm/MHz)		DG (dBi)			Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	100	5500	7.21	-		11.00	-	-2.20	-		Pass
11a	6Mbps	1	116	5580	6.54	-		11.00	-	-2.20	-		Pass
11a	6Mbps	1	140	5700	6.56	-		11.00	-	-2.20	-		Pass
HT20	MCS0	1	100	5500	6.81	-		11.00	-	-2.20	-		Pass
HT20	MCS0	1	116	5580	6.17	-		11.00	-	-2.20	-		Pass
HT20	MCS0	1	140	5700	6.12	-		11.00	-	-2.20	-		Pass
HT40	MCS0	1	102	5510	1.13	-		11.00	-	-2.20	-		Pass
HT40	MCS0	1	110	5550	1.95	-		11.00	-	-2.20	-		Pass
HT40	MCS0	1	134	5670	2.33	-		11.00	-	-2.20	-		Pass
VHT80	MCS0	1	106	5530	-5.10	-		11.00	-	-2.20	-		Pass
VHT80	MCS0	1	122	5610	-3.85	-		11.00	-	-2.20	-		Pass

U-NII-2C straddle channel single antenna													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Power Density (dBm/MHz)			Average PSD Limit (dBm/MHz)		DG (dBi)			Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2		
11a	6Mbps	1	144	5720	6.52	-		11.00	-	-2.20	-		Pass
HT20	MCS0	1	144	5720	6.14	-		11.00	-	-2.20	-		Pass
HT40	MCS0	1	142	5710	2.01	-		11.00	-	-2.20	-		Pass
VHT80	MCS0	1	138	5690	-3.56	-		11.00	-	-2.20	-		Pass

Appendix B. AC Conducted Emission Test Results

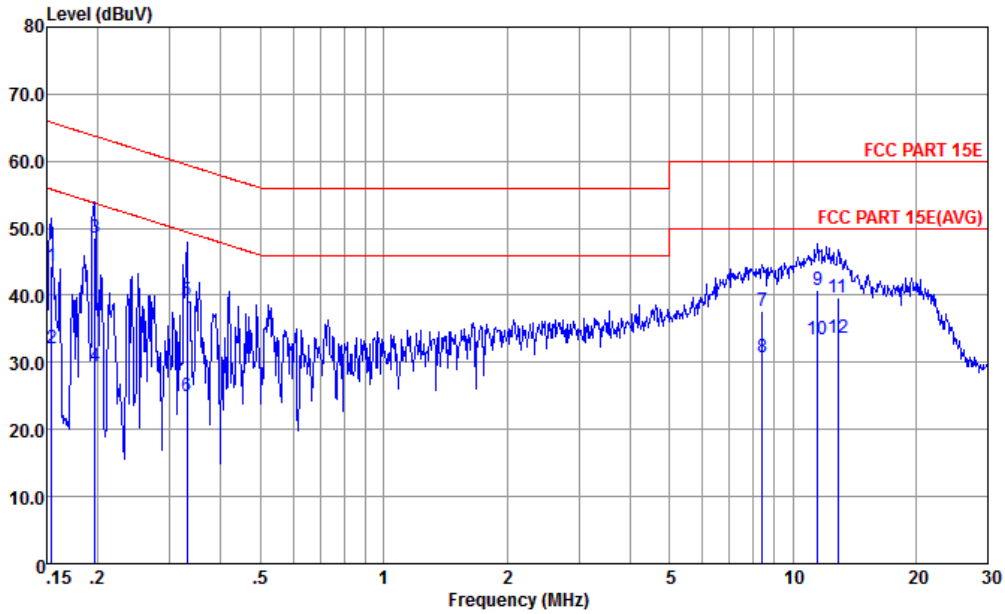
Test Engineer :	Amos Zhang	**Temperature :**	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line



