FCC RF Test Report

APPLICANT : VERTU Corporation Limited

EQUIPMENT: Cellular Telephone

BRAND NAME : VERTU

MODEL NAME : ASTER T

TYPE NAME : VM-01T

FCC ID : P7QVM-01T

STANDARD : FCC Part 15 Subpart C §15.247

CLASSIFICATION : (DTS) Digital Transmission System

The product was received on Mar. 20, 2014 and testing was completed on Nov. 09, 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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Report No.: FR492650B

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR492650B	Rev. 01	Initial issue of report	Dec. 22, 2014

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SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
-	15.247(a)(2)	RSS-210 A8.2(a)	6dB Bandwidth	≥ 0.5MHz	Pass	Please refer to Sporton Report No. : FR430314B
-	1	RSS-Gen 4.6.1	99% Bandwidth	-	Pass	Please refer to Sporton Report No. : FR430314B
-	15.247(b)(1)	RSS-210 A8.1(b)	Peak Output Power	≤ 30dBm	Pass	-
-	15.247(e)	RSS-210 A8.2(b)	Power Spectral Density	≤ 8dBm/3kHz	Pass	Please refer to Sporton Report No. : FR430314B
-	15.247(d)	RSS-210 A8.5	Conducted Band Edges and Spurious Emission	≤ 20dBc	Pass	Please refer to Sporton Report No. : FR430314B
3.1	15.247(d)	RSS-210 A8.5	Radiated Band Edges and Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 9.31 dB at 119.910 MHz
3.2	15.207	RSS-Gen 7.2.4	AC Conducted Emission	15.207(a)	Pass	Under limit 8.60 dB at 13.558 MHz
3.3	15.203 & 15.247(b)	RSS-210 A8.4	Antenna Requirement	N/A	Pass	-

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1 General Description

1.1 Applicant

VERTU Corporation Limited

Beacon Hill Road, Church Crookham, Hampshire GU52 8DY, United Kingdom

1.2 Manufacturer

VERTU Corporation Limited

Beacon Hill Road, Church Crookham, Hampshire GU52 8DY, United Kingdom

1.3 Product Feature of Equipment Under Test

Product Feature				
Equipment	Cellular Telephone			
Brand Name	VERTU			
Model Name	ASTER T			
Type Name	VM-01T			
FCC ID	P7QVM-01T			
EUT supports Radios application	GSM/EGPRS/WCDMA/HSPA/LTE/NFC WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth v4.0 EDR/LE			
HW Version	F2			
EUT Stage	Identical Prototype			

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

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Specification of Accessory			
AC Adoptor	Brand Name	VERTU	
AC Adapter	Model Name	AC-32V	
Car Charger	Brand Name	VERTU	
Cai Chargei	Model Name	DC-30V	
Pattory	Brand Name	VERTU	
Battery	Model Name	BP-9V	
Portable Power	Brand Name	VERTU	
Charger	Model Name	DC-15V	
Earphone 1	Brand Name	VERTU	
Earphone i	Model Name	WH-4V	
Earphone 2	Brand Name	VERTU	
	Model Name	WH-5V	
Earphone 3	Brand Name	VERTU	
Earphone 3	Model Name	HP-1V	
USB Cable	Brand Name	VERTU	
USB Cable	Model Name	CA-225DV	
Wireless Charger	Brand Name	VERTU	
wileless Charger	Model Name	AC-35V	
Wireless Speeker	Brand Name	VERTU	
Wireless Speaker	Model Name	SP-1V	

1.4 Product Specification subjective to this standard

Product Specification subjective to this standard			
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz		
Number of Channels	40		
Carrier Frequency of Each Channel	40 Channel(37 hopping + 3 advertising channel)		
Maximum Output Power to Antenna	1.99 dBm (0.0016 W)		
Antenna Type	PIFA Antenna type with gain -2.00 dBi		
Type of Modulation	Bluetooth LE : GFSK		

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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.

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Test Site	SPORTON INTERNATIONAL INC.		
	No. 52, Hwa Ya 1 st Rd., F	lwa Ya Technology Park,	
Toot Site Leastion	Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.		
Test Site Location	TEL: +886-3-327-3456		
	FAX: +886-3-328-4978		
Took Site No.		Sporton Site No.	
Test Site No.	TH02-HY	CO05-HY	03CH05-HY

Note: The test site complies with ANSI C63.4 2009 requirement.

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 C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02
- ANSI C63.10-2009

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.

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2 Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

The RF output power was recorded in the following table:

	I Frequency	Bluetooth 4.0 – LE RF Output Power
Channal		Data Rate / Modulation
Channel		GFSK
		1Mbps
Ch00	2402MHz	1.14 dBm
Ch19	2440MHz	<mark>1.99</mark> dBm
Ch39	2480MHz	0.85 dBm

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction (150 kHz to 30 MHz), radiation (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). Pre-scanned tests, X, Y, Z in three orthogonal panels to determine the final configuration (Y plane as worst plane) from all possible combinations.
- b. AC power line Conducted Emission was tested under maximum output power.

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2.2 Test Mode

The following summary table is showing all test modes to demonstrate in compliance with the standard.

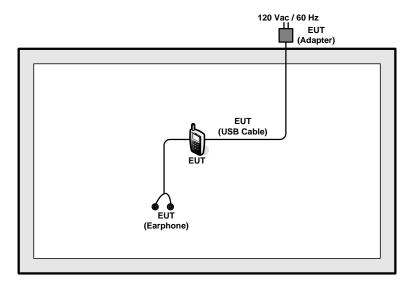
Summary table of Test Cases						
Test Item	Data Rate / Modulation					
rest item	Bluetooth 4.0 – LE / GFSK					
Conducted	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps					
TCs	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps					
ICS	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps					
Radiated	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps					
TCs	Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps					
ics	Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps					
A.C.	Mode 1: LTE Band 7 Idle + WLAN (2.4GHz) Link + Bluetooth Link + Earphone 2 + NFC					
AC Canduated	On + USB Cable (Data Link with Notebook)					
Conducted	Mode 2: LTE Band 7 Idle + WLAN (5GHz) Link + Bluetooth Link + Earphone 2 + NFC On					
Emission	+ USB Cable (Data Link with Notebook)					
Remark: The	worst case of conducted emission is mode 2; only the test data of it was reported.					

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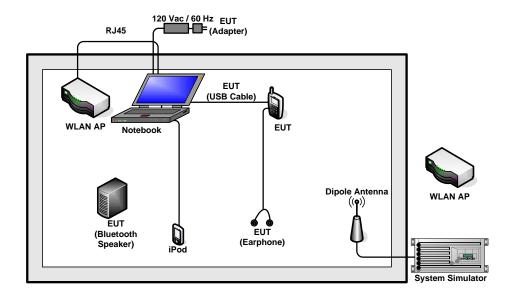
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2.3 Connection Diagram of Test System

<Bluetooth 4.0 - LE Tx Mode>



<AC Conducted Emission Mode>



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2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded, 1.8 m
2.	WLAN AP	D-Link	DIR-628	KA2DIR628A2	N/A	Unshielded, 1.8 m
3.	WLAN AP	D-Link	DIR-865L	KA2IR865LA1	N/A	Unshielded, 1.8 m
4.	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
5.	iPod	Apple	A1285	FCC DoC	Shielded, 1.0 m	N/A
6.	Wireless Speaker	VERTU	SP-1V	P7Q-SP1V	N/A	N/A
7.	NFC Card	Metro Taipei	Easy Card	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 transmitting and receiving signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

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

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

 $Offset = RF \ cable \ loss + attenuator \ factor.$

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) Report No.: FR492650B

3 Test Result

3.1 Radiated Band Edges and Spurious Emission Measurement

3.1.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

_	- 1.1.0,	
Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(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

3.1.2 Measuring Instruments

The section 4.0 of List of Measuring Equipment of this test report is used for test.

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3.1.3 Test Procedures

- 1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r02.
- 2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.

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- 3. The EUT was placed on a turntable with 0.8 meter above ground.
- 4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 5. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- 7. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \ge 1$ GHz for peak measurement. For average measurement:
 - 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.

Band	Duty Cycle(%)	T(µs)	1/T(kHz)	VBW Setting
Bluetooth 4.0 - LE	62.42	392	2.55	3kHz

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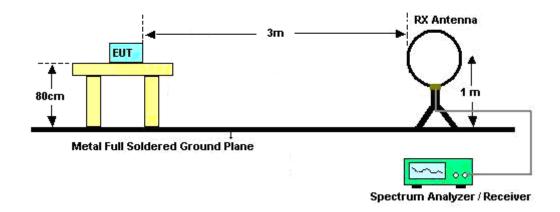
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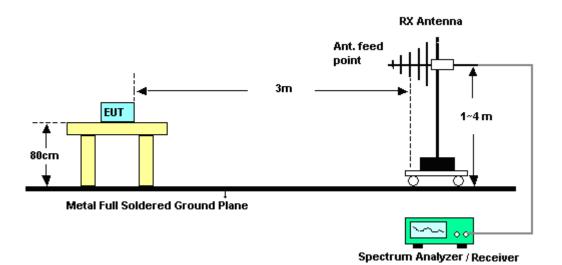
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3.1.4 Test Setup

For radiated emissions below 30MHz



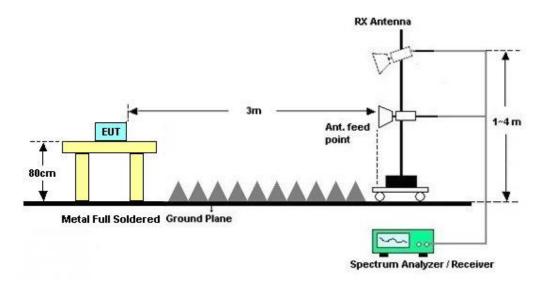
For radiated emissions from 30MHz to 1GHz



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For radiated emissions above 1GHz



3.1.5 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.

3.1.6 Test Result

Please refer to appendix A as below.

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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.

Eroquency of emission (MUz)	Conducted limit (dBµV)				
Frequency of emission (MHz)	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 section 4.0 of List of Measuring Equipment of this test report is used for test.

3.2.3 Test Procedures

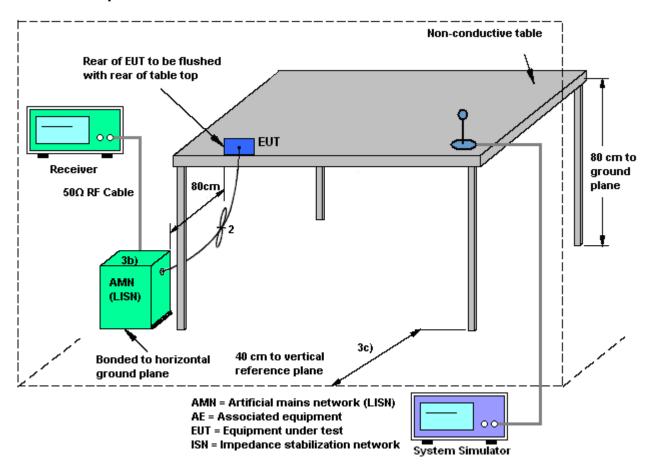
- 1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- 2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- 3. All the support units are connecting to the other 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.

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3.2.4 Test Setup



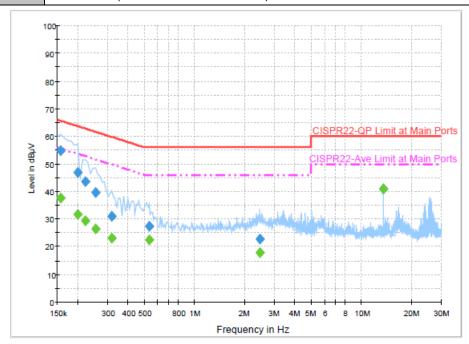
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3.2.5 Test Result of AC Conducted Emission

Test Mode :	Mode 2	Temperature :	21~23 ℃			
Test Engineer :	Eric Jeng	Relative Humidity :	46~48%			
Test Voltage :	120Vac / 60Hz	Phase :	Line			
Function Type	LTE Band 7 Idle + WLAN (5GHz) Link + Bluetooth Link + Earphone 2 + NFC On +					

Function Type : LTE Band 7 Idle + WLAN (5GHz) Link + Bluetooth Link + Earphone 2 + NFC On + USB Cable (Data Link with Notebook)



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	54.8	Off	L1	19.4	10.8	65.6
0.198000	46.8	Off	L1	19.5	16.9	63.7
0.222000	43.6	Off	L1	19.5	19.1	62.7
0.254000	39.7	Off	L1	19.5	21.9	61.6
0.318000	31.2	Off	L1	19.5	28.6	59.8
0.534000	27.5	Off	L1	19.5	28.5	56.0
2.462000	22.8	Off	L1	19.5	33.2	56.0
13.558000	41.0	Off	L1	19.8	19.0	60.0

Final Result : Average

mai Nesuit						
Frequency	Average	Filter	Line	Corr.	Margin	Limit
(MHz)	(dBµV)			(dB)	(dB)	(dBµV)
0.158000	37.6	Off	L1	19.4	18.0	55.6
0.198000	31.7	Off	L1	19.5	22.0	53.7
0.222000	29.4	Off	L1	19.5	23.3	52.7
0.254000	26.4	Off	L1	19.5	25.2	51.6
0.318000	23.2	Off	L1	19.5	26.6	49.8
0.534000	22.4	Off	L1	19.5	23.6	46.0
2.462000	17.7	Off	L1	19.5	28.3	46.0
13.558000	41.0	Off	L1	19.8	9.0	50.0

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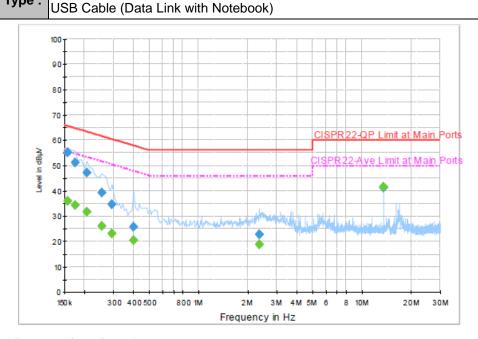
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 Test Mode :
 Mode 2
 Temperature :
 21~23°C

 Test Engineer :
 Eric Jeng
 Relative Humidity :
 46~48%

 Test Voltage :
 120Vac / 60Hz
 Phase :
 Neutral

 Function Type :
 LTE Band 7 Idle + WLAN (5GHz) Link + Bluetooth Link + Earphone 2 + NFC On +



Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	55.1	Off	N	19.5	10.5	65.6
0.174000	51.1	Off	N	19.5	13.7	64.8
0.206000	47.0	Off	N	19.5	16.4	63.4
0.254000	39.2	Off	N	19.5	22.4	61.6
0.294000	34.8	Off	N	19.5	25.6	60.4
0.398000	25.9	Off	N	19.5	32.0	57.9
2.334000	22.9	Off	N	19.4	33.1	56.0
13.558000	41.4	Off	N	19.8	18.6	60.0

Final Result : Average

Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	36.0	Off	N	19.5	19.6	55.6
0.174000	34.4	Off	N	19.5	20.4	54.8
0.206000	31.8	Off	N	19.5	21.6	53.4
0.254000	26.0	Off	N	19.5	25.6	51.6
0.294000	23.2	Off	N	19.5	27.2	50.4
0.398000	20.3	Off	N	19.5	27.6	47.9
2.334000	19.0	Off	N	19.4	27.0	46.0
13.558000	41.4	Off	N	19.8	8.6	50.0

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3.3 Antenna Requirements

3.3.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

3.3.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.3.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

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4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Meter	Agilent	E4416A	GB41292344	300MHz~40GHz	Jan. 28, 2014	Oct. 26, 2014	Jan. 27, 2015	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US40441548	300MHz~40GHz	Jan. 28, 2014	Oct. 26, 2014	Jan. 27, 2015	Conducted (TH02-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100055	9kHz~40GHz	Jun. 09, 2014	Nov. 08, 2014 ~ Nov. 09, 2014	Jun. 08, 2015	Radiation (03CH05-HY)
Bilog Antenna	Schaffner	CBL6111C	2725	30MHz~1GHz	Sep. 27, 2014	Nov. 08, 2014 ~ Nov. 09, 2014	Sep. 26, 2015	Radiation (03CH05-HY)
Double Ridged Guide Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-1241	1GHz~18GHz	Apr. 16, 2014	Nov. 08, 2014 ~ Nov. 09, 2014	Apr. 15, 2015	Radiation (03CH05-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA91702 51	18GHz~40GHz	Oct. 02, 2014	Nov. 08, 2014 ~ Nov. 09, 2014	Oct. 01, 2015	Radiation (03CH05-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590074	100kHz~18GHz	Jul. 07, 2014	Nov. 08, 2014 ~ Nov. 09, 2014	Jul. 06, 2015	Radiation (03CH05-HY)
Preamplifier	EMCI	EMC011830	980148	DC~18GHz	Jun. 23, 2014	Nov. 08, 2014 ~ Nov. 09, 2014	Jun. 22, 2015	Radiation (03CH05-HY)
Preamplifier	COM-POWER	PA-103	161075	9kHz~30MHz	Apr. 15, 2014	Nov. 08, 2014 ~ Nov. 09, 2014	Apr. 14, 2015	Radiation (03CH05-HY)
Preamplifier	Miteq	TTA0204	1872107	18GHz~40GHz	May 23, 2014	Nov. 08, 2014 ~ Nov. 09, 2014	May 22, 2015	Radiation (03CH05-HY)
Turn Table	HD	HD100	420/611	0 - 360 degree	N/A	Nov. 08, 2014 ~ Nov. 09, 2014	N/A	Radiation (03CH05-HY)
Antenna Mast	HD	HD100	240/666	1 m - 4 m	N/A	Nov. 08, 2014 ~ Nov. 09, 2014	N/A	Radiation (03CH05-HY)
Loop Antenna	TESEQ	HLA 6120	31244	9 kHz~30 MhZ	Dec. 02, 2012	Nov. 08, 2014 ~ Nov. 09, 2014	Dec. 01, 2014	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)

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5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence	2.26
of 95% (U = 2Uc(y))	2.20

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

Measuring Uncertainty for a Level of Confidence	5.1
of 95% (U = 2Uc(y))	J. 1

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