



FCC RF Test Report

APPLICANT : Ring LLC
EQUIPMENT : Video Doorbell Pro 2
BRAND NAME : Ring
MODEL NAME : 5AT2S2
FCC ID : 2AEUPBHALP031
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure

The product was received on Sep. 08, 2020 and testing was completed on Oct. 28, 2020. 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.

Jason Jia

Reviewed by: Jason Jia / Supervisor

James Huang

Approved by: James Huang / Manager



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People's Republic of China



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR090815H	Rev. 01	Initial issue of report	Jan. 11, 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 3.38 dB at 433.520 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 22.39 dB at 16.839 MHz
3.6	15.407(c)	Automatically Discontinue Transmission	Discontinue Transmission	Pass	-
3.7	15.203 & 15.407(a)	Antenna Requirement	N/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

Ring LLC
1523 26th Street, Santa Monica CA 90404, USA

1.2 Manufacturer

Goertek Inc.
No.268 Dongfang Road High-Tech Industrial Development District, Weifang Shandong, China

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Video Doorbell Pro 2
Brand Name	Ring
Model Name	5AT2S2
FCC ID	2AEUPBHALP031
EUT supports Radios application	WLAN 2.4GHz 802.11b/g/n HT20 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE LoRa DTS/LoRa FHSS/FSK FHSS/Radar
HW Version	R6
SW Version	7.1.61
EUT Stage	Production Unit

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 ~ 5825 MHz							
Maximum Output Power		<MIMO Ant. 1+2> <5745 MHz ~ 5825 MHz> 802.11a : 19.84 dBm / 0.0964 W 802.11n HT20 : 18.76 dBm / 0.0752 W 802.11n HT40 : 19.05 dBm / 0.0804 W 802.11ac VHT20: 18.79 dBm / 0.0757 W 802.11ac VHT40: 18.98 dBm / 0.0791 W 802.11ac VHT80: 17.28 dBm / 0.0535 W							
99% Occupied Bandwidth		<MIMO Ant. 1+2> 802.11a : 18.13 MHz 802.11n HT40 : 36.56 MHz 802.11ac VHT20 : 18.68 MHz 802.11ac VHT80 : 75.28 MHz							
Type of Modulation		802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) 802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)							
Antenna Type / Gain		<Ant. 1> : Loop Antenna with gain 4.07 dBi <Ant. 2> : Loop Antenna with gain 4.18 dBi							
Antenna Function Description		<table><tr><td></td><td>Ant. 1</td><td>Ant. 2</td></tr><tr><td>802.11 n/ac SISO/MIMO</td><td>V</td><td>V</td></tr></table>			Ant. 1	Ant. 2	802.11 n/ac SISO/MIMO	V	V
	Ant. 1	Ant. 2							
802.11 n/ac SISO/MIMO	V	V							

Note:

- For 802.11n HT20/HT40 and 802.11ac VHT20/VHT40 mode, the whole testing have assessed only 802.11n HT40 and 802.11ac VHT20 by referring to their maximum conducted power.
- For WLAN SISO & MIMO mode, the whole testing has assessed only MIMO mode by referring to the higher normal 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 03CH06-KS TH01-KS	CN1257	314309

1.7 Test Software

Item	Site	Manufacture	Name	Version
1.	03CH06-KS	AUDIX	E3	6.2009-8-24a1
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.
- FCC KDB 662911 D01 Multiple Transmitter Output 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)
5745-5825 MHz Band 4 (U-NII-3)	149	5745	157	5785
	151*	5755	159*	5795
	153	5765	161	5805
	155 [#]	5775	165	5825

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.

MIMO Mode

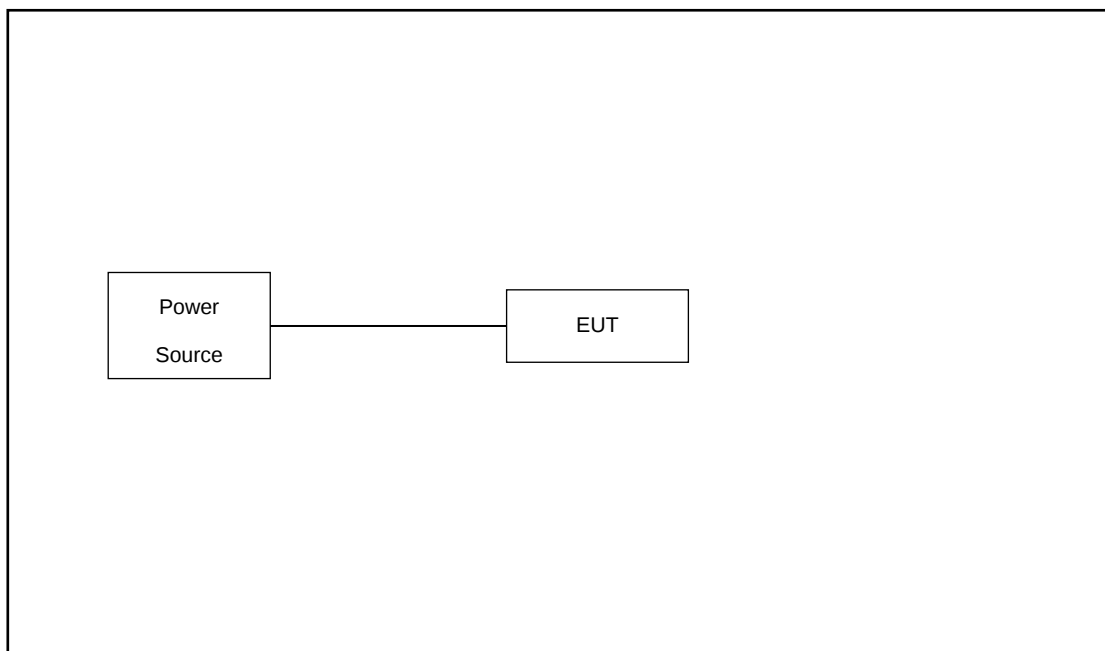
Modulation	Data Rate
802.11a	6 Mbps
802.11n HT40	MCS0
802.11ac VHT20	MCS0
802.11ac VHT80	MCS0

AC Conducted Emission	Mode 1 : Lora Tx + Bluetooth Link + WLAN Link(5G) + charging from adaptor + 24G Radar Tx
Remark: For Radiated Test Cases, The tests were performed with Adapter	

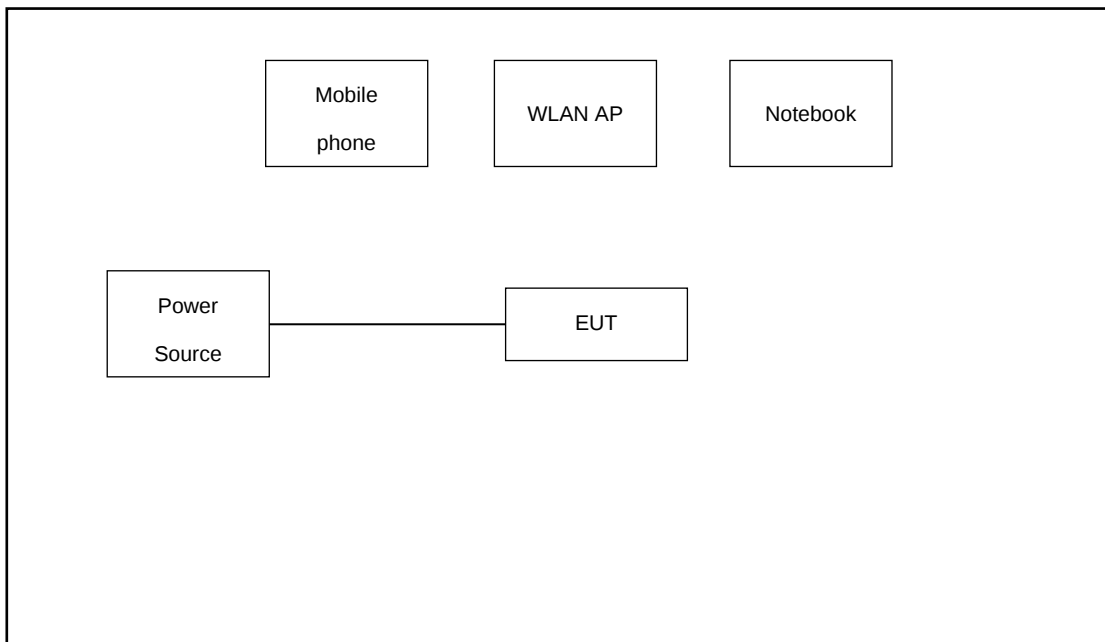
Ch. #		Band IV : 5725-5850 MHz			
		802.11a	802.11ac VHT20	802.11n HT40	802.11ac VHT80
L	Low	149	149	151	-
M	Middle	157	157	-	155
H	High	165	165	159	-

2.3 Connection Diagram of Test System

For Radiated Emission:



For AC Conducted Emission:



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded, 1.8m
2.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
3.	Mobile Phone	MOTO	XT1952-1	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 and attenuator factor 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 and attenuator factor.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 7.2 dB attenuator.

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

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 $\geq 3 \times$ 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.

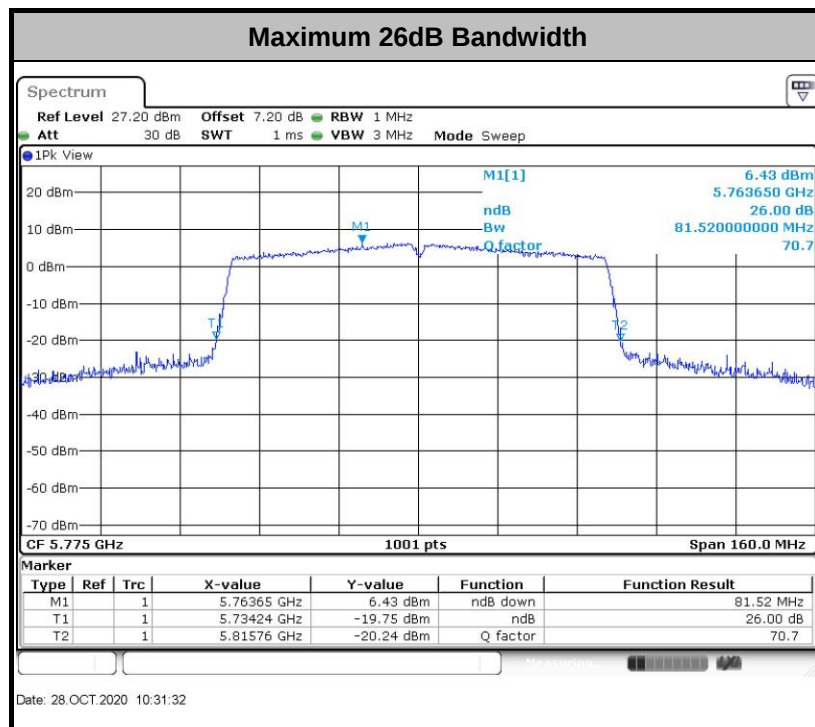
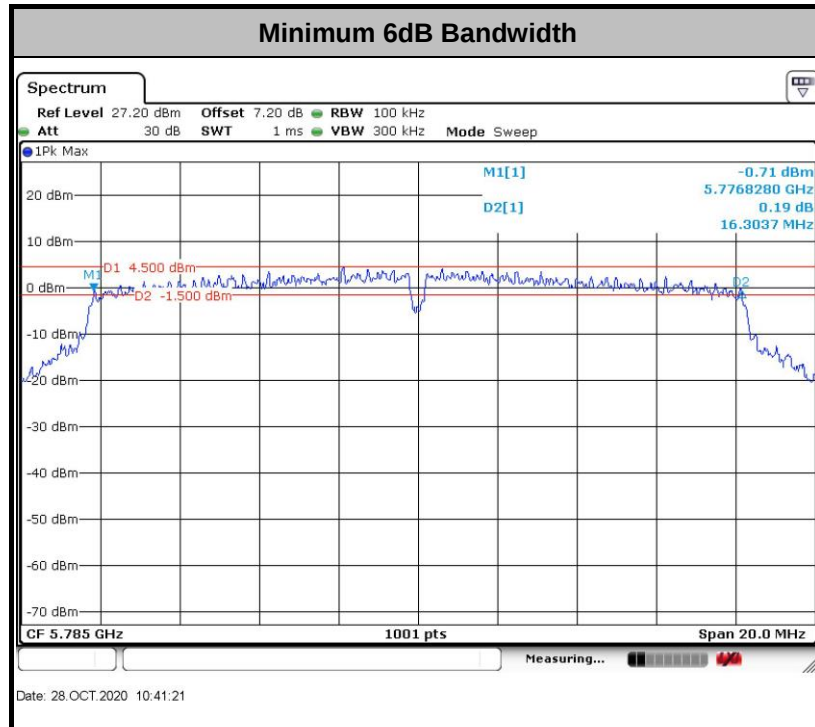
3.1.4 Test Setup

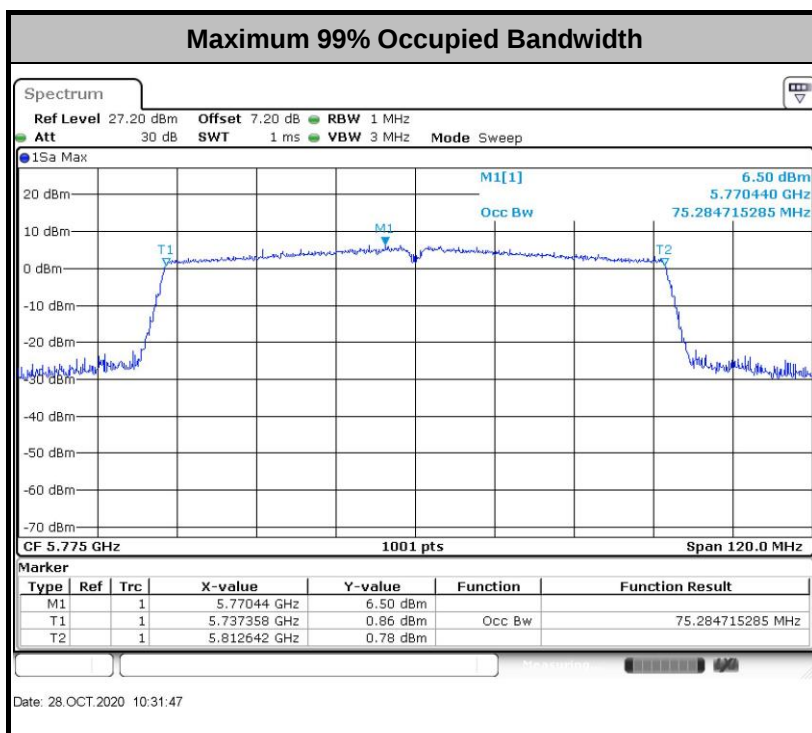




3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.





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.

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.

3.2.2 Measuring Instruments

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

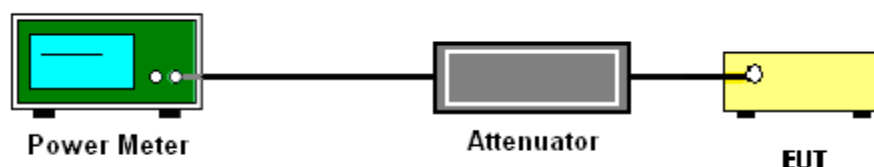
3.2.3 Test Procedures

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.

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).

