



FCC RF Test Report

APPLICANT : Motorola Solutions Inc.
EQUIPMENT : WAVE PTX TWO-WAY RADIO
BRAND NAME : MOTOROLA
MODEL NAME : TLK 110
MODEL NUMBER : HK2183A
FCC ID : AZ489FT7166
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure
TEST DATE(S) : Oct. 13, 2022 ~ Dec. 09, 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

Approved by: Jason Jia



Sporton International Inc. (Kunshan)

No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China



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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)	Radiated Band Edge and Radiated Spurious Emission	15.407(b) & 15.209(a)	Pass	Under limit 5.33 dB at 5727.240 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 13.43 dB at 21.147 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 Solutions Inc.
8000 West Sunrise Boulevard, Fort Lauderdale, Florida

1.2 Manufacturer

Motorola Solutions Inc.
8000 West Sunrise Boulevard, Fort Lauderdale, Florida

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	WAVE PTX TWO-WAY RADIO
Brand Name	MOTOROLA
Model Name	TLK 110
Model Number	HK2183A
FCC ID	AZ489FT7166
SN	Conducted: 642QYQ0108 Conduction: 642QYQ0061 Radiation: 642QYQ0066
HW Version	REV1
SW Version	TAURUS_BASE_D00.00.02_APP_D00.01.63
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	<p><5180 MHz ~ 5240 MHz> 802.11a : 17.90 dBm / 0.0617 W 802.11n HT20 : 16.89 dBm / 0.0489 W 802.11n HT40 : 15.34 dBm / 0.0342 W 802.11ac VHT20 : 16.92 dBm / 0.0492 W 802.11ac VHT40 : 15.36 dBm / 0.0344 W 802.11ac VHT80 : 13.30 dBm / 0.0214 W</p> <p><5260 MHz ~ 5320 MHz> 802.11a : 15.66 dBm / 0.0368 W 802.11n HT20 : 13.75 dBm / 0.0237 W 802.11n HT40 : 12.26 dBm / 0.0168 W 802.11ac VHT20 : 14.24 dBm / 0.0265 W 802.11ac VHT40 : 12.45 dBm / 0.0176 W 802.11ac VHT80 : 11.79 dBm / 0.0151 W</p> <p><5500 MHz ~ 5720 MHz > 802.11a : 16.74 dBm / 0.0472 W 802.11n HT20 : 15.99 dBm / 0.0397 W 802.11n HT40 : 14.73 dBm / 0.0297 W 802.11ac VHT20 : 16.14 dBm / 0.0411 W 802.11ac VHT40 : 14.77 dBm / 0.0300 W 802.11ac VHT80 : 13.26 dBm / 0.0212 W</p>
99% Occupied Bandwidth	<p><5180 MHz ~ 5240 MHz> 802.11a : 17.29 MHz 802.11ac VHT20: 18.13 MHz 802.11ac VHT40 : 36.76 MHz 802.11ac VHT80 : 74.57 MHz</p> <p><5260 MHz ~ 5320 MHz> 802.11a : 18.18 MHz 802.11ac VHT20: 18.03 MHz 802.11ac VHT40 : 36.76 MHz 802.11ac VHT80 : 74.69 MHz</p> <p><5500 MHz ~ 5720 MHz > 802.11a : 17.18 MHz 802.11ac VHT20: 18.08 MHz 802.11ac VHT40 : 36.76 MHz 802.11ac VHT80 : 74.57 MHz</p>
Antenna Type / Gain	<p><5180 MHz ~ 5240 MHz> FPC Antenna with gain 1.37 dBi</p> <p><5260 MHz ~ 5320 MHz> FPC Antenna with gain 1.96 dBi</p> <p><5500 MHz ~ 5720 MHz> FPC Antenna with gain 3.53 dBi</p>
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)

Note: For 802.11n HT20 / ac VHT20 and 802.11n HT40 / ac VHT40 mode, the whole testing have



assessed only 802.11 ac VHT20/ VHT40 by referring to their maximum conducted power.

1.5 Specification of Accessory

Accessories Information				
AC Adapter	Brand Name	MOTOROLA	Model Name	PS000150A31
Battery	Brand Name	MOTOROLA	Model Name	PMNN4578A
USB Cable	Brand Name	MOTOROLA	Model Name	PMKN4294A
Swivel Carry Holster	Brand Name	MOTOROLA	Model Name	PMLN8439A
Antenna	Brand Name	MOTOROLA	Model Name	HKAN4005A

1.6 Modification of EUT

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

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 03CH06-KS TH01-KS	CN1257	314309

1.8 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH06-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 (X 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
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0

Test Cases	
AC Conducted Emission	Mode 1 : WCDMA Band II Idle + BT Link + WLAN Link(5G) + Earphone 5 + USB Cable (Charging From Adapter)
<p>Remark:</p> <ol style="list-style-type: none"> 1. For Conducted Emission, the accessories are chosen from Part 15B worst case. 2. For Radiated Test Cases, The tests were performance with Adapter, Battery, Earphone 1 and USB Cable. 	



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

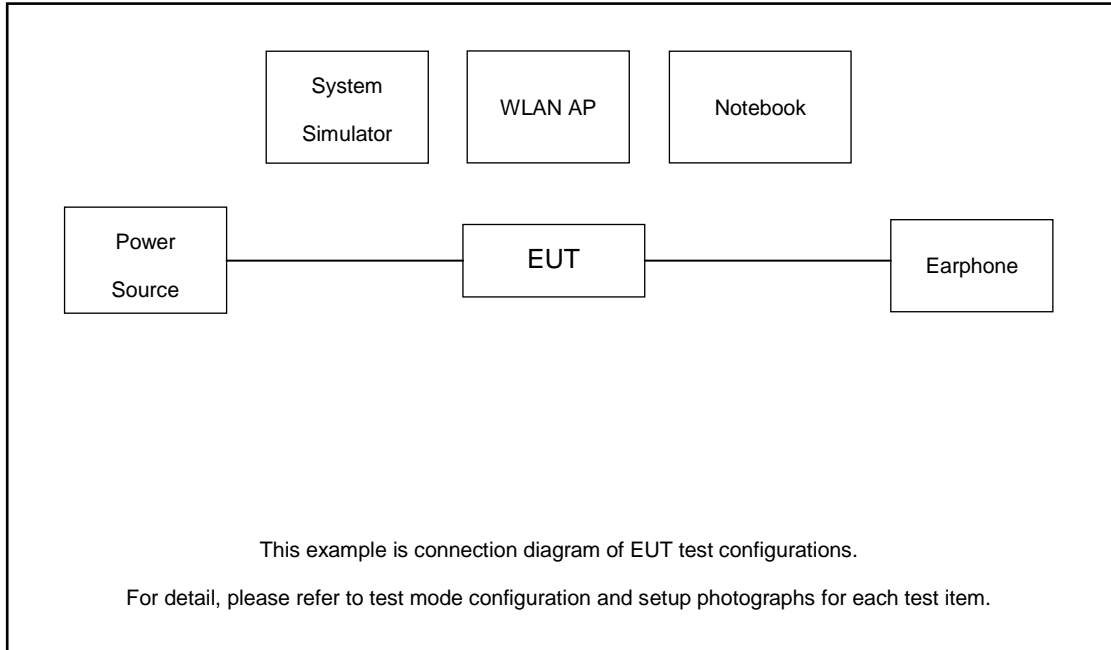
Ch. #		U-NII-1 : 5180-5240 MHz	U-NII-2A : 5260-5320 MHz	U-NII-2C : 5500- 5720 MHz
		802.11ac VHT20	802.11ac VHT20	802.11ac VHT20
L	Low	36	52	100
M	Middle	44	60	116
H	High	48	64	140
Straddle		-	-	144

Ch. #		U-NII-1 : 5180-5240 MHz	U-NII-2A : 5260-5320 MHz	U-NII-2C : 5500- 5720 MHz
		802.11ac VHT40	802.11ac VHT40	802.11ac VHT40
L	Low	38	54	102
M	Middle	-	-	110
H	High	46	62	134
Straddle		-	-	142

