



FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

For

**4K IPTV Set Top Box
MODEL NUMBER: A12E**

FCC ID: WNA-A12E

REPORT NUMBER: 4787944978.2-2

ISSUE DATE: June 15, 2017

Prepared for

**Shenzhen Skyworth Digital Technology Co., Ltd
Unit A14/F. Skyworth Building, Gaoxin Ave.1s., Nanshan District, Shenzhen, China**

Prepared by

**UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch
Room 101, Building 10, Innovation Technology Park,
Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China**
Tel: +86 769 33817100
Fax: +86 769 33244054
Website: www.ul.com

Revision History

Rev.	Issue Date	Revisions	Revised By
--	06/15/17	Initial Issue	

Summary of Test Results			
Clause	Test Items	FCC/IC Rules	Test Results
1	6dB Bandwidth and 99% Bandwidth	FCC 15.247 (a) IC RSS-247 Clause 5.1	Complied
2	Peak Conducted Output Power	FCC 15.247 (b) IC RSS-247 Clause 5.4	Complied
3	Power Spectral Density	FCC 15.27 (e) IC RSS-247 Clause 5.1 (2)	Complied
4	Conducted Bandedge and Spurious	FCC 15.207 RSS-Gen Issue 4 clause 7.2	Complied
5	Radiated Bandedge and Spurious	FCC 15.247 (d) FCC 15.209 FCC 15.205 IC RSS-247 Clause 5.5 IC RSS-GEN Clause 8.9	Complied
6	Conducted Emission Test For AC Power Port	FCC 15.207 RSS-GEN Clause 8.8	Complied
7	Antenna Requirement	FCC 15.203 RSS-GEN Clause 8.3	Complied

Remark: N/A is an abbreviation for Not Applicable, and means this item is not applicable for this device.

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS.....	5
2. TEST METHODOLOGY.....	6
3. FACILITIES AND ACCREDITATION.....	6
4. CALIBRATION AND UNCERTAINTY.....	7
4.1. MEASURING INSTRUMENT CALIBRATION	7
4.2. MEASUREMENT UNCERTAINTY	7
5. EQUIPMENT UNDER TEST.....	8
5.1. DESCRIPTION OF EUT	8
5.2. MAXIMUM OUTPUT POWER.....	8
5.3. CHANNEL LIST.....	8
5.4. TEST CHANNEL CONFIGURATION	9
5.5. THE WORSE CASE POWER SETTING PARAMETER.....	9
5.6. DESCRIPTION OF AVAILABLE ANTENNAS	9
5.7. WORST-CASE CONFIGURATIONS.....	9
5.8. DESCRIPTION OF TEST SETUP	9
5.9. MEASURING INSTRUMENT AND SOFTWARE USED.....	11
6. MEASUREMENT METHODS.....	12
7. ANTENNA PORT TEST RESULTS.....	13
7.1. 6 dB DTS BANDWIDTH AND 99% BANDWIDTH	13
7.2. PEAK CONDUCTED OUTPUT POWER.....	16
7.3. POWER SPECTRAL DENSITY.....	19
7.4. CONDUCTED BANDEDGE.....	22
8. RADIATED TEST RESULTS.....	24
8.1. LIMITS AND PROCEDURE.....	24
8.2. RESTRICTED BANDEDGE.....	28
8.3. SPURIOUS EMISSIONS BELOW 30M	34
9. AC POWER LINE CONDUCTED EMISSIONS.....	35
10. ANTENNA REQUIREMENTS.....	38

1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: Shenzhen Skyworth Digital Technology Co., Ltd
Address: Unit A14/F. Skyworth Building, Gaoxin Ave.1s., Nanshan District, Shenzhen, China

Manufacturer Information

Company Name: Shenzhen Skyworth Digital Technology Co., Ltd
Address: Unit A14/F. Skyworth Building, Gaoxin Ave.1s., Nanshan District, Shenzhen, China

EUT Description

Product Name 4K IPTV Set Top Box
Brand Name VectorMax
Model Name A12E
FCC ID WNA-A12E
Date Tested June 08, 2017 ~ June 12, 2017

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	PASS

Tested By: Checked By:



Leo Liu
Engineer



Shawn Wen
Laboratory Leader

Approved By:



Stephen Guo
Laboratory Manager

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

Test Location	Dongguan Dongdian Testing Service Co., Ltd
Address	No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Dongguan City, Guangdong Province, 523808, China
Accreditation Certificate	<p>Dongguan Dongdian Testing Service Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. Valid time is until January 31, 2018.</p> <p>Dongguan Dongdian Testing Service Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 270092, Renewal date March 11, 2015, valid time is until March 11, 2018.</p> <p>The 3m Alternate Test Site of Dongguan Dongdian Testing Service Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 10288A on April 23, 2015, valid time is until April 23, 2018.</p>

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Bandwidth	1.1%
Peak Output Power(Conducted)(Spectrum analyzer)	0.86dB(10 MHz \leq f < 3.6GHz);
	1.38dB(3.6GHz \leq f < 8GHz)
Peak Output Power(Conducted)(Power Sensor)	0.74dB
Dwell Time	0.6%
Conducted spurious emissions	0.86dB(10 MHz \leq f < 3.6GHz);
	1.40dB(3.6GHz \leq f < 8GHz)
	1.66dB(8GHz \leq f < 22GHz)
Uncertainty for radio frequency (RBW<20KHz)	3×10-8
Temperature	0.4 °C
Humidity	2%
Uncertainty for Radiation Emission test (30MHz-1GHz)	4.70 dB (Antenna Polarize: V)
	4.84 dB (Antenna Polarize: H)
Uncertainty for Radiation Emission test (1GHz-18GHz)	4.10dB(1-6GHz)
	4.40dB (6GHz-18Gz)
Uncertainty for Power line conduction emission test	3.32dB (150KHz-30MHz)

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Equipment	4K IPTV Set Top Box				
Model Name	A12E				
Product Description	Operation Frequency	2402 MHz ~ 2480 MHz			
	Modulation Type	Data Rate			
	GFSK	1Mbps			
Bluetooth Version	BT 4.0				
Battery	N/A				
Power Adapter	Input: AC 100~240V, 50/60Hz, 0.5A Output: DC 12V, 1A				

5.2. MAXIMUM OUTPUT POWER

Frequency Range (MHz)	Number of Transmit Chains (NTX)	Bluetooth Mode	Frequency (MHz)	Channel Number	Max PK Conducted Power (dBm)
2400-2483.5	1	BLE	2402-2480	0-39[40]	8.540

5.3. CHANNEL LIST

Channel	Frequency (MHz)						
00	2402	11	2424	22	2446	33	2468
01	2404	12	2426	23	2448	34	2470
02	2406	13	2428	24	2450	35	2472
03	2408	14	2430	25	2452	36	2474
04	2410	15	2432	26	2454	37	2476
05	2412	16	2434	27	2456	38	2478
06	2414	17	2436	28	2458	39	2480
07	2416	18	2438	29	2460		
08	2418	19	2440	30	2462		
09	2420	20	2442	31	2464		
10	2422	21	2444	32	2466		

5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
GFSK	CH 00, CH 19, CH 39	2402MHz, 2440MHz, 2480MHz

5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software Version		Bluetooth MP Test Tool		
Modulation Type	Transmit Antenna Number	Test Channel		
		CH 00	CH 19	CH 39
GFSK	1	default	default	default

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
2	2402-2480	PCB Antenna	5

Test Mode	Transmit and Receive Mode	Description
GFSK	<input checked="" type="checkbox"/> 1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.

5.7. WORST-CASE CONFIGURATIONS

Bluetooth Mode	Modulation Technology	Modulation Type	Data Rate (Mbps)
BLE	DTS	GFSK	1Mbit/s

5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Remarks
1	Laptop	ThinkPad	Latitude D610	N/A
2	LCD Monitor	DELL	S2440Lb	N/A

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB out 1	USB	Unshielded	0.50	N/A

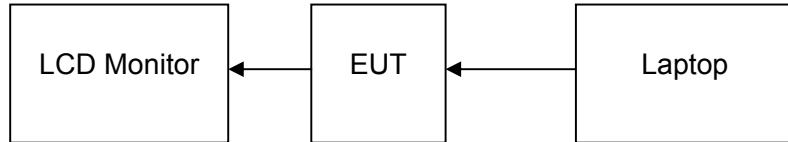
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	Power Adapter	GIANTSUN	GSCU1000S012V15G	Input: AC 100~240V, 50/60Hz, 0.5A Output: DC 12V, 1A

TEST SETUP

The EUT can work in an engineer mode with a software through a Laptop.

