# FCC RADIO TEST REPORT

| | | |
|---|---|---|
| **FCC ID** | : | **U4G-SGVNRNA** |
| **Equipment** | : | **Mobile Computer/Barcode Reader** |
| **Brand Name** | : | **Datalogic** |
| **Model Name** | : | **SGVNRNA** |
| **Applicant** | : | **Datalogic S.r.l.**<br>**Via San Vitalino 13, 40012 Lippo di Calderara di Reno (BO) – Italy** |
| **Manufacturer** | : | **Datalogic S.r.l.**<br>**Via San Vitalino 13, 40012 Lippo di Calderara di Reno (BO) – Italy** |
| **Standard** | : | **FCC Part 15 Subpart C §15.247** |

**The product was received on Apr. 17, 2024 and testing was performed from Apr. 25, 2024 to May 29, 2024. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.**

**The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.**

Louis Wu

**Approved by: Louis Wu**

***Sporton International Inc. Wensan Laboratory***
*No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)*

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# History of this test report

| Report No. | Version | Description | Issue Date |
|---|---|---|---|
| FR440146A | 01 | Initial issue of report | Jul. 03, 2024 |
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# Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---|---|---|---|---|
| 3.1 | 15.247(a)(1) | Number of Channels | Pass | - |
| 3.2 | 15.247(a)(1) | Hopping Channel Separation | Pass | - |
| 3.3 | 15.247(a)(1) | Dwell Time of Each Channel | Pass | - |
| 3.4 | 15.247(a)(1) | 20dB Bandwidth | Pass | - |
| 3.4 | 2.1049 | 99% Occupied Bandwidth | Reporting only | - |
| 3.5 | 15.247(b)(1)<br>15.247(b)(4) | Peak Output Power | Pass | - |
| 3.6 | 15.247(d) | Conducted Band Edges | Pass | - |
| 3.7 | 15.247(d) | Conducted Spurious Emission | Pass | - |
| 3.8 | 15.247(d) | Radiated Band Edges and Radiated Spurious Emission | Pass | 9.51 dB under the limit at 57.54 MHz |
| 3.9 | 15.207 | AC Conducted Emission | Pass | 8.78 dB under the limit at 0.63 MHz |
| 3.10 | 15.203 | Antenna Requirement | Pass | - |

**Conformity Assessment Condition:**

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section “Measurement Uncertainty”.

**Disclaimer:**

1. The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.
2. The purpose of different equipment name is for marketing segmentation.

**Reviewed by: Wei Chen**

**Report Producer: Mila Chen**

# 1 General Description

## 1.1 Product Feature of Equipment Under Test

| Product Feature | |
|---|---|
| **General Specs** | GSM/WCDMA/LTE/5G NR, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax, Wi-Fi 5GHz 802.11a/n/ac/ax, Wi-Fi 6GHz 802.11a/ax, NFC, WPC Rx, and GNSS |
| **Antenna Type** | WWAN:<br>**<Ant. 0>**: Loop Antenna<br>**<Ant. 1>**: Loop Antenna<br>**<Ant. 2+3>**: Coupling monopole Antenna<br>**<Ant. 4>**: PIFA Antenna<br>**<Ant. 5>**: PIFA Antenna<br>**<Ant. 6>**: Loop Antenna<br>**<Ant. 7>**: Monopole Antenna<br>WLAN:<br>**<Ant. 8>**: Coupling monopole Antenna<br>**<Ant. 9>**: Loop Antenna<br>Bluetooth: Coupling monopole Antenna<br>GPS/Glonass/BDS/Galileo: Coupling monopole Antenna<br>NFC: Loop Antenna<br>WPC Rx: Single Coil Antenna |
| **Sample 1** | scan (Argon) |
| **Sample 2** | scan (Xenon) |
| **HW Version** | DVT2 |
| **SW Version** | dl4490_gms-userdebug_1.04.001.20240520_a13_qfil_fastboot |

| Antenna information | | |
|---|---|---|
| **2400 MHz ~ 2483.5 MHz** | Peak Gain (dBi) | -1.1 |

**Remark:** The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.

| EUT Information List | | |
|---|---|---|
| S/N | P/N | Performed Test Item |
| 919f8e49 | 944850003 | RF Conducted Measurement |
| V24D00530<br>V24D00429 | 944850003<br>944850006 | Radiated Spurious Emission |
| V24D00547<br>V24D00390 | 944850003<br>944850006 | AC Conducted Emission |

## 1.2 Modification of EUT

No modifications made to the EUT during the testing.

