## 3.7. Time of Occupancy (Dwell Time)

**Limit**

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.

**Test Procedure**

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 3MHz VBW, Span 0Hz.

**Test Configuration**

**Test Results**

| Modulation | Packet | Pulse time (ms) | Number of transmission in 31.6s (79 Hopping*0.4)= Burst Count | Dwell time (second) | Limit (second) | Result |
|---|---|---|---|---|---|---|
| GFSK | DH1 | 0.381 | 32 (pulses)*10=320 | 0.122 | 0.40 | PASS |
| | DH3 | 1.637 | 15 (pulses)*10=150 | 0.246 | | |
| | DH5 | 2.885 | 11 (pulses)*10=110 | 0.317 | | |
| π/4DQPSK | 2-DH1 | 0.391 | 31 (pulses)*10=310 | 0.121 | 0.40 | PASS |
| | 2-DH3 | 1.642 | 16 (pulses)*10=160 | 0.263 | | |
| | 2-DH5 | 2.891 | 12 (pulses)*10=120 | 0.347 | | |

Note:

1. We have tested all mode at high, middle and low channel, and recoreded worst case at middle channel.
2. Dwell time =[Pulse time (ms) /1000] x Burst Count

Test plot as follows:

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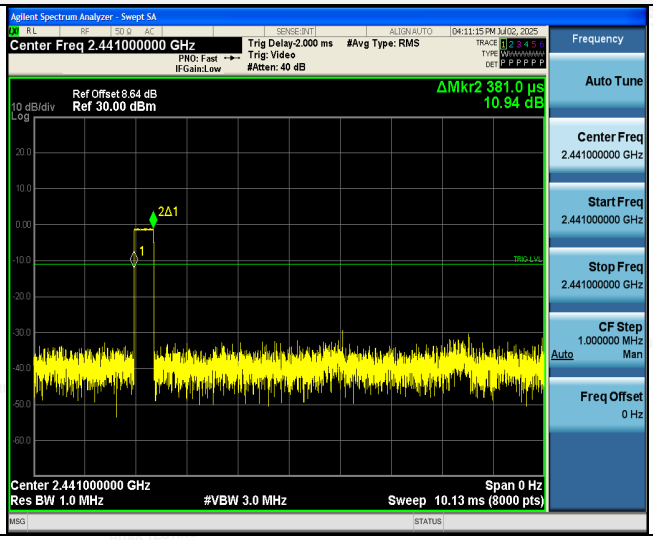
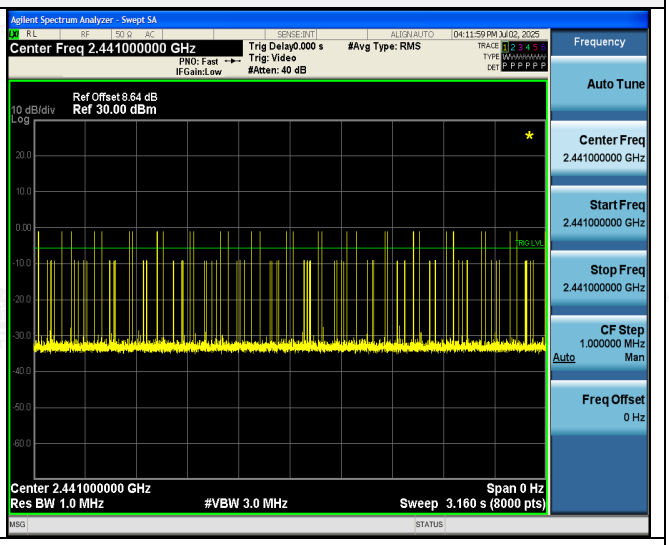
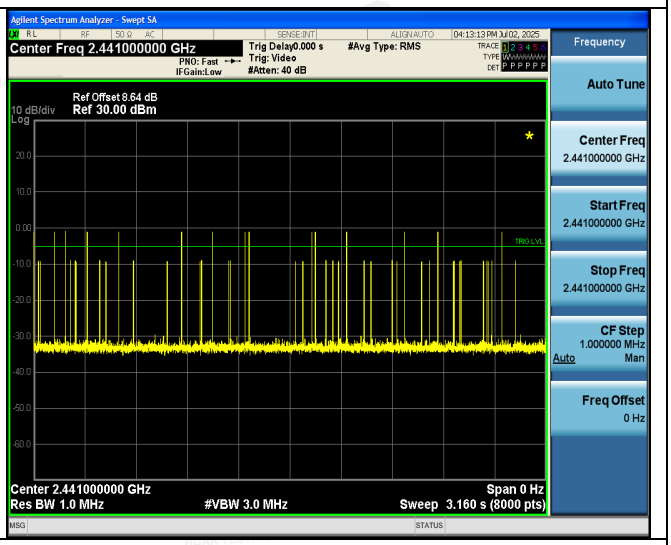
GFSK Modulation




DH1

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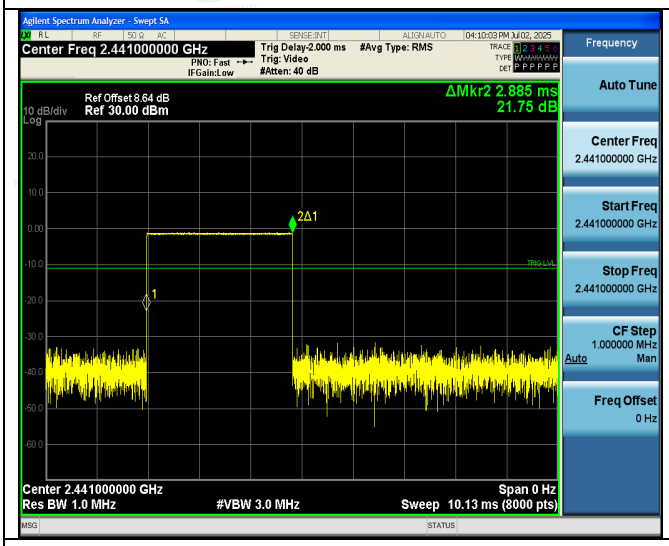


