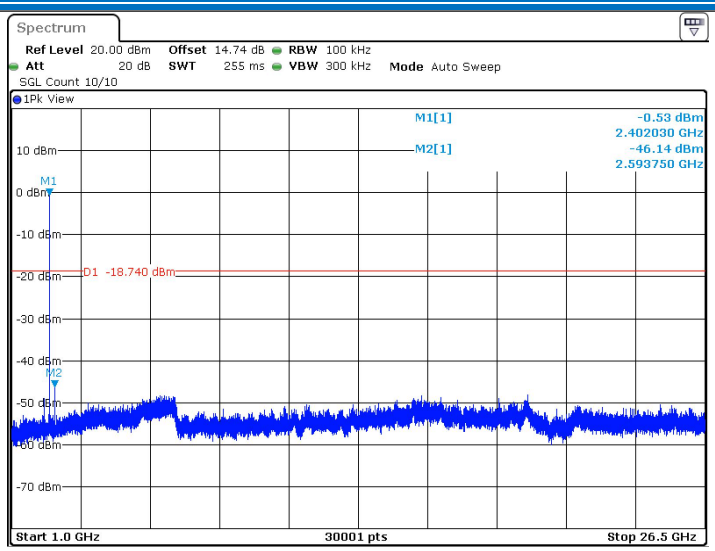
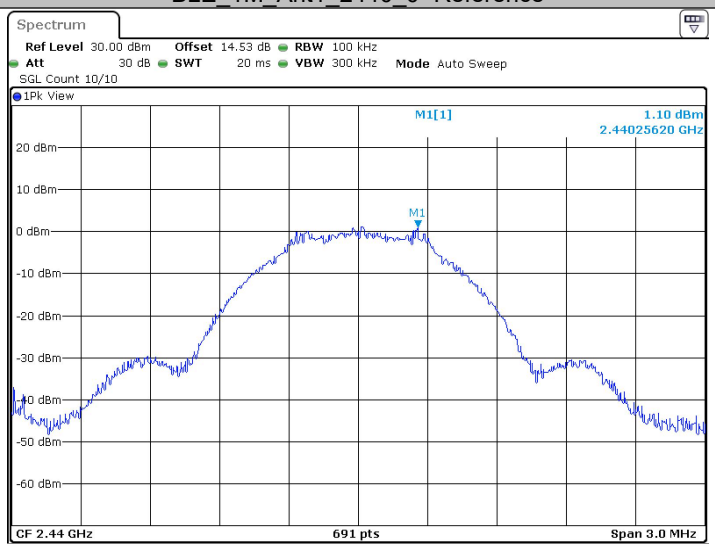