## 1.3 Testing Location

| | |
|---|---|
| **Test Site** | Sporton International Inc. EMC & Wireless Communications Laboratory |
| **Test Site Location** | No.52, Huaya 1st Rd., Guishan Dist.,<br>Taoyuan City 333, Taiwan (R.O.C.)<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |
| **Test Site No.** | **Sporton Site No.** |
| | CO05-HY (TAF Code: 1190) |
| **Remark** | The Conducted Emission test item subcontracted to Sporton International Inc. EMC & Wireless Communications Laboratory. |

**Note:** The test site complies with ANSI C63.4 2014 requirement.

| | |
|---|---|
| **Test Site** | Sporton International Inc. Wensan Laboratory |
| **Test Site Location** | No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist.,<br>Taoyuan City 333010, Taiwan (R.O.C.)<br>TEL: +886-3-327-0868<br>FAX: +886-3-327-0855 |
| **Test Site No.** | **Sporton Site No.** |
| | TH05-HY, 03CH16-HY |

**Note:** The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW1190 and TW3786

## 1.4 Applicable Standards

According to the specifications declared by the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01
- ANSI C63.10-2013

**Remark:**

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

# 2 Test Configuration of Equipment Under Test

## 2.1 Carrier Frequency Channel

| Frequency Band | Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---|---|---|---|---|---|---|
| 2400-2483.5 MHz | 0 | 2402 | 27 | 2429 | 54 | 2456 |
| | 1 | 2403 | 28 | 2430 | 55 | 2457 |
| | 2 | 2404 | 29 | 2431 | 56 | 2458 |
| | 3 | 2405 | 30 | 2432 | 57 | 2459 |
| | 4 | 2406 | 31 | 2433 | 58 | 2460 |
| | 5 | 2407 | 32 | 2434 | 59 | 2461 |
| | 6 | 2408 | 33 | 2435 | 60 | 2462 |
| | 7 | 2409 | 34 | 2436 | 61 | 2463 |
| | 8 | 2410 | 35 | 2437 | 62 | 2464 |
| | 9 | 2411 | 36 | 2438 | 63 | 2465 |
| | 10 | 2412 | 37 | 2439 | 64 | 2466 |
| | 11 | 2413 | 38 | 2440 | 65 | 2467 |
| | 12 | 2414 | 39 | 2441 | 66 | 2468 |
| | 13 | 2415 | 40 | 2442 | 67 | 2469 |
| | 14 | 2416 | 41 | 2443 | 68 | 2470 |
| | 15 | 2417 | 42 | 2444 | 69 | 2471 |
| | 16 | 2418 | 43 | 2445 | 70 | 2472 |
| | 17 | 2419 | 44 | 2446 | 71 | 2473 |
| | 18 | 2420 | 45 | 2447 | 72 | 2474 |
| | 19 | 2421 | 46 | 2448 | 73 | 2475 |
| | 20 | 2422 | 47 | 2449 | 74 | 2476 |
| | 21 | 2423 | 48 | 2450 | 75 | 2477 |
| | 22 | 2424 | 49 | 2451 | 76 | 2478 |
| | 23 | 2425 | 50 | 2452 | 77 | 2479 |
| | 24 | 2426 | 51 | 2453 | 78 | 2480 |
| | 25 | 2427 | 52 | 2454 | - | - |
| | 26 | 2428 | 53 | 2455 | - | - |

## 2.2 Test Mode

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and only the worst plane, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded in this report.

