

APPLICATION CERTIFICATION FCC Part 15C

On Behalf of

Shenzhen Marvo Technology Co., Ltd

Wireless Stereo Headset

Model No.: TCU007, PBT96, DEP001, DEP002, DEP006, DEP007,
DEP008, DEP009, DEP010

FCC ID: 2ASWR-TCU007

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Report No. : ATE20190447
Date of Test : April 8-April 16, 2019
Date of Report : April 17, 2019

TABLE OF CONTENTS

Description	Page
Test Report Certification	
TABLE OF CONTENTS	2
1. GENERAL INFORMATION	5
1.1. Description of Device (EUT)	5
1.2. Accessory and Auxiliary Equipment	5
1.3. Description of Test Facility	6
1.4. Measurement Uncertainty	6
2. MEASURING DEVICE AND TEST EQUIPMENT	7
3. OPERATION OF EUT DURING TESTING	8
3.1. Operating Mode	8
3.2. Configuration and peripherals	8
4. FREQUENCY HOPPING SYSTEM REQUIREMENTS	9
4.1. Standard and Limit	9
4.2. EUT Pseudorandom Frequency Hopping Sequence	9
4.3. Frequency Hopping System	10
5. TEST PROCEDURES AND RESULTS	11
6. 20DB BANDWIDTH TEST	12
6.1. Block Diagram of Test Setup	12
6.2. The Requirement For Section 15.247(a)(1)	12
6.3. EUT Configuration on Measurement	12
6.4. Operating Condition of EUT	12
6.5. Test Procedure	12
6.6. Test Result	13
7. CARRIER FREQUENCY SEPARATION TEST	18
7.1. Block Diagram of Test Setup	18
7.2. The Requirement For Section 15.247(a)(1)	18
7.3. EUT Configuration on Measurement	18
7.4. Operating Condition of EUT	18
7.5. Test Procedure	19
7.6. Test Result	19
8. NUMBER OF HOPPING FREQUENCY TEST	25
8.1. Block Diagram of Test Setup	25
8.2. The Requirement For Section 15.247(a)(1)(iii)	25
8.3. EUT Configuration on Measurement	25
8.4. Operating Condition of EUT	25
8.5. Test Procedure	25
8.6. Test Result	26
9. DWELL TIME TEST	28
9.1. Block Diagram of Test Setup	28
9.2. The Requirement For Section 15.247(a)(1)(iii)	28
9.3. EUT Configuration on Measurement	28
9.4. Operating Condition of EUT	28

9.5.	Test Procedure	28
9.6.	Test Result	29
10.	MAXIMUM PEAK OUTPUT POWER TEST	35
10.1.	Block Diagram of Test Setup.....	35
10.2.	The Requirement For Section 15.247(b)(1).....	35
10.3.	EUT Configuration on Measurement	35
10.4.	Operating Condition of EUT	35
10.5.	Test Procedure	35
10.6.	Test Result	36
11.	RADIATED EMISSION TEST	42
11.1.	Block Diagram of Test Setup.....	42
11.2.	The Limit For Section 15.247(d)	43
11.3.	Restricted bands of operation	44
11.4.	Configuration of EUT on Measurement	44
11.5.	Operating Condition of EUT	45
11.6.	Test Procedure	45
11.7.	Data Sample.....	46
11.8.	The Field Strength of Radiation Emission Measurement Results	46
12.	BAND EDGE COMPLIANCE TEST	59
12.1.	Block Diagram of Test Setup.....	59
12.2.	The Requirement For Section 15.247(d)	59
12.3.	EUT Configuration on Measurement	59
12.4.	Operating Condition of EUT	59
12.5.	Test Procedure	60
12.6.	Test Result	60
13.	AC POWER LINE CONDUCTED EMISSION TEST	71
13.1.	Block Diagram of Test Setup.....	71
13.2.	Power Line Conducted Emission Test Limits	72
13.3.	Configuration of EUT on Measurement	72
13.4.	Operating Condition of EUT	72
13.5.	Test Procedure	72
13.6.	Data Sample.....	73
13.7.	Test Results.....	73
14.	ANTENNA REQUIREMENT.....	78
14.1.	The Requirement	78
14.2.	Antenna Construction	78

Test Report Certification

Applicant : Shenzhen Marvo Technology Co., Ltd

Address : 6 F, Building A, DongFangYaYuan, Chentian Community, Xixiang,
Bao'an District, Shenzhen, China

EUT Description : Wireless Stereo Headset

Model No. : TCU007, PBT96, DEP001, DEP002, DEP006, DEP007, DEP008,
DEP009, DEP010

Measurement Procedure Used:

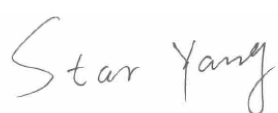
FCC Rules and Regulations Part 15 Subpart C Section 15.247
ANSI C63.10: 2013

The device described above is tested by Shenzhen Accurate Technology Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart C Section 15.247 limits. The measurement results are contained in this test report and Shenzhen Accurate Technology Co., Ltd. is assumed full responsibility for the accuracy and completeness of these measurements. Also, this report shows that the Equipment Under Test (EUT) is to be technically compliant with the FCC requirements.

This report applies to above tested sample only. This report shall not be reproduced in part without written approval of Shenzhen Accurate Technology Co., Ltd.

Date of Test : April 8-April 16, 2019

Date of Report : April 17, 2019

Test Engineer : 
(Star Yang, Engineer)

Prepared by : 
(Star Yang, Engineer)

Approved & Authorized Signer : 
(Sean Liu, Manager)

1. GENERAL INFORMATION

1.1. Description of Device (EUT)

Model Number	:	TCU007, PBT96, DEP001, DEP002, DEP006, DEP007, DEP008, DEP009, DEP010 (Note: We hereby state that these models are identical in interior structure, electrical circuits and components, Just model name is different. Therefore only model TCU007 is for tests.)
Bluetooth version	:	V4.2 (BR+EDR)
Frequency Range	:	2402MHz-2480MHz
Number of Channels	:	79
Antenna Gain(Max)	:	1.3dBi
Antenna type	:	PCB antenna
Modulation mode	:	GFSK, $\pi/4$ DQPSK, 8DPSK
Hardware version	:	V1.0
Software version	:	V1.0
Power Supply	:	DC 3.7V (Powered by Lithium battery) or DC 5V (Powered by charging port)
Applicant Address	:	Shenzhen Marvo Technology Co., Ltd 6 F, Building A, DongFangYaYuan, Chentian Community, Xixiang, Bao'an District, Shenzhen, China
Manufacturer Address	:	Shenzhen Marvo Technology Co., Ltd 6 F, Building A, DongFangYaYuan, Chentian Community, Xixiang, Bao'an District, Shenzhen, China

1.2. Accessory and Auxiliary Equipment

AC/DC Power Adapter: (provided by laboratory)	:	Model: TEKA006-0501000UKU
		Input: 100-240V~50/60Hz 0.3A
		Output: DC 5V/1A

1.3. Description of Test Facility

EMC Lab : Recognition of accreditation by Federal Communications Commission (FCC)
The Designation Number is CN1189
The Registration Number is 708358

Listed by Innovation, Science and Economic Development Canada (ISED)
The Registration Number is 5077A-2

Accredited by China National Accreditation Service for Conformity Assessment (CNAS)
The Registration Number is CNAS L3193

Accredited by American Association for Laboratory Accreditation (A2LA)
The Certificate Number is 4297.01

Name of Firm : Shenzhen Accurate Technology Co., Ltd.

Site Location : 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China

1.4. Measurement Uncertainty

Conducted Emission Expanded Uncertainty = 2.23dB, k=2

Radiated emission expanded uncertainty (9kHz-30MHz) = 3.08dB, k=2

Radiated emission expanded uncertainty (30MHz-1000MHz) = 4.42dB, k=2

Radiated emission expanded uncertainty (Above 1GHz) = 4.06dB, k=2

2. MEASURING DEVICE AND TEST EQUIPMENT

Table 1: List of Test and Measurement Equipment

Kind of equipment	Manufacturer	Type	S/N	Calibrated dates	Calibrated until
EMI Test Receiver	Rohde&Schwarz	ESCS30	100307	Jan. 05, 2019	1 Year
EMI Test Receiver	Rohde& Schwarz	ESR	101817	Jan. 05, 2019	1 Year
Spectrum Analyzer	Rohde&Schwarz	FSV40	101495	Jan. 05, 2019	1 Year
Pre-Amplifier	Compliance Direction	RSU-M2	38322	Jan. 05, 2019	1 Year
Pre-Amplifier	Agilent	8447D	294A10619	Jan. 05, 2019	1 Year
Loop Antenna	Schwarzbeck	FMZB1516	1516131	Jan. 05, 2019	1 Year
Bilog Antenna	Schwarzbeck	VULB9163	9163-323	Jan. 05, 2019	1 Year
Horn Antenna	Schwarzbeck	BBHA9120D	9120D-655	Jan. 05, 2019	1 Year
Horn Antenna	Schwarzbeck	BBHA9170	9170-359	Jan. 05, 2019	1 Year
LISN	Schwarzbeck	NSLK8126	8126431	Jan. 05, 2019	1 Year
Highpass Filter	Wainwright Instruments	WHKX3.6/18G-10S	N/A	Jan. 05, 2019	1 Year
Band Reject Filter	Wainwright Instruments	WRCG2400/2485-2375/2510-60/11SS	N/A	Jan. 05, 2019	1 Year
RF Coaxial Cable	SUHNER	N-5m(Frequency range:9KHz-26.5GHz)	NO.3	Jan. 05, 2019	1 Year
RF Coaxial Cable	SUHNER	N-5m(Frequency range:9KHz-26.5GHz)	NO.4	Jan. 05, 2019	1 Year
RF Coaxial Cable	SUHNER	N-1m(Frequency range:9KHz-26.5GHz)	NO.5	Jan. 05, 2019	1 Year
RF Coaxial Cable	SUHNER	N-1m(Frequency range:9KHz-26.5GHz)	NO.6	Jan. 05, 2019	1 Year
Temporary antenna connector	NTGS	14AE	N/A	Apr. 11, 2019	N/A

Note: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

3. OPERATION OF EUT DURING TESTING

3.1.Operating Mode

The mode is used: Transmitting mode

Low Channel: 2402MHz

Middle Channel: 2441MHz

High Channel: 2480MHz

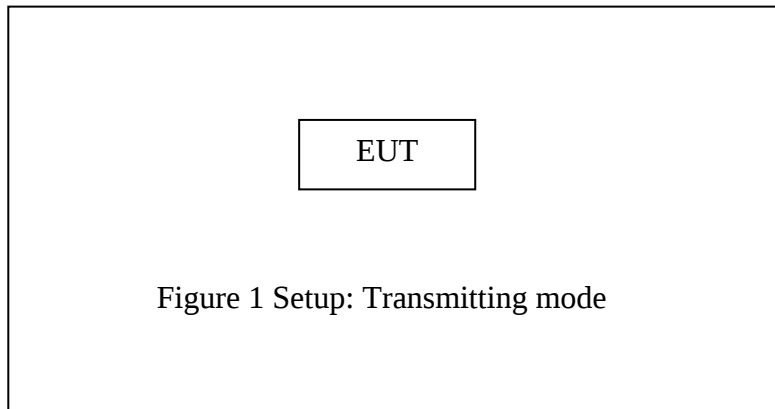
Hopping

Note: The equipment under test (EUT) was tested under fully-charged battery.
The Bluetooth has been tested under continuous transmission mode.

EUT is connected to a computer through the usb-serial controller tool and Use test software to set the test mode.

Test software is (RDA ToolKit 8.03.03)

3.2.Configuration and peripherals



4. FREQUENCY HOPPING SYSTEM REQUIREMENTS

4.1. Standard and Limit

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

4.2. EUT Pseudorandom Frequency Hopping Sequence

Pseudorandom Frequency Hopping Sequence Table as below:

Channel: 08, 24, 40, 56, 34, 51, 72, 09, 01, 64, 22, 33, 41, 32, 47, 65, 73, 53, 69, 06, 17, 04, 20, 36, 52, 38, 66, 70, 78, 68, 76, 21, 29, 10, 26, 49, 00, 58, 44, 59, 75, 13, 03, 14, 11, 35, 43, 37, 50, 61, 77, 55, 71, 02, 23, 07, 27, 39, 54, 46, 48, 15, 63, 62, 67, 25, 31, 12, 28, 19, 60, 42, 57, 74, 16, 05, 18, 30, 45, etc.

The system receiving have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

4.3.Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

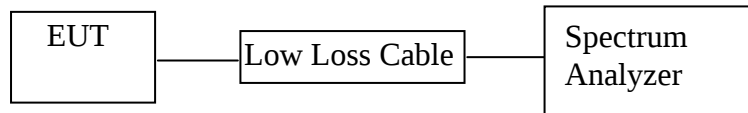
This device was tested with a bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements FCC Part 15.247 rule.

5. TEST PROCEDURES AND RESULTS

FCC Rules	Description of Test	Result
Section 15.247(a)(1)	20dB Bandwidth Test	Compliant
Section 15.247(a)(1)	Carrier Frequency Separation Test	Compliant
Section 15.247(a)(1)(iii)	Number Of Hopping Frequency Test	Compliant
Section 15.247(a)(1)(iii)	Dwell Time Test	Compliant
Section 15.247(b)(1)	Maximum Peak Output Power Test	Compliant
Section 15.247(d) Section 15.209	Radiated Emission Test	Compliant
Section 15.247(d)	Band Edge Compliance Test	Compliant
Section 15.207	AC Power Line Conducted Emissions Limits Test	Compliant
Section 15.203	Antenna Requirement	Compliant

6. 20DB BANDWIDTH TEST

6.1. Block Diagram of Test Setup



6.2. The Requirement For 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.

6.3. EUT Configuration on Measurement

The equipment are installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

6.4. Operating Condition of EUT

6.4.1. Setup the EUT and simulator as shown as Section 6.1.

6.4.2. Turn on the power of all equipment.

6.4.3. Let the EUT work in TX (Hopping off) modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2441MHz, and 2480MHz TX frequency to transmit.

6.5. Test Procedure

6.5.1. The transmitter output was connected to the spectrum analyzer through a low loss cable.

6.5.2. Set RBW of spectrum analyzer to 100 kHz and VBW to 300 kHz.

6.5.3. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

6.6.Test Result

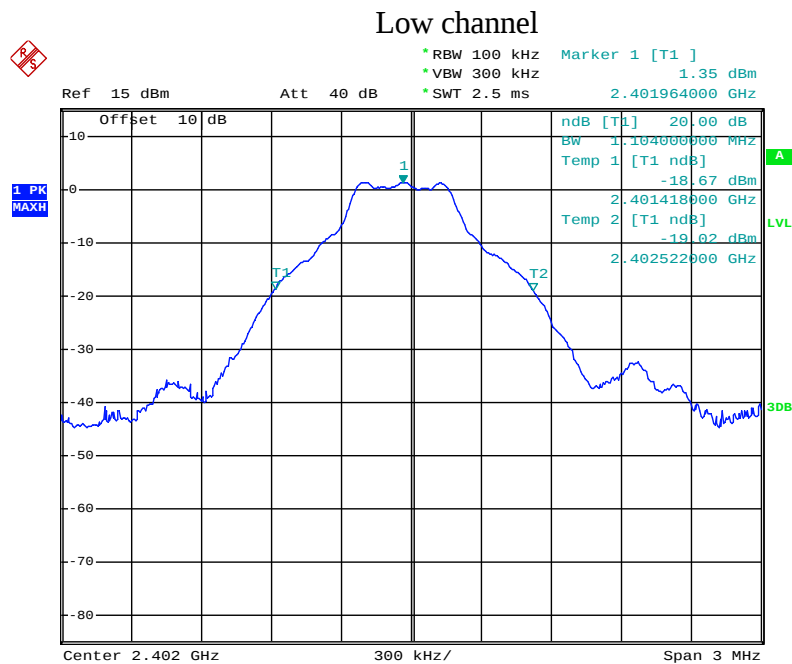
Test Lab: Shielding room

Test Engineer: Star

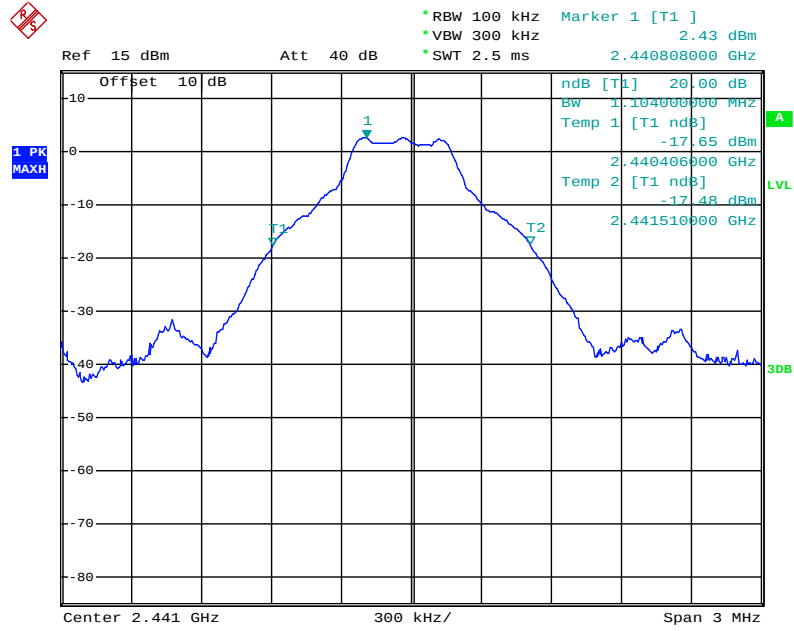
Channel	Frequency (MHz)	GFSK 20dB Bandwidth (MHz)	$\Pi/4$ -DQPSK 20dB Bandwidth (MHz)	8DPSK 20dB Bandwidth (MHz)	Result
Low	2402	1.104	1.362	1.344	Pass
Middle	2441	1.104	1.380	1.350	Pass
High	2480	1.098	1.368	1.350	Pass

The spectrum analyzer plots are attached as below.

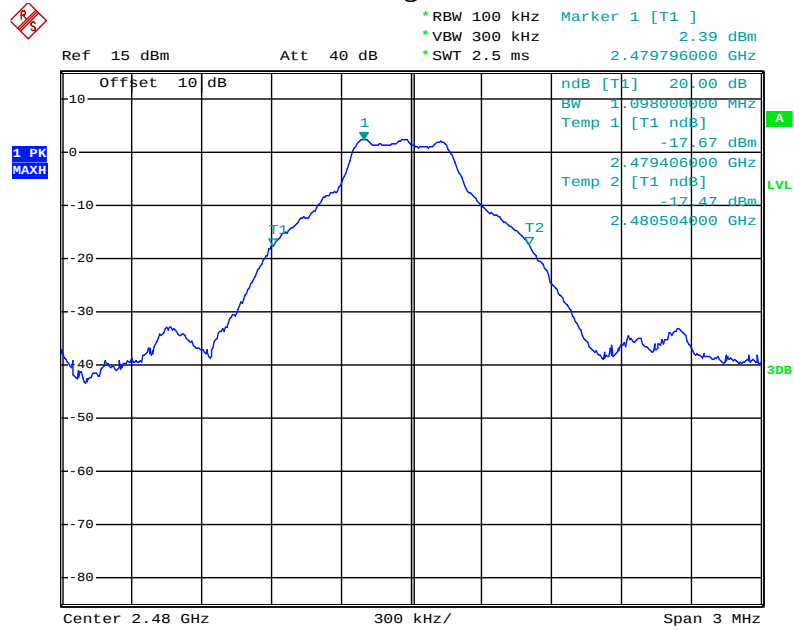
GFSK Mode



Middle channel

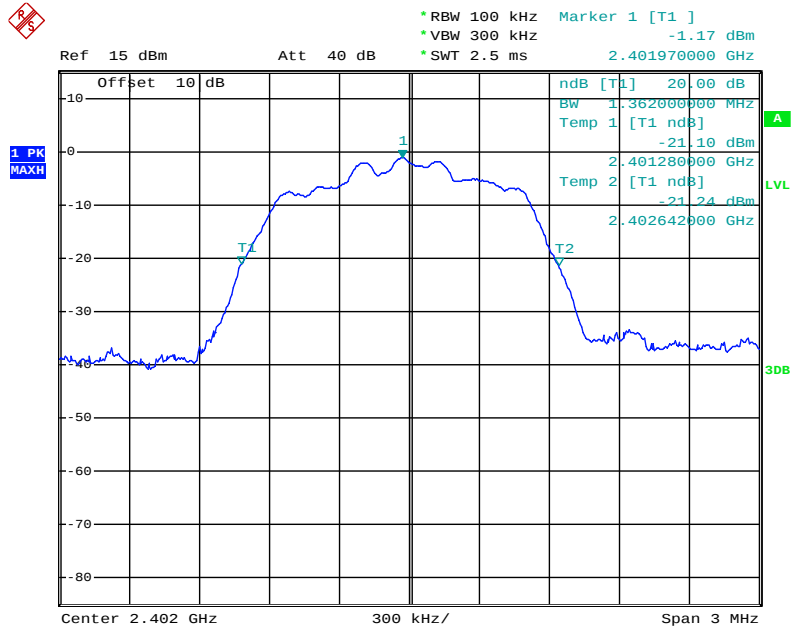


High channel

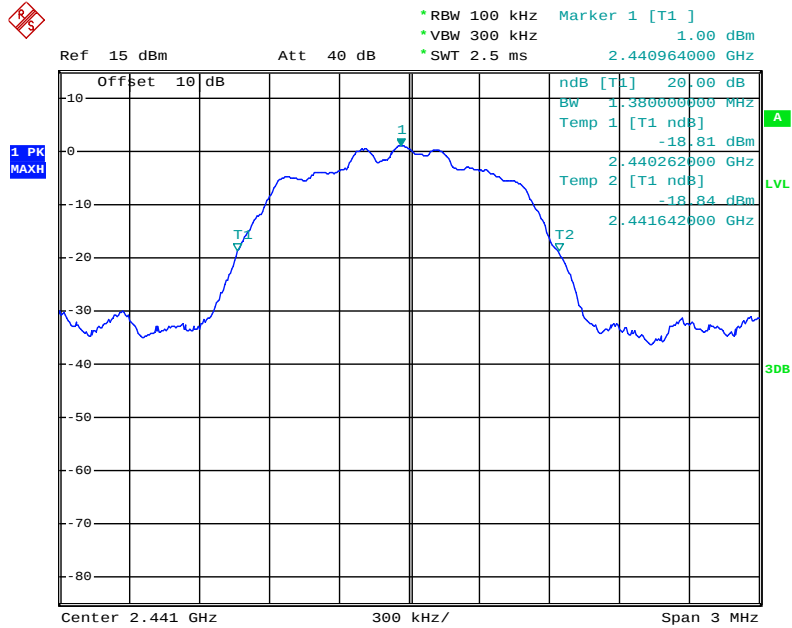


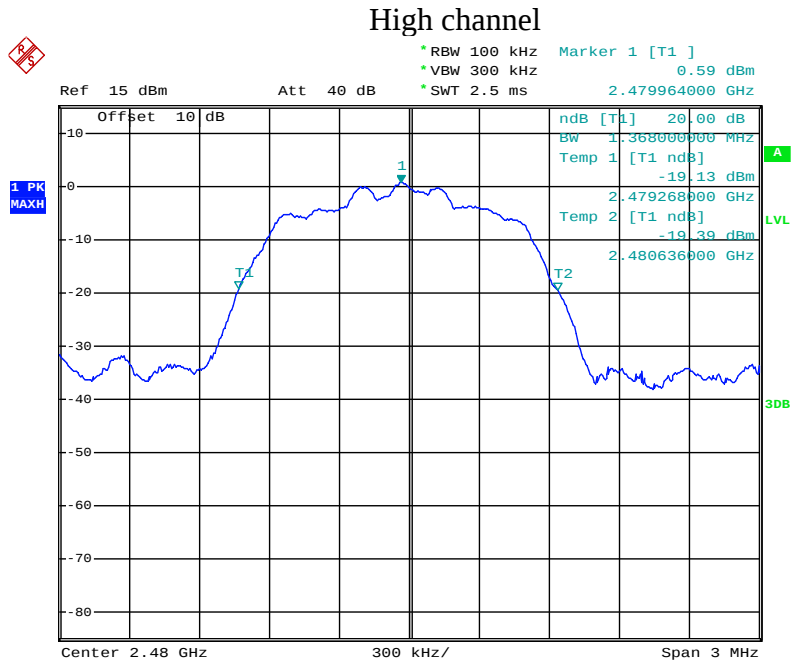
$\Pi/4$ -DQPSK Mode

Low channel

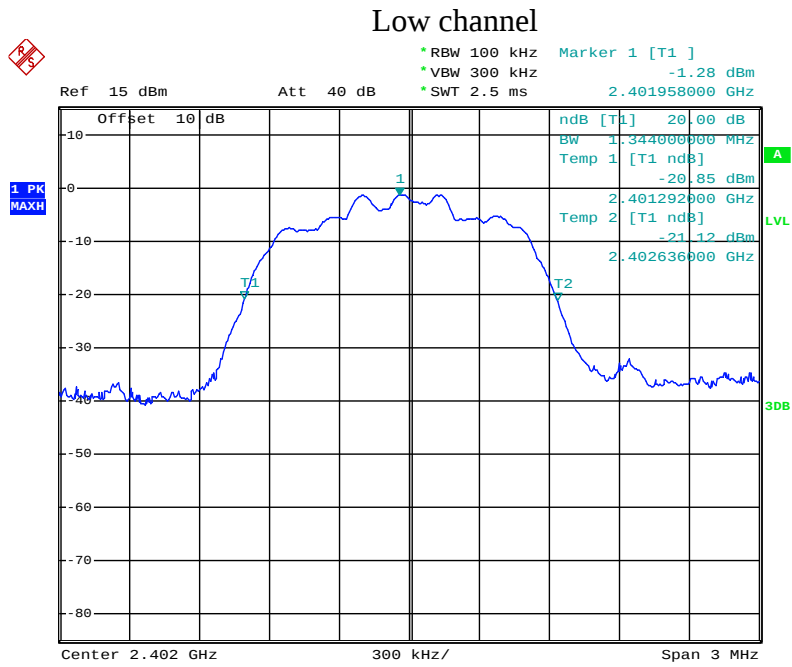


Middle channel

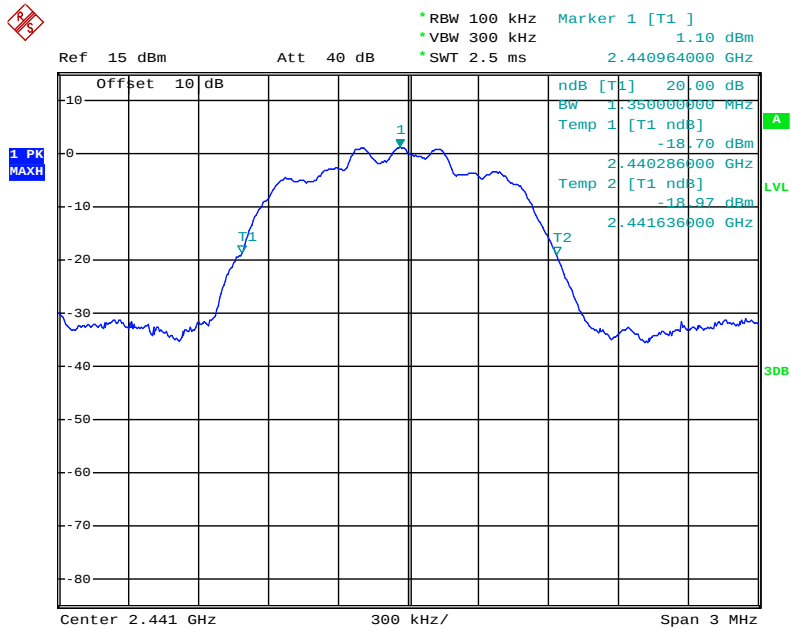




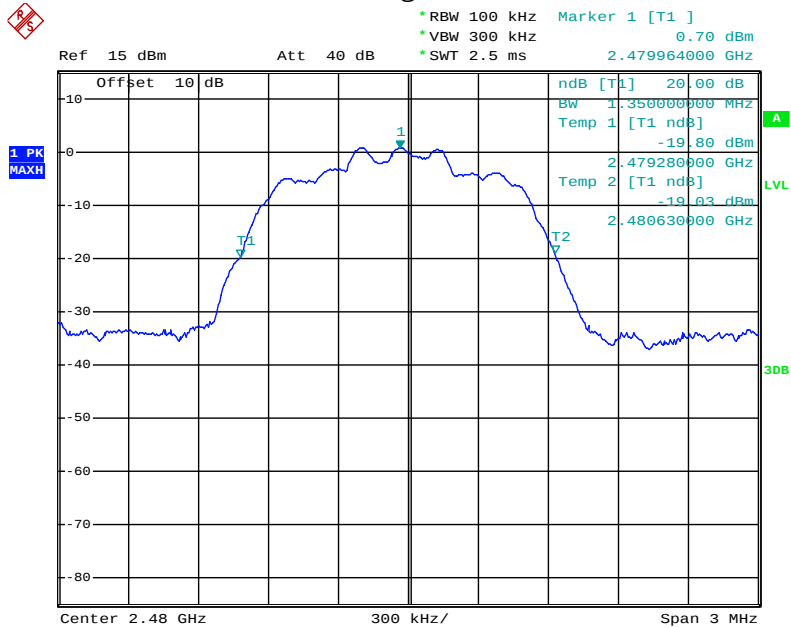
8DPSK Mode



Middle channel



High channel



7. CARRIER FREQUENCY SEPARATION TEST

7.1. Block Diagram of Test Setup



7.2. The Requirement For 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. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

7.3. EUT Configuration on Measurement

The equipment are installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

7.4. Operating Condition of EUT

7.4.1. Setup the EUT and simulator as shown as Section 7.1.

7.4.2. Turn on the power of all equipment.

7.4.3. Let the EUT work in TX (Hopping on) modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2441MHz, and 2480MHz TX frequency to transmit.

7.5. Test Procedure

7.5.1. The transmitter output was connected to the spectrum analyzer through a low loss cable.

7.5.2. Set RBW of spectrum analyzer to 30 kHz and VBW to 100 kHz. Adjust Span to 3 MHz.

7.5.3. Set the adjacent channel of the EUT Maxhold another trace.

7.5.4. Measurement the channel separation

7.6. Test Result

Test Lab: Shielding room

Test Engineer: Star

GFSK

Channel	Frequency (MHz)	Channel Separation(MHz)	Limit (MHz)	Result
Low	2402	1.008	25KHz or 2/3*20dB bandwidth	Pass
	2403			
Middle	2440	1.002	25KHz or 2/3*20dB bandwidth	Pass
	2441			
High	2479	1.002	25KHz or 2/3*20dB bandwidth	Pass
	2480			

II/4-DQPSK

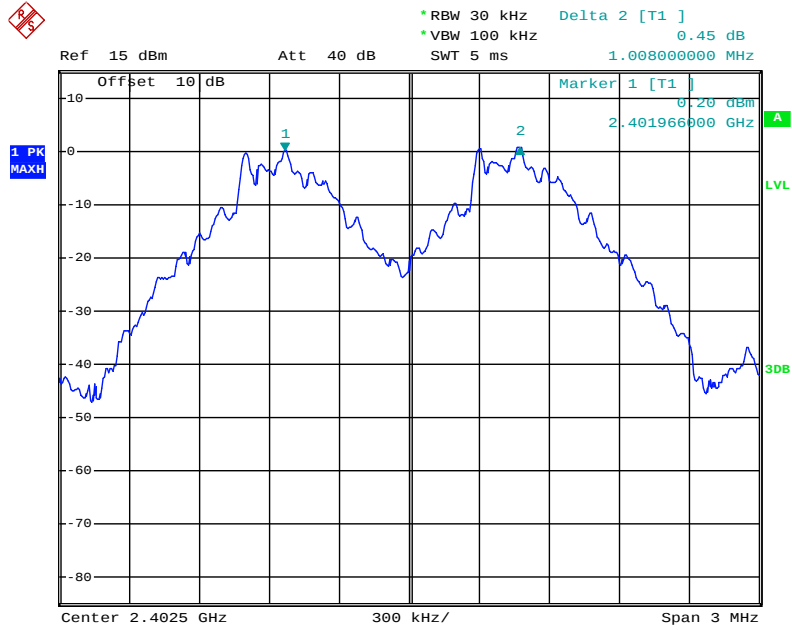
Channel	Frequency (MHz)	Channel Separation(MHz)	Limit (MHz)	Result
Low	2402	1.002	25KHz or 2/3*20dB bandwidth	Pass
	2403			
Middle	2440	1.002	25KHz or 2/3*20dB bandwidth	Pass
	2441			
High	2479	1.002	25KHz or 2/3*20dB bandwidth	Pass
	2480			

8DPSK

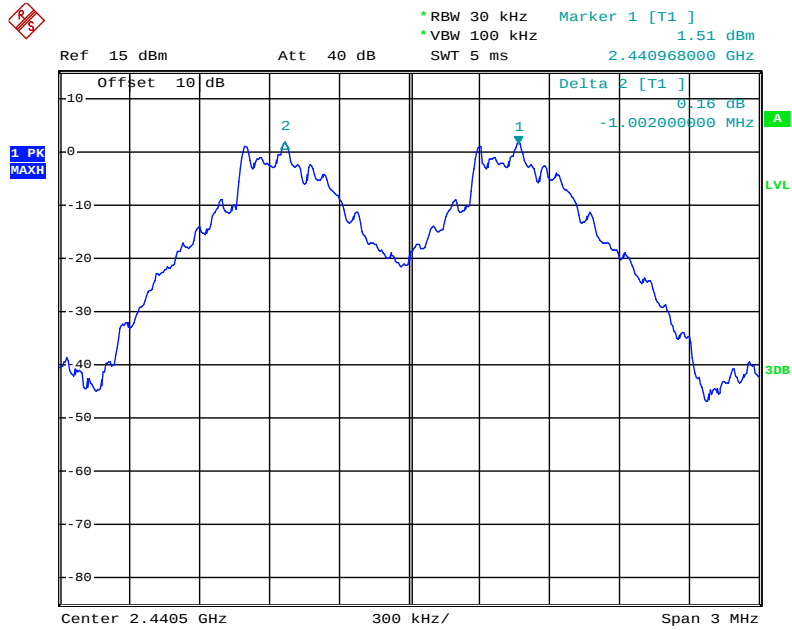
Channel	Frequency (MHz)	Channel Separation(MHz)	Limit (MHz)	Result
Low	2402	1.002	25KHz or 2/3*20dB bandwidth	Pass
	2403			
Middle	2440	1.002	25KHz or 2/3*20dB bandwidth	Pass
	2441			
High	2479	1.002	25KHz or 2/3*20dB bandwidth	Pass
	2480			

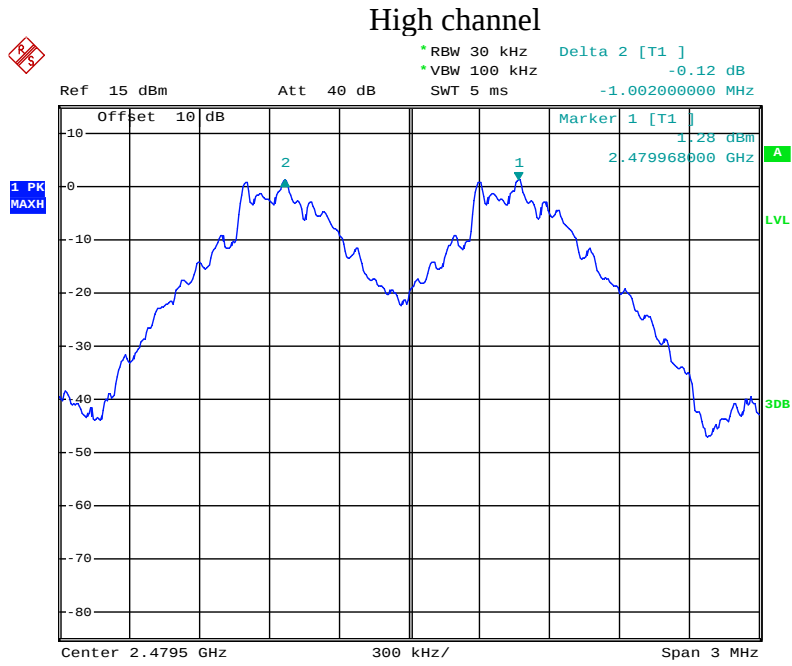
GFSK Mode

Low channel

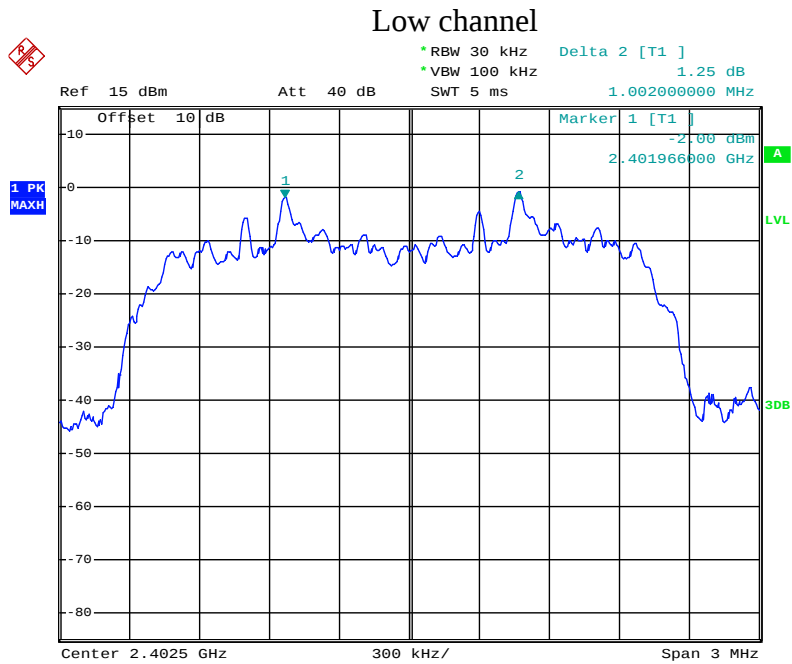


Middle channel

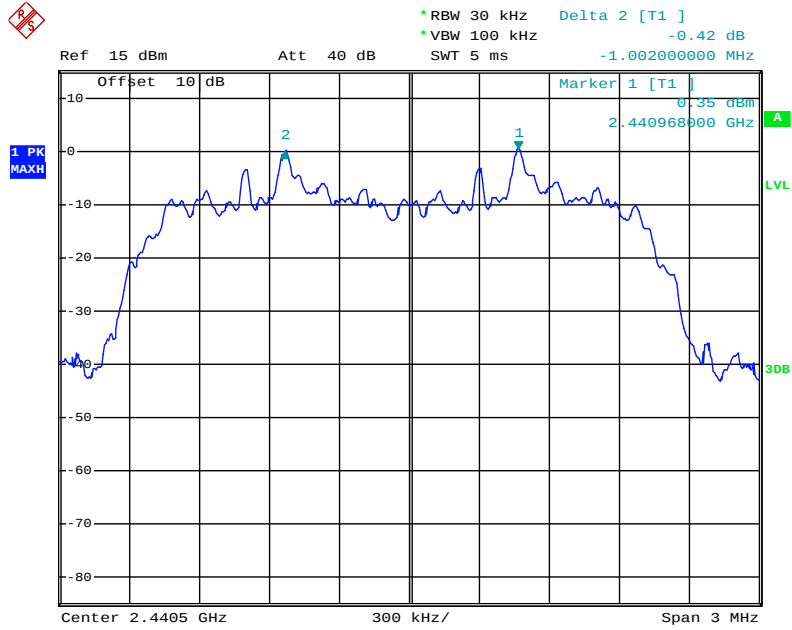




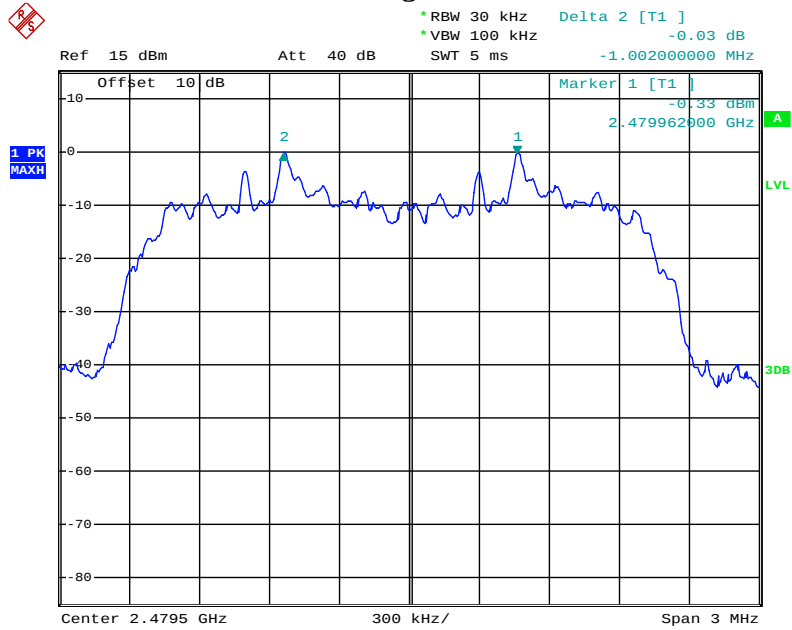
$\Pi/4$ -DQPSK Mode



Middle channel

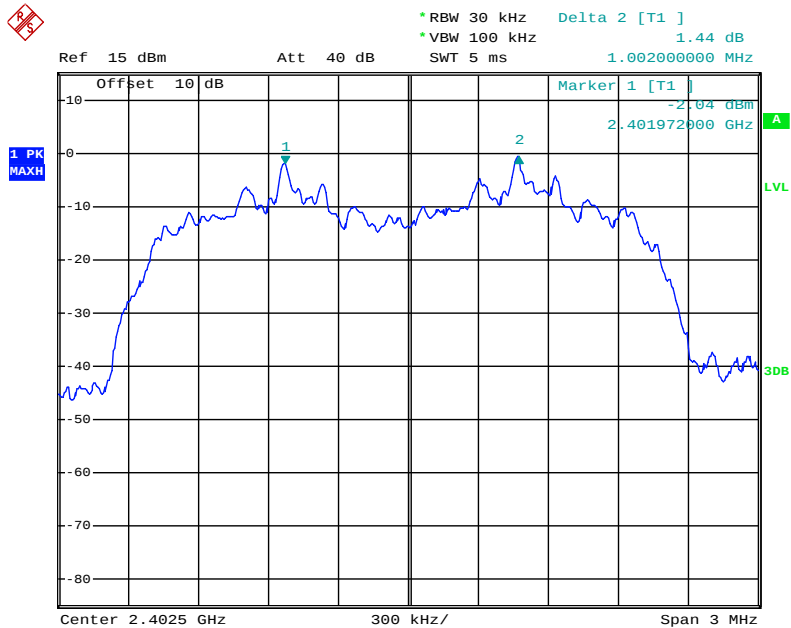


High channel

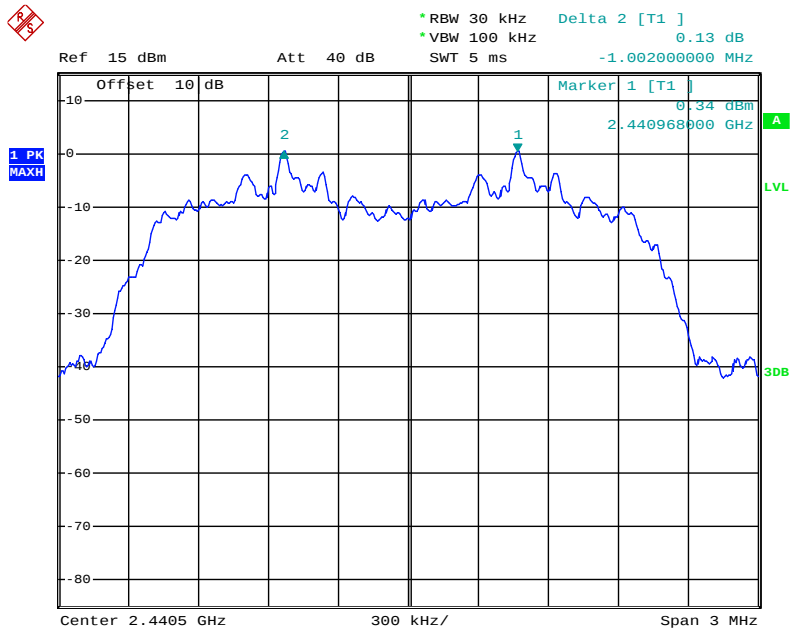


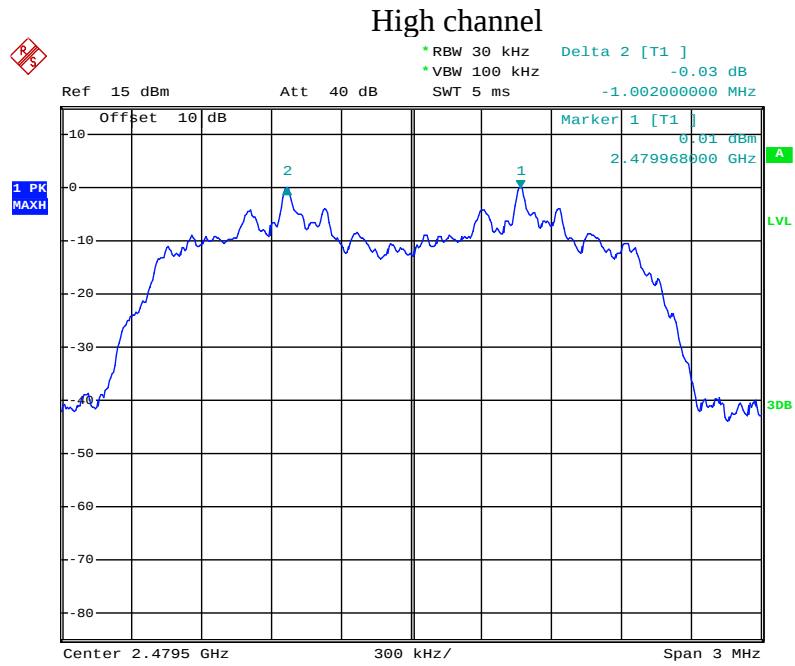
8DPSK Mode

Low channel



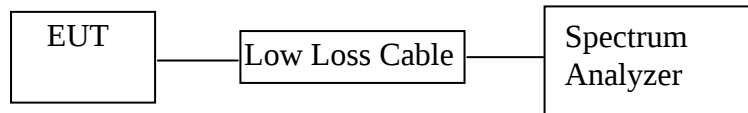
Middle channel





8. NUMBER OF HOPPING FREQUENCY TEST

8.1. Block Diagram of Test Setup



8.2. The Requirement For Section 15.247(a)(1)(iii)

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

8.3. EUT Configuration on Measurement

The equipment are installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

8.4. Operating Condition of EUT

8.4.1. Setup the EUT and simulator as shown as Section 8.1.

8.4.2. Turn on the power of all equipment.

8.4.3. Let the EUT work in TX (Hopping on) modes measure it.

8.5. Test Procedure

8.5.1. The transmitter output was connected to the spectrum analyzer through a low loss cable.

8.5.2. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz.

