# 10 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

## 10.1 Standard Applicable

### 10.1.1 Duty Cycle Correction Factor

According to 15. 35(c) and RSS-Gen §8.2, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification.

### 10.1.2 Spurious Emission

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. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 and RSS-Gen §8.9 Table 5 and 6 limit as below.
And according to §15.33(a) (1) & RSS-Gen §6.13.2.a, for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

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

***Note:*** *The lower limit shall apply at the transition frequencies.*

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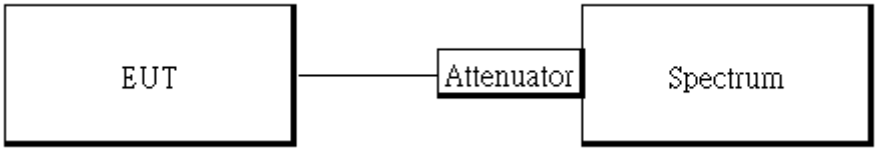
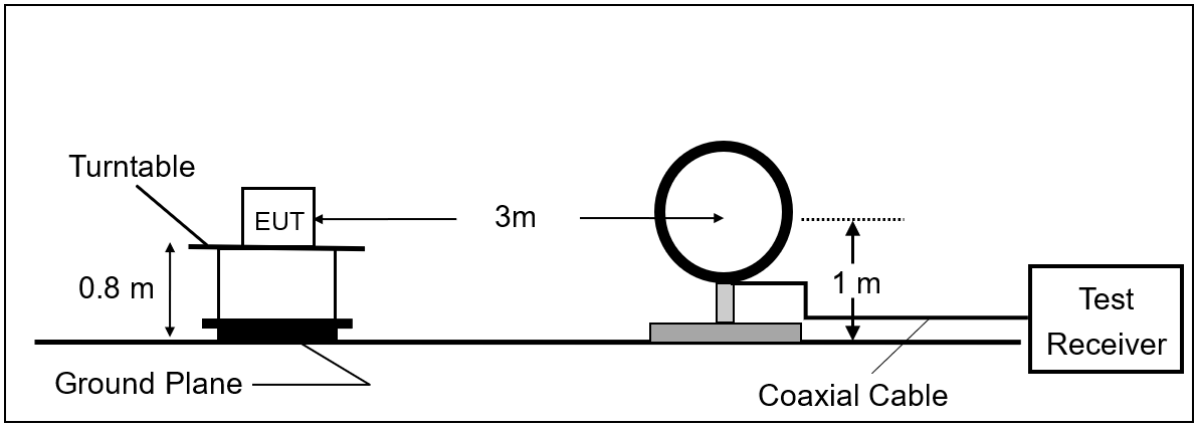
## 10.2 Test Setup

### 10.2.1 Duty Cycle Correction Factor

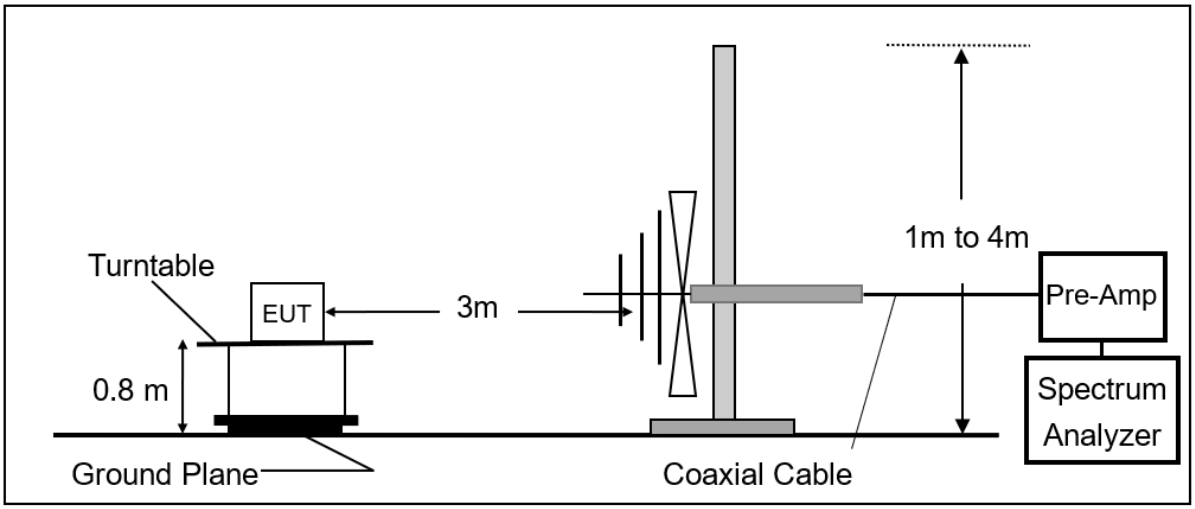



### 10.2.2 Radiated Emission

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.




(B) Radiated Emission Test Set-Up, Frequency From 30MHz to 1000MHz.

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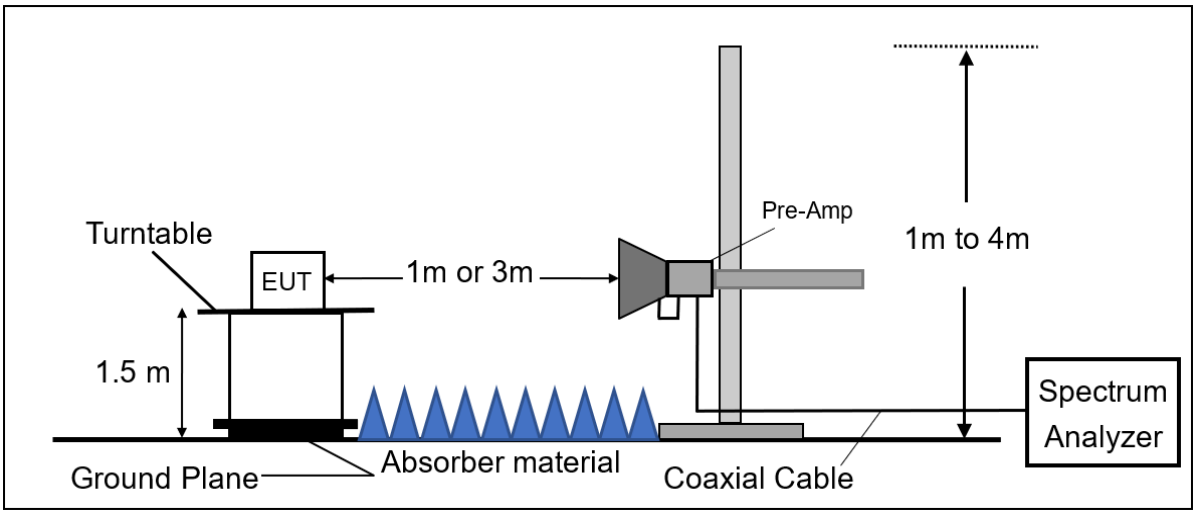
(C) Radiated Emission Test Set-Up, Frequency Above 1 GHz.




## 10.3 Measurement Procedure

### 10.3.1 Duty Cycle Correction Factor

1. Adjust and configure any EUT switches, controls, or input data streams to ensure that the EUT is transmitting or encoded to obtain the “worst-case” pulse ON time.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz , Detector = Peak, Adjust Sweep=100ms.
6. Repeat above procedures until all frequency of the interest measured were complete.

### 10.3.2 Radiated Emission

1. The testing follows the Measurement Procedure of ANSI C63.10:2013.
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. Set the spectrum analyzer as RBW=100 kHz and VBW=300 kHz for Peak Detector (PK) at frequency between 30MHz and 1 GHz.
6. Use receiver mode as RBW=120 kHz for Quasi-peak (QP) at frequency between 30MHz and 1 GHz.

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7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Maximum Emission Measurements at frequency above 1 GHz.
8. According to C63.10:2013 Section 7.5 Procedure for determining the average value of pulsed emissions with duty cycle correction factor 20 log ($T_{on}$/100ms).
9. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
12. Repeat above procedures until all default test channel measured were complete.

## 10.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

***Where*** *FS = Field Strength*
*RA = Reading Amplitude*
*AF = Antenna Factor*
*CL = Cable Attenuation Factor (Cable Loss)*
*AG = Amplifier Gain*

*The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)*

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Average value(dBμV/m)=Peak Actual FS(dBμV/m)+ Duty Cycle Correction Factor(dB)

Duty Cycle Correction Factor(dB) = 20 log ($T_{on}$/100 ms)

## 10.5 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) & RSS-GEN §6.13.2 was not reported.

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## 10.6 Measurement Result:

### 10.6.1 Duty Cycle Correction Factor (normal mode)

**BR**

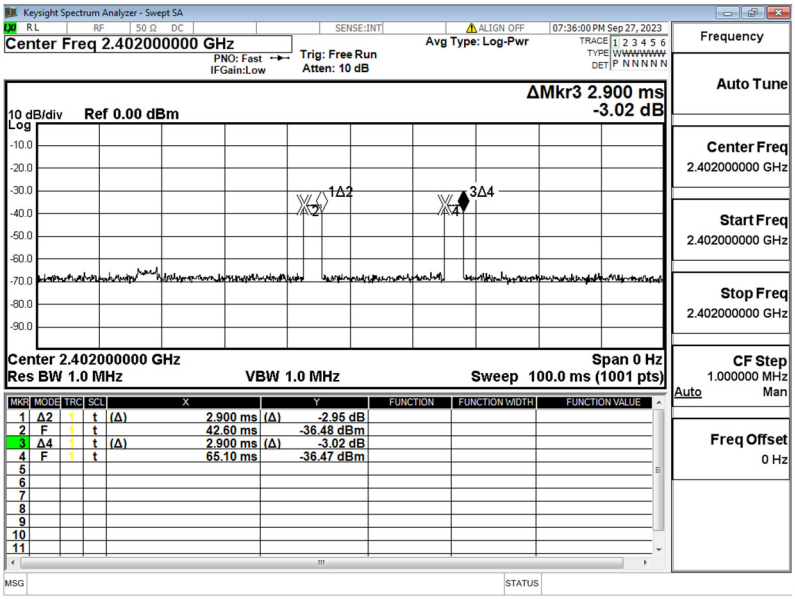
| | | |
|---|---|---|
| Time ON of 100ms: | 5.800 | ms |
| Duty Cycle=5.8ms / 100ms: | 0.058 | |
| Duty Cycle correction factor=20 LOG 0.058= | -24.73 | dB |

**EDR**

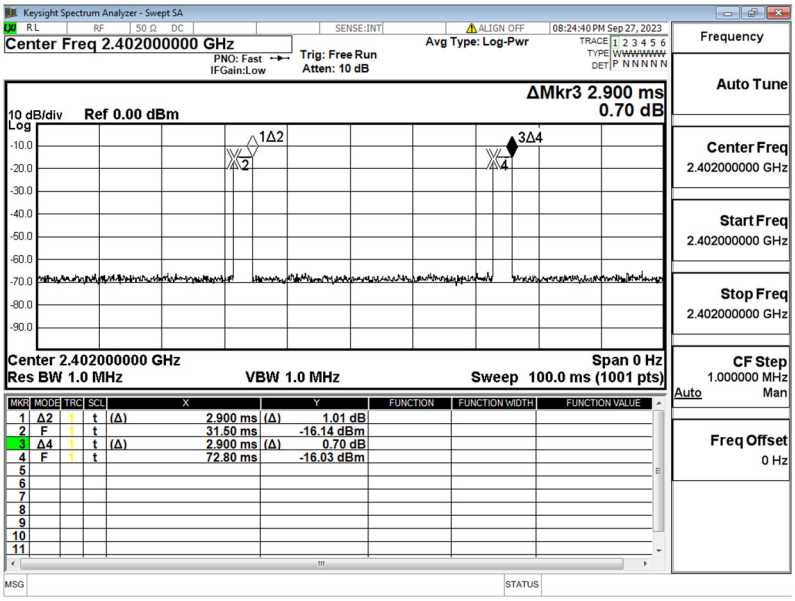
| | | |
|---|---|---|
| Time ON of 100ms: | 5.800 | ms |
| Duty Cycle=5.8ms / 100ms: | 0.058 | |
| Duty Cycle correction factor=20 LOG 0.058= | -24.73 | dB |

### 10.6.2 Duty Cycle test plot

BR




EDR

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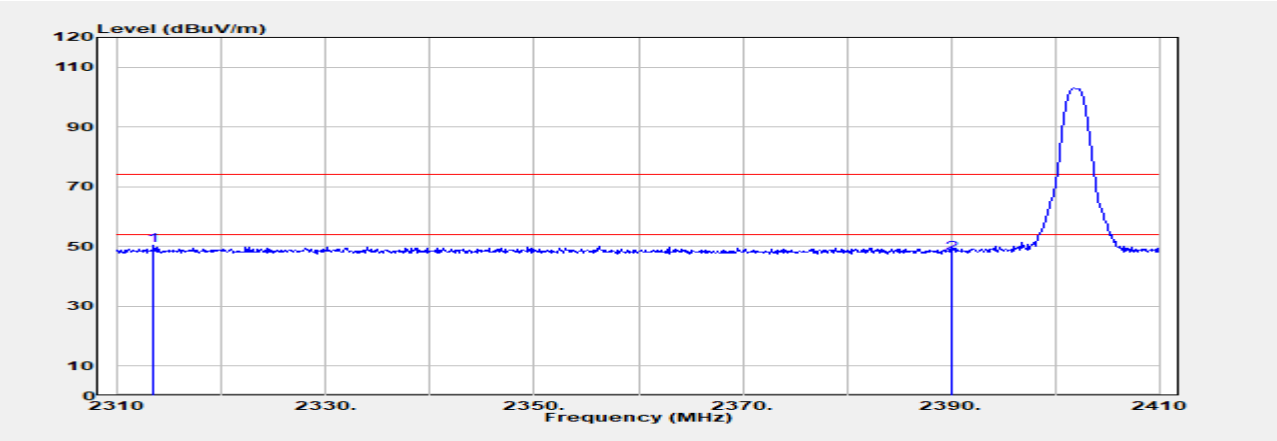
### 10.6.3 Bandedge Result

| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2313.400 | Peak | 53.54 | -3.27 | 50.28 | 74.00 | -23.72 |
| 2390.000 | Peak | 51.38 | -3.51 | 47.87 | 74.00 | -26.13 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2313.400 | Average | 50.28 | -24.73 | 25.55 | 54.00 | -28.45 |
| 2390.000 | Average | 47.87 | -24.73 | 23.14 | 54.00 | -30.86 |

