

## **FCC Appendix RF Test Data for BLE**

**FCC ID** : 2AZ2R-M6

**Company** : Shenzhen USEER Robotics Co.,Ltd.

**EUT** : Robotic Vacuum Cleaner

**Model Number** : M6

**Report No.** : CTA25092202301

**Reviewed By** : Eric Wang

## Appendix A: DTS Bandwidth

### Test Result

| TestMode | Antenna | Freq(MHz) | DTS BW<br>[MHz] | FL[MHz]  | FH[MHz]  | Limit[MHz] | Verdict |
|----------|---------|-----------|-----------------|----------|----------|------------|---------|
| BLE_1M   | Ant1    | 2402      | 0.648           | 2401.688 | 2402.336 | 0.5        | PASS    |
|          |         | 2440      | 0.652           | 2439.688 | 2440.340 | 0.5        | PASS    |
|          |         | 2480      | 0.648           | 2479.696 | 2480.344 | 0.5        | PASS    |
| BLE_2M   | Ant1    | 2402      | 1.108           | 2401.444 | 2402.552 | 0.5        | PASS    |
|          |         | 2440      | 1.136           | 2439.440 | 2440.576 | 0.5        | PASS    |
|          |         | 2480      | 1.116           | 2479.448 | 2480.564 | 0.5        | PASS    |

Test Graphs





BLE\_2M\_Ant1\_2402



BLE\_2M\_Ant1\_2440



# BLE\_2M\_Ant1\_2480

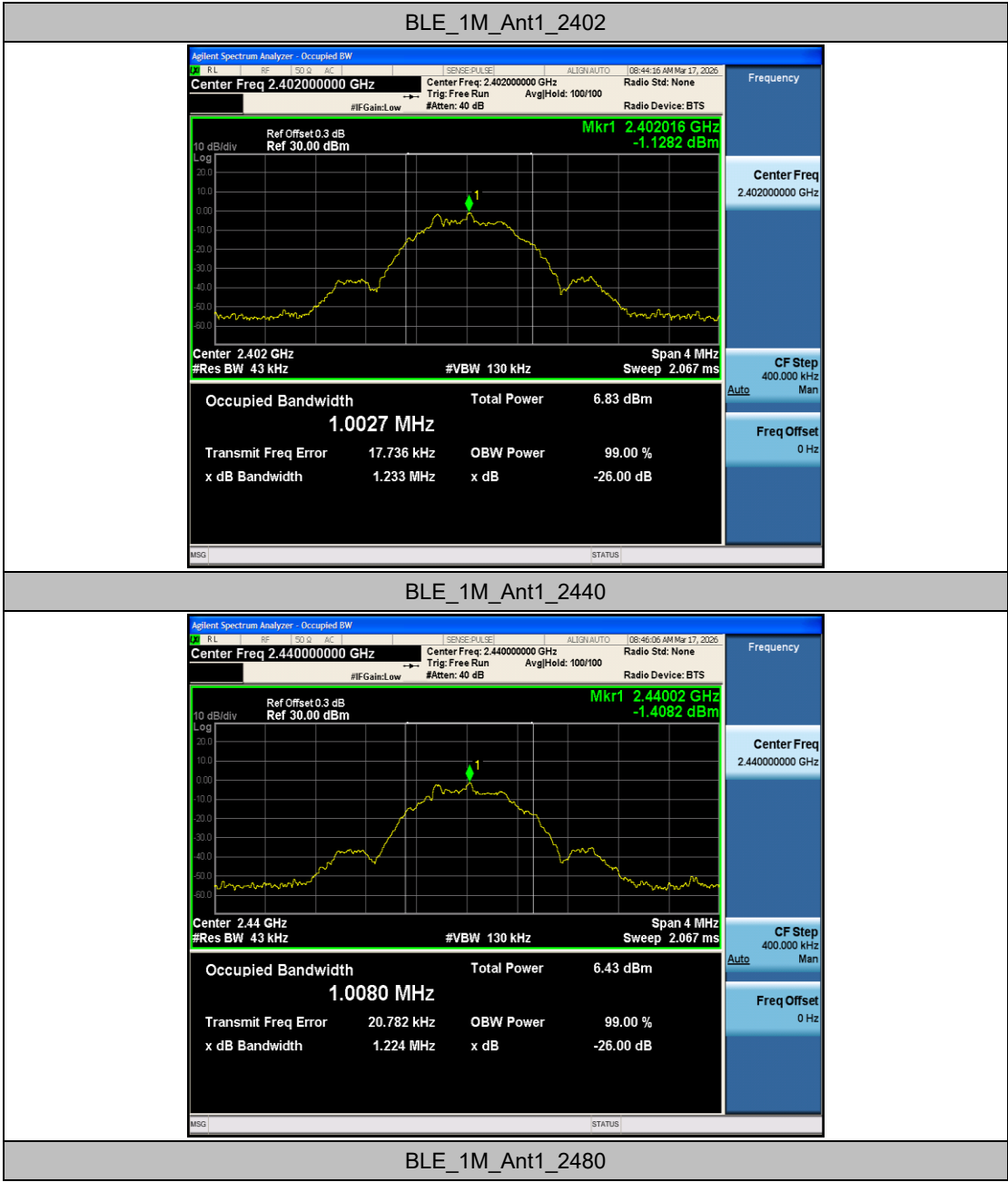


## Appendix B: Occupied Channel Bandwidth

### Test Result

| TestMode | Antenna | Freq(MHz) | OCB [MHz] | FL[MHz]   | FH[MHz]   | Limit[MHz] | Verdict |
|----------|---------|-----------|-----------|-----------|-----------|------------|---------|
| BLE_1M   | Ant1    | 2402      | 1.0027    | 2401.5164 | 2402.5191 | ---        | ---     |
|          |         | 2440      | 1.0080    | 2439.5168 | 2440.5248 | ---        | ---     |
|          |         | 2480      | 0.99894   | 2479.5201 | 2480.5191 | ---        | ---     |
| BLE_2M   | Ant1    | 2402      | 2.0073    | 2401.0323 | 2403.0396 | ---        | ---     |
|          |         | 2440      | 2.0156    | 2439.0245 | 2441.0401 | ---        | ---     |
|          |         | 2480      | 2.0098    | 2479.0294 | 2481.0392 | ---        | ---     |

Test Graphs





BLE\_2M\_Ant1\_2402



BLE\_2M\_Ant1\_2440



# BLE\_2M\_Ant1\_2480



## Appendix C: Maximum conducted output power

### Test Result Peak

| TestMode | Antenna | Freq(MHz) | Conducted Peak Power[dBm] | Conducted Limit[dBm] | Verdict |
|----------|---------|-----------|---------------------------|----------------------|---------|
| BLE_1M   | Ant1    | 2402      | -0.01                     | ≤30                  | PASS    |
|          |         | 2440      | -0.37                     | ≤30                  | PASS    |
|          |         | 2480      | -0.45                     | ≤30                  | PASS    |
| BLE_2M   | Ant1    | 2402      | -0.01                     | ≤30                  | PASS    |
|          |         | 2440      | -0.33                     | ≤30                  | PASS    |
|          |         | 2480      | -0.35                     | ≤30                  | PASS    |

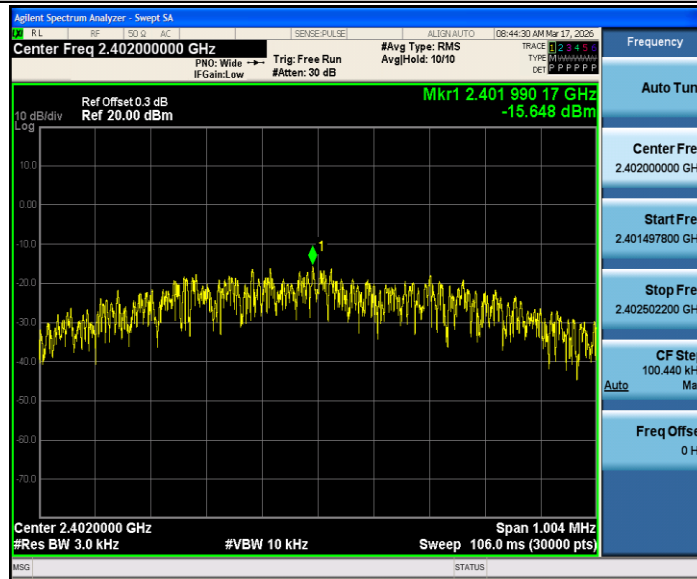
## Appendix D: Maximum power spectral density