Site : CO01-KS
Condition : FCC PART 15E LISN-060105-L LINE

		Freq MHz	Level dBuV	Over Limit dB	Limit Line dBuV	Read Level dBuV	LISN Factor dB	Cable Loss dB	Remark
1	*	0.193	51.92	-11.97	63.89	41.50	0.04	10.38	QP
2		0.193	31.92	-21.97	53.89	21.50	0.04	10.38	Average
3		0.264	42.89	-18.40	61.29	32.51	0.06	10.32	QP
4		0.264	26.89	-24.40	51.29	16.51	0.06	10.32	Average
5		0.320	40.87	-18.84	59.71	30.50	0.07	10.30	QP
6		0.320	25.47	-24.24	49.71	15.10	0.07	10.30	Average
7		4.430	35.23	-20.77	56.00	24.80	0.17	10.26	QP
8		4.430	28.63	-17.37	46.00	18.20	0.17	10.26	Average
9		7.728	40.01	-19.99	60.00	29.50	0.20	10.31	QP
10		7.728	33.41	-16.59	50.00	22.90	0.20	10.31	Average
11		12.253	38.13	-21.87	60.00	27.50	0.26	10.37	QP
12		12.253	31.83	-18.17	50.00	21.20	0.26	10.37	Average

Test Engineer :	Amos Zhang	**Temperature :**	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Neutral



Site : CO01-KS
Condition : FCC PART 15E LISN-060105-N NEUTRAL

		Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1		0.154	44.38	-21.40	65.78	33.80	0.11	10.47	QP
2		0.154	32.08	-23.70	55.78	21.50	0.11	10.47	Average
3	*	0.197	48.67	-15.09	63.76	38.20	0.10	10.37	QP
4		0.197	29.37	-24.39	53.76	18.90	0.10	10.37	Average
5		0.330	39.30	-20.14	59.44	28.91	0.10	10.29	QP
6		0.330	24.90	-24.54	49.44	14.51	0.10	10.29	Average
7		8.412	37.74	-22.26	60.00	27.20	0.22	10.32	QP
8		8.412	30.74	-19.26	50.00	20.20	0.22	10.32	Average
9		11.498	40.82	-19.18	60.00	30.20	0.26	10.36	QP
10		11.498	33.42	-16.58	50.00	22.80	0.26	10.36	Average
11		12.920	39.56	-20.44	60.00	28.90	0.28	10.38	QP
12		12.920	33.56	-16.44	50.00	22.90	0.28	10.38	Average

Note:

1. Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
2. Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)

Appendix C. Radiated Spurious Emission

For each bandwidth, only the worst cases are shown in the report.

UNII-1 5150~5250MHz

WIFI 802.11a (Band Edge @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 36 5180MHz		5113.28	59.65	-14.35	74	44.16	34.1	10.65	29.26	120	42	P	H
		5149.76	50.85	-3.15	54	35.3	34.17	10.69	29.31	120	42	A	H
	*	5176	108.64	—	—	93.02	34.23	10.73	29.34	120	42	P	H
		5176	102.27	—	—	86.65	34.23	10.73	29.34	120	42	A	H
		5148.8	58.85	-15.15	74	43.3	34.17	10.69	29.31	303	107	P	V
		5149.92	48.93	-5.07	54	33.38	34.17	10.69	29.31	303	107	A	V
	*	5182	105.89	—	—	90.27	34.23	10.73	29.34	303	107	P	V
		5182	98.17	—	—	82.55	34.23	10.73	29.34	303	107	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

UNII-1 5150~5250MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 36 5180MHz		10358.36	40.44	-27.86	68.3	51.89	37.06	15.54	64.05	100	360	P	H
		10358.36	40.88	-27.42	68.3	52.33	37.06	15.54	64.05	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

UNII-2C 5470~5725MHz

WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 102 5510MHz		5459.28	58.79	-15.21	74	42.9	34.44	11.08	29.63	104	159	P	H
		5470	64.69	-3.61	68.3	48.79	34.44	11.09	29.63	104	159	P	H
		5460	50.92	-3.08	54	35.03	34.44	11.08	29.63	104	159	A	H
	*	5512	101.82	—	—	85.96	34.44	11.1	29.68	104	159	P	H
		5512	94.86	—	—	79	34.44	11.1	29.68	104	159	A	H
		5761.64	57.23	-11.07	68.3	41.18	34.5	11.32	29.77	104	159	P	H
		5356.4	56.85	-17.15	74	40.97	34.42	10.98	29.52	274	255	P	V
		5469.68	57.94	-10.36	68.3	42.04	34.44	11.09	29.63	274	255	P	V
		5459.98	48.19	-5.81	54	32.3	34.44	11.08	29.63	274	255	A	V
	*	5506	97.26	—	—	81.4	34.44	11.1	29.68	274	255	P	V
		5506	89.89	—	—	74.03	34.44	11.1	29.68	274	255	A	V
		5746.76	57.84	-10.46	68.3	41.83	34.49	11.3	29.78	274	255	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

UNII-2C 5470~5725MHz

WIFI 802.11n HT40 (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 102 5510MHz		7352	47.76	-26.24	74	63.84	35.4	12.73	64.21	100	360	P	H
		11015	43.67	-30.33	74	52.82	37.39	15.88	62.42	100	360	P	H
		7352	49.43	-24.57	74	65.51	35.4	12.73	64.21	100	0	P	V
		11015	43.4	-30.6	74	52.55	37.39	15.88	62.42	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

UNII-2C 5470~5725MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 106 5530MHz		5449.04	58.59	-15.41	74	42.67	34.44	11.08	29.6	113	168	P	H
		5467.76	58.63	-9.67	68.3	42.73	34.44	11.09	29.63	113	168	P	H
		5452.72	50.82	-3.18	54	34.93	34.44	11.08	29.63	113	168	A	H
		5530	96.09	—	—	80.25	34.44	11.1	29.7	113	168	P	H
		5530	89.06	—	—	73.22	34.44	11.1	29.7	113	168	A	H
		5727.4	56.84	-11.46	68.3	40.89	34.47	11.27	29.79	113	168	P	H
		5445.52	56.6	-17.4	74	40.68	34.44	11.08	29.6	302	275	P	V
		5469.2	57.11	-11.19	68.3	41.21	34.44	11.09	29.63	302	275	P	V
		5458.32	48.8	-5.2	54	32.91	34.44	11.08	29.63	302	275	A	V
		5518	91.35	—	—	75.49	34.44	11.1	29.68	302	275	P	V
		5518	84.62	—	—	68.76	34.44	11.1	29.68	302	275	A	V
		5729.4	56.72	-11.58	68.3	40.77	34.47	11.27	29.79	302	275	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

UNII-2C 5470~5725MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 106 5530MHz		7374	45.54	-28.46	74	61.64	35.4	12.74	64.24	300	0	P	H
		11059	42.81	-31.19	74	51.87	37.43	15.92	62.41	300	0	P	H
		7374	49.96	-24.04	74	66.06	35.4	12.74	64.24	305	326	P	V
		7374	48.02	-5.98	54	64.12	35.4	12.74	64.24	305	326	A	V
		11059	43.57	-30.43	74	52.63	37.43	15.92	62.41	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

WIFI 802.11n HT40 (LF @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 LF		50.37	21.73	-18.27	40	38.57	14.33	1.02	32.19	-	-	P	H
		96.93	21.53	-21.97	43.5	36.71	15.55	1.46	32.19	-	-	P	H
		176.47	21.82	-21.68	43.5	36.94	15.08	1.94	32.14	-	-	P	H
		190.05	20.69	-22.81	43.5	35.98	14.81	2.01	32.11	-	-	P	H
		309.36	21.21	-24.79	46	31.49	19.21	2.58	32.07	-	-	P	H
		607.15	25.98	-20.02	46	28.68	25.84	3.62	32.16	-	-	P	H
		31.94	23.92	-16.08	40	31.25	24.14	0.72	32.19	-	-	P	V
		61.04	24.95	-15.05	40	44.28	11.77	1.11	32.21	-	-	P	V
		99.84	24.01	-19.49	43.5	38.85	15.9	1.45	32.19	-	-	P	V
		161.92	23.78	-19.72	43.5	38.02	16.08	1.85	32.17	-	-	P	V
		178.41	23.54	-19.96	43.5	38.77	14.95	1.95	32.13	-	-	P	V
		358.83	20.63	-25.37	46	29.34	20.54	2.77	32.02	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

<Simultaneous transmission>

UNII-2C 5470~5725MHz

WIFI 802.11n HT40 & GSM 850 (Band Edge @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 102 5510MHz		5459.76	56.78	-17.22	74	40.89	34.44	11.08	29.63	101	156	P	H
		5469.68	59.71	-8.59	68.3	43.81	34.44	11.09	29.63	101	156	P	H
		5460	48.47	-5.53	54	32.58	34.44	11.08	29.63	101	156	A	H
	*	5512	101.08	—	—	85.22	34.44	11.1	29.68	101	156	P	H
		5512	93.02	—	—	77.16	34.44	11.1	29.68	101	156	A	H
		5757.48	57	-11.3	68.3	40.95	34.5	11.32	29.77	101	156	P	H
		5352.72	56.49	-17.51	74	40.61	34.42	10.98	29.52	190	273	P	V
		5463.92	57.02	-11.28	68.3	41.12	34.44	11.09	29.63	190	273	P	V
		5458.96	47.46	-6.54	54	31.57	34.44	11.08	29.63	190	273	A	V
	*	5512	94.83	—	—	78.97	34.44	11.1	29.68	190	273	P	V
		5512	87.94	—	—	72.08	34.44	11.1	29.68	190	273	A	V
		5754.44	56.6	-11.7	68.3	40.56	34.5	11.32	29.78	190	273	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

UNII-2C 5470~5725MHz

WIFI 802.11n HT40 & GSM 850 (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11n HT40 CH 102 5510MHz		7352	43.24	-30.76	74	59.32	35.4	12.73	64.21	100	360	P	H
		11015	41.48	-32.52	74	50.63	37.39	15.88	62.42	100	360	P	H
		16530	46.24	-22.06	68.3	51.43	41.07	19.48	65.74	100	0	P	H
		7352	47.29	-26.71	74	63.37	35.4	12.73	64.21	100	360	P	V
		11015	42.82	-31.18	74	51.97	37.39	15.88	62.42	100	360	P	V
		16526	45.83	-22.47	68.3	51.06	41.06	19.46	65.75	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) = Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
3. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

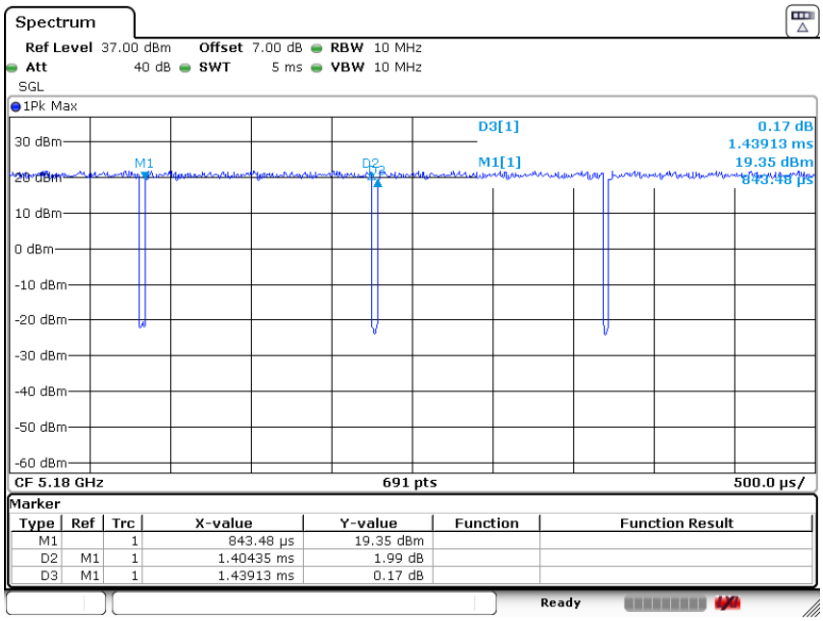
= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11a	97.58	1.404	0.712	0.75KHz
802.11n HT20	97.41	1.310	0.763	0.82KHz
802.11n HT40	94.53	0.651	1.537	1.6KHz
802.11ac VHT80	90.32	0.325	3.080	3.3KHz

802.11a



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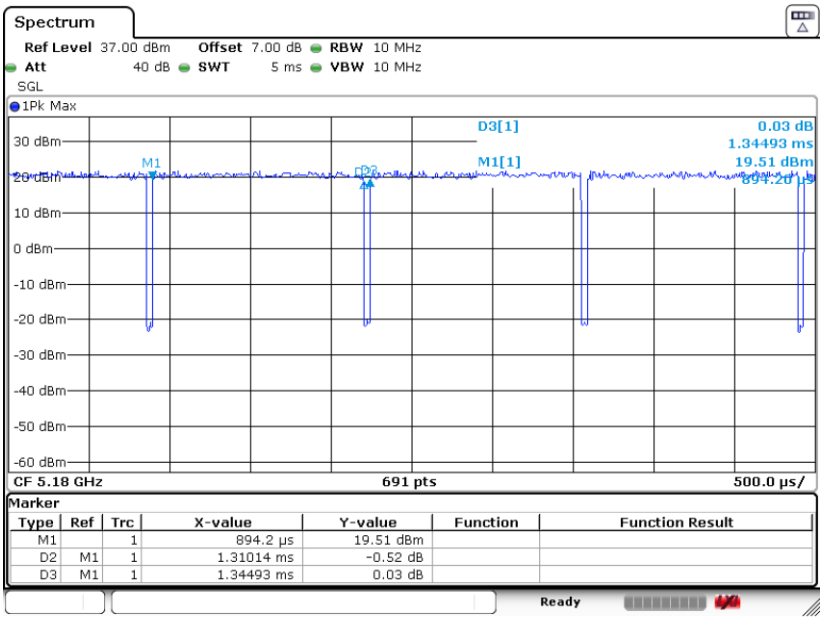
802.11n HT20



