FCC RF Test Report

APPLICANT	:	Honeywell International Inc.
EQUIPMENT	:	Dolphin CT60
BRAND NAME	:	Honeywell
MODEL NAME	:	CT60L1N
FCC ID	:	HD5-CT60L1N
STANDARD	:	FCC Part 15 Subpart E §15.407
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure

The product was received on Apr. 24, 2020 and testing was completed on May 09, 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

ACCREDITED
Cert #5145.02

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
FR042407C	Rev. 01	Initial issue of report	Jun. 11, 2020

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 10.50 dB at 5650.000 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 12.94 dB at 0.452 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

Honeywell International Inc.
9680 Old Bailes Road, Fort Mill, SC 29707 USA

1.2 Manufacturer

Honeywell International Inc.
9680 Old Bailes Road, Fort Mill, SC 29707 USA

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Dolphin CT60
Brand Name	Honeywell
Model Name	CT60L1N
FCC ID	HD5-CT60L1N
EUT supports Radios application	CDMA/GSM/WCDMA/LTE/NFC/GNSS WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 2.4GHz 802.11ac VHT20/VHT40 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE
IMEI Code	Conducted:N/A Conduction: 990010901597139 Radiation: 990010901594474
HW Version	V1.0
HW P/N	DVT
SW Version	OS.03.003-HON.02.001
SW P/N	88.00.00-DEBUG(0579)
EUT Stage	Identical Prototype

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. This is a variant report for CT60L1N (Original FCC ID: HD5-CT60L1N, Model: CT60L1N, approval date: 01/31/2018). For change note, please refer to the change list as below. According to the difference, all test items for full test.

the detail differences between Original and Variant product are list in the following table:

Object	Original	Variant	Remark
Carrier Board	Scanner N6703 imager	Scanner change to N6803 imager	

CT60L1N have the following new parts:

RF Module	Under fill Modified
RF Module	LPDDR4x Layout Optimization
RF Module	Wi-Fi Layout Optimization
RF Module	WWAN Path Optimization
RF Module	WWAN Shielding Frame Optimization
RF Module	WWAN PA Power Optimization
RF Module	SOM PAD Mask Optimization
RF Module	Change DC regulator and WLAN amplifier DC power
RF Module	BOM Change for Optimization **
RF Module	B25 Duplexer-AVAGO-ACMD-6225-TR1
RF Module	B40 TRX filter-AVAGO-ACPF-8240-TR1
RF Module	Add New power inductor in BOM
RF Module	Remove un-used CLK trace WCN_CLK
Carrier Board	Add 1F/2.7V supercap
Carrier Board	Add MAX38888 DC/DC for supercap charge/ change discharge circuit
Carrier Board	Add low battery protection circuit
Carrier Board	Change speaker and add a connector for it
Carrier Board	Change ADS1014 to ADS1015 to add supercap voltage detection
Carrier Board	AUX antenna tuner circuit change placement location
Carrier Board	Upgrade the SOM to SOM4
Carrier Board	Add new model battery
Carrier Board	Add WIFI-AUX layout, RF WIFI AUX Matching
Carrier Board	Modify two n-PTH to PTH to reduce RSE issue.
Carrier Board	Upgrade to gen 8 scanner, adjust 2 spring contacts' location.
Carrier Board	Add a high-G sensor.
WIFI 11b	Power reduction from 18+/-1.5 dB to 17.5+/-1.5 dB
LTE 7	Power reduction from 23.4 + 1 / -2.7 dB to 23 + 1 / -2.7dB
GSM 850	Power reduction for Head with WIFI ON mode from 33.4 + 1 / - 2 dB to 32.8 + 1 / -2 dB
CDMA2K BC0	Power reduction for Head with WIFI ON mode from 24.4 +/- 1 dB to 23.8 + /- 1dB
CDMA2K BC10	Power reduction for Head with WIFI ON mode from 24.4 +/- 1 dB to 23.8 + /- 1dB

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 : 15.74 dBm / 0.0375 W 802.11n HT20 : 15.24 dBm / 0.0334 W 802.11n HT40 : 15.18 dBm / 0.0330 W 802.11ac VHT20: 15.34 dBm / 0.0342 W 802.11ac VHT40: 15.21 dBm / 0.0332 W 802.11ac VHT80: 15.14 dBm / 0.0327 W
99% Occupied Bandwidth	**<MIMO Ant.1+2>** 802.11a : 18.38 MHz 802.11ac VHT20 : 19.08 MHz 802.11ac VHT40 : 37.06 MHz 802.11ac VHT80 : 76.12 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> : PIFA Antenna with gain 1.14 dBi <Ant. 2> : Monopole Antenna with gain 2.10 dBi
Antenna Function Description	<table><tr><td></td><td>Ant. 1</td><td>Ant. 2</td></tr><tr><td>802.11 a/n/ac SISO/MIMO</td><td>V</td><td>V</td></tr></table>

Note:

1. For 802.11n HT20 / ac VHT20 and 802.11n HT40 / ac VHT40 mode, the whole testing have assessed only 802.11ac VHT20/ VHT40 by referring to their maximum conducted power.
2. For SISO & MIMO mode, the whole testing has assessed MIMO mode by referring to their higher 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	6.2009-8-24al
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 (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)
5725-5850 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

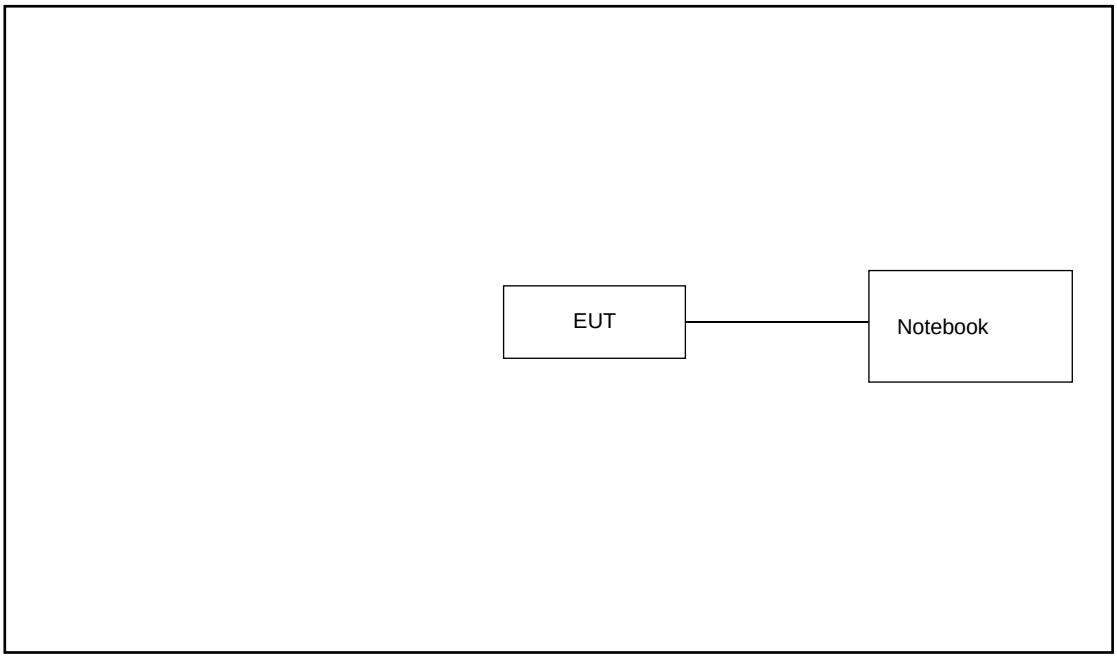
Modulation	Data Rate
802.11a	6 Mbps
802.11ac VHT20	MCS0
802.11ac VHT40	MCS0
802.11ac VHT80	MCS0

AC Conducted Emission	Mode 1 : GSM 850 Idle + Bluetooth Link + WLAN Link(5G) + USB Cable(Data Link with Notebook) + snap on Adapter
Remark: For Radiated Test Cases, The tests were performance with Adapter , USB Cable	