### Test Result

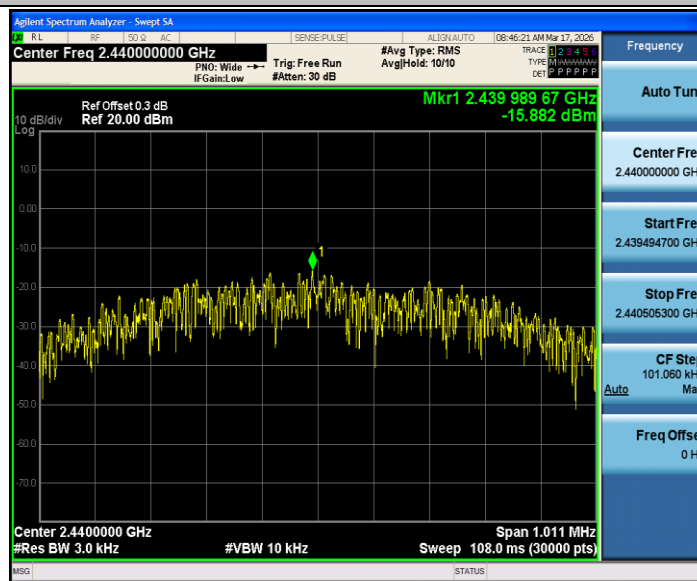
| TestMode | Antenna | Freq(MHz) | Result[dBm/3kHz] | Limit[dBm/3kHz] | Verdict |
|----------|---------|-----------|------------------|-----------------|---------|
| BLE_1M   | Ant1    | 2402      | -15.65           | ≤8.00           | PASS    |
|          |         | 2440      | -15.88           | ≤8.00           | PASS    |
|          |         | 2480      | -16.01           | ≤8.00           | PASS    |
| BLE_2M   | Ant1    | 2402      | -17.51           | ≤8.00           | PASS    |
|          |         | 2440      | -17.70           | ≤8.00           | PASS    |
|          |         | 2480      | -17.96           | ≤8.00           | PASS    |