SETUP DIAGRAM FOR TESTS



5.9. MEASURING INSTRUMENT AND SOFTWARE USED

Instrument (Conducted for RF Port)						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
<input checked="" type="checkbox"/>	Spectrum analyzer	R&S	FSU26	1166.1660.26	Oct. 16, 2016	Oct. 16, 2017
<input checked="" type="checkbox"/>	Wideband Radio Communication tester	R&S	CMW500	155523	Dec. 20, 2016	Dec. 20, 2017
<input checked="" type="checkbox"/>	Vector Signal Generator	Agilent	E8267D	MY52098743	Oct. 20, 2016	Oct. 20, 2017
<input checked="" type="checkbox"/>	Vector Signal Generator	Agilent	N5182A	MY48180737	Jul. 05, 2016	Jul. 05, 2017
<input checked="" type="checkbox"/>	Power Sensor	Agilent	U2021XA	MY55150010	Apr. 18, 2017	Apr. 18, 2018
<input checked="" type="checkbox"/>	Power Sensor	Agilent	U2021XA	MY55150011	Apr. 19, 2017	Apr. 19, 2018
<input checked="" type="checkbox"/>	DC Power Source	MATRIS	MPS-3005L-3	D813058W	Oct. 24, 2016	Oct. 24, 2017
<input checked="" type="checkbox"/>	Attenuator	Mini-Circuits	BW-S10W2	101109	Aug. 18, 2016	Aug. 18, 2017
<input checked="" type="checkbox"/>	RF Cable	Micable	C10-01-01-1	100309	Aug. 18, 2016	Aug. 18, 2017
<input checked="" type="checkbox"/>	Test Software	JS Tonscend	JS1120-2	Ver.2.5	N/A	N/A
<input checked="" type="checkbox"/>	USB Data acquisition	Agilent	U2531A	TW55043503	N/A	N/A
<input checked="" type="checkbox"/>	Auto control Unit	JS Tonscend	JS0806-2	158060010	N/A	N/A

Instrument (Radiated Tests)						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Expired date
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESU8	100316	Oct. 16, 2016	Oct. 16, 2017
<input checked="" type="checkbox"/>	PSA Series Spectrum analyzer	Agilent	E4447A	MY50180031	Jul. 06, 2016	Jul. 06, 2017
<input checked="" type="checkbox"/>	Trilog Broadband Antenna	Schwarzbeck	VULB9163	9163-462	Oct. 27, 2016	Oct. 27, 2017
<input checked="" type="checkbox"/>	Active Loop antenna	Schwarzbeck	FMZB-1519	1519-038	Oct. 27, 2016	Oct. 27, 2017
<input checked="" type="checkbox"/>	Double Ridged Horn Antenna	R&S	HF907	100276	Oct. 12, 2016	Oct. 12, 2017
<input checked="" type="checkbox"/>	Horn Antenna	ETS-LINDGREN	3160-09	SEL0076	Oct. 16, 2016	Oct. 16, 2017
<input checked="" type="checkbox"/>	Pre-amplifier	A.H.	PAM-0118	360	Oct. 16, 2016	Oct. 16, 2017
<input checked="" type="checkbox"/>	Pre-amplifier	Compliance Directions Systems Inc.	PAP-1G26-48	6279.628	Oct. 16, 2016	Oct. 16, 2017

<input checked="" type="checkbox"/>	RF Cable	HUBSER	CP-X2	W11.03	Oct. 16, 2016	Oct. 16, 2017
<input checked="" type="checkbox"/>	RF Cable	HUBSER	CP-X1	W12.02	Oct. 16, 2016	Oct. 16, 2017
<input checked="" type="checkbox"/>	MI Cable	HUBSER	C10-01-01-1M	1091629	Oct. 16, 2016	Oct. 16, 2017
<input checked="" type="checkbox"/>	Test software	Audix	E3	V 6.11111b	N/A	N/A

Instrument (Line Conducted Emission (AC Main))

Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Expired date
<input checked="" type="checkbox"/>	Test Receiver	R&S	ESU8	100316	Oct.16, 2016	Oct.16, 2017
<input checked="" type="checkbox"/>	LISN 1	R&S	ENV216	101109	Oct.16, 2016	Oct.16, 2017
<input checked="" type="checkbox"/>	LISN 2	R&S	ESH2-Z5	100309	Oct.16, 2016	Oct.16, 2017
<input checked="" type="checkbox"/>	Pulse Limiter	R&S	ESH3-Z2	101242	Oct.16, 2016	Oct.16, 2017
<input checked="" type="checkbox"/>	CE Cable 1	HUBSER	ESU8/RF2	W10.01	Oct.16, 2016	Oct.16, 2017
<input checked="" type="checkbox"/>	Test software	Audix	E3	V 6.11111b	N/A	N/A

6. MEASUREMENT METHODS

No.	Test Item	Standard	Results
1	6 dB Bandwidth	FCC Part 15: 15.247 ANSI C63.10:2013 RSS-247 Issue 2	PASS
2	Peak Output Power	FCC Part 15: 15.247 ANSI C63.10:2013 RSS-247 Issue 2	PASS
3	Power Spectral Density	FCC Part 15:15.247 ANSI C63.10:2013 RSS-247 Issue 2	PASS
4	Out-of-band emissions in non-restricted bands	FCC Part 15: 15.247 ANSI C63.10:2013 RSS-247 Issue 2 RSS-Gen Issue 4	PASS
5	Out-of-band emissions in restricted bands	FCC Part 15: 15.247 ANSI C63.10:2013 RSS-247 Issue 2 RSS-Gen Issue 4	PASS
6	Band-edge	FCC Part 15: 15.209 FCC Part 15: 15.247 RSS-247 Issue 2 RSS-Gen Issue 4	PASS
7	Conducted Emission Test For AC Power Port	FCC Part 15: 15.207 RSS-Gen Issue 4	PASS

7. ANTENNA PORT TEST RESULTS

7.1. 6 dB DTS BANDWIDTH AND 99% BANDWIDTH

LIMITS

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(a)(2) IC RSS-247 5.1 (1)	6 dB Bandwidth	>= 500KHz	2400-2483.5
RSS-Gen Clause 4.4.1	99% Bandwidth	for reporting purposes only.	2400-2483.5

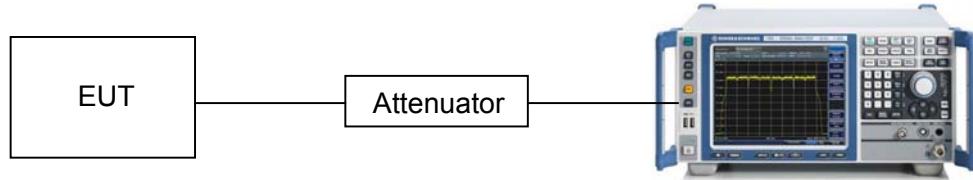
TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	100K
VBW	$\geq 3 \times$ RBW
Trace	Max hold
Sweep	Auto couple

