CNAS L1659

RF TEST REPORT

Report No.:	SET2013-02642
Product Name:	3D Bluetooth Glasses
FCC ID:	A4GESG808
Model No. :	ESG808, GX33AB
Brand Name:	N.A
Applicant:	ESTAR DISPLAY TECHCO.,LTD
Address:	16F Hall A, GDC Building, 9 Gaoxin Central Avenue 3rd, Nanshan District, Shenzhen, China
Issued by:	CCIC-SET
Lab Location:	Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen, 518055, P. R. China
	Tel: 86 755 26627338 **Fax:** 86 755 26627238

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Test Report

Product Name ..... :	3D Bluetooth Glasses
Model No. ..... :	ESG808, GX33AB
Trade Name ..... :	N.A
Brand Name..... :	N.A
Applicant ..... :	ESTAR DISPLAY TECHCO.,LTD
Applicant Address ..... :	16F Hall A, GDC Building, 9 Gaoxin Central Avenue 3rd, Nanshan District, Shenzhen, China
Manufacturer..... :	ESTAR DISPLAY TECHCO.,LTD
Manufacturer Address..... :	16F Hall A, GDC Building, 9 Gaoxin Central Avenue 3rd, Nanshan District, Shenzhen, China
Test Standards ..... :	47 CFR Part 15 Subpart C: Radio Frequency Devices ANSI C63.10:2009: American National Standard for Testing Unlicensed Wireless Devices DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
Test Result..... :	PASS
Tested by ..... :	Mo Huina June 24, 2013 Mo Huina, Test Engineer
Reviewed by..... :	Shuangwen Zhang June 24. 2013 Shuangwen Zhang, Senior Egineer
Approved by..... :	June. 24. 2013. Wu Li'an, Manager

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Change History		
Issue	Date	Reason for change
1.0	June 24, 2013	First edition

1. General Information

1.1. EUT Description

EUT Type ..... :	3D Bluetooth Glasses
Serial No..... :	(n.a, marked #1 by test site)
Hardware Version ..... :	N.A
Software Version ..... :	N.A
Applicant ..... :	ESTAR DISPLAY TECHCO.,LTD 16F Hall A, GDC Building, 9 Gaoxin Central Avenue 3rd, Nanshan District, Shenzhen, China
Manufacturer ..... :	ESTAR DISPLAY TECHCO.,LTD 16F Hall A, GDC Building, 9 Gaoxin Central Avenue 3rd, Nanshan District, Shenzhen, China
Frequency Range..... :	The frequency range used is 2402MHz - 2480MHz (79 channels, at intervals of 1MHz); The frequency block is 2400MHz to 2483.5MHz.
Modulation Type ..... :	Bluetooth: FHSS (GFSK)
Antenna Type..... :	PCB Antenna
Antenna Gain..... :	1.87dBi

Note 1: The EUT is a 3D Bluetooth Glasses, it contains Bluetooth Module operating at 2.4GHz ISM band; the frequencies allocated for the Bluetooth Module is F(MHz)=2402+1*n (0<=n<=78). The lowest, middle, highest channel numbers of the Bluetooth Module used and tested in this report are separately 0 (2402MHz), 39 (2441MHz) and 78 (2480MHz).

Note 2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 3: a. When power on, the EUT will scan the whole frequency until a Connection command from the other BT devices.

b. When receiving the signal from the other BT devices, The EUT transmit aresponse signal.

c. The other devices receive the response signal and recognize it, then send a connection command to establish the connection.

d. After the connection establish successfully, the data transmission is beginning. At the same time, the both devices will shift frequencies in synchronization per a same pseudo randomly ordered list of hopping frequencies, the hopping rate is1600 times per second. This device conforms to the criteria in FCC Public Notice DA 00-705.

e. The bandwidth of the receiver, which is set to a fixed width by the software.

Note 4: Bluetooth signal has 9 packages DH1, DH3, DH5, DH5 package is largest, we are testing DH5 in the document.

Note5: The antenna of EUT is designed with permanent attachment and no consideration of replacement, it is printed on the circuit board with a maximum gain of 1.87dBi, and it is used to radiate the RF emissions

1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (Bluetooth, 2.4GHz ISM band radiators) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 (10-1-09 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section in CFR 47	Description	Result
1	15.203	Antenna Requirement	PASS
2	15.247(a)	Number of Hopping Frequency	PASS
3	15.247(b)	Peak Output Power	PASS
4	15.247(a)	20dB Bandwidth	PASS
5	15.247(a)	Carrier Frequency Separation	PASS
6	15.247(a)	Time of Occupancy (Dwell time)	PASS
7	15.247(d)	Conducted Spurious Emission	PASS
8	15.247(d)	Band Edge	PASS
9	15.207	Conducted Emission	PASS
10	15.209 15.247(c)	Radiated Emission	PASS

Note 1: The tests were performed according to the method of measurements prescribed in DA-00-705.

Note 2: The test of Radiated Emission and Conducted Spurious Emission were performed according to the method of measurements prescribed in ANSI C63.4 2009.

1.3. Facilities and Accreditations

1.3.1. Facilities

CNAS-Lab Code: L1659

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. CCIC is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659. A 12.8*6.8*6.4 (m) fully anechoic chamber was used for the radiated spurious emissions test.

FCC-Registration No.: 406086

CCIC Southern Electronic Product Testing (Shenzhen) 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 406086, Renewal date Nov. 19, 2011, valid time is until Nov. 18, 2014.

1.3.2. Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86KPa-106KPa

2. 47 CFR Part 15C Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 provisions of this section.

2.1.2. **Result:** Compliant

The antennas used for this product is PCB Antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 1.87dBi.

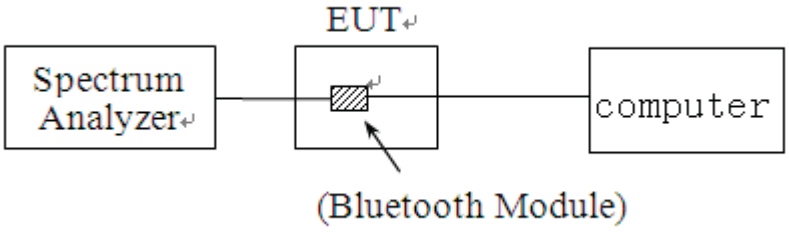
2.2. Number of Hopping Frequency

2.2.1. Requirement

According to FCC §15.247(a)(1)(iii), frequency hopping systems operating in the 2400MHz to 2483.5MHz bands shall use at least 15 hopping frequencies.

2.2.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2013.06.10

The Cal. Interval was one year.

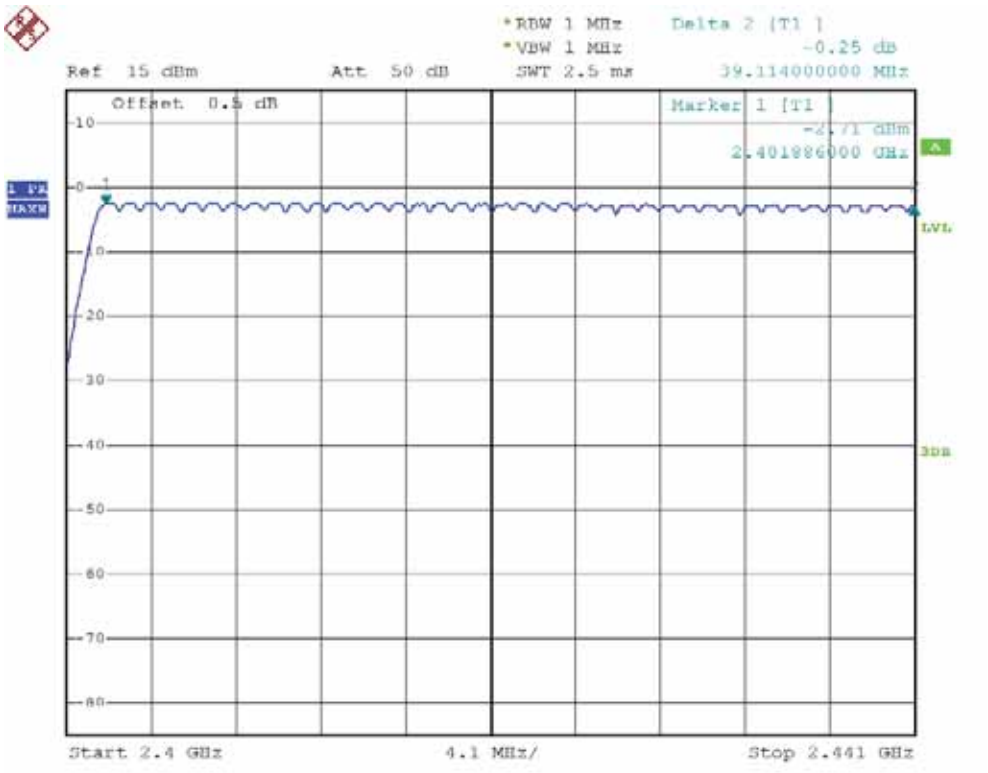
2.2.3. Test Result

The Bluetooth Module operates at hopping-on test mode; the frequencies number employed is counted to verify the Module's using the number of hopping frequency.

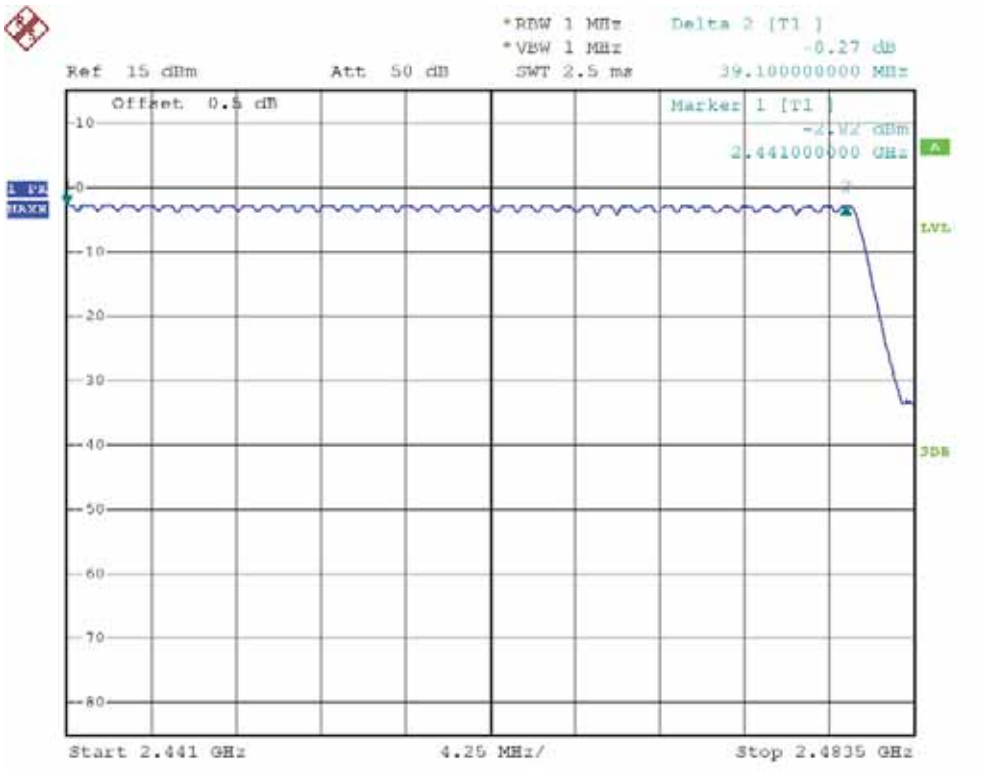
A. Test Verdict:

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Refer to Plot	Verdict
GFSK	2400 - 2483.5	79	15	Plot A/ Plot B	PASS

B. Test Plots:



(Plot A)


*RBW 1 MHz
*VBW 1 MHz
SWT 2.5 ms
Delta 2 [T1]
-0.27 dB
39.100000000 MHz
Ref 15 dBm
Att 50 dB
Offset 0.5 dB
Marker 1 [T1]
2.441000000 GHz
1 PK
MAXH
A
LVL
3DB
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Start 2.441 GHz
4.25 MHz/
Stop 2.4835 GHz

(Plot B)

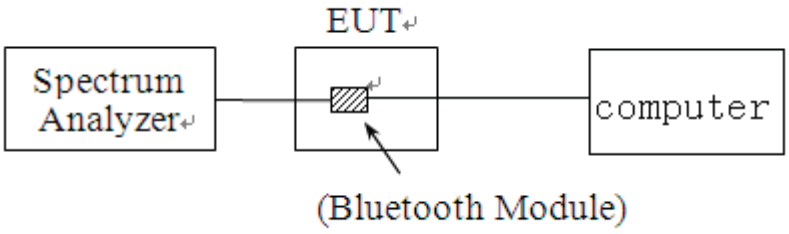
2.3. Peak Output Power

2.3.1. Requirement

According to FCC §15.247(b)(1), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt. For all other frequency hopping systems in the 2400MHz to 2483.5MHz band, it is 0.125Watts.

2.3.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2013.06.10

The Cal. Interval was one year.

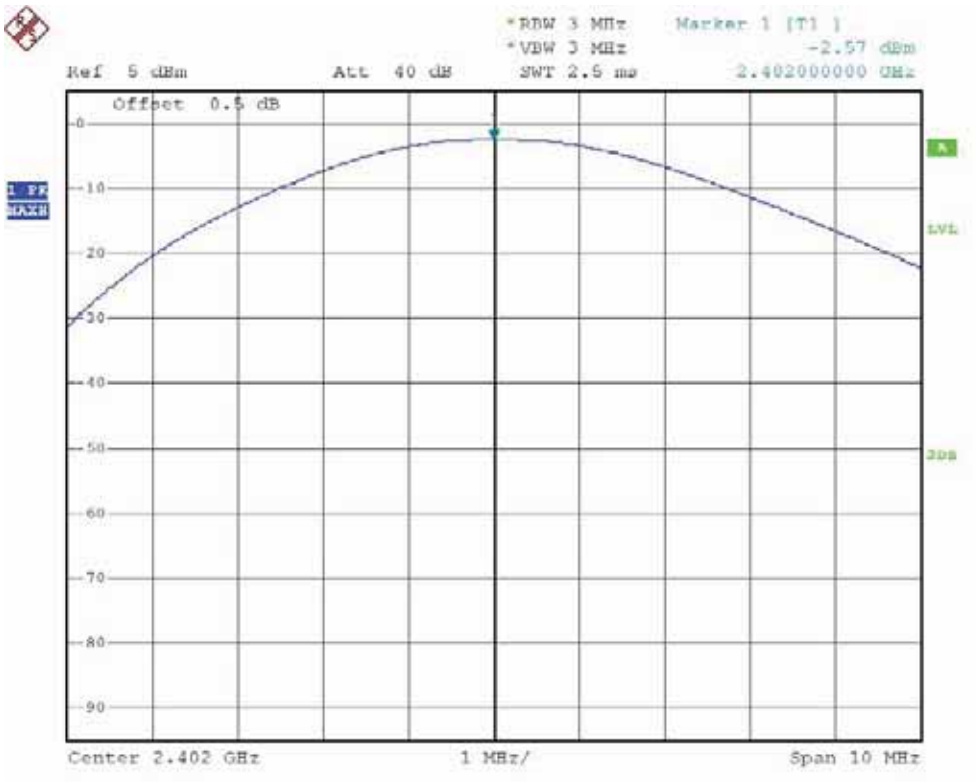
2.3.3. Test Result

The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module. The lowest, middle and highest channel were tested by Spectrum Analyzer.

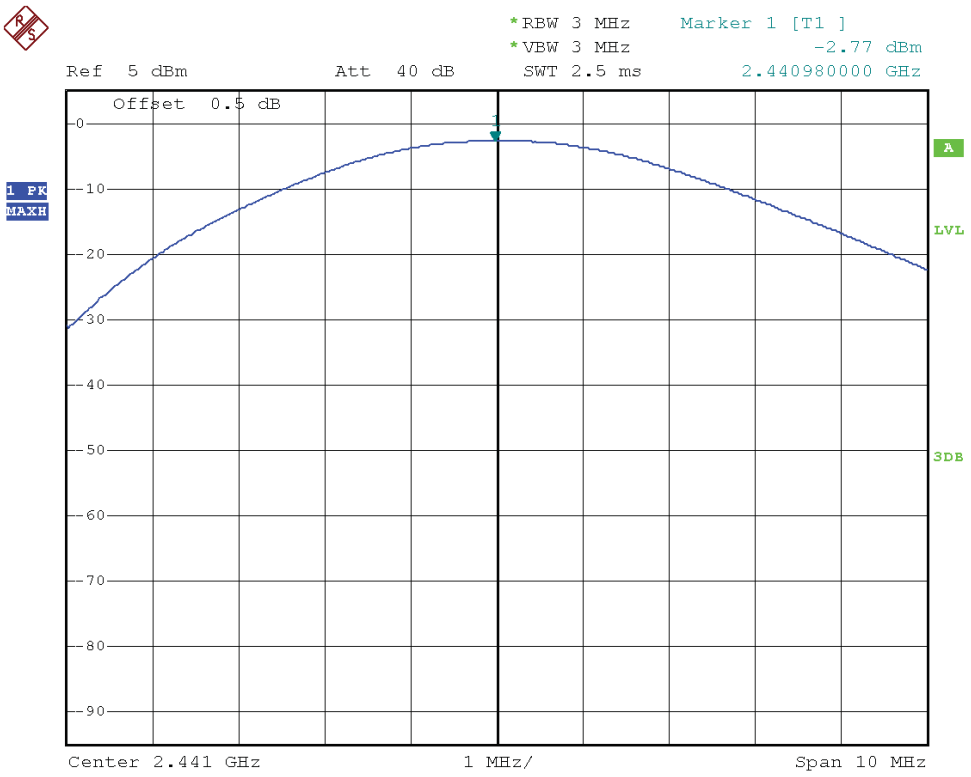
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict	Refer to Plot
		dBm	W	dBm	W		
0	2402	-2.57	0.000553	30	1	PASS	Plot A
39	2441	-2.77	0.000528			PASS	Plot B
78	2480	-3.03	0.000498			PASS	Plot C

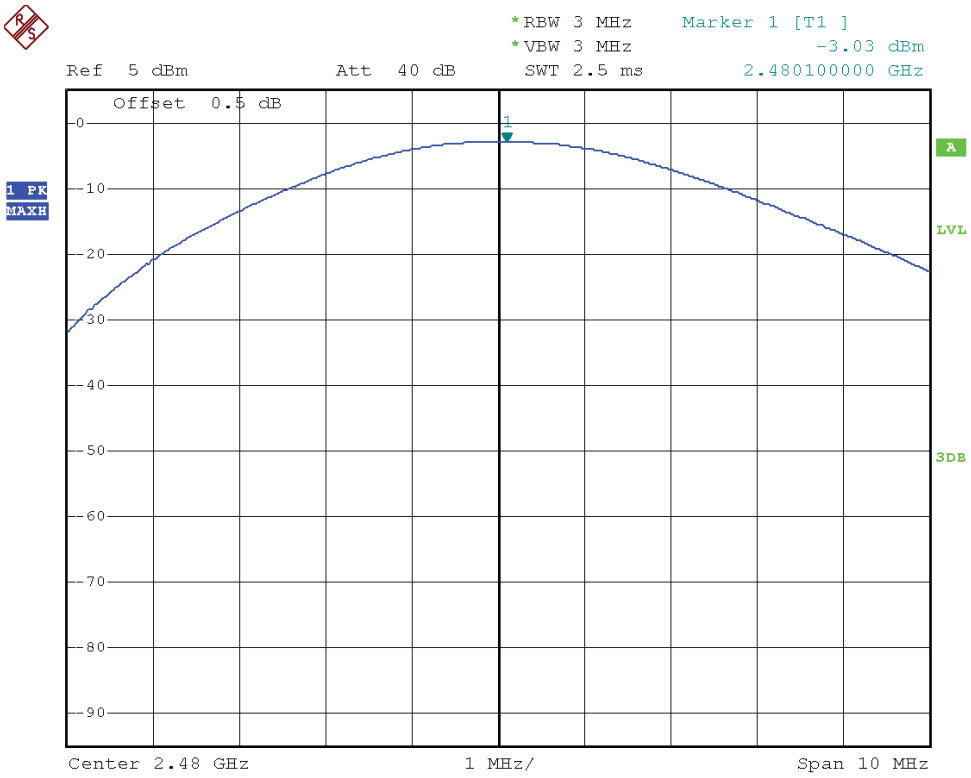
B. Test Plots::



(Plot A)


*RBW 3 MHz
Marker 1 [T1]
*VBW 3 MHz
-2.77 dBm
Ref 5 dBm
Att 40 dB
SWT 2.5 ms
2.440980000 GHz
Offset 0.5 dB
1 PK
MAXH
A
LVL
3DB
Center 2.441 GHz
1 MHz/
Span 10 MHz

(Plot B)


*RBW 3 MHz
Marker 1 [T1]
*VBW 3 MHz
-3.03 dBm
Ref 5 dBm
Att 40 dB
SWT 2.5 ms
2.480100000 GHz
Offset 0.5 dB
1 PK
MAXH
A
LVL
3DB
Center 2.48 GHz
1 MHz/
Span 10 MHz

(Plot C)

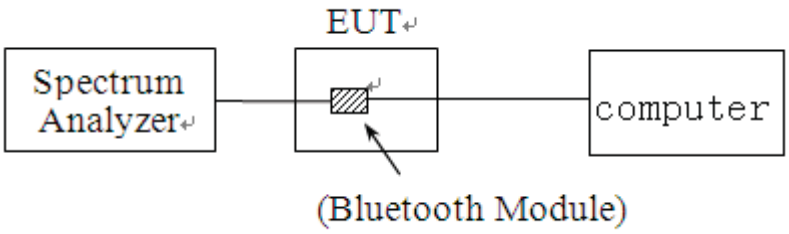
2.4. 20dB Bandwidth

2.4.1. Definition

According to FCC §15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

2.4.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2013.06.10

The Cal. Interval was one year.

2.4.1. Test Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW ≥ 1% of the 20 dB bandwidth

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

2.4.2. Test Result

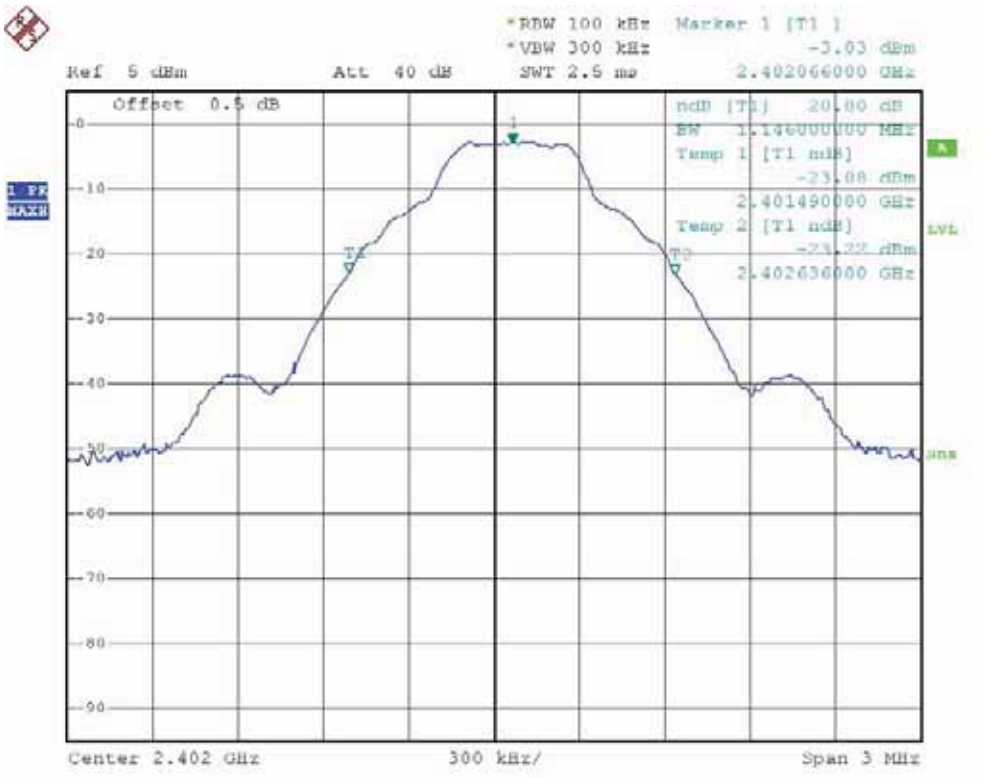
The Bluetooth Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

A. Test Verdict:

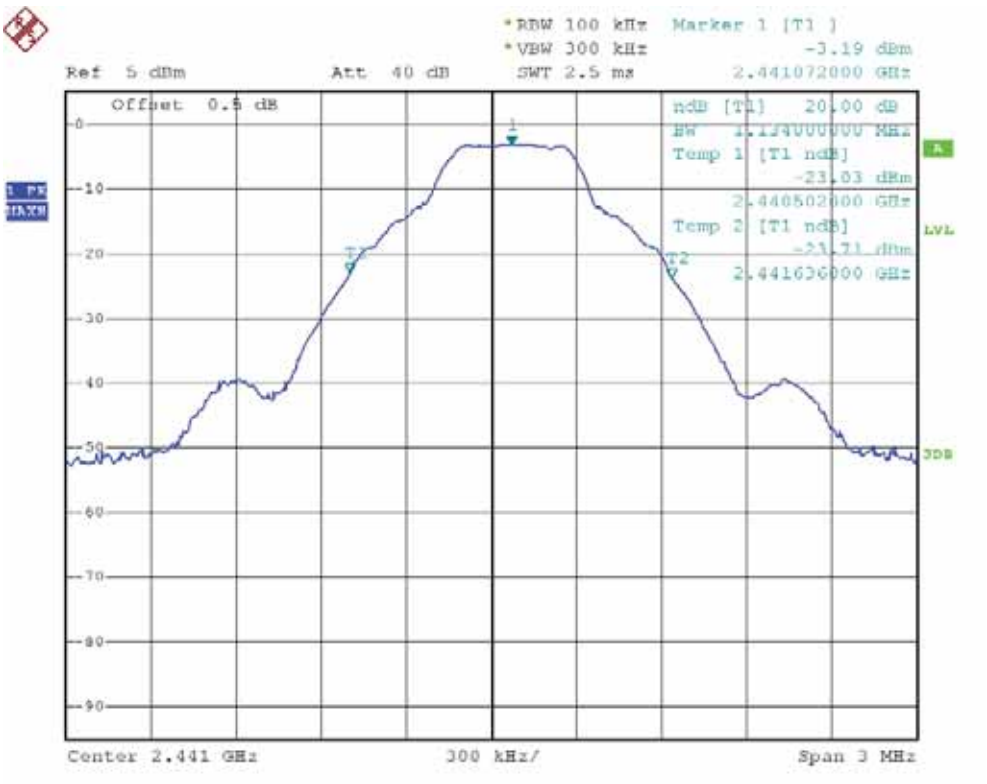
The maximum 20dB bandwidth measured is 1.120MHz according to the table below.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
0	2402	1.146	Plot A
39	2441	1.134	Plot B
78	2480	1.134	Plot C