## Test Graphs

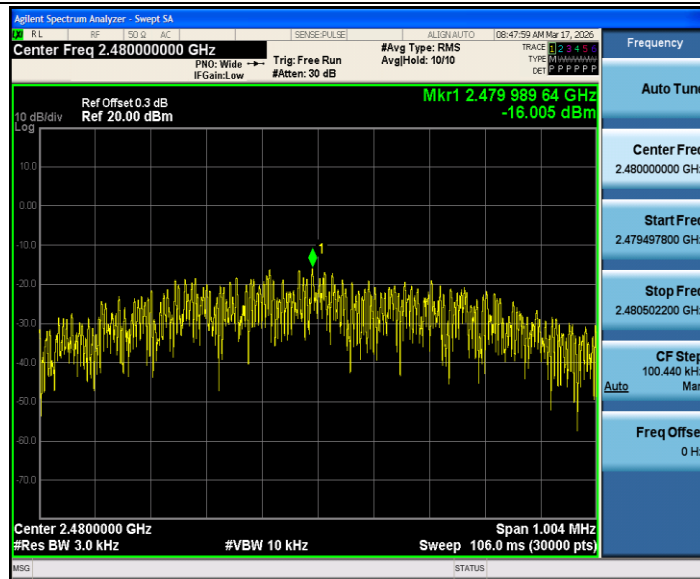
BLE\_1M\_Ant1\_2402



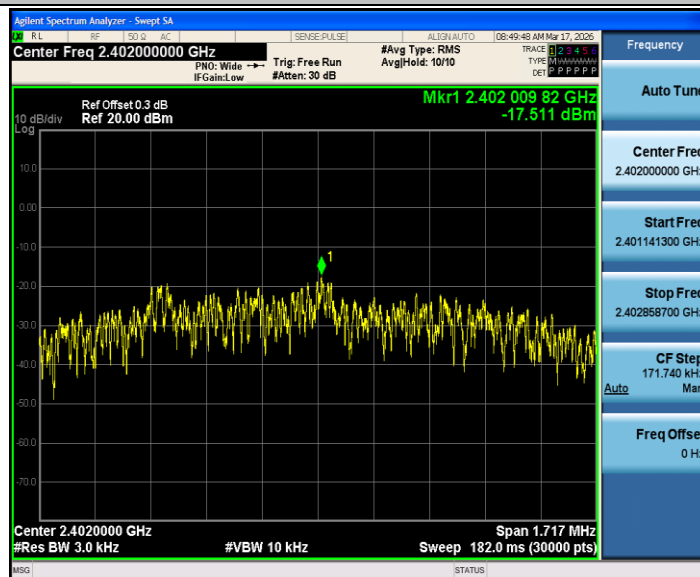
BLE\_1M\_Ant1\_2440



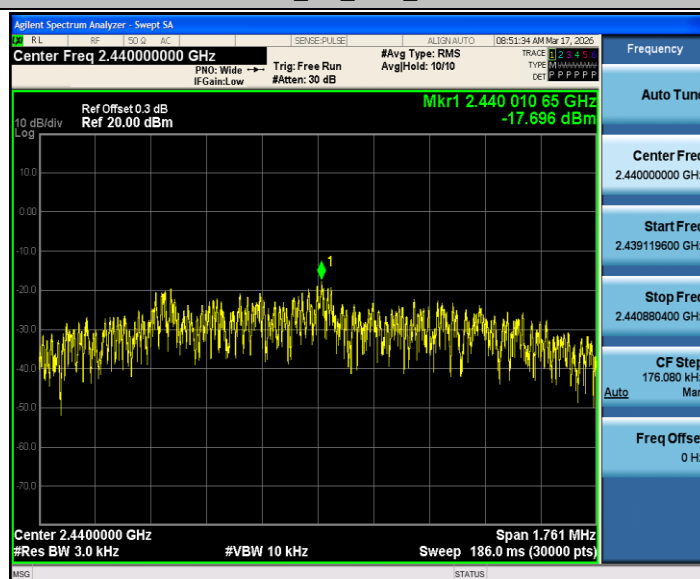
BLE\_1M\_Ant1\_2480



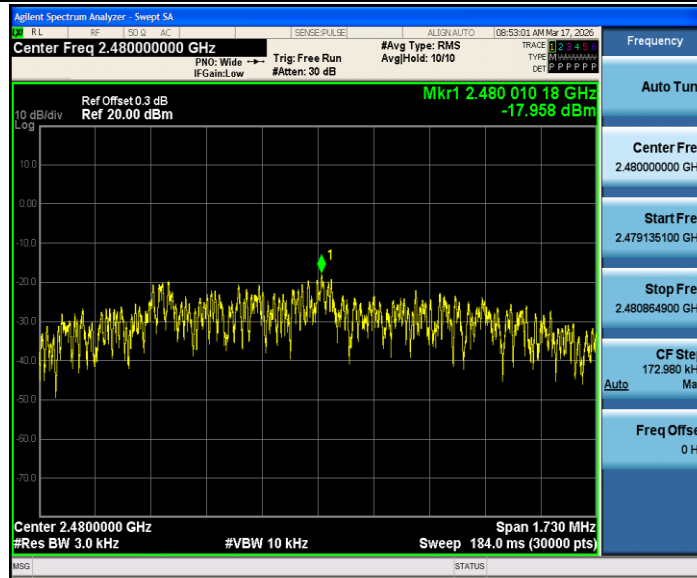
BLE\_2M\_Ant1\_2402



BLE\_2M\_Ant1\_2440



# BLE\_2M\_Ant1\_2480



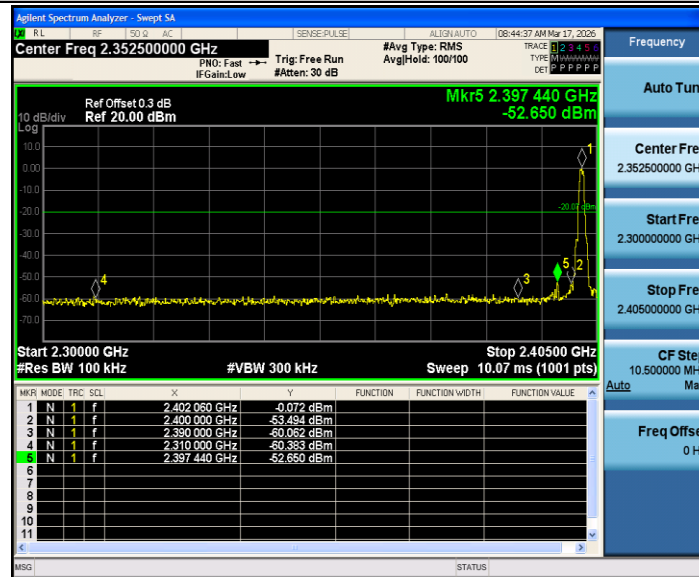
## Appendix E: Band edge measurements

### Test Result

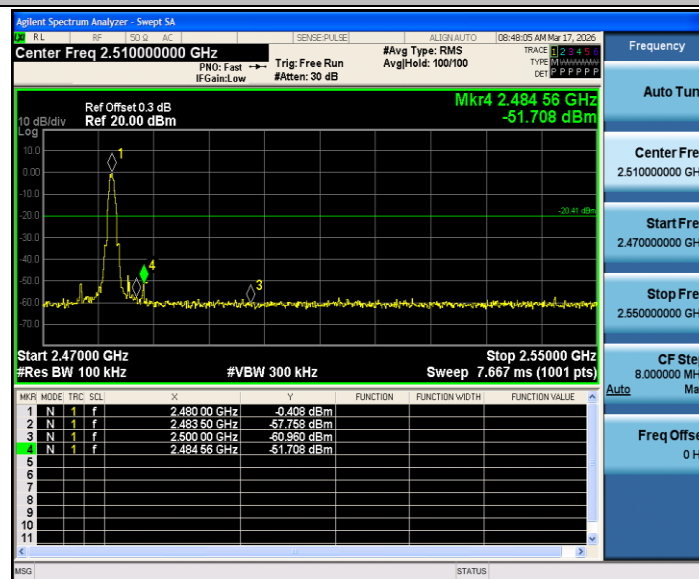
| TestMod<br>e | Antenn<br>a | ChNam<br>e | Freq(MHz<br>) | RefLevel[dBm<br>] | Result[dBm<br>] | Limit[dBm<br>] | Verdic<br>t |
|--------------|-------------|------------|---------------|-------------------|-----------------|----------------|-------------|
| BLE_1M       | Ant1        | Low        | 2402          | -0.07             | -52.65          | ≤-20.07        | PASS        |
|              |             | High       | 2480          | -0.41             | -51.71          | ≤-20.41        | PASS        |
| BLE_2M       | Ant1        | Low        | 2402          | -0.38             | -35.61          | ≤-20.38        | PASS        |
|              |             | High       | 2480          | -0.40             | -51.63          | ≤-20.4         | PASS        |