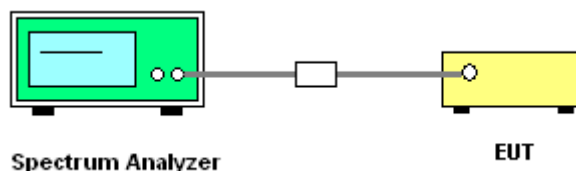
- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz.
- Set VBW $\geq$ 1 MHz.
- Number of points in sweep $\geq$ 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- Add $10 \log(500\text{kHz}/\text{RBW})$ 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. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Method (c): Measure and add $10 \log(N_{\text{ANT}})$ dB.

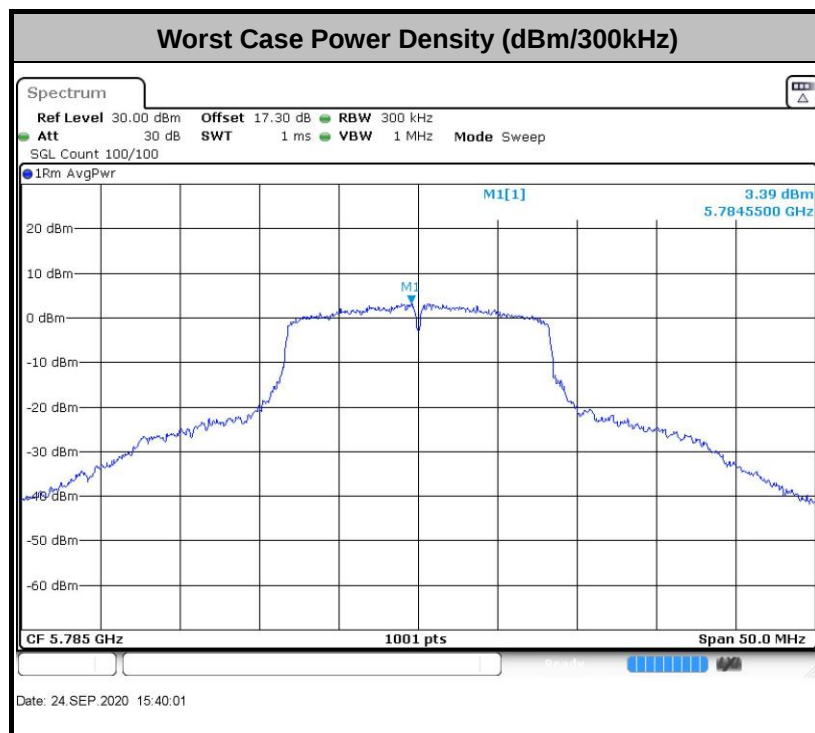
With this technique, spectrum measurements are performed at each output of the device, but rather than summing the spectra or the spectral peaks across the outputs, the quantity $10 \log(N_{\text{ANT}})$ dB is added to each spectrum value before comparing to the emission limit. The addition of $10 \log(N_{\text{ANT}})$ dB serves to apportion the emission limit among the N_{ANT} outputs so that each output is permitted to contribute no more than $1/N_{\text{ANT}}^{\text{th}}$ of the PSD limit.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.



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.

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

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.

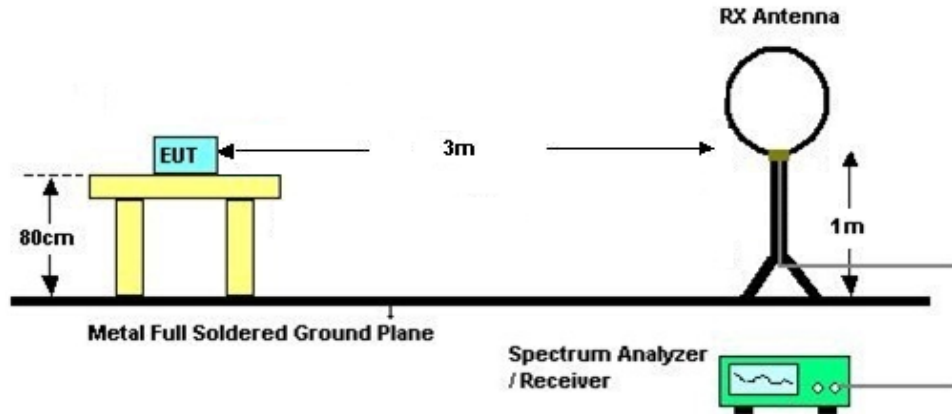


3.4.3 Test Procedures

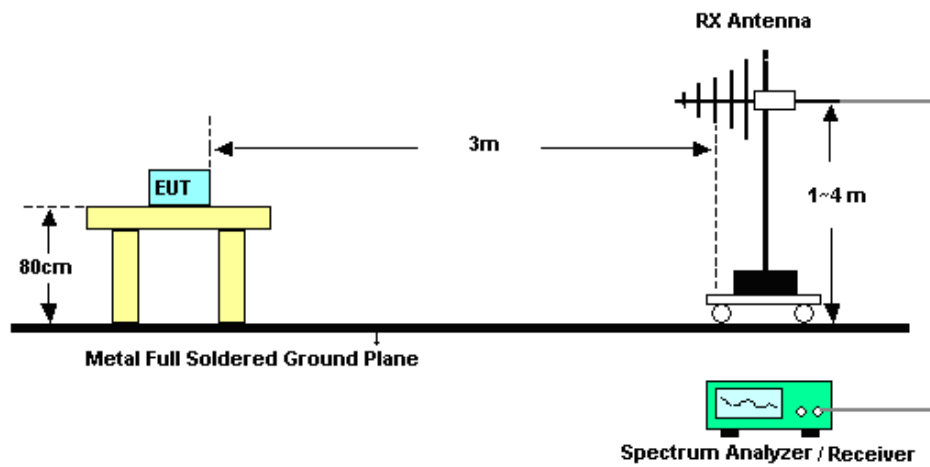
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
Section G) Unwanted emissions measurement.
(1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold(2) Procedure for Peak Unwanted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

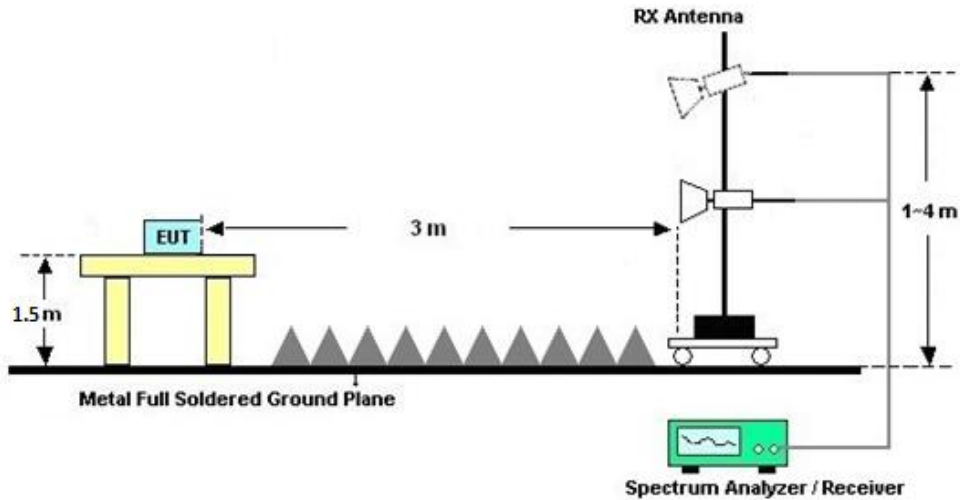
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.4.5 Test Results of Radiated 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 (dB μ V)	
	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.

