

9. CONDUCTED BANDEGE MEASUREMENT

9.1 Test Setup



9.2 Test Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as TX operation and connect directly to the spectrum analyzer.
3. Based on FCC Part15 C Section 15.247: RBW=100KHz, VBW=300KHz.
4. Set detected by the spectrum analyzer with peak detector.

9.3 Limit

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 20dB.

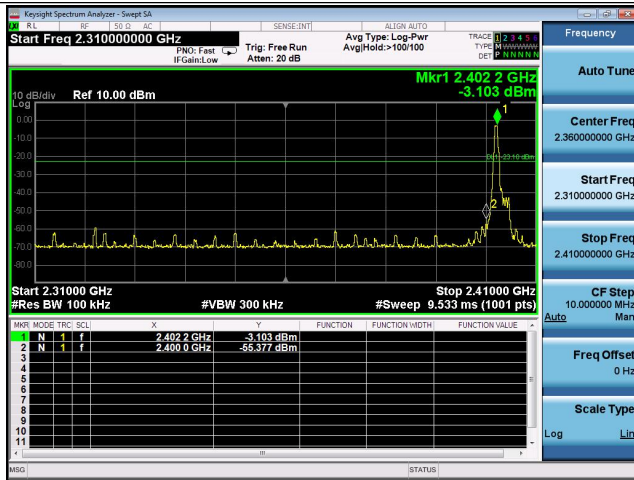
9.4 Test Result

PASS

Modulation		Frequency Band	Delta Peak to band emission (dBc)	> Limit (dBc)	Result
GFSK	Non-hopping	Left Band	52.27	20	Pass
		Right Band	61.21	20	Pass
	hopping	Left Band	55.92	20	Pass
		Right Band	48.98	20	Pass
$\pi/4$ DQPSK	Non-hopping	Left Band	52.64	20	Pass
		Right Band	58.32	20	Pass
	hopping	Left Band	55.95	20	Pass
		Right Band	60.00	20	Pass
8DPSK	Non-hopping	Left Band	52.20	20	Pass
		Right Band	58.68	20	Pass
	hopping	Left Band	59.33	20	Pass
		Right Band	59.02	20	Pass

GFSK

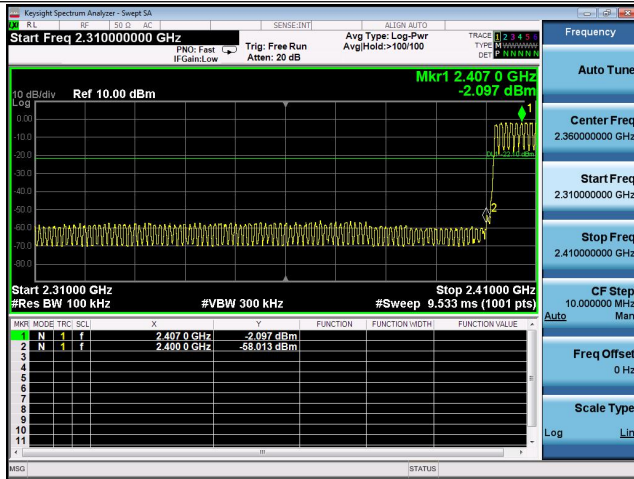
2402MHz



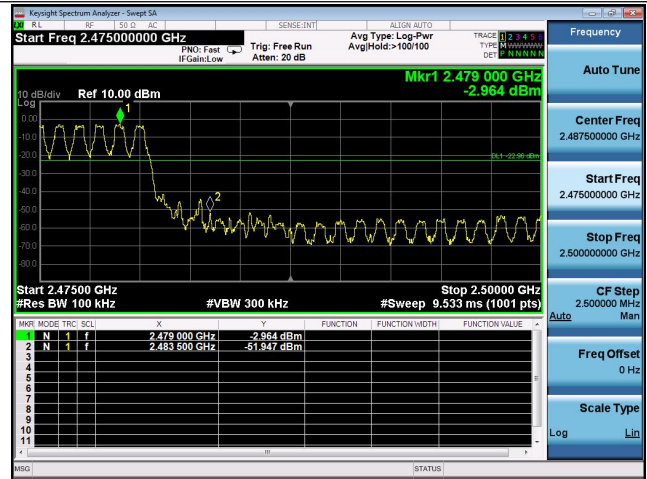
2480MHz



Hoping Off



Hoping Off



Hoping On

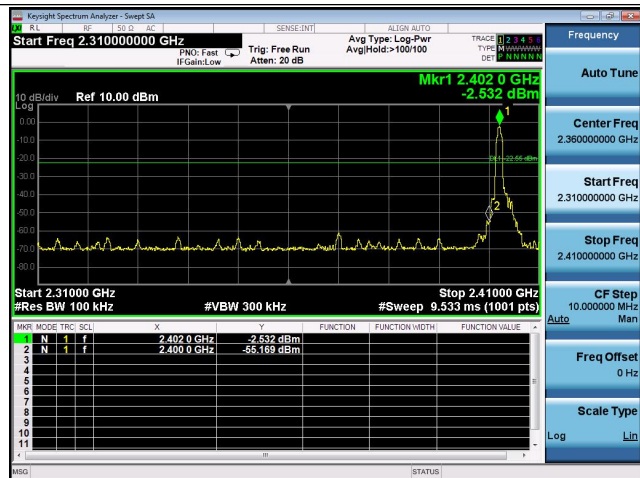


Hoping On



π /4DQPSK

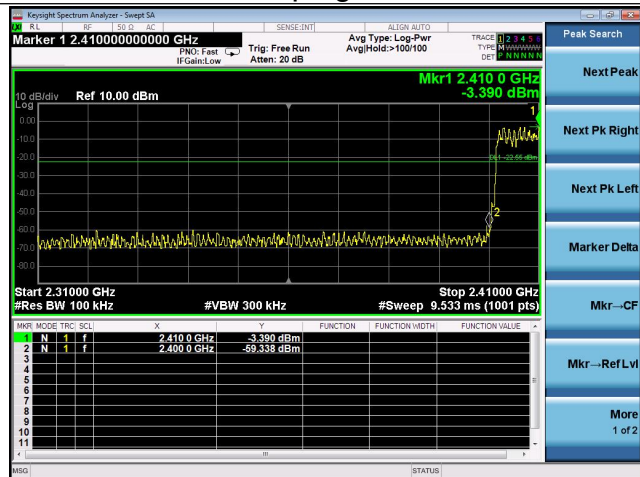
2402MHz



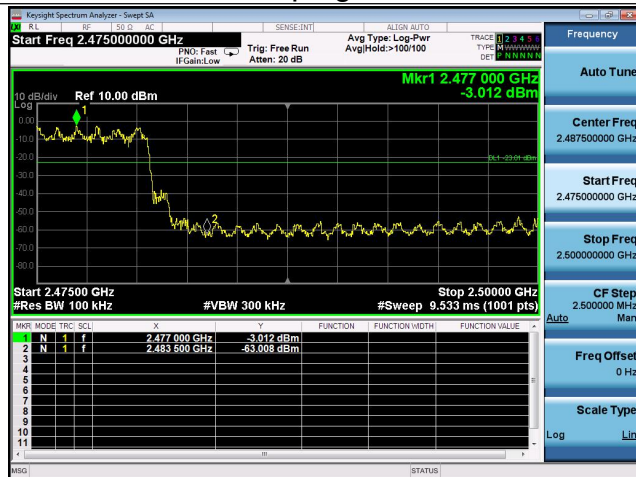
2480MHz



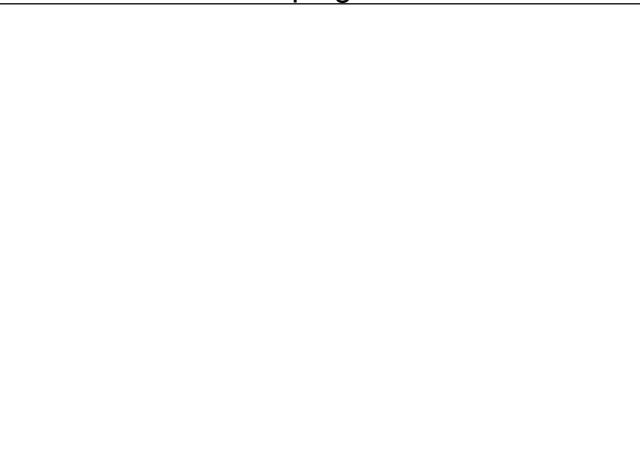
Hoping Off



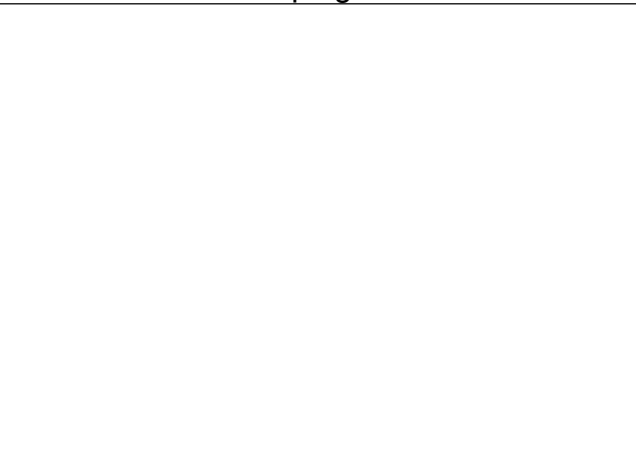
Hoping Off



Hoping On

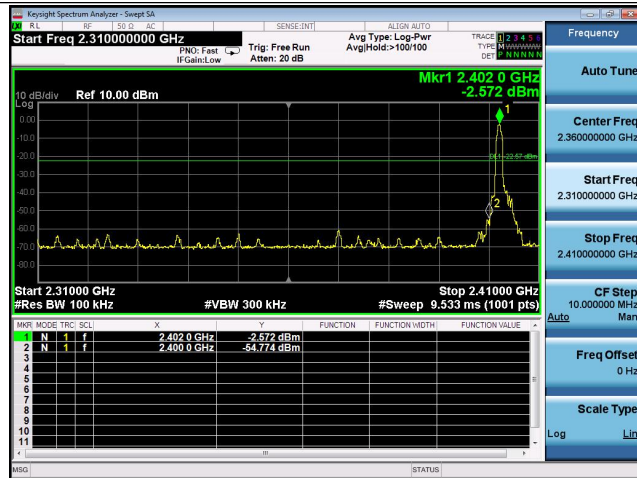


Hoping On



8DPSK

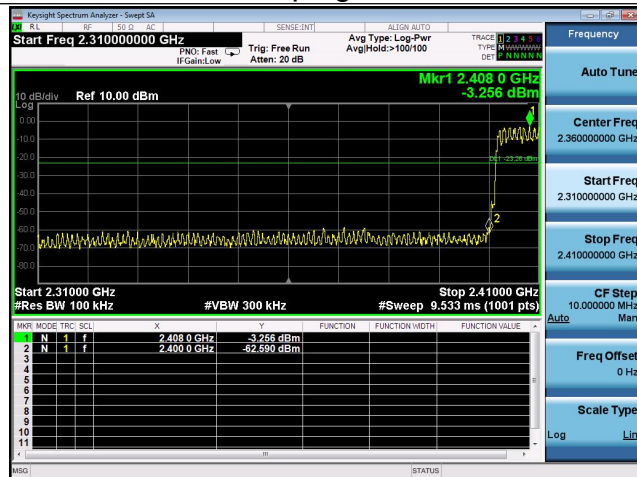
2402MHz



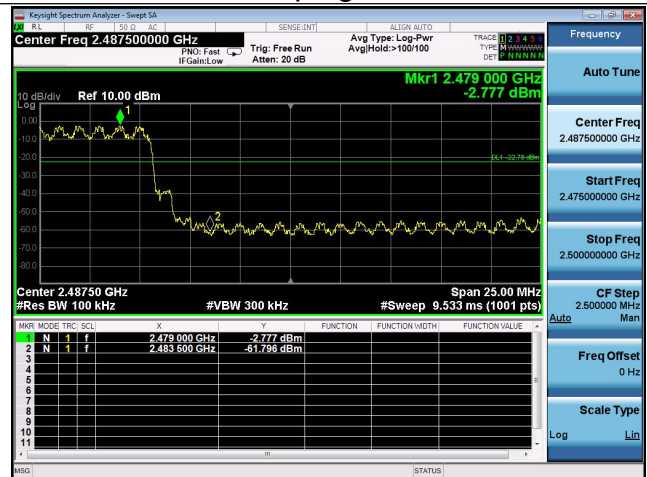
2480MHz



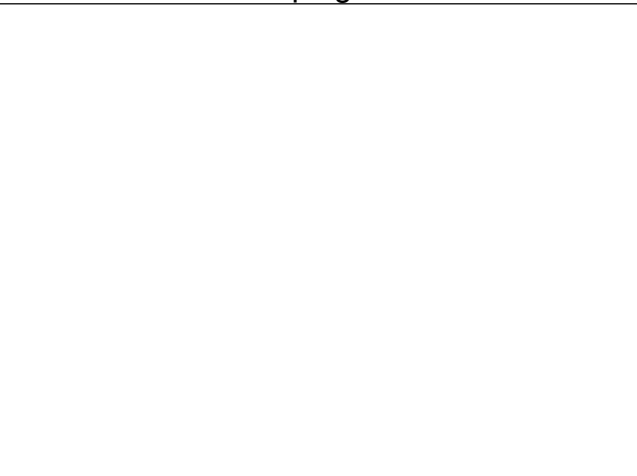
Hopping Off



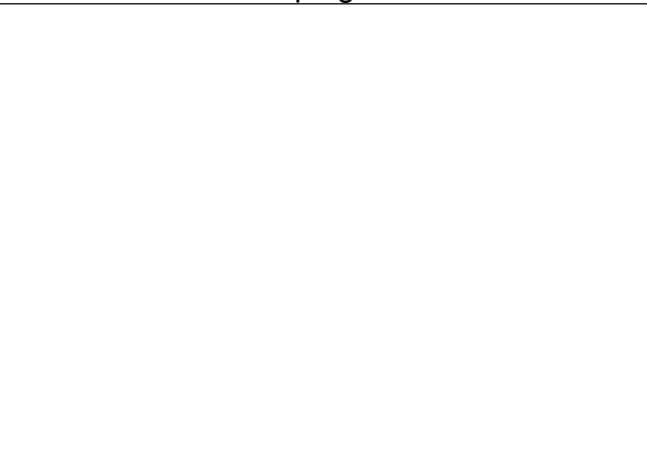
Hopping Off



Hopping On



Hopping On



10. SPURIOUS RF CONDUCTED EMISSION

10.1 Test Limit