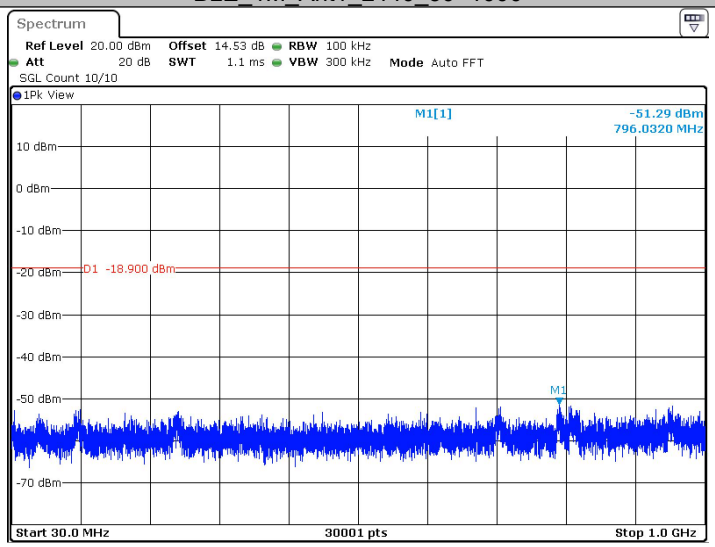

Date: 21.MAY.2025 18:31:02

BLE_1M_Ant1_2440_0~Reference



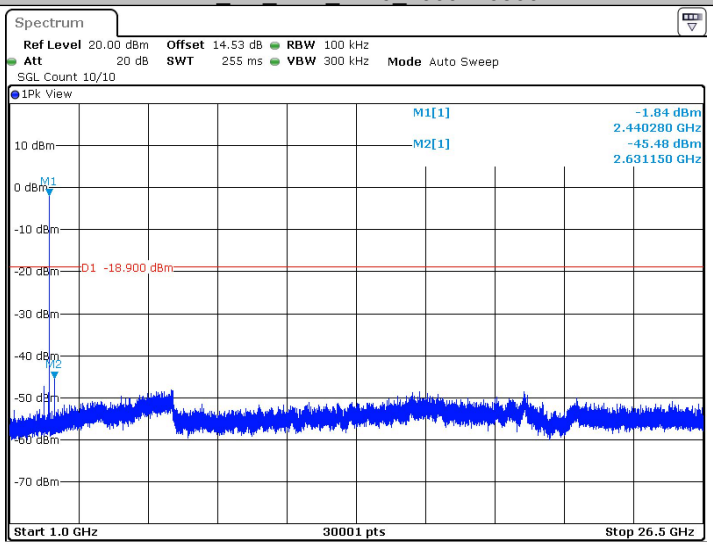

Date: 21.MAY.2025 18:31:49

BLE_1M_Ant1_2440_30~1000



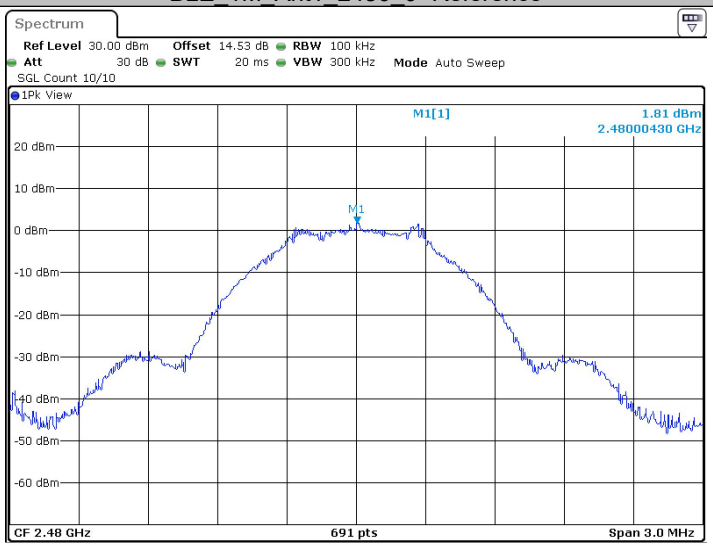

Date: 21.MAY.2025 18:31:54

BLE_1M_Ant1_2440_1000~26500



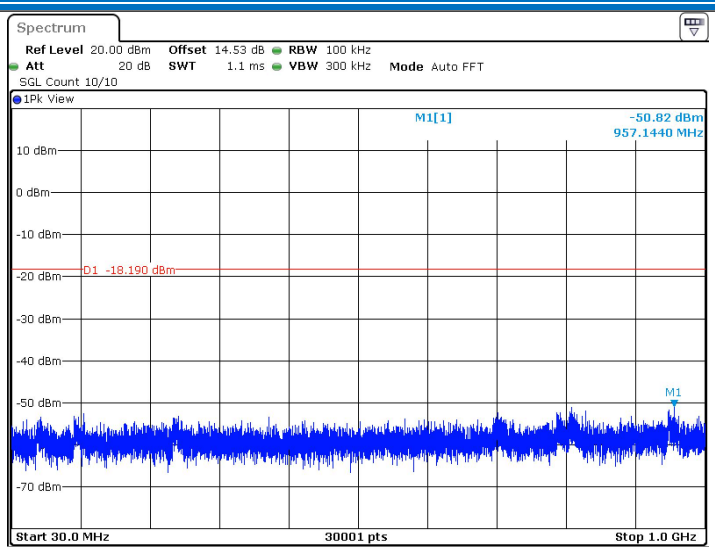

Date: 21.MAY.2025 18:32:04

BLE_1M_Ant1_2480_0~Reference



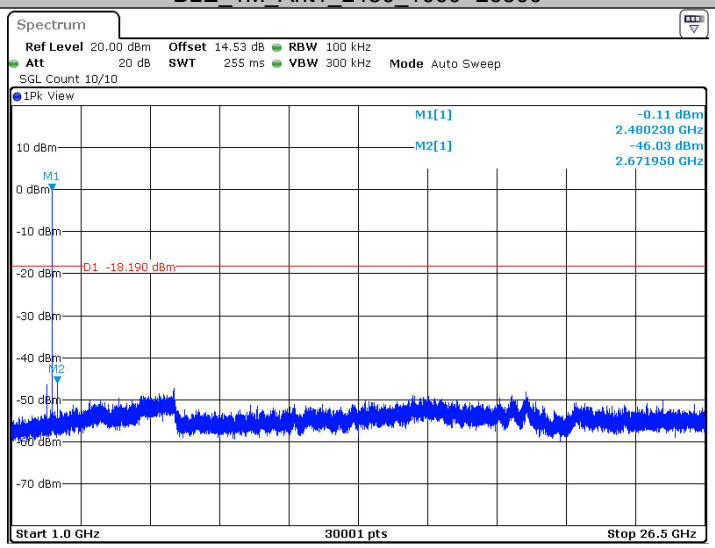

Date: 21.MAY.2025 18:38:24

BLE_1M_Ant1_2480_30~1000



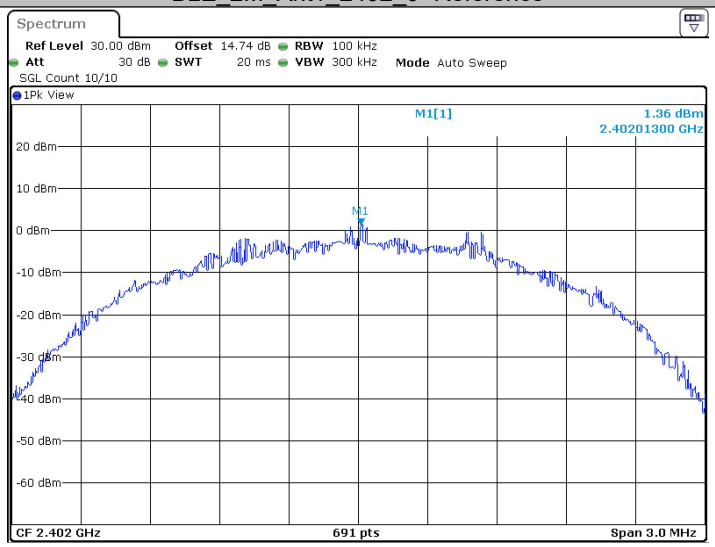

Date: 21.MAY.2025 18:38:29

BLE_1M_Ant1_2480_1000~26500



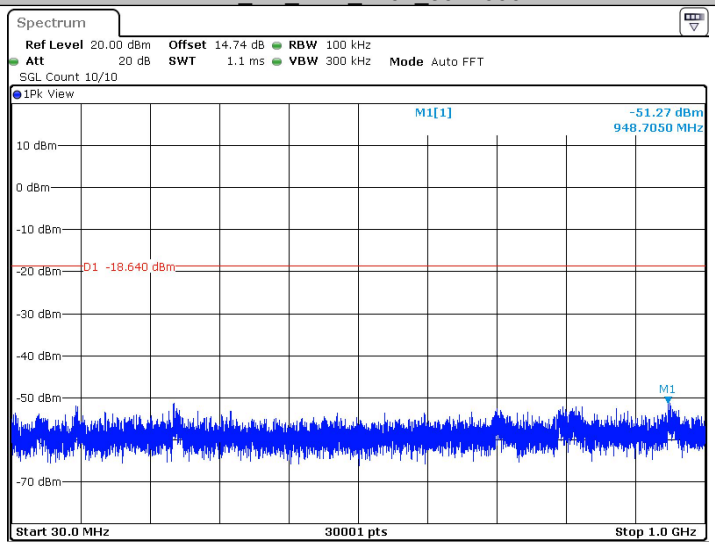

Date: 21.MAY.2025 18:38:39

BLE_2M_Ant1_2402_0~Reference



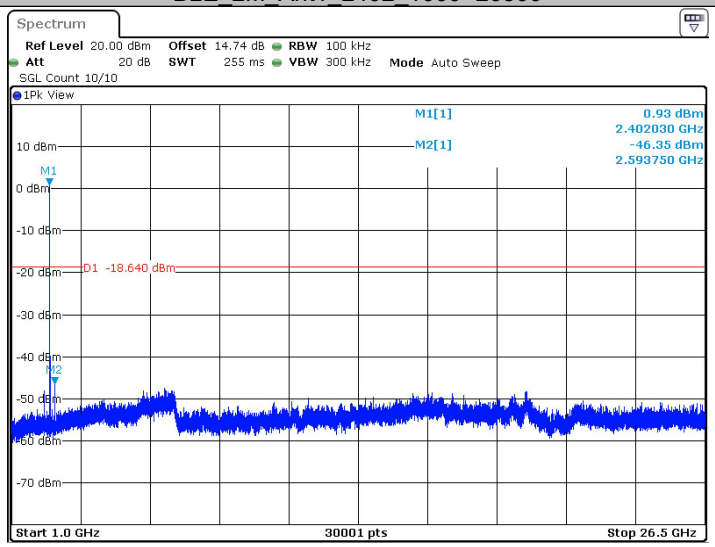

Date: 21.MAY.2025 18:42:33

BLE_2M_Ant1_2402_30~1000



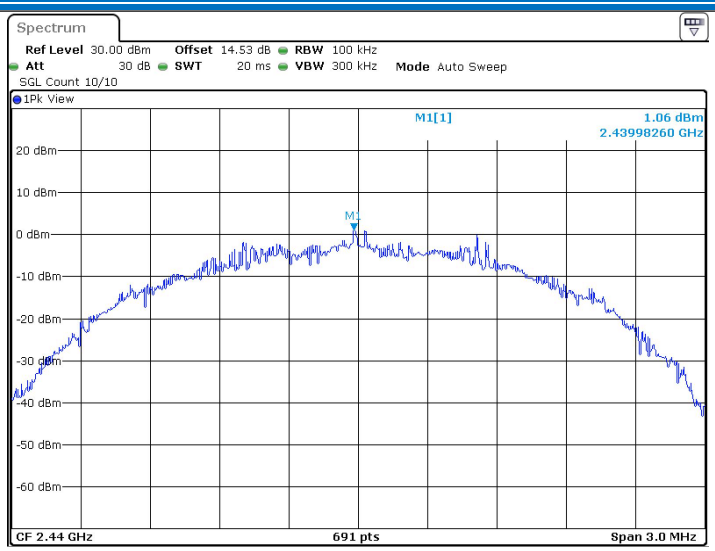

Date: 21.MAY.2025 18:42:38

BLE_2M_Ant1_2402_1000~26500



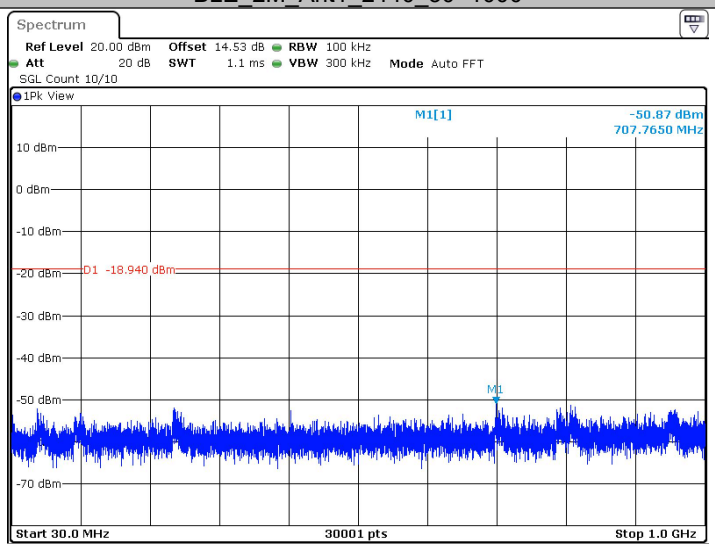

Date: 21.MAY.2025 18:42:48

BLE_2M_Ant1_2440_0~Reference



