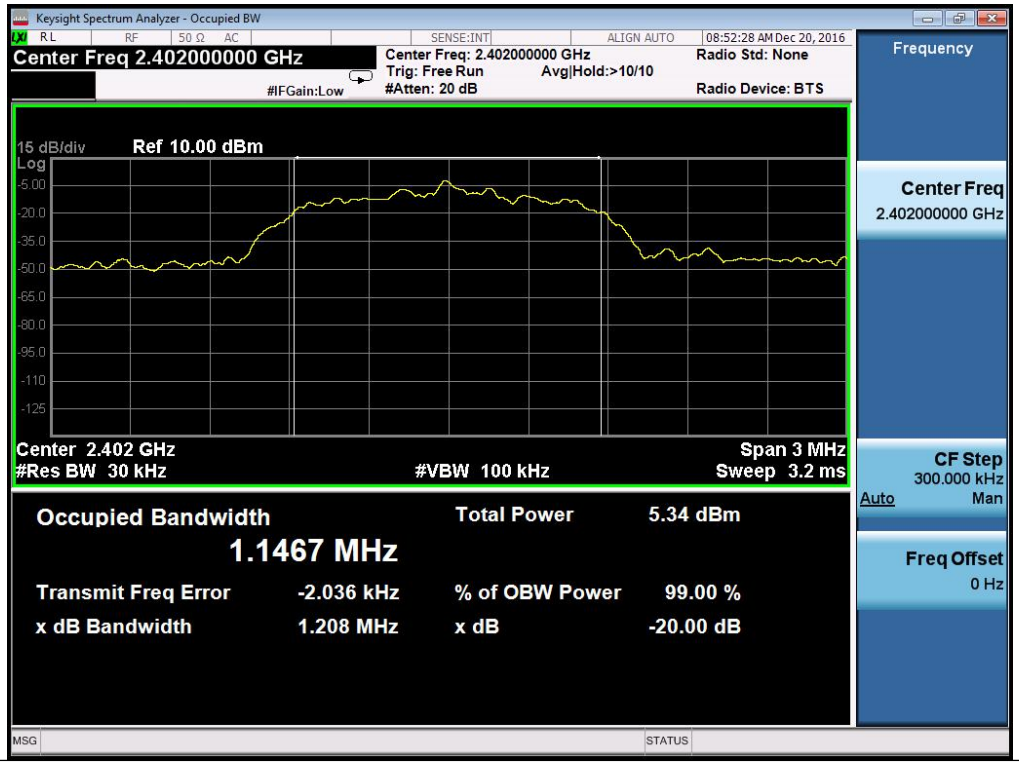
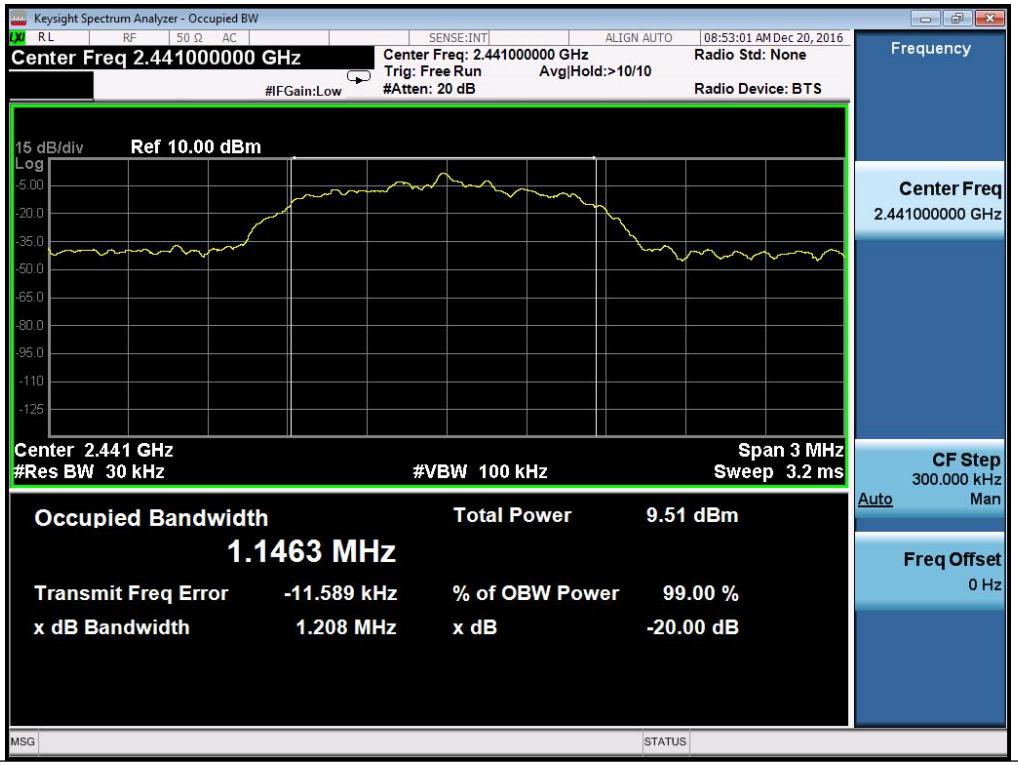
EUT :	Bluetooth Headphone	Model Name :	F8
Temperature :	25 ℃	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 3.7V
Test Mode :	CH00 / CH39 /CH78**(3Mbps)**		

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.208	**PASS**
2441 MHz	1.208	**PASS**
2480 MHz	1.210	**PASS**

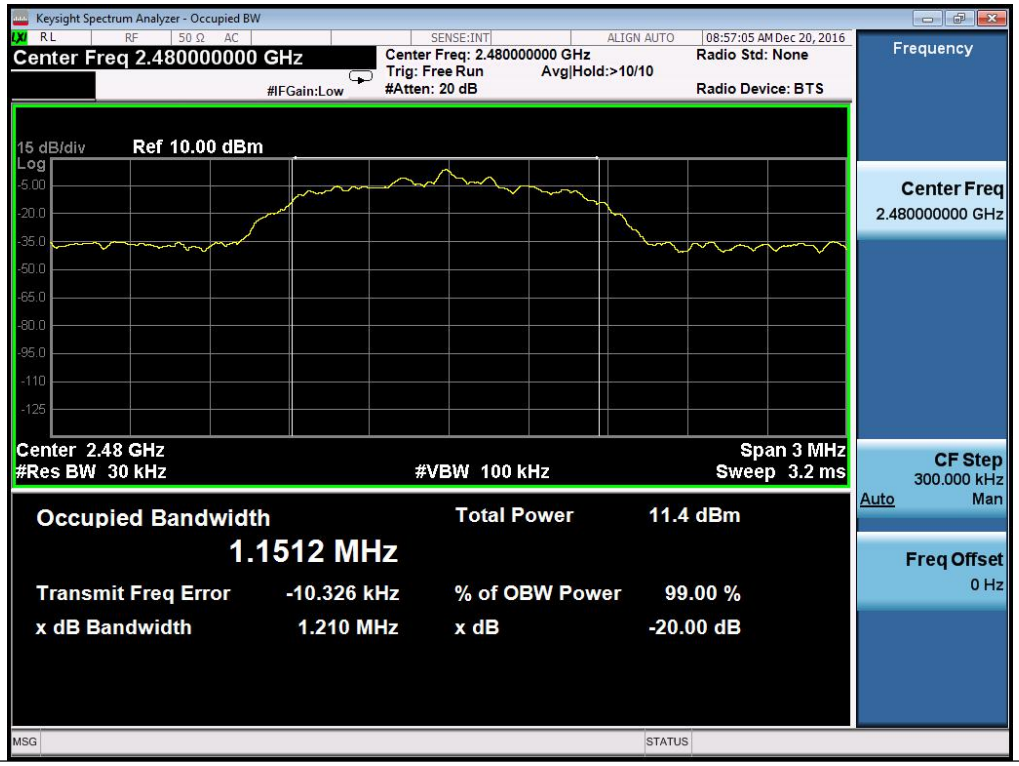
CH00



CH39


Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
08:53:01 AM Dec 20, 2016
Center Freq 2.441000000 GHz
Center Freq: 2.441000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
Frequency
15 dB/div
Ref 10.00 dBm
Log
-5.00
-20.0
-35.0
-50.0
-65.0
-80.0
-95.0
-110
-125
Center 2.441 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.1463 MHz
Total Power
9.51 dBm
Transmit Freq Error
-11.589 kHz
% of OBW Power
99.00 %
x dB Bandwidth
1.208 MHz
x dB
-20.00 dB
Center Freq
2.441000000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

CH78


Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
08:57:05 AM Dec 20, 2016
Center Freq 2.480000000 GHz
Center Freq: 2.480000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 20 dB
Radio Std: None
Radio Device: BTS
Frequency
15 dB/div
Ref 10.00 dBm
Log
-5.00
-20.0
-35.0
-50.0
-65.0
-80.0
-95.0
-110
-125
Center 2.48 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 3 MHz
Sweep 3.2 ms
Occupied Bandwidth
1.1512 MHz
Total Power
11.4 dBm
Transmit Freq Error
-10.326 kHz
% of OBW Power
99.00 %
x dB Bandwidth
1.210 MHz
x dB
-20.00 dB
Center Freq
2.480000000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz
MSG
STATUS

7. FREQUENCY SEPARATION

7.1. Limits

According to FCC Section 15.247(a)(1), 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 setup

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

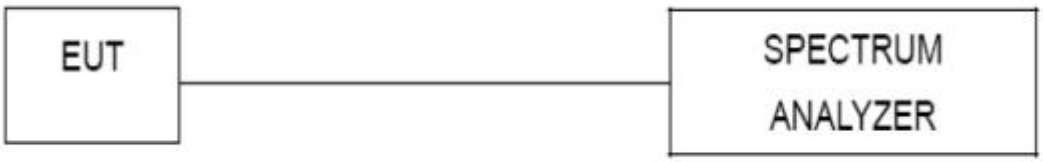
RBW ≥1% of the span(30KHz)

VBW ≥ RBW(100KHz)

Sweep=auto

Detector function=peak

Trace=max hold



Test data:

EUT :	Bluetooth Headphone	Model Name :	F8
Temperature :	24 ℃	Relative Humidity :	58%
Pressure :	1010hPa	Test Voltage :	DC 3.7V
Test Mode :	CH00 / CH39 /CH78**(1Mbps)**		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	1.000	908.8	**Complies**
2441 MHz	1.004	857.2	**Complies**
2480 MHz	0.996	869.8	**Complies**

Ch. Separation Limits: > 20dB bandwidth
Test plot as follows:

CH00

CH39

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.441500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:25:29 AM Dec 20, 2016
ΔMkr1 -1.000 MHz
-0.061 dB
10 dB/div
Log
Ref 10.00 dBm
1Δ2
X2
Center 2.441500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2.000 MHz
Sweep 2.133 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.441500000 GHz
Start Freq
2.440500000 GHz
Stop Freq
2.442500000 GHz
CF Step
200.000 kHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin
MSG
STATUS

CH78

Keysight Spectrum Analyzer - Swept SA
Center Freq 2.479500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
09:26:09 AM Dec 20, 2016
ΔMkr1 -1.000 MHz
-0.030 dB
10 dB/div
Log
Ref 10.00 dBm
1Δ2
X2
Center 2.479500 GHz
#Res BW 30 kHz
#VBW 100 kHz
Span 2.000 MHz
Sweep 2.133 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.479500000 GHz
Start Freq
2.478500000 GHz
Stop Freq
2.480500000 GHz
CF Step
200.000 kHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin
MSG
STATUS

EUT :	Bluetooth Headphone	Model Name :	F8
Temperature :	24 ℃	Relative Humidity :	58%
Pressure :	1010 hPa	Test Voltage :	DC 3.7V
Test Mode :	CH00 / CH39 /CH78**(2Mbps)**		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	1.000	802.667	**Complies**
2441 MHz	1.003	813.333	**Complies**
2480 MHz	1.000	814.000	**Complies**

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

CH00 -2Mbps

CH39 -2Mbps

CH78 -2Mbps

EUT :	Bluetooth Headphone	Model Name :	F8
Temperature :	24 ℃	Relative Humidity :	58%
Pressure :	1010 hPa	Test Voltage :	DC 3.7V
Test Mode :	CH00 / CH39 /CH78**(3Mbps)**		

Frequency	Ch. Separation (MHz)	Limit (KHz)	Result
2402 MHz	1.003	805.333	Complies
2441 MHz	1.000	805.333	Complies
2480 MHz	1.000	806.667	Complies

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

CH00 -3Mbps

CH39 -3Mbps

CH78 -3Mbps

8. NUMBER OF HOPPING FREQUENCY

8.1. Limits

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

8.2. Test setup

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

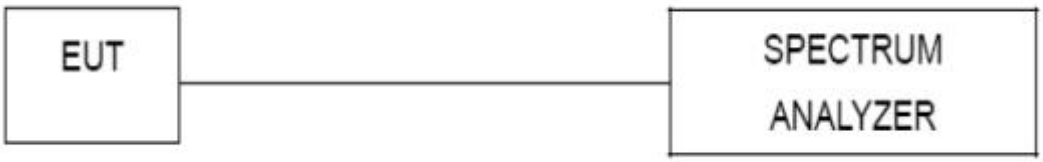
RBW =100KHz

VBW=300KHz

Sweep=auto

Detector function=peak

Trace=max hold

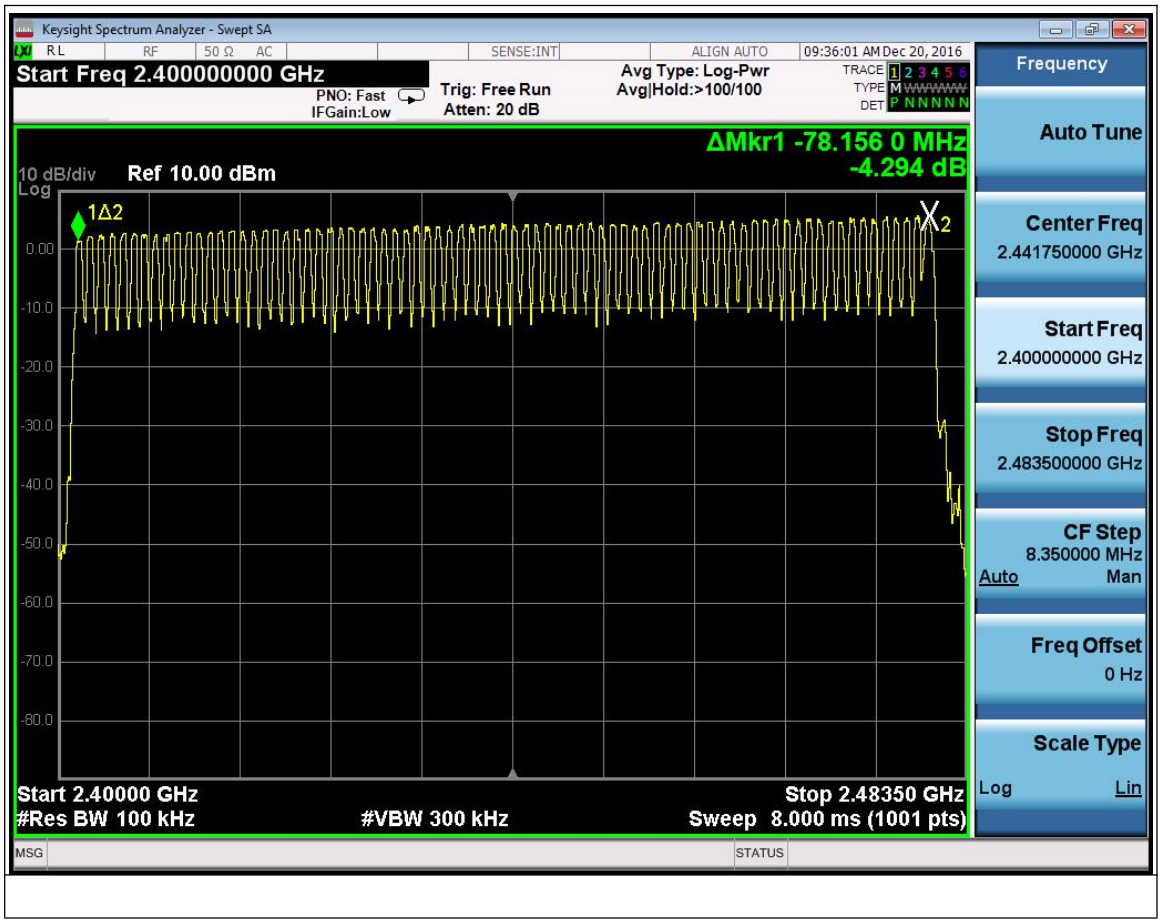


EUT :	Bluetooth Headphone	Model Name :	F8
Temperature :	24 ℃	Relative Humidity :	58%
Pressure :	1010 hPa	Test Voltage :	DC 3.7V
Test Mode :	1M		

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), 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 setup

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.

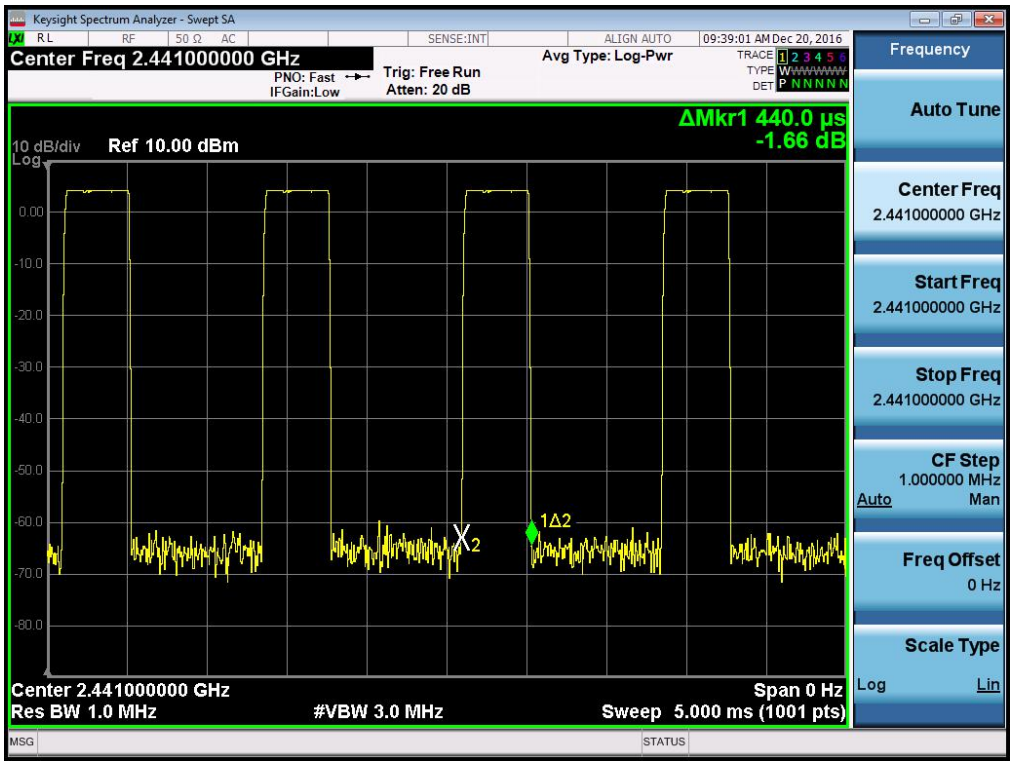
A Period Time = (channel number)*0.4
DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)
DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)
DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)
For Example:
BT hopping rate is 1600 hops/s with 6 slots in 79 hopping channels.
With channel hopping 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

Test data:

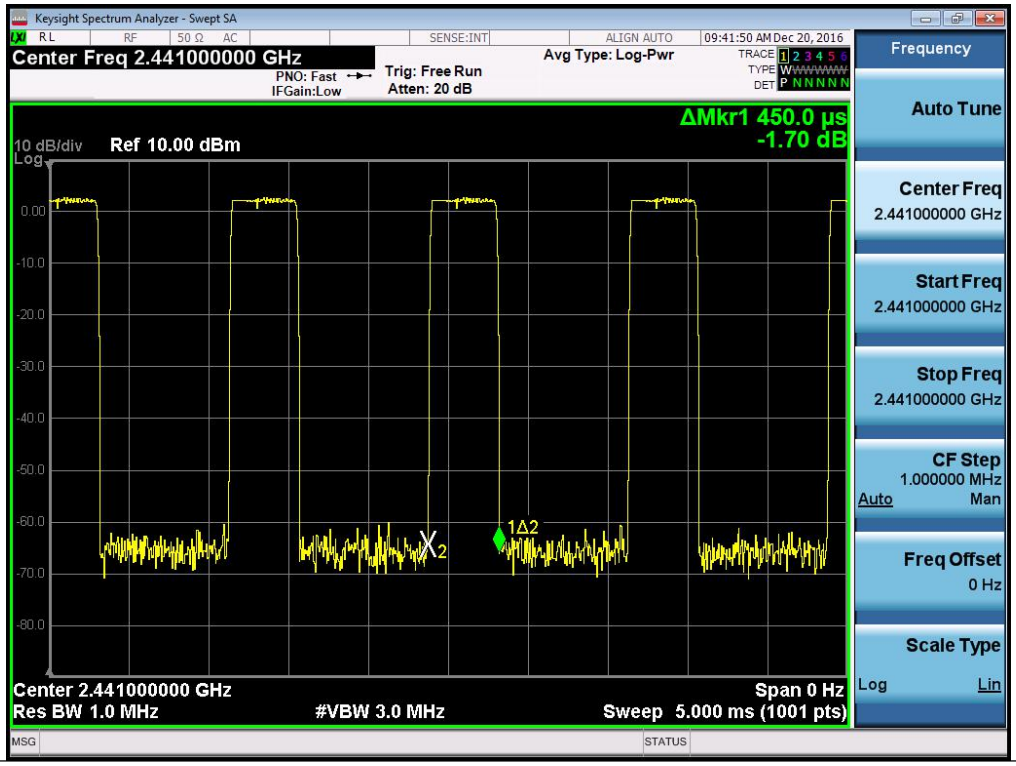
Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH1	2441 MHz	0.530	0.14	0.4
2DH1	2441 MHz	0.545	0.14	0.4
3DH1	2441 MHz	0.545	0.14	0.4

Test plot as follows as below:

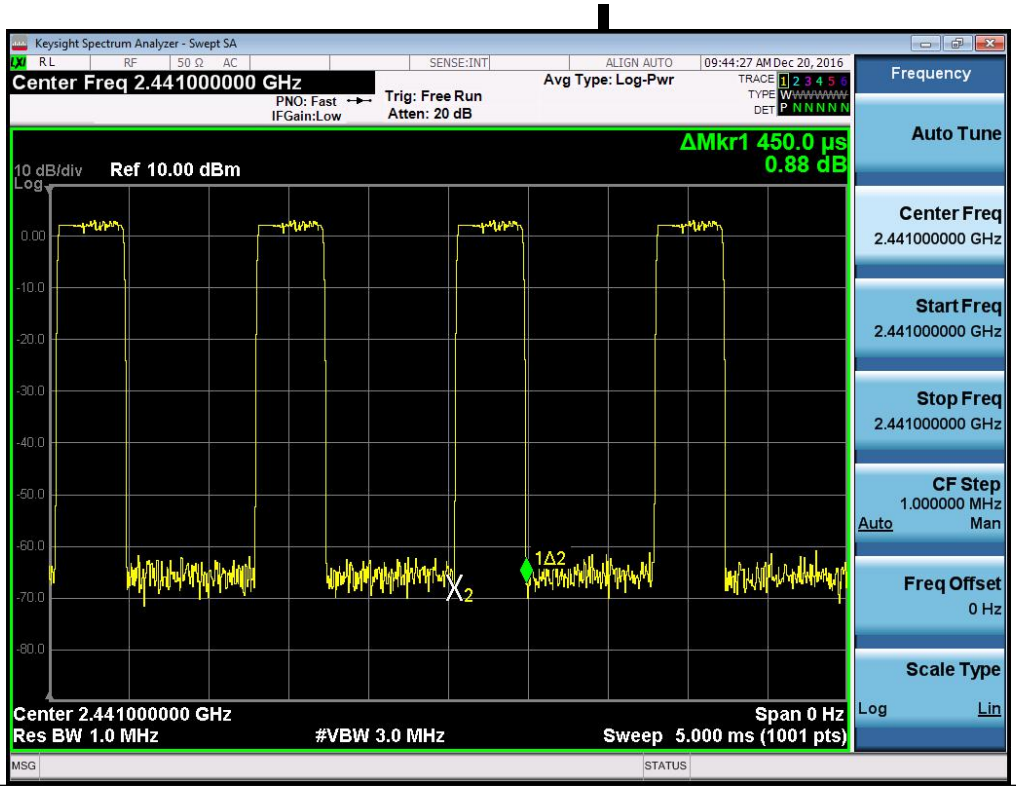
CH39-DH1



CH39-2DH1

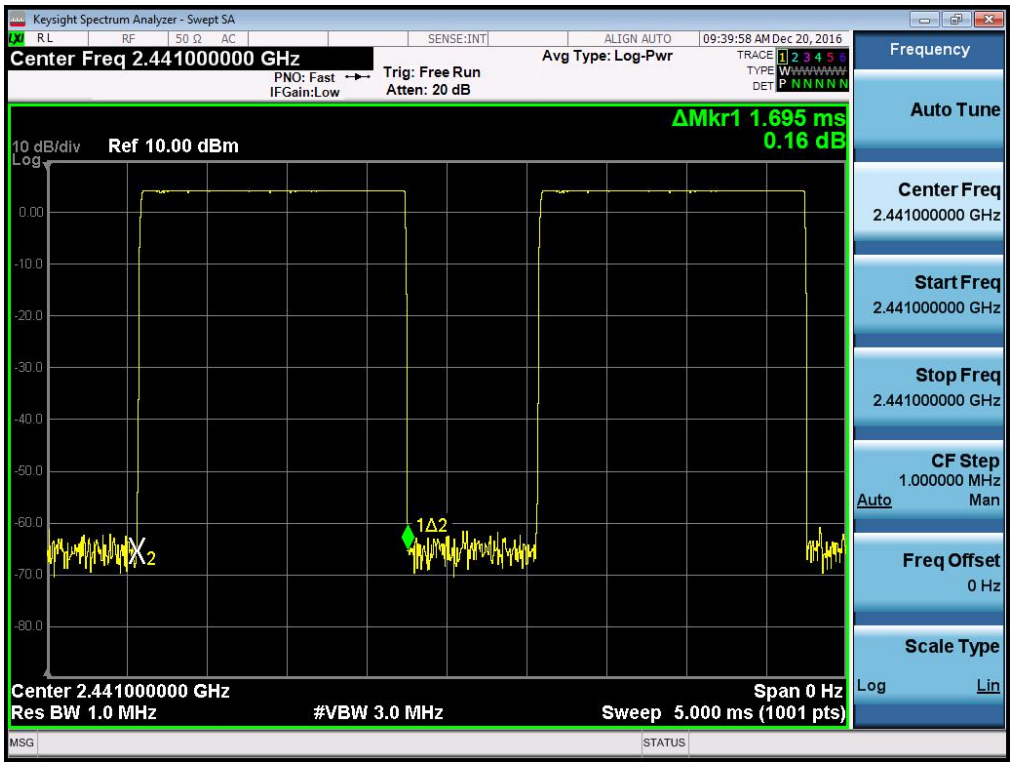


CH39-3DH1

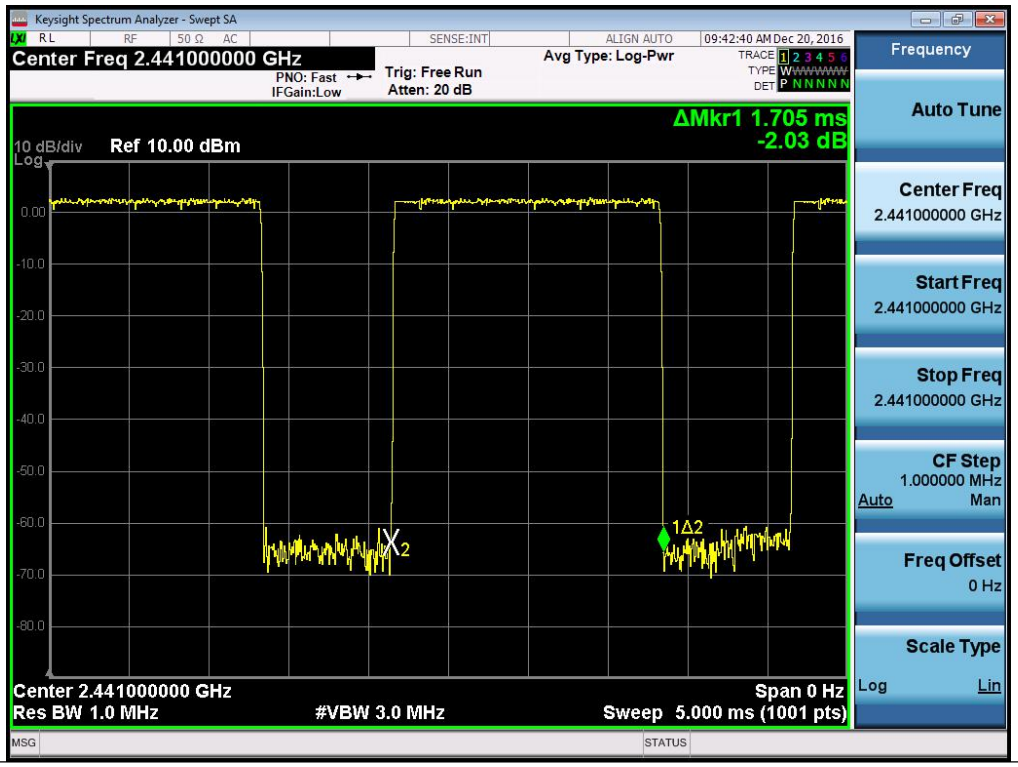


Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH3	2441 MHz	1.79	0.27	0.4
2DH3	2441 MHz	1.80	0.27	0.4
3DH3	2441 MHz	1.79	0.27	0.4

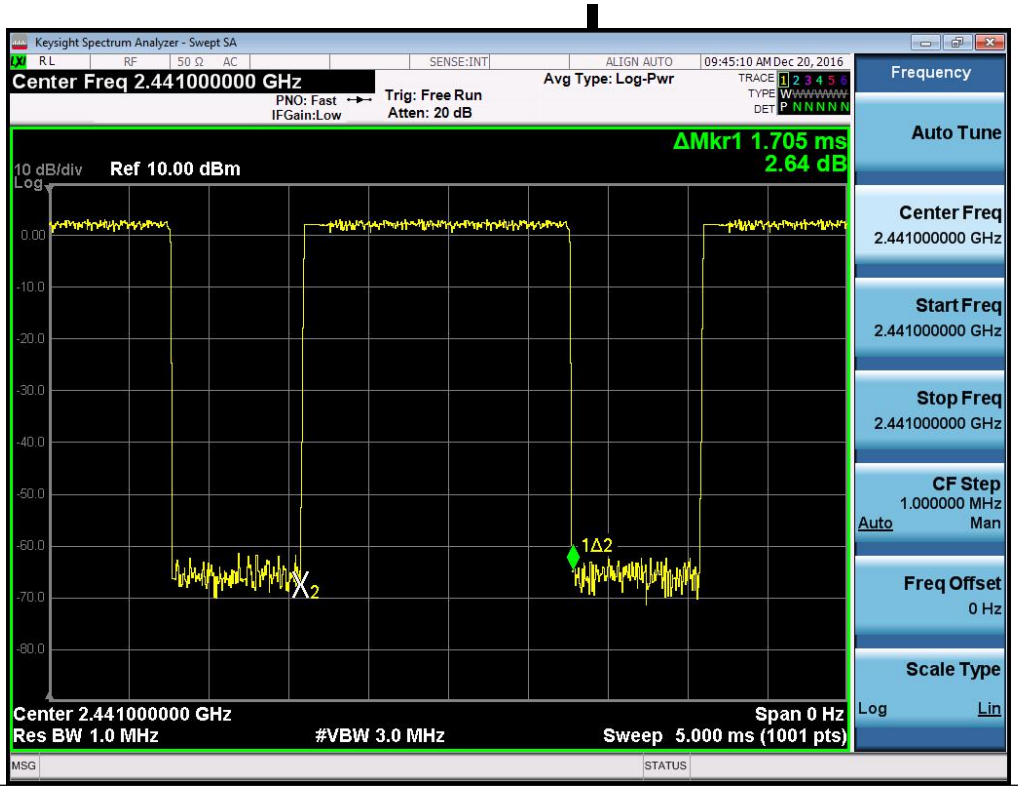
CH39-DH3



CH39-2DH3

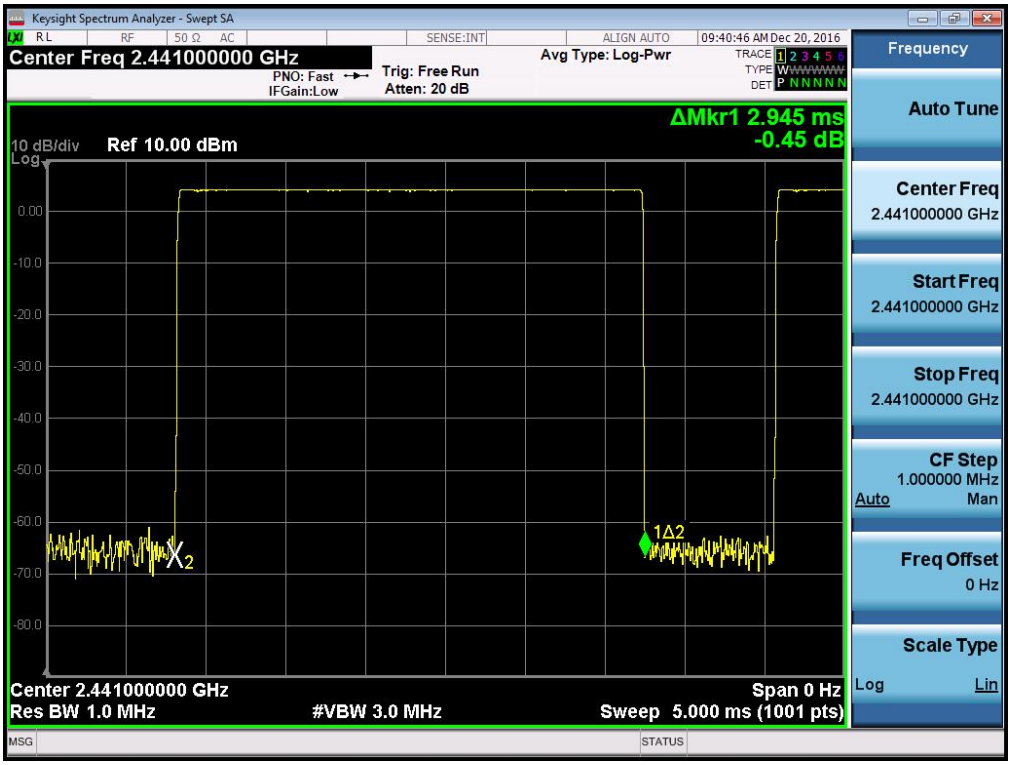


CH39-3DH3

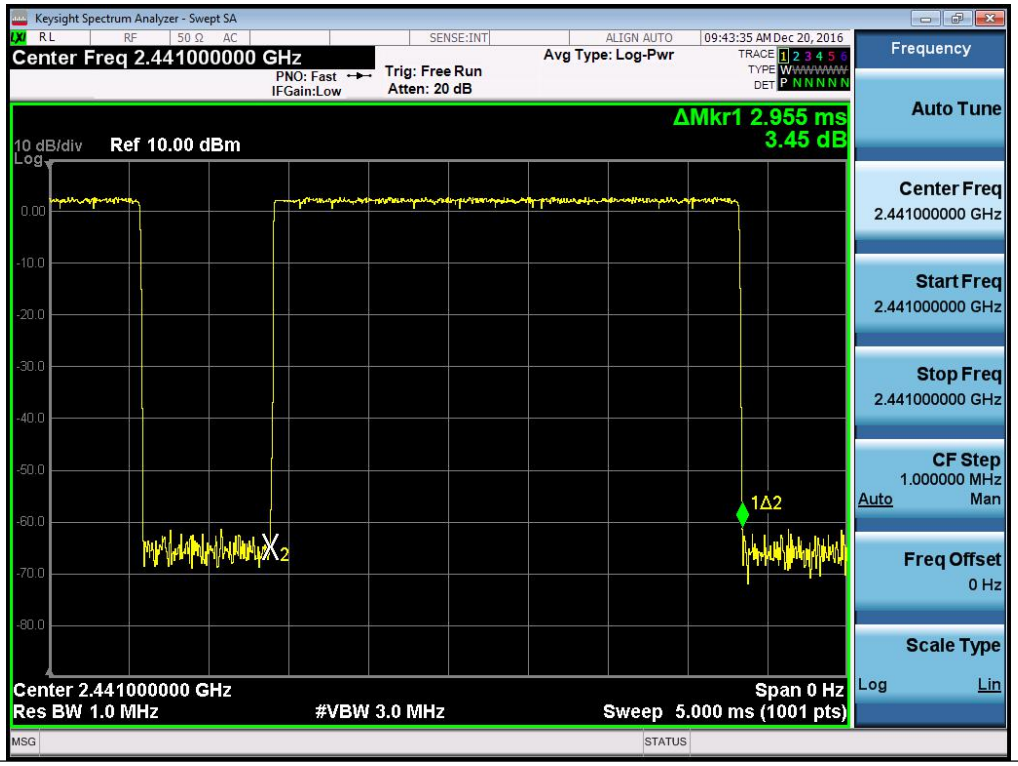


Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
		(ms)	(s)	(s)
DH5	2441 MHz	3.04	0.31	0.4
2DH5	2441 MHz	3.04	0.32	0.4
3DH5	2441 MHz	3.05	0.32	0.4

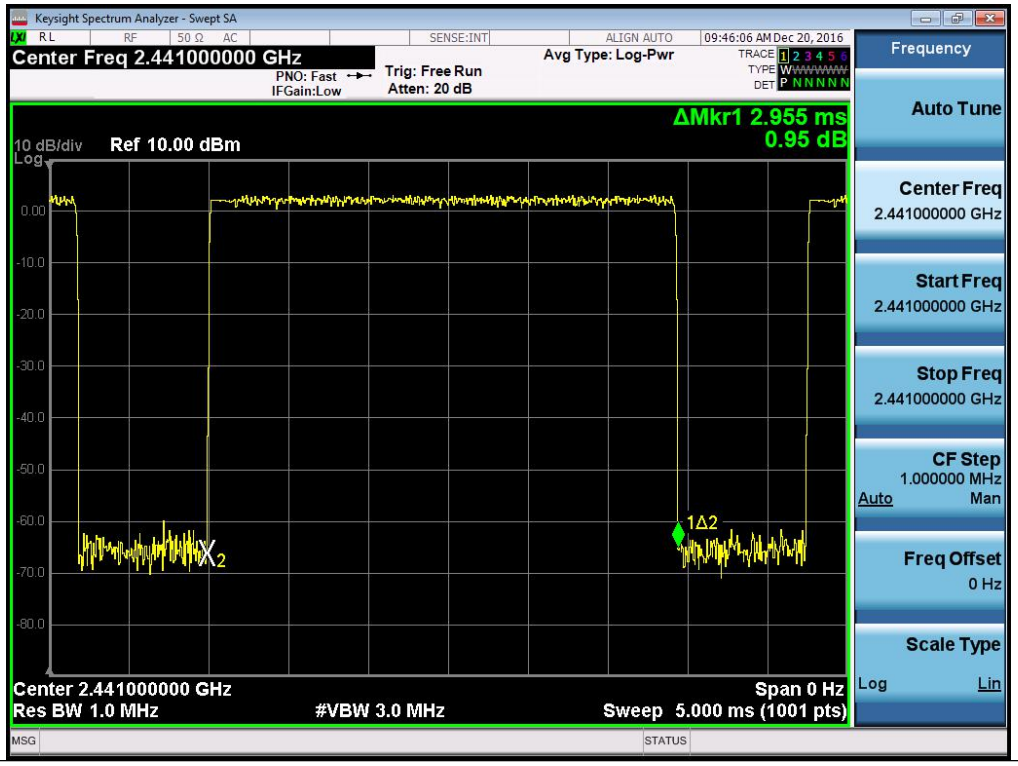
CH39-DH5



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.

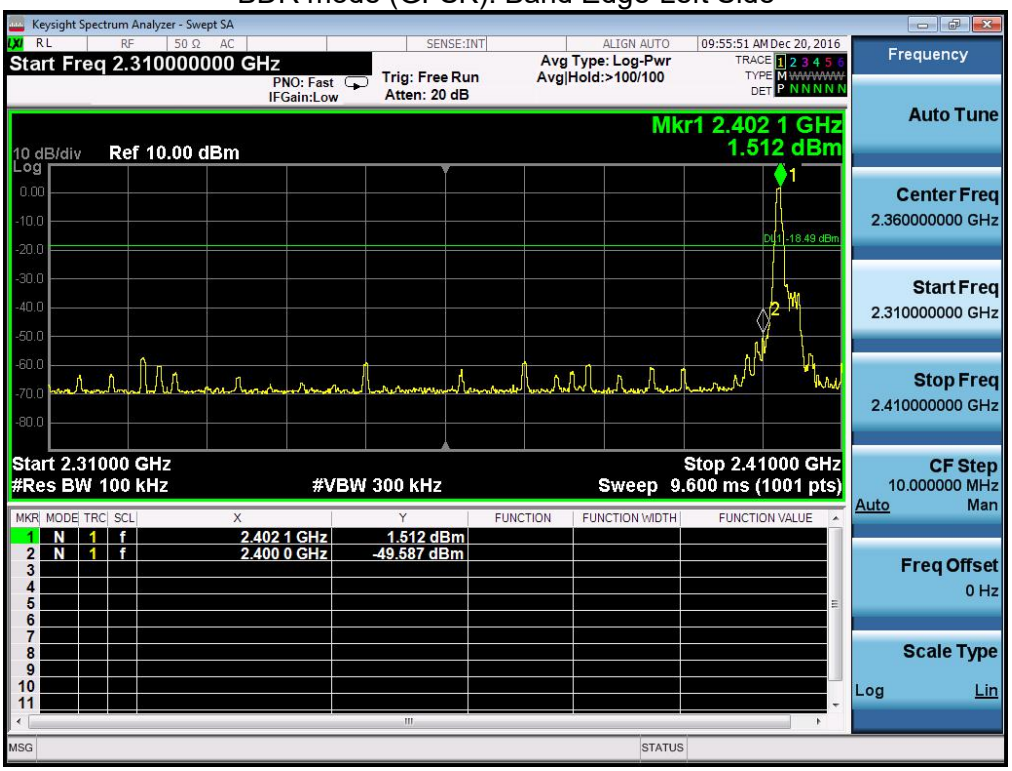
d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

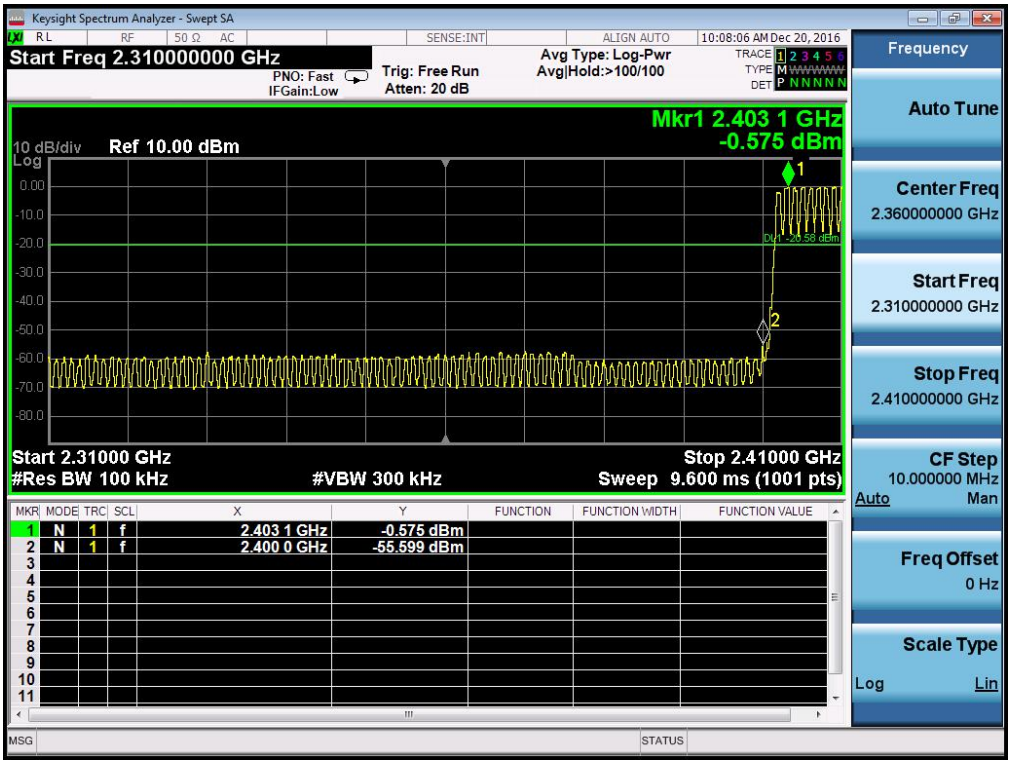
e) Repeat above procedures until all measured frequencies were complete.

For conducted test:

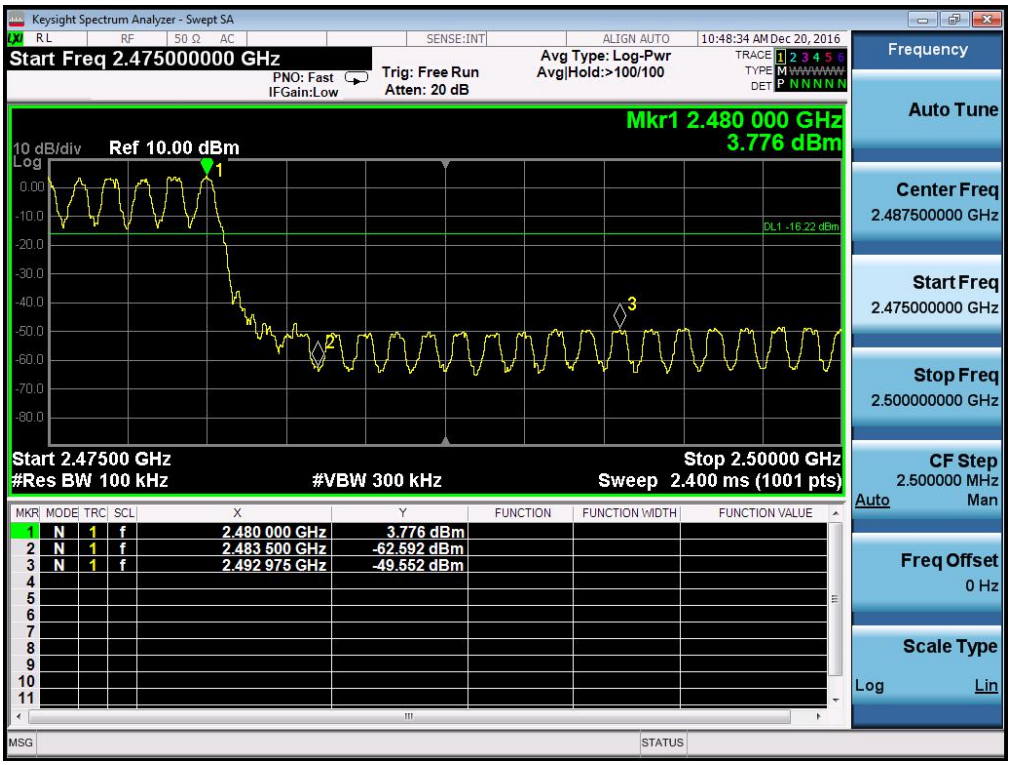
Frequency Band	Delta Peak to band emission (dBc)	> Limit (dBc)	Result
GFSK Non-hopping			
Left Band	51.10	20	Pass
Right Band	56.55	20	Pass
π/4-DQPSK Non-hopping			
Left Band	52.42	20	Pass
Right Band	59.98	20	Pass
8DPSK Non-hopping			
Left Band	51.93	20	Pass
Right Band	58.28	20	Pass
GFSK hopping			
Left Band	55.02	20	Pass
Right Band	53.33	20	Pass
π/4-DQPSK hopping			
Left Band	56.00	20	Pass
Right Band	52.21	20	Pass
8DPSK hopping			
Left Band	59.48	20	Pass
Right Band	52.21	20	Pass