## Test Graphs

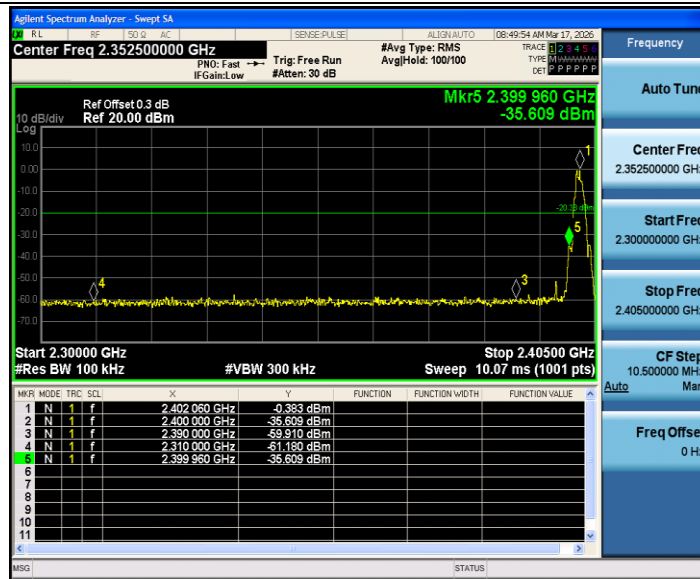
BLE\_1M\_Ant1\_Low\_2402



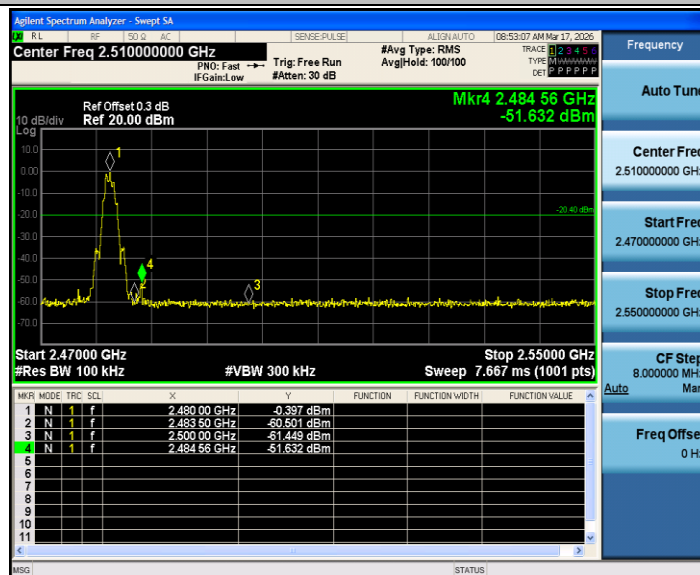
BLE\_1M\_Ant1\_High\_2480



BLE\_2M\_Ant1\_Low\_2402



### BLE\_2M\_Ant1\_High\_2480

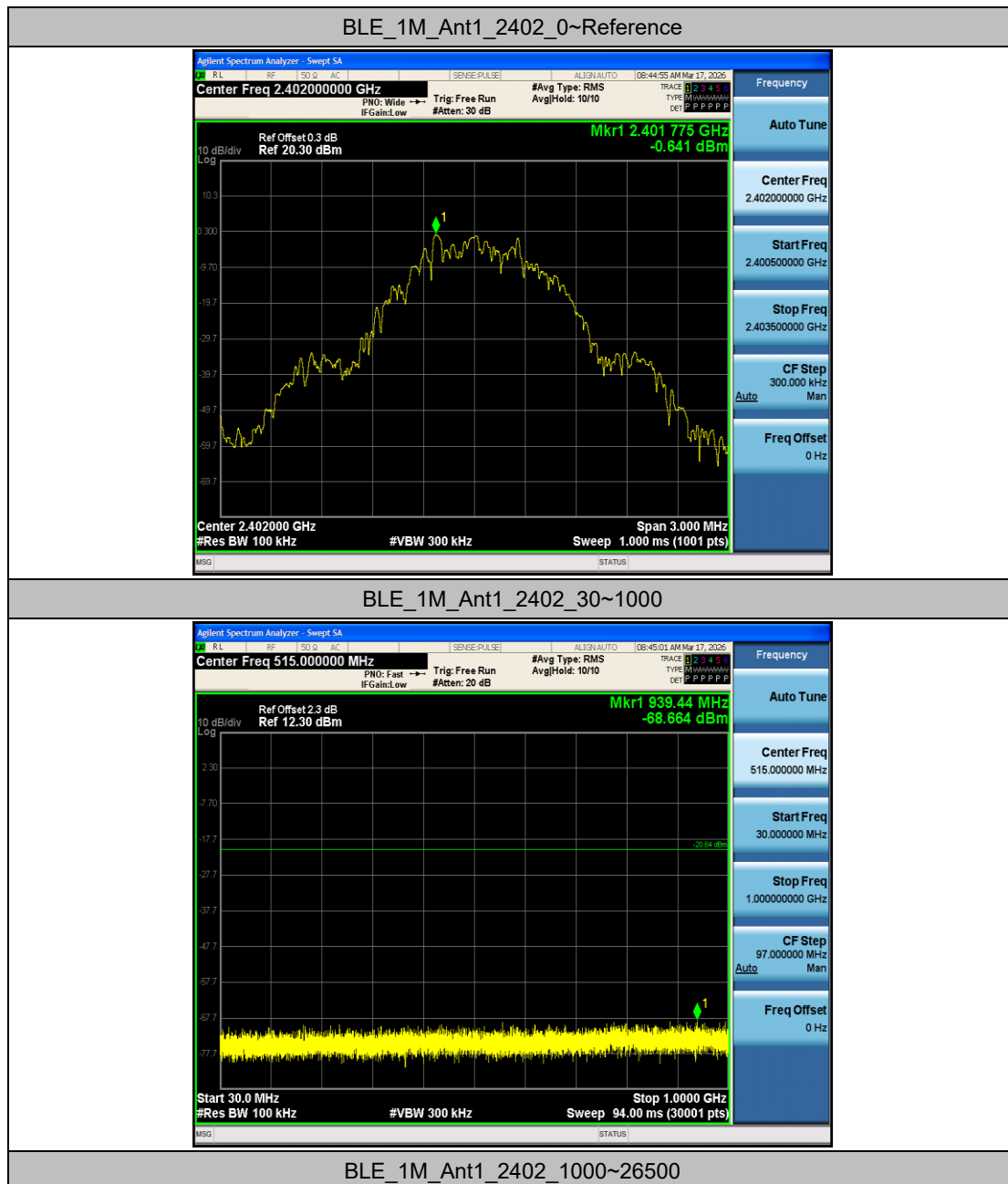


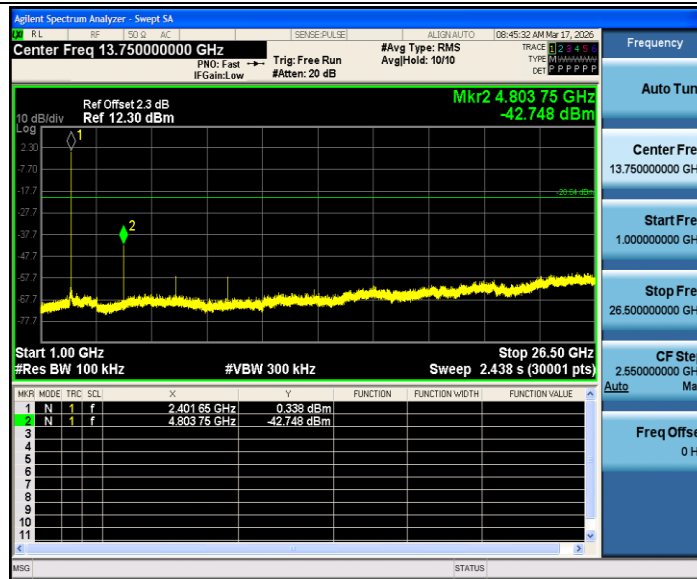
## Appendix F: Conducted Spurious Emission

### Test Result

| TestMode | Antenna | Freq(MHz) | FreqRange<br>[MHz] | RefLevel<br>[dBm] | Result[dBm] | Limit[dBm] | Verdict |
|----------|---------|-----------|--------------------|-------------------|-------------|------------|---------|
| BLE_1M   | Ant1    | 2402      | Reference          | -0.64             | -0.64       | ---        | PASS    |
|          |         |           | 30~1000            | -0.64             | -68.66      | ≤-20.64    | PASS    |
|          |         |           | 1000~26500         | -0.64             | -42.75      | ≤-20.64    | PASS    |
|          |         | 2440      | Reference          | -1.07             | -1.07       | ---        | PASS    |
|          |         |           | 30~1000            | -1.07             | -68.55      | ≤-21.07    | PASS    |
|          |         |           | 1000~26500         | -1.07             | -44.33      | ≤-21.07    | PASS    |
|          |         | 2480      | Reference          | -0.76             | -0.76       | ---        | PASS    |
|          |         |           | 30~1000            | -0.76             | -67.53      | ≤-20.76    | PASS    |
|          |         |           | 1000~26500         | -0.76             | -45.86      | ≤-20.76    | PASS    |
| BLE_2M   | Ant1    | 2402      | Reference          | -0.95             | -0.95       | ---        | PASS    |
|          |         |           | 30~1000            | -0.95             | -67.5       | ≤-20.95    | PASS    |
|          |         |           | 1000~26500         | -0.95             | -43.27      | ≤-20.95    | PASS    |
|          |         | 2440      | Reference          | -1.08             | -1.08       | ---        | PASS    |
|          |         |           | 30~1000            | -1.08             | -67.67      | ≤-21.08    | PASS    |
|          |         |           | 1000~26500         | -1.08             | -45.52      | ≤-21.08    | PASS    |
|          |         | 2480      | Reference          | -1.58             | -1.58       | ---        | PASS    |
|          |         |           | 30~1000            | -1.58             | -68.43      | ≤-21.58    | PASS    |
|          |         |           | 1000~26500         | -1.58             | -46.8       | ≤-21.58    | PASS    |