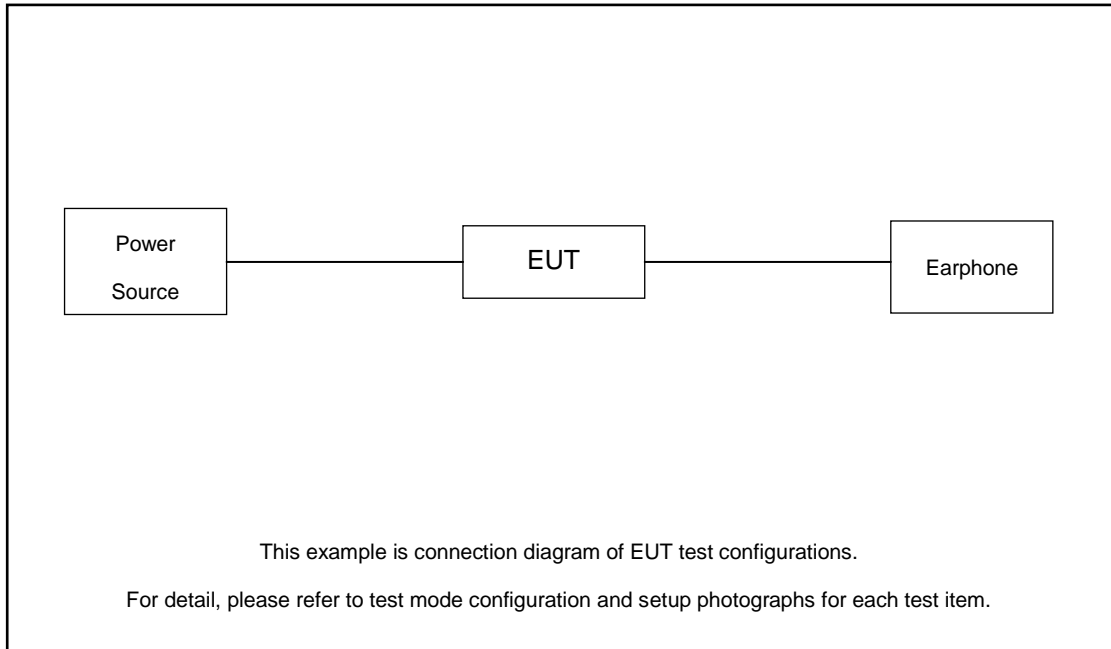
Ch. #		U-NII-1 : 5180-5240 MHz	U-NII-2A : 5260-5320 MHz	U-NII-2C : 5500- 5720 MHz
		802.11ac VHT80	802.11ac VHT80	802.11ac VHT80
L	Low	-	-	106
M	Middle	42	58	-
H	High	-	-	122
Straddle		-	-	138

2.3 Connection Diagram of Test System

For Conducted Emission:



For Radiated Emission:



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	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	V130-15IKB005	N/A	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
4.	Earphone 1	MOTOROLA	PMLN7156A	N/A	N/A	N/A
5.	Earphone 5	MOTOROLA	PMLN7158A	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.

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 7.2 dB.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)}. \\ &= 7.2 \text{ (dB)} \end{aligned}$$

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.

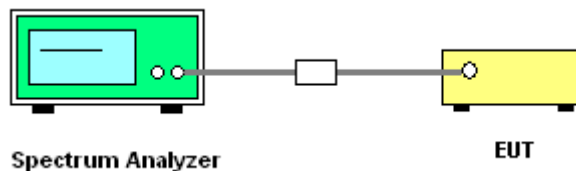
3.1.2 Measuring Instruments

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) $\geq 3 * RBW$.
8. Measure and record the results in the test report.

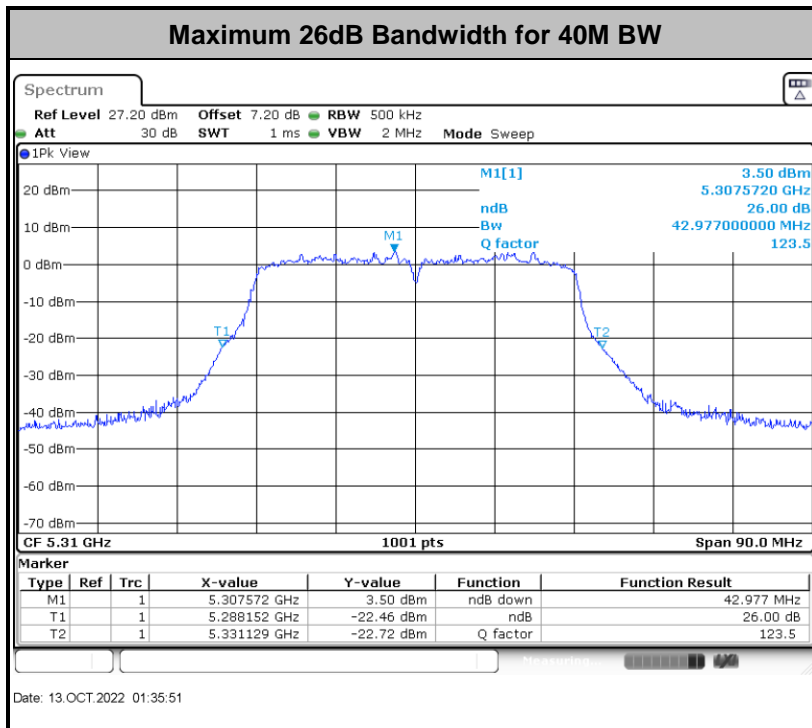
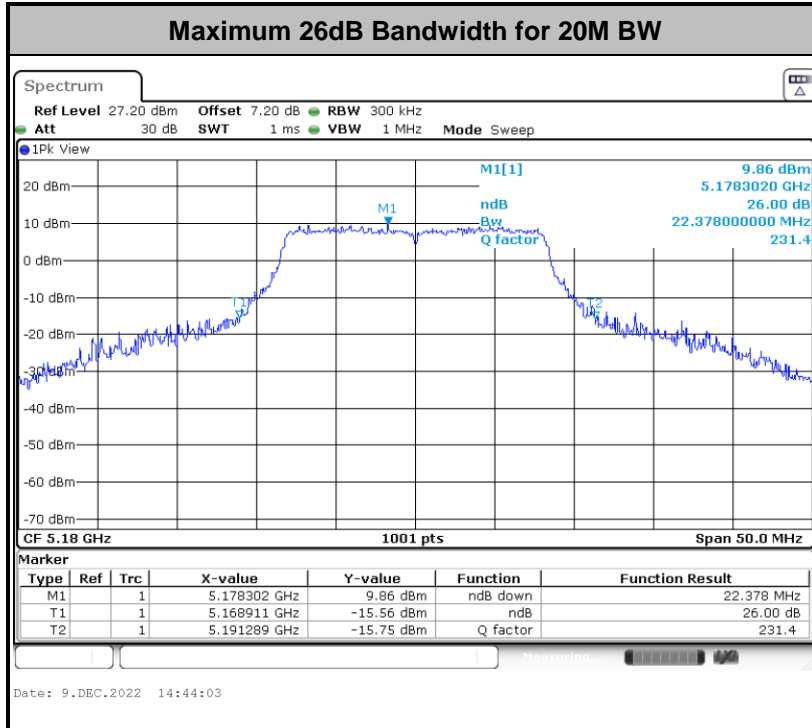
3.1.4 Test Setup