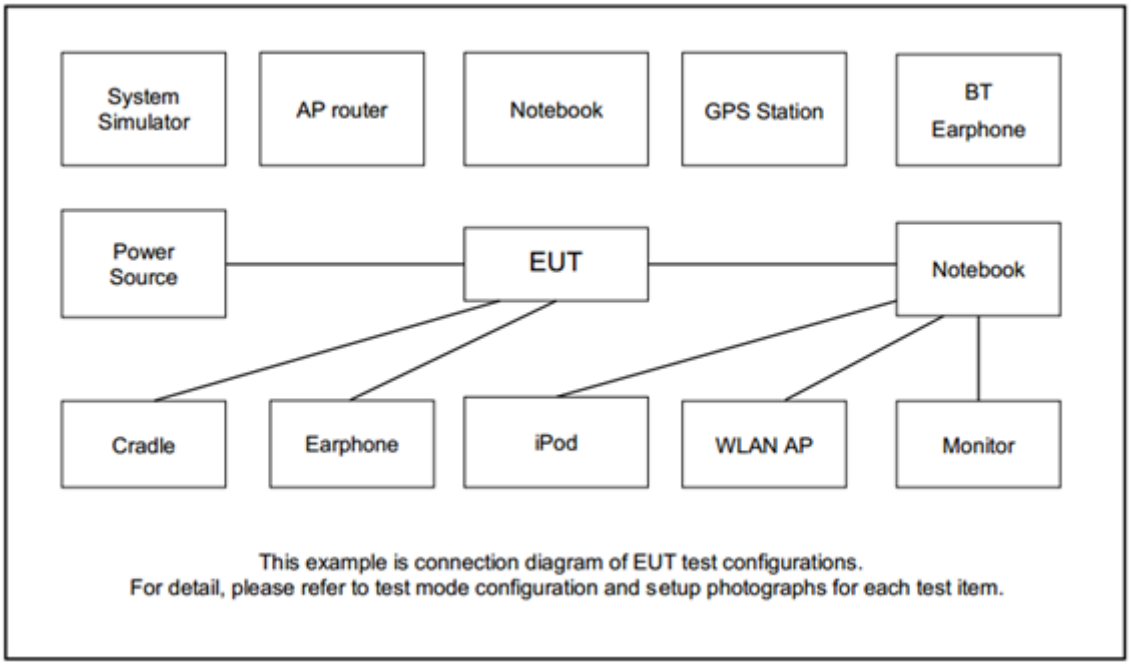
b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

| Summary table of Test Cases | | | |
|---|---|---|---|
| **Test Item** | **Data Rate / Modulation** | | |
| **Conducted Test Cases** | **Bluetooth BR 1Mbps GFSK** | **Bluetooth EDR 2Mbps $\pi$/4-DQPSK** | **Bluetooth EDR 3Mbps 8-DPSK** |
| | Mode 1: CH00_2402 MHz | Mode 4: CH00_2402 MHz | Mode 7: CH00_2402 MHz |
| | Mode 2: CH39_2441 MHz | Mode 5: CH39_2441 MHz | Mode 8: CH39_2441 MHz |
| | Mode 3: CH78_2480 MHz | Mode 6: CH78_2480 MHz | Mode 9: CH78_2480 MHz |
| **Radiated Test Cases** | **Bluetooth BR 1Mbps GFSK** | | |
| | **<Sample 1>**<br>Mode 1: CH00_2402 MHz<br>Mode 2: CH39_2441 MHz<br>Mode 3: CH78_2480 MHz<br>**<Sample 2>**<br>Mode 4: CH78_2480 MHz | | |
| **AC Conducted Emission** | Mode 1 :GSM 900 Link + WLAN (2.4GHz) Link + Bluetooth Link + NFC Link + GPS + Battery (low power) + USB Cable (Charging from AC Adapter) for Sample 1 | | |

**Remark:**
1. For Radiated Test Cases, the worst mode data rate 1Mbps was reported only since the highest RF output power in the preliminary tests. The conducted spurious emissions and conducted band edge measurement for other data rates were not worse than 1Mbps, and no other significantly frequencies found in conducted spurious emission.
2. During the preliminary test, both charging modes (Adapter mