FCC TEST REPORT
For
Cary P. Gallaway
Bluetooth speakers
Model No.: QuarterWave
Additional Model No.: F1, F2, F3, F12, F12L, F16, F17, F19, F20, F21, F22, F23, F25

Prepared for	:	Cary P. Gallaway
Address	:	7102 Autumn Bluff Lane, Richmond, TEXAS 77407, USA

Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Tel	:	(+86)755-82591330
Fax	:	(+86)755-82591332
Web	:	www.LCS-cert.com
Mail	:	webmaster@LCS-cert.com

Date of receipt of test sample	:	November 03, 2015
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	November 03, 2015 – November 18, 2015
Date of Report	:	November 18, 2015

This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd..

FCC TEST REPORT
FCC CFR 47 PART 15 C(15.247): 2014

Report Reference No.	**:**	**LCS1511030162E**
Date of Issue	:	November 18, 2015
Testing Laboratory Name.....	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure.....	:	Full application of Harmonised standards ■ Partial application of Harmonised standards ☐ Other standard testing method ☐
Applicant's Name.....	**:**	**Cary P. Gallaway**
Address	:	7102 Autumn Bluff Lane, Richmond, TEXAS 77407, USA
Test Specification		
Standard	:	FCC CFR 47 PART 15 C(15.247): 2014
Test Report Form No.....	**:**	LCSEMC-1.0
TRF Originator	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	:	Dated 2011-03

Shenzhen LCS Compliance Testing Laboratory Ltd. All rights reserved.
This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen LCS Compliance Testing Laboratory Ltd. is acknowledged as copyright owner and source of the material. Shenzhen LCS Compliance Testing Laboratory Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

Test Item Description.	**:**	**Bluetooth speakers**
Trade Mark	:	QuarterWave
Model/ Type reference.....	:	QuarterWave
Ratings	:	Adapter parameter: Input:100-240V~50/60Hz, 1.0-1.5A max; Output:DC 12V/4A
Result	:	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Jacky Li		Gavin Liang
Jacky Li/ File administrators	Glin Lu/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS1511030162E	November 18, 2015 Date of issue

Type / Model.....	: QuarterWave
EUT.....	: Bluetooth speakers
Applicant.....	**: Cary P. Gallaway**
Address.....	: 7102 Autumn Bluff Lane, Richmond, TEXAS 77407, USA
Telephone.....	: 713 213 8801
Fax.....	: 713 213 8801
Manufacturer.....	**: Cary P. Gallaway**
Address.....	: 7102 Autumn Bluff Lane, Richmond, TEXAS 77407, USA
Telephone.....	: 713 213 8801
Fax.....	: 713 213 8801
Factory.....	**: Cary P. Gallaway**
Address.....	: 7102 Autumn Bluff Lane, Richmond, TEXAS 77407, USA
Telephone.....	: 713 213 8801
Fax.....	: 713 213 8801

Test Result	**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

TABLE OF CONTENTS

1. GENERAL INFORMATION 5
1.1. DESCRIPTION OF DEVICE (EUT) 5
1.2. HOST SYSTEM CONFIGURATION LIST AND DETAILS 5
1.3. EXTERNAL I/O CABLE 6
1.4. DESCRIPTION OF TEST FACILITY 6
1.5. STATEMENT OF THE MEASUREMENT UNCERTAINTY 6
1.6. MEASUREMENT UNCERTAINTY 6
1.7. DESCRIPTION OF TEST MODES 7
2. TEST METHODOLOGY 8
2.1. EUT CONFIGURATION 8
2.2. EUT EXERCISE 8
2.3. GENERAL TEST PROCEDURES 8
3. SYSTEM TEST CONFIGURATION 9
3.1. JUSTIFICATION 9
3.2. EUT EXERCISE SOFTWARE 9
3.3. SPECIAL ACCESSORIES 9
3.4. BLOCK DIAGRAM/SCHEMATICS 9
3.5. EQUIPMENT MODIFICATIONS 9
3.6. TEST SETUP 9
4. SUMMARY OF TEST RESULTS 10
5. TEST RESULT 11
5.1. MAXIMUM CONDUCTED OUTPUT POWER MEASUREMENT 11
5.2. POWER SPECTRAL DENSITY MEASUREMENT 12
5.3. 6 DB SPECTRUM BANDWIDTH MEASUREMENT 15
5.4. OCCUPIED BANDWIDTH 18
5.5. RADIATED EMISSIONS MEASUREMENT 20
5.6. CONDUCTED SPURIOUS EMISSIONS AND BAND EDGES TEST 30
5.7. POWER LINE CONDUCTED EMISSIONS 34
5.8. ANTENNA REQUIREMENTS 37
6. LIST OF MEASURING EQUIPMENTS 39

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

EUT : Bluetooth speakers

Model No. : QuarterWave

Frequency Range : 2.402-2.480GHz

Channel Number : 79 channels & 40 channels

Channel frequency : 2402.00-2480.00MHz (Channel Frequency=2402+1(K-1), K=1, 2, 3 ……79);
2402.00-2480.00MHz (Channel Frequency=2402+2(K-1), K=0, 2, 3 ……39);

Channel Spacing : 1MHz for 79 channels; 2MHz for 40 channels

Modulation Type : GFSK, π/4-DQPSK, 8-DPSK

Bluetooth Version : V4.1

Antenna Gain : PCB antenna, -0.61 dBi(Max.)

Input Voltage : Adapter parameter: Input:100-240V~50/60Hz, 1.0-1.5A max; Output:DC 12V/4A

Additional models No.					
F1	F2	F3	F12	F12L	F16
F17	F19	F20	F21	F22	F23
F25					
Remark: PCB board, structure and internal of these model(s) are the same, So no addition al models were tested.					

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
--	AC/DC Adapter	BX-120400	--	VOC

1.3. External I/O Cable

I/O Port Description	Quantity	Cable
DC	1	N/A
Aux	1	N/A
USB	1	N/A
Audio	1	N/A

1.4. Description of Test Facility

Site Description EMC Lab.	:	CNAS Registration Number. is L4595. FCC Registration Number. is 899208. Industry Canada Registration Number. is 9642A-1. VCCI Registration Number. is C-4260 and R-3804. ESMD Registration Number. is ARCB0108. UL Registration Number. is 100571-492. TUV SUD Registration Number. is SCN1081. TUV RH Registration Number. is UA 50296516-001

1.5. Statement of The Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.10dB	(1)
		30MHz~200MHz	±2.96dB	(1)
		200MHz~1000MHz	±3.10dB	(1)
		1GHz~26.5GHz	±3.80dB	(1)
		26.5GHz~40GHz	±3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±1.63dB	(1)
Power disturbance	:	30MHz~300MHz	±1.60dB	(1)

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

1.7. Description Of Test Modes

The EUT has been tested under operating condition.

This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.

Worst-case mode and channel used for 150kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power, that was determined to be BLE mode(High Channel).

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be BLE mode(High Channel).

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:
BLE Mode : 1 Mbps, GFSK.

Note: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd..

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to FCC's request, Test Procedure KDB558074 D01 DTS Meas. Guidance v03r02 is required to be used for this kind of FCC 15.247 digital modulation device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013.

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmit condition.

3.2. EUT Exercise Software

N/A

3.3. Special Accessories

N/A

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C		
FCC Rules	**Description of Test**	**Result**
§15.247(b)	Maximum Conducted Output Power	Compliant
§15.247(e)	Power Spectral Density	Compliant
§15.247(a)(2)	6dB Bandwidth	Compliant
§15.247(a)	Occupied Bandwidth	Compliant
§15.209, §15.247(d)	Radiated and Conducted Spurious Emissions	Compliant
§15.205	Emissions at Restricted Band	Compliant
§15.207(a)	Conducted Emissions	Compliant
§15.203	Antenna Requirements	Compliant

This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd..

5. TEST RESULT

5.1. Maximum Conducted Output Power Measurement

5.1.1. Standard Applicable

According to §15.247(b): For systems using digital modulation in the 2400-2483.5 MHz and 5725-5850 MHz band, the limit for maximum peak conducted output power is 30dBm. The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi without any corresponding reduction in transmitter peak output power.

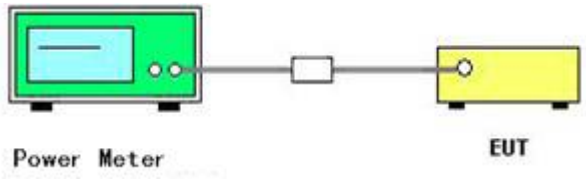
5.1.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the power meter.

5.1.3. Test Procedures

The transmitter output (antenna port) was connected to the power meter.

5.1.4. Test Setup Layout



5.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.1.6. Test Result of Maximum Conducted Output Power

Temperature	25℃	Humidty	60%
Test Engineer	Jacky	Configurations	BLE

Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Max. Limit (dBm)	Result
1	2402	-3.816	30	Complies
19	2440	-3.390	30	Complies
40	2480	-3.628	30	Complies

5.2. Power Spectral Density Measurement

5.2.1. Standard Applicable

According to §15.247(e): For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

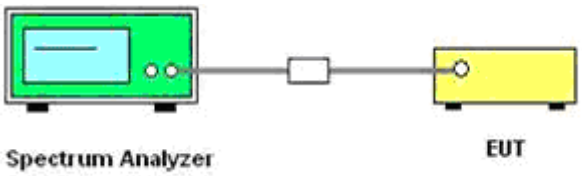
5.2.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

5.2.3. Test Procedures

1. The transmitter was connected directly to a Spectrum Analyzer through a directional couple.
2. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
3. Set the RBW = 3 kHz.
4. Set the VBW ≥ 3*RBW
5. Set the span to 1.5 times the DTS channel bandwidth.
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum power level in any 3 kHz band segment within the fundamental EBW.

5.2.4. Test Setup Layout



5.2.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.2.6. Test Result of Power Spectral Density

Temperature	25˚C	Humidity	60%
Test Engineer	Jakcy	Configurations	BLE

Channel	Frequency (MHz)	Power *Density* (dBm/3KHz)	Max. Limit (dBm/3KHz)	Result
1	2402	-19.058	8	Complies
19	2440	-18.606	8	Complies
40	2480	-18.837	8	Complies

Test plot of power density

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.439974500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 22/100
02:25:29 PM Nov 17, 2015
Ref Offset 0.5 dB
10 dB/div
Ref 0.00 dBm
Log
Mkr1 2.439 974 5 GHz
-18.606 dBm
Center 2.4400000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 1.500 MHz
Sweep 158.2 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.479974500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold: 51/100
02:24:32 PM Nov 17, 2015
Ref Offset 0.5 dB
10 dB/div
Ref 0.00 dBm
Log
Mkr1 2.479 974 5 GHz
-18.837 dBm
Center 2.4800000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 1.500 MHz
Sweep 158.2 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

5.3. 6 dB Spectrum Bandwidth Measurement

5.3.1. Standard Applicable

According to §15.247(a)(2): For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

5.3.2. Measuring Instruments and Setting

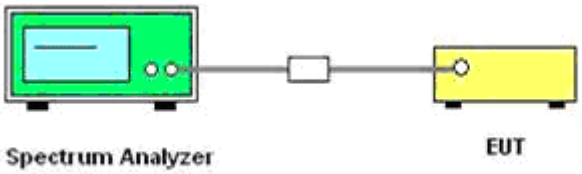
Please refer to section 6 of equipments list in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> RBW
Detector	Peak
Trace	Max Hold
Sweep Time	100ms

5.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth and the video bandwidth were set according to KDB558074.
3. Measured the spectrum width with power higher than 6dB below carrier.

5.3.4. Test Setup Layout



5.3.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.3.6. Test Result of 6dB Spectrum Bandwidth

Temperature	25˚C	Humidity	60%
Test Engineer	Jacky	Configurations	BLE

Channel	Frequency	6dB Bandwidth (KHz)	Min. Limit (kHz)	Result
1	2402	690.2	500	Complies
19	2440	695.0	500	Complies
40	2480	687.9	500	Complies

Test plot of 6dB bandwidth

Agilent Spectrum Analyzer - Occupied BW
Center Freq 2.440000000 GHz
Center Freq: 2.440000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
02:22:51 PM Nov 17, 2015
10 dB/div
Ref 10.00 dBm
Center 2.44 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3 MHz
Sweep 1 ms
Occupied Bandwidth
1.0255 MHz
Total Power 3.02 dBm
Transmit Freq Error -209 Hz
OBW Power 99.00 %
x dB Bandwidth 695.0 kHz
x dB -6.00 dB
Trace/Detector
Clear Write
Average
Max Hold
Min Hold
Detector
Peak
Auto
Man
MSG
STATUS

Agilent Spectrum Analyzer - Occupied BW
x dB -6.00 dB
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
02:24:09 PM Nov 17, 2015
10 dB/div
Ref 10.00 dBm
Center 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3 MHz
Sweep 1 ms
Occupied Bandwidth
1.0285 MHz
Total Power 2.77 dBm
Transmit Freq Error -716 Hz
OBW Power 99.00 %
x dB Bandwidth 687.9 kHz
x dB -6.00 dB
Trace/Detector
Clear Write
Average
Max Hold
Min Hold
Detector
Peak
Auto
Man
MSG
STATUS

5.4. Occupied Bandwidth

5.4.1. Standard Applicable

According to §15.247(a): Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

5.4.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the Spectrum Analyzer.

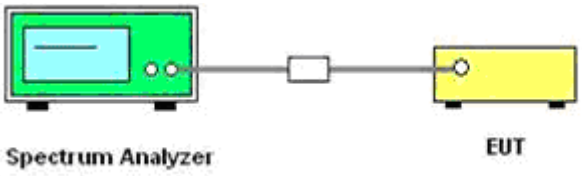
Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> RBW
RBW	1% to 3% of the band
VBW	3 times the RBW
Detector	Peak
Trace	Max Hold
Sweep Time	100ms

5

5.4.3. Test Procedures

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth measurement function is utilized.

5.4.4. Test Setup Layout



5.4.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.4.6. Test Result of 99% Occupied Bandwidth.

Temperature	25˚C	Humidity	60%
Test Engineer	Jacky	Configurations	BLE

Channel	Frequency (MHz)	99% OBW (MHz)
1	2402	1.0226
19	2440	1.0255
40	2480	1.0285

Test plots: Please refer to clause 5.3.6

5.5. Radiated Emissions Measurement

5.5.1. Standard Applicable

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

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

5.5.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 100kHz for QP

5.5.3. Test Procedures

1) **Sequence of testing 9 kHz to 30 MHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0 °to 315 °using 45 °steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0 °to 360 °) and by rotating the elevation axes (0 °to 360 °).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) **Sequence of testing 30 MHz to 1 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0 °to 315 °using 45 °steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (±45 °) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) **Sequence of testing 1 GHz to 18 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0 °to 315 °using 45 °steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (±45 °) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) **Sequence of testing above 18 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarisations of the antenna.

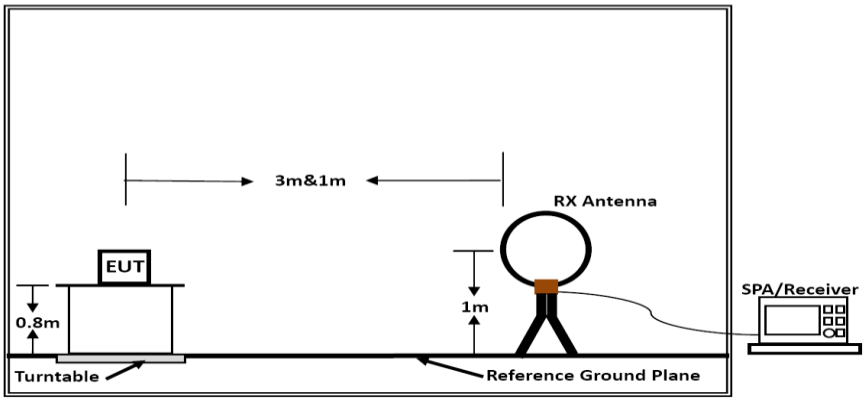
Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

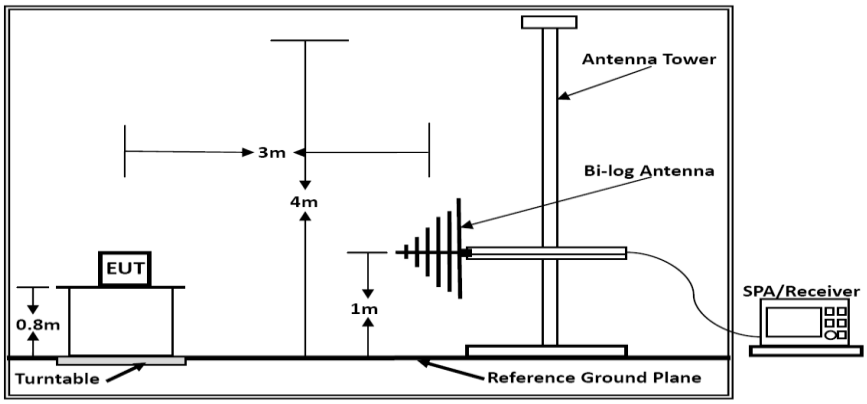
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

5.5.4. Test Setup Layout

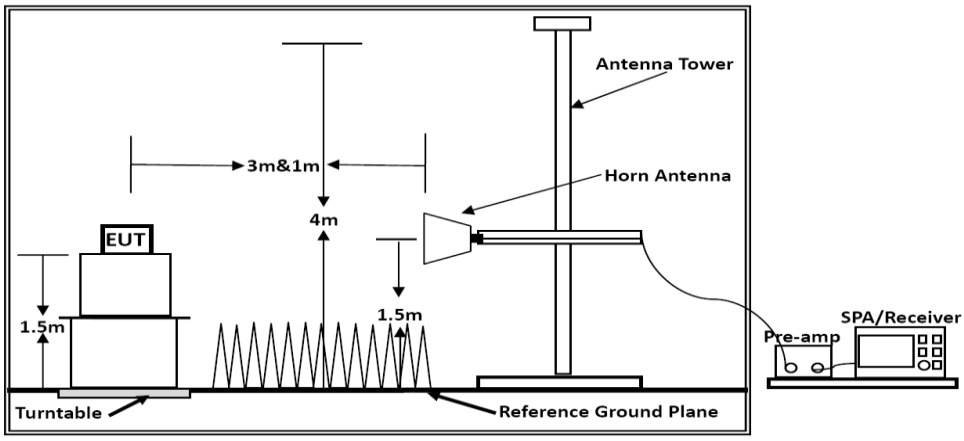
For radiated emissions below 30MHz



Below 30MHz



Below 1GHz



Above 1GHz

Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1.5m.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1.5m]) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

5.5.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.5.6. Results of Radiated Emissions (9kHz~30MHz)

Temperature	25℃	Humidty	60%
Test Engineer	Jacky	Configurations	BLE

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

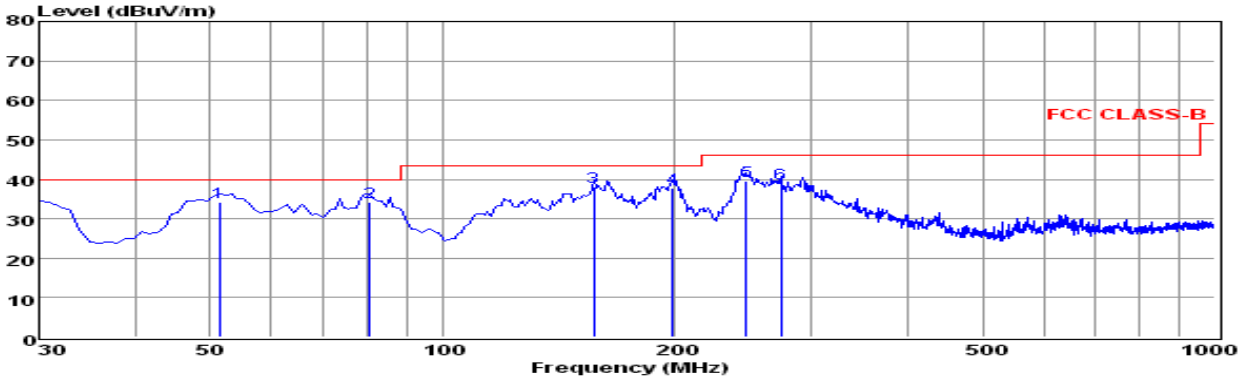
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

5.5.7. Results of Radiated Emissions (30MHz~1GHz)

Temperature	25℃	Humidty	60%
Test Engineer	Jacky	Configurations	BLE (High CH)

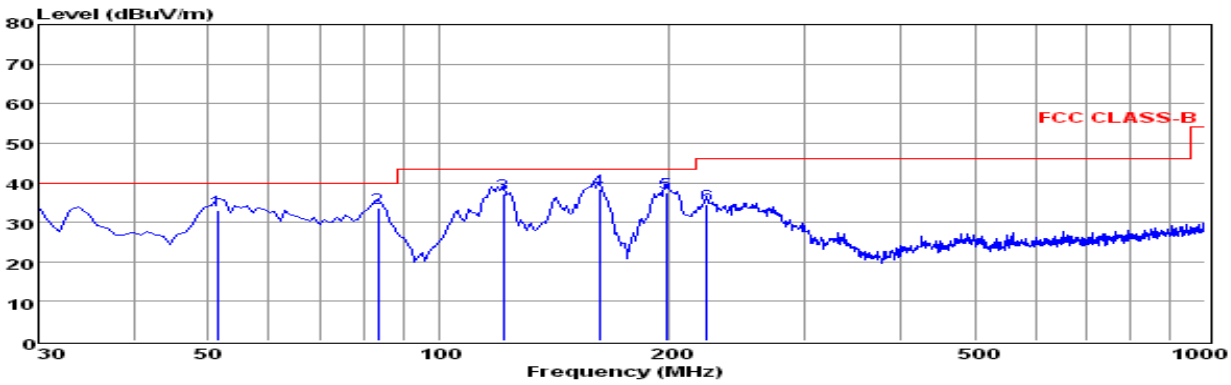
Test result for BLE (High Channel)



Env./Ins: 24℃/56%
EUT: Bluetooth speaker
M/N: QuarterWave
Power Rating: AC 120V/60Hz
Test Mode: BLE-High channel
Operator: Jacky
Memo:
pol: HORIZONTAL