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

TEST SETUP



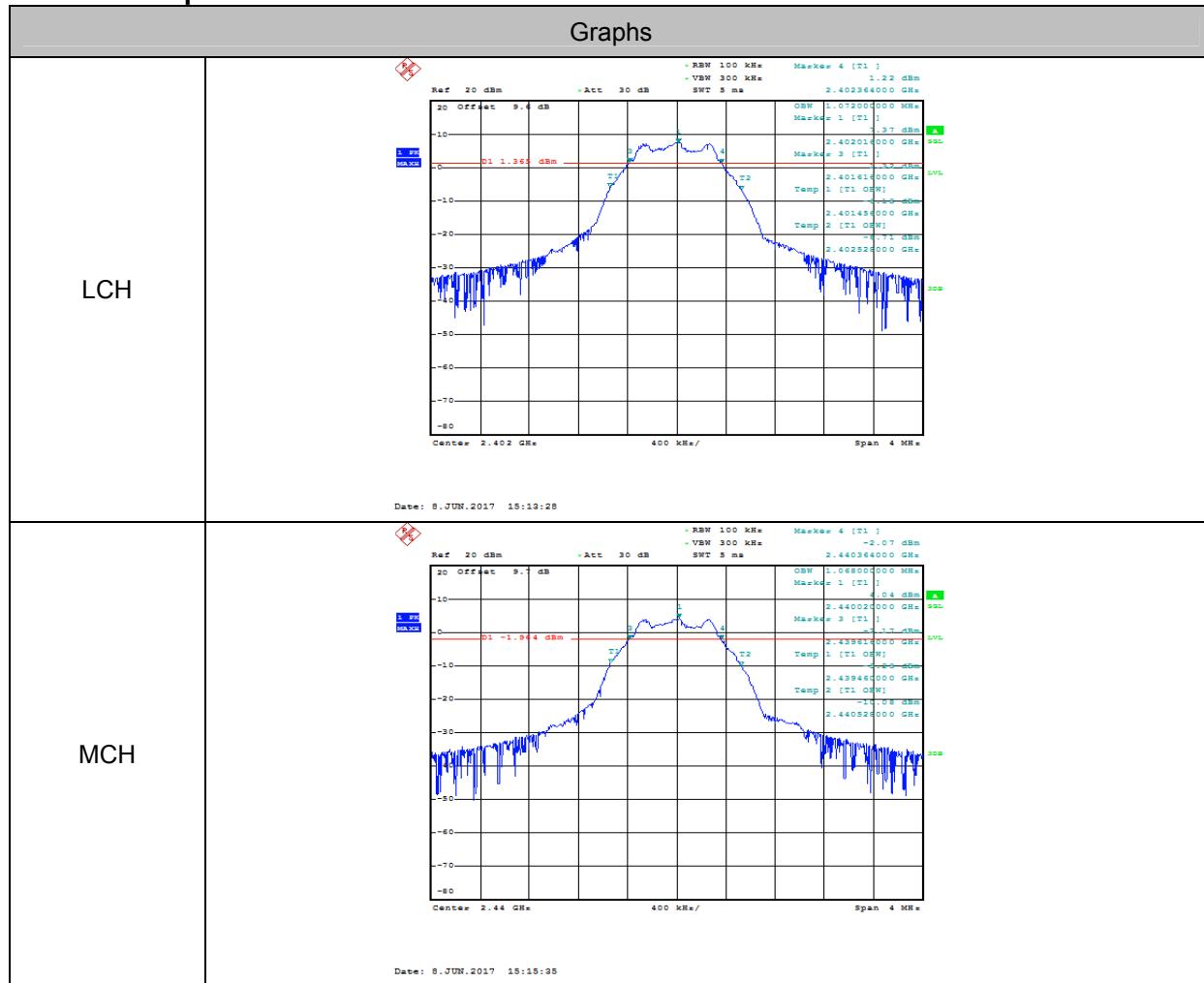
TEST CONDITIONS

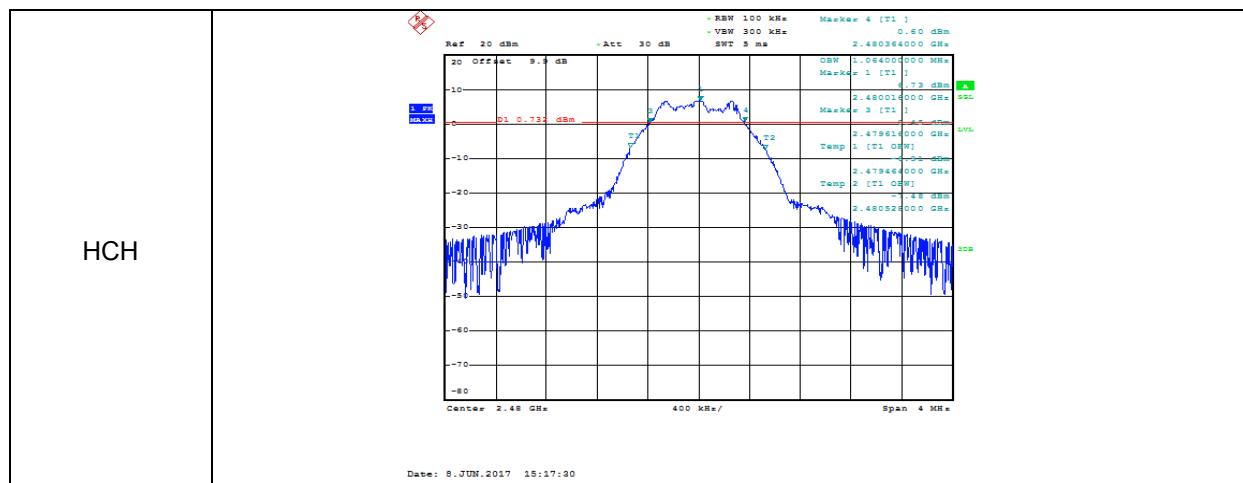
Temperature: 24.6°C
Relative Humidity: 58%
Test Voltage: AC 120V/60HZ

RESULTS

Mode	Channel	6dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
BLE	LCH	0.748	1.072	PASS
BLE	MCH	0.748	1.068	PASS
BLE	HCH	0.748	1.064	PASS

Test Graphs





7.2. PEAK CONDUCTED OUTPUT POWER

LIMITS

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(b)(3) IC RSS-247 5.4 (4)	Peak Output Power	1 watt or 30dBm	2400-2483.5

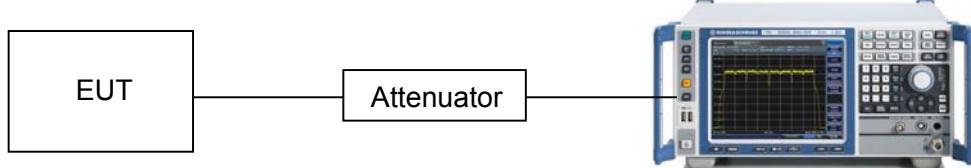
TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	\geq DTS bandwidth(e.g. 1 MHz for BLE)
VBW	$\geq 3 \times$ RBW
Span	3 x RBW
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use peak marker function to determine the peak amplitude level.

TEST SETUP



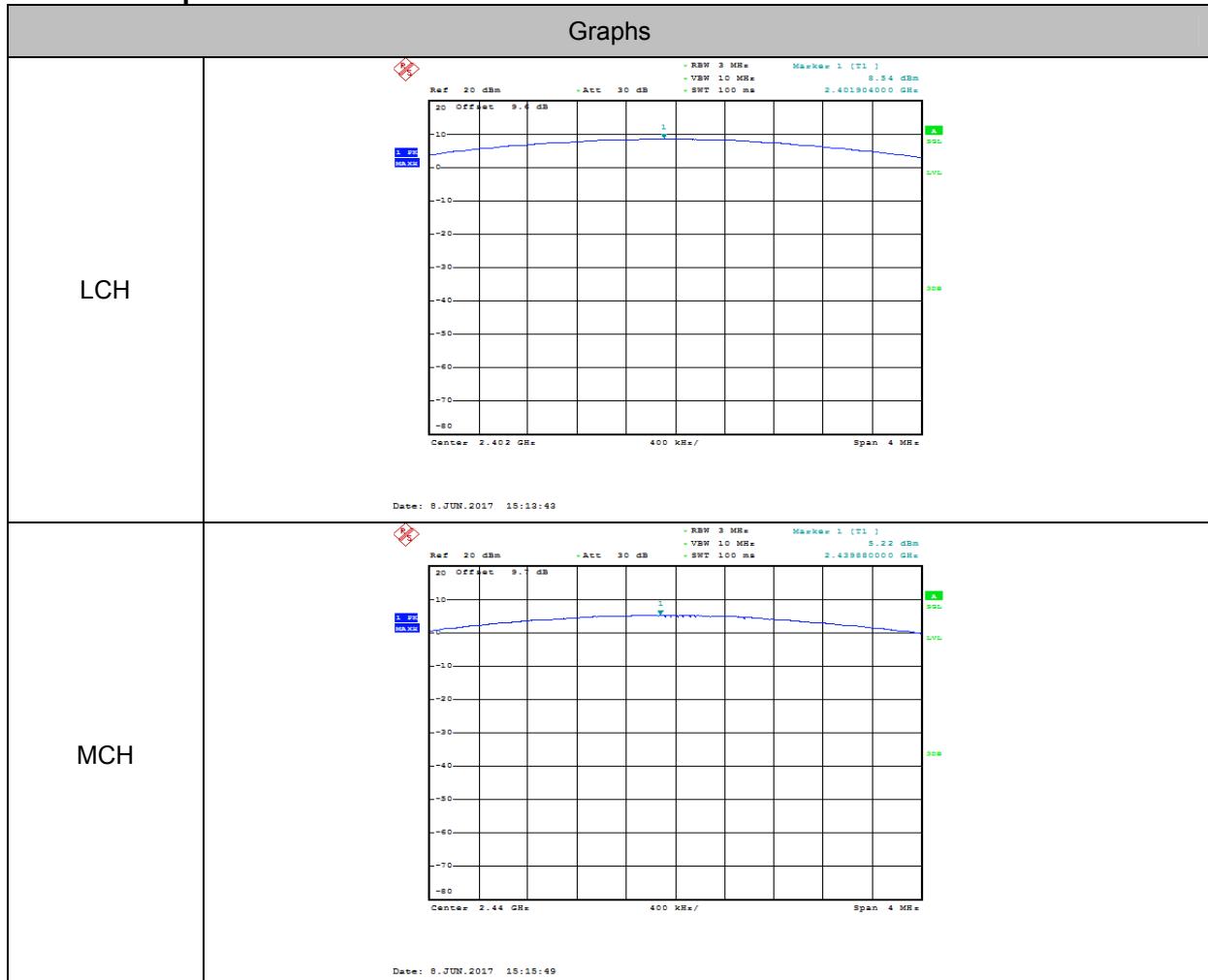
TEST CONDITIONS

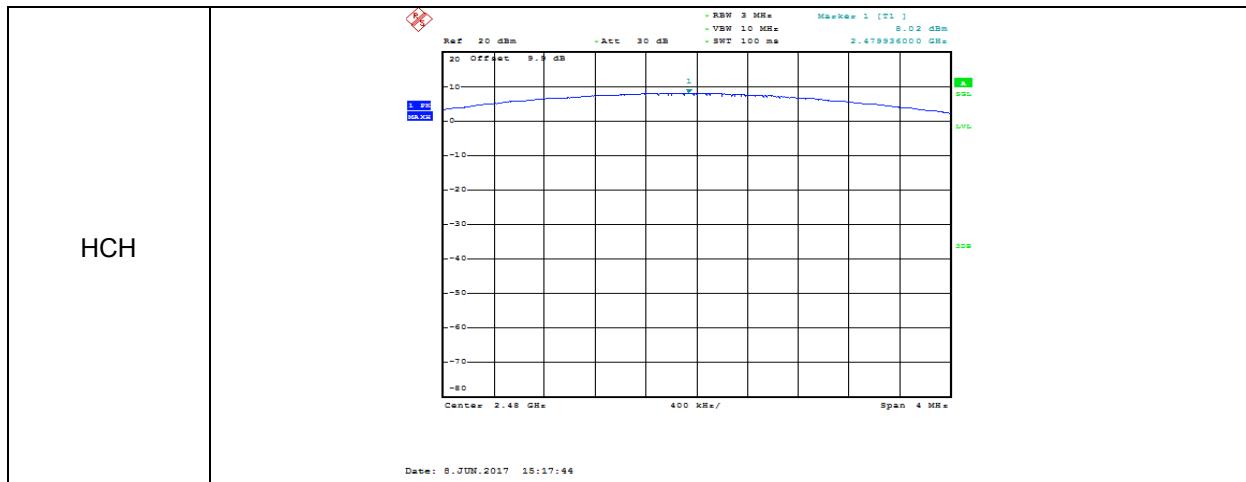
Temperature: 24.6°C
Relative Humidity: 58%
Test Voltage: AC 120V/60HZ

