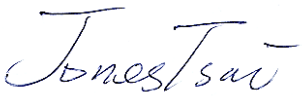
FCC RF Test Report

APPLICANT	:	FUJITSU LIMITED
EQUIPMENT	:	FUJITSU LIFEBOOK T series
BRAND NAME	:	FUJITSU
MODEL NAME	:	T935;TH935
FCC ID	:	EJE-WB0089
STANDARD	:	FCC Part 15 Subpart E §15.407
CLASSIFICATION	:	(NII) Unlicensed National Information Infrastructure

This is a partial report which is included RF conducted power and Unwanted Emissions Measurement. The product was received on Sep. 15, 2014 and testing was completed on Nov. 06, 2014. We, SPORTON INTERNATIONAL 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 INC., the test report shall not be reproduced except in full.

Reviewed by: Joseph Lin / Supervisor



Approved by: Jones Tsai / Manager

SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

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APPENDIX A. TEST RESULT OF RADIATED TEST RESULTS

REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR491525D	Rev. 01	Initial issue of report	Oct. 30, 2014
FR491525D	Rev. 02	Adding AC Conducted Emission Measurement data in Section 3.2	Nov. 07, 2014

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.407(b)	Unwanted Emissions	≤ -17, -27 dBm (depend on band)&15.209(a)	Pass	Under limit 1.88 dB at 15903.000 MHz
3.2	15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 0.10 dB at 6.710 MHz
3.3	15.407(c)	Automatically Discontinue Transmission	Discontinue Transmission	Pass	-
3.4	15.203 & 15.407(a)	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

FUJITSU LIMITED

1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki, 211-8588 Japan

1.2 Manufacturer

FUJITSU LIMITED

1-1, Kamikodanaka 4-chome, Nakahara-ku, Kawasaki, 211-8588 Japan

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	FUJITSU LIFEBOOK T series
Brand Name	FUJITSU
Model Name	T935;TH935
FCC ID	EJE-WB0089
Installed WLAN Module	Brand Name: Intel Model Name: 7265NGW
EUT supports Radios application	WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth v4.0 EDR/LE
EUT Stage	Pre-Production Unit

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

1.4 Product Specification subjective to this standard

Product Specification subjective to this standard	
Tx/Rx Channel Frequency Range	5180 MHz ~ 5240 MHz 5260 MHz ~ 5320 MHz 5500 MHz ~ 5580 MHz and 5660 MHz ~ 5700 MHz
Maximum Output Power	**<5180 MHz ~ 5240 MHz>** **<Ant. 1>** 802.11a : 13.73 dBm / 0.0236 W **SISO <Ant. Port 1>** 802.11n HT20 : 13.47 dBm / 0.0222 W 802.11n HT40 : 14.42 dBm / 0.0277 W 802.11ac VHT80: 11.82 dBm / 0.0152 W **<Ant. 2>** 802.11a : 13.49 dBm / 0.0223 W **SISO <Ant. Port 2>** 802.11n HT20 : 13.44 dBm / 0.0221 W 802.11n HT40 : 14.45 dBm / 0.0279 W 802.11ac VHT80: 11.62 dBm / 0.0145 W **MIMO <Ant. Port 1 + 2>** 802.11n HT20 : 13.00 dBm / 0.0200 W 802.11n HT40 : 14.43 dBm / 0.0277 W 802.11ac VHT80: 12.63 dBm / 0.0183 W **<5260 MHz ~ 5320 MHz>** **<Ant. 1>** 802.11a : 14.49 dBm / 0.0281 W **SISO <Ant. Port 1>** 802.11n HT20 : 14.48 dBm / 0.0281 W 802.11n HT40 : 14.37 dBm / 0.0274 W 802.11ac VHT80: 11.75 dBm / 0.0150 W **<Ant. 2>** 802.11a : 14.45 dBm / 0.0279 W **SISO <Ant. Port 2>** 802.11n HT20 : 14.44 dBm / 0.0278 W 802.11n HT40 : 14.27 dBm / 0.0267 W 802.11ac VHT80: 11.63 dBm / 0.0146 W **MIMO <Ant. Port 1 + 2>** 802.11n HT20 : 14.28 dBm / 0.0268 W 802.11n HT40 : 14.37 dBm / 0.0274 W 802.11ac VHT80: 13.24 dBm / 0.0211 W

<table>
<tr><th colspan="2">Product Specification subjective to this standard</th></tr>
<tr><td>Maximum Output Power</td><td><5500 MHz ~ 5580 MHz and 5660 MHz ~ 5700 MHz>
<Ant. 1>
802.11a : 14.27 dBm / 0.0267 W
SISO <Ant. Port 1>
802.11n HT20 : 14.42 dBm / 0.0277 W
802.11n HT40 : 14.85 dBm / 0.0305 W
802.11ac VHT80: 14.94 dBm / 0.0312 W
<Ant. 2>
802.11a : 14.26 dBm / 0.0267 W
SISO <Ant. Port 2>
802.11n HT20 : 14.21 dBm / 0.0264 W
802.11n HT40 : 14.71 dBm / 0.0296 W
802.11ac VHT80: 14.54 dBm / 0.0284 W
MIMO <Ant. Port 1 + 2>
802.11n HT20 : 14.84 dBm / 0.0305 W
802.11n HT40 : 15.19 dBm / 0.0330 W
802.11ac VHT80: 15.56 dBm / 0.0360 W</td></tr>
<tr><td>Type of Modulation</td><td>802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)
802.11ac : OFDM (BPSK / QPSK / 16QAM / 64QAM / 256QAM)</td></tr>
<tr><td>Antenna Type</td><td><5180 MHz ~ 5240 MHz>
Ant. 1 : PIFA Antenna
Ant. 2 : PIFA Antenna
<5250 MHz ~ 5350 MHz>
Ant. 1 : PIFA Antenna
Ant. 2 : PIFA Antenna
<5470 MHz ~ 5725 MHz>
Ant. 1 : PIFA Antenna
Ant. 2 : PIFA Antenna</td></tr>
<tr><td>Antenna Gain</td><td><5180 MHz ~ 5240 MHz>
Ant. 1 : 0.15 dBi
Ant. 2 : 0.83 dBi
<5250 MHz ~ 5350 MHz>
Ant. 1 : 0.63 dBi
Ant. 2 : 1.58 dBi
<5470 MHz ~ 5725 MHz>
Ant. 1 : 2.05 dBi
Ant. 2 : 1.54 dBi</td></tr>
<tr><td>Antenna Function Description</td><td>
<table>
<tr><th></th><th>Chain
Port 1</th><th>Chain
Port 2</th></tr>
<tr><td>802.11 a</td><td>V</td><td>V</td></tr>
<tr><td>802.11 n/ac
SISO</td><td>V</td><td>V</td></tr>
<tr><td>802.11 n/ac
MIMO</td><td>V</td><td>V</td></tr>
</table>
</td></tr>
</table>

1.5 Modification of EUT

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

1.6 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1022 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site	SPORTON INTERNATIONAL INC.		
Test Site Location	No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978		
Test Site No.	**Sporton Site No.**		
	TH02-HY	CO05-HY	03CH05-HY

1.7 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 D01 General UNII Test Procedures Old Rules v01r04.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- FCC KDB 644545 D01 Guidance for IEEE 802 11ac Old Rules v01r02.
- ANSI C63.4-2003

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

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 four orthogonal panels, X, Y, Z, and Notebook Type. The worst cases (X plane and Notebook Type) were recorded in this report.

The final configuration from all the combinations and the worst-case data rates were investigated by measuring the maximum power across all the data rates and modulation modes under section 2.2.

Based on the worst configuration found above, the RF power setting is set individually to meet FCC compliance limit for the final conducted and radiated tests shown in section 2.3.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5150-5250 MHz Band 1 (U-NII-1)	36	5180	44	5220
	38	**5190**	**46**	**5230**
	40	5200	48	5240
	42	5210		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5250-5350 MHz Band 2 (U-NII-2A)	52	5260	60	5300
	54	**5270**	**62**	**5310**
	56	5280	64	5320
	58	5290		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5470-5600 MHz and 5650-5725 MHz Band 3 (U-NII-2C)	100	5500	112	5560
	102	**5510**	116	5580
	104	5520	132	5660
	106	5530	**134**	**5670**
	108	5540	136	5680
	110	**5550**	140	5700

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
Straddle Channel	138	5690	144	5720
	142	**5710**		

Note: The above Frequency and Channel in boldface were 802.11n HT40.

2.2 Pre-Scanned RF Power

Preliminary tests were performed in different data rate and data rate associated with the highest power were chosen for full test in the following tables.

<Ant. 1>

5GHz 802.11a mode										
Channel	36	44	48	52	60	64	100	116	140	144
Frequency (MHz)	5180	5220	5240	5260	5300	5320	5500	5580	5700	5720
Average Power (dBm)	12.37	**13.73**	13.36	**14.49**	14.47	11.92	12.36	**14.27**	11.47	14.11

SISO <Ant. 1>

5GHz 802.11n HT20 mode										
Channel	36	44	48	52	60	64	100	116	140	144
Frequency (MHz)	5180	5220	5240	5260	5300	5320	5500	5580	5700	5720
Average Power (dBm)	12.41	13.26	**13.47**	14.45	**14.48**	11.65	12.09	14.27	11.37	**14.42**

5GHz 802.11n HT40 mode								
Channel	38	46	54	62	102	110	134	142
Frequency (MHz)	5190	5230	5270	5310	5510	5550	5670	5710
Average Power (dBm)	10.39	**14.42**	**14.37**	11.95	12.06	14.42	14.40	**14.85**

5GHz 802.11ac VHT80 mode					
Channel	42	58	106	122	138
Frequency (MHz)	5210	5290	5530	5610	5690
Average Power (dBm)	**11.82**	**11.75**	11.56	13.33	**14.94**

<Ant. 2>

5GHz 802.11a mode										
Channel	36	44	48	52	60	64	100	116	140	144
Frequency (MHz)	5180	5220	5240	5260	5300	5320	5500	5580	5700	5720
Average Power (dBm)	12.34	**13.49**	13.34	14.26	**14.45**	11.86	11.69	**14.26**	11.27	13.90

SISO <Ant. 2>

5GHz 802.11n HT20 mode										
Channel	36	44	48	52	60	64	100	116	140	144
Frequency (MHz)	5180	5220	5240	5260	5300	5320	5500	5580	5700	5720
Average Power (dBm)	12.39	13.25	**13.44**	14.24	**14.44**	11.57	12.08	**14.21**	11.27	13.70

5GHz 802.11n HT40 mode								
Channel	38	46	54	62	102	110	134	142
Frequency (MHz)	5190	5230	5270	5310	5510	5550	5670	5710
Average Power (dBm)	11.86	14.45	14.27	12.05	12.41	14.16	14.13	14.71

5GHz 802.11ac VHT80 mode					
Channel	42	58	106	122	138
Frequency (MHz)	5210	5290	5530	5610	5690
Average Power (dBm)	11.62	11.63	11.51	13.31	14.54

MIMO <Ant. 1+2>

5GHz 802.11n HT20 mode										
Channel	36	44	48	52	60	64	100	116	140	144
Frequency (MHz)	5180	5220	5240	5260	5300	5320	5500	5580	5700	5720
Average Power (dBm)	12.80	13.00	12.76	14.21	14.28	12.99	12.13	14.84	12.40	14.59

5GHz 802.11n HT40 mode								
Channel	38	46	54	62	102	110	134	142
Frequency (MHz)	5190	5230	5270	5310	5510	5550	5670	5710
Average Power (dBm)	11.86	14.43	14.37	13.21	13.35	14.63	14.73	15.19

5GHz 802.11ac VHT80 mode					
Channel	42	58	106	122	138
Frequency (MHz)	5210	5290	5530	5610	5690
Average Power (dBm)	12.63	13.24	13.39	15.56	15.36

Note: MIMO Ant. 1+2 is a calculated result from sum of the power MIMO Ant. 1 and MIMO Ant. 2.

2.3 Test Mode

Final results of test modes, data rates and test channels are shown as following table.

Test Cases					
	Test Items	Mode	Data rate	Test Channel	Remark
Radiated TCs	Radiated Band Edge	802.11a	6 Mbps	L/M/H	<Ant. 1> & <Ant. 2>
		802.11n HT20	MCS0/ MCS8	L/M/H	SISO <Ant. 1> & MIMO <Ant. 1+2>
		802.11n HT40	MCS0/ MCS8	L/M/H	SISO <Ant. 1> & MIMO <Ant. 1+2>
		802.11ac VHT80	MCS0/ MCS10	M	SISO <Ant. 1> & MIMO <Ant. 1+2>
	Radiated Spurious Emission	802.11a	6 Mbps	L/M/H	<Ant. 1> & <Ant. 2>
		802.11n HT20	MCS0/ MCS8	L/M/H/Straddle	SISO <Ant. 1> & MIMO <Ant. 1+2>
		802.11n HT40	MCS0/ MCS8	L/M/H/Straddle	SISO <Ant. 1> & MIMO <Ant. 1+2>
		802.11ac VHT80	MCS0/ MCS10	M/Straddle	SISO <Ant. 1> & MIMO <Ant. 1+2>
AC Conducted Emission	Mode 1 ： WLAN (5GHz) Link + Bluetooth Link + TC + TF				

Remark:

1. TC stands for Test Configuration, and consists of HDMI Cable, Earphone, Smart Card (Load), USB HD, RJ-45 Link, and SD Card.

2. TF stands for Test Function, and consists of H-Pattern, Camera, and MPEG4.

Ch. #		Band I：5150-5250 MHz	Band II：5250-5350 MHz	Band III：5470-5600 MHz and 5650-5725MHz
		802.11a	802.11a	802.11a
L	Low	36	52	100
M	Middle	44	60	116
H	High	48	64	140
-	Straddle	-	-	144

Ch. #		Band I：5150-5250 MHz	Band II：5250-5350 MHz	Band III：5470-5600 MHz and 5650-5725MHz
		802.11n HT20	802.11n HT20	802.11n HT20
L	Low	36	52	100
M	Middle	44	60	116
H	High	48	64	140
-	Straddle	-	-	144

Ch. #		Band I：5150-5250 MHz	Band II：5250-5350 MHz	Band III：5470-5600 MHz and 5650-5725MHz
		802.11n HT40	802.11n HT40	802.11n HT40
L	Low	38	54	102
M	Middle	-	-	110
H	High	46	62	134
-	Straddle	-	-	142

Ch. #		Band I：5150-5250 MHz	Band II：5250-5350 MHz	Band III：5470-5600 MHz and 5650-5725MHz
		802.11ac VHT80	802.11ac VHT80	802.11ac VHT80
L	Low	-	-	-
M	Middle	42	58	106
H	High	-	-	-
-	Straddle	-	-	138

2.4 Connection Diagram of Test System

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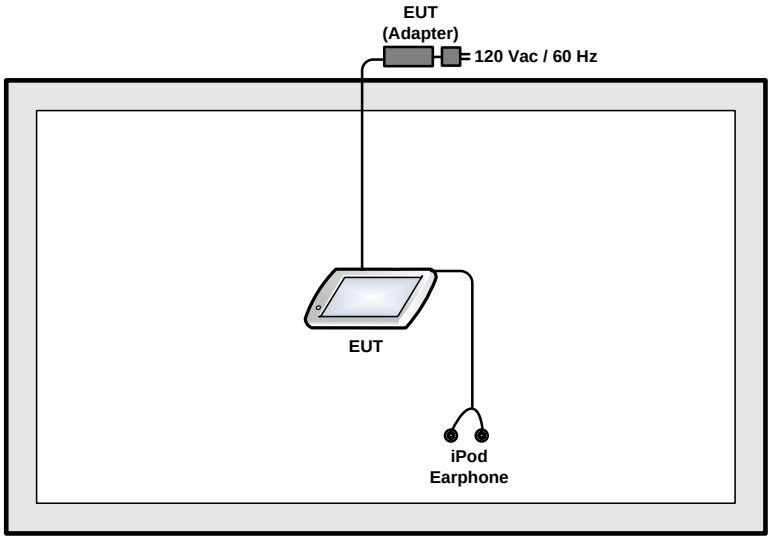

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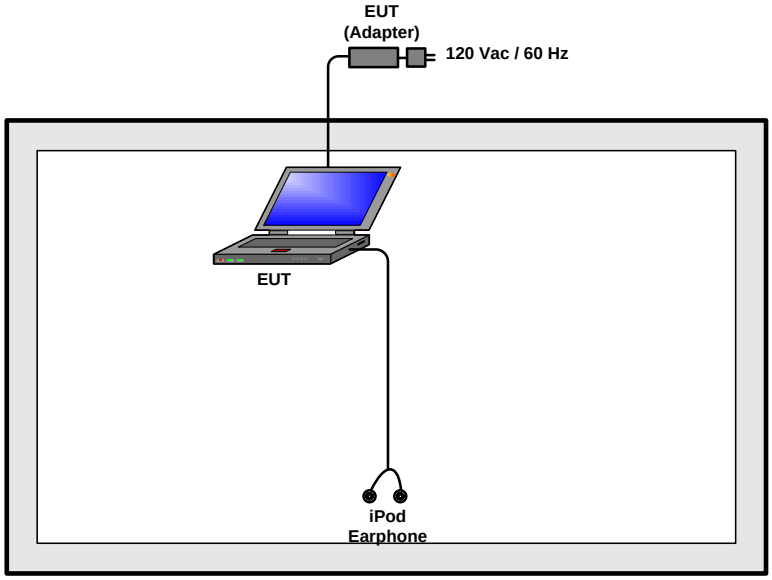
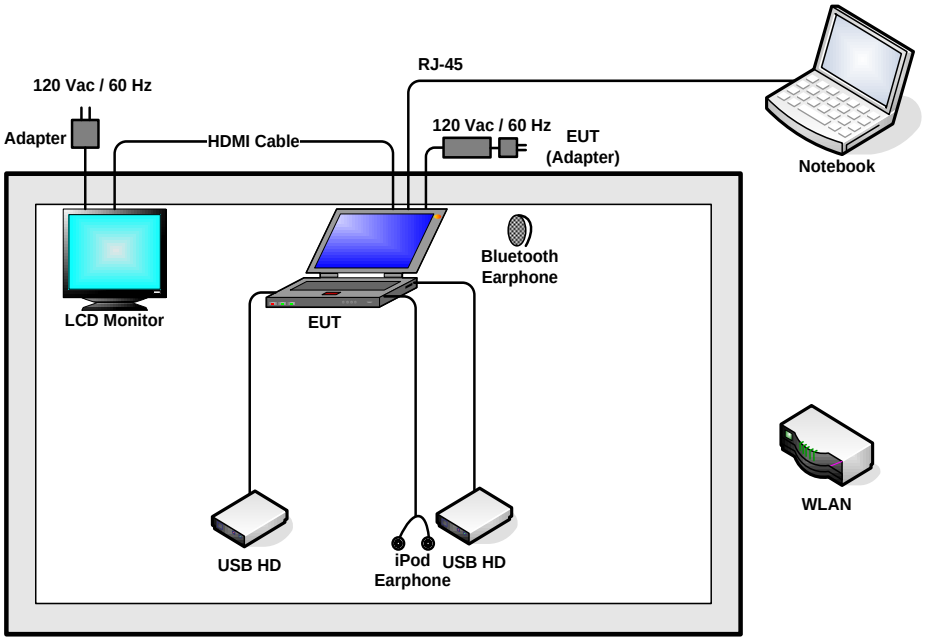


<AC Conducted Emission Mode>



2.5 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-865L	KA2DIR865LA1	N/A	Unshielded, 1.8 m
2.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A
3.	Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
4.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A
5.	USB HD	WD	WDBAAR3200ABK-PESN	FCC DoC	Unshielded, 0.5 m	N/A
6.	LCD Monitor	DELL	U2410	FCC DoC	Shielded, 1.6 m	Unshielded, 1.8 m
7.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A
8.	Smart Card	N/A	N/A	N/A	N/A	N/A

2.6 EUT Operation Test Setup

The programmed RF utility “TestTool”, is installed in EUT to provide channel selection, power level, data rate and the application type. RF Utility can send transmitting signal for all testing. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

2.7 Measurement Results Explanation Example

For all conducted test items:

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

Example :
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.
Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 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.

3.1.1 Limit of Unwanted Emissions

(1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of –27dBm/MHz.

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5600 MHz and 5650-5725MHz band: all emissions outside of the 5470-5600 MHz and 5650-5725MHz band shall not exceed an EIRP of -27 dBm/MHz.

(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.

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

EIRP (dBm)	Field Strength at 3m (dBμV/m)
-17	78.3
- 27	68.3

(3) KDB789033 Old Rules v01r04 H)2)c)(i) As specified in 15.407(b), emissions above 1000 MHz

that are outside of the restricted bands are subject to a peak emission limit of -27 dBm/MHz (or -17 dBm/MHz as specified in 15.407(b)(4)). However, an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.

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 D01 General UNII Test Procedures Old Rules v01r04. Section H) 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

   - The setting follows the H) 5) of FCC KDB 789033.
   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

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

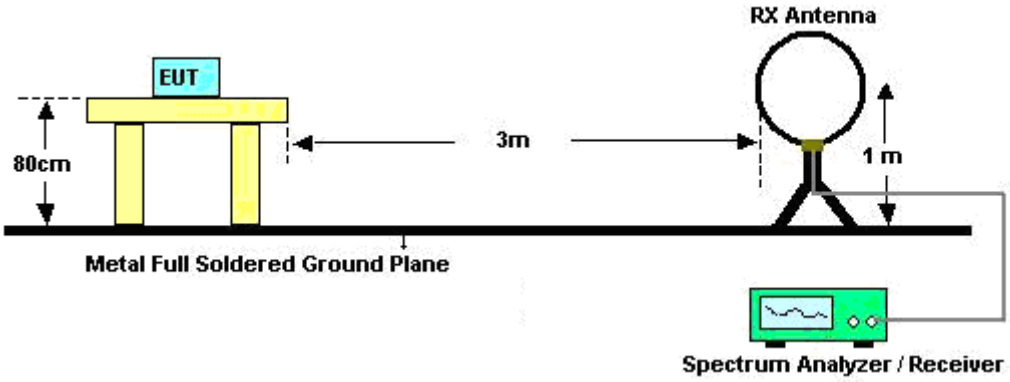
- The setting follows H) 6) of FCC KDB 789033.
- RBW = 1 MHz
- VBW = 10 Hz, when duty cycle is no less than 98 percent.
- VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Antenna	Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
1	802.11a	98.47	-	-	10Hz
2	802.11a	98.47	-	-	10Hz
1	5GHz 802.11n HT20	98.35	-	-	10Hz
2	5GHz 802.11n HT20	98.37	-	-	10Hz
1+2	5GHz 802.11n HT20	98.77	-	-	10Hz
1	5GHz 802.11n HT40	96.75	953.525	1.048740201	3kHz
2	5GHz 802.11n HT40	97.52	945.512	1.057628036	3kHz
1+2	5GHz 802.11n HT40	97.54	953.525	1.048740201	3kHz
1	5GHz 802.11ac VHT80	92.52	435.897	2.294119941	3kHz
2	5GHz 802.11ac VHT80	92.62	442.307	2.260873104	3kHz
1+2	5GHz 802.11ac VHT80	90.91	256.410	3.900003900	10kHz

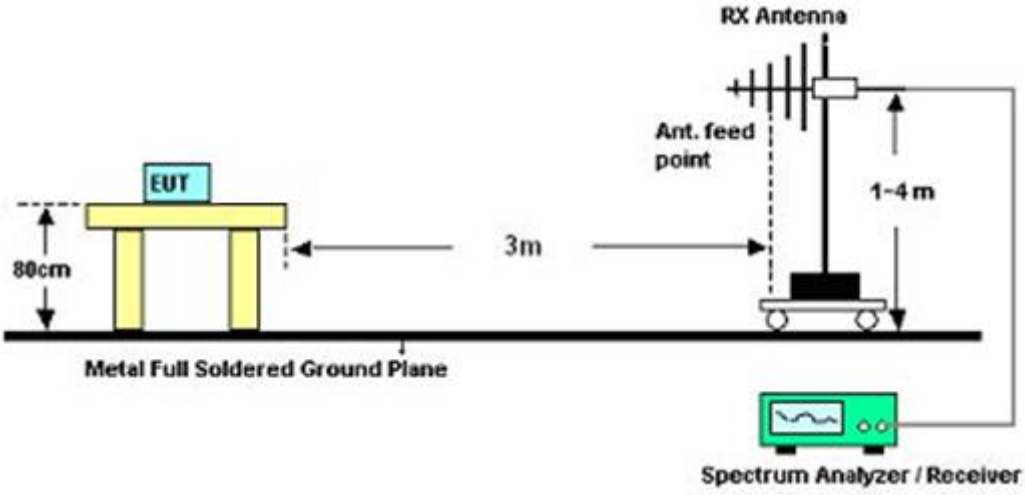
2. The EUT was placed on a rotatable table top 0.8 meter above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters 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.

3.1.4 Test Setup

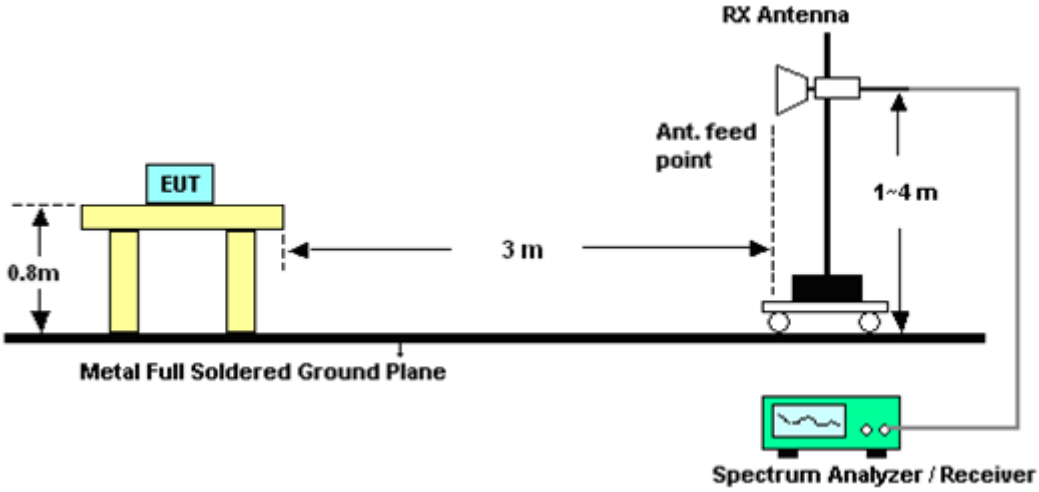
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.1.5 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 per 15.31(o) was not reported.

