

## 7. FREQUENCY SEPARATION

### 7.1. Limits

According to FCC Section 15.247(a)(1)& RSS-247 §5.1(2), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

### 7.2. Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

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

RBW  $\geq$  1% of the span(30KHz)

VBW  $\geq$  RBW(100KHz)

Sweep=auto

Detector function=peak

Trace=max hold

### 7.3. Test Setup

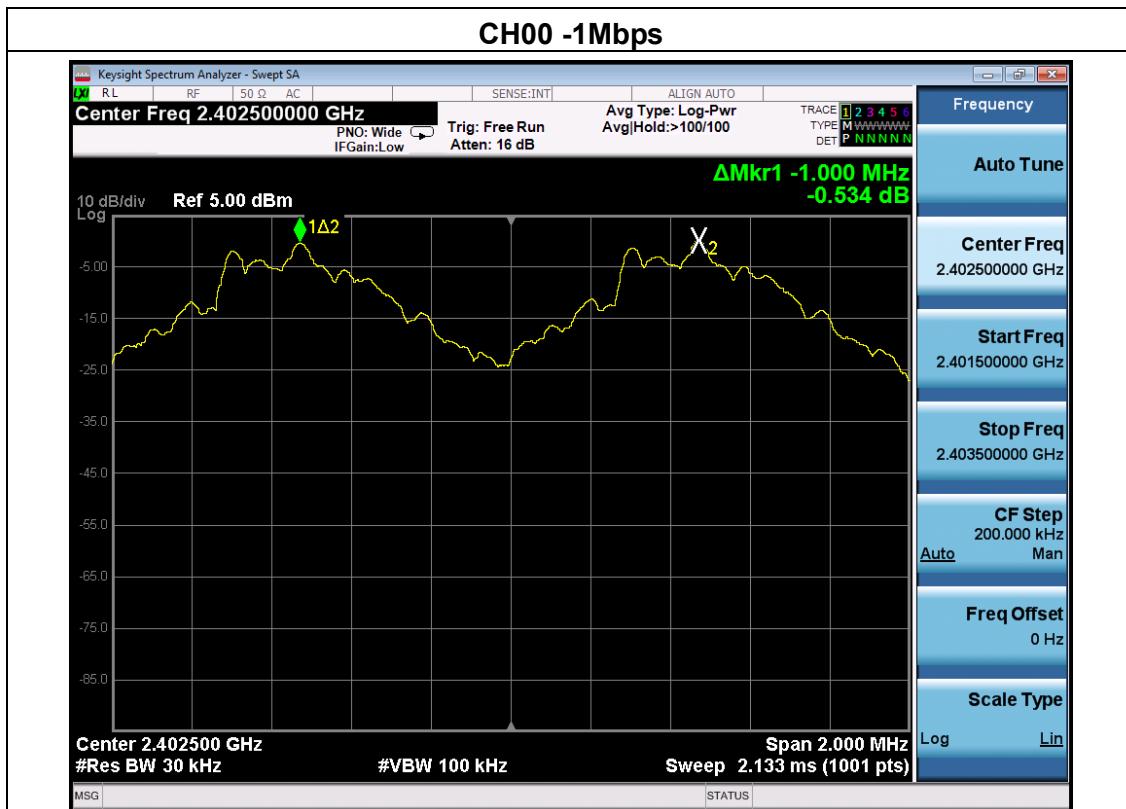


## 7.4. Test Results

EUT:	Bluetooth Speaker	Model Name :	VG3
Temperature:	24 °C	Relative Humidity:	58%
Pressure:	1010hPa	Test Voltage :	DC 3.65V
Test Mode :	CH00 / CH39 /CH78(1Mbps)		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	1.000	866.9	Complies
2441 MHz	1.004	864.7	Complies
2480 MHz	0.996	849.2	Complies

### Ch. Separation Limits: > 20dB bandwidth



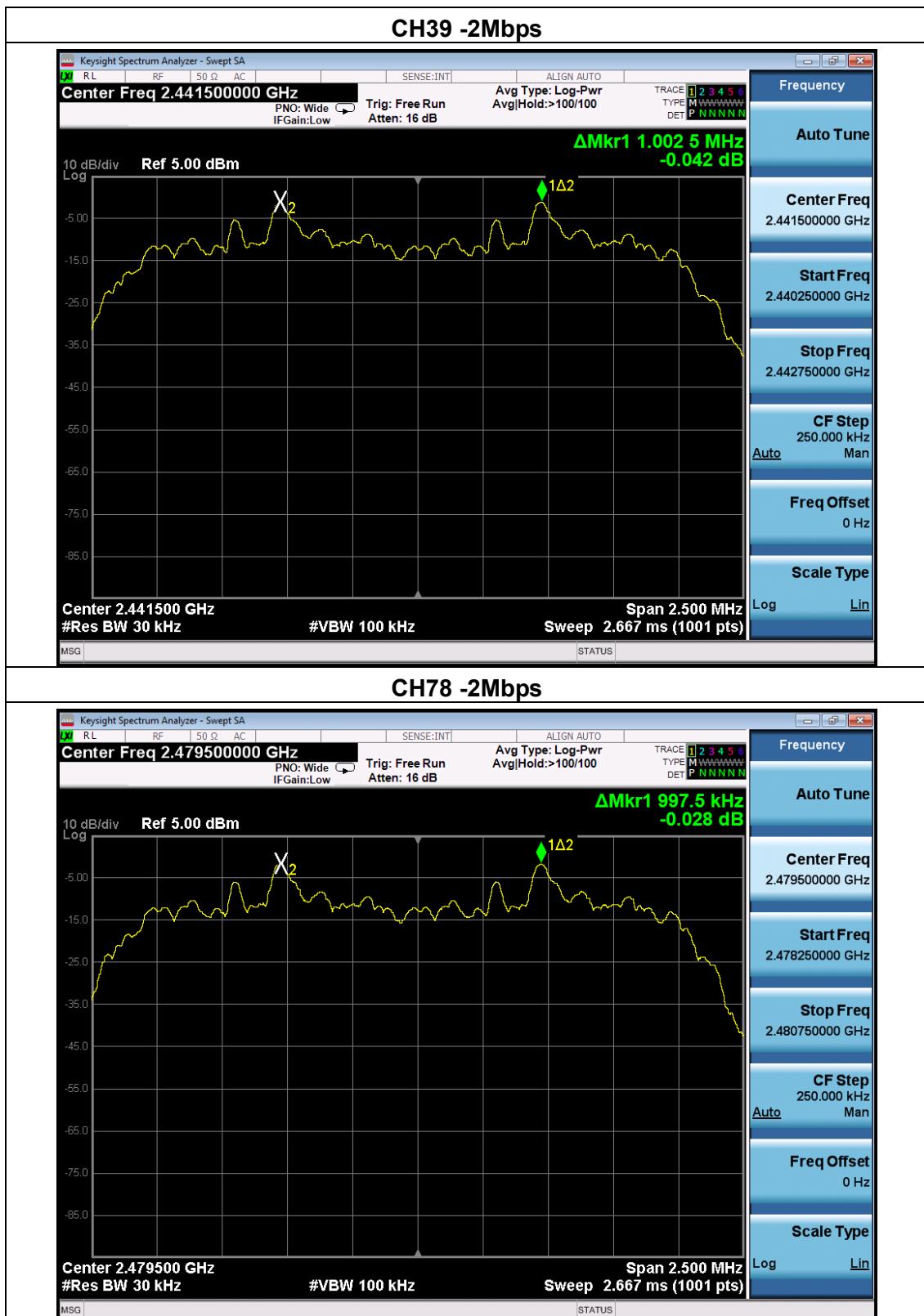


EUT:	Bluetooth Speaker	Model Name :	VG3
Temperature:	24 °C	Relative Humidity:	58%
Pressure:	1010 hPa	Test Voltage :	DC 3.65V
Test Mode :	CH00 / CH39 /CH78(2Mbps)		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	1.000	0.810	Complies
2441 MHz	1.003	0.819	Complies
2480 MHz	0.998	0.841	Complies

Ch. Separation Limits: >2/3 of 20dB bandwidth.

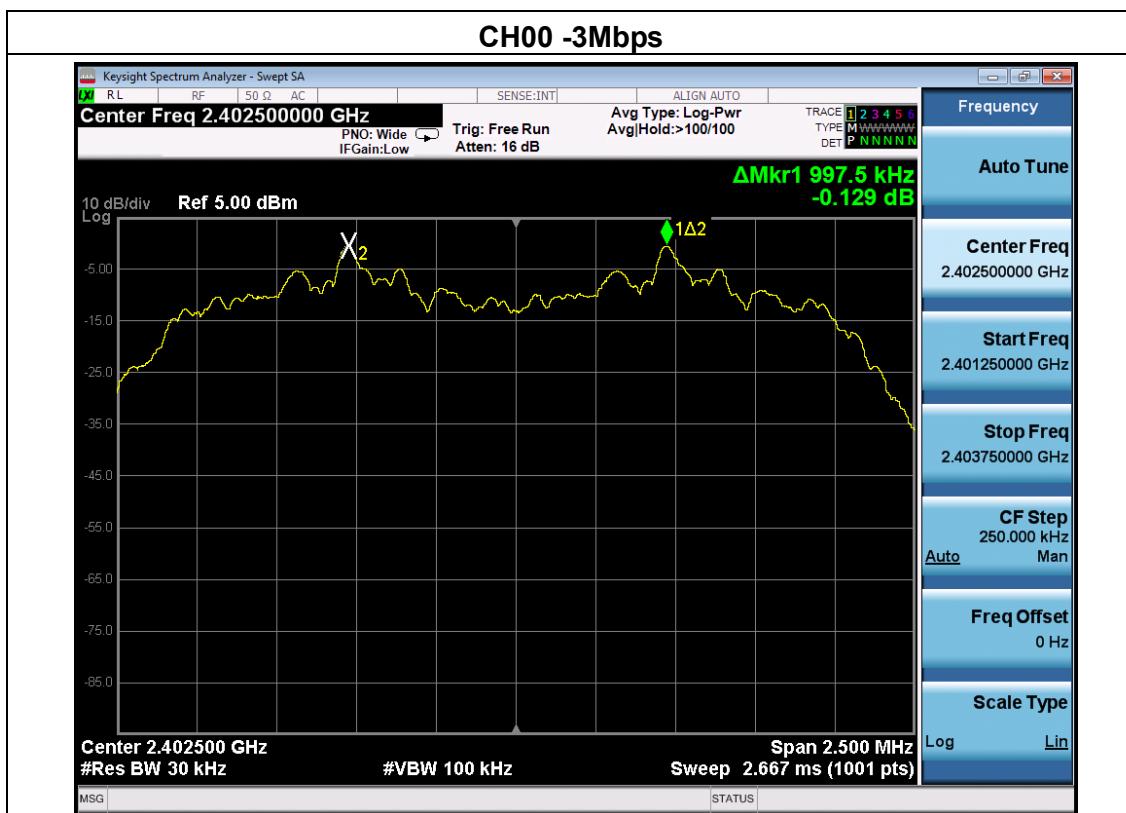


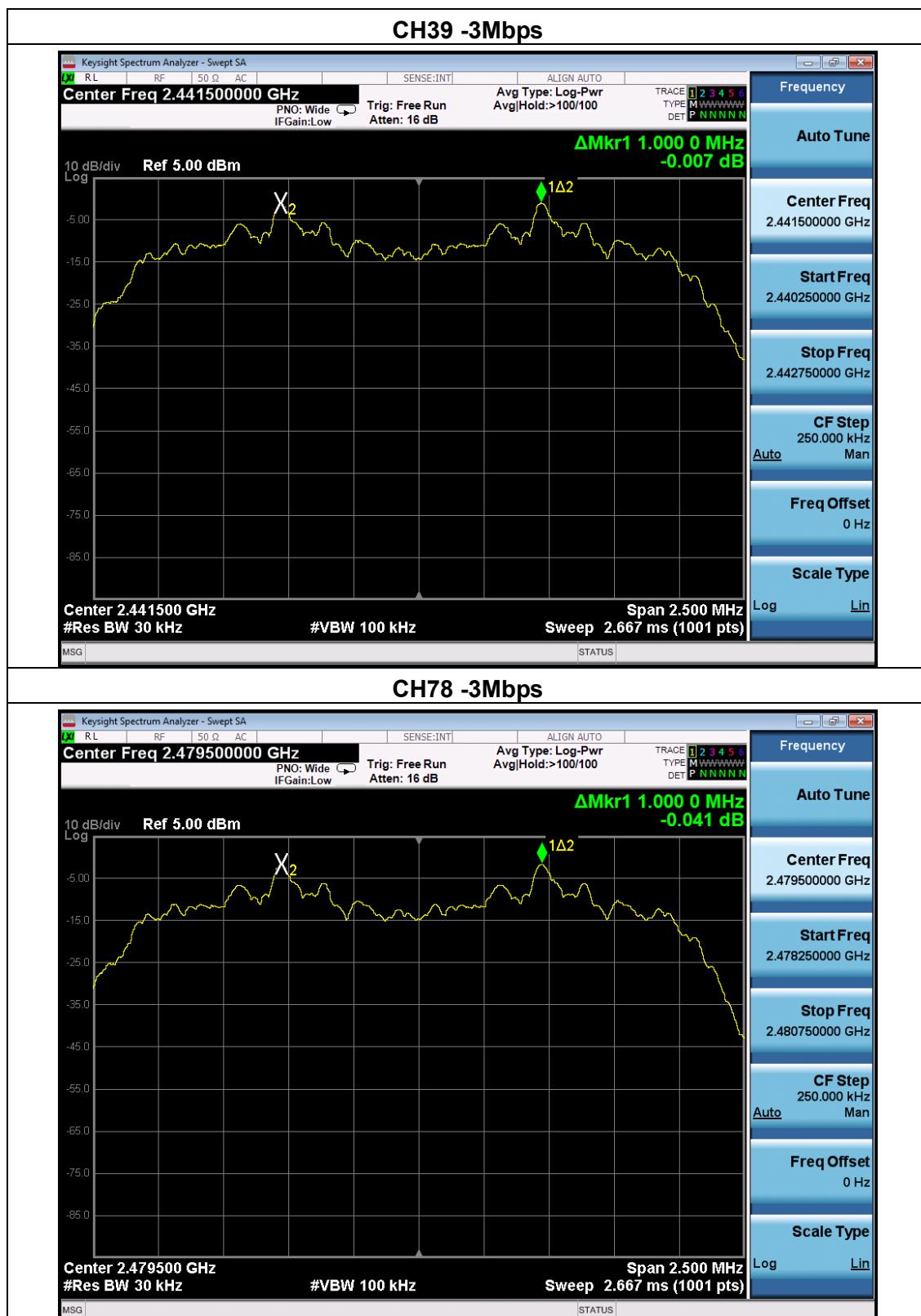


EUT:	Bluetooth Speaker	Model Name :	VG3
Temperature:	24 °C	Relative Humidity:	58%
Pressure:	1010 hPa	Test Voltage :	DC 3.65V
Test Mode :	CH00 / CH39 /CH78(3Mbps)		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	0.998	0.803	Complies
2441 MHz	1.000	0.809	Complies
2480 MHz	1.000	0.835	Complies

Ch. Separation Limits: >2/3 of 20dB bandwidth.





## 8. NUMBER OF HOPPING FREQUENCY

### 8.1. Limits

According to FCC Section 15.247(a)(1)(iii)& RSS-247 §5.1(4), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

### 8.2. Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum. During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: the frequency band of operation

RBW =100KHz

VBW=300KHz

Sweep=auto

Detector function=peak

Trace=max hold

### 8.3. Test Setup



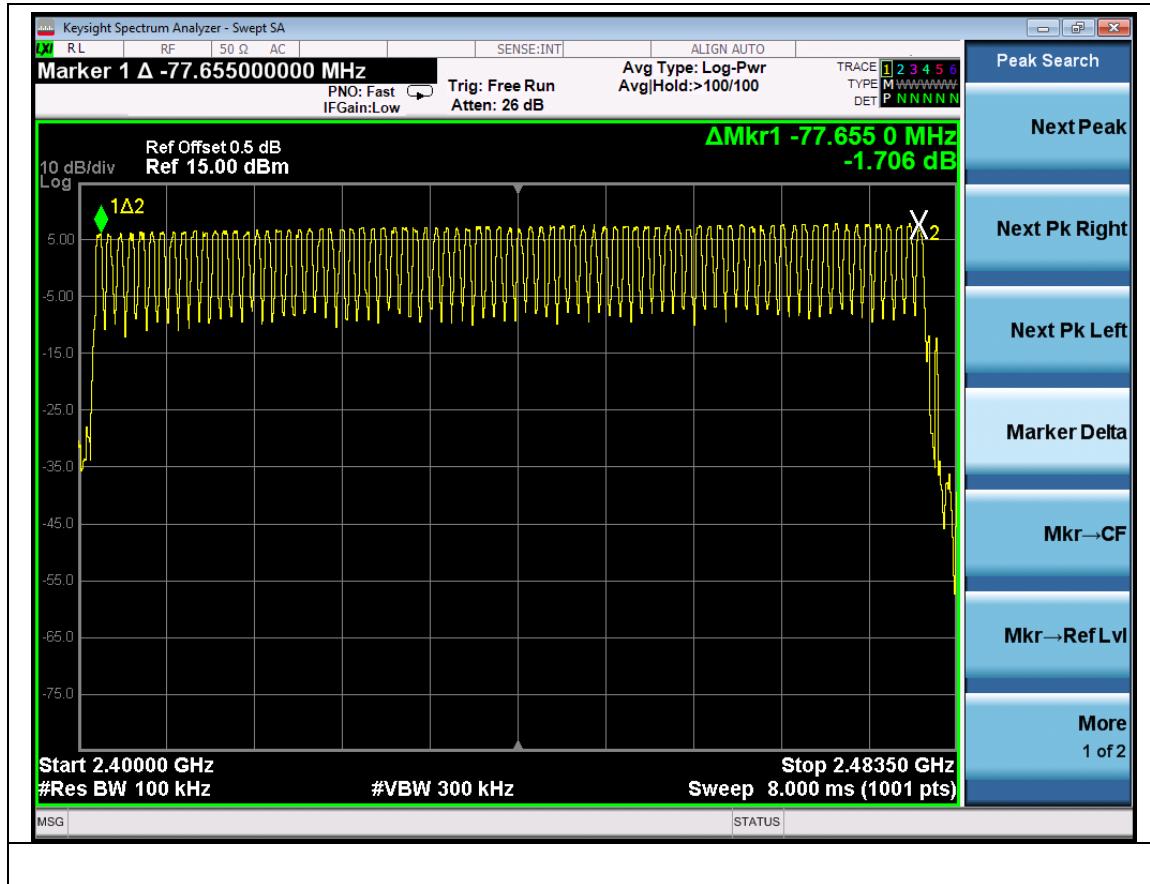
## 8.4. Test Results

EUT:	Bluetooth Speaker	Model Name :	VG3
Temperature:	24 °C	Relative Humidity:	58%
Pressure:	1010 hPa	Test Voltage :	DC 3.65V
Test Mode :	GFSK		

Test data:

Measured channel numbers	Limit	Result
79	≥15	PASS

Test plot as follows:



## 9. DWELL TIME

### 9.1. Limits

According to FCC Section 15.247(a)(1)(iii)& RSS-247 §5.1(4), 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.

### 9.2. Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum. During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode power.

2. Set the spectrum analyzer:

Span= 0Hz, RBW =1000 kHz, VBW = 3000 kHz

Use a video trigger with the trigger level set to enable triggering only on full pulses.

Detector function=peak, Sweep Time is more than once pulse time.

Set the EUT for DH5, DH3 and DH1 packet transmitting

Measure the maximum time duration of one single pulse.

A Period Time = (channel number)\*0.4

DH1 Time Slot: Reading \* (1600/2)\*31.6/(channel number)

DH3 Time Slot: Reading \* (1600/4)\*31.6/(channel number)

DH5 Time Slot: Reading \* (1600/6)\*31.6/(channel number)

For Example:

BT hopping rate is 1600 hops/s with 6 slots in 79 hopping channels.

With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s),

Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.

Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

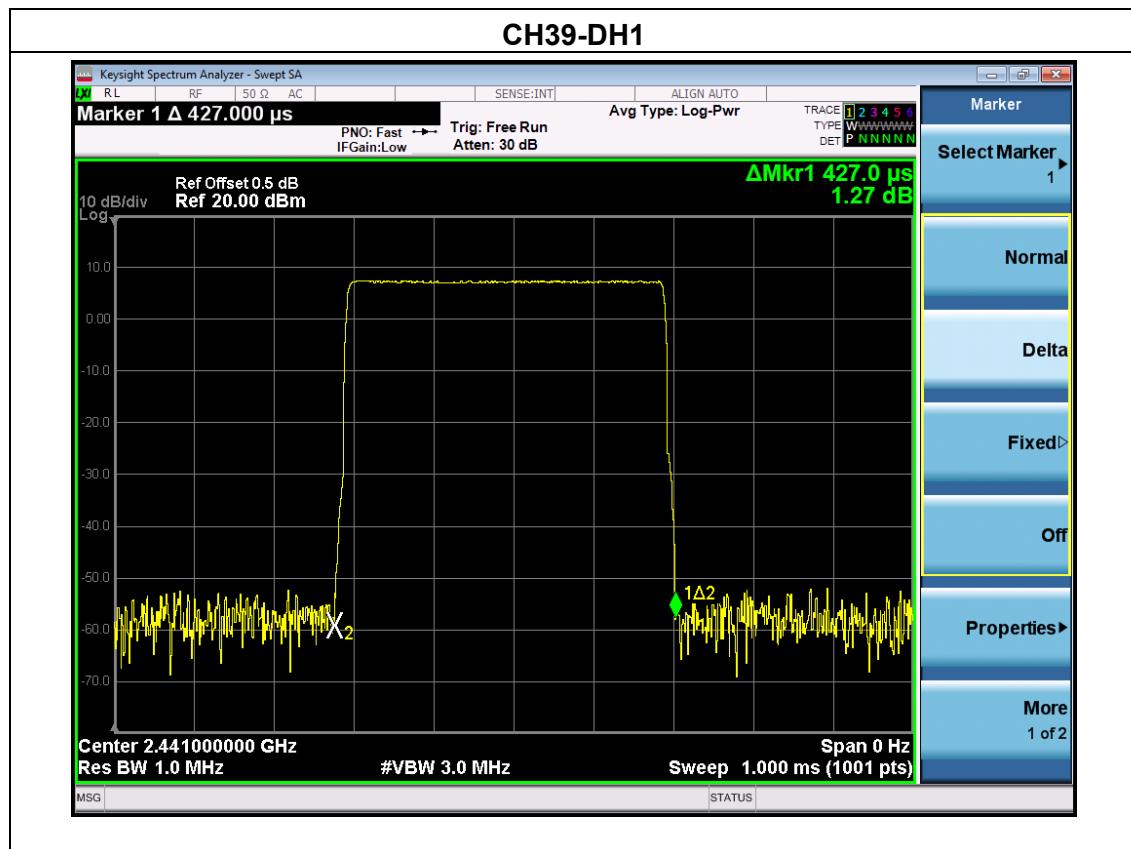
### 9.3. Test Setup



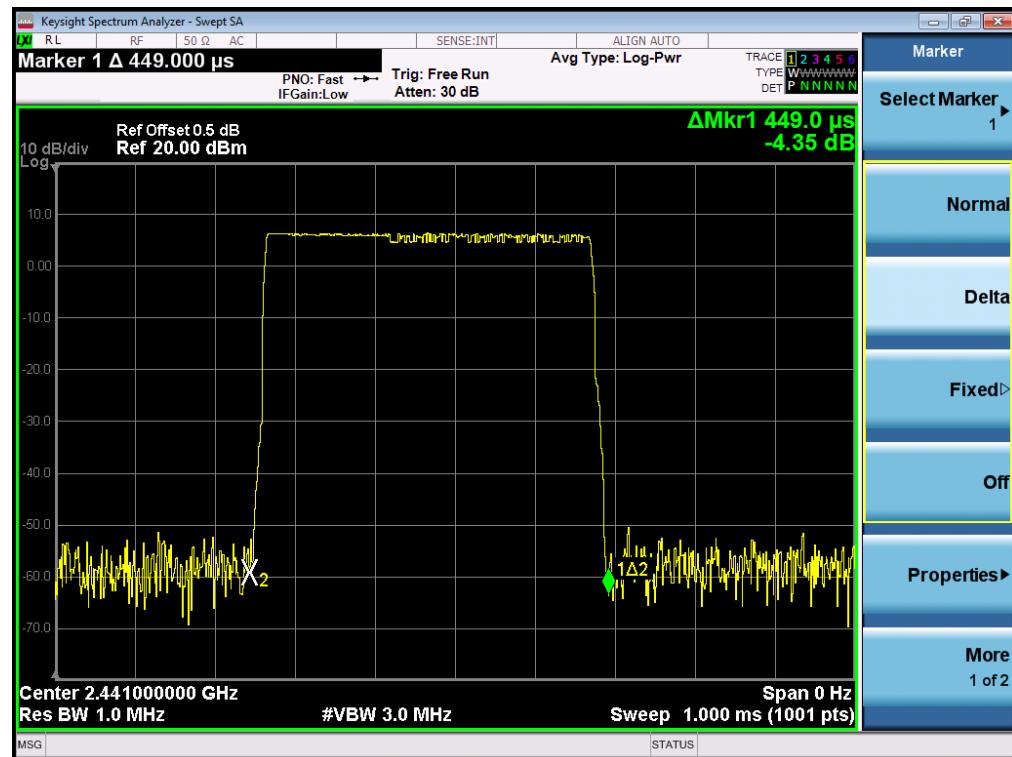
## 9.4. Test Results

Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH1	2441 MHz	0.427	0.14	0.4
2DH1	2441 MHz	0.449	0.14	0.4
3DH1	2441 MHz	0.442	0.14	0.4

Test plot as follows:



## CH39-2DH1

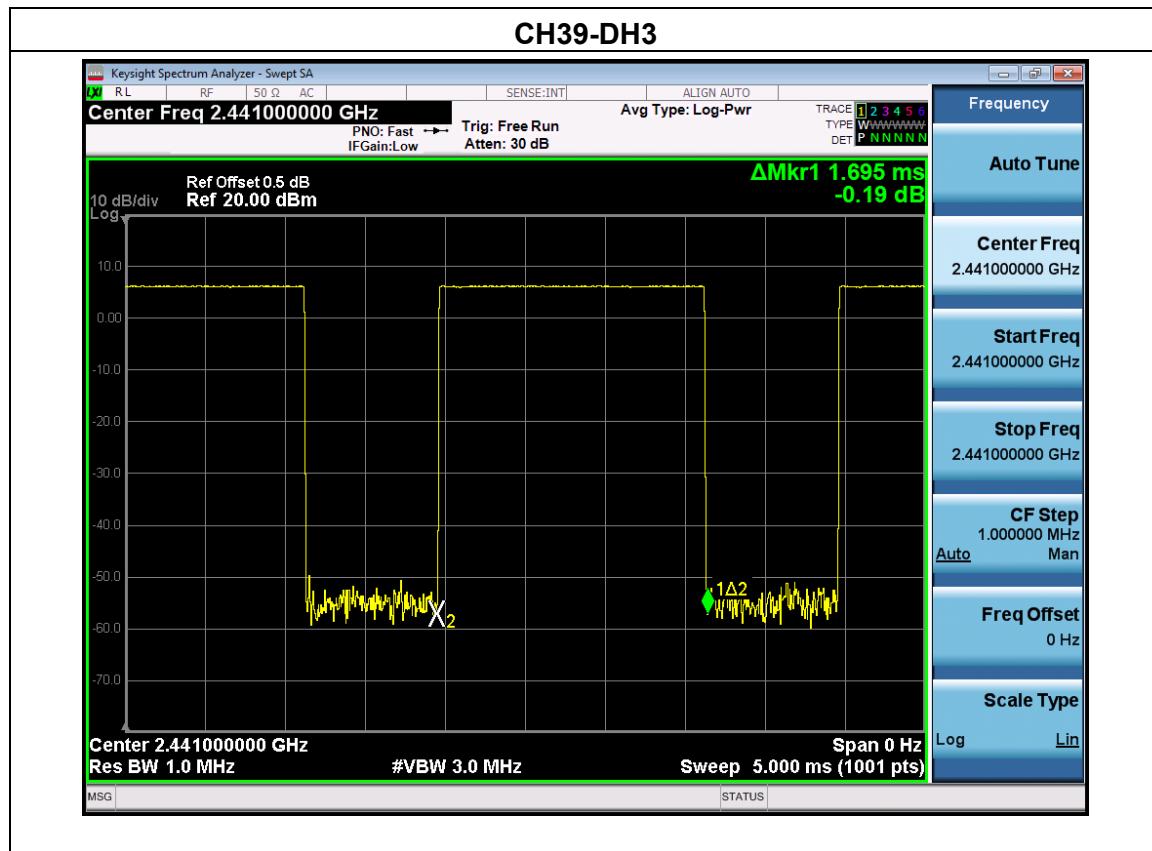


## CH39-3DH1

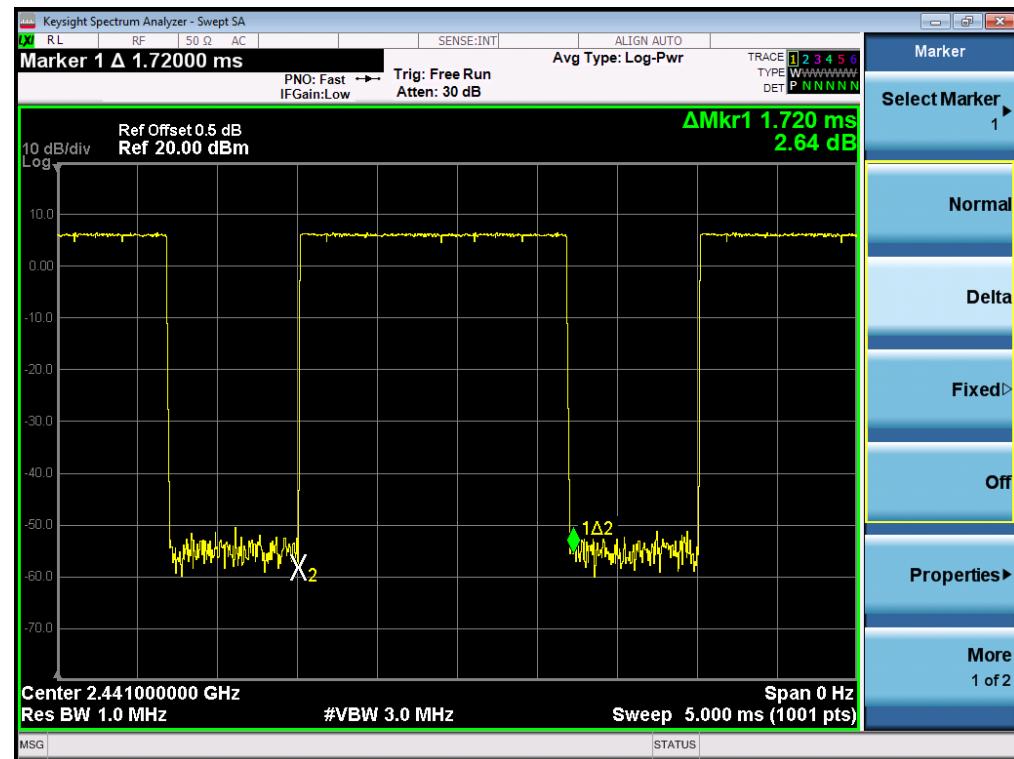


Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH3	2441 MHz	1.79	0.27	0.4
2DH3	2441 MHz	1.81	0.28	0.4
3DH3	2441 MHz	1.79	0.28	0.4

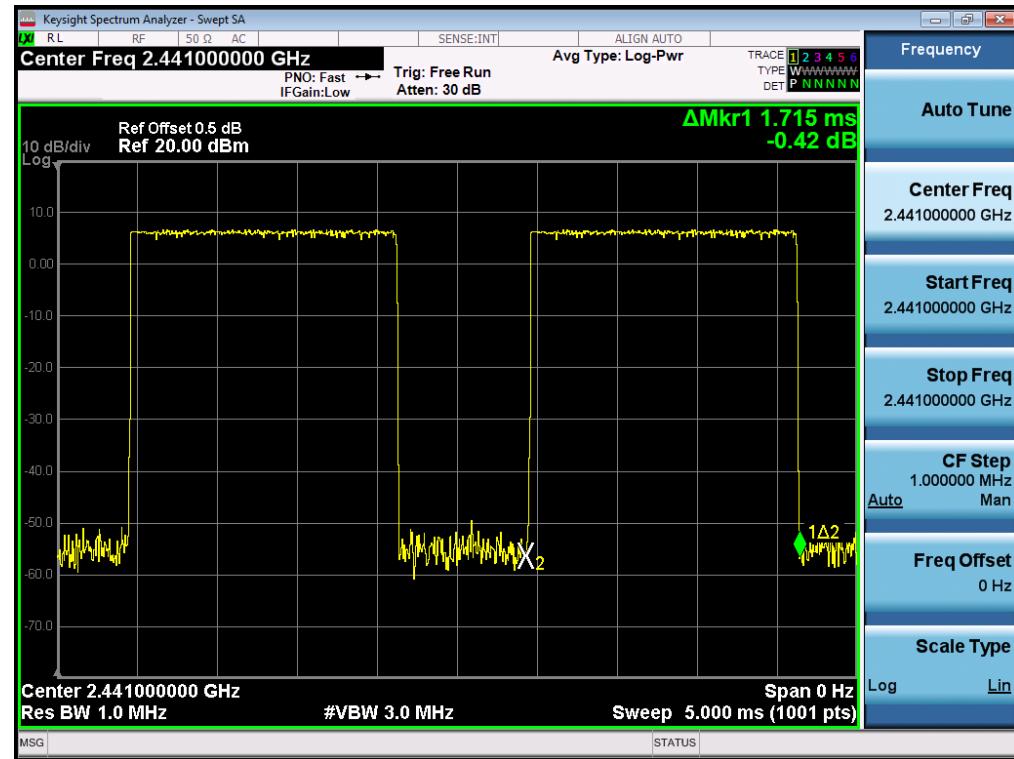
Test plot as follows:



## CH39-2DH3

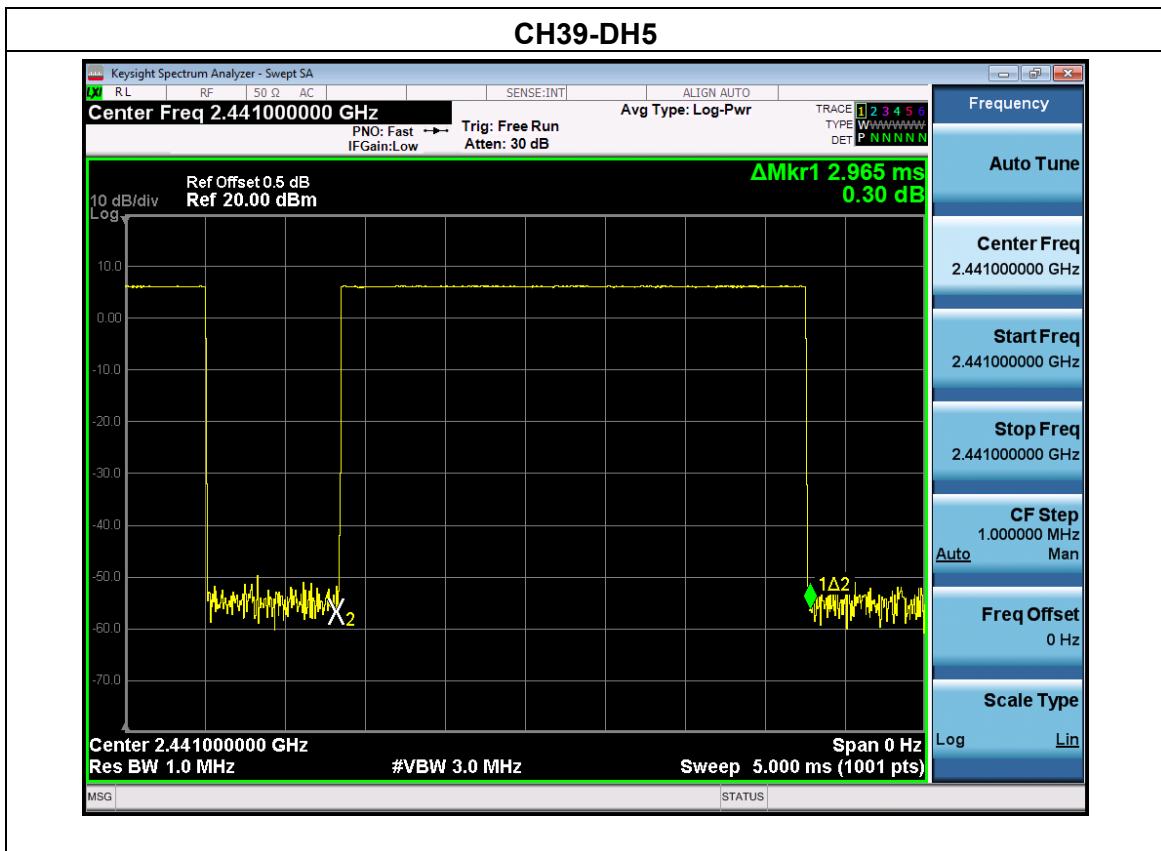


## CH39-3DH3



Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH5	2441 MHz	3.05	0.32	0.4
2DH5	2441 MHz	3.05	0.31	0.4
3DH5	2441 MHz	3.05	0.32	0.4

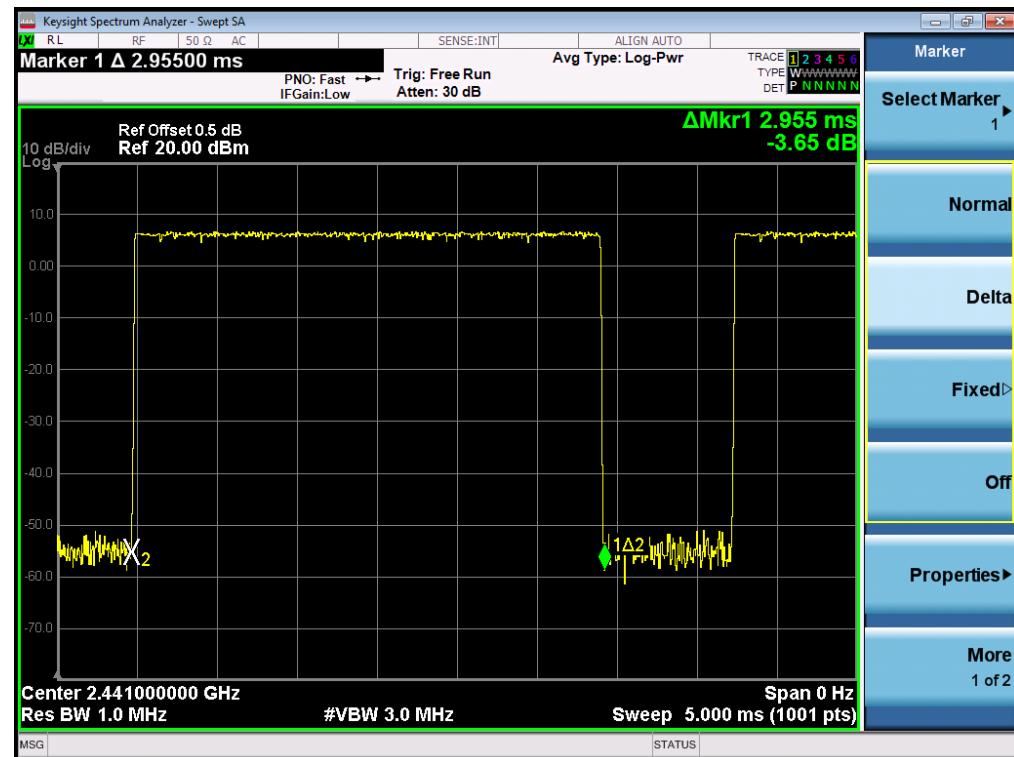
Test plot as follows:



## CH39-2DH5



## CH39-3DH5

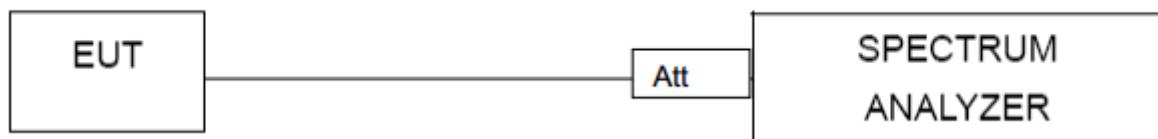


## 10. BAND EDGE COMPLIANCE TEST

### 10.1. Limits

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 § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see §15.205(c)).

### 10.2. Test Setup



### 10.3. Test Procedure

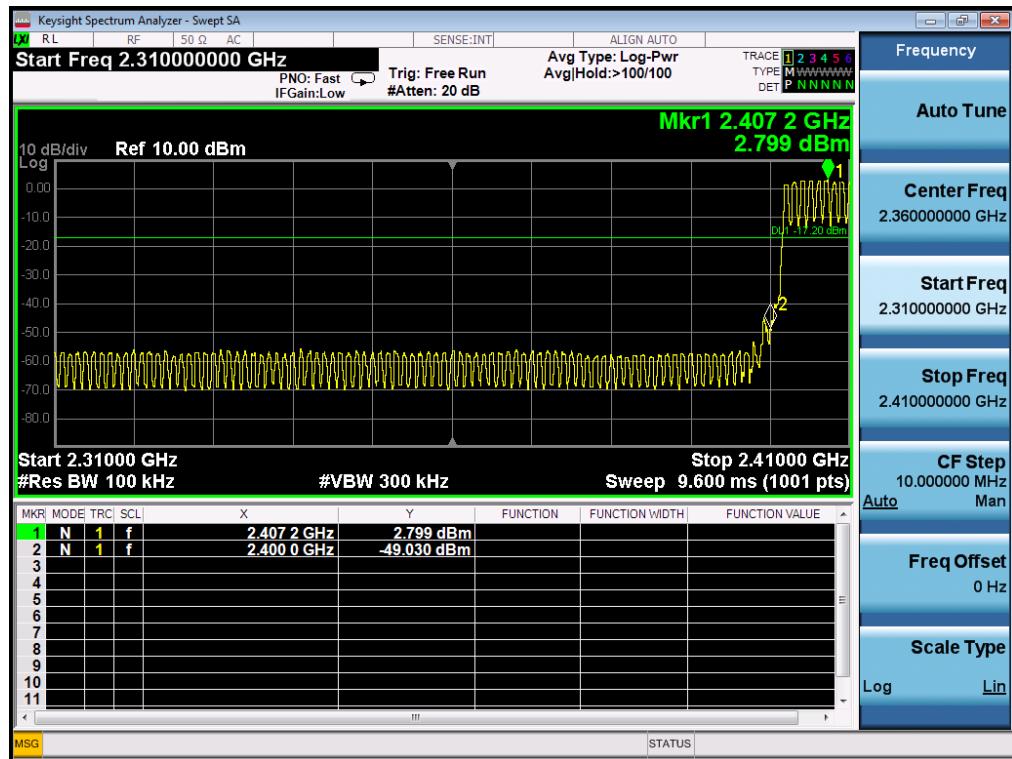
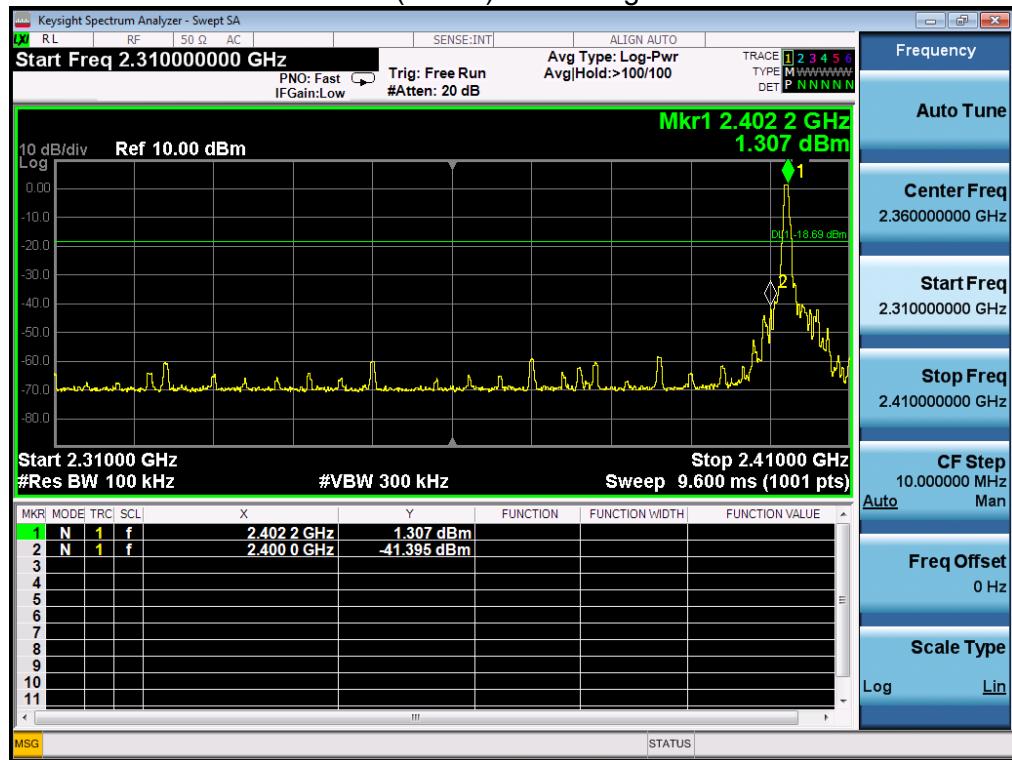
- a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- e) Repeat above procedures until all measured frequencies were complete.

## 10.4. Test Results

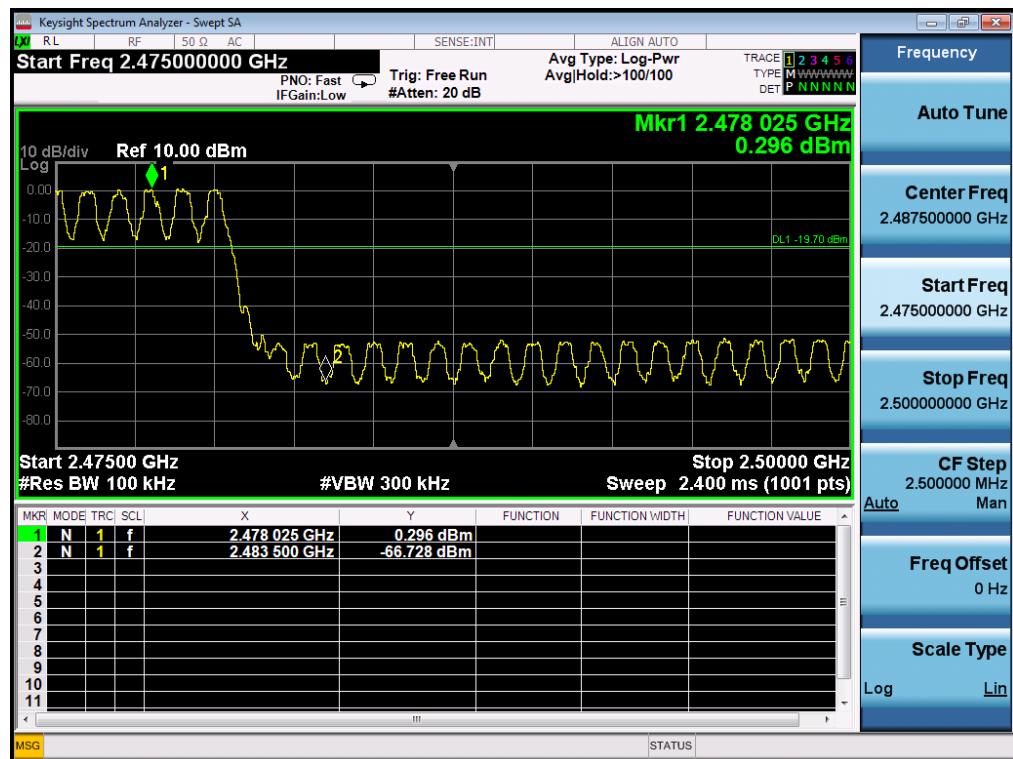
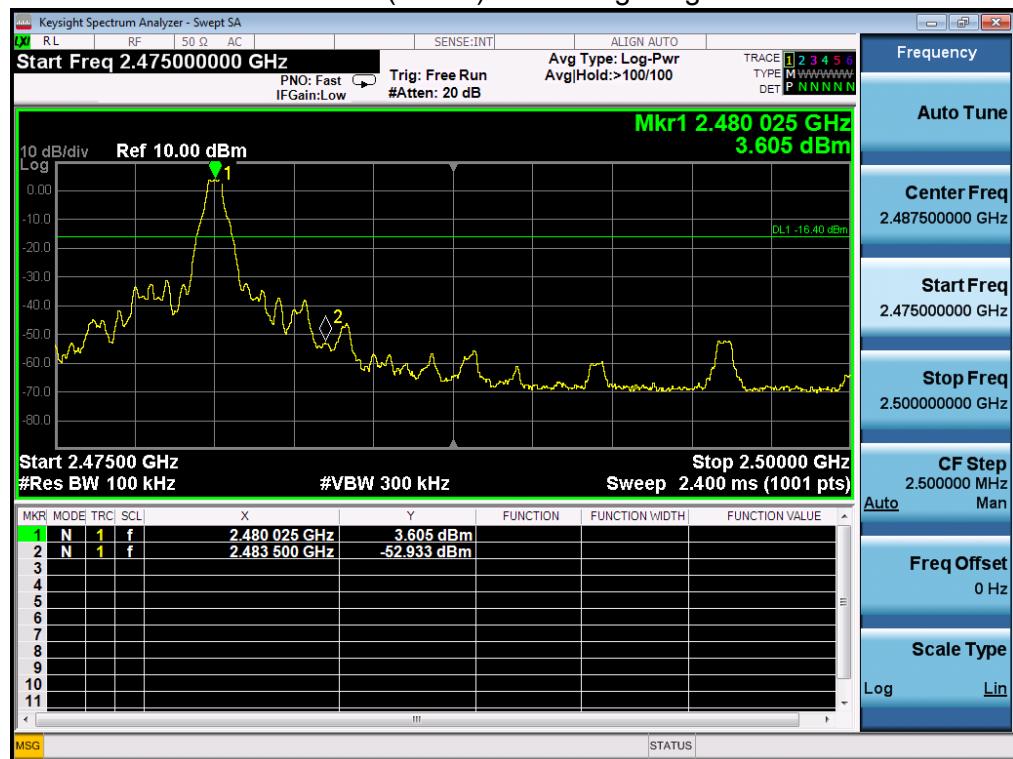
For conducted test:

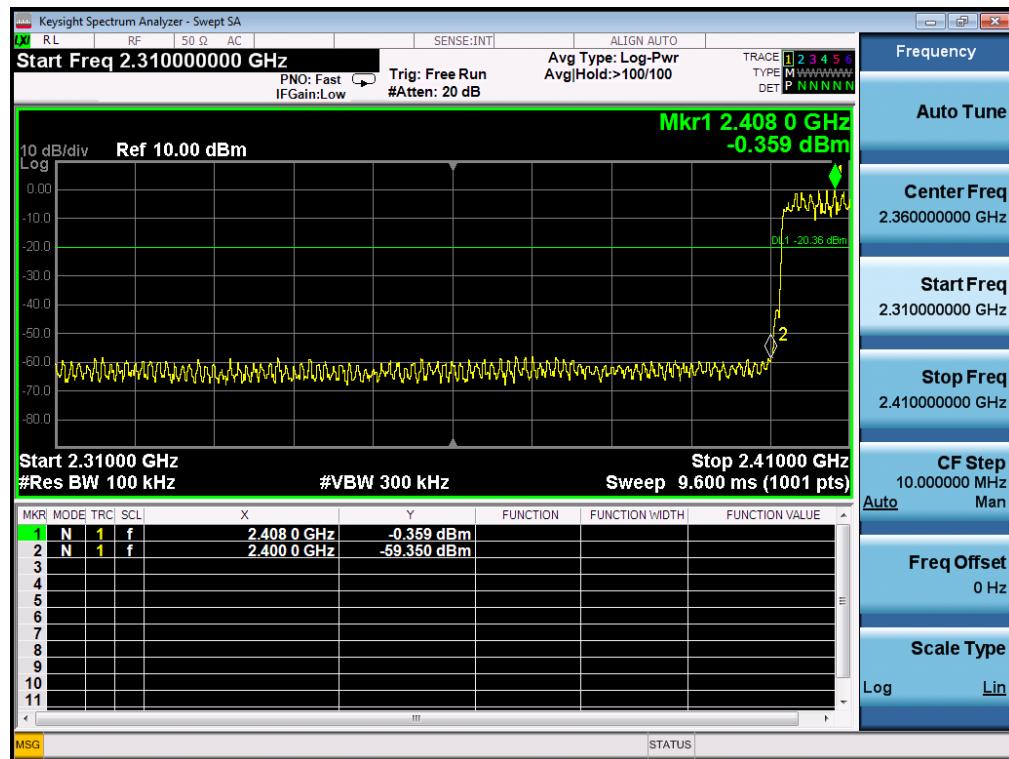
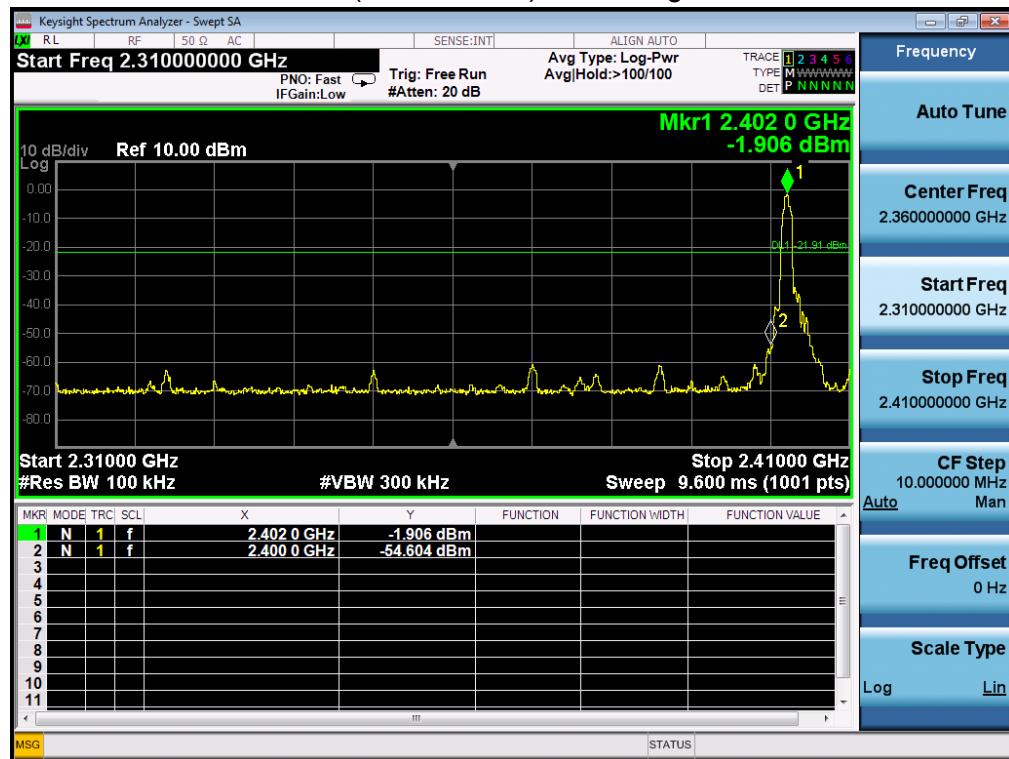
Frequency Band	Delta Peak to band emission (dBc)	> Limit (dBc)	Result
GFSK Non-hopping			
Left Band	42.702	20	Pass
Right Band	56.538	20	Pass
$\pi/4$ -DQPSK Non-hopping			
Left Band	52.698	20	Pass
Right Band	57.032	20	Pass
8DPSK Non-hopping			
Left Band	52.079	20	Pass
Right Band	58.468	20	Pass
GFSK hopping			
Left Band	51.829	20	Pass
Right Band	67.024	20	Pass
$\pi/4$ -DQPSK hopping			
Left Band	59.001	20	Pass
Right Band	59.636	20	Pass
8DPSK hopping			
Left Band	58.678	20	Pass
Right Band	59.459	20	Pass