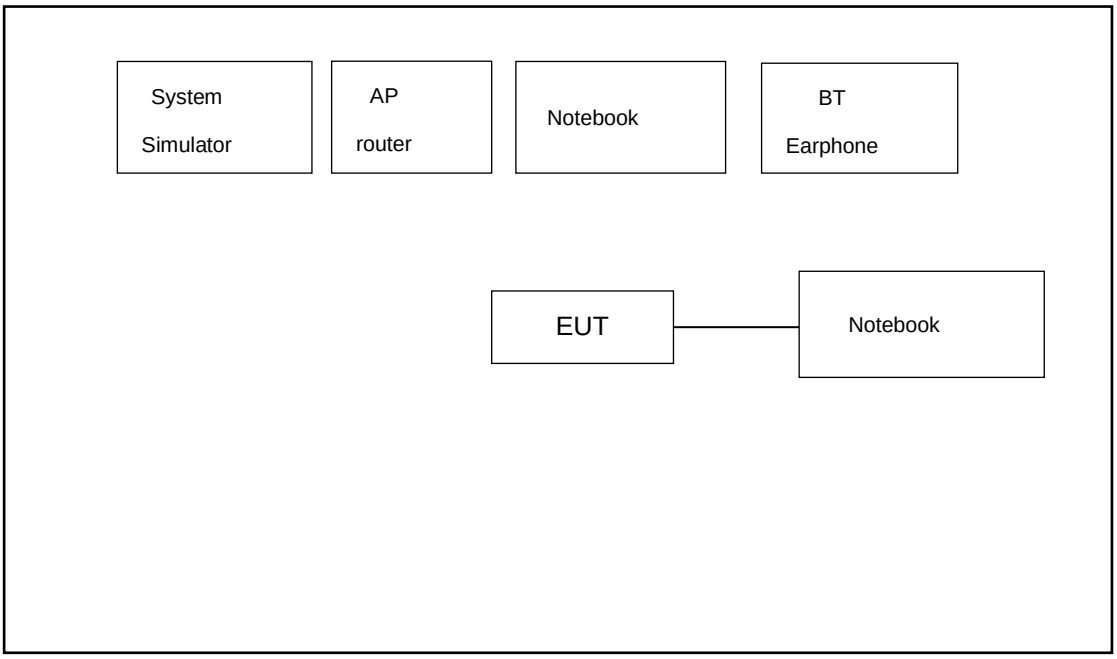
Ch. #		Band IV：5725-5850 MHz			
		802.11a	802.11ac VHT20	802.11ac VHT40	802.11ac VHT80
L	Low	149	149	151	-
M	Middle	157	157	-	155
H	High	165	165	159	-

2.3 Connection Diagram of Test System

For Radiation



For 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.	LTE Base Station	Anritus	MT8820C	N/A	N/A	Unshielded,1.8m
2.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
3.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
4.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A
5.	SD Card	Kingston	8GB	N/A	N/A	N/A
6.	Hard Disk	Lenovo	F310	DoC	Shielded, 1.2m	N/A

2.5 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuously 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.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 7.6 dB.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 7.6 (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.

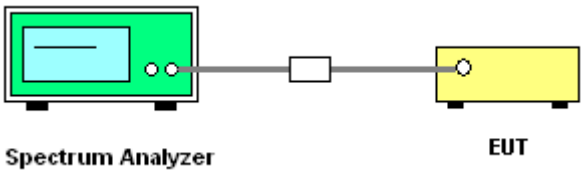
3.1.2 Measuring Instruments

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.

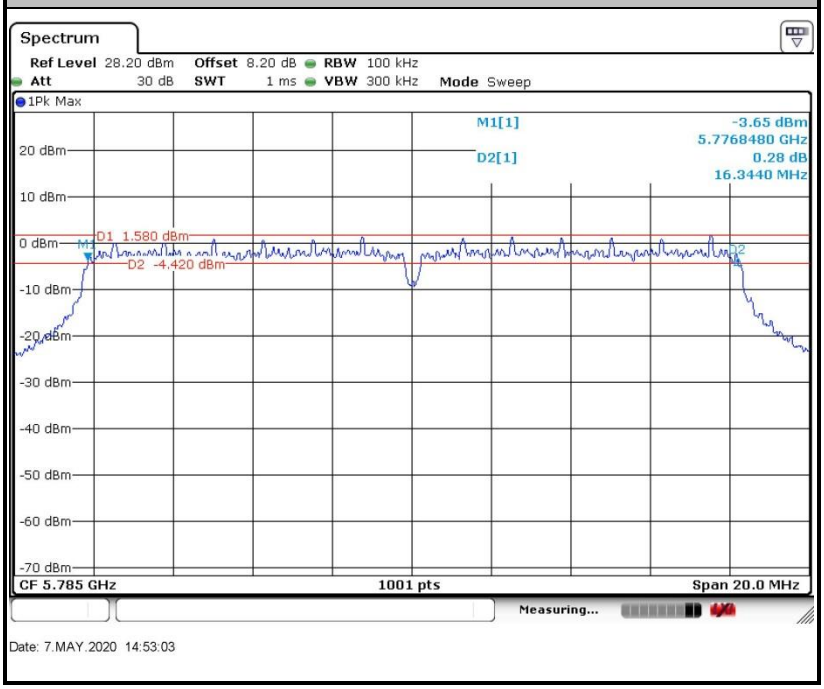
3.1.4 Test Setup



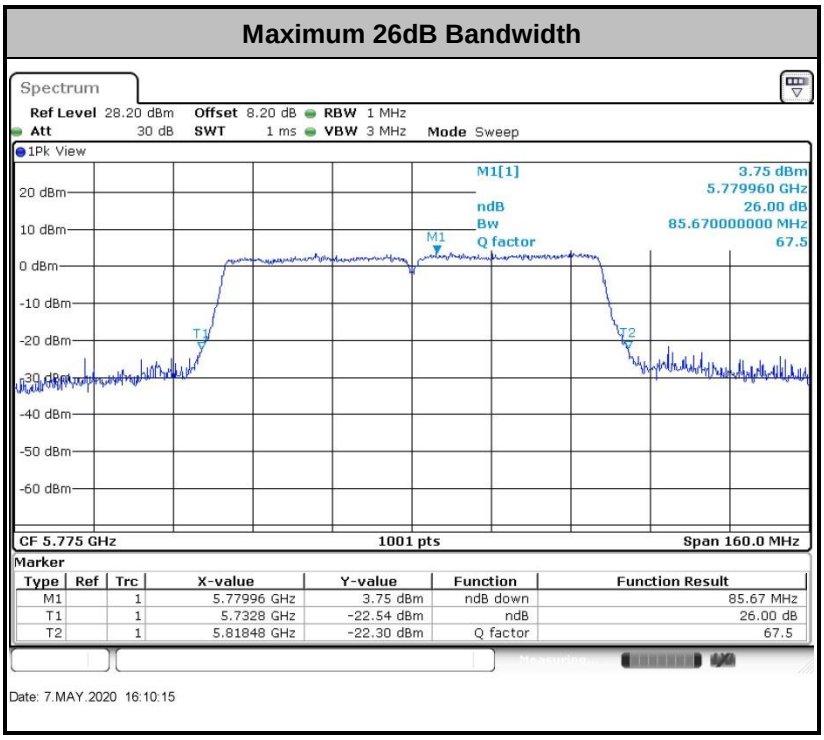
3.1.5 Test Result of 6dB Bandwidth

Please refer to Appendix A.