RESULTS

Mode	Channel	Conduct Peak Power[dBm]	Verdict
BLE	LCH	8.540	PASS
BLE	MCH	5.220	PASS
BLE	HCH	8.020	PASS

Test Graphs





7.3. POWER SPECTRAL DENSITY

LIMITS

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1			
Section	Test Item	Limit	Frequency Range (MHz)
FCC §15.247 (e) IC RSS-247 5.2 (2)	Power Spectral Density	8 dBm in any 3 kHz band	2400-2483.5

TEST PROCEDURE

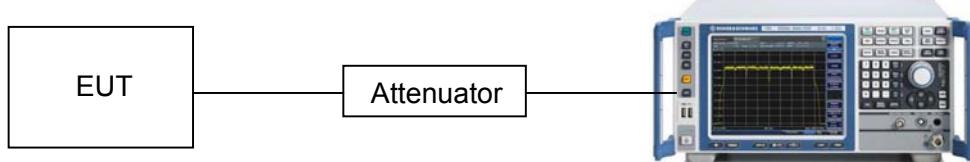
Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	3 kHz ≤ RBW 100 ≤ kHz
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST SETUP



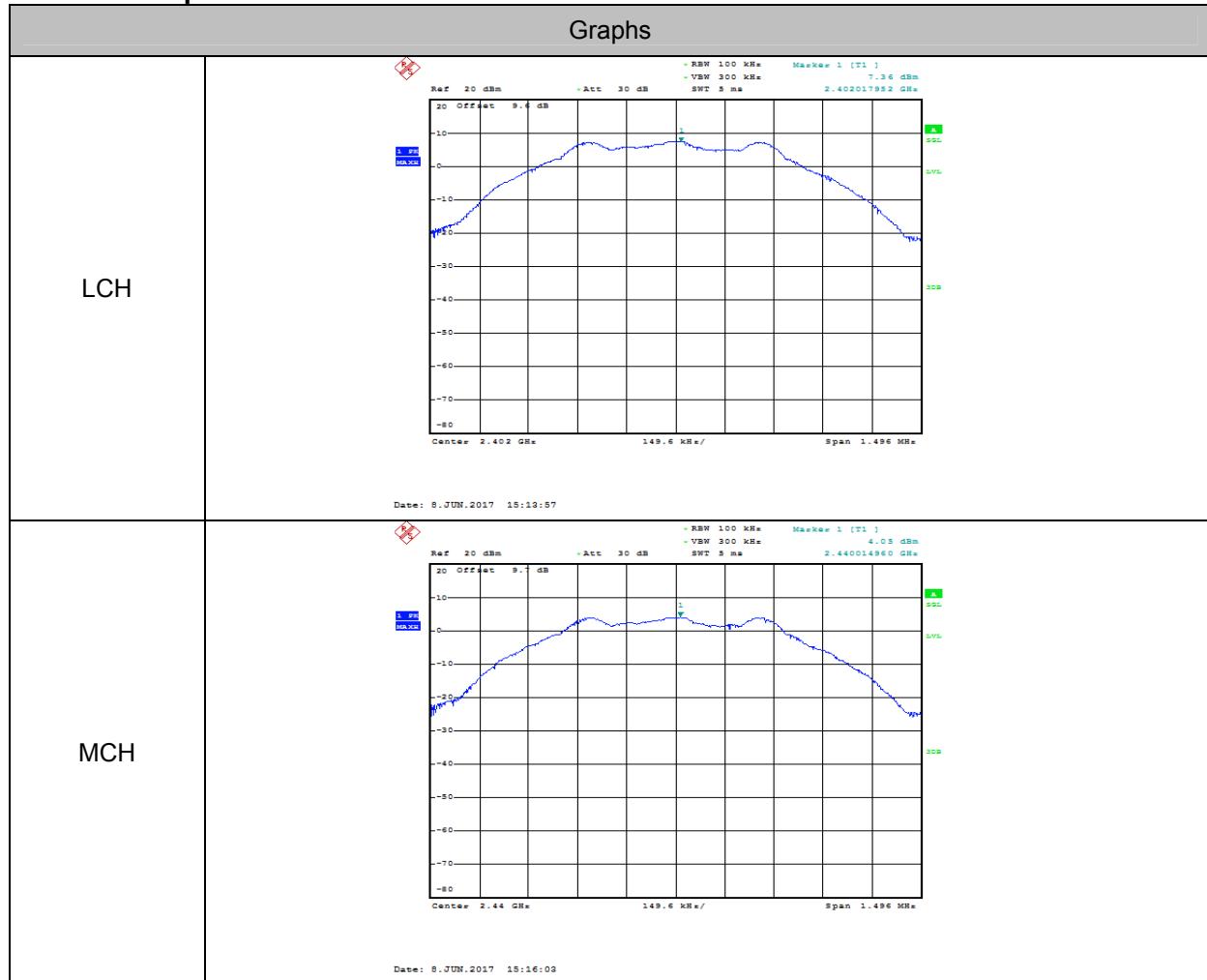
TEST CONDITIONS

Temperature: 24.6° C
Relative Humidity: 58%
Test Voltage: AC 120V/60HZ

RESULTS

Mode	Channel	PSD [dBm]	Verdict
BLE	LCH	7.360	PASS
BLE	MCH	4.050	PASS
BLE	HCH	6.720	PASS

Test Graphs





7.4. CONDUCTED BANDEDGE

LIMITS

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1		
Section	Test Item	Limit
FCC §15.247 (d) IC RSS-247 5.5	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

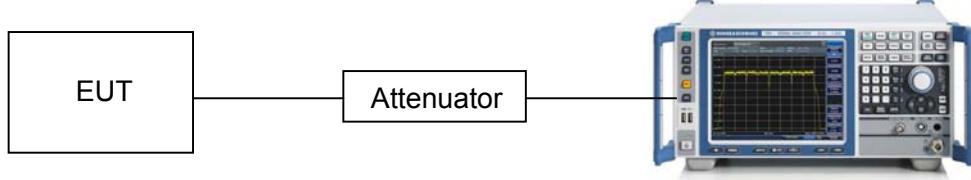
Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	100K
VBW	$\geq 3 \times$ RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum PSD level.

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100K
VBW	$\geq 3 \times$ RBW
measurement points	\geq span/RBW
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum amplitude level.

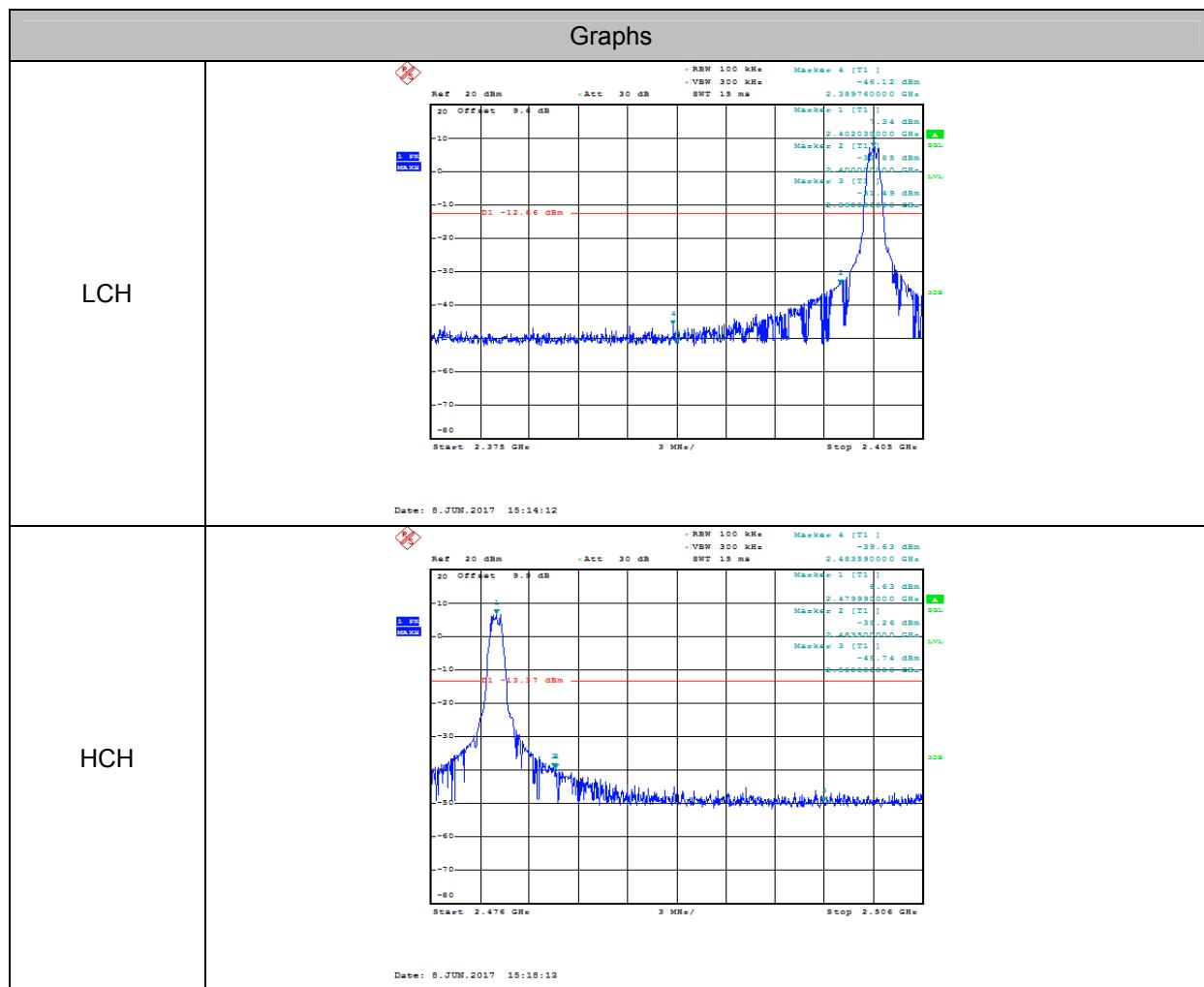
TEST SETUP



TEST CONDITIONS

Temperature: 24.6° C
Relative Humidity: 58%
Test Voltage: AC 120V/60HZ

RESULTS



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

Please refer to FCC §15.205 and §15.209

Please refer to IC RSS-GEN Clause 8.9 (Transmitter)

Radiation Disturbance Test Limit for FCC (Class B)(9KHz-1GHz)

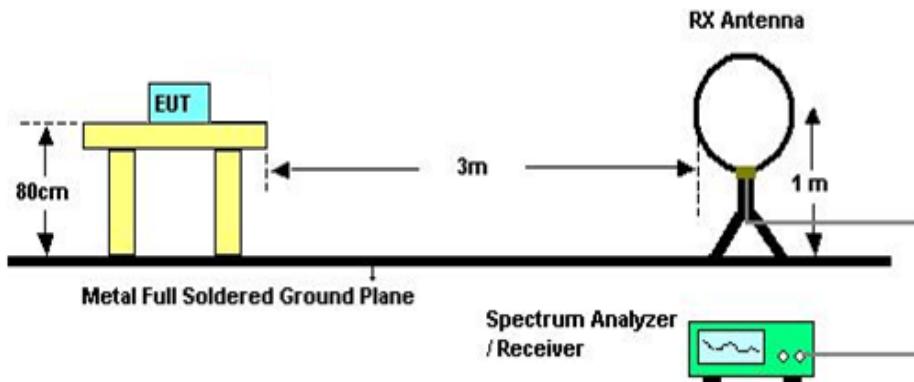
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

Radiation Disturbance Test Limit for FCC (Above 1G)

Frequency (MHz)	dB(uV/m) (at 3 meters)	
	Peak	Average
Above 1000	74	54

TEST SETUP AND PROCEDURE

Below 30MHz

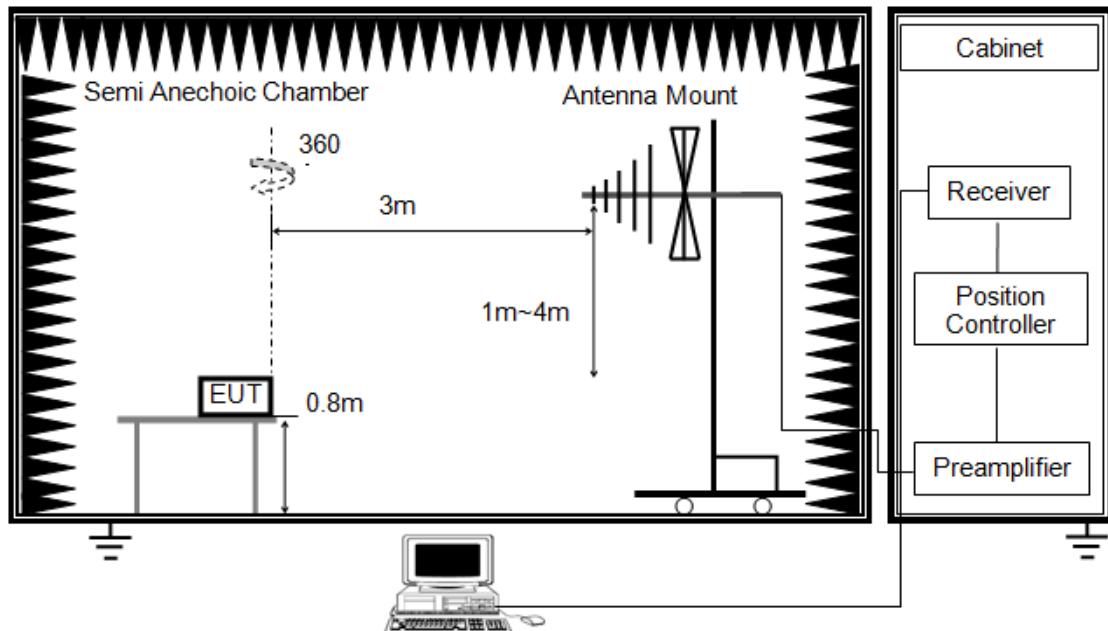


The setting of the spectrum analyser

RBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
VBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
Sweep	Auto
Detector	Peak/QP/ Average
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013
2. The EUT was arranged to its worst case and then 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. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
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, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. 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. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

Below 1G

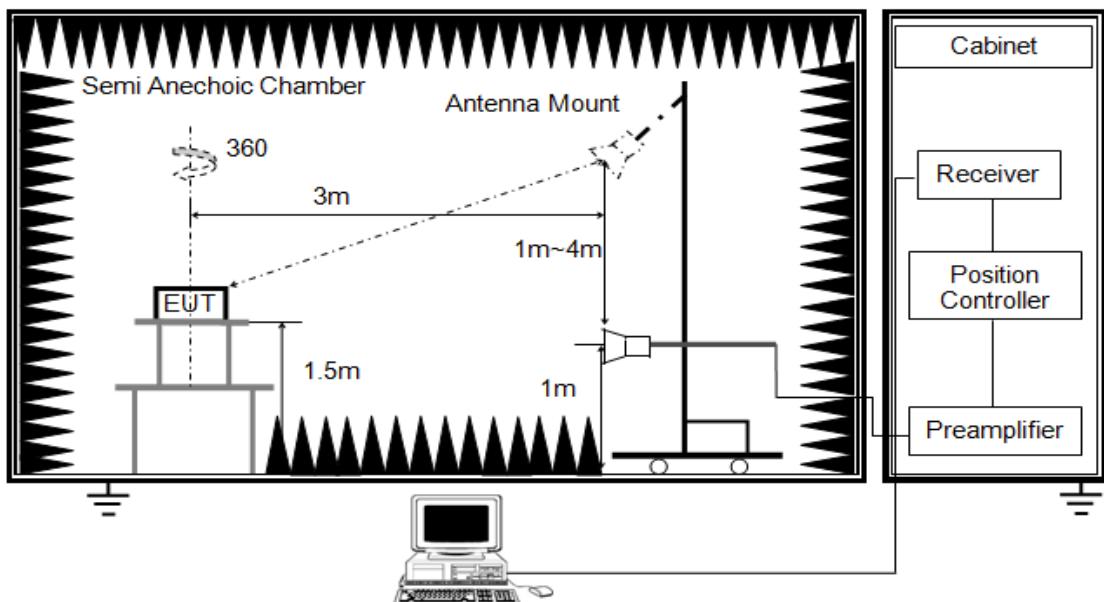


The setting of the spectrum analyser

RBW	120K
VBW	300K
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.
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. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
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, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. 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. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration)

ABOVE 1G



The setting of the spectrum analyser

RBW	1M
VBW	3M
Sweep	Auto
Detector	Peak and CISPR Average
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (1.5 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. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 1.5 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 above 1GHz, the emission measurement will be measured by the peak detector and the AV detector.
7. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration)