## Test Graphs

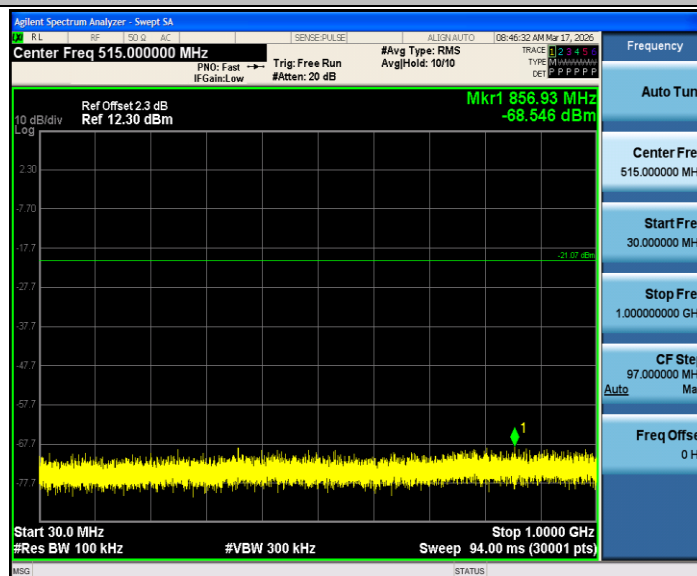




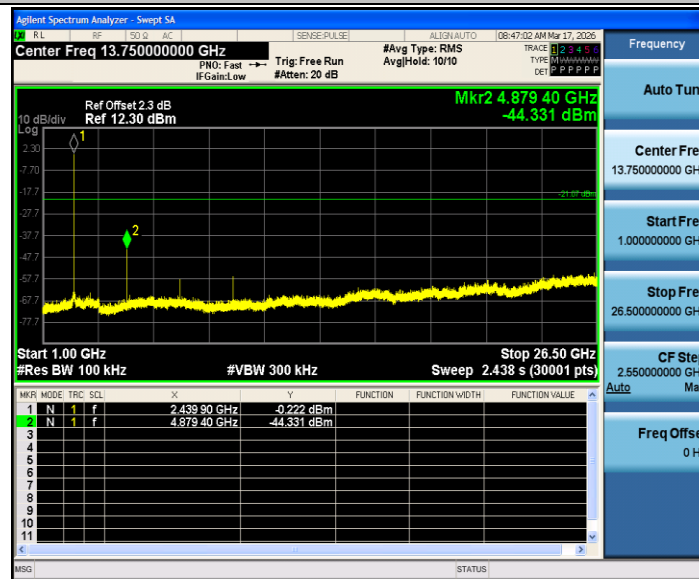
BLE\_1M\_Ant1\_2440\_0~Reference



BLE\_1M\_Ant1\_2440\_30~1000



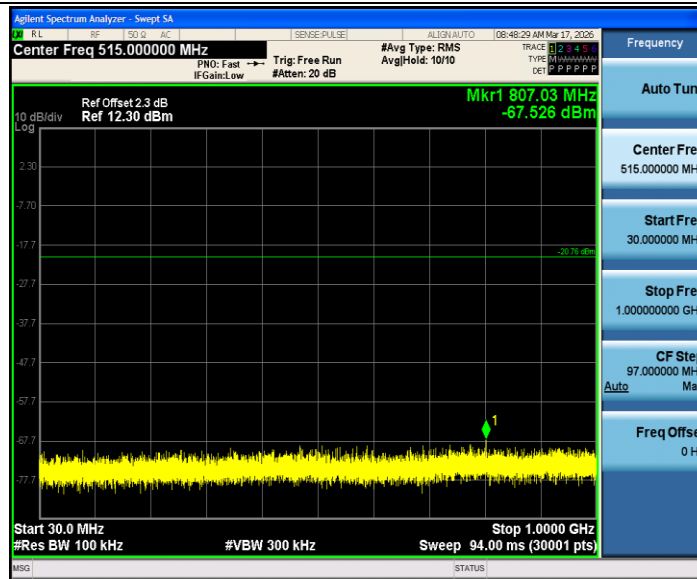
# BLE\_1M\_Ant1\_2440\_1000~26500



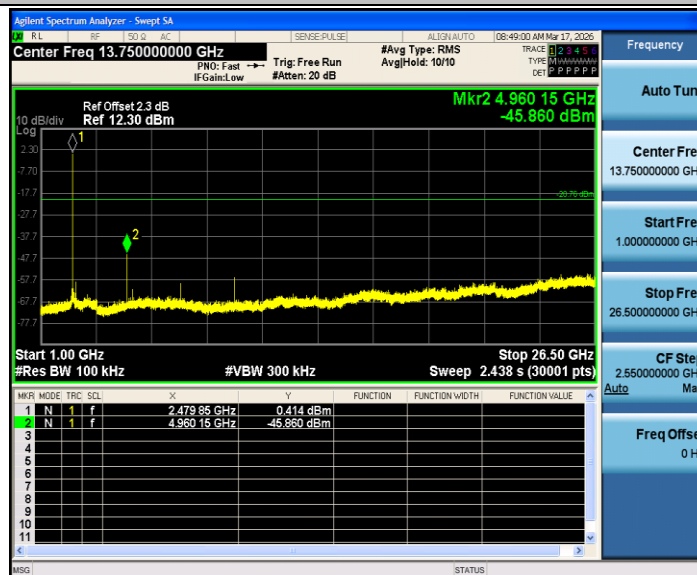
# BLE\_1M\_Ant1\_2480\_0~Reference



# BLE\_1M\_Ant1\_2480\_30~1000



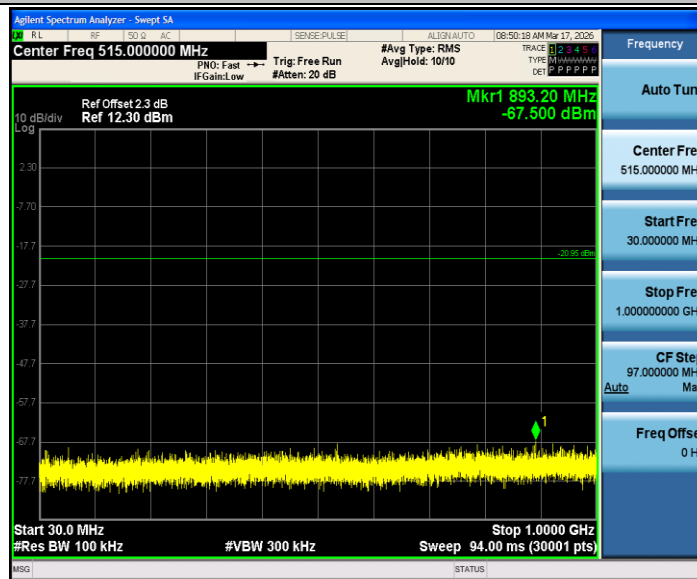
BLE\_1M\_Ant1\_2480\_1000~26500



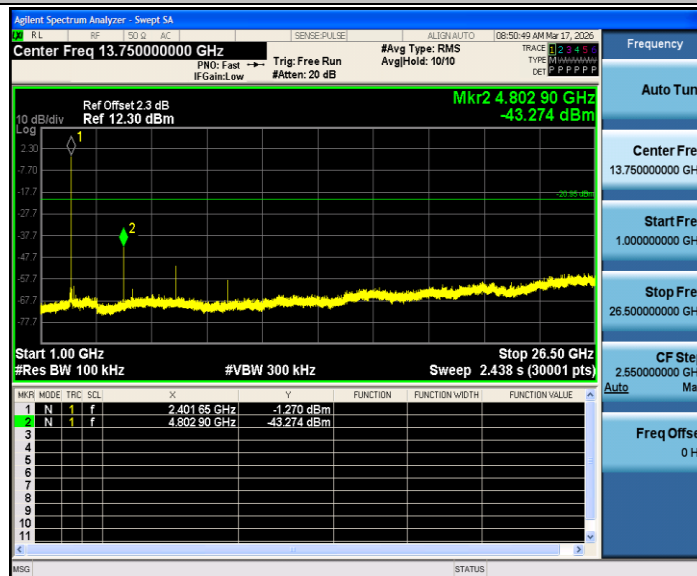
BLE\_2M\_Ant1\_2402\_0~Reference



# BLE\_2M\_Ant1\_2402\_30~1000



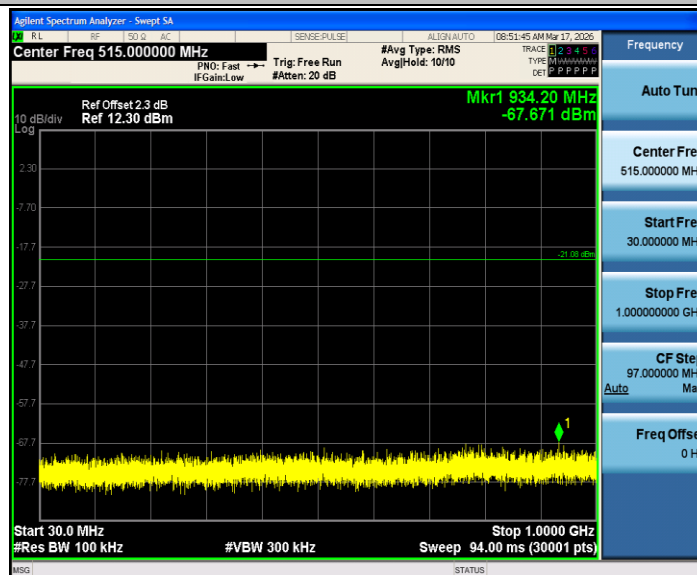
# BLE\_2M\_Ant1\_2402\_1000~26500



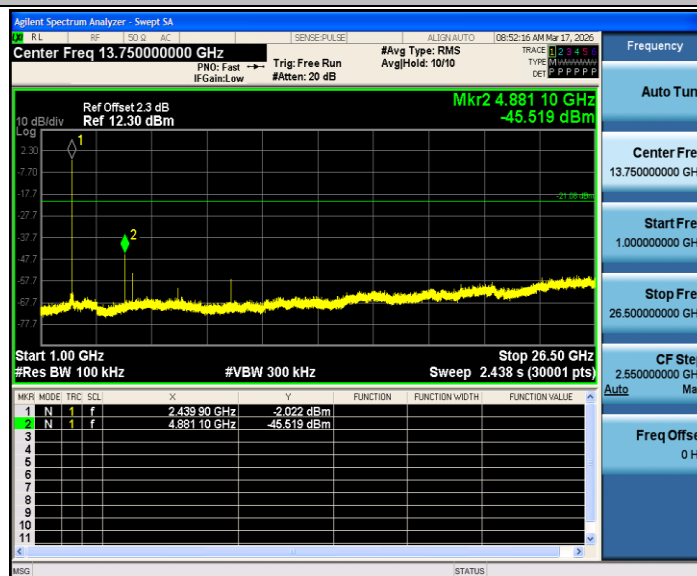
# BLE\_2M\_Ant1\_2440\_0~Reference



BLE\_2M\_Ant1\_2440\_30~1000



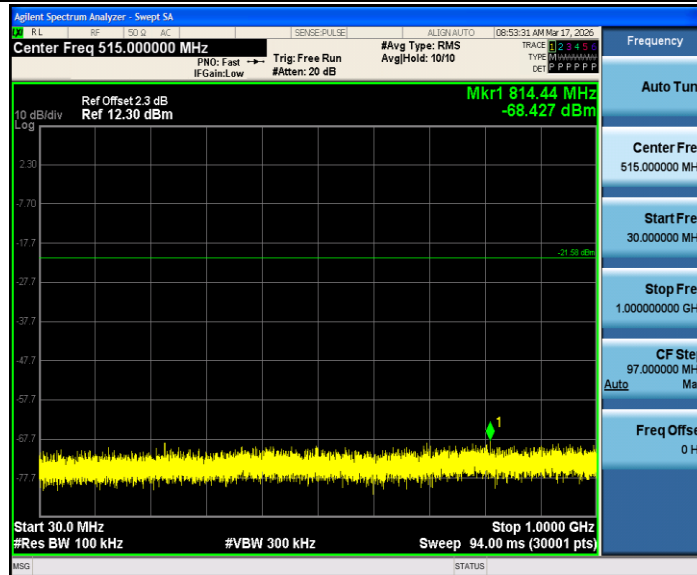
BLE\_2M\_Ant1\_2440\_1000~26500



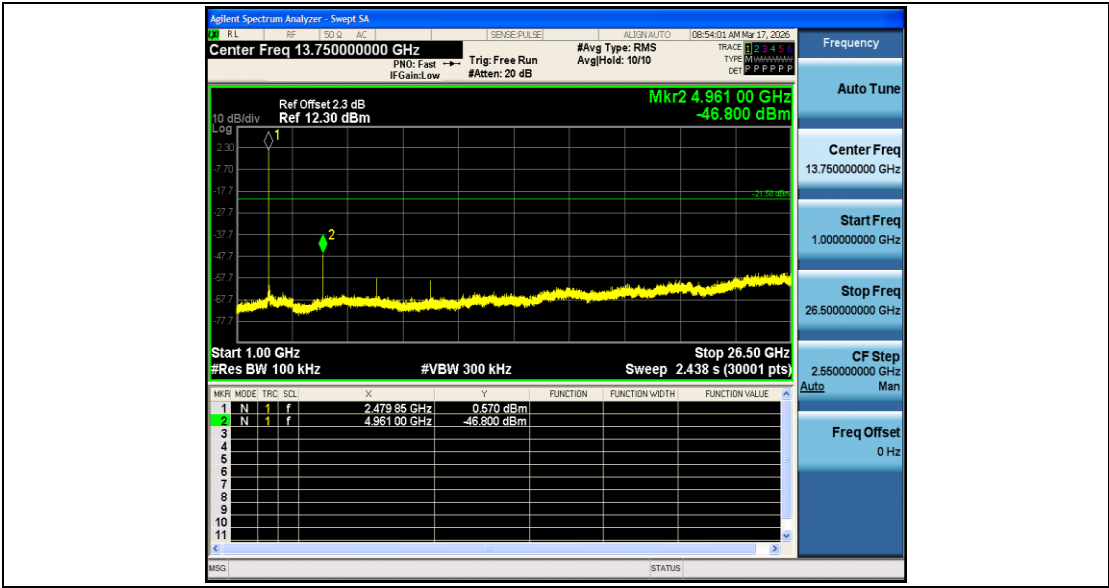
# BLE\_2M\_Ant1\_2480\_0~Reference



# BLE\_2M\_Ant1\_2480\_30~1000



# BLE\_2M\_Ant1\_2480\_1000~26500



## Appendix G: Duty Cycle

### Test Result

| TestMode | Antenna | Freq(MHz) | ON Time<br>[ms] | Period<br>[ms] | X      | DC<br>[%] | xFactor | Limit | Verdict |
|----------|---------|-----------|-----------------|----------------|--------|-----------|---------|-------|---------|
| BLE_1M   | Ant1    | 2402      | 0.41            | 0.62           | 0.6613 | 66.13     | 1.80    | ---   | ---     |
|          |         | 2440      | 0.41            | 0.62           | 0.6613 | 66.13     | 1.80    | ---   | ---     |
|          |         | 2480      | 0.41            | 0.62           | 0.6613 | 66.13     | 1.80    | ---   | ---     |
| BLE_2M   | Ant1    | 2402      | 0.22            | 0.62           | 0.3548 | 35.48     | 4.50    | ---   | ---     |
|          |         | 2440      | 0.23            | 0.63           | 0.3651 | 36.51     | 4.38    | ---   | ---     |
|          |         | 2480      | 0.23            | 0.63           | 0.3651 | 36.51     | 4.38    | ---   | ---     |

Agilent Spectrum Analyzer - Swept SA

Center Freq 2.402000000 GHz

Trig Delay: 2.000 ms #Avg Type: RMS

Ref Offset 0.3 dB Ref 20.30 dBm

ΔMkr3 620.0 μs -10.23 dB

Center 2.402000000 GHz Res BW 8 MHz #VBW 8.0 MHz Sweep 1.000 ms (1001 pts)