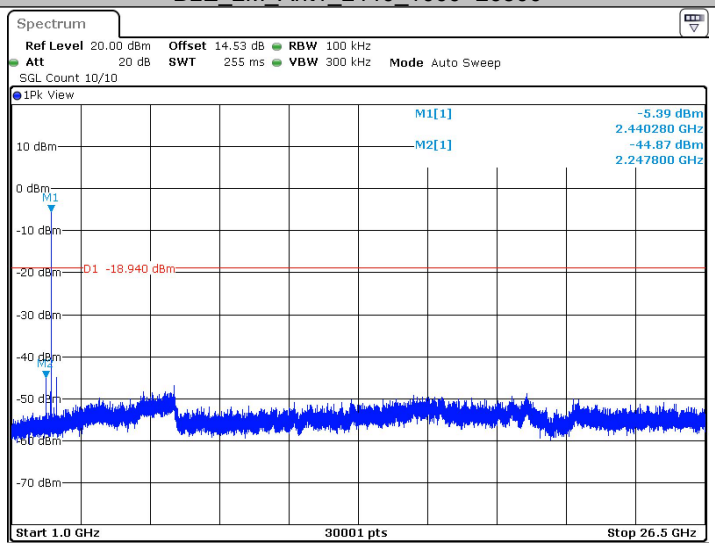

Date: 21.MAY.2025 18:43:26

BLE_2M_Ant1_2440_30~1000



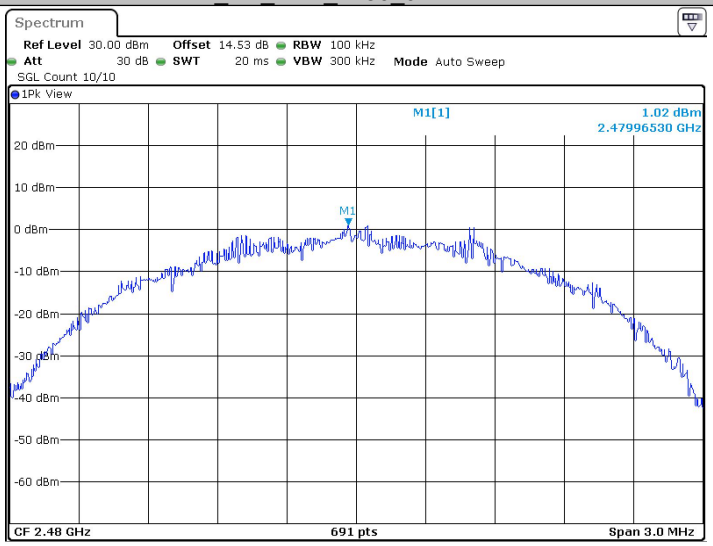

Date: 21.MAY.2025 18:43:31

BLE_2M_Ant1_2440_1000~26500



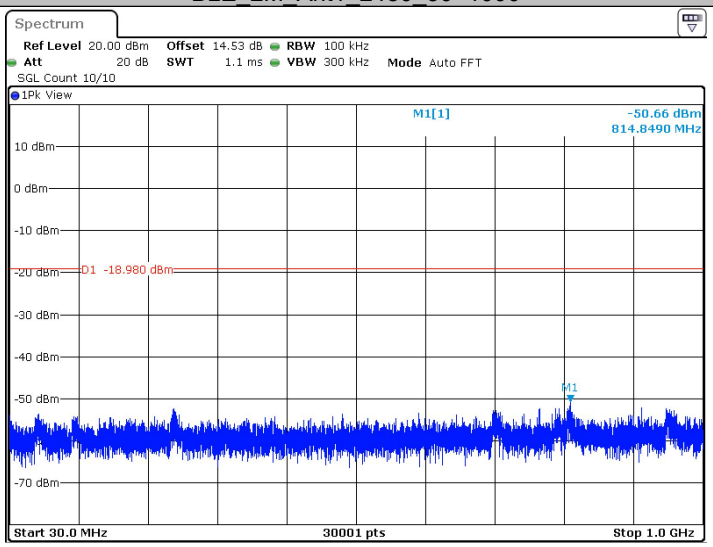

Date: 21.MAY.2025 18:43:41

BLE_2M_Ant1_2480_0~Reference



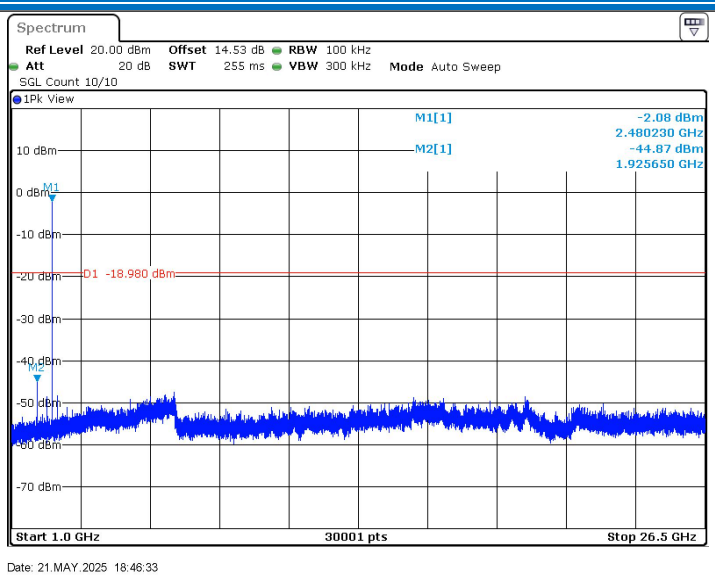

Date: 21.MAY.2025 18:46:18

BLE_2M_Ant1_2480_30~1000




Date: 21.MAY.2025 18:46:22

BLE_2M_Ant1_2480_1000~26500




Remark:

Pretest 9kHz to 25GHz, find the highest point when testing, so only the worst data were shown in the test report. Per FCC Part 15.33 (a) and 15.31 (o) ,The amplitude of spurious emissions from intentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

## 5.8 Radiated Spurious Emission & Restricted bands

### 5.8.1 Spurious Emissions

| | |
|---|---|
| Test Requirement: | 47 CFR Part 15C Section 15.209 and 15.205 |
| Test Method: | ANSI C63.10 2013 |
| Test Site: | Measurement Distance: 3m (Semi-Anechoic Chamber) |

Receiver Setup:

| Frequency | Detector | RBW | VBW | Remark |