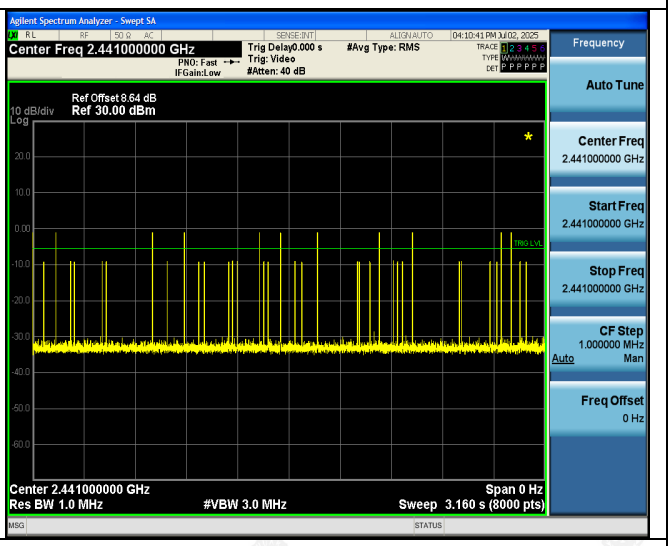


DH5

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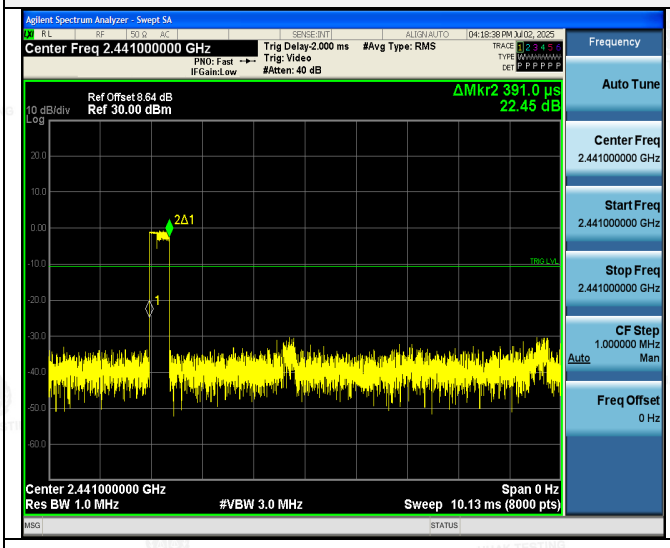
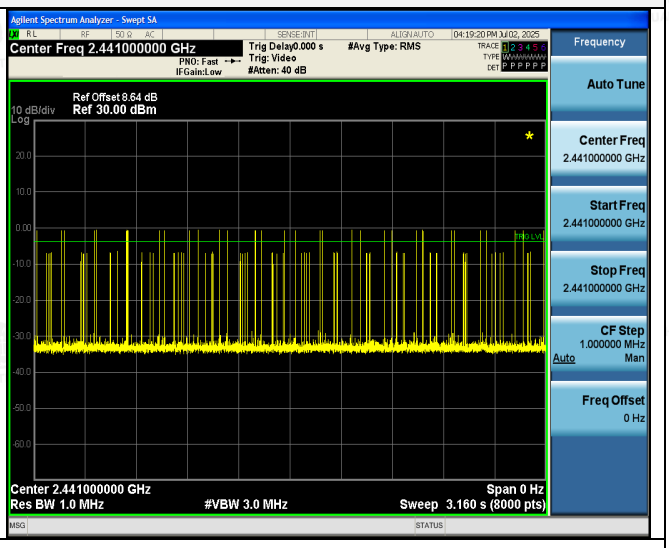
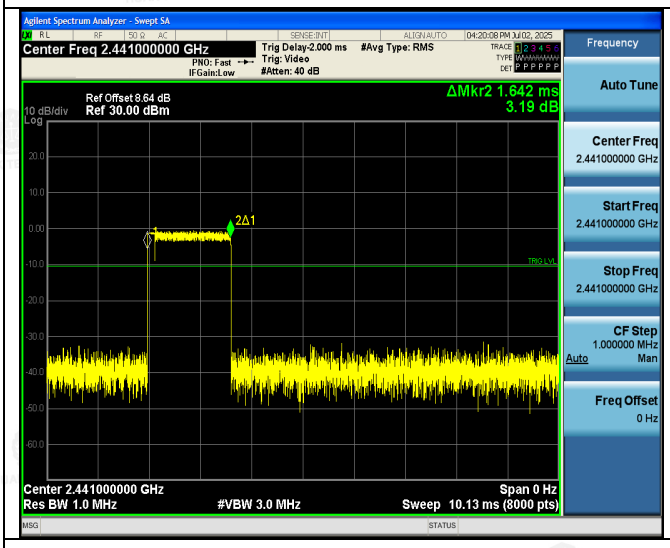
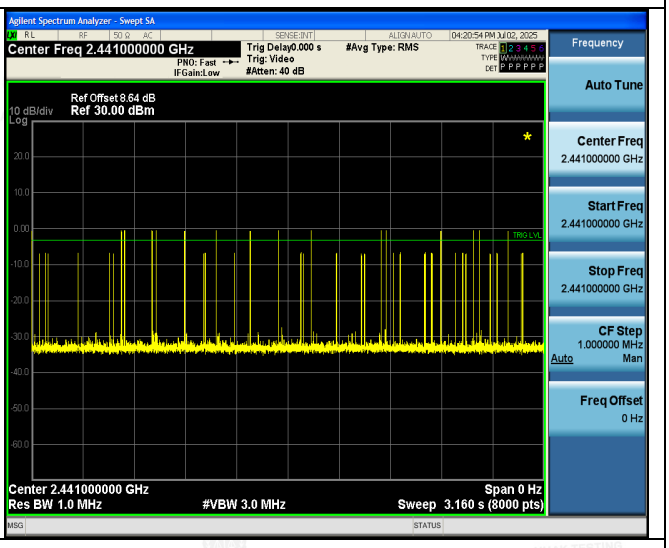
π/4DQPSK Modulation




2-DH1

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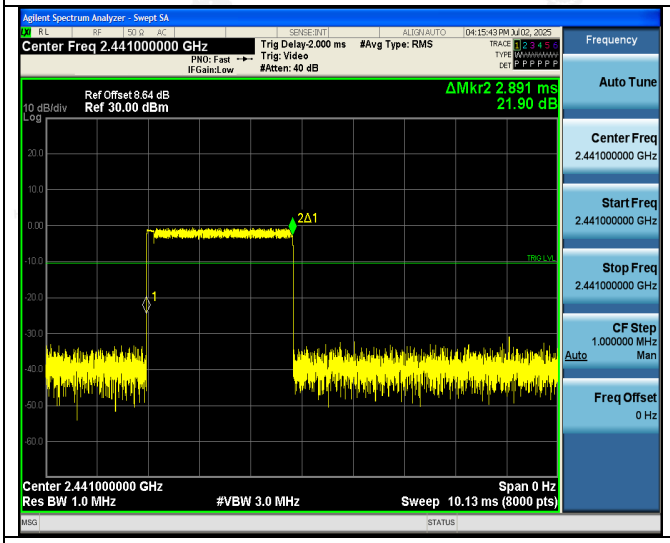


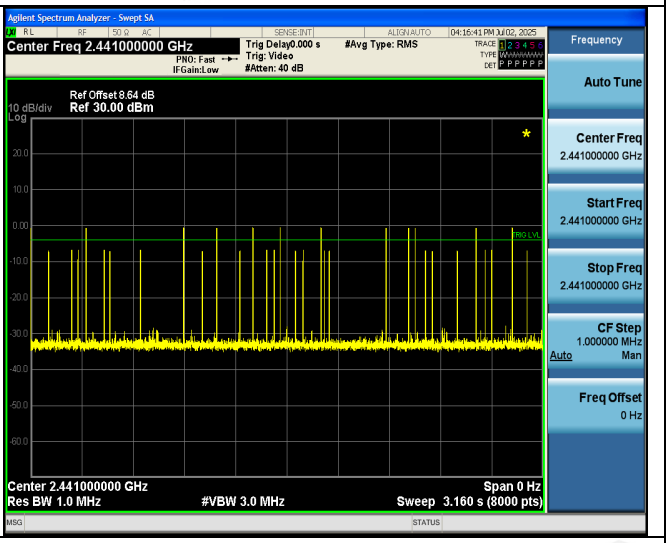


2-DH5

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## 3.8. Out-of-Band Emissions

**Limit**

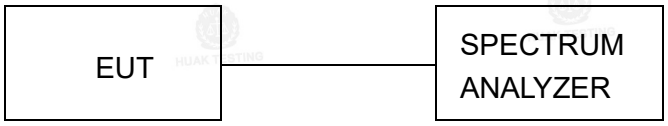
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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.