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.
3. For below 30MHz, For 9KHz-150kHz, 150K-10MHz, We use the RBW 1KHz, 10KHz, So the limit need to be calculated by " $10\lg(BW1/BW2)$ ". for example For 9KHz-150kHz, RBW 1KHz, The Limit= the highest emission level-20-10lg(100/1)= the highest emission level-40.

10.2 Test Procedure

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013, For 9KHz-150kHz, Set RBW=1kHz and VBW= 3KHz; For 150KHz-10MHz, Set RBW=10kHz and VBW= 30KHz; For 10MHz-25GHz, Set RBW=100kHz and VBW= 300KHz in order to measure the peak field strength, and measure frequency range from 9KHz to 25GHz.

10.3 Test Setup



10.4 Test Result

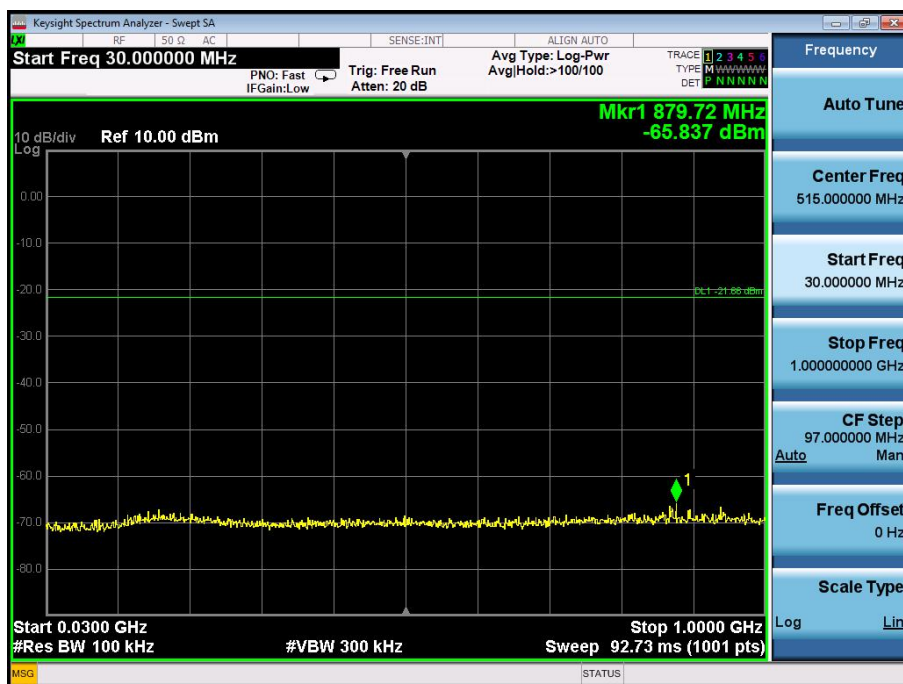
PASS

Remark: All modes of GFSK, $\pi/4$ DQPSK, 8DPSK were tested, only the worst result of GFSK was reported as below:

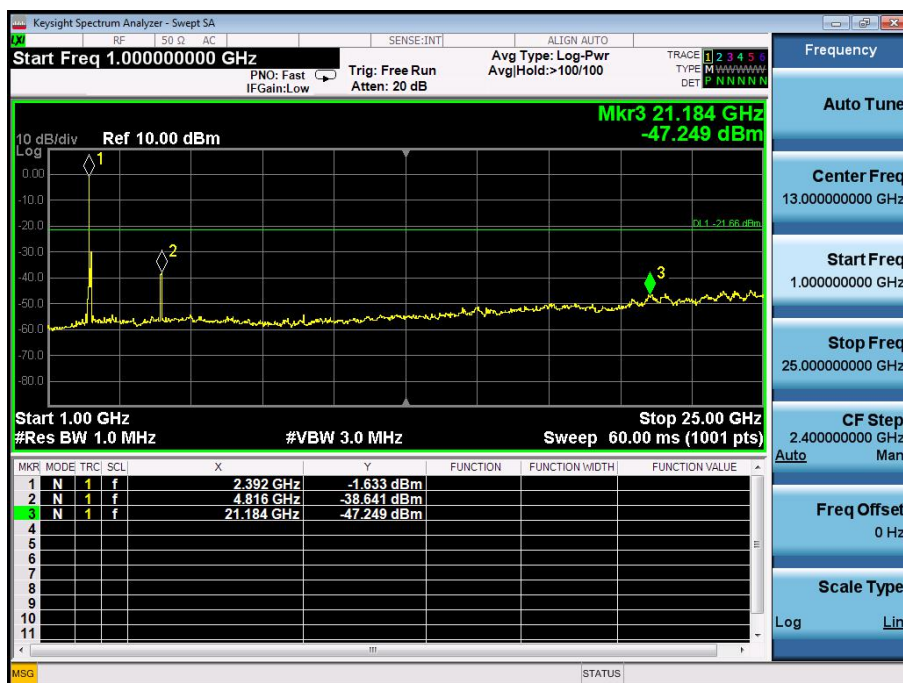
GFSK

CH: 2402MHz





30MHz~1GHz

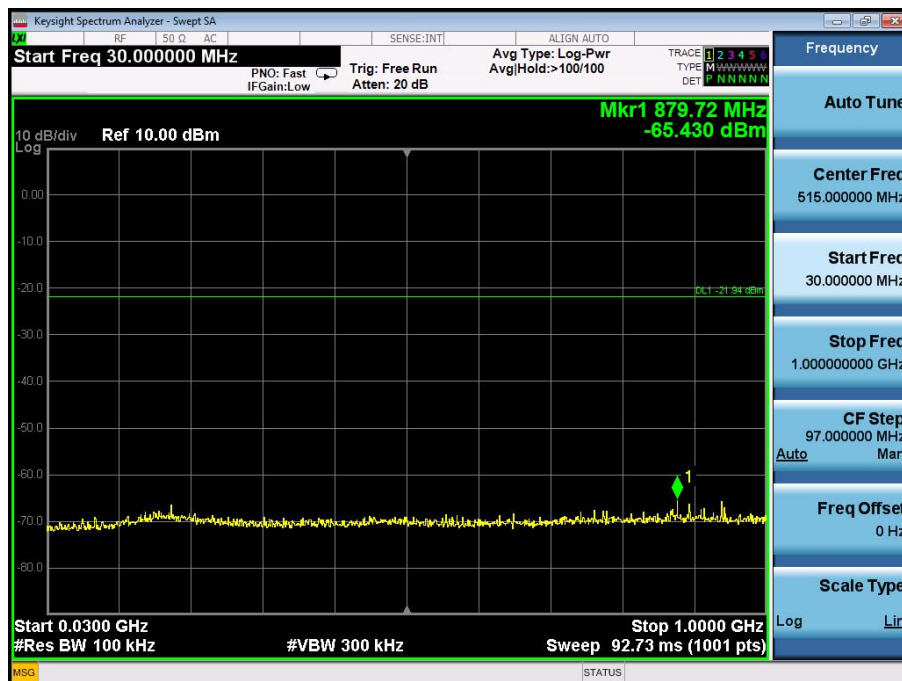


1GHz~25GHz

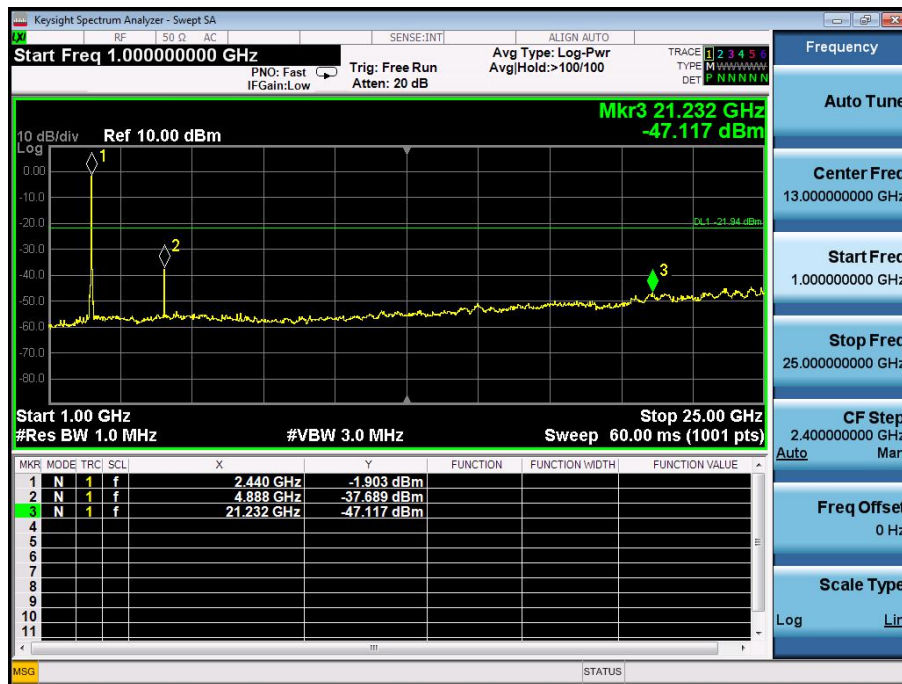


GFSK

CH: 2441MHz



30MHz~1GHz

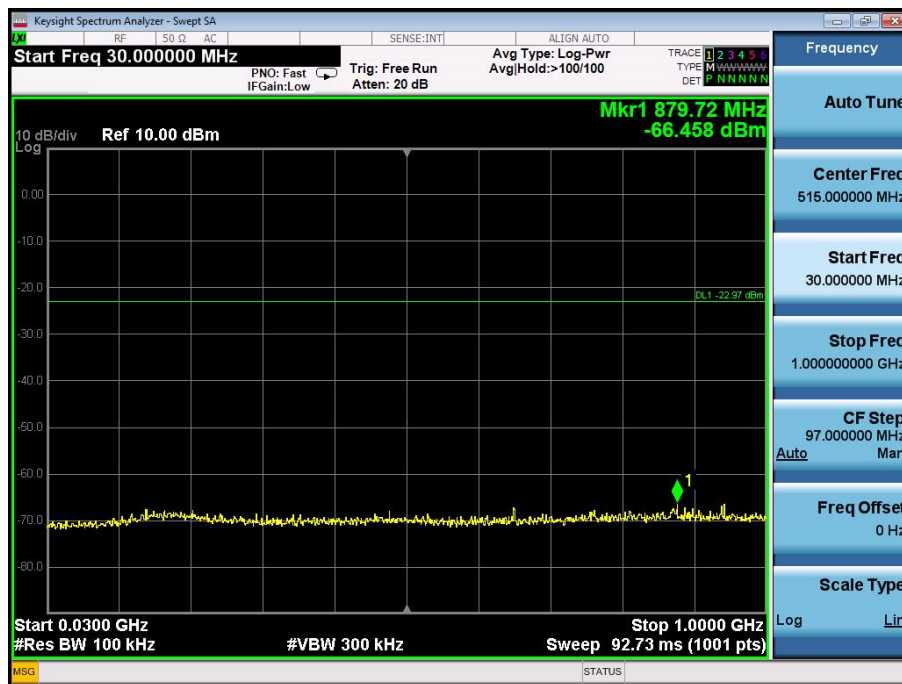


1GHz~25GHz

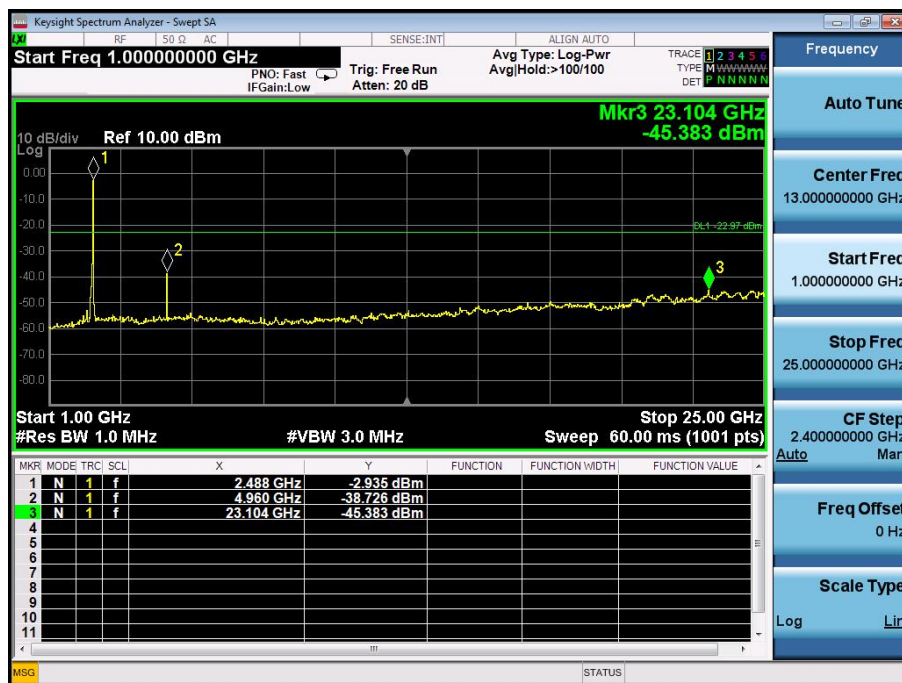
GFSK

CH: 2480MHz





30MHz~1GHz



1GHz~25GHz

11. NUMBER OF HOPPING FREQUENCY

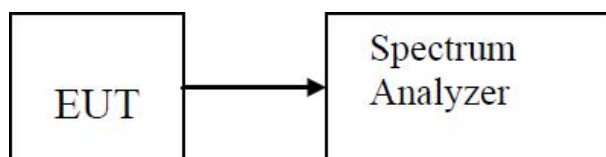
11.1 Test Limit

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

11.2 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz with RBW=1MHz and VBW=3MHz.

11.3 Test Setup

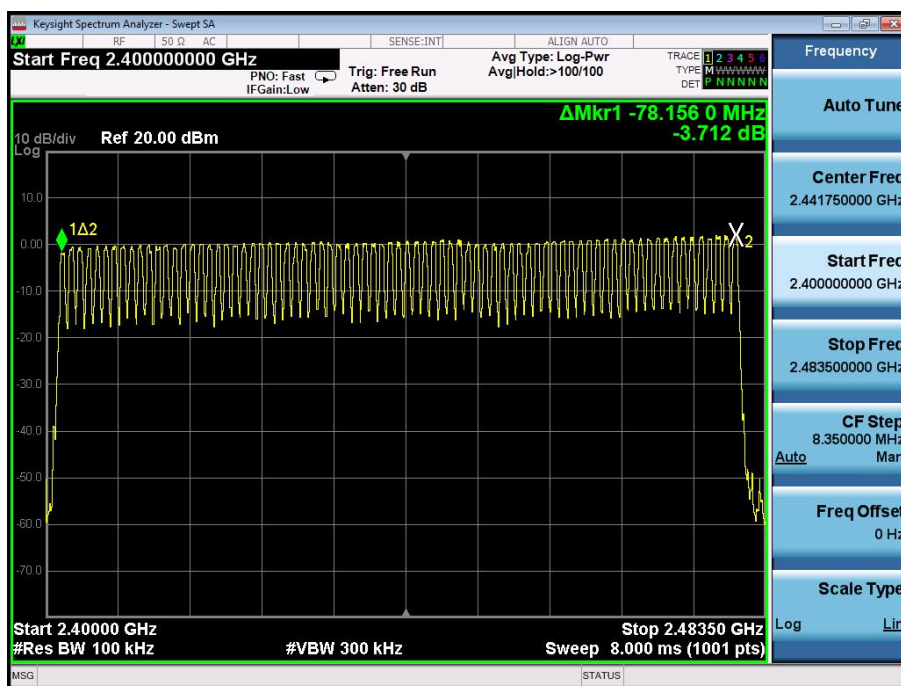


11.4 Test Result

PASS

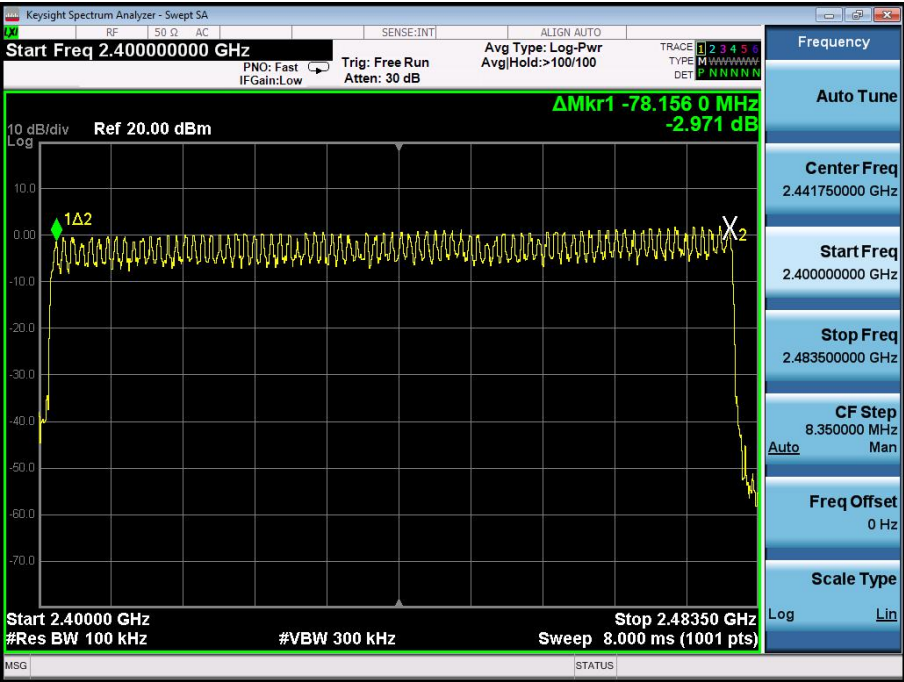
Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	≥15	Pass
$\pi/4$ DQPSK	79		
8DPSK	79		

GFSK

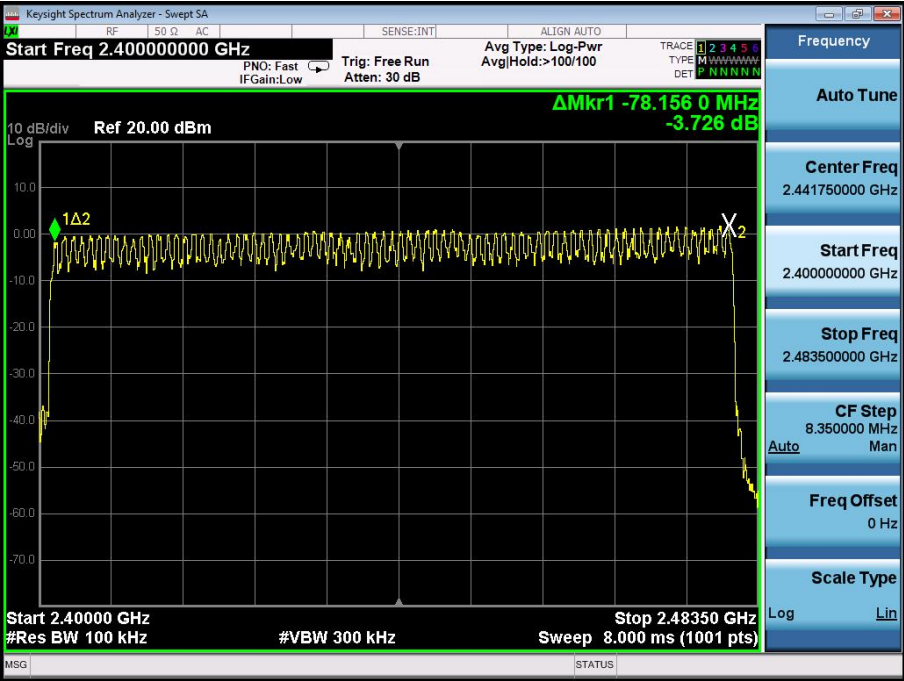




$\pi/4$ DQPSK

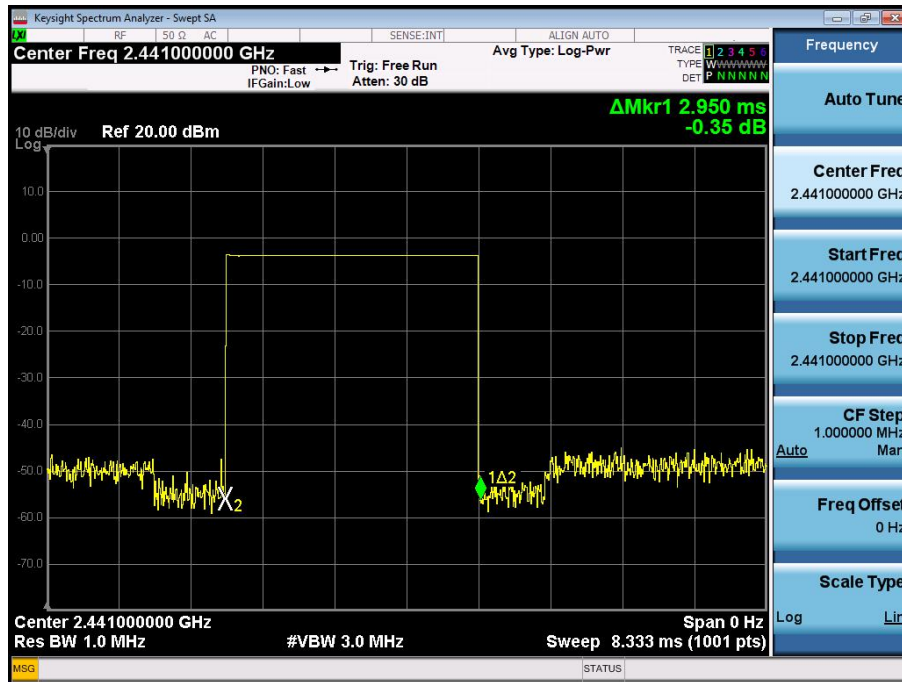


8DPSK

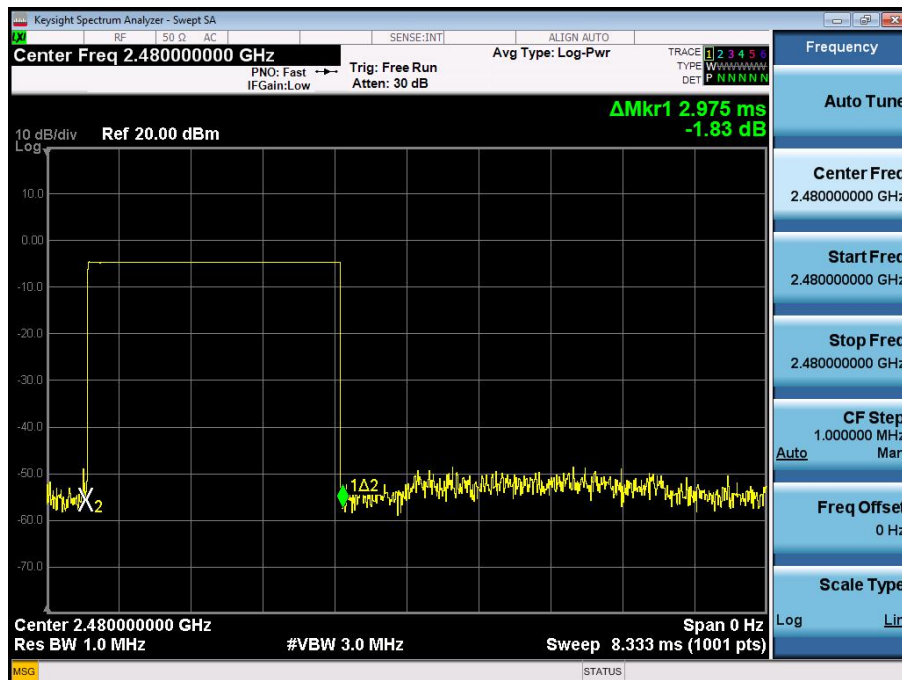




CH: 2441MHz

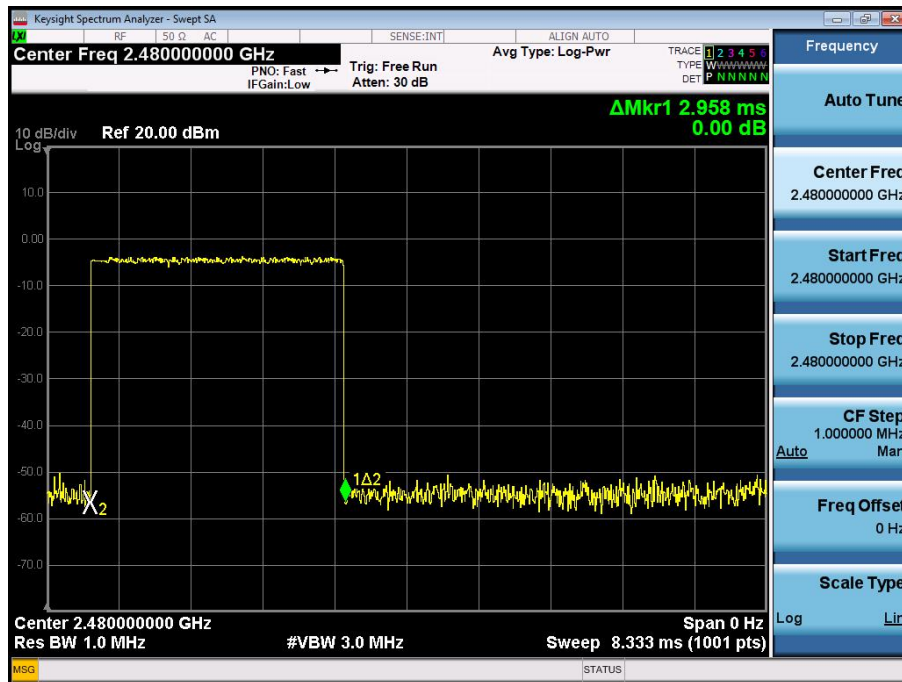


CH: 2480MHz

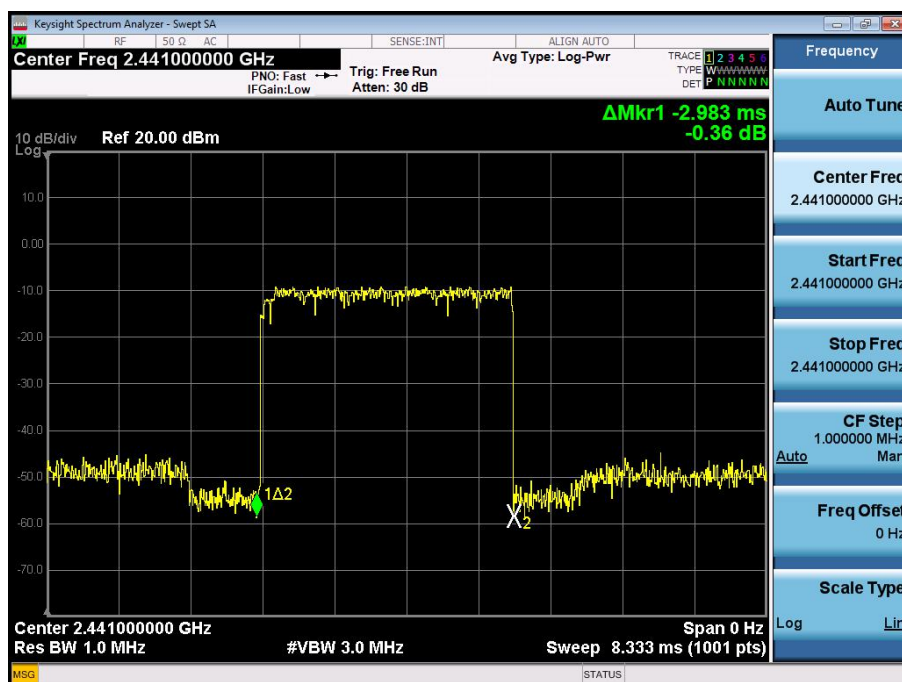


Type	Modulation	CH	Pulse time(ms)	Dwell Time(ms)	Limit(ms)	Result
Dwell Time	$\pi/4$ DQPSK	Low	2.958	315.530	400	Pass
		Mid	2.983	318.197	400	Pass
		High	2.950	314.677	400	Pass
Remark: Dwell Time=Pulse time(ms)×(1600÷6÷79)×31.6						

CH: 2402MHz



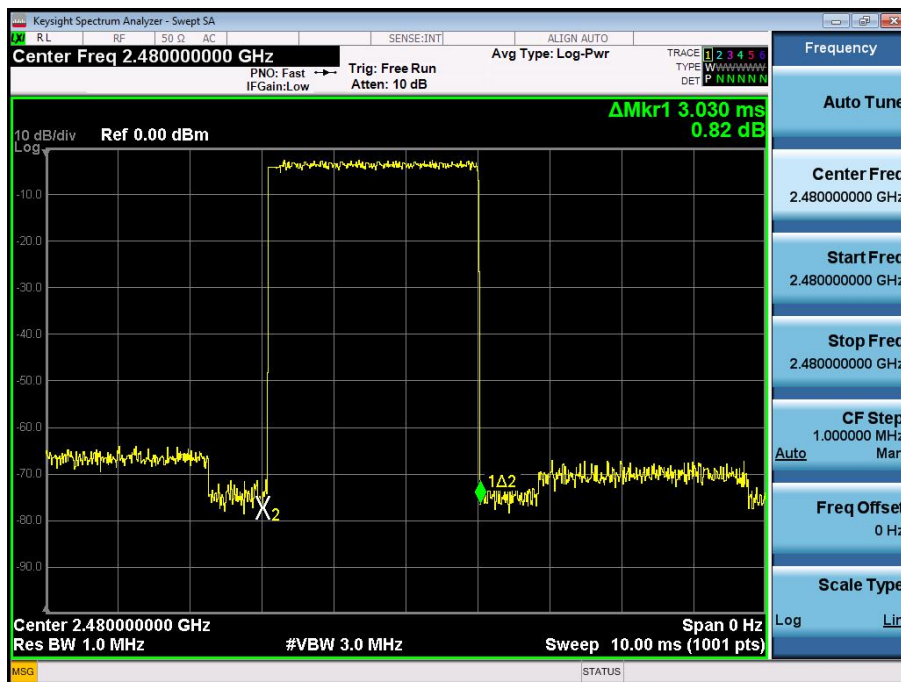
CH: 2441MHz



CH: 2441MHz



CH: 2480MHz



13. PSEUDORANDOM FREQUENCY HPPING SEQUENCE

