FCC RF Test Report

APPLICANT	:	Xiaomi Communications Co., Ltd.
EQUIPMENT	:	Mobile Phone
BRAND NAME	:	Redmi
MODEL NAME	:	2201117TY
FCC ID	:	2AFZZ117TY
STANDARD	:	FCC Part 15 Subpart E §15.407
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure
TEST DATE(S)	:	Dec. 11, 2021 ~ Dec. 20, 2021

We, Sporton International (Kunshan) Inc., 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 (Kunshan) Inc., the test report shall not be reproduced except in full.

Reviewed by: Jason Jia / Supervisor

Approved by: Alex Wang / Manager

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

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR1O2304F	Rev. 01	Initial issue of report	Dec. 31, 2021

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.403(i)	6dB, 26dB and 99% Occupied Bandwidth	> 500kHz	Pass	-
3.2	15.407(a)	Maximum Conducted Output Power	≤ 30 dBm	Pass	-
3.3	15.407(a)	Power Spectral Density	≤ 30 dBm/500kHz	Pass	-
3.4	15.407(b)	Unwanted Emissions	15.407(b)(4)(i) &15.209(a)	Pass	Under limit 2.00 dB at 7660.000 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 12.24 dB at 9.966 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

Xiaomi Communications Co., Ltd.
#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

1.2 Manufacturer

Xiaomi Communications Co., Ltd.
#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Phone
Brand Name	Redmi
Model Name	2201117TY
FCC ID	2AFZZ117TY
IMEI Code	Conducted: 864154050024785/864154050024793 Conduction: 864154050025923/864154050025931 Radiation: 864154050025949/864154050025956
HW Version	P1.1
SW Version	MIUI13
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 Channel Frequency Range	5745 MHz ~ 5805 MHz
Maximum Output Power	**<5745 MHz ~ 5805 MHz>** 802.11a : 13.93 dBm / 0.0247 W 802.11n HT20 : 13.73 dBm / 0.0236 W 802.11n HT40 : 14.20 dBm / 0.0263 W 802.11ac VHT20: 13.64 dBm / 0.0231 W 802.11ac VHT40: 14.05 dBm / 0.0254 W 802.11ac VHT80: 14.07 dBm / 0.0255 W
99% Occupied Bandwidth	802.11a : 17.33 MHz 802.11n HT20 : 18.43 MHz 802.11n HT40 : 36.26 MHz 802.11ac VHT80 : 75.04 MHz
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac：OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)
Antenna Type / Gain	PIFA Antenna with gain -1.46 dBi

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 Testing Location

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

Test Firm	Sporton International (Kunshan) Inc.		
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 03CH02-KS TH01-KS	CN1257	314309

1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH02-KS	AUDIX	E3	6.2009-8-24a
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8 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 (Z 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)
5745-5805 MHz U-NII-3	149	5745	157	5785
	151*	5755	159*	5795
	153	5765	161	5805
	155#	5775		

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 VHT80	MCS0

AC Conducted Emission	Mode 1 : GSM 850 Idle+ Bluetooth Link+WLAN Link(5G)+USB Cable1 (Charging from Adapter) +Earphone

Remark:

1. For Radiated Test Cases, The tests were performed with Adapter, Earphone and USB Cable 1
2. All test modes of the Radiated Spurious Emission (RSE) were tested; only the worse data which are 802.11n HT20 CH149 (5745MHz) were reported.

Simultaneous transmission
802.11n HT20 CH149(5745MHz) Link + GSM 850 link

Ch. #		U-NII-3：5745-5805 MHz			
		802.11a	802.11n HT20	802.11n HT40	802.11ac VHT80
L	Low	149	149	151	-
M	Middle	157	157	-	155
H	High	161	161	159	-

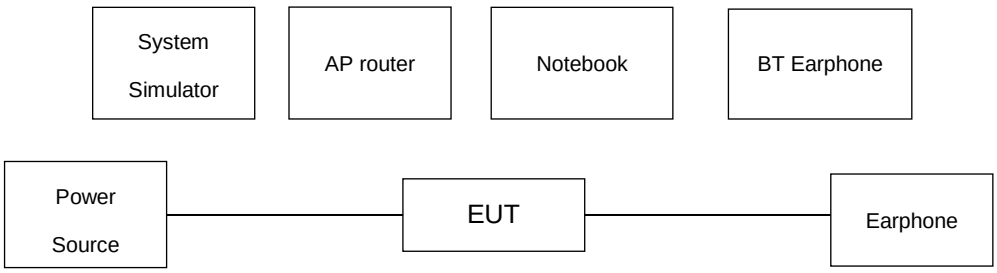
2.3 Connection Diagram of Test System

< Radiated Emission >

This example is connection diagram of EUT test configurations.

. For detail, please refer to test mode configuration and setup photographs for each test item.

< Conducted Emission>



This example is connection diagram of EUT test configurations.

. For detail, please refer to test mode configuration and setup photographs for each test item.

2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Base Station	Anritsu	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	Xiaomi	LYEJ02LM	N/A	N/A	N/A
5.	Earphone	MI	EM023	N/A	Unshielded,1.2m	N/A
6.	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 7.20dB.

Offset(dB) = RF cable loss(dB)

= 7.20 (dB)

3 Test Result

3.1 6dB and 26dB and 99% Occupied Bandwidth Measurement

3.1.1 Description of 6dB and 26dB and 99% Occupied Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

26dB and 99% Occupied bandwidth are reporting only.

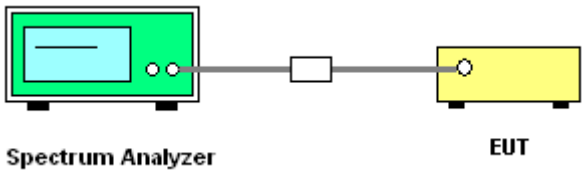
3.1.2 Measuring Instruments

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 for the band 5.725-5.85GHz
2. Set RBW = 100kHz.
3. Set the VBW ≥ 3 x RBW.
4. Detector = Peak.
5. Trace mode = max hold
6. Measure the maximum width of the emission that is 6 dB down from the peak of the emission.
7. Measure and record the results in the test report.