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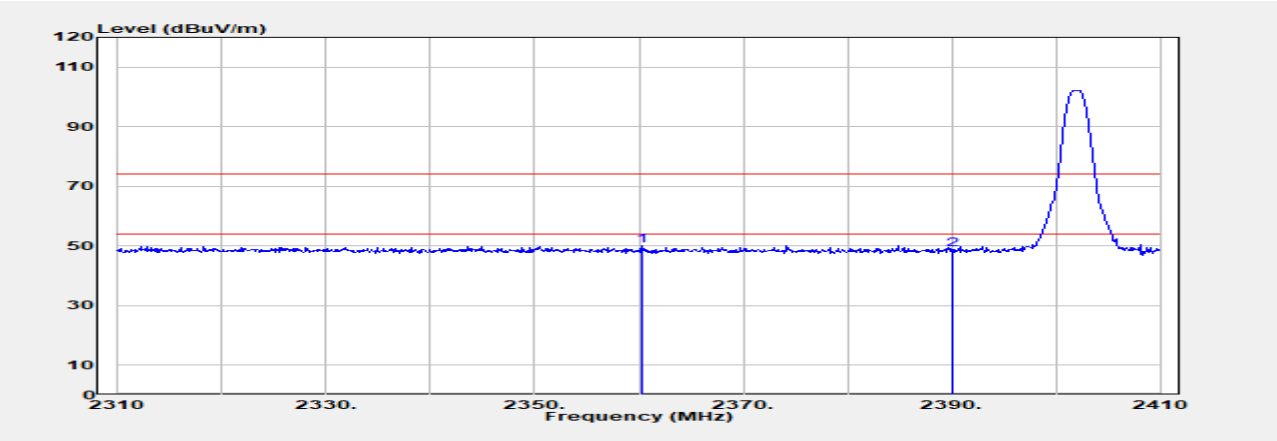
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2360.300 | Peak | 53.42 | -3.36 | 50.06 | 74.00 | -23.94 |
| 2390.000 | Peak | 52.35 | -3.51 | 48.84 | 74.00 | -25.16 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2360.300 | Average | 50.06 | -24.73 | 25.33 | 54.00 | -28.67 |
| 2390.000 | Average | 48.84 | -24.73 | 24.11 | 54.00 | -29.89 |

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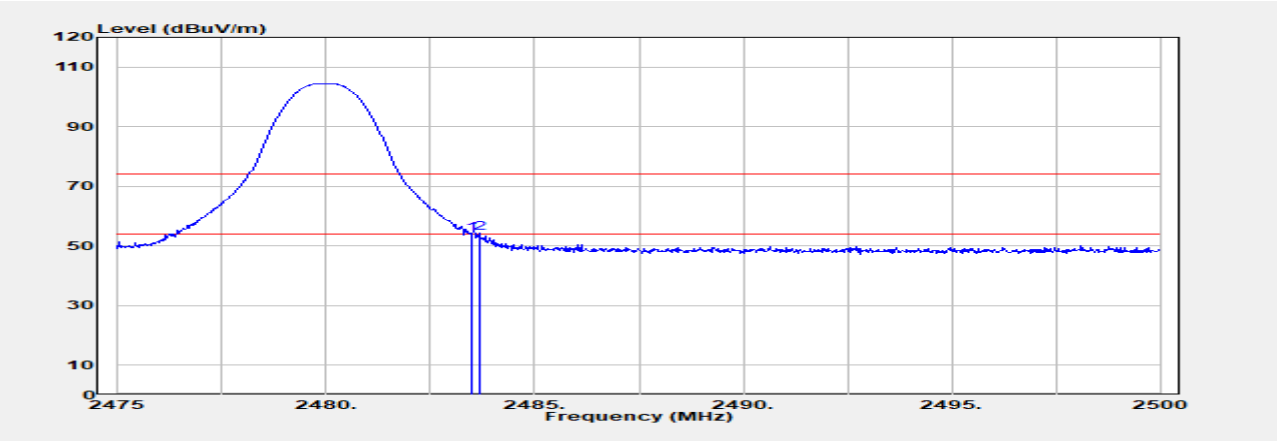
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 57.63 | -3.54 | 54.09 | 74.00 | -19.91 |
| 2483.675 | Peak | 57.85 | -3.54 | 54.31 | 74.00 | -19.69 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 54.09 | -24.73 | 29.36 | 54.00 | -24.64 |
| 2483.675 | Average | 54.31 | -24.73 | 29.58 | 54.00 | -24.42 |

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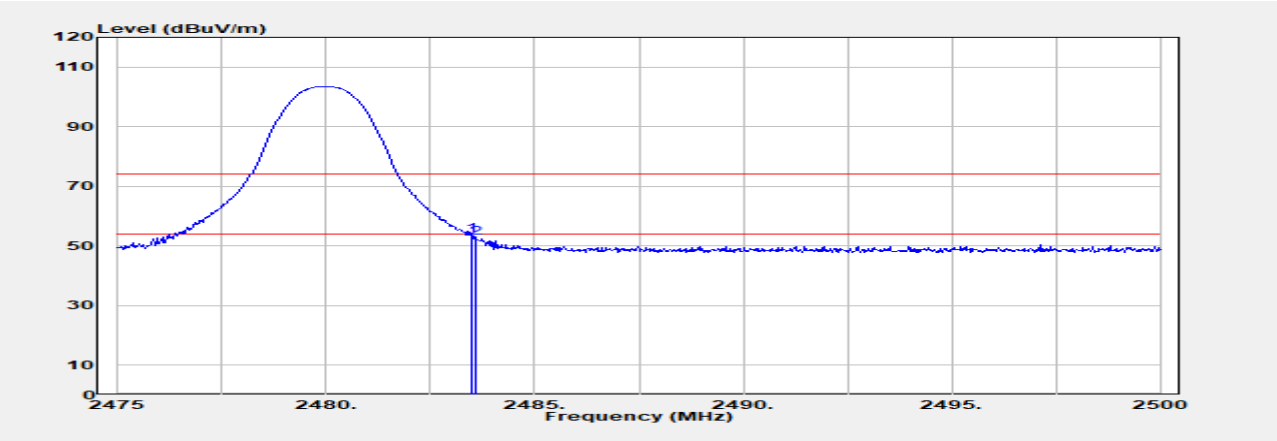
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 57.13 | -3.54 | 53.58 | 74.00 | -20.42 |
| 2483.600 | Peak | 56.11 | -3.54 | 52.57 | 74.00 | -21.43 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 53.58 | -24.73 | 28.85 | 54.00 | -25.15 |
| 2483.600 | Average | 52.57 | -24.73 | 27.84 | 54.00 | -26.16 |

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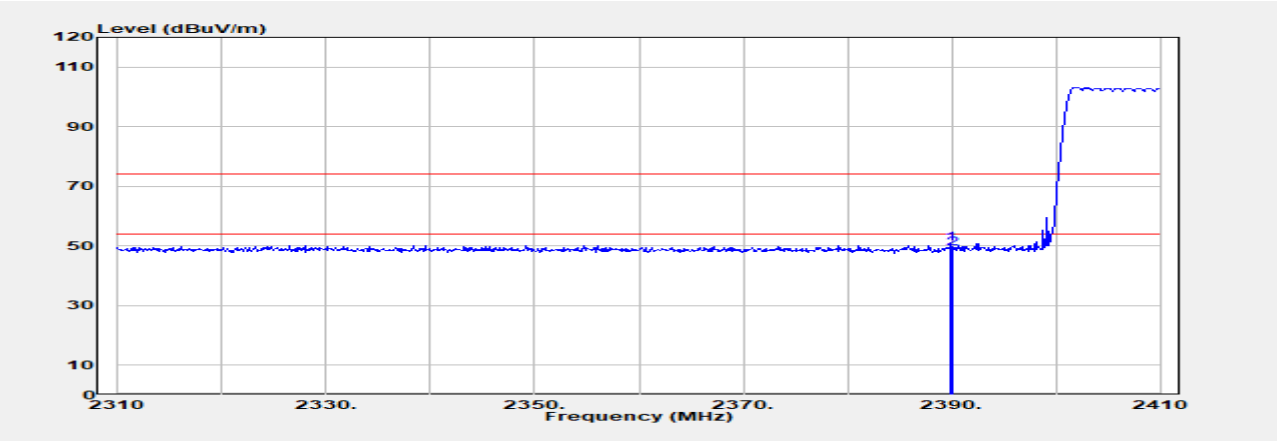
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR Hopping | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2389.900 | Peak | 54.27 | -3.51 | 50.77 | 74.00 | -23.23 |
| 2390.000 | Peak | 52.46 | -3.51 | 48.95 | 74.00 | -25.05 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2389.900 | Average | 50.77 | -24.73 | 26.04 | 54.00 | -27.96 |
| 2390.000 | Average | 48.95 | -24.73 | 24.22 | 54.00 | -29.78 |

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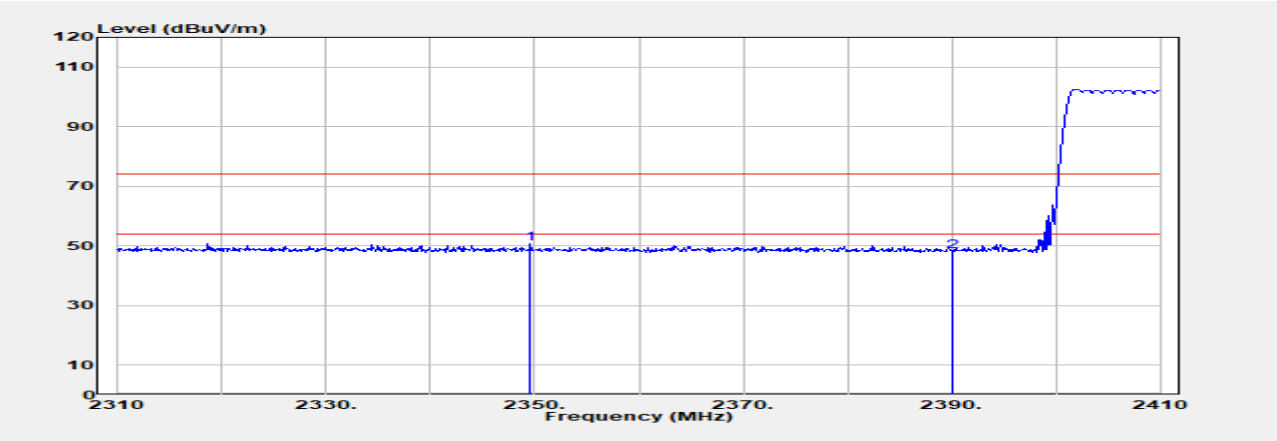
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR Hopping | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2349.600 | Peak | 54.02 | -3.31 | 50.72 | 74.00 | -23.28 |
| 2390.000 | Peak | 51.64 | -3.51 | 48.13 | 74.00 | -25.87 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2349.600 | Average | 50.72 | -24.73 | 25.99 | 54.00 | -28.01 |
| 2390.000 | Average | 48.13 | -24.73 | 23.40 | 54.00 | -30.60 |

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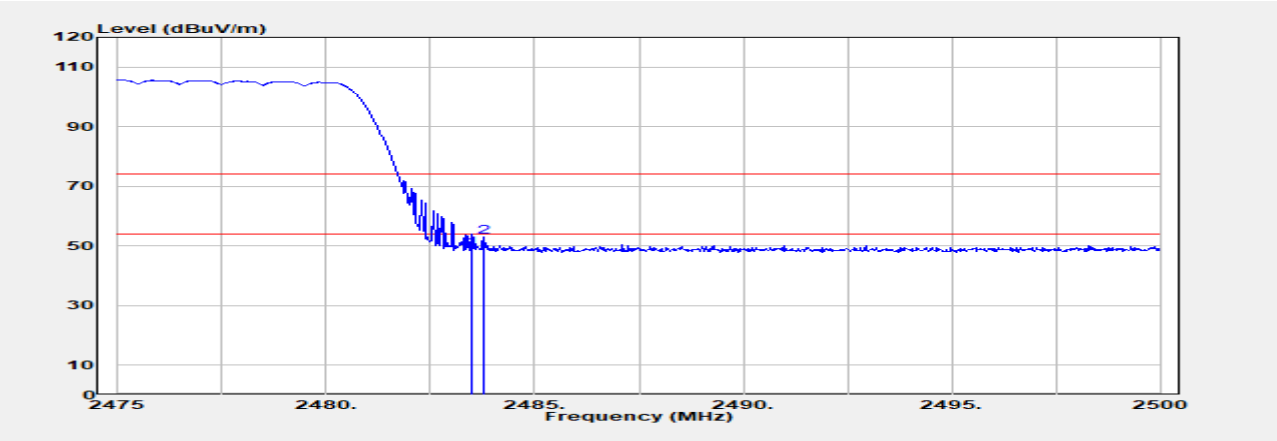
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR Hopping | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 52.66 | -3.54 | 49.12 | 74.00 | -24.88 |
| 2483.775 | Peak | 56.62 | -3.54 | 53.08 | 74.00 | -20.92 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 49.12 | -24.73 | 24.39 | 54.00 | -29.61 |
| 2483.775 | Average | 53.08 | -24.73 | 28.35 | 54.00 | -25.65 |

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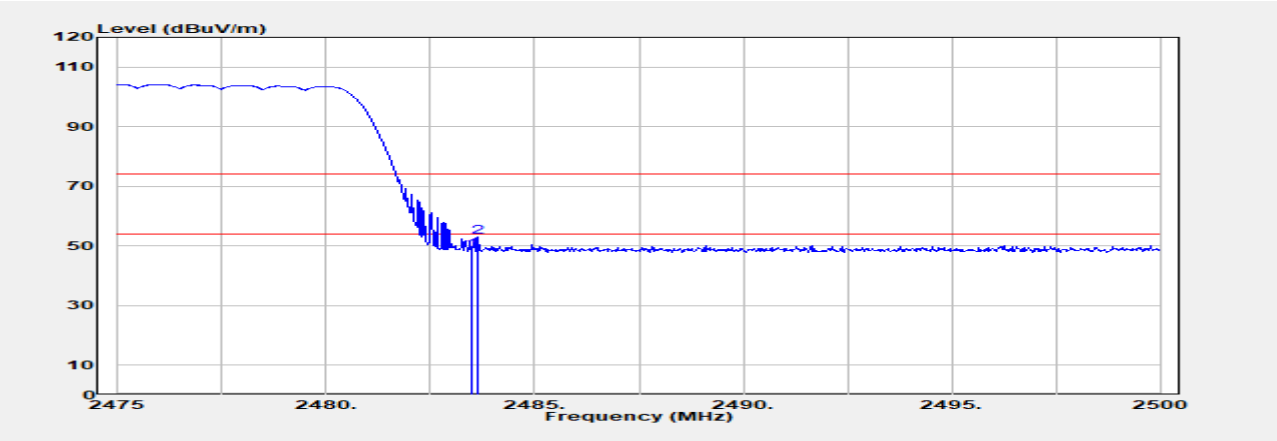
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR Hopping | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 51.88 | -3.54 | 48.34 | 74.00 | -25.66 |
| 2483.650 | Peak | 56.42 | -3.54 | 52.88 | 74.00 | -21.12 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 48.34 | -24.73 | 23.61 | 54.00 | -30.39 |
| 2483.650 | Average | 52.88 | -24.73 | 28.15 | 54.00 | -25.85 |

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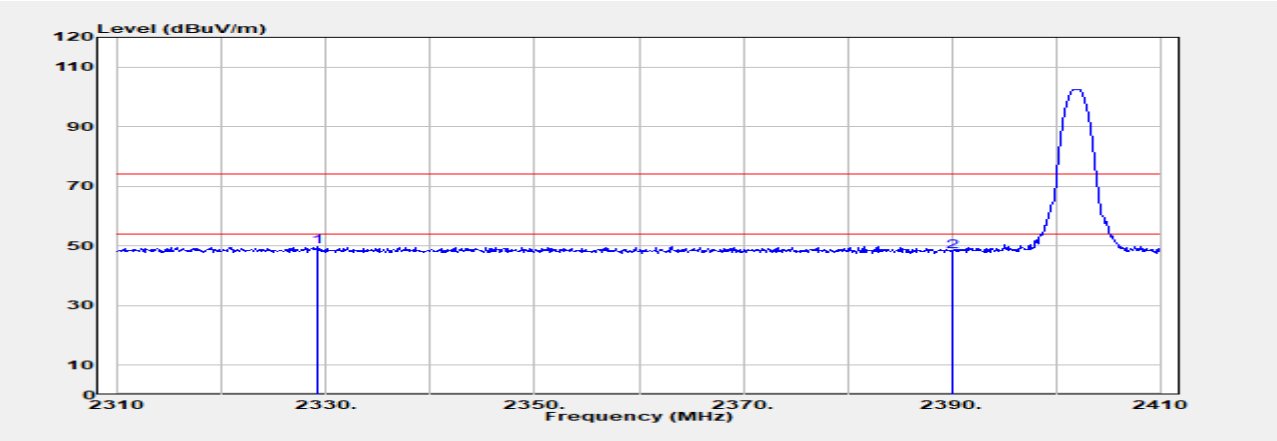
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2329.100 | Peak | 53.14 | -3.28 | 49.86 | 74.00 | -24.14 |
| 2390.000 | Peak | 51.70 | -3.51 | 48.19 | 74.00 | -25.81 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2329.100 | Average | 49.86 | -24.73 | 25.13 | 54.00 | -28.87 |
| 2390.000 | Average | 48.19 | -24.73 | 23.46 | 54.00 | -30.54 |

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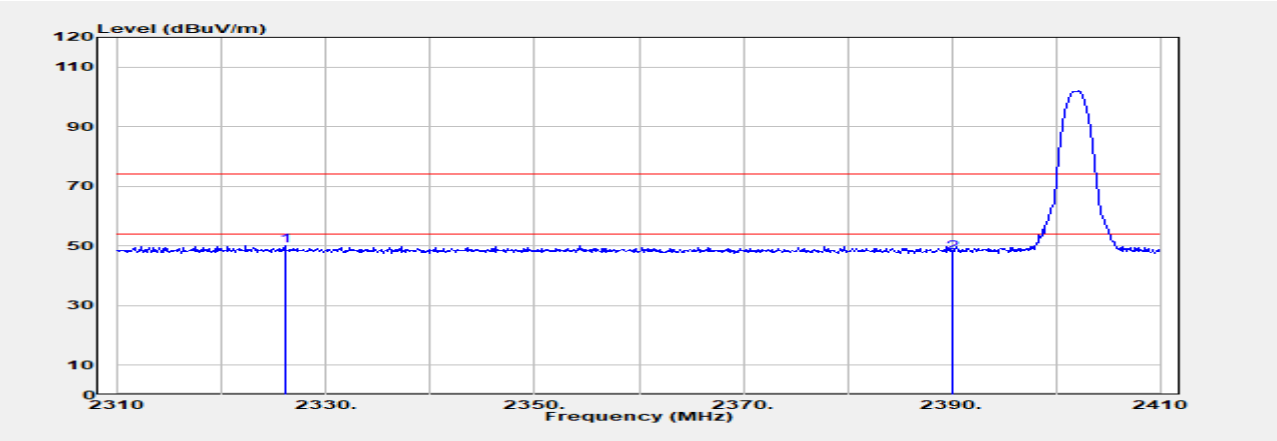
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2326.000 | Peak | 53.41 | -3.28 | 50.13 | 74.00 | -23.87 |
| 2390.000 | Peak | 51.36 | -3.51 | 47.85 | 74.00 | -26.15 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2326.000 | Average | 50.13 | -24.73 | 25.40 | 54.00 | -28.60 |
| 2390.000 | Average | 47.85 | -24.73 | 23.12 | 54.00 | -30.88 |

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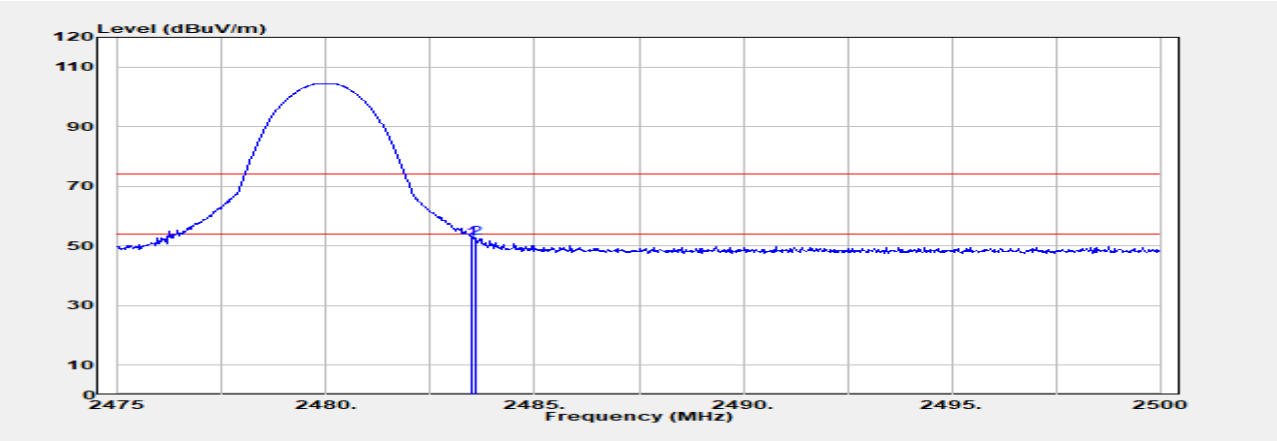
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 55.92 | -3.54 | 52.37 | 74.00 | -21.63 |
| 2483.600 | Peak | 56.19 | -3.54 | 52.64 | 74.00 | -21.36 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 52.37 | -24.73 | 27.64 | 54.00 | -26.36 |
| 2483.600 | Average | 52.64 | -24.73 | 27.91 | 54.00 | -26.09 |

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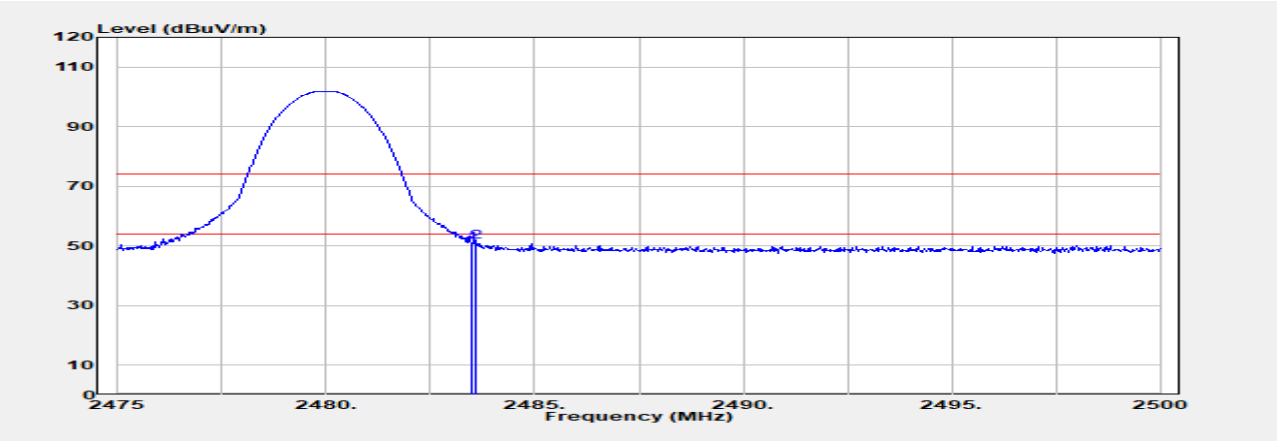
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 54.40 | -3.54 | 50.85 | 74.00 | -23.15 |
| 2483.600 | Peak | 55.03 | -3.54 | 51.49 | 74.00 | -22.51 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 50.85 | -24.73 | 26.12 | 54.00 | -27.88 |
| 2483.600 | Average | 51.49 | -24.73 | 26.76 | 54.00 | -27.24 |

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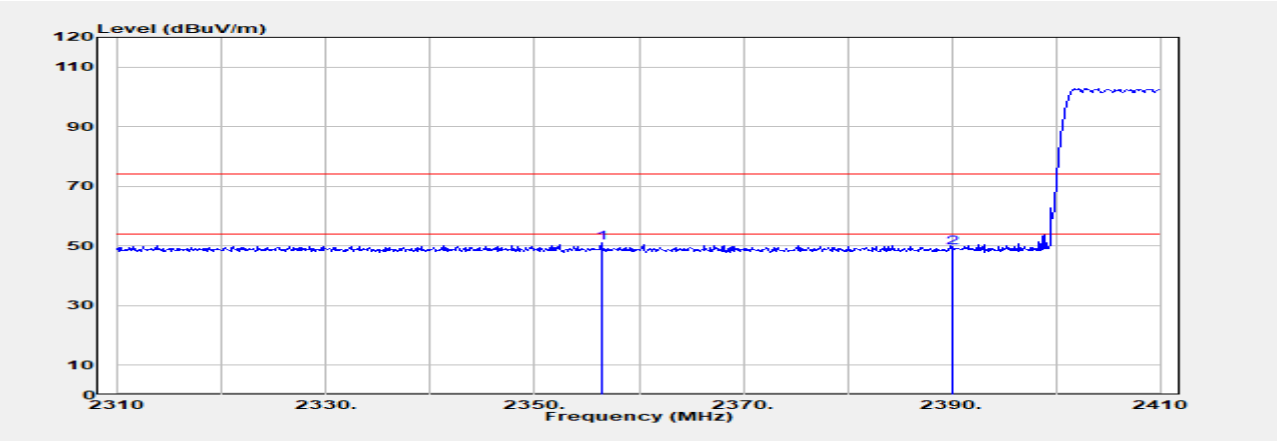
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M Hopping | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2356.400 | Peak | 54.24 | -3.34 | 50.90 | 74.00 | -23.10 |
| 2390.000 | Peak | 52.88 | -3.51 | 49.37 | 74.00 | -24.63 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2356.400 | Average | 50.90 | -24.73 | 26.17 | 54.00 | -27.83 |
| 2390.000 | Average | 49.37 | -24.73 | 24.64 | 54.00 | -29.36 |

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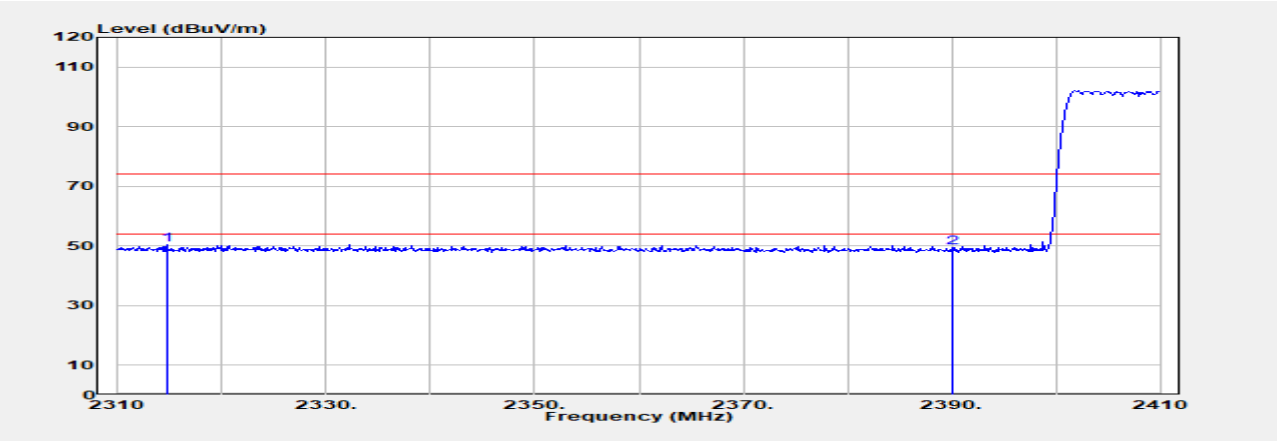
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M Hopping | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2314.700 | Peak | 53.68 | -3.27 | 50.42 | 74.00 | -23.58 |
| 2390.000 | Peak | 52.80 | -3.51 | 49.29 | 74.00 | -24.71 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2314.700 | Average | 50.42 | -24.73 | 25.69 | 54.00 | -28.31 |
| 2390.000 | Average | 49.29 | -24.73 | 24.56 | 54.00 | -29.44 |

