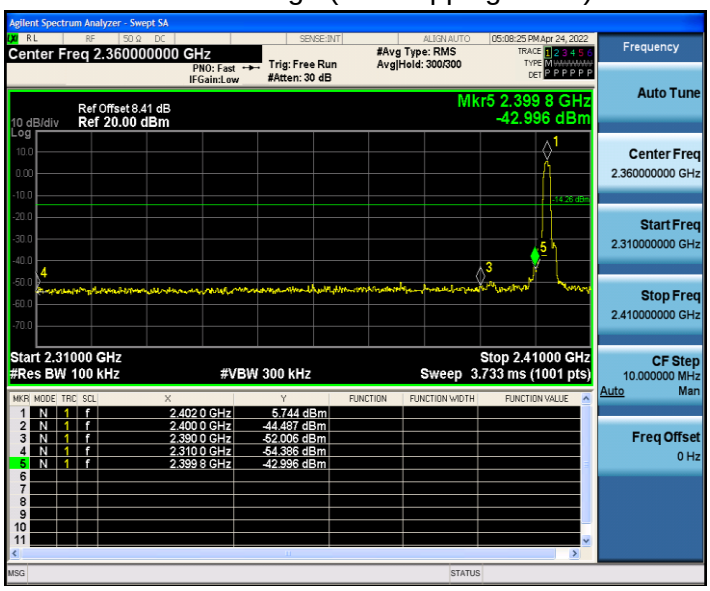
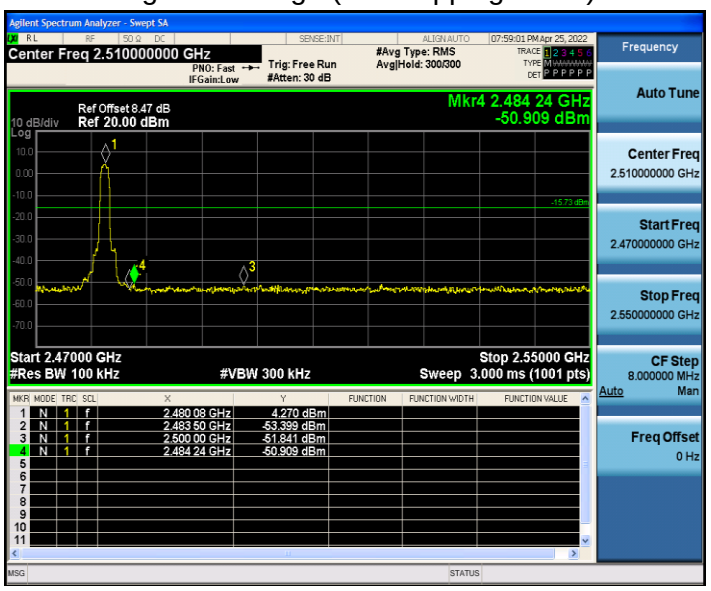
**8DPSK mode - conducted emissions at the band edge**

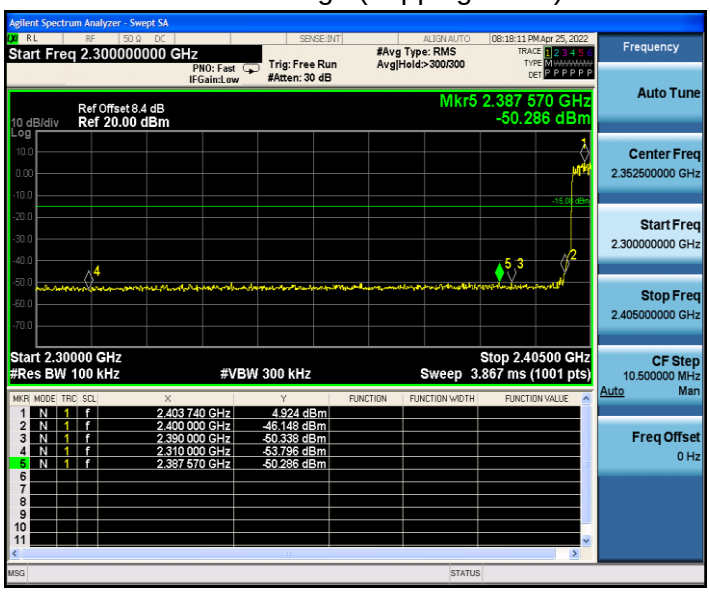
Low band-edge (non-hopping mode)



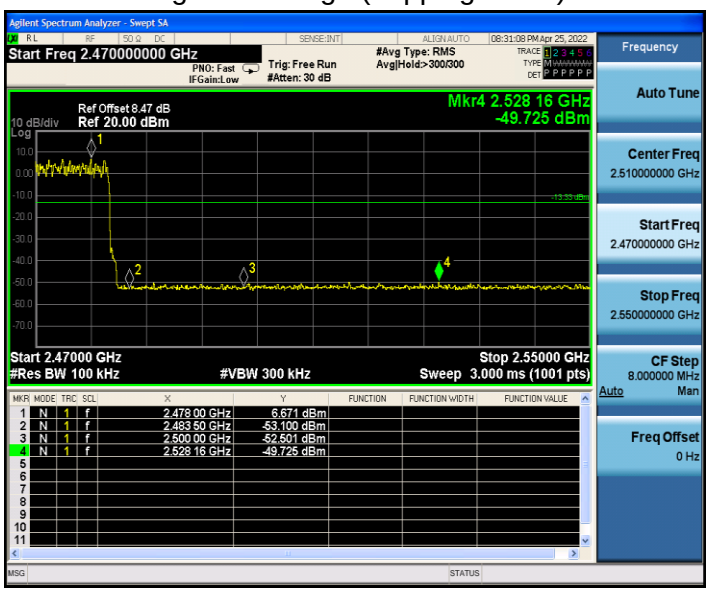

High band-edge (non-hopping mode)




Low band-edge (hopping mode)




High band-edge (hopping mode)

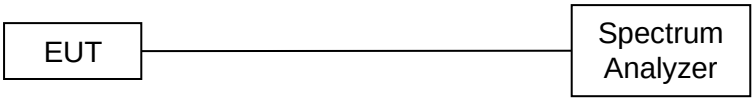


## 5.9 Conducted spurious emissions

### 5.9.1 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)).

### 5.9.2 Test setup




### 5.9.3 Test procedure

a) Test method: ANSI C63.10-2013 Section 6.10.4
b) The EUT was set to non-hopping mode & hopping mode during the test.
c) The transmitter output of EUT is connected to the spectrum analyzer.
d) Spectrum analyzer setting: RBW = 100 kHz, VBW = 300 kHz, Detector = Peak.

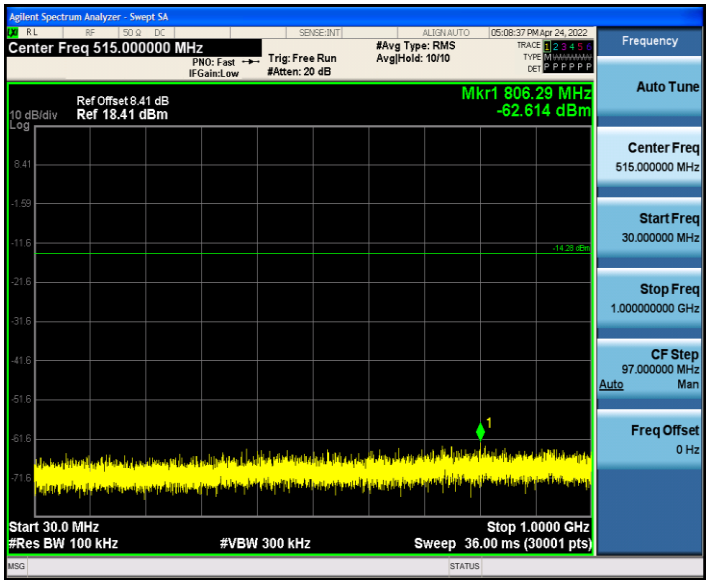
### 5.9.4 Test results

**Notes:**
All modes of operation of the EUT were investigated, and only the worst-case results are reported.
The worst-case mode: TX mode (8DPSK).

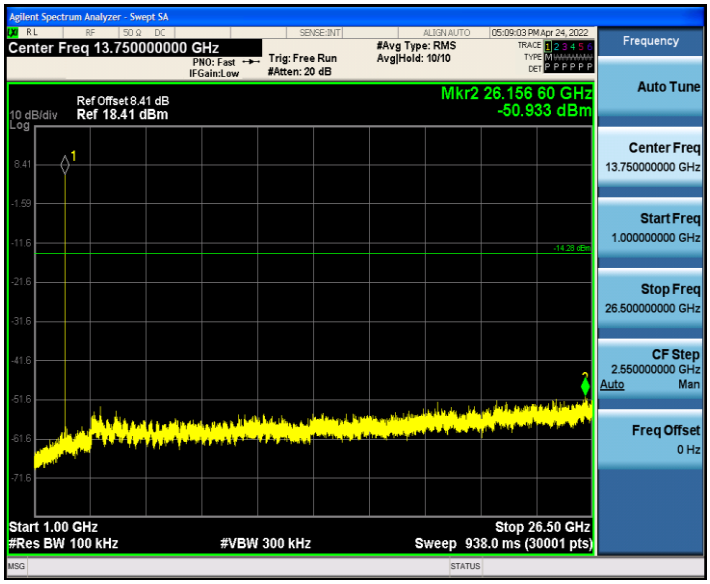
## Conducted spurious emissions – 8DPSK mode

CH0

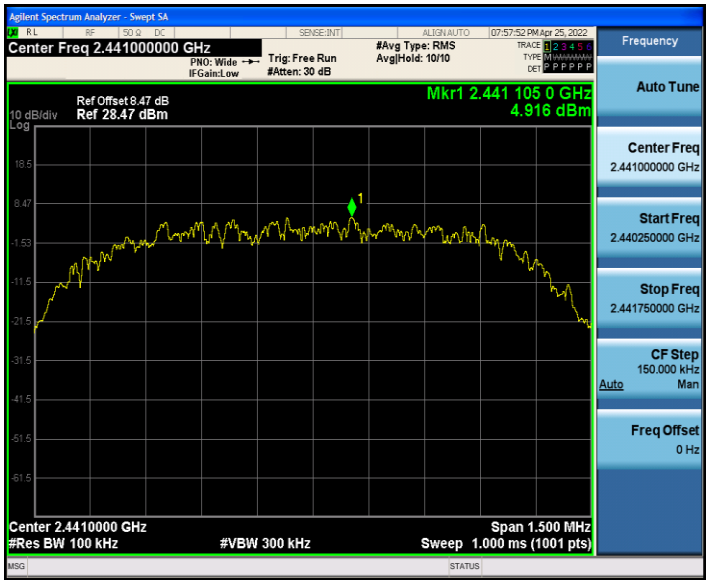

CH0



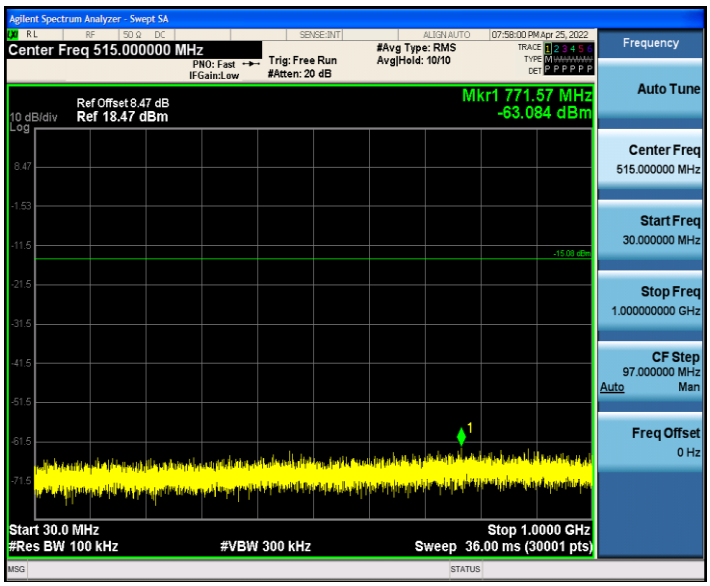

CH0



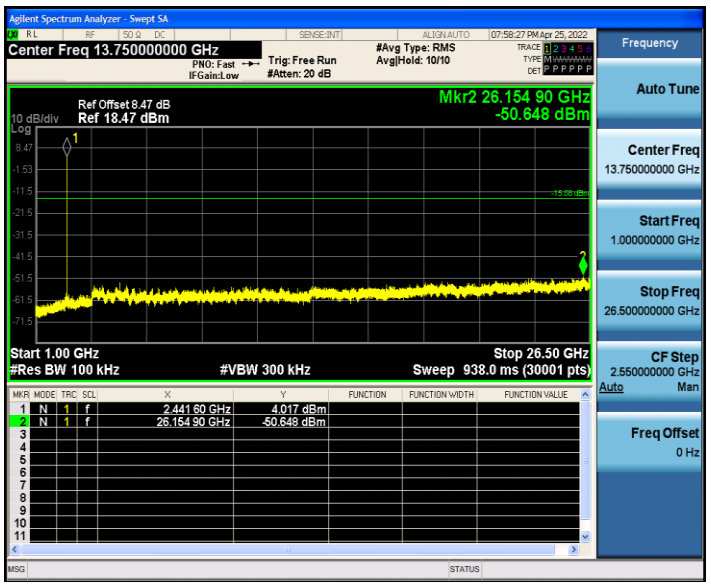

CH39




CH39

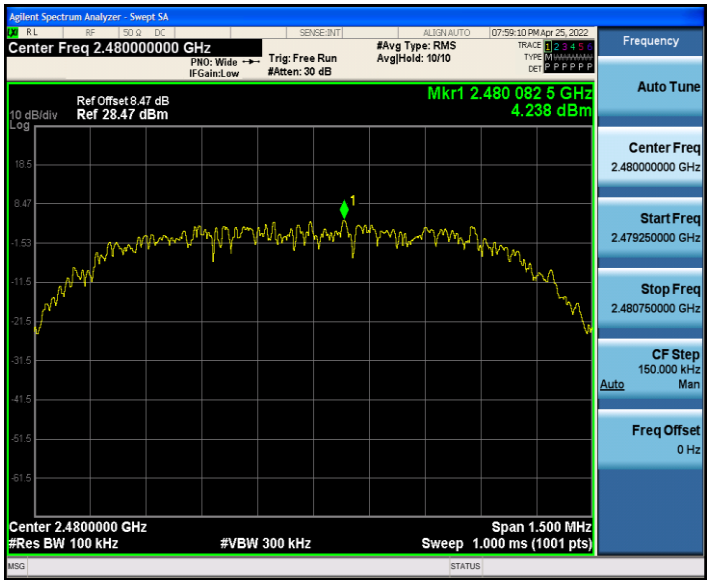



CH39

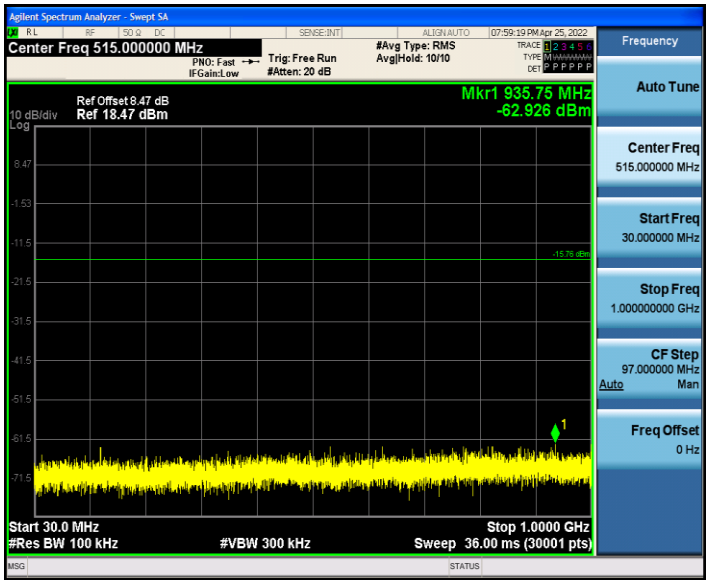


## Conducted spurious emissions – 8DPSK mode

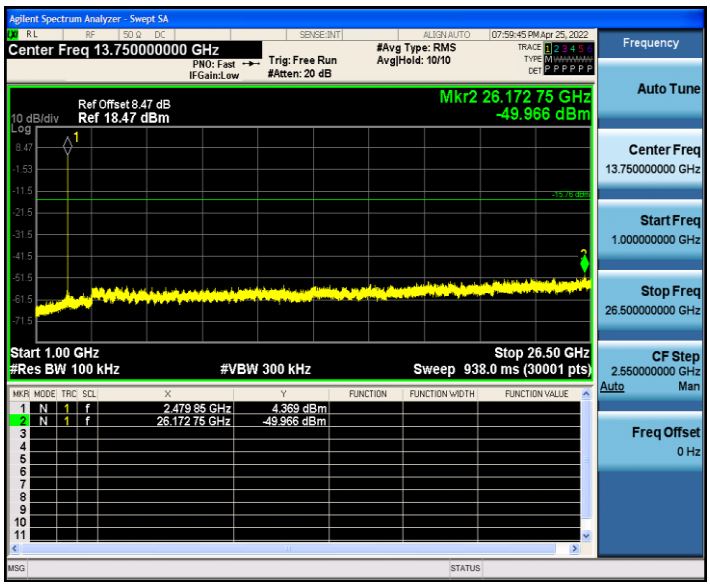
CH78




CH78




CH78



## 5.10 Radiated spurious emission

### 5.10.1 Limits

§ 15.247 (d) 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)).

§ 15.209 Radiated emission limits; general requirements.

| Frequency (MHz) | Field strength (microvolts/meter) | Measurement distance (meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

**Note 1:** the tighter limit applies at the band edges.
**Note 2:** the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector

§ 15.35 (b) requirements:
When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

According to ANSI C63.10-2013, the tests shall be performed in the frequency range shown in the following table:

**Frequency range of measurements for unlicensed wireless device**

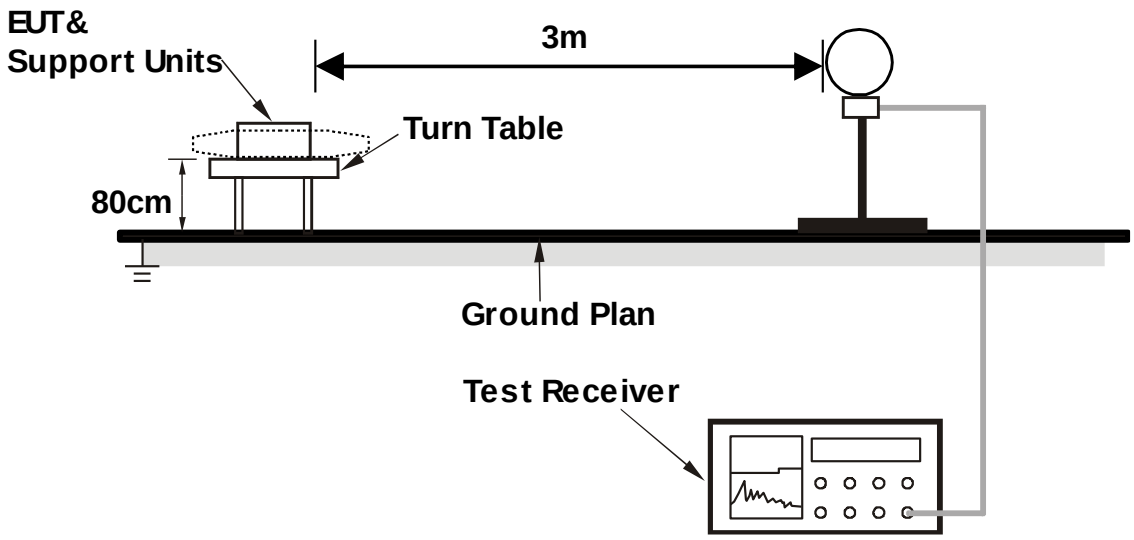
| Lowest frequency generated in the device | Upper frequency range of measurement |
|---|---|
| 9 kHz to below 10 GHz | 10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower |
| At or above 10 GHz to below 30 GHz | 5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower |
| At or above 30 GHz | 5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified |

**Frequency range of measurements for unlicensed wireless device with digital device**

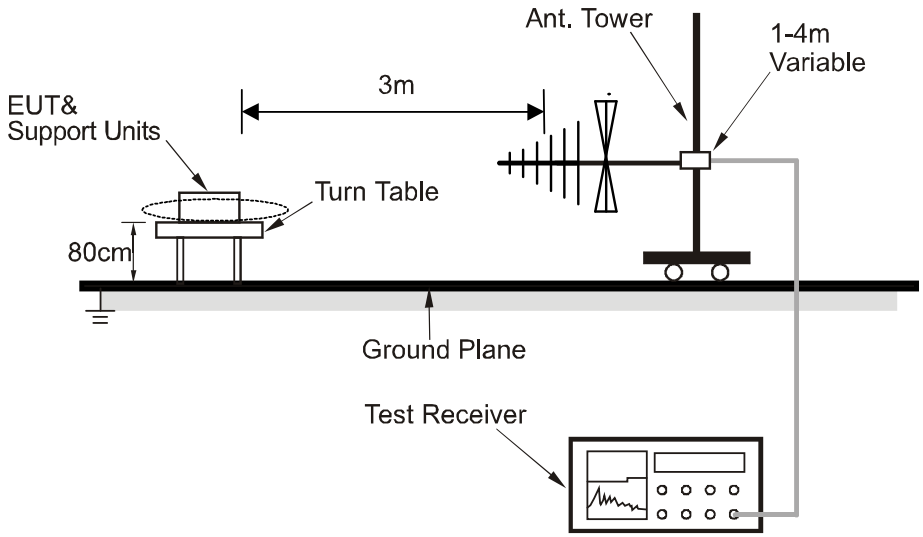
| Highest frequency generated or used in the device or on which the device operates or tunes | Upper frequency range of measurement |
|---|---|
| Below 1.705 MHz | 30 MHz |
| 1.705 MHz to 108 MHz | 1000 MHz |
| 108 MHz to 500 MHz | 2000 MHz |
| 500 MHz to 1000 MHz | 5000 MHz |
| Above 1000 MHz | 5th harmonic of the highest frequency or 40 GHz, whichever is lower |

**5.10.2 Test setup**

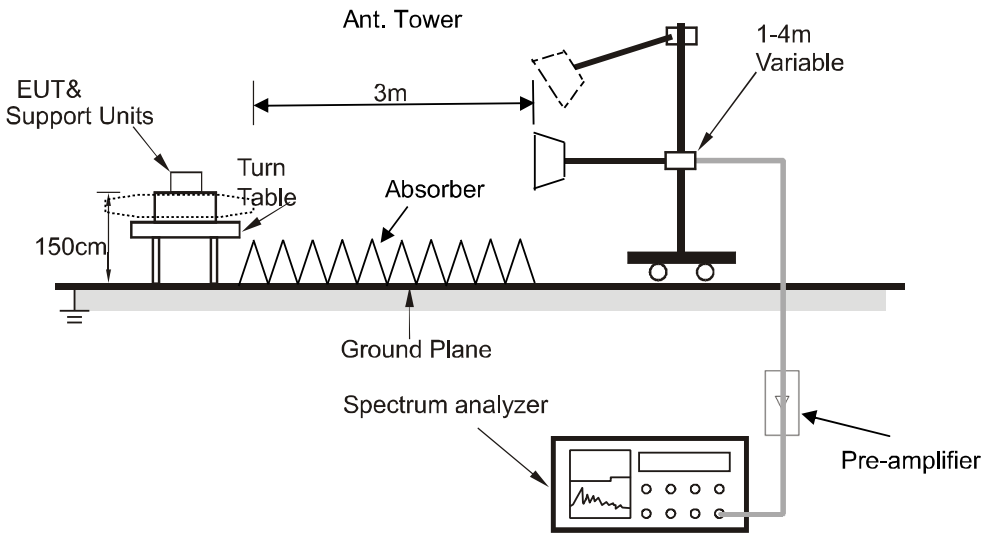
Below 30MHz




30MHz~1GHz




Above 1GHz




For the actual test configuration, please refer to the related item – Photographs of the test setup.

**5.10.3 Test procedure**

a) Test method: ANSI C63.10-2013 Section 6.3, 6.4, 6.5, 6.6, 6.10.
b) The EUT is placed on an on-conducting table 0.8 meters above the ground plane for measurement below 1GHz, 1.5 meters above the ground plane for measurement above 1GHz.
c) Emission blew 18 GHz were measured at a 3 meters test distance, above 18 GHz were measured at 1-meter test distance with the application of a distance correction factor
d) The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

KDB 558074 D01 15.247 Meas Guidance v05r02
The use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the unwanted emission limit is subject to an average field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period.

**Test instrument setup**

| Frequency | Test receiver / Spectrum analyzer setting |
|---|---|
| 9 kHz ~ 150 kHz | Quasi Peak / RBW: 200 Hz |
| 150 kHz ~ 30 MHz | Quasi Peak / RBW: 9 kHz |
| 30 MHz ~ 1 GHz | Quasi Peak / RBW: 120 kHz |
| Above 1 GHz | Peak / RBW: 1 MHz, VBW: 3MHz, Peak detector<br>AVG / RBW: 1 MHz, VBW: 1/T, Peak detector |

**5.10.4 Test results**

**Notes:**

The amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported.

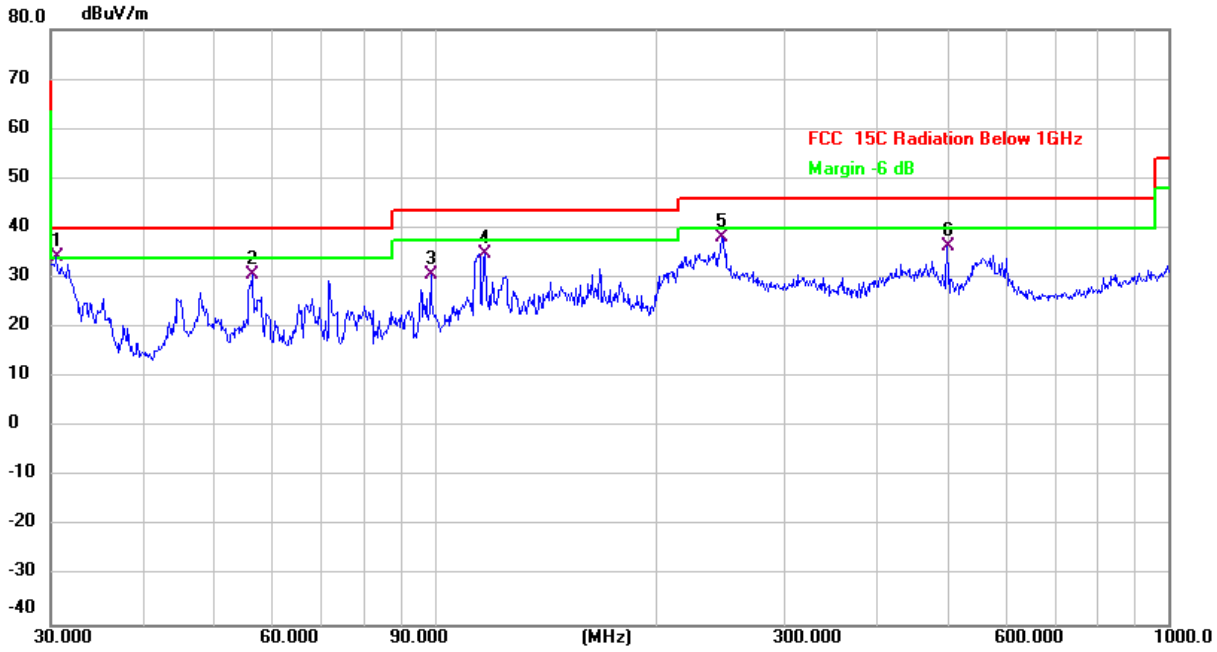
All modes of operation of the EUT were investigated, and only the worst-case results are reported.

There were no emissions found below 30MHz within 20dB of the limit.

**Calculation formula:**
Measurement (dBμV/m) = Reading Level (dBμV) + Correct Factor (dB/m)
Over (dB) = Measurement (dBμV/m) – Limit (dBμV/m)

**Radiated emissions between 30MHz – 1GHz**

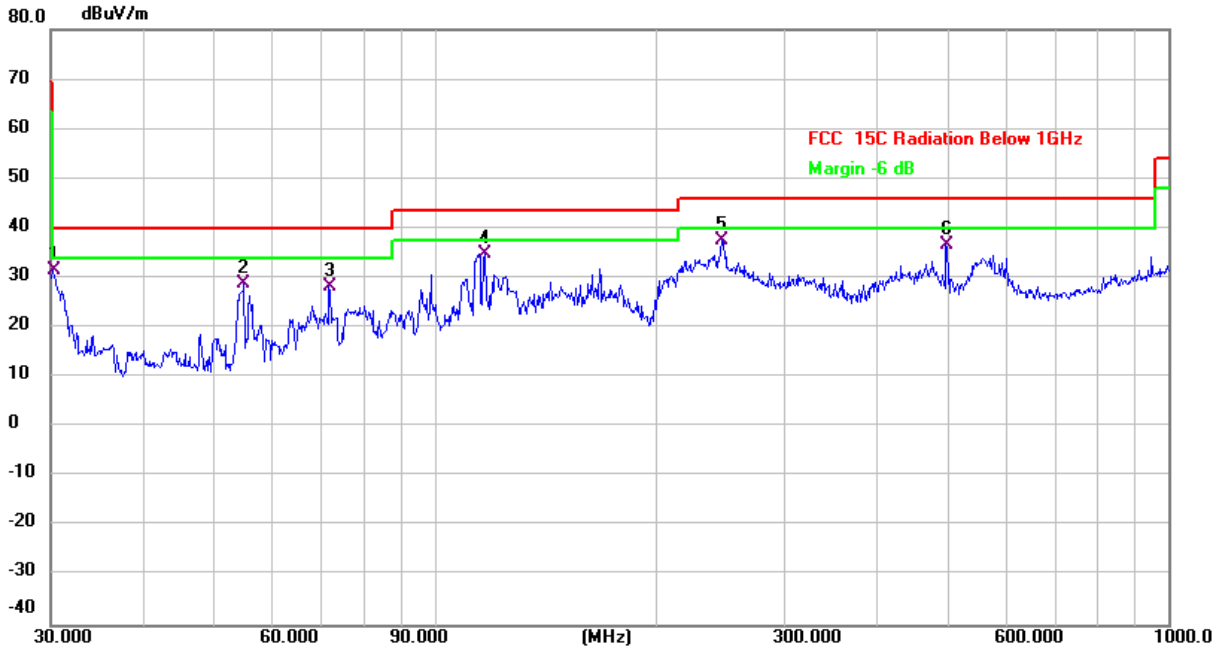
| Test mode: | 8DPSK-TX-2441MHz | Polarization: | Horizontal |
|---|---|---|---|
| Power supply: | DC 3.7V from battery | Test site: | RE chamber 2 |




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | * | 30.5306 | 43.11 | -8.83 | 34.28 | 40.00 | -5.72 | QP |
| 2 | | 56.3948 | 39.57 | -8.84 | 30.73 | 40.00 | -9.27 | QP |
| 3 | | 98.8326 | 39.13 | -8.54 | 30.59 | 43.50 | -12.91 | QP |
| 4 | | 116.9495 | 44.63 | -9.78 | 34.85 | 43.50 | -8.65 | QP |
| 5 | | 245.9509 | 44.17 | -6.03 | 38.14 | 46.00 | -7.86 | QP |
| 6 | | 499.4247 | 38.47 | -2.22 | 36.25 | 46.00 | -9.75 | QP |

**Radiated emissions between 30MHz – 1GHz**

| Test mode: | 8DPSK-TX-2441MHz | Polarization: | Vertical |
|---|---|---|---|
| Power supply: | DC 3.7V from battery | Test site: | RE chamber 2 |




| No. | Mk. | Freq. | Reading Level | Correct Factor | Measure-ment | Limit | Over | |
|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | Detector |
| 1 | | 30.2111 | 40.48 | -8.88 | 31.60 | 40.00 | -8.40 | QP |
| 2 | | 55.0274 | 37.31 | -8.59 | 28.72 | 40.00 | -11.28 | QP |
| 3 | | 71.8320 | 38.42 | -10.03 | 28.39 | 40.00 | -11.61 | QP |
| 4 | | 116.9495 | 44.63 | -9.78 | 34.85 | 43.50 | -8.65 | QP |
| 5 | * | 245.9509 | 43.67 | -6.03 | 37.64 | 46.00 | -8.36 | QP |
| 6 | | 497.6765 | 38.82 | -2.31 | 36.51 | 46.00 | -9.49 | QP |

**Radiated emissions 1 GHz ~ 25 GHz**

| Frequency | Reading Level | Correct Factor | Measurement | Limits | Over | Detector | Polarization |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB/m) | (dBμV/m) | (dBμV/m) | (dB) | Peak/AVG | H/V |
| **8DPSK - 2402 MHz TX mode** | | | | | | | |
| 4804 | 41.38 | 1.52 | 42.9 | 74 | -31.1 | Peak | V |
| 4804 | 34.8 | 1.52 | 36.32 | 54 | -17.68 | AVG | V |
| 7206 | 40.12 | 5.46 | 45.58 | 74 | -28.42 | Peak | V |
| 7206 | 33.69 | 5.46 | 39.15 | 54 | -14.85 | AVG | V |
| 9608 | 42.38 | 6.33 | 48.71 | 74 | -25.29 | Peak | V |
| 9608 | 35.85 | 6.33 | 42.18 | 54 | -11.82 | AVG | V |
| 4804 | 41.48 | 1.52 | 43.00 | 74 | -31.00 | Peak | H |
| 4804 | 35.74 | 1.52 | 37.26 | 54 | -16.74 | AVG | H |
| 7206 | 40.45 | 5.46 | 45.91 | 74 | -28.09 | Peak | H |
| 7206 | 33.95 | 5.46 | 39.41 | 54 | -14.59 | AVG | H |
| 9608 | 42.64 | 6.33 | 48.97 | 74 | -25.03 | Peak | H |
| 9608 | 36.04 | 6.33 | 42.37 | 54 | -11.63 | AVG | H |
| **8DPSK - 2441 MHz TX mode** | | | | | | | |
| 4882 | 41.01 | 1.68 | 42.69 | 74 | -31.31 | Peak | V |
| 4882 | 34.46 | 1.68 | 36.14 | 54 | -17.86 | AVG | V |
| 7323 | 41.02 | 5.45 | 46.47 | 74 | -27.53 | Peak | V |
| 7323 | 34.8 | 5.45 | 40.25 | 54 | -13.75 | AVG | V |
| 9764 | 42.15 | 6.37 | 48.52 | 74 | -25.48 | Peak | V |
| 9764 | 35.94 | 6.37 | 42.31 | 54 | -11.69 | AVG | V |
| 4882 | 41.4 | 1.68 | 43.08 | 74 | -30.92 | Peak | H |
| 4882 | 35.58 | 1.68 | 37.26 | 54 | -16.74 | AVG | H |
| 7323 | 40.93 | 5.45 | 46.38 | 74 | -27.62 | Peak | H |
| 7323 | 34.86 | 5.45 | 40.31 | 54 | -13.69 | AVG | H |
| 9764 | 42.32 | 6.37 | 48.69 | 74 | -25.31 | Peak | H |
| 9764 | 35.81 | 6.37 | 42.18 | 54 | -11.82 | AVG | H |

| Frequency | Reading Level | Correct Factor | Measurement | Limits | Over | Detector | Polarization |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB/m) | (dBμV/m) | (dBμV/m) | (dB) | Peak/AVG | H/V |
| **8DPSK - 2480 MHz TX mode** | | | | | | | |
| 4960 | 40.75 | 1.83 | 42.58 | 74 | -31.42 | Peak | V |
| 4960 | 34.48 | 1.83 | 36.31 | 54 | -17.69 | AVG | V |
| 7440 | 40.32 | 5.43 | 45.75 | 74 | -28.25 | Peak | V |
| 7440 | 33.74 | 5.43 | 39.17 | 54 | -14.83 | AVG | V |
| 9920 | 41.23 | 6.41 | 47.64 | 74 | -26.36 | Peak | V |
| 9920 | 34.85 | 6.41 | 41.26 | 54 | -12.74 | AVG | V |
| 4960 | 41.12 | 1.83 | 42.95 | 74 | -31.05 | Peak | H |
| 4960 | 34.32 | 1.83 | 36.15 | 54 | -17.85 | AVG | H |
| 7440 | 40.56 | 5.43 | 45.99 | 74 | -28.01 | Peak | H |
| 7440 | 34.22 | 5.43 | 39.65 | 54 | -14.35 | AVG | H |
| 9920 | 41.49 | 6.41 | 47.9 | 74 | -26.1 | Peak | H |
| 9920 | 34.83 | 6.41 | 41.24 | 54 | -12.76 | AVG | H |

**Radiated emissions at band edge**

| Frequency | Reading Level | Correct Factor | Measurement | Limits | Over | Detector | Polarization |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB/m) | (dBμV/m) | (dBμV/m) | (dB) | Peak/AVG | H/V |
| **8DPSK– Low band-edge** | | | | | | | |
| (MHz) | (dBμV) | (dB/m) | (dBμV/m) | (dBμV/m) | (dB) | Peak/AVG | H/V |
| 2310 | 48.41 | -6.6 | 41.81 | 74 | -32.19 | Peak | V |
| 2310 | 38.64 | -6.6 | 32.04 | 54 | -21.96 | AVG | V |
| 2390 | 49.63 | -6.23 | 43.4 | 74 | -30.6 | Peak | V |
| 2390 | 39.58 | -6.23 | 33.35 | 54 | -20.65 | AVG | V |
| 2310 | 48.3 | -6.6 | 41.7 | 74 | -32.3 | Peak | H |
| 2310 | 38.55 | -6.6 | 31.95 | 54 | -22.05 | AVG | H |
| 2390 | 48.93 | -6.23 | 42.7 | 74 | -31.3 | Peak | H |
| 2390 | 39.04 | -6.23 | 32.81 | 54 | -21.19 | AVG | H |
| **8DPSK– High band-edge** | | | | | | | |
| 2483.5 | 52.13 | -5.79 | 46.34 | 74 | -27.66 | Peak | V |
| 2483.5 | 41.47 | -5.79 | 35.68 | 54 | -18.32 | AVG | V |
| 2500 | 50.78 | -5.72 | 45.06 | 74 | -28.94 | Peak | V |
| 2500 | 39.23 | -5.72 | 33.51 | 54 | -20.49 | AVG | V |
| 2483.5 | 50.37 | -5.79 | 44.58 | 74 | -29.42 | Peak | H |
| 2483.5 | 41.2 | -5.79 | 35.41 | 54 | -18.59 | AVG | H |
| 2500 | 48.92 | -5.72 | 43.2 | 74 | -30.8 | Peak | H |
| 2500 | 39.27 | -5.72 | 33.55 | 54 | -20.45 | AVG | H |

## Photographs of the Test Setup

See the appendix – Test Setup Photos.

## Photographs of the EUT

See the appendix - EUT Photos.

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