8.5.3. Max hold, view and count how many channel in the band.

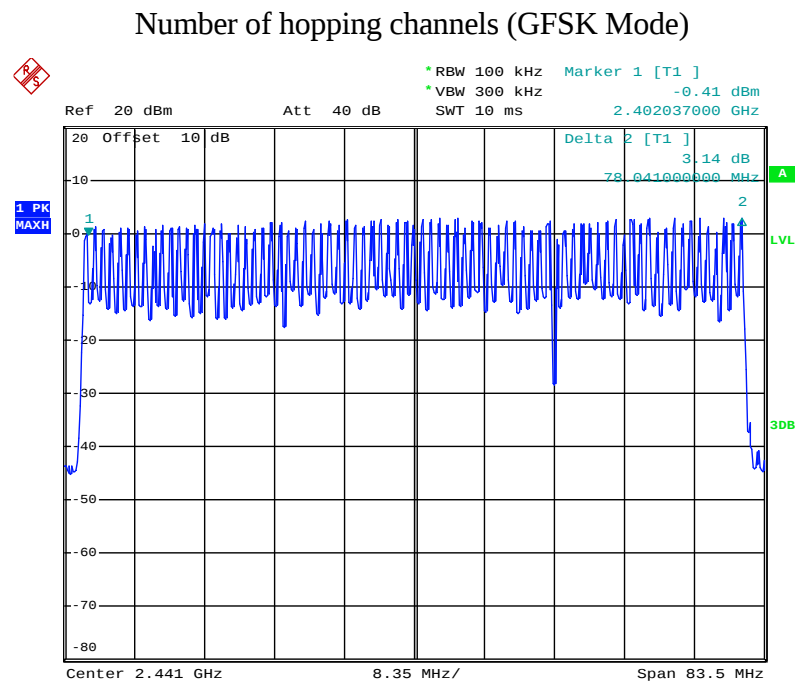
8.6.Test Result

Test Lab: Shielding room

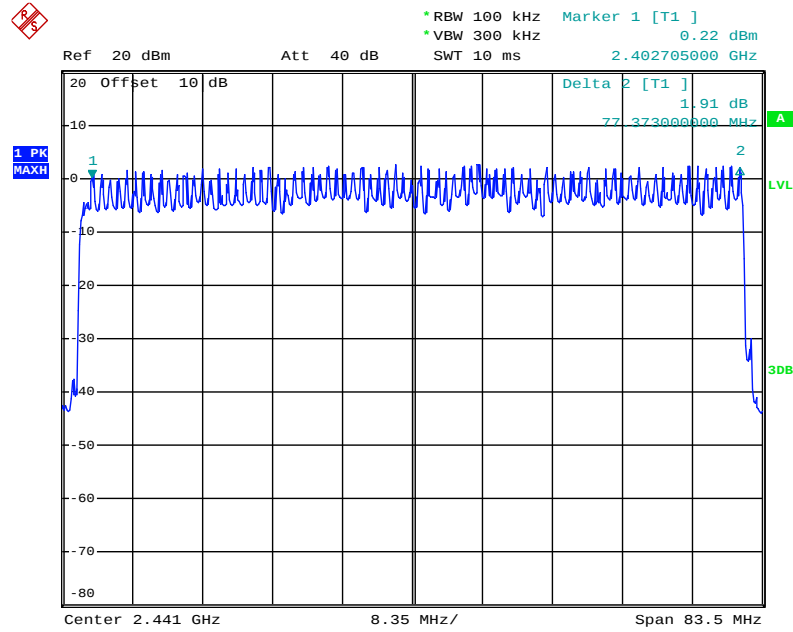
Test Engineer: Star

Total number of hopping channel	Measurement result(CH)	Limit(CH)	Result
	79	≥ 15	Pass

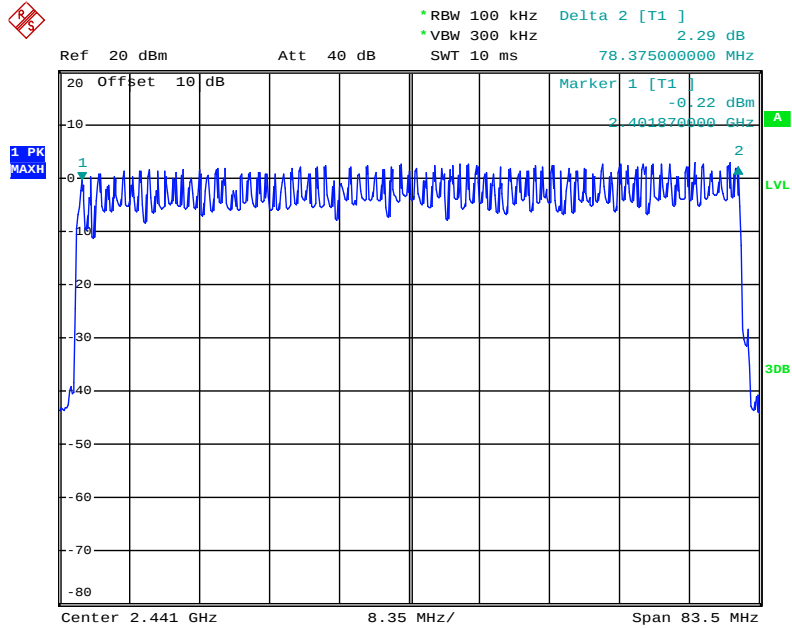
The spectrum analyzer plots are attached as below.



Number of hopping channels ($\Pi/4$ -DQPSK Mode)

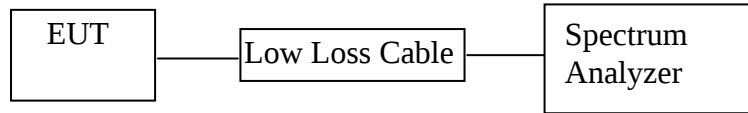


Number of hopping channels (8DPSK Mode)



9. DWELL TIME TEST

9.1. Block Diagram of Test Setup



9.2. The Requirement For Section 15.247(a)(1)(iii)

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

9.3. EUT Configuration on Measurement

The equipment are installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

9.4. Operating Condition of EUT

9.4.1. Setup the EUT and simulator as shown as Section 9.1.

9.4.2. Turn on the power of all equipment.

9.4.3. Let the EUT work in TX (Hopping on) modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2441MHz, and 2480MHz TX frequency to transmit.

9.5. Test Procedure

9.5.1. The transmitter output was connected to the spectrum analyzer through a low loss cable.

9.5.2. Set center frequency of spectrum analyzer = operating frequency.

9.5.3. Set the spectrum analyzer as RBW=1MHz, VBW=3MHz, Span=0Hz, Adjust Sweep=5ms, 10ms, 15ms. Get the pulse time.

9.5.4. Repeat above procedures until all frequency measured were complete.

9.6. Test Result

Test Lab: Shielding room

Test Engineer: Star

GFSK Mode (Worse case)

Mode	Channel Frequency (MHz)	Pulse Time (ms)	Dwell Time (ms)	Limit (ms)
DH1	2441	0.430	137.6	400
A period transmit time = $0.4 \times 79 = 31.6$ Dwell time = pulse time $\times (1600/(2 \times 79)) \times 31.6$				
DH3	2441	1.680	268.8	400
A period transmit time = $0.4 \times 79 = 31.6$ Dwell time = pulse time $\times (1600/(4 \times 79)) \times 31.6$				
DH5	2441	2.960	315.7	400
A period transmit time = $0.4 \times 79 = 31.6$ Dwell time = pulse time $\times (1600/(6 \times 79)) \times 31.6$				

$\Pi/4$ -DQPSK Mode (Worse case)

Mode	Channel Frequency (MHz)	Pulse Time (ms)	Dwell Time (ms)	Limit (ms)
DH1	2441	0.450	144.0	400
A period transmit time = $0.4 \times 79 = 31.6$ Dwell time = pulse time $\times (1600/(2 \times 79)) \times 31.6$				
DH3	2441	1.720	275.2	400
A period transmit time = $0.4 \times 79 = 31.6$ Dwell time = pulse time $\times (1600/(4 \times 79)) \times 31.6$				
DH5	2441	2.960	315.7	400
A period transmit time = $0.4 \times 79 = 31.6$ Dwell time = pulse time $\times (1600/(6 \times 79)) \times 31.6$				

8DPSK Mode (Worse case)

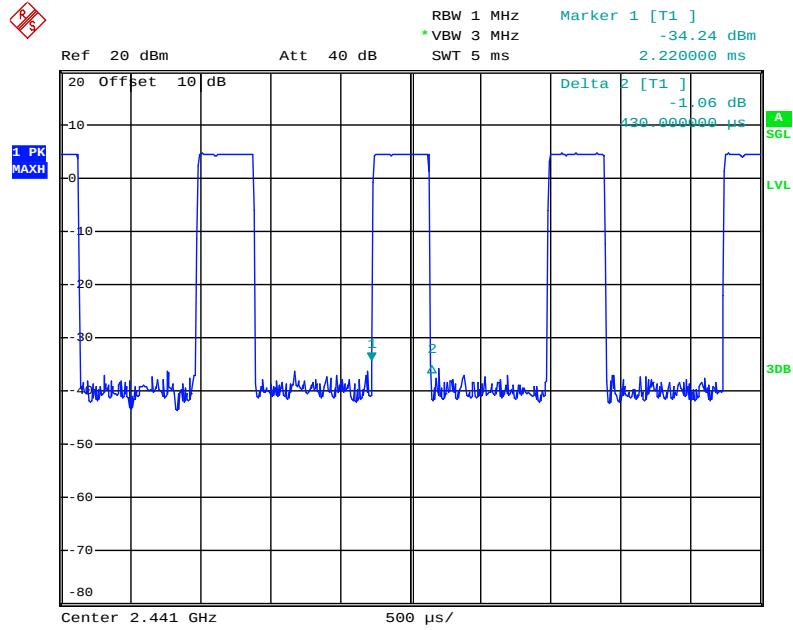
Mode	Channel Frequency (MHz)	Pulse Time (ms)	Dwell Time (ms)	Limit (ms)
DH1	2441	0.440	140.8	400
A period transmit time = $0.4 \times 79 = 31.6$ Dwell time = pulse time $\times (1600/(2 \times 79)) \times 31.6$				
DH3	2441	1.720	275.2	400
A period transmit time = $0.4 \times 79 = 31.6$ Dwell time = pulse time $\times (1600/(4 \times 79)) \times 31.6$				
DH5	2441	2.990	318.9	400
A period transmit time = $0.4 \times 79 = 31.6$ Dwell time = pulse time $\times (1600/(6 \times 79)) \times 31.6$				

Note: We tested GFSK mode and $\Pi/4$ -DQPSK & 8DPSK mode the low, middle and high channel and recorded the worse case data for all test mode.

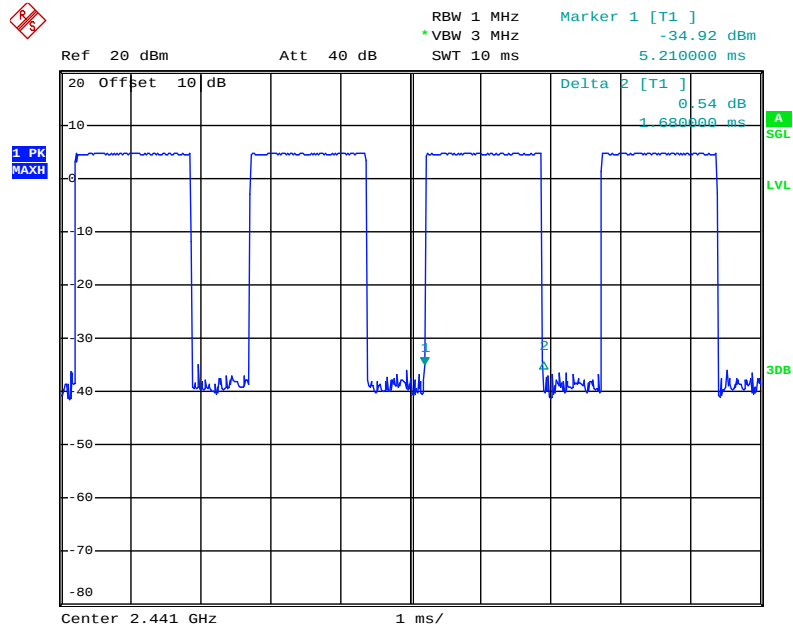
The spectrum analyzer plots are attached as below.

GFSK Mode

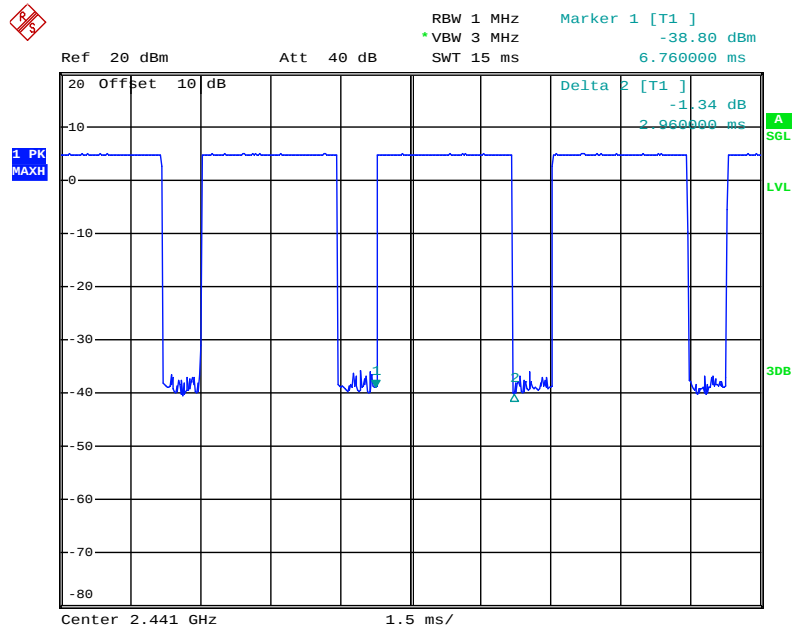
DH1 Middle channel



DH3 Middle channel

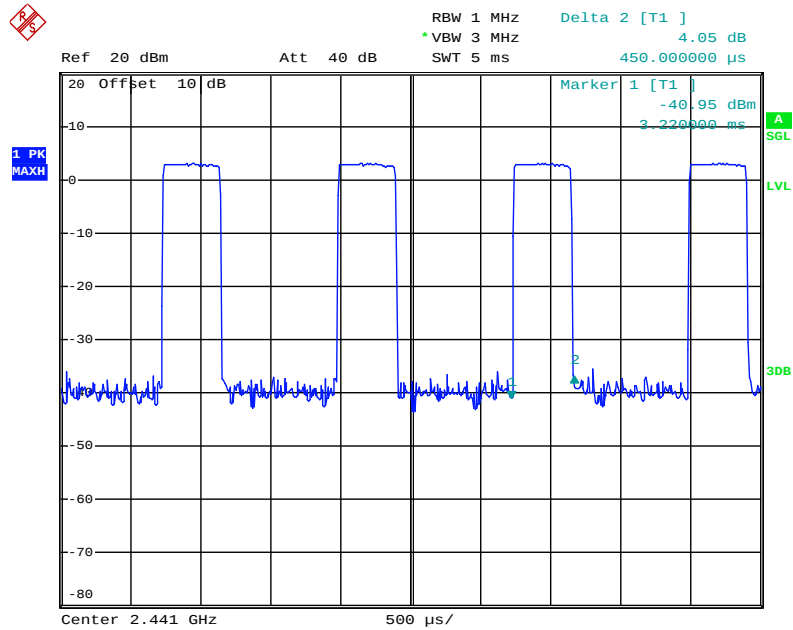


DH5 Middle channel

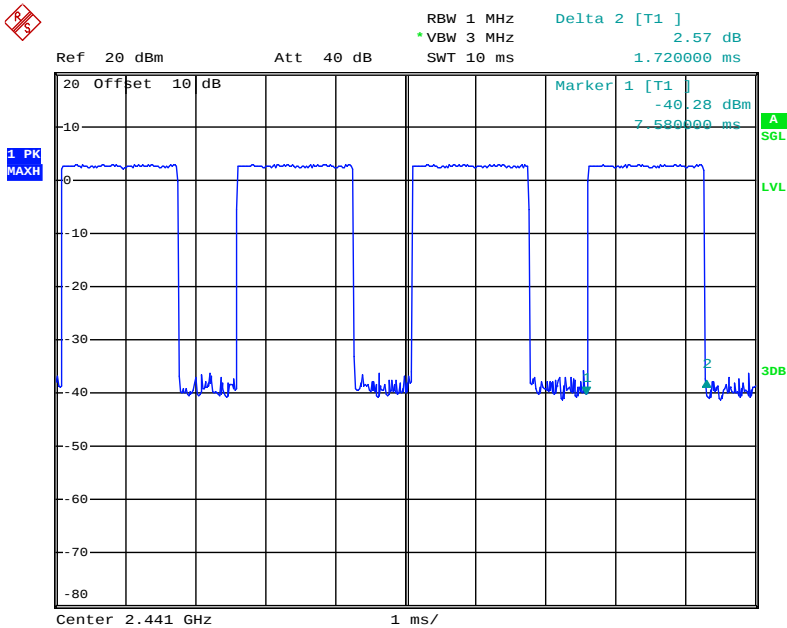


Π/4-DQPSK Mode

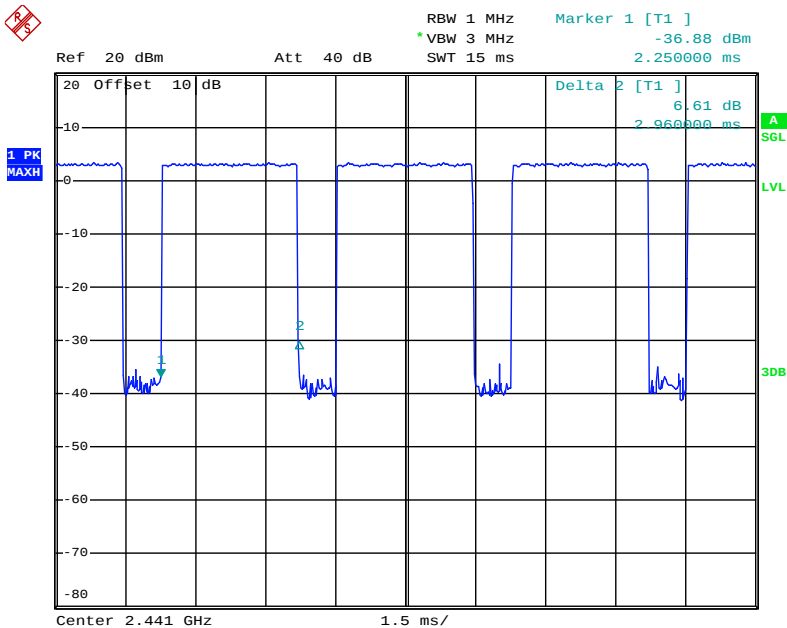
2-DH1 Middle channel



2-DH3 Middle channel

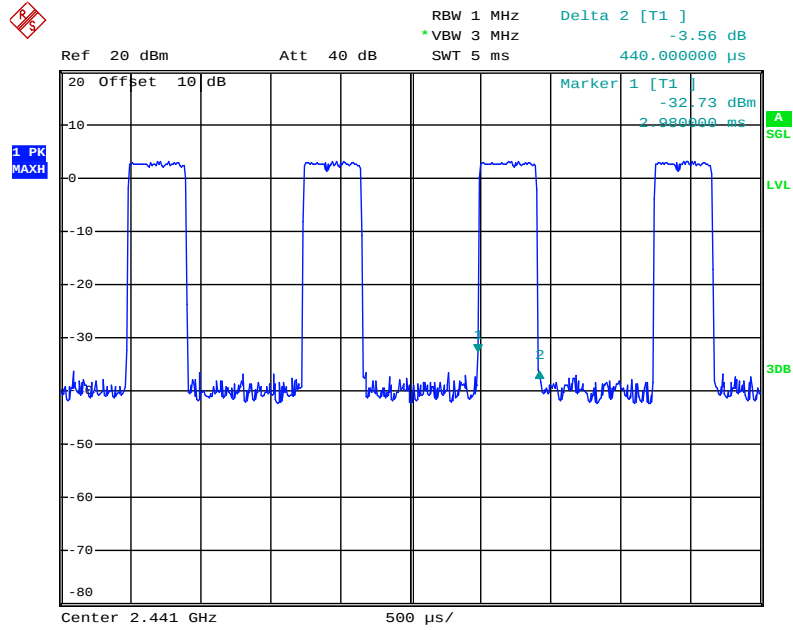


2-DH5 Middle channel

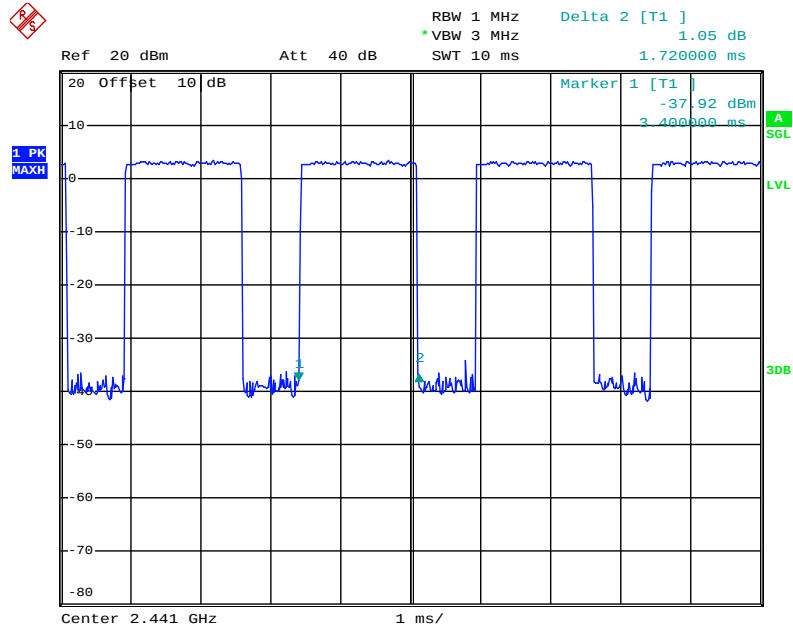


8DPSK Mode

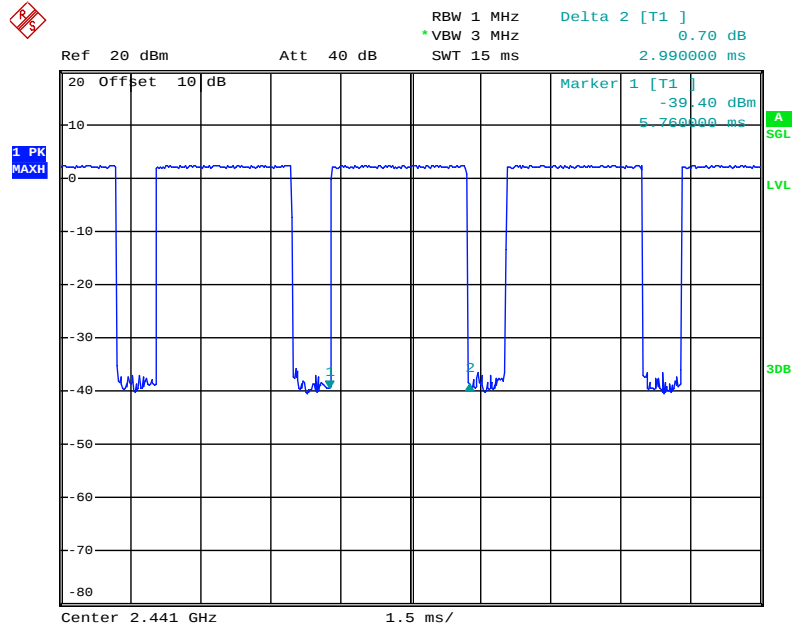
3-DH1 Middle channel



3-DH3 Middle channel

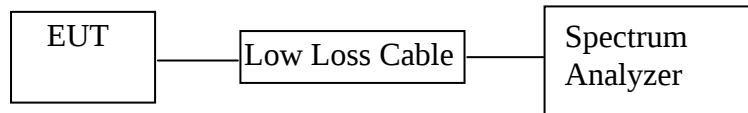


3-DH5 Middle channel



10. MAXIMUM PEAK OUTPUT POWER TEST

10.1. Block Diagram of Test Setup



10.2. The Requirement For 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 all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

10.3. EUT Configuration on Measurement

The equipment are installed on the emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

10.4. Operating Condition of EUT

10.4.1. Setup the EUT and simulator as shown as Section 10.1.

10.4.2. Turn on the power of all equipment.

10.4.3. Let the EUT work in TX (Hopping off) modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2441MHz, and 2480MHz TX frequency to transmit.

10.5. Test Procedure

10.5.1. The transmitter output was connected to the spectrum analyzer through a low loss cable.

10.5.2. Set RBW of spectrum analyzer to 3MHz and VBW to 3MHz.

10.5.3. Measurement the maximum peak output power.

10.6.Test Result

Test Lab: Shielding room

Test Engineer: Star

GFSK Mode

Channel	Frequency (MHz)	Peak Output Power (dBm/W)	Limits (dBm/W)	Result
Low	2402	2.02/0.0016	21 / 0.125	Pass
Middle	2441	2.57/0.0018	21 / 0.125	Pass
High	2480	2.42/0.0017	21 / 0.125	Pass

II/4-DQPSK Mode

Channel	Frequency (MHz)	Peak Output Power (dBm/W)	Limits (dBm/W)	Result
Low	2402	-0.23/0.0009	21 / 0.125	Pass
Middle	2441	1.69/0.0015	21 / 0.125	Pass
High	2480	1.41/0.0014	21 / 0.125	Pass

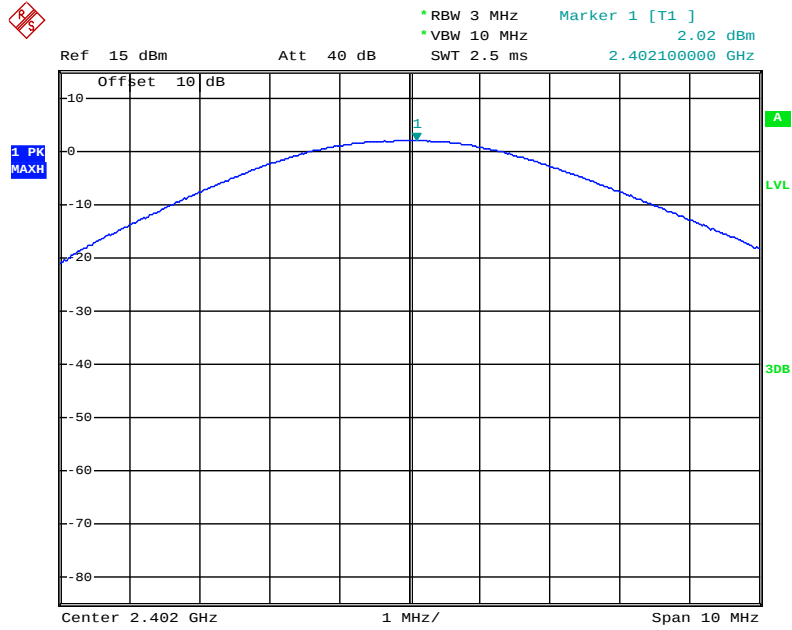
8DPSK Mode

Channel	Frequency (MHz)	Peak Output Power (dBm/W)	Limits (dBm/W)	Result
Low	2402	0.38/0.0011	21 / 0.125	Pass
Middle	2441	1.87/0.0015	21 / 0.125	Pass
High	2480	1.60/0.0014	21 / 0.125	Pass

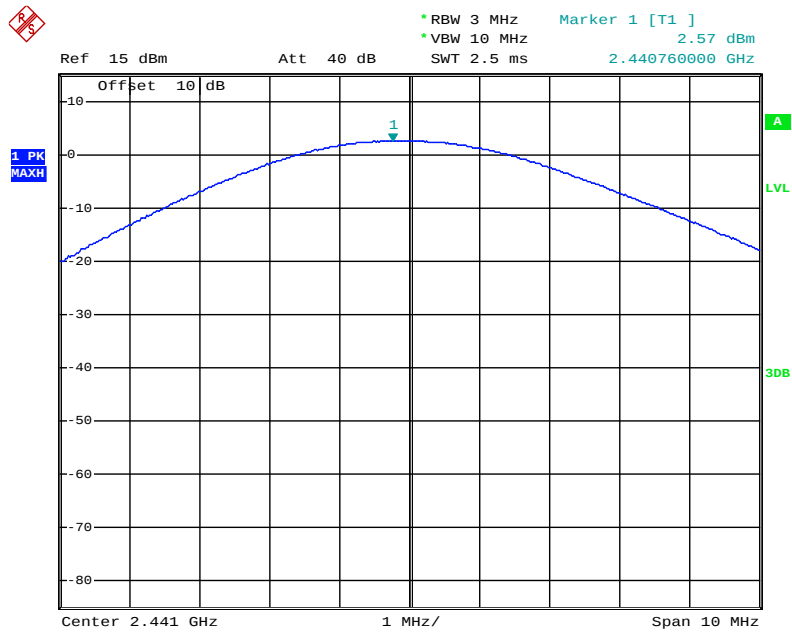
The spectrum analyzer plots are attached as below.

GFSK Mode

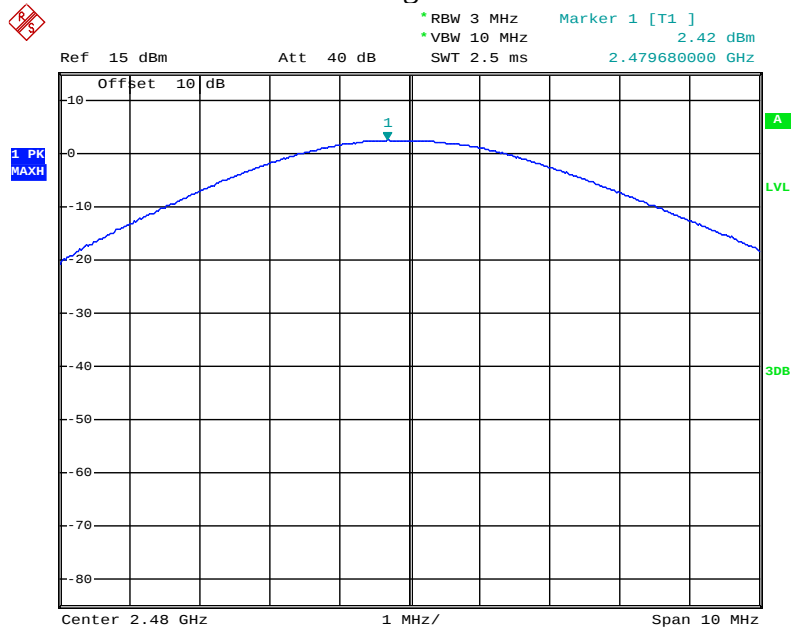
Low channel



Middle channel

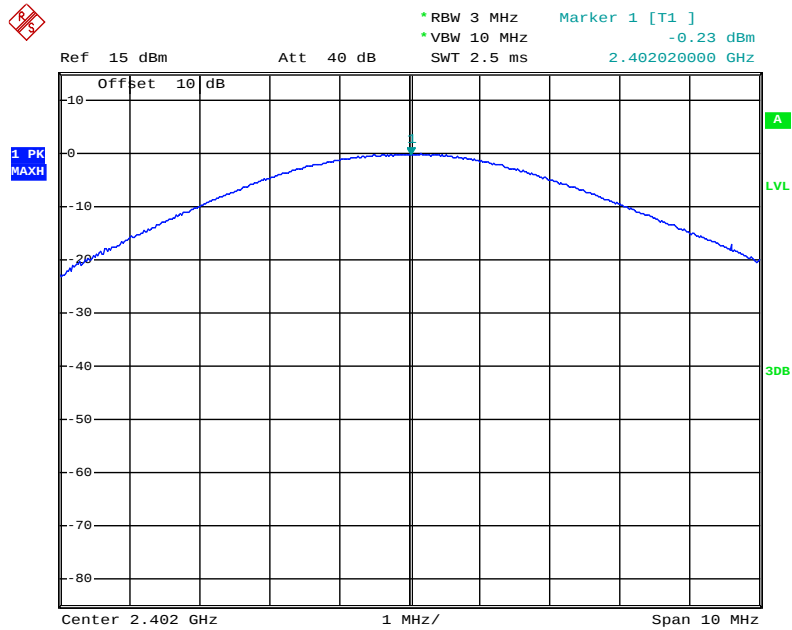


High channel

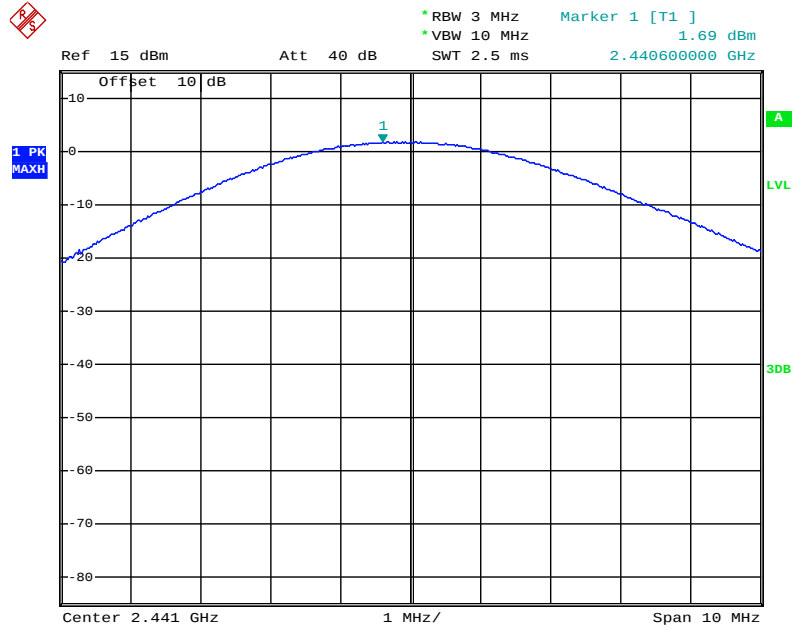


Π/4-DQPSK Mode

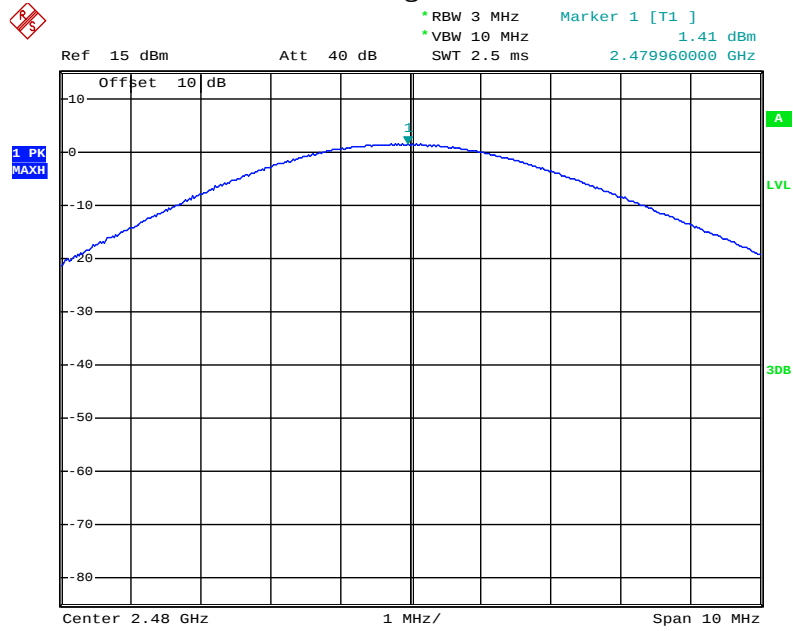
Low channel



Middle channel

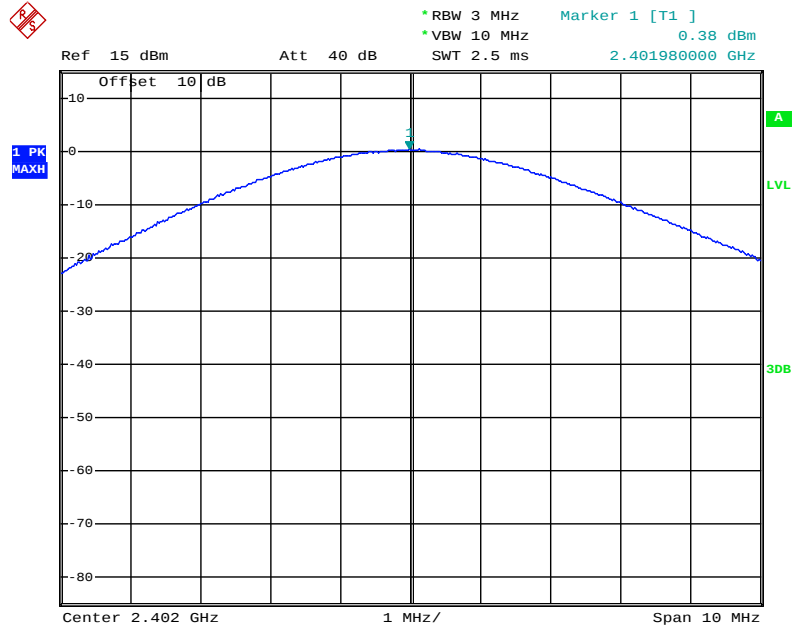


High channel

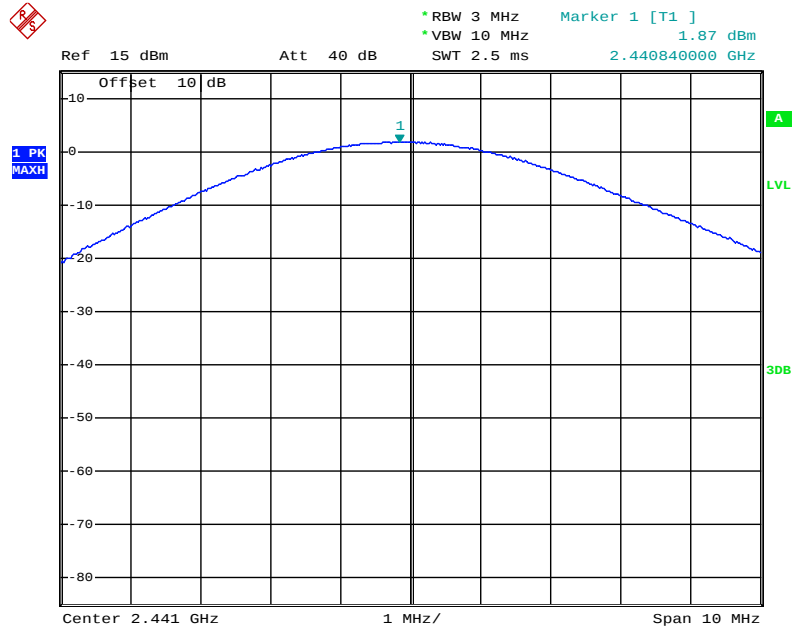


8DPSK Mode

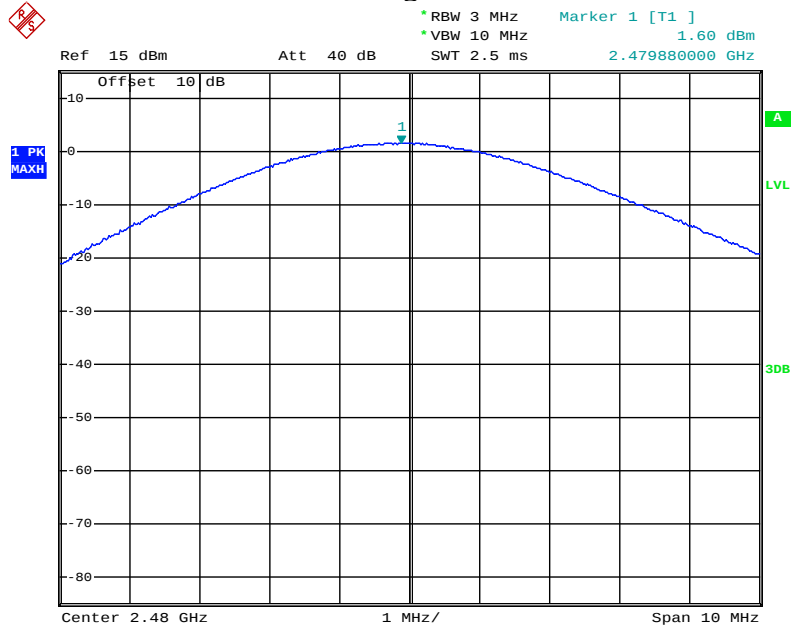
Low channel



Middle channel



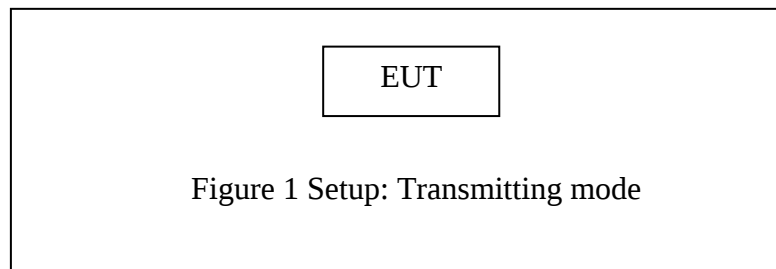
High channel



11.RADIATED EMISSION TEST

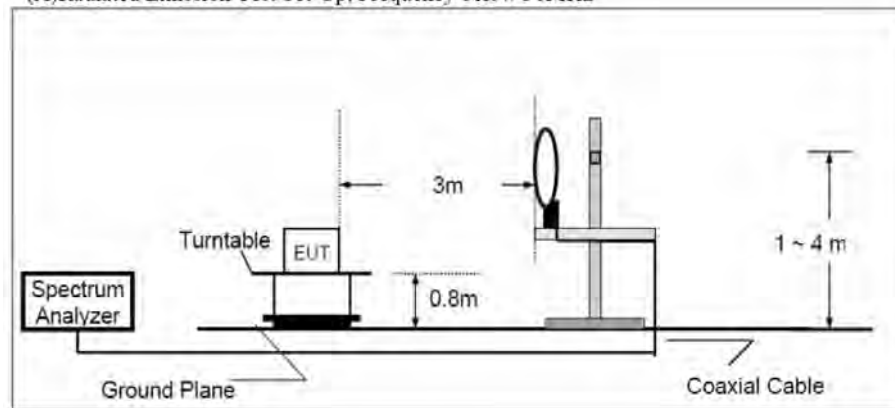
11.1.Block Diagram of Test Setup

11.1.1.Block diagram of connection between the EUT and peripherals

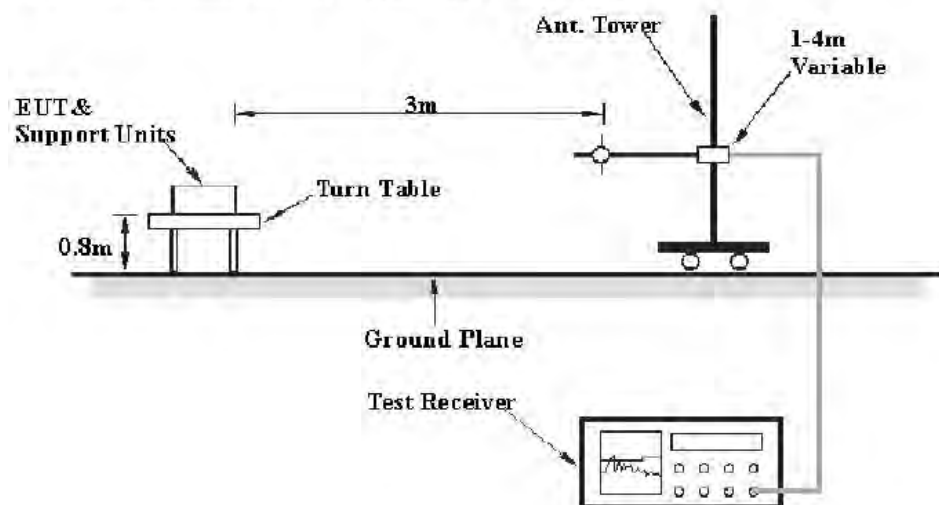


11.1.2.Semi-Anechoic Chamber Test Setup Diagram

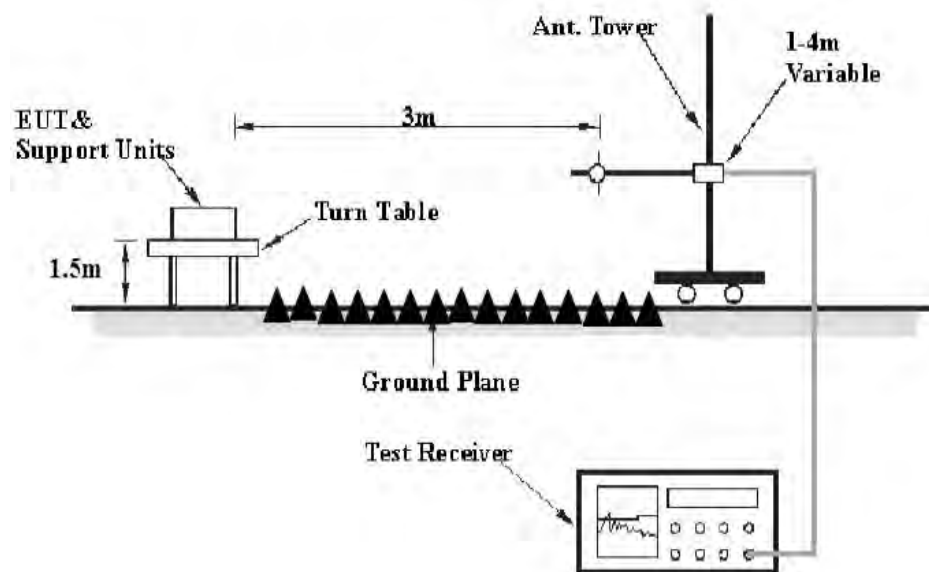
(A) Radiated Emission Test Set-Up, Frequency below 30MHz



(B) Radiated Emission Test Set-Up, Frequency 30MHz-1GHz



(C) Radiated Emission Test Set-Up, Frequency above 1GHz



11.2.The Limit For 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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).

11.3.Restricted bands of operation

11.3.1.FCC Part 15.205 Restricted bands of operation

(a) Except as shown in paragraph (d) of this section, Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(²)
13.36-13.41			

¹Until February 1, 1999, this restricted band shall be 0.490-0.510

²Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emission appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000MHz, Compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

11.4.Configuration of EUT on Measurement

The equipment is installed on Radiated Emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

11.5. Operating Condition of EUT

11.5.1. Setup the EUT and simulator as shown as Section 11.1.

11.5.2. Turn on the power of all equipment.

11.5.3. Let the EUT work in TX modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2441MHz, and 2480MHz TX frequency to transmit.

11.6. Test Procedure

The EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground (Below 1GHz). The EUT and its simulators are placed on a turntable, which is 1.5 meter high above ground (Above 1GHz). The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bi-log antenna) is used as receiving antenna. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the EUT location must be manipulated according to ANSI C63.10:2013 on radiated emission measurement. This EUT was tested in 3 orthogonal positions and the Worst case position data was reported.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

11.7.Data Sample

Frequency (MHz)	Reading (dB μ v)	Factor (dB/m)	Result (dB μ v/m)	Limit (dB μ v/m)	Margin (dB)	Remark
X.XX	28.66	-15.19	13.47	40.0	-26.53	QP

Frequency(MHz) = Emission frequency in MHz

Reading(dB μ v) = Uncorrected Analyzer/Receiver reading

Factor (dB/m) = Antenna factor + Cable Loss – Amplifier gain

Result(dB μ v/m) = Reading(dB μ v) + Factor(dB/m)

Limit (dB μ v/m) = Limit stated in standard

Margin (dB) = Result(dB μ v/m) - Limit (dB μ v/m)

QP = Quasi-peak Reading

Calculation Formula:

Margin(dB) = Result (dB μ V/m)–Limit(dB μ V/m)

Result(dB μ V/m)= Reading(dB μ V)+ Factor(dB/m)

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the limit.

11.8.The Field Strength of Radiation Emission Measurement Results

Pass.

Test Lab: 3m Anechoic chamber

Test Engineer: Star

Note: 1.We tested GFSK mode, $\Pi/4$ -DQPSK Mode & 8QPSK mode and recorded the Worse case data (GFSK mode) for all test mode.

2. Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 3th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The measurements greater than 20dB below the limit from 9kHz to 30MHz and 18 to 26.5GHz.

The spectrum analyzer plots are attached as below.

Below 1GHz



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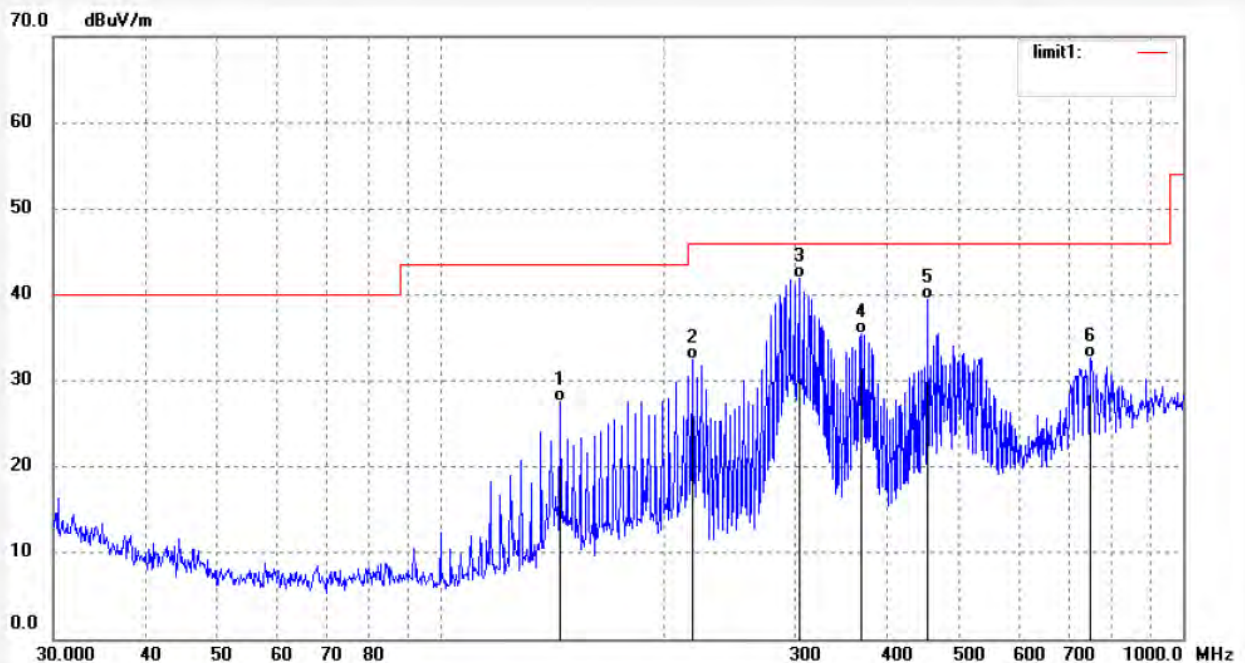
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 1# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: star2019 #35
Standard: FCC Part 15C 3M Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 25 C / 55 %
EUT: Wireless Stereo Headset
Mode: TX 2402MHz
Model: TCU007
Manufacturer: Marvo

Polarization: Horizontal
Power Source: DC 3.7V
Date: 19/04/16/
Time: 9/15/23
Engineer Signature: star
Distance: 3m

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	144.7898	55.56	-28.05	27.51	43.50	-15.99	QP	200	178	
2	218.4097	56.45	-24.03	32.42	46.00	-13.58	QP	200	269	
3	303.8851	63.07	-21.11	41.96	46.00	-4.04	QP	200	300	
4	368.6681	54.20	-18.80	35.40	46.00	-10.60	QP	200	247	
5	452.0013	56.74	-17.21	39.53	46.00	-6.47	QP	200	135	
6	749.6761	42.92	-10.34	32.58	46.00	-13.42	QP	200	175	



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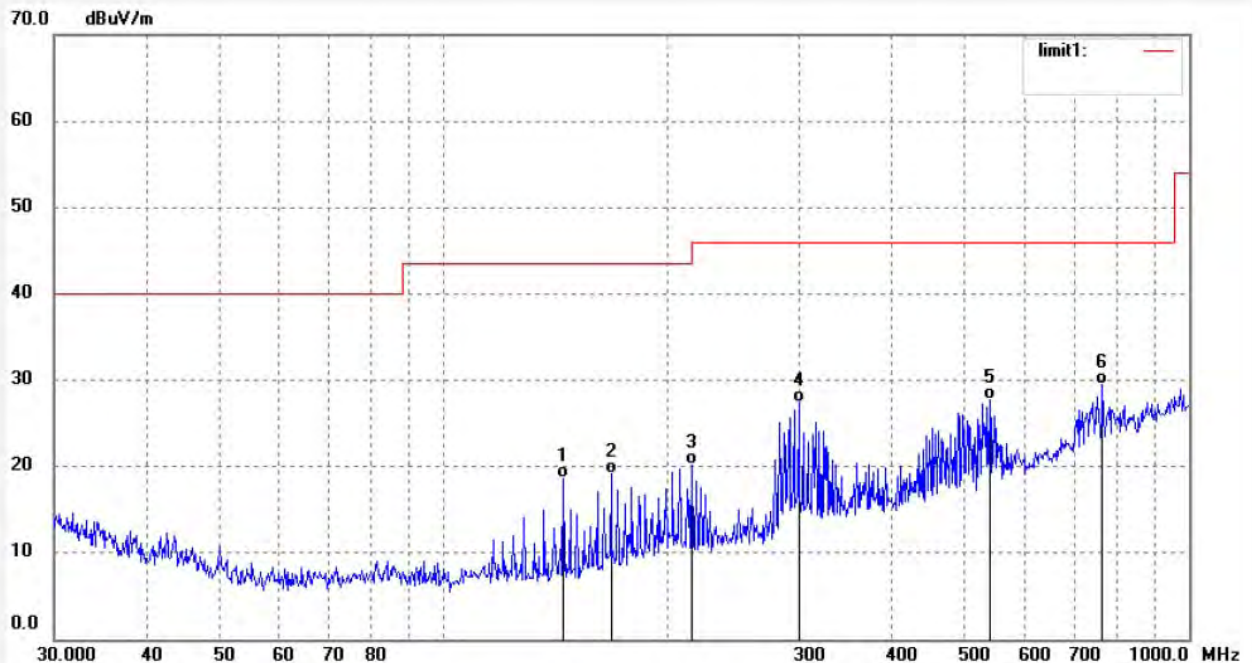
F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 1# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: star2019 #36
Standard: FCC Part 15C 3M Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 25 C / 55 %
EUT: Wireless Stereo Headset
Mode: TX 2402MHz
Model: TCU007
Manufacturer: Marvo

Polarization: Vertical
Power Source: DC 3.7V
Date: 19/04/16/
Time: 9/16/26
Engineer Signature: star
Distance: 3m

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	144.7898	46.66	-28.05	18.61	43.50	-24.89	QP	100	300	
2	167.8136	45.40	-26.23	19.17	43.50	-24.33	QP	100	245	
3	215.3616	44.23	-24.05	20.18	43.50	-23.32	QP	100	103	
4	299.6440	48.62	-21.23	27.39	46.00	-18.61	QP	100	42	
5	540.7070	42.87	-15.09	27.78	46.00	-18.22	QP	100	92	
6	765.6480	39.44	-9.89	29.55	46.00	-16.45	QP	100	144	



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Site: 1# Chamber

Tel:+86-0755-26503290

Fax:+86-0755-26503396

Job No.: star2019 #37

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: TX 2441MHz

Model: TCU007

Manufacturer: Marvo

Polarization: Horizontal

Power Source: DC 3.7V

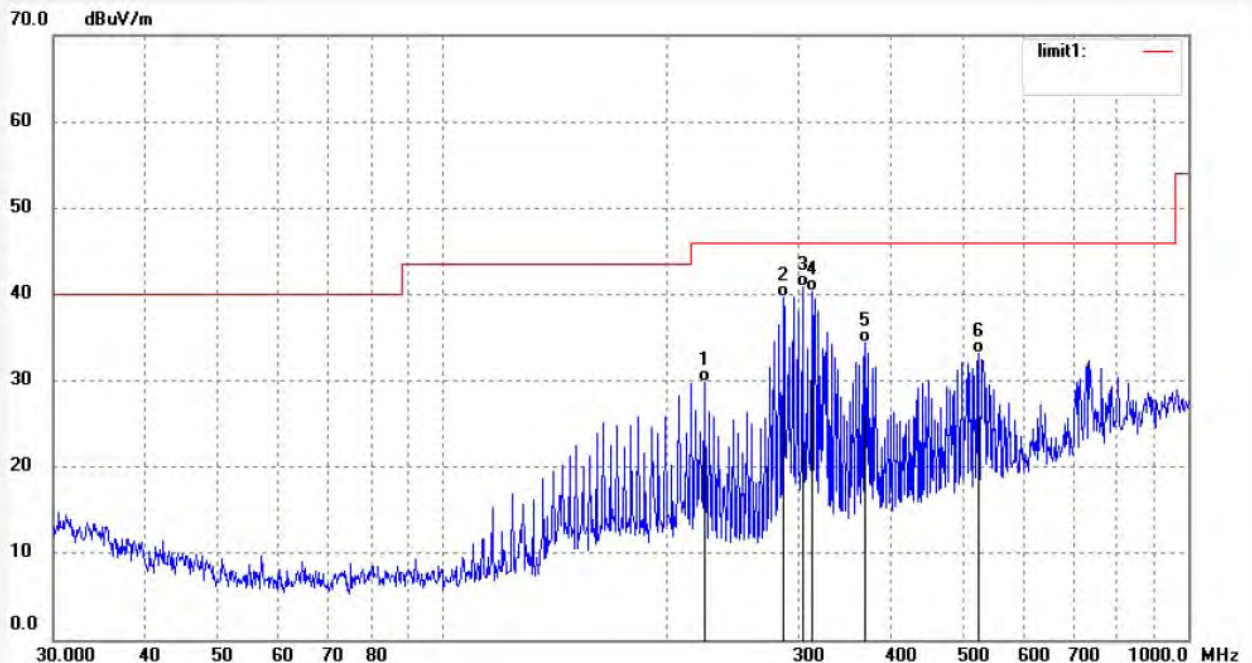
Date: 19/04/16/

Time: 9/14/08

Engineer Signature: star

Distance: 3m

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	224.6361	53.72	-23.94	29.78	46.00	-16.22	QP	200	321	
2	286.2653	61.39	-21.83	39.56	46.00	-6.44	QP	200	25	
3	303.8851	61.95	-21.11	40.84	46.00	-5.16	QP	200	214	
4	312.5482	61.19	-20.86	40.33	46.00	-5.67	QP	200	103	
5	368.6681	53.27	-18.80	34.47	46.00	-11.53	QP	200	254	
6	523.8763	48.74	-15.59	33.15	46.00	-12.85	QP	200	166	



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Site: 1# Chamber

Tel:+86-0755-26503290

Fax:+86-0755-26503396

Job No.: star2019 #38

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: TX 2441MHz

Model: TCU007

Manufacturer: Marvo

Polarization: Vertical

Power Source: DC 3.7V

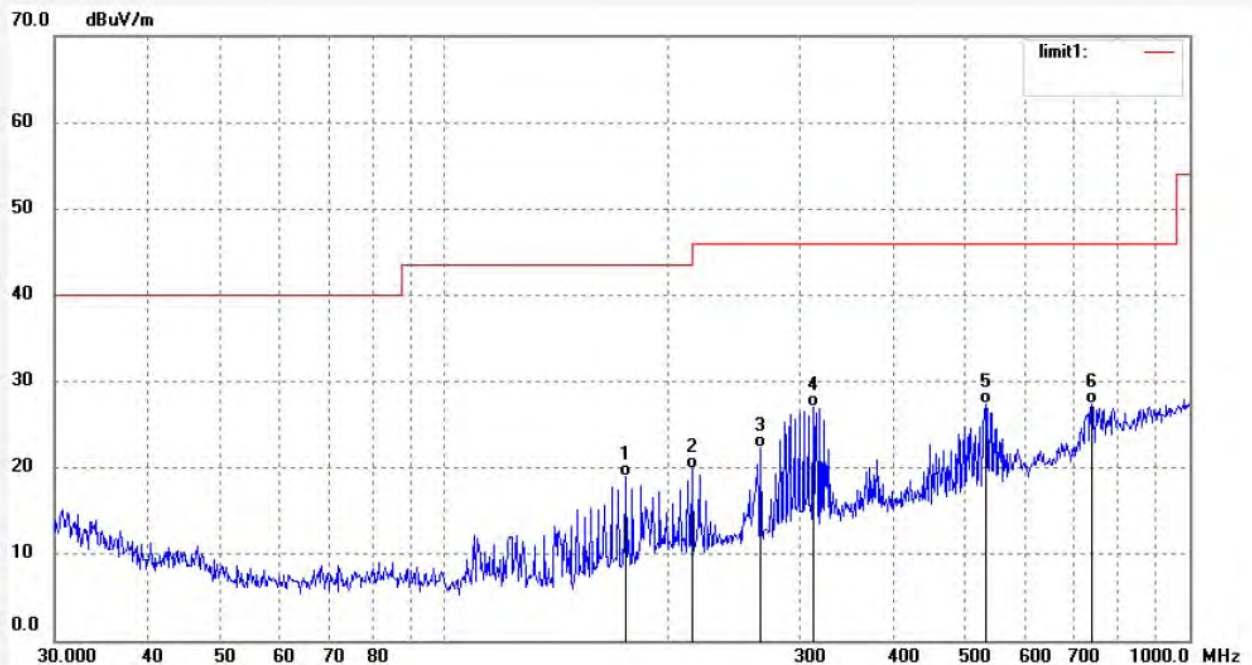
Date: 19/04/16/

Time: 9/17/23

Engineer Signature: star

Distance: 3m

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	175.0404	45.44	-26.51	18.93	43.50	-24.57	QP	100	39	
2	215.3616	44.00	-24.05	19.95	43.50	-23.55	QP	100	54	
3	265.9035	45.04	-22.71	22.33	46.00	-23.67	QP	100	102	
4	312.5482	47.93	-20.86	27.07	46.00	-18.93	QP	100	244	
5	533.1611	42.61	-15.29	27.32	46.00	-18.68	QP	100	66	
6	739.2136	37.89	-10.57	27.32	46.00	-18.68	QP	100	14	



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Job No.: star2019 #40

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: TX 2480MHz

Model: TCU007

Manufacturer: Marvo

Polarization: Horizontal

Power Source: DC 3.7V

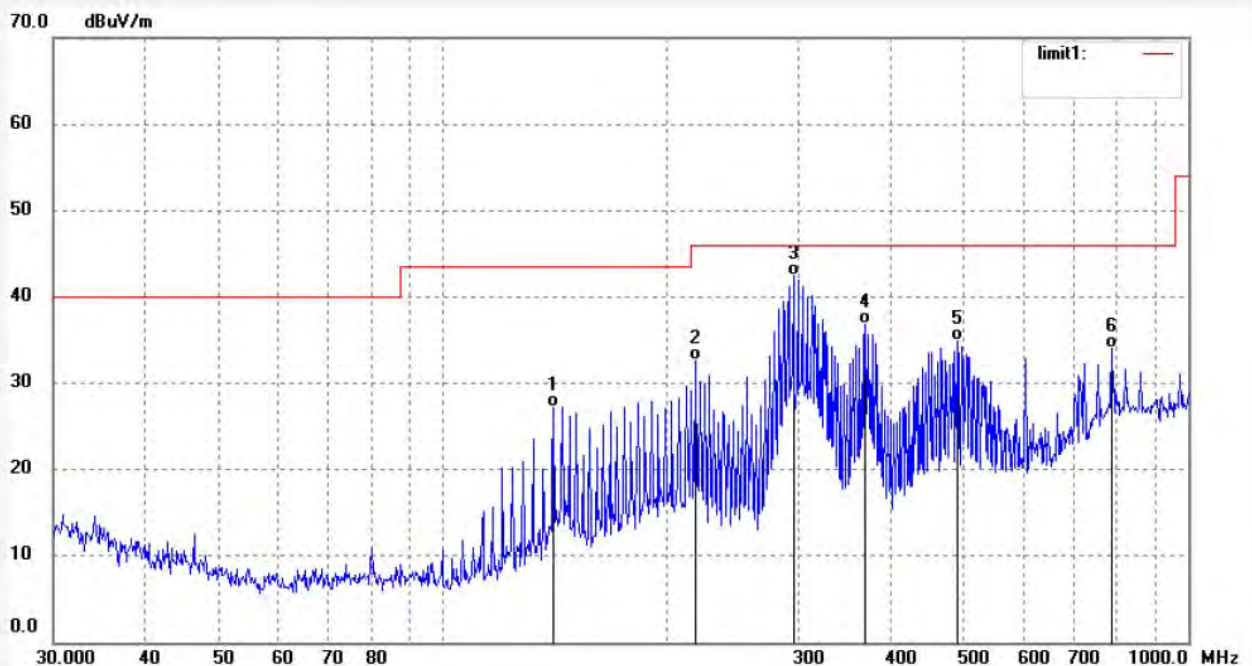
Date: 19/04/16/

Time: 9/19/59

Engineer Signature: star

Distance: 3m

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	140.7767	55.11	-27.96	27.15	43.50	-16.35	QP	200	145	
2	218.4097	56.72	-24.03	32.69	46.00	-13.31	QP	200	320	
3	295.4623	63.75	-21.39	42.36	46.00	-3.64	QP	200	144	
4	368.6681	55.58	-18.80	36.78	46.00	-9.22	QP	200	176	
5	490.0450	51.36	-16.46	34.90	46.00	-11.10	QP	200	52	
6	790.2465	43.29	-9.25	34.04	46.00	-11.96	QP	200	351	



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Job No.: star2019 #39

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: TX 2480MHz

Model: TCU007

Manufacturer: Marvo

Polarization: Vertical

Power Source: DC 3.7V

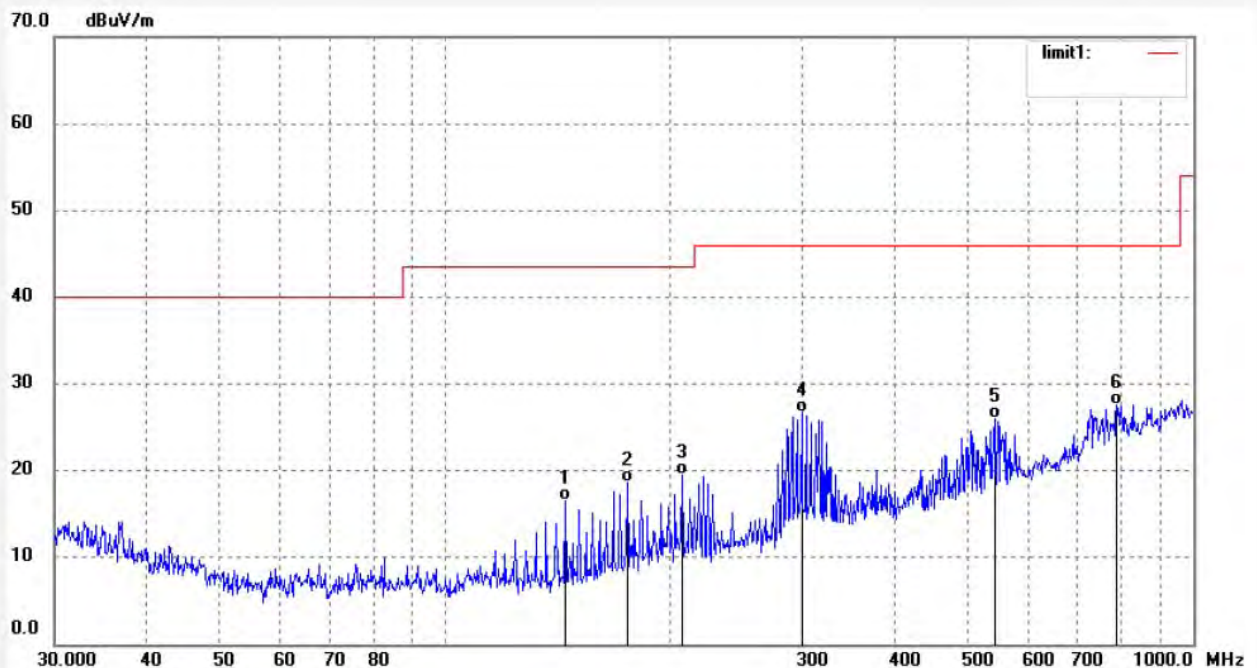
Date: 19/04/16/

Time: 9/18/23

Engineer Signature: star

Distance: 3m

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	144.7899	44.59	-28.05	16.54	43.50	-26.96	QP	100	136	
2	175.0404	45.23	-26.51	18.72	43.50	-24.78	QP	100	148	
3	207.1968	43.66	-24.14	19.52	43.50	-23.98	QP	100	211	
4	299.6441	47.87	-21.23	26.64	46.00	-19.36	QP	100	265	
5	544.5202	40.96	-14.97	25.99	46.00	-20.01	QP	100	345	
6	790.2466	36.78	-9.25	27.53	46.00	-18.47	QP	100	212	

Above 1GHz



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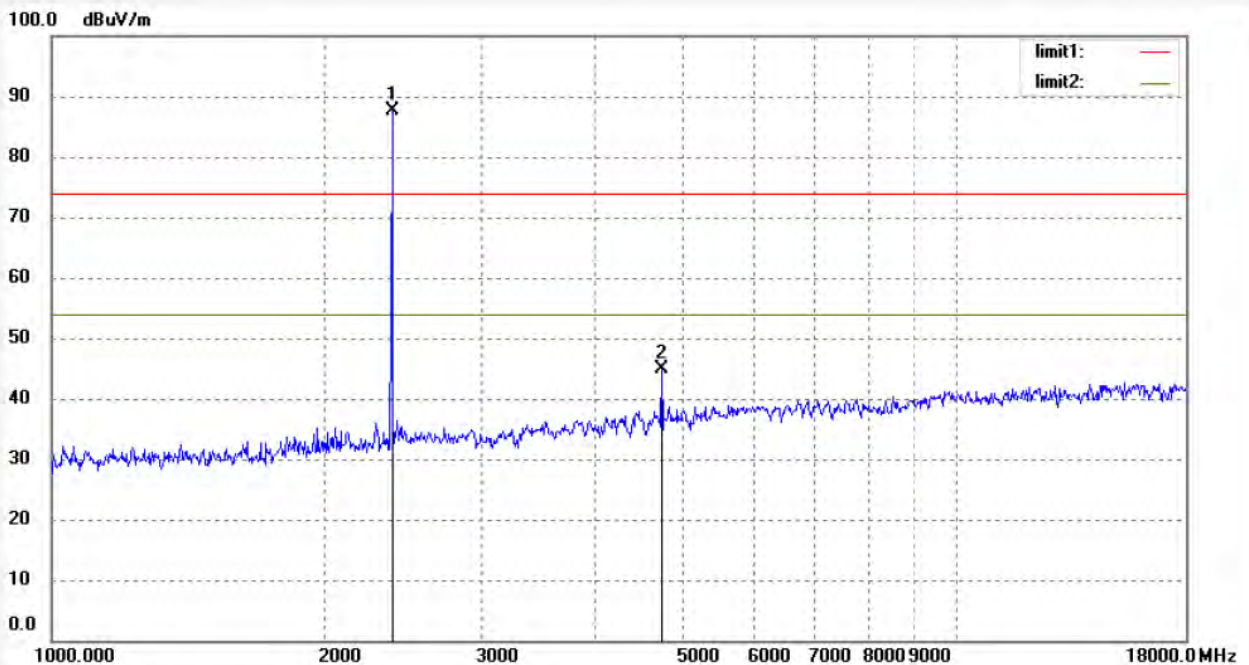
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Site: 1# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: star2018 #289
Standard: FCC Part 15C 3M Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 25 C / 55 %
EUT: Wireless Stereo Headset
Mode: TX 2402MHz
Model: TCU007
Manufacturer: Marvo

