

## 3.8. Out-of-Band Emissions

### 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 con-ducted or a radiated measurement, pro-vided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter com-plies 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.

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In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

## **Test Procedure**

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector, and max hold. Measurements utilizing these setting are made of the in-band reference level, band edge and out-of-band emissions.

## **Test Configuration**



#### **Test Results**

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.

We measured all conditions (DH1, DH3, DH5) and recorded worst case at DH5 and 3DH5

Test plot as follows:

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2.401 65 GHz 5.212 60 GHz

3.847 dBm -47.531 dBm

Report No.: HK2405242700-1E **GFSK** CH<sub>0</sub>0 **CH39** er Freq 2.441000000 GHz r Freq 2.402000000 GHz #Avg Type: RMS Avg|Hold: 100/100 #Avg Type: RMS Avg|Hold: 100/100 Trig: Free Run Trig: Free Run Auto Tun Auto Tur Ref Offset 8.94 dB Ref 28.94 dBm Ref Offset 8.94 dB Ref 28.94 dBm Center Free Center Fre Stop Fre Freq Offse Freq Offs #VBW 300 kHz #Avg Type: RMS Avg|Hold: 10/10 #Avg Type: RMS Avg|Hold: 10/10 917.84 M 60.821 dE 832.09 N 60.899 d Ref Offset 8.94 dB Ref 18.94 dBm Ref Offset 8.94 dB Ref 18.94 dBm Center Free Center Fre Start Fre Start Fre 30.000000 MH CF Ste 97.000000 M CF Ste 97.000000 MH Freq Offse Freq Offse nter Freq 13.750000000 GHz er Freq 13.750000000 GHz #Avg Type: RMS Avg|Hold: 10/10 #Avg Type: RMS Avg|Hold: 10/10 Trig: Free Run #Atten: 20 dB Trig: Free Run #Atten: 20 dB Auto Tur Auto Tun 5.238 10 0 -46.431 d Ref Offset 8.94 dB Ref 18.94 dBm Ref Offset 8.94 dB Ref 18.94 dBm Center Free Start Fre Stop Fred 26.500000000 GHz Stop Fre 26.500000000 GH CF Step 2.550000000 GH Stop 26.50 GH: Sweep 2.438 s (30001 pts Stop 26.50 GH Sweep 2.438 s (30001 pts CF Ste 2.550000000 GF #VBW 300 kHz

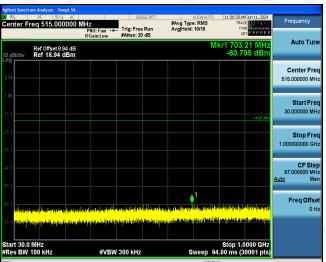
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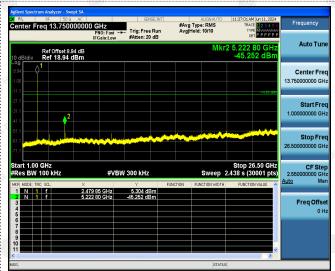
Freq Offse

2.441 60 GHz 5.238 10 GHz

Freq Offs







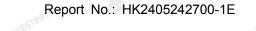
MANAY TESTING

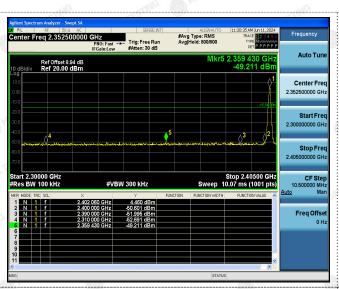
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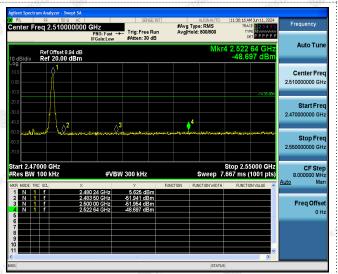
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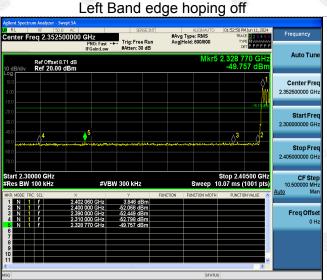
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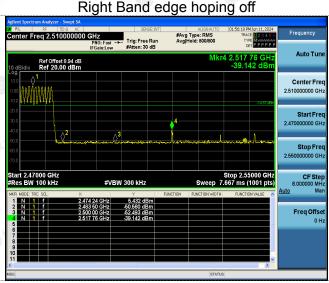
MANAY TESTING