3.1.6 Test Result of Unwanted Radiated Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix A.

3.2 AC Conducted Emission Measurement

3.2.1 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.

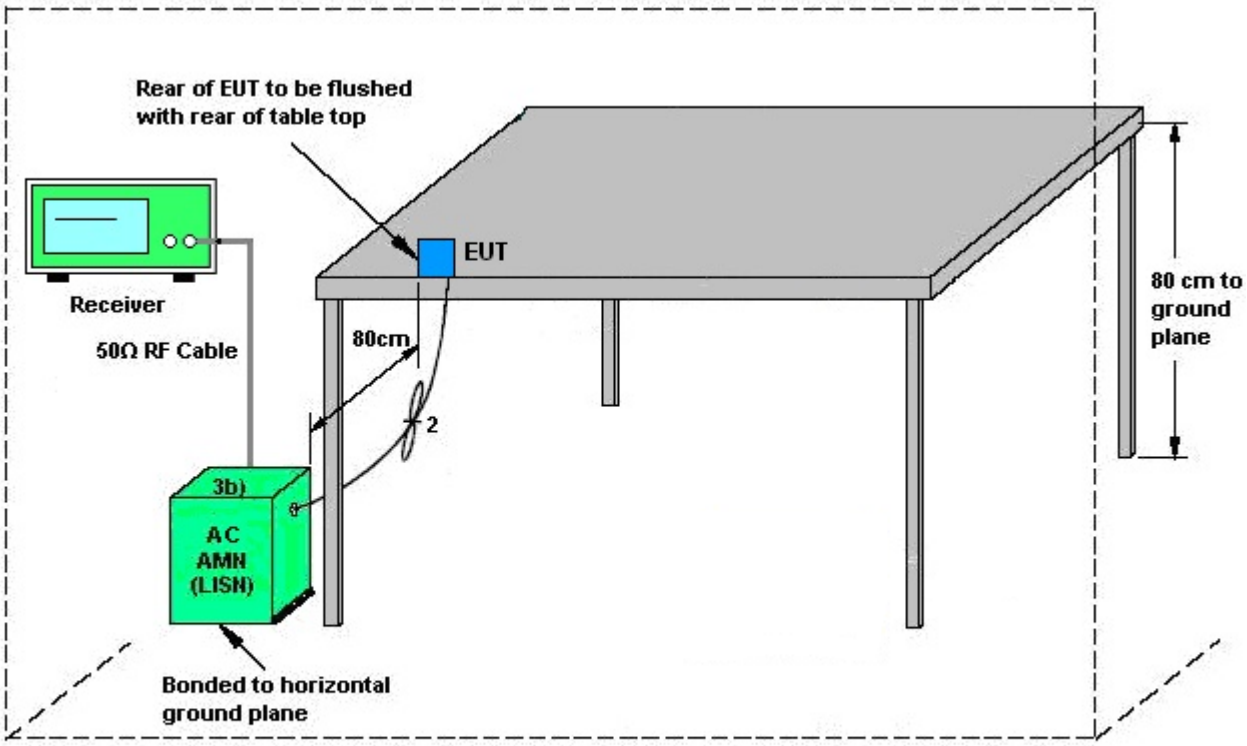
3.2.2 Measuring Instruments

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

3.2.3 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 (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

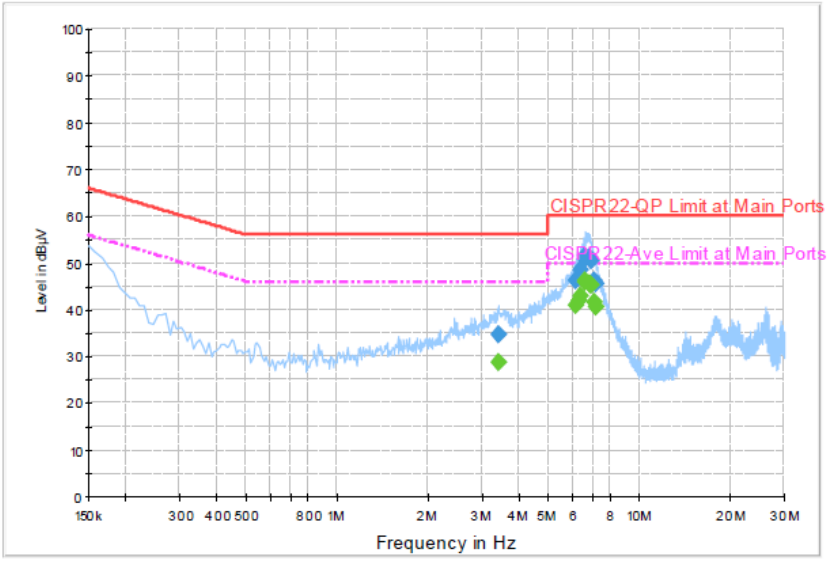
3.2.4 Test Setup



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

3.2.5 Test Result of AC Conducted Emission

Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Cosmo Xu	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	WLAN (5GHz) Link + Bluetooth Link + TC + TF		



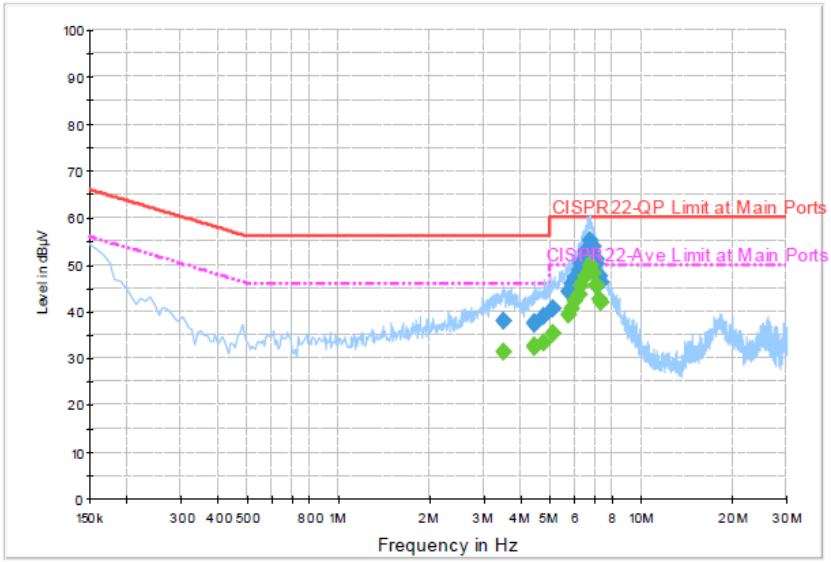
Final Result : QuasiPeak

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
3.406000	34.8	Off	L1	19.6	21.2	56.0
6.166000	46.1	Off	L1	19.6	13.9	60.0
6.254000	46.9	Off	L1	19.6	13.1	60.0
6.366000	48.5	Off	L1	19.6	11.5	60.0
6.598000	50.7	Off	L1	19.7	9.3	60.0
6.622000	51.6	Off	L1	19.7	8.4	60.0
6.862000	51.0	Off	L1	19.7	9.0	60.0
6.902000	50.6	Off	L1	19.7	9.4	60.0
7.110000	46.1	Off	L1	19.7	13.9	60.0
7.134000	45.5	Off	L1	19.7	14.5	60.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
3.406000	28.8	Off	L1	19.6	17.2	46.0
6.166000	40.9	Off	L1	19.6	9.1	50.0
6.254000	41.9	Off	L1	19.6	8.1	50.0
6.366000	43.1	Off	L1	19.6	6.9	50.0
6.598000	45.8	Off	L1	19.7	4.2	50.0
6.622000	46.1	Off	L1	19.7	3.9	50.0
6.862000	45.4	Off	L1	19.7	4.6	50.0
6.902000	45.2	Off	L1	19.7	4.8	50.0
7.110000	41.6	Off	L1	19.7	8.4	50.0
7.134000	40.7	Off	L1	19.7	9.3	50.0

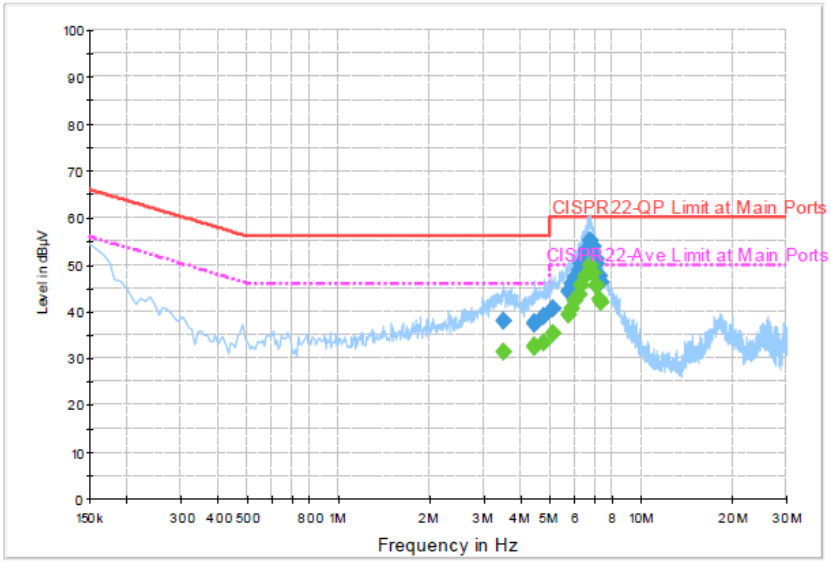
Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Cosmo Xu	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WLAN (5GHz) Link + Bluetooth Link + TC + TF		



Final Result : QuasiPeak

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
3.494000	38.0	Off	N	19.6	18.0	56.0
4.422000	37.5	Off	N	19.6	18.5	56.0
4.446000	37.6	Off	N	19.6	18.4	56.0
4.766000	39.1	Off	N	19.6	16.9	56.0
5.118000	40.7	Off	N	19.6	19.3	60.0
5.702000	44.3	Off	N	19.6	15.7	60.0
5.894000	45.8	Off	N	19.6	14.2	60.0
6.030000	47.4	Off	N	19.6	12.6	60.0
6.198000	48.8	Off	N	19.6	11.2	60.0
6.310000	50.0	Off	N	19.6	10.0	60.0
6.518000	52.7	Off	N	19.6	7.3	60.0
6.710000	55.0	Off	N	19.7	5.0	60.0
6.910000	53.7	Off	N	19.7	6.3	60.0
7.046000	51.0	Off	N	19.7	9.0	60.0
7.070000	50.2	Off	N	19.7	9.8	60.0
7.254000	47.4	Off	N	19.7	12.6	60.0
7.310000	46.3	Off	N	19.7	13.7	60.0