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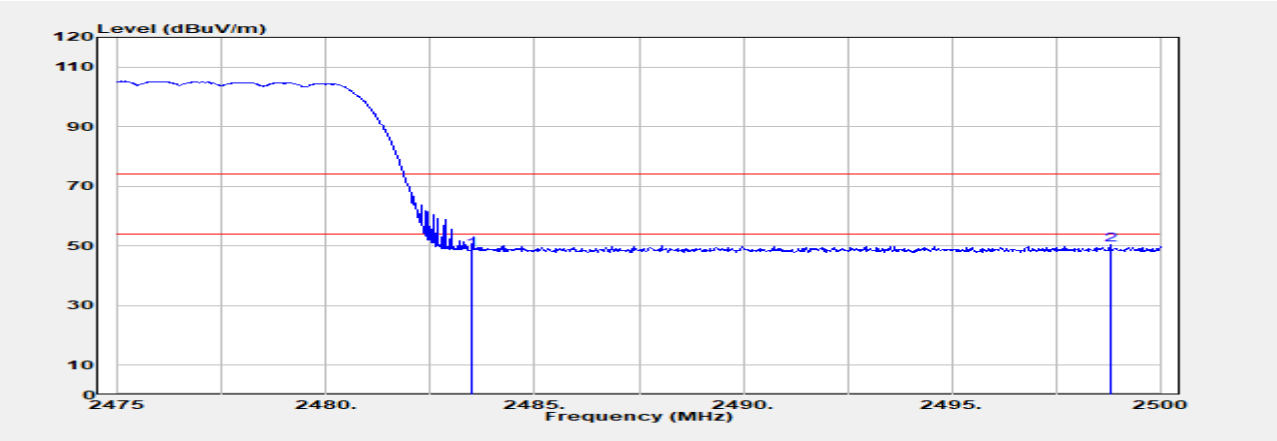
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M Hopping | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 52.34 | -3.54 | 48.80 | 74.00 | -25.20 |
| 2498.800 | Peak | 53.83 | -3.52 | 50.31 | 74.00 | -23.69 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 48.80 | -24.73 | 24.07 | 54.00 | -29.93 |
| 2498.800 | Average | 50.31 | -24.73 | 25.58 | 54.00 | -28.42 |

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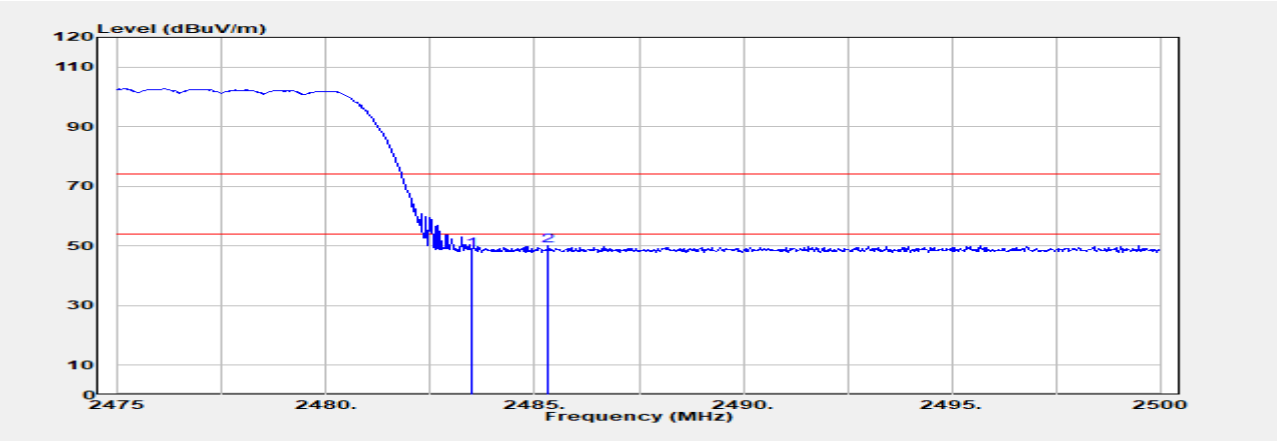
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M Hopping | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Bandedge | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 2483.500 | Peak | 52.35 | -3.54 | 48.80 | 74.00 | -25.20 |
| 2485.325 | Peak | 53.65 | -3.54 | 50.11 | 74.00 | -23.89 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.500 | Average | 48.80 | -24.73 | 24.07 | 54.00 | -29.93 |
| 2485.325 | Average | 50.11 | -24.73 | 25.38 | 54.00 | -28.62 |

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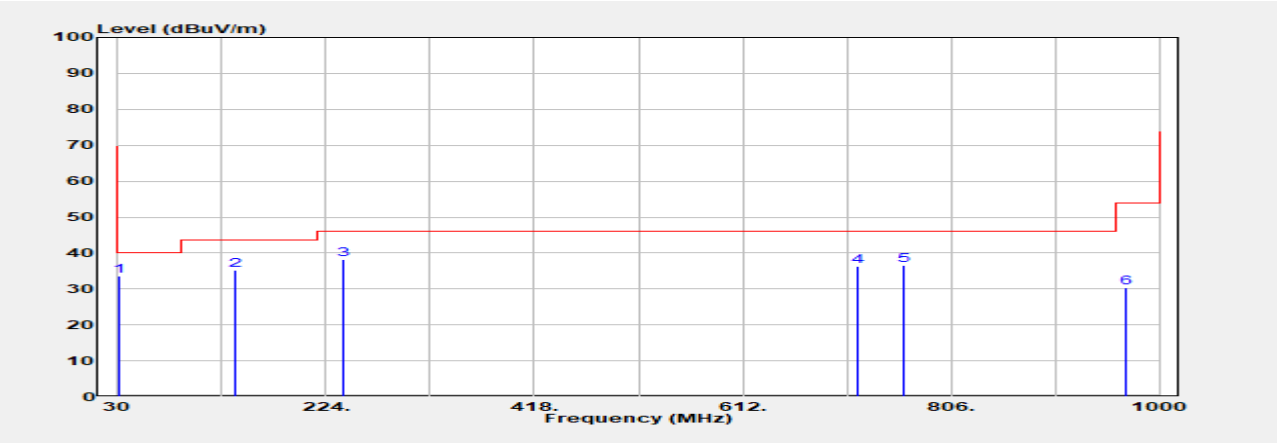
### 10.6.4 Radiated Spurious Emission

| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-10-02 |
| Test Frequency | :2441 MHz | Temp./Humi. | :23.6℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP/AVG | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 31.940 | QP | 47.80 | -14.31 | 33.49 | 40.00 | -6.51 |
| 139.610 | QP | 48.70 | -13.42 | 35.28 | 43.50 | -8.22 |
| 240.490 | QP | 52.40 | -14.07 | 38.33 | 46.00 | -7.67 |
| 719.670 | Peak | 39.72 | -3.39 | 36.33 | 46.00 | -9.67 |
| 762.350 | Peak | 38.36 | -1.88 | 36.49 | 46.00 | -9.51 |
| 969.930 | Peak | 29.56 | 0.92 | 30.48 | 54.00 | -23.52 |

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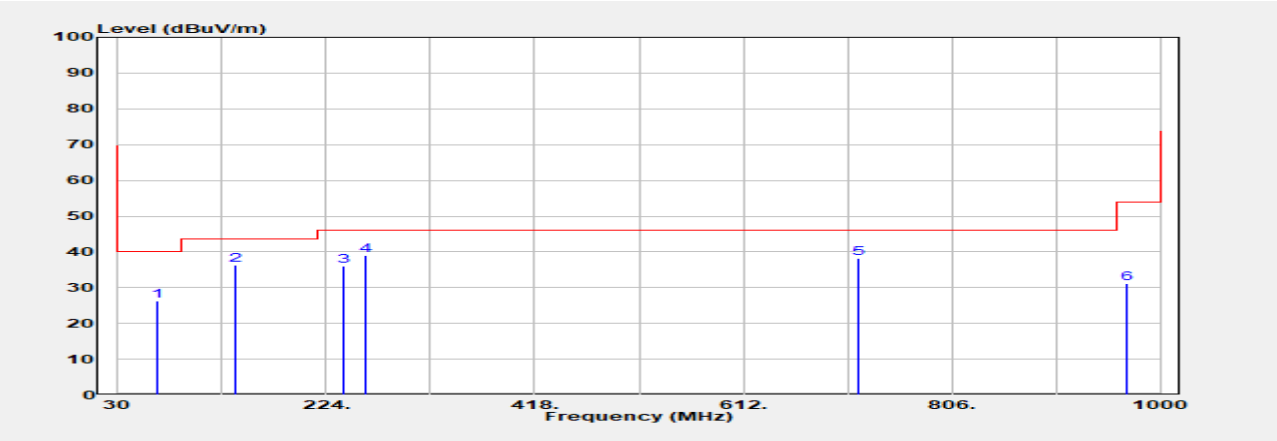
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-10-02 |
| Test Frequency | :2441 MHz | Temp./Humi. | :23.6℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP/AVG | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 66.860 | Peak | 40.71 | -14.32 | 26.39 | 40.00 | -13.61 |
| 139.610 | Peak | 49.86 | -13.42 | 36.45 | 43.50 | -7.05 |
| 240.490 | QP | 50.21 | -14.07 | 36.14 | 46.00 | -9.86 |
| 260.860 | Peak | 52.31 | -13.34 | 38.97 | 46.00 | -7.03 |
| 719.670 | Peak | 41.64 | -3.39 | 38.25 | 46.00 | -7.75 |
| 968.960 | Peak | 30.18 | 0.91 | 31.09 | 54.00 | -22.91 |

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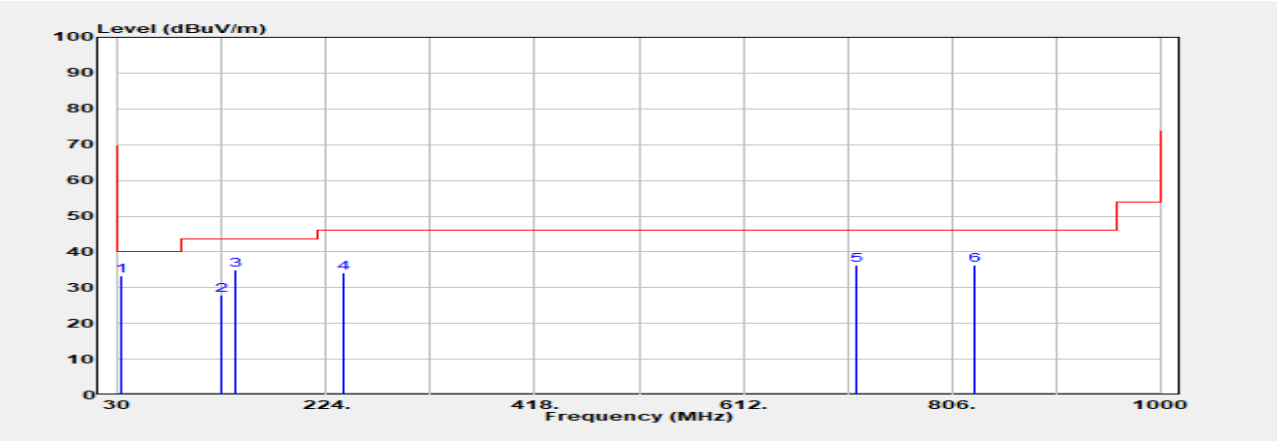
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-10-02 |
| Test Frequency | :2441 MHz | Temp./Humi. | :23.6℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP/AVG | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 33.880 | QP | 47.60 | -14.14 | 33.46 | 40.00 | -6.54 |
| 127.000 | QP | 42.80 | -14.92 | 27.88 | 43.50 | -15.62 |
| 139.610 | QP | 48.30 | -13.42 | 34.88 | 43.50 | -8.62 |
| 240.490 | QP | 48.30 | -14.07 | 34.23 | 46.00 | -11.77 |
| 717.730 | Peak | 39.84 | -3.43 | 36.41 | 46.00 | -9.59 |
| 827.340 | Peak | 38.10 | -1.72 | 36.38 | 46.00 | -9.62 |

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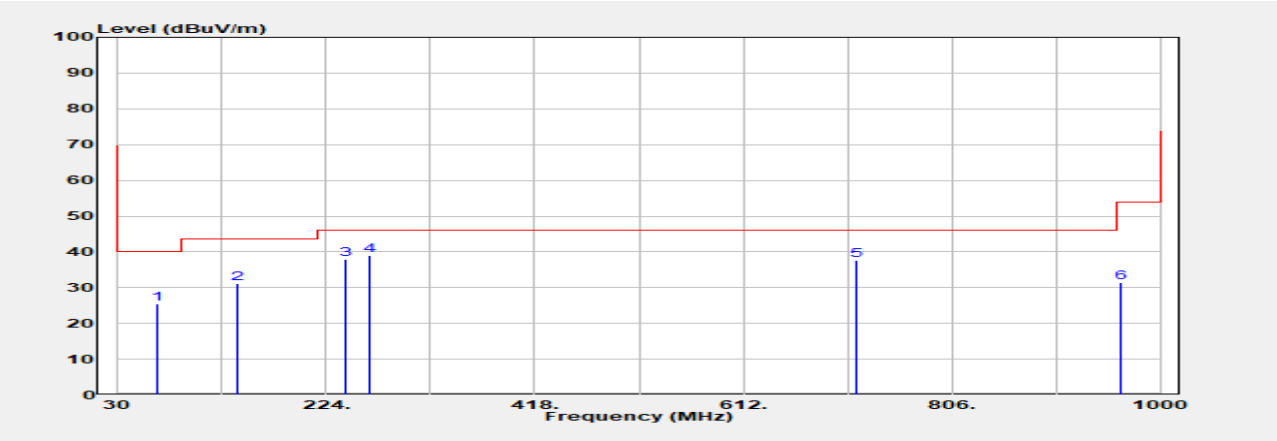
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-10-02 |
| Test Frequency | :2441 MHz | Temp./Humi. | :23.6℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP/AVG | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 66.860 | Peak | 39.78 | -14.32 | 25.46 | 40.00 | -14.54 |
| 140.580 | QP | 44.50 | -13.41 | 31.09 | 43.50 | -12.41 |
| 241.460 | QP | 52.10 | -14.04 | 38.06 | 46.00 | -7.94 |
| 263.770 | Peak | 52.16 | -13.16 | 39.00 | 46.00 | -7.00 |
| 716.760 | Peak | 41.01 | -3.45 | 37.56 | 46.00 | -8.44 |
| 964.110 | Peak | 30.60 | 0.88 | 31.47 | 54.00 | -22.53 |

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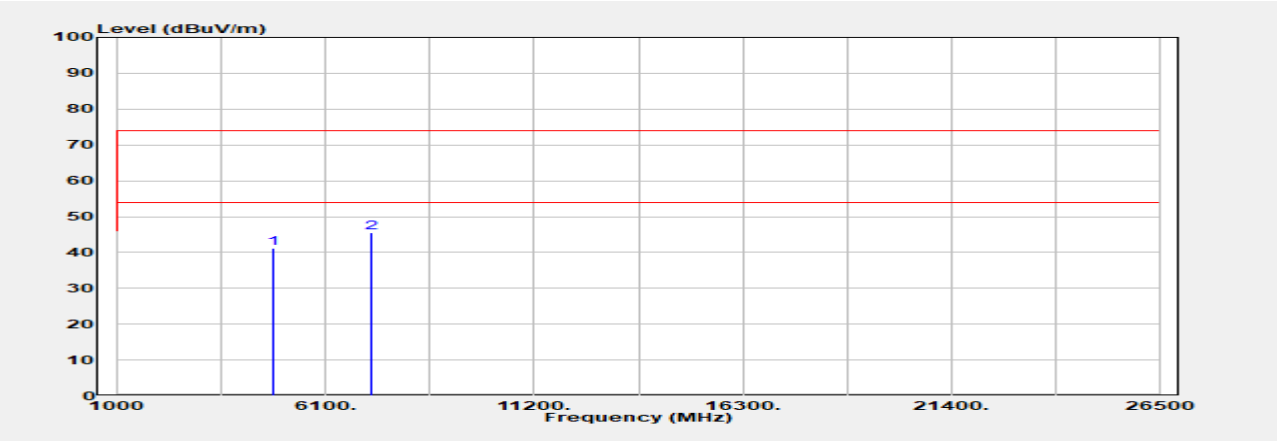
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4804.000 | Peak | 37.92 | 3.26 | 41.18 | 74.00 | -32.82 |
| 7206.000 | Peak | 36.89 | 8.51 | 45.40 | 74.00 | -28.60 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4804.000 | Average | 41.18 | -24.73 | 16.45 | 54.00 | -37.55 |
| 7206.000 | Average | 45.40 | -24.73 | 20.67 | 54.00 | -33.33 |

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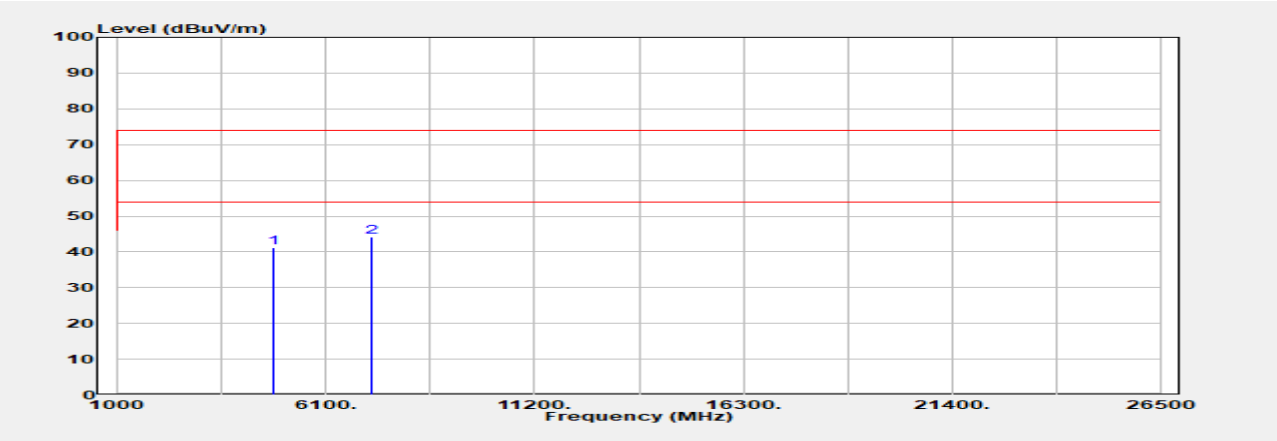
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4804.000 | Peak | 38.01 | 3.26 | 41.27 | 74.00 | -32.73 |
| 7206.000 | Peak | 35.55 | 8.51 | 44.05 | 74.00 | -29.95 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4804.000 | Average | 41.27 | -24.73 | 16.54 | 54.00 | -37.46 |
| 7206.000 | Average | 44.05 | -24.73 | 19.32 | 54.00 | -34.68 |

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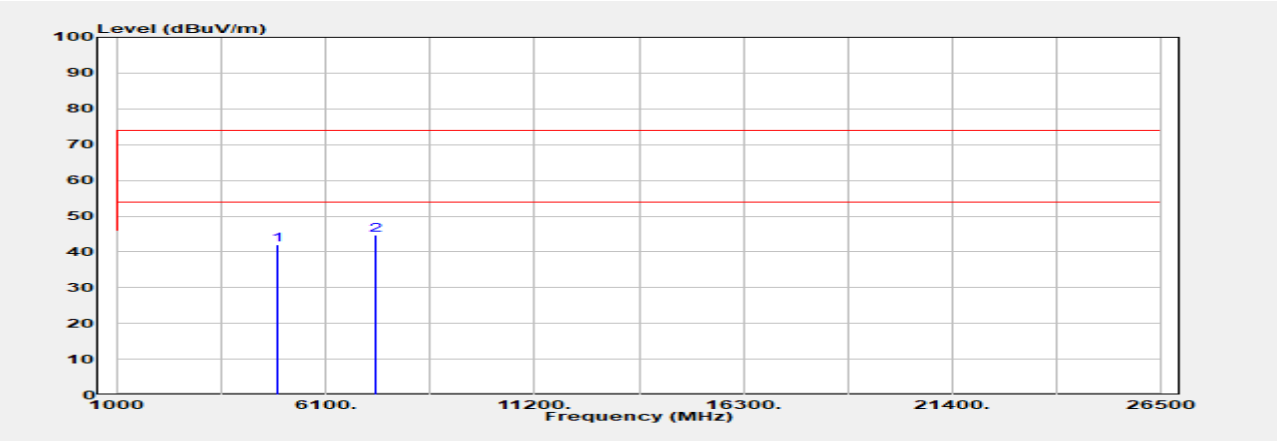
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-09-27 |
| Test Frequency | :2441 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4882.000 | Peak | 38.61 | 3.36 | 41.97 | 74.00 | -32.03 |
| 7323.000 | Peak | 35.94 | 8.66 | 44.60 | 74.00 | -29.40 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4882.000 | Average | 41.97 | -24.73 | 17.24 | 54.00 | -36.76 |
| 7323.000 | Average | 44.60 | -24.73 | 19.87 | 54.00 | -34.13 |

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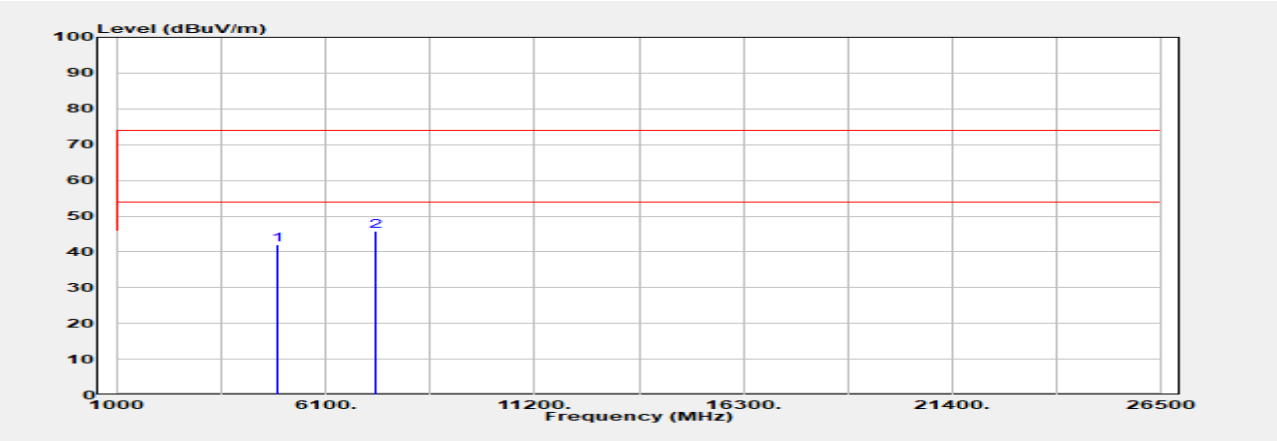
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-09-27 |
| Test Frequency | :2441 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4882.000 | Peak | 38.67 | 3.36 | 42.04 | 74.00 | -31.96 |
| 7323.000 | Peak | 37.12 | 8.66 | 45.78 | 74.00 | -28.22 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4882.000 | Average | 42.04 | -24.73 | 17.31 | 54.00 | -36.69 |
| 7323.000 | Average | 45.78 | -24.73 | 21.05 | 54.00 | -32.95 |

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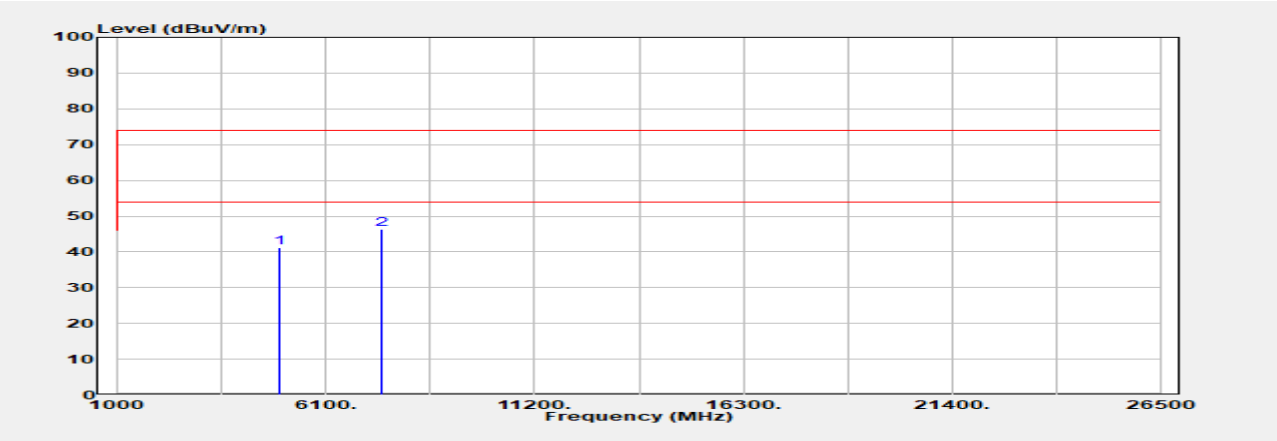
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4960.000 | Peak | 37.56 | 3.62 | 41.17 | 74.00 | -32.83 |
| 7440.000 | Peak | 36.79 | 9.42 | 46.21 | 74.00 | -27.79 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4960.000 | Average | 41.17 | -24.73 | 16.44 | 54.00 | -37.56 |
| 7440.000 | Average | 46.21 | -24.73 | 21.48 | 54.00 | -32.52 |

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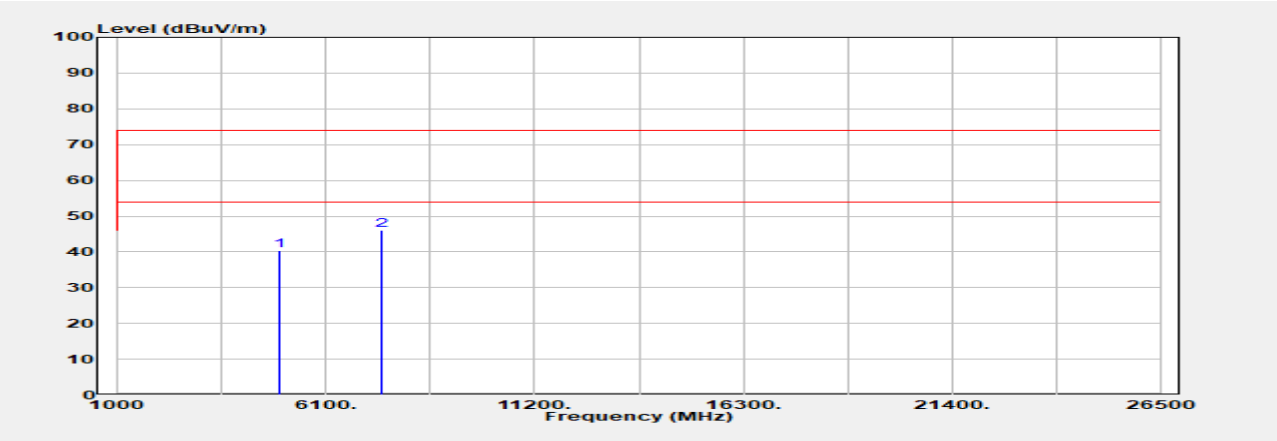
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :BR | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4960.000 | Peak | 36.77 | 3.62 | 40.39 | 74.00 | -33.61 |
| 7440.000 | Peak | 36.69 | 9.42 | 46.11 | 74.00 | -27.89 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4960.000 | Average | 40.39 | -24.73 | 15.66 | 54.00 | -38.34 |
| 7440.000 | Average | 46.11 | -24.73 | 21.38 | 54.00 | -32.62 |

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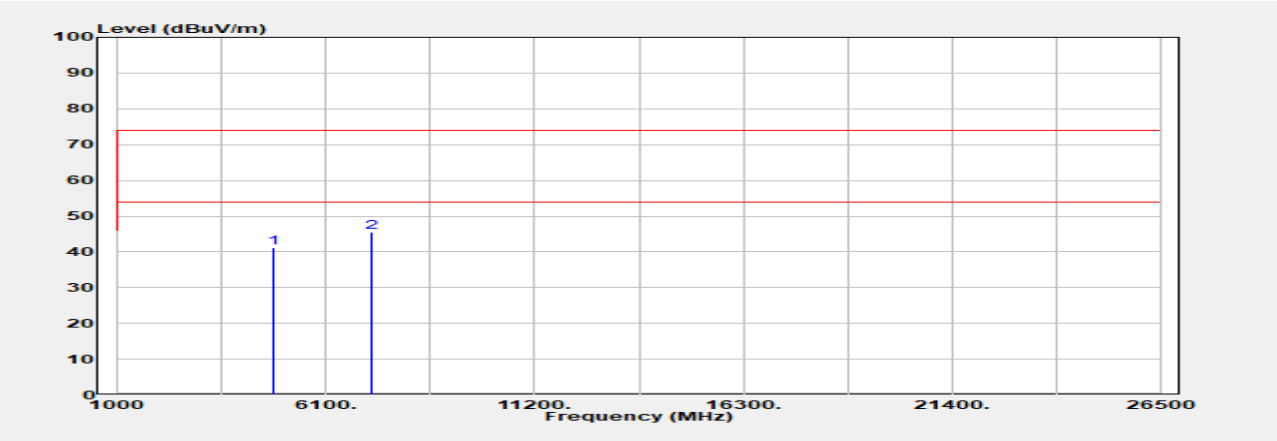
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4804.000 | Peak | 37.99 | 3.26 | 41.24 | 74.00 | -32.76 |
| 7206.000 | Peak | 37.01 | 8.51 | 45.52 | 74.00 | -28.48 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4804.000 | Average | 41.24 | -24.73 | 16.51 | 54.00 | -37.49 |
| 7206.000 | Average | 45.52 | -24.73 | 20.79 | 54.00 | -33.21 |

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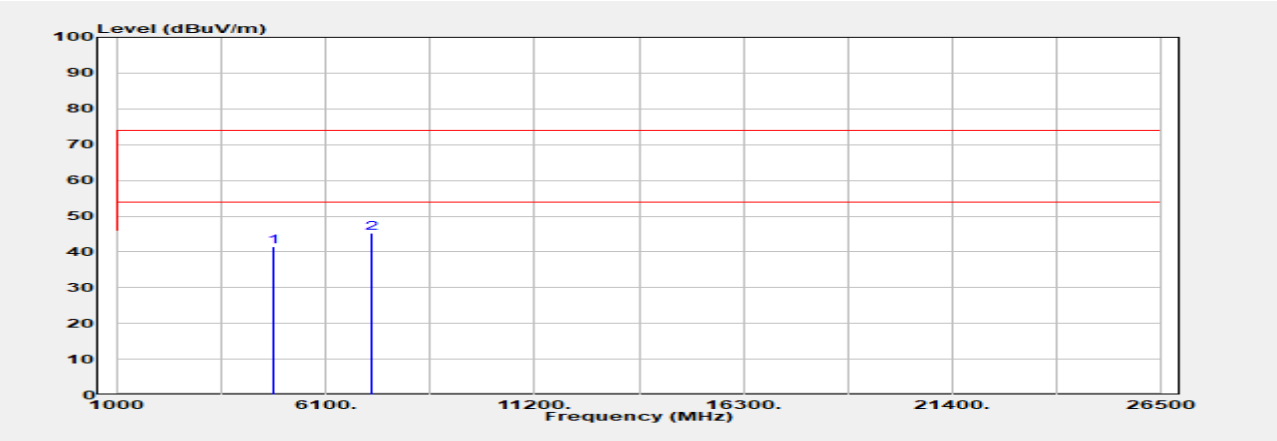
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-09-27 |
| Test Frequency | :2402 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4804.000 | Peak | 38.26 | 3.26 | 41.52 | 74.00 | -32.48 |
| 7206.000 | Peak | 36.85 | 8.51 | 45.35 | 74.00 | -28.65 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4804.000 | Average | 41.52 | -24.73 | 16.79 | 54.00 | -37.21 |
| 7206.000 | Average | 45.35 | -24.73 | 20.62 | 54.00 | -33.38 |

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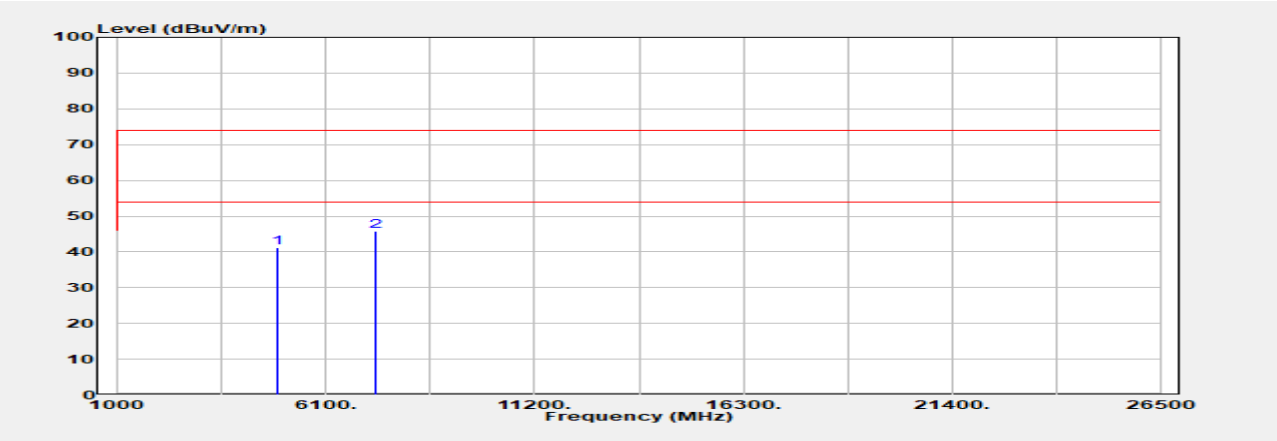
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-09-27 |
| Test Frequency | :2441 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4882.000 | Peak | 37.90 | 3.36 | 41.26 | 74.00 | -32.74 |
| 7323.000 | Peak | 37.02 | 8.66 | 45.68 | 74.00 | -28.32 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4882.000 | Average | 41.26 | -24.73 | 16.53 | 54.00 | -37.47 |
| 7323.000 | Average | 45.68 | -24.73 | 20.95 | 54.00 | -33.05 |

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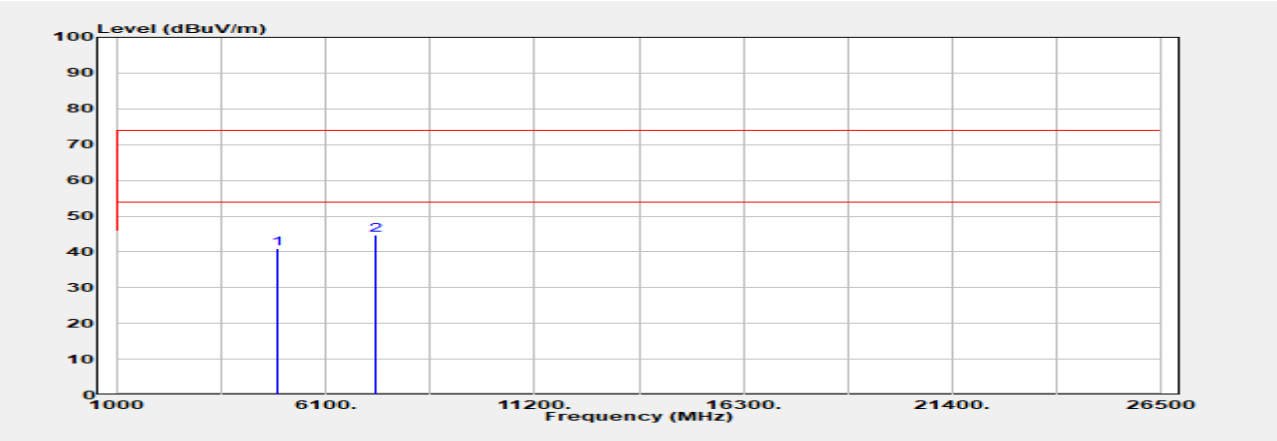
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-09-27 |
| Test Frequency | :2441 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4882.000 | Peak | 37.49 | 3.36 | 40.85 | 74.00 | -33.15 |
| 7323.000 | Peak | 35.98 | 8.66 | 44.65 | 74.00 | -29.35 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4882.000 | Average | 40.85 | -24.73 | 16.12 | 54.00 | -37.88 |
| 7323.000 | Average | 44.65 | -24.73 | 19.92 | 54.00 | -34.08 |

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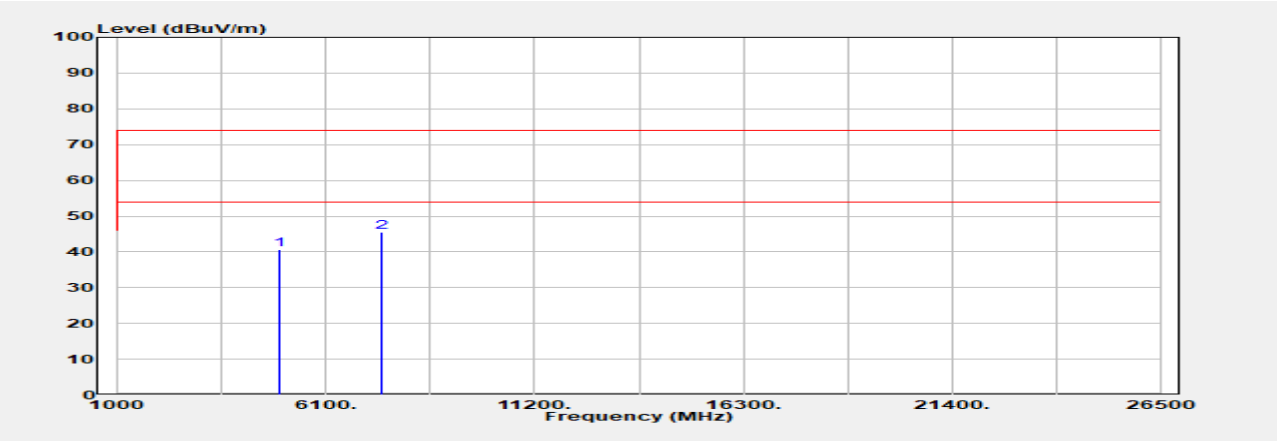
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Vertical |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4960.000 | Peak | 37.16 | 3.62 | 40.77 | 74.00 | -33.23 |
| 7440.000 | Peak | 36.13 | 9.42 | 45.55 | 74.00 | -28.45 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4960.000 | Average | 40.77 | -24.73 | 16.04 | 54.00 | -37.96 |
| 7440.000 | Average | 45.55 | -24.73 | 20.82 | 54.00 | -33.18 |

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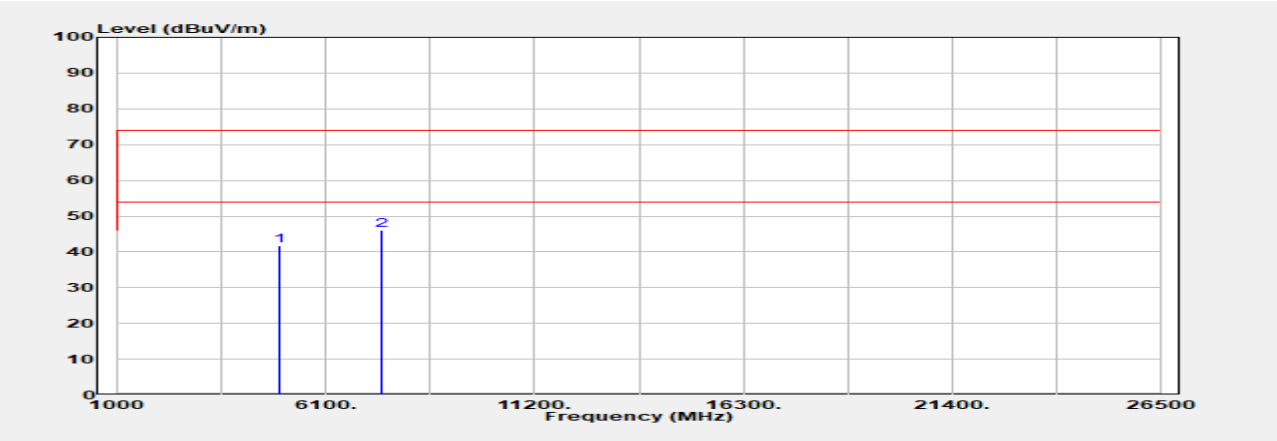
| | | | |
|---|---|---|---|
| Report Number | :TERF2309002385E2 | Test Site | :SAC G Chamber |
| Operation Mode | :EDR 3M | Test Date | :2023-09-27 |
| Test Frequency | :2480 MHz | Temp./Humi. | :22.2℃/60% |
| Test Mode | :Tx | Antenna Pol. | :Horizontal |
| EUT Pol | :H Plane | Engineer | :Temo Chen |




| Freq. MHz | Detector Mode PK/QP | Spectrum Reading Level dBμV | Factor dB | Actual FS dBμV/m | Limit @3m dBμV/m | Margin dB |
|---|---|---|---|---|---|---|
| 4960.000 | Peak | 38.14 | 3.62 | 41.75 | 74.00 | -32.25 |
| 7440.000 | Peak | 36.69 | 9.42 | 46.11 | 74.00 | -27.89 |

| Freq. MHz | Detector Mode AV | Peak Actual FS (dBμV/m) | Duty Cycle Factor (dB) | Average Value (dBuV/m) | Average Limit@3m (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4960.000 | Average | 41.75 | -24.73 | 17.02 | 54.00 | -36.98 |
| 7440.000 | Average | 46.11 | -24.73 | 21.38 | 54.00 | -32.62 |

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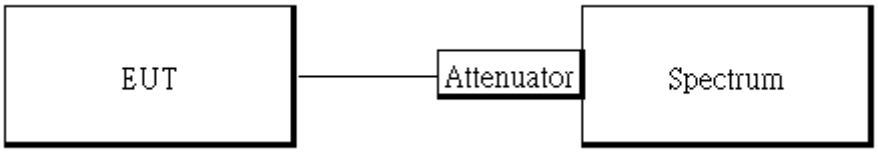
# 11 FREQUENCY SEPARATION

## 11.1 Standard Applicable

Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

## 11.2 Test Setup




## 11.3 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = middle of hopping channel.
5. Set the RBW approximately 30% of the channel spacing, VBW ≥ RBW.
6. Adjust Span to Wide enough to capture the peaks of two adjacent channels.
7. Sweep = auto.
8. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

## 11.4 Measurement Result

| Channel separation (MHz) | Limit | Result |
|---|---|---|
| 1 | ≧25 kHz or<br>2/3 times 20dB bandwidth | PASS |

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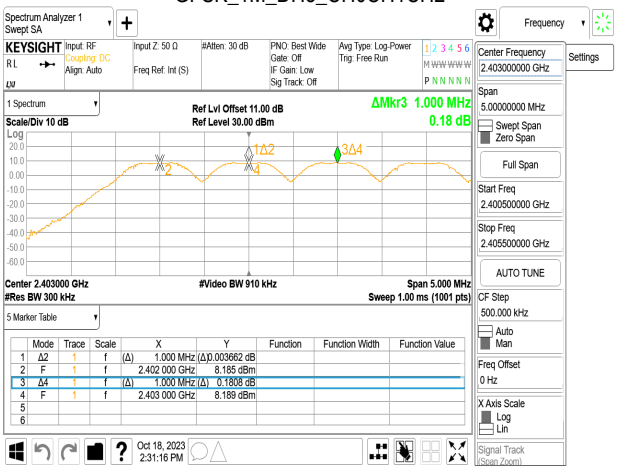
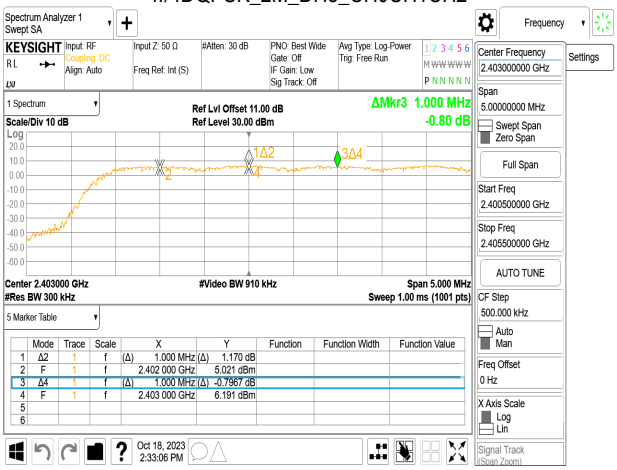
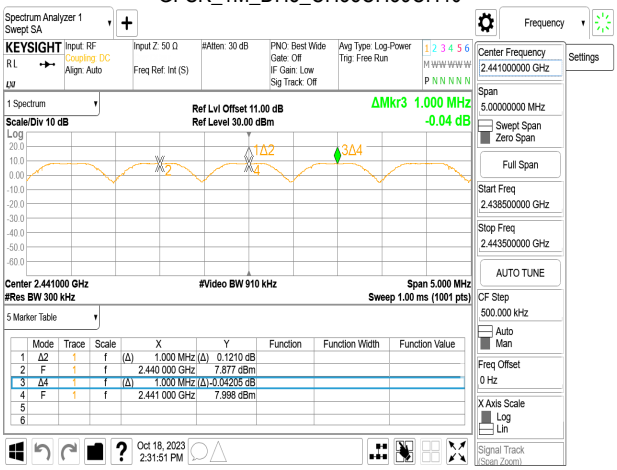



π/4DQPSK_2M_DH5_CH0CH1CH2




GFSK_1M_DH5_CH38CH39CH40

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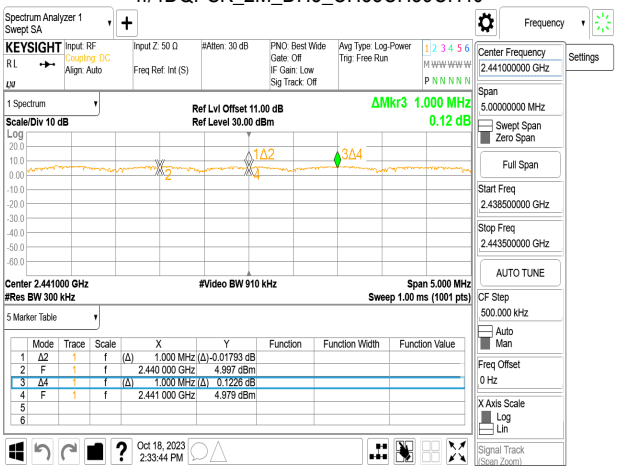
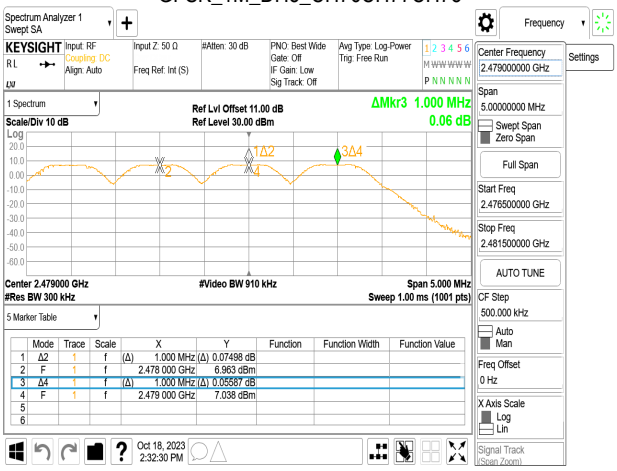



GFSK_1M_DH5_CH76CH77CH78

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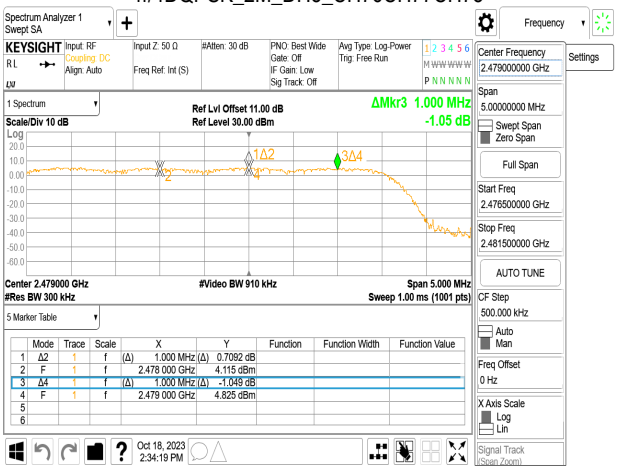


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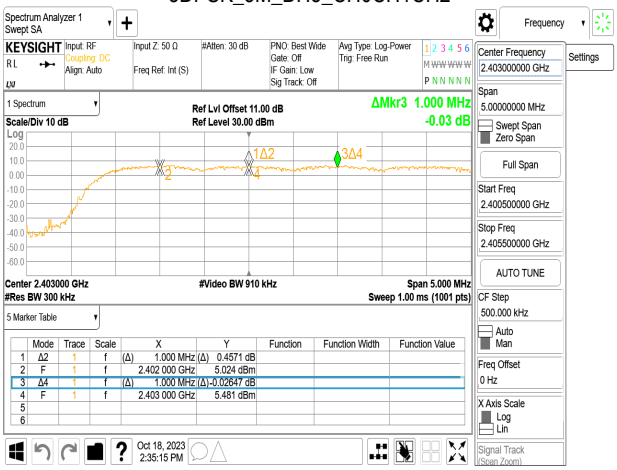
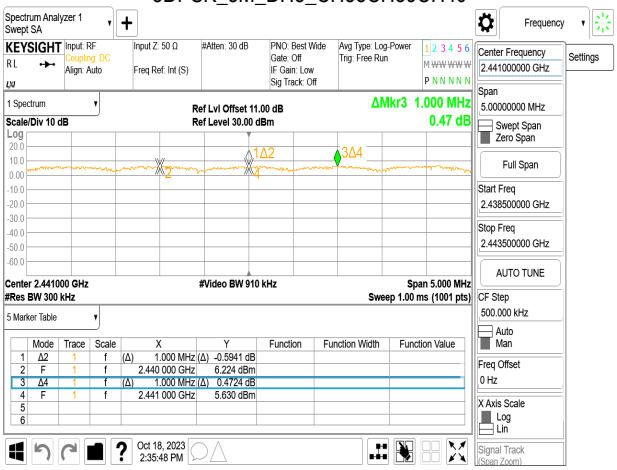
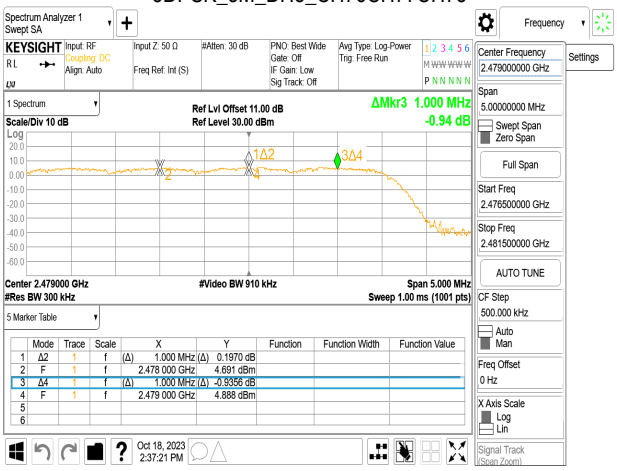
8DPSK_3M_DH5_CH0CH1CH2




8DPSK_3M_DH5_CH38CH39CH40




8DPSK_3M_DH5_CH76CH77CH78

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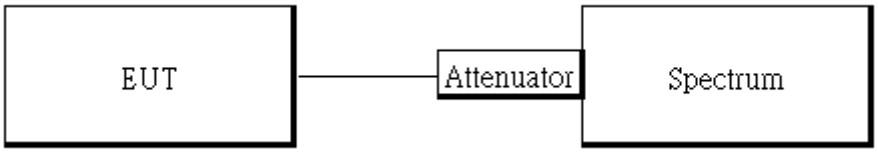
# 12 NUMBER OF HOPPING FREQUENCY

## 12.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

## 12.2 Test Setup




## 12.3 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
5. Set the spectrum analyzer as RBW = 30% of the channel spacing, VBW ≥ RBW., Detector = Peak
6. Max hold, view and count how many channel in the band.

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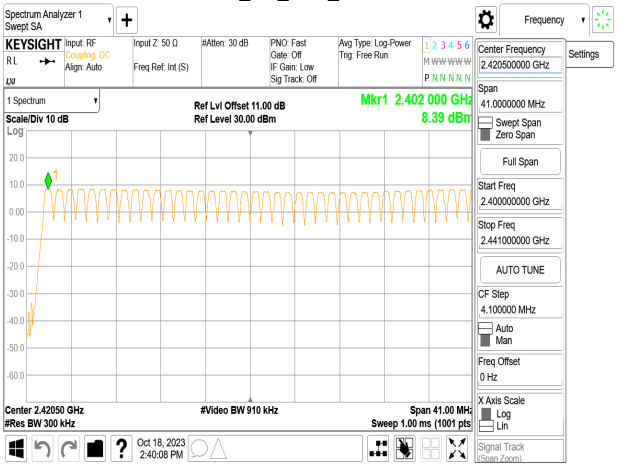
## 12.4 Measurement Result

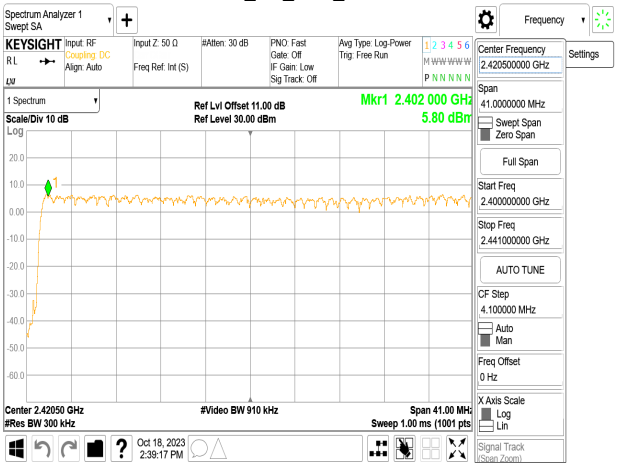
### Tabular Data of Total Channel Number

| | *Channel Number* | Limit |
|---|---|---|
| *2.4 GHz – 2.441 GHz* | 40 | >15 |
| *2.441 GHz – 2.4835 GHz* | 39 | |
| *2.4 GHz ~2.4835 GHz* | (40+39) = 79 | |

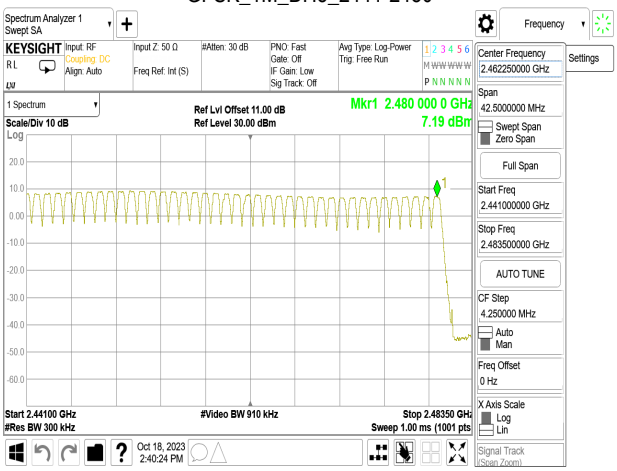
GFSK_1M_DH5_2400-2441



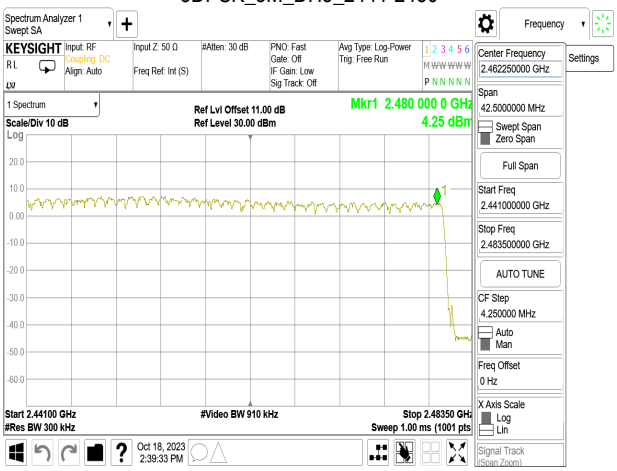

8DPSK_3M_DH5_2400-2441




GFSK_1M_DH5_2441-2480




8DPSK_3M_DH5_2441-2480

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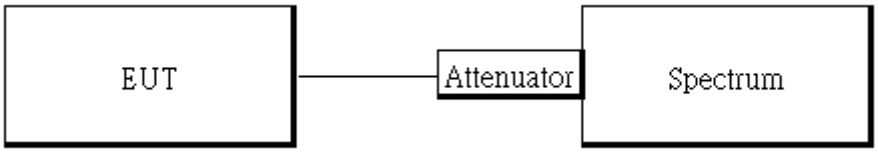
# 13 TIME OF OCCUPANCY (DWELL TIME)

## 13.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

## 13.2 Test Setup




## 13.3 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows ANSI C63.10:2013.
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set center frequency of spectrum analyzer = operating frequency.
5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz , Detector = Peak, Adjust Sweep = 2~8ms.
6. Repeat above procedures until all frequency of the interest measured were complete.

Formula Deduced: time occupancy of one time slot X Hopping rate / total slot in one channel / total channel that hops X period of working channels.

Where, standard hopping rate is 1600 hops/s, slot in one channel for DH1, DH3, and DH5 is 2, 4, and 6, respectively.

DH1 consists of single time slot of the uplink, and one slot of the downlink Total Slot: 2

DH3 consists of three time slot of the uplink, and one slot of the downlink. Total Slot: 4

DH5 consists of five time slot of the uplink, and one slot of the downlink. Total Slot: 6

Note: the result of the complete test default channel at 1Mbps is recorded on the test report, 2Mbps, and 3Mbps only records the measurement result at middle channel that reveals no much deviation.

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## 13.4 Measurement Result

**GFSK (1Mbps)**

| Channel | PACKET TYPE | Measurement Result (ms) | Limit (ms) |
|---|---|---|---|
| Mid | DH1 | 121.60 | 400 |
| | DH3 | 260.80 | 400 |
| | DH5 | 308.80 | 400 |

**π/4 DQPSK (2Mbps)**

| Channel | PACKET TYPE | Measurement Result (ms) | Limit (ms) |
|---|---|---|---|
| Mid | 2DH1 | 124.80 | 400 |
| | 2DH3 | 262.40 | 400 |
| | 2DH5 | 308.80 | 400 |

**8-DPSK (3Mbps)**

| Channel | PACKET TYPE | Measurement Result (ms) | Limit (ms) |
|---|---|---|---|
| Mid | 3DH1 | 124.80 | 400 |
| | 3DH3 | 262.40 | 400 |
| | 3DH5 | 308.80 | 400 |

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**GFSK (1Mbps):**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CH Mid | DH1 time slot | = | 0.380 | * | (1600/2/79) | * | 31.6 | = | 121.60 | (ms) |
| | DH3 time slot | = | 1.630 | * | (1600/4/79) | * | 31.6 | = | 260.80 | (ms) |
| | DH5 time slot | = | 2.895 | * | (1600/6/79) | * | 31.6 | = | 308.80 | (ms) |

**π/4 -DQPSK (2Mbps):**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CH Mid | 2DH1 time slot | = | 0.390 | * | (1600/2/79) | * | 31.6 | = | 124.80 | (ms) |
| | 2DH3 time slot | = | 1.640 | * | (1600/4/79) | * | 31.6 | = | 262.40 | (ms) |
| | 2DH5 time slot | = | 2.895 | * | (1600/6/79) | * | 31.6 | = | 308.80 | (ms) |

**8-DPSK (3Mbps):**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| CH Mid | 3DH1 time slot | = | 0.390 | * | (1600/2/79) | * | 31.6 | = | 124.80 | (ms) |
| | 3DH3 time slot | = | 1.640 | * | (1600/4/79) | * | 31.6 | = | 262.40 | (ms) |
| | 3DH5 time slot | = | 2.895 | * | (1600/6/79) | * | 31.6 | = | 308.80 | (ms) |

A period time = 0.4 (s) * 79 = 31.6 (s)

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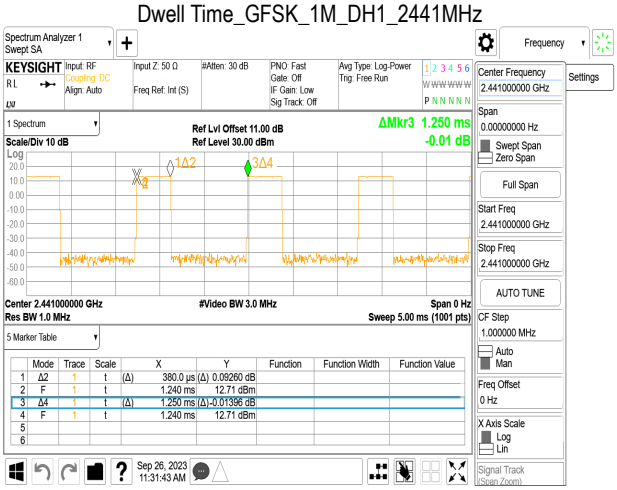
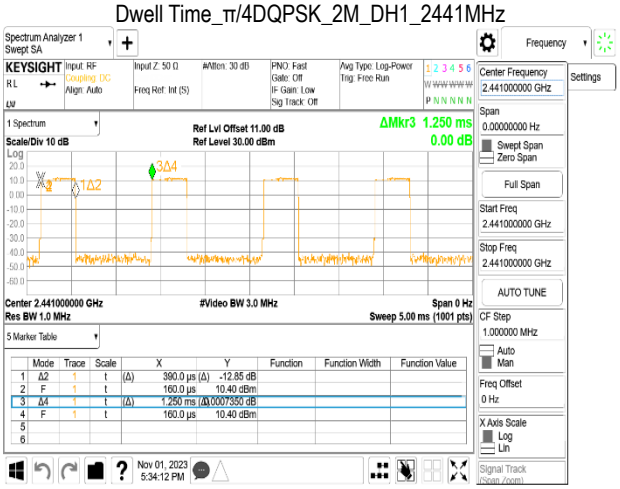
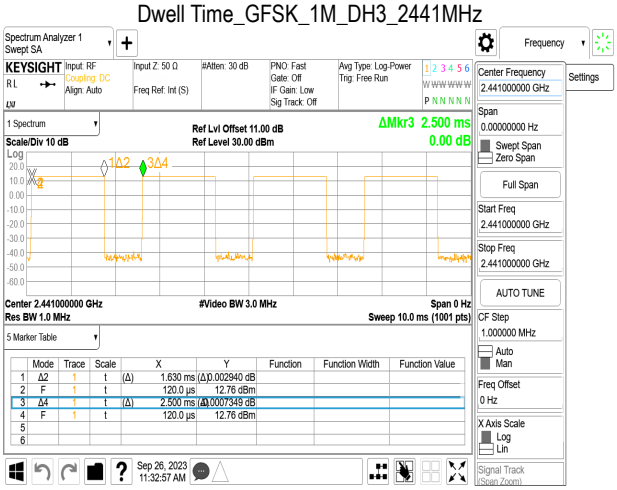
Dwell Time_GFSK_1M_DH1_2441MHz



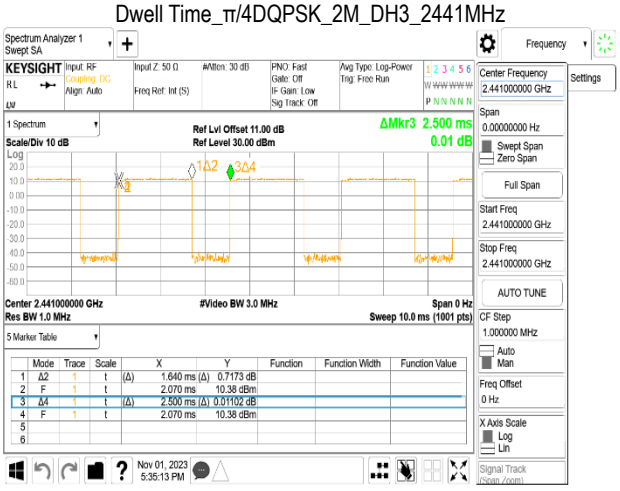

Dwell Time_π/4DQPSK_2M_DH1_2441MHz



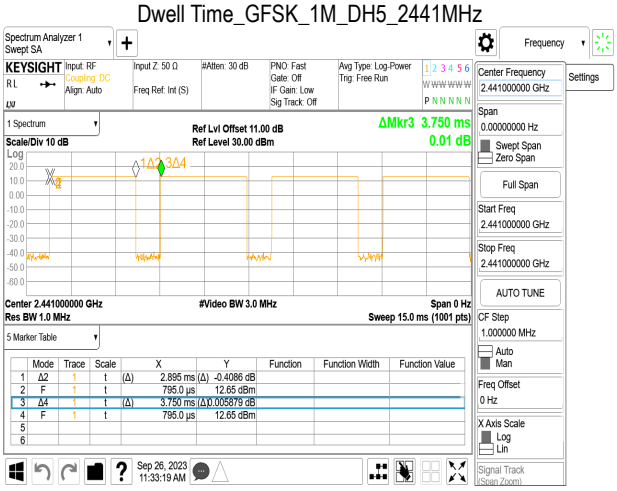

Dwell Time_GFSK_1M_DH3_2441MHz



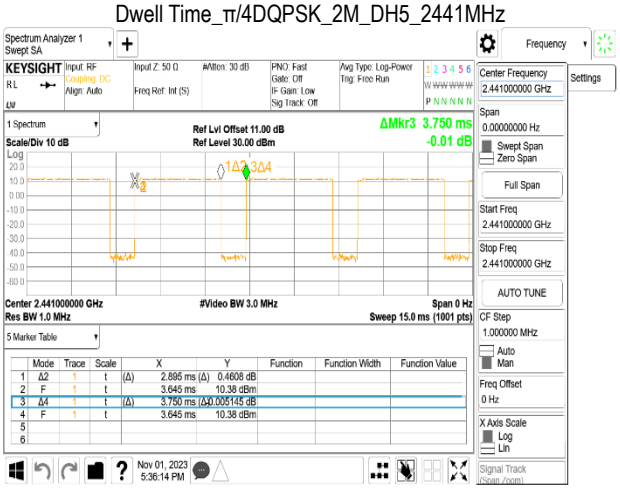

Dwell Time_π/4DQPSK_2M_DH3_2441MHz




Dwell Time_GFSK_1M_DH5_2441MHz




Dwell Time_π/4DQPSK_2M_DH5_2441MHz

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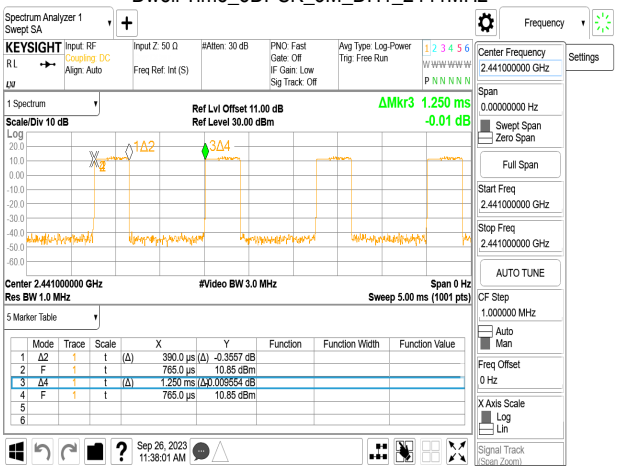
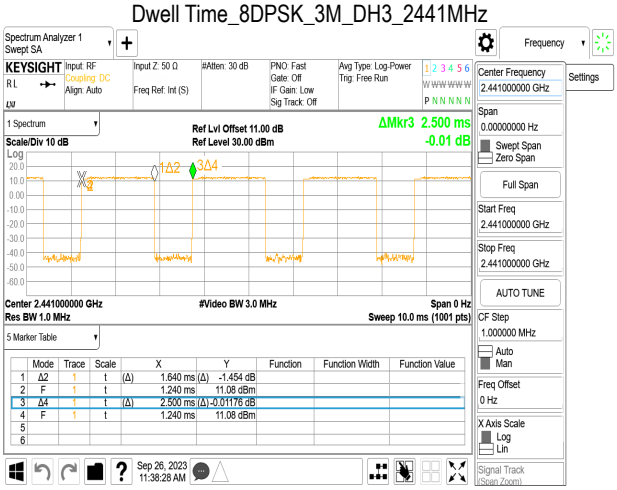
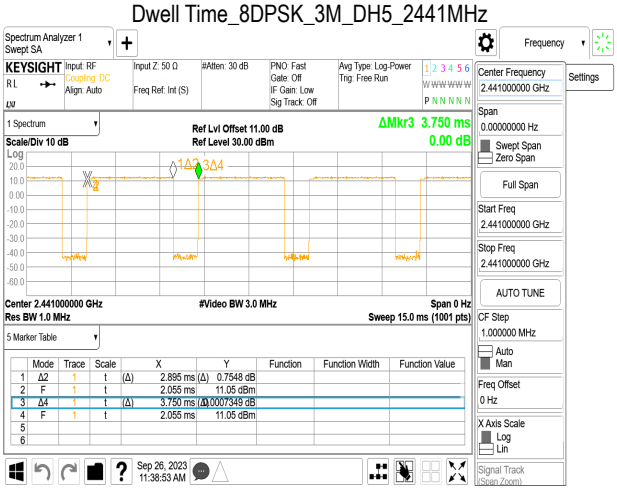
Dwell Time_8DPSK_3M_DH1_2441MHz




Dwell Time_8DPSK_3M_DH3_2441MHz




Dwell Time_8DPSK_3M_DH5_2441MHz

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# 14 ANTENNA REQUIREMENT

## 14.1 Standard Applicable

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

## 14.2 Antenna Connected Construction:

The antenna complies with this requirement and no consideration of replacement. Please see EUT photo for details.

***~ End of Report ~***

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
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