3.1.4 Test Setup

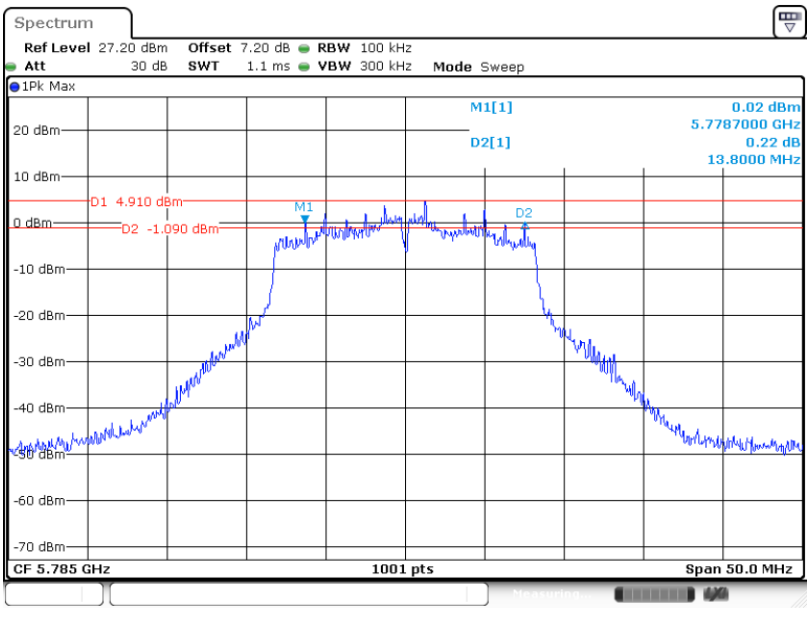


3.1.5 Test Result of 6dB Bandwidth

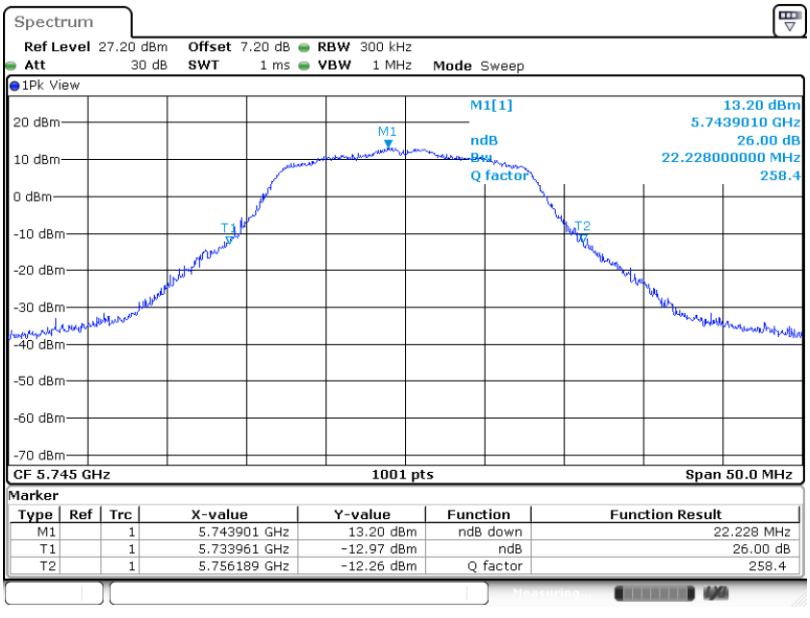
Please refer to Appendix A.

11a

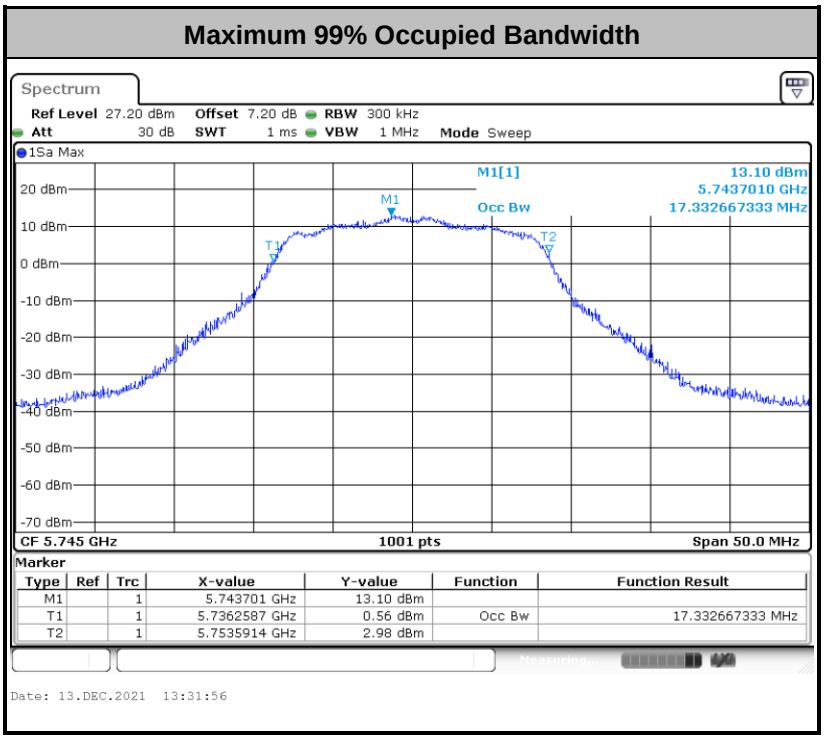
Minimum 6dB Bandwidth



Maximum 26dB Bandwidth

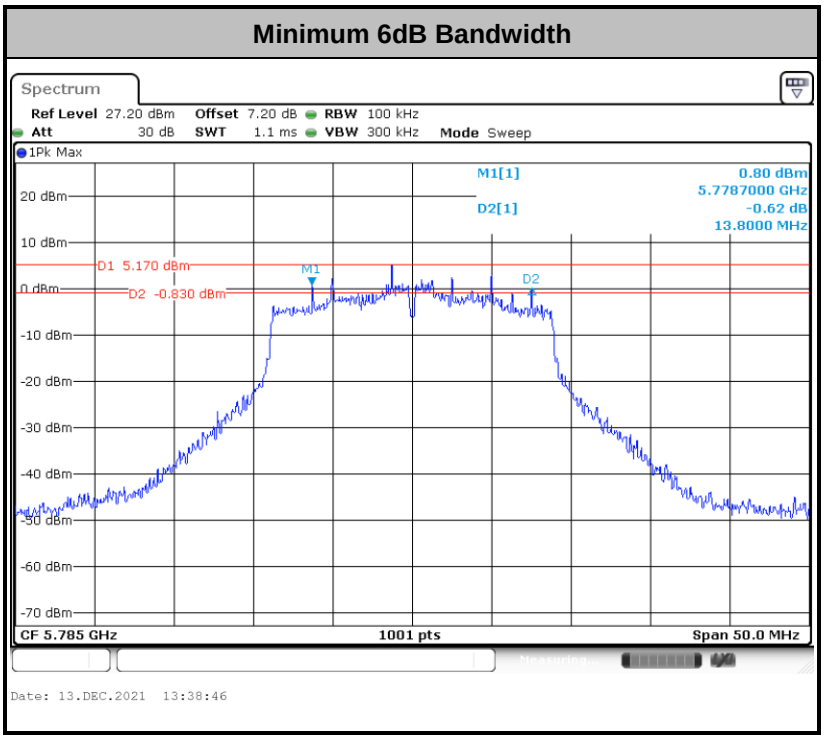


Maximum 99% Occupied Bandwidth

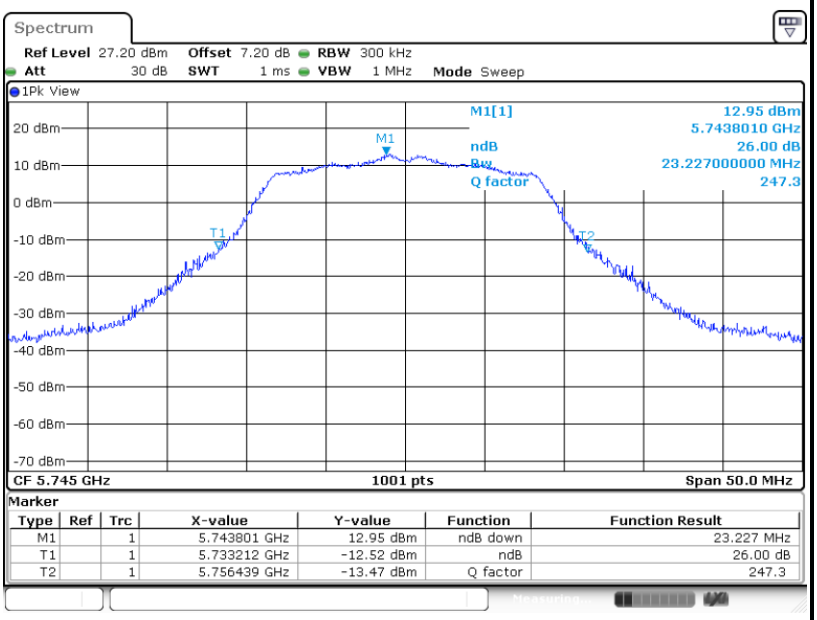


11n HT20

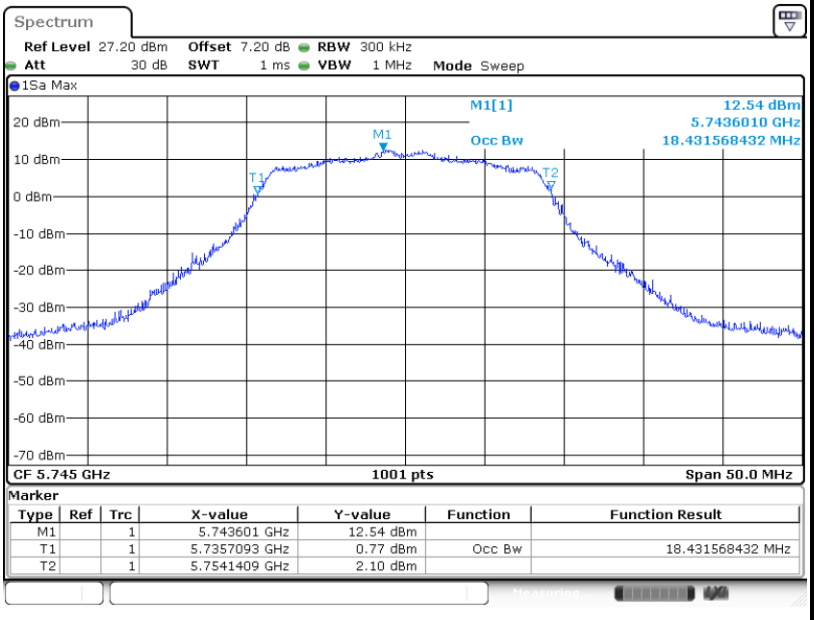
Minimum 6dB Bandwidth



Maximum 26dB Bandwidth

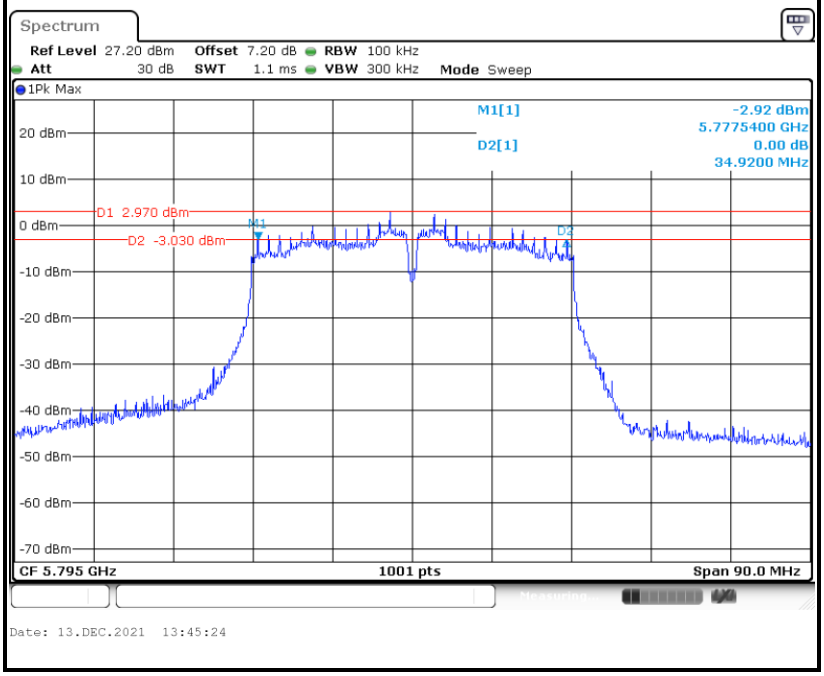


Maximum 99% Occupied Bandwidth

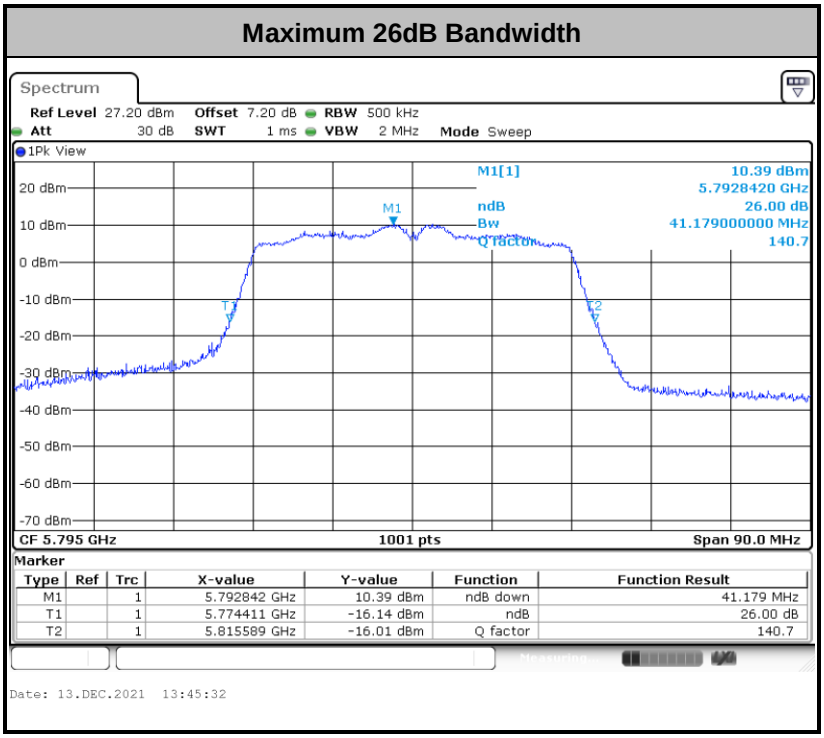


11n HT40

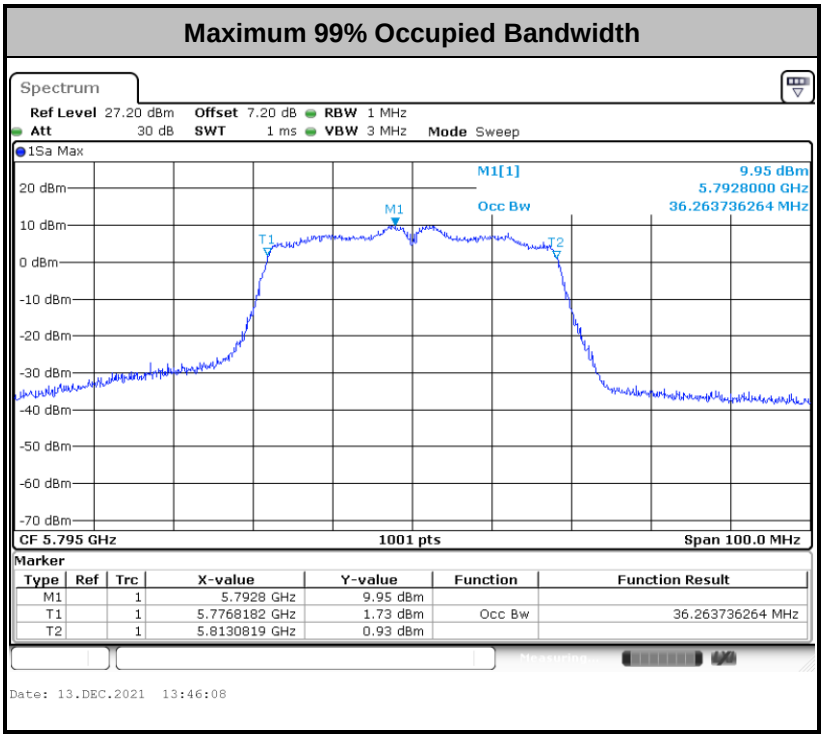
Minimum 6dB Bandwidth



Maximum 26dB Bandwidth

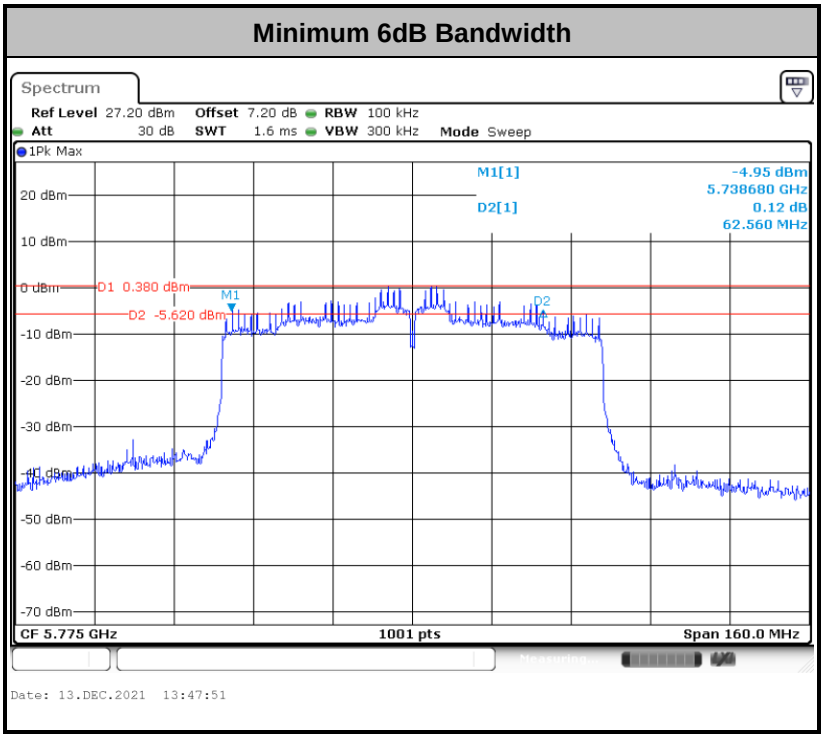


Maximum 99% Occupied Bandwidth

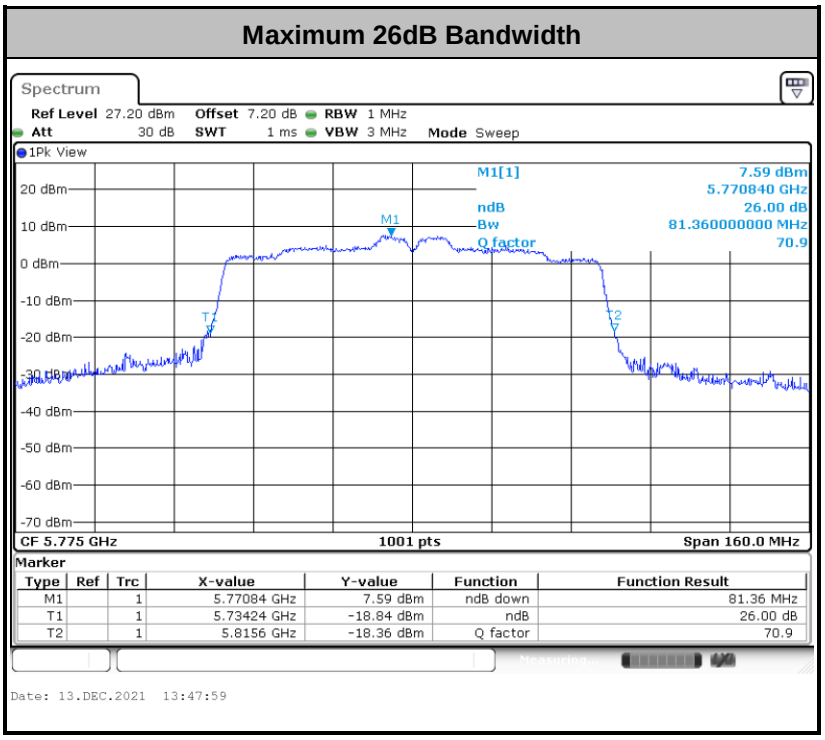


11ac VHT80

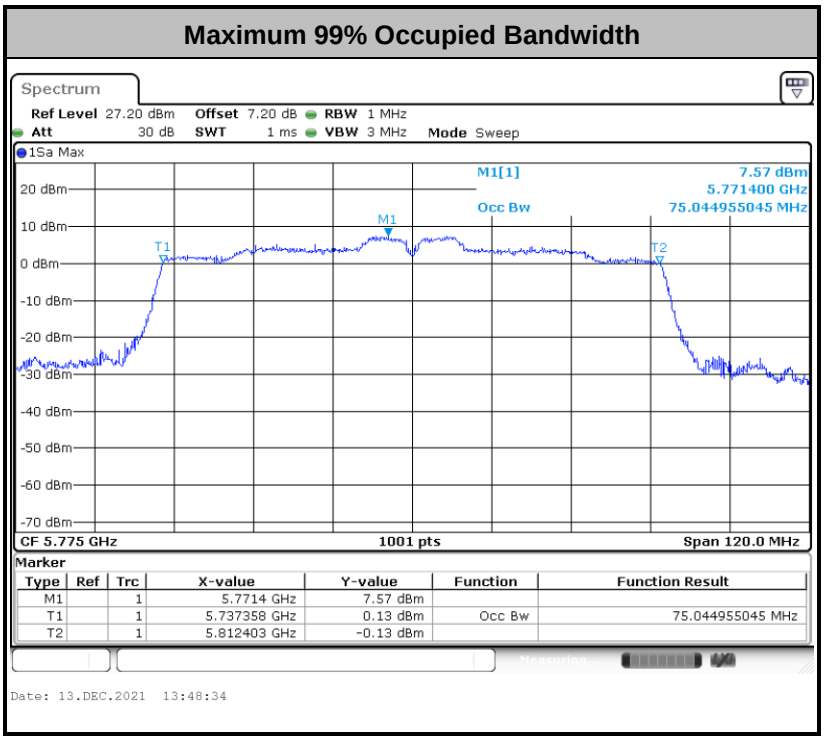
Minimum 6dB Bandwidth



Maximum 26dB Bandwidth



Maximum 99% Occupied Bandwidth



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

For the band 5.725–5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

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.

3.2.2 Measuring Instruments

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

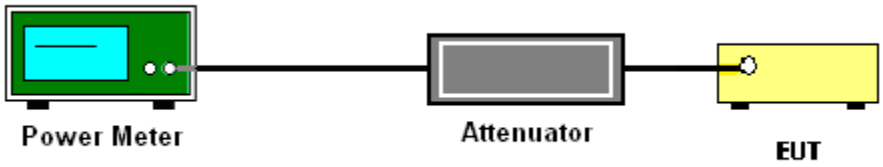
3.2.3 Test Procedures

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.

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

For the band 5.725–5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, 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.

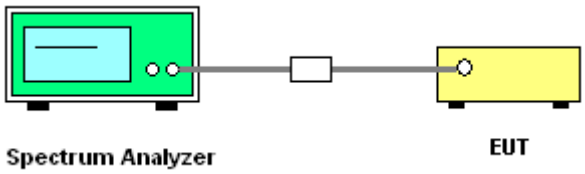
 # Method SA-2 #

(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 = 300 kHz.
- Set VBW ≥ 1 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(500kHz/RBW) to the test result.
- 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.