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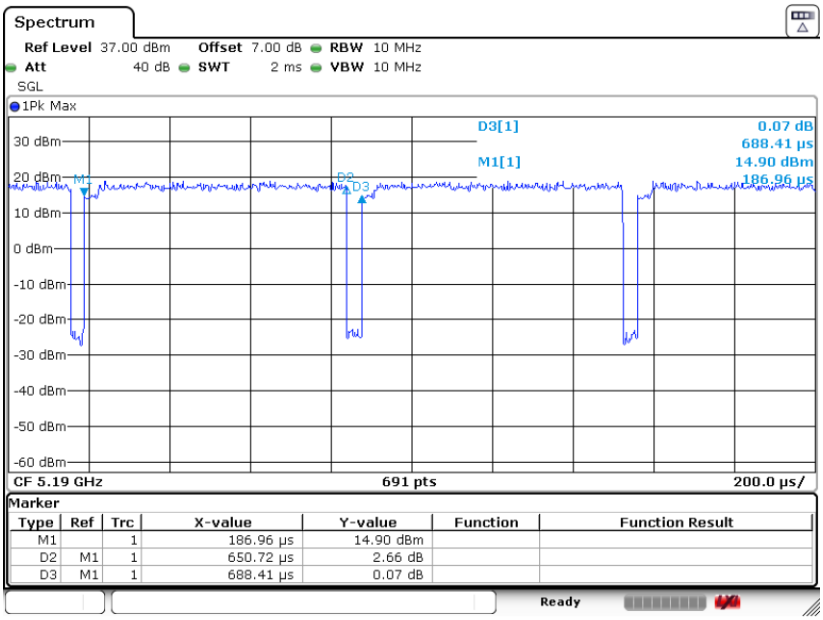
802.11n HT40



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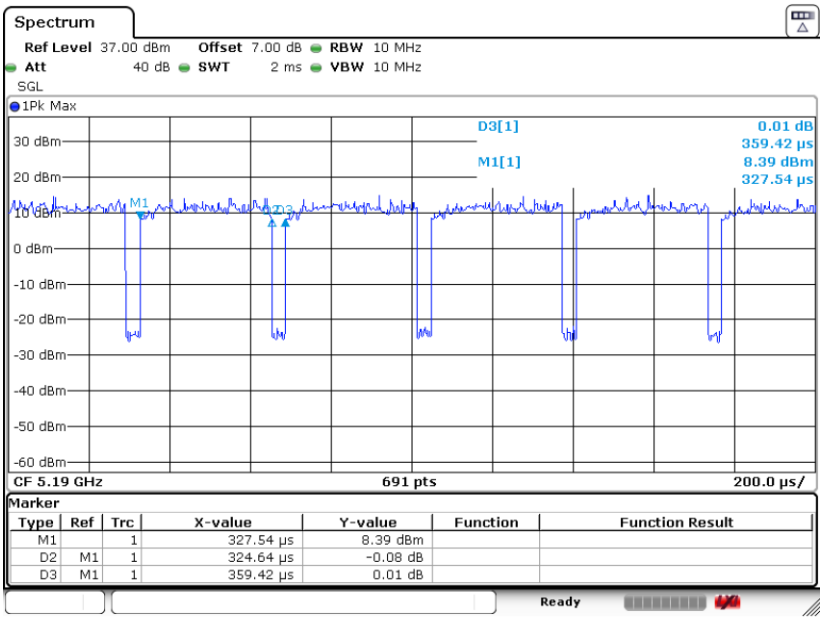
802.11ac VHT80



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