	Freq MHz	Reading dBuV	CabLos dB	Antfac dB/m	Measured dBuV/m	Limit dBuV/m	Over dB	Remark
1	51.34	20.59	0.54	13.19	34.32	40.00	-5.68	Peak
2	80.44	24.91	0.65	8.70	34.26	40.00	-5.74	Peak
3	157.07	28.59	0.83	8.55	37.97	43.50	-5.53	Peak
4	198.78	26.45	0.84	10.57	37.86	43.50	-5.64	Peak
5	247.28	26.61	0.97	12.08	39.66	46.00	-6.34	Peak
6	274.44	25.30	1.04	12.50	38.84	46.00	-7.16	Peak

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported



Env./Ins: 24℃/56%
EUT: Bluetooth speaker
M/N: QuarterWave
Power Rating: AC 120V/60Hz
Test Mode: BLE-High channel
Operator: Jacky
Memo:
pol: VERTICAL

	Freq MHz	Reading dBuV	CabLos dB	Antfac dB/m	Measured dBuV/m	Limit dBuV/m	Over dB	Remark
1	51.34	19.30	0.54	13.19	33.03	40.00	-6.97	Peak
2	83.35	23.30	0.54	9.73	33.57	40.00	-6.43	Peak
3	121.18	26.22	0.70	10.30	37.22	43.50	-6.28	Peak
4	161.92	28.98	0.75	8.73	38.46	43.50	-5.04	Peak
5	197.81	26.14	0.84	10.57	37.55	43.50	-5.95	Peak
6	224.00	22.10	0.95	11.38	34.43	46.00	-11.57	Peak

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported

Note:

Pre-scan all mode and recorded the worst case results in this report (BLE (High Channel)).

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

5.5.8. Results for Radiated Emissions (Above 1GHz)

The worst test result for Tx-Low Channel:

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4804.00	52.73	33.06	35.04	3.94	54.69	74	-19.31	Peak	Horizontal
4804.00	38.52	33.06	35.04	3.94	40.48	54	-13.52	Average	Horizontal
4804.00	50.29	33.06	35.04	3.94	52.25	74	-21.75	Peak	Vertical
4804.00	37.07	33.06	35.04	3.94	39.03	54	-14.97	Average	Vertical

The worst test result for Tx-Middle Channel:

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4880.00	52.91	33.16	35.15	3.96	54.88	74	-19.12	Peak	Horizontal
4880.00	38.16	33.16	35.15	3.96	40.13	54	-13.87	Average	Horizontal
4880.00	50.75	33.16	35.15	3.96	52.72	74	-21.28	Peak	Vertical
4880.00	37.51	33.16	35.15	3.96	39.48	54	-14.52	Average	Vertical

The worst test result for Tx-High Channel:

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac dB	Cab. Los dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4960.00	52.26	33.26	35.14	3.98	54.36	74	-19.64	Peak	Horizontal
4960.00	38.02	33.26	35.14	3.98	40.12	54	-13.88	Average	Horizontal
4960.00	50.75	33.26	35.14	3.98	52.85	74	-21.15	Peak	Vertical
4960.00	37.89	33.26	35.14	3.98	39.99	54	-14.01	Average	Vertical

Notes:

1. *Measuring frequencies from 9k~10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30 MHz.*
2. *Radiated emissions measured in frequency range from 9k~10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.*
3. *18~25GHz at least have 20dB margin. No recording in the test report.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*

5.5.9. Results of Band Edges Test (Radiated)

Tx-2402

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2390.00	48.92	32.89	35.16	3.51	50.16	74	-23.84	Peak	Horizontal
2390.00	34.54	32.89	35.16	3.51	35.78	54	-18.22	Average	Horizontal
2400.00	52.12	32.92	35.16	3.54	53.42	74	-20.58	Peak	Horizontal
2400.00	34.92	32.92	35.16	3.54	36.22	54	-17.78	Average	Horizontal
2390.00	49.16	32.89	35.16	3.51	50.40	74	-23.60	Peak	Vertical
2390.00	33.54	32.89	35.16	3.51	34.78	54	-19.22	Average	Vertical
2400.00	51.39	32.92	35.16	3.54	52.69	74	-21.31	Peak	Vertical
2400.00	35.51	32.92	35.16	3.54	36.81	54	-17.19	Average	Vertical

Tx-2480

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2483.50	49.29	33.06	35.18	3.60	50.77	74	-23.23	Peak	Horizontal
2483.50	35.15	33.06	35.18	3.60	36.63	54	-17.37	Average	Horizontal
2483.50	47.64	33.06	35.18	3.60	49.12	74	-24.88	Peak	Vertical
2483.50	35.30	33.06	35.18	3.60	36.78	54	-17.22	Average	Vertical

5.6. Conducted Spurious Emissions and Band Edges Test

5.6.1. Standard Applicable

According to §15.247 (d): In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

5.6.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Detector	Peak
Attenuation	Auto
RB / VB (Emission in restricted band)	100KHz/300KHz
RB / VB (Emission in non-restricted band)	100KHz/300KHz

5.6.3. Test Procedures

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz

The spectrum from 9kHz to 40GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

5.6.4. Test Setup Layout

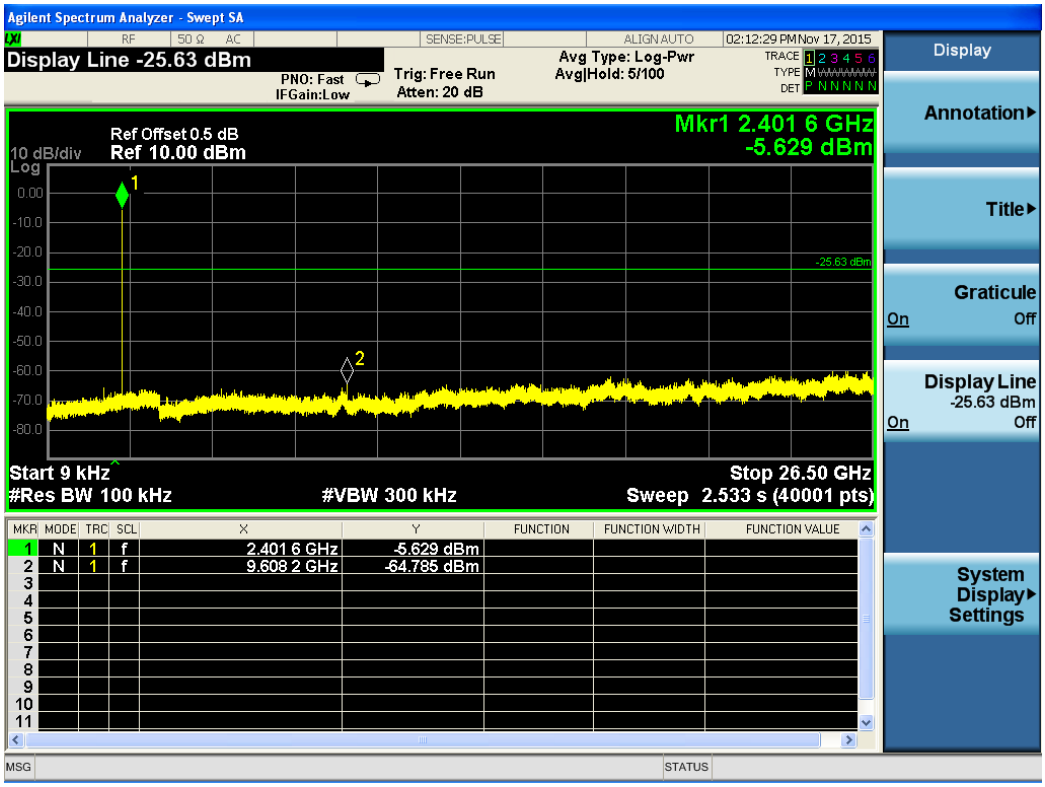
This test setup layout is the same as that shown in section 5.4.4.

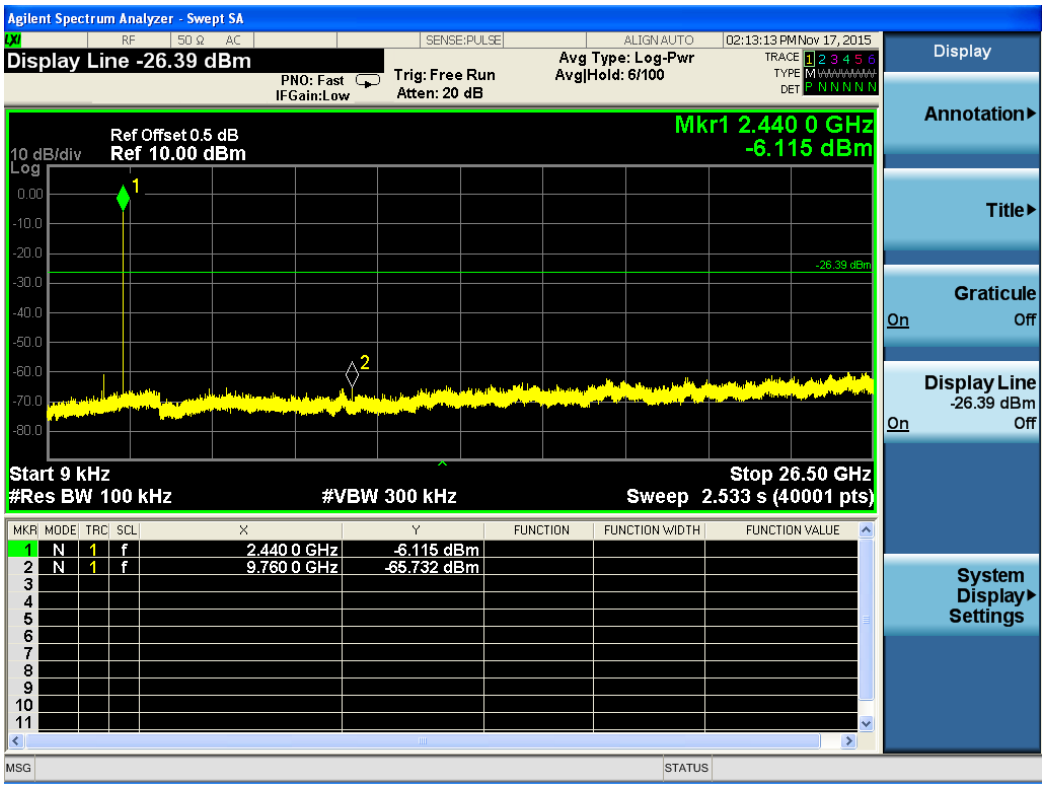
5.6.5. EUT Operation during Test

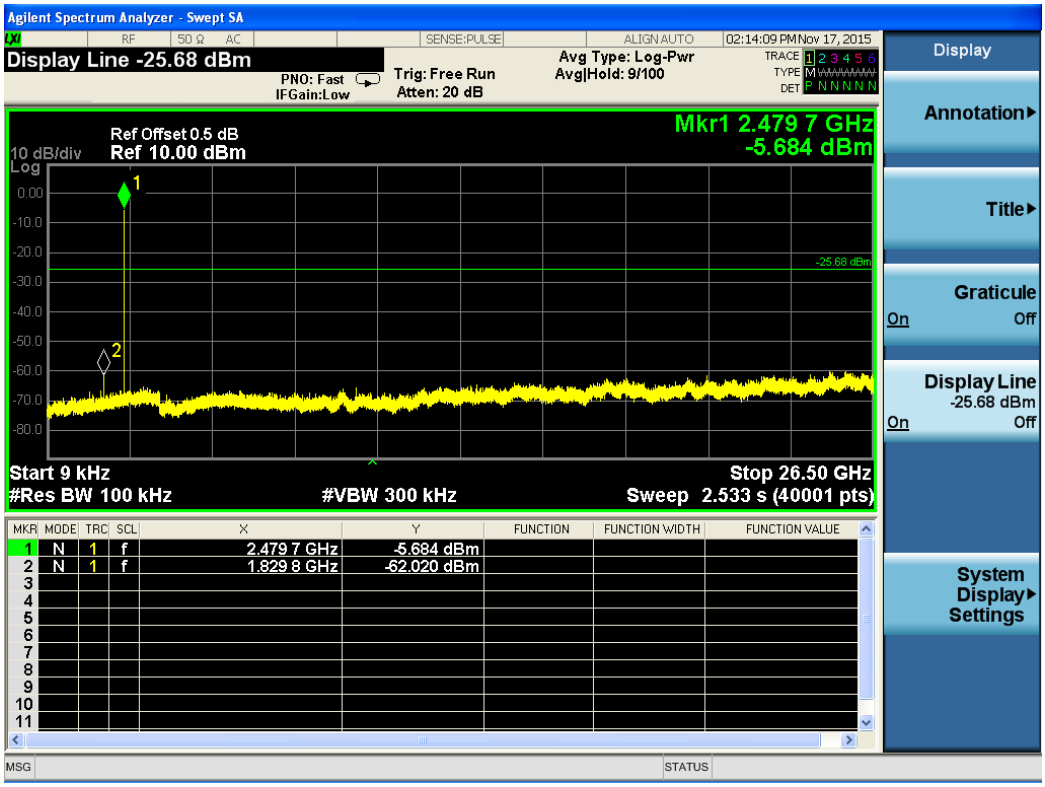
The EUT was programmed to be in continuously transmitting mode.