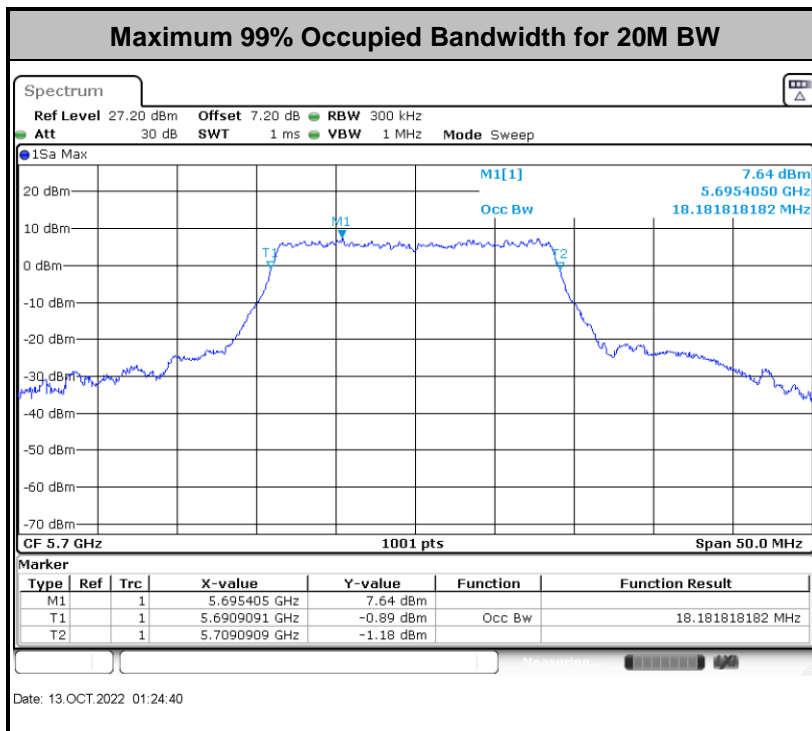
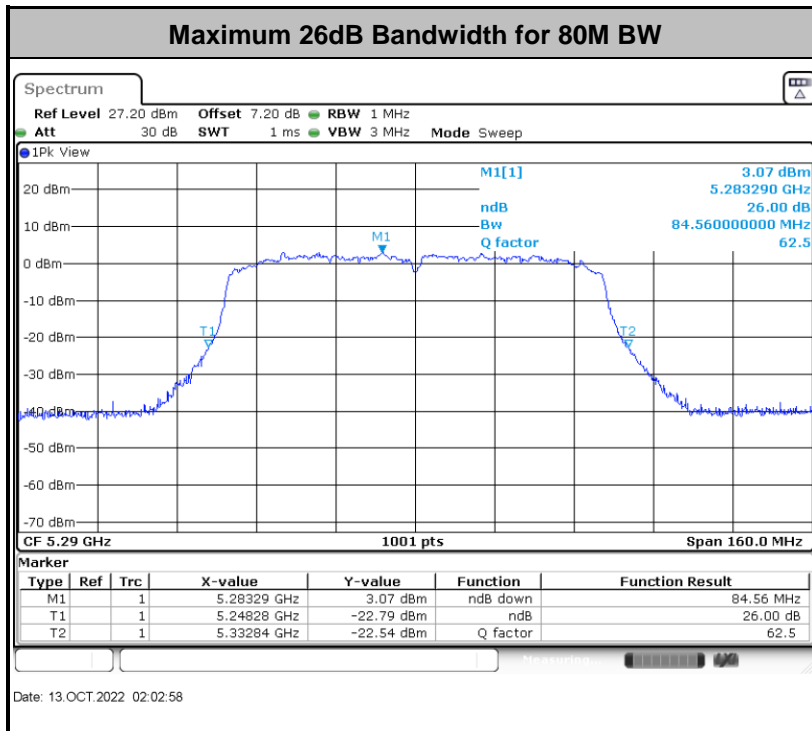


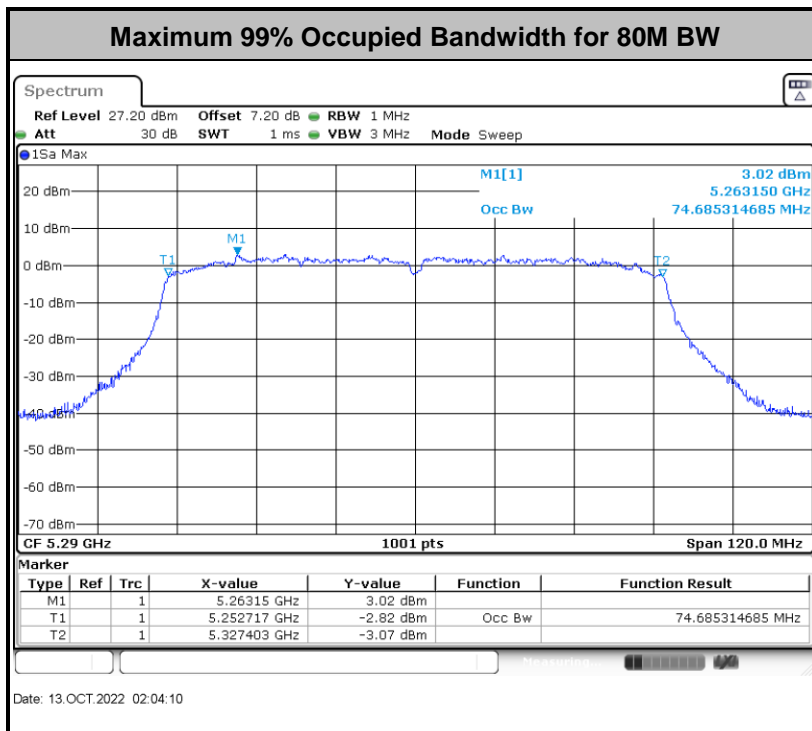
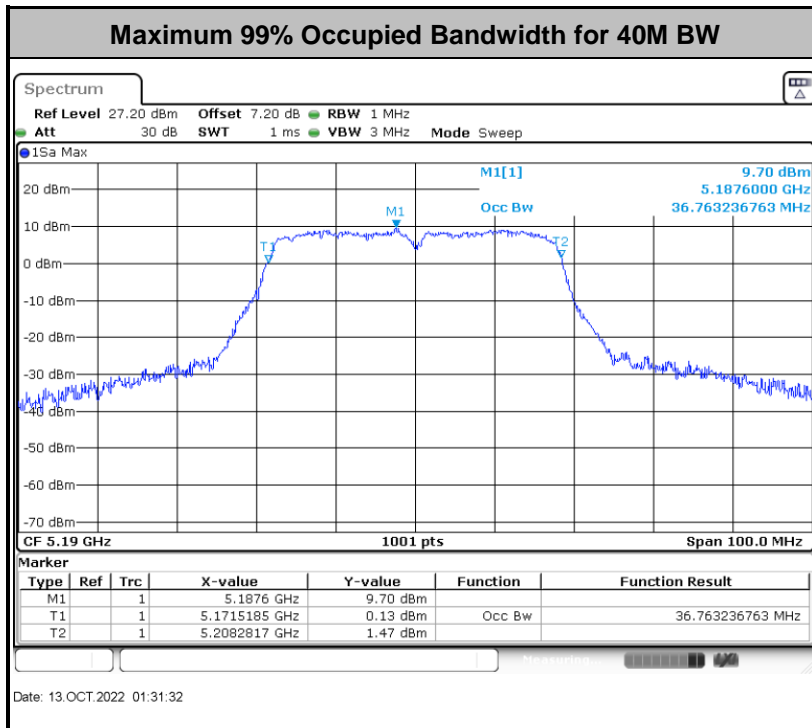


3.1.5 Test Result of 26dB & 99% Occupied Bandwidth

Please refer to Appendix A.







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 10 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

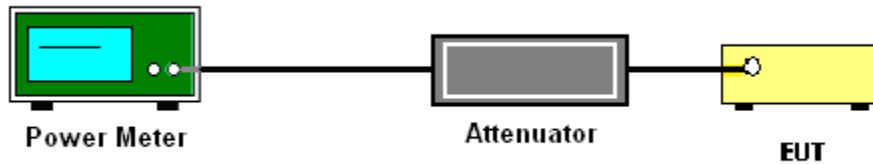
The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

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.

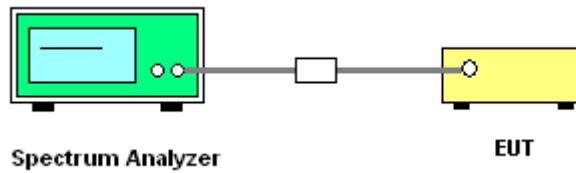
Method SA-2

(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 \geq 3 MHz.
- Number of points in sweep \geq 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.