BDR mode (GFSK): Band Edge-Left Side

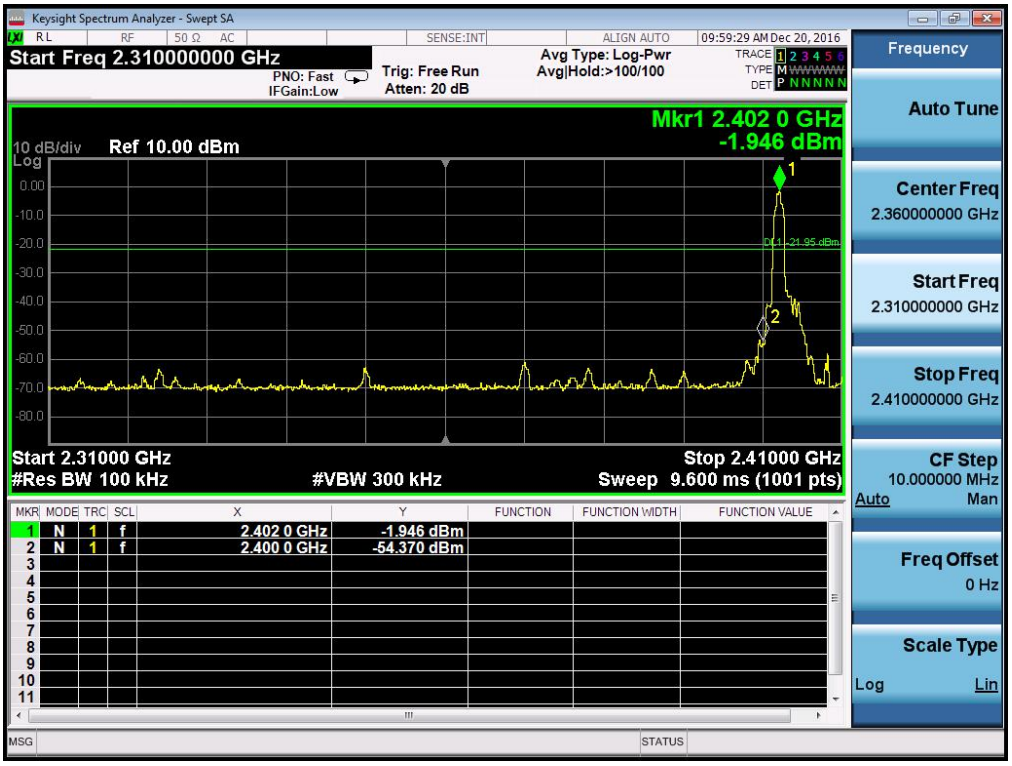


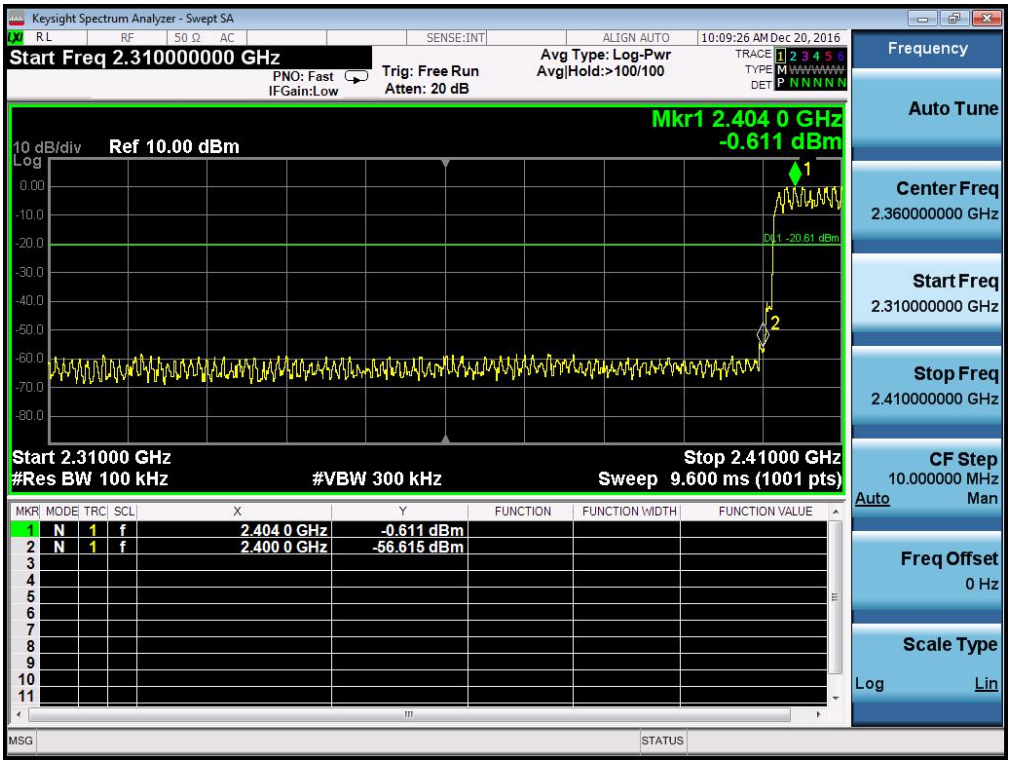


BDR mode (GFSK): Band Edge-Right Side

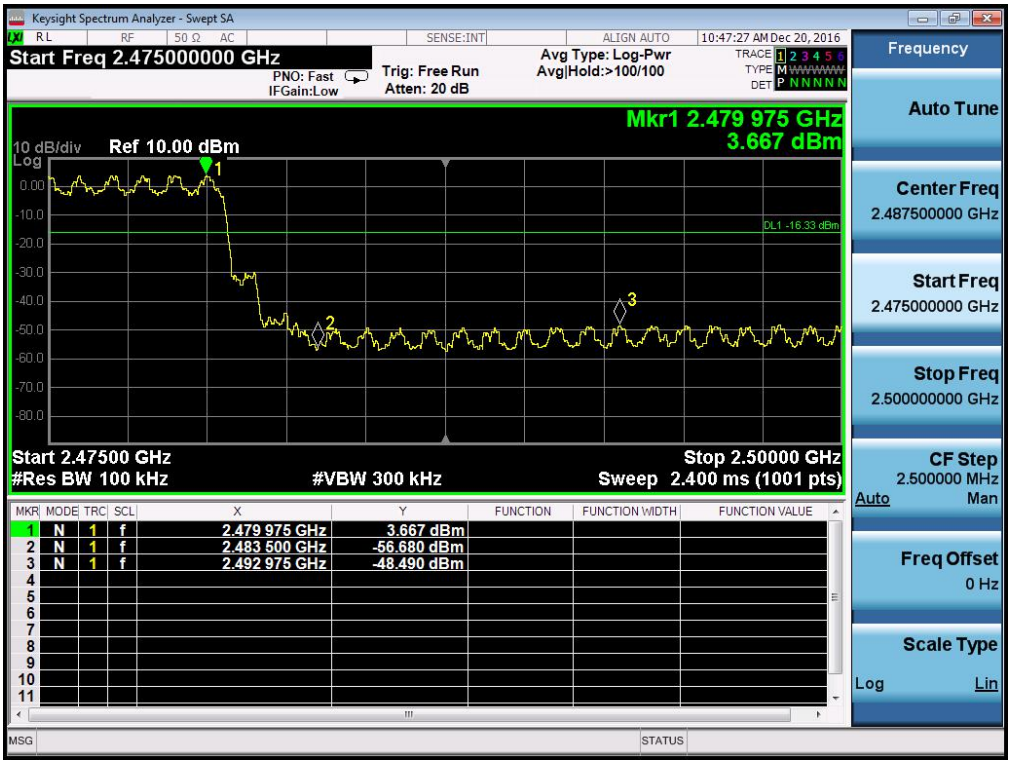


EDR mode (π/4-DQPSK): Band Edge-Left Side

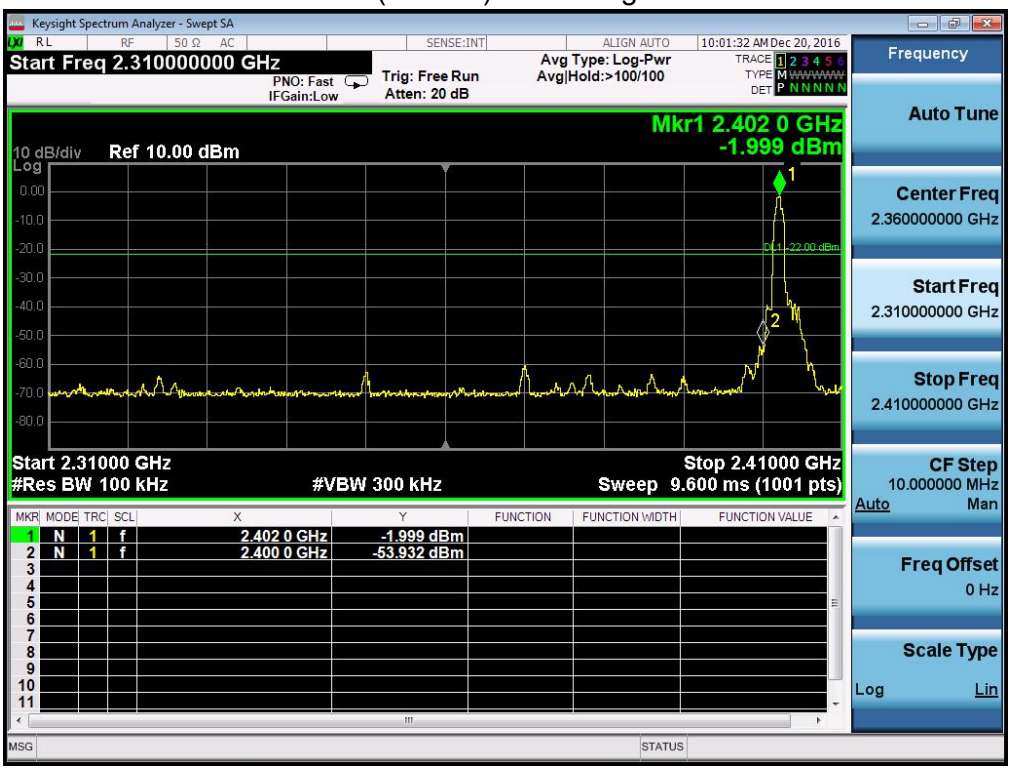


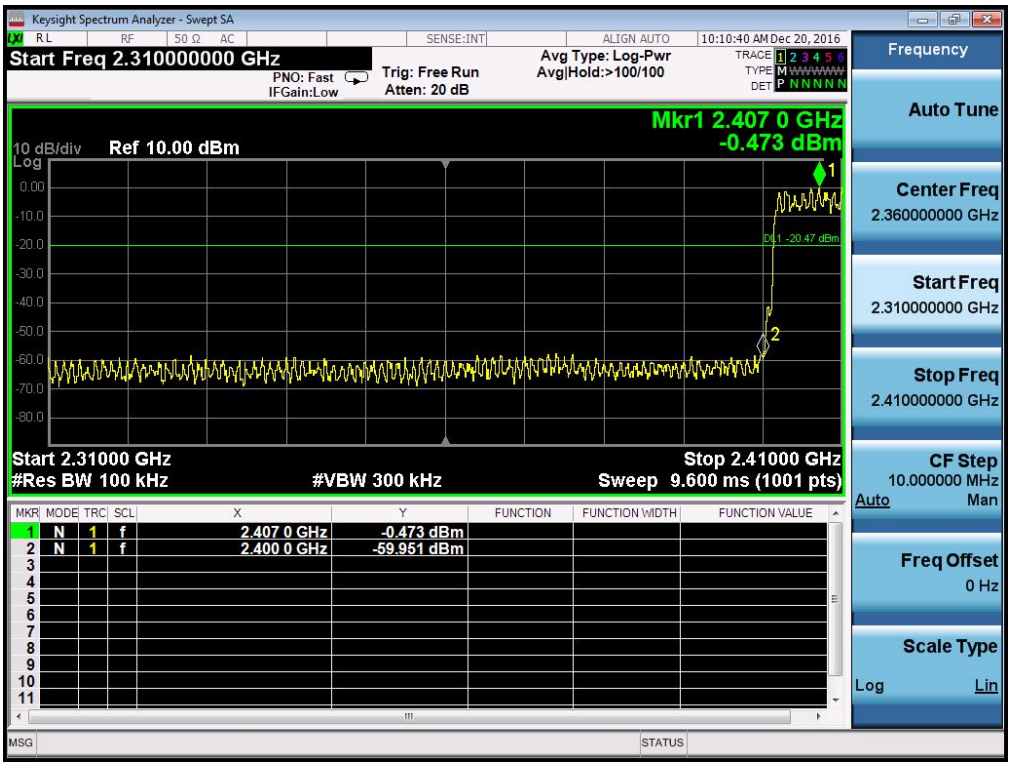


EDR mode (π/4-DQPSK): Band Edge- Right Side

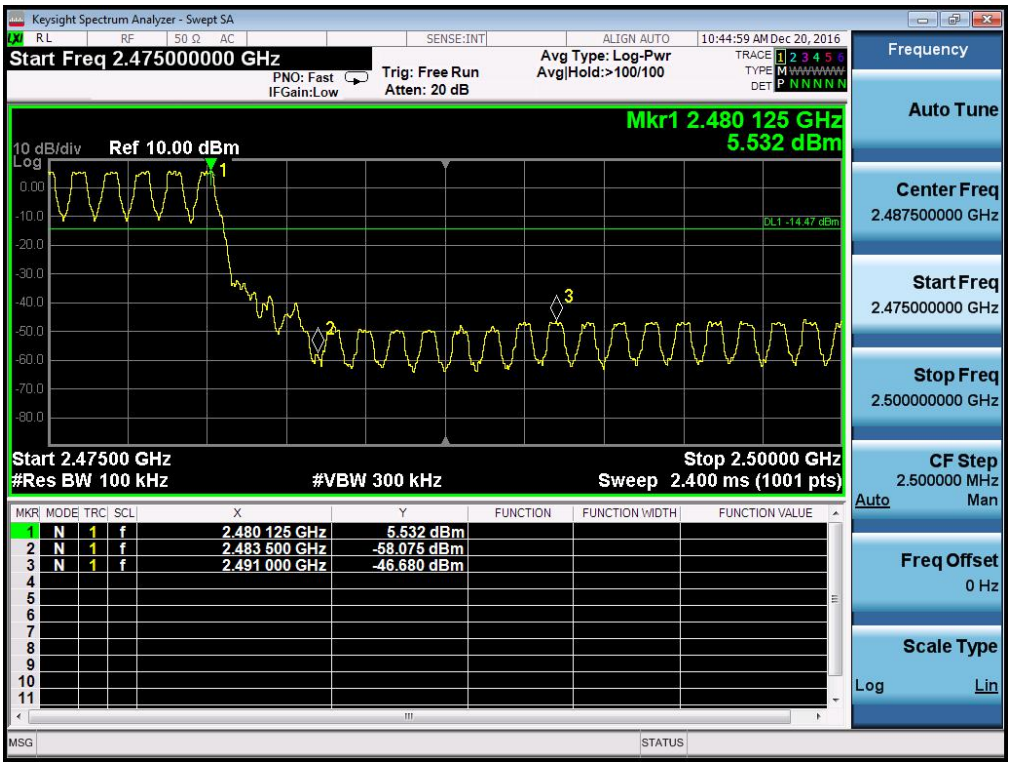