5.6.6. Test Results of Conducted Spurious Emissions

Test plot of Conducted Spurious Emissions

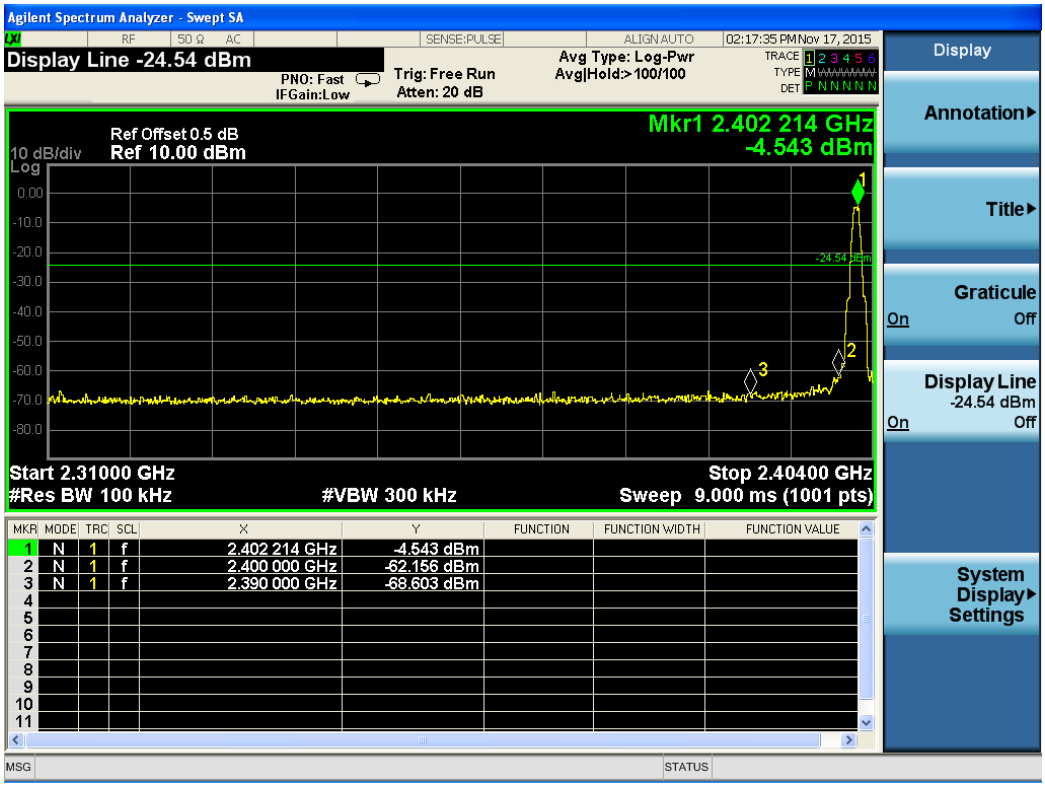


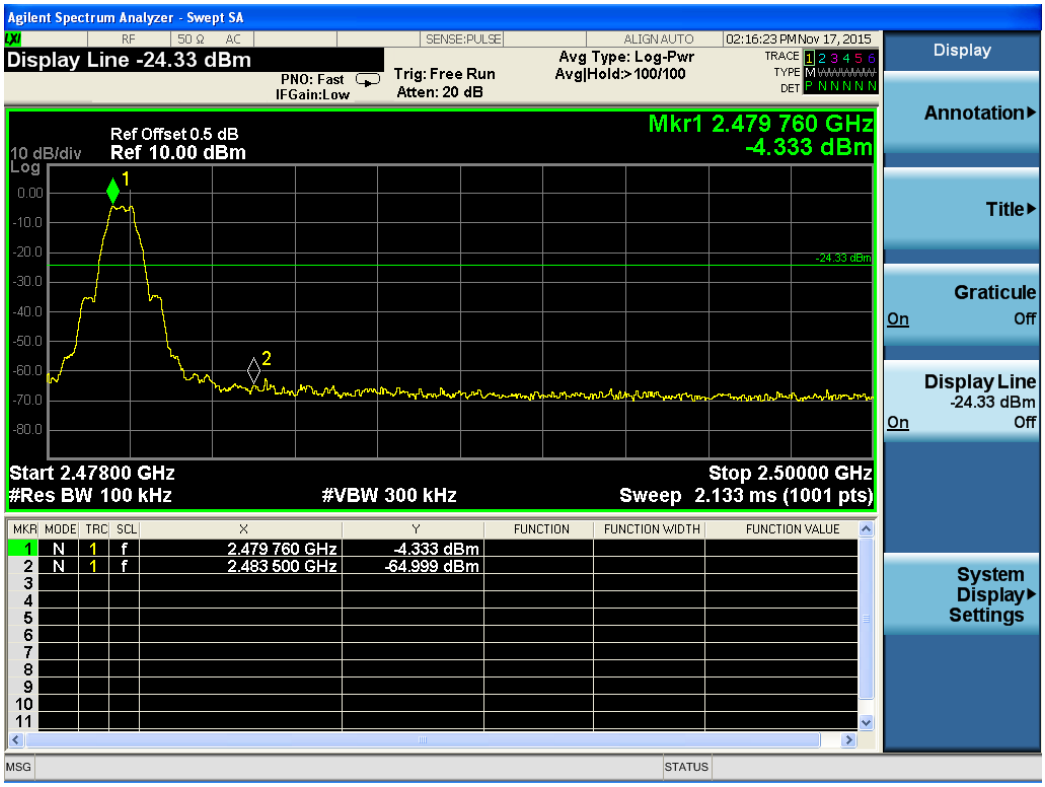



Agilent Spectrum Analyzer - Swept SA
Display Line -25.68 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 9/100
02:14:09 PM Nov 17, 2015
Ref Offset 0.5 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 2.479 7 GHz
-5.684 dBm
-25.68 dBm
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26.50 GHz
Sweep 2.533 s (40001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.479 7 GHz -5.684 dBm
2 N 1 f 1.829 8 GHz -62.020 dBm
Display
Annotation
Title
Graticule
On Off
Display Line
-25.68 dBm
On Off
System Display Settings
MSG
STATUS

5.6.7. Test Results of Band Edges Test

Test plot of Band Edges Test





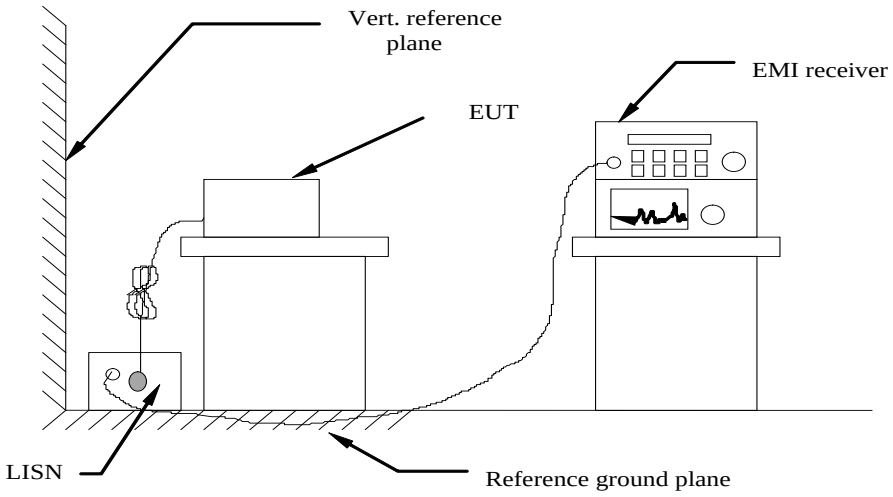
5.7. Power line conducted emissions

5.7.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

5.7.2 Block Diagram of Test Setup

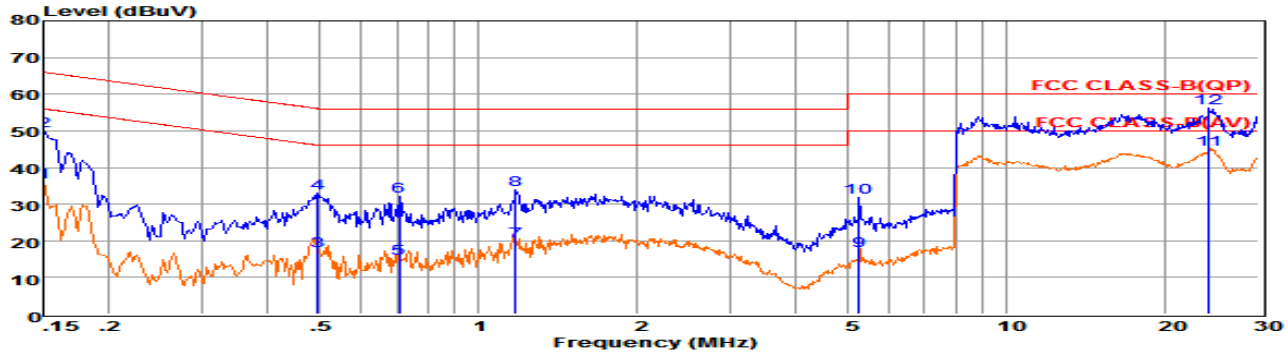


5.7.3 Test Results

PASS.