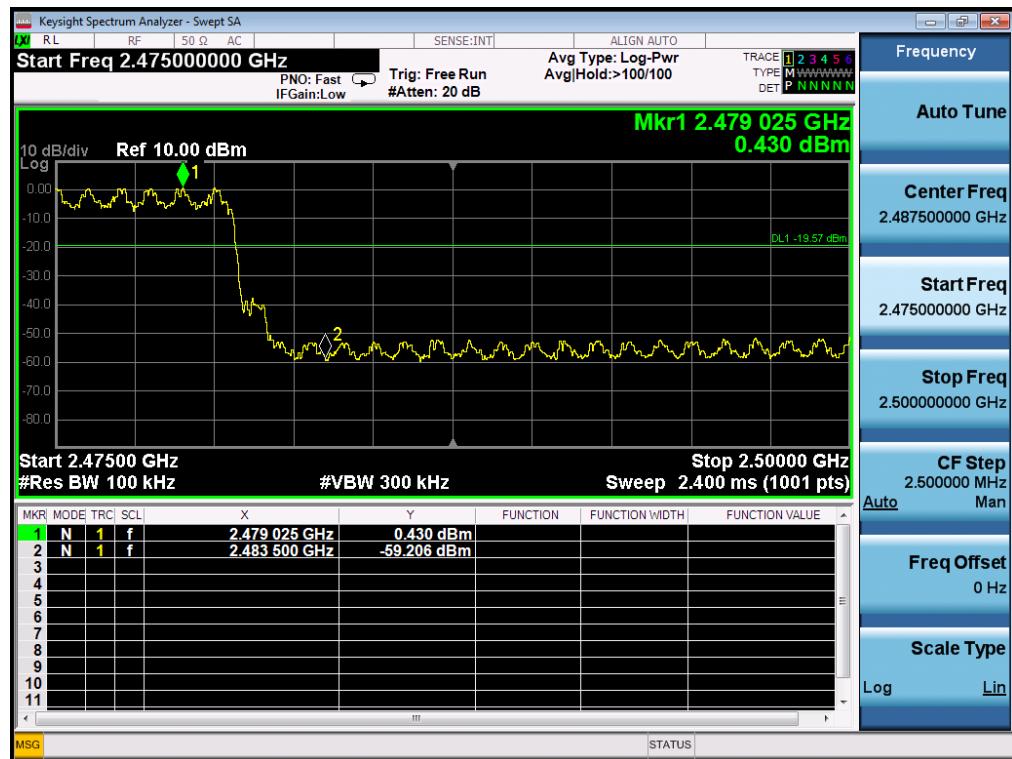
## EDR mode (GFSK): Band Edge-Left Side



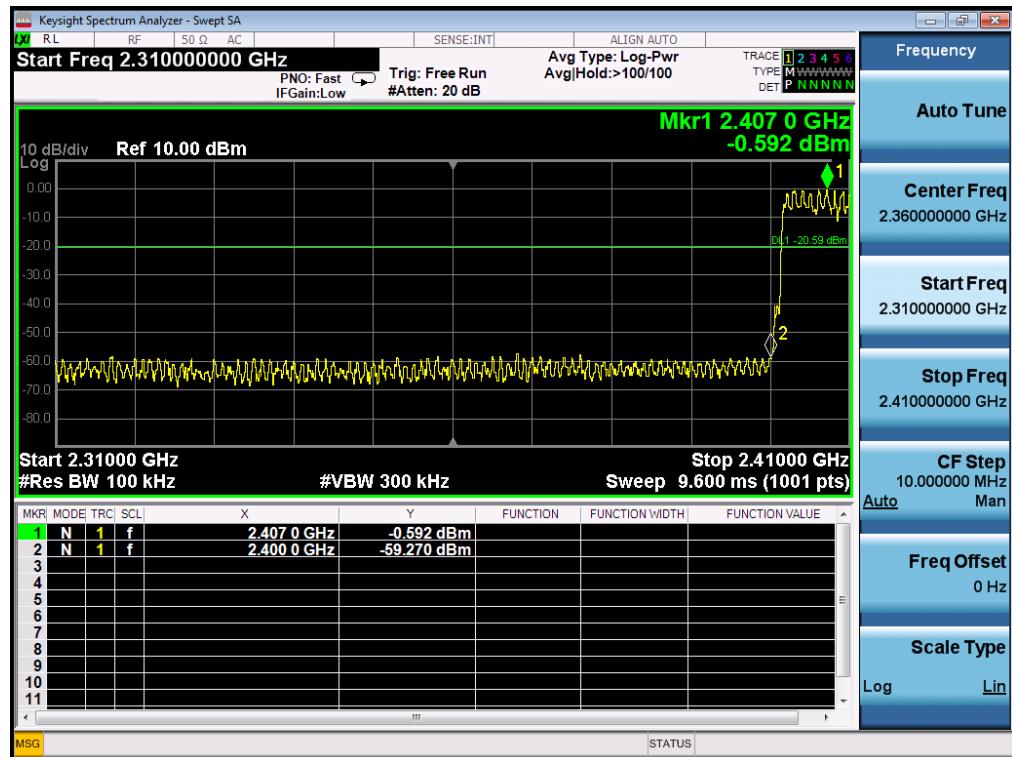
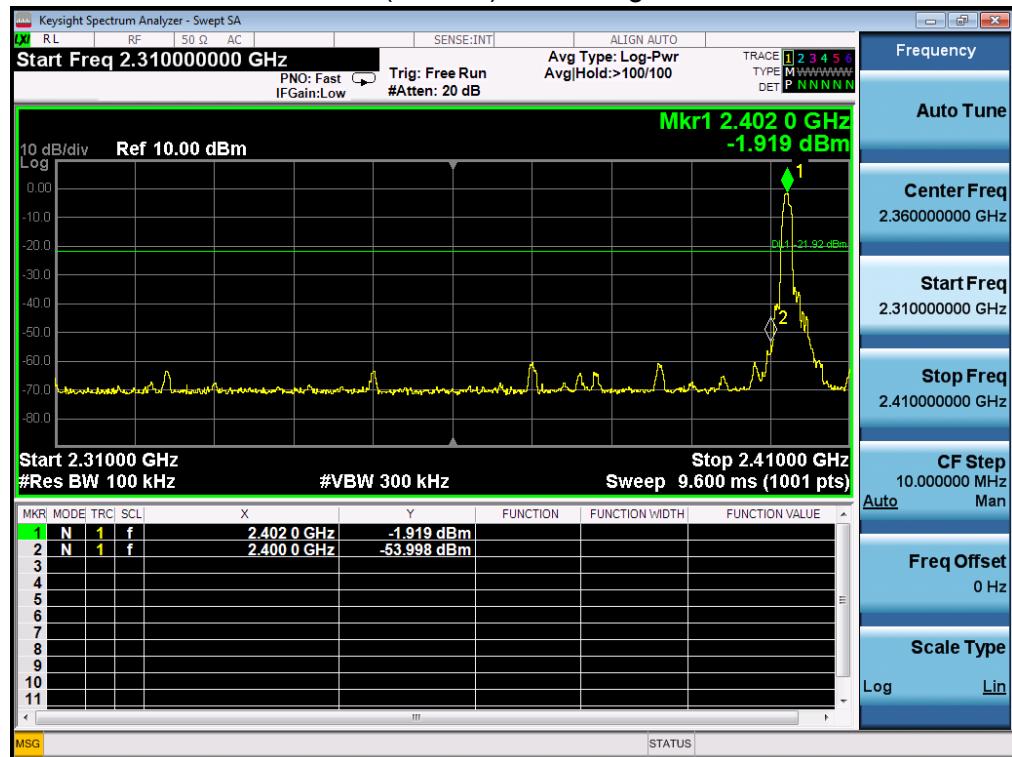
## EDR mode (GFSK): Band Edge-Right Side



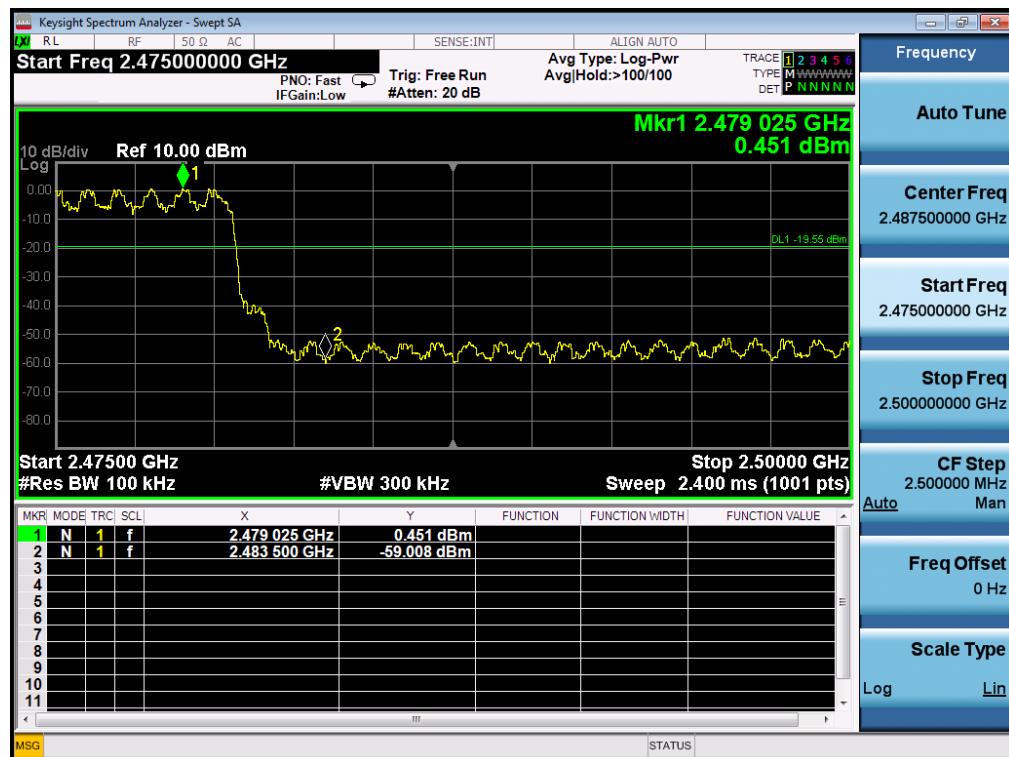
EDR mode ( $\pi/4$ -DQPSK): Band Edge-Left Side

EDR mode ( $\pi/4$ -DQPSK): Band Edge- Right Side

## EDR mode(8DPSK): Band Edge-Left Side



## EDR mode(8DPSK): Band Edge-Right Side



NOTE: Hopping enabled and disabled have evaluated, and the worst data was reported.

## 11. ANTENNA REQUIREMENTS

### 11.1. Limits

For intentional device, according to FCC 47 CFR 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

According to RSS-Gen§8.3

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.

### 11.2. Test Result

The antennas used for this product is PCB antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 1.0dBi.

## 12. PHOTOGRAPHS OF TEST SET-UP

### Radiated Emission Test

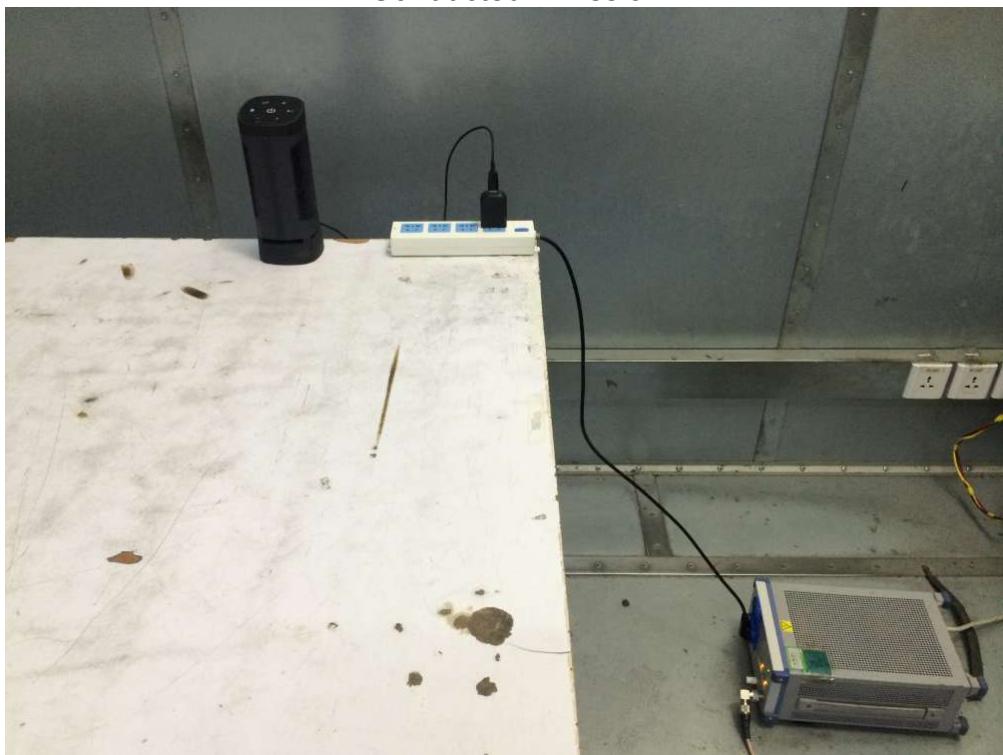
Below 1GHz



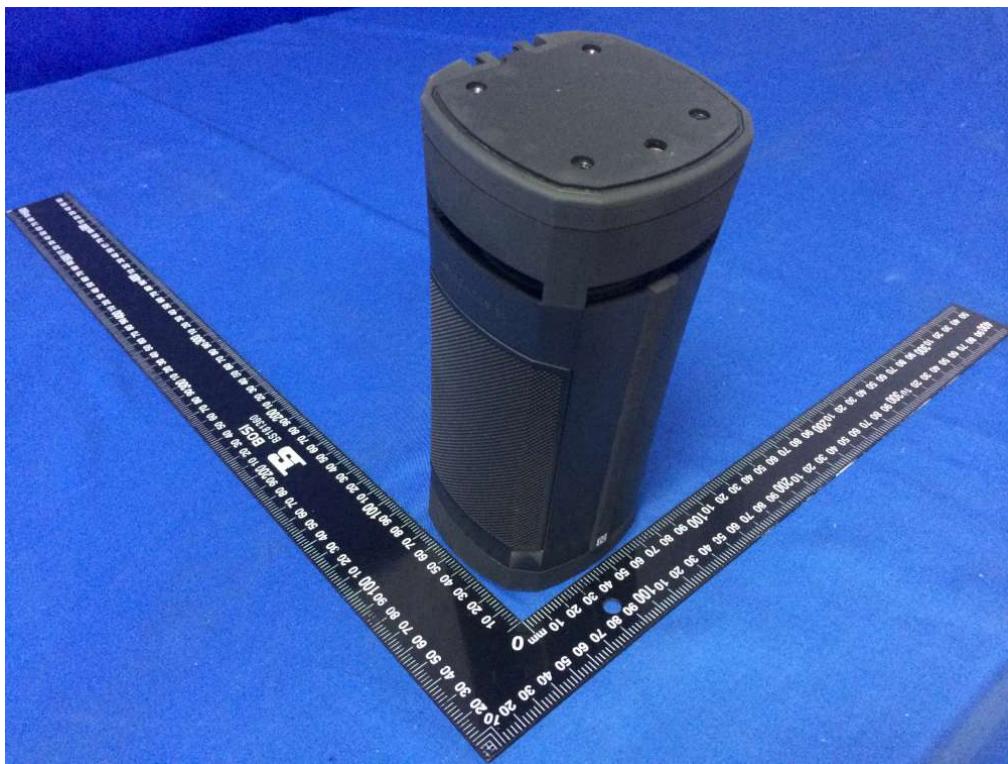
Above 1GHz



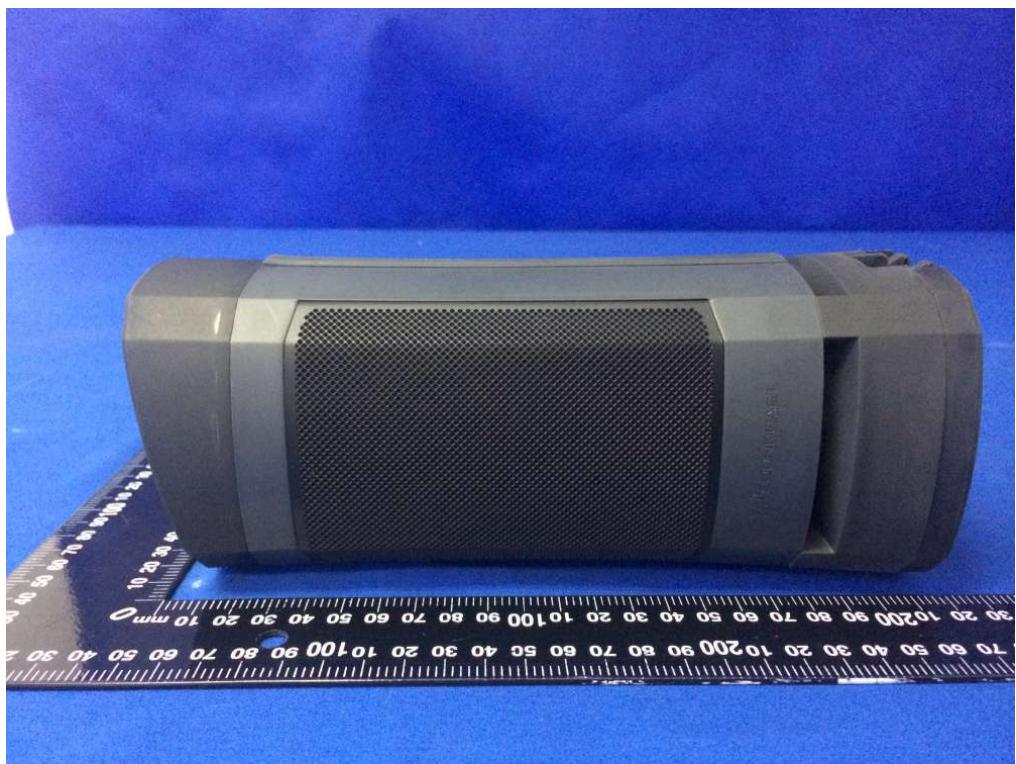
Conducted Emission



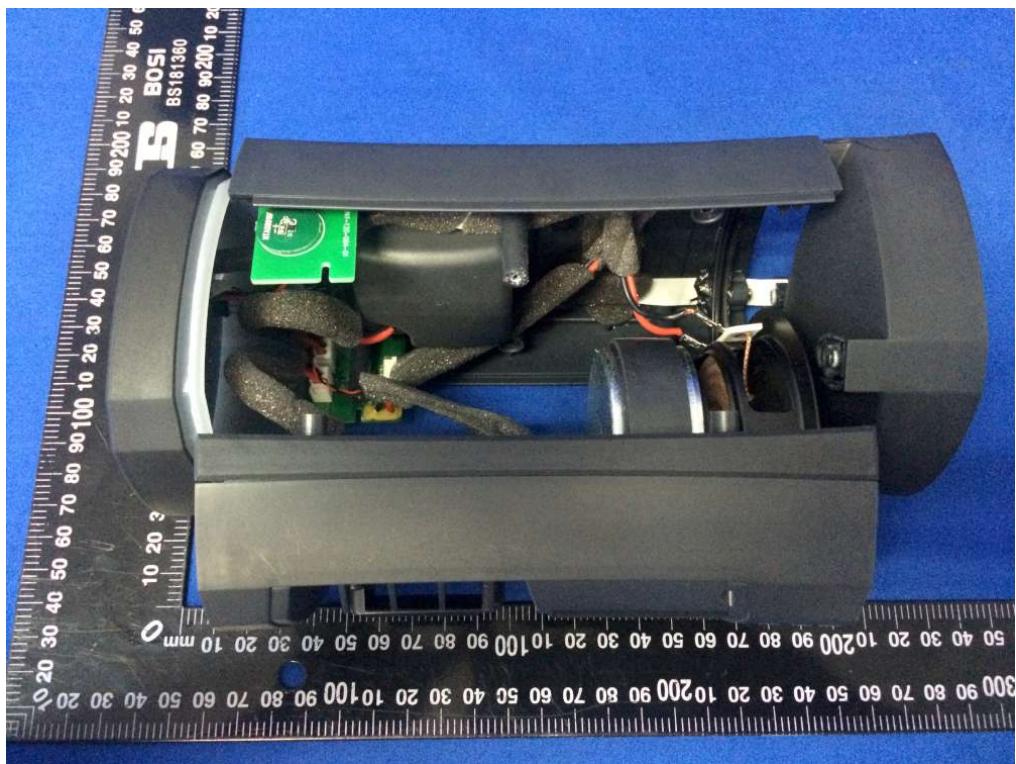
## 13. PHOTOGRAPHS OF THE EUT

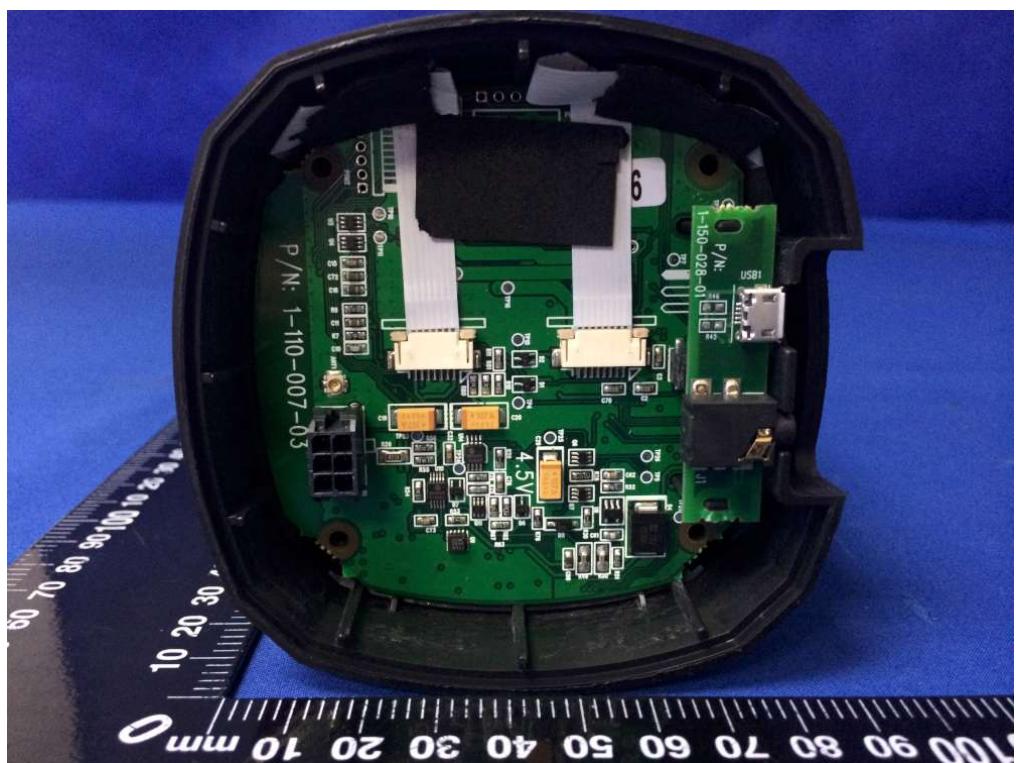


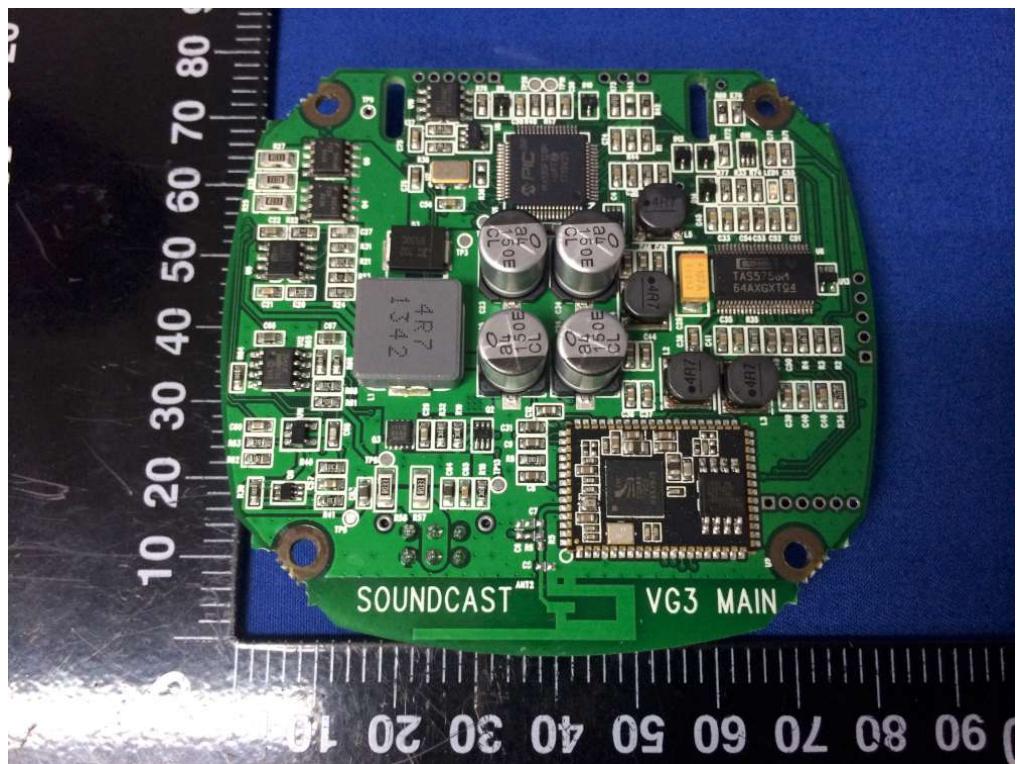
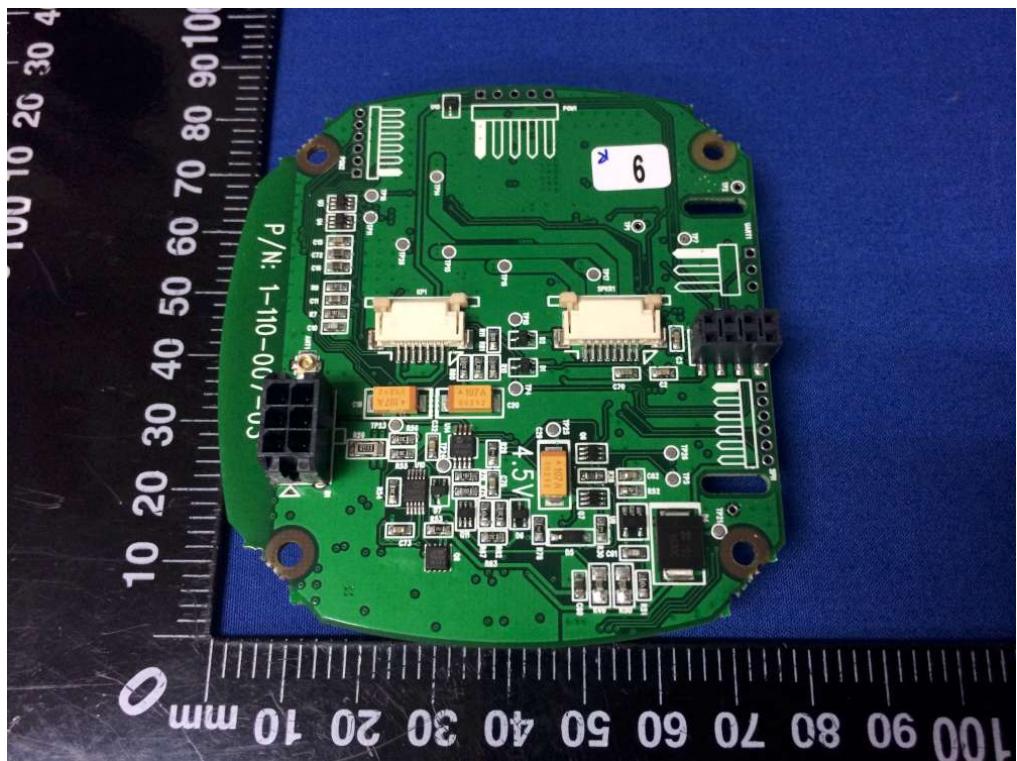


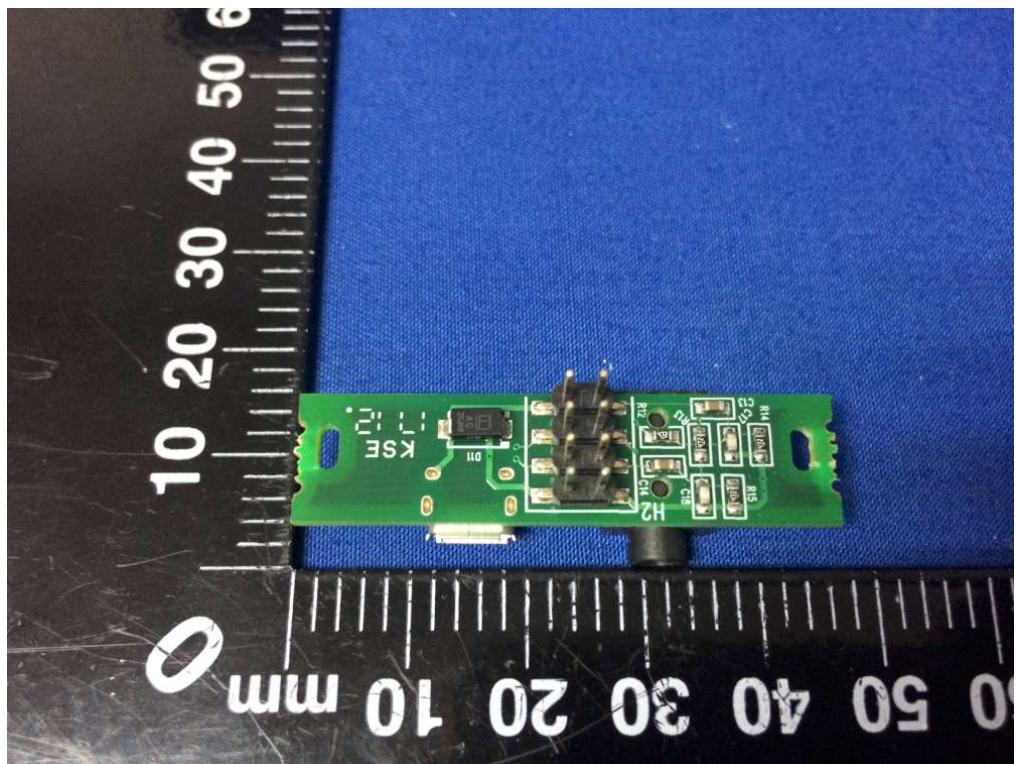
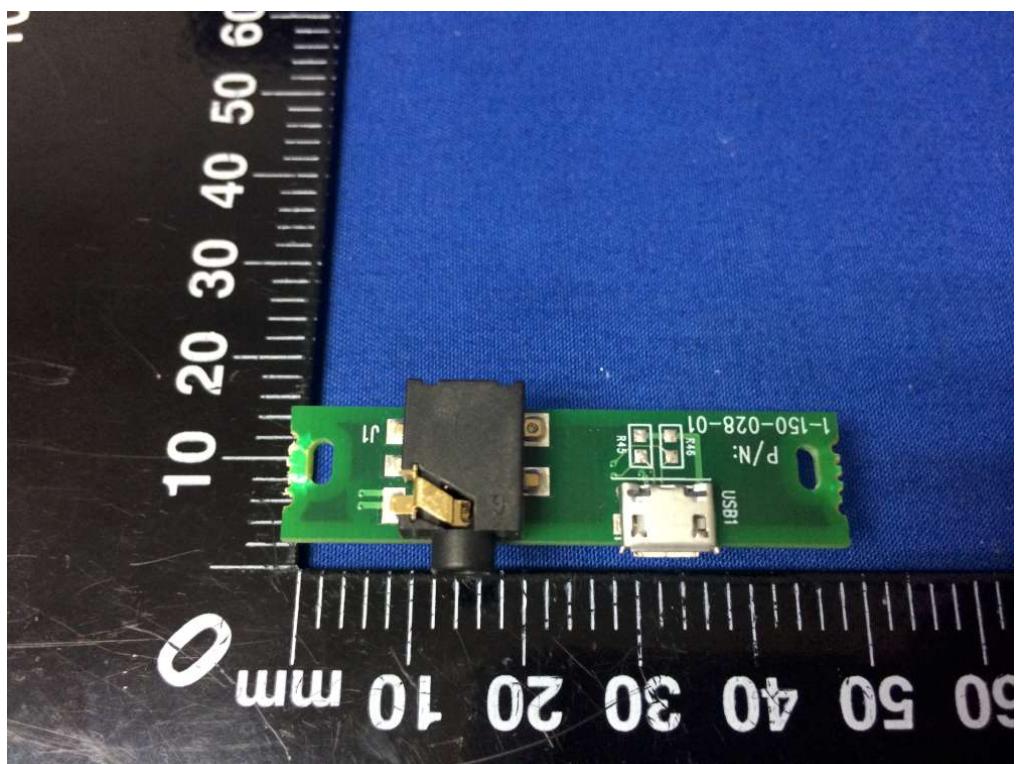


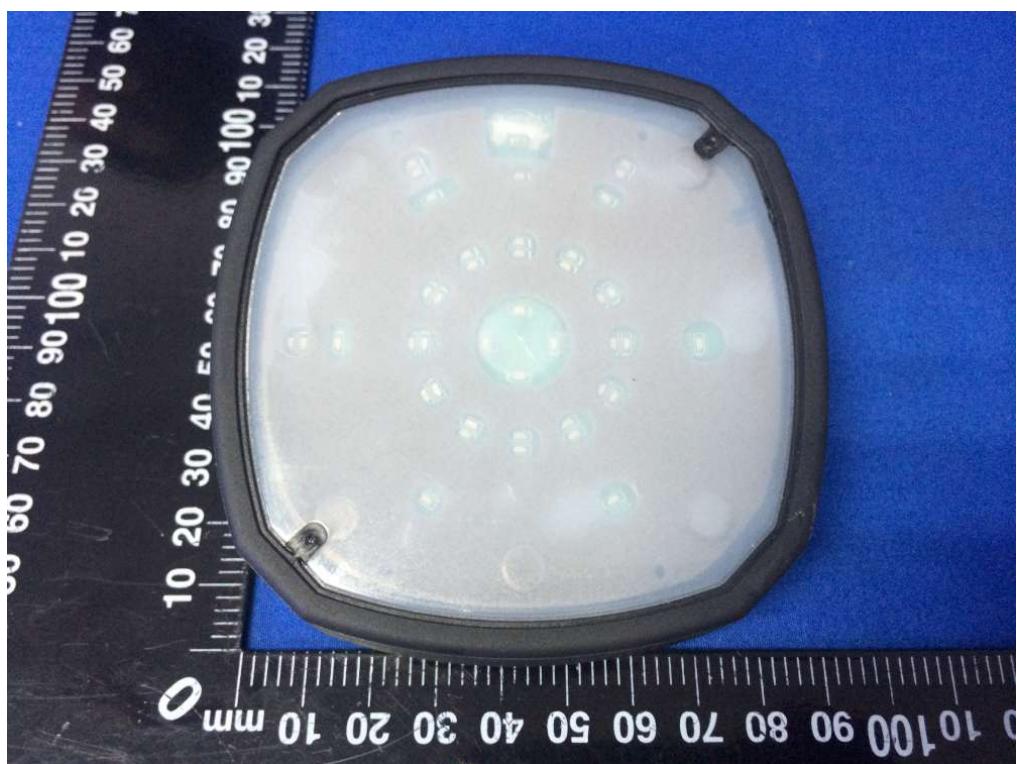


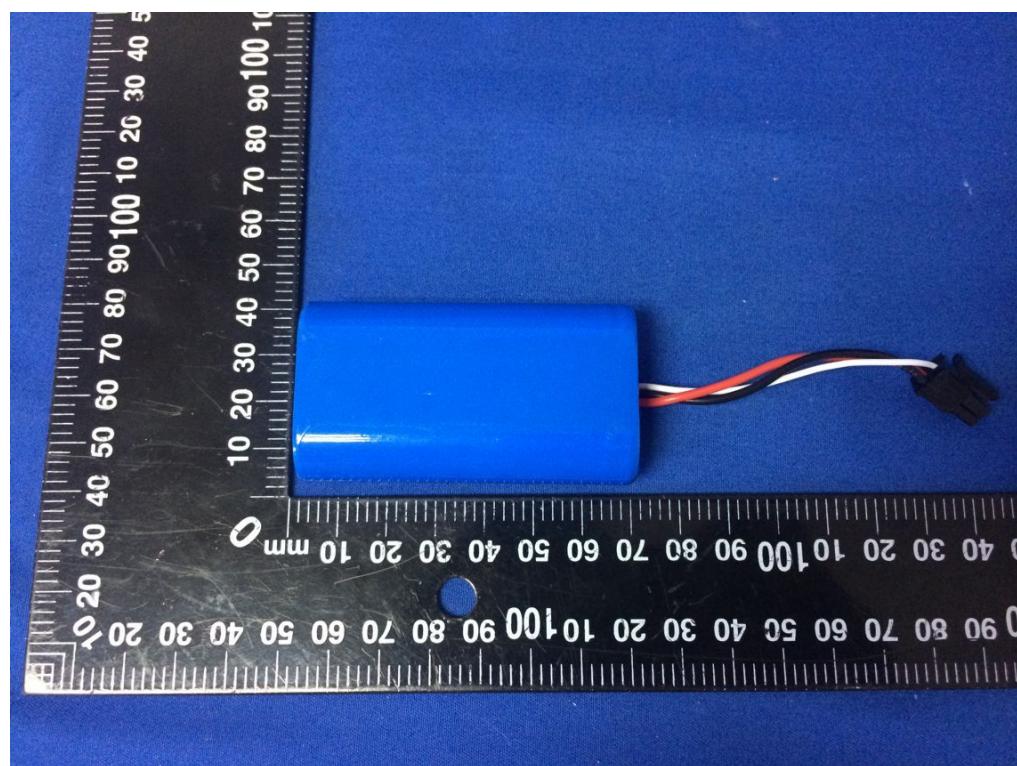
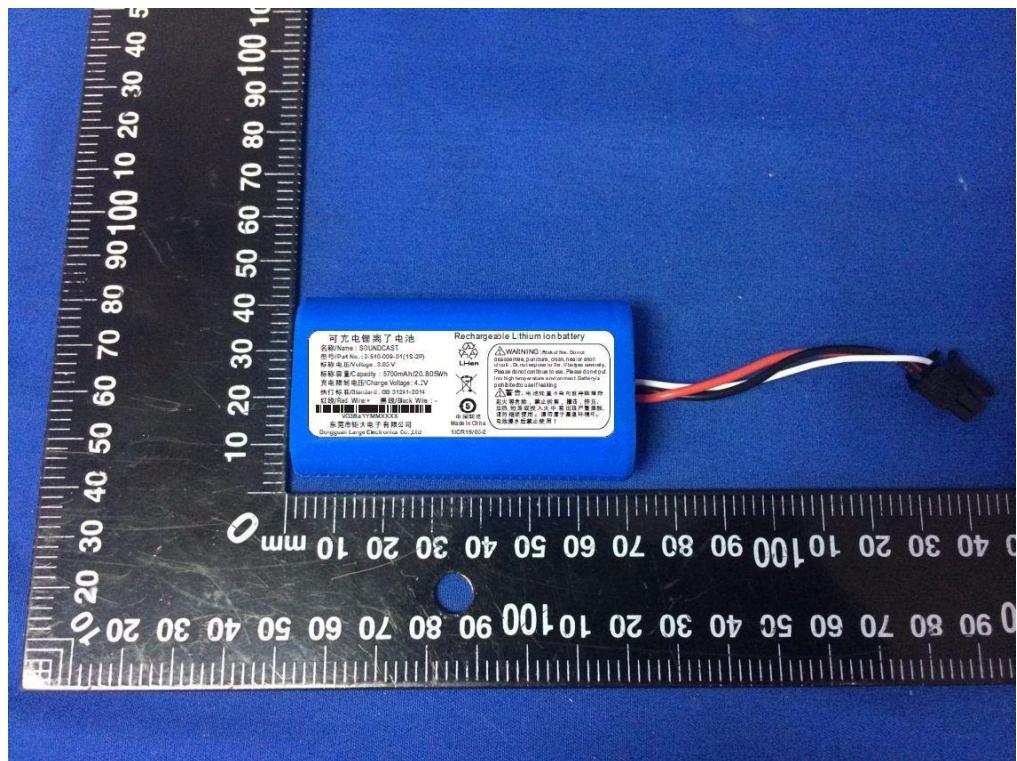












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