Test Report of FCC CFR 47 Part 15 Subpart C

On Behalf of

Novomill Creative Co., Ltd

213 6D-8/Rm 6D-8, Block 213, Chegongmiao Industrial park, Futian District, ShenZhen, China

Product Name:	E-Button portable bluetooth speaker
Model/Type No.:	ES001
Trade Name:	Novomill
FCC ID:	2ANQJ-ES001
Prepared By:	**Shenzhen Hongcai Testing Technology Co., Ltd.** 1st-3rd Floor, Building C, Shuanghuan Xin Yi Dai Hi-Tech Industrial Park, No.8 Baoqing Road, Baolong Industrial Zone, Longgang District, Shenzhen, Guangdong, China Tel: +86-755-86337020 Fax:+86-755-86337028
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Reviewed By: Owen.Yang — Owen.Yang, EMC Technical Supervisor

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	**Novomill Creative Co., Ltd**
Address of applicant:	213 6D-8/Rm 6D-8, Block 213, Chegongmiao Industrial park, Futian District, ShenZhen, China
Manufacturer :	**Novomill Creative Co., Ltd**
Address of applicant:	213 6D-8/Rm 6D-8, Block 213, Chegongmiao Industrial park, Futian District, ShenZhen, China

General Description of E.U.T

Items	Description
EUT Description:	E-Button portable bluetooth speaker
Model No.:	ES001
Supplementary ModelNo.:	N/A
Trade Name:	Novomill
Frequency Band:	2402~2480MHz
Channel Spacing:	1MHz
Number of Channels:	79
Type of Modulation:	GFSK
Antenna Gain	0dBi
Antenna Type:	PCB Antenna
Rated Voltage:	DC 3.7V from battery

Remark:* The test data gathered are from the production sample provided by the manufacturer.

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1.2 Related Submittal(s) / Grant (s) and Test Methodology

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

1.3 Test Facility

All measurement required was performed at laboratory of Shenzhen CTL Testing Technology Co., Ltd.

Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 22/EN 55022 requirements.

FCC – Registration No.: 970318

Shenzhen CTL Testing Technology 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 970318, December, 2013.

IC Registration No.: 9618B

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

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2. SYSTEM TEST CONFIGURATION

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 calibrated antennas used to sample the radiated field strength are mounted on a non-conductive, motorized antenna mast 3 or 10 meters from the leading edge of the turntable.

2.3 General Test Procedures

Conducted Emissions: The EUT is placed on the table, which is 0.8 m above ground plane According to the requirements in ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak detector mode.

Radiated Emissions: The EUT is a placed on as turntable, 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 ANSI C63.10-2013.

2.4 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 Shenzhen CTL Testing Technology Co., Ltd. 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.

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

Parameter	Uncertainty
Transmitter power conducted	+/- 0.57 dB
Transmitter power Radiated	+/- 2.20 dB
Conducted spurious emission 9KHz-40 GHz	+/- 2.20 dB
Power Line Conducted Emission	+/- 3.20 dB
Radiated Emission	+/- 4.32 dB

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

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2.5 Measure Results Explanation Example

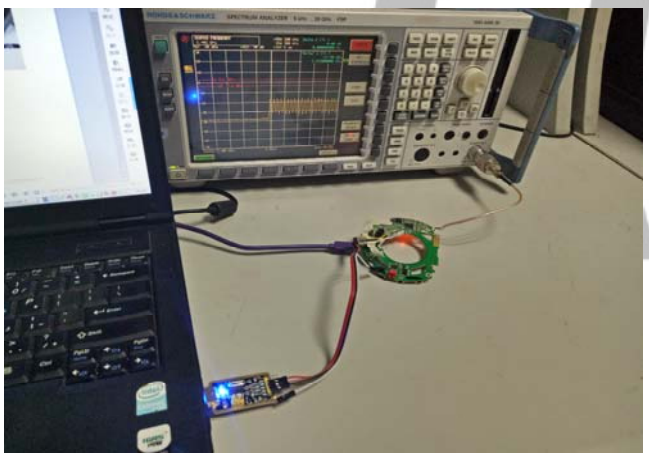
For all conducted test items:

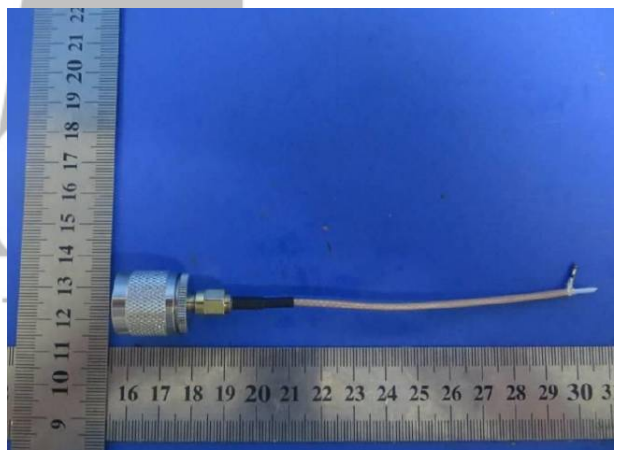
The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable less and attenuator factor.
Offset= RF cable less+ attenuator factor.

Note: Using a temporary antenna connector for the EUT when the conducted measurements are performed.

Equipment	Manufacturer	Model No.	Frequency range(GHz)	Attenuation values(dBm)
Line	Zhenjiang south electronic	RG316	1-12	0.08
Connector	Zhenjiang south electronic	SMA-K/N-J	1-12	0.01





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2.6 List of Measuring Equipments Used

No.	Equipment	Manufacturer	Model No.	S/N	Last Calculator	Due Calculator
1	EMI Test Receiver	R&S	ESCI	100687	2016-7-25	2017-7-24
2	EMI Test Receiver	R&S	ESPI	100097	2016-10-1	2017-10-31
3	Teo Line Single Phase Module	SCHWARZBECK	NSLK8128	8128247	2016-10-1	2017-10-31
4	Amplifier	HP	8447D	1937A02492	2016-7-25	2017-7-24
5	TRILOG Broadband Test-Antenna	SCHWARZBECK	VULB9163	9163-324	2016-7-25	2017-7-24
6	Power Sensor	Anritsu	ML2438A	1241002	2016-7-25	2017-7-24
7	Power Sensor	Anritsu	MA2411B	1207366	2016-7-25	2017-7-24
8	10dB attenuator	ELECTRO-METRICS	EM-7600	836	2016-7-25	2017-7-24
9	Spectrum Analyzer	R&S	FSP	100397	2016-10-1	2017-10-31
10	Broadband preamplifier	SCH WARZBECK	BBV9718	9718-182	2016-7-25	2017-7-24
11	Horn Antenna	SCHWARZBECK	BBHA 9120D	0437	2016-7-25	2017-7-24
12	Horn Antenna	SCHWARZBECK	BBHA9170	0483	2016-7-25	2017-7-24

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.207	AC Power Line Conducted Emission	N/A
FCC §15.247(a)(1)	Hopping Channel Bandwidth	Pass
FCC §15.247(a)(1)	Hopping Channel Separation	Pass
FCC §15.247(a)(1)	Number of Hopping Frequency Used	Pass
FCC §15.247(a)(1)(iii)	Dwell Time of Each Frequency	Pass
FCC §15.247(b)(1)	Maximum Peak Output Power	Pass
FCC §15.247(d)	Band Edges Emission	Pass
FCC §15.247(d)	Spurious Radiated Emission	Pass
FCC §15.203/15.247(b)/(c)	Antenna Requirement	Pass

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4. TEST OF AC POWER LINE CONDUCTED EMISSION

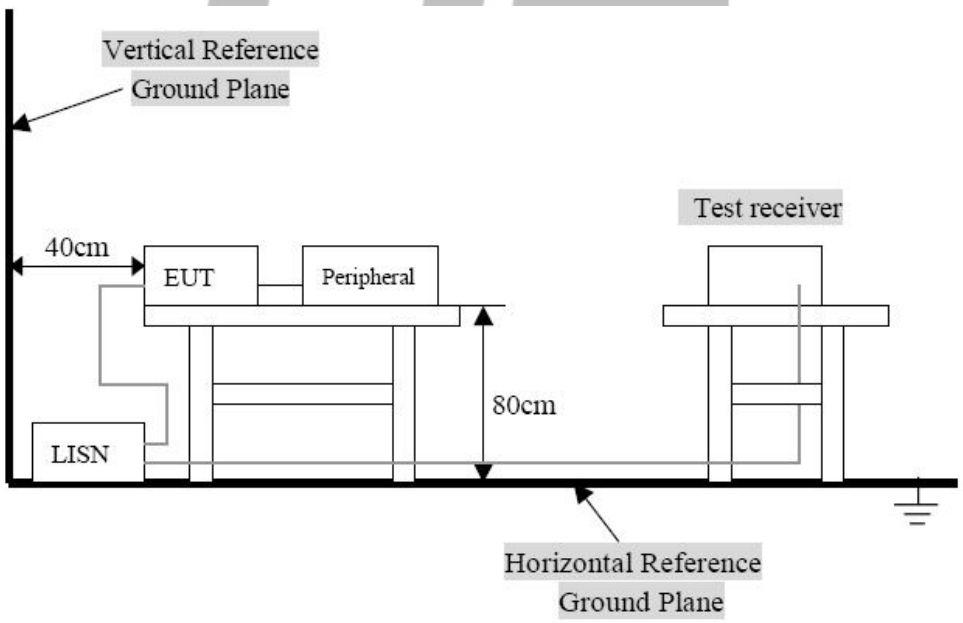
4.1 Applicable Standard

Refer to FCC §15.207.

For a Low-power Radio-frequency Device is designed to be connected to the 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 below limits table.

Frequency Range (MHz)	Limits (dBuV)	
	Quasi-Peak	Average
0.150～0.500	66～56	56～46
0.500～5.000	56	46
5.000～30.00	60	50

4.2 Test Setup Diagram



Remark: The EUT was connected to a 120VAC/ 60Hz power source.

4.3 Test Result

Not applicable.

The EUT is powered by battery.

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5. Test of Hopping Channel Bandwidth

5.1 Applicable Standard

Section 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

5.2 EUT Setup

Spectrum Analyzer

5.3 Test Equipment List and Details

See section 2.6

5.4 Test Procedure

1. 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. The spectrum width with level higher than 20dB below the peak level.

3. Repeat above 1~3 points for the middle and highest channel of the EUT.

5.5 Test Result

Temperature (℃) : 22~23	EUT: E-Button portable bluetooth speaker
Humidity (%RH): 50~54	M/N: ES001
Barometric Pressure (mbar): 950~1000	Operation Condition: Continuously Tx Mode

Modulation Type	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)
GFSK	Low	2402	1002
GFSK	Middle	2440	1000
GFSK	High	2480	1000

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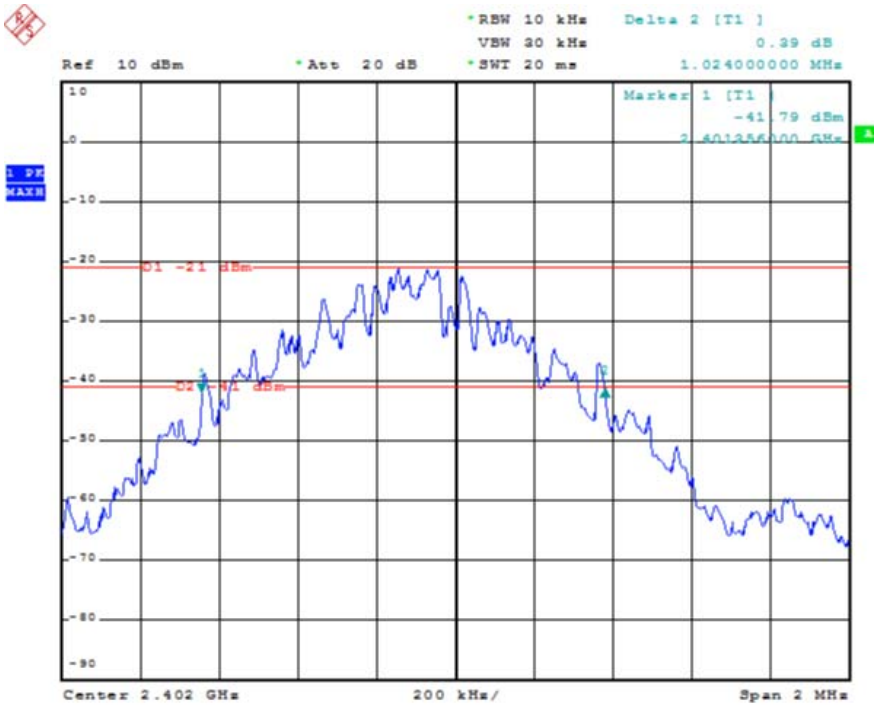
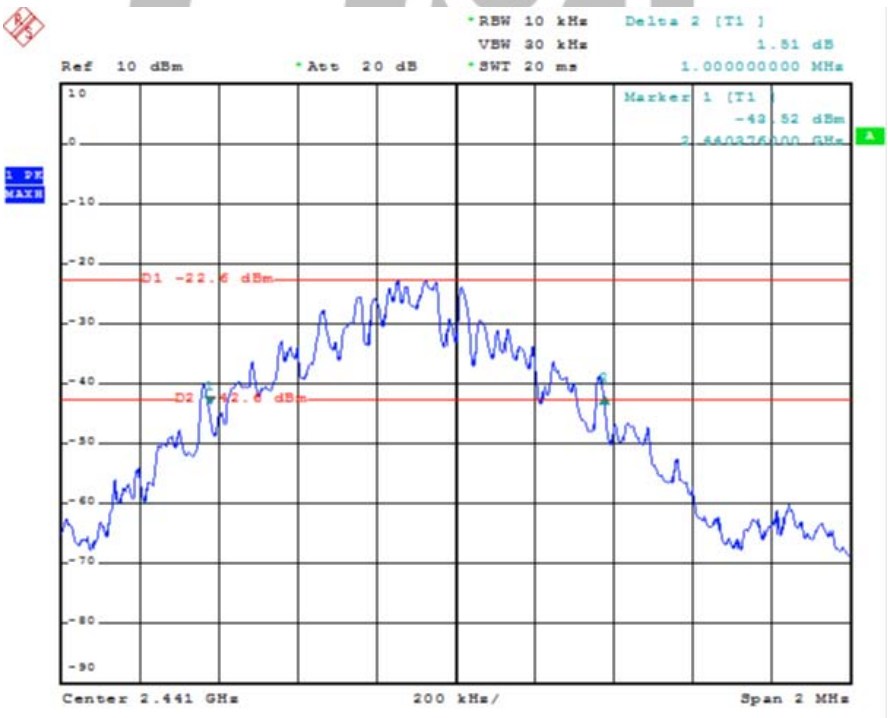
Channel Low：



Channel Middle：



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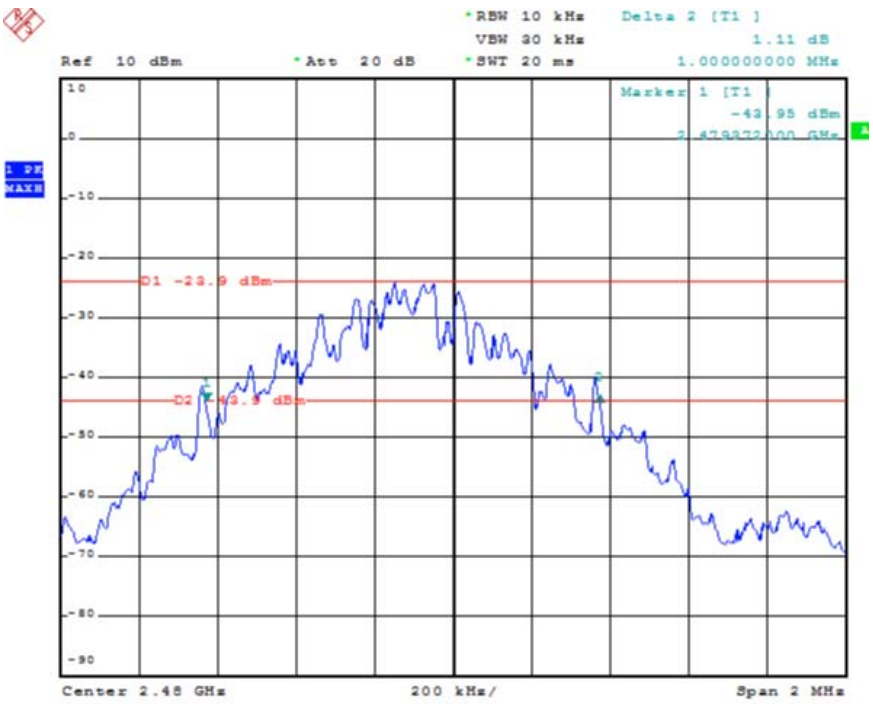
Channel High：



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6. Test of Hopping Channel Separation

6.1 Applicable Standard

Section 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

6.2 EUT Setup

Spectrum Analyzer

6.3 Test Equipment List and Details

See section 2.6

6.4 Test Procedure

1. The EUT must have its hopping function enabled.

2. 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

4. The Hopping Channel Separation is defined as the separation between 2 neighboring hopping frequencies.

5. Repeat above 1~3 points for the middle and highest channel of the EUT.

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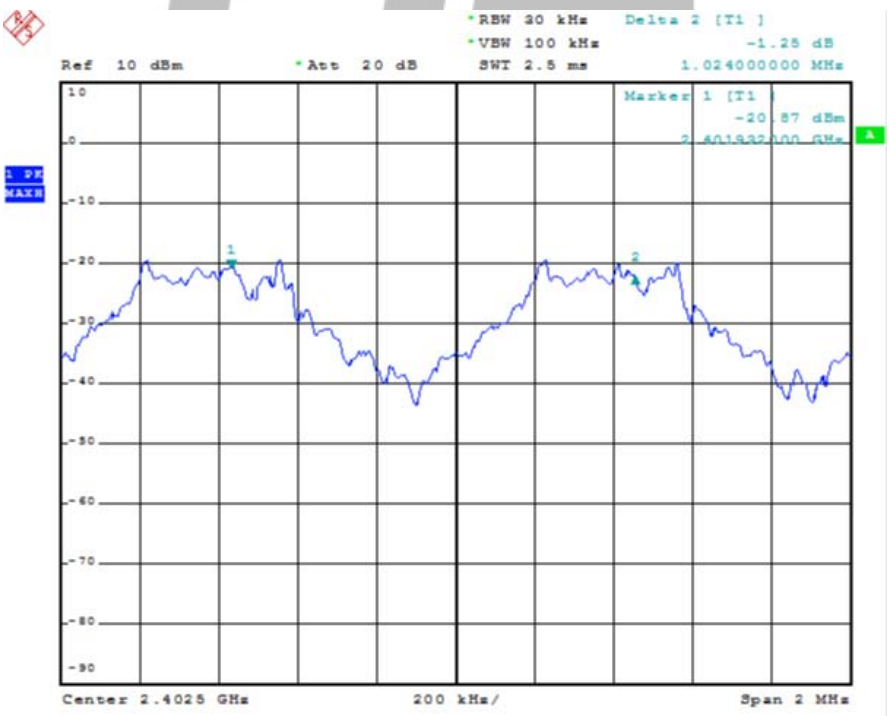
6.5 Test Result

Temperature (℃) : 22~23	EUT: E-Button portable bluetooth speaker
Humidity (%RH): 50~54	M/N: ES001
Barometric Pressure (mbar): 950~1000	Operation Condition: Continuously Tx Mode

Modulation Type	Frequency (MHz)	Channel Separation (MHz)	Min. Limit (kHz)
GFSK	2401.5~2403.5	1.992	>1002
GFSK	2440.5~2442.5	2.008	>1002
GFSK	2478.5~2480.5	2.016	>1002

Test plot as follows:

Channel Low：



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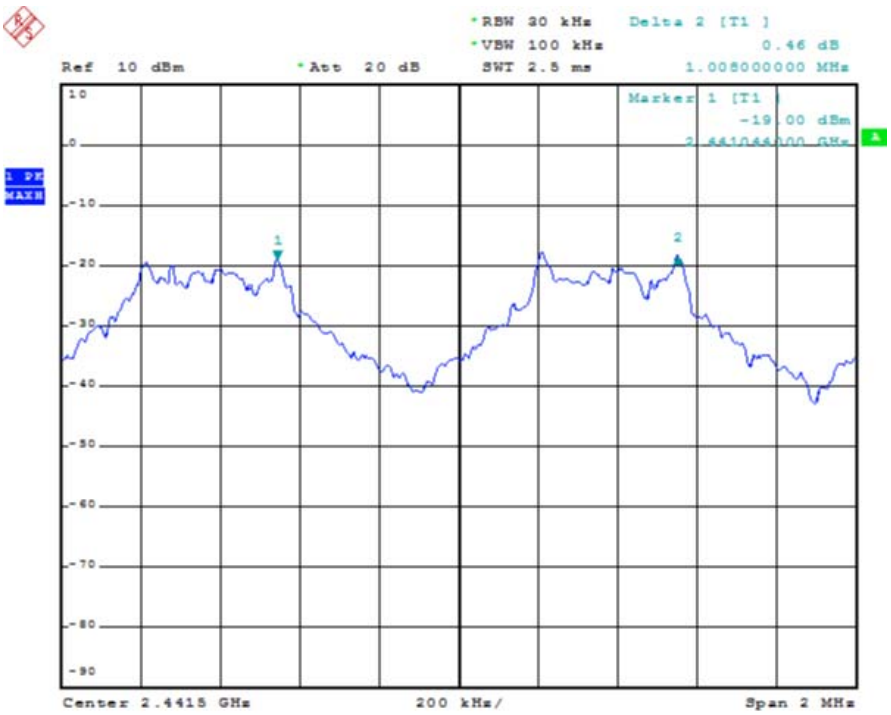
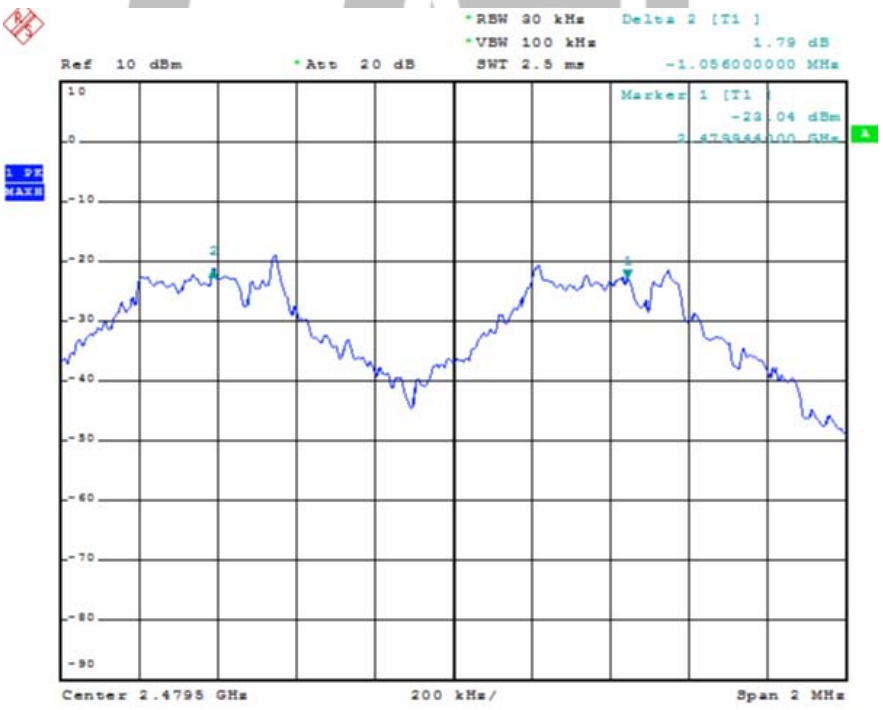
Channel Middle:



Channel High:



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7. Test of Number of Hopping Frequency

7.1 Applicable Standard

Section 15.247(a)(1)(iii): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 15 non-overlapping hopping channels. Frequency hopping system which use fewer than 75 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping system may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping channels are used.

7.2 EUT Setup

Spectrum Analyzer

7.3 Test Equipment List and Details

See section 2.6

7.4 Test Procedure

1. The EUT must have its hopping function enabled.

2. Use the following spectrum analyzer settings:

   Span = the frequency band of operation

   RBW ≥ 1% of the span

   VBW ≥ RBW

   Sweep = Auto

   Detector function = peak

   Trace = max hold

3. Observe frequency hopping in 2400MHz~2483.5MHz, there are at least 32 non-overlapping channels.

4. Repeat above 1~3 points for the middle and highest channel of the EUT.

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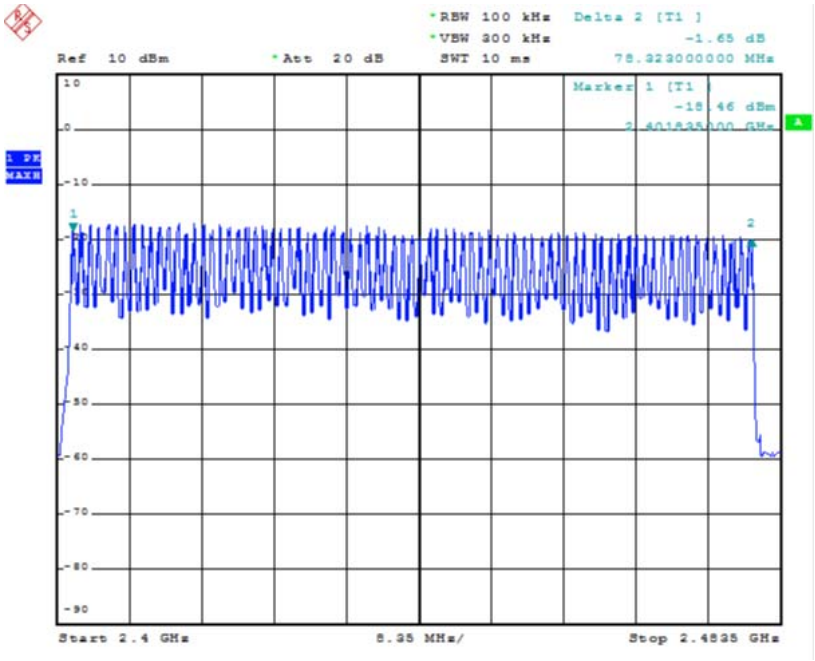
7.5 Test Result

Temperature (℃) : 22~23	EUT: E-Button portable bluetooth speaker
Humidity (%RH): 50~54	M/N: ES001
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode

Modulation Type	Frequency (MHz)	Number of Hopping Channels	Min. Limit
GFSK	2402~2480	79	≥15

Test plot as follow:



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8. Test of Dwell Time of Each Frequency

8.1 Applicable Standard

Section 15.247(a)(1)(iii): For frequency hopping systems operating in the 2400-2483.5 MHz band The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4seconds multiplied by the number of hopping channels employed.

8.2 EUT Setup

Spectrum Analyzer

8.3 Test Equipment List and Details

See section 2.6.

8.4 Test Procedure

1. The EUT must have its hopping function enabled.
2. 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

3. Measure the maximum time duration of one single pulse.

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8.5 Test Result

Temperature (℃) : 22~23	EUT: E-Button portable bluetooth speaker
Humidity (%RH): 50~54	M/N: ES001
Barometric Pressure (mbar): 950~1000	Operation Condition: Continuously Tx Mode

Modulation Type	Channel	Dwell Time (ms)	Limit (ms)	Result
GFSK	Low	124.8ms	400	Pass
GFSK	Mid	124.8ms	400	Pass
GFSK	High	124.8ms	400	Pass

Note:

1. We have tested all mode at high,middle and low channel

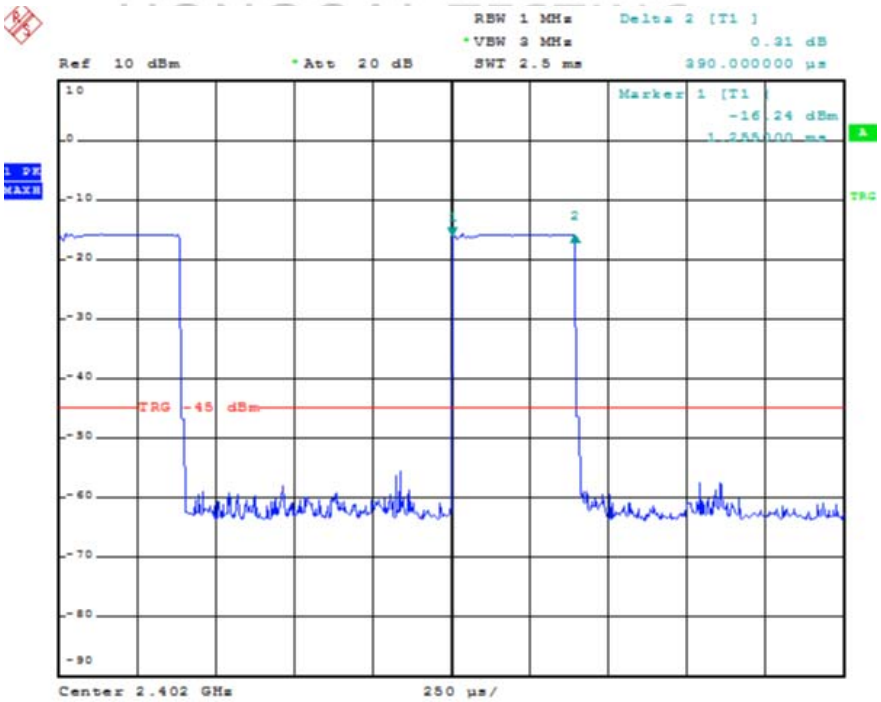
2. For Low:Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 40) ×16
=390×10^(-3) ×(1600 ÷ 2 ÷ 40) ×16=124.8ms

for Mid:Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 40) ×16
=390×10^(-3) ×(1600 ÷ 4 ÷ 40) ×16=124.8ms

for High:Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 40) ×16
=390×10^(-3) ×(1600 ÷ 6 ÷ 40) ×16=124.8ms

Test plot as follows:

LOW：



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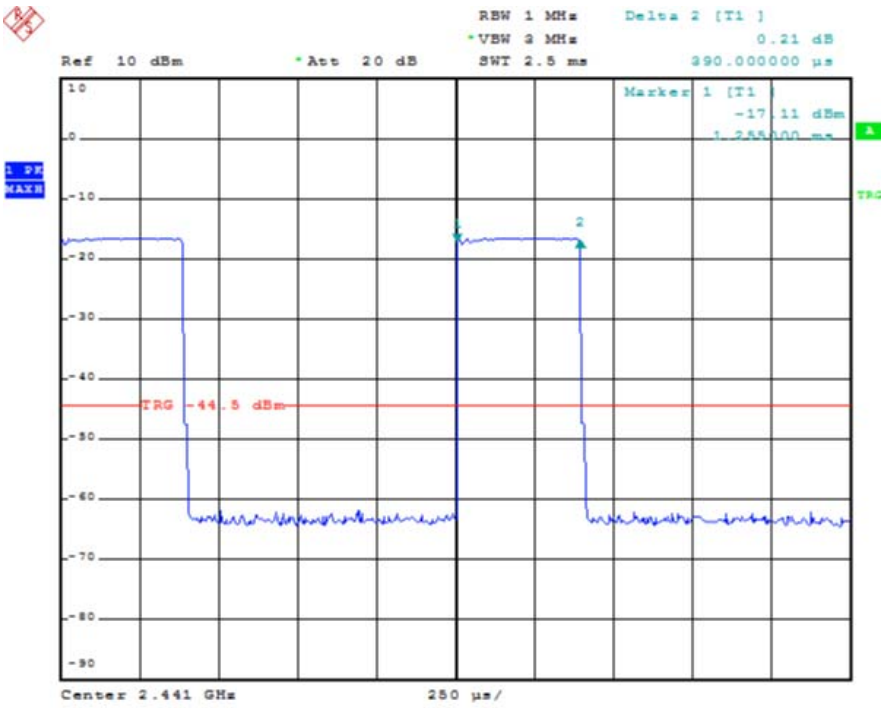
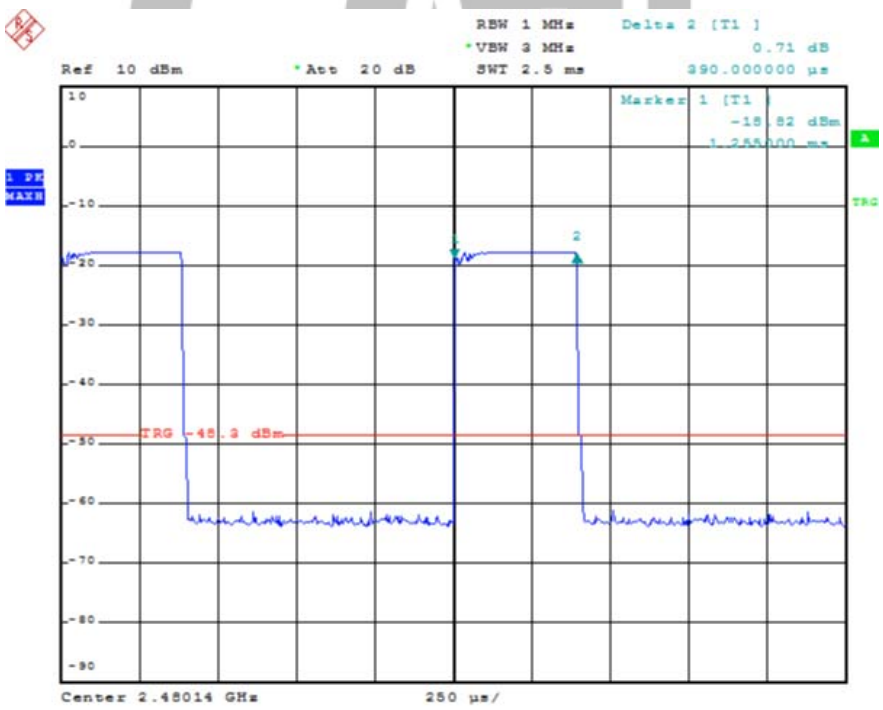
Mid：



High：



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9. Test of Maximum Peak Output Power

9.1 Applicable Standard

Section 15.247(b)(1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels and The maximum peak output power shall not exceed 1 watt. For all other frequency hopping systems in this frequency band, The maximum peak output power shall not exceed 0.125 watt.

9.2 EUT Setup

Peak Output Power：

Maximum Conducted (Average) Output Power:

Spectrum Analyzer

9.3 Test Equipment List and Details

See section 2.6.

9.4 Test Procedure

☒ Maximum Peak Conducted Output Power

☒ Spectrum analyzer

1) Set RBW = 1MHz, VBW = 3MHz, Detector = Peak.
2) Sweep time = auto, Trace mode = max hold, Allow trace to fully stabilize.
3) Use the spectrum analyzer channel power measurement function with the band limits set equal to the DTS bandwidth edges.

☐ Power meter

A broadband Peak RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.

☐ Maximum Conducted Average Output Power (For reference only)

☐ Power meter

A broadband Average RF power meter is used for output power measurement. The video bandwidth of power meter is greater than DTS bandwidth of EUT. If duty cycle of test signal is not 100 %, trigger and gating function of power meter will be enabled to capture transmission burst for measuring output power.

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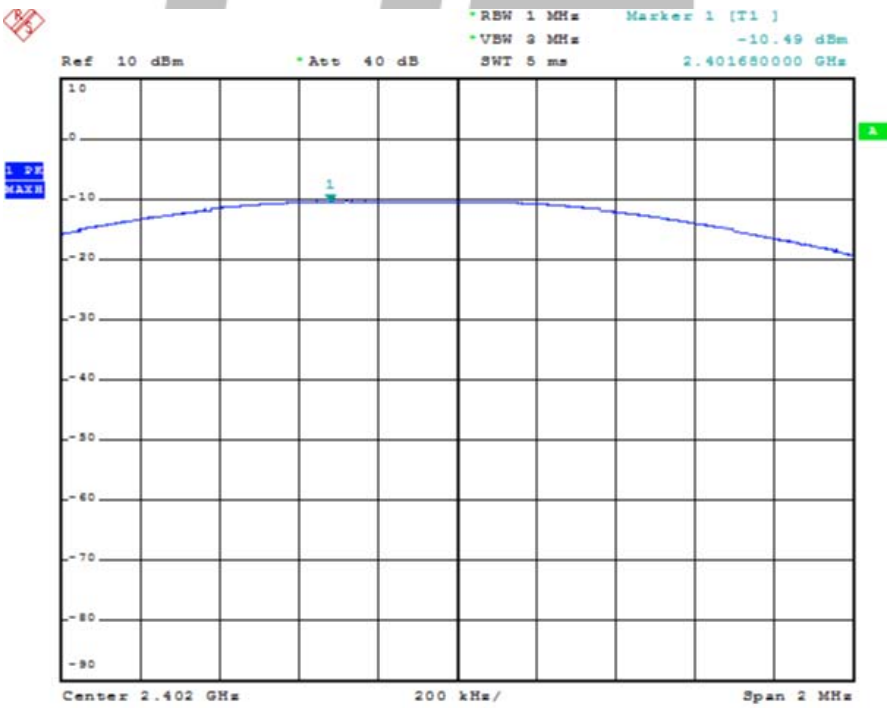
9.5 Test Result

Temperature (℃) : 22~23	EUT: E-Button portable bluetooth speaker
Humidity (%RH): 50~54	M/N: ES001
Barometric Pressure (mbar): 950~1000	Operation Condition: Continuously Tx Mode

Modulation Type	Channel No.	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
GFSK	Low	2402	-10.49	21	Pass
GFSK	Middle	2440	-11.87	21	Pass
GFSK	High	2480	-13.00	21	Pass

Test plot as follows:

Channel Low：



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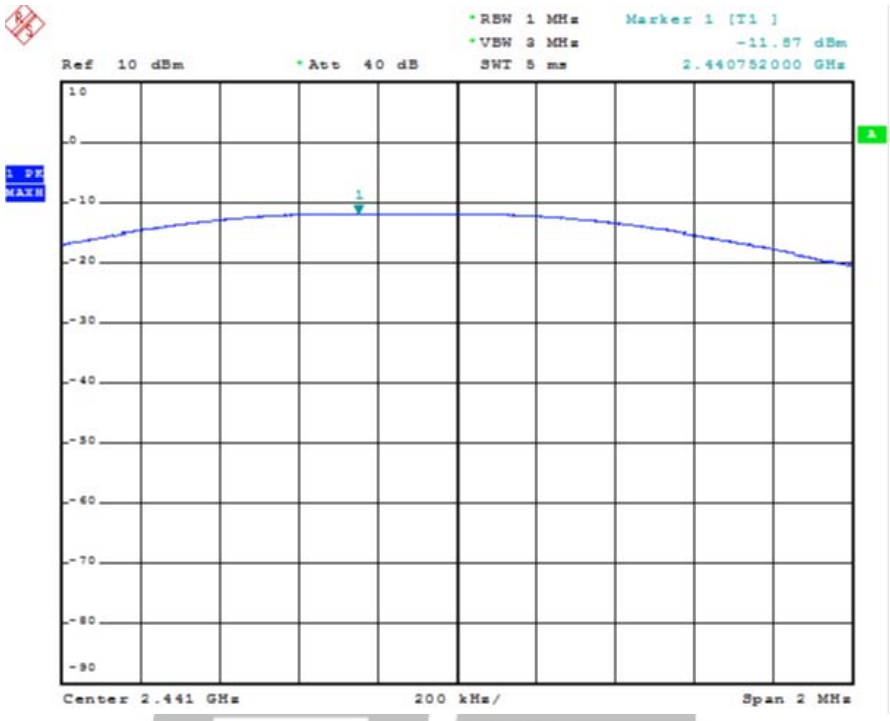
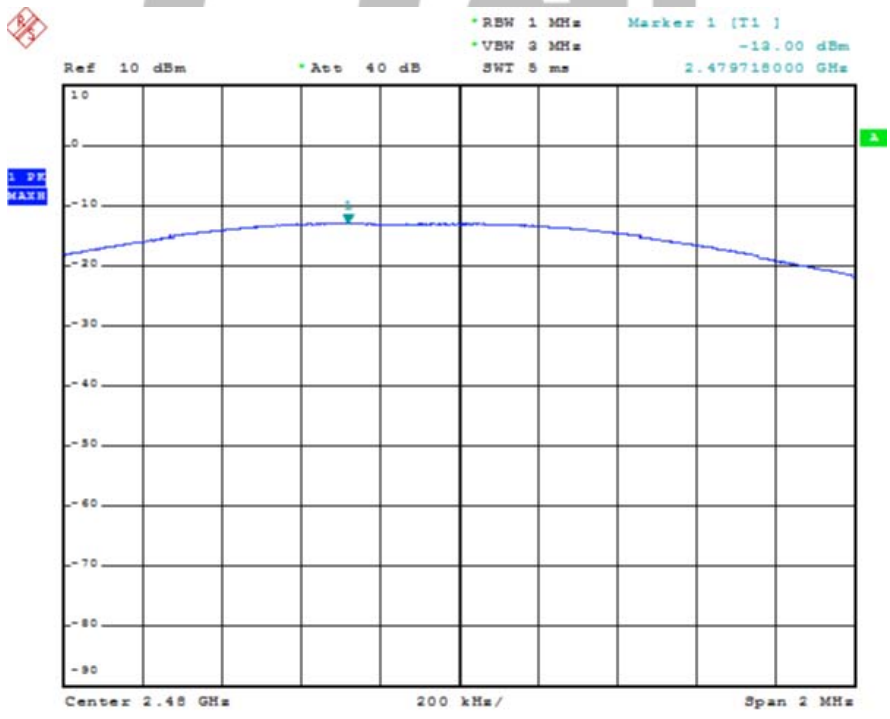
Channel Middle：



Channel High：



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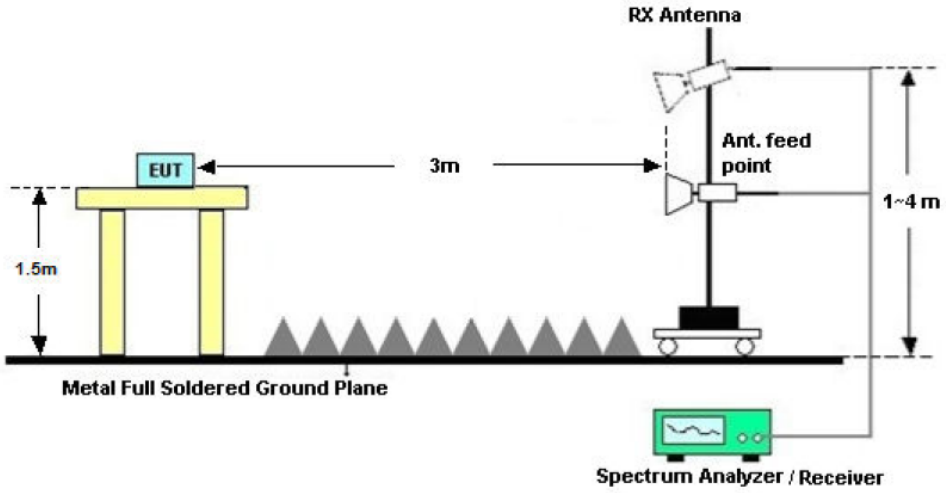
10. Test of Band Edges Emission

10.1 Applicable Standard

Section 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. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

10.2 EUT Setup

Radiated Measurement Setup



Conducted Measurement Setup

Spectrum Analyzer

10.3 Test Equipment List and Details

See section 2.6.

10.4 Test Procedure

Conducted Measurement

1. 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.
2. Set the RBW≥ 1% of the span
3. Set the VBW ≥ RBW.
4. Detector = peak.

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5. Sweep time = auto
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

Radiated Measurement

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

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

3. Set VBW ≥ RBW

4. Detector = Peak

5. Trace Mode = max hold.

6. Sweep = auto couple.

7. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

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

3. Set VBW ≥ RBW

4. Detector = power average (RMS)

5. Sweep = auto couple.

6. Trace (RMS) averaging was performed over at least 100 traces

NOTE :

1. Configure the EUT according to ANSI C63.10-2013

2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.

3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.

4. For band edge emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.

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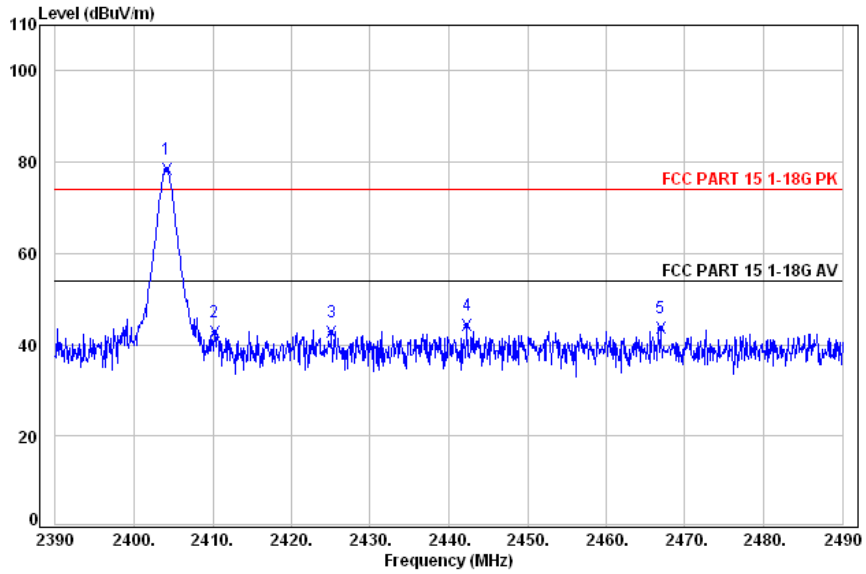
10.5 Test Result

Temperature (℃) : 22~23	EUT: E-Button portable bluetooth speaker
Humidity (%RH): 50~54	M/N: ES001
Barometric Pressure (mbar): 950~1000	Operation Condition: Continuously Tx Mode

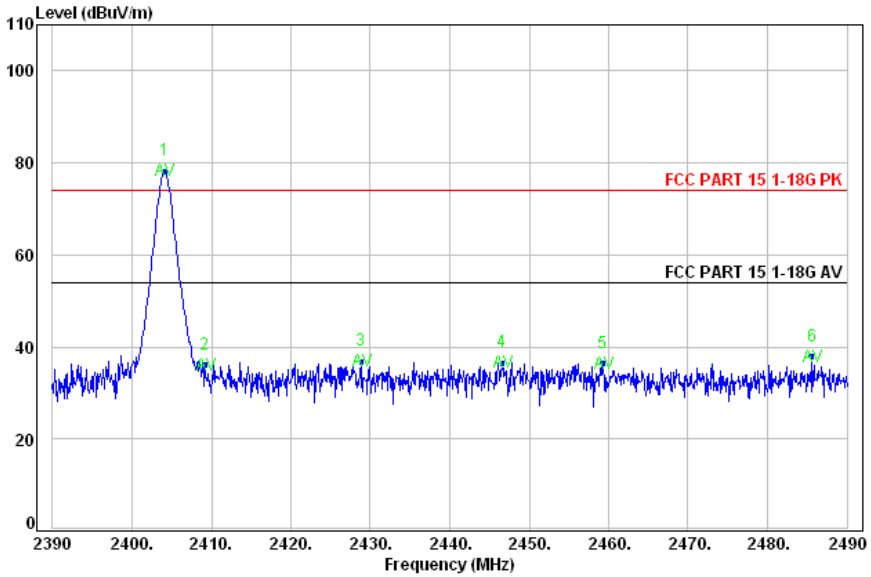
For Radiated Bandedge Measurement

Channel Low：2402MHz

PK



AV:



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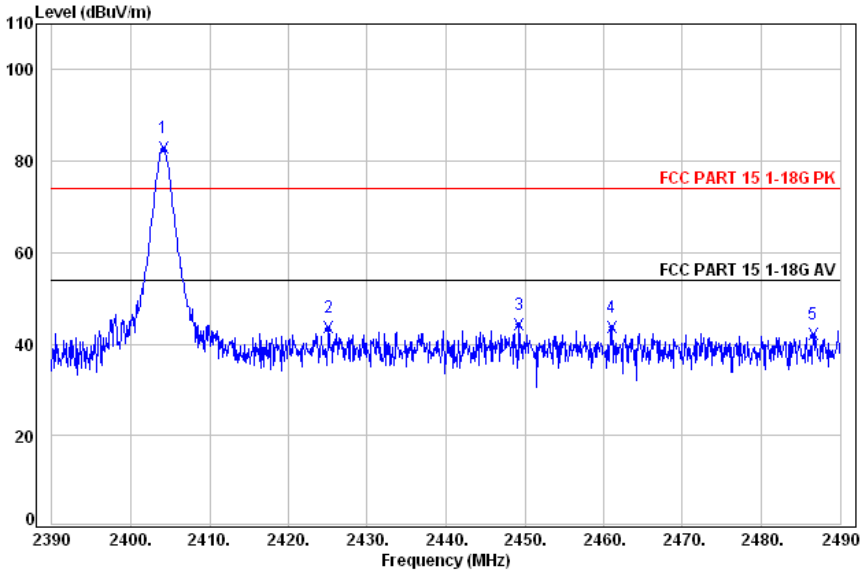
PK



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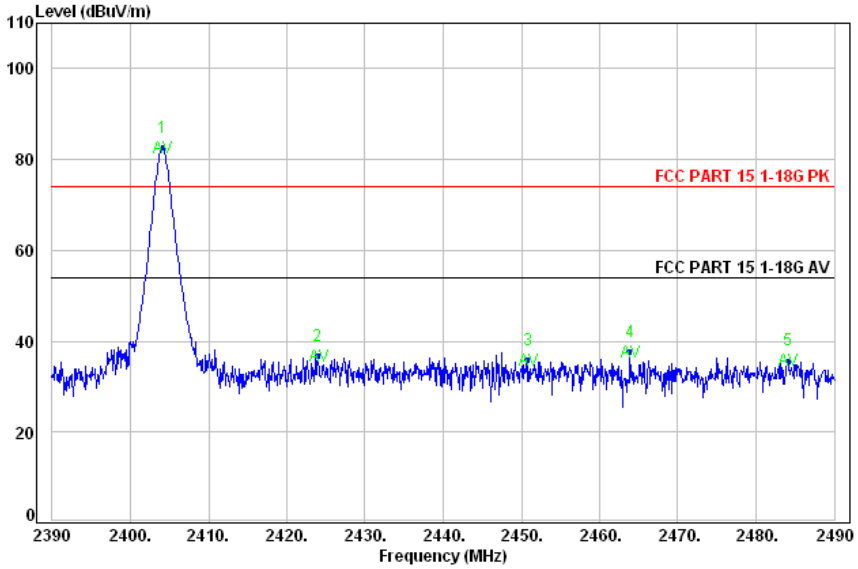

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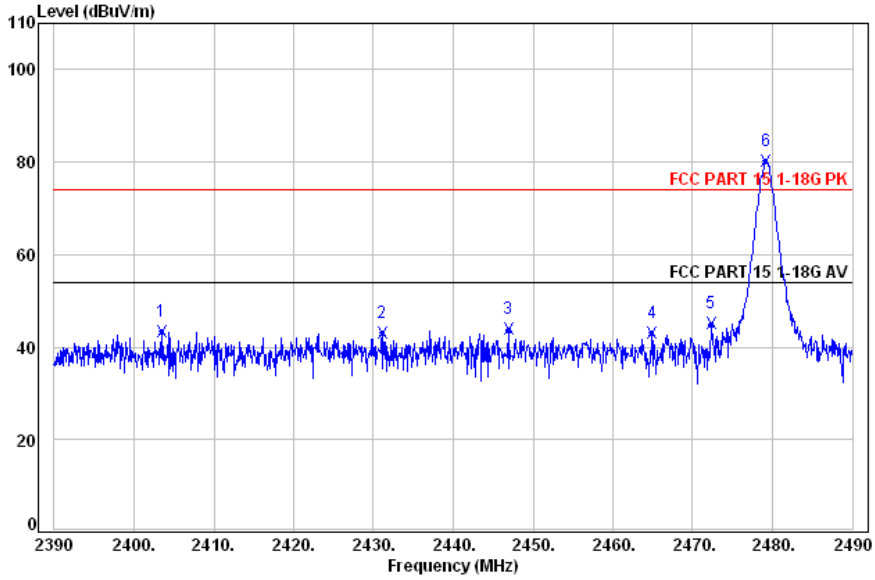
Channel High：2480MHz

PK



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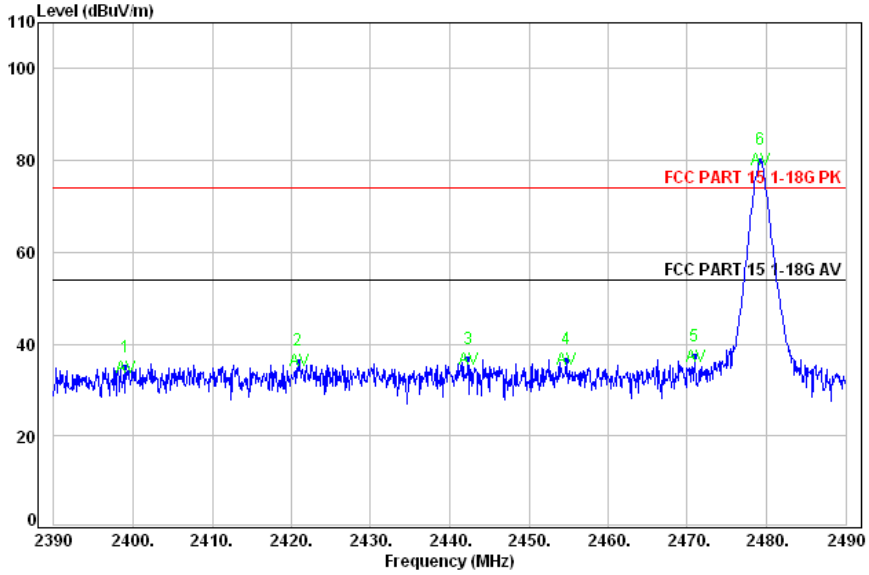

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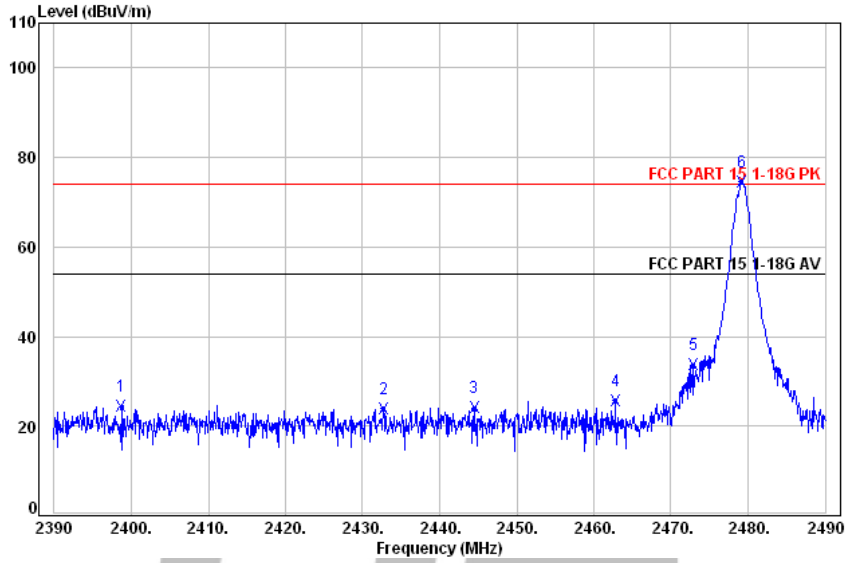
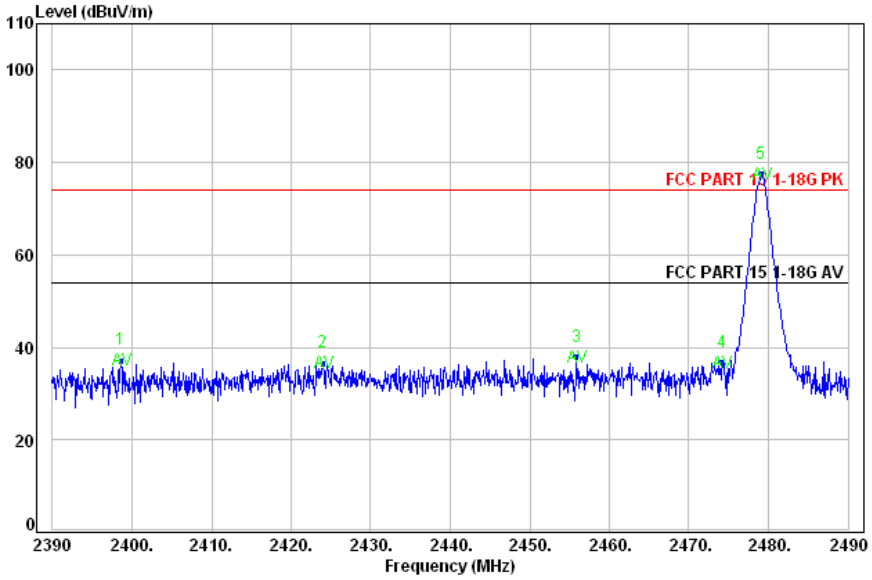
PK



AV



Note:

1. Margin value = Emission level.- Limit

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

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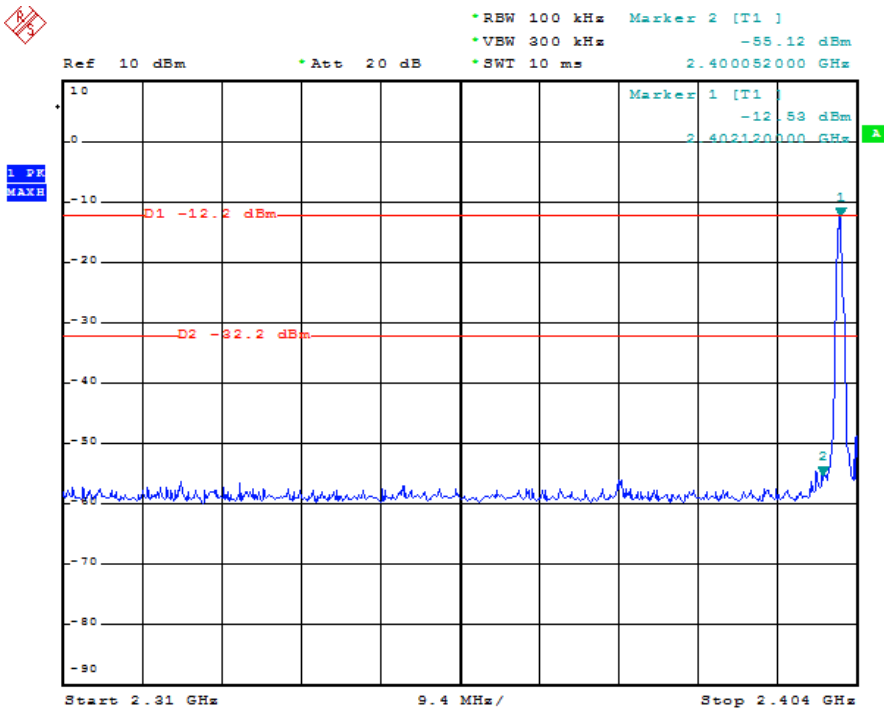
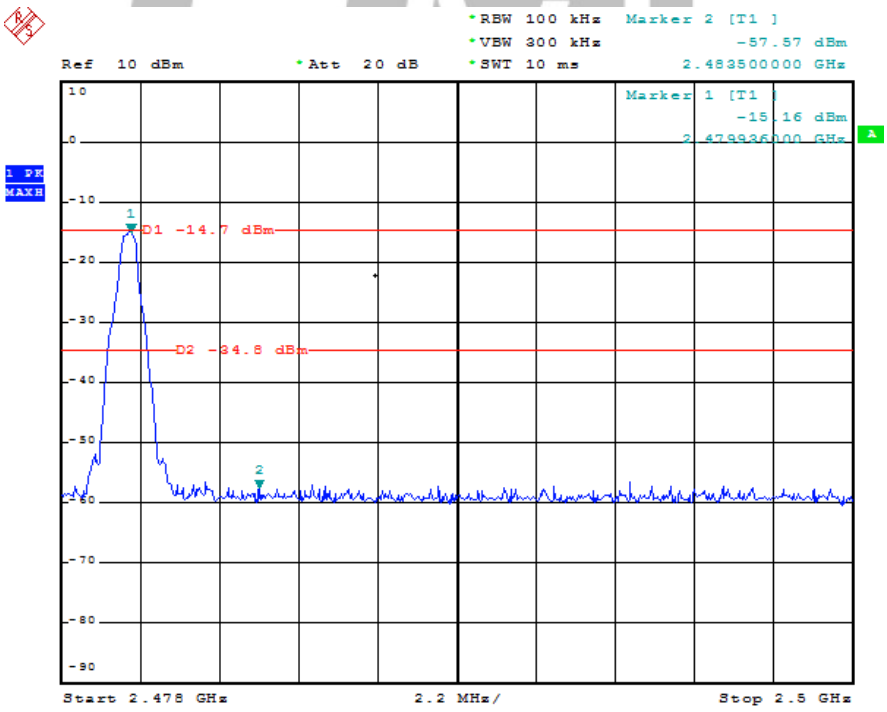
For Conducted Bandedge Measurement

Low Channel



High Channel



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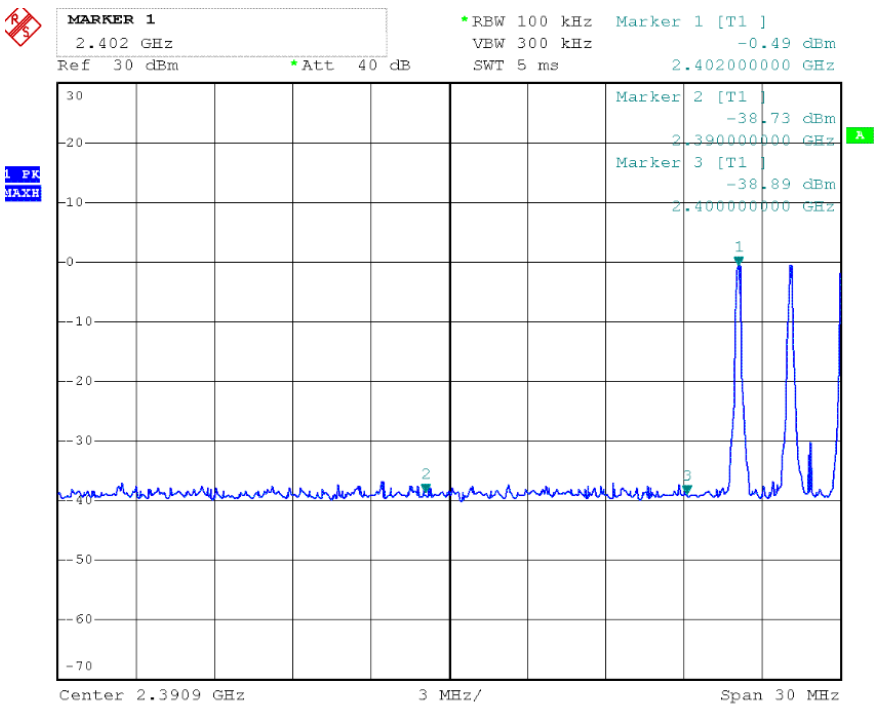
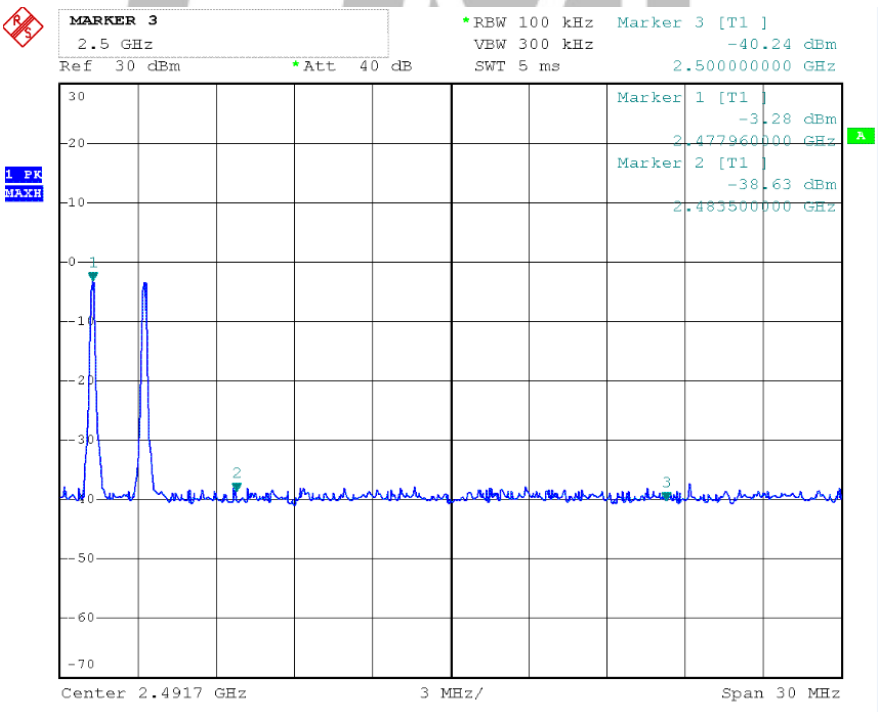
Hopping Conducted Test Result
Low Channel



High Channel



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11. Test of Spurious Radiated Emission

11.1 Applicable Standard

Refer to FCC §15.205 and §15.209.

11.1.1 Limits

Section 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. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

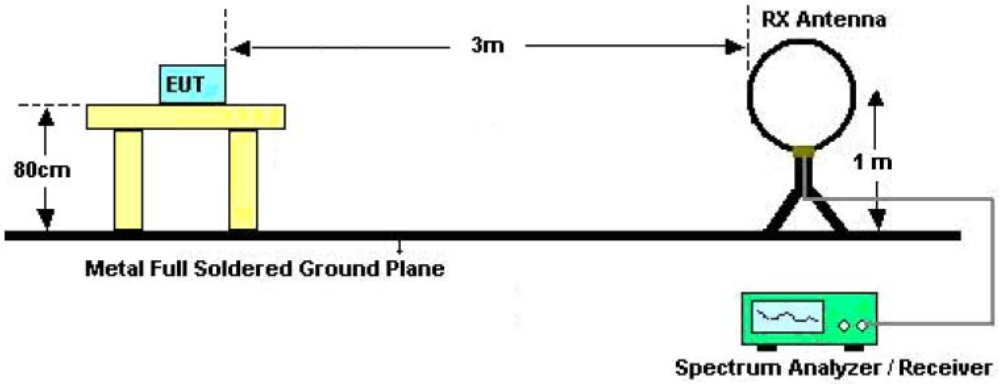
All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

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

11.2 EUT Setup

Radiated Measurement Setup

For radiated emission below 30MHz



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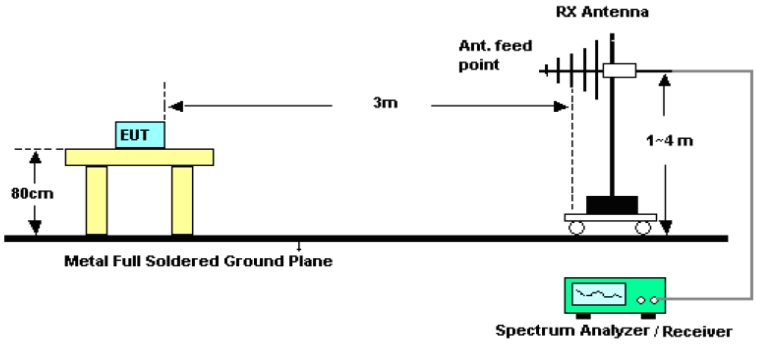
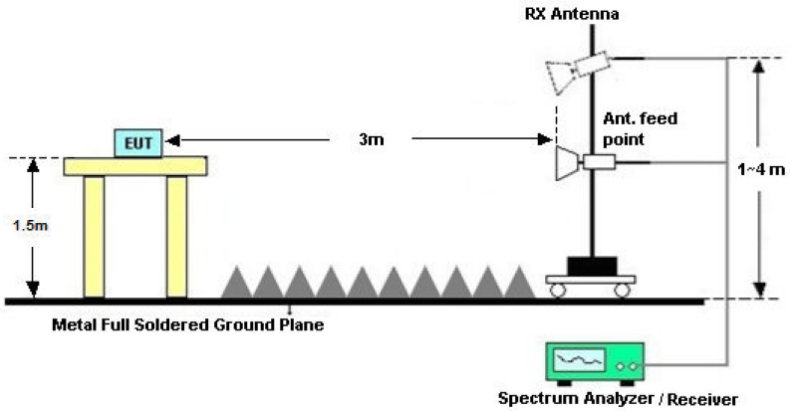
For radiated emission from 30MHz to1GHz



For radiated emission from above1GHz



Conducted Measurement Setup

Spectrum Analyzer

11.3 Test Equipment List and Details

See section 2.6.

11.4 Test Procedure

Conducted Measurement

1. Set the center frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW ≥ RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

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Radiated Measurement

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

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

3. Set VBW ≥ RBW

4. Detector = Peak

5. Trace Mode = max hold.

6. Sweep = auto couple.

7. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

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

3. Set VBW ≥ RBW

4. Detector = power average (RMS)

5. Sweep = auto couple.

6. Trace (RMS) averaging was performed over at least 100 traces

NOTE: 1. Configure the EUT according to ANSI C63.10-2013

2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.

3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.