Test Mode :	Mode 1	Temperature :	20~22℃
Test Engineer :	Cosmo Xu	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	WLAN (5GHz) Link + Bluetooth Link + TC + TF		



Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
3.494000	31.2	Off	N	19.6	14.8	46.0
4.422000	32.8	Off	N	19.6	13.2	46.0
4.446000	32.4	Off	N	19.6	13.6	46.0
4.766000	33.2	Off	N	19.6	12.8	46.0
5.118000	35.3	Off	N	19.6	14.7	50.0
5.702000	39.1	Off	N	19.6	10.9	50.0
5.894000	40.7	Off	N	19.6	9.3	50.0
6.030000	42.2	Off	N	19.6	7.8	50.0
6.198000	43.5	Off	N	19.6	6.5	50.0
6.310000	45.5	Off	N	19.6	4.5	50.0
6.518000	47.6	Off	N	19.6	2.4	50.0
6.710000	49.9	Off	N	19.7	0.1	50.0
6.910000	48.2	Off	N	19.7	1.8	50.0
7.046000	45.5	Off	N	19.7	4.5	50.0
7.070000	45.4	Off	N	19.7	4.6	50.0
7.254000	42.5	Off	N	19.7	7.5	50.0
7.310000	42.1	Off	N	19.7	7.9	50.0

3.3 Automatically Discontinue Transmission

3.3.1 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.

3.3.2 Measuring Instruments

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

3.3.3 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.

3.4 Antenna Requirements

3.4.1 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.

3.4.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.4.3 Antenna Gain

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

For CDD transmissions, directional gain is calculated as

$$Directional Gain = 10 \cdot \log \left[\frac{\sum_{j=1}^{N_{SS}} \left\{ \sum_{k=1}^{N_{ANT}} g_{j,k} \right\}^2}{N_{ANT}} \right]$$

where

Each antenna is driven by no more than one spatial stream;

N_{SS} = the number of independent spatial streams of data;

N_{ANT} = the total number of antennas

$g_{j,k} = 10^{G_k / 20}$ if the kth antenna is being fed by spatial stream j, or zero if it is not;

G_k is the gain in dBi of the kth antenna.

The EUT supports CDD mode.

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 I	0.15	0.83	3.51	3.51	0.00	0.00
Band II	0.63	1.58	4.13	4.13	0.00	0.00
Band III	2.05	1.54	4.81	4.81	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
Power Meter	Anritsu	ML2495A	1036004	300MHz~40GHz	Aug. 09, 2014	Oct. 06, 2014	Aug. 08, 2015	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Aug. 09, 2014	Oct. 06, 2014	Aug. 08, 2015	Conducted (TH02-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 09, 2014	Oct. 10, 2014 ~ Oct. 30, 2014	Jun. 08, 2015	Radiation (03CH05-HY)
Bilog Antenna	Schaffner	CBL6111C	2725	30MHz~1GHz	Sep. 27, 2014	Oct. 10, 2014 ~ Oct. 30, 2014	Sep. 26, 2015	Radiation (03CH05-HY)
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-1241	1GHz~18GHz	Apr. 16, 2014	Oct. 10, 2014 ~ Oct. 30, 2014	Apr. 15, 2015	Radiation (03CH05-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Oct. 02, 2014	Oct. 10, 2014 ~ Oct. 30, 2014	Oct. 01, 2015	Radiation (03CH05-HY)
Loop Antenna	TESEQ	HLA 6120	31244	9 kHz~30 MhZ	Dec. 02, 2012	Oct. 10, 2014 ~ Oct. 30, 2014	Dec. 01, 2014	Radiation (03CH05-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590074	100kHz~18GHz	Jul. 07, 2014	Oct. 10, 2014 ~ Oct. 30, 2014	Jul. 06, 2015	Radiation (03CH05-HY)
Preamplifier	EMCI	EMC011830	980148	DC~18GHz	Jun. 23, 2014	Oct. 10, 2014 ~ Oct. 30, 2014	Jun. 22, 2015	Radiation (03CH05-HY)
Preamplifier	COM-POWER	PA-103	161075	9kHz~30MHz	Apr. 15, 2014	Oct. 10, 2014 ~ Oct. 30, 2014	Apr. 14, 2015	Radiation (03CH05-HY)
Preamplifier	Miteq	TTA0204	1872107	18GHz~40GHz	May 23, 2014	Oct. 10, 2014 ~ Oct. 30, 2014	May 22, 2015	Radiation (03CH05-HY)
Turn Table	HD	HD100	420/611	0 - 360 degree	N/A	Oct. 10, 2014 ~ Oct. 30, 2014	N/A	Radiation (03CH05-HY)
Antenna Mast	HD	HD100	240/666	1 m - 4 m	N/A	Oct. 10, 2014 ~ Oct. 30, 2014	N/A	Radiation (03CH05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCS 30	100356	9kHz ~ 2.75GHz	Nov. 15, 2013	Nov. 06, 2014	Nov. 14, 2014	Conduction (CO05-HY)
LISN (for auxiliary equipment)	Rohde & Schwarz	ENV216	100081	9kHz ~ 30MHz	Dec. 12, 2013	Nov. 06, 2014	Dec. 11, 2014	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz ~ 30MHz	Dec. 04, 2013	Nov. 06, 2014	Dec. 03, 2014	Conduction (CO05-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Nov. 06, 2014	N/A	Conduction (CO05-HY)

5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.26**

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.10**