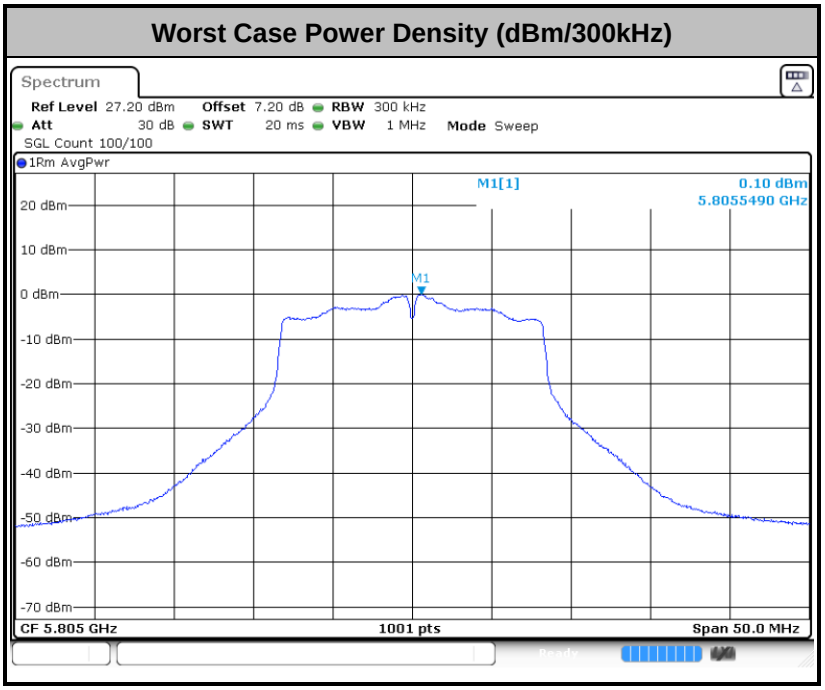
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/300kHz)



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 5.725-5.85 GHz band:

15.407(b)(4)(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(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 ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

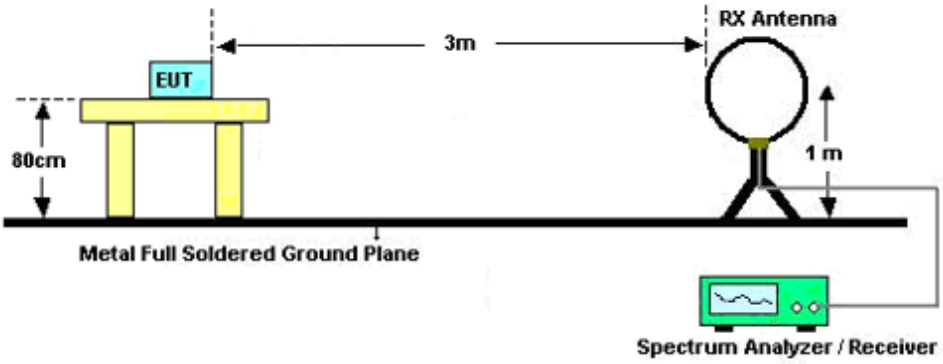
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

   - 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.

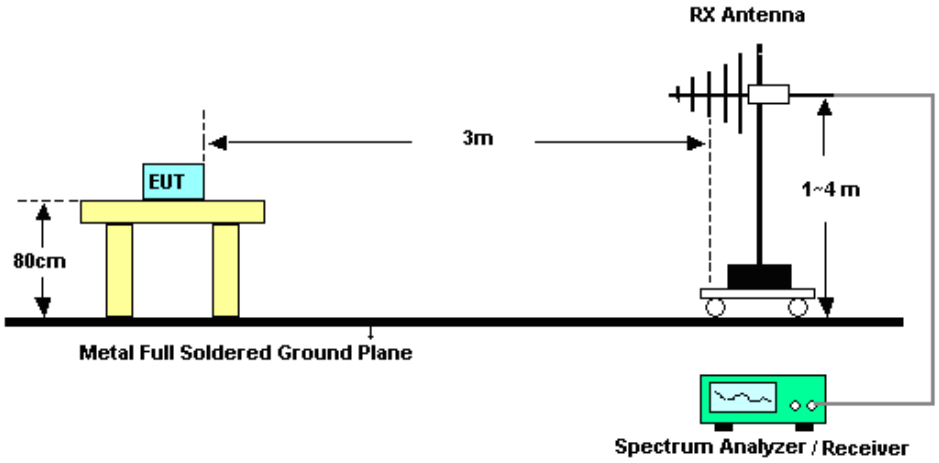
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband 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

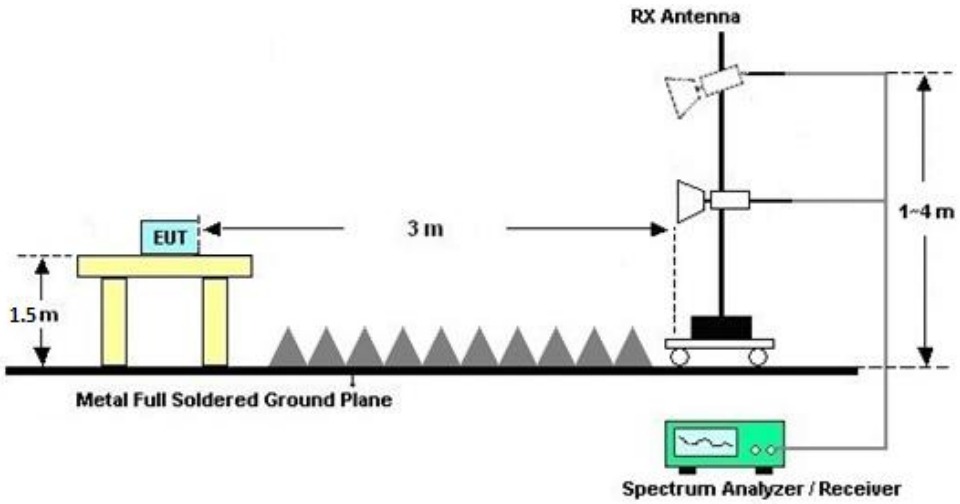
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated 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 Band Edges

Please refer to Appendix C.

3.4.7 Duty Cycle

Please refer to Appendix D.