| MKR | MODE | TRIG | SCL | X   | Y            | FUNCTION   | FUNCTION WIDTH | FUNCTION VALUE |
|-----|------|------|-----|-----|--------------|------------|----------------|----------------|
| 1   | N    | 1    | t   |     | 120.0 μs     | -11.65 dBm |                |                |
| 2   | Δ1   | 1    | t   | (Δ) | 410.0 μs (Δ) | -22.43 dB  |                |                |
| 3   | Δ1   | 1    | t   | (Δ) | 620.0 μs (Δ) | -10.23 dB  |                |                |

Frequency

Auto Tune

Center Freq 2.402000000 GHz

Start Freq 2.402000000 GHz

Stop Freq 2.402000000 GHz

CF Step 8.0000000 MHz Man

Freq Offset 0 Hz

BLE\_1M\_Ant1\_2402

Agilent Spectrum Analyzer - Swept SA

Center Freq 2.440000000 GHz

Trig Delay: 2.000 ms #Avg Type: RMS

Ref Offset 0.3 dB Ref 20.30 dBm

ΔMkr3 620.0 μs -10.85 dB

Center 2.440000000 GHz Res BW 8 MHz #VBW 8.0 MHz Sweep 1.000 ms (1001 pts)

| MKR | MODE | TRIG | SCL | X   | Y            | FUNCTION   | FUNCTION WIDTH | FUNCTION VALUE |
|-----|------|------|-----|-----|--------------|------------|----------------|----------------|
| 1   | N    | 1    | t   |     | 120.0 μs     | -12.18 dBm |                |                |
| 2   | Δ1   | 1    | t   | (Δ) | 410.0 μs (Δ) | -22.08 dB  |                |                |
| 3   | Δ1   | 1    | t   | (Δ) | 620.0 μs (Δ) | -10.85 dB  |                |                |

Frequency

Auto Tune

Center Freq 2.440000000 GHz

Start Freq 2.440000000 GHz

Stop Freq 2.440000000 GHz

CF Step 8.0000000 MHz Man

Freq Offset 0 Hz

BLE\_1M\_Ant1\_2440

Agilent Spectrum Analyzer - Swept SA

Center Freq 2.480000000 GHz

Trig Delay: 2.000 ms #Avg Type: RMS

Ref Offset 0.3 dB Ref 20.30 dBm

ΔMkr3 620.0 μs -10.85 dB

Center 2.480000000 GHz Res BW 8 MHz #VBW 8.0 MHz Sweep 1.000 ms (1001 pts)

| MKR | MODE | TRIG | SCL | X   | Y            | FUNCTION   | FUNCTION WIDTH | FUNCTION VALUE |
|-----|------|------|-----|-----|--------------|------------|----------------|----------------|
| 1   | N    | 1    | t   |     | 120.0 μs     | -12.18 dBm |                |                |
| 2   | Δ1   | 1    | t   | (Δ) | 410.0 μs (Δ) | -22.08 dB  |                |                |
| 3   | Δ1   | 1    | t   | (Δ) | 620.0 μs (Δ) | -10.85 dB  |                |                |