|---|---|---|---|---|
| 0.009MHz-0.090MHz | Peak | 10kHz | 30kHz | Peak |
| 0.009MHz-0.090MHz | Average | 10kHz | 30kHz | Average |
| 0.090MHz-0.110MHz | Quasi-peak | 10kHz | 30kHz | Quasi-peak |
| 0.110MHz-0.490MHz | Peak | 10kHz | 30kHz | Peak |
| 0.110MHz-0.490MHz | Average | 10kHz | 30kHz | Average |
| 0.490MHz -30MHz | Quasi-peak | 10kHz | 30kHz | Quasi-peak |
| 30MHz-1GHz | Quasi-peak | 100 kHz | 300kHz | Quasi-peak |
| Above 1GHz | Peak | 1MHz | 3MHz | Peak |
| | Peak | 1MHz | 10Hz | Average |

Limit:

| Frequency | Field strength (microvolt/meter) | Limit (dBuV/m) | Remark | Measurement distance (m) |
|---|---|---|---|---|
| 0.009MHz-0.490MHz | 2400/F(kHz) | - | - | 300 |
| 0.490MHz-1.705MHz | 24000/F(kHz) | - | - | 30 |
| 1.705MHz-30MHz | 30 | - | - | 30 |
| 30MHz-88MHz | 100 | 40.0 | Quasi-peak | 3 |
| 88MHz-216MHz | 150 | 43.5 | Quasi-peak | 3 |
| 216MHz-960MHz | 200 | 46.0 | Quasi-peak | 3 |
| 960MHz-1GHz | 500 | 54.0 | Quasi-peak | 3 |
| Above 1GHz | 500 | 54.0 | Average | 3 |