3.4.8 Test Result of Unwanted Radiated Emission (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.

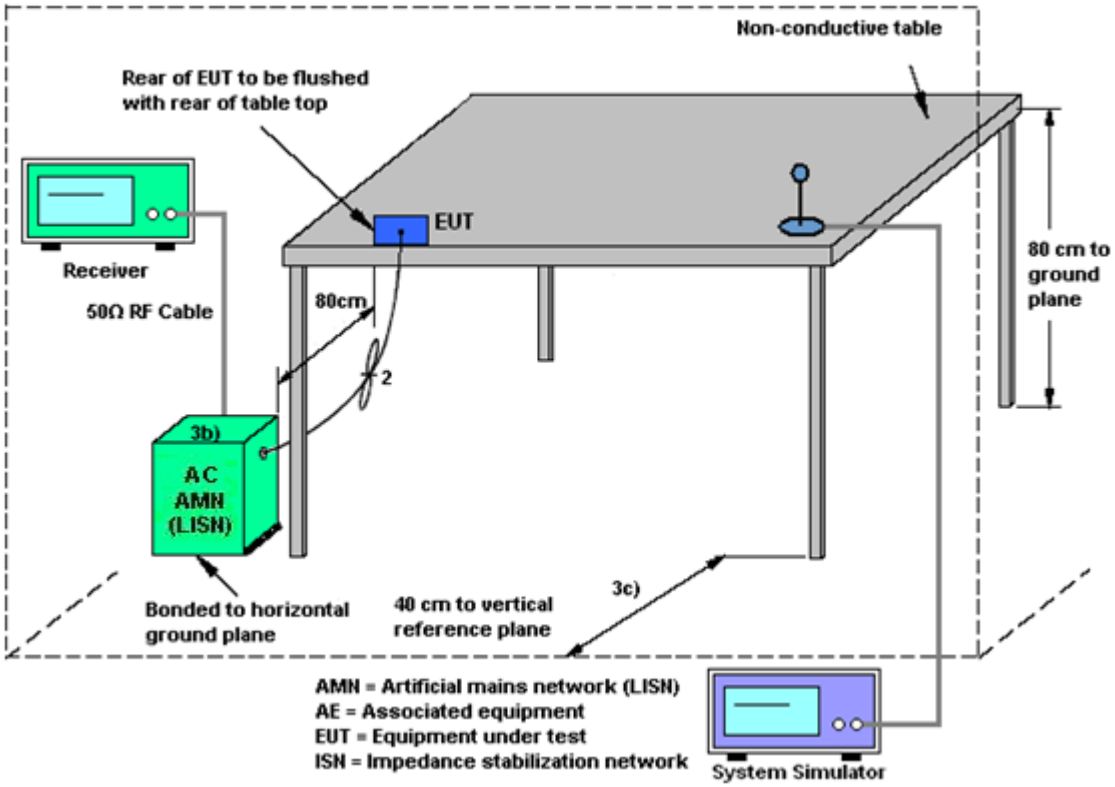
3.5.2 Measuring Instruments

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	Dec. 13, 2021	Oct. 13, 2022	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 07, 2021	Dec. 13, 2021	Jan. 06, 2022	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 07, 2021	Dec. 13, 2021	Jan. 06, 2022	Conducted (TH01-KS)
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz;Max 30dBm	Oct. 16, 2021	Dec. 20, 2021	Oct. 15, 2022	Radiation (03CH02-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55370528	10Hz-44G,MAX 30dB	Oct. 16, 2021	Dec. 20, 2021	Oct. 15,2022	Radiation (03CH02-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 30, 2021	Dec. 20, 2021	Oct. 29, 2022	Radiation (03CH02-KS)
Bilog Antenna	TeseQ	CBL6111D	44483	30MHz-1GHz	Jan. 26, 2021	Dec. 20, 2021	Jan. 25, 2022	Radiation (03CH02-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75957	1GHz~18GHz	Oct. 30, 2021	Dec. 20, 2021	Oct. 29, 2022	Radiation (03CH02-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	100MHz-18GHz	Jan. 06, 2021	Dec. 20, 2021	Jan. 05, 2022	Radiation (03CH02-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 05, 2021	Dec. 20, 2021	Nov. 04, 2022	Radiation (03CH02-KS)
Amplifier	SONOMA	310N	187289	9KHz-1GHz	Jan. 06, 2021	Dec. 20, 2021	Jan. 05, 2022	Radiation (03CH02-KS)
Amplifier	Keysight	83017A	MY53270316	500MHz~26.5GHz	Oct. 16, 2021	Dec. 20, 2021	Oct. 15, 2022	Radiation (03CH02-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 06, 2021	Dec. 20, 2021	Jan. 05, 2022	Radiation (03CH02-KS)
AC Power Source	Chroma	61601	616010002473	N/A	NCR	Dec. 20, 2021	NCR	Radiation (03CH02-KS)
Turn Table	MF	MF7802	N/A	0~360 degree	NCR	Dec. 20, 2021	NCR	Radiation (03CH02-KS)
Antenna Mast	MF	MF7802	N/A	1 m~4 m	NCR	Dec. 20, 2021	NCR	Radiation (03CH02-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 21, 2021	Dec. 11, 2021	Apr. 20, 2022	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 14, 2021	Dec. 11, 2021	Oct. 13, 2022	Conduction (CO01-KS)
AC LISN	R&S	ENV216	100334	9kHz~30MHz	Apr. 13, 2021	Dec. 11, 2021	Apr. 12, 2022	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 14, 2021	Dec. 11, 2021	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))	**4.9dB**

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))	**5.1dB**

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

Appendix A. Conducted Test Results

Report Number : FR1O2304F

Test Engineer:	Jacob Zhang	Temperature:	21~25	°C
Test Date:	2021/12/13	Relative Humidity:	51~54	%

Report Number : FR1O2304F

TEST RESULTS DATA
6dB and 26dB EBW and 99% OBW

U-NII-3									
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)	26 dB Bandwidth (MHz)	6 dB Bandwidth (MHz)	6dB Bandwidth min. Limit (MHz)	Pass/Fail
11a	6M bps	1	149	5745	17.33	22.23	15.1	0.5	Pass
11a	6Mbps	1	157	5785	17.28	22.18	13.8	0.5	Pass
11a	6Mbps	1	161	5805	16.43	20.88	15.05	0.5	Pass
HT20	MCS 0	1	149	5745	18.43	23.23	15	0.5	Pass
HT20	MCS 0	1	157	5785	18.43	23.23	13.8	0.5	Pass
HT20	MCS 0	1	161	5805	17.68	21.43	15.05	0.5	Pass
HT40	MCS 0	1	151	5755	36.16	41.00	35.1	0.5	Pass
HT40	MCS 0	1	159	5795	36.26	41.18	34.92	0.5	Pass
VHT80	MCS 0	1	155	5775	75.04	81.36	62.56	0.5	Pass

Report Number : FR1O2304F

TEST RESULTS DATA
Average Power Table

U-NII-3										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)		Pass/Fail
11a	6M bps	1	149	5745	0.11	13.93	30.00	-1.46		Pass
11a	6Mbps	1	157	5785	0.11	13.77	30.00	-1.46		Pass
11a	6Mbps	1	161	5805	0.11	13.75	30.00	-1.46		Pass
HT20	MCS 0	1	149	5745	0.12	13.73	30.00	-1.46		Pass
HT20	MCS 0	1	157	5785	0.12	13.64	30.00	-1.46		Pass
HT20	MCS 0	1	161	5805	0.12	13.55	30.00	-1.46		Pass
HT40	MCS 0	1	151	5755	0.23	14.20	30.00	-1.46		Pass
HT40	MCS 0	1	159	5795	0.23	14.00	30.00	-1.46		Pass
VHT20	MCS 0	1	149	5745	0.11	13.64	30.00	-1.46		Pass
VHT20	MCS 0	1	157	5785	0.11	13.59	30.00	-1.46		Pass
VHT20	MCS 0	1	161	5805	0.11	13.50	30.00	-1.46		Pass
VHT40	MCS 0	1	151	5755	0.22	14.05	30.00	-1.46		Pass
VHT40	MCS 0	1	159	5795	0.22	13.95	30.00	-1.46		Pass
VHT80	MCS 0	1	155	5775	0.48	14.07	30.00	-1.46		Pass

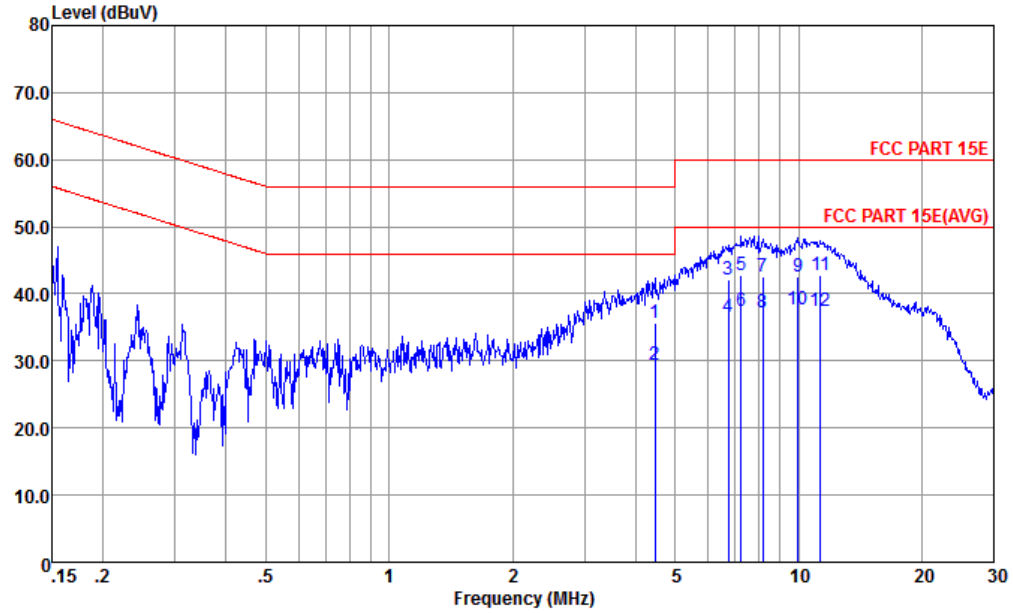
Report Number : FR1O2304F

TEST RESULTS DATA
Power Spectral Density

U-NII-3										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	10log (500kHz /RBW) Factor (dB)	Average Power Density (dBm/500kHz)	Average PSD Limit (dBm/500kHz)	DG (dBi)	Pass/Fail
11a	6M bps	1	149	5745	0.11	2.22	2.31	30.00	-1.46	Pass
11a	6Mbps	1	157	5785	0.11	2.22	2.08	30.00	-1.46	Pass
11a	6Mbps	1	161	5805	0.11	2.22	2.43	30.00	-1.46	Pass
HT20	MCS 0	1	149	5745	0.12	2.22	2.00	30.00	-1.46	Pass
HT20	MCS 0	1	157	5785	0.12	2.22	1.56	30.00	-1.46	Pass
HT20	MCS 0	1	161	5805	0.12	2.22	1.91	30.00	-1.46	Pass
HT40	MCS 0	1	151	5755	0.23	2.22	-0.54	30.00	-1.46	Pass
HT40	MCS 0	1	159	5795	0.23	2.22	-0.78	30.00	-1.46	Pass
VHT80	MCS 0	1	155	5775	0.48	2.22	-3.24	30.00	-1.46	Pass