Minimum 6dB Bandwidth



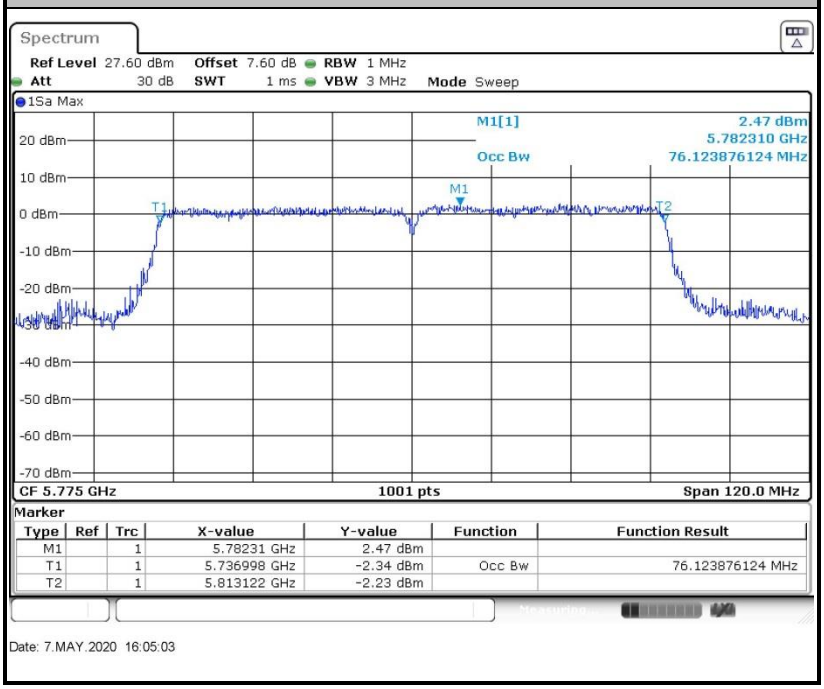
Maximum 26dB Bandwidth



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	5.77996 GHz	3.75 dBm	ndB down	85.67 MHz
T1		1	5.7328 GHz	-22.54 dBm	ndB	26.00 dB
T2		1	5.81848 GHz	-22.30 dBm	Q factor	67.5

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.

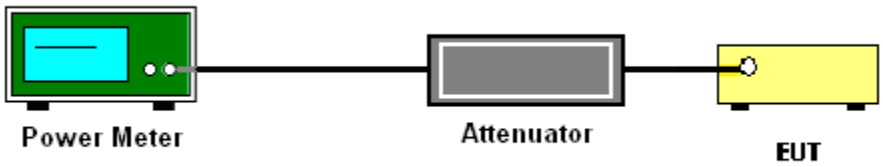
3.2.3 Test Procedures

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).

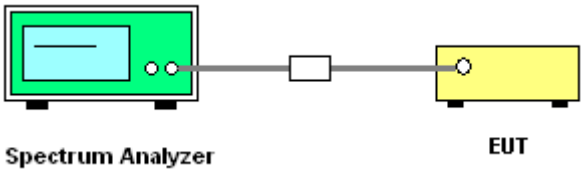
- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz.
- Set VBW ≥ 1 MHz.
- Number of points in sweep ≥ 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- Add 10 log(500kHz/RBW)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

   Method (c): Measure and add 10 log(N_{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_{ANT}) dB is added to each spectrum value before comparing to the emission limit. The addition of 10 log(N_{ANT}) dB serves to apportion the emission limit among the N_{ANT} outputs so that each output is permitted to contribute no more than $1/N_{ANT}$ th of the PSD limit.

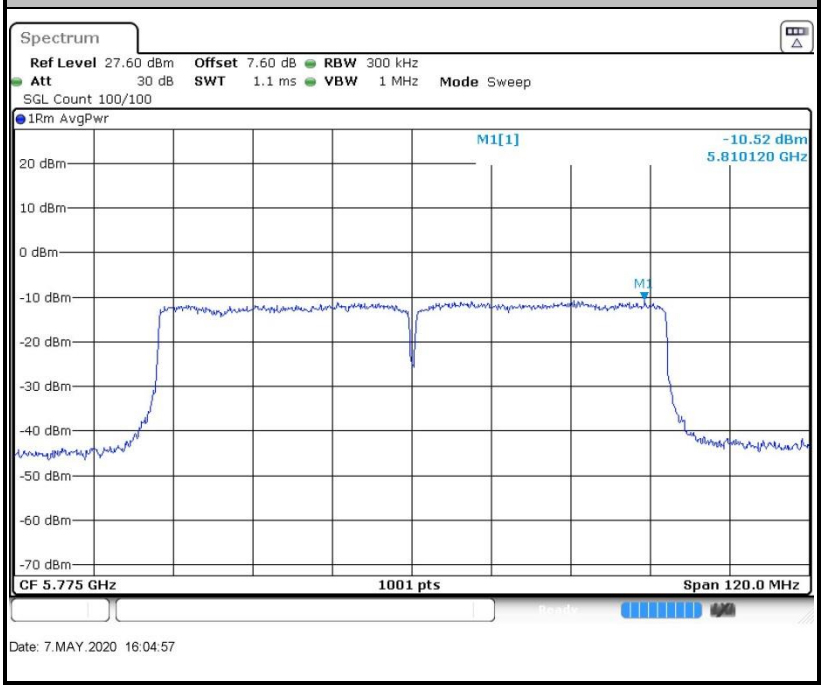
3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

Worst Case Power Density (dBm/MHz)



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.

$$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.8$$

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.

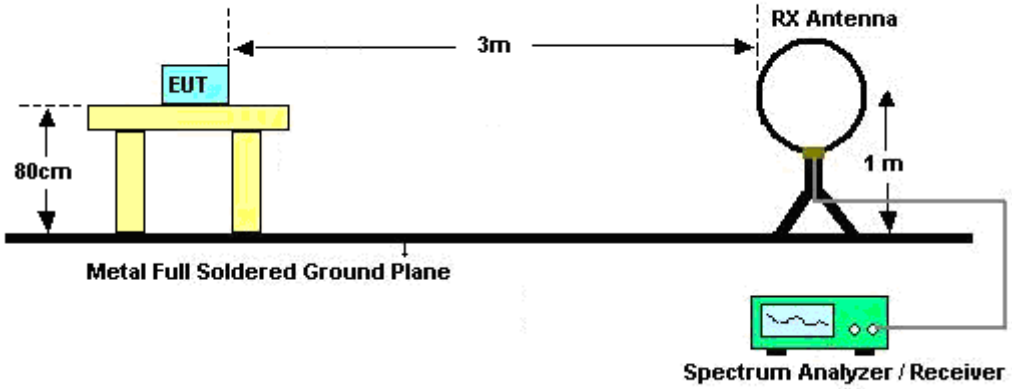
   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (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

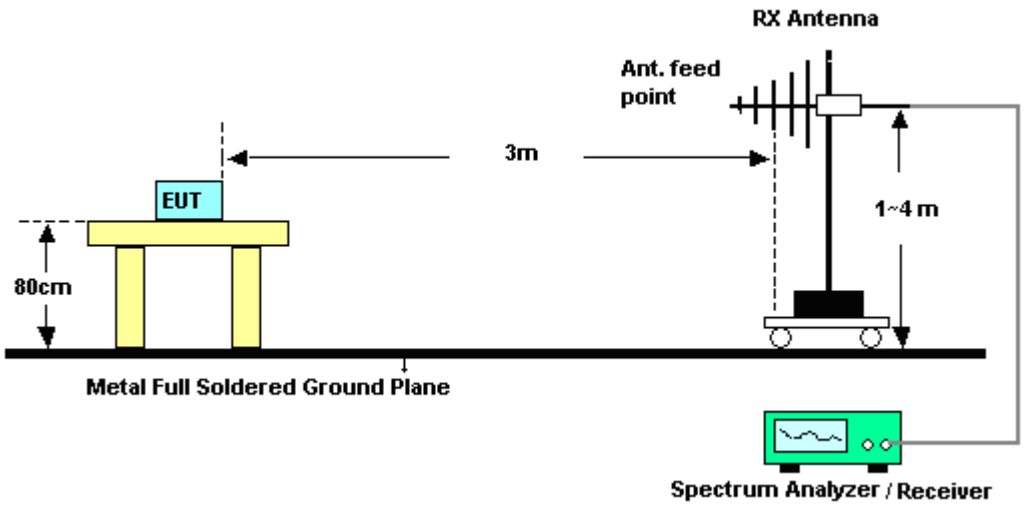
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting 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 average 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

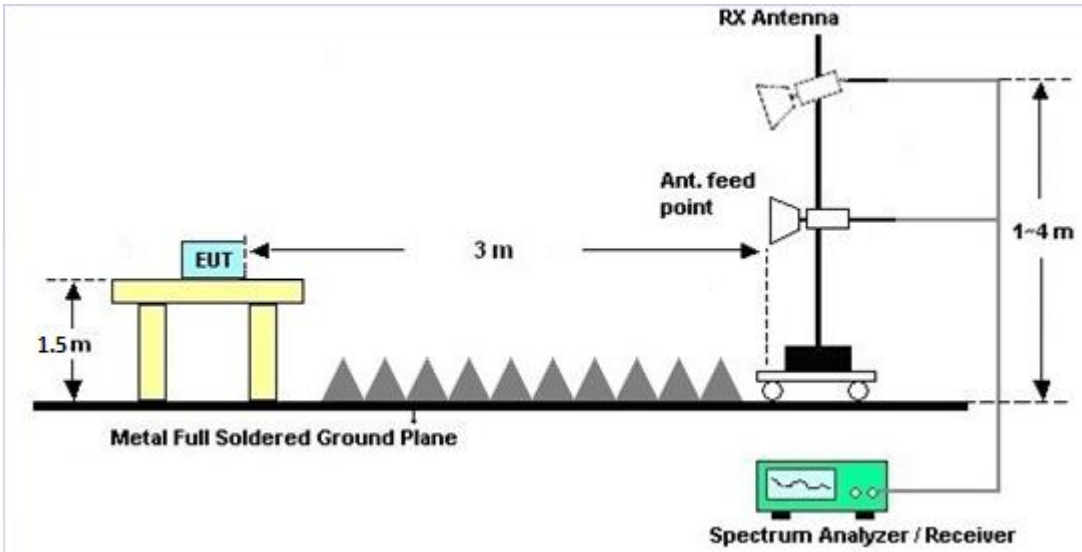
For radiated emissions below 30MHz



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)

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.

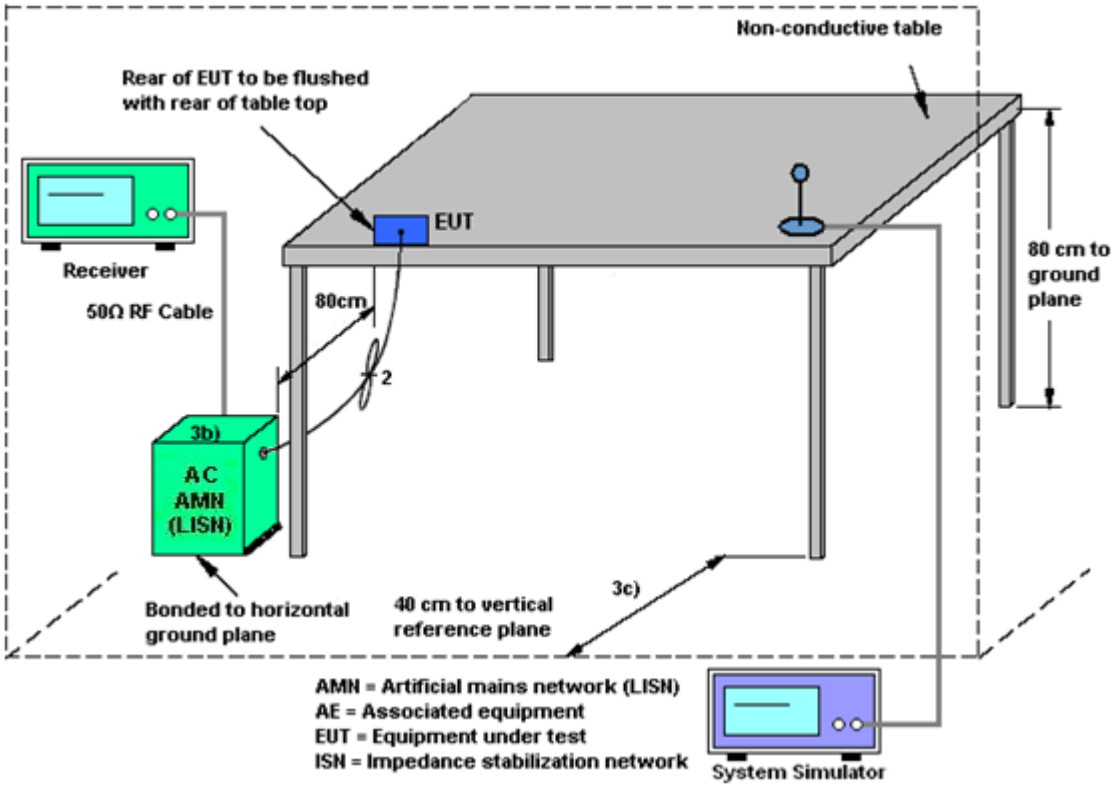
3.5.2 Measuring Instruments

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 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

<CDD Modes >

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

Directional gain = GANT + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,

Array Gain = 10 log(NANT/NSS=1) dB.

For power measurements on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for NANT ≤ 4.

Directional gain may be calculated by using the formulas applicable to equal gain antennas with GANT set equal to the gain of the antenna having the highest gain;

The EUT supports CDD mode.

For power, the directional gain G_{ANT} is set equal to the antenna having the highest gain, i.e., F)2)f)i).

For PSD, the directional gain calculation is following F)2)f)ii) of KDB 662911 D01 v02r01.

The power and PSD limit should be modified if the directional gain of EUT is over 6 dBi,

The directional gain “DG” is calculated as following table.

<CDD Modes>

	Ant. 1 (dBi)	Ant. 2 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
Band IV	1.14	2.10	2.10	4.64	0.00	0.00

Power Limit Reduction = DG(Power) – 6dBi, (min = 0)

PSD Limit Reduction = DG(PSD) – 6dBi, (min = 0)

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	May 07, 2020	Nov. 01, 2020	Conducted (TH01-KS)
Pulse Power Senor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 15, 2020	May 07, 2020	Jan. 14, 2021	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 08, 2020	May 07, 2020	Jan. 07, 2021	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY57290157	3Hz~8.5GHz;Max 30dBm	Jul. 18, 2019	May 04, 2020	Jul. 17, 2020	Radiation (03CH06-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz-44GHz	Apr. 15, 2020	May 04, 2020	Apr. 16, 2021	Radiation (03CH06-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Nov. 10, 2019	May 04, 2020	Nov. 09, 2020	Radiation (03CH06-KS)
Bilog Antenna	TeseQ	CBL6111D	49921	30MHz-1GHz	May 30, 2020	May 04, 2020	May 29, 2021	Radiation (03CH06-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	00218652	1GHz~18GHz	Apr. 27, 2020	May 04, 2020	Apr. 26, 2021	Radiation (03CH06-KS)
SHF-EHF Horn	Com-power	AH-840	101115	18GHz~40GHz	Nov. 10, 2019	May 04, 2020	Nov. 09, 2020	Radiation (03CH06-KS)
Amplifier	SONOMA	310N	187289	9KHz ~1GHZ	Aug. 06, 2019	May 04, 2020	Aug. 05, 2020	Radiation (03CH06-KS)
Amplifier	MITEQ	EM18G40GGA	060728	18~40GHz	Jan. 08, 2020	May 04, 2020	Jan. 07, 2021	Radiation (03CH06-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2025788	1Ghz-18Ghz	Aug. 16, 2019	May 04, 2020	Aug. 15, 2020	Radiation (03CH06-KS)
Amplifier	Keysight	83017A	MY53270203	500MHz~26.5GHz	Apr. 15, 2020	May 04, 2020	Apr. 14, 2021	Radiation (03CH06-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	May 04, 2020	NCR	Radiation (03CH06-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	May 04, 2020	NCR	Radiation (03CH06-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	May 04, 2020	NCR	Radiation (03CH06-KS)
EMI Receiver	R&S	ESCI7	100768	9kHz~7GHz;	Apr. 14, 2020	May 09, 2020	Apr. 13, 2021	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 18, 2019	May 09, 2020	Oct. 17, 2020	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	Oct. 28, 2019	May 09, 2020	Oct. 27, 2020	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 18, 2019	May 09, 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**

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**

Appendix A. Conducted Test Results

Report Number : FR042407C

Test Engineer:	Asa Cheng	Temperature:	21~25	°C
Test Date:	2020/5/7	Relative Humidity:	51~54	%

Report Number : FR042407C

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	18.38	17.68	24.98	23.38	16.36	16.34	0.5		Pass
11a	6Mbps	2	157	5785	18.28	17.78	24.38	23.18	16.34	16.34	0.5		Pass
11a	6Mbps	2	165	5825	17.83	17.73	24.08	23.53	16.34	16.34	0.5		Pass
VHT20	MCS0	2	149	5745	19.08	18.78	25.08	24.98	17.58	17.58	0.5		Pass
VHT20	MCS0	2	157	5785	19.08	18.83	25.18	24.73	17.58	17.58	0.5		Pass
VHT20	MCS0	2	165	5825	18.93	18.88	25.28	25.18	17.56	17.56	0.5		Pass
VHT40	MCS0	2	151	5755	37.06	36.86	43.70	43.07	36.20	36.32	0.5		Pass
VHT40	MCS0	2	159	5795	36.96	37.06	43.52	42.98	36.28	36.28	0.5		Pass
VHT80	MCS0	2	155	5775	75.88	76.12	85.67	84.72	76.32	75.76	0.5		Pass

Report Number : FR042407C

TEST RESULTS DATA
Average Power Table

Band IV															
Mod.	Data Rate	NTX	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	0.06	0.08	12.54	12.25	15.41	30.00		2.10			Pass
11a	6Mbps	2	157	5785	0.06	0.08	12.56	12.04	15.32	30.00		2.10			Pass
11a	6Mbps	2	165	5825	0.06	0.08	12.97	12.48	15.74	30.00		2.10			Pass
HT20	MCS0	2	149	5745	0.07	0.12	12.45	12.01	15.24	30.00		2.10			Pass
HT20	MCS0	2	157	5785	0.07	0.12	12.48	11.94	15.22	30.00		2.10			Pass
HT20	MCS0	2	165	5825	0.07	0.12	12.41	11.91	15.17	30.00		2.10			Pass
HT40	MCS0	2	151	5755	0.17	0.17	12.44	11.88	15.18	30.00		2.10			Pass
HT40	MCS0	2	159	5795	0.17	0.17	12.50	11.73	15.14	30.00		2.10			Pass
VHT20	MCS0	2	149	5745	0.08	0.08	12.48	12.18	15.34	30.00		2.10			Pass
VHT20	MCS0	2	157	5785	0.08	0.08	12.50	12.05	15.29	30.00		2.10			Pass
VHT20	MCS0	2	165	5825	0.08	0.08	12.39	11.94	15.18	30.00		2.10			Pass
VHT40	MCS0	2	151	5755	0.17	0.17	12.50	11.88	15.21	30.00		2.10			Pass
VHT40	MCS0	2	159	5795	0.17	0.17	12.52	11.72	15.14	30.00		2.10			Pass
VHT80	MCS0	2	155	5775	0.31	0.33	12.56	11.65	15.14	30.00		2.10			Pass

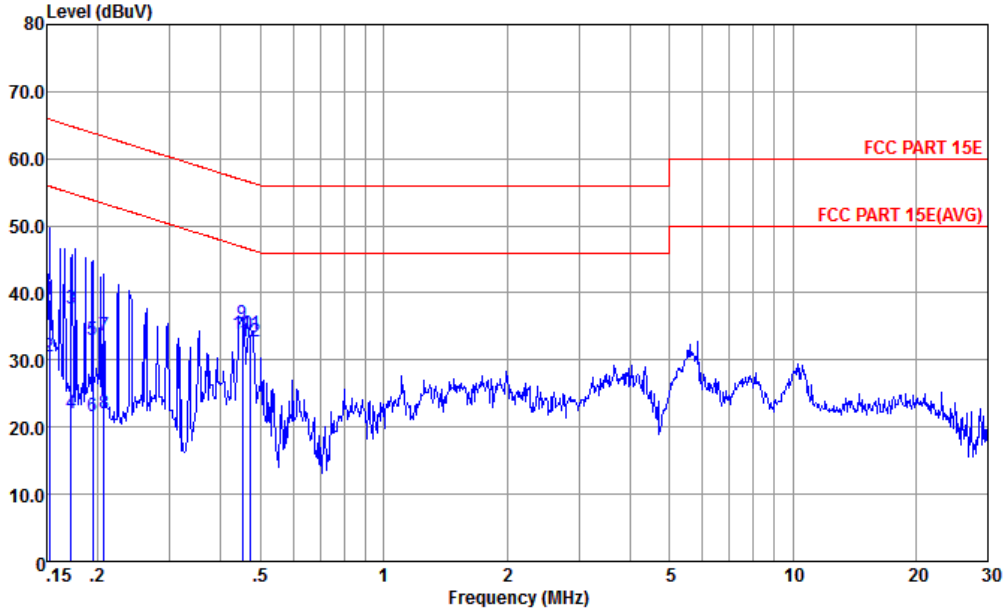
Report Number : FR042407C

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	0.06	0.08	2.22				1.60	30.00		4.64		Pass
11a	6Mbps	2	157	5785	0.06	0.08	2.22				1.77	30.00		4.64		Pass
11a	6Mbps	2	165	5825	0.06	0.08	2.22				1.75	30.00		4.64		Pass
VHT20	MCS0	2	149	5745	0.08	0.08	2.22				1.29	30.00		4.64		Pass
VHT20	MCS0	2	157	5785	0.08	0.08	2.22				1.48	30.00		4.64		Pass
VHT20	MCS0	2	165	5825	0.08	0.08	2.22				1.20	30.00		4.64		Pass
VHT40	MCS0	2	151	5755	0.17	0.17	2.22				-1.47	30.00		4.64		Pass
VHT40	MCS0	2	159	5795	0.17	0.17	2.22				-1.53	30.00		4.64		Pass
VHT80	MCS0	2	155	5775	0.31	0.33	2.22				-4.67	30.00		4.64		Pass

Appendix B. AC Conducted Emission Test Results

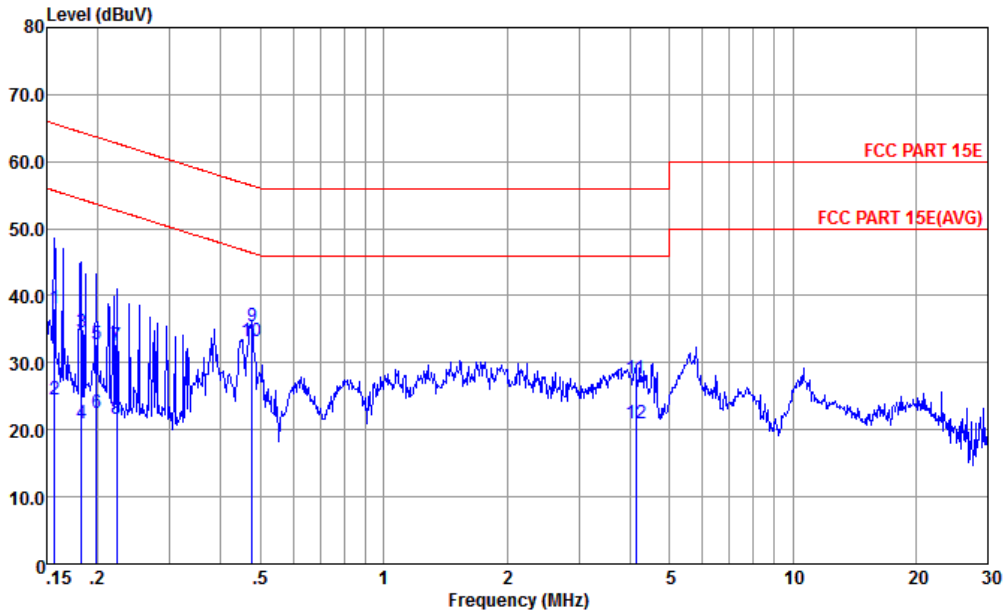
Test Engineer :	Amos Zhang	**Temperature :**	24.2~25.6℃
		Relative Humidity :	37~39%
Test Voltage :	120Vac / 60Hz	**Phase :**	Line
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Site : CO01-KS
Condition : FCC PART 15E LISN-L-191028-060105 LINE

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.152	39.10	-26.77	65.87	28.60	0.03	10.47	QP
2	0.152	30.60	-25.27	55.87	20.10	0.03	10.47	Average
3	0.172	37.66	-27.20	64.86	27.21	0.03	10.42	QP
4	0.172	22.06	-32.80	54.86	11.61	0.03	10.42	Average
5	0.194	33.01	-30.83	63.84	22.60	0.04	10.37	QP
6	0.194	21.61	-32.23	53.84	11.20	0.04	10.37	Average
7	0.207	33.60	-29.72	63.32	23.20	0.04	10.36	QP
8	0.207	22.00	-31.32	53.32	11.60	0.04	10.36	Average
9	0.452	35.51	-21.34	56.85	25.20	0.06	10.25	QP
10 *	0.452	33.91	-12.94	46.85	23.60	0.06	10.25	Average
11	0.474	33.90	-22.55	56.45	23.60	0.06	10.24	QP
12	0.474	32.80	-13.65	46.45	22.50	0.06	10.24	Average

Test Engineer :	Amos Zhang	**Temperature :**	24.2~25.6℃
		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 : FCC PART 15E LISN-N-191028-060105 NEUTRAL

	Freq MHz	Level dBuV	Over Limit dB	Limit Line dBuV	Read Level dBuV	LISN Factor dB	Cable Loss dB	Remark
1	0.156	38.09	-27.56	65.65	27.55	0.08	10.46	QP
2	0.156	24.59	-31.06	55.65	14.05	0.08	10.46	Average
3	0.182	34.64	-29.73	64.37	24.16	0.08	10.40	QP
4	0.182	21.04	-33.33	54.37	10.56	0.08	10.40	Average
5	0.199	32.71	-30.96	63.67	22.26	0.08	10.37	QP
6	0.199	22.61	-31.06	53.67	12.16	0.08	10.37	Average
7	0.222	32.49	-30.25	62.74	22.06	0.08	10.35	QP
8	0.222	21.69	-31.05	52.74	11.26	0.08	10.35	Average
9	0.476	35.50	-20.91	56.41	25.16	0.10	10.24	QP
10 *	0.476	33.20	-13.21	46.41	22.86	0.10	10.24	Average
11	4.136	27.59	-28.41	56.00	17.19	0.15	10.25	QP
12	4.136	20.99	-25.01	46.00	10.59	0.15	10.25	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 Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 149 5745MHz		5613.6	56.54	-11.76	68.3	41.76	34.6	15.92	35.74	100	151	P	H
		5695.2	58.05	-43.71	101.76	43.05	34.7	16.05	35.75	100	151	P	H
		5705.2	57.44	-49.32	106.76	42.39	34.73	16.08	35.76	100	151	P	H
		5723.6	56.91	-62.2	119.11	41.8	34.77	16.11	35.77	100	151	P	H
		5740	106.4	-	-	91.25	34.8	16.13	35.78	100	151	P	H
		5740	98.27	-	-	83.12	34.8	16.13	35.78	100	151	A	H
		5638	55.65	-12.65	68.3	40.73	34.67	15.97	35.72	315	272	P	V
		5683.6	57.12	-36.08	93.2	42.12	34.7	16.05	35.75	315	272	P	V
		5707.2	61.17	-46.15	107.32	46.12	34.73	16.08	35.76	315	272	P	V
		5722.4	63.34	-53.03	116.37	48.23	34.77	16.11	35.77	315	272	P	V
		5740	105.46	-	-	90.31	34.8	16.13	35.78	315	272	P	V
		5740	97.26	-	-	82.11	34.8	16.13	35.78	315	272	A	V
802.11a CH 165 5825MHz		5853.2	56.31	-58.69	115	41.32	34.88	10.98	30.87	104	233	P	H
		5869.2	60.78	-46.14	106.92	45.73	34.9	11.03	30.88	104	233	P	H
		5877.2	57.32	-46.35	103.67	42.22	34.91	11.08	30.89	104	233	P	H
		5958	55.45	-12.85	68.3	40.08	34.95	11.33	30.91	104	233	P	H
		5824	106.13	-	-	91.19	34.87	10.93	30.86	104	233	P	H
		5824	98.96	-	-	84.02	34.87	10.93	30.86	104	233	A	H
		5853.2	54.11	-60.89	115	39.12	34.88	10.98	30.87	100	116	P	V
		5857.2	54.95	-55.33	110.28	39.9	34.9	11.03	30.88	100	116	P	V
		5922.4	55.62	-14.6	70.22	40.36	34.93	11.23	30.9	100	116	P	V
		5976	55.32	-12.98	68.3	39.89	34.96	11.39	30.92	100	116	P	V
		5824	103.15	-	-	88.21	34.87	10.93	30.86	100	116	P	V
		5824	95.67	-	-	80.73	34.87	10.93	30.86	100	116	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 149 5745MHz		11489.48	44.06	-29.94	74	44.27	38.08	23.52	61.81	100	360	P	H
		11489.48	44.31	-29.69	74	44.52	38.08	23.52	61.81	100	360	P	V
802.11a CH 157 5785MHz		11569.56	44.18	-29.82	74	44.18	38.17	23.58	61.75	100	360	P	H
		11569.56	44.37	-29.63	74	44.37	38.17	23.58	61.75	100	360	P	V
802.11a CH 165 5825MHz		11650	44.61	-29.39	74	50.75	37.98	16.21	60.33	100	360	P	H
		11650	42.91	-31.09	74	49.05	37.98	16.21	60.33	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT20 CH 149 5745MHz		5606.8	56.28	-12.02	68.3	41.5	34.6	15.92	35.74	100	151	P	H
		5698	56.47	-47.36	103.83	41.47	34.7	16.05	35.75	100	151	P	H
		5716	64.09	-45.69	109.78	49.04	34.73	16.08	35.76	100	151	P	H
		5724.8	56.96	-64.88	121.84	41.85	34.77	16.11	35.77	100	151	P	H
		5752	106.58	-	-	91.39	34.83	16.16	35.8	100	151	P	H
		5752	98.14	-	-	82.95	34.83	16.16	35.8	100	151	A	H
		5619.2	56.43	-11.87	68.3	41.59	34.63	15.94	35.73	315	272	P	V
		5663.6	56.55	-21.85	78.4	41.58	34.7	16	35.73	315	272	P	V
		5714.8	61.79	-47.66	109.45	46.74	34.73	16.08	35.76	315	272	P	V
		5721.6	59.48	-55.07	114.55	44.37	34.77	16.11	35.77	315	272	P	V
		5752	106.38	-	-	91.19	34.83	16.16	35.8	315	272	P	V
		5752	97.39	-	-	82.2	34.83	16.16	35.8	315	272	A	V
802.11ac VHT20 CH 165 5825MHz		5850.8	56.86	-63.62	120.48	41.42	35	16.29	35.85	100	151	P	H
		5874.4	59.71	-45.76	105.47	44.16	35.07	16.34	35.86	100	151	P	H
		5893.2	56.14	-35.66	91.8	40.55	35.1	16.36	35.87	100	151	P	H
		5968.4	57.55	-10.75	68.3	41.75	35.23	16.46	35.89	100	151	P	H
		5818	106.62	-	-	91.28	34.93	16.24	35.83	100	151	P	H
		5818	98.08	-	-	82.74	34.93	16.24	35.83	100	151	A	H
		5851.2	55.65	-63.91	119.56	40.21	35	16.29	35.85	322	283	P	V
		5861.2	61.61	-47.55	109.16	46.13	35.03	16.31	35.86	322	283	P	V
		5888.8	56.94	-38.12	95.06	41.35	35.1	16.36	35.87	322	283	P	V
		5953.6	56.53	-11.77	68.3	40.77	35.2	16.44	35.88	322	283	P	V
		5824	105.61	-	-	90.22	34.97	16.26	35.84	322	283	P	V
		5824	96.98	-	-	81.59	34.97	16.26	35.84	322	283	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT20 CH 149 5745MHz		11489.48	44.84	-29.16	74	45.05	38.08	23.52	61.81	100	360	P	H
		11489.48	44.08	-29.92	74	44.29	38.08	23.52	61.81	100	360	P	V
802.11ac VHT20 CH 157 5785MHz		11569.56	44.78	-29.22	74	44.78	38.17	23.58	61.75	100	360	P	H
		11569.56	44.25	-29.75	74	44.25	38.17	23.58	61.75	100	360	P	V
802.11ac VHT20 CH 165 5825MHz		11649.64	44.95	-29.05	74	44.77	38.24	23.63	61.69	100	360	P	H
		11649.64	44.25	-29.75	74	44.07	38.24	23.63	61.69	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 VHT40 (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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT40 CH 151 5755MHz		5647.2	55.97	-12.33	68.3	41.05	34.67	15.97	35.72	100	153	P	H
		5699.6	61.91	-43.1	105.01	46.91	34.7	16.05	35.75	100	153	P	H
		5719.6	71.57	-39.22	110.79	56.46	34.77	16.11	35.77	100	153	P	H
		5722.4	74.49	-41.88	116.37	59.38	34.77	16.11	35.77	100	153	P	H
		5851.6	54.83	-63.82	118.65	39.39	35	16.29	35.85	100	153	P	H
		5862.8	55.31	-53.4	108.71	39.83	35.03	16.31	35.86	100	153	P	H
		5923.2	57.01	-12.62	69.63	41.31	35.17	16.41	35.88	100	153	P	H
		5993.2	57.04	-11.26	68.3	41.13	35.3	16.51	35.9	100	153	P	H
		5758	103.78	-	-	88.59	34.83	16.16	35.8	100	153	P	H
		5758	95.1	-	-	79.91	34.83	16.16	35.8	100	153	A	H
		5605.2	55.73	-12.57	68.3	40.95	34.6	15.92	35.74	315	272	P	V
		5695.6	59.71	-42.35	102.06	44.71	34.7	16.05	35.75	315	272	P	V
		5719.6	68.23	-42.56	110.79	53.12	34.77	16.11	35.77	315	272	P	V
		5723.2	70.73	-47.47	118.2	55.62	34.77	16.11	35.77	315	272	P	V
		5854	55.3	-57.88	113.18	39.82	35.03	16.31	35.86	315	272	P	V
		5872.4	55.57	-50.46	106.03	40.02	35.07	16.34	35.86	315	272	P	V
		5902.8	56.34	-28.35	84.69	40.75	35.1	16.36	35.87	315	272	P	V
		5999.2	56.54	-11.76	68.3	40.63	35.3	16.51	35.9	315	272	P	V
		5740	102.69	-	-	87.54	34.8	16.13	35.78	315	272	P	V
		5740	93.41	-	-	78.26	34.8	16.13	35.78	315	272	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		5645.6	56.94	-11.36	68.3	42.02	34.67	15.97	35.72	100	154	P	H
		5658	57.05	-17.19	74.24	42.08	34.7	16	35.73	100	154	P	H
		5705.2	55.36	-51.4	106.76	40.31	34.73	16.08	35.76	100	154	P	H
		5724.8	55.04	-66.8	121.84	39.93	34.77	16.11	35.77	100	154	P	H
		5850.4	62.5	-58.89	121.39	47.06	35	16.29	35.85	100	154	P	H
		5856.8	56.42	-53.98	110.4	40.94	35.03	16.31	35.86	100	154	P	H
		5912	56.18	-21.71	77.89	40.53	35.13	16.39	35.87	100	154	P	H
		5963.2	56.89	-11.41	68.3	41.09	35.23	16.46	35.89	100	154	P	H
802.11ac		5812	103.34	-	-	88	34.93	16.24	35.83	100	154	P	H
VHT40		5812	94.63	-	-	79.29	34.93	16.24	35.83	100	154	A	H
CH 159		5605.6	56.87	-11.43	68.3	42.09	34.6	15.92	35.74	315	272	P	V
5795MHz		5690	56.01	-41.92	97.93	41.01	34.7	16.05	35.75	315	272	P	V
		5717.6	56.37	-53.86	110.23	41.26	34.77	16.11	35.77	315	272	P	V
		5721.2	55.24	-58.4	113.64	40.13	34.77	16.11	35.77	315	272	P	V
		5852	60.72	-57.02	117.74	45.28	35	16.29	35.85	315	272	P	V
		5870	57.04	-49.66	106.7	41.56	35.03	16.31	35.86	315	272	P	V
		5908	56.09	-24.75	80.84	40.44	35.13	16.39	35.87	315	272	P	V
		5960	57.2	-11.1	68.3	41.4	35.23	16.46	35.89	315	272	P	V
		5788	101.57	-	-	86.28	34.9	16.21	35.82	315	272	P	V
		5788	93.27	-	-	77.98	34.9	16.21	35.82	315	272	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 VHT40 (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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT40 CH 151 5755MHz		11509.5	43.89	-30.11	74	44.06	38.1	23.54	61.81	100	360	P	H
		11509.5	43.76	-30.24	74	43.93	38.1	23.54	61.81	100	360	P	V
802.11ac VHT40 CH 159 5795MHz		11589.58	44.73	-29.27	74	44.68	38.18	23.6	61.73	100	360	P	H
		11589.58	44.96	-29.04	74	44.91	38.18	23.6	61.73	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)	Cable 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	57.8	-10.5	68.3	42.83	34.7	16	35.73	100	151	P	H
		5700	61.32	-43.98	105.3	46.32	34.7	16.05	35.75	100	151	P	H
		5714.8	63.33	-46.12	109.45	48.28	34.73	16.08	35.76	100	151	P	H
		5721.2	63.79	-49.85	113.64	48.68	34.77	16.11	35.77	100	151	P	H
		5852	64.87	-52.87	117.74	49.43	35	16.29	35.85	100	151	P	H
		5856	63.33	-47.29	110.62	47.85	35.03	16.31	35.86	100	151	P	H
		5876.4	57.52	-46.74	104.26	41.97	35.07	16.34	35.86	100	151	P	H
		5958	56.17	-12.13	68.3	40.37	35.23	16.46	35.89	100	151	P	H
		5800	101.19	-	-	85.9	34.9	16.21	35.82	100	151	P	H
		5800	92.05	-	-	76.76	34.9	16.21	35.82	100	151	A	H
		5630.8	56.71	-11.59	68.3	41.87	34.63	15.94	35.73	313	274	P	V
		5699.2	63.32	-41.39	104.71	48.32	34.7	16.05	35.75	313	274	P	V
		5718	62.59	-47.75	110.34	47.48	34.77	16.11	35.77	313	274	P	V
		5722.4	62.58	-53.79	116.37	47.47	34.77	16.11	35.77	313	274	P	V
		5852.8	59.4	-56.52	115.92	43.96	35	16.29	35.85	313	274	P	V
		5862.8	62.67	-46.04	108.71	47.19	35.03	16.31	35.86	313	274	P	V
		5876.4	57.92	-46.34	104.26	42.37	35.07	16.34	35.86	313	274	P	V
		5951.2	56.28	-12.02	68.3	40.52	35.2	16.44	35.88	313	274	P	V
		5782	99.32	-	-	84.07	34.87	16.19	35.81	313	274	P	V
		5782	91.06	-	-	75.81	34.87	16.19	35.81	313	274	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)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11ac VHT80 CH 155 5775MHz		11549.54	44.08	-29.92	74	44.12	38.15	23.57	61.76	100	360	P	H
		11549.54	43.81	-30.19	74	43.85	38.15	23.57	61.76	100	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												

Emission below 1GHz

WIFI 802.11ac VHT80 (LF @ 3m)

WIFI Ant.	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
1+2		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11ac VHT80 LF		34.85	16.52	-23.48	40	32.87	22.45	1.09	39.89	-	-	P	H
		89.17	16.59	-26.91	43.5	39.19	14.66	1.71	38.97	-	-	P	H
		157.07	16.13	-27.37	43.5	36.63	16.47	2.22	39.19	-	-	P	H
		233.7	17.48	-28.52	46	36.5	16.74	2.74	38.5	-	-	P	H
		481.05	22.85	-23.15	46	32.31	23.38	3.85	36.69	-	-	P	H
		725.49	24.72	-21.28	46	27.49	26.88	4.74	34.39	100	0	P	H
		45.52	19.94	-20.06	40	43.41	15.17	1.28	39.92	-	-	P	V
		65.89	16.07	-23.93	40	43.02	11.6	1.45	40	-	-	P	V
		100.81	16.18	-27.32	43.5	36.29	16.79	1.79	38.69	-	-	P	V
		200.72	16.98	-26.52	43.5	37.66	15.36	2.46	38.5	-	-	P	V
		242.43	20.63	-25.37	46	38.56	17.75	2.82	38.5	-	-	P	V
		950.53	30.55	-15.45	46	29.93	27.21	5.34	31.93	100	0	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	**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	Cable	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 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. Level(dBμV/m) =

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

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

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable 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) + Cable 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)

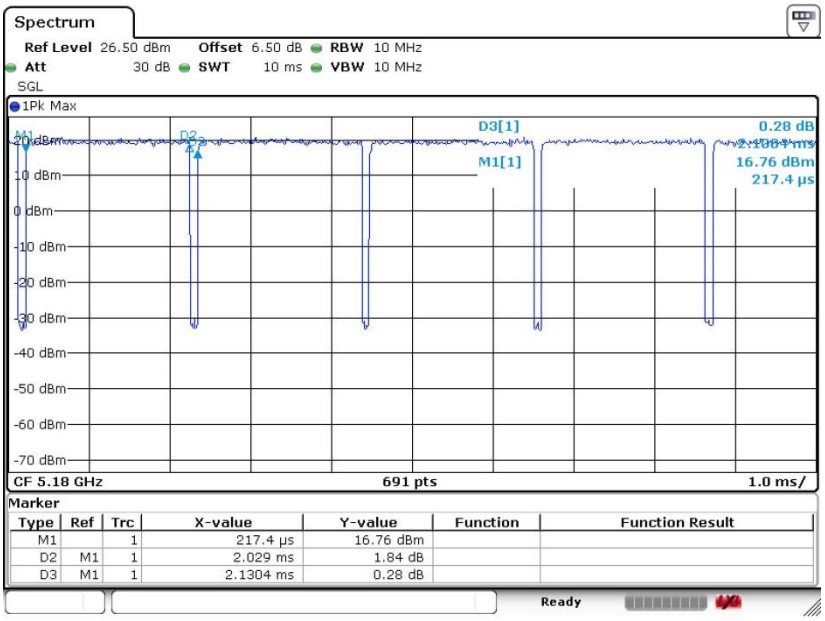
Both peak and average measured complies with the limit line, so test result is "PASS".

Appendix D. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1+2	802.11a	95.24	2.029	0.493	0.51kHz
1+2	5GHz 802.11ac VHT20	95.65	1.913	0.523	0.56kHz
1+2	5GHz 802.11ac VHT40	91.49	0.935	1.070	1.1kHz
1+2	5GHz 802.11ac VHT80	84.49	0.458	2.184	2.2kHz

<MIMO Ant.1+2>

802.11a



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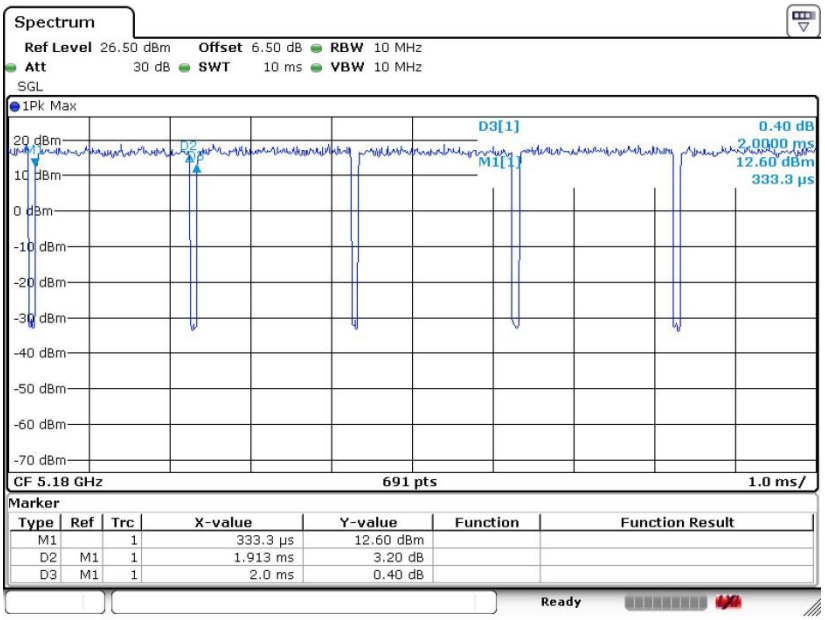
802.11ac VHT20



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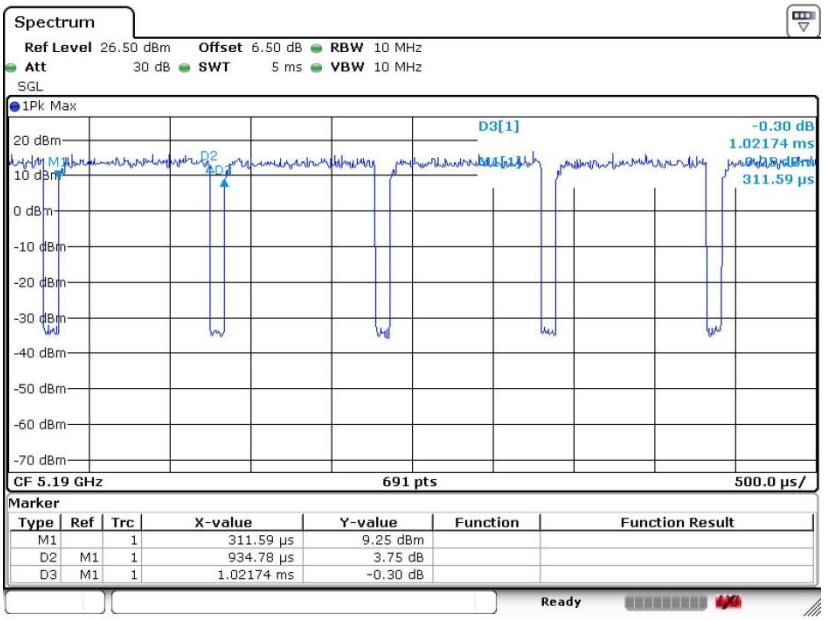
802.11ac VHT40



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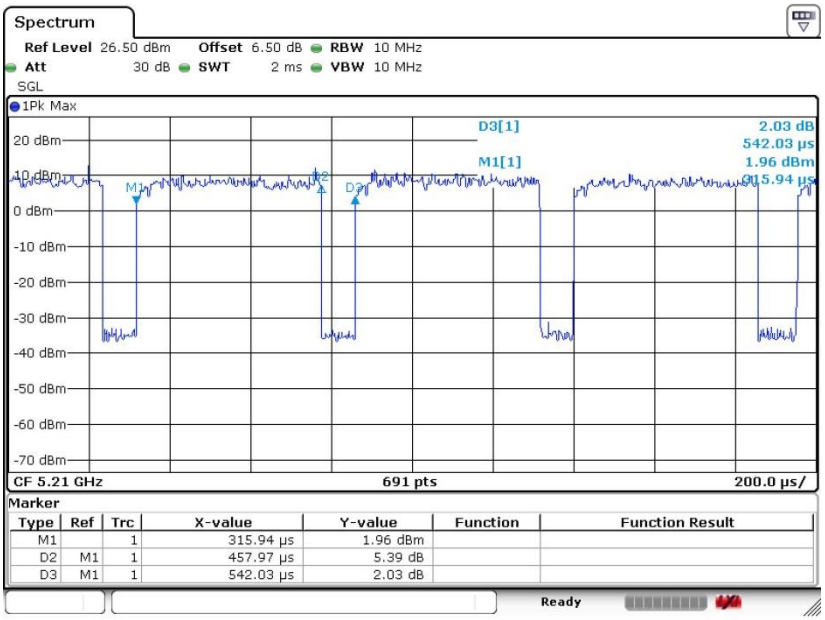
802.11ac VHT80



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