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

| Test Setup: | |
|---|---|

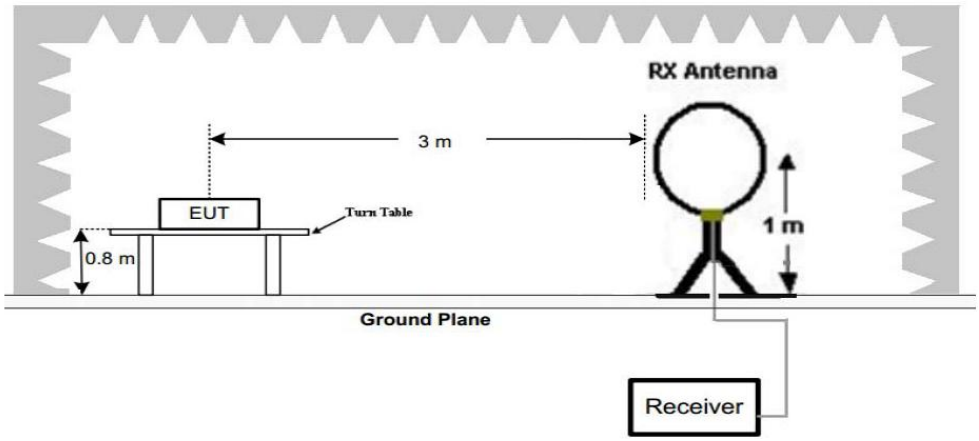



Figure 1. Below 30MHz

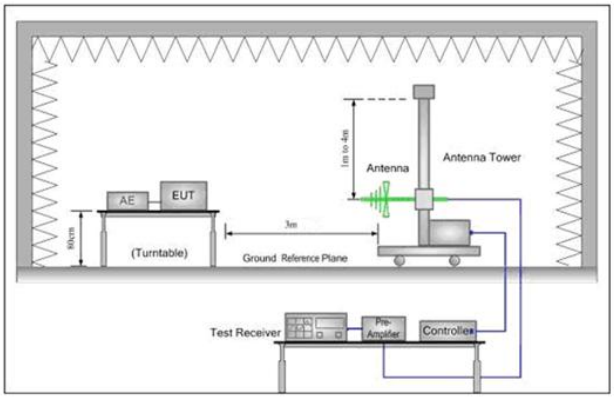



Figure 2. 30MHz to 1GHz

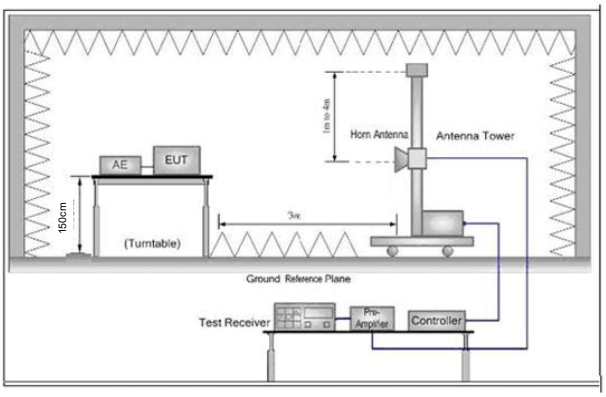
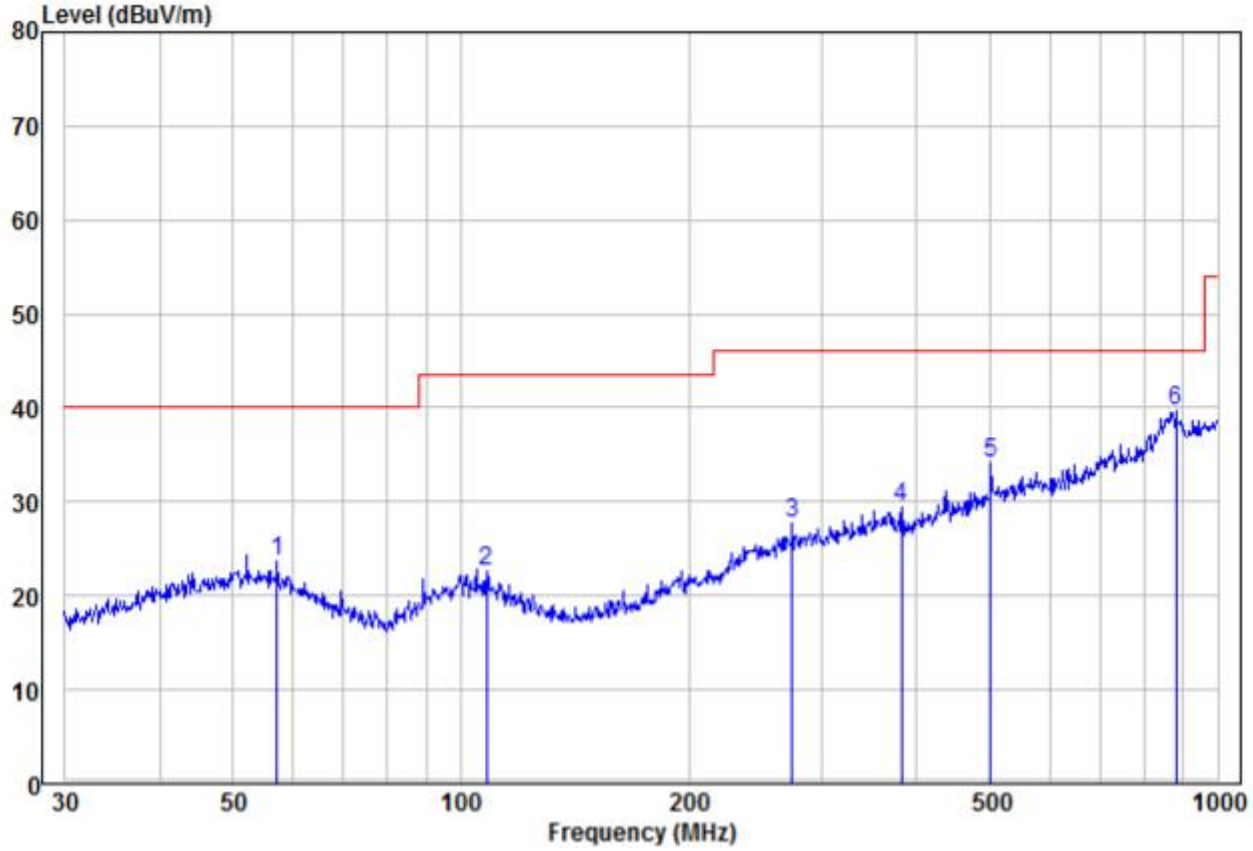



Figure 3. Above 1 GHz

| Test Procedure: | a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.<br>Note: For the radiated emission test above 1GHz:<br>Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.<br>b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. |
|---|---|

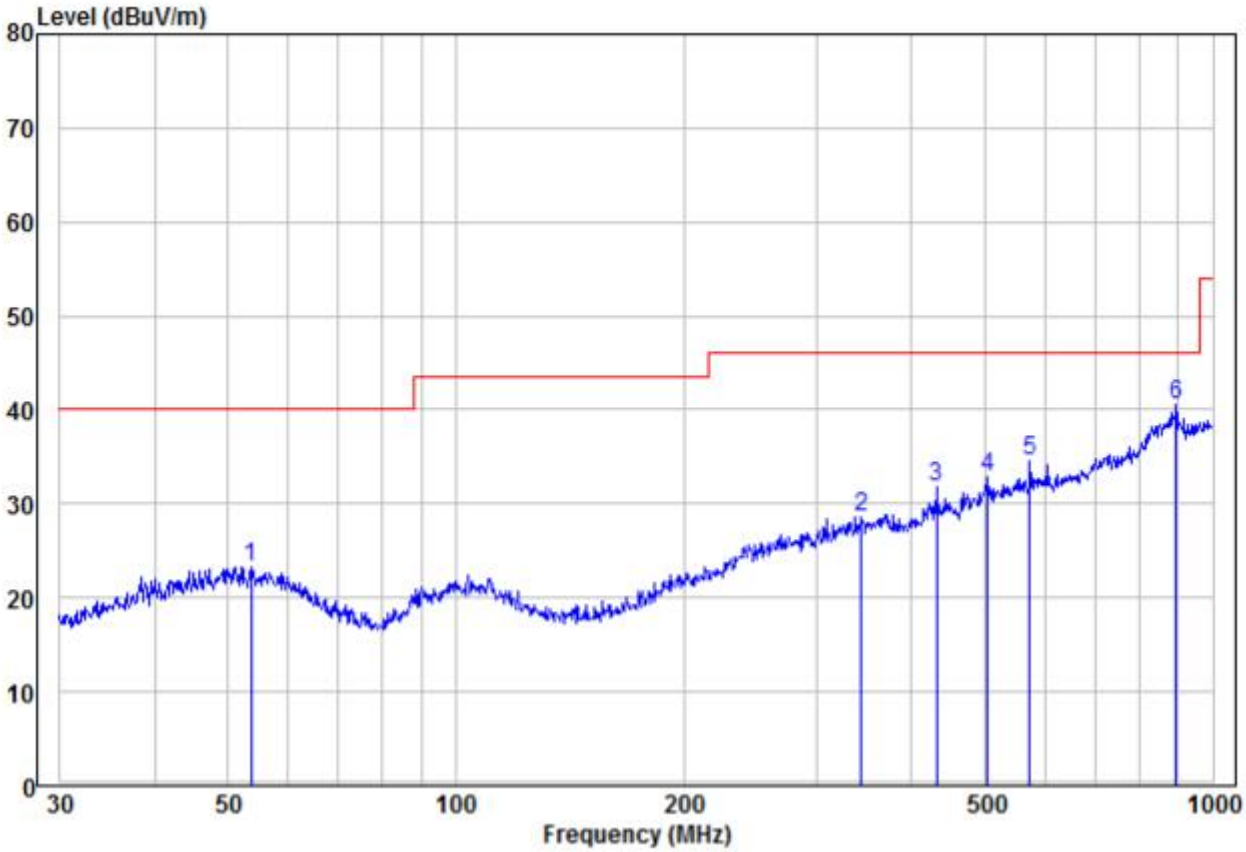
| | |
|---|---|
| | c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.<br>d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.<br>e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.<br>f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.<br>g. Test the EUT in the lowest channel (2402MHz),the middle channel (2440MHz),the Highest channel (2480MHz)<br>h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.<br>i. Repeat above procedures until all frequencies measured was complete. |
| Exploratory Test Mode: | Transmitting with GFSK modulation.<br>Transmitting mode. |
| Final Test Mode: | Through Pre-scan, find the 1Mbps of data type and GFSK modulation is the worst case.<br>For below 1GHz part, through pre-scan, the worst case is the highest channel.<br>Only the worst case is recorded in the report. |
| Test Results: | Pass |

| Radiated Emission below 1GHz | | |
|---|---|---|
| 30MHz~1GHz, the worst case | | |
| Test mode: | Transmitting mode | Horizontal |




| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark | Pol/Phase | APos | TPos |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | | cm | deg |
| 1 | 57.19 | 10.32 | 13.41 | 23.73 | 40.00 | -16.27 | Peak | HORIZONTAL | 100 | 108 |
| 2 | 108.27 | 9.83 | 12.79 | 22.62 | 43.50 | -20.88 | Peak | HORIZONTAL | 100 | 322 |
| 3 | 274.19 | 10.72 | 17.04 | 27.76 | 46.00 | -18.24 | Peak | HORIZONTAL | 100 | 39 |
| 4 | 382.59 | 10.65 | 18.77 | 29.42 | 46.00 | -16.58 | Peak | HORIZONTAL | 100 | 28 |
| 5 | 501.18 | 12.21 | 21.84 | 34.05 | 46.00 | -11.95 | Peak | HORIZONTAL | 100 | 106 |
| 6 pp | 881.41 | 10.17 | 29.52 | 39.69 | 46.00 | -6.31 | Peak | HORIZONTAL | 100 | 7 |

| 30MHz~1GHz, the worst case | | |
|---|---|---|
| Test mode: | Transmitting mode | Vertical |




| | Freq | Read Level | Factor | Level | Limit Line | Over Limit | Remark | Pol/Phase | APos | TPos |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | | cm | deg |
| 1 | 53.69 | 9.38 | 13.81 | 23.19 | 40.00 | -16.81 | Peak | VERTICAL | 100 | 12 |
| 2 | 343.18 | 9.81 | 18.83 | 28.64 | 46.00 | -17.36 | Peak | VERTICAL | 100 | 256 |
| 3 | 431.03 | 11.94 | 19.86 | 31.80 | 46.00 | -14.20 | Peak | VERTICAL | 100 | 205 |
| 4 | 504.71 | 11.03 | 21.88 | 32.91 | 46.00 | -13.09 | Peak | VERTICAL | 100 | 79 |
| 5 | 572.61 | 11.79 | 22.76 | 34.55 | 46.00 | -11.45 | Peak | VERTICAL | 100 | 142 |
| 6 pp | 893.86 | 10.76 | 29.71 | 40.47 | 46.00 | -5.53 | Peak | VERTICAL | 100 | 250 |