Appendix B. AC Conducted Emission Test Results

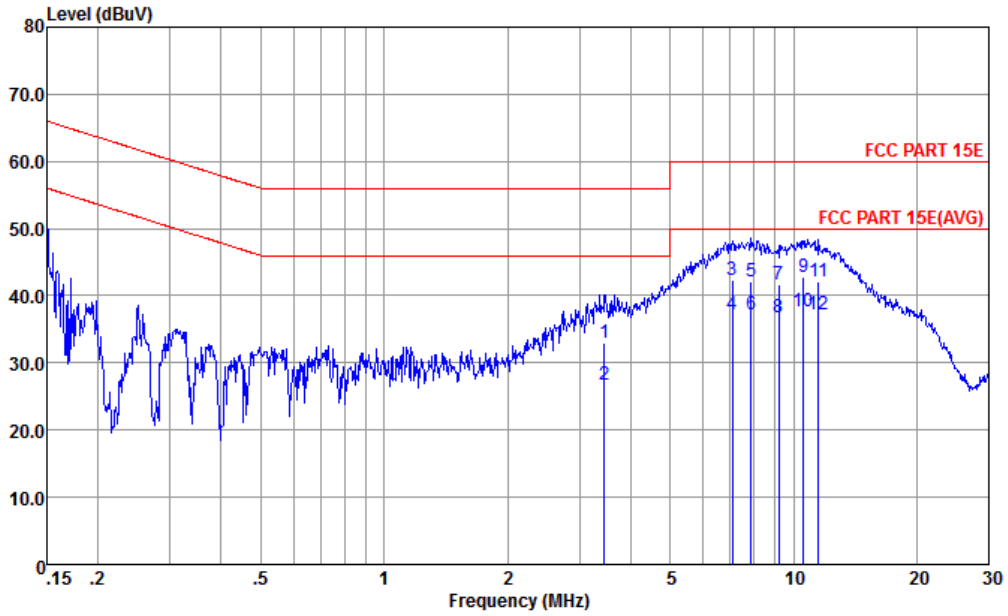
Test Engineer :	Amos Zhang	**Temperature :**	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line



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

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	4.454	35.63	-20.37	56.00	25.20	0.17	10.26	QP
2	4.454	29.33	-16.67	46.00	18.90	0.17	10.26	Average
3	6.733	42.09	-17.91	60.00	31.60	0.19	10.30	QP
4	6.733	36.59	-13.41	50.00	26.10	0.19	10.30	Average
5	7.252	42.70	-17.30	60.00	32.20	0.19	10.31	QP
6	7.252	37.40	-12.60	50.00	26.90	0.19	10.31	Average
7	8.192	42.62	-17.38	60.00	32.10	0.20	10.32	QP
8	8.192	37.22	-12.78	50.00	26.70	0.20	10.32	Average
9	9.966	42.66	-17.34	60.00	32.10	0.22	10.34	QP
10 *	9.966	37.76	-12.24	50.00	27.20	0.22	10.34	Average
11	11.317	42.80	-17.20	60.00	32.20	0.24	10.36	QP
12	11.317	37.50	-12.50	50.00	26.90	0.24	10.36	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		3.454	33.01	-22.99	56.00	22.60	0.16	10.25	QP
2		3.454	26.71	-19.29	46.00	16.30	0.16	10.25	Average
3		7.100	42.40	-17.60	60.00	31.90	0.20	10.30	QP
4		7.100	37.10	-12.90	50.00	26.60	0.20	10.30	Average
5		7.893	42.12	-17.88	60.00	31.59	0.21	10.32	QP
6		7.893	37.12	-12.88	50.00	26.59	0.21	10.32	Average
7		9.204	41.75	-18.25	60.00	31.20	0.22	10.33	QP
8		9.204	36.75	-13.25	50.00	26.20	0.22	10.33	Average
9		10.564	42.79	-17.21	60.00	32.20	0.24	10.35	QP
10	*	10.564	37.69	-12.31	50.00	27.10	0.24	10.35	Average
11		11.498	42.22	-17.78	60.00	31.60	0.26	10.36	QP
12		11.498	37.22	-12.78	50.00	26.60	0.26	10.36	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

5725~5825MHz

WIFI 802.11n HT20 (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)
802.11n HT20 CH 149 5745MHz		5612.8	56.19	-12.11	68.3	41.67	35.47	11.13	32.08	256	164	P	H
		5698.4	55.73	-48.39	104.12	40.99	35.58	11.22	32.06	256	164	P	H
		5719.2	56.44	-54.24	110.68	41.63	35.6	11.25	32.04	256	164	P	H
		5722.8	56.69	-60.59	117.28	41.86	35.62	11.25	32.04	256	164	P	H
		5746	106.12	-	-	91.21	35.65	11.27	32.01	256	164	P	H
		5746	99.72	-	-	84.81	35.65	11.27	32.01	256	164	A	H
		5600.8	55.56	-12.74	68.3	41.05	35.45	11.13	32.07	194	226	P	V
		5697.6	55.81	-47.72	103.53	41.07	35.58	11.22	32.06	194	226	P	V
		5719.98	57.58	-53.31	110.89	42.77	35.6	11.25	32.04	194	226	P	V
		5724.8	59.16	-62.68	121.84	44.33	35.62	11.25	32.04	194	226	P	V
		5746	110.29	-	-	95.38	35.65	11.27	32.01	194	226	P	V
		5746	103.51	-	-	88.6	35.65	11.27	32.01	194	226	A	V

5725~5825MHz

WIFI 802.11n HT20 (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)
802.11n HT20 CH 149 5745MHz		7660	50.34	-23.66	74	61.13	36.69	13.1	60.58	300	0	P	H
		11490	46.61	-27.39	74	52.04	38.69	16.31	60.43	300	0	P	H
		7660	54.46	-19.54	74	65.25	36.69	13.1	60.58	285	85	P	V
		7660	52	-2	54	62.79	36.69	13.1	60.58	281	85	A	V
		11490	46.61	-27.39	74	52.04	38.69	16.31	60.43	100	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

5GHz WIFI 802.11n HT20 (LF)

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)
5GHz 802.11n HT20 LF		31.94	19.94	-20.06	40	28.18	23.2	0.76	32.2	-	-	P	H
		71.71	19.15	-20.85	40	37.65	12.5	1.2	32.2	-	-	P	H
		145.43	20.71	-22.79	43.5	33.85	17.2	1.77	32.11	-	-	P	H
		257.95	22.26	-23.74	46	32.6	19.68	2.16	32.18	-	-	P	H
		643.04	25.91	-20.09	46	28.17	26.24	3.71	32.21	-	-	P	H
		828.31	27.99	-18.01	46	28.09	28.02	4.24	32.36	-	-	P	H
		44.55	30.48	-9.52	40	45.01	16.7	0.95	32.18	-	-	P	V
		60.07	27.46	-12.54	40	46.69	11.8	1.07	32.1	-	-	P	V
		191.99	21.44	-22.06	43.5	36.9	14.6	2.04	32.1	-	-	P	V
		256.98	21.32	-24.68	46	31.84	19.52	2.15	32.19	-	-	P	V
		569.32	24.89	-21.11	46	27.88	25.94	3.37	32.3	-	-	P	V
		801.15	28.27	-17.73	46	28.37	27.98	4.22	32.3	-	-	P	V
Remark	1. No other spurious found. 2. All results are PASS against limit line.												