EDR mode(8DPSK): Band Edge-Left Side





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

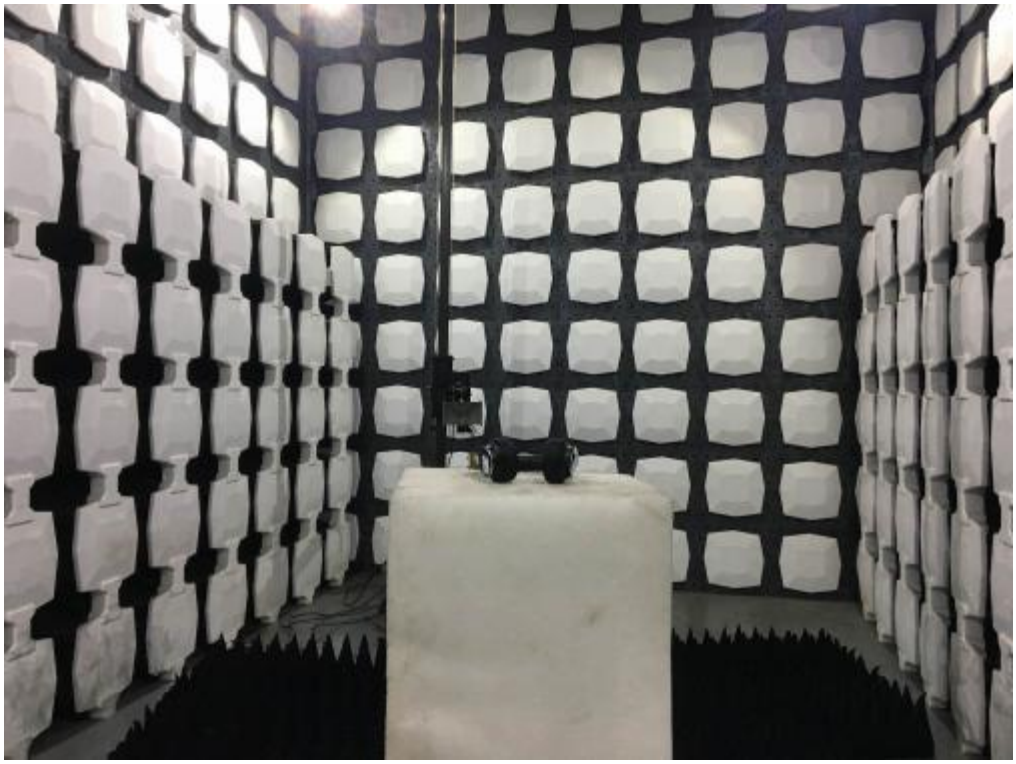
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional 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.

11.2. 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



Conducted Emission

13. PHOTOGRAPHS OF THE EUT

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------End------