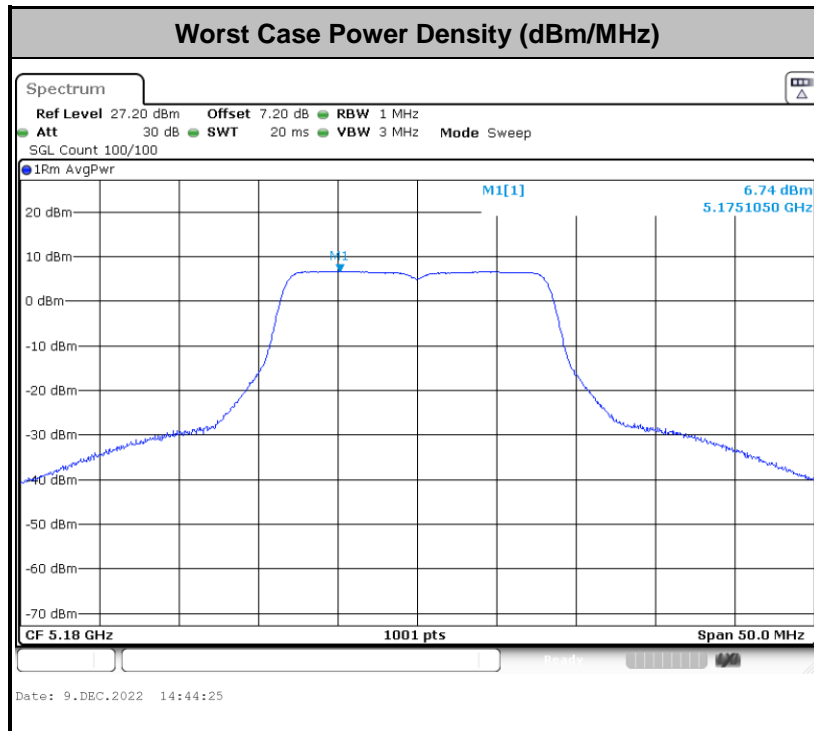
1. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
2. Each plot has already offset with cable loss, and attenuator loss. Measure the PPSD and record it.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



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	68.3

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

3.4.2 Measuring Instruments

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

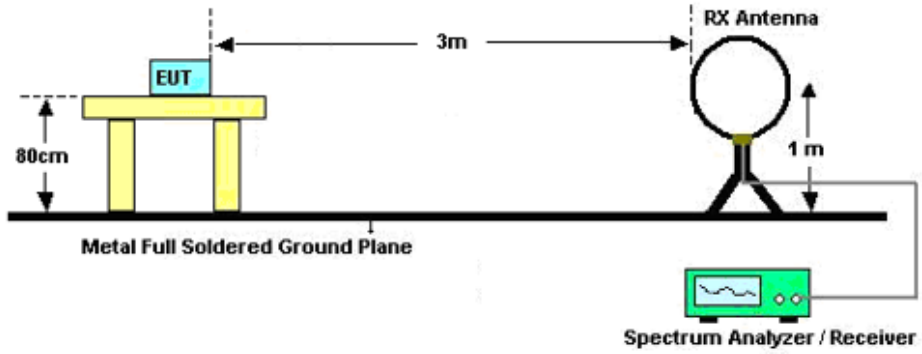


3.4.3 Test Procedures

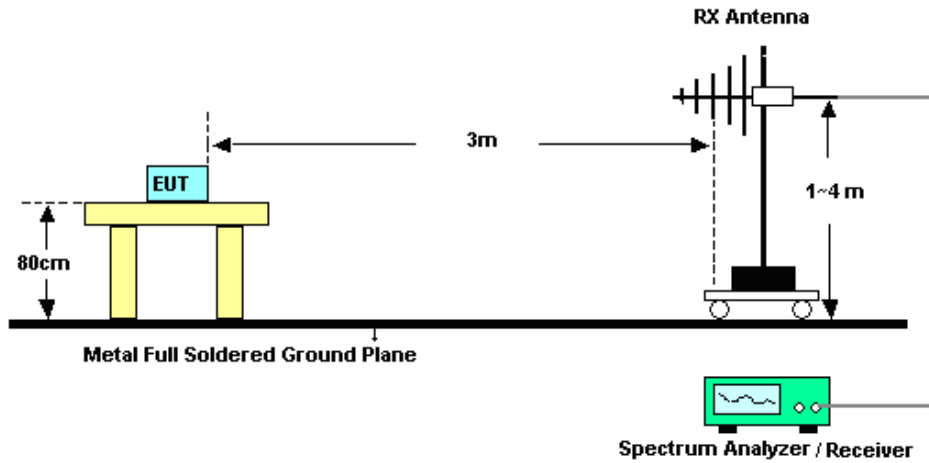
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
 - (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW \geq 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 \geq 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

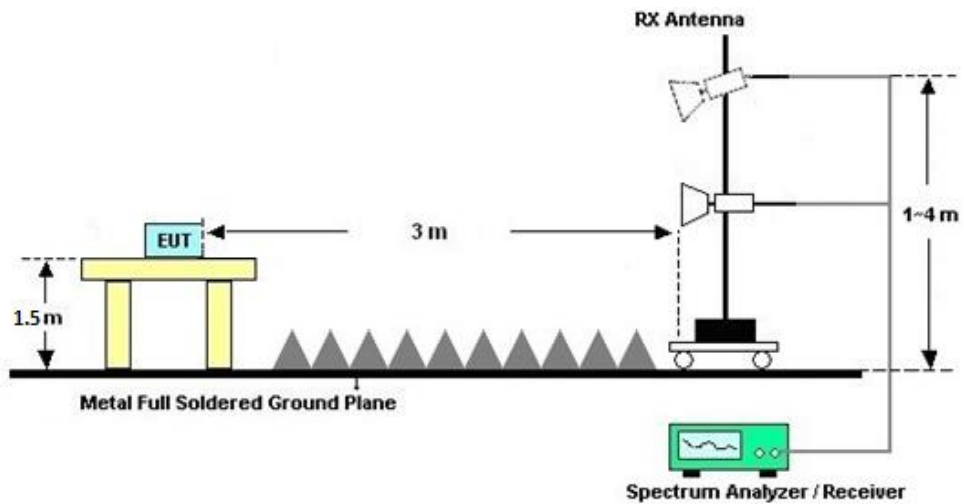
For radiated emissions below 30MHz



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. 12, 2022	Oct. 13, 2022~ Dec. 09, 2022	Oct. 11, 2023	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 05, 2022	Oct. 13, 2022~ Dec. 09, 2022	Jan. 04, 2023	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2022	Oct. 13, 2022~ Dec. 09, 2022	Jan. 04, 2023	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY564000 04	3Hz~8.5GHz;Max 30dBm	Oct. 13, 2022	Nov. 01, 2022~ Dec. 09, 2022	Oct. 12, 2023	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010B	MY602421 26	10Hz~44GHz	Oct. 13, 2022	Nov. 01, 2022~ Dec. 09, 2022	Oct. 12, 2023	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 16, 2022	Nov. 01, 2022~ Dec. 09, 2022	Oct. 15, 2023	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz~1GHz	May 24, 2022	Nov. 01, 2022~ Dec. 09, 2022	May 23, 2023	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218642	1GHz~18GHz	Apr. 18, 2022	Nov. 01, 2022~ Dec. 09, 2022	Apr. 17, 2023	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101093	18GHz~40GHz	Jan. 05, 2022	Nov. 01, 2022~ Dec. 09, 2022	Jan. 04, 2023	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	380827	9KHz ~1GHZ	Jul. 11, 2022	Nov. 01, 2022~ Dec. 09, 2022	Jul. 10, 2023	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GG A	060728	18~40GHz	Jan. 05, 2022	Nov. 01, 2022~ Dec. 09, 2022	Jan. 04, 2023	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	2082395	1Ghz-18Ghz	Jan. 05, 2022	Nov. 01, 2022~ Dec. 09, 2022	Jan. 04, 2023	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY532703 19	500MHz~26.5GHz	Oct. 13, 2022	Nov. 01, 2022~ Dec. 09, 2022	Oct. 12, 2023	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F1040900 04	N/A	NCR	Nov. 01, 2022~ Dec. 09, 2022	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Nov. 01, 2022~ Dec. 09, 2022	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Nov. 01, 2022~ Dec. 09, 2022	NCR	Radiation (03CH06-KS)
EMI Receiver	R&S	ESC17	100768	9kHz~7GHz;	May 24, 2022	Nov. 02, 2022	May 23, 2023	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 13, 2022	Nov. 02, 2022	Oct. 12, 2023	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	May 24, 2022	Nov. 02, 2022	May 23, 2023	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP00000 0811	AC 0V~300V, 45Hz~1000Hz	Oct. 12, 2022	Nov. 02, 2022	Oct. 11, 2023	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 Measurement