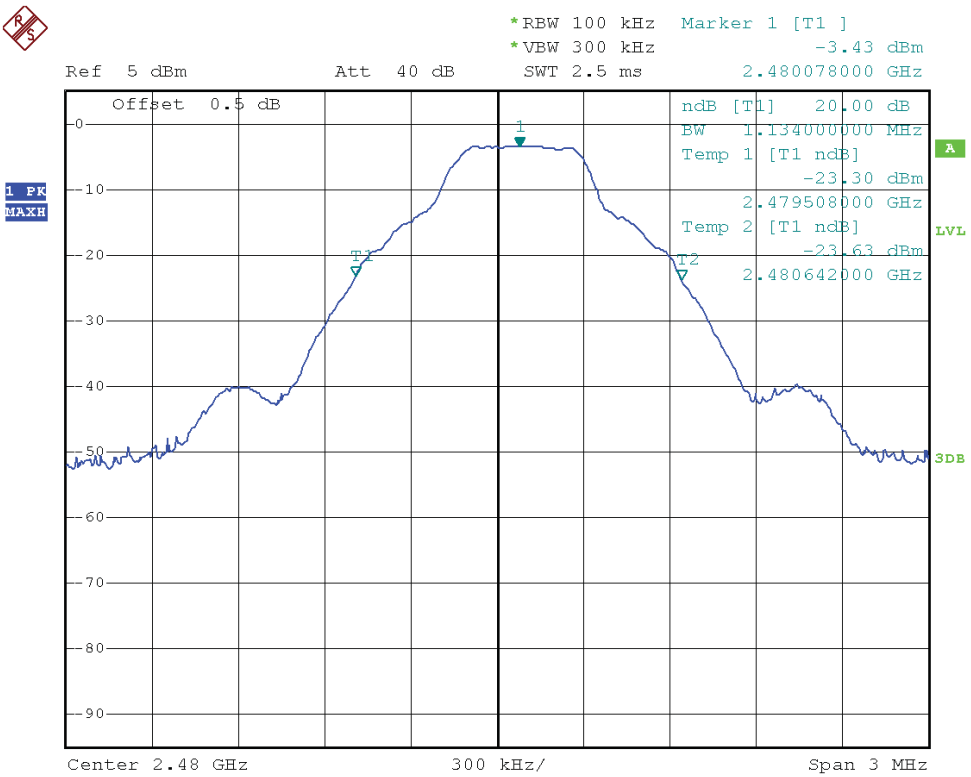
B. Test Plots:



(Plot A: Channel = 2402)



(Plot B: Channel = 2441)



(Plot C: Channel = 2480)

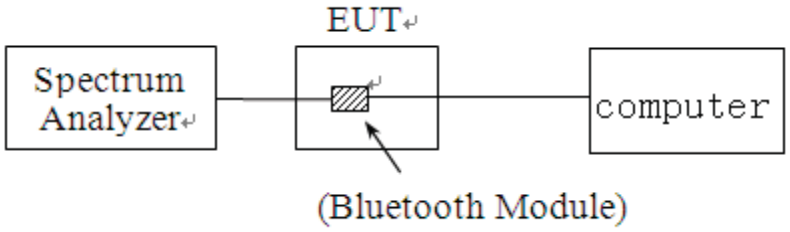
2.5. Carried Frequency Separation

2.5.1. Definition

According to FCC §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

2.5.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2013.06.10

The Cal. Interval was one year.

2.5.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span

Video (or Average) Bandwidth (VBW) ≥ RBW

Sweep = auto

Detector function = peak

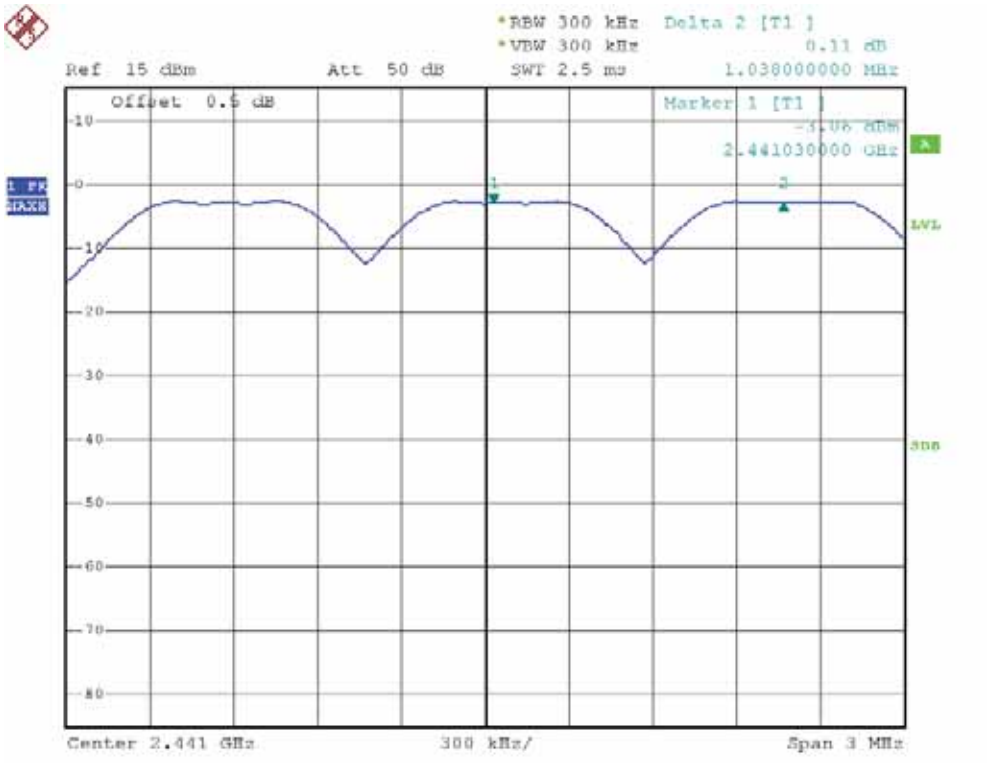
Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

2.5.4. Test Result

The Bluetooth Module operates at hopping-on test mode.

1. For any adjacent channels (e.g. the channel 39 and 40 as showed in the Plot A), the Module does have hopping channel carrier frequencies separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel (1.146MHz for GFSK mode, refer to section 2.4.2), whichever is greater. So, the verdict is PASSING



(Plot A)

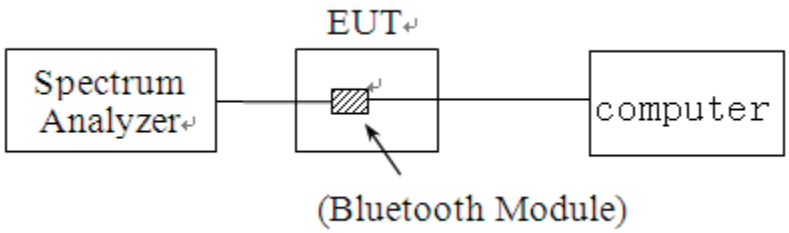
2.6. Time of Occupancy (Dwell time)

2.6.1. Requirement

According to FCC §15.247(a) (1) (iii), frequency hopping systems in the 2400 - 2483.5MHz band shall use at least 15 non-overlapping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

2.6.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2013.06.10

The Cal. Interval was one year.

2.6.3. Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW = 1 MHz

VBW ≥ RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

2.6.4. Test Result

The average time of occupancy on any channel within the Period can be calculated with formulas (for DH5 package type):

{Total of Dwell} = {Pulse Time} * (1600 / 6) / {Number of Hopping Frequency} * {Period}
{Period} = 0.4s * {Number of Hopping Frequency}

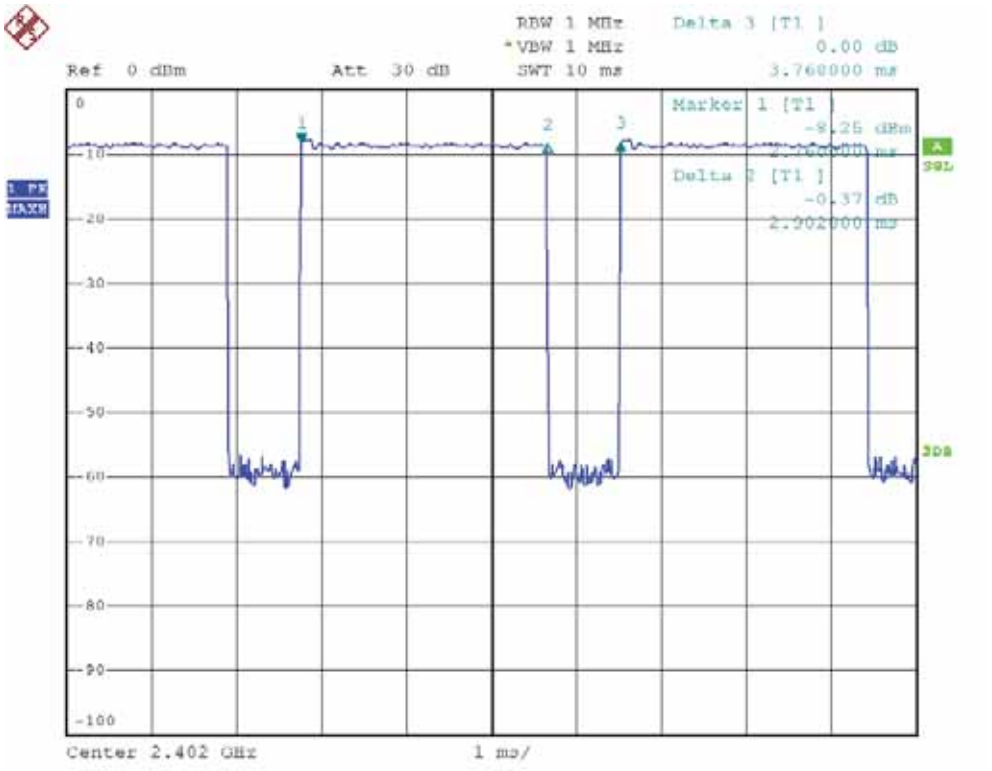
The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

A. Test Verdict:

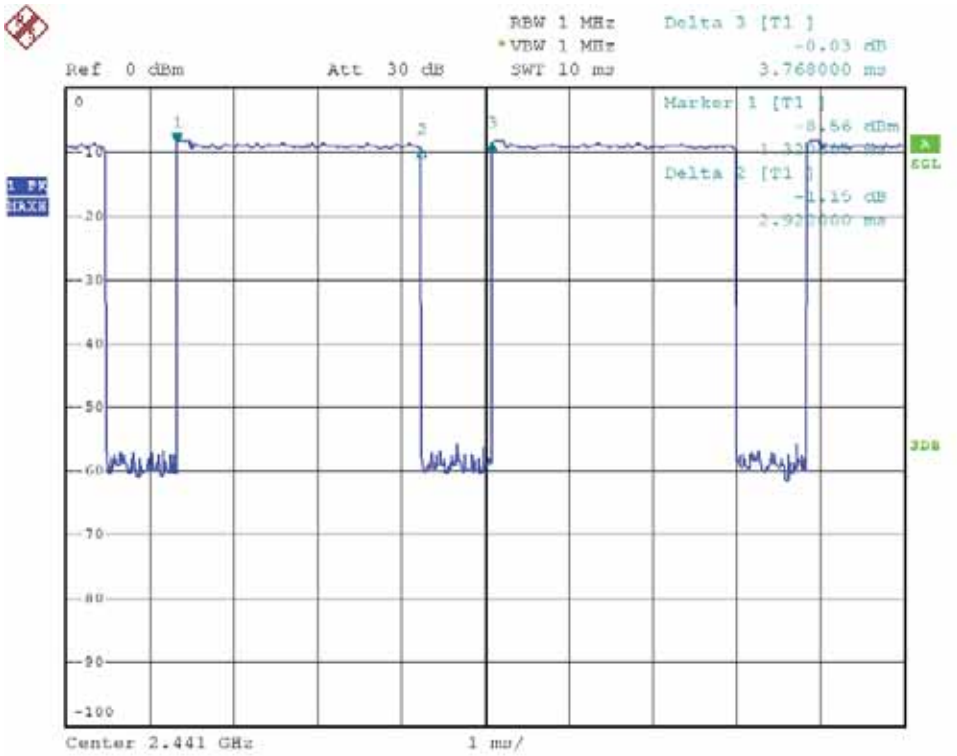
Channel	Frequency (MHz)	Pulse Time		Total of Dwell (ms)	Limit (ms)	Verdict
		ms	Refer to Plot			
0	2402	2.902	Plot A	309.5476	400	PASS
39	2441	2.922	Plot B	311.681		PASS
78	2480	2.912	Plot C	310.6143		PASS

Test Plots:

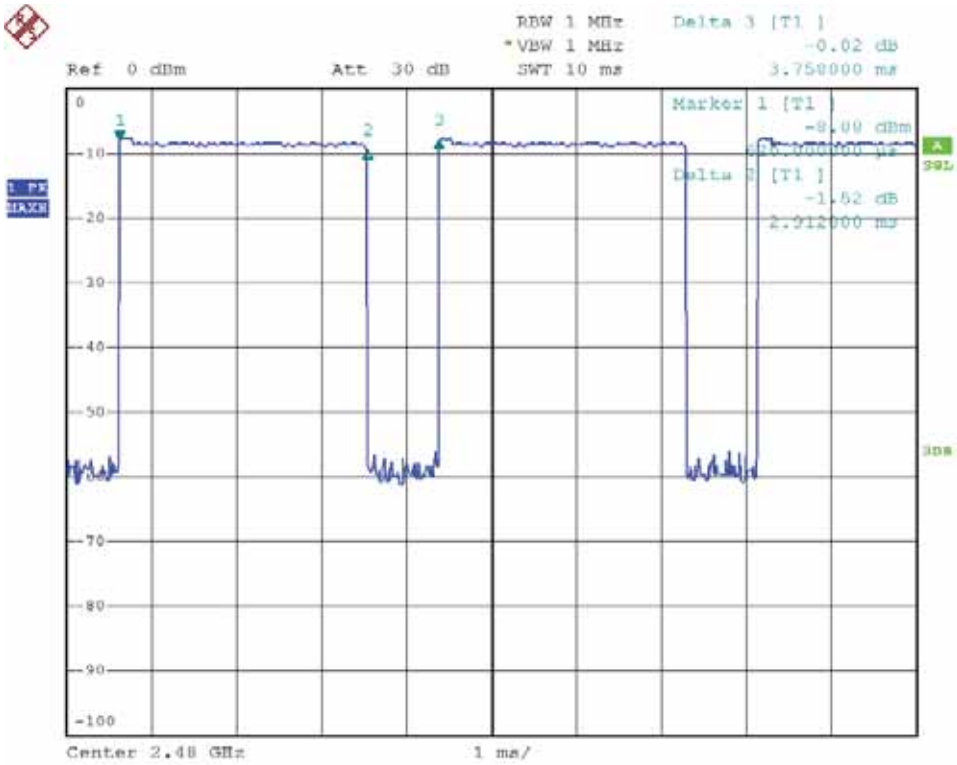
Note: the following plots record the Pulse Time of the Module carrier.



(Plot A: Channel = 2402)



(Plot B: Channel = 2441)



(Plot C: Channel = 2480)

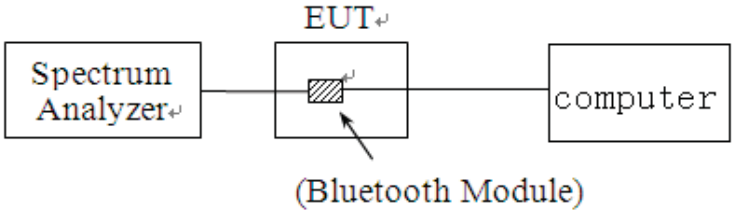
2.7. Conducted Spurious Emissions

2.7.1. Requirement

According to FCC §15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.7.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT, which is powered by the Battery, is connected to the Spectrum Analyzer (SA), the path loss as the factor is calibrated to correct the reading. During the measurement, the Bluetooth Module of the EUT is activated and controlled by the PC, and is set to operate under test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSP40	1164.4391.40	2013.06.10

The Cal. Interval was one year.

2.7.3. Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

2.7.4. Test Result

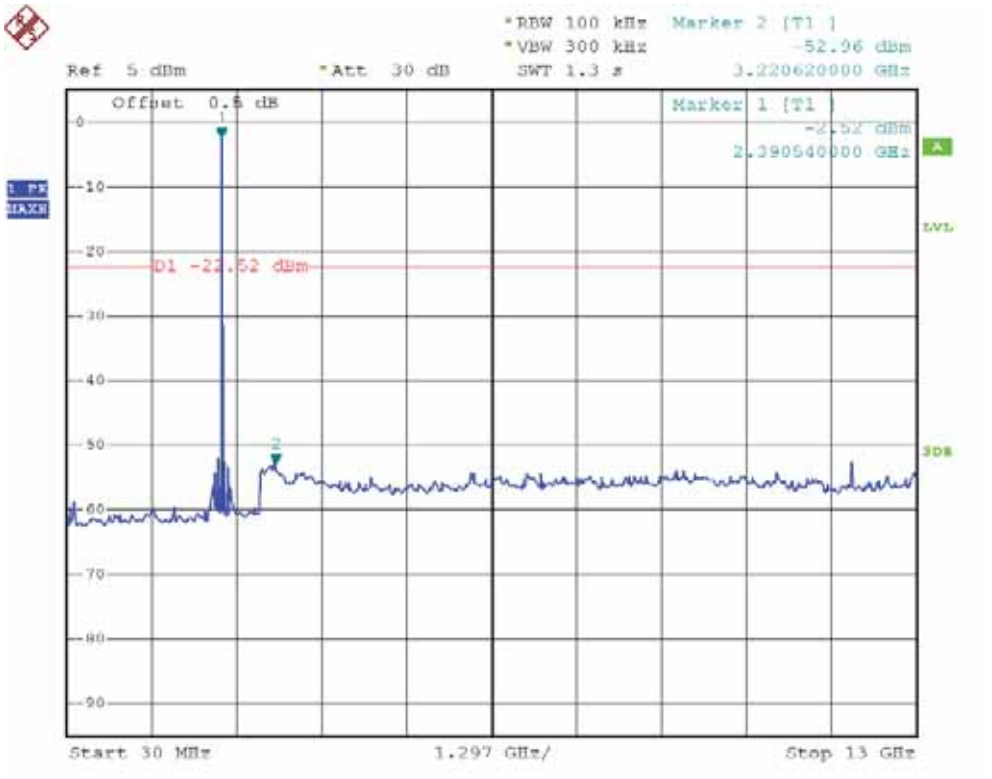
The Bluetooth Module operates at hopping-off test mode. The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

A. Test Verdict:

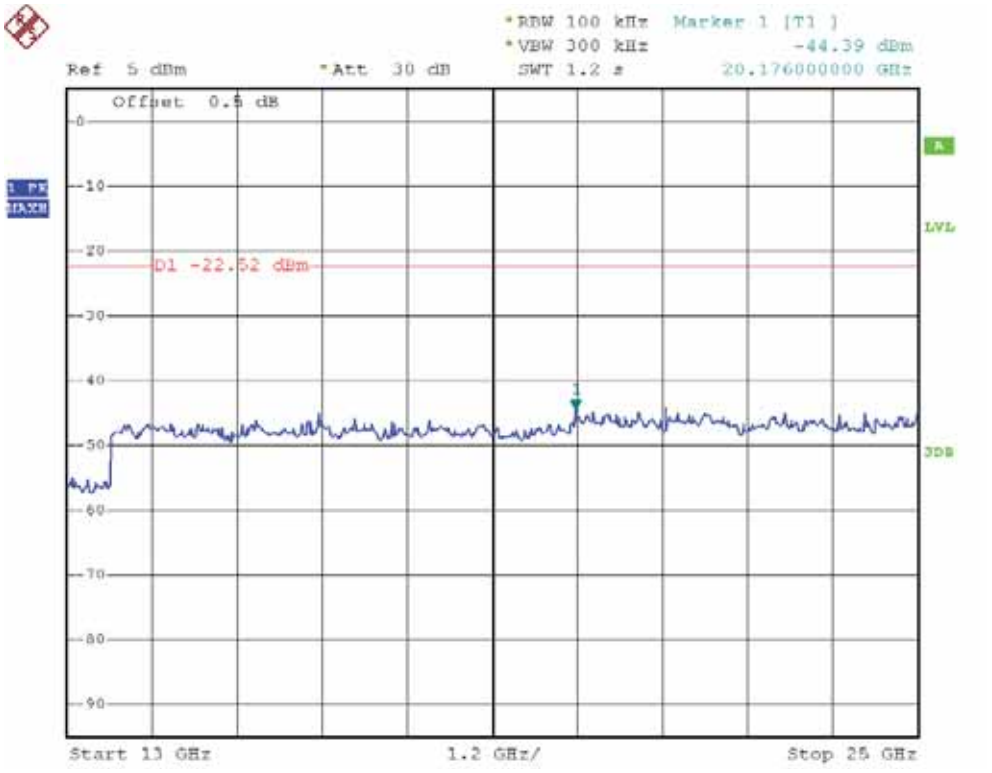
Channel	Frequency (MHz)	Measured Max. Out of Band EmissiondBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
0	2402	-44.39	Plot A.2	-2.52	-22.52	PASS
39	2441	-44.25	Plot B.2	-3.09	-23.09	PASS
78	2480	-44.59	Plot C.2	-3.37	-23.37	PASS

B. Test Plots:

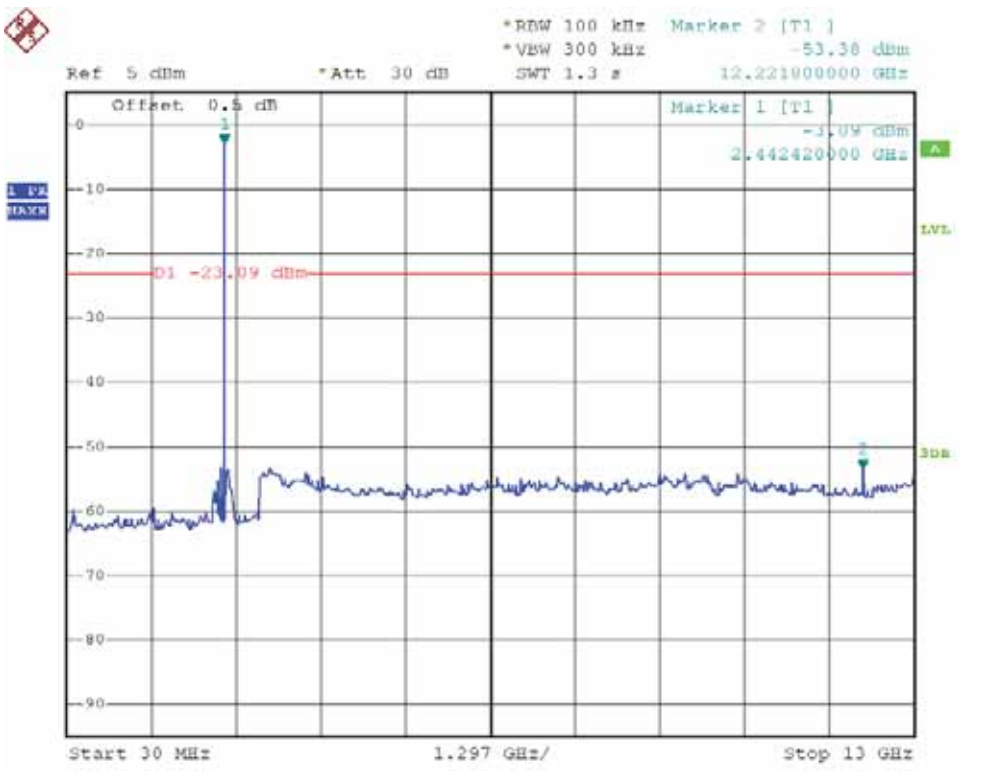
Note: the power of the Module transmitting frequency should be ignored.



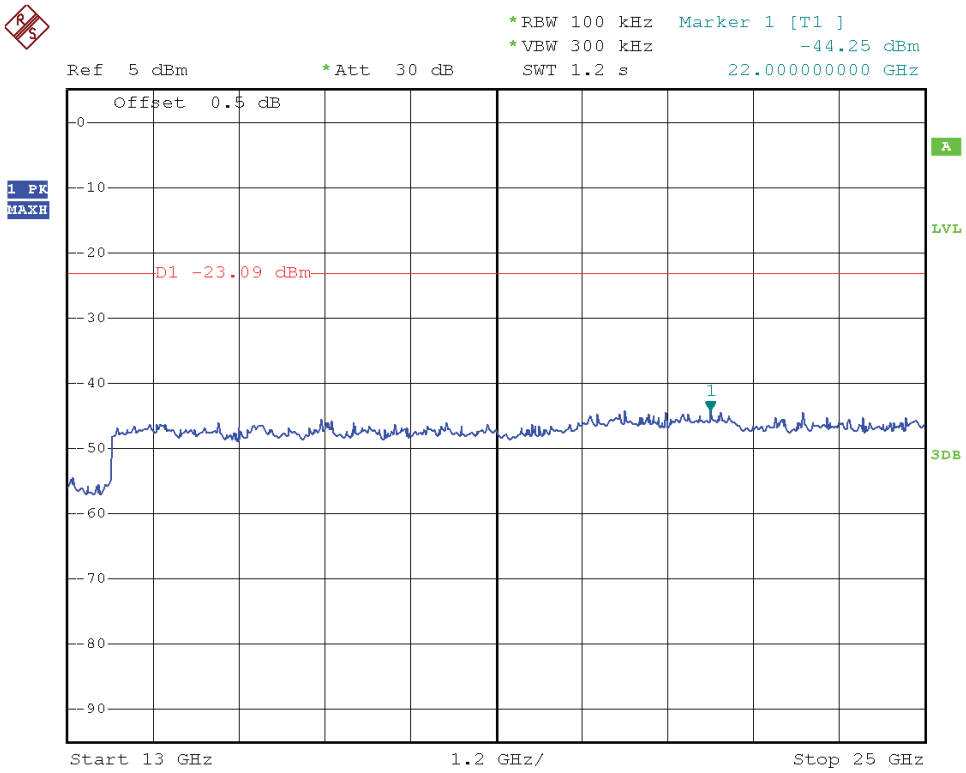
(Plot A.1: Channel = 0, 30MHz to 13GHz)



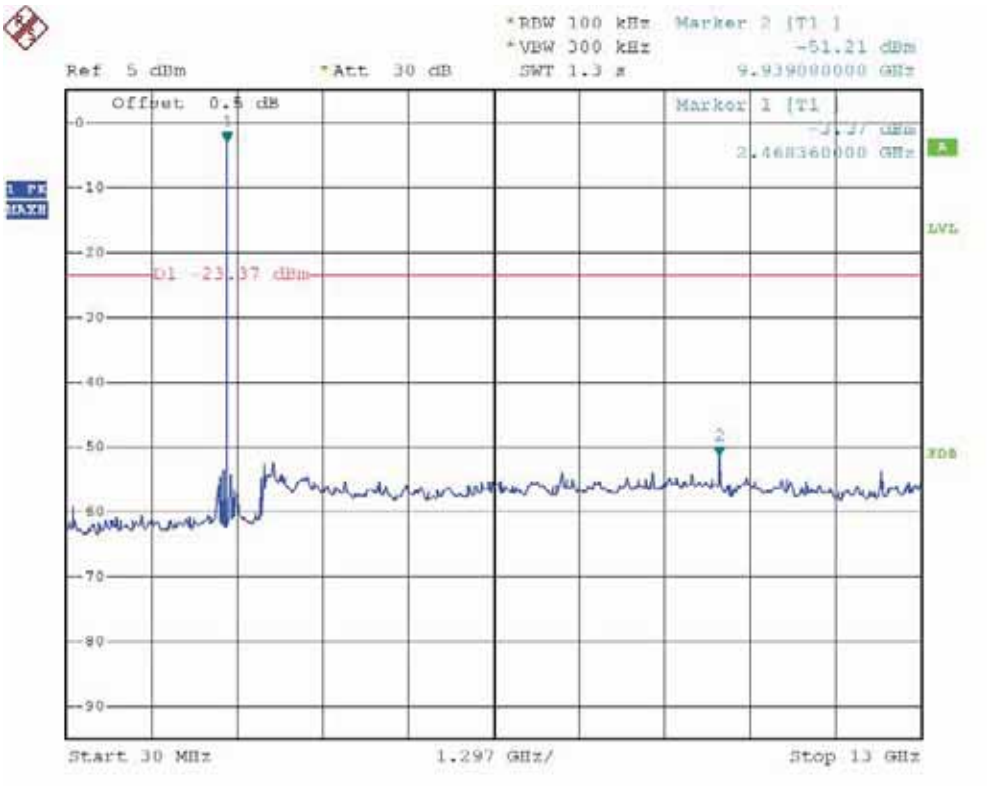
(Plot A.2: Channel = 0, 13GHz to 25GHz)



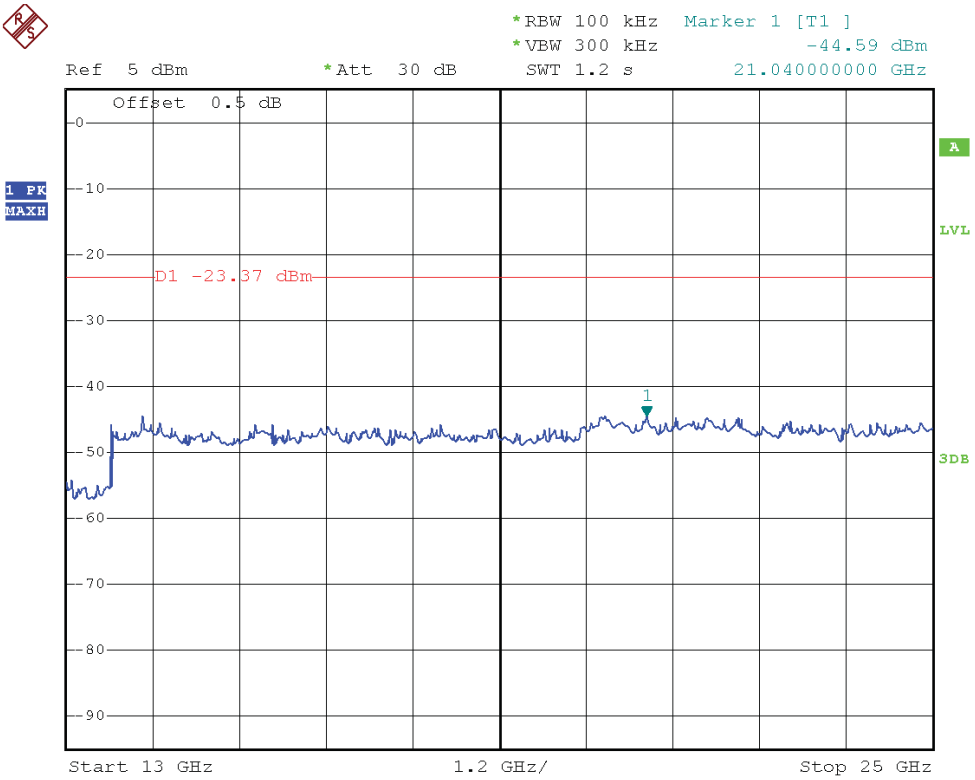
(Plot B.1: Channel = 39, 30MHz to 13GHz)



(Plot B.2: Channel = 39, 13GHz to 25GHz)



(Plot C.1: Channel = 78, 30MHz to 13GHz)



(Plot C.2: Channel = 78, 13GHz to 25GHz)

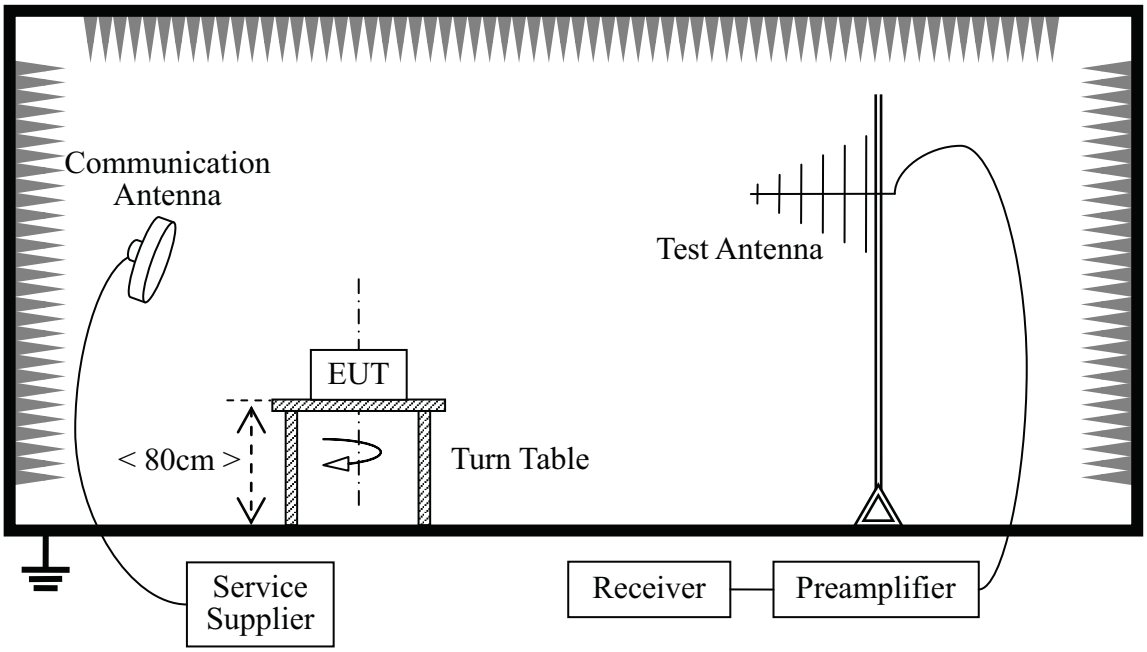
2.8. Band Edge

2.8.1. Requirement

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.8.2. Test Description

A. Test Setup:



The Bluetooth Module of the EUT is powered by the Battery. The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Bluetooth Module is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

For the Test Antenna:

Horn Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
Receiver	R&S	FSP40	1164.4391.40	2013.06.10
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2013.06.10
Double ridge horn antenna	R&S	HF906	100150	2013.06.10
Ultra-wideband antenna	R&S	HL562	A0304224	2013.06.10
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101800	25-S-42	2013.06.10

2.8.3. Test Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation

RBW = 100 kHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Remark : For AV value above 1GHz ,setting is AV detector , RBW=100kHz ,VBW >=RBW

Allow the trace to stabilize.

2.8.4. Test Result

The Bluetooth Module operates at hopping-off test mode. The lowest and highest channels are tested to verify the band edge emissions.

The measurement results are obtained as below:

E [dBμV/m] =U_R + A_T + A_{Factor} [dB]; A_T =$L_{Cable\ loss}$ [dB]-G_{preamp} [dB]

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

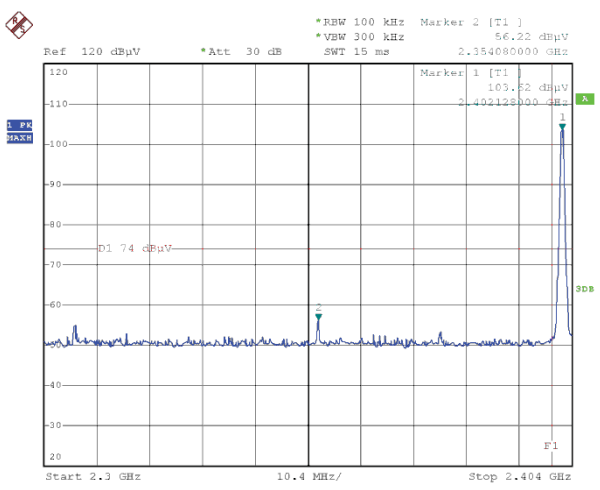
Note: The red vertical lines “F1” in the following charts is to indicate the frequencies 2400MHz and 2483.5MHz respectively

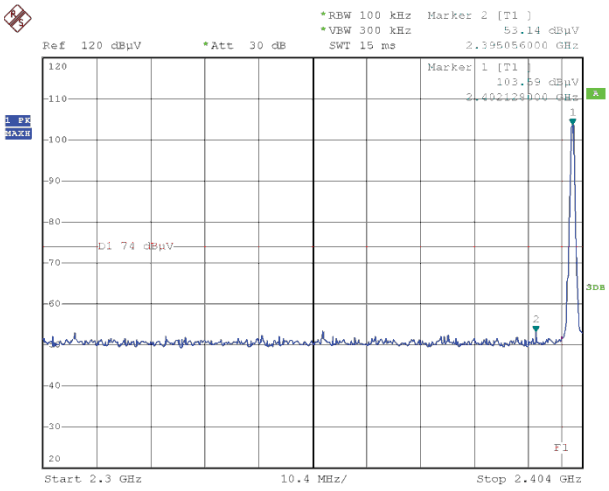
A. Test Verdict:

(Un-hopping)

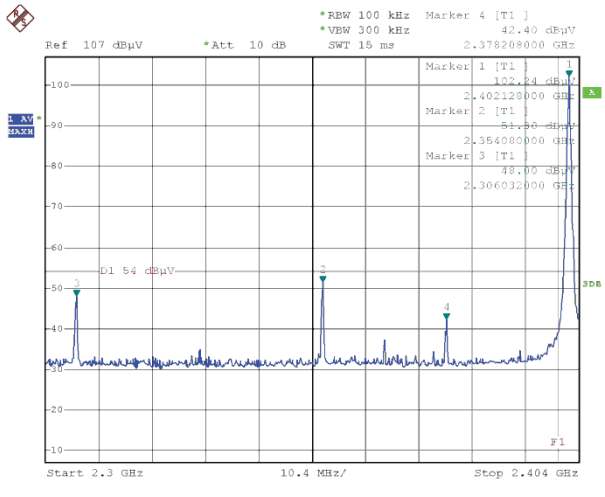
CH	Frequency (MHz)	Detector PK/ AV	ANT polarity	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2354.080	PK	Horizontal	56.22	-31.70	28.3	52.82	74	Pass
	2395.056		Vertical	53.14	-31.65	28.5	49.99		Pass
0	2354.08	AV	Horizontal	51.30	-31.70	28.3	47.9	54	Pass
	2366.144		Vertical	37.85	-31.62	28.4	34.63		Pass
78	2487.900	PK	Horizontal	53.53	-29.45	29.2	53.28	74	Pass
	2492.828		Vertical	46.08	-29.24	29.3	46.14		Pass
78	2484.116	AV	Horizontal	40.26	-29.45	29.2	40.01	54	Pass
	2497.712		Vertical	39.45	-29.25	29.3	39.5		Pass

B. Test Plots:

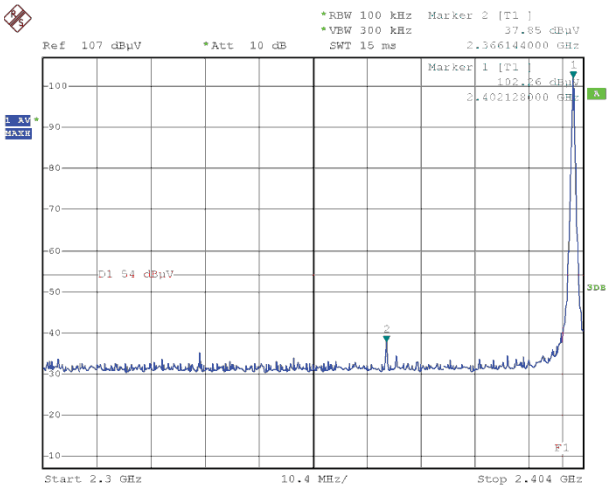




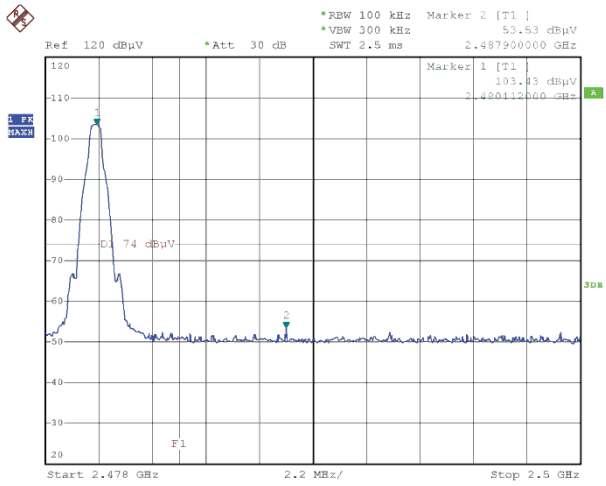
(Plot A1: Channel = 0 PEAK@ Horizontal) (Plot A2: Channel = 0 PEAK@ Vertical)



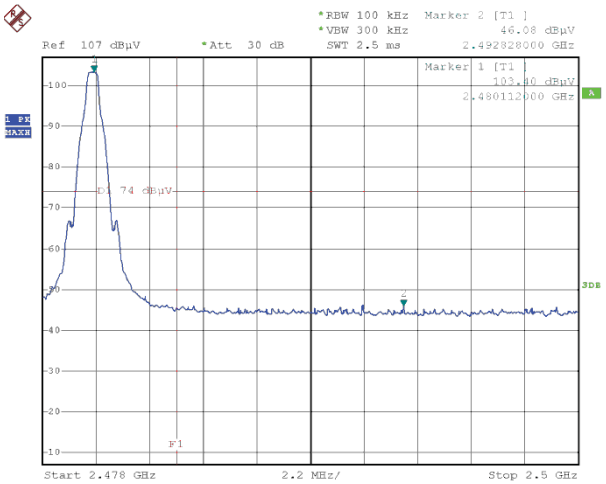
(Plot B1: Channel = 0 AVG@ Horizontal)



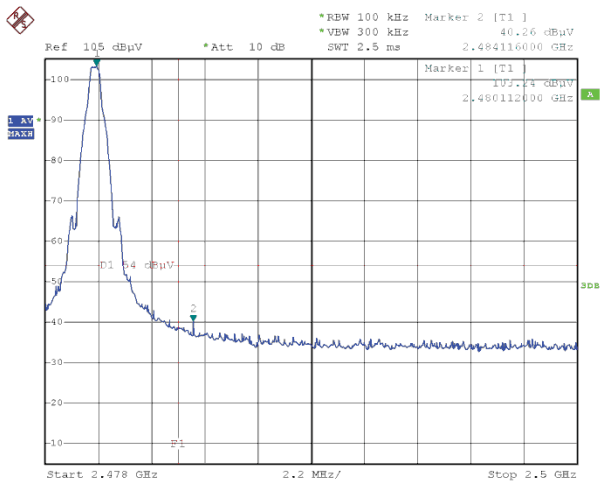
(Plot B2: Channel = 0 AVG@ Vertical)



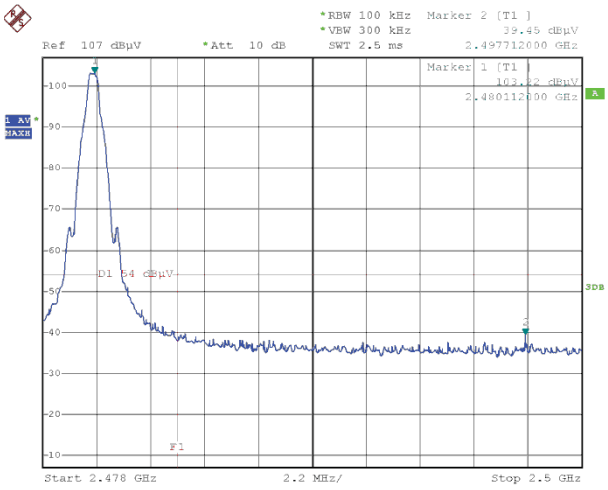
(Plot C1: Channel = 78 PEAK@ Horizontal)



(Plot C2: Channel = 78 PEAK@ Vertical)



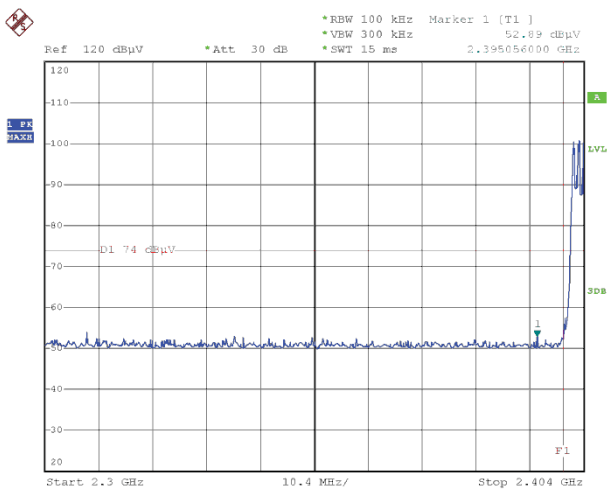
(Plot D1: Channel = 78 AVG@ Horizontal)



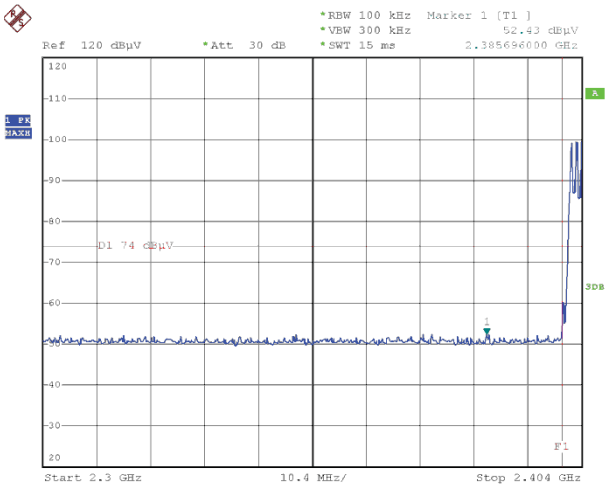
(Plot D2: Channel = 78 AVG@ Vertical)

(hopping)

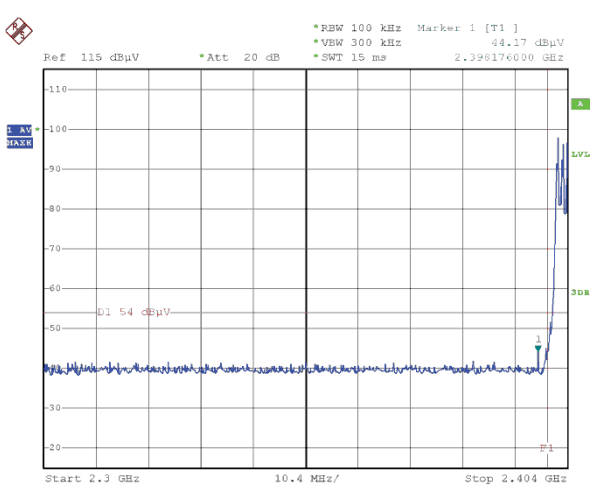
CH	Frequency (MHz)	Detector PK/ AV	ANT polarity	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
0	2395.056	PK	Horizontal	52.89	-31.70	28.3	49.49	74	Pass
	2385.696		Vertical	52.43	-31.70	28.3	49.03		Pass
0	2398.176	AV	Horizontal	44.17	-31.70	28.3	40.77	54	Pass
	2396.096		Vertical	41.71	-31.70	28.3	38.31		Pass
78	2487.540	PK	Horizontal	52.29	-29.45	29.2	52.04	74	Pass
	2484.908		Vertical	51.56	-29.45	29.2	51.31		Pass
78	2483.852	AV	Horizontal	41.42	-29.45	29.2	41.17	54	Pass
	2484.996		Vertical	42.73	-29.45	29.2	42.48		Pass



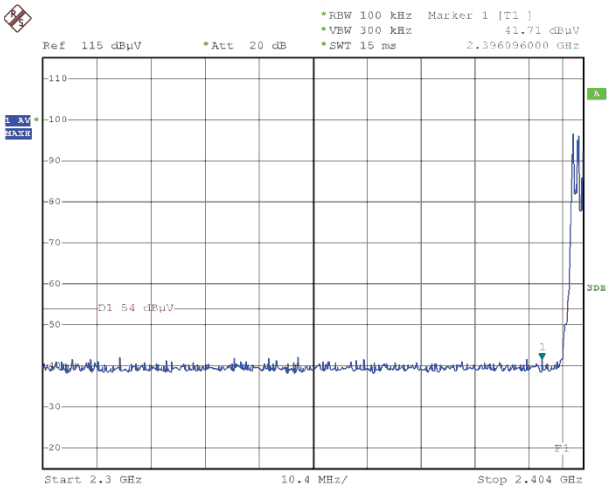
(Plot E1: Channel = 0 PEAK@ Horizontal)



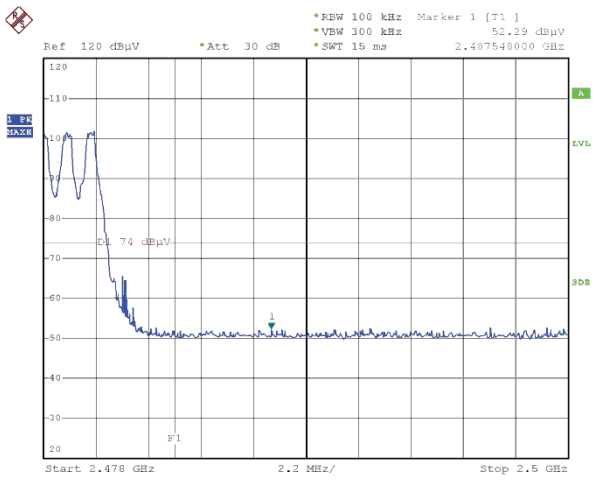
(Plot E2: Channel = 0 PEAK @ Vertical)

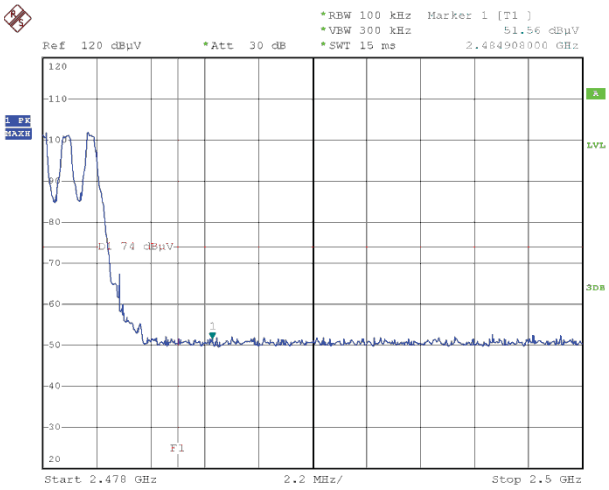


(Plot F1: Channel = 0 AVG@ Horizontal)

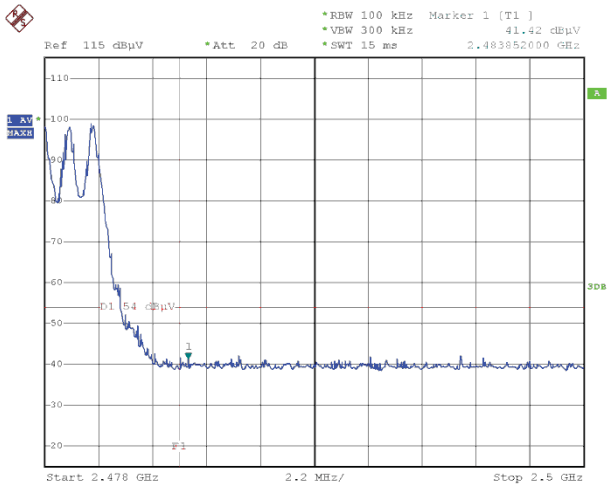


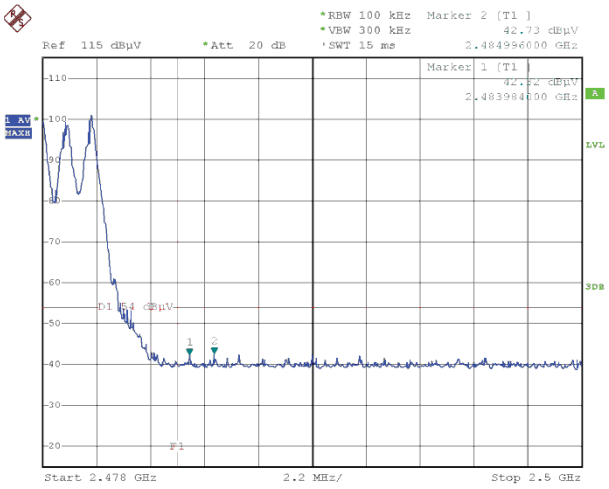
(Plot F2: Channel = 0 AVG@ Vertical)





(Plot G1: Channel = 78 PEAK@ Horizontal) (Plot G2:Channel = 78 PEAK@ Vertical)





(PlotH1: Channel = 78 AVG@ Horizontal) (PlotH2: Channel = 78 AVG@ Vertical)

2.9. Conducted Emission

2.9.1. Requirement

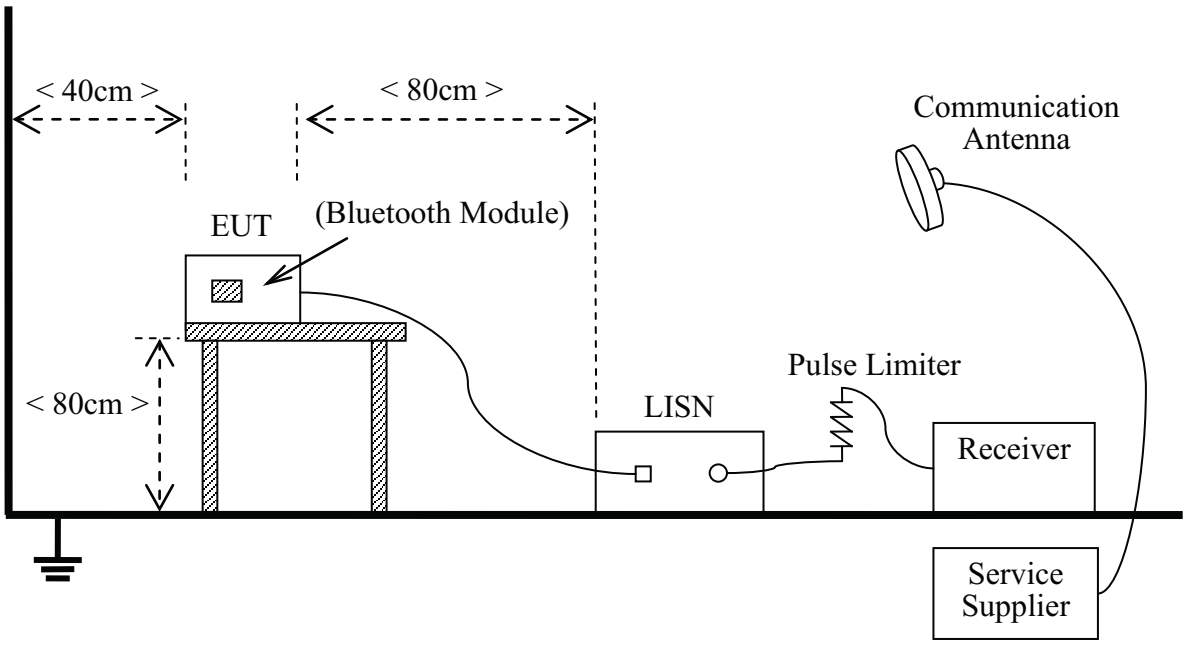
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

NOTE:
(a) The lower limit shall apply at the band edges.
(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.9.2. Test Description

A. Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.4:2009

The Bluetooth Module of the EUT is powered by the Battery charged with USB port of PC, PC is powered by 120V, 60Hz AC mains supply. The factors of the site are calibrated to correct the reading. During the measurement, the Bluetooth Module is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

B. Equipments List:

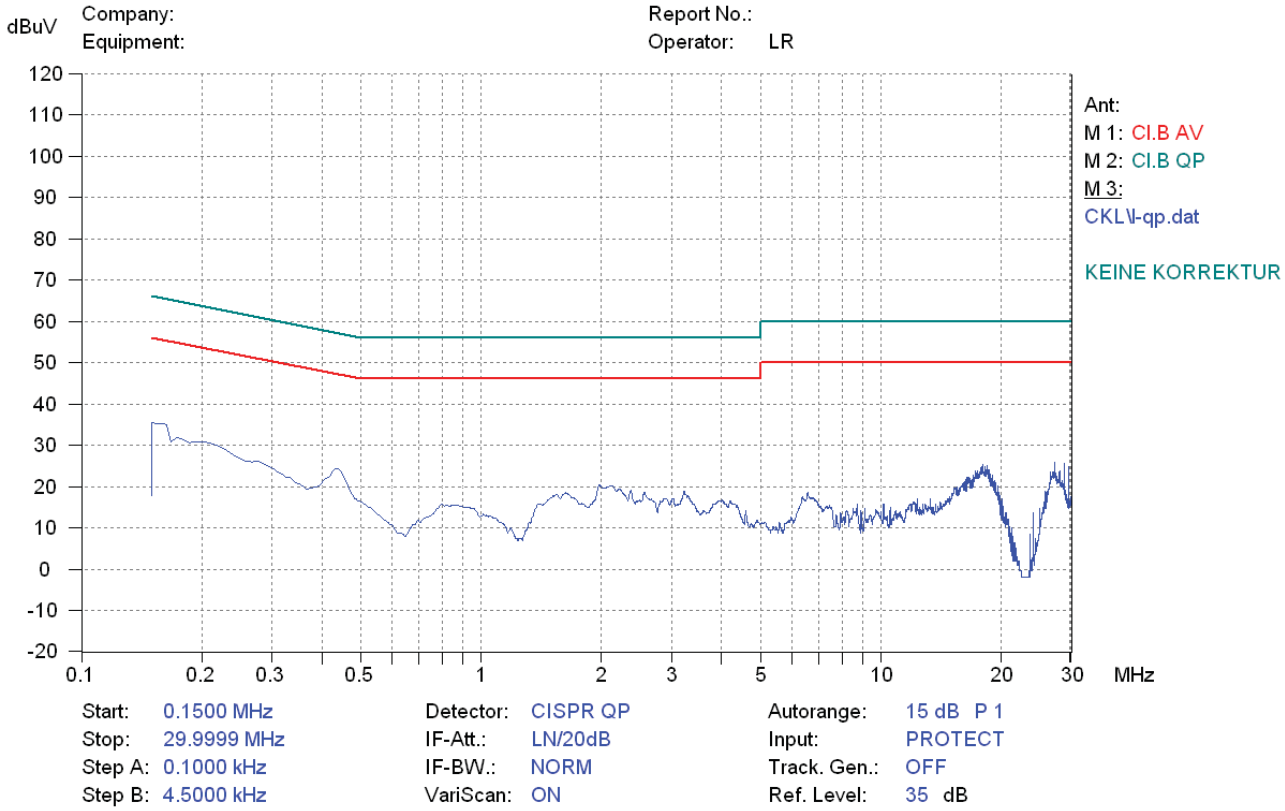
Description	Manufacturer	Model	Serial No.	Cal. Date
Test Receiver	ROHDE&SCHWARZ	ESCS30	A0304260	2013.06.10
LISN	ROHDE&SCHWARZ	ESH2-Z5	A0304221	2013.06.10
System Simulator	ROHDE&SCHWARZ	CMU200	A0304212	2013.06.10
PC	IBM	T43	26688CC2	Remark :FCC DOC

2.9.3. Test Result

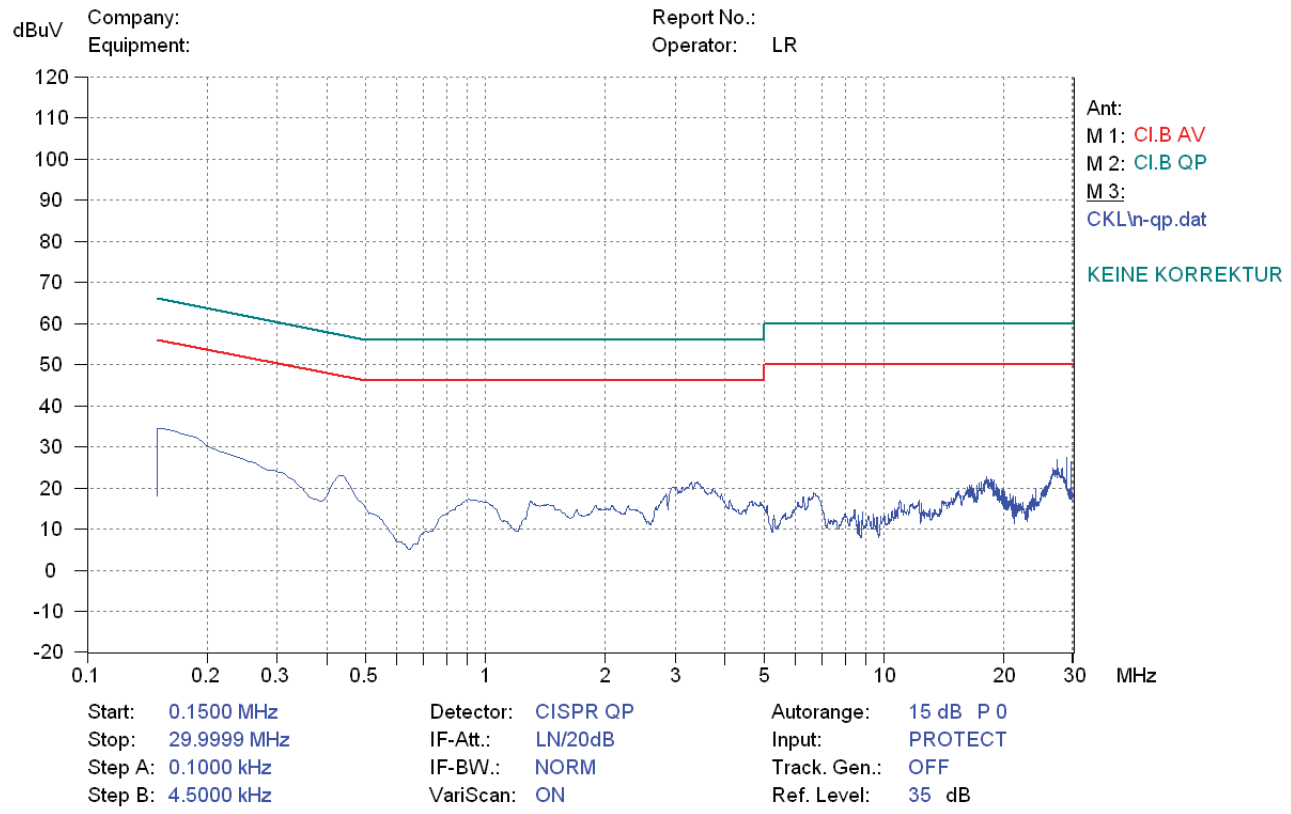
B. Test setup:

The EUT configuration of the emission tests is EUT + PC.

Test Plots:



(Plot A: L Phase)



(Plot B: N Phase)

2.10. Radiated Emission

2.10.1. Requirement

According to FCC section 15.247(c) and RSS-A8.5, radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
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:

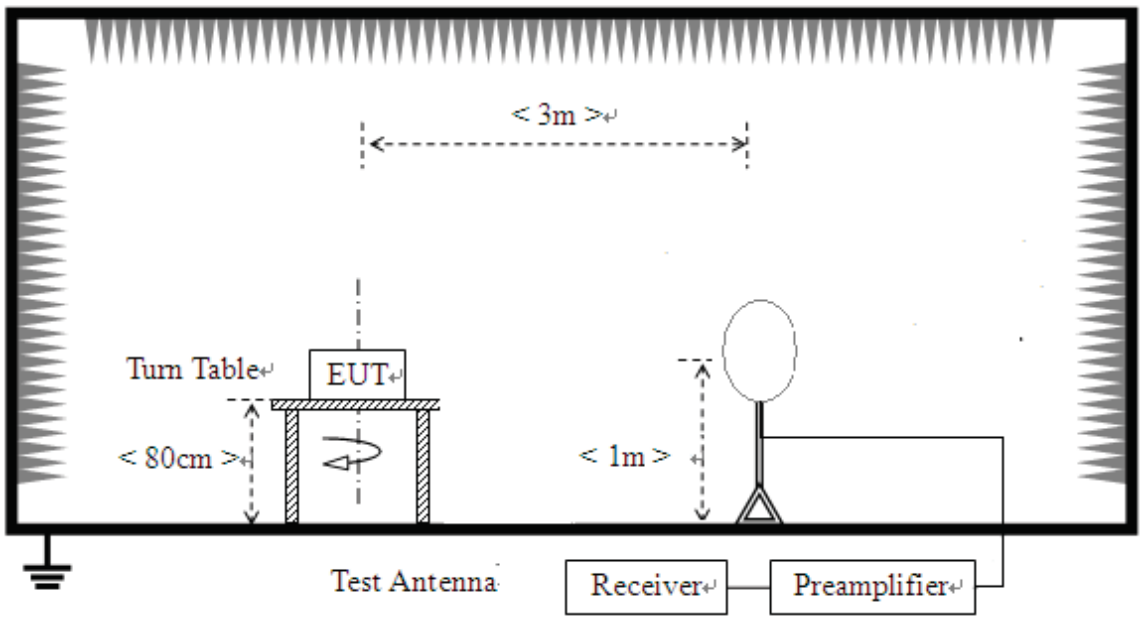
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

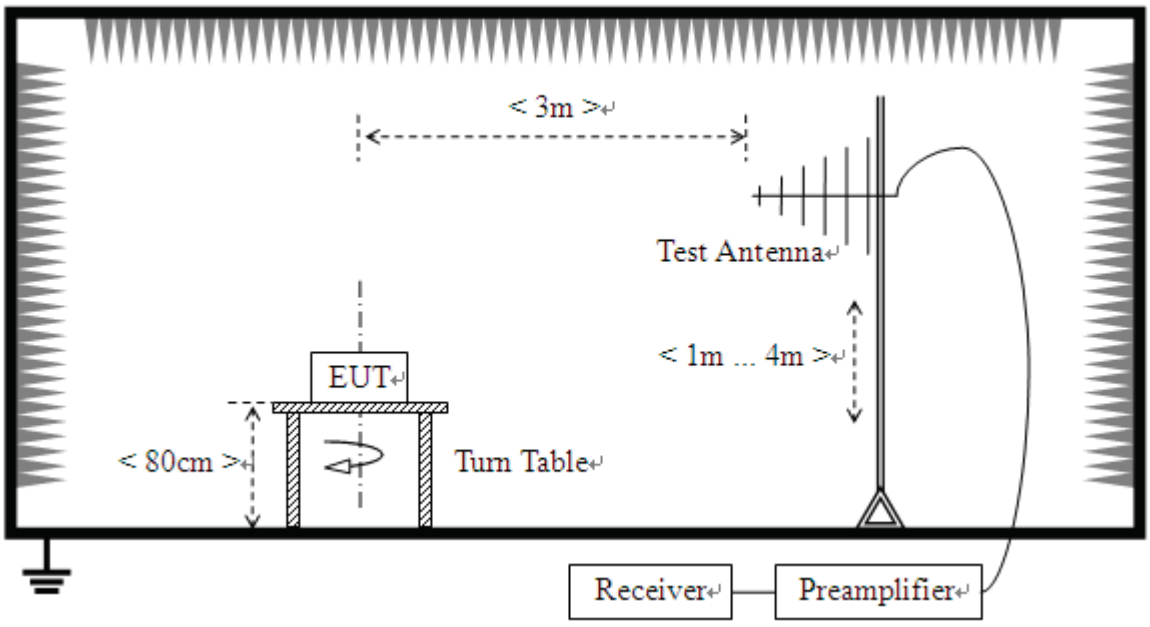
2.10.2. Test Description

A. Test Setup:

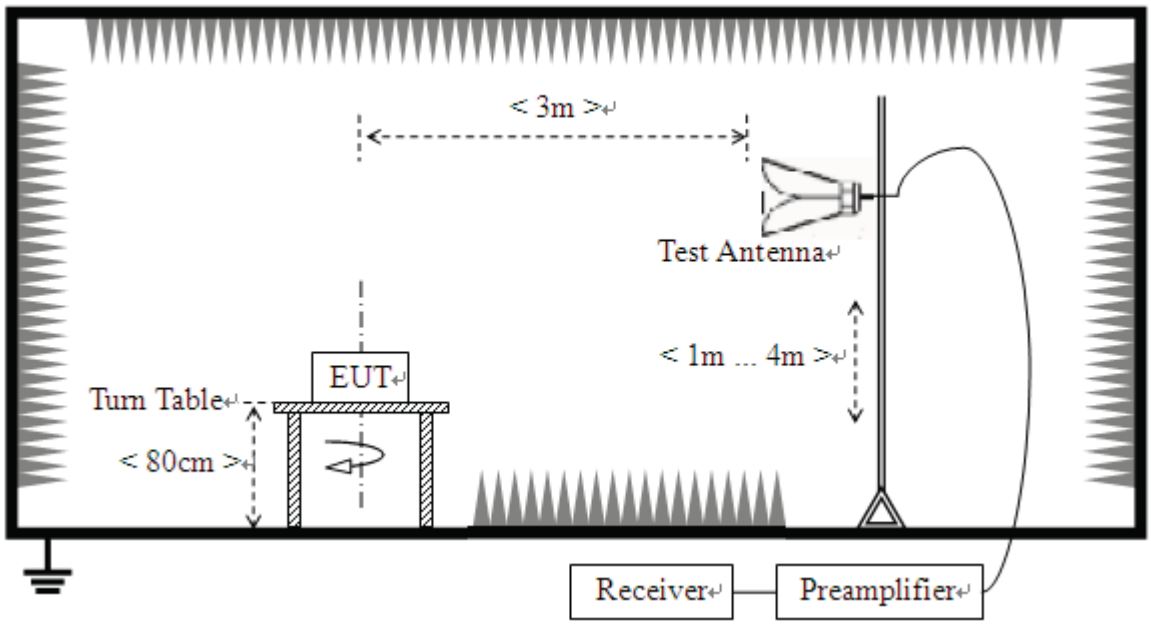
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2009). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4.

The Bluetooth Module of the EUT is powered by the Battery. The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the Bluetooth Module is activated and controlled by the Bluetooth Service Supplier (SS) via a Common Antenna, and is set to operate under hopping-on test mode transmitting 339 bytes DH5 packages at maximum power.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date
System Simulator	R&S	CMU200	100448	2013.06.10
Receiver	R&S	ESIB26	A0304218	2013.06.10
Full-Anechoic Chamber	Albatross	12.8m*6.8m*6.4m	A0412372	2013.06.10
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2013.06.10
Test Antenna - Horn	Schwarzbeck	BBHA 9120D	9120C-963	2013.06.10
Test Antenna - Horn	R&S	HL050S7	71688	2013.06.10
Test Antenna -Loop	Schwarzbeck	HFH2-Z2	100047	2013.06.10
Ampilier 1G~18GHz	R&S	MITEQ AFS42-00101800	25-S-42	2013.06.10
amplifier 20M~3GHz	R&S	PAP-0203H	22018	2013.06.10

Note: The Cal. Interval was one year.

2.10.3. Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Remark : For AV value above 1GHz ,setting is Pk detector , RBW=1MHz ,VBW =10Hz

2.10.4. Test Result

According to ANSI C63.4 selection 4.2.2, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

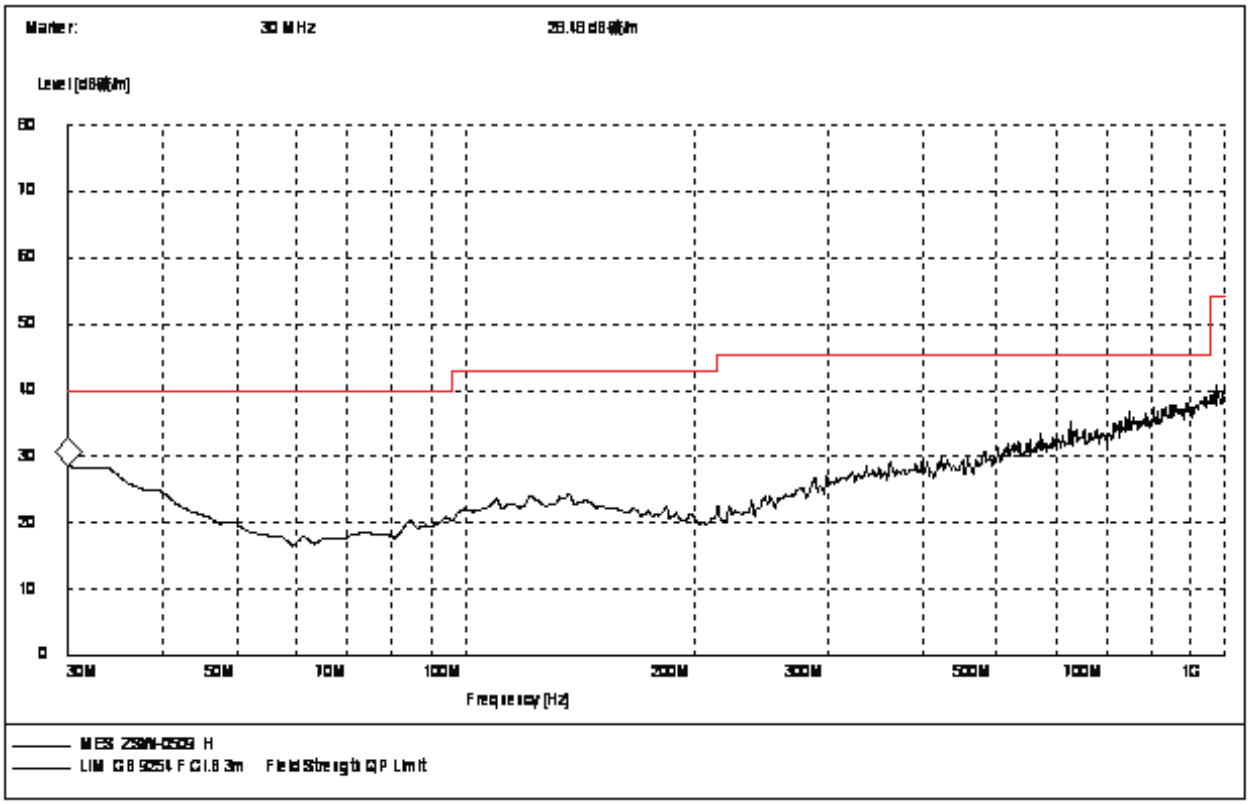
During the test, the total correction Factor AT and A_{Factor} were built in test software.

Note: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

For 9KHz to 30MHz

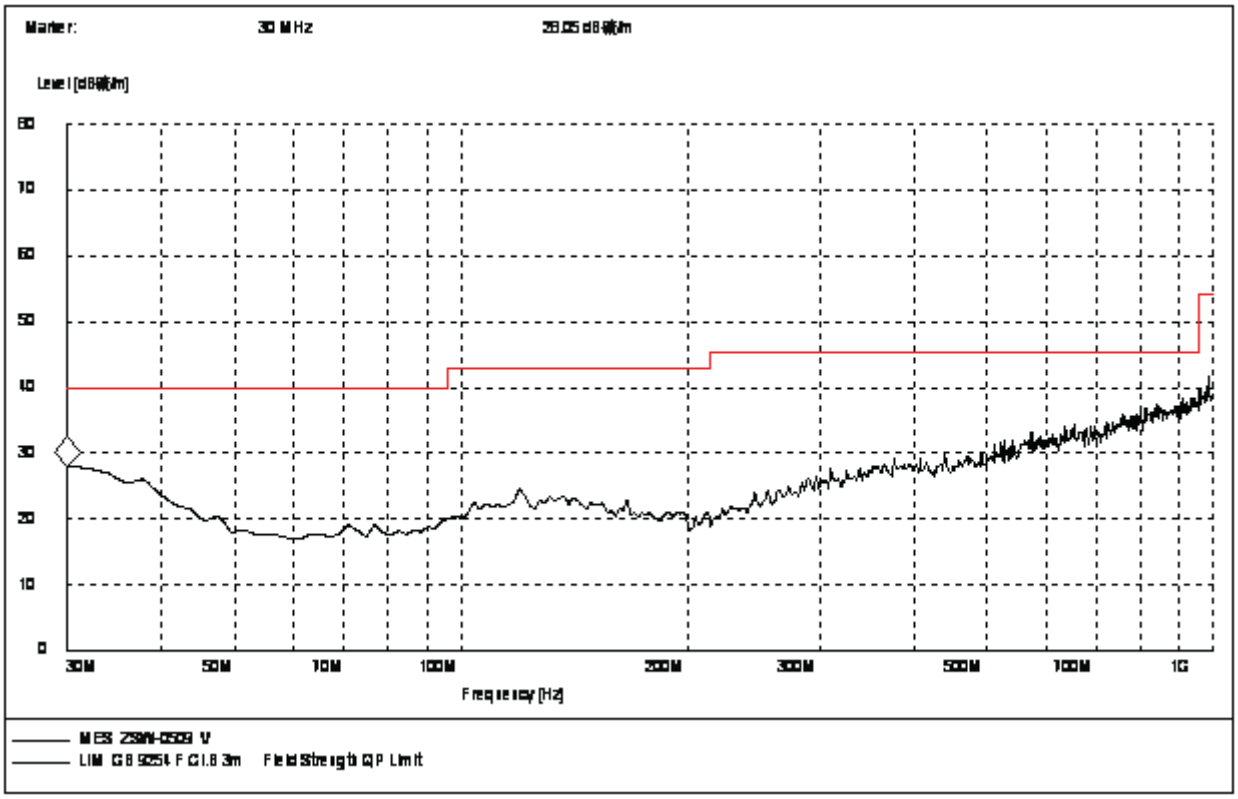
The test has been performed, and the Radiated Emission level is too low to the limit.

For 30MHz to 1000 MHz



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Degree	Antenna	Verdict
30	28.48	N.A	N.A	N.A	46.0	N.A	5.9	Horizontal	PASS

(Plot A: 30MHz to 1GHz, Antenna Horizontal @ GFSK)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Degree	Antenna	Verdict
30	28.05	N.A	N.A	N.A	46.0	N.A	126.1	Vertical	PASS

(Plot B: 30MHz to 1GHz, Antenna Vertical)

For 1GHz to 25GHz Antenna Height is adjusted from 1 to 4 m and the position at 1 m is the worse case .

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（0CH_2402MHz）

No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2402.00	92.92	PK	/	/	1.00 H	39	96.32	28.3	4.90	-36.6
1	*2402.00	89.47	AV	/	/	1.00 H	39	92.87	28.3	4.90	-36.6
2	4804.00	45.98	PK	74.00	28.02	1.00 H	301	42.78	32.7	7.00	-36.5
2	4804.00	43.05	AV	54.00	10.95	1.00 H	301	39.85	32.7	7.00	-36.5
3	7206.00	48.38	PK	74.00	25.62	1.00 H	158	38.98	35.8	8.90	-35.3
3	7206.00	46.12	AV	54.00	7.88	1.00 H	158	36.72	35.8	8.90	-35.3
4	9608.00	61.69	PK	74.00	12.31	1.00 H	149	49.09	37.2	10.20	-34.8
4	9608.00	48.38	AV	54.00	5.62	1.00 H	149	35.78	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（0CH_2402MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2402.00	96.55	PK	/	/	1.00 V	120	99.95	28.3	4.90	-36.6
1	*2402.00	93.64	AV	/	/	1.00 V	120	97.04	28.3	4.90	-36.6
2	4804.00	48.81	PK	74.00	25.19	1.00 V	304	45.61	32.7	7.00	-36.5
2	4804.00	46.03	AV	54.00	7.97	1.00 V	304	42.83	32.7	7.00	-36.5
3	7206.00	50.46	PK	74.00	23.54	1.00 V	310	41.06	35.8	8.90	-35.3
3	7206.00	43.22	AV	54.00	10.78	1.00 V	310	33.82	35.8	8.90	-35.3
4	9608.00	51.56	PK	74.00	22.44	1.00 V	18	38.96	37.2	10.20	-34.8
4	9608.00	46.64	AV	54.00	7.36	1.00 V	18	34.04	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（39CH_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	96.89	PK	/	/	1.00 H	15	100.09	28.3	5.10	-36.6
1	*2441.00	94.28	AV	/	/	1.00 H	15	97.48	28.3	5.10	-36.6
2	4882.00	45.29	PK	74.00	28.71	1.00 H	29	41.89	32.3	7.60	-36.5
2	4882.00	38.42	AV	54.00	15.58	1.00 H	29	35.02	32.3	7.60	-36.5
3	7323.00	51.48	PK	74.00	22.52	1.00 H	305	42.08	36.1	8.60	-35.3
3	7323.00	47.62	AV	54.00	6.38	1.00 H	305	38.22	36.1	8.60	-35.3
4	9764.00	50.76	PK	74.00	23.24	1.00 H	280	38.16	37.2	10.20	-34.8
4	9764.00	43.66	AV	54.00	10.34	1.00 H	280	31.06	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（39CH_2441MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2441.00	96.38	PK	/	/	1.00 V	132	99.58	28.3	5.10	-36.6
1	*2441.00	91.01	AV	/	/	1.00 V	132	94.21	28.3	5.10	-36.6
2	4882.00	47.34	PK	74.00	26.66	1.00 V	91	43.94	32.3	7.60	-36.5
2	4882.00	37.49	AV	54.00	16.51	1.00 V	91	34.09	32.3	7.60	-36.5
3	7323.00	56.28	PK	74.00	17.72	1.00 V	212	46.88	36.1	8.60	-35.3
3	7323.00	44.13	AV	54.00	9.87	1.00 V	212	34.73	36.1	8.60	-35.3
4	9764.00	51.01	PK	74.00	22.99	1.00 V	82	38.41	37.2	10.20	-34.8
4	9764.00	38.08	AV	54.00	15.92	1.00 V	82	25.48	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M（78CH_2480MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2480.00	97.73	PK	/	/	1.00 H	14	101.03	28.6	4.70	-36.6
1	*2480.00	91.47	AV	/	/	1.00 H	14	94.77	28.6	4.70	-36.6
2	4960.00	49.72	PK	74.00	24.28	1.00 H	101	45.92	33.0	7.00	-36.2
2	4960.00	36.86	AV	54.00	17.14	1.00 H	101	33.06	33.0	7.00	-36.2
3	7440.00	50.21	PK	74.00	23.79	1.00 H	90	40.81	36.2	8.50	-35.3
3	7440.00	42.47	AV	54.00	11.53	1.00 H	90	33.07	36.2	8.50	-35.3
4	9920.00	51.11	PK	74.00	22.89	1.00 H	18.	3851	37.2	10.20	-34.8
4	9920.00	43.51	AV	54.00	10.49	1.00 H	18	30.91	37.2	10.20	-34.8

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M（78CH_2480MHz）											
No.	Frequency (MHz)	Emssion Level		Limit (dBuV/m)	Margin (dB)	Antenna Height	Table Angle	Raw Value	Antenna Factor	Cable Factor	Pre-amplifier
1	*2480.00	96.18	PK	/	/	1.00 V	27	99.48	28.6	4.70	-36.6
1	*2480.00	88.77	AV	/	/	1.00 V	27	92.07	28.6	4.70	-36.6
2	4960.00	51.79	PK	74.00	22.21	1.00 V	94	47.99	33.0	7.00	-36.2
2	4960.00	46.72	AV	54.00	7.28	1.00 V	94	42.92	33.0	7.00	-36.2
3	7440.00	54.18	PK	74.00	19.82	1.00 V	114	44.78	36.2	8.50	-35.3
3	7440.00	43.42	AV	54.00	10.58	1.00 V	114	34.02	36.2	8.50	-35.3
4	9920.00	52.09	PK	74.00	21.91	1.00 V	220	39.49	37.2	10.20	-34.8
4	9920.00	43.65	AV	54.00	10.35	1.00 V	220	31.05	37.2	10.20	-34.8

REMARKS: 1. Emission level (dBuV/m)=Raw Value(dBuV) +Antenna Factor (dB/m) + Cable Factor (dB) +Pre-amplifier Factor

2. The other emission levels were very low against the limit.

3. Margin value = Limit value- Emission level.

4. The limit value is defined as per 15.247

5. “* “: Fundamental frequency

Remark : All restriction band include 2310-2390MHz and 2483.5-2500MHz , the worse cases are recorded in the tables as above ,no other emission found .

2.11. RF exposure evaluation

According to § 1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy lever in excess of Commission's guideline.

According to 447498 D01 section 4.3.1General RF Exposure Guidance v05, exclusion threshold values at selected frequencies and distances table as following.

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,16 where

f(GHz) is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation17

The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Routine SAR evaluation refers to the specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evolution is not required, the portable transmitters with output power greater than the applicable low threshold SAR evolution to qualify for TCB approval.

Result:

Please refer to the MPE report.

** END OF REPORT **