Transmitter Emission above 1GHz

| Worse case mode: | | GFSK(1Mbps) | | Test channel: | | Lowest | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Over (dB) | Detector Type | Ant. Pol. H/V | Antenna Height (m) | Table Angle (Degree) |
| **2390** | 55.68 | -9.2 | 46.48 | 74 | -27.52 | Peak | H | 1.5 | 138 |
| 2400 | 54.44 | -9.39 | 45.05 | 74 | -28.95 | Peak | H | 1.5 | 254 |
| 4804 | 53.58 | -4.33 | 49.25 | 74 | -24.75 | Peak | H | 1.5 | 85 |
| 7206 | 49.82 | 1.01 | 50.83 | 74 | -23.17 | Peak | H | 1.5 | 323 |
| **2390** | 53.19 | -9.2 | 43.99 | 74 | -30.01 | Peak | V | 1.5 | 275 |
| 2400 | 53.10 | -9.39 | 43.71 | 74 | -30.29 | Peak | V | 1.5 | 159 |
| 4804 | 52.42 | -4.33 | 48.09 | 74 | -25.91 | Peak | V | 1.5 | 30 |
| 7206 | 51.01 | 1.01 | 52.02 | 74 | -21.98 | Peak | V | 1.5 | 183 |

| Worse case mode: | | GFSK(1Mbps) | | Test channel: | | Middle | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Over (dB) | Detector Type | Ant. Pol. H/V | Antenna Height (m) | Table Angle (Degree) |
| 4880 | 51.24 | -4.11 | 47.13 | 74 | -26.87 | peak | H | 1.5 | 122 |
| 7320 | 50.06 | 1.51 | 51.57 | 74 | -22.43 | peak | H | 1.5 | 232 |
| 4880 | 53.92 | -4.11 | 49.81 | 74 | -24.19 | peak | V | 1.5 | 45 |
| 7320 | 50.53 | 1.51 | 52.04 | 74 | -21.96 | peak | V | 1.5 | 325 |

| Worse case mode: | | GFSK(1Mbps) | | Test channel: | | Highest | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Over (dB) | Detector Type | Ant. Pol. H/V | Antenna Height (m) | Table Angle (Degree) |
| **2483.5** | 54.48 | -9.29 | 45.19 | 74 | -28.81 | Peak | H | 1.5 | 12 |
| 4960 | 53.15 | -4.04 | 49.11 | 74 | -24.89 | Peak | H | 1.5 | 105 |
| 7440 | 48.77 | 1.57 | 50.34 | 74 | -23.66 | Peak | H | 1.5 | 346 |
| **2483.5** | 57.61 | -9.29 | 48.32 | 74 | -25.68 | Peak | V | 1.5 | 334 |
| 4960 | 51.96 | -4.04 | 47.92 | 74 | -26.08 | Peak | V | 1.5 | 325 |
| 7440 | 48.71 | 1.57 | 50.28 | 74 | -23.72 | Peak | V | 1.5 | 248 |

| Worse case mode: | | GFSK(2Mbps) | | Test channel: | | Lowest | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency | Meter Reading | Factor | Emission Level | Limits | Over | Detector Type | Ant. Pol. | Antenna Height | Table Angle |
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | | H/V | (m) | (Degree) |
| **2390** | 55.81 | -9.2 | 46.61 | 74 | -27.39 | Peak | H | 1.5 | 256 |
| 2400 | 56.29 | -9.39 | 46.90 | 74 | -27.10 | Peak | H | 1.5 | 155 |
| 4804 | 53.66 | -4.33 | 49.33 | 74 | -24.67 | Peak | H | 1.5 | 249 |
| 7206 | 49.24 | 1.01 | 50.25 | 74 | -23.75 | Peak | H | 1.5 | 293 |
| **2390** | 54.05 | -9.2 | 44.85 | 74 | -29.15 | Peak | V | 1.5 | 253 |
| 2400 | 50.57 | -9.39 | 41.18 | 74 | -32.82 | Peak | V | 1.5 | 358 |
| 4804 | 52.77 | -4.33 | 48.44 | 74 | -25.56 | Peak | V | 1.5 | 205 |
| 7206 | 49.26 | 1.01 | 50.27 | 74 | -23.73 | Peak | V | 1.5 | 92 |

| Worse case mode: | | GFSK(2Mbps) | | Test channel: | | Middle | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency | Meter Reading | Factor | Emission Level | Limits | Over | Detector Type | Ant. Pol. | Antenna Height | Table Angle |
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | | H/V | (m) | (Degree) |
| 4880 | 50.40 | -4.11 | 46.29 | 74 | -27.71 | peak | H | 1.5 | 269 |
| 7320 | 48.94 | 1.51 | 50.45 | 74 | -23.55 | peak | H | 1.5 | 292 |
| 4880 | 53.32 | -4.11 | 49.21 | 74 | -24.79 | peak | V | 1.5 | 83 |
| 7320 | 49.65 | 1.51 | 51.16 | 74 | -22.84 | peak | V | 1.5 | 27 |

| Worse case mode: | | GFSK(2Mbps) | | Test channel: | | Highest | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency | Meter Reading | Factor | Emission Level | Limits | Over | Detector Type | Ant. Pol. | Antenna Height | Table Angle |
| (MHz) | (dBμV) | (dB) | (dBμV/m) | (dBμV/m) | (dB) | | H/V | (m) | (Degree) |
| **2483.5** | 54.59 | -9.29 | 45.30 | 74 | -28.70 | Peak | H | 1.5 | 318 |
| 4960 | 51.66 | -4.04 | 47.62 | 74 | -26.38 | Peak | H | 1.5 | 206 |
| 7440 | 48.27 | 1.57 | 49.84 | 74 | -24.16 | Peak | H | 1.5 | 355 |
| **2483.5** | 56.42 | -9.29 | 47.13 | 74 | -26.87 | Peak | V | 1.5 | 338 |
| 4960 | 50.74 | -4.04 | 46.70 | 74 | -27.30 | Peak | V | 1.5 | 190 |
| 7440 | 51.21 | 1.57 | 52.78 | 74 | -21.22 | Peak | V | 1.5 | 14 |