Test Item	Uncertainty
Conducted Power	±0.46 dB
Conducted Emissions	±0.48dB
Occupied Channel Bandwidth	±0.10 %
Conducted Power Spectral Density	±0.40 dB

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.78dB
---------------------------------------------------------------------	--------

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))	5.0dB
---------------------------------------------------------------------	-------

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

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

----- THE END -----



Appendix A. Conducted Test Results

Test Engineer:	Jacob Zhang	Temperature:	21~25	°C
Test Date:	2022/10/13~2022/12/9	Relative Humidity:	51~54	%

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)		IC 99% Bandwidth Power Limit (dBm)		IC 99% Bandwidth EIRP Limit (dBm)		Note
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	36	5180	17.29	-	22.38	-	-	-	22.38	-	
11a	6Mbps	1	44	5220	17.13	-	22.23	-	-	-	22.34	-	
11a	6Mbps	1	48	5240	17.13	-	22.03	-	-	-	22.34	-	
VHT20	MCS0	1	36	5180	18.13	-	22.28	-	-	-	22.58	-	
VHT20	MCS0	1	44	5220	18.08	-	22.28	-	-	-	22.57	-	
VHT20	MCS0	1	48	5240	18.03	-	22.23	-	-	-	22.56	-	
VHT40	MCS0	1	38	5190	36.76	-	42.62	-	-	-	23.01	-	
VHT40	MCS0	1	46	5230	36.66	-	42.80	-	-	-	23.01	-	
VHT80	MCS0	1	42	5210	74.57	-	83.12	-	-	-	23.01	-	

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	17.90	-		24.00	-	1.37	-	Pass
11a	6Mbps	1	44	5220	15.88	-		24.00	-	1.37	-	Pass
11a	6Mbps	1	48	5240	15.82	-		24.00	-	1.37	-	Pass
HT20	MCS0	1	36	5180	16.89	-		24.00	-	1.37	-	Pass
HT20	MCS0	1	44	5220	13.71	-		24.00	-	1.37	-	Pass
HT20	MCS0	1	48	5240	13.54	-		24.00	-	1.37	-	Pass
HT40	MCS0	1	38	5190	15.34	-		24.00	-	1.37	-	Pass
HT40	MCS0	1	46	5230	12.11	-		24.00	-	1.37	-	Pass
VHT20	MCS0	1	36	5180	16.92	-		24.00	-	1.37	-	Pass
VHT20	MCS0	1	44	5220	14.28	-		24.00	-	1.37	-	Pass
VHT20	MCS0	1	48	5240	14.35	-		24.00	-	1.37	-	Pass
VHT40	MCS0	1	38	5190	15.36	-		24.00	-	1.37	-	Pass
VHT40	MCS0	1	46	5230	12.40	-		24.00	-	1.37	-	Pass
VHT80	MCS0	1	42	5210	13.30	-		24.00	-	1.37	-	Pass

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	6.74	-		11.00	-	1.37	-	Pass
11a	6Mbps	1	44	5220	4.26	-		11.00	-	1.37	-	Pass
11a	6Mbps	1	48	5240	4.08	-		11.00	-	1.37	-	Pass
VHT20	MCS0	1	36	5180	5.06	-		11.00	-	1.37	-	Pass
VHT20	MCS0	1	44	5220	2.19	-		11.00	-	1.37	-	Pass
VHT20	MCS0	1	48	5240	2.41	-		11.00	-	1.37	-	Pass
VHT40	MCS0	1	38	5190	0.80	-		11.00	-	1.37	-	Pass
VHT40	MCS0	1	46	5230	-2.25	-		11.00	-	1.37	-	Pass
VHT80	MCS0	1	42	5210	-4.06	-		11.00	-	1.37	-	Pass

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)		IC 99% Bandwidth Power Limit (dBm)		IC 99% Bandwidth EIRP Limit (dBm)		FCC 26dB Bandwidth Power Limit (dBm)		Note
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	52	5260	17.18	-	22.03	-	23.35	-	29.35	-	23.98	-	
11a	6Mbps	1	60	5300	17.18	-	22.23	-	23.35	-	29.35	-	23.98	-	
11a	6Mbps	1	64	5320	18.18	-	22.08	-	23.60	-	29.60	-	23.98	-	
VHT20	MCS0	1	52	5260	18.03	-	22.28	-	23.56	-	29.56	-	23.98	-	
VHT20	MCS0	1	60	5300	18.03	-	22.28	-	23.56	-	29.56	-	23.98	-	
VHT20	MCS0	1	64	5320	18.03	-	22.28	-	23.56	-	29.56	-	23.98	-	
VHT40	MCS0	1	54	5270	36.76	-	42.53	-	23.98	-	30.00	-	23.98	-	
VHT40	MCS0	1	62	5310	36.76	-	42.98	-	23.98	-	30.00	-	23.98	-	
VHT80	MCS0	1	58	5290	74.69	-	84.56	-	23.98	-	30.00	-	23.98	-	

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	15.66	-		23.98	-	1.96	-	26.99	Pass
11a	6Mbps	1	60	5300	15.61	-		23.98	-	1.96	-	26.99	Pass
11a	6Mbps	1	64	5320	15.57	-		23.98	-	1.96	-	26.99	Pass
HT20	MCS0	1	52	5260	13.75	-		23.98	-	1.96	-	26.99	Pass
HT20	MCS0	1	60	5300	13.72	-		23.98	-	1.96	-	26.99	Pass
HT20	MCS0	1	64	5320	13.68	-		23.98	-	1.96	-	26.99	Pass
HT40	MCS0	1	54	5270	12.23	-		23.98	-	1.96	-	26.99	Pass
HT40	MCS0	1	62	5310	12.26	-		23.98	-	1.96	-	26.99	Pass
VHT20	MCS0	1	52	5260	14.18	-		23.98	-	1.96	-	26.99	Pass
VHT20	MCS0	1	60	5300	14.20	-		23.98	-	1.96	-	26.99	Pass
VHT20	MCS0	1	64	5320	14.24	-		23.98	-	1.96	-	26.99	Pass
VHT40	MCS0	1	54	5270	12.45	-		23.98	-	1.96	-	26.99	Pass
VHT40	MCS0	1	62	5310	12.36	-		23.98	-	1.96	-	26.99	Pass
VHT80	MCS0	1	58	5290	11.79	-		23.98	-	1.96	-	26.99	Pass

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	4.08	-		11.00	-	1.96	-	Pass
11a	6Mbps	1	60	5300	3.82	-		11.00	-	1.96	-	Pass
11a	6Mbps	1	64	5320	3.81	-		11.00	-	1.96	-	Pass
VHT20	MCS0	1	52	5260	2.38	-		11.00	-	1.96	-	Pass
VHT20	MCS0	1	60	5300	2.20	-		11.00	-	1.96	-	Pass
VHT20	MCS0	1	64	5320	2.08	-		11.00	-	1.96	-	Pass
VHT40	MCS0	1	54	5270	-2.04	-		11.00	-	1.96	-	Pass
VHT40	MCS0	1	62	5310	-2.27	-		11.00	-	1.96	-	Pass
VHT80	MCS0	1	58	5290	-5.90	-		11.00	-	1.96	-	Pass