Polarization: Horizontal
Power Source: DC 3.7V
Date: 19/04/16/
Time: 9/23/55
Engineer Signature: star
Distance:

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2402.019	95.70	-8.03	87.67	/	/	peak			
2	4804.057	47.40	-2.53	44.87	74.00	-29.13	peak			



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Job No.: star2018 #288

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: TX 2402MHz

Model: TCU007

Manufacturer: Marvo

Polarization: Vertical

Power Source: DC 3.7V

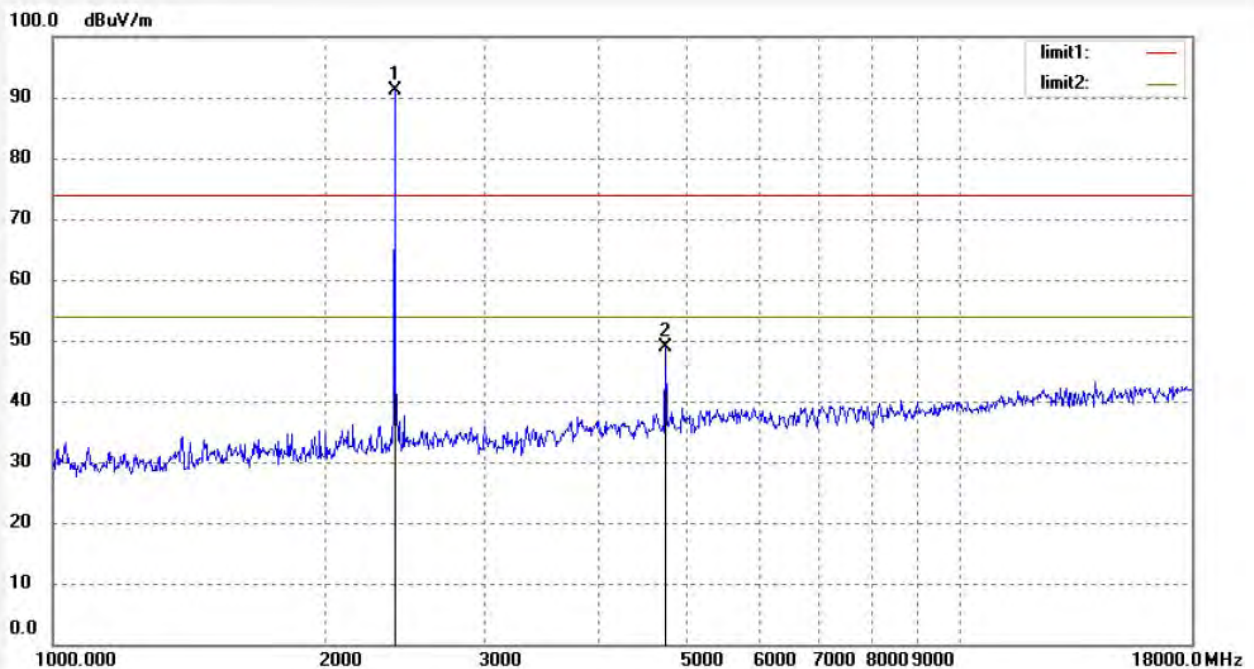
Date: 19/04/16/

Time: 9/21/56

Engineer Signature: star

Distance:

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2402.019	99.14	-8.03	91.11	/	/	peak			
2	4804.057	51.36	-2.53	48.83	74.00	-25.17	peak			



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Job No.: star2018 #290

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: TX 2441MHz

Model: TCU007

Manufacturer: Marvo

Polarization: Horizontal

Power Source: DC 3.7V

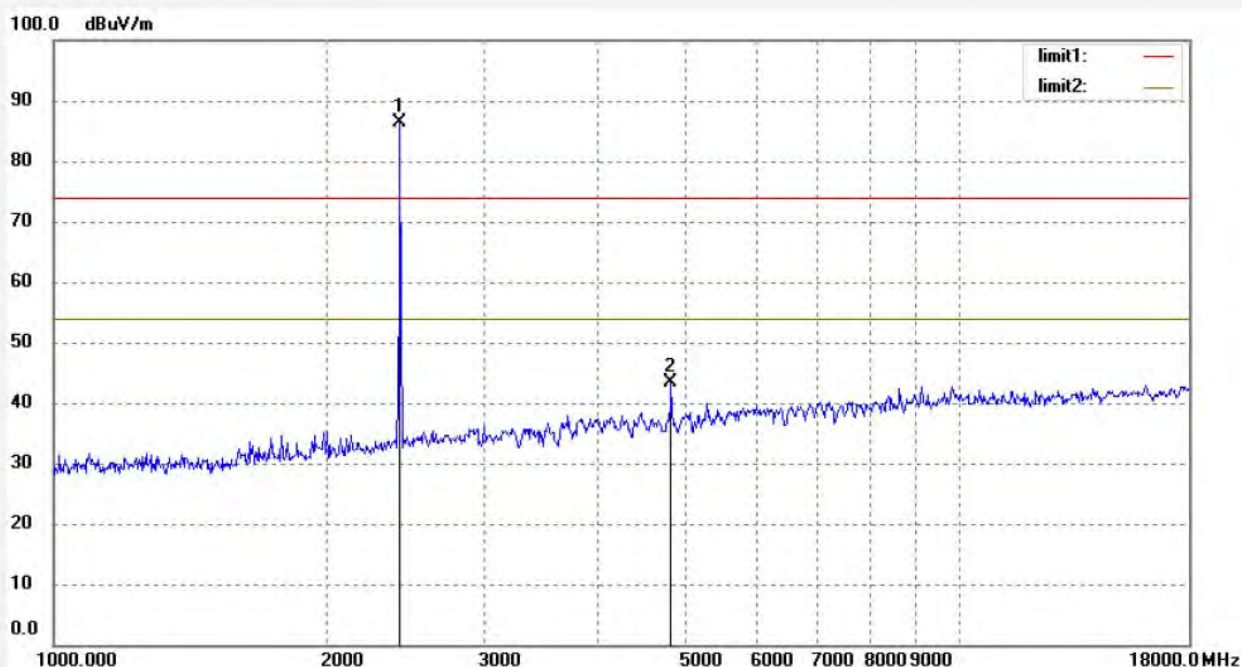
Date: 19/04/16/

Time: 9/25/59

Engineer Signature: star

Distance:

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2441.021	94.29	-7.93	86.36	/	/	peak			
2	4882.324	45.72	-2.25	43.47	74.00	-30.53	peak			



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Job No.: star2018 #291

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: TX 2441MHz

Model: TCU007

Manufacturer: Marvo

Polarization: Vertical

Power Source: DC 3.7V

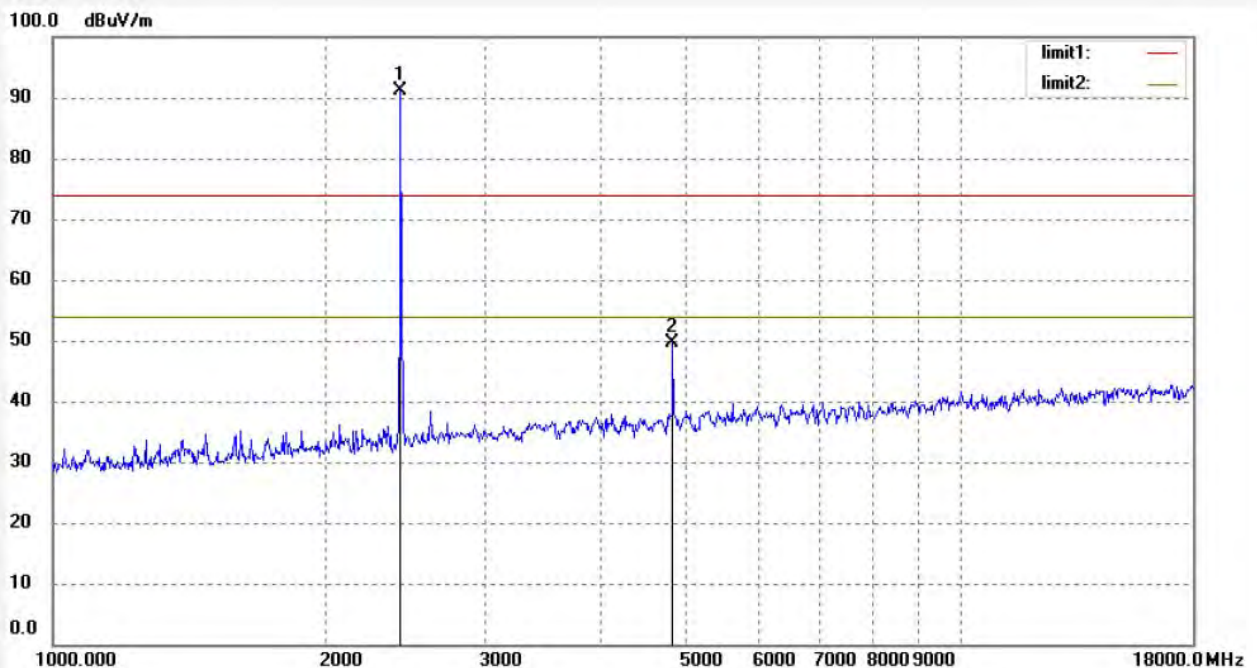
Date: 19/04/16/

Time: 9/28/10

Engineer Signature: star

Distance:

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2441.021	99.02	-7.93	91.09	/	/	peak			
2	4882.324	51.90	-2.25	49.65	74.00	-24.35	peak			



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Job No.: star2018 #293

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: TX 2480MHz

Model: TCU007

Manufacturer: Marvo

Polarization: Horizontal

Power Source: DC 3.7V

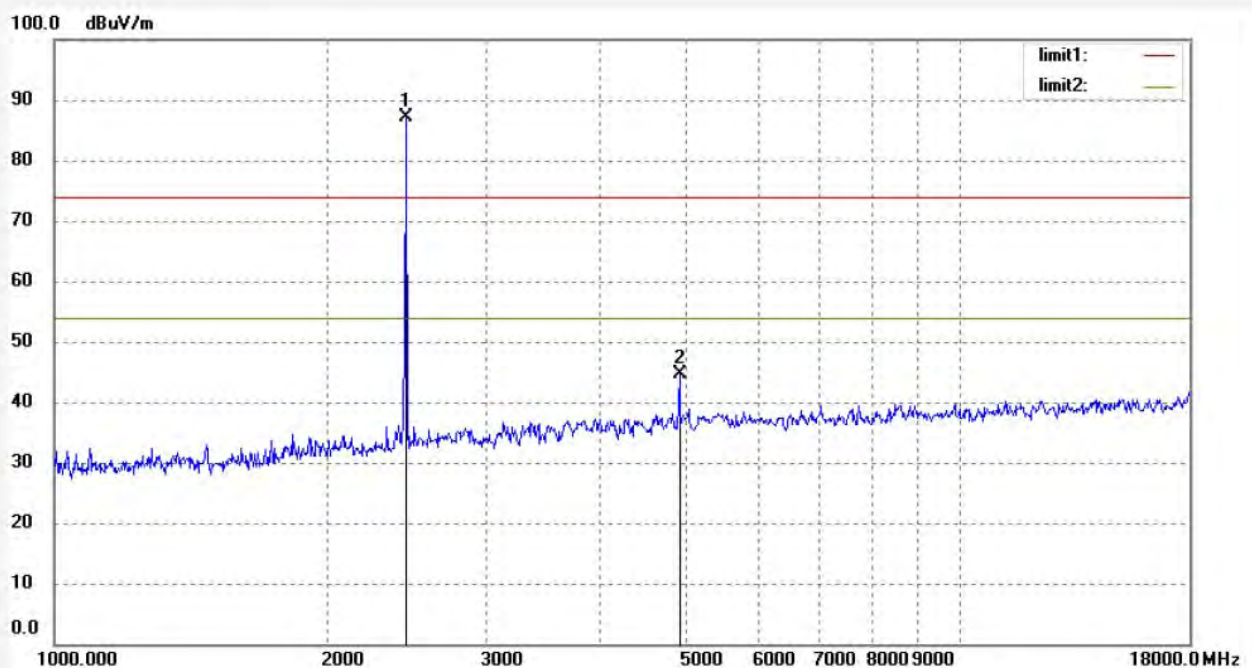
Date: 19/04/16/

Time: 9/32/40

Engineer Signature: star

Distance:

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2480.034	95.03	-7.84	87.19	/	/	peak			
2	4960.044	46.46	-1.92	44.54	74.00	-29.46	peak			



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Job No.: star2018 #292

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: TX 2480MHz

Model: TCU007

Manufacturer: Marvo

Polarization: Vertical

Power Source: DC 3.7V

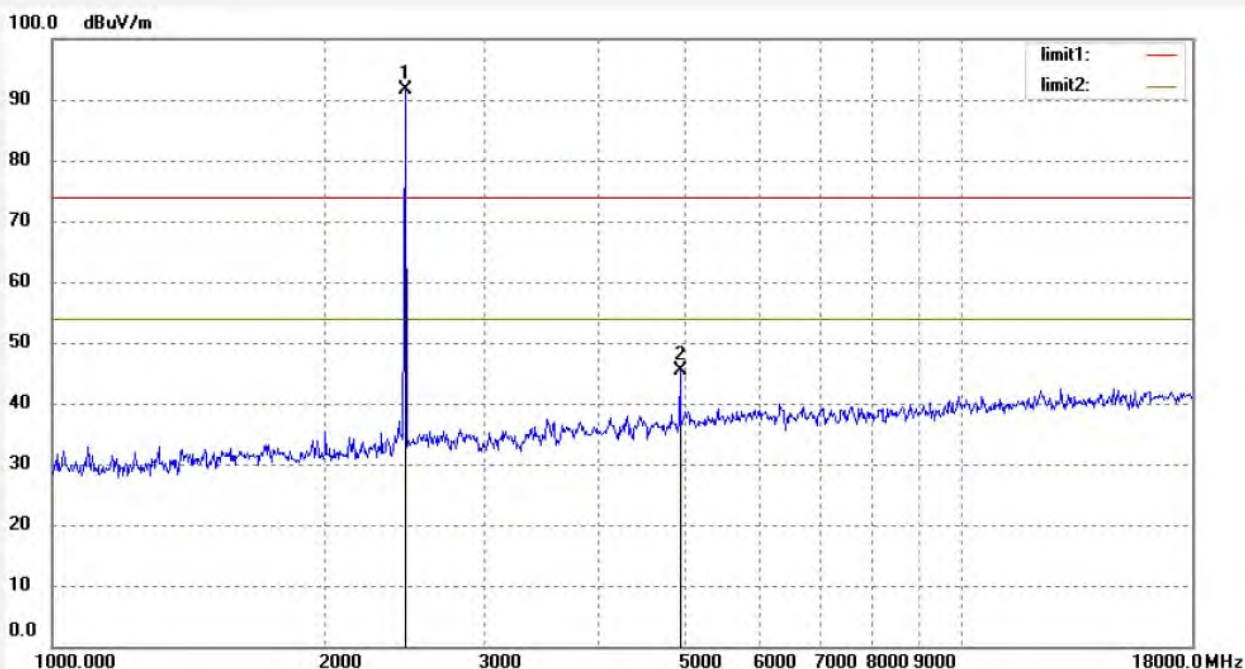
Date: 19/04/16/

Time: 9/30/32

Engineer Signature: star

Distance:

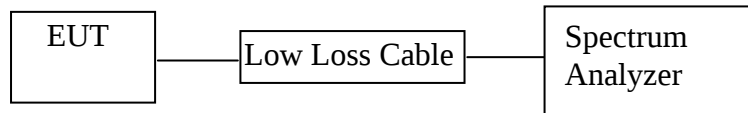
Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2480.034	99.52	-7.84	91.68	/	/	peak			
2	4960.044	47.28	-1.92	45.36	74.00	-28.64	peak			

12.BAND EDGE COMPLIANCE TEST

12.1.Block Diagram of Test Setup



12.2.The Requirement For 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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).

12.3.EUT Configuration on Measurement

The equipment are installed on the emission Measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

12.4.Operating Condition of EUT

12.4.1.Setup the EUT and simulator as shown as Section 12.1.

12.4.2.Turn on the power of all equipment.

12.4.3.Let the EUT work in TX (Hopping off, Hopping on) modes measure it. The transmit frequency are 2402-2480MHz. We select 2402MHz, 2480MHz TX frequency to transmit.

12.5. Test Procedure

12.5.1. The transmitter output was connected to the spectrum analyzer via a low loss cable.

12.5.2. Set RBW of spectrum analyzer to 100 kHz and VBW to 300 kHz with convenient frequency span including 100 kHz bandwidth from band edge.

12.5.3. The band edges was measured and recorded.

12.6. Test Result

Test Lab: Shielding room

Test Engineer: Star

Note: Both hopping-on mode and hopping-off mode had been pre-tested, and only the Worse case was recorded in the test report.

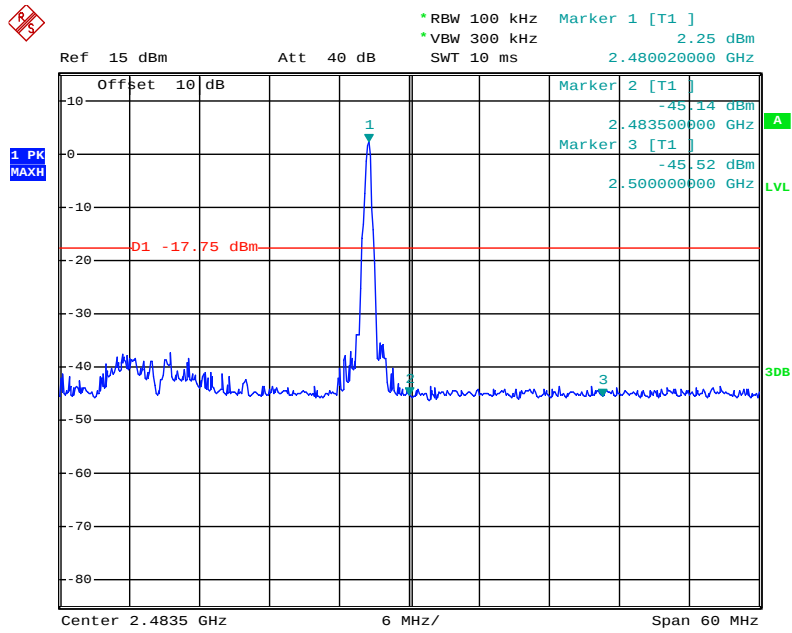
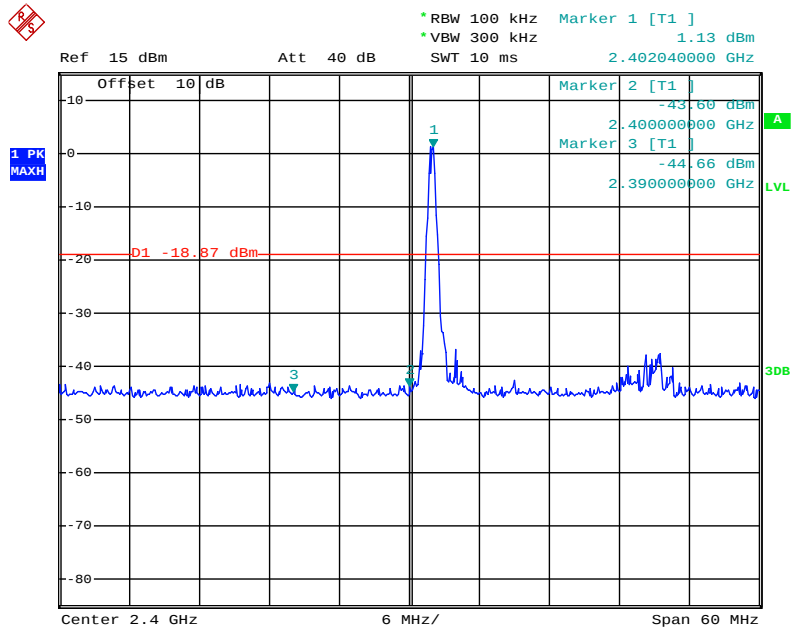
Conducted Band Edge Result

Non-hopping mode

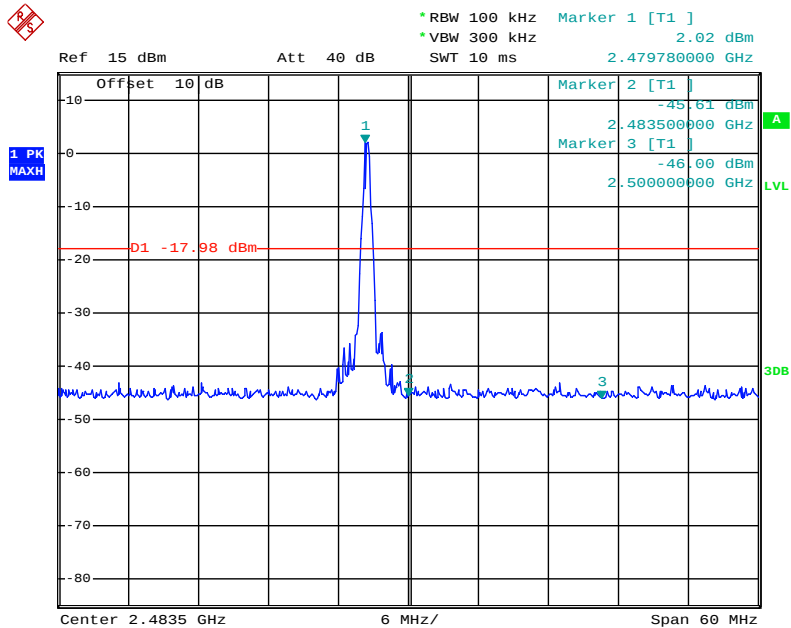
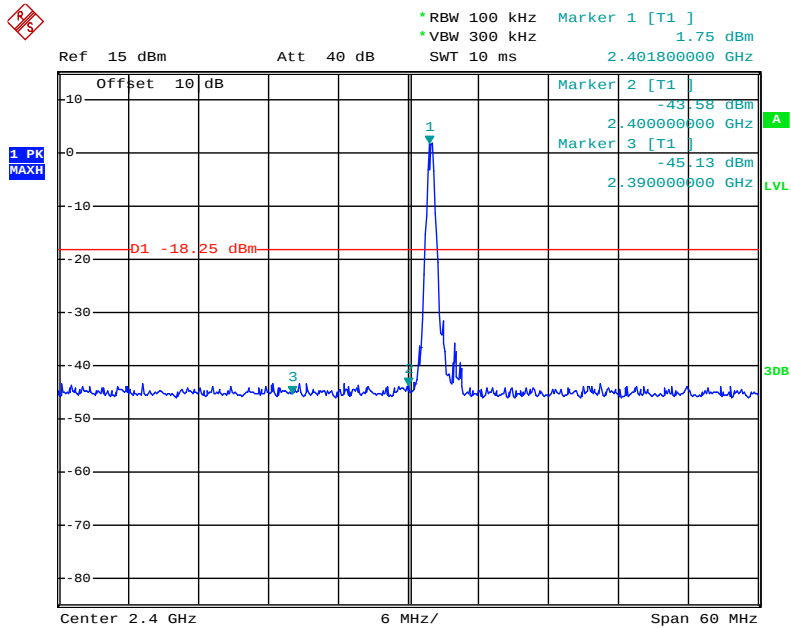
Frequency (MHz)	Result of Band Edge (dBc)	Limit of Band Edge (dBc)	Result
GFSK Mode			
2400.00	44.73	> 20dBc	Pass
2483.50	47.39	> 20dBc	Pass
Π/4-DQPSK Mode			
2400.00	45.33	> 20dBc	Pass
2483.50	47.63	> 20dBc	Pass
8DPSK Mode			
2400.00	44.82	> 20dBc	Pass
2483.50	45.31	> 20dBc	Pass

The spectrum analyzer plots are attached as below.