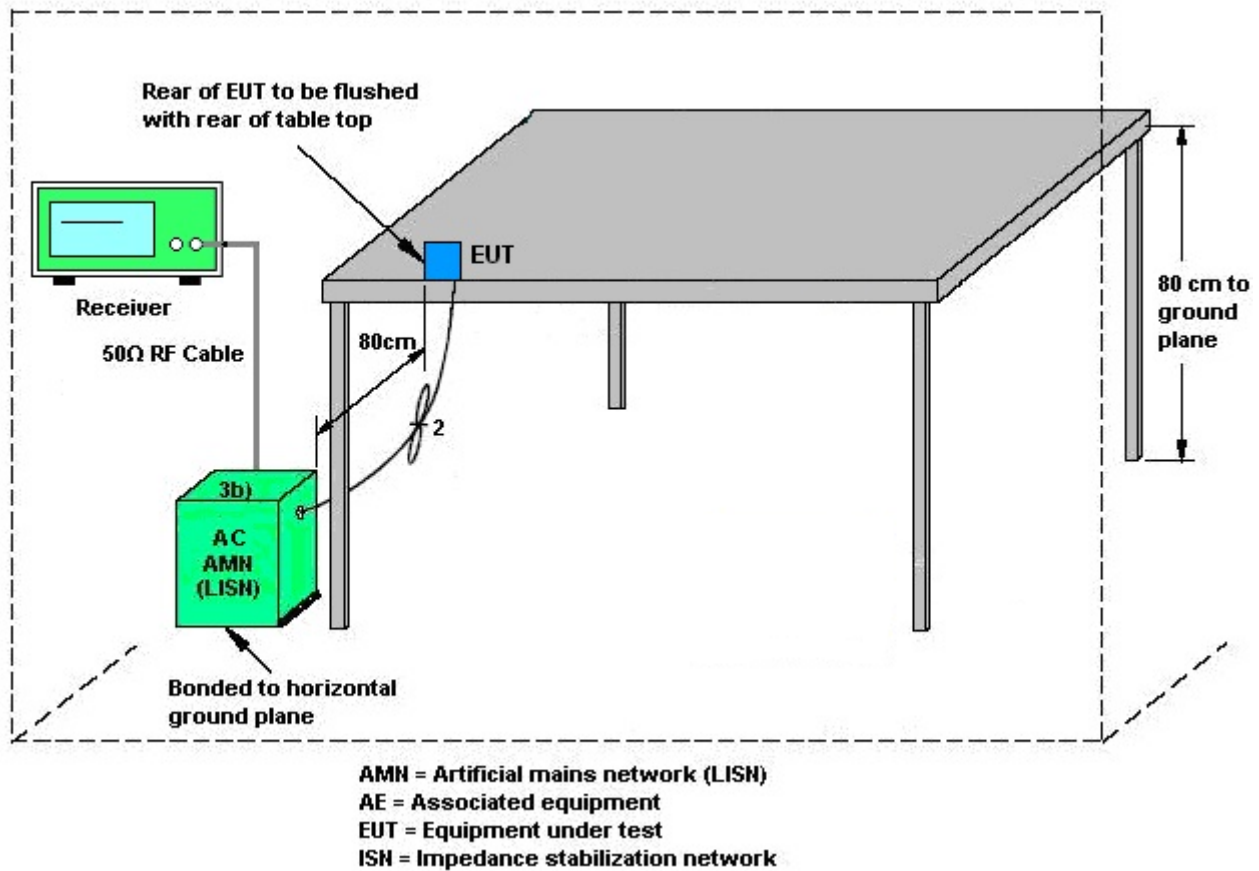
3.5.2 Measuring Instruments

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 Automatically Discontinue Transmission

3.6.1 Limit of Automatically Discontinue Transmission

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization to describe how this requirement is met.

3.6.2 Measuring Instruments

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

3.6.3 Test Result of Automatically Discontinue Transmission

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.

3.7 Antenna Requirements

3.7.1 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.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

選擇一個項目。

			DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
	Ant. 1 (dBi)	Ant. 2 (dBi)				
Band IV	4.06	4.18	4.18	4.18	0.00	0.00



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	Nov. 02, 2019	Sep. 24, 2020~ Oct. 28, 2020	Nov. 01, 2020	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 08, 2020	Sep. 24, 2020~ Oct. 28, 2020	Jan. 07, 2021	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 08, 2020	Sep. 24, 2020~ Oct. 28, 2020	Jan. 07, 2021	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400004	3Hz~8.5GHz; Max 30dBm	Oct. 18, 2019	Sep. 23, 2020	Oct. 17, 2020	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz~44GHz	Apr. 14, 2020	Sep. 23, 2020	Apr. 13, 2021	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 10, 2019	Sep. 23, 2020	Nov. 09, 2020	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz~1GHz	May 29, 2020	Sep. 23, 2020	May 28, 2021	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 27, 2020	Sep. 23, 2020	Apr. 26, 2021	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 10, 2019	Sep. 23, 2020	Nov. 09, 2020	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	187289	9KHz ~1GHZ	Apr. 14, 2020	Sep. 23, 2020	Apr. 13, 2021	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 08, 2020	Sep. 23, 2020	Jan. 07, 2021	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	2025788	1Ghz-18Ghz	Jan. 02, 2020	Sep. 23, 2020	Jan. 01, 2021	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY53270203	500MHz~26.5GHz	Apr. 15, 2020	Sep. 23, 2020	Apr. 14, 2021	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Sep. 23, 2020	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Sep. 23, 2020	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Sep. 23, 2020	NCR	Radiation (03CH06-KS)
EMI Receiver	R&S	ESC17	100768	9kHz~7GHz;	Apr. 14, 2020	Sep. 23, 2020	Apr. 13, 2021	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 18, 2019	Sep. 23, 2020	Oct. 17, 2020	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	Oct. 28, 2019	Sep. 23, 2020	Oct. 27, 2020	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 18, 2019	Sep. 23, 2020	Oct. 17, 2020	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% ($U = 2Uc(y)$)	2.9dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
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Appendix A. Conducted Test Results

Test Engineer:	Aly Cao	Temperature:	21~25	°C
Test Date:	2020/9/24~2020/10/28	Relative Humidity:	51~54	%

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

Band IV													
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	99% Bandwidth (MHz)		26dB Bandwidth (MHz)		6 dB Bandwidth (MHz)		6 dB Bandwidth Min. Limit (MHz)		Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	2	149	5745	18.08	17.53	24.83	21.18	16.32	16.32	0.5		Pass
11a	6Mbps	2	157	5785	18.13	17.63	22.88	21.18	16.32	16.30	0.5		Pass
11a	6Mbps	2	165	5825	17.88	17.58	22.28	21.93	16.32	16.32	0.5		Pass
HT40	MCS0	2	151	5755	36.56	36.46	41.99	41.90	36.32	36.28	0.5		Pass
HT40	MCS0	2	159	5795	36.46	36.46	42.26	41.99	36.32	36.00	0.5		Pass
VHT20	MCS0	2	149	5745	18.53	18.43	22.03	21.43	17.56	17.58	0.5		Pass
VHT20	MCS0	2	157	5785	18.68	18.53	21.73	22.23	17.56	17.54	0.5		Pass
VHT20	MCS0	2	165	5825	18.43	18.38	21.58	21.38	17.58	17.56	0.5		Pass
VHT80	MCS0	2	155	5775	75.28	75.28	81.52	80.72	76.32	76.32	0.5		Pass