For 47 CFR Part 15C section 15.247 (a)(1) requirement

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping 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 hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

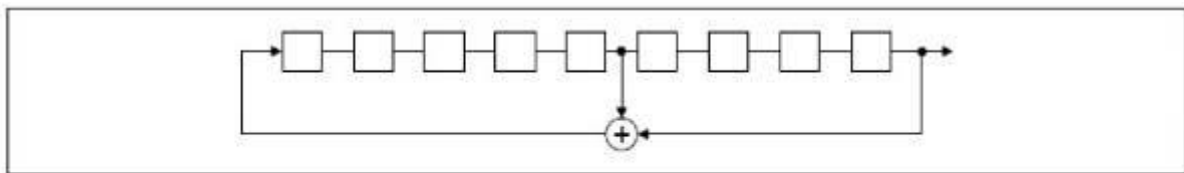
TEUT Pseudorandom Frequency Hopping Sequence Requirement

The pseudorandom frequency hopping sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

Number of shift register stages: 9

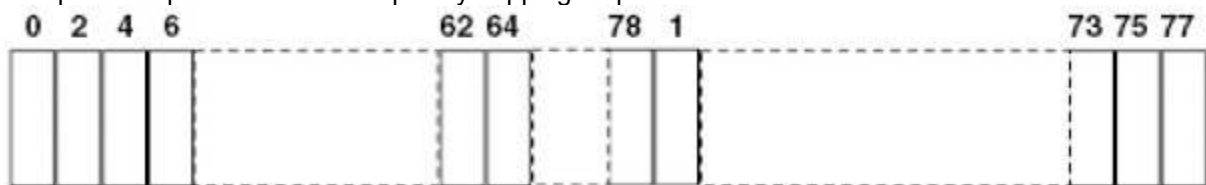
Length of pseudo-random sequence: $2^9 - 1 = 511$ bits

Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally on the average by each transmitter.

The system receiver has input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shifts frequencies in synchronization with the transmitted signals.

14. ANTENNA REQUIREMENT

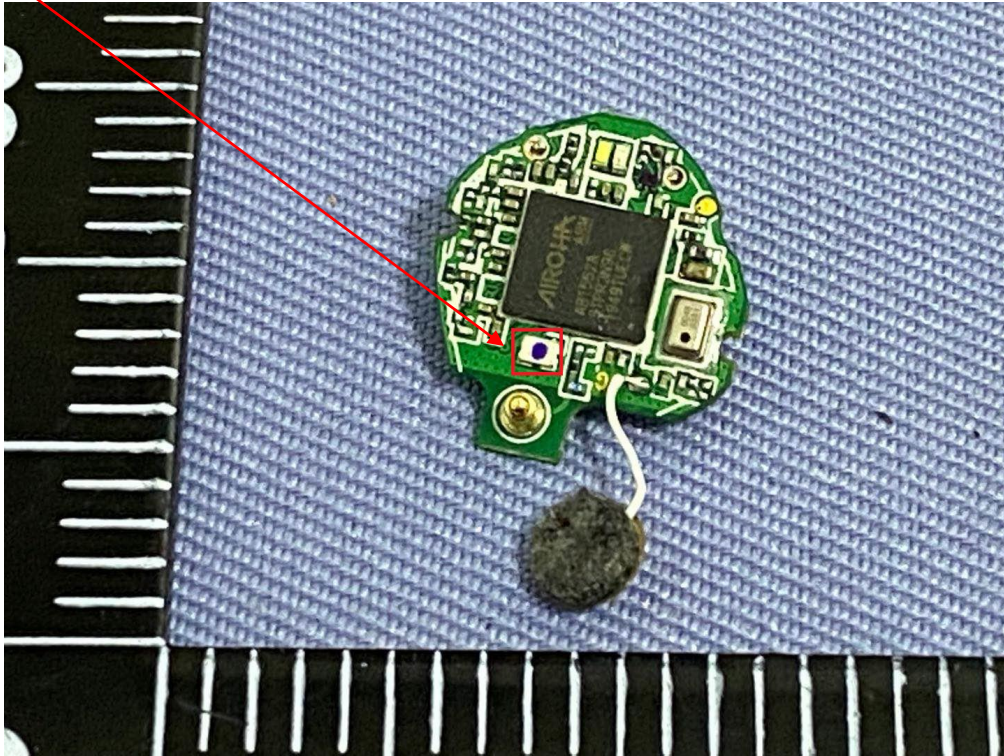
Standard Applicable:

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.

Antenna Connected Construction

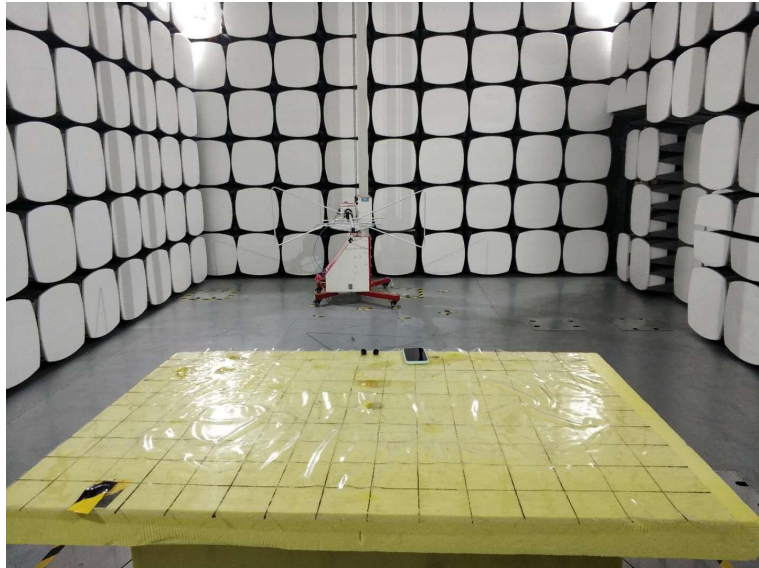
The antenna used in this product is an internal Antenna, The directional gains of antenna used for transmitting is 0dBi.

ANTENNA:

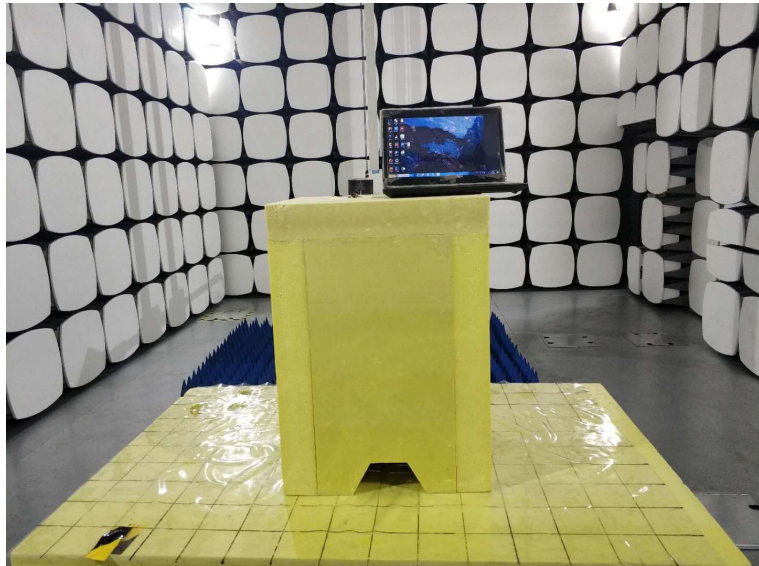


15. PHOTOGRAPH OF TEST

**Radiated Emission
(Below 1G)**



**Radiated Emission
(Above 1G)**



Conducted Emission



End of Report