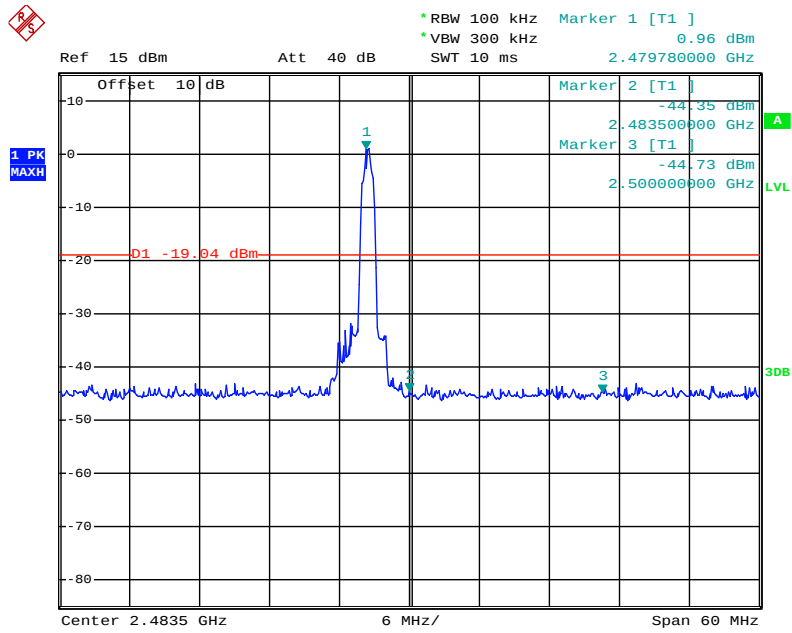
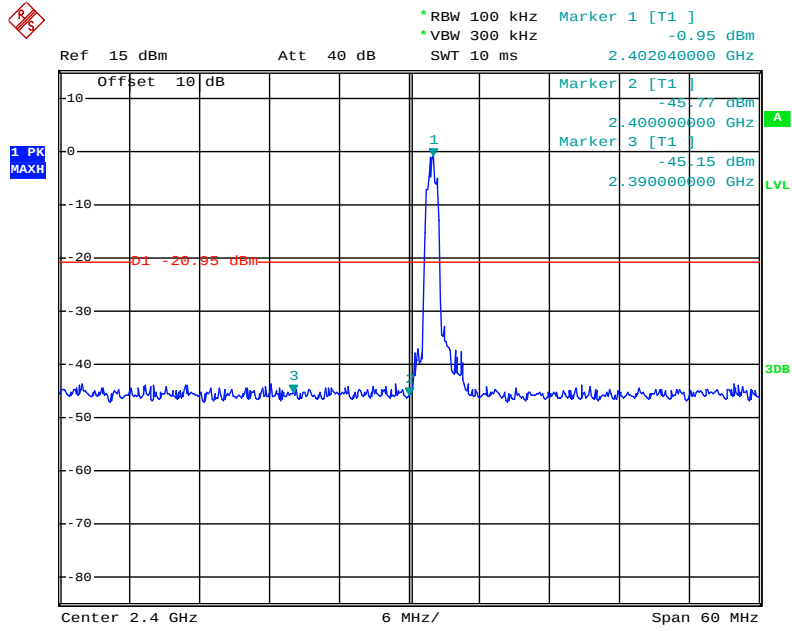
GFSK Mode



Π/4-DQPSK Mode



8DPSK Mode



Radiated Band Edge Result

Note:

1. Emissions attenuated more than 20 dB below the permissible value are not reported.
2. The field strength is calculated by adding the antenna factor, high pass filter loss(if used) and cable loss, and subtracting the amplifier gain(if any)from the measured reading. The basic equation calculation is as follows:

Result = Reading + Corrected Factor

3. Display the measurement of peak values.

Test Procedure:

The EUT and its simulators are placed on a turntable, which is 1.5 meter high above ground(Above 1GHz). The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bi-log antenna) is used as receiving antenna. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the EUT location must be manipulated according to ANSI C63.10:2013 on radiated emission measurement. The EUT was tested in 3 orthogonal planes.

Let the EUT work in TX (Hopping off, Hopping on) modes measure it.
We select 2402MHz, 2480MHz TX frequency to transmit(Hopping off mode).
We select 2402-2480MHz TX frequency to transmit(Hopping on mode).

During the radiated emission test, the spectrum analyzer was set with the following configurations:

- 1.The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz.
- 2.The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.
- 3.All modes of operation were investigated and the Worse case (GFSK Mode) emissions are reported.

Test Lab: 3m Anechoic chamber

Test Engineer: Star

The spectrum analyzer plots are attached as below.



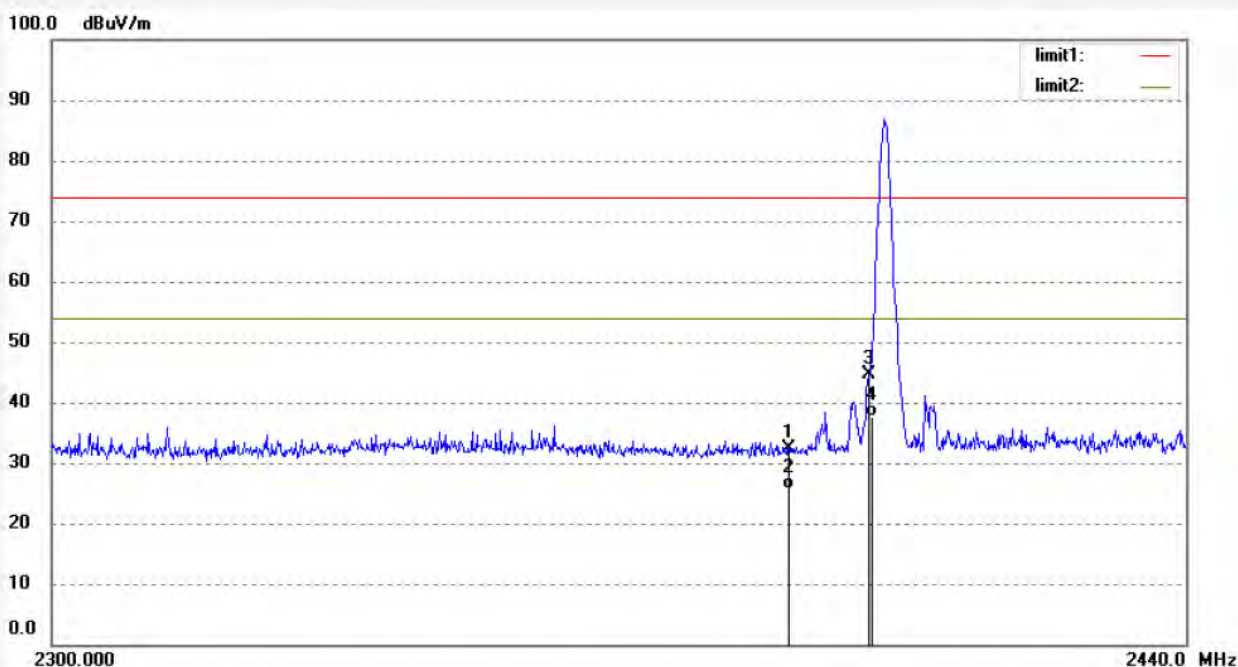
Non-hopping mode
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Site: 1# Chamber
 Tel:+86-0755-26503290
 Fax:+86-0755-26503396

Job No.: star2018 #297
 Standard: FCC Part 15C 3M Radiated
 Test item: Radiation Test
 Temp.(C)/Hum.(%) 25 C / 55 %
 EUT: Wireless Stereo Headset
 Mode: TX 2402MHz
 Model: TCU007
 Manufacturer: Marvo

Polarization: Horizontal
 Power Source: DC 3.7V
 Date: 19/04/16/
 Time: 9/43/34
 Engineer Signature: star
 Distance:

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2390.000	40.50	-8.00	32.50	74.00	-41.50	peak			
2	2390.000	33.57	-8.00	25.57	54.00	-28.43	AVG			
3	2400.000	52.56	-7.97	44.59	74.00	-29.41	peak			
4	2400.000	45.61	-7.97	37.64	54.00	-16.36	AVG			

Note: Average measurement with peak detection at No.2&4



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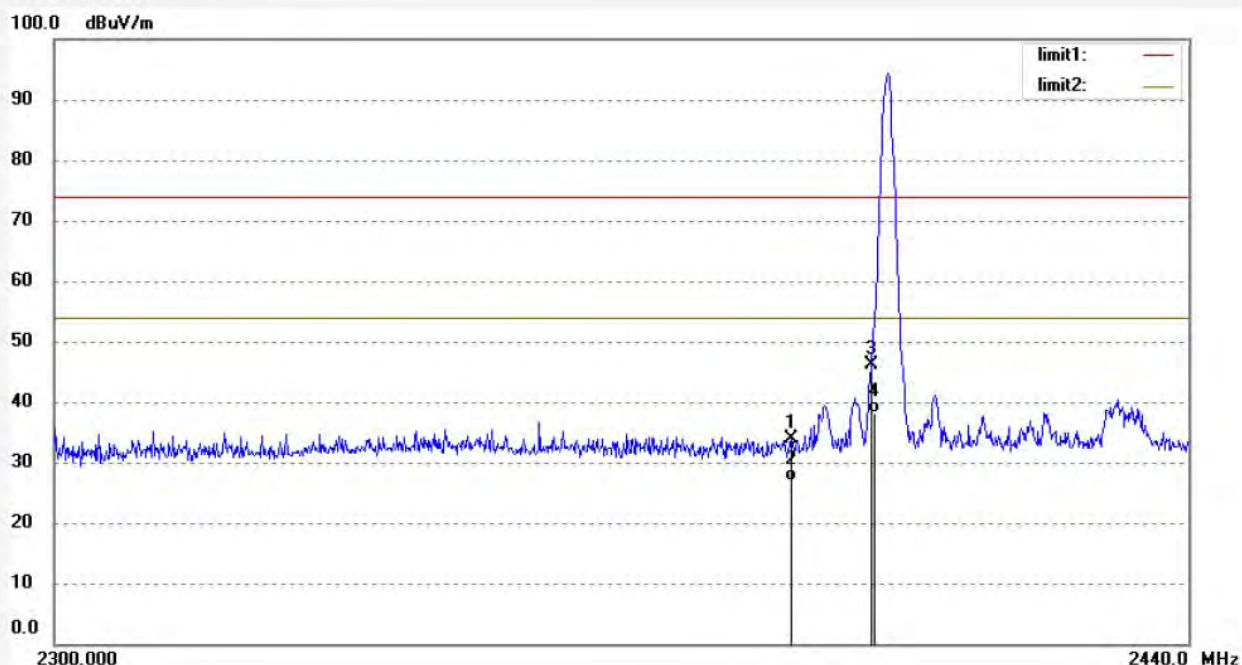
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Site: 1# Chamber
Tel:+86-0755-26503290
Fax:+86-0755-26503396

Job No.: star2018 #296
Standard: FCC Part 15C 3M Radiated
Test item: Radiation Test
Temp.(C)/Hum.(%) 25 C / 55 %
EUT: Wireless Stereo Headset
Mode: TX 2402MHz
Model: TCU007
Manufacturer: Marvo

Polarization: Vertical
Power Source: DC 3.7V
Date: 19/04/16/
Time: 9/41/56
Engineer Signature: star
Distance:

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2390.000	41.86	-8.00	33.86	74.00	-40.14	peak			
2	2390.000	34.90	-8.00	26.90	54.00	-27.10	AVG			
3	2400.000	54.19	-7.97	46.22	74.00	-27.78	peak			
4	2400.000	46.21	-7.97	38.24	54.00	-15.76	AVG			

Note: Average measurement with peak detection at No.2&4



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Job No.: star2018 #294

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: TX 2480MHz

Model: TCU007

Manufacturer: Marvo

Polarization: Horizontal

Power Source: DC 3.7V

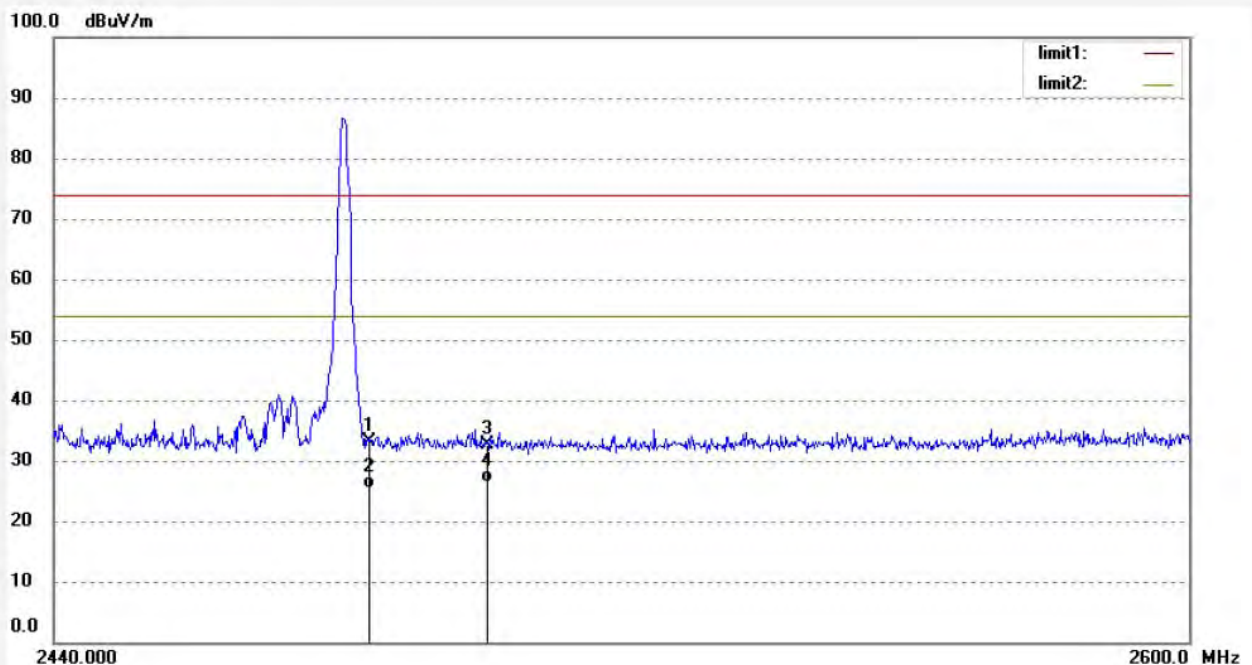
Date: 19/04/16/

Time: 9/36/39

Engineer Signature: star

Distance:

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2483.500	40.87	-7.76	33.11	74.00	-40.89	peak			
2	2483.500	33.24	-7.76	25.48	54.00	-28.52	AVG			
3	2500.000	40.36	-7.71	32.65	74.00	-41.35	peak			
4	2500.000	34.01	-7.71	26.30	54.00	-27.70	AVG			

Note: Average measurement with peak detection at No.2&4



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Site: 1# Chamber

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Job No.: star2018 #295

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: TX 2480MHz

Model: TCU007

Manufacturer: Marvo

Polarization: Vertical

Power Source: DC 3.7V

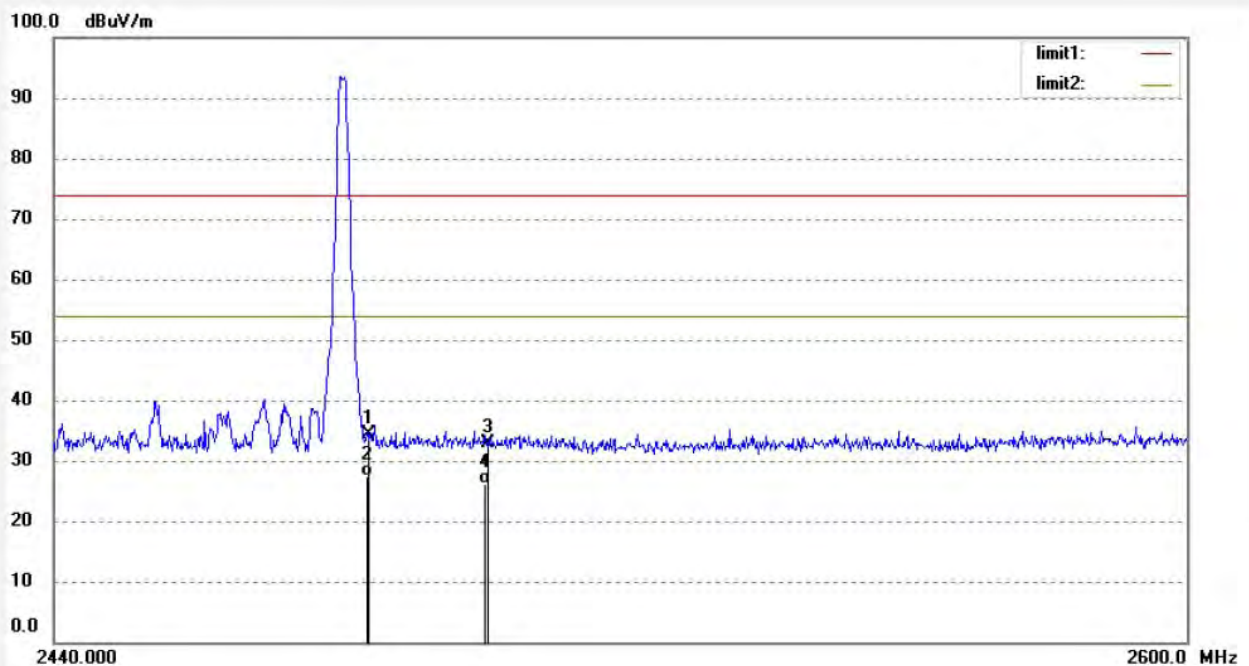
Date: 19/04/16/

Time: 9/37/47

Engineer Signature: star

Distance:

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2483.500	42.12	-7.76	34.36	74.00	-39.64	peak			
2	2483.500	35.10	-7.76	27.34	54.00	-26.66	AVG			
3	2500.000	40.58	-7.71	32.87	74.00	-41.13	peak			
4	2500.000	33.94	-7.71	26.23	54.00	-27.77	AVG			

Note: Average measurement with peak detection at No.2&4



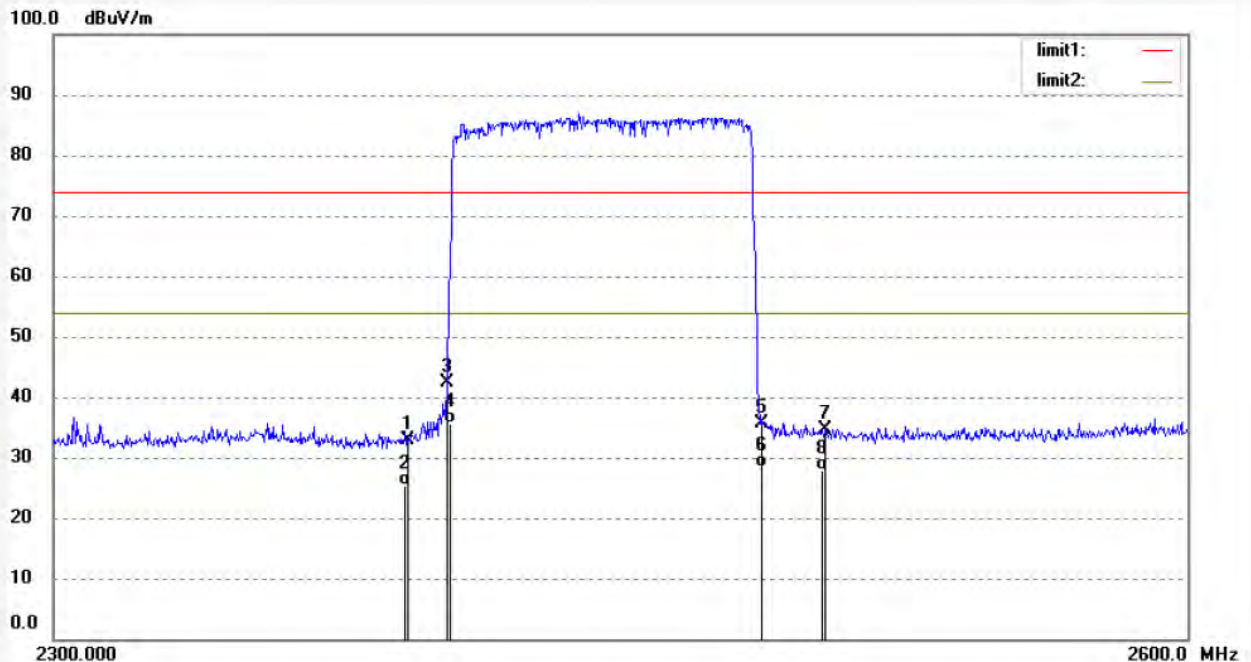
Hopping mode
ACCURATE TECHNOLOGY CO., LTD.
 F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
 Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 1# Chamber
 Tel:+86-0755-26503290
 Fax:+86-0755-26503396

Job No.: star2018 #298
 Standard: FCC Part 15C 3M Radiated
 Test item: Radiation Test
 Temp.(C)/Hum.(%) 25 C / 55 %
 EUT: Wireless Stereo Headset
 Mode: Hopping
 Model: TCU007
 Manufacturer: Marvo

Polarization: Horizontal
 Power Source: DC 3.7V
 Date: 19/04/16/
 Time: 9/50/14
 Engineer Signature: star
 Distance:

Note: Report No.:ATE20190447



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2390.000	40.77	-8.00	32.77	74.00	-41.23	peak			
2	2390.000	33.41	-8.00	25.41	54.00	-28.59	AVG			
3	2400.000	50.23	-7.97	42.26	74.00	-31.74	peak			
4	2400.000	43.55	-7.97	35.58	54.00	-18.42	AVG			
5	2483.500	43.50	-7.76	35.74	74.00	-38.26	peak			
6	2483.500	36.08	-7.76	28.32	54.00	-25.68	AVG			
7	2500.000	42.26	-7.71	34.55	74.00	-39.45	peak			
8	2500.000	35.47	-7.71	27.76	54.00	-26.24	AVG			

Note: Average measurement with peak detection at No.2&4&6&8



ACCURATE TECHNOLOGY CO., LTD.