4. For band edge emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.

11.5 Test Result

Temperature (℃) : 22~23	EUT: E-Button portable bluetooth speaker
Humidity (%RH): 50~54	M/N: ES001
Barometric Pressure (mbar): 950~1000	Operation Condition: TX Mode

Test Result: PASS

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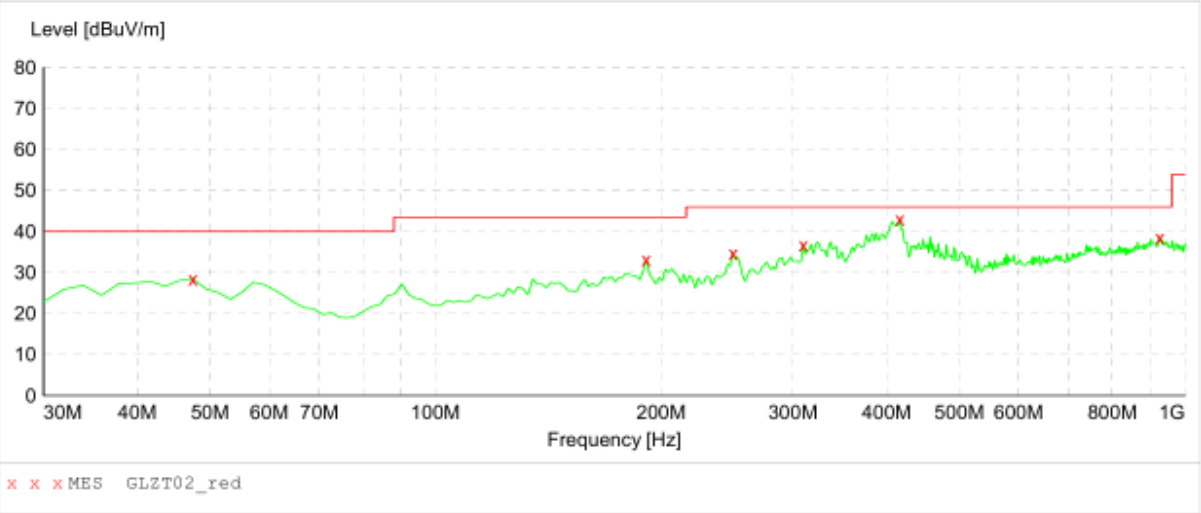
Radiated Spurious Emission Data Below 1GHz Channel Low:

EUT:	E-Button portable bluetooth speaker
M/N:	ES001
Operating Condition:	TX Mode
Test Site:	3m CHAMBER
Operator:	Chen
Test Specification:	DC 3.7V from battery
Comment:	Polarization: Horizontal

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "GLZT02_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	28.50	16.7	40.0	11.5	---	100.0	0.00	HORIZONTAL
191.020000	33.20	13.6	43.5	10.3	---	100.0	0.00	HORIZONTAL
249.220000	34.70	13.7	46.0	11.3	---	100.0	0.00	HORIZONTAL
309.360000	36.70	15.6	46.0	9.3	---	100.0	0.00	HORIZONTAL
416.060000	43.10	18.2	46.0	2.9	---	100.0	0.00	HORIZONTAL
924.340000	38.50	25.8	46.0	7.5	---	100.0	0.00	HORIZONTAL

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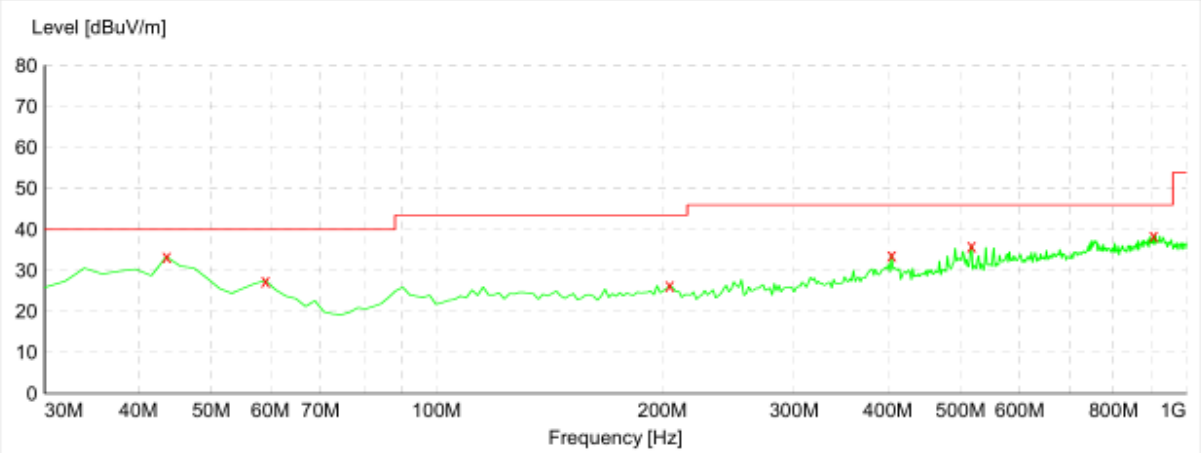
Radiated Spurious Emission Data Below 1GHz Channel Low:

EUT:	E-Button portable bluetooth speaker
M/N:	ES001
Operating Condition:	TX Mode
Test Site:	3m CHAMBER
Operator:	Chen
Test Specification:	DC 3.7V from battery
Comment:	Polarization: Vertical

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "MES GLZT01_red "

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
43.580000	33.40	15.8	40.0	6.6	---	100.0	0.00	VERTICAL
59.100000	27.50	15.7	40.0	12.5	---	100.0	0.00	VERTICAL
204.600000	26.40	14.1	43.5	17.1	---	100.0	0.00	VERTICAL
404.420000	33.80	17.9	46.0	12.2	---	100.0	0.00	VERTICAL
516.940000	36.00	19.6	46.0	10.0	---	100.0	0.00	VERTICAL
904.940000	38.50	25.8	46.0	7.5	---	100.0	0.00	VERTICAL

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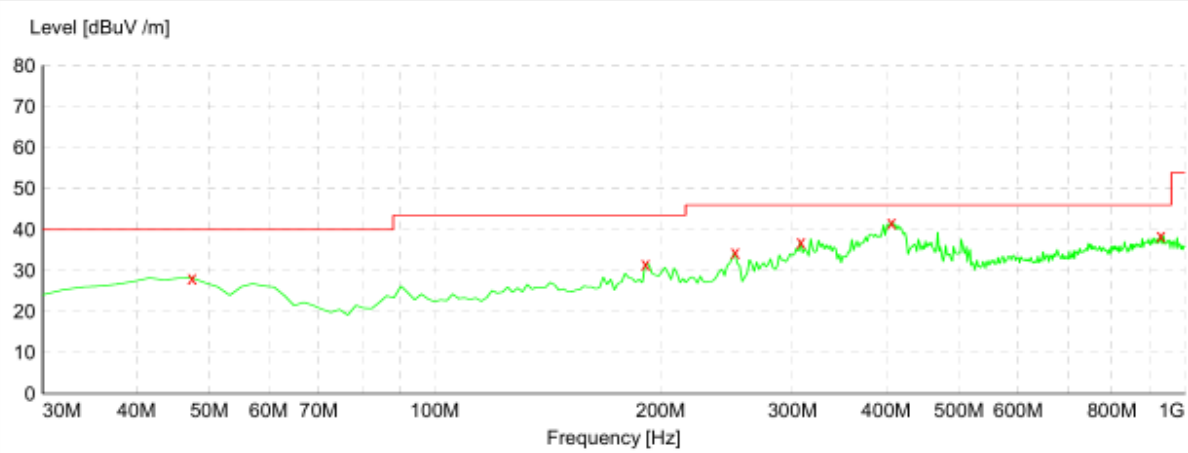
Radiated Spurious Emission Data Below 1GHz Channel Middle:

EUT:	E-Button portable bluetooth speaker
M/N:	ES001
Operating Condition:	TX Mode
Test Site:	3m CHAMBER
Operator:	Chen
Test Specification:	DC 3.7V from battery
Comment:	Polarization: Horizontal

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "GLZT03_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	28.20	16.7	40.0	11.8	---	100.0	0.00	HORIZONTAL
191.020000	31.70	13.6	43.5	11.8	---	100.0	0.00	HORIZONTAL
251.160000	34.50	13.8	46.0	11.5	---	100.0	0.00	HORIZONTAL
307.420000	37.00	15.4	46.0	9.0	---	100.0	0.00	HORIZONTAL
406.360000	41.70	17.9	46.0	4.3	---	100.0	0.00	HORIZONTAL
928.220000	38.60	25.9	46.0	7.4	---	100.0	0.00	HORIZONTAL

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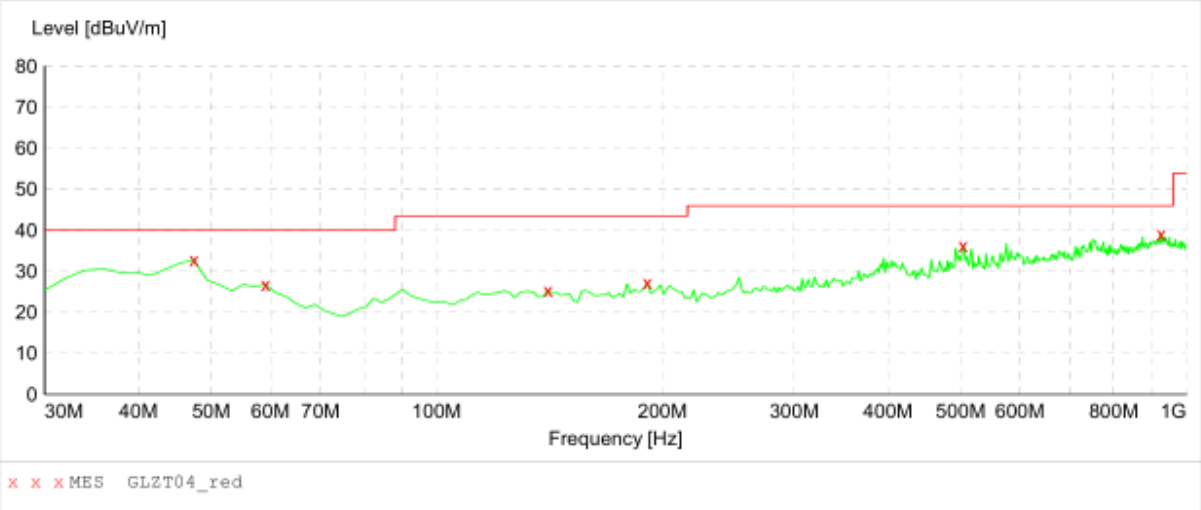
Radiated Spurious Emission Data Below 1GHz Channel Middle:

EUT:	E-Button portable bluetooth speaker
M/N:	ES001
Operating Condition:	TX Mode
Test Site:	3m CHAMBER
Operator:	Chen
Test Specification:	DC 3.7V from battery
Comment:	Polarization: Vertical

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "GLZT04_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	32.80	16.7	40.0	7.2	---	100.0	0.00	VERTICAL
59.100000	26.80	15.7	40.0	13.2	---	100.0	0.00	VERTICAL
140.580000	25.40	12.5	43.5	18.1	---	100.0	0.00	VERTICAL
191.020000	27.20	13.6	43.5	16.3	---	100.0	0.00	VERTICAL
503.360000	36.30	19.6	46.0	9.7	---	100.0	0.00	VERTICAL
924.340000	39.10	25.8	46.0	6.9	---	100.0	0.00	VERTICAL

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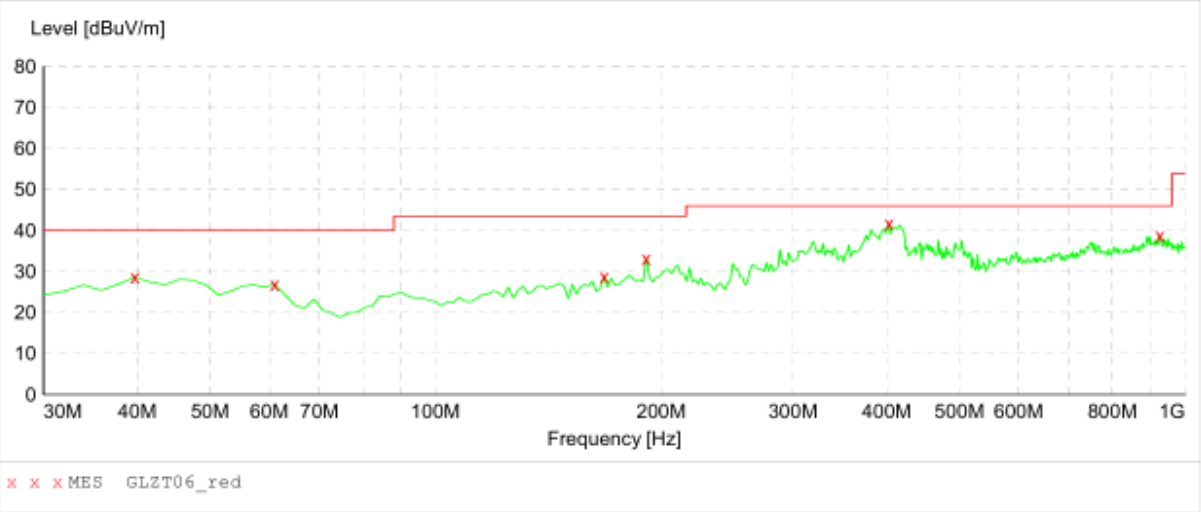
Radiated Spurious Emission Data Below 1GHz Channel High:

EUT:	E-Button portable bluetooth speaker
M/N:	ES001
Operating Condition:	TX Mode
Test Site:	3m CHAMBER
Operator:	Chen
Test Specification:	DC 3.7V from battery
Comment:	Polarization: Horizontal

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "GLZT06_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
39.700000	28.70	15.7	40.0	11.3	---	100.0	0.00	HORIZONTAL
61.040000	26.90	14.9	40.0	13.1	---	100.0	0.00	HORIZONTAL
167.740000	28.80	12.7	43.5	14.7	---	100.0	0.00	HORIZONTAL
191.020000	33.20	13.6	43.5	10.3	---	100.0	0.00	HORIZONTAL
402.480000	41.70	17.8	46.0	4.3	---	100.0	0.00	HORIZONTAL
924.340000	38.80	25.8	46.0	7.2	---	100.0	0.00	HORIZONTAL

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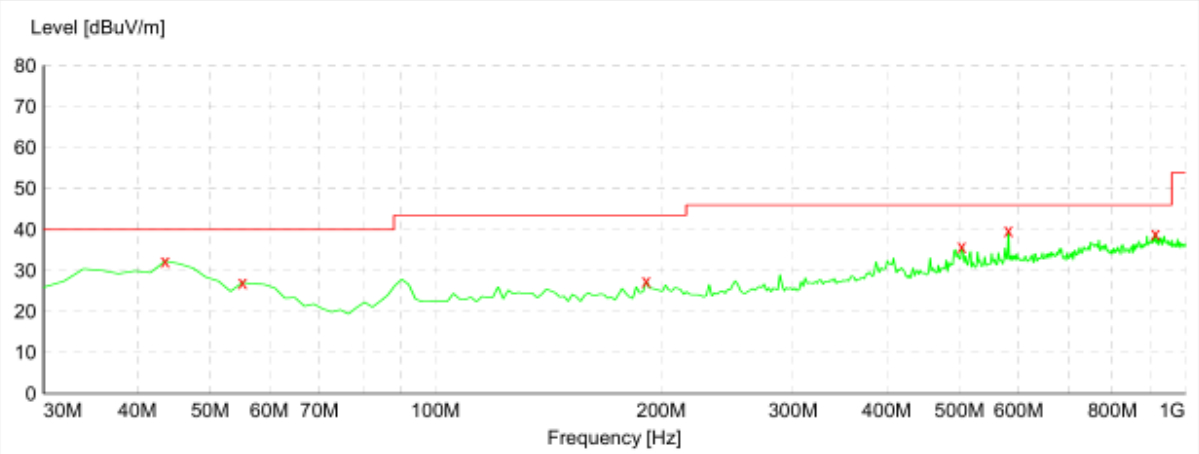
Radiated Spurious Emission Data Below 1GHz Channel High:

EUT:	E-Button portable bluetooth speaker
M/N:	ES001
Operating Condition:	TX Mode
Test Site:	3m CHAMBER
Operator:	Chen
Test Specification:	DC 3.7V from battery
Comment:	Polarization: Vertical

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	9163-2015



MEASUREMENT RESULT: "GLZT05_red"

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
43.580000	32.40	15.8	40.0	7.6	---	100.0	0.00	VERTICAL
55.220000	27.10	15.1	40.0	12.9	---	100.0	0.00	VERTICAL
191.020000	27.50	13.6	43.5	16.0	---	100.0	0.00	VERTICAL
503.360000	35.90	19.6	46.0	10.1	---	100.0	0.00	VERTICAL
580.960000	39.80	21.2	46.0	6.2	---	100.0	0.00	VERTICAL
912.700000	39.00	25.8	46.0	7.0	---	100.0	0.00	VERTICAL

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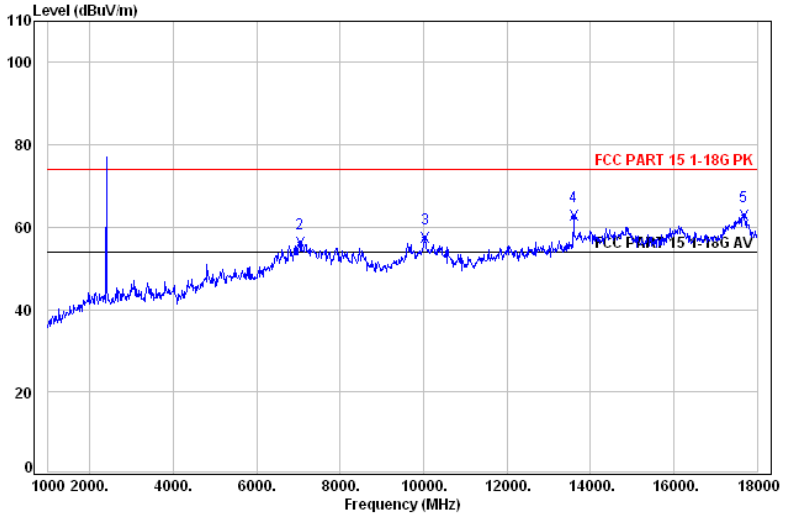
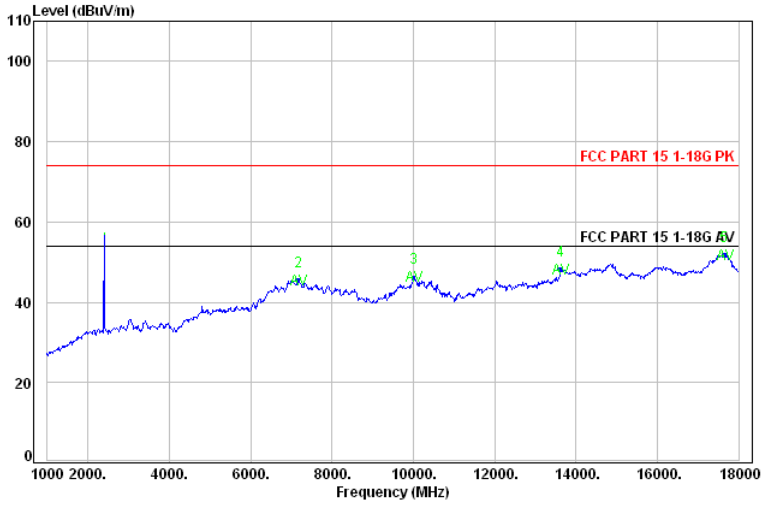
Radiated Spurious Emission Test Data Above 1GHz
Polarization: Vertical
Low Channel:2402MHz
pk:



	Freq	Ant Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
2	7171.00	39.47	26.96	45.50	74.00	-28.50	Peak
3	10010.00	39.40	28.85	46.24	74.00	-27.76	Peak
4	13614.00	42.39	33.78	48.13	74.00	-25.87	Peak
5	17660.00	43.46	34.87	51.79	74.00	-22.21	Peak

AV:



	Freq	Ant Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
2	7035.00	39.49	37.37	56.30	74.00	-17.70	Average
3	10044.00	39.42	40.22	57.51	74.00	-16.49	Average
4	13597.00	42.38	43.34	62.67	74.00	-11.33	Average
5	17677.00	43.31	46.09	62.92	74.00	-11.08	Average

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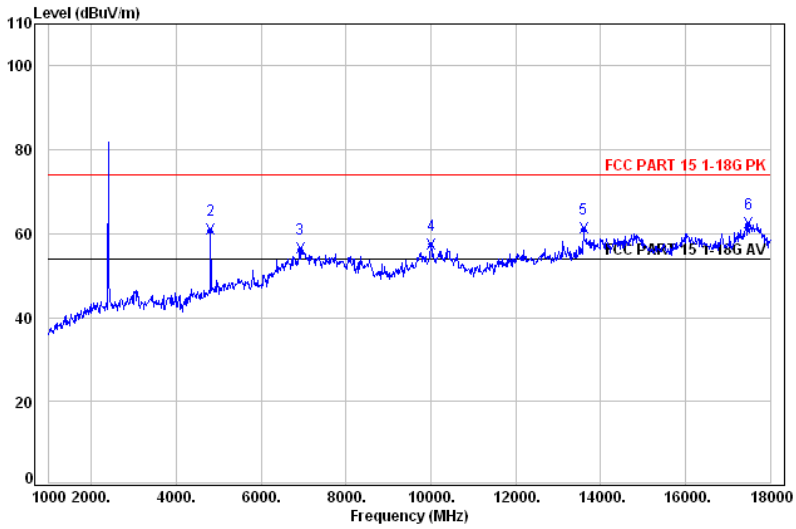
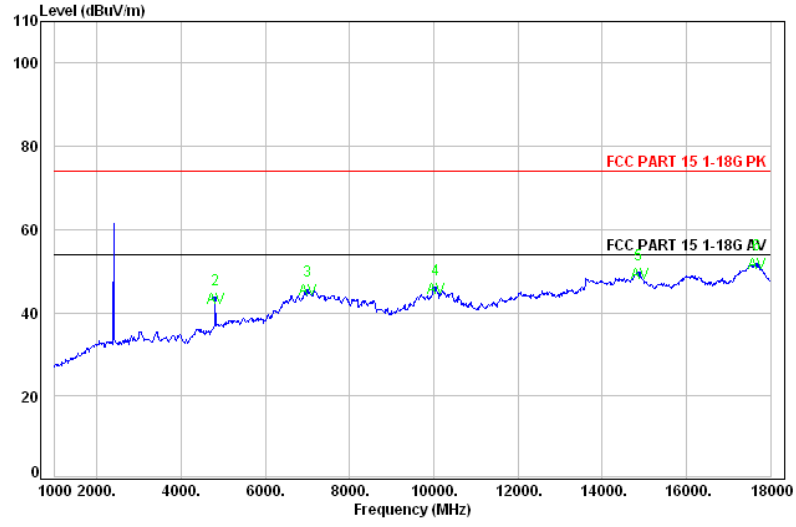
Polarization: Horizontal
PK:



	Freq	Ant Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
2	4808.00	35.16	34.34	43.32	74.00	-30.68	Peak
3	7001.00	39.50	26.26	45.28	74.00	-28.72	Peak
4	10044.00	39.42	28.55	45.84	74.00	-28.16	Peak
5	14872.00	42.30	36.01	49.45	74.00	-24.55	Peak
6	17677.00	43.31	34.82	51.65	74.00	-22.35	Peak

AV:



	Freq	Ant Factor	Read Level	Limit Level	Limit Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
2	4808.00	35.16	51.95	60.93	74.00	-13.07	Average
3	6916.00	39.30	37.91	56.39	74.00	-17.61	Average
4	10010.00	39.40	40.10	57.49	74.00	-16.51	Average
5	13597.00	42.38	41.85	61.18	74.00	-12.82	Average
6	17490.00	44.79	44.73	62.40	74.00	-11.60	Average

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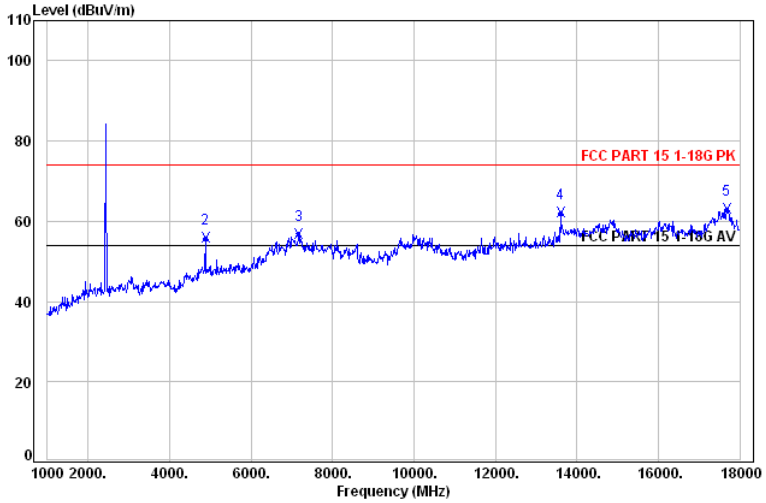
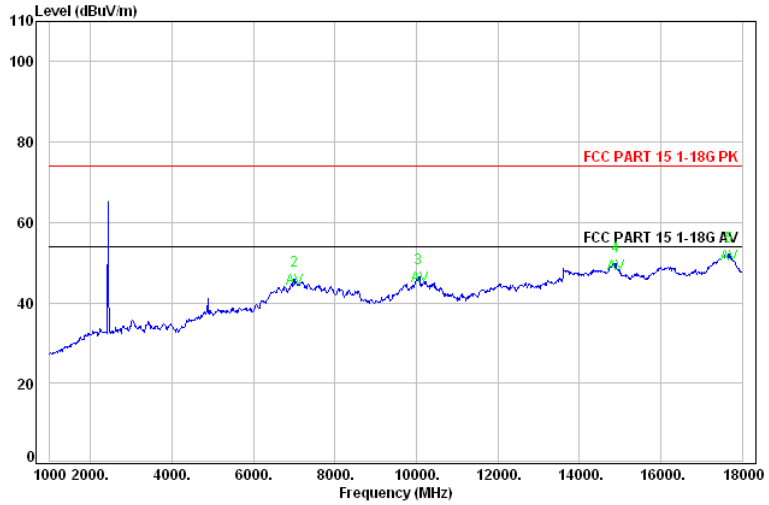
Polarization: Vertical
Low Channel:2440MHz
PK:



	Freq	Ant Factor	Read Level	Limit Level	Over Line	Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
2	7001.00	39.50	26.54	45.56	74.00	-28.44	Peak
3	10061.00	39.42	28.97	46.19	74.00	-27.81	Peak
4	14889.00	42.28	36.00	49.40	74.00	-24.60	Peak
5	17677.00	43.31	34.96	51.79	74.00	-22.21	Peak

AV:



	Freq	Ant Factor	Read Level	Limit Level	Over Line	Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
2	4876.00	35.35	46.46	55.75	74.00	-18.25	Average
3	7171.00	39.47	38.32	56.86	74.00	-17.14	Average
4	13597.00	42.38	42.74	62.07	74.00	-11.93	Average
5	17677.00	43.31	46.26	63.09	74.00	-10.91	Average

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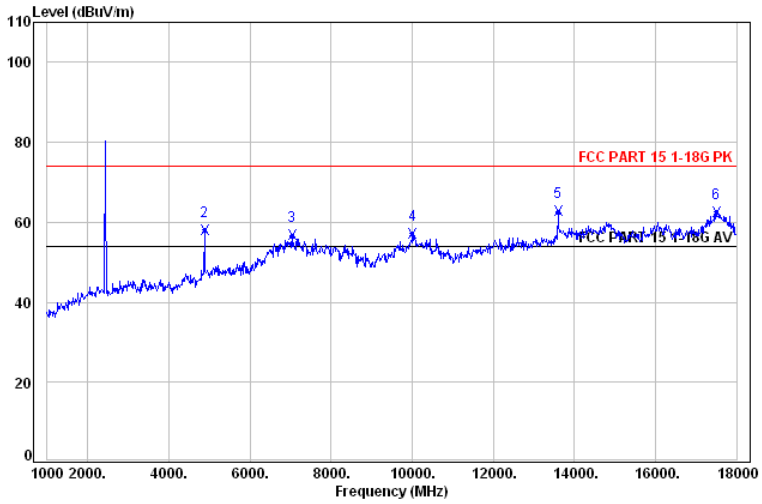
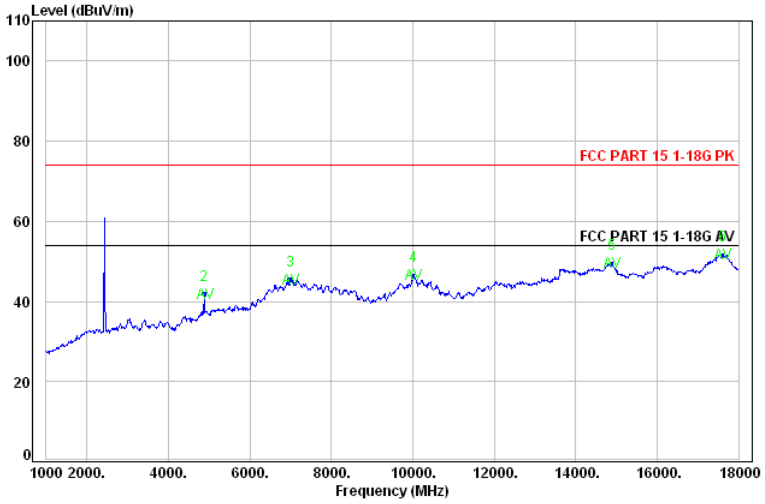
Polarization: Horizontal
PK:



	Freq	Ant Factor	Read Level	Limit Level	Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
2	4876.00	35.35	32.55	41.84	74.00	-32.16	Peak
3	7001.00	39.50	26.51	45.53	74.00	-28.47	Peak
4	10010.00	39.40	29.09	46.48	74.00	-27.52	Peak
5	14889.00	42.28	36.15	49.55	74.00	-24.45	Peak
6	17609.00	43.88	34.48	51.65	74.00	-22.35	Peak

AV:



	Freq	Ant Factor	Read Level	Limit Level	Line	Over Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
2	4876.00	35.35	48.73	58.02	74.00	-15.98	Average
3	7035.00	39.49	37.81	56.74	74.00	-17.26	Average
4	10010.00	39.40	39.81	57.20	74.00	-16.80	Average
5	13597.00	42.38	43.34	62.67	74.00	-11.33	Average
6	17507.00	44.74	44.88	62.56	74.00	-11.44	Average

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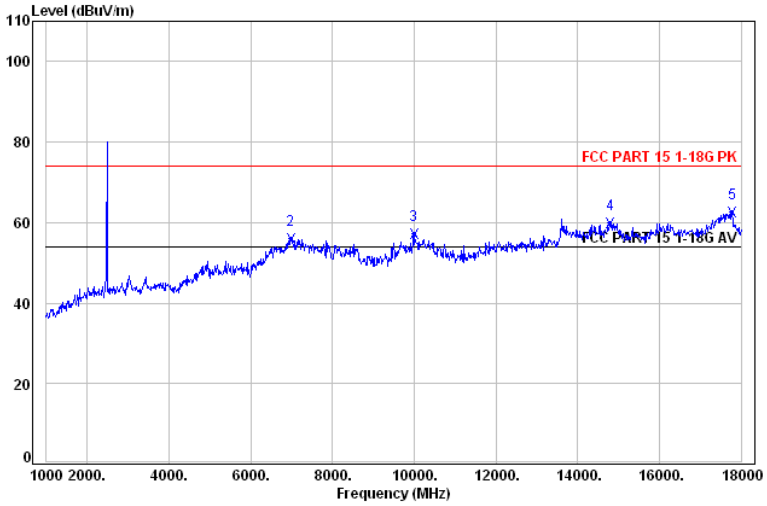
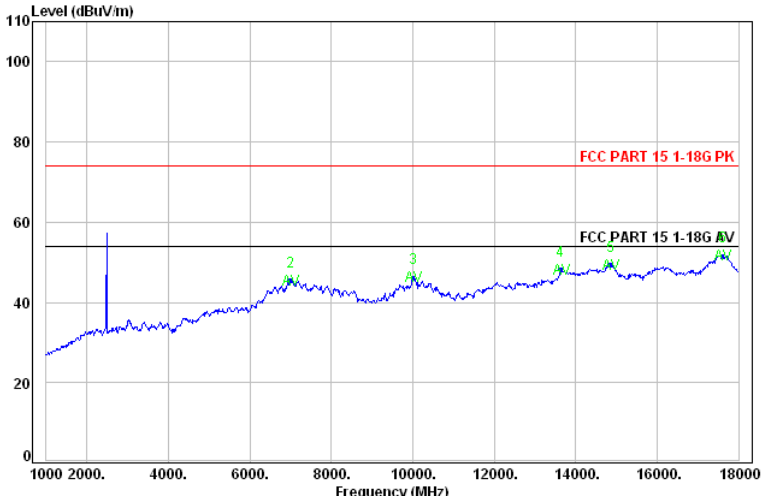
Polarization: Vertical
Low Channel:2480MHz
PK:



	Freq	Ant Factor	Read Level	Limit Level	Over Line Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB
2	7001.00	39.50	26.44	45.46	74.00	-28.54 Peak
3	10010.00	39.40	28.78	46.17	74.00	-27.83 Peak
4	13631.00	42.40	33.89	48.26	74.00	-25.74 Peak
5	14855.00	42.33	35.90	49.38	74.00	-24.62 Peak
6	17609.00	43.88	34.53	51.70	74.00	-22.30 Peak

AV:



	Freq	Ant Factor	Read Level	Limit Level	Over Line Limit	Remark
	MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB
2	6984.00	39.46	37.07	55.99	74.00	-18.01 Average
3	9993.00	39.39	39.74	57.13	74.00	-16.87 Average
4	14804.00	42.41	46.27	59.89	74.00	-14.11 Average
5	17779.00	42.46	46.27	62.60	74.00	-11.40 Average

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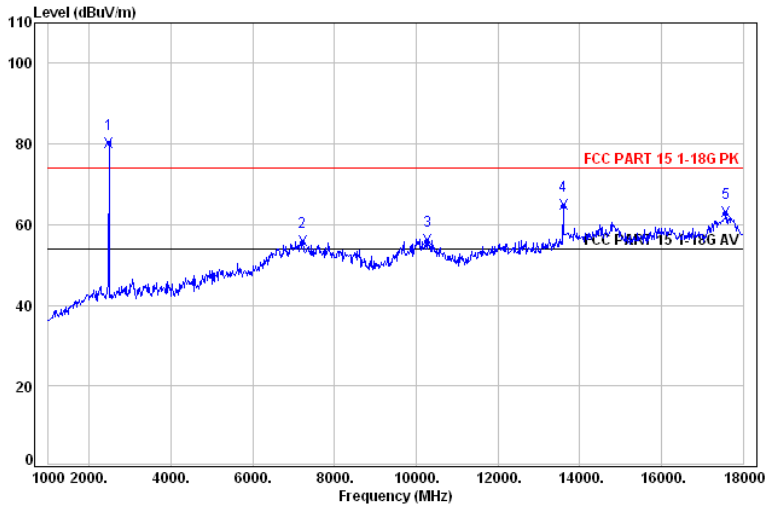
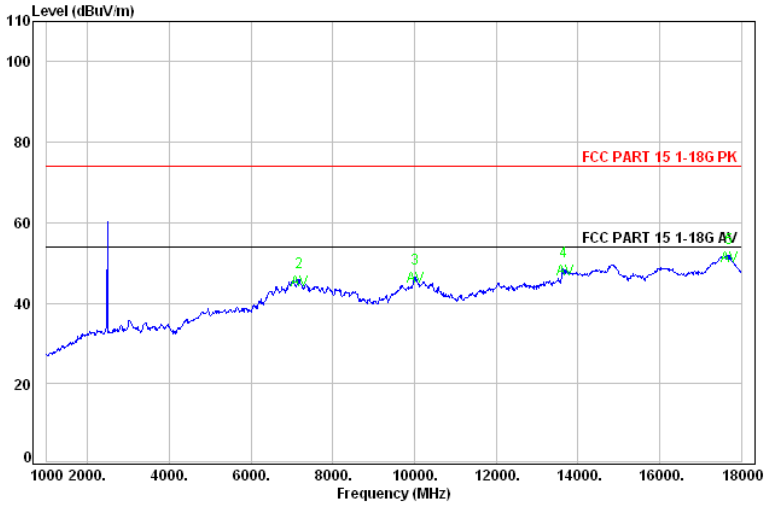
Polarization: Horizontal



Freq	Ant Factor	Read Level	Limit Level	Line	Over Limit	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
2	7171.00	39.47	27.00	45.54	74.00	-28.46 Peak
3	10010.00	39.40	28.88	46.27	74.00	-27.73 Peak
4	13665.00	42.43	33.66	48.06	74.00	-25.94 Peak
5	17694.00	43.17	34.77	51.52	74.00	-22.48 Peak



Freq	Ant Factor	Read Level	Limit Level	Line	Over Limit	Remark
MHz	dB/m	dBuV	dBuV/m	dBuV/m	dB	
2	7222.00	39.46	37.44	55.84	74.00	-18.16 Average
3	10282.00	39.51	39.60	56.15	74.00	-17.85 Average
4	13597.00	42.38	45.44	64.77	74.00	-9.23 Average
5	17575.00	44.17	45.71	63.05	74.00	-10.95 Average

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Radiated Emission Below 30 MHz TX (CH Low)

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Emission Levels (dBuV/m)	Limit (dBμV/m)	Margin (dB)	Detector Mode
0.59	25.56	8.22	-1.01	32.77	67.00	-34.23	QP
19.55	24.45	8.17	-1.20	31.42	49.50	-18.08	QP
22.58	24.00	8.03	-1.05	30.98	49.50	-18.52	QP

Note:

1. The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos. The worst case data is recorded in the report.
2. Emission level (dBuV/m) =Raw Value (dBuV) + Correction Factor (dB/m)
3. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
4. The other emission levels were very low against the limit.
5. Margin value = Emission level.- Limit value

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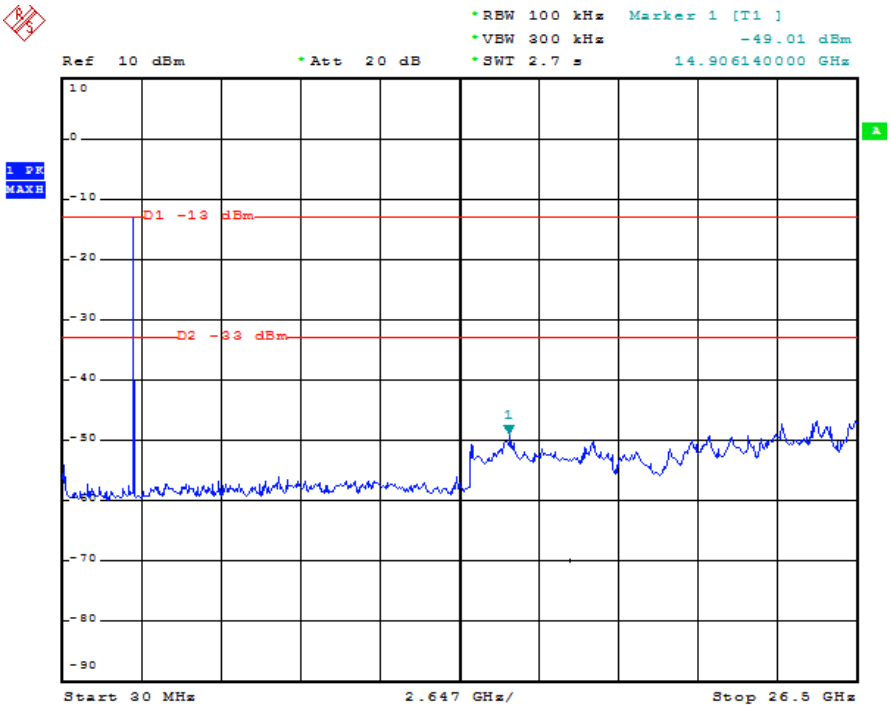
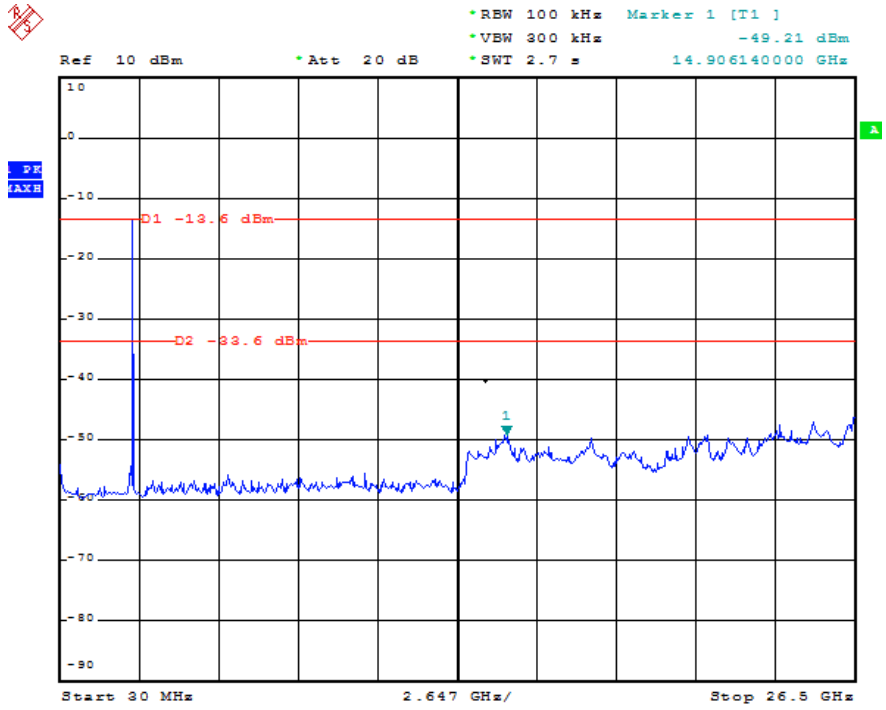
Conducted Spurious Emission Test Data
Channel Low



Channel Mid



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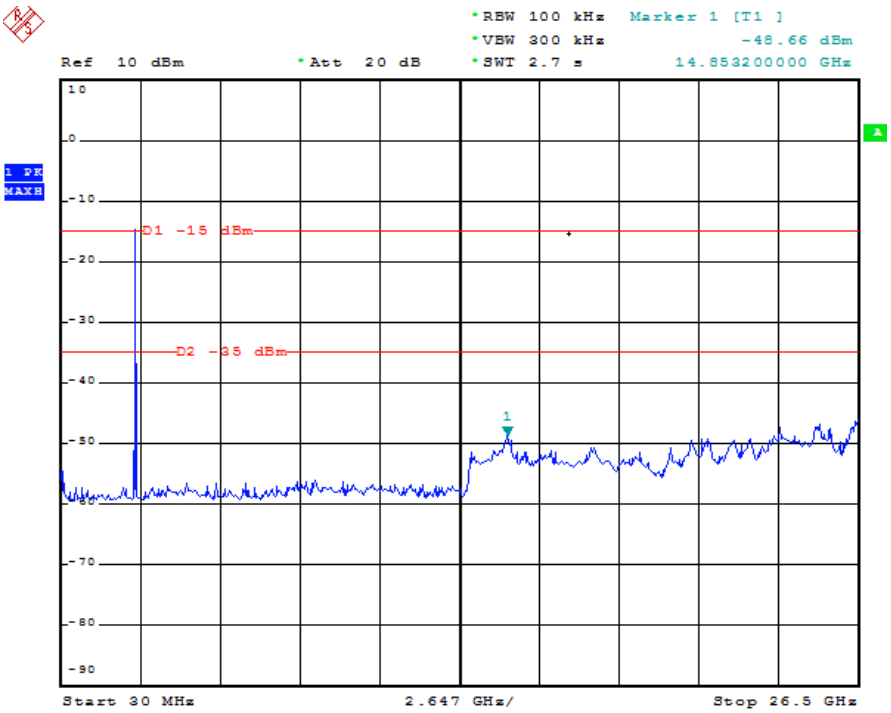
Channel High



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12. ANTENNA REQUIREMENT

12.1 Standard Applicable

Section 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 replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Section 15.247(b)/(c):

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

If the intentional radiator is used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi 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 6 dBi.

12.2 Antenna Connected Construction

There are no provisions for connections to an external antenna.
The antenna is designed with PCB antenna and no consideration of replacement.
The antenna used in this product is complied with standard. The maximum Gain of the antenna lower than 6.0dBi and have the definite antenna Specification.

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