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

   Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

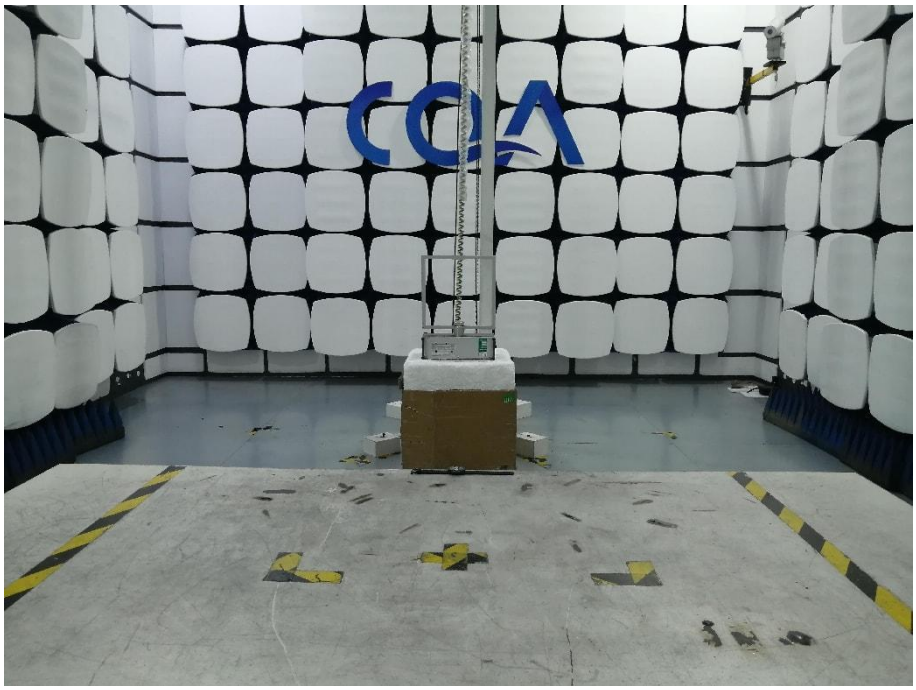
2) Scan from 9kHz to 25GHz, the disturbance above 10GHz and below 30MHz was very low. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified

above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

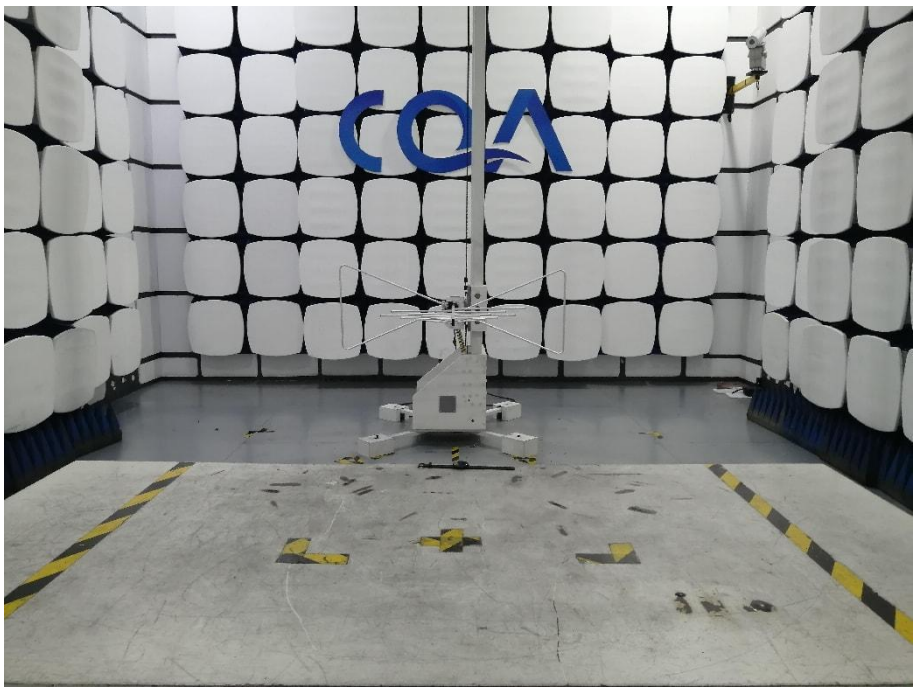
# 6 Photographs - EUT Test Setup

## 6.1 Radiated Spurious Emission

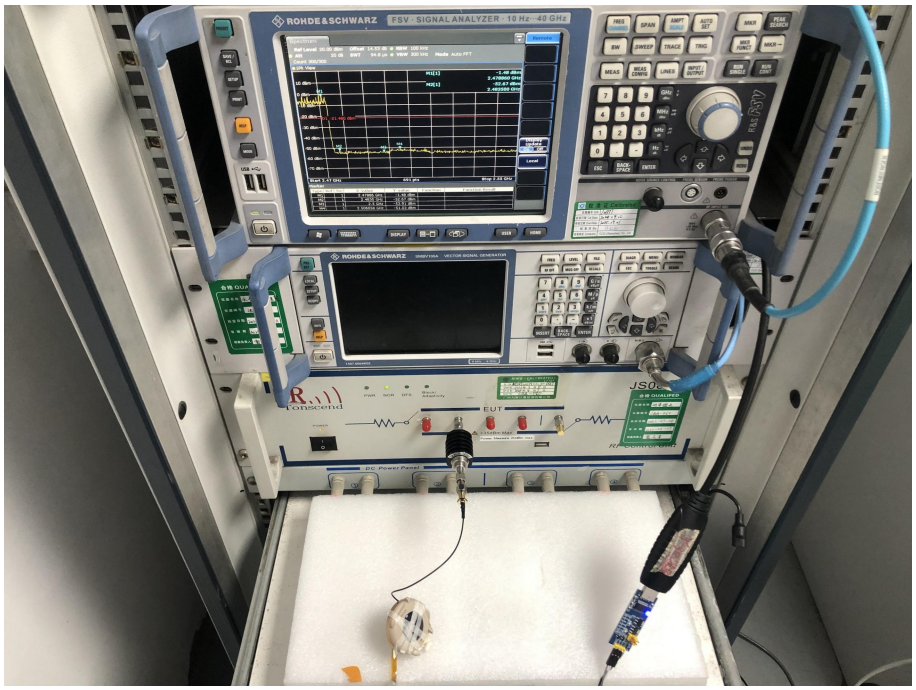
9kHz~30MHz:



30MHz~1GHz:



Above 1GHz:

## 6.2 Conducted Emissions Test Setup

## 6.3 RF Conducted measurement