TEST RESULTS DATA
Average Power Table

Band IV														
Mod.	Data Rate	N _{TX}	CH.	Freq. (MHz)	Duty Factor (dB)		Average Conducted Power (dBm)			FCC Conducted Power Limit (dBm)		DG (dBi)		Pass/Fail
					Ant 1	Ant 2	Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	2	149	5745	0.00	0.00	16.39	17.22	19.84	30.00		4.18		Pass
11a	6Mbps	2	157	5785	0.00	0.00	16.23	17.01	19.65	30.00		4.18		Pass
11a	6Mbps	2	165	5825	0.00	0.00	16.18	16.83	19.53	30.00		4.18		Pass
HT20	MCS0	2	149	5745	0.00	0.00	15.33	16.14	18.76	30.00		4.18		Pass
HT20	MCS0	2	157	5785	0.00	0.00	15.08	15.76	18.44	30.00		4.18		Pass
HT20	MCS0	2	165	5825	0.00	0.00	14.96	15.80	18.41	30.00		4.18		Pass
HT40	MCS0	2	151	5755	0.00	0.00	15.69	16.37	19.05	30.00		4.18		Pass
HT40	MCS0	2	159	5795	0.00	0.00	15.14	16.22	18.72	30.00		4.18		Pass
VHT20	MCS0	2	149	5745	0.00	0.00	15.40	16.12	18.79	30.00		4.18		Pass
VHT20	MCS0	2	157	5785	0.00	0.00	15.01	15.83	18.45	30.00		4.18		Pass
VHT20	MCS0	2	165	5825	0.00	0.00	14.88	15.78	18.36	30.00		4.18		Pass
VHT40	MCS0	2	151	5755	0.00	0.00	15.54	16.36	18.98	30.00		4.18		Pass
VHT40	MCS0	2	159	5795	0.00	0.00	15.19	16.25	18.76	30.00		4.18		Pass
VHT80	MCS0	2	155	5775	0.00	0.00	13.85	14.66	17.28	30.00		4.18		Pass

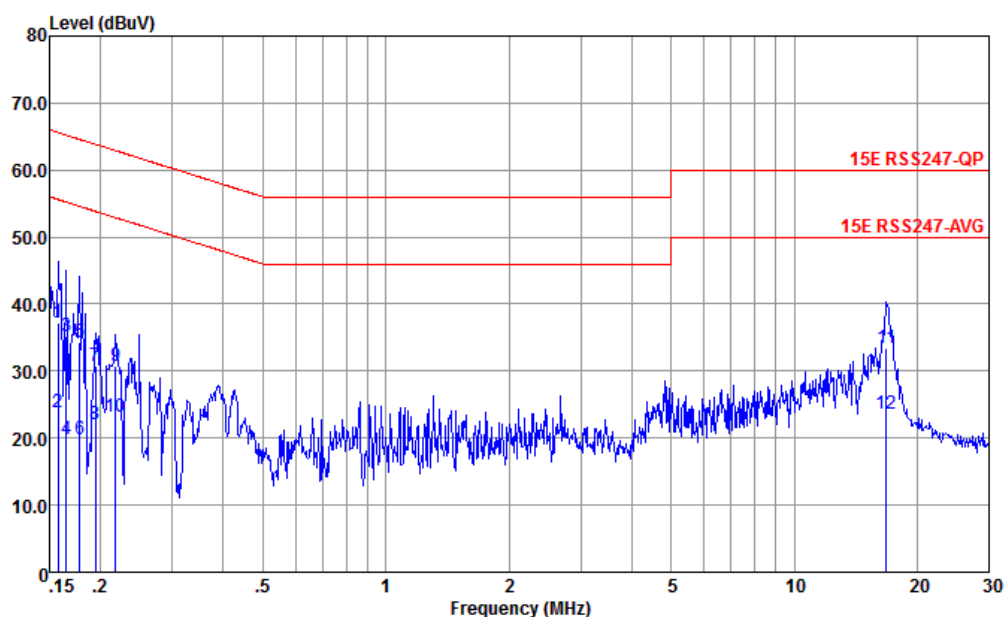
TEST RESULTS DATA
Power Spectral Density

Band IV																
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
					Ant 1	Ant 2	Ant 1	Ant 2	Ant 1	Ant 2	SUM	Ant 1	Ant 2	Ant 1	Ant 2	
11a	6Mbps	2	149	5745	0.00	0.00	2.22					8.56	30.00	4.18		Pass
11a	6Mbps	2	157	5785	0.00	0.00	2.22					8.62	30.00	4.18		Pass
11a	6Mbps	2	165	5825	0.00	0.00	2.22					8.42	30.00	4.18		Pass
HT40	MCS0	2	151	5755	0.00	0.00	2.22					4.14	30.00	4.18		Pass
HT40	MCS0	2	159	5795	0.00	0.00	2.22					3.50	30.00	4.18		Pass
VHT20	MCS0	2	149	5745	0.00	0.00	2.22					8.34	30.00	4.18		Pass
VHT20	MCS0	2	157	5785	0.00	0.00	2.22					8.35	30.00	4.18		Pass
VHT20	MCS0	2	165	5825	0.00	0.00	2.22					8.50	30.00	4.18		Pass
VHT80	MCS0	2	155	5775	0.00	0.00	2.22					1.55	30.00	4.18		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.		

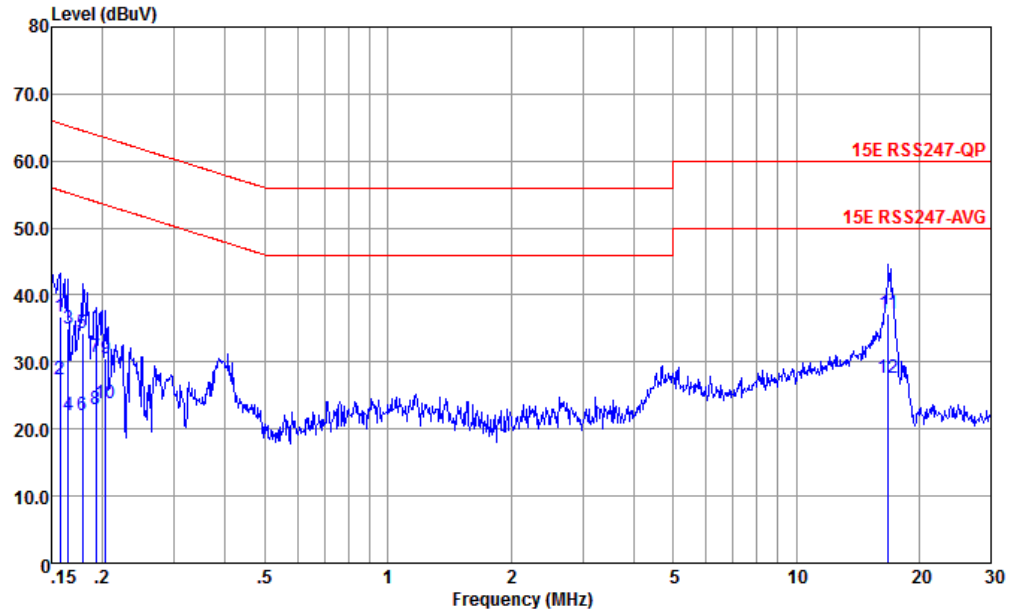


Site : CO01-KS
Condition : 15E RSS247-QP LISN-L-191028-CN02 LINE

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	0.157	37.13	-28.47	65.60	26.60	0.07	10.46	QP
2	0.157	23.83	-31.77	55.60	13.30	0.07	10.46	Average
3	0.165	35.12	-30.09	65.21	24.60	0.08	10.44	QP
4	0.165	19.82	-35.39	55.21	9.30	0.08	10.44	Average
5	0.178	34.29	-30.30	64.59	23.80	0.08	10.41	QP
6	0.178	19.79	-34.80	54.59	9.30	0.08	10.41	Average
7	0.194	30.66	-33.18	63.84	20.20	0.09	10.37	QP
8	0.194	21.96	-31.88	53.84	11.50	0.09	10.37	Average
9	0.217	30.64	-32.28	62.92	20.20	0.09	10.35	QP
10	0.217	23.24	-29.68	52.92	12.80	0.09	10.35	Average
11	16.839	33.43	-26.57	60.00	21.19	1.80	10.44	QP
12 *	16.839	23.73	-26.27	50.00	11.49	1.80	10.44	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-N-191028-CN02 NEUTRAL