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 2DH5.

Test plot as follows:

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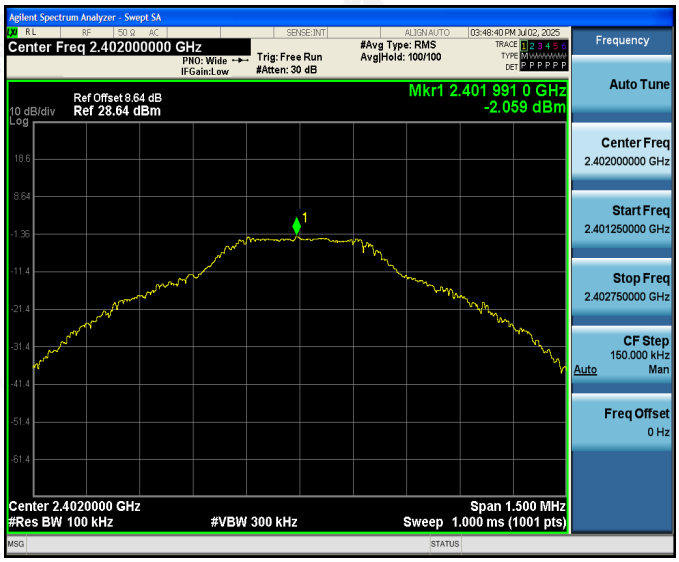
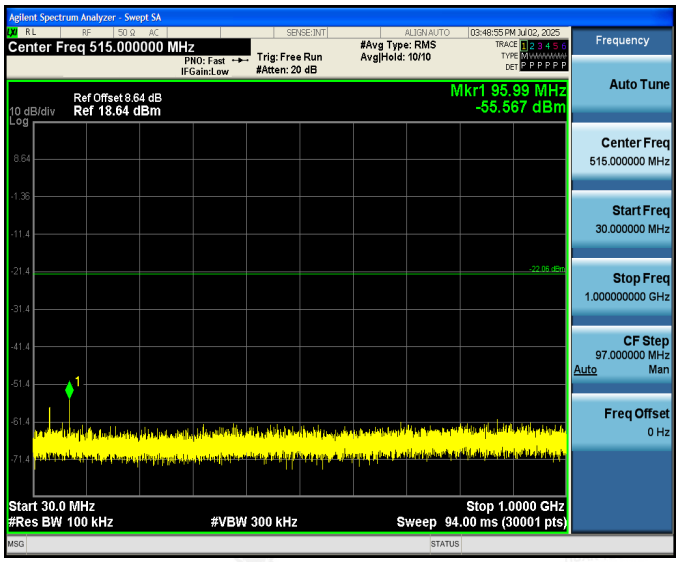
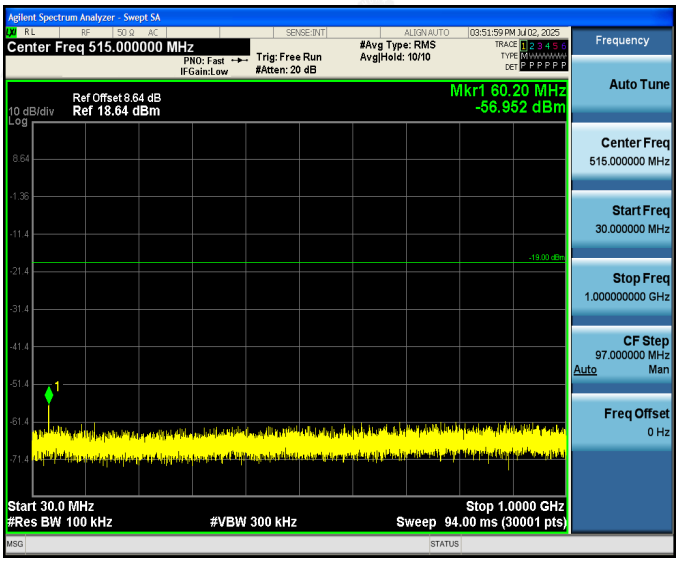
## GFSK

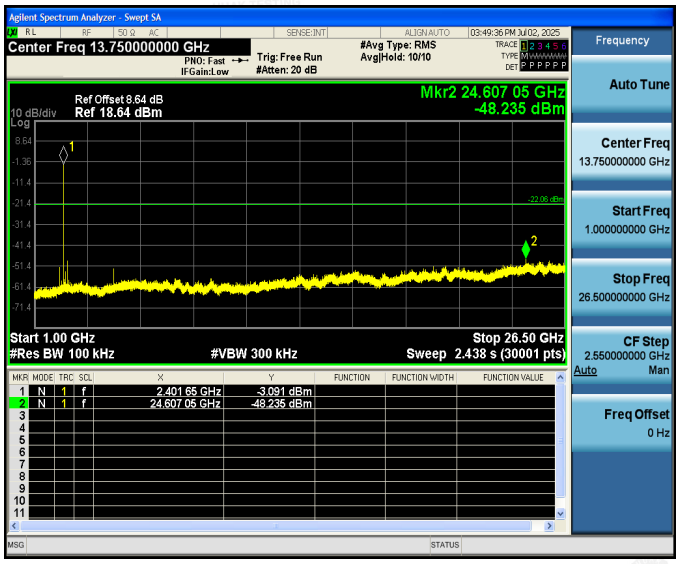
### CH00

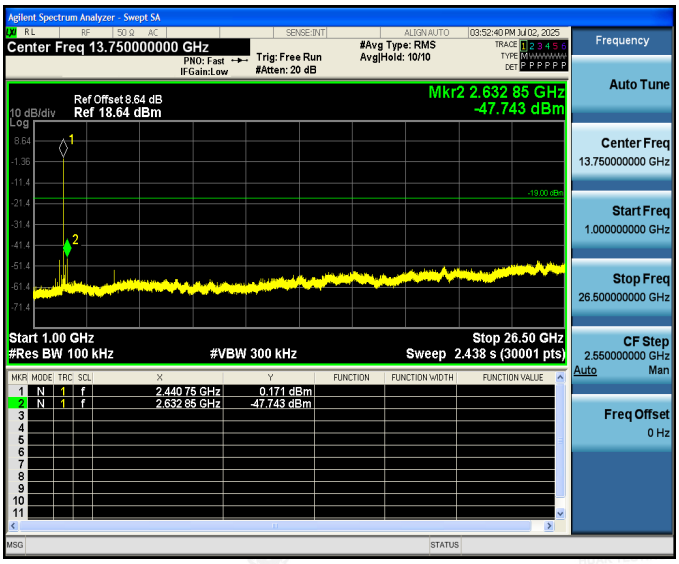



### CH39

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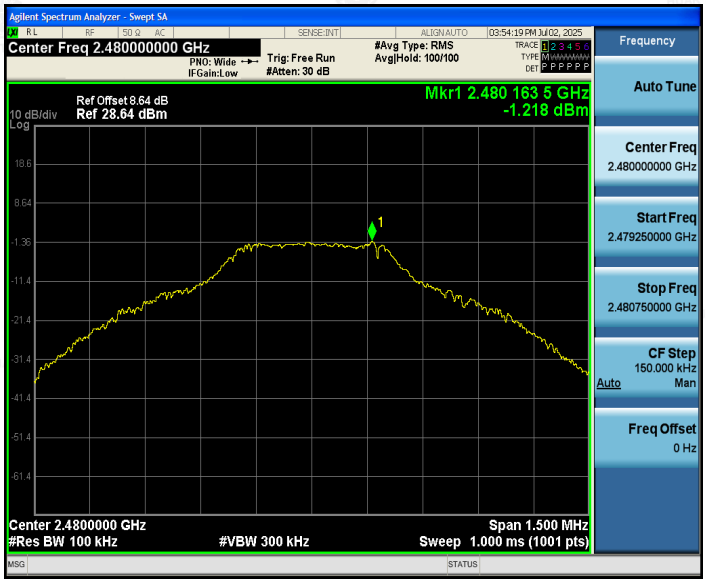
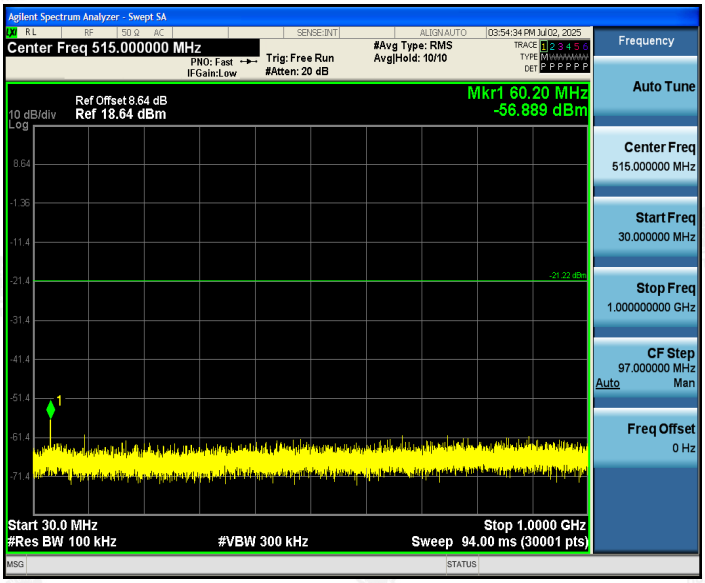
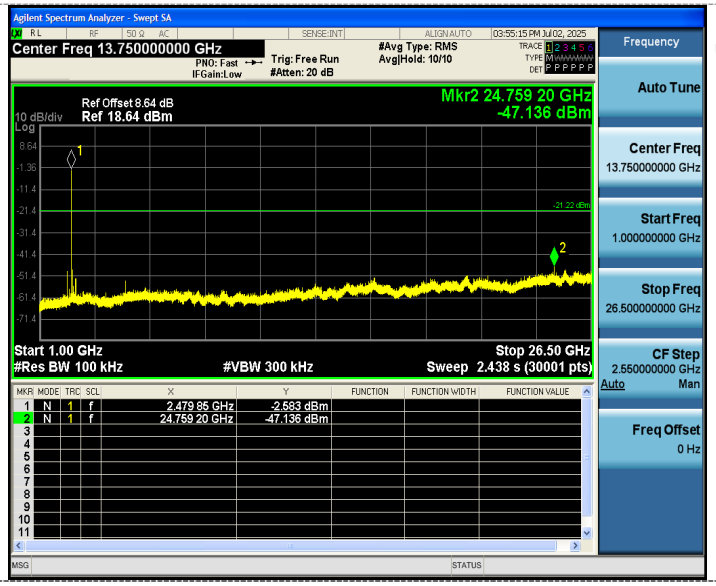
*CH78*

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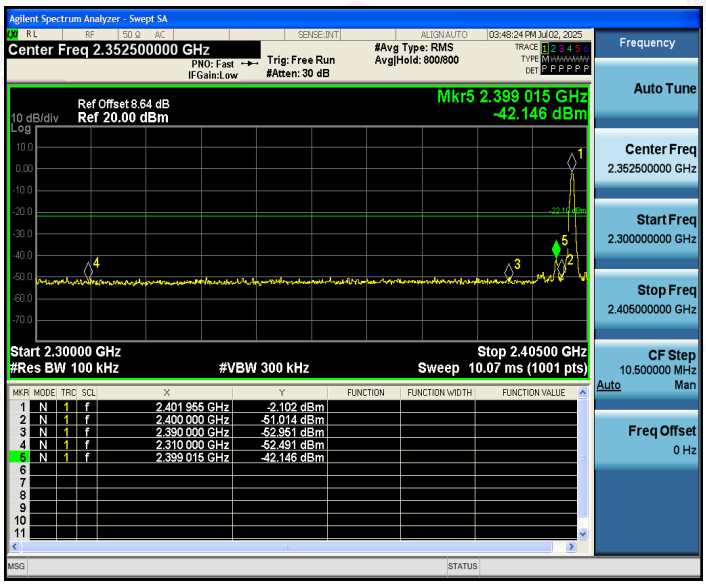
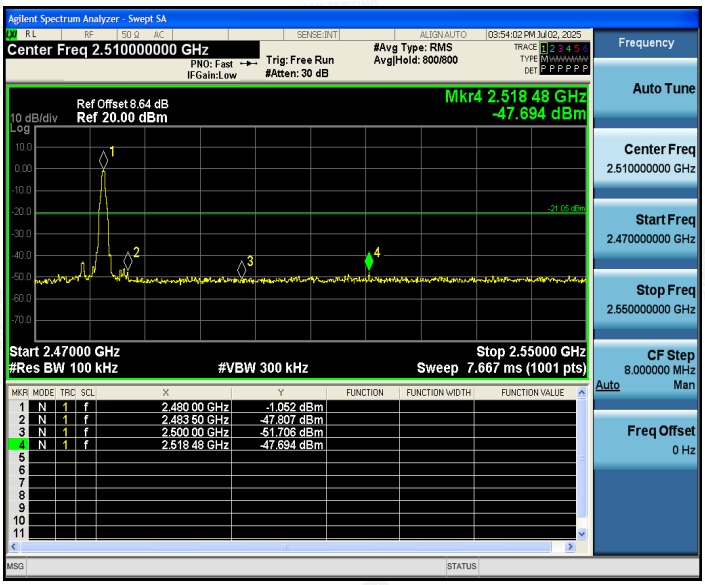
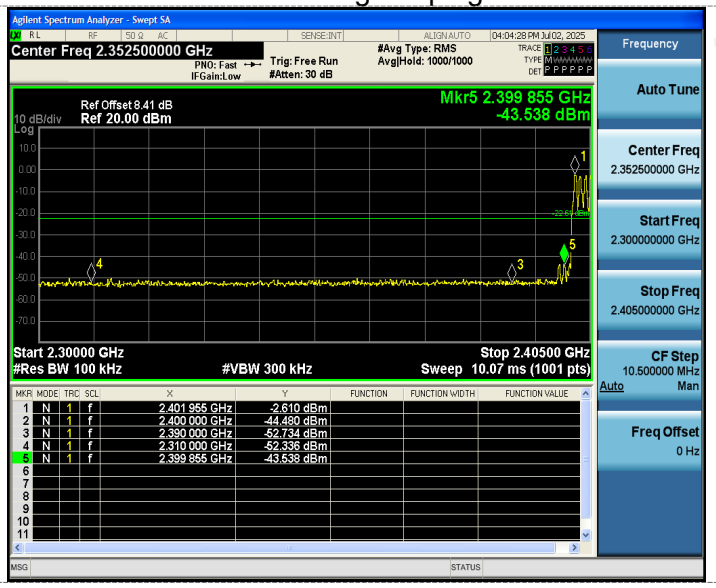


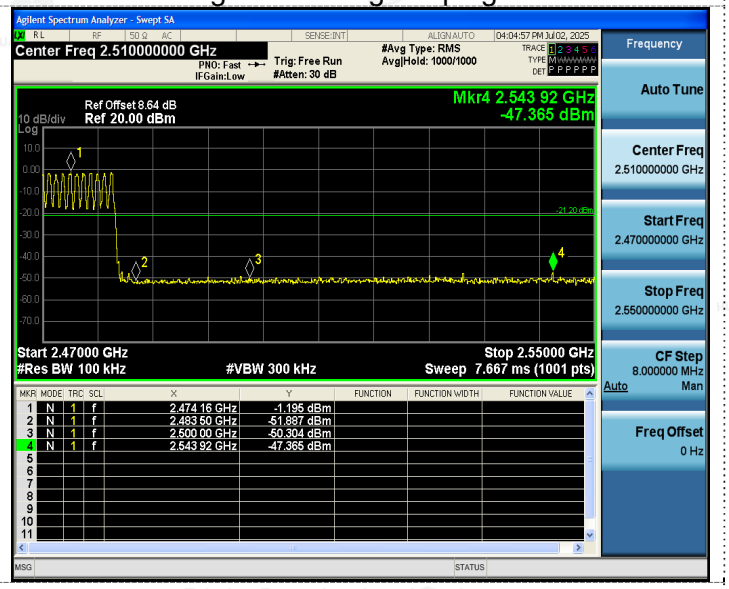

Left Band edge hoping off




Right Band edge hoping off




Left Band edge hoping on




Right Band edge hoping on

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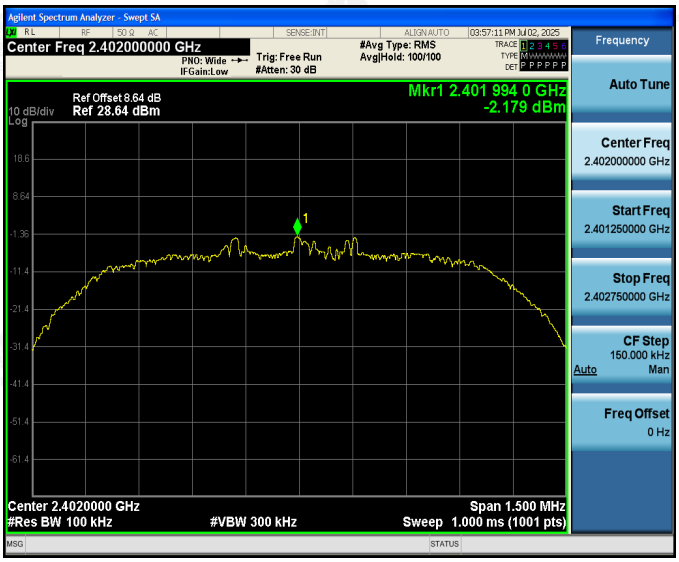
## π/4DQPSK

### CH00

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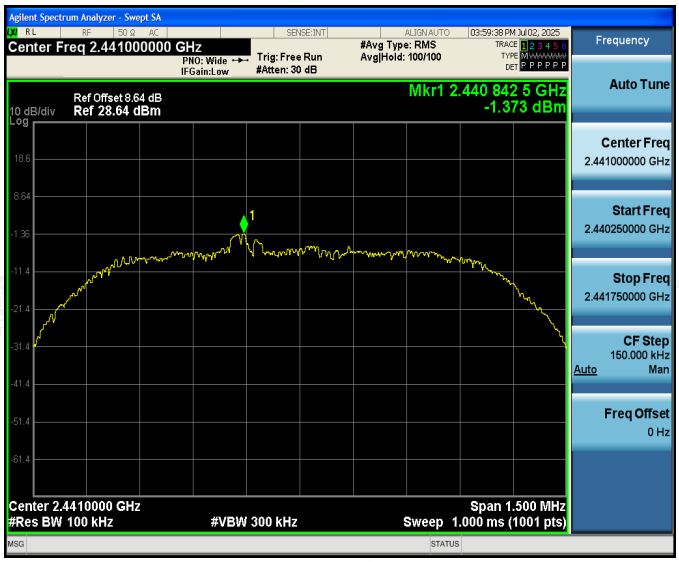


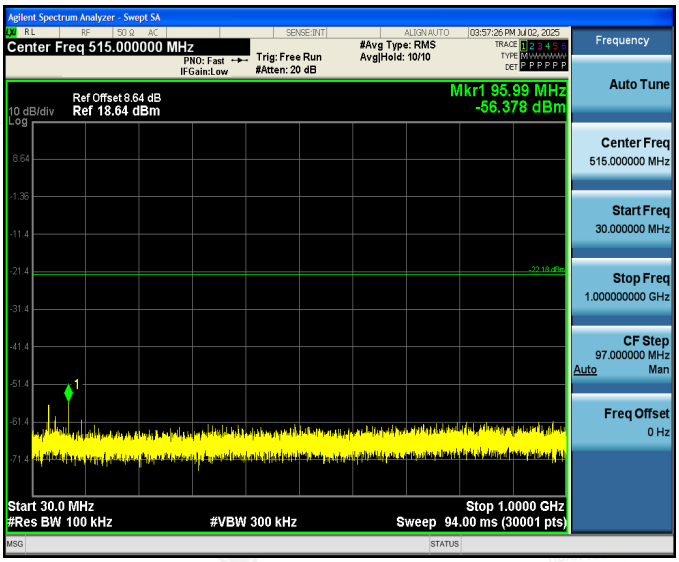


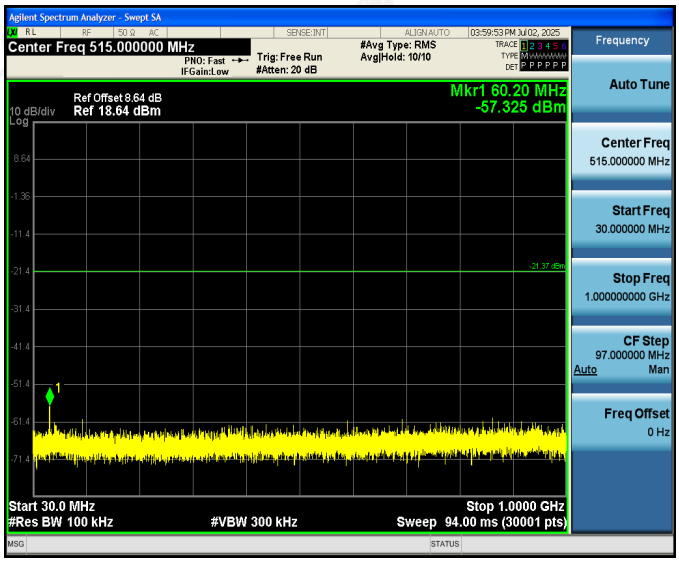


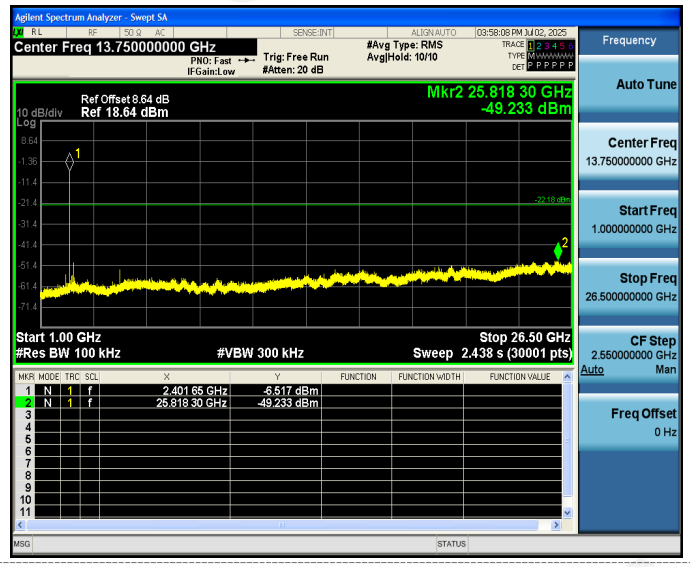


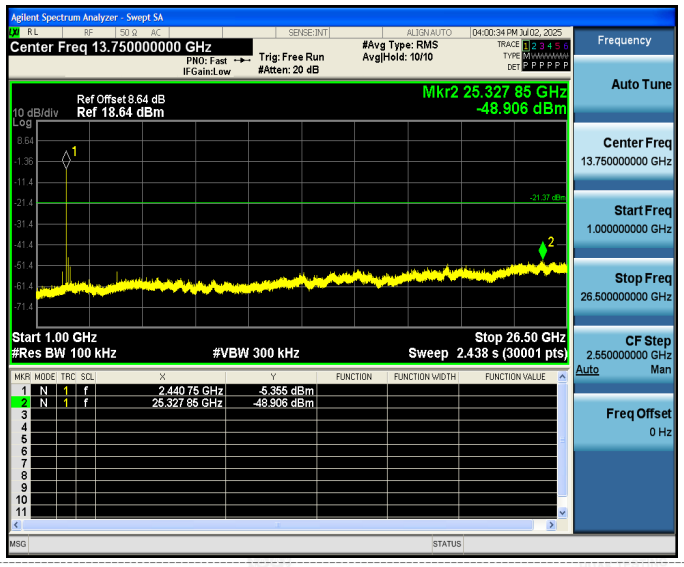


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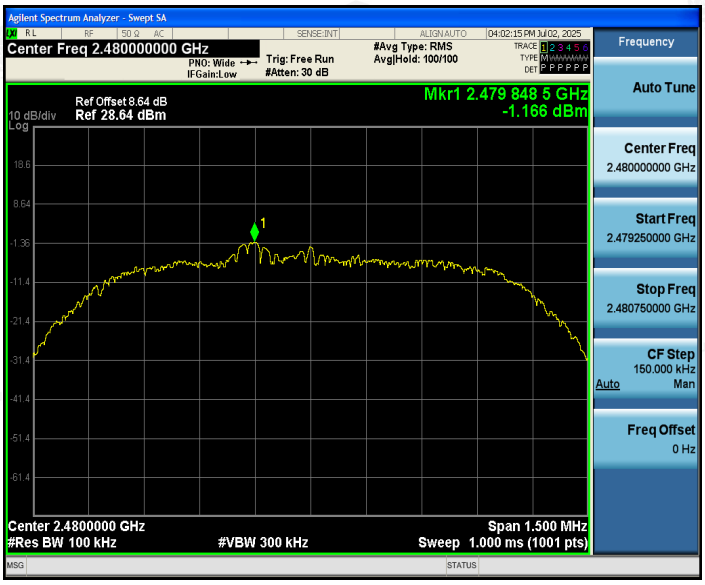
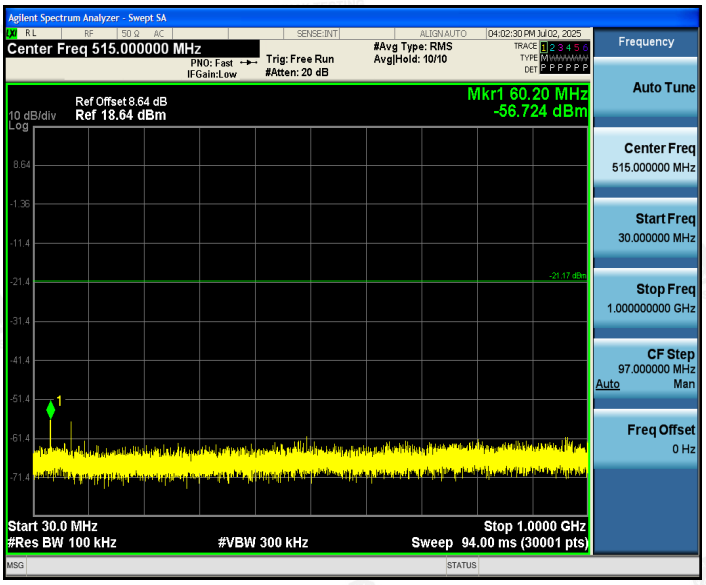
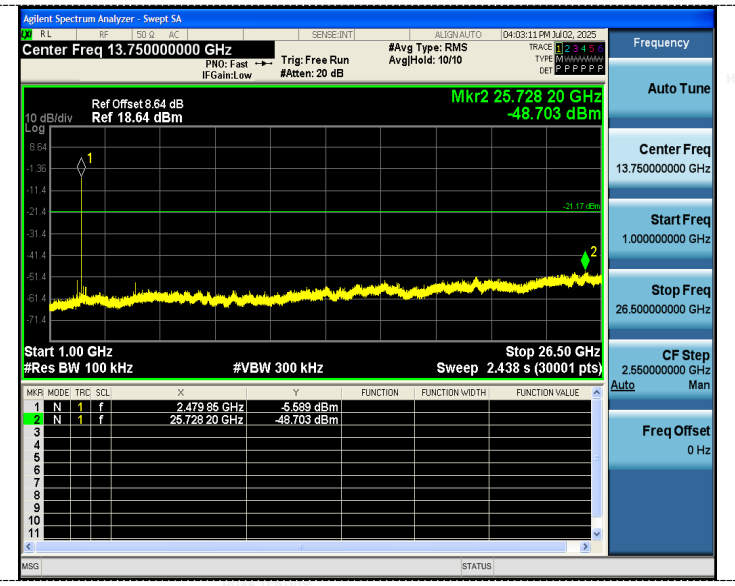
*CH78*

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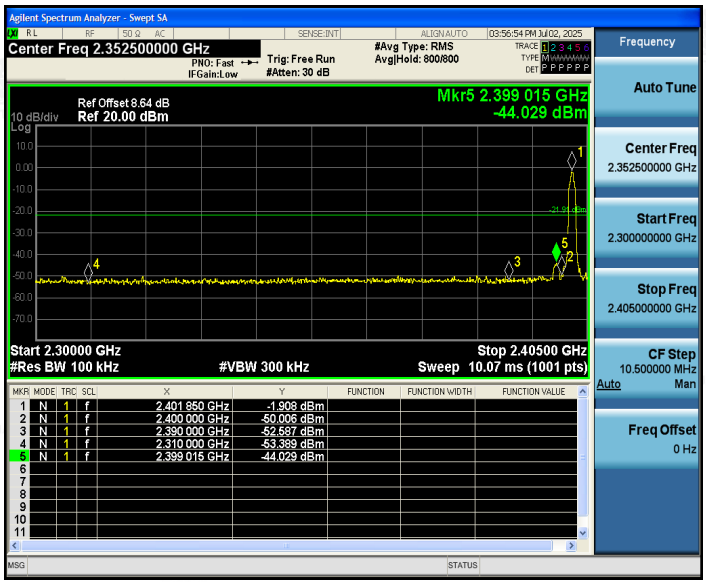
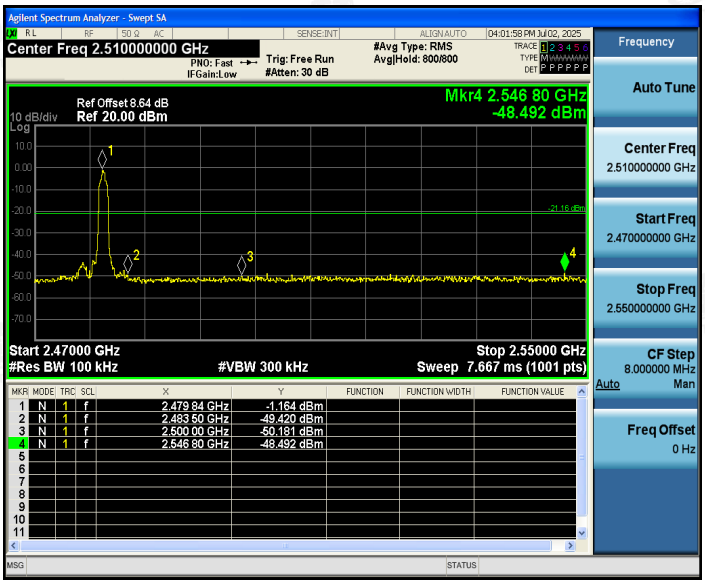



Left Band edge hoping off

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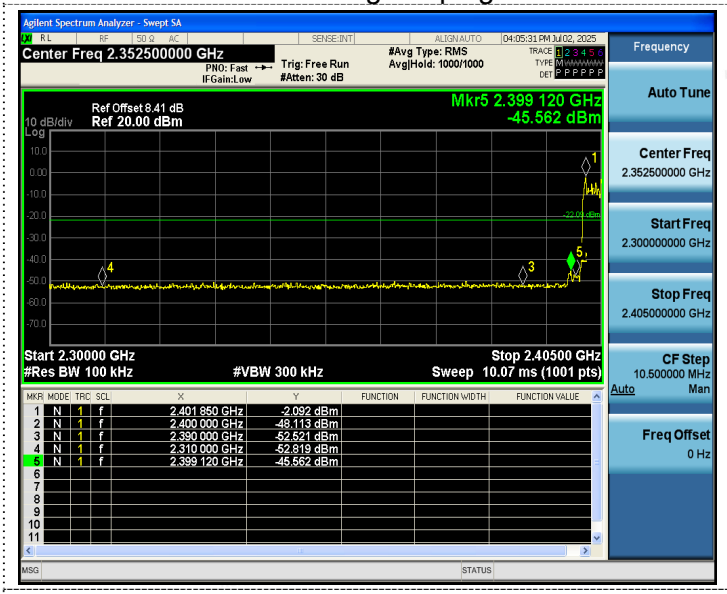
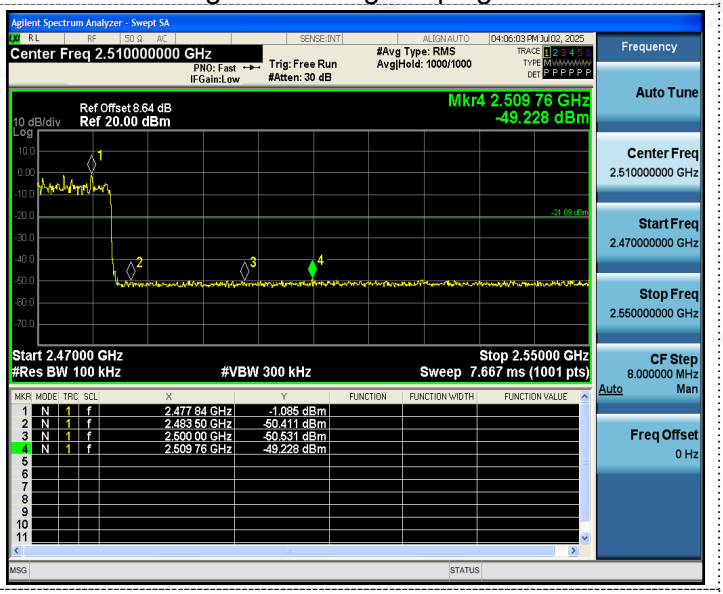



Left Band edge hoping on




Right Band edge hoping on

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## 3.9. Pseudorandom Frequency Hopping Sequence

**TEST APPLICABLE**

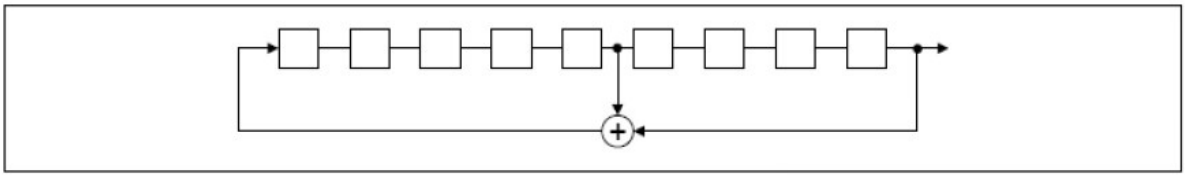
**For 47 CFR Part 15C section 15.247 (a) (1):**

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.

**EUT Pseudorandom Frequency Hopping Sequence Requirement**

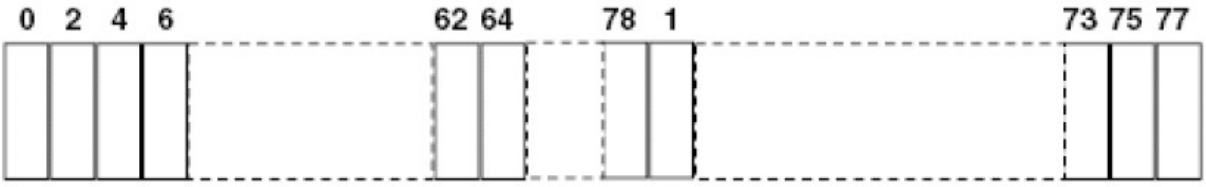
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: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

- Number of shift register stages:9
- Length of pseudo-random sequence: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.

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## 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.

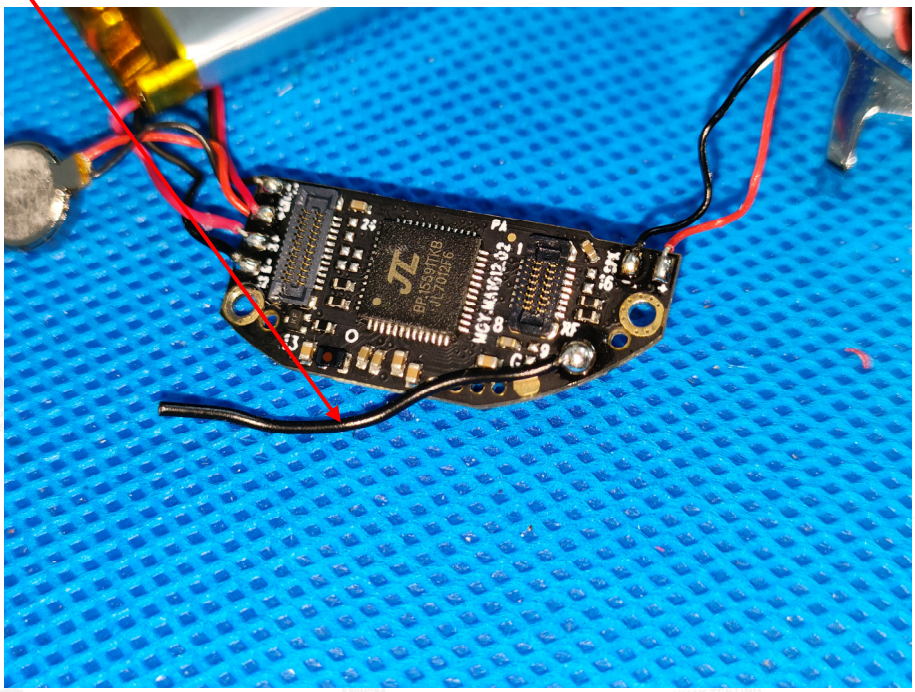
**Refer to statement below for compliance.**

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 a Internal Antenna, which permanently attached. It conforms to the standard requirements. The directional gains of antenna used for transmitting is 0.17dBi.

Antenna



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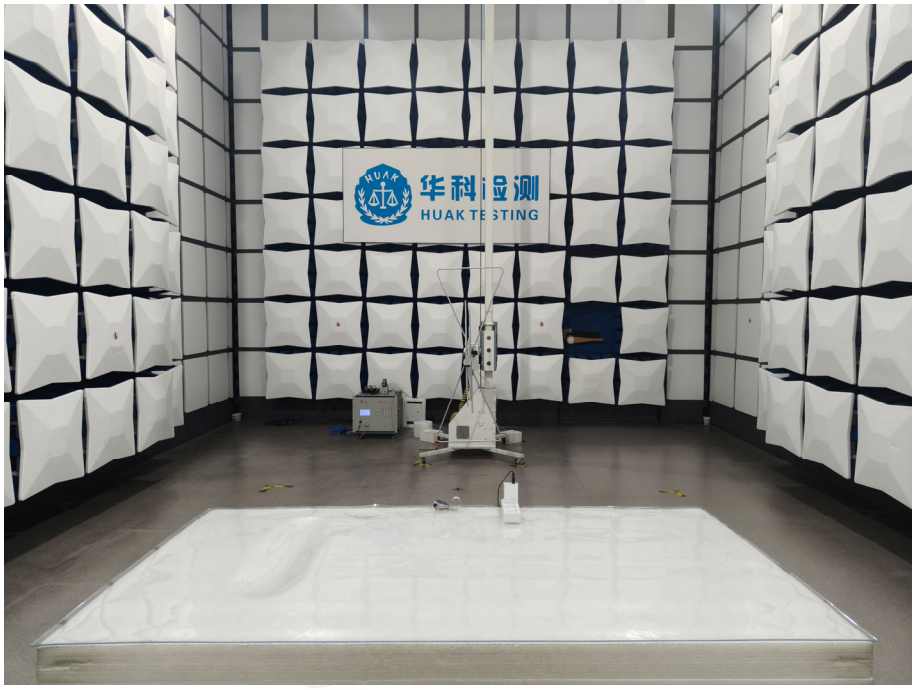
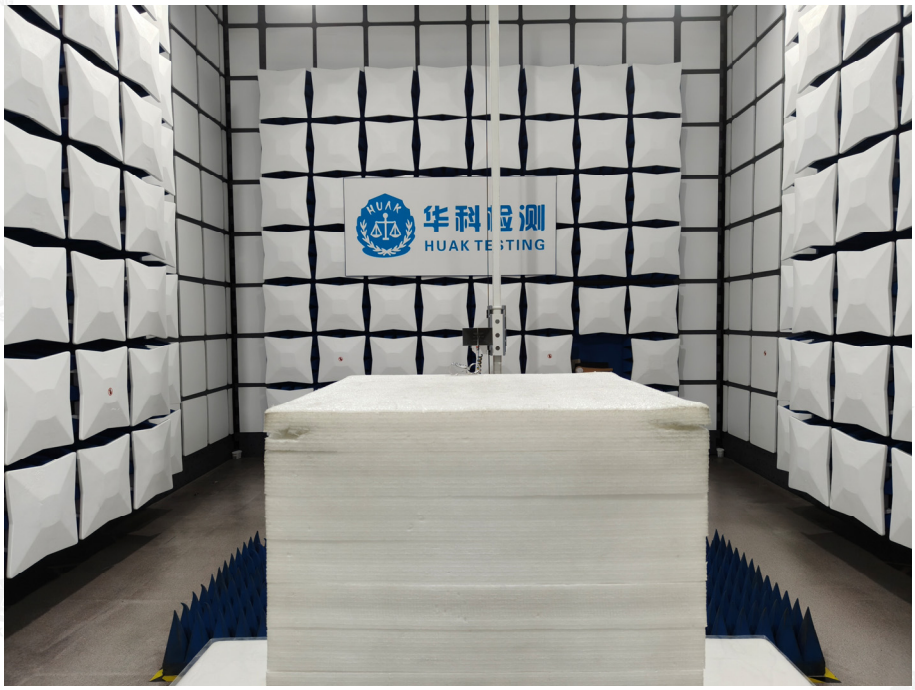
# 4. Test Setup Photos of the EUT

Radiated Emissions

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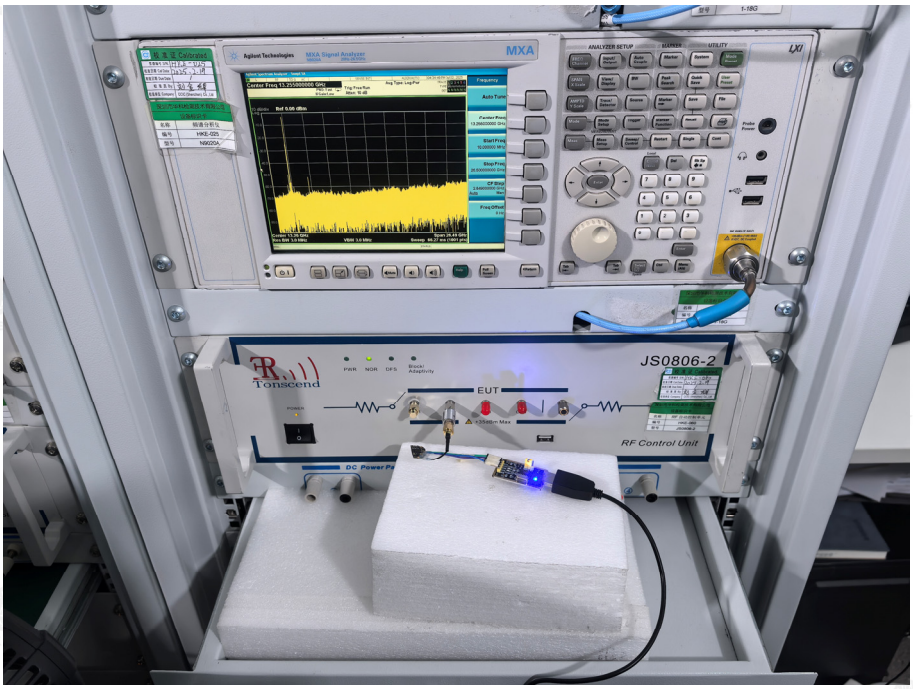
AC Conducted Emission

RF Conducted Emission

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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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