Frequency

Auto Tune

Center Freq 2.480000000 GHz

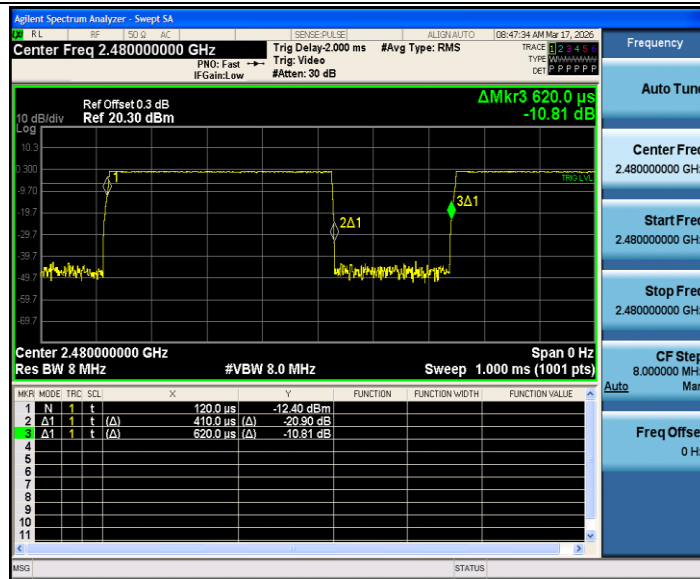
Start Freq 2.480000000 GHz

Stop Freq 2.480000000 GHz

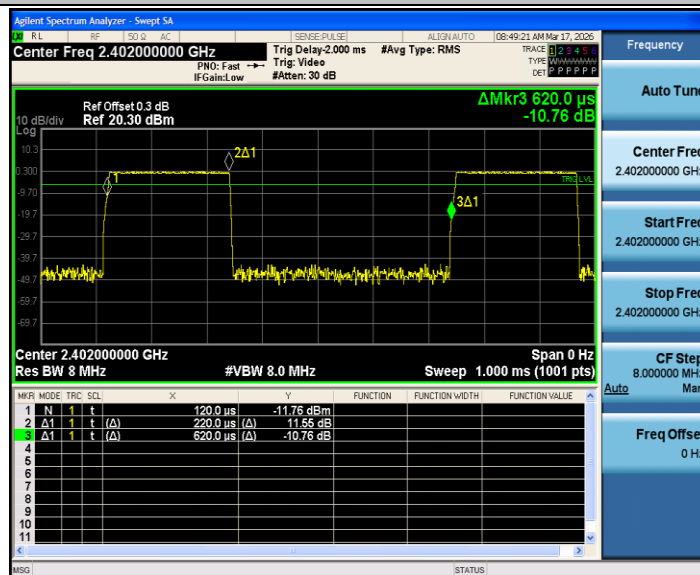
CF Step 8.0000000 MHz Man

Freq Offset 0 Hz

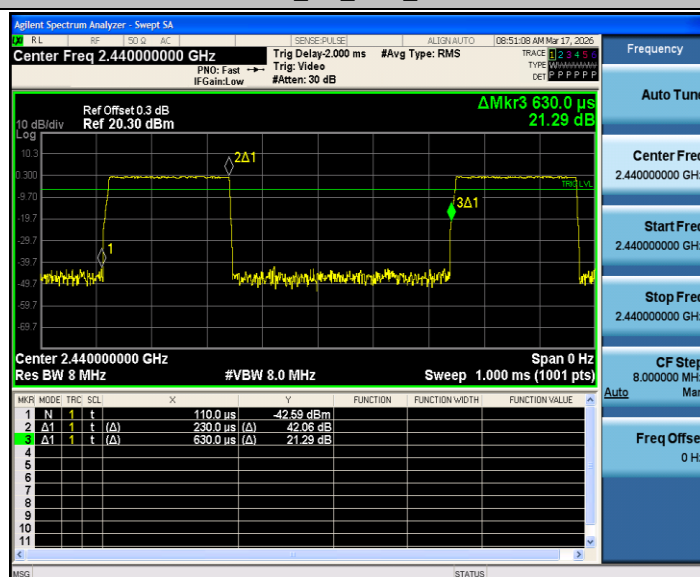
BLE\_1M\_Ant1\_2480



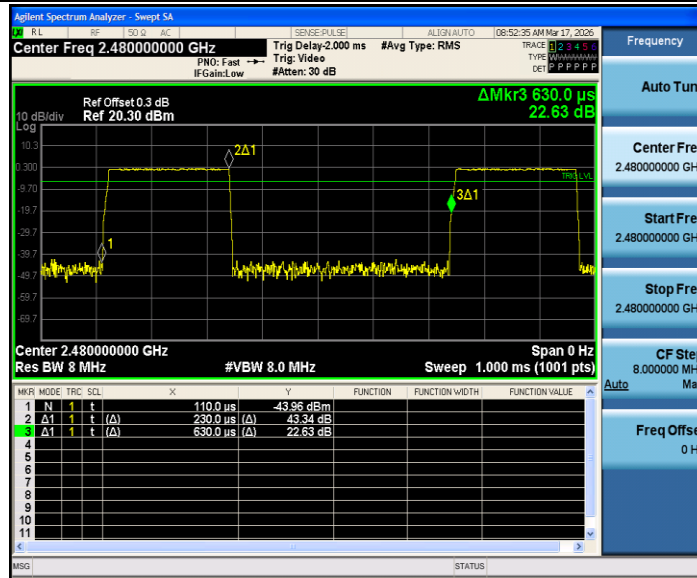
BLE\_2M\_Ant1\_2402



BLE\_2M\_Ant1\_2440



# BLE\_2M\_Ant1\_2480



## Appendix H: Emissions in Restricted Bands

### Test Result

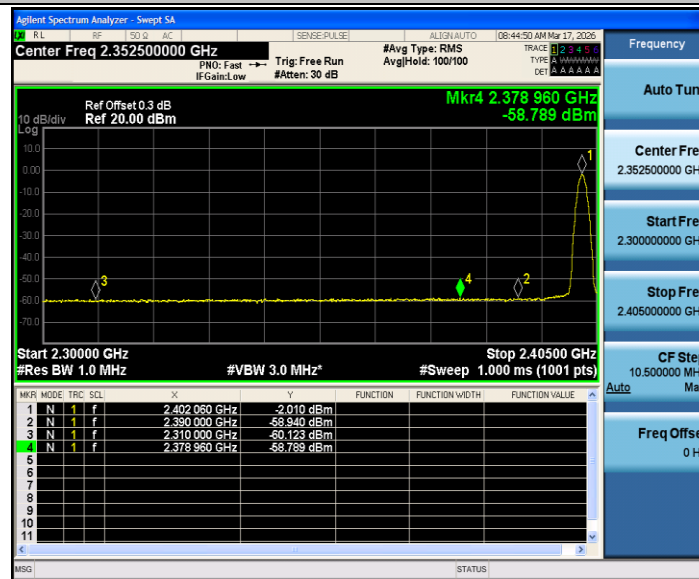
| TestMode | Antenna | ChName | Freq(MHz) | Detector | Freq [MHz] | Result [dBm] | Gain [dB] | DC Factor [dB] | Result [dBuV/m] | Limit [dBuV/m] | Verdict |
|----------|---------|--------|-----------|----------|------------|--------------|-----------|----------------|-----------------|----------------|---------|
| BLE_1M   | Ant1    | Low    | 2402      | AV       | 2310.000   | -60.12       | 2.98      | 1.80           | 39.86           | ≤54            | PASS    |
|          |         |        |           | AV       | 2378.960   | -58.79       | 2.98      | 1.80           | 41.19           | ≤54            | PASS    |
|          |         |        |           | AV       | 2390.000   | -58.94       | 2.98      | 1.80           | 41.04           | ≤54            | PASS    |
|          |         |        |           | Peak     | 2310.000   | -52.93       | 2.98      | 0.00           | 45.25           | ≤74            | PASS    |
|          |         |        |           | Peak     | 2360.270   | -48.96       | 2.98      | 0.00           | 49.22           | ≤74            | PASS    |
|          |         |        |           | Peak     | 2390.000   | -51.37       | 2.98      | 0.00           | 46.81           | ≤74            | PASS    |
|          |         | High   | 2480      | AV       | 2483.500   | -57.28       | 2.98      | 1.80           | 42.7            | ≤54            | PASS    |
|          |         |        |           | AV       | 2483.520   | -57.28       | 2.98      | 1.80           | 42.7            | ≤54            | PASS    |
|          |         |        |           | AV       | 2500.000   | -59.24       | 2.98      | 1.80           | 40.74           | ≤54            | PASS    |
|          |         |        |           | Peak     | 2483.500   | -48.07       | 2.98      | 0.00           | 50.11           | ≤74            | PASS    |
|          |         |        |           | Peak     | 2484.400   | -43.87       | 2.98      | 0.00           | 54.31           | ≤74            | PASS    |
|          |         |        |           | Peak     | 2500.000   | -51.85       | 2.98      | 0.00           | 46.33           | ≤74            | PASS    |
| BLE_2M   | Ant1    | Low    | 2402      | AV       | 2310.000   | -60.42       | 2.98      | 4.50           | 42.26           | ≤54            | PASS    |
|          |         |        |           | AV       | 2374.970   | -58.83       | 2.98      | 4.50           | 43.85           | ≤54            | PASS    |
|          |         |        |           | AV       | 2390.000   | -60.17       | 2.98      | 4.50           | 42.51           | ≤54            | PASS    |
|          |         |        |           | Peak     | 2310.000   | -52.02       | 2.98      | 0.00           | 46.16           | ≤74            | PASS    |
|          |         |        |           | Peak     | 2374.655   | -46.93       | 2.98      | 0.00           | 51.25           | ≤74            | PASS    |
|          |         |        |           | Peak     | 2390.000   | -50.4        | 2.98      | 0.00           | 47.78           | ≤74            | PASS    |
|          |         | High   | 2480      | AV       | 2483.500   | -58.14       | 2.98      | 4.38           | 44.42           | ≤54            | PASS    |
|          |         |        |           | AV       | 2484.080   | -57.94       | 2.98      | 4.38           | 44.62           | ≤54            | PASS    |
|          |         |        |           | AV       | 2500.000   | -59.37       | 2.98      | 4.38           | 43.19           | ≤54            | PASS    |
|          |         |        |           | Peak     | 2483.500   | -47.06       | 2.98      | 0.00           | 51.12           | ≤74            | PASS    |
|          |         |        |           | Peak     | 2484.880   | -44.98       | 2.98      | 0.00           | 53.2            | ≤74            | PASS    |
|          |         |        |           | Peak     | 2500.000   | -51.11       | 2.98      | 0.00           | 47.07           | ≤74            | PASS    |

Note:

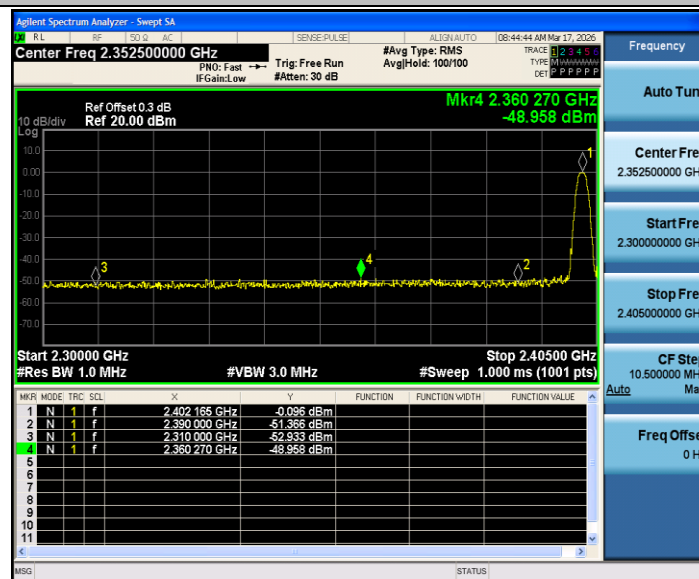
1. The limit in dBm for average detector is conversion from 54dBuV/m, according to 15.209(a). The limit in dBm for peak detector is 20dB above the limit of average detector in dBm.

## Test Graphs

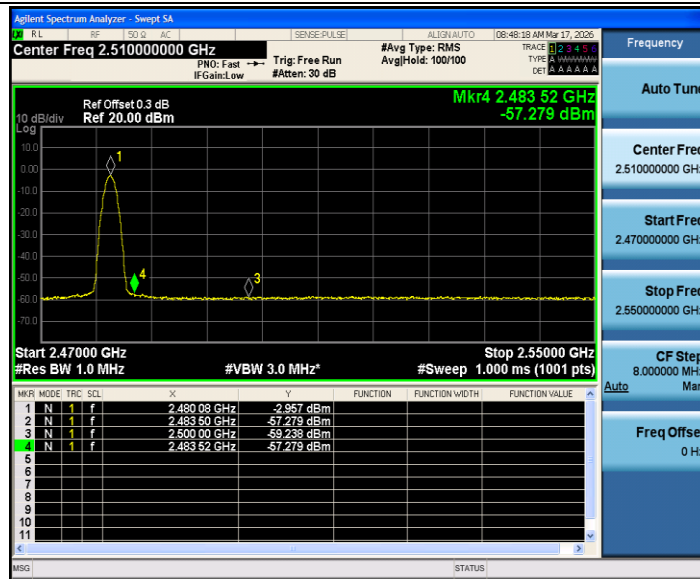
BLE\_1M\_Ant1\_Low\_2402\_AV



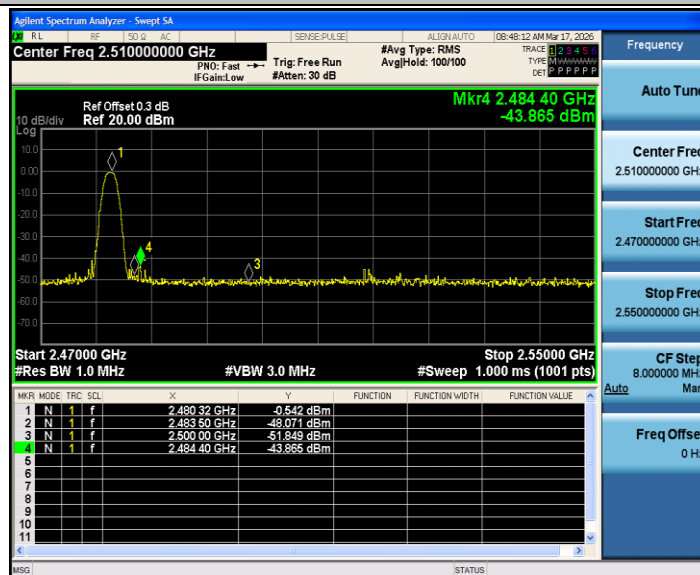
BLE\_1M\_Ant1\_Low\_2402\_Peak



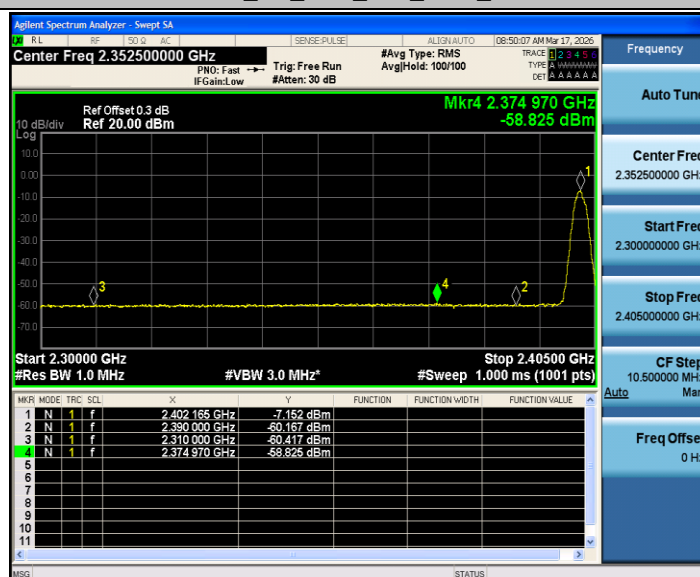
BLE\_1M\_Ant1\_High\_2480\_AV



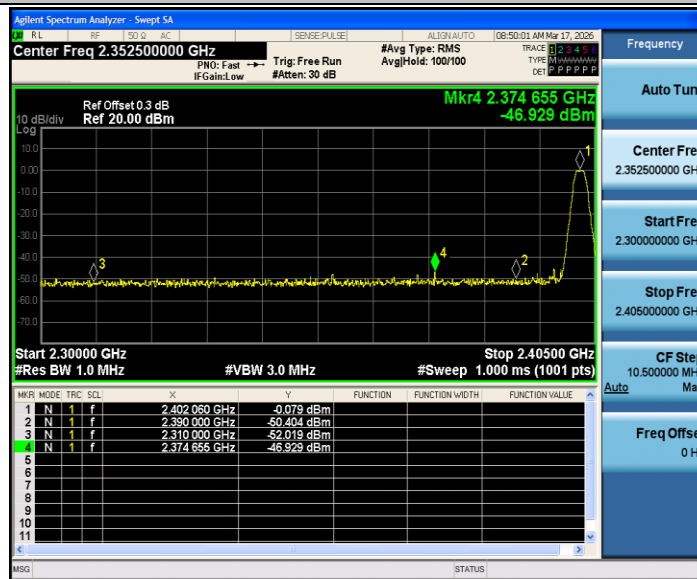
BLE\_1M\_Ant1\_High\_2480\_Peak



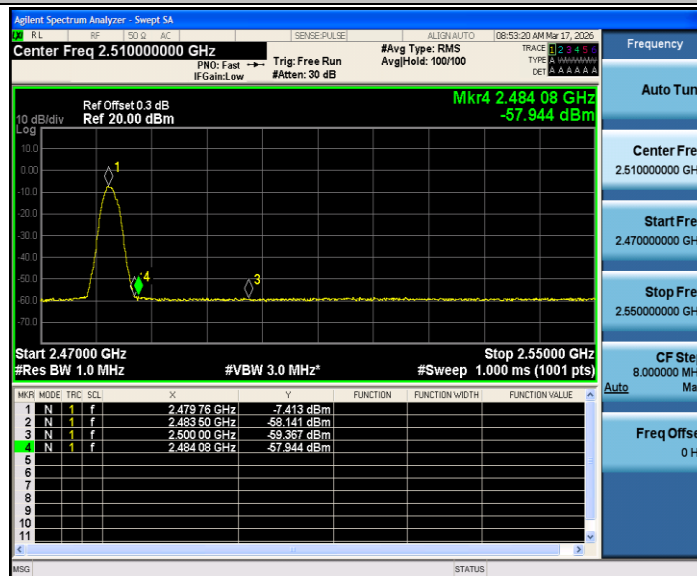
BLE\_2M\_Ant1\_Low\_2402\_AV



# BLE\_2M\_Ant1\_Low\_2402\_Peak



# BLE\_2M\_Ant1\_High\_2480\_AV



# BLE\_2M\_Ant1\_High\_2480\_Peak