	Freq	Level	Over	Limit	Read	LISN	Cable	
	MHz	dBuV	Limit	Line	Level	Factor	Loss	Remark
			dB	dBuV	dBuV	dB	dB	
1	0.157	36.81	-28.79	65.60	26.20	0.15	10.46	QP
2	0.157	27.51	-28.09	55.60	16.90	0.15	10.46	Average
3	0.165	35.10	-30.11	65.21	24.50	0.16	10.44	QP
4	0.165	22.10	-33.11	55.21	11.50	0.16	10.44	Average
5	0.179	34.37	-30.18	64.55	23.80	0.16	10.41	QP
6	0.179	22.07	-32.48	54.55	11.50	0.16	10.41	Average
7	0.192	30.64	-33.29	63.93	20.09	0.17	10.38	QP
8	0.192	23.04	-30.89	53.93	12.49	0.17	10.38	Average
9	0.204	30.63	-32.82	63.45	20.10	0.17	10.36	QP
10	0.204	23.83	-29.62	53.45	13.30	0.17	10.36	Average
11	16.839	37.31	-22.69	60.00	24.59	2.28	10.44	QP
12 *	16.839	27.61	-22.39	50.00	14.89	2.28	10.44	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

Band 4 - 5725~5850MHz

WIFI 802.11a (Band Edge @ 3m)

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+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 149 5745MHz		5609.6	54.71	-13.59	68.3	40.71	35.77	11.57	33.34	136	159	P	H
		5698.4	57.5	-46.62	104.12	43.4	35.82	11.65	33.37	136	159	P	H
		5719.2	67.23	-43.45	110.68	53.09	35.84	11.68	33.38	136	159	P	H
		5724.4	72.71	-48.22	120.93	58.57	35.84	11.68	33.38	136	159	P	H
		5740	111.38	-	-	97.22	35.85	11.69	33.38	136	159	P	H
		5740	105.33	-	-	91.17	35.85	11.69	33.38	136	159	A	H
		5642.4	57.11	-11.19	68.3	43.07	35.8	11.6	33.36	189	176	P	V
		5669.6	59.16	-23.68	82.84	45.07	35.82	11.63	33.36	189	176	P	V
		5719.2	73.5	-37.18	110.68	59.36	35.84	11.68	33.38	189	176	P	V
		5724.4	80.69	-40.24	120.93	66.55	35.84	11.68	33.38	189	176	P	V
		5746	115.15	-	-	101	35.85	11.69	33.39	189	176	P	V
		5746	108.31	-	-	94.16	35.85	11.69	33.39	189	176	A	V
802.11a CH 165 5825MHz		5851.2	65.94	-53.62	119.56	51.66	35.89	11.81	33.42	128	160	P	H
		5855.6	62.9	-47.83	110.73	48.58	35.9	11.84	33.42	128	160	P	H
		5880.4	57.13	-44.16	101.29	42.78	35.92	11.86	33.43	128	160	P	H
		5944.4	55.15	-13.15	68.3	40.63	36	11.97	33.45	128	160	P	H
		5824	112.38	-	-	98.12	35.88	11.79	33.41	128	160	P	H
		5824	105.59	-	-	91.33	35.88	11.79	33.41	128	160	A	H
		5850	64.75	-57.55	122.3	50.47	35.89	11.81	33.42	196	188	P	V
		5855.2	63.28	-47.56	110.84	48.96	35.9	11.84	33.42	196	188	P	V
		5887.6	57.11	-38.84	95.95	42.72	35.94	11.89	33.44	196	188	P	V
		5956.4	55.78	-12.52	68.3	41.23	36.02	11.99	33.46	196	188	P	V
		5824	114.04	-	-	99.78	35.88	11.79	33.41	196	188	P	V
		5824	107.02	-	-	92.76	35.88	11.79	33.41	196	188	A	V
Remark	1. No other spurious found.												
	2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 1+2	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 149 5745MHz		11490	48.47	-25.53	74	53.35	40.19	16.87	61.94	300	0	P	H
		11490	48.14	-25.86	74	53.02	40.19	16.87	61.94	100	360	P	V
802.11a CH 157 5785MHz		11570	45.21	-28.79	74	49.96	40.27	16.94	61.96	100	360	P	H
		11570	46.06	-27.94	74	50.81	40.27	16.94	61.96	100	360	P	V
802.11a CH 165 5825MHz		11650	46.59	-27.41	74	51.22	40.34	17.01	61.98	100	360	P	H
		11650	45.9	-28.1	74	50.53	40.34	17.01	61.98	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11ac VHT20 (Band Edge @ 3m)

WIFI Ant. 1+2	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 149 5745MHz		5639.2	55.93	-12.37	68.3	41.89	35.8	11.6	33.36	136	159	P	H
		5699.2	59.36	-45.35	104.71	45.26	35.82	11.65	33.37	136	159	P	H
		5718.8	71.2	-39.36	110.56	57.06	35.84	11.68	33.38	136	159	P	H
		5724.4	82.12	-38.81	120.93	67.98	35.84	11.68	33.38	136	159	P	H
		5752	110.67	-	-	96.5	35.85	11.71	33.39	136	159	P	H
		5752	105.54	-	-	91.37	35.85	11.71	33.39	136	159	A	H
		5633.6	56.62	-11.68	68.3	42.57	35.8	11.6	33.35	202	179	P	V
		5698	59.15	-44.68	103.83	45.05	35.82	11.65	33.37	202	179	P	V
		5719.2	72.18	-38.5	110.68	58.04	35.84	11.68	33.38	202	179	P	V
		5722.4	83.39	-32.98	116.37	69.25	35.84	11.68	33.38	202	179	P	V
		5746	115.45	-	-	101.3	35.85	11.69	33.39	202	179	P	V
		5746	108.51	-	-	94.36	35.85	11.69	33.39	202	179	A	V
802.11ac VHT20 CH 165 5825MHz		5851.2	72.74	-46.82	119.56	58.46	35.89	11.81	33.42	187	123	P	H
		5855.6	70.17	-40.56	110.73	55.85	35.9	11.84	33.42	187	123	P	H
		5902.8	57.07	-27.62	84.69	42.68	35.94	11.89	33.44	187	123	P	H
		5927.6	55.51	-12.79	68.3	41.04	35.98	11.94	33.45	187	123	P	H
		5824	113.57	-	-	99.31	35.88	11.79	33.41	187	123	P	H
		5824	106.83	-	-	92.57	35.88	11.79	33.41	187	123	A	H
		5850.8	70.28	-50.2	120.48	56	35.89	11.81	33.42	181	176	P	V
		5855.6	66.13	-44.6	110.73	51.81	35.9	11.84	33.42	181	176	P	V
		5911.2	56.66	-21.82	78.48	42.23	35.96	11.91	33.44	181	176	P	V
		5985.6	56.25	-12.05	68.3	41.65	36.04	12.02	33.46	181	176	P	V
		5824	114.61	-	-	100.35	35.88	11.79	33.41	181	176	P	V
		5824	107.57	-	-	93.31	35.88	11.79	33.41	181	176	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11ac VHT20 (Harmonic @ 3m)

WIFI Ant. 1+2	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		11490	45.93	-28.07	74	50.81	40.19	16.87	61.94	100	360	P	H
CH 149 5745MHz		11490	46.83	-27.17	74	51.71	40.19	16.87	61.94	100	360	P	V
802.11ac VHT20		11570	45.79	-28.21	74	50.54	40.27	16.94	61.96	100	360	P	H
CH 157 5785MHz		11570	46.1	-27.9	74	50.85	40.27	16.94	61.96	100	360	P	V
802.11ac VHT20		11650	46.28	-27.72	74	50.91	40.34	17.01	61.98	100	360	P	H
CH 165 5825MHz		11650	45.61	-28.39	74	50.24	40.34	17.01	61.98	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11n HT40 (Band Edge @ 3m)

WIFI Ant. 1+2	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 151 5755MHz		5614.8	54.88	-13.42	68.3	40.88	35.77	11.57	33.34	290	214	P	H
		5696.8	63.97	-38.97	102.94	49.87	35.82	11.65	33.37	290	214	P	H
		5716.8	79.33	-30.68	110.01	65.22	35.83	11.66	33.38	290	214	P	H
		5721.2	80.19	-33.45	113.64	66.05	35.84	11.68	33.38	290	214	P	H
		5854	57.86	-55.32	113.18	43.54	35.9	11.84	33.42	290	214	P	H
		5856	56.26	-54.36	110.62	41.94	35.9	11.84	33.42	290	214	P	H
		5909.6	55.25	-24.41	79.66	40.82	35.96	11.91	33.44	290	214	P	H
		5972.4	55.21	-13.09	68.3	40.66	36.02	11.99	33.46	290	214	P	H
		5752	109.06	-	-	94.89	35.85	11.71	33.39	290	214	P	H
		5752	101.77	-	-	87.6	35.85	11.71	33.39	290	214	A	H
		5621.2	57.42	-10.88	68.3	43.4	35.78	11.59	33.35	191	177	P	V
		5698.8	67.46	-36.96	104.42	53.36	35.82	11.65	33.37	191	177	P	V
		5720	85.31	-25.59	110.9	71.17	35.84	11.68	33.38	191	177	P	V
		5724.8	84.55	-37.29	121.84	70.41	35.84	11.68	33.38	191	177	P	V
		5850	58.64	-63.66	122.3	44.36	35.89	11.81	33.42	191	177	P	V
		5865.6	55.94	-51.99	107.93	41.63	35.9	11.84	33.43	191	177	P	V
		5887.6	55.94	-40.01	95.95	41.55	35.94	11.89	33.44	191	177	P	V
		5928	55.42	-12.88	68.3	40.95	35.98	11.94	33.45	191	177	P	V
		5758	112.19	-	-	98.02	35.85	11.71	33.39	191	177	P	V
		5758	104.75	-	-	90.58	35.85	11.71	33.39	191	177	A	V



WIFI Ant. 1+2	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 159 5795MHz		5621.2	54.93	-13.37	68.3	40.91	35.78	11.59	33.35	291	207	P	H
		5700	54.99	-50.31	105.3	40.89	35.82	11.65	33.37	291	207	P	H
		5718.8	59.28	-51.28	110.56	45.14	35.84	11.68	33.38	291	207	P	H
		5720.4	59.38	-52.43	111.81	45.24	35.84	11.68	33.38	291	207	P	H
		5854	66.57	-46.61	113.18	52.25	35.9	11.84	33.42	291	207	P	H
		5855.2	64.48	-46.36	110.84	50.16	35.9	11.84	33.42	291	207	P	H
		5875.2	58.36	-46.79	105.15	44.01	35.92	11.86	33.43	291	207	P	H
		5962.4	56.39	-11.91	68.3	41.84	36.02	11.99	33.46	291	207	P	H
		5788	108.94	-	-	94.73	35.87	11.74	33.4	291	207	P	H
		5788	101.6	-	-	87.39	35.87	11.74	33.4	291	207	A	H
		5635.6	55.83	-12.47	68.3	41.78	35.8	11.6	33.35	189	178	P	V
		5697.6	58.18	-45.35	103.53	44.08	35.82	11.65	33.37	189	178	P	V
		5717.2	60.85	-49.27	110.12	46.74	35.83	11.66	33.38	189	178	P	V
		5722.8	61.34	-55.94	117.28	47.2	35.84	11.68	33.38	189	178	P	V
		5853.2	67.89	-47.11	115	53.61	35.89	11.81	33.42	189	178	P	V
		5858	63.42	-46.64	110.06	49.1	35.9	11.84	33.42	189	178	P	V
		5882.4	57.69	-42.11	99.8	43.35	35.92	11.86	33.44	189	178	P	V
		5948	55.24	-13.06	68.3	40.72	36	11.97	33.45	189	178	P	V
		5794	112.32	-	-	98.12	35.87	11.74	33.41	189	178	P	V
		5794	105.15	-	-	90.95	35.87	11.74	33.41	189	178	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz
WIFI 802.11n HT40 (Harmonic @ 3m)

WIFI Ant. 1+2	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		11510	47.74	-26.26	74	52.6	40.2	16.88	61.94	100	360	P	H
CH 151 5755MHz		11510	47.23	-26.77	74	52.09	40.2	16.88	61.94	100	360	P	V
802.11n HT40		11590	45.52	-28.48	74	50.24	40.29	16.96	61.97	100	360	P	H
CH 159 5795MHz		11590	46.34	-27.66	74	51.06	40.29	16.96	61.97	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11ac VHT80 (Band Edge @ 3m)

WIFI Ant. 1+2	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 155 5775MHz		5650	57.88	-10.42	68.3	43.81	35.81	11.62	33.36	167	152	P	H
		5700	72.11	-33.19	105.3	58.01	35.82	11.65	33.37	167	152	P	H
		5718	78.04	-32.3	110.34	63.9	35.84	11.68	33.38	167	152	P	H
		5721.2	78.79	-34.85	113.64	64.65	35.84	11.68	33.38	167	152	P	H
		5850	73.27	-49.03	122.3	58.99	35.89	11.81	33.42	167	152	P	H
		5856	74.19	-36.43	110.62	59.87	35.9	11.84	33.42	167	152	P	H
		5875.2	66.51	-38.64	105.15	52.16	35.92	11.86	33.43	167	152	P	H
		5937.6	56.65	-11.65	68.3	42.18	35.98	11.94	33.45	167	152	P	H
		5776	104.41	-	-	90.23	35.86	11.72	33.4	167	152	P	H
		5776	97.71	-	-	83.53	35.86	11.72	33.4	167	152	A	H
		5644.8	61.99	-6.31	68.3	47.95	35.8	11.6	33.36	204	187	P	V
		5691.2	76.92	-21.89	98.81	62.82	35.82	11.65	33.37	204	187	P	V
		5718.8	81.22	-29.34	110.56	67.08	35.84	11.68	33.38	204	187	P	V
		5721.2	82.78	-30.86	113.64	68.64	35.84	11.68	33.38	204	187	P	V
		5850.8	76.71	-43.77	120.48	62.43	35.89	11.81	33.42	204	187	P	V
		5855.2	74.37	-36.47	110.84	60.05	35.9	11.84	33.42	204	187	P	V
		5875.2	64.99	-40.16	105.15	50.64	35.92	11.86	33.43	204	187	P	V
		5926.4	57.3	-11	68.3	42.83	35.98	11.94	33.45	204	187	P	V
		5776	108.31	-	-	94.13	35.86	11.72	33.4	204	187	P	V
		5776	100.83	-	-	86.65	35.86	11.72	33.4	204	187	A	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Band 4 5725~5850MHz

WIFI 802.11ac VHT80 (Harmonic @ 3m)

WIFI Ant. 1+2	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		11550	45.77	-28.23	74	50.55	40.25	16.93	61.96	100	360	P	H
CH 155 5775MHz		11550	45.42	-28.58	74	50.2	40.25	16.93	61.96	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz

5GHz WIFI 802.11ac VHT80 (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+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
5GHz 802.11ac VHT80 LF		61.04	21.51	-18.49	40	45.71	13.38	0.94	38.52	-	-	P	H
		136.7	18.5	-25	43.5	37.85	17.66	1.72	38.73	-	-	P	H
		193.93	21.41	-22.09	43.5	41.15	16.44	2.08	38.26	-	-	P	H
		241.46	26.03	-19.97	46	43.37	18.86	2.33	38.53	-	-	P	H
		433.52	42.62	-3.38	46	53.18	23.31	3.14	37.01	200	0	P	H
		947.62	41.42	-4.58	46	40.81	27.88	4.66	31.93	-	-	P	H
		47.46	32.45	-7.55	40	54.24	16.15	0.76	38.7	-	-	P	V
		136.7	29.08	-14.42	43.5	48.43	17.66	1.72	38.73	-	-	P	V
		254.07	24.28	-21.72	46	40.93	19.46	2.39	38.5	-	-	P	V
		347.19	31.28	-14.72	46	44.83	21.33	2.8	37.68	-	-	P	V
		451.95	40.02	-5.98	46	50.41	23.63	3.21	37.23	-	-	P	V
		946.65	41.51	-4.49	46	40.93	27.87	4.65	31.94	100	360	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.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1+2		(MHz)	(dBμV/m)	(dB)	(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													
2412MHz		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)

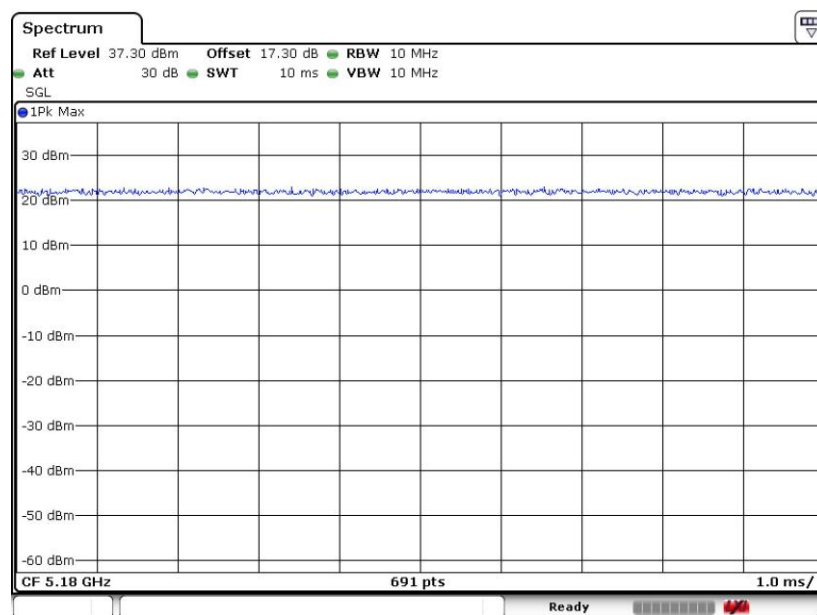
Both peak and average measured complies with the limit line, so test result is “PASS”.

Appendix D. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1+2	802.11a	100	-	-	10Hz
1+2	5GHz 802.11n HT40	100	-	-	10Hz
1+2	5GHz 802.11ac VHT20	100	-	-	10Hz
1+2	5GHz 802.11ac VHT80	100	-	-	10Hz

<MIMO Ant.1+2>

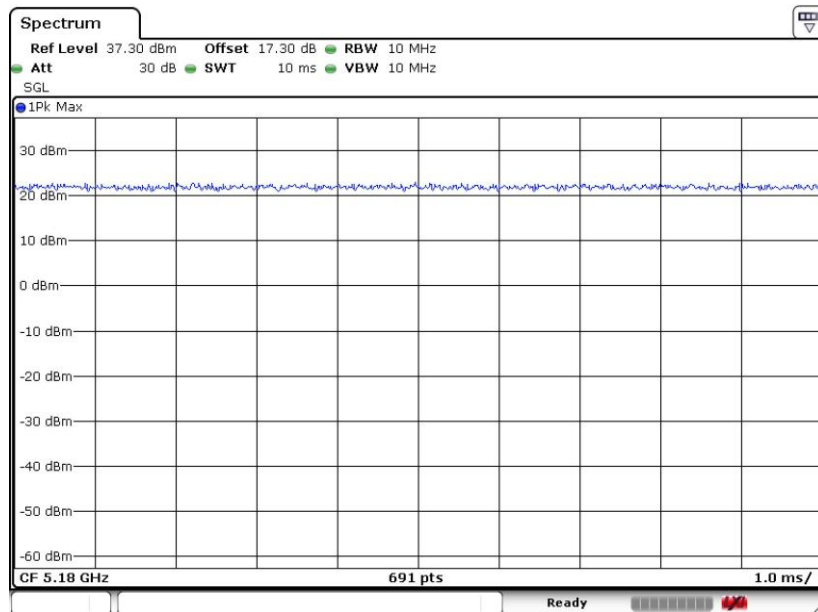
802.11a



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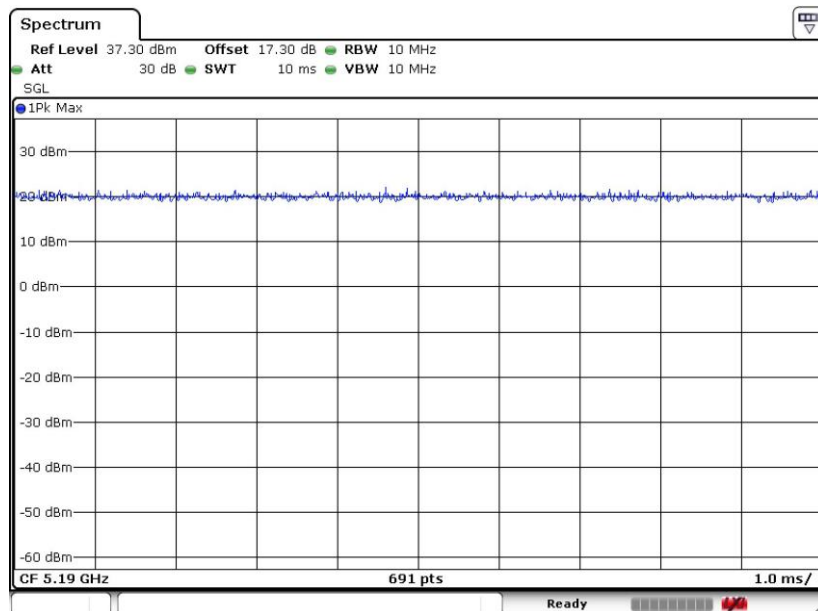


802.11n HT40



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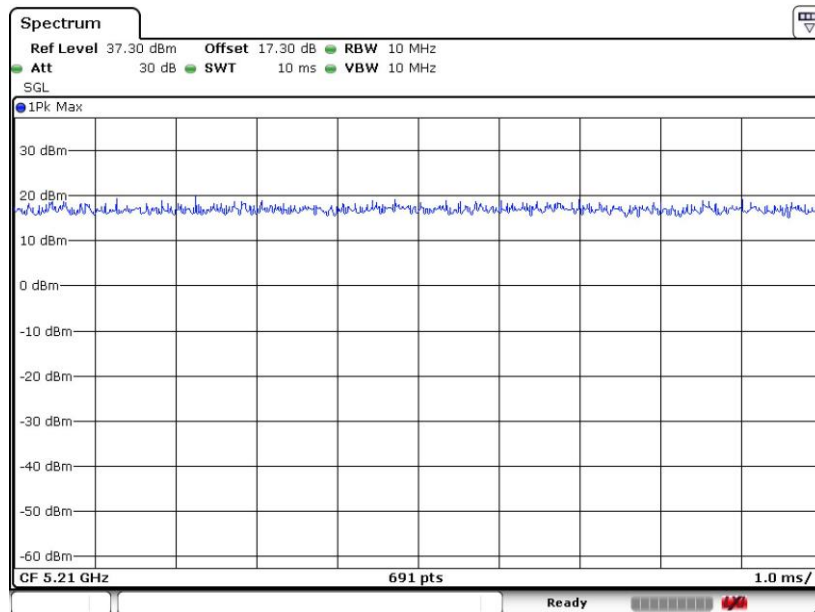
802.11ac VHT20



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802.11ac VHT80



Date: 15.SEP.2020 08:55:51