<Simultaneous transmission>

5725~5825MHz

WIFI 802.11n HT20_CH149 + GSM850 Link (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)
802.11n HT20 CH 149 5745MHz +GSM 850		5620	55.83	-12.47	68.3	41.29	35.47	11.15	32.08	112	257	P	H
		5687.2	55.7	-40.16	95.86	40.99	35.55	11.22	32.06	112	257	P	H
		5700.8	57.29	-48.23	105.52	42.54	35.58	11.23	32.06	112	257	P	H
		5723.2	58.73	-59.47	118.2	43.9	35.62	11.25	32.04	112	257	P	H
		5746	108.95	-	-	94.04	35.65	11.27	32.01	112	257	P	H
		5746	101.49	-	-	86.58	35.65	11.27	32.01	112	257	A	H
		5605.2	54.73	-13.57	68.3	40.21	35.47	11.13	32.08	100	171	P	V
		5681.6	56.87	-34.85	91.72	42.18	35.55	11.2	32.06	100	171	P	V
		5712.4	56.08	-52.69	108.77	41.29	35.6	11.23	32.04	100	171	P	V
		5724	55.66	-64.36	120.02	40.83	35.62	11.25	32.04	100	171	P	V
		5746	103.34	-	-	88.43	35.65	11.27	32.01	100	171	P	V
		5746	95.48	-	-	80.57	35.65	11.27	32.01	100	171	A	V

5725~5825MHz

WIFI 802.11n HT20 (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)
802.11n HT20 CH 149 5745MHz+ GSM 850		7660	50.57	-23.43	74	61.36	36.69	13.1	60.58	300	0	P	H
		7660	54.78	-19.22	74	65.57	36.69	13.1	60.58	301	104	P	V
		7660	51.96	-2.04	54	62.75	36.69	13.1	60.58	301	104	A	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)

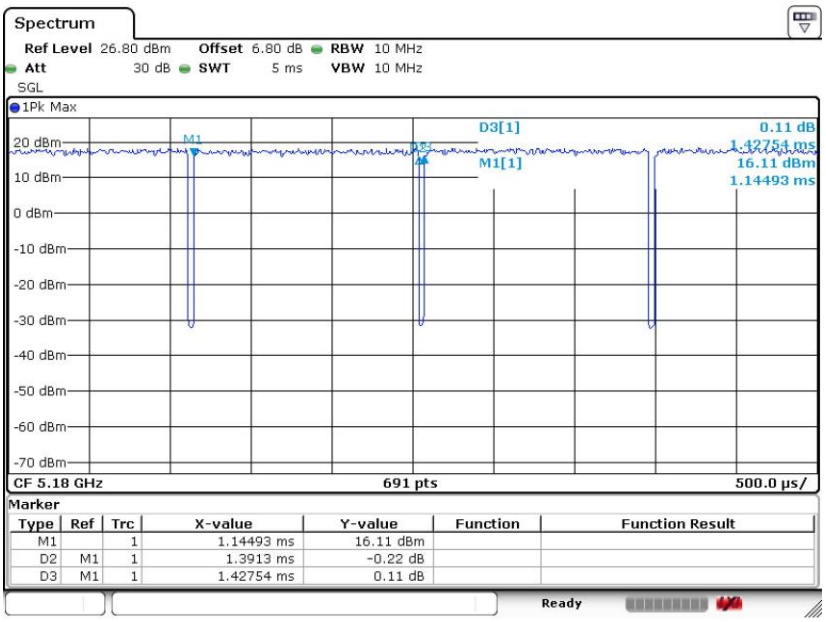
= -10.46(dB)

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

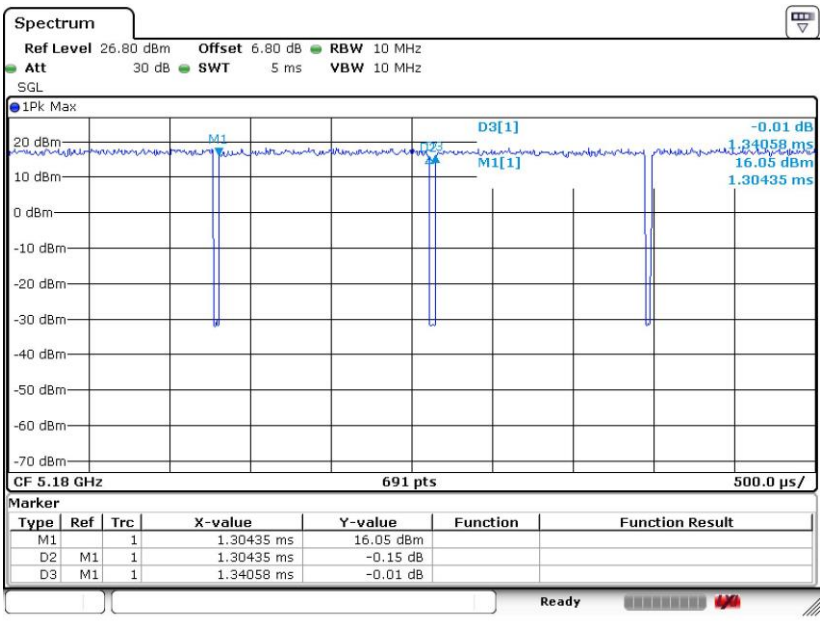
Appendix D. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11a	97.46	1.3913	0.7188	0.75KHz
802.11n HT20	97.30	1.3044	0.7667	0.82KHz
802.11n HT40	94.90	0.6464	1.5471	1.6KHz
802.11ac VHT80	89.60	0.3246	3.0803	3.3KHz

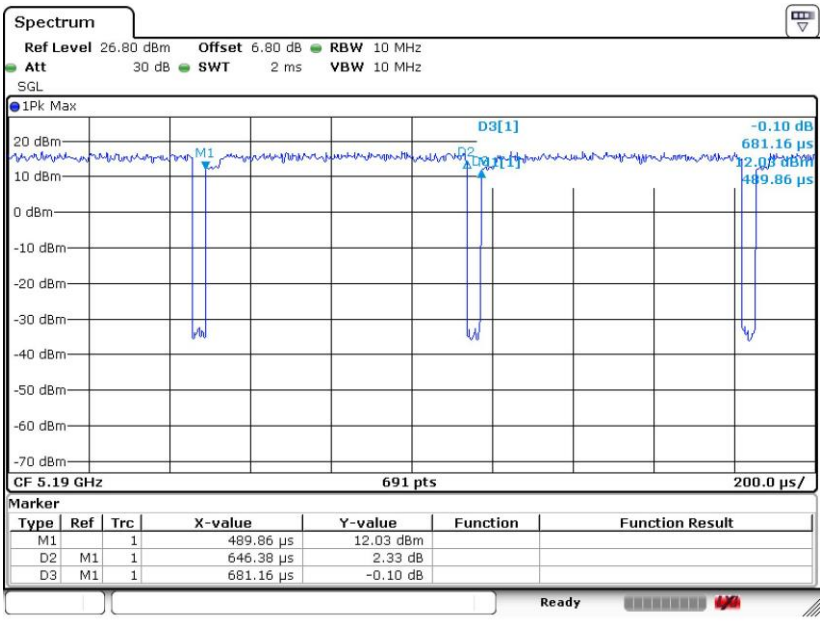
802.11a



802.11n HT20



802.11n HT40



802.11ac VHT80