The test data please refer to following page.

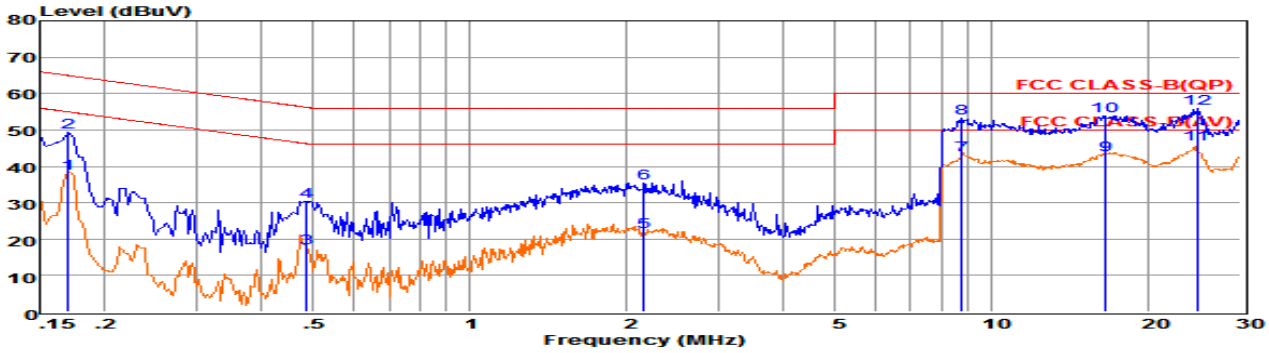
Test result for BLE(AC 120V/60Hz)



Env. Ins: 24*/56%
EUT: Bluetooth speaker
M/N: QuarterWave
Power Rating: AC 120V/60Hz
Test Mode: BLEHigh channel
Operator: Jacky
Memo:
Pol: NEUTRAL

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15000	16.13	9.70	0.02	10.00	35.85	56.00	-20.15	Average
2	0.15000	30.30	9.70	0.02	10.00	50.02	66.00	-15.98	QP
3	0.49673	-2.46	9.62	0.04	10.00	17.20	46.05	-28.85	Average
4	0.49673	13.37	9.62	0.04	10.00	33.03	56.05	-23.02	QP
5	0.70842	-4.37	9.63	0.04	10.00	15.30	46.00	-30.70	Average
6	0.70842	12.36	9.63	0.04	10.00	32.03	56.00	-23.97	QP
7	1.17813	0.20	9.63	0.05	10.00	19.88	46.00	-26.12	Average
8	1.17813	14.36	9.63	0.05	10.00	34.04	56.00	-21.96	QP
9	5.24907	-2.52	9.66	0.06	10.00	17.20	50.00	-32.80	Average
10	5.24907	12.05	9.66	0.06	10.00	31.77	60.00	-28.23	QP
11	24.14232	25.06	9.82	0.13	10.00	45.01	50.00	-4.99	Average
12	24.14232	36.21	9.82	0.13	10.00	56.16	60.00	-3.84	QP

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.

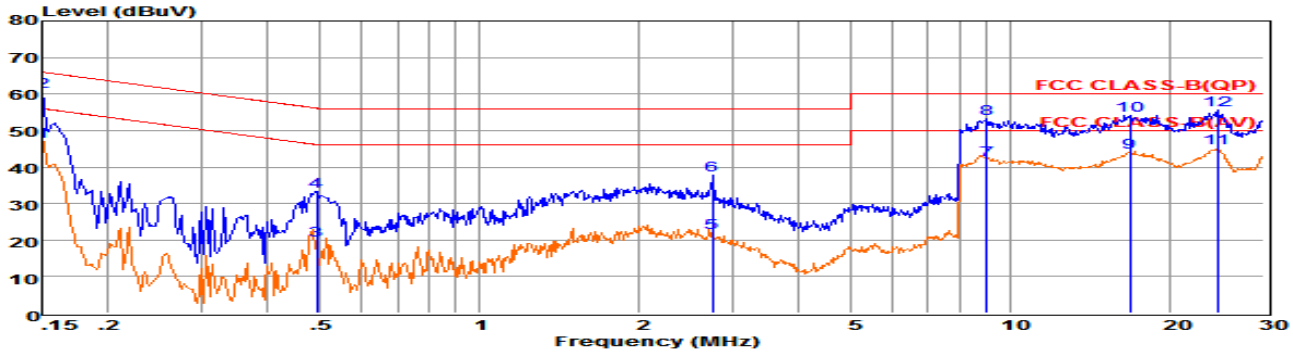


Env. Ins: 24*/56%
EUT: Bluetooth speaker
M/N: QuarterWave
Power Rating: AC 120V/60Hz
Test Mode: BLEHigh channel
Operator: Jacky
Memo:
Pol: LINE

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.17034	18.55	9.60	0.02	10.00	38.17	54.94	-16.77	Average
2	0.17034	29.69	9.60	0.02	10.00	49.31	64.94	-15.63	QP
3	0.48632	-2.07	9.62	0.04	10.00	17.59	46.23	-28.64	Average
4	0.48632	10.81	9.62	0.04	10.00	30.47	56.23	-25.76	QP
5	2.15531	2.22	9.64	0.05	10.00	21.91	46.00	-24.09	Average
6	2.15531	15.73	9.64	0.05	10.00	35.42	56.00	-20.58	QP
7	8.77571	23.21	9.69	0.08	10.00	42.98	50.00	-7.02	Average
8	8.77571	33.54	9.69	0.08	10.00	53.31	60.00	-6.69	QP
9	16.57318	23.24	9.73	0.11	10.00	43.08	50.00	-6.92	Average
10	16.57318	34.02	9.73	0.11	10.00	53.86	60.00	-6.14	QP
11	24.79044	26.32	9.71	0.13	10.00	46.16	50.00	-3.84	Average
12	24.79044	36.04	9.71	0.13	10.00	55.88	60.00	-4.12	QP

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.

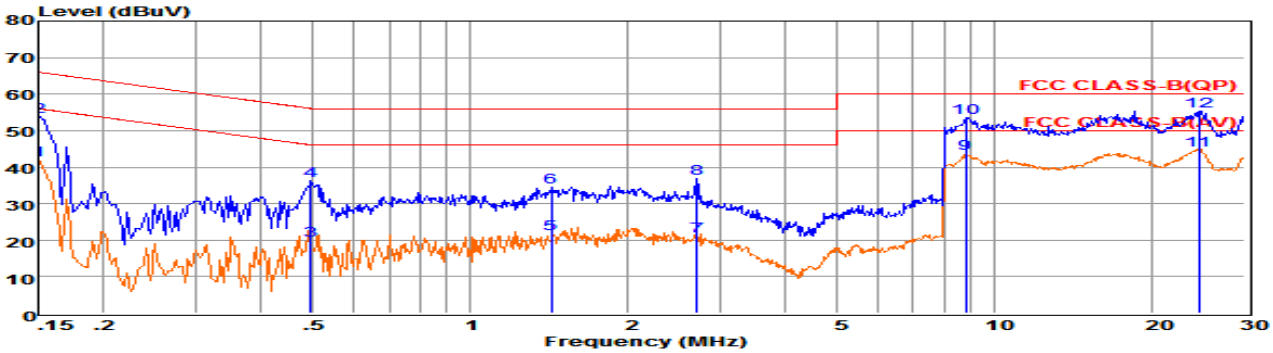
Test result for BLE(AC 230V/50Hz)