TEST CONDITIONS

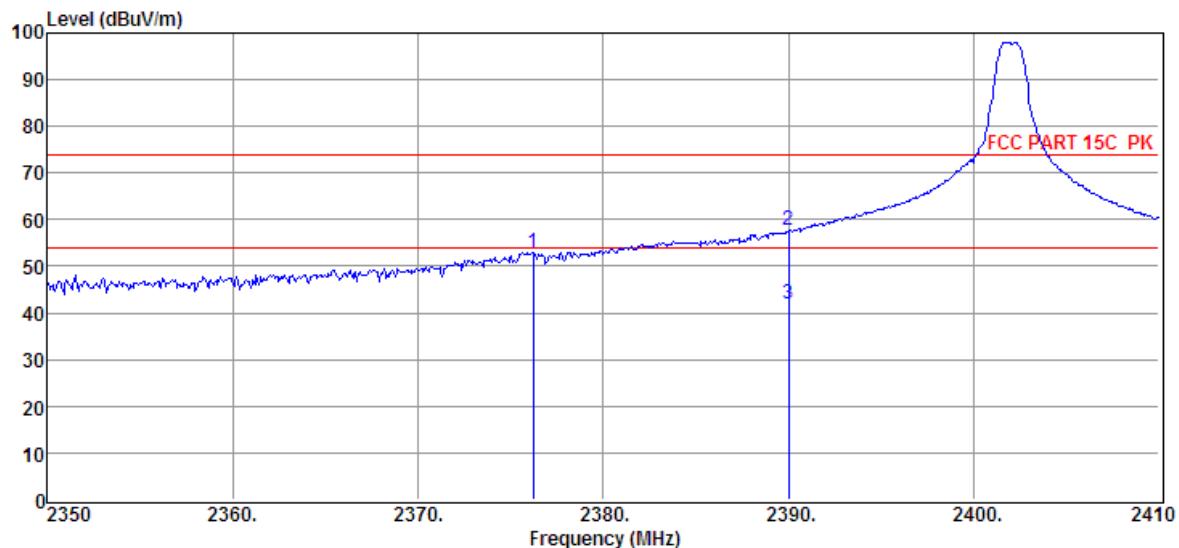
Temperature: 24.8°C

Relative Humidity: 58%

Test Voltage: AC 120V/60Hz

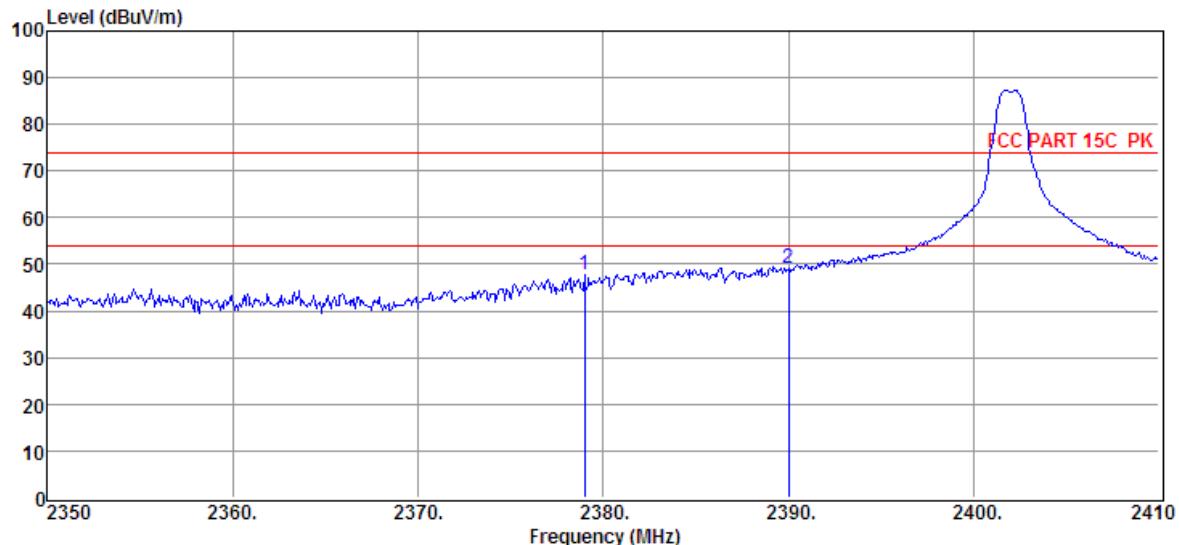
8.2. RESTRICTED BANDEdge

RESTRICTED BANDEdge (LOW CHANNEL, HORIZONTAL)



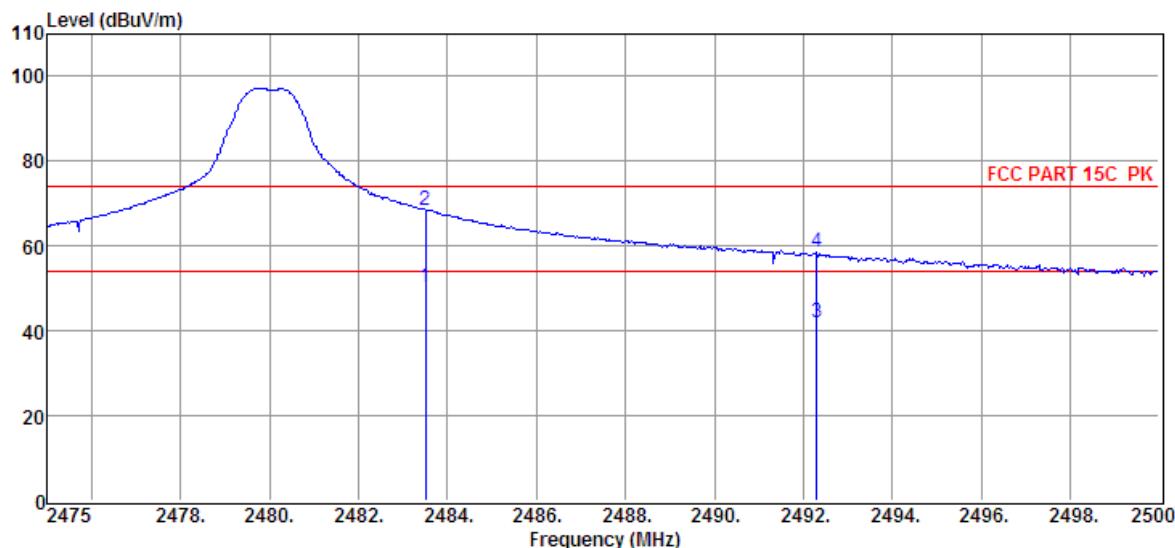
Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Facto r dB	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	2376.22	46.70	29.72	29.39	6.01	53.04	74.00	-20.96	Peak	HORIZONTAL
2	2390.00	51.32	29.78	29.42	6.03	57.71	74.00	-16.29	Peak	HORIZONTAL
3	2390.02	35.63	29.78	29.42	6.03	42.02	54.00	-11.98	Average	HORIZONTAL

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



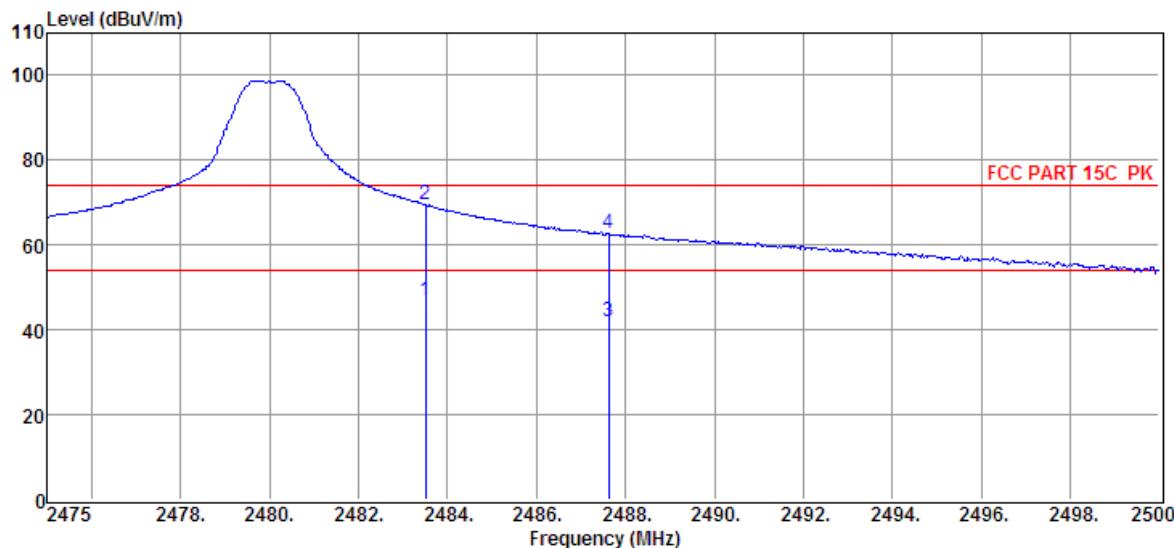
Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Facto r dB	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	2378.98	41.37	29.73	29.39	6.01	47.72	74.00	-26.28	Peak	VERTICAL
2	2390.02	42.85	29.78	29.42	6.03	49.24	74.00	-24.76	Peak	VERTICAL

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Facto r dB	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	2483.50	43.53	30.14	29.71	6.13	50.09	54.00	-3.91	Average	HORIZONTAL
2	2483.50	62.01	30.14	29.71	6.13	68.57	74.00	-5.43	Peak	HORIZONTAL
3	2492.30	35.24	30.17	29.73	6.17	41.85	54.00	-12.15	Average	HORIZONTAL
4	2492.30	51.84	30.17	29.73	6.17	58.45	74.00	-15.55	Peak	HORIZONTAL

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



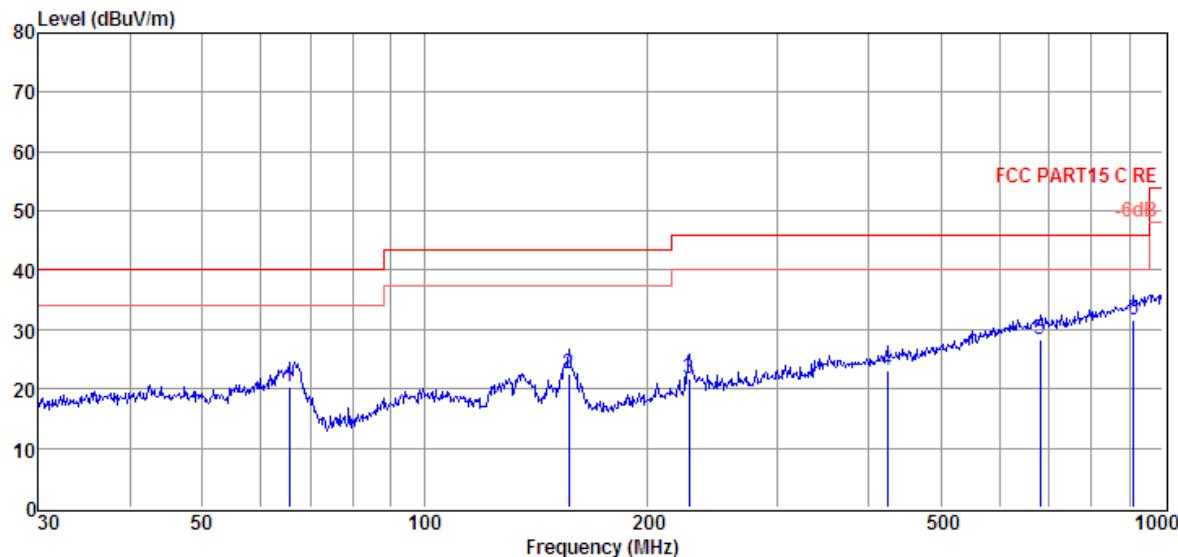
Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	PRM Facto r dB	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	2483.50	40.24	30.14	29.71	6.13	46.80	54.00	-7.20	Average	VERTICAL
2	2483.50	62.92	30.14	29.71	6.13	69.48	74.00	-4.52	Peak	VERTICAL
3	2487.63	35.47	30.15	29.71	6.13	42.04	54.00	-11.96	Average	VERTICAL
4	2487.63	56.32	30.15	29.71	6.13	62.89	74.00	-11.11	Peak	VERTICAL

Note: EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

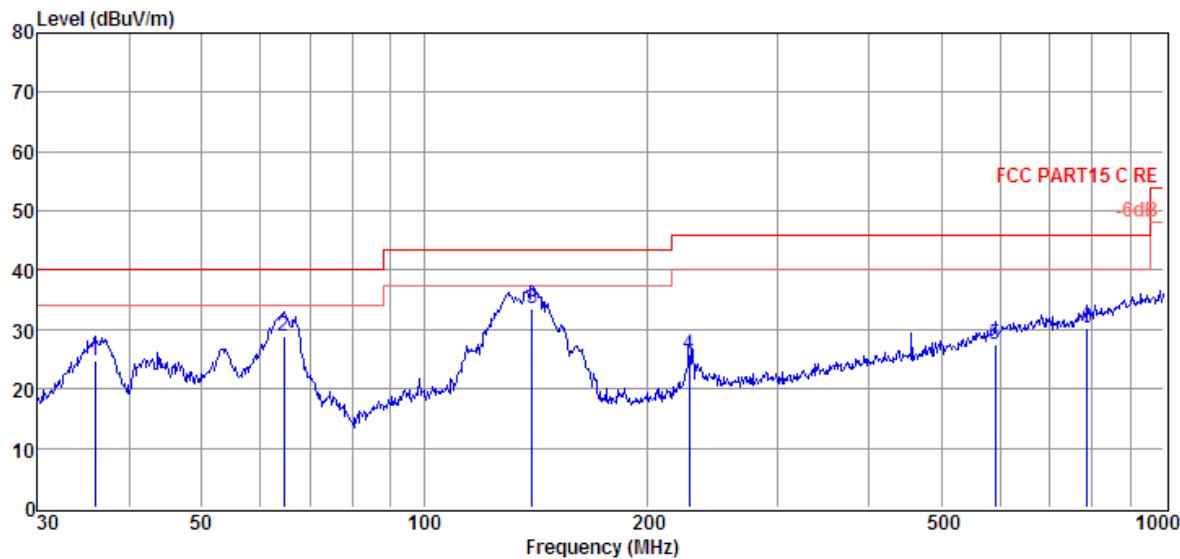
SPURIOUS EMISSIONS (1~25GHz)

Freq (MHz)	Read level (dB μ V)	Antenn a Factor (dB/m)	PRM Facto r(dB)	Cable Loss (dB)	Result Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Detector type	Polarization
GFSK Tx mode 2402MHz									
5760.00	33.93	34.86	29.21	9.43	49.01	74.00	-24.99	Peak	VERTICAL
6984.00	34.68	36.19	30.38	10.40	50.89	74.00	-23.11	Peak	VERTICAL
7936.00	34.72	36.69	31.11	11.10	51.40	74.00	-22.60	Peak	VERTICAL
8769.00	34.70	36.50	32.15	11.73	50.78	74.00	-23.22	Peak	VERTICAL
12849.00	34.06	38.65	35.61	14.66	51.76	74.00	-22.24	Peak	VERTICAL
13257.00	34.17	39.06	35.50	14.74	52.47	74.00	-21.53	Peak	VERTICAL
4791.00	40.47	33.74	29.31	8.46	53.36	74.00	-20.64	Peak	HORIZONTAL
7069.00	34.82	36.26	30.42	10.50	51.16	74.00	-22.84	Peak	HORIZONTAL
8004.00	35.03	36.69	31.13	11.13	51.72	74.00	-22.28	Peak	HORIZONTAL
9041.00	33.85	37.41	32.34	11.87	50.79	74.00	-23.21	Peak	HORIZONTAL
12696.00	34.06	38.50	35.48	14.65	51.73	74.00	-22.27	Peak	HORIZONTAL
12866.00	34.19	38.67	35.64	14.66	51.88	74.00	-22.12	Peak	HORIZONTAL
GFSK Tx mode 2440MHz									
4876.00	38.96	33.72	29.33	8.56	51.91	74.00	-22.09	Peak	VERTICAL
6865.00	34.09	36.09	30.28	10.31	50.21	74.00	-23.79	Peak	VERTICAL
7936.00	34.49	36.69	31.11	11.10	51.17	74.00	-22.83	Peak	VERTICAL
9211.00	34.18	37.03	32.42	12.05	50.84	74.00	-23.16	Peak	VERTICAL
10775.00	33.30	37.18	33.59	13.14	50.03	74.00	-23.97	Peak	VERTICAL
12866.00	34.22	38.67	35.64	14.66	51.91	74.00	-22.09	Peak	VERTICAL
4876.00	39.52	33.72	29.33	8.56	52.47	74.00	-21.53	Peak	HORIZONTAL
7171.00	34.97	36.34	30.48	10.57	51.40	74.00	-22.60	Peak	HORIZONTAL
7800.00	35.19	36.66	31.04	11.02	51.83	74.00	-22.17	Peak	HORIZONTAL
9041.00	34.69	37.41	32.34	11.87	51.63	74.00	-22.37	Peak	HORIZONTAL
11591.00	33.85	36.87	34.56	13.70	49.86	74.00	-24.14	Peak	HORIZONTAL
13444.00	34.32	39.24	35.28	14.78	53.06	74.00	-20.94	Peak	HORIZONTAL
GFSK Tx mode 2480MHz									
4960.00	30.14	33.71	29.35	8.63	43.13	54.00	-10.87	Average	VERTICAL
4960.00	42.65	33.71	29.35	8.63	55.64	74.00	-18.36	Peak	VERTICAL
7579.00	34.25	36.62	30.86	10.90	50.91	74.00	-23.09	Peak	VERTICAL
8939.00	34.77	37.24	32.26	11.79	51.54	74.00	-22.46	Peak	VERTICAL
12016.00	34.08	37.62	34.80	14.24	51.14	74.00	-22.86	Peak	VERTICAL
13070.00	35.20	38.87	35.64	14.68	53.11	74.00	-20.89	Peak	VERTICAL
4060.00	36.14	33.45	29.05	7.67	48.21	74.00	-25.79	Peak	HORIZONTAL
4961.00	38.60	33.71	29.35	8.63	51.59	74.00	-22.41	Peak	HORIZONTAL
6899.00	34.44	36.12	30.31	10.33	50.58	74.00	-23.42	Peak	HORIZONTAL
7936.00	34.59	36.69	31.11	11.10	51.27	74.00	-22.73	Peak	HORIZONTAL
11234.00	34.17	37.28	34.25	13.53	50.73	74.00	-23.27	Peak	HORIZONTAL
13376.00	34.22	39.18	35.38	14.76	52.78	74.00	-21.22	Peak	HORIZONTAL
Result: Pass									
Note1: Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.									
Note2: EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.									

SPURIOUS EMISSIONS 30M ~ 1 GHz



Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	65.57	7.09	9.26	4.03	20.38	40.00	-19.62	QP	HORIZONTAL
2	157.01	10.03	7.92	4.64	22.59	43.50	-20.91	QP	HORIZONTAL
3	228.49	5.23	11.57	5.03	21.83	46.00	-24.17	QP	HORIZONTAL
4	423.54	1.07	16.26	5.89	23.22	46.00	-22.78	QP	HORIZONTAL
5	682.35	1.77	19.88	6.77	28.42	46.00	-17.58	QP	HORIZONTAL
6	912.86	1.65	22.56	7.45	31.66	46.00	-14.34	QP	HORIZONTAL



Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	Antenna Factor (dB/m)	Cable Loss dB	Result Level (dB μ V/m)	Limit Line (dB μ V/m)	Over Limit (dB)	Detector	Polarization
1	35.88	9.14	11.98	3.74	24.86	40.00	-15.14	QP	VERTICAL
2	64.66	15.29	9.64	4.02	28.95	40.00	-11.05	QP	VERTICAL
3	139.85	21.51	7.41	4.54	33.46	43.50	-10.04	QP	VERTICAL
4	228.49	9.30	11.57	5.03	25.90	46.00	-20.10	QP	VERTICAL
5	590.97	1.79	19.12	6.48	27.39	46.00	-18.61	QP	VERTICAL
6	787.85	2.25	20.86	7.09	30.20	46.00	-15.80	QP	VERTICAL

Note: EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

8.3. SPURIOUS EMISSIONS BELOW 30M

Note 1: 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.

Note 2: EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

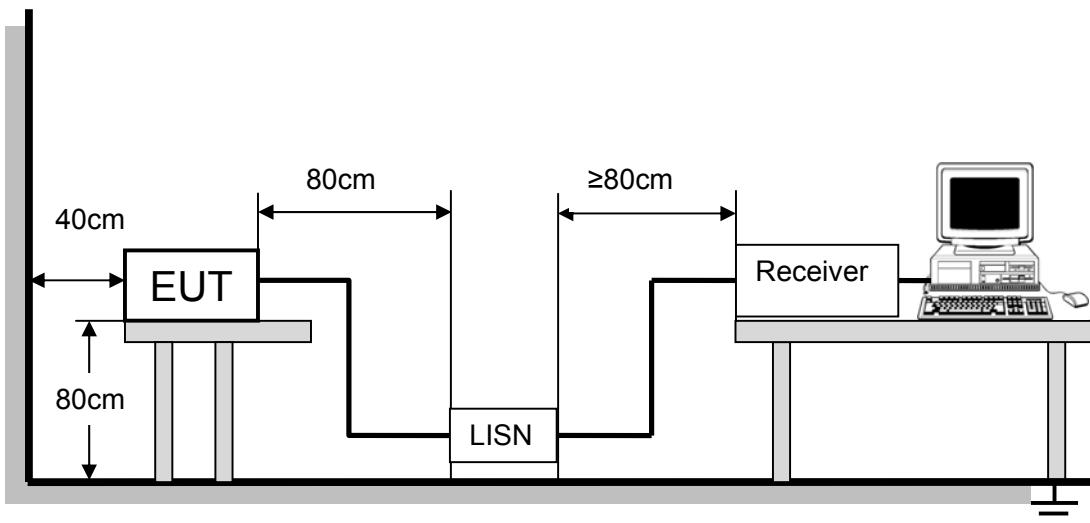
9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

Please refer to FCC §15.207 (a) and RSS-Gen Clause 8.8

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	60.00	50.00

TEST SETUP AND PROCEDURE

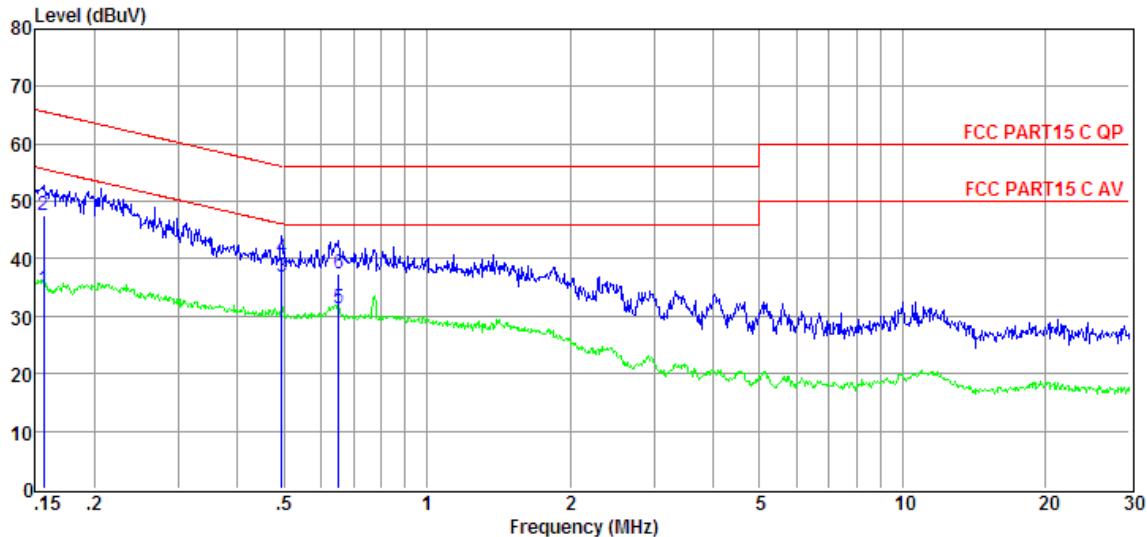


The EUT is put on a table of non-conducting material that is 80cm high. The vertical conducting wall of shielding is located 40cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 7 and 13 of ANSI C63.4-2014. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9kHz.

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

TEST RESULTS

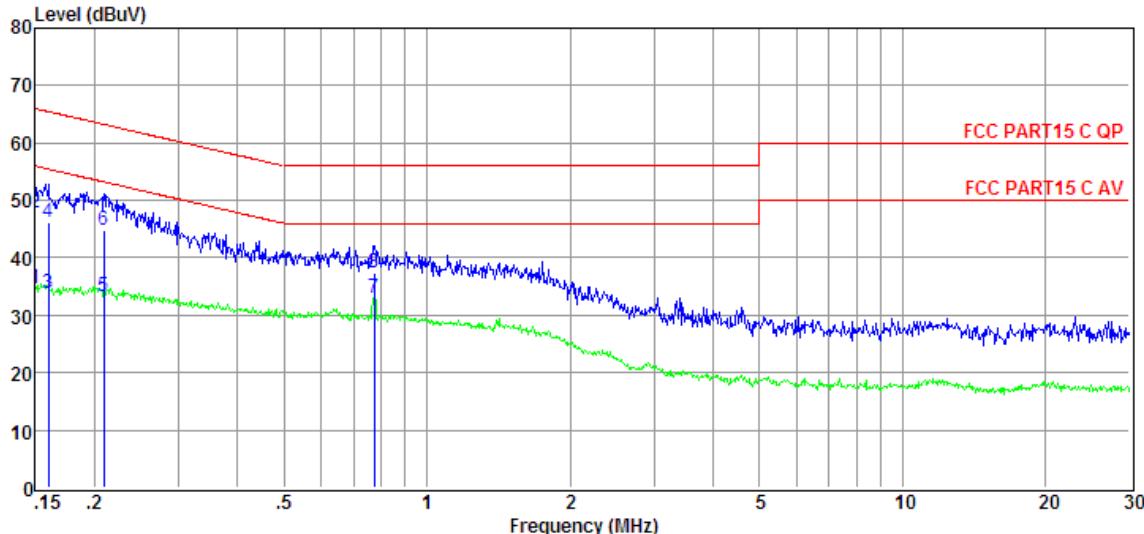
Temperature:	24.5°C	Relative Humidity:	55%
Pressure:	1012 hPa	Test Voltage:	AC 120V/60Hz
Test Mode:	Tx Mode	Phase :	L1



Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	LISN Factor (dB)	Cable Loss (dB)	Pulse Limiter Factor (dB)	Result Level (dB μ V)	Limit Line (dB μ V)	Over Limit (dB)	Detector	Phase
1	0.16	15.19	9.61	0.02	9.86	34.68	55.65	-20.97	Average	LINE
2	0.16	28.20	9.61	0.02	9.86	47.69	65.65	-17.96	QP	LINE
3	0.49	17.32	9.61	0.02	9.86	36.81	46.10	-9.29	Average	LINE
4	0.49	20.52	9.61	0.02	9.86	40.01	56.10	-16.09	QP	LINE
5	0.65	11.96	9.61	0.03	9.86	31.46	46.00	-14.54	Average	LINE
6	0.65	17.77	9.61	0.03	9.86	37.27	56.00	-18.73	QP	LINE

Note: 1. Result Level = Read Level + LISN Factor + Pulse Limiter Factor + Cable loss.
 2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
 4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

Temperature:	24.5°C	Relative Humidity:	55%
Pressure:	1012 hPa	Test Voltage:	AC 120V/60Hz
Test Mode:	Tx Mode	Phase :	N



Item (Mark)	Freq. (MHz)	Read Level (dB μ V)	LISN Factor (dB)	Cable Loss (dB)	Pulse Limiter Factor (dB)	Result Level (dB μ V)	Limit Line (dB μ V)	Over Limit (dB)	Detector	Phase
1	0.15	15.05	9.61	0.02	9.86	34.54	56.00	-21.46	Average	NEUTRAL
2	0.15	28.43	9.61	0.02	9.86	47.92	66.00	-18.08	QP	NEUTRAL
3	0.16	14.39	9.61	0.02	9.86	33.88	55.47	-21.59	Average	NEUTRAL
4	0.16	26.76	9.61	0.02	9.86	46.25	65.47	-19.22	QP	NEUTRAL
5	0.21	13.73	9.61	0.02	9.86	33.22	53.23	-20.01	Average	NEUTRAL
6	0.21	25.23	9.61	0.02	9.86	44.72	63.23	-18.51	QP	NEUTRAL
7	0.78	13.60	9.61	0.03	9.86	33.10	46.00	-12.90	Average	NEUTRAL
8	0.78	17.97	9.61	0.03	9.86	37.47	56.00	-18.53	QP	NEUTRAL

Note: 1. Result Level = Read Level +LISN Factor + Pulse Limiter Factor + Cable loss.
 2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
 4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

10. ANTENNA REQUIREMENTS

APPLICABLE REQUIREMENTS

Please refer to FCC §15.203

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. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. 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.

ANTENNA CONNECTOR

EUT has a PCB antenna without antenna connector.

ANTENNA GAIN

The antenna gain of EUT is less than 6 dBi.

END OF REPORT