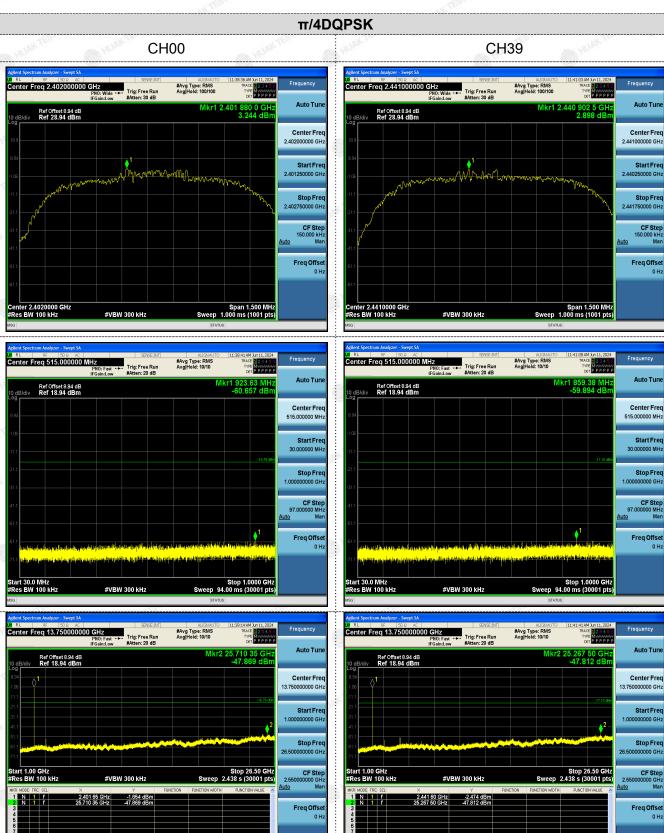


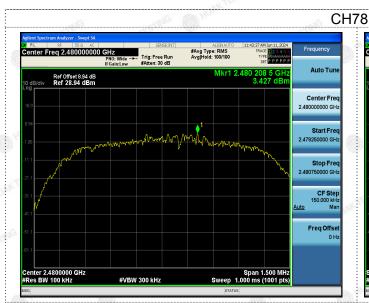


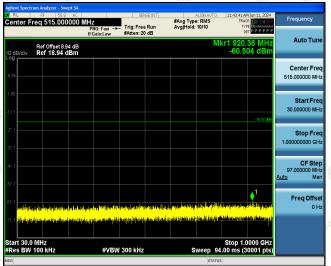


Left Band edge hoping on

Right Band edge hoping on







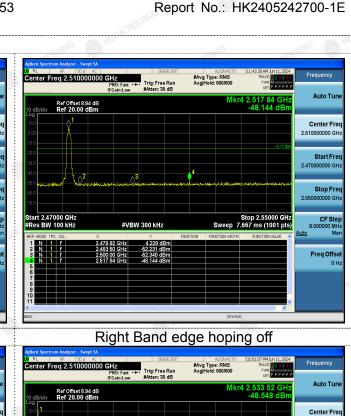


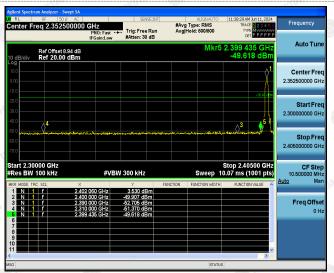
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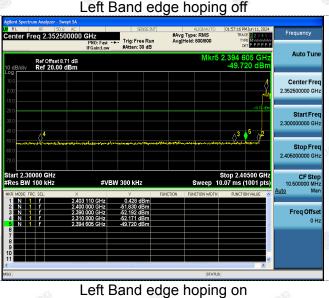
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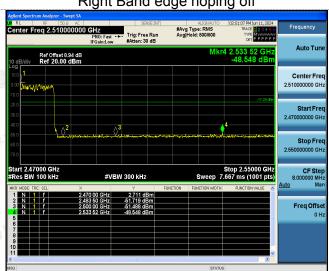
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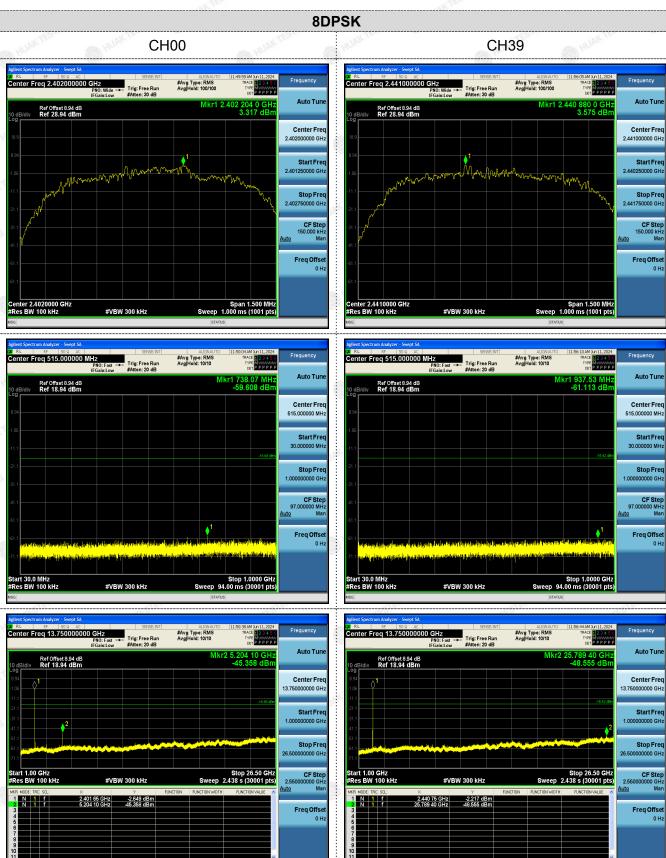


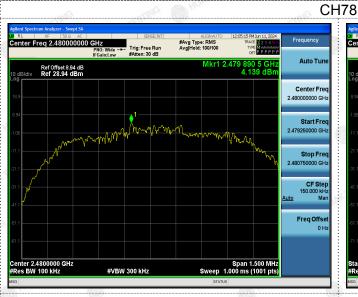


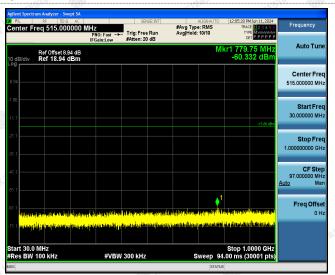




Right Band edge hoping on



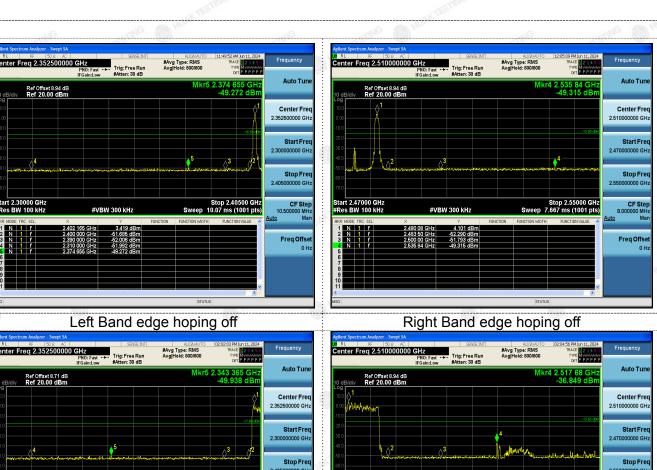






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Freq Offse

Left Band edge hoping on Right Band edge hoping on

CF Ste 10.500000 MH <u>o</u> Ma

Freq Offse

Start 2.47000 GHz #Res BW 100 kHz

Stop 2.40500 GHz Sweep 10.07 ms (1001 pts)



## 3.9. Pseudorandom Frequency Hopping Sequence

## **Test Applicable**

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

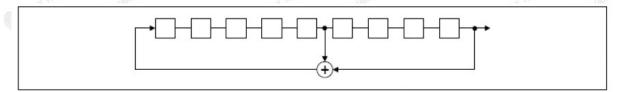
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that 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 corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

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## **EUT Pseudorandom Frequency Hopping Sequence Requirement**

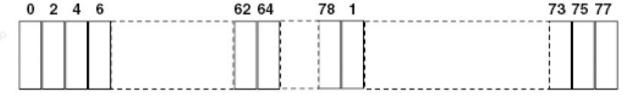
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5<sup>th</sup> and 9<sup>th</sup> stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive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

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



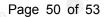
Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

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





## 3.10. 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. And according to FCC 47 CFR Section 15.247, 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.

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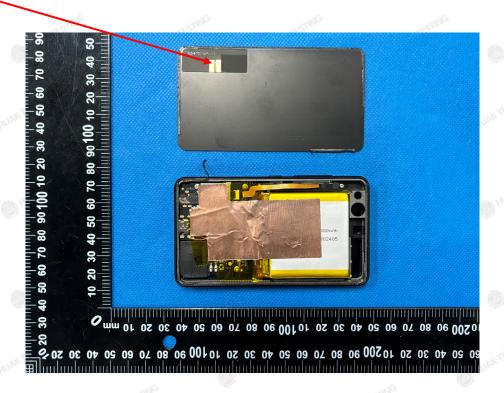
## Refer to Statement Below for Compliance.

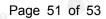
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

## **Antenna Connected Construction**

The antenna used in this product is an Internal antenna, need professional installation, not easy to remove. It conforms to the standard requirements. The directional gains of antenna used for transmitting is -2.36dBi.

#### <u>Antenna</u>

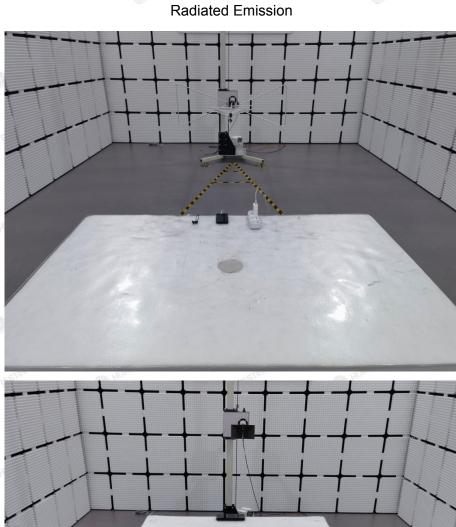


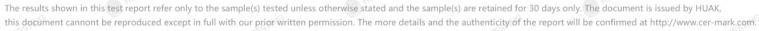




# 4. Test Setup Photos of the EUT

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# 5. Photos of the EUT

Reference to the report: ANNEX A of External photos and ANNEX B of Internal photos

End of test report-

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