Env. Ins: 24*/56%
EUT: Bluetooth speaker
M/N: QuarterWave
Power Rating: AC 230V/50Hz
Test Mode: BLEHigh channel
Operator: Jacky
Memo:
Pol: LINE

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15000	27.29	9.57	0.02	10.00	46.88	56.00	-9.12	Average
2	0.15000	41.13	9.57	0.02	10.00	60.72	66.00	-5.28	QP
3	0.49411	0.37	9.62	0.04	10.00	20.03	46.10	-26.07	Average
4	0.49411	13.59	9.62	0.04	10.00	33.25	56.10	-22.85	QP
5	2.75015	2.27	9.64	0.05	10.00	21.96	46.00	-24.04	Average
6	2.75015	17.95	9.64	0.05	10.00	37.64	56.00	-18.36	QP
7	9.01130	22.24	9.69	0.08	10.00	42.01	50.00	-7.99	Average
8	9.01130	33.57	9.69	0.08	10.00	53.34	60.00	-6.66	QP
9	16.74973	24.27	9.73	0.11	10.00	44.11	50.00	-5.89	Average
10	16.74973	34.44	9.73	0.11	10.00	54.28	60.00	-5.72	QP
11	24.52913	25.40	9.71	0.13	10.00	45.24	50.00	-4.76	Average
12	24.52913	35.92	9.71	0.13	10.00	55.76	60.00	-4.24	QP

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.



Env. Ins: 24*/56%
EUT: Bluetooth speaker
M/N: QuarterWave
Power Rating: AC 230V/50Hz
Test Mode: BLEHigh channel
Operator: Jacky
Memo:
Pol: NEUTRAL

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15000	22.32	9.70	0.02	10.00	42.04	56.00	-13.96	Average
2	0.15000	34.19	9.70	0.02	10.00	53.91	66.00	-12.09	QP
3	0.49673	0.32	9.62	0.04	10.00	19.98	46.05	-26.07	Average
4	0.49673	16.48	9.62	0.04	10.00	36.14	56.05	-19.91	QP
5	1.42570	1.93	9.63	0.05	10.00	21.61	46.00	-24.39	Average
6	1.42570	14.92	9.63	0.05	10.00	34.60	56.00	-21.40	QP
7	2.70678	1.55	9.64	0.05	10.00	21.24	46.00	-24.76	Average
8	2.70678	17.09	9.64	0.05	10.00	36.78	56.00	-19.22	QP
9	8.82233	23.81	9.71	0.08	10.00	43.60	50.00	-6.40	Average
10	8.82233	33.86	9.71	0.08	10.00	53.65	60.00	-6.35	QP
11	24.52913	24.68	9.83	0.13	10.00	44.64	50.00	-5.36	Average
12	24.52913	35.50	9.83	0.13	10.00	55.46	60.00	-4.54	QP

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.

****Note: Pre-scan all mode and recorded the worst case results in this report (BLE (High Channel)).*

5.8. Antenna Requirements

5.8.1 Standard Applicable

According to antenna requirement of §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. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

5.8.2 Antenna Connected Construction

5.8.2.1. Standard Applicable

According to §15.203 & RSS-Gen, 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.

5.8.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is -0.61dBi, and the antenna is an PCB antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

5.8.2.3. Results: Compliance.

Measurement parameters:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	3 MHz
Video bandwidth:	3 MHz
Trace-Mode:	Max hold

Note: The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal Bluetooth devices, the GFSK mode is used.

Limits:

FCC	IC
Antenna Gain	
6dBi	

Tnom	Vnom	Lowest channel 2402 MHz	Middle channel 2440 MHz	Highest channel 2480 MHz
Conducted power [dBm] Measured with GFSK modulation		-3.81	-3.39	-3.62
Radiated power [dBm] Measured with GFSK modulation		-4.65	-4.04	-4.50
Gain [dBi] Calculated		-0.84	-0.65	-0.88
Measurement uncertainty			± 1.5 dB (cond.) / ± 3 dB (rad.)	

Result: -/-

6. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Cal Date	Due Date
EMC Receiver	R&S	ESCS 30	100174	9kHz – 2.75GHz	June 18, 2015	June 17, 2016
Signal analyzer	Agilent	E4448A(External mixers to 40GHz)	US44300469	9kHz~40GHz	July 16, 2015	July 15, 2016
Signal analyzer	Agilent	N9020A	MY50510140	9kHz~26.5GHz	October 27, 2015	November 18, 2016
LISN	MESS Tec	NNB-2/16Z	99079	9KHz-30MHz	June 18, 2015	June 17, 2016
LISN (Support Unit)	EMCO	3819/2NM	9703-1839	9KHz-30MHz	June 18, 2015	June 17, 2016
RF Cable-CON	UTIFLEX	3102-26886-4	CB049	9KHz-30MHz	June 18, 2015	June 17, 2016
ISN	SCHAFFNER	ISN ST08	21653	9KHz-30MHz	June 18, 2015	June 17, 2016
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30M-1GHz 3m	June 18, 2015	June 17, 2016
Amplifier	SCHAFFNER	COA9231A	18667	9kHz-2GHzz	June 18, 2015	June 17, 2016
Amplifier	Agilent	8449B	3008A02120	1GHz-26.5GHz	July 16, 2015	July 15, 2016
Amplifier	MITEQ	AMF-6F-260400	9121372	26.5GHz-40GHz	July 16, 2015	July 15, 2016
Loop Antenna	R&S	HFH2-Z2	860004/001	9k-30MHz	June 18, 2015	June 17, 2016
By-log Antenna	SCHWARZBECK	VULB9163	9163-470	30MHz-1GHz	June 10, 2015	June 09, 2016
Horn Antenna	EMCO	3115	6741	1GHz-18GHz	June 10, 2015	June 09, 2016
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15GHz-40GHz	June 10, 2015	June 09, 2016
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz-1GHz	June 18, 2015	June 17, 2016
RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	1GHz-40GHz	June 18, 2015	June 17, 2016
Spectrum Meter	R&S	FSP 30	100023	9kHz-30GHz	July 16, 2015	July 15, 2016
Power Meter	R&S	NRVS	100444	DC-40GHz	June 18, 2015	June 17, 2016
Power Sensor	R&S	NRV-Z51	100458	DC-30GHz	June 18, 2015	June 17, 2016
Power Sensor	R&S	NRV-Z32	10057	30MHz-6GHz	June 18, 2015	June 17, 2016
AC Power Source	HPC	HPA-500E	HPA-9100024	AC 0~300V	June 18, 2015	June 17, 2016
DC power Soure	GW	GPC-6030D	C671845	DC 1V-60V	June 18, 2015	June 17, 2016
Temp. and Humidigy	Giant Force	GTH-225-20-S	MAB0103-00	N/A	June 18, 2015	June 17, 2016
RF CABLE-1m	JYE Bao	RG142	CB034-1m	20MHz-7GHz	June 18, 2015	June 17, 2016
RF CABLE-2m	JYE Bao	RG142	CB)35-2m	20MHz-1GHz	June 18, 2015	June 17, 2016
Vector signal Generator	R&S	SMU200A	102098	100kHz~6GHz	June 18, 2015	June 17, 2016
Signal Generator	R&S	SMR40	10016	10MHz~40GHz	July 16, 2015	July 15, 2016
Note: All equipment through GRGT EST calibration						

----------THE END OF REPORT----------

This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd..