



FCC RF Test Report

APPLICANT : Lenovo(Shanghai) Electronics Technology Co., Ltd.
EQUIPMENT : Standalone VR Headset
BRAND NAME : Lenovo
MODEL NAME : Lenovo VR-1541F
FCC ID : O57VR1541F
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure

The product was received on Sep. 01, 2017 and testing was completed on Dec. 11, 2017. 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.



Approved by: James Huang / Manager

Sporton International (Kunshan) Inc.

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China



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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 7.00 dB at 30.97 MHz
3.5	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 10.79 dB at 0.156 MHz
3.6	15.407(g)	Frequency Stability	Within Operation Band	Pass	-
3.7	15.407(c)	Automatically Discontinue Transmission	Discontinue Transmission	Pass	-
3.8	15.203 & 15.407(a)	Antenna Requirement	N/A	Pass	-



1 General Description

1.1 Applicant

Lenovo(Shanghai) Electronics Technology Co., Ltd.
NO.68 BUILDING, 199 FENJU RD, Pilot Free Trade Zone, 200131, China

1.2 Manufacturer

Lenovo PC HK Limited
23/F, Lincoln House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Standalone VR Headset
Brand Name	Lenovo
Model Name	Lenovo VR-1541F
FCC ID	O57VR1541F
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 v2.0 + EDR/ Bluetooth v 4.0 LE/ Bluetooth v4.2 LE/ Bluetooth v5.0 LE
HW Version	R5
SW Version	OVR2.170822.001
EUT Stage	Identical Prototype

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



1.4 Product Specification of Equipment Under Test

Standards-related Product Specification										
Tx/Rx Channel Frequency Range	5745 MHz ~ 5825 MHz									
Maximum Output Power	<5745 MHz ~ 5825 MHz> <Ant. 1> 802.11a : 16.94 dBm / 0.0494 W MIMO <Ant. 1 + 2> 802.11n HT20 : 19.52 dBm / 0.0895 W 802.11n HT40 : 19.14 dBm / 0.0820 W 802.11ac VHT80: 18.27 dBm / 0.0671 W									
99% Occupied Bandwidth	<Ant. 1> 802.11a : 18.18 MHz <Ant. 1+2> 802.11n HT20 : 19.38 MHz 802.11n HT40 : 37.46 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> : Dipole Antenna with gain 1.40 dBi <Ant. 2> : Dipole Antenna with gain 1.40 dBi									
Antenna Function Description	<table border="1"> <thead> <tr> <th></th> <th>Ant. 1</th> <th>Ant. 2</th> </tr> </thead> <tbody> <tr> <td>802.11a/n/ac</td> <td>V</td> <td>V</td> </tr> <tr> <td>802.11n/ac MIMO</td> <td>V</td> <td>V</td> </tr> </tbody> </table>		Ant. 1	Ant. 2	802.11a/n/ac	V	V	802.11n/ac MIMO	V	V
	Ant. 1	Ant. 2								
802.11a/n/ac	V	V								
802.11n/ac MIMO	V	V								

Note:

1. 802.11a only support SISO mode, 802.11n/ac support SISO & MIMO mode.
2. For 802.11a SISO mode, we only test Antenna 1 by referring to its higher conducted power.
3. For 802.11n/ac mode, we only test MIMO mode because the MIMO power is higher than SIMO power.
4. MIMO Ant. 1+2 is a calculated result from sum of the power MIMO Ant. 1 and MIMO Ant. 2.
5. For 11n HT20 & 11ac VHT20 mode, the whole testing has assessed only one by referring to their higher conducted power.
6. For 11n HT40 & 11ac VHT40 mode, the whole testing has assessed only one 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 Specification of Accessory

Specification of Accessory			
AC Adapter 1 (US)	Brand Name	Lenovo (Huntkey)	Model Name C-P35
	Power Rating	I/P: 100-240Vac, 500mA, O/P: 5.2V/ 2000 mA	
AC Adapter 1 (EU)	Brand Name	Lenovo (Huntkey)	Model Name C-P36
	Power Rating	I/P: 100-240Vac, 500mA, O/P: 5.2V/ 2000 mA	
AC Adapter 1 (UK)	Brand Name	Lenovo (Huntkey)	Model Name C-P37
	Power Rating	I/P: 100-240Vac, 500mA, O/P: 5.2V/ 2000 mA	
AC Adapter 1 (Korea)	Brand Name	Lenovo (Huntkey)	Model Name C-P46
	Power Rating	I/P: 100-240Vac, 500mA, O/P: 5.2V/ 2000 mA	
AC Adapter 1 (AU)	Brand Name	Lenovo (Huntkey)	Model Name C-P48
	Power Rating	I/P: 100-240Vac, 500mA, O/P: 5.2V/ 2000 mA	
AC Adapter 2 (US)	Brand Name	Lenovo (Acbel)	Model Name C-P35
	Power Rating	I/P: 100-240Vac, 300mA, O/P: 5.2V/ 2000 mA	
AC Adapter 2 (EU)	Brand Name	Lenovo (Acbel)	Model Name C-P36
	Power Rating	I/P: 100-240Vac, 300mA, O/P: 5.2V/ 2000 mA	
AC Adapter 2 (UK)	Brand Name	Lenovo (Acbel)	Model Name C-P37
	Power Rating	I/P: 100-240Vac, 300mA, O/P: 5.2V/ 2000 mA	
Battery	Brand Name	Lenovo (SCUD)	Model Name L17D1P33
	Power Rating	3.85Vdc, 4000mAh	Type Li-ion
USB cable	Brand Name	Lenovo (Saibao)	Model Name SGA-A016A
	Signal Line	1.0 meter, shielded cable, without ferrite core	
Controller	Brand Name	Lenovo (Daydream)	Model Name DG1CA
Earphone	Brand Name	Lenovo	Model Name CE-1601T
	Signal Line	0.5 meter, Unshielded cable, without ferrite core	

1.7 Component List

Note: There are two types of EUT, the details refer the following table. According to the difference, we choose the sample 1 to full test.

Component	Sample 1		Sample 2	
UFS(64G)	THGAF4G9N4LBAIR	Toshiba	KLUCG4J1ED-B0C1	Samsung



1.8 Testing Location

Sporton International (Kunshan) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600155-0) and the FCC designation No is CN5013.

Test Site	Sporton International (Kunshan) Inc.		
Test Site Location	No.3-2 Ping-Xiang Rd, Kunshan Development Zone Kunshan City Jiangsu Province 215335 China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.		FCC Test Firm Registration No.
	TH01-KS	CO01-KS	630927

Sporton International (Shenzhen) Inc. is accredited to ISO 17025 by National Voluntary Laboratory Accreditation Program (NVLAP code: 600156-0) and the FCC designation No is CN5019.

Test Site	Sporton International (Shenzhen) Inc.		
Test Site Location	No. 3 Bldg the third floor of south, Shahe River west, Fengzeyuan Warehouse, Nanshan District Shenzhen City Guangdong Province 518055 China TEL: +86-755-3320-2398		
Test Site No.	Sporton Site No.		FCC Test Firm Registration No.
	03CH04-SZ		577730

Note: The test site complies with ANSI C63.4 2014 requirement.



1.9 Applicable Standards

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

- ♦ FCC Part 15 Subpart E
- ♦ FCC KDB 789033 D02 General U-NII Test Procedures New Rules v02
- ♦ 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

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: conducted emission (150 kHz to 30 MHz) and radiated 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 were recorded in this report.

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 "#n" were 802.11ac VHT80.



2.2 Test Mode

Final test mode of conducted test items and radiated spurious emissions are considering the modulation and worse data rates as below table.

Single Antenna

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

MIMO Antenna

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

AC Conducted Emission	Mode 1 : Bluetooth Link + WLAN Link(5G) + USB Cable (Charging from Adapter 1) + Earphone Mode 2 : Bluetooth Link + WLAN Link(5G) + USB Cable (Charging from Adapter 2) + Earphone
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Remark:

1. The worst case of conducted emission is mode 1; only the test data of it was reported.
2. For Radiated Test Cases, The tests were performed with Adapter 1, USB Cable and Earphone.
3. For 11n HT20 & 11ac VHT20 mode, 11n HT40 & 11ac VHT40 mode, the whole testing has assessed only one by referring to their higher conducted power.

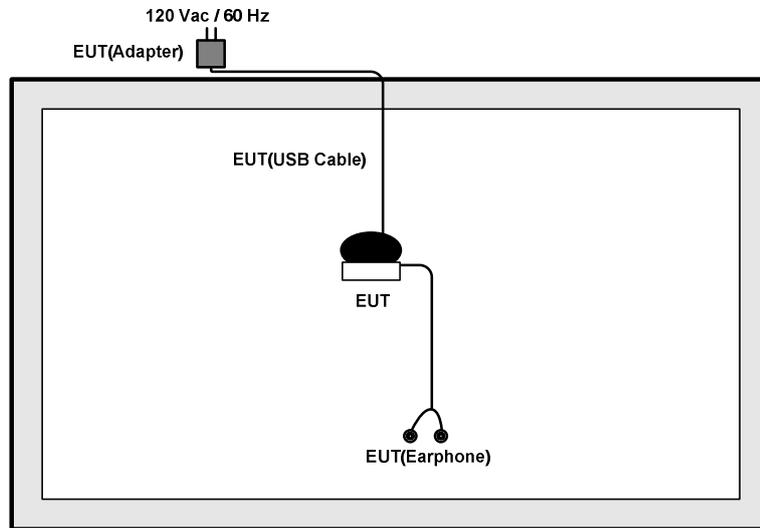


Ch. #		Band IV : 5725-5850 MHz		
		802.11a	802.11n HT20	802.11n HT40
L	Low	149	149	151
M	Middle	157	157	-
H	High	165	165	159

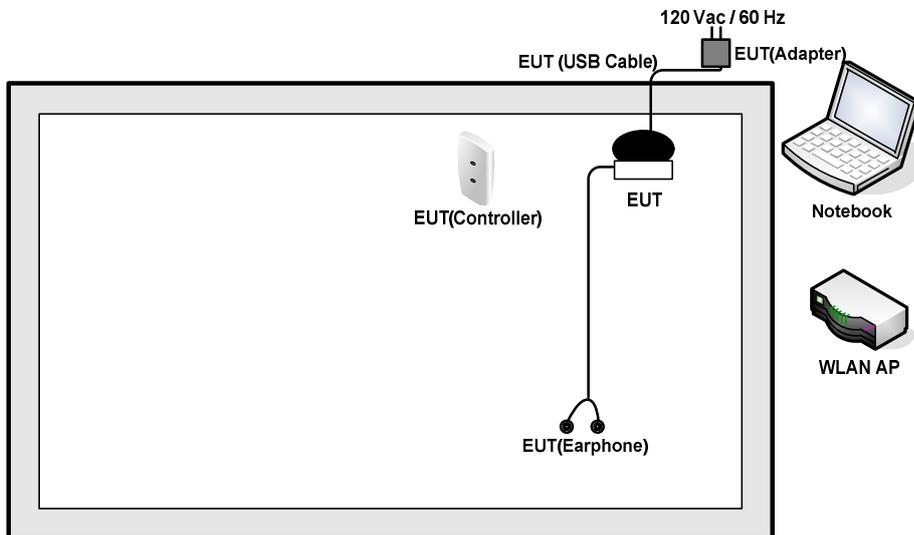
Ch. #		Band IV : 5725-5850 MHz
		802.11ac VHT80
L	Low	-
M	Middle	155
H	High	-

2.3 Connection Diagram of Test System

<WLAN Tx Mode>



<AC Conducted Emission Mode>





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-855	KA2DIR855A2	N/A	Unshielded, 1.8 m
2.	Notebook	Lenovo	G480	PRC4	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
3.	SD Card	Kingston	8GB	N/A	N/A	N/A

2.5 EUT Operation Test Setup

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

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

2.6 Measurement Results Explanation Example

For all conducted test items:

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

Example :

The spectrum analyzer offset is derived from RF cable loss.

Offset = RF cable loss.

Following shows an offset computation example with cable loss 6.8 dB.

Offset(dB) = RF cable loss(dB) = 6.8 (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.

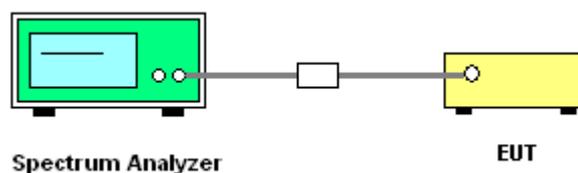
3.1.2 Measuring Instruments

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 U-NII Test Procedures New Rules v02.
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.

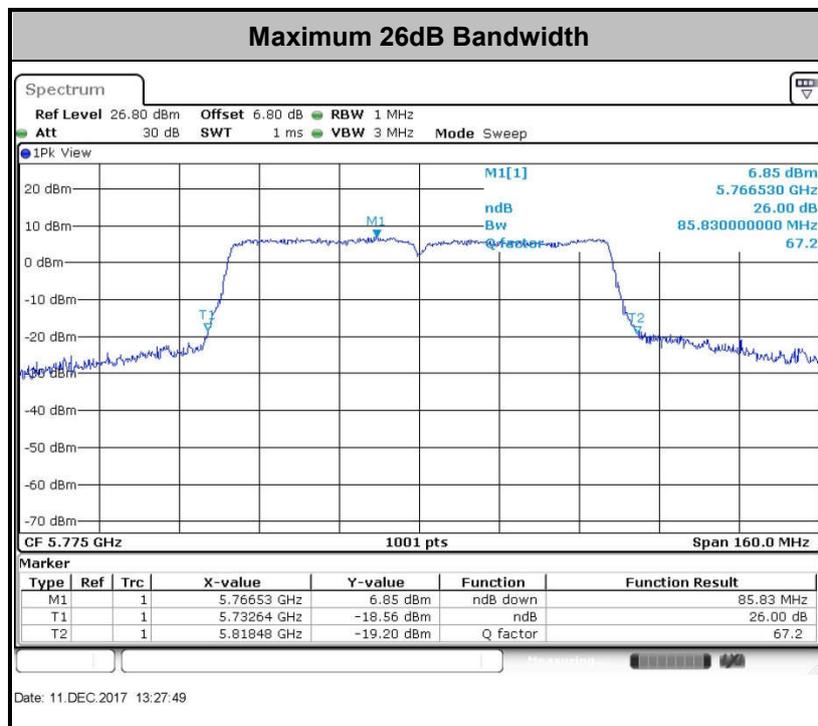
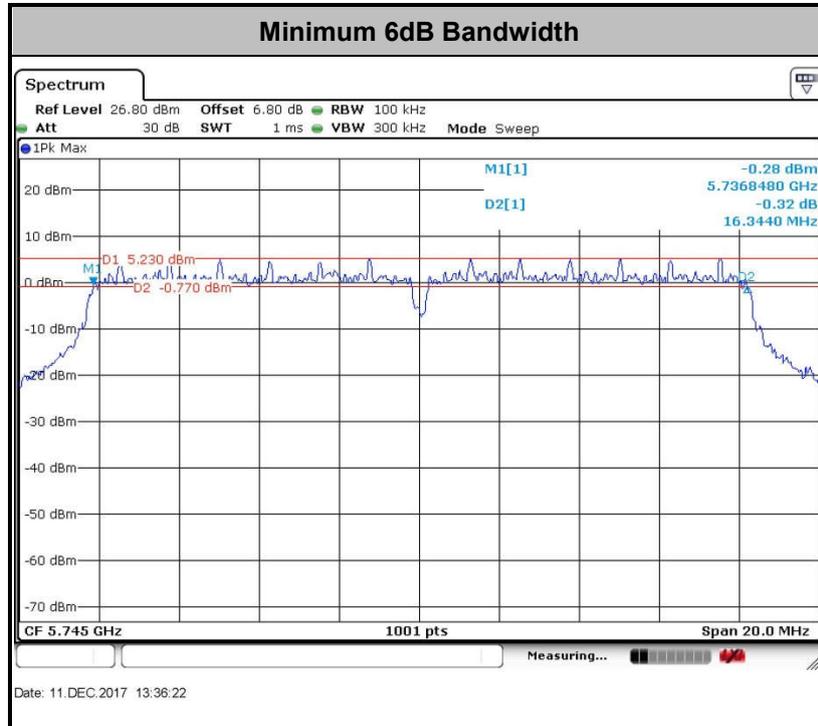
3.1.4 Test Setup

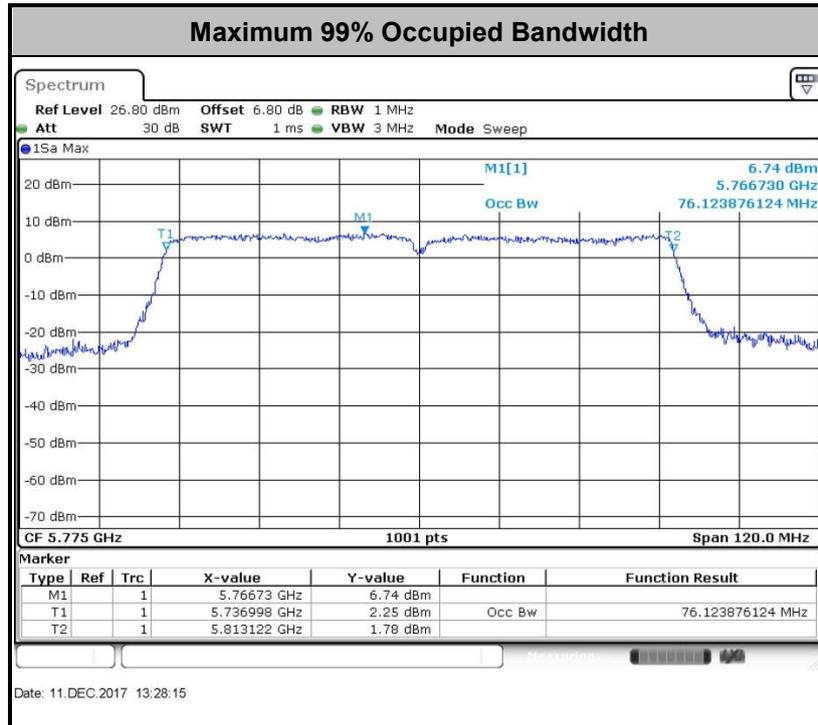




3.1.5 Test Result of 6dB Bandwidth

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.

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.

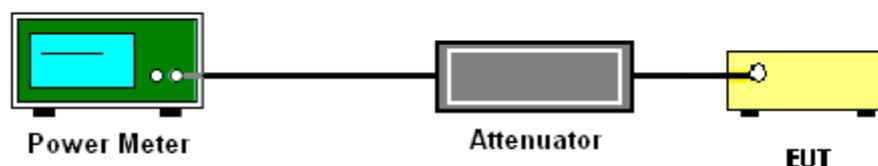
3.2.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General U-NII Test Procedures New Rules v02.

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 U-NII Test Procedures New Rules v02. 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).

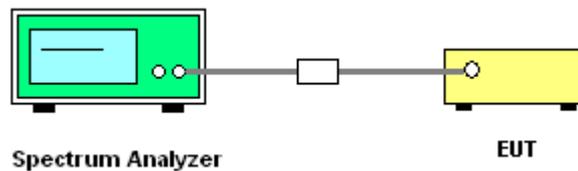
- Measure the duty cycle.
- Set span to encompass the entire emission bandwidth (EBW) of the signal.
- Set RBW = 300 kHz.
- Set VBW \geq 1 MHz.
- Number of points in sweep \geq 2 Span / RBW.
- Sweep time = auto.
- Detector = RMS
- Trace average at least 100 traces in power averaging mode.
- Add $10 \log(500\text{kHz}/\text{RBW})$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

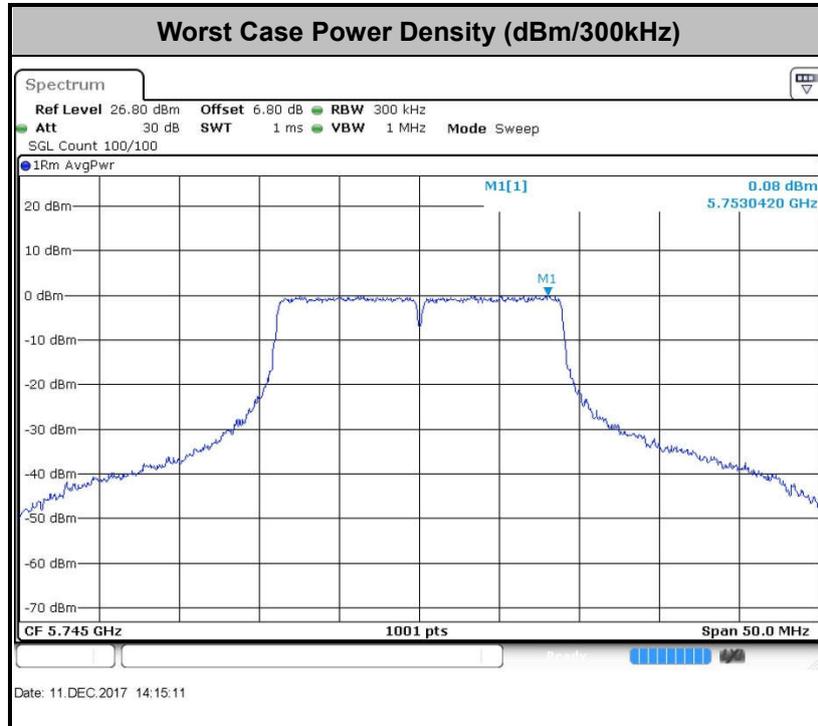
3.3.4 Test Setup





3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.





3.4 Unwanted Emissions Measurement

This section as specified in FCC Part 15.407(b) is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement. The unwanted emissions shall comply with 15.407(b)(1) to (6), and restricted bands per FCC Part15.205.

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 per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 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

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

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts)}$$



EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.3

(3) KDB789033 D02 v01r04 G)2)c)

- (i) Section 15.407(b)(1) to (b)(3) specify the unwanted emission limits for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz.³
- (ii) Section 15.407(b)(4) specifies the unwanted emission limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are in terms of a Peak detector. An alternative to the band emissions mask is specified in Section 15.407(b)(4)(ii). The alternative limits are based on the highest antenna gain specified in the filing. There are also marketing and importation restrictions for the devices using the alternative limit.⁴

Note 3: An out-of-band emission that complies with both the average and peak limits of Section 15.209 is not required to satisfy the -27 dBm/MHz peak emission limit.

Note 4: Only devices with antenna gains of 10 dBi or less may be approved using the emission limits specified in Section 15.247(d) till March 2, 2018; all other devices operating in this band must use the mask specified in Section 15.407(b)(4)(i).



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 U-NII Test Procedures New Rules v02. 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

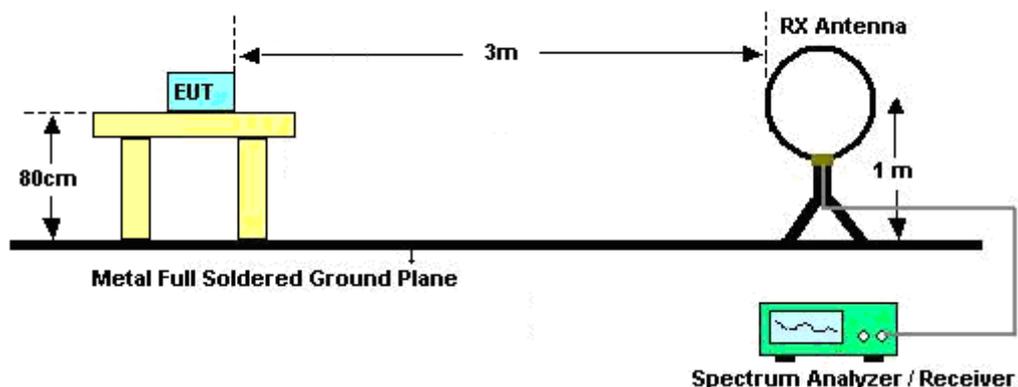
(3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz

- 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.

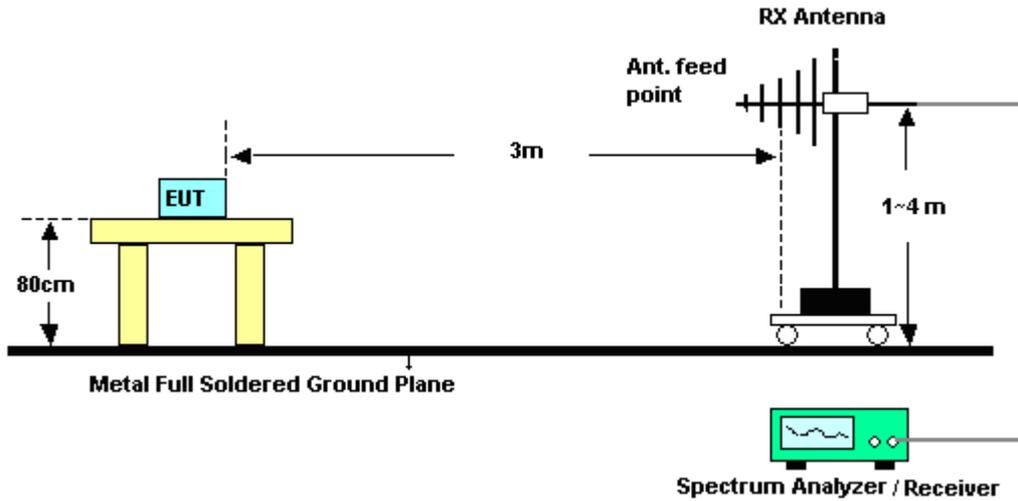
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband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

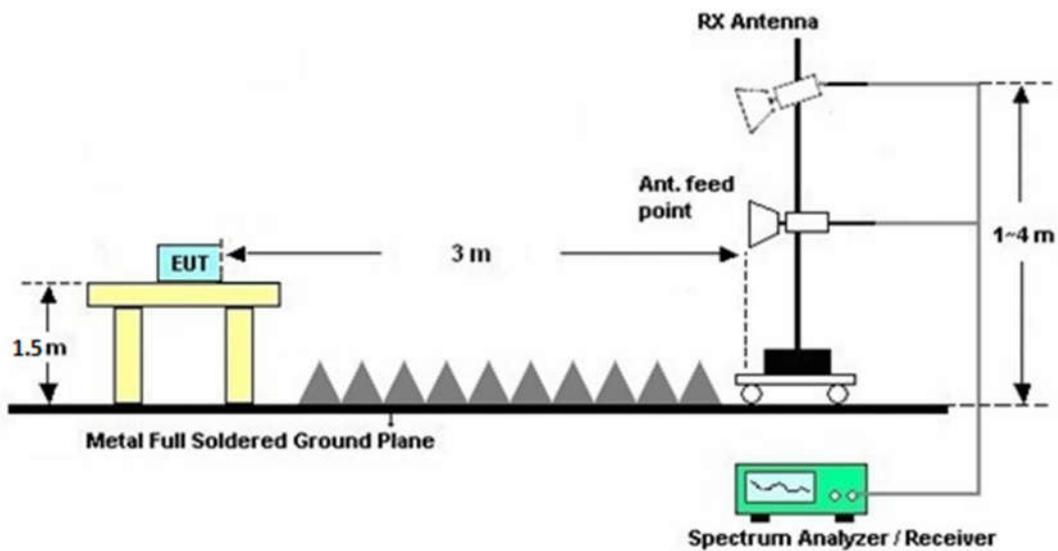
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





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

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

3.4.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B.

3.4.7 Duty Cycle

Please refer to Appendix C.

3.4.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix B.



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.

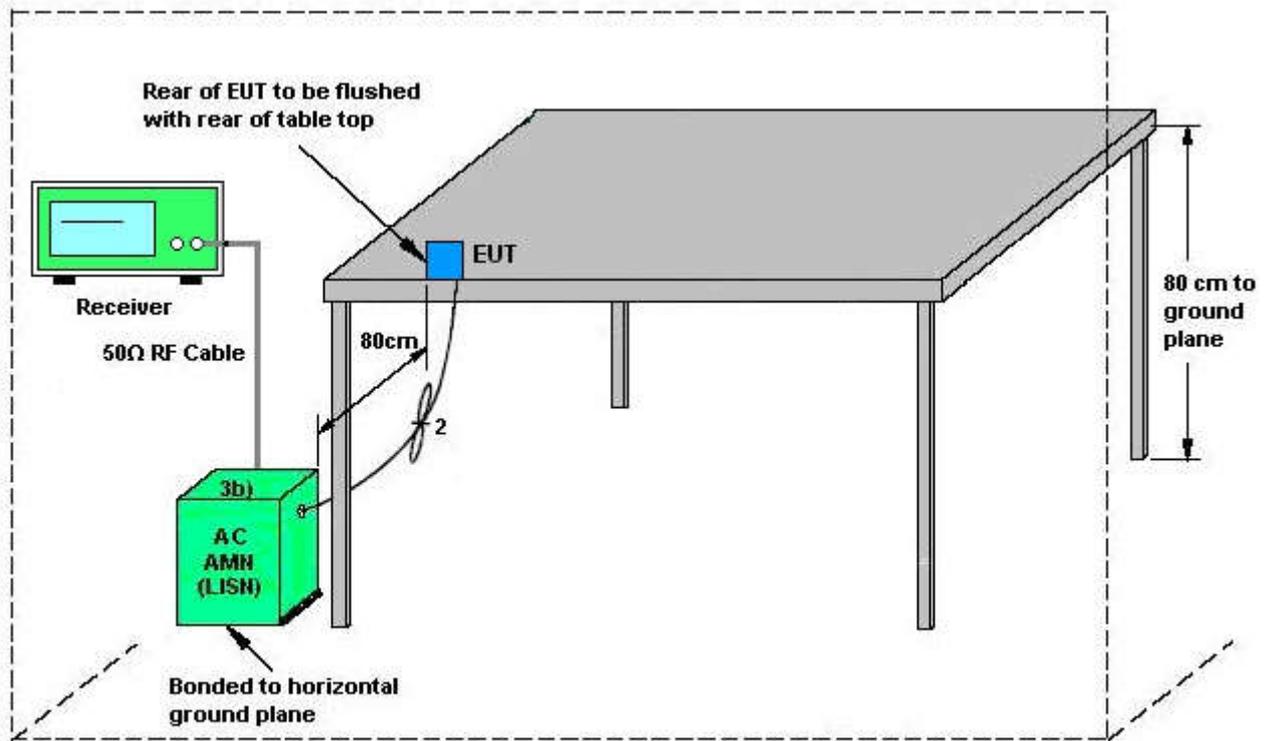
3.5.2 Measuring Instruments

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

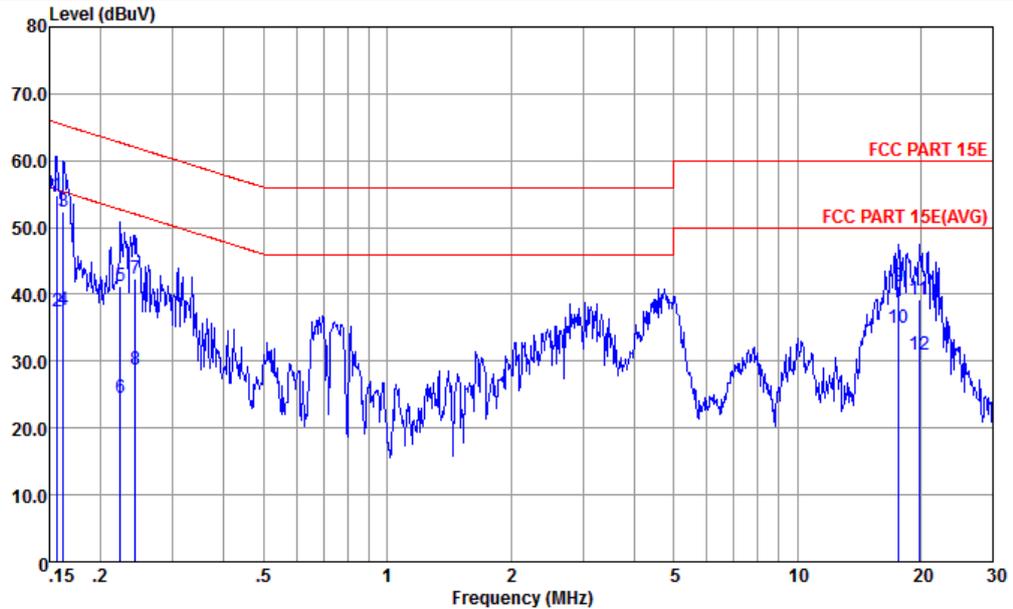


AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network



3.5.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	22~24°C
Test Engineer :	Amos Zhang	Relative Humidity :	42~46%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	Bluetooth Link + WLAN Link(5G) + USB Cable (Charging from Adapter 1) + Earphone		

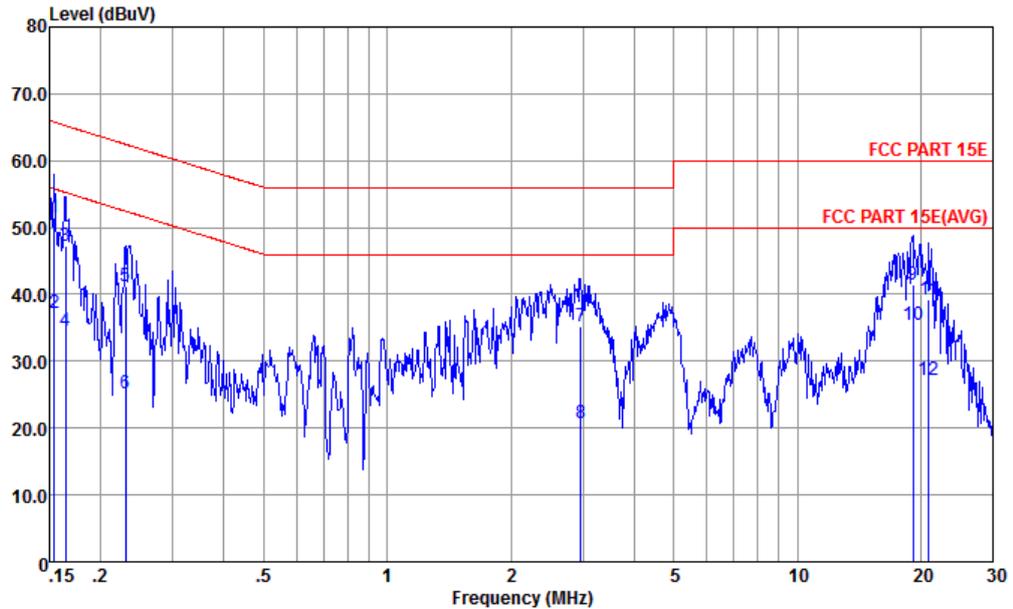


Site : CO01-KS
 Condition : FCC PART 15E LISN-L-171013-060103 LINE
 mode : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1 *	0.156	54.86	-10.79	65.65	44.10	0.17	10.59	QP
2	0.156	37.36	-18.29	55.65	26.60	0.17	10.59	Average
3	0.162	52.35	-12.99	65.34	41.61	0.17	10.57	QP
4	0.162	37.65	-17.69	55.34	26.91	0.17	10.57	Average
5	0.223	41.25	-21.45	62.70	30.59	0.21	10.45	QP
6	0.223	24.45	-28.25	52.70	13.79	0.21	10.45	Average
7	0.243	42.25	-19.75	62.00	31.60	0.21	10.44	QP
8	0.243	28.85	-23.15	52.00	18.20	0.21	10.44	Average
9	17.661	41.26	-18.74	60.00	30.60	0.21	10.45	QP
10	17.661	34.96	-15.04	50.00	24.30	0.21	10.45	Average
11	19.845	39.26	-20.74	60.00	28.60	0.18	10.48	QP
12	19.845	30.96	-19.04	50.00	20.30	0.18	10.48	Average



Test Mode :	Mode 1	Temperature :	22~24°C
Test Engineer :	Amos Zhang	Relative Humidity :	42~46%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	Bluetooth Link + WLAN Link(5G) + USB Cable (Charging from Adapter 1) + Earphone		



Site : CO01-KS
 Condition : FCC PART 15E LISN-N-171013-060103 NEUTRAL
 mode : Mode 1

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1 *	0.154	51.48	-14.30	65.78	40.60	0.28	10.60	QP
2	0.154	37.18	-18.60	55.78	26.30	0.28	10.60	Average
3	0.164	47.15	-18.10	65.25	36.30	0.28	10.57	QP
4	0.164	34.45	-20.80	55.25	23.60	0.28	10.57	Average
5	0.230	41.33	-21.11	62.44	30.60	0.28	10.45	QP
6	0.230	25.23	-27.21	52.44	14.50	0.28	10.45	Average
7	2.962	35.11	-20.89	56.00	24.59	0.33	10.19	QP
8	2.962	20.81	-25.19	46.00	10.29	0.33	10.19	Average
9	19.122	41.50	-18.50	60.00	30.90	0.13	10.47	QP
10	19.122	35.50	-14.50	50.00	24.90	0.13	10.47	Average
11	20.924	39.16	-20.84	60.00	28.50	0.16	10.50	QP
12	20.924	27.26	-22.74	50.00	16.60	0.16	10.50	Average

3.6 Frequency Stability Measurement

3.6.1 Limit of Frequency Stability

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

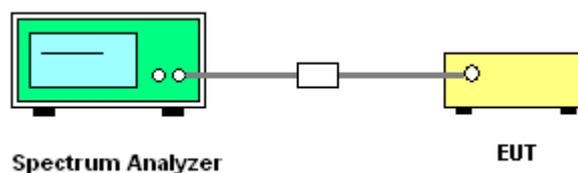
3.6.2 Measuring Instruments

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

3.6.3 Test Procedures

1. To ensure emission at the band edge is maintained within the authorized band, those values shall be measured by radiation emissions at upper and lower frequency points, and finally compensated by frequency deviation as procedures below.
2. The EUT was operated at the maximum output power, and connected to the spectrum analyzer, which is set to maximum hold function and peak detector. The peak value of the power envelope was measured and noted. The upper and lower frequency points were respectively measured relatively 10dB lower than the measured peak value.
3. The frequency deviation was calculated by adding the upper frequency point and the lower frequency point divided by two. Those detailed values of frequency deviation are provided in table below.

3.6.4 Test Setup



3.6.5 Test Result of Frequency Stability

Please refer to Appendix A.



3.7 Automatically Discontinue Transmission

3.7.1 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.

3.7.2 Measuring Instruments

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

3.7.3 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.



3.8 Antenna Requirements

3.8.1 Standard Applicable

According to FCC 47 CFR Section 15.407(a)(1)(2) ,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.

3.8.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.8.3 Antenna Gain

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

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.

	Ant 1 (dBi)	Ant 2 (dBi)	DG for Power (dBi)	DG for PSD (dBi)	Power Limit Reduction (dB)	PSD Limit Reduction (dB)
Band IV	1.40	1.40	1.40	4.41	0.00	0.00

Power limit reduction = Composite gain – 6dBi, (min = 0)

PSD limit reduction = Composite gain + PSD Array gain – 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	Aug. 08, 2017	Nov. 20, 2017~ Dec. 11, 2017	Aug. 07, 2018	Conducted (TH01-KS)
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 19, 2017	Nov. 20, 2017~ Dec. 11, 2017	Jan. 19, 2018	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 19, 2017	Nov. 20, 2017~ Dec. 11, 2017	Jan. 19, 2018	Conducted (TH01-KS)
Thermal Chamber	Ten Billion	TTC-B3S	TBN-960502	-40~+150°C	Oct. 12, 2017	Nov. 20, 2017~ Dec. 11, 2017	Oct. 11, 2018	Conducted (TH01-KS)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY55150213	10Hz~44GHz	Apr. 20, 2017	Nov. 20, 2017~ Dec. 09, 2017	Apr. 19, 2018	Radiation (03CH04-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	May 14, 2017	Nov. 20, 2017~ Dec. 09, 2017	May 13, 2018	Radiation (03CH04-SZ)
Bilog Antenna	TeseQ	CBL6111D	41909	30MHz~1GHz	May 16, 2017	Nov. 20, 2017~ Dec. 09, 2017	May 15, 2018	Radiation (03CH04-SZ)
Double Ridge Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-1474	1GHz~18GHz	Jan. 12, 2017	Nov. 20, 2017~ Dec. 09, 2017	Jan. 11, 2018	Radiation (03CH04-SZ)
Horn Antenna	SCHWARZBECK	BBHA9170	9170#679	15GHz~40GHz	May 17, 2017	Nov. 20, 2017~ Dec. 09, 2017	May 16, 2018	Radiation (03CH04-SZ)
Amplifier	Burgeon	BPA-530	102211	0.01Hz ~3000MHz	Oct. 19, 2017	Nov. 20, 2017~ Dec. 09, 2017	Oct. 18, 2018	Radiation (03CH04-SZ)
HF Amplifier	MITEQ	AMF-7D-0010 1800-30-10P-R	1989346	1GHz~18GHz	Jul. 27, 2017	Nov. 20, 2017~ Dec. 09, 2017	Jul. 26, 2018	Radiation (03CH04-SZ)
HF Amplifier	MITEQ	TTA1840-35-H G	1988315	18GHz~40GHz	Jul. 27, 2017	Nov. 20, 2017~ Dec. 09, 2017	Jul. 26, 2018	Radiation (03CH04-SZ)
Amplifier	Agilent Technologies	83017A	MY53270156	500MHz~26.5G Hz	Apr. 20, 2017	Nov. 20, 2017~ Dec. 09, 2017	Apr. 19, 2018	Radiation (03CH04-SZ)
AC Power Source	Chroma	61601	N/A	N/A	NCR	Nov. 20, 2017~ Dec. 09, 2017	NCR	Radiation (03CH04-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Nov. 20, 2017~ Dec. 09, 2017	NCR	Radiation (03CH04-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Nov. 20, 2017~ Dec. 09, 2017	NCR	Radiation (03CH04-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Jan. 06, 2017	Dec. 07, 2017	Jan. 05, 2018	Conduction (CO01-KS)
AC LISN	EMCO	3816/2SH	00103912	9kHz~30MHz	Jan. 05, 2017	Dec. 07, 2017	Jan. 04, 2018	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	3816/2SH	00103892	9kHz~30MHz	Jan. 05, 2017	Dec. 07, 2017	Jan. 04, 2018	Conduction (CO01-KS)
AC Power Source	Chroma	61602	616020000891	100Vac~250Vac	Jul. 19, 2017	Dec. 07, 2017	Jul. 18, 2018	Conduction (CO01-KS)
Pulse Limiter	SCHWARZBECK MESS-ELEKT RONIK	VTSD9561-FN	9561-F N00294	150kHz~30MHz	Oct. 18, 2017	Dec. 07, 2017	Oct. 17, 2018	Conduction (CO01-KS)

NCR: No Calibration Required



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.3dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.1dB
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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% ($U = 2Uc(y)$)	5.1dB
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Appendix A. Conducted Test Results

Test Engineer:	Silent Hai	Temperature:	21~25	°C
Test Date:	2017/11/20~2017/12/11	Relative Humidity:	51~55	%

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	1	149	5745	18.18		26.17		16.34		0.5	0.5	Pass
11a	6Mbps	1	157	5785	18.13		25.48		16.34		0.5	0.5	Pass
11a	6Mbps	1	165	5825	18.08		24.78		16.34		0.5	0.5	Pass
HT20	MCS0	2	149	5745	19.28	19.18	26.22	25.28	17.56	17.54	0.5		Pass
HT20	MCS0	2	157	5785	19.33	19.38	26.62	25.77	17.56	17.56	0.5		Pass
HT20	MCS0	2	165	5825	18.98	19.18	25.57	25.13	17.54	17.54	0.5		Pass
HT40	MCS0	2	151	5755	37.26	36.96	45.05	43.70	36.32	36.28	0.5		Pass
HT40	MCS0	2	159	5795	37.46	37.16	45.32	43.61	36.32	36.32	0.5		Pass
VHT80	MCS0	2	155	5775	76.12	76.00	85.83	84.88	76.24	76.00	0.5		Pass

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	1	149	5745	0.23	0.21	16.94	16.93		30.00	30.00	1.40	1.40	Pass
11a	6Mbps	1	157	5785	0.23	0.21	15.99	15.63		30.00	30.00	1.40	1.40	Pass
11a	6Mbps	1	165	5825	0.23	0.21	16.09	15.89		30.00	30.00	1.40	1.40	Pass
HT20	MCS0	2	149	5745	0.22	0.23	16.87	16.12	19.52	30.00		1.40		Pass
HT20	MCS0	2	157	5785	0.22	0.23	16.41	15.35	18.92	30.00		1.40		Pass
HT20	MCS0	2	165	5825	0.22	0.23	16.48	15.67	19.11	30.00		1.40		Pass
HT40	MCS0	2	151	5755	0.44	0.41	16.86	15.24	19.14	30.00		1.40		Pass
HT40	MCS0	2	159	5795	0.44	0.41	16.23	15.08	18.71	30.00		1.40		Pass
VHT20	MCS0	2	149	5745	0.25	0.22	16.81	15.62	19.27	30.00		1.40		Pass
VHT20	MCS0	2	157	5785	0.25	0.22	16.40	15.20	18.85	30.00		1.40		Pass
VHT20	MCS0	2	165	5825	0.25	0.22	16.01	15.18	18.63	30.00		1.40		Pass
VHT40	MCS0	2	151	5755	0.46	0.41	16.41	14.88	18.72	30.00		1.40		Pass
VHT40	MCS0	2	159	5795	0.46	0.41	15.83	14.67	18.30	30.00		1.40		Pass
VHT80	MCS0	2	155	5775	0.78	0.78	15.91	14.49	18.27	30.00		1.40		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	1	149	5745	0.23	0.21	2.22	2.22	2.69			30.00	30.00	1.40	1.40	Pass
11a	6Mbps	1	157	5785	0.23	0.21	2.22	2.22	2.01			30.00	30.00	1.40	1.40	Pass
11a	6Mbps	1	165	5825	0.23	0.21	2.22	2.22	1.94			30.00	30.00	1.40	1.40	Pass
HT20	MCS0	2	149	5745	0.22	0.23	2.22				5.53	30.00		4.41		Pass
HT20	MCS0	2	157	5785	0.22	0.23	2.22				5.18	30.00		4.41		Pass
HT20	MCS0	2	165	5825	0.22	0.23	2.22				5.07	30.00		4.41		Pass
HT40	MCS0	2	151	5755	0.44	0.41	2.22				2.94	30.00		4.41		Pass
HT40	MCS0	2	159	5795	0.44	0.41	2.22				2.44	30.00		4.41		Pass
VHT80	MCS0	2	155	5775	0.78	0.78	2.22				-1.21	30.00		4.41		Pass

TEST RESULTS DATA
Frequency Stability

Band IV										
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Center Frequency (MHz)	Frequency Deviation (MHz)	Frequency Stability (ppm)	Temperature (°C)	Voltage (V)	Note
11a	6Mbps	1	149	5745	5745.000	0.000	0.00	50	3.85	
11a	6Mbps	1	149	5745	5745.100	0.100	17.41	-30	3.85	
11a	6Mbps	1	149	5745	5745.025	0.025	4.35	20	4.4	
11a	6Mbps	1	149	5745	5745.025	0.025	4.35	20	3.7	
11a	6Mbps	1	149	5745	5745.000	0.000	0.00	20	3.85	



Appendix B. Radiated Spurious Emission

Antenna 1

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		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11a CH 149 5745MHz		5649.6	51.25	-16.95	68.2	41.78	32.41	6.25	29.19	116	106	P	H
		5666	49.7	-30.38	80.08	40.26	32.41	6.23	29.2	116	106	P	H
		5719.4	50.14	-60.49	110.63	40.59	32.55	6.22	29.22	116	106	P	H
		5723.2	54.11	-63.99	118.1	44.56	32.55	6.22	29.22	116	106	P	H
	*	5745	97.66	-	-	88.1	32.58	6.2	29.22	116	106	P	H
	*	5745	89.57	-	-	80.01	32.58	6.2	29.22	116	106	A	H
		5649.8	49.83	-18.37	68.2	40.36	32.41	6.25	29.19	100	147	P	V
		5687.2	51.77	-43.99	95.76	42.27	32.48	6.23	29.21	100	147	P	V
		5719	56.76	-53.76	110.52	47.21	32.55	6.22	29.22	100	147	P	V
		5725	62.22	-59.98	122.2	52.67	32.55	6.22	29.22	100	147	P	V
	*	5745	104.29	-	-	94.73	32.58	6.2	29.22	100	147	P	V
	*	5745	96.06	-	-	86.5	32.58	6.2	29.22	100	147	A	V



WIFI Ant. 1	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)
		5647.6	50.58	-17.62	68.2	41.14	32.38	6.25	29.19	113	108	P	H
		5670	50.64	-32.4	83.04	41.17	32.44	6.23	29.2	113	108	P	H
		5702.8	48.35	-57.64	105.99	38.83	32.51	6.22	29.21	113	108	P	H
		5722.6	49.25	-67.48	116.73	39.7	32.55	6.22	29.22	113	108	P	H
	*	5785	97.05	-	-	87.46	32.65	6.18	29.24	113	108	P	H
	*	5785	89.6	-	-	80.01	32.65	6.18	29.24	113	108	A	H
		5851.2	48.21	-71.25	119.46	38.38	32.79	6.29	29.25	113	108	P	H
		5864.4	51	-57.17	108.17	41.04	32.82	6.4	29.26	113	108	P	H
		5900.4	50.1	-36.26	86.36	39.96	32.89	6.52	29.27	113	108	P	H
		5931.8	50.63	-17.57	68.2	40.43	32.96	6.52	29.28	113	108	P	H
		5623	50.38	-17.82	68.2	42.01	32.34	6.25	29.18	100	148	P	V
		5665	51.29	-28.04	79.33	41.85	32.41	6.23	29.2	100	148	P	V
		5711.2	51.8	-56.54	108.34	42.29	32.51	6.22	29.22	100	148	P	V
		5722.2	49.12	-66.7	115.82	39.57	32.55	6.22	29.22	100	148	P	V
	*	5785	104.02	-	-	94.43	32.65	6.18	29.24	100	148	P	V
	*	5785	94.69	-	-	85.1	32.65	6.18	29.24	100	148	A	V
		5855	49.29	-61.51	110.8	39.43	32.82	6.29	29.25	100	148	P	V
		5856.4	49.98	-60.43	110.41	40.01	32.82	6.4	29.25	100	148	P	V
		5905.2	50.91	-31.9	82.81	40.73	32.93	6.52	29.27	100	148	P	V
		5940.8	50.12	-18.08	68.2	39.77	33	6.63	29.28	100	148	P	V



WiFi Ant. 1	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 165 5825MHz	*	5825	98.02	-	-	88.22	32.76	6.29	29.25	110	107	P	H
	*	5825	90.9	-	-	81.1	32.76	6.29	29.25	110	107	A	H
		5852.2	51.54	-65.64	117.18	41.71	32.79	6.29	29.25	110	107	P	H
		5855.6	51.95	-58.68	110.63	41.98	32.82	6.4	29.25	110	107	P	H
		5890.8	50.13	-43.34	93.47	40.11	32.89	6.4	29.27	110	107	P	H
		5949.4	49.89	-18.31	68.2	39.54	33	6.63	29.28	110	107	P	H
	*	5825	103.23	-	-	93.43	32.76	6.29	29.25	101	148	P	V
	*	5825	94.96	-	-	85.16	32.76	6.29	29.25	101	148	A	V
		5852.8	55.18	-60.64	115.82	45.35	32.79	6.29	29.25	101	148	P	V
		5855	55.04	-55.76	110.8	45.18	32.82	6.29	29.25	101	148	P	V
		5878	51.09	-51.88	102.97	41.09	32.86	6.4	29.26	101	148	P	V
		5949.8	50.57	-17.63	68.2	40.22	33	6.63	29.28	101	148	P	V
	Remark	<ol style="list-style-type: none"> No other spurious found. All results are PASS against Peak and Average limit line. 											



Band 4 5725~5850MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 1	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 149 5745MHz		11490	45.39	-28.61	74	52.03	39.22	9.5	55.36	160	360	P	H
		17235	50.02	-18.18	68.2	50.13	41.49	14.89	56.49	170	360	P	H
		11490	45.28	-28.72	74	51.92	39.22	9.5	55.36	160	360	P	V
		17235	50.16	-18.04	68.2	50.27	41.49	14.89	56.49	170	360	P	V
802.11a CH 157 5785MHz		11570	50.64	-23.36	74	57.22	39.14	9.52	55.24	175	198	P	H
		17355	49.98	-18.22	68.2	49.2	42.24	15.12	56.58	189	185	P	H
		11570	50.51	-23.49	74	57.09	39.14	9.52	55.24	175	198	P	V
		17355	50.5	-17.7	68.2	49.72	42.24	15.12	56.58	189	185	P	V
802.11a CH 165 5825MHz		11650	50.52	-23.48	74	57.02	39.09	9.54	55.13	156	347	P	H
		17475	49.68	-18.52	68.2	48.01	42.99	15.36	56.68	151	0	P	H
		11650	49.25	-24.75	74	55.75	39.09	9.54	55.13	156	347	P	V
		17475	50.66	-17.54	68.2	48.99	42.99	15.36	56.68	151	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Antenna 2 verify the worst mode of Antenna 1

Band 4 - 5725~5850MHz

WIFI 802.11a (Band Edge @ 3m)

WIFI Ant.	Note	Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
802.11a CH 149 5745MHz		5647.2	49.68	-18.52	68.2	40.24	32.38	6.25	29.19	105	107	P	H
		5661.4	49.51	-27.15	76.66	40.07	32.41	6.23	29.2	105	107	P	H
		5720	53.07	-57.73	110.8	43.52	32.55	6.22	29.22	105	107	P	H
		5724.6	58.15	-63.14	121.29	48.6	32.55	6.22	29.22	105	107	P	H
	*	5745	97.24	-	-	87.68	32.58	6.2	29.22	105	107	P	H
	*	5745	88.96	-	-	79.4	32.58	6.2	29.22	105	107	A	H
		5641.6	50.18	-18.02	68.2	40.74	32.38	6.25	29.19	100	82	P	V
		5681.8	52.16	-39.61	91.77	42.7	32.44	6.23	29.21	100	82	P	V
		5719.6	54.95	-55.74	110.69	45.4	32.55	6.22	29.22	100	82	P	V
		5724.4	62.38	-58.45	120.83	52.83	32.55	6.22	29.22	100	82	P	V
	*	5745	105.04	-	-	95.48	32.58	6.2	29.22	100	82	P	V
	*	5745	96.76	-	-	87.2	32.58	6.2	29.22	100	82	A	V



Band 4 5725~5850MHz

WIFI 802.11a (Harmonic @ 3m)

WIFI Ant. 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		11490	50.6	-23.4	74	57.24	39.22	9.5	55.36	160	360	P	H
		17235	50.77	-17.43	68.2	50.88	41.49	14.89	56.49	170	360	P	H
		11490	50.13	-23.87	74	56.77	39.22	9.5	55.36	160	360	P	V
		17235	50.07	-18.13	68.2	50.18	41.49	14.89	56.49	170	360	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Antenna 1+2

Band 4 5725~5850MHz

WIFI 802.11n HT20 (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)
802.11n HT20 CH 149 5745MHz		5613	49.47	-18.73	68.2	40.07	32.31	6.27	29.18	100	50	P	H
		5665.2	50.44	-29.04	79.48	41	32.41	6.23	29.2	100	50	P	H
		5720	54.93	-55.87	110.8	45.38	32.55	6.22	29.22	100	50	P	H
		5722.4	60.62	-55.65	116.27	51.07	32.55	6.22	29.22	100	50	P	H
	*	5745	101.26	-	-	91.7	32.58	6.2	29.22	100	50	P	H
	*	5745	93.06	-	-	83.5	32.58	6.2	29.22	100	50	A	H
		5645.8	50.1	-18.1	68.2	40.66	32.38	6.25	29.19	107	84	P	V
		5697.8	50.81	-52.77	103.58	41.31	32.48	6.23	29.21	107	84	P	V
		5720	58.13	-52.67	110.8	48.58	32.55	6.22	29.22	107	84	P	V
		5724.2	71.58	-48.8	120.38	62.03	32.55	6.22	29.22	107	84	P	V
	*	5745	108.63	-	-	99.07	32.58	6.2	29.22	107	84	P	V
	*	5745	100.96	-	-	91.4	32.58	6.2	29.22	107	84	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)
802.11n HT20 CH 157 5785MHz		5638	49.93	-18.27	68.2	40.49	32.38	6.25	29.19	100	50	P	H
		5654.6	49.13	-22.49	71.62	39.67	32.41	6.25	29.2	100	50	P	H
		5716.6	48.57	-61.28	109.85	39.06	32.51	6.22	29.22	100	50	P	H
		5721.4	47.46	-66.53	113.99	37.91	32.55	6.22	29.22	100	50	P	H
	*	5785	100.76	-	-	91.17	32.65	6.18	29.24	100	50	P	H
	*	5785	92.65	-	-	83.06	32.65	6.18	29.24	100	50	A	H
		5852.2	49.59	-67.59	117.18	39.76	32.79	6.29	29.25	100	50	P	H
		5866.4	49.06	-58.55	107.61	39.1	32.82	6.4	29.26	100	50	P	H
		5913.2	50.36	-26.54	76.9	40.19	32.93	6.52	29.28	100	50	P	H
		5943.4	49.75	-18.45	68.2	39.4	33	6.63	29.28	100	50	P	H
		5615.8	50.72	-17.48	68.2	41.29	32.34	6.27	29.18	143	83	P	V
		5683.4	50.58	-42.37	92.95	41.12	32.44	6.23	29.21	143	83	P	V
		5710.6	49.71	-58.46	108.17	40.2	32.51	6.22	29.22	143	83	P	V
		5720.4	49.41	-62.3	111.71	39.86	32.55	6.22	29.22	143	83	P	V
	*	5785	108.93	-	-	99.34	32.65	6.18	29.24	143	83	P	V
	*	5785	101.63	-	-	92.04	32.65	6.18	29.24	143	83	A	V
		5854.2	51.25	-61.37	112.62	41.39	32.82	6.29	29.25	143	83	P	V
		5856	51.24	-59.28	110.52	41.27	32.82	6.4	29.25	143	83	P	V
	5911	50.35	-28.18	78.53	40.18	32.93	6.52	29.28	143	83	P	V	
	5931.8	49.4	-18.8	68.2	39.2	32.96	6.52	29.28	143	83	P	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)
802.11n HT20 CH 165 5825MHz	*	5825	102	-	-	92.2	32.76	6.29	29.25	100	125	P	H
	*	5825	93.83	-	-	84.03	32.76	6.29	29.25	100	125	A	H
		5851.6	57.38	-61.17	118.55	47.55	32.79	6.29	29.25	100	125	P	H
		5864.8	50.53	-57.52	108.05	40.57	32.82	6.4	29.26	100	125	P	H
		5882.6	50.01	-49.55	99.56	40.01	32.86	6.4	29.26	100	125	P	H
		5925.2	50.11	-18.09	68.2	39.91	32.96	6.52	29.28	100	125	P	H
	*	5825	110.21	-	-	100.41	32.76	6.29	29.25	129	86	P	V
	*	5825	102.3	-	-	92.5	32.76	6.29	29.25	129	86	A	V
		5850.8	67.45	-52.93	120.38	57.62	32.79	6.29	29.25	129	86	P	V
		5857.2	60.83	-49.35	110.18	50.86	32.82	6.4	29.25	129	86	P	V
		5876.2	55.34	-48.97	104.31	45.34	32.86	6.4	29.26	129	86	P	V
	5931.2	49.51	-18.69	68.2	39.31	32.96	6.52	29.28	129	86	P	V	
Remark	<ol style="list-style-type: none"> No other spurious found. All results are PASS against Peak and Average limit line. 												



Band 4 5725~5850MHz
WIFI 802.11n HT20 (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)
802.11n HT20		11490	50.02	-23.98	74	56.66	39.22	9.5	55.36	160	360	P	H
		17235	50.7	-17.5	68.2	50.81	41.49	14.89	56.49	170	360	P	H
CH 149 5745MHz		11490	49.81	-24.19	74	56.45	39.22	9.5	55.36	151	360	P	V
		17235	49.79	-18.41	68.2	49.9	41.49	14.89	56.49	151	0	P	V
802.11n HT20		11570	49.61	-24.39	74	56.19	39.14	9.52	55.24	175	198	P	H
		17355	50.16	-18.04	68.2	49.38	42.24	15.12	56.58	152	0	P	H
CH 157 5785MHz		11570	50.94	-23.06	74	57.52	39.14	9.52	55.24	175	198	P	V
		17355	50.39	-17.81	68.2	49.61	42.24	15.12	56.58	152	0	P	V
802.11n HT20		11650	50.34	-23.66	74	56.84	39.09	9.54	55.13	156	347	P	H
		17475	50.19	-18.01	68.2	48.52	42.99	15.36	56.68	151	0	P	H
CH 165 5825MHz		11650	49.9	-24.1	74	56.4	39.09	9.54	55.13	156	347	P	V
		17475	50.34	-17.86	68.2	48.67	42.99	15.36	56.68	151	0	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)

Table with 14 columns: 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). Rows include frequencies from 5625.4 to 5938.4 MHz.



