

4.8 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 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.

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 settings are made of the in-band reference level, bandedge 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 bandedge measurement data.

The test results including the cable loss + power divider loss.

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

GFSK(CH00)



Keysight Spectrum Analyzer - Sweet SA

Center Freq 2.44100000 GHz

Ref Offset 8.30 dB
Ref 28.38 dBm

Mkr 2.441 022 5 GHz
0.024 dBm

Center 2.4410000 GHz
#Res BW 100 kHz
#VBW 300 kHz

Span 1.500 MHz
Sweep 1.000 ms (1001 pts)

Auto Tune

Center Freq 2.44100000 GHz

Start Freq 2.440250000 GHz

Stop Freq 2.441750000 GHz

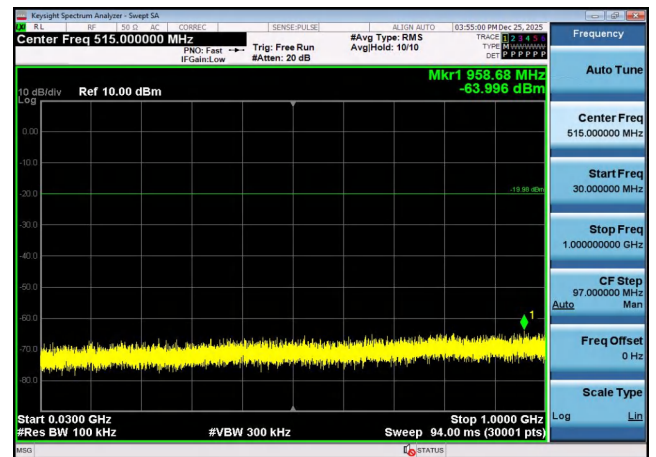
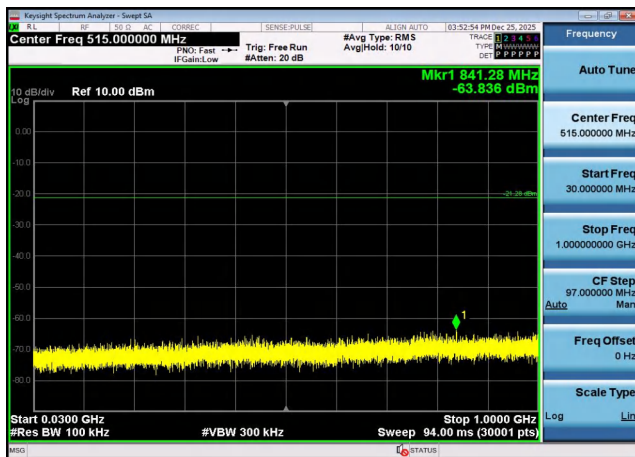
CF Step 150.000 kHz

Freq Offset 0 Hz

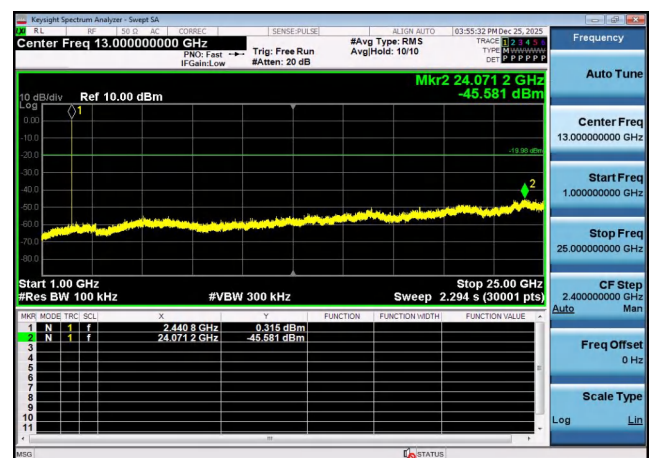
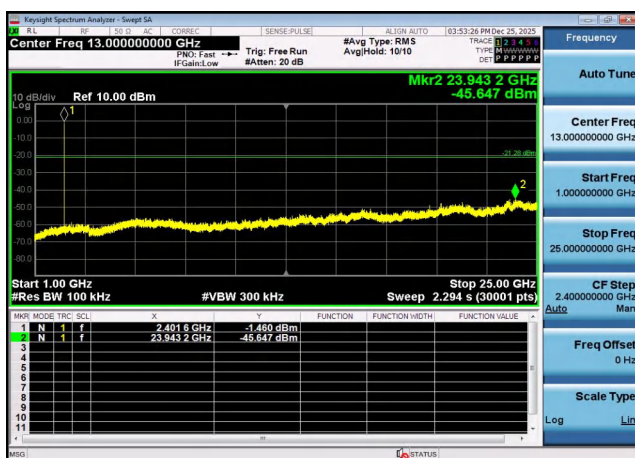
Scale Type

Log Lin

reference



30MHz-1G

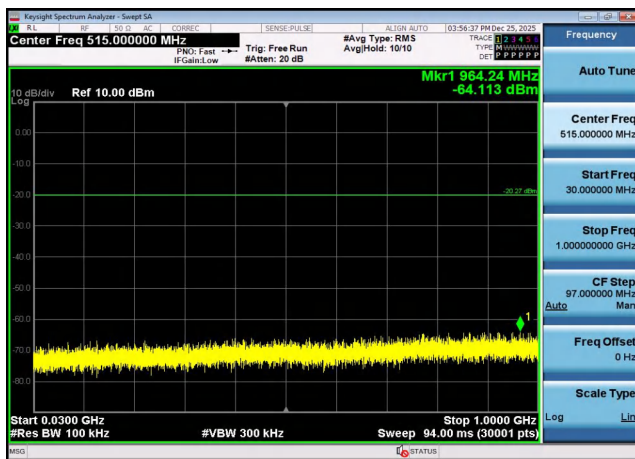


1G-25G

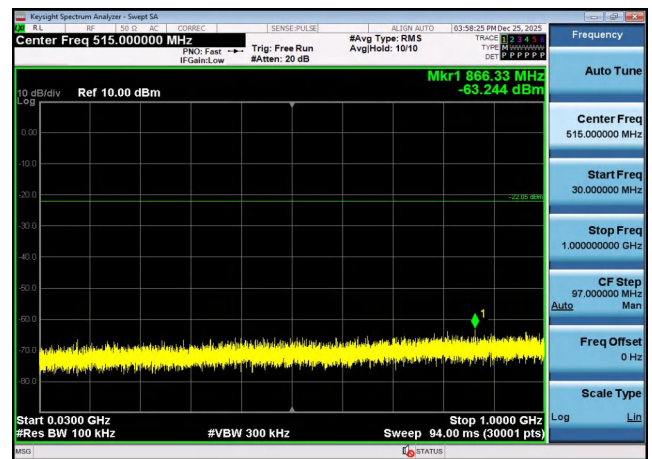
GFSK(CH78)

 $\pi/4$ DQPSK (CH00)

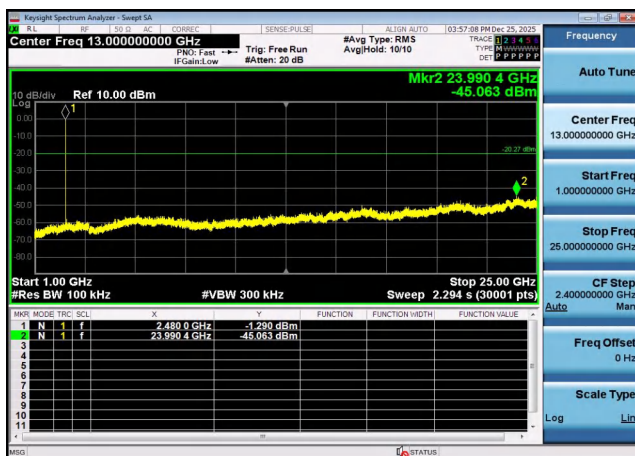
reference



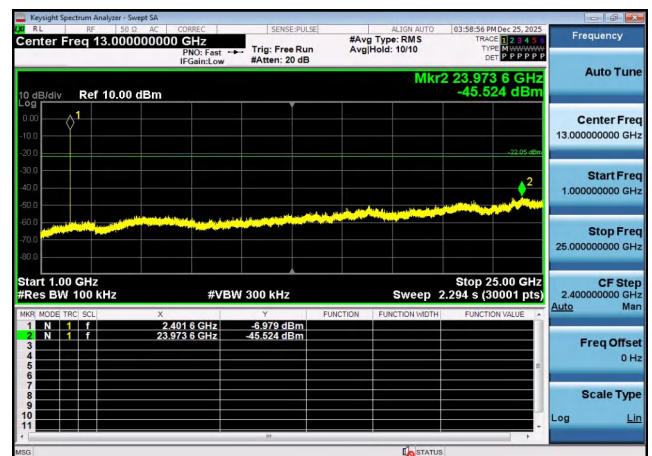
reference



30MHz-1G

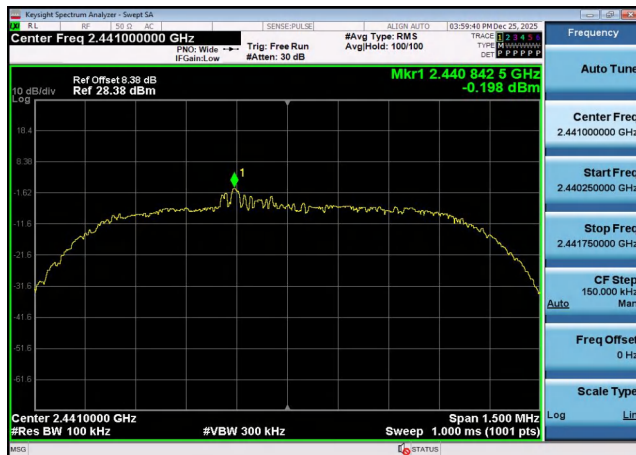


30MHz-1G

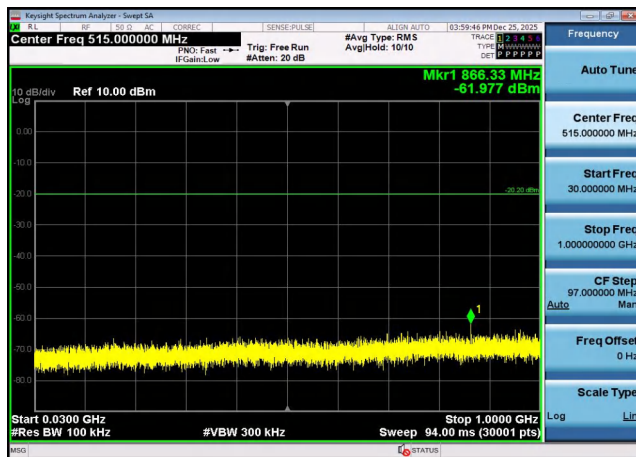


1G-25G

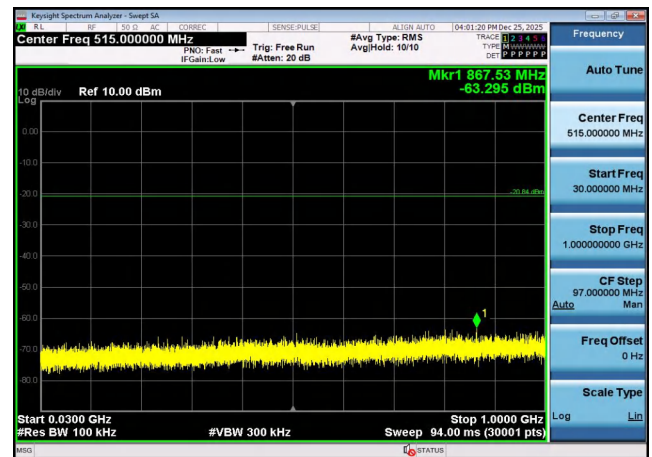
1G-25G

$\pi/4$ DQPSK (CH39) $\pi/4$ DQPSK (CH78)

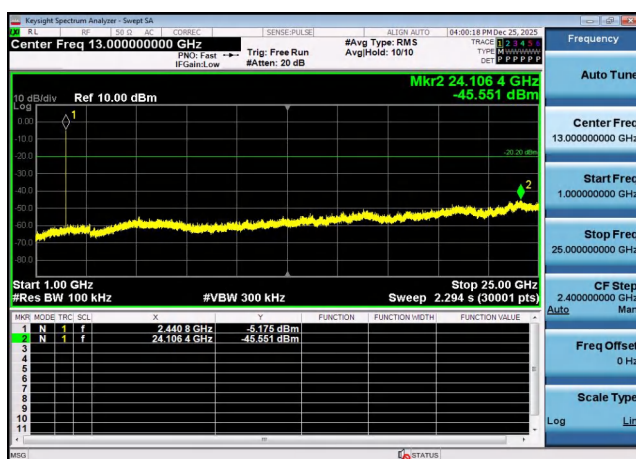
reference



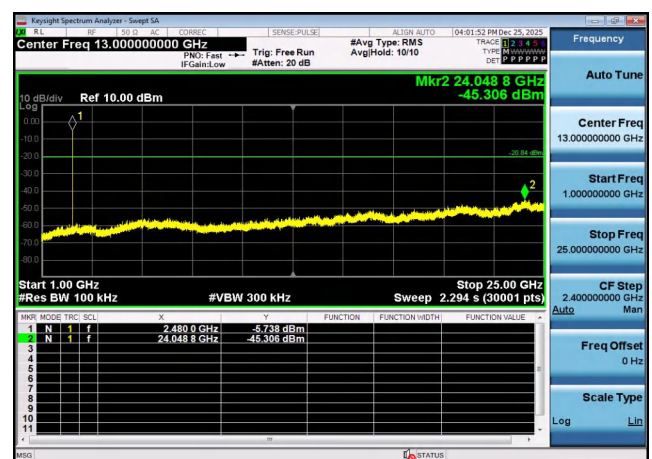
reference



30MHz-1G



30MHz-1G



1G-25G

1G-25G

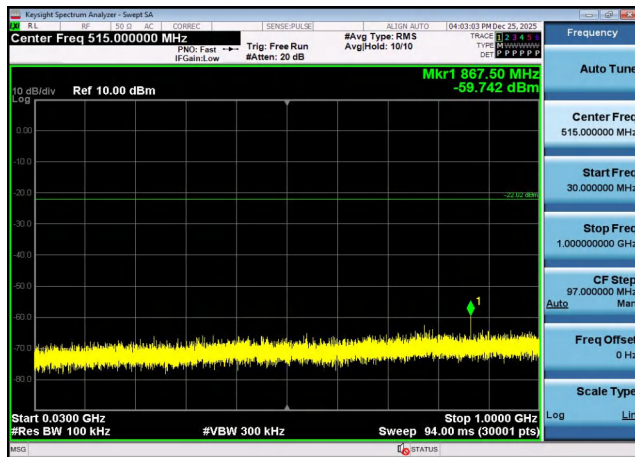
8DPSK (CH00)



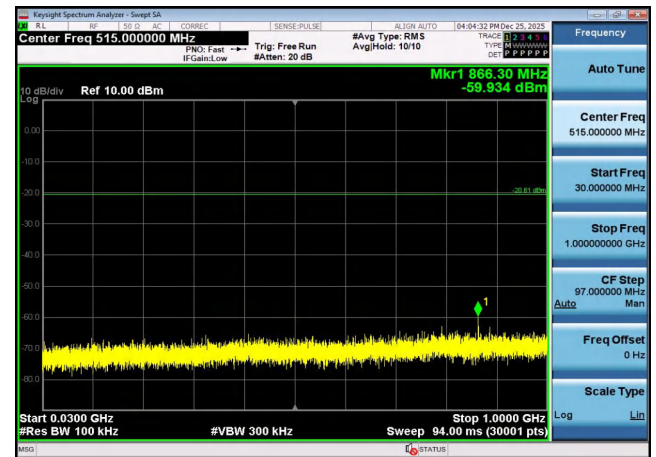
8DPSK (CH39)



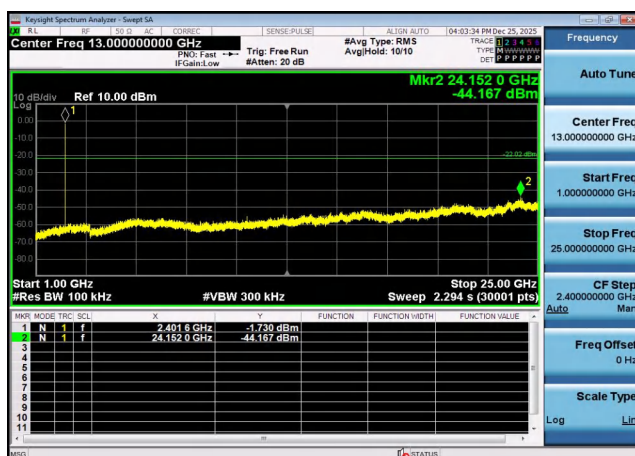
reference



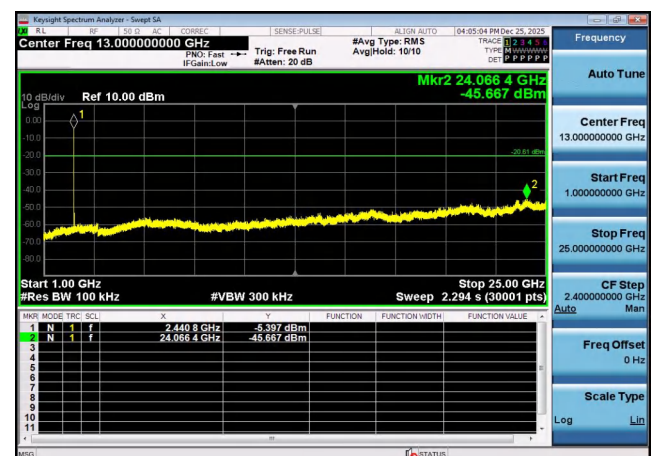
reference



30MHz-1G

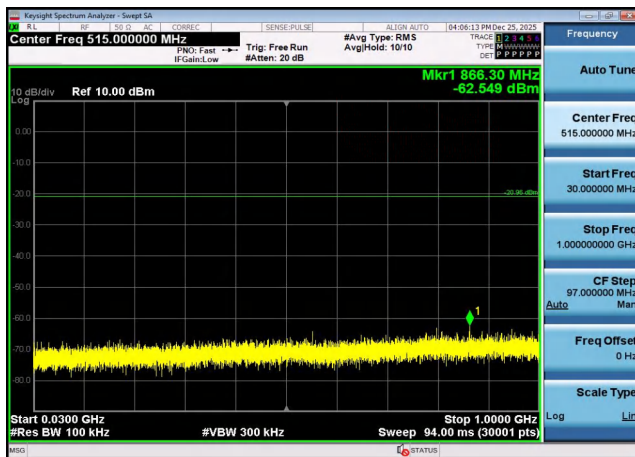
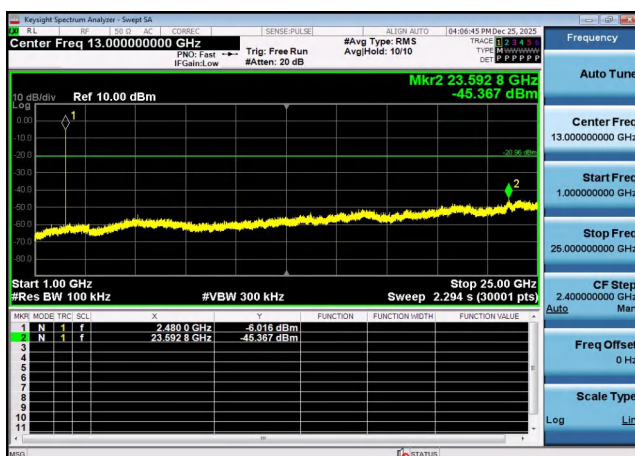


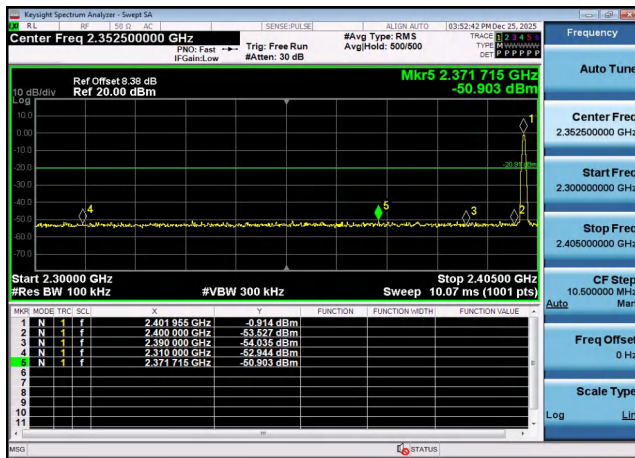
30MHz-1G



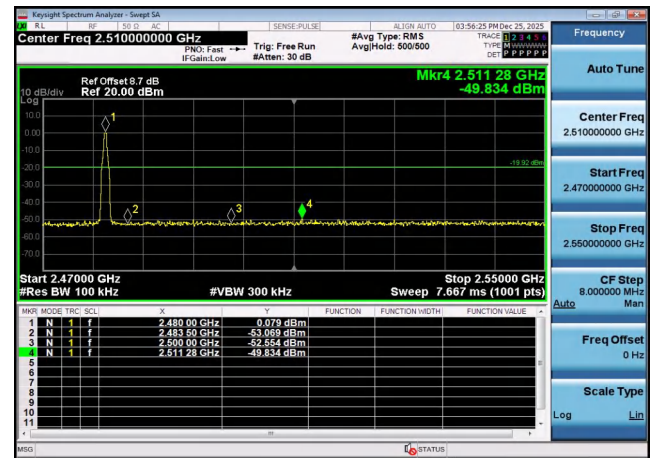
1G-25G

1G-25G

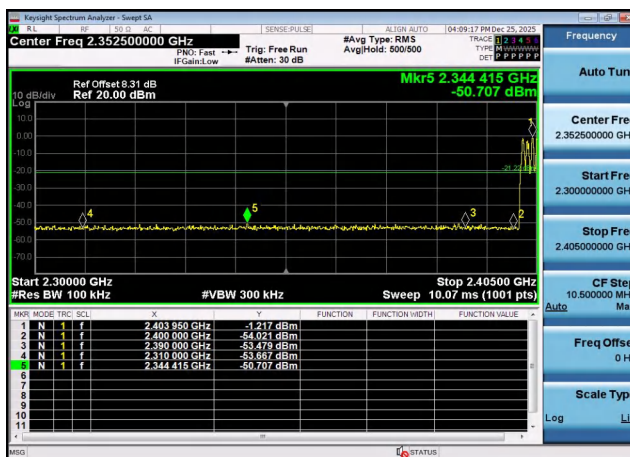
8DPSK (CH78)**reference****30MHz-1G****1G-25G**

Band-edge Measurements for RF Conducted Emissions:**GFSK**

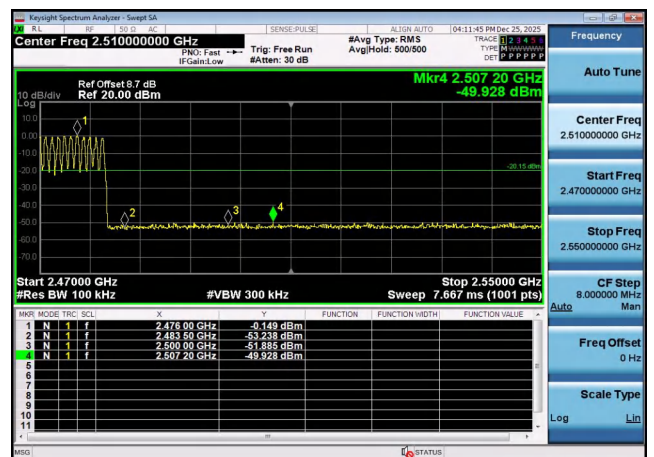
Left bandedge hopping off



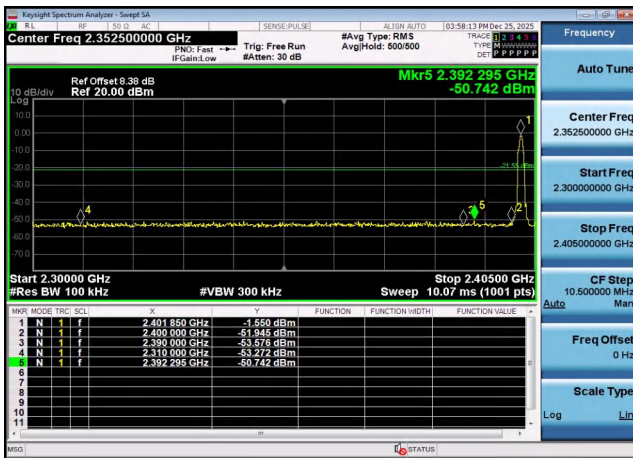
Right bandedge hopping off

GFSK

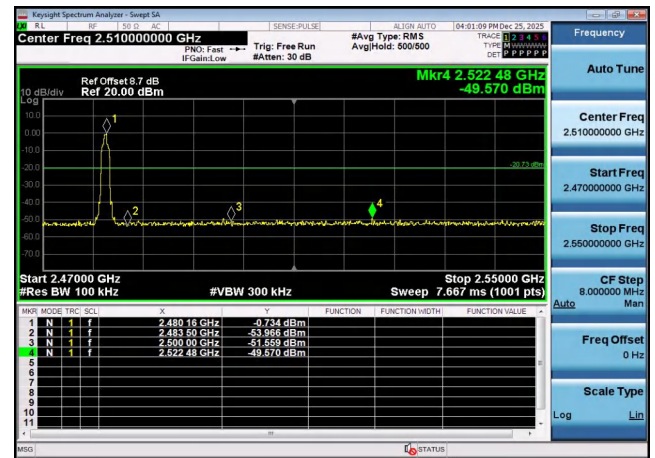
Left bandedge hopping on



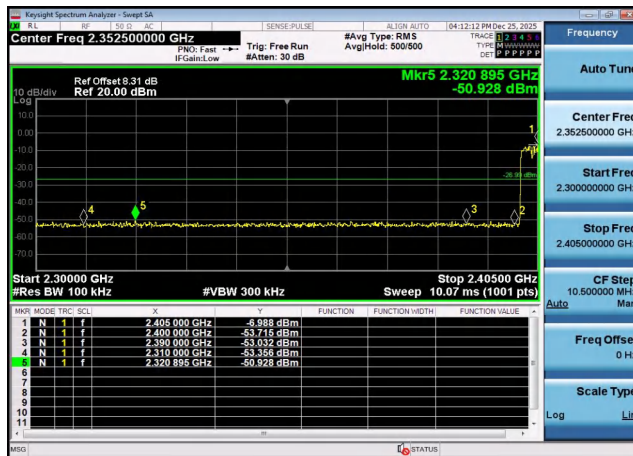
Right bandedge hopping on

$\pi/4$ DQPSK

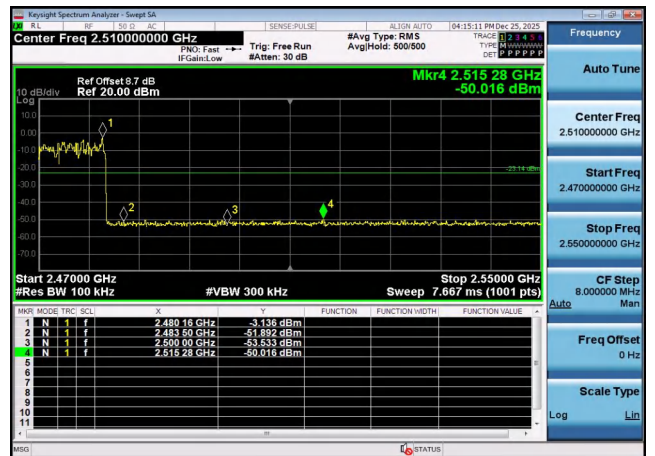
Left bandedge hopping off



Right bandedge hopping off

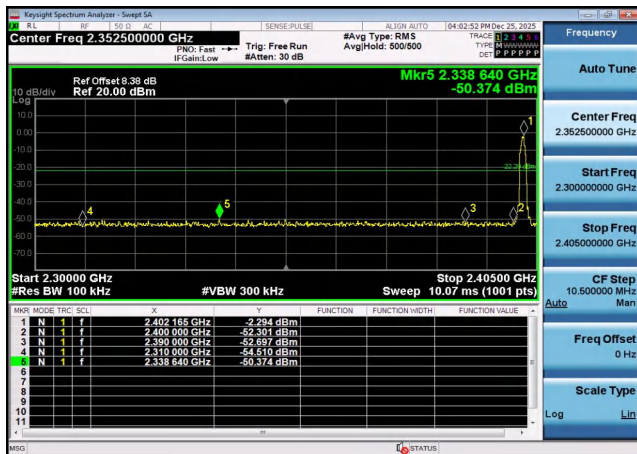
 $\pi/4$ DQPSK

Left bandedge hopping on

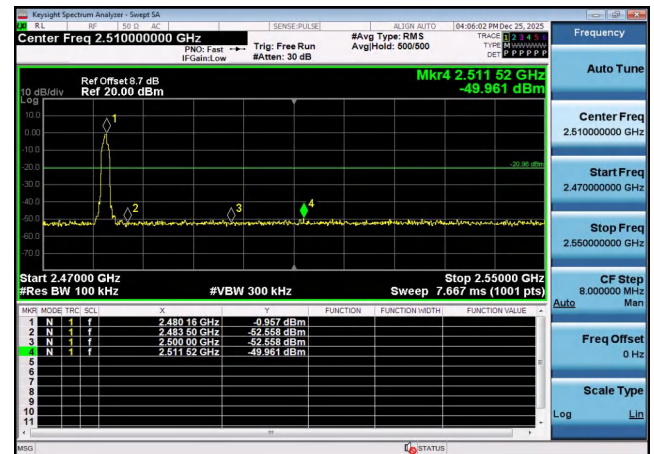


Right bandedge hopping on

8DPSK

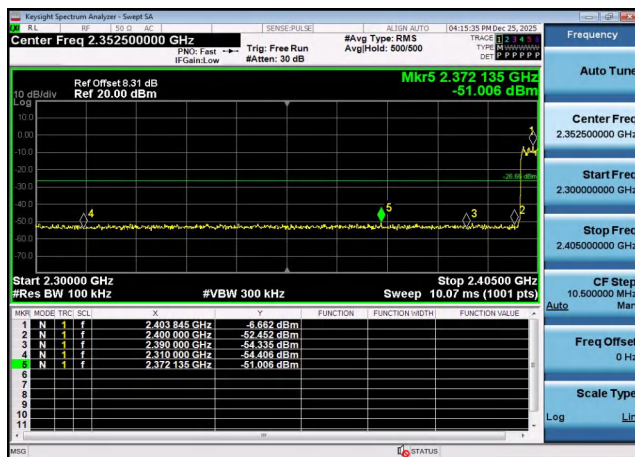


Left bandedge hopping off

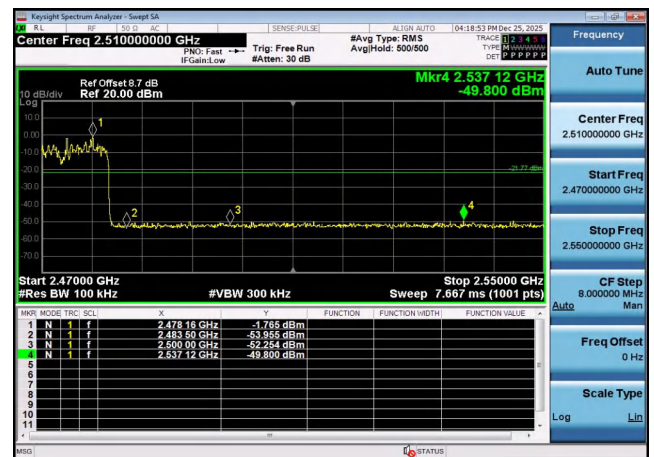


Right bandedge hopping off

8DPSK



Left bandedge hopping on



Right bandedge hopping on

4.9 Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

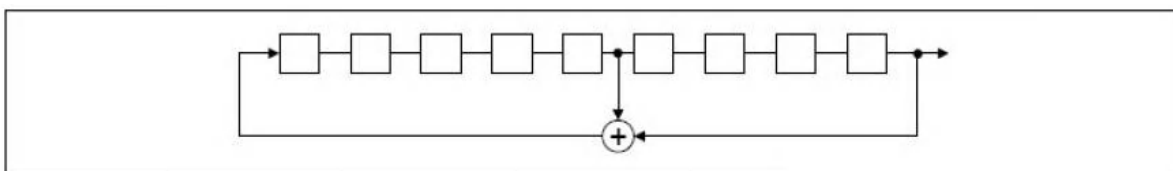
For 47 CFR Part 15C section 15.247 (a) (1) requirement:

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 corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

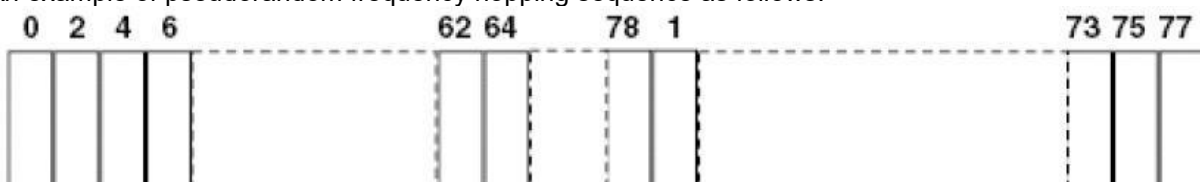
The pseudorandom frequency hopping sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: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

4.10 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 (c), 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

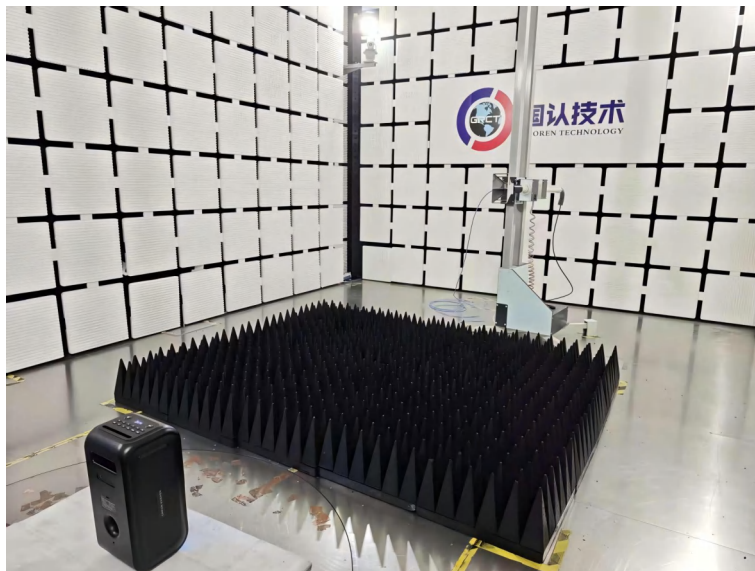
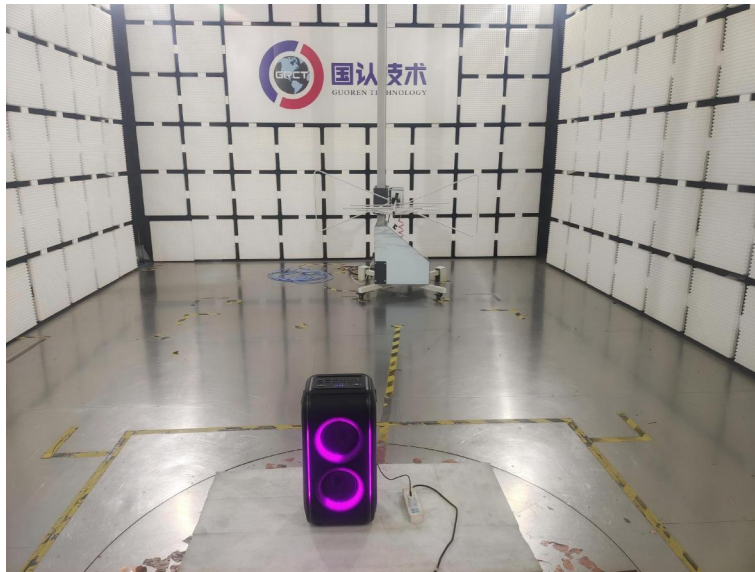
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

The maximum gain of antenna was 1.70 dBi.

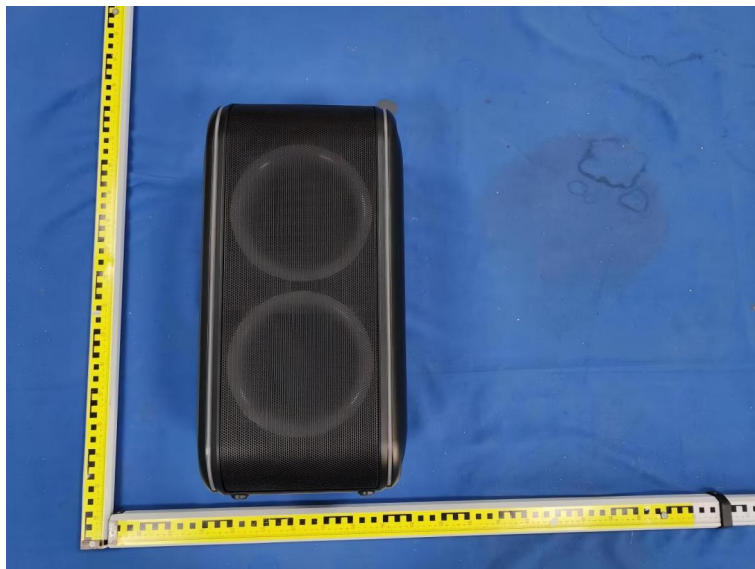
Remark: The antenna gain is provided by the customer, if the data provided by the customer is not accurate, Shenzhen GUOREN Certification Technology Service Co., Ltd. does not assume any responsibility.

5 Test Setup Photos of the EUT



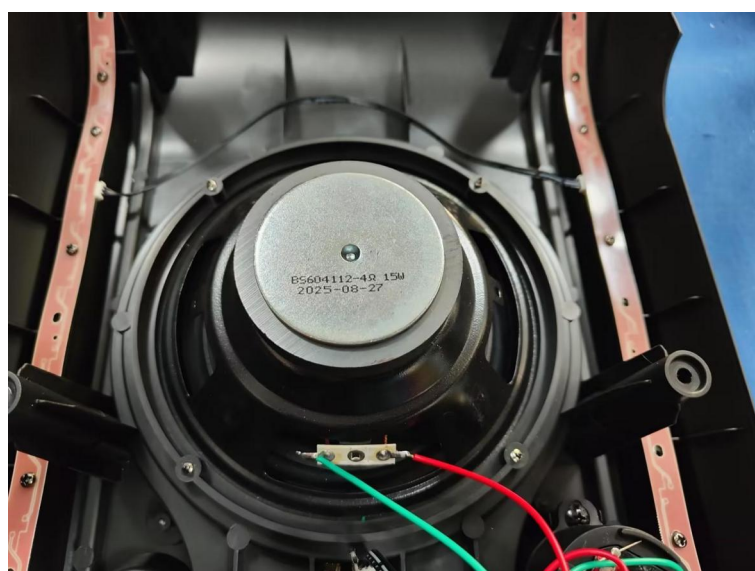
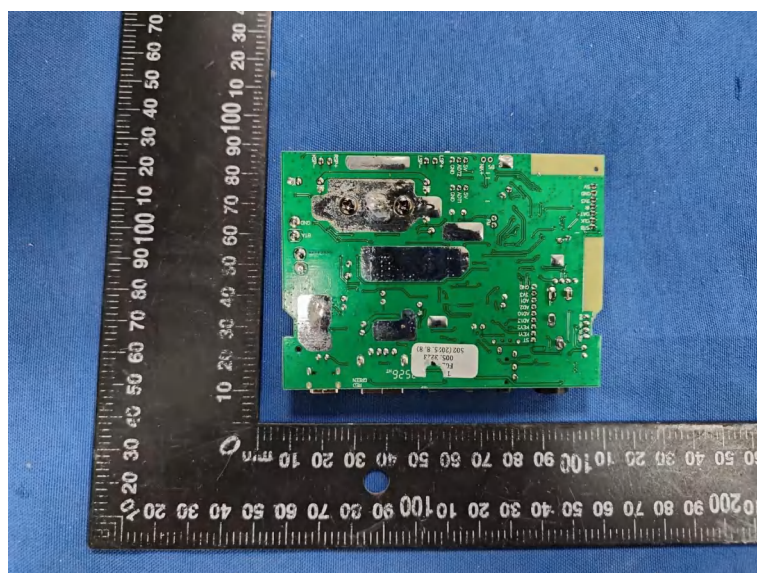
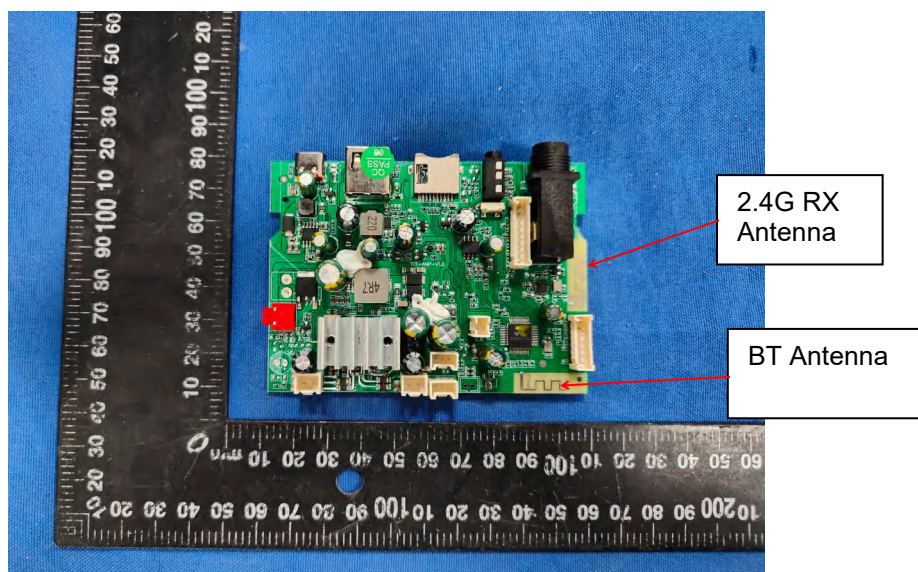


6 Photos of the EUT









***** End of Report *****