F1,Bldg,A,Changyuan New Material Port Keyuan Rd,
Science & Industry Park,Nanshan Shenzhen,P.R.China

Site: 1# Chamber

Tel:+86-0755-26503290

Fax:+86-0755-26503396

Job No.: star2018 #299

Standard: FCC Part 15C 3M Radiated

Test item: Radiation Test

Temp.(C)/Hum.(%) 25 C / 55 %

EUT: Wireless Stereo Headset

Mode: Hopping

Model: TCU007

Manufacturer: Marvo

Polarization: Vertical

Power Source: DC 3.7V

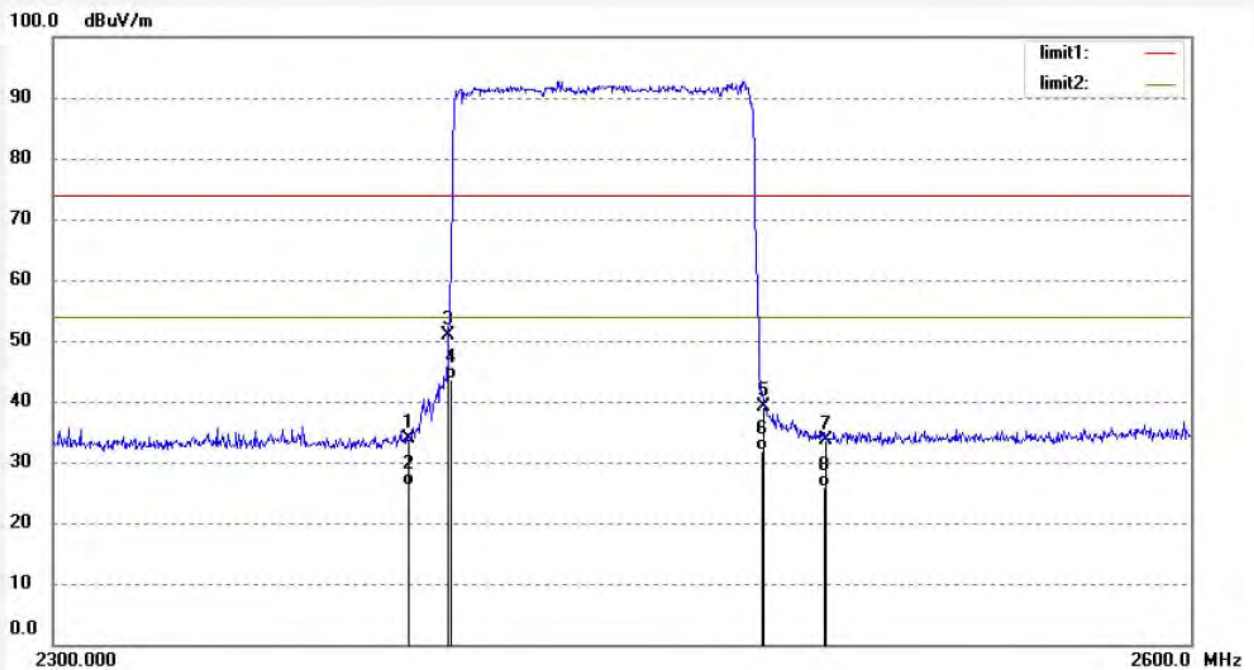
Date: 19/04/16/

Time: 10/00/31

Engineer Signature: star

Distance:

Note: Report No.:ATE20190447



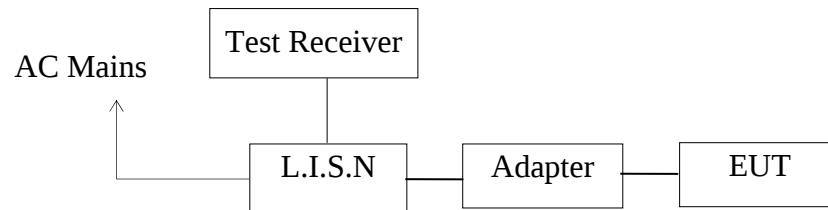
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Degree (deg.)	Remark
1	2390.000	41.98	-8.00	33.98	74.00	-40.02	peak			
2	2390.000	34.25	-8.00	26.25	54.00	-27.75	AVG			
3	2400.000	58.78	-7.97	50.81	74.00	-23.19	peak			
4	2400.000	51.71	-7.97	43.74	54.00	-10.26	AVG			
5	2483.500	46.96	-7.76	39.20	74.00	-34.80	peak			
6	2483.500	39.62	-7.76	31.86	54.00	-22.14	AVG			
7	2500.000	41.22	-7.71	33.51	74.00	-40.49	peak			
8	2500.000	33.58	-7.71	25.87	54.00	-28.13	AVG			

Note: Average measurement with peak detection at No.2&4&6&8

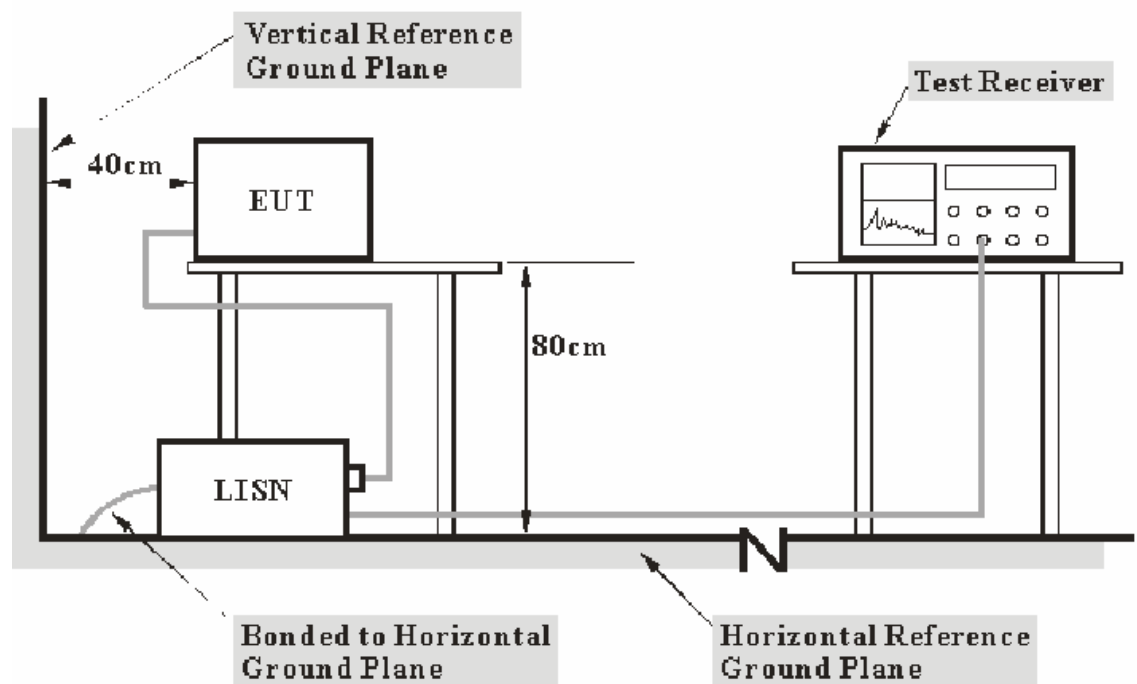
13.AC POWER LINE CONDUCTED EMISSION TEST

13.1.Block Diagram of Test Setup

13.1.1.Block diagram of connection between the EUT and simulators



13.1.2.Test System Setup



- Note:**
1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

13.2.Power Line Conducted Emission Test Limits

Frequency (MHz)	Limit dB(μ V)	
	Quasi-peak Level	Average Level
0.15 - 0.50	66.0 – 56.0 *	56.0 – 46.0 *
0.50 - 5.00	56.0	46.0
5.00 - 30.00	60.0	50.0
NOTE1: The lower limit shall apply at the transition frequencies.		
NOTE2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.50MHz.		

13.3.Configuration of EUT on Measurement

The equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner, which tends to maximize its emission characteristics in a normal application.

13.4.Operating Condition of EUT

13.4.1.Setup the EUT and simulator as shown as Section 13.1.

13.4.2.Turn on the power of all equipment.

13.4.3.Let the EUT work in test mode and measure it.

13.5.Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC lines are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI C63.10: 2013 on Conducted Emission Measurement. The bandwidth of test receiver (R & S ESCS30) is set at 9kHz.

The frequency range from 150kHz to 30MHz is checked.

13.6.Data Sample

Frequency (MHz)	Transducer value (dB)	QuasiPeak Level (dBμV)	Average Level (dBμV)	QuasiPeak Limit (dBμV)	Average Limit (dBμV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
X.XX	10.6	25.3	17.0	59.0	49.0	33.4	31.7	Pass

Frequency(MHz) = Emission frequency in MHz

Transducer value(dB) = Insertion loss of LISN + Cable Loss

Level(dBμV) = Quasi-peak Reading/Average Reading + Transducer value

Limit (dBμV) = Limit stated in standard

Margin = Limit (dBμV) - Level (dBμV)

Calculation Formula:

Margin = Limit (dBμV) - Level (dBμV)

13.7.Test Results

Pass.

The frequency range from 150kHz to 30MHz is checked.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.
Emissions attenuated more than 20 dB below the permissible value are not reported.

All data was recorded in the Quasi-peak and average detection mode.

The spectral diagrams are attached as below.

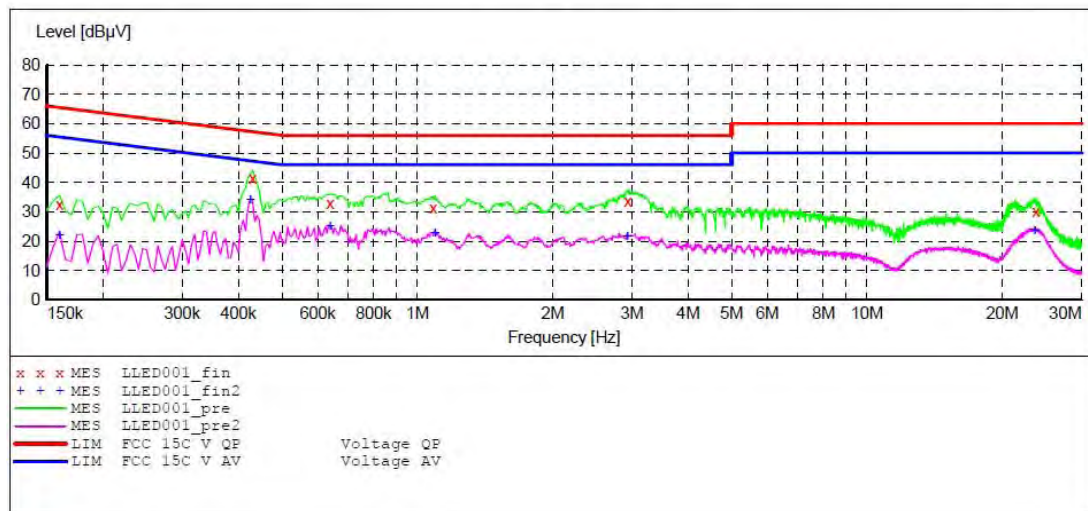
ACCURATE TECHNOLOGY CO.,LTD

CONDUCTED EMISSION STANDARD FCC PART 15 C

EUT: Wireless Stereo Headset M/N:TCU007
 Manufacturer:
 Operating Condition: BT communication
 Test Site: 1#Shielding Room
 Operator: Star
 Test Specification: L 120V/60Hz
 Comment: Report No.:ATE20190447
 Start of Test: 04/08/2019 / 3:14:29PM

SCAN TABLE: "V 9K-30MHz fin"

Short Description: _SUB_STD_VTERM2 1.70
 Start Stop Step Detector Meas. IF Transducer
 Frequency Frequency Width Time Bandw.
 9.0 kHz 150.0 kHz 100.0 Hz QuasiPeak 1.0 s 200 Hz NSLK8126 2008
 Average
 150.0 kHz 30.0 MHz 5.0 kHz QuasiPeak 1.0 s 9 kHz NSLK8126 2008
 Average



MEASUREMENT RESULT: "LLED001_fin"

04/08/2019 3:18PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.160000	32.30	10.5	66	33.2	QP	L1	GND
0.430000	41.50	10.7	57	15.8	QP	L1	GND
0.640000	33.00	10.8	56	23.0	QP	L1	GND
1.085000	31.20	10.9	56	24.8	QP	L1	GND
2.940000	33.50	11.1	56	22.5	QP	L1	GND
23.755000	30.00	11.5	60	30.0	QP	L1	GND

MEASUREMENT RESULT: "LLED001_fin2"

04/08/2019 3:18PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.160000	21.90	10.5	56	33.6	AV	L1	GND
0.425000	33.80	10.7	47	13.5	AV	L1	GND
0.640000	24.90	10.8	46	21.1	AV	L1	GND
1.095000	22.70	10.9	46	23.3	AV	L1	GND
2.930000	21.40	11.1	46	24.6	AV	L1	GND
23.635000	23.50	11.5	50	26.5	AV	L1	GND

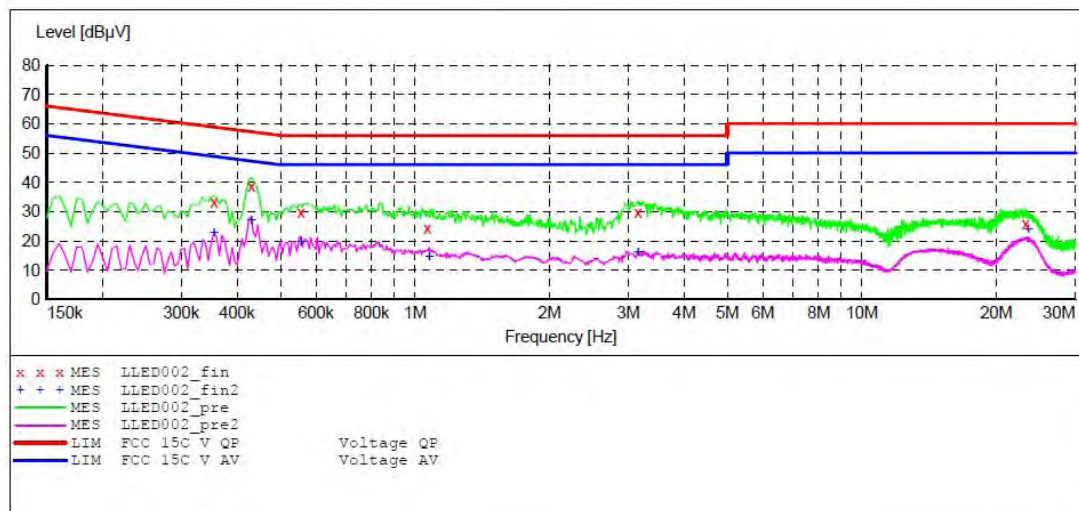
ACCURATE TECHNOLOGY CO.,LTD

CONDUCTED EMISSION STANDARD FCC PART 15 C

EUT: Wireless Stereo Headset M/N:TCU007
 Manufacturer:
 Operating Condition: BT communication
 Test Site: 1#Shielding Room
 Operator: Star
 Test Specification: N 120V/60Hz
 Comment: Report No.:ATE20190447
 Start of Test: 04/08/2019 / 3:18:47PM

SCAN TABLE: "V 9K-30MHz fin"

Short Description: _SUB_STD_VTERM2 1.70
 Start Stop Step Detector Meas. IF Transducer
 Frequency Frequency Width Time Bandw.
 9.0 kHz 150.0 kHz 100.0 Hz QuasiPeak 1.0 s 200 Hz NSLK8126 2008
 Average
 150.0 kHz 30.0 MHz 5.0 kHz QuasiPeak 1.0 s 9 kHz NSLK8126 2008
 Average



MEASUREMENT RESULT: "LLED002_fin"

04/08/2019 3:23PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.355000	33.20	10.6	59	25.6	QP	N	GND
0.430000	38.70	10.7	57	18.6	QP	N	GND
0.555000	29.70	10.7	56	26.3	QP	N	GND
1.065000	24.40	10.9	56	31.6	QP	N	GND
3.150000	29.80	11.1	56	26.2	QP	N	GND
23.260000	25.80	11.5	60	34.2	QP	N	GND

MEASUREMENT RESULT: "LLED002_fin2"

04/08/2019 3:23PM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.355000	22.60	10.6	49	26.2	AV	N	GND
0.430000	26.90	10.7	47	20.4	AV	N	GND
0.555000	19.60	10.7	46	26.4	AV	N	GND
1.075000	14.40	10.9	46	31.6	AV	N	GND
3.150000	16.10	11.1	46	29.9	AV	N	GND
23.560000	23.70	11.5	50	26.3	AV	N	GND

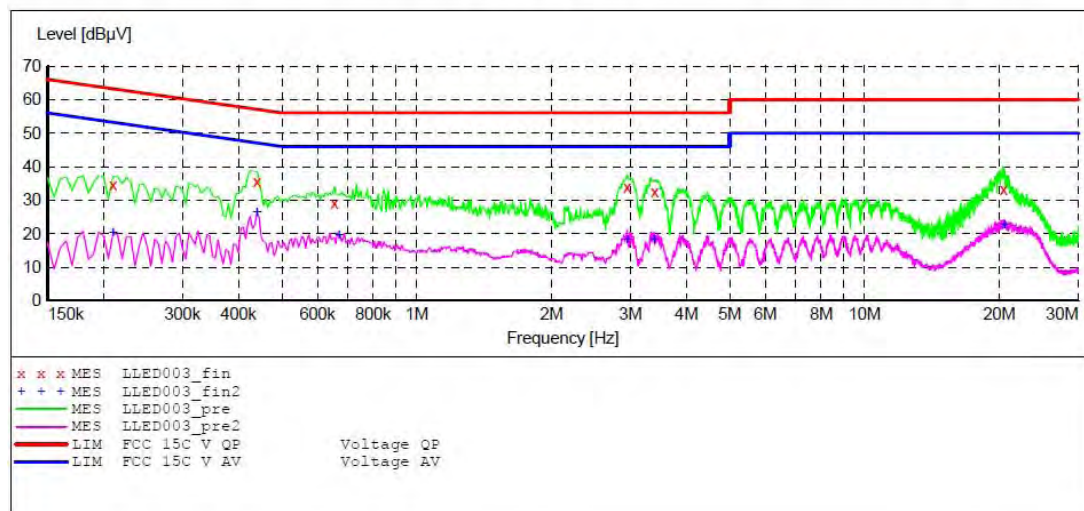
ACCURATE TECHNOLOGY CO.,LTD

CONDUCTED EMISSION STANDARD FCC PART 15 C

EUT: Wireless Stereo Headset M/N:TCU007
 Manufacturer:
 Operating Condition: BT communication
 Test Site: 1#Shielding Room
 Operator: Star
 Test Specification: N 240V/60Hz
 Comment: Report No.:ATE20190447
 Start of Test: 04/08/2019 / 3:24:17PM

SCAN TABLE: "V 9K-30MHz fin"

Short Description: _SUB_STD_VTERM2 1.70
 Start Stop Step Detector Meas. IF Transducer
 Frequency Frequency Width Time Bandw.
 9.0 kHz 150.0 kHz 100.0 Hz QuasiPeak 1.0 s 200 Hz NSLK8126 2008
 Average
 150.0 kHz 30.0 MHz 5.0 kHz QuasiPeak 1.0 s 9 kHz NSLK8126 2008
 Average



MEASUREMENT RESULT: "LLED003_fin"

04/08/2019 3:27PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.210000	34.60	10.5	63	28.6	QP	N	GND
0.440000	35.60	10.7	57	21.5	QP	N	GND
0.655000	29.10	10.8	56	26.9	QP	N	GND
2.950000	33.70	11.1	56	22.3	QP	N	GND
3.400000	32.60	11.1	56	23.4	QP	N	GND
20.410000	33.10	11.4	60	26.9	QP	N	GND

MEASUREMENT RESULT: "LLED003_fin2"

04/08/2019 3:27PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.210000	20.20	10.5	53	33.0	AV	N	GND
0.440000	26.20	10.7	47	20.9	AV	N	GND
0.670000	19.50	10.8	46	26.5	AV	N	GND
2.950000	18.10	11.1	46	27.9	AV	N	GND
3.390000	18.30	11.1	46	27.7	AV	N	GND
20.530000	22.50	11.4	50	27.5	AV	N	GND

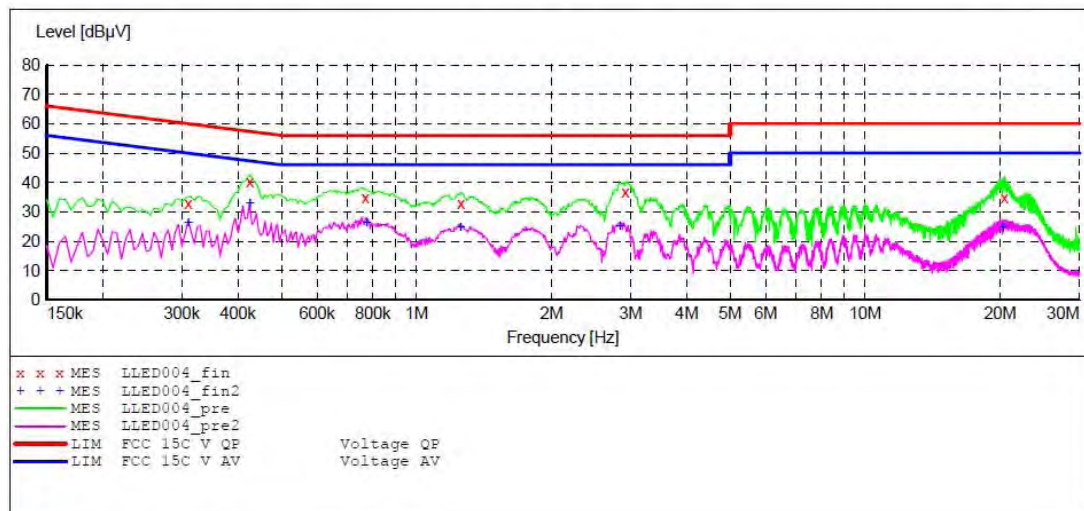
ACCURATE TECHNOLOGY CO.,LTD

CONDUCTED EMISSION STANDARD FCC PART 15 C

EUT: Wireless Stereo Headset M/N:TCU007
 Manufacturer:
 Operating Condition: BT communication
 Test Site: 1#Shielding Room
 Operator: Star
 Test Specification: L 240V/60Hz
 Comment: Report No.:ATE20190447
 Start of Test: 04/08/2019 / 3:28:20PM

SCAN TABLE: "V 9K-30MHz fin"

Short Description: _SUB_STD_VTERM2 1.70
 Start Stop Step Detector Meas. IF Transducer
 Frequency Frequency Width Time Bandw.
 9.0 kHz 150.0 kHz 100.0 Hz QuasiPeak 1.0 s 200 Hz NSLK8126 2008
 Average
 150.0 kHz 30.0 MHz 5.0 kHz QuasiPeak 1.0 s 9 kHz NSLK8126 2008
 Average



MEASUREMENT RESULT: "LLED004_fin"

04/08/2019 3:32PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.310000	32.90	10.6	60	27.1	QP	L1	GND
0.425000	40.40	10.7	57	16.9	QP	L1	GND
0.770000	34.90	10.8	56	21.1	QP	L1	GND
1.255000	33.00	10.9	56	23.0	QP	L1	GND
2.920000	36.60	11.1	56	19.4	QP	L1	GND
20.410000	34.90	11.4	60	25.1	QP	L1	GND

MEASUREMENT RESULT: "LLED004_fin2"

04/08/2019 3:32PM

Frequency MHz	Level dBuV	Transd dB	Limit dBuV	Margin dB	Detector	Line	PE
0.310000	26.10	10.6	50	23.9	AV	L1	GND
0.425000	32.80	10.7	47	14.5	AV	L1	GND
0.775000	26.20	10.8	46	19.8	AV	L1	GND
1.255000	24.70	10.9	46	21.3	AV	L1	GND
2.840000	25.00	11.0	46	21.0	AV	L1	GND
20.260000	24.60	11.4	50	25.4	AV	L1	GND

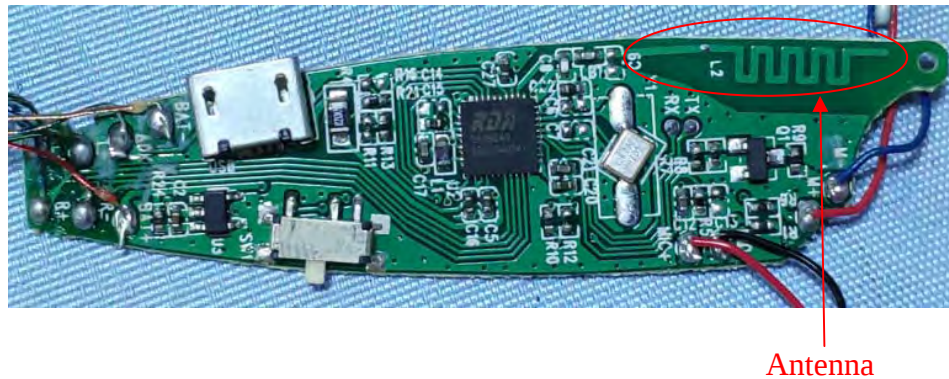
14.ANTENNA REQUIREMENT

14.1.The Requirement

According to 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.

14.2.Antenna Construction

Device is equipped with permanent attached antenna, which isn't displaced by other antenna. The Max Antenna gain of EUT is 1.3dBi. Therefore, the equipment complies with the antenna requirement of Section 15.203.



***** End of Test Report *****