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)
802.11n HT40 CH 159 5795MHz		5617.8	50.74	-17.46	68.2	41.31	32.34	6.27	29.18	136	155	P	H
		5661.6	50.39	-26.42	76.81	40.95	32.41	6.23	29.2	136	155	P	H
		5712.2	49.38	-59.24	108.62	39.87	32.51	6.22	29.22	136	155	P	H
		5723.4	49.37	-69.18	118.55	39.82	32.55	6.22	29.22	136	155	P	H
	*	5795	100.41	-	-	90.78	32.69	6.18	29.24	136	155	P	H
	*	5795	91.77	-	-	82.14	32.69	6.18	29.24	136	155	A	H
		5850.6	53.35	-67.48	120.83	43.52	32.79	6.29	29.25	136	155	P	H
		5868.8	50.99	-55.94	106.93	41.03	32.82	6.4	29.26	136	155	P	H
		5885	50.52	-47.25	97.77	40.53	32.86	6.4	29.27	136	155	P	H
		5937.6	49.65	-18.55	68.2	39.34	32.96	6.63	29.28	136	155	P	H
		5618.6	50.04	-18.16	68.2	40.61	32.34	6.27	29.18	105	85	P	V
		5690.4	51.05	-47.07	98.12	41.55	32.48	6.23	29.21	105	85	P	V
		5707.4	51.21	-56.06	107.27	41.7	32.51	6.22	29.22	105	85	P	V
		5723.8	53.12	-66.34	119.46	43.57	32.55	6.22	29.22	105	85	P	V
	*	5795	106.28	-	-	96.65	32.69	6.18	29.24	105	85	P	V
	*	5795	99.13	-	-	89.5	32.69	6.18	29.24	105	85	A	V
		5853.8	51.77	-61.77	113.54	41.91	32.82	6.29	29.25	105	85	P	V
		5862.4	55.84	-52.89	108.73	45.88	32.82	6.4	29.26	105	85	P	V
	5884.8	52.29	-45.63	97.92	42.3	32.86	6.4	29.27	105	85	P	V	
	5939.8	51.21	-16.99	68.2	40.86	33	6.63	29.28	105	85	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 (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)
802.11n HT40 CH 151		11510	50.04	-23.96	74	56.68	39.2	9.5	55.34	160	360	P	H
		17265	50.5	-17.7	68.2	50.34	41.71	14.97	56.52	152	0	P	H
5755MHz		11510	50.4	-23.6	74	57.04	39.2	9.5	55.34	160	360	P	V
		17265	50.58	-17.62	68.2	50.42	41.71	14.97	56.52	152	0	P	V
802.11n HT40 CH 159		11590	50.44	-23.56	74	56.99	39.13	9.53	55.21	170	300	P	H
		17385	50.68	-17.52	68.2	49.64	42.45	15.2	56.61	151	0	P	H
5795MHz		11590	50.72	-23.28	74	57.27	39.13	9.53	55.21	170	300	P	V
		17385	50.95	-17.25	68.2	49.91	42.45	15.2	56.61	151	0	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		5602.2	51.26	-16.94	68.2	41.86	32.31	6.27	29.18	123	155	P	H
		5668.6	50.3	-31.7	82	40.83	32.44	6.23	29.2	123	155	P	H
		5708.2	50.31	-57.19	107.5	40.8	32.51	6.22	29.22	123	155	P	H
		5723.6	49.83	-69.18	119.01	40.28	32.55	6.22	29.22	123	155	P	H
	*	5775	98.46	-	-	88.84	32.65	6.2	29.23	123	155	P	H
	*	5775	89.66	-	-	80.04	32.65	6.2	29.23	123	155	A	H
		5851.4	49.74	-69.27	119.01	39.91	32.79	6.29	29.25	123	155	P	H
		5873.6	50.48	-55.11	105.59	40.48	32.86	6.4	29.26	123	155	P	H
		5919.8	50.46	-21.57	72.03	40.29	32.93	6.52	29.28	123	155	P	H
		5932.6	49.94	-18.26	68.2	39.74	32.96	6.52	29.28	123	155	P	H
		5601	51.21	-16.99	68.2	41.81	32.31	6.27	29.18	100	87	P	V
		5696	50.26	-51.99	102.25	40.76	32.48	6.23	29.21	100	87	P	V
		5717.2	54.07	-55.95	110.02	44.56	32.51	6.22	29.22	100	87	P	V
		5724.4	57.27	-63.56	120.83	47.72	32.55	6.22	29.22	100	87	P	V
	*	5775	104.18	-	-	94.56	32.65	6.2	29.23	100	87	P	V
	*	5775	97.02	-	-	87.4	32.65	6.2	29.23	100	87	A	V
		5851	50.57	-69.35	119.92	40.74	32.79	6.29	29.25	100	87	P	V
		5858	52.76	-57.2	109.96	42.8	32.82	6.4	29.26	100	87	P	V
	5901.6	50.78	-34.7	85.48	40.64	32.89	6.52	29.27	100	87	P	V	
	5928.8	52.32	-15.88	68.2	42.12	32.96	6.52	29.28	100	87	P	V	

Remark

- No other spurious found.
- 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		11550	49.91	-24.09	74	56.49	39.16	9.52	55.26	160	360	P	H
VHT80		17325	50.37	-17.83	68.2	49.78	42.03	15.12	56.56	152	0	P	H
CH 155		11550	50.24	-23.76	74	56.82	39.16	9.52	55.26	160	360	P	V
5775MHz		17325	50.13	-18.07	68.2	49.54	42.03	15.12	56.56	152	0	P	V
Remark	1. No other spurious found. 2. All results are PASS against Peak and Average limit line.												



Emission below 1GHz

5GHz WIFI 802.11ac VHT80 (LF @ 3m)

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)
5GHz 802.11ac VHT80 LF		30.97	23.98	-16.02	40	30.95	24.52	0.29	31.78	100	142	P	H
		112.45	20.26	-23.24	43.5	33.81	16.88	1.11	31.54	-	-	P	H
		232.73	22.3	-23.7	46	35.02	16.87	1.69	31.28	-	-	P	H
		393.75	23.03	-22.97	46	31.17	20.98	2.13	31.25	-	-	P	H
		625.58	27.26	-18.74	46	30.67	25.05	2.77	31.23	-	-	P	H
		836.07	29.84	-16.16	46	30.23	27.61	3.25	31.25	-	-	P	H
		30.97	33	-7	40	39.99	24.52	0.27	31.78	100	254	P	V
		119.24	24.54	-18.96	43.5	37.84	17.08	1.14	31.52	-	-	P	V
		172.59	22.8	-20.7	43.5	36.08	16.69	1.37	31.34	-	-	P	V
		523.73	26.96	-19.04	46	31.98	23.66	2.49	31.17	-	-	P	V
	769.14	29.35	-16.65	46	31.08	26.42	3.08	31.23	-	-	P	V	
	881.66	32.31	-13.69	46	32.06	28.18	3.34	31.27	-	-	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	Cable	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b		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

- Level(dBμV/m) =
Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)
- Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 2390MHz:

- 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)
- Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 55.45(dBμV/m) – 74(dBμV/m)
= -18.55(dB)

For Average Limit @ 2390MHz:

- 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)
- 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”.

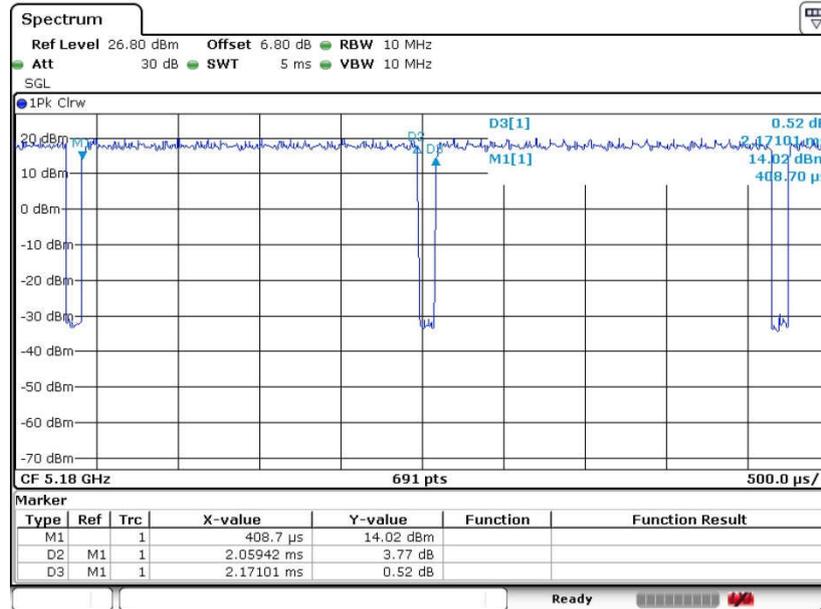


Appendix C. Duty Cycle Plots

Antenna	Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
1	802.11a	94.86	2.059	0.486	1kHz
2	802.11a	95.18	2.059	0.486	1kHz
1+2(1)	802.11n HT20	94.97	1.917	0.522	1kHz
1+2(2)	802.11n HT20	94.83	1.914	0.522	1kHz
1+2(1)	802.11n HT40	90.32	0.946	1.057	3kHz
1+2(2)	802.11n HT40	90.95	0.946	1.057	3kHz
1+2(1)	802.11ac VHT80	83.59	0.465	2.150	3kHz
1+2(2)	802.11ac VHT80	83.51	0.462	2.163	3kHz

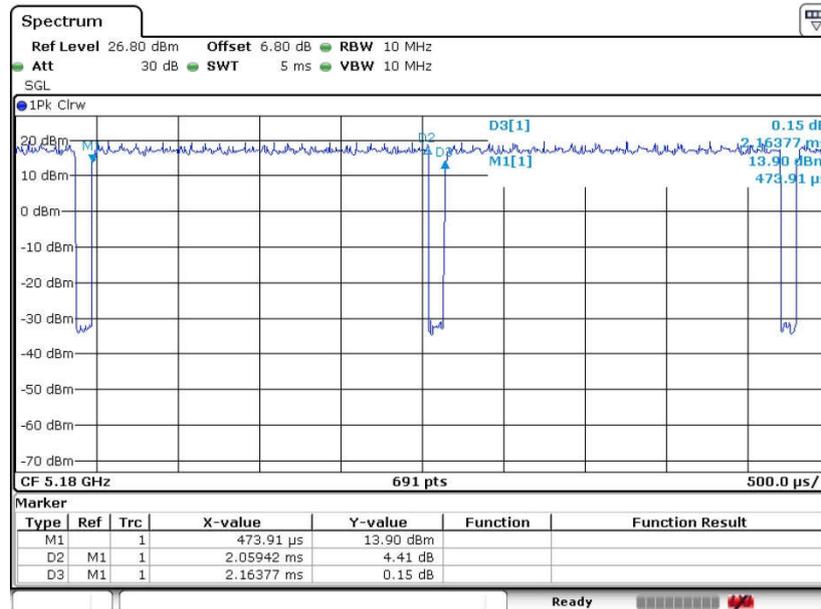


802.11a Ant.1



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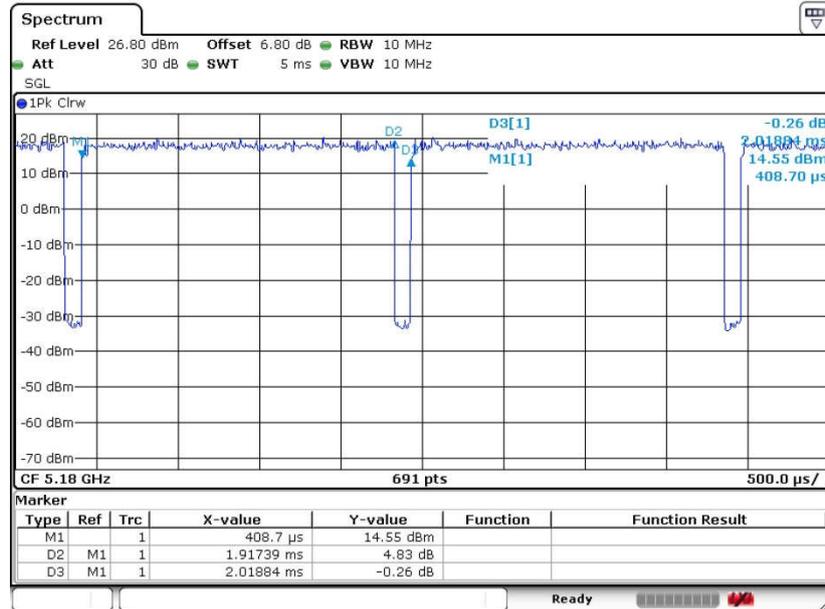
802.11a Ant.2



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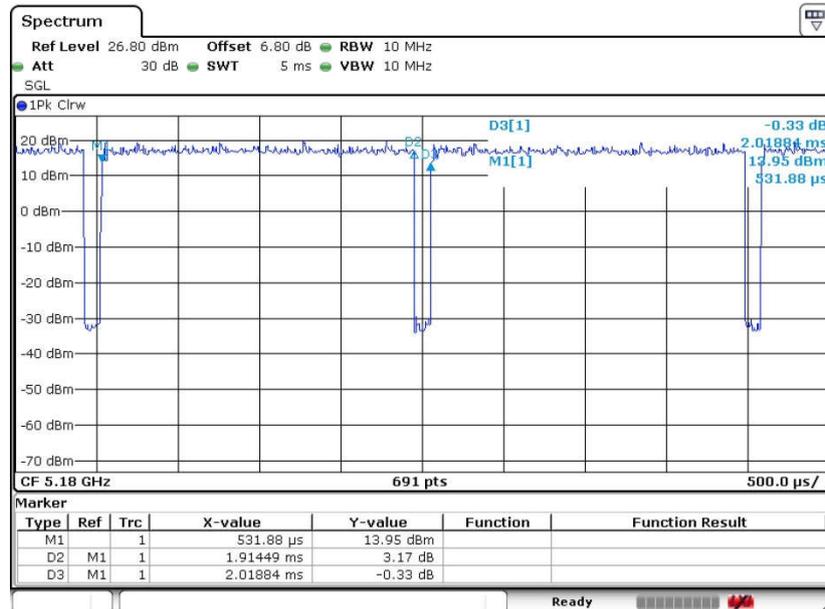


802.11n HT20 Ant.1+2(1)



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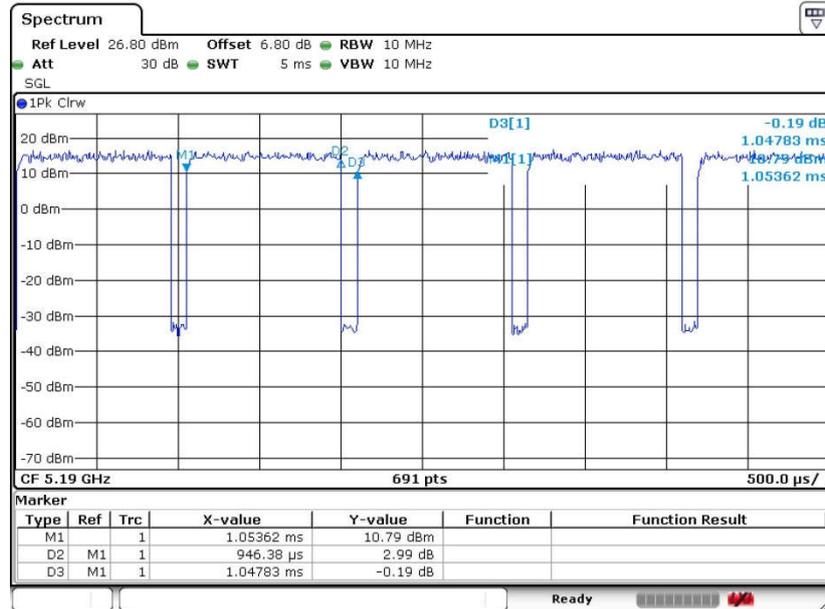
802.11n HT20 Ant.1+2(2)



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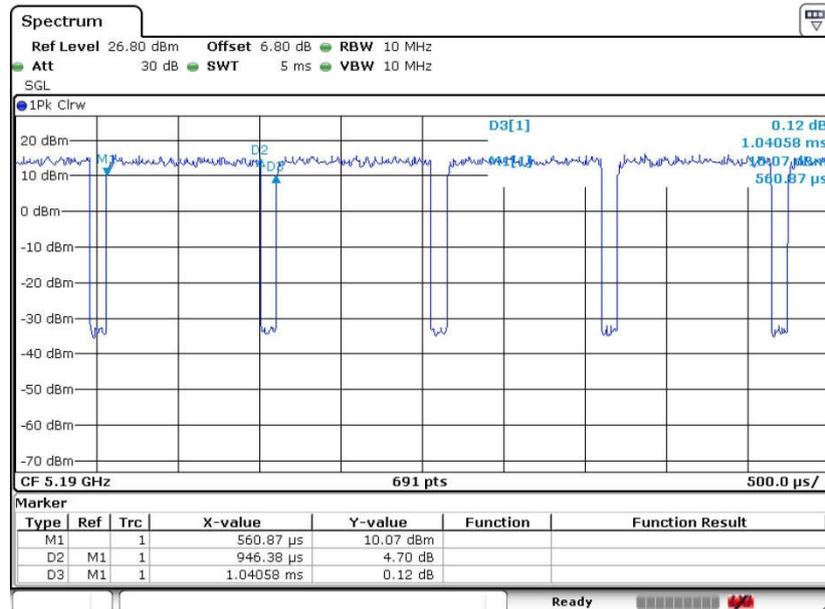


802.11n HT40 Ant.1+2(1)



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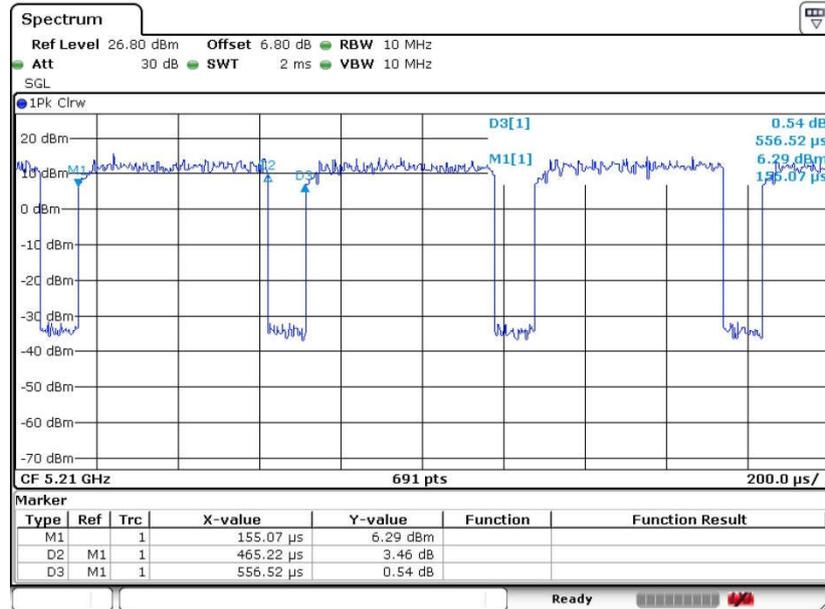
802.11n HT40 Ant.1+2(2)



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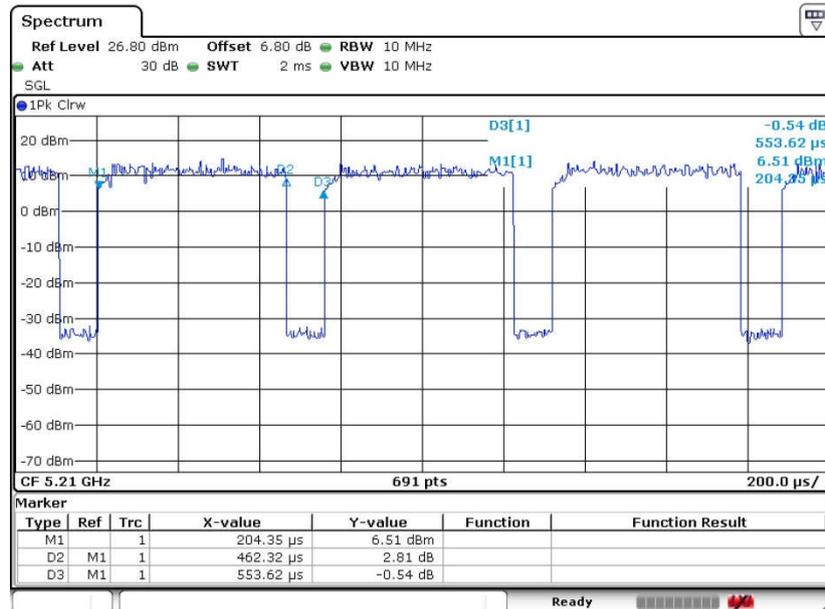


802.11ac VHT80 Ant.1+2(1)



Date: 20.NOV.2017 08:26:35

802.11ac VHT80 Ant.1+2(2)



Date: 20.NOV.2017 08:25:45