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)		IC 99% Bandwidth Power Limit (dBm)		IC 99% Bandwidth EIRP Limit (dBm)		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	Ant 1	Ant 2	Ant 1	Ant 2
11a	6Mbps	1	100	5500	17.13	-	22.23	-	23.34	-	29.34	-	23.98	-	----	----
11a	6Mbps	1	116	5580	17.13	-	22.03	-	23.34	-	29.34	-	23.98	-	----	----
11a	6Mbps	1	140	5700	17.18	-	22.08	-	23.35	-	29.35	-	23.98	-	----	----
VHT20	MCS0	1	100	5500	18.03	-	22.13	-	23.56	-	29.56	-	23.98	-	----	----
VHT20	MCS0	1	116	5580	18.08	-	22.28	-	23.57	-	29.57	-	23.98	-	----	----
VHT20	MCS0	1	140	5700	18.08	-	22.23	-	23.57	-	29.57	-	23.98	-	----	----
VHT40	MCS0	1	102	5510	36.76	-	42.89	-	23.98	-	30.00	-	23.98	-	----	----
VHT40	MCS0	1	110	5550	36.76	-	42.89	-	23.98	-	30.00	-	23.98	-	----	----
VHT40	MCS0	1	134	5670	36.76	-	42.98	-	23.98	-	30.00	-	23.98	-	----	----
VHT80	MCS0	1	106	5530	74.57	-	84.08	-	23.98	-	30.00	-	23.98	-	----	----
VHT80	MCS0	1	122	5610	74.57	-	73.76	-	23.98	-	30.00	-	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)		IC 99% Bandwidth Power Limit (dBm)		IC 99% Bandwidth EIRP Limit (dBm)		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	Ant 1	Ant 2	Ant 1	Ant 2
11a	6Mbps	1	144	5720	17.13	-	21.73	-	23.34	-	29.34	-	23.98	-	-	-
VHT20	MCS0	1	144	5720	18.03	-	22.23	-	23.56	-	29.56	-	23.98	-	-	-
VHT80	MCS0	1	138	5690	74.57	-	84.56	-	23.98	-	30.00	-	23.98	-	-	-

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	16.74	-		23.98	-	3.53	-	26.99	Pass
11a	6Mbps	1	116	5580	15.59	-		23.98	-	3.53	-	26.99	Pass
11a	6Mbps	1	140	5700	16.14	-		23.98	-	3.53	-	26.99	Pass
HT20	MCS0	1	100	5500	15.16	-		23.98	-	3.53	-	26.99	Pass
HT20	MCS0	1	116	5580	13.58	-		23.98	-	3.53	-	26.99	Pass
HT20	MCS0	1	140	5700	15.99	-		23.98	-	3.53	-	26.99	Pass
HT40	MCS0	1	102	5510	13.59	-		23.98	-	3.53	-	26.99	Pass
HT40	MCS0	1	110	5550	12.24	-		23.98	-	3.53	-	26.99	Pass
HT40	MCS0	1	134	5670	14.73	-		23.98	-	3.53	-	26.99	Pass
VHT20	MCS0	1	100	5500	15.21	-		23.98	-	3.53	-	26.99	Pass
VHT20	MCS0	1	116	5580	14.36	-		23.98	-	3.53	-	26.99	Pass
VHT20	MCS0	1	140	5700	16.14	-		23.98	-	3.53	-	26.99	Pass
VHT40	MCS0	1	102	5510	13.65	-		23.98	-	3.53	-	26.99	Pass
VHT40	MCS0	1	110	5550	12.41	-		23.98	-	3.53	-	26.99	Pass
VHT40	MCS0	1	134	5670	14.77	-		23.98	-	3.53	-	26.99	Pass
VHT80	MCS0	1	106	5530	12.39	-		23.98	-	3.53	-	26.99	Pass
VHT80	MCS0	1	122	5610	11.90	-		23.98	-	3.53	-	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	15.80	-		23.98	-	3.53	-	26.99	Pass
HT20	MCS0	1	144	5720	13.65	-		23.98	-	3.53	-	26.99	Pass
HT40	MCS0	1	142	5710	12.30	-		23.98	-	3.53	-	26.99	Pass
VHT20	MCS0	1	144	5720	14.06	-		23.98	-	3.53	-	26.99	Pass
VHT40	MCS0	1	142	5710	12.32	-		23.98	-	3.53	-	26.99	Pass
VHT80	MCS0	1	138	5690	13.26	-		23.98	-	3.53	-	26.99	Pass

TEST RESULTS DATA
Power Spectral Density

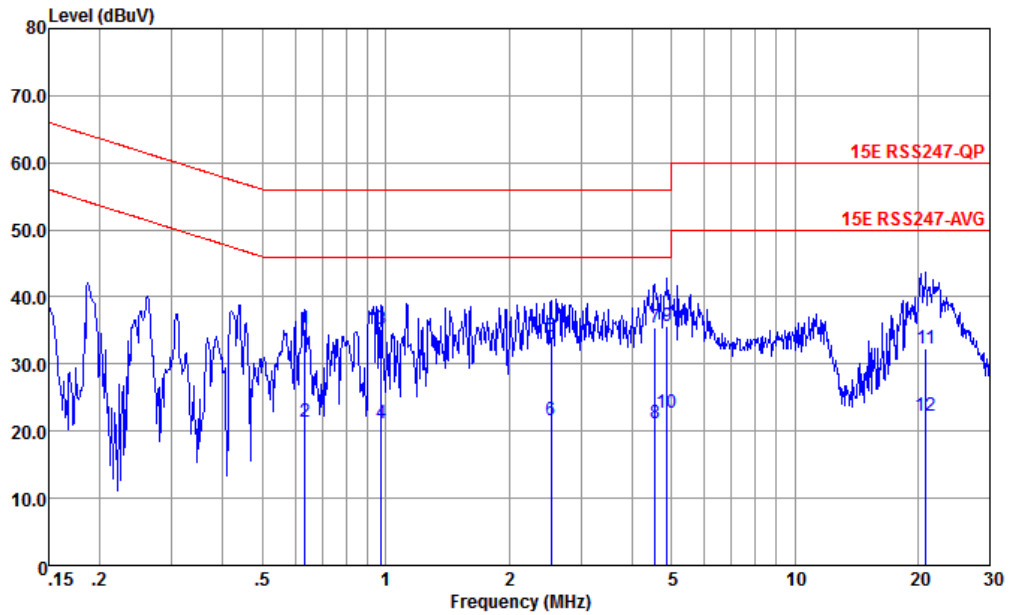
U-NII-2C single antenna												
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Average Power Density (dBm/MHz)			Average PSD Limit (dBm/MHz)		DG (dBi)		Pass /Fail
					Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	1	100	5500	4.92	-	11.00	11.00	-	3.53	-	Pass
11a	6Mbps	1	116	5580	3.75	-		11.00	-	3.53	-	Pass
11a	6Mbps	1	140	5700	4.64	-		11.00	-	3.53	-	Pass
VHT20	MCS0	1	100	5500	3.17	-		11.00	-	3.53	-	Pass
VHT20	MCS0	1	116	5580	2.16	-		11.00	-	3.53	-	Pass
VHT20	MCS0	1	140	5700	4.08	-		11.00	-	3.53	-	Pass
VHT40	MCS0	1	102	5510	-1.17	-		11.00	-	3.53	-	Pass
VHT40	MCS0	1	110	5550	-2.25	-		11.00	-	3.53	-	Pass
VHT40	MCS0	1	134	5670	-0.39	-		11.00	-	3.53	-	Pass
VHT80	MCS0	1	106	5530	-5.42	-		11.00	-	3.53	-	Pass
VHT80	MCS0	1	122	5610	-6.23	-	11.00	-	3.53	-	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	3.71	-	11.00	11.00	-	3.53	-	Pass
VHT20	MCS0	1	144	5720	1.64	-		11.00	-	3.53	-	Pass
VHT40	MCS0	1	142	5710	-2.80	-		11.00	-	3.53	-	Pass
VHT80	MCS0	1	138	5690	-4.87	-		11.00	-	3.53	-	Pass



Appendix B. AC Conducted Emission Test Results

Test Engineer :	Amos Zhang	Temperature :	24.2~25.6°C
		Relative Humidity :	37~39%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		

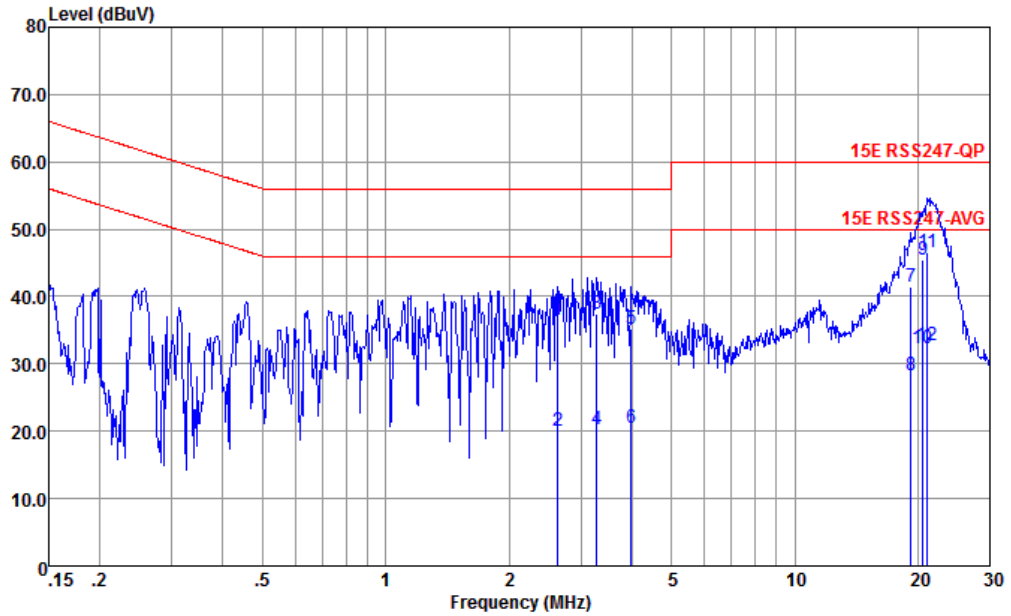


Site : CO01-KS
 Condition : 15E RSS247-QP LISN-060105-LINE LINE

	Freq	Level	Over	Limit	Read	LISN	Cable	Remark
	MHz	dBuV	Limit	Line	Level	Factor	Loss	
			dB	dBuV	dBuV	dB	dB	
1	0.634	35.30	-20.70	56.00	25.20	-0.07	10.17	QP
2	0.634	21.40	-34.60	56.00	11.30	-0.07	10.17	Average
3	0.974	35.21	-20.79	56.00	25.20	-0.10	10.11	QP
4	0.974	21.21	-34.79	56.00	11.20	-0.10	10.11	Average
5	2.540	34.15	-21.85	56.00	24.20	-0.11	10.06	QP
6	2.540	21.85	-34.45	56.00	11.60	-0.11	10.06	Average
7	4.549	35.63	-20.47	56.00	25.59	-0.12	10.06	QP
8	4.549	21.24	-34.76	56.00	11.30	-0.12	10.06	Average
9 *	4.874	35.73	-20.27	56.00	25.80	-0.13	10.06	QP
10	4.874	22.83	-33.17	56.00	12.90	-0.13	10.06	Average
11	20.924	32.24	-27.76	60.00	21.20	-0.32	11.36	QP
12	20.924	22.34	-37.66	60.00	11.30	-0.32	11.36	Average



Test Engineer :	Amos Zhang	Temperature :	24.2~25.6°C
		Relative Humidity :	37~39%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
 Condition : 15E RSS247-QP LISN-060105-NEUTRAL NEUTRAL

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	2.636	36.53	-19.47	56.00	26.60	-0.13	10.06	QP
2	2.636	20.13	-35.87	56.00	10.20	-0.13	10.06	Average
3	3.276	37.43	-18.57	56.00	27.50	-0.13	10.06	QP
4	3.276	20.23	-35.77	56.00	10.30	-0.13	10.06	Average
5	3.985	35.14	-20.86	56.00	25.20	-0.12	10.06	QP
6	3.985	20.54	-35.46	56.00	10.60	-0.12	10.06	Average
7	19.224	41.54	-18.46	60.00	30.50	-0.27	11.31	QP
8	19.224	28.34	-31.66	60.00	17.30	-0.27	11.31	Average
9	20.594	45.36	-14.64	60.00	34.31	-0.30	11.35	QP
10	20.594	32.26	-27.74	60.00	21.21	-0.30	11.35	Average
11 *	21.147	46.57	-13.43	60.00	35.50	-0.30	11.37	QP
12	21.147	32.67	-27.33	60.00	21.60	-0.30	11.37	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

Test Engineer :	Carry Xu	Temperature :	22~23°C
		Relative Humidity :	41~42%

Note: All modes had been tested and only the worst channel test data of each bandwidth shown in the report

UNII-1 - 5150~5250MHz

WIFI 802.11ac VHT40 (Band Edge @ 3m)

WIFI Ant.	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 VHT40 CH 38 5190MHz		5150	57.84	-16.16	74	45.77	34.1	9.78	31.81	112	360	P	H
		5149.96	44.91	-9.09	54	28.25	34.93	13.54	31.81	112	360	A	H
	*	5206	102.82	-	-	90.73	34.1	9.83	31.84	112	360	P	H
		5206	95.19	-	-	83.1	34.1	9.83	31.84	112	360	A	H
		5350.68	52.75	-21.25	74	40.12	34.65	9.91	31.93	112	360	P	H
		5396.58	42.14	-11.86	54	29.35	34.8	9.94	31.95	112	360	A	H
		5147.2	56.92	-17.08	74	44.85	34.1	9.78	31.81	100	306	P	V
		5149.28	45.13	-8.87	54	33.06	34.1	9.78	31.81	100	306	A	V
	*	5200	102.68	-	-	90.59	34.1	9.83	31.84	100	306	P	V
		5200	96.12	-	-	84.03	34.1	9.83	31.84	100	306	A	V
		5395.5	51.92	-22.08	74	39.13	34.8	9.94	31.95	100	306	P	V
	5394.6	42.23	-11.77	54	29.44	34.8	9.94	31.95	100	306	A	V	
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



UNII-1 5150~5250MHz
WIFI 802.11ac VHT40 (Harmonic @ 3m)

WIFI Ant.	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 VHT40		10377	46.13	-22.17	68.3	56.17	37.65	14.15	61.84	300	0	P	H
CH 38 5190MHz		10377	48.9	-19.4	68.3	58.94	37.65	14.15	61.84	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

UNII-2A - 5250~5350MHz
WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI Ant.	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 58 5290MHz		5141.76	53.04	-20.96	74	40.95	34.1	9.78	31.79	100	351	P	H
		5121.12	44.67	-9.33	54	32.6	34.1	9.76	31.79	100	351	A	H
	*	5296	97.22	-	-	84.71	34.5	9.89	31.88	100	351	P	H
		5296	90.45	-	-	77.94	34.5	9.89	31.88	100	351	A	H
		5357.6	54.1	-19.9	74	41.47	34.65	9.91	31.93	100	351	P	H
		5350	45.79	-8.21	54	33.16	34.65	9.91	31.93	100	351	A	H
		5119.04	52.74	-21.26	74	40.67	34.1	9.76	31.79	105	321	P	V
		5130.56	44.41	-9.59	54	32.33	34.1	9.77	31.79	105	321	A	V
	*	5302	97.5	-	-	85.01	34.5	9.89	31.9	105	321	P	V
		5302	90.89	-	-	78.4	34.5	9.89	31.9	105	321	A	V
		5356.7	55.69	-18.31	74	43.06	34.65	9.91	31.93	105	321	P	V
	5350.5	46.52	-7.48	54	33.89	34.65	9.91	31.93	105	321	A	V	
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



UNII-2A 5250~5350MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI Ant.	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		10575	46.45	-21.85	68.3	56.07	37.74	14.27	61.63	300	0	P	H
CH 58 5290MHz		10575	49.41	-18.89	68.3	59.03	37.74	14.27	61.63	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 802.11a (Band Edge @ 3m)

WIFI Ant.	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)
802.11a CH 140 5700MHz	*	5729.56	62.03	-6.27	68.3	49.19	34.53	10.35	32.04	100	279	P	H
		5698	107.15	-	-	94.39	34.5	10.32	32.06	100	279	P	H
		5698	100.14	-	-	87.38	34.5	10.32	32.06	100	279	A	H
	*	5727.24	62.97	-5.33	68.3	50.13	34.53	10.35	32.04	100	302	P	V
		5698	108.7	-	-	95.94	34.5	10.32	32.06	100	302	P	V
		5698	100.66	-	-	87.9	34.5	10.32	32.06	100	302	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



UNII-2C - 5470~5725MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant.	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)
802.11a CH 140 5700MHz		11400	47	-27	74	55.46	38.24	14.85	61.55	300	0	P	H
		11400	47.54	-26.46	74	56	38.24	14.85	61.55	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 VHT20 (Band Edge @ 3m)

WIFI Ant.	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 VHT20 CH 140 5700MHz	*	5725	62.46	-5.84	68.3	49.62	34.53	10.35	32.04	100	283	P	H
		5704	107.25	-	-	94.46	34.52	10.33	32.06	100	283	A	H
	!	5704	99.73	-	-	86.94	34.52	10.33	32.06	100	283	P	H
	*	5728.76	62.66	-5.64	68.3	49.82	34.53	10.35	32.04	101	295	P	V
		5710	107.47	-	-	94.66	34.52	10.33	32.04	101	295	A	V
	!	5710	100.35	-	-	87.54	34.52	10.33	32.04	101	295	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 VHT20 (Harmonic @ 3m)

WIFI Ant.	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 VHT20		11400	45.28	-28.72	74	53.74	38.24	14.85	61.55	300	0	P	H
CH 140 5700MHz		11400	47.08	-26.92	74	55.54	38.24	14.85	61.55	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 802.11a (LF @ 3m)

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a LF		30	27.6	-12.4	40	34.32	25.9	0.68	33.3	-	-	P	H
		72.68	27.12	-12.88	40	46.52	12.58	1.22	33.2	-	-	P	H
		167.74	25.41	-18.09	43.5	41.13	15.26	1.88	32.86	-	-	P	H
		321.97	28.25	-17.75	46	37.92	19.87	2.63	32.17	-	-	P	H
		524.7	26.15	-19.85	46	29.31	24.49	3.38	31.03	-	-	P	H
		873.9	34.75	-11.25	46	29.95	29.06	4.32	28.58	-	-	P	H
		47.46	32.81	-7.19	40	49.44	15.68	0.99	33.3	-	-	P	V
		101.78	32.03	-11.47	43.5	47.91	15.84	1.47	33.19	-	-	P	V
		150.28	23.04	-20.46	43.5	38.74	15.41	1.79	32.9	-	-	P	V
		211.39	29.58	-13.92	43.5	44.69	15.48	2.12	32.71	-	-	P	V
		273.47	26.84	-19.16	46	38.59	18.22	2.42	32.39	-	-	P	V
	825.4	38.76	-7.24	46	34.79	28.68	4.21	28.92	-	-	P	V	
Remark	1. No other spurious found. 2. All results are PASS against 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	Peak or Average
H/V	Horizontal or Vertical



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.		(MHz)	(dBμV/m)	(dB)	Limit Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
					(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
CH 01		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H
2412MHz													

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)

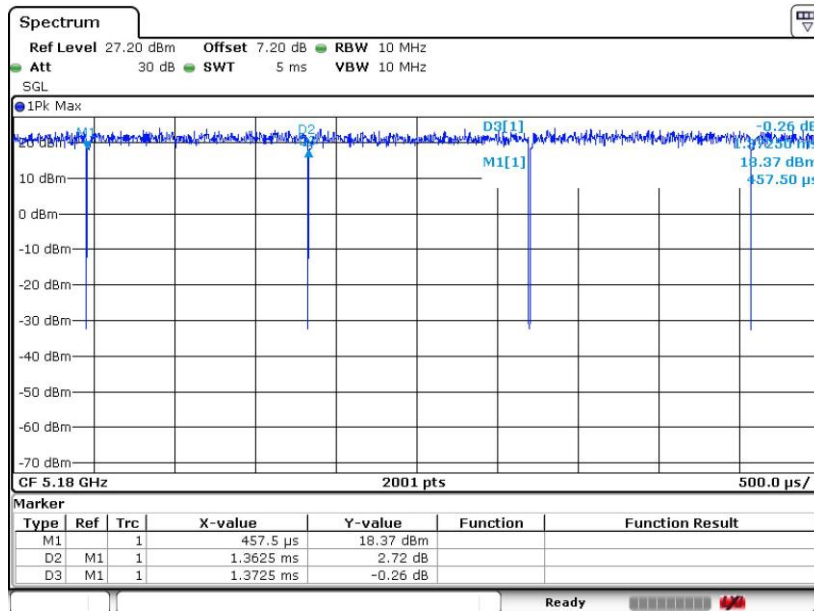
Both peak and average measured complies with the limit line, so test result is “PASS”.



Appendix D. Duty Cycle Plots

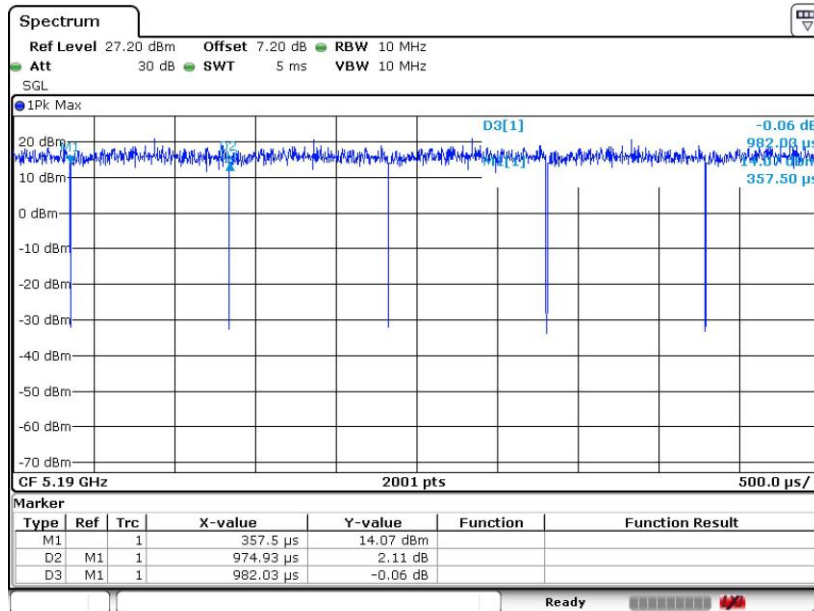
Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11a	99.27	-	-	10Hz
802.11ac VHT20	99.28	-	-	10Hz
802.11ac VHT40	98.00	-	-	10Hz
802.11ac VHT80	96.11	0.2474	4.0422	4.3kHz

802.11a

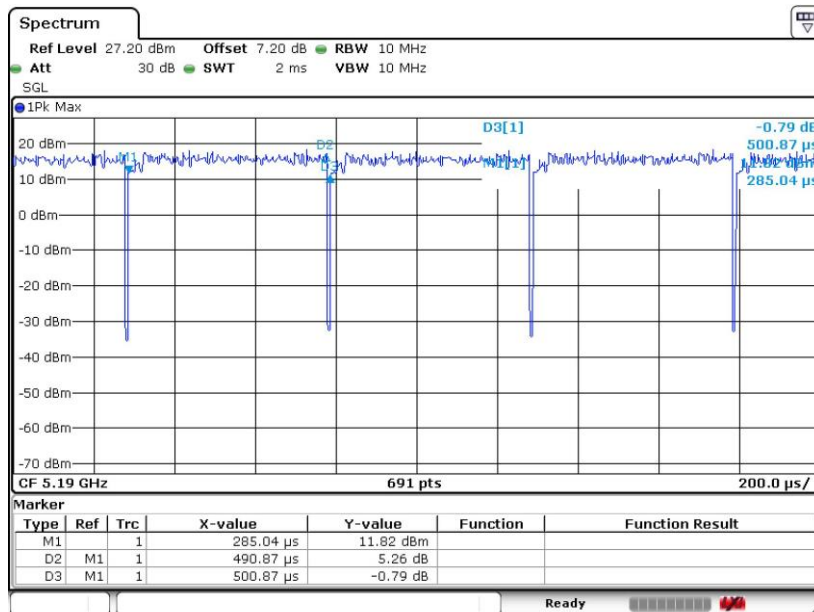




802.11ac VHT20



802.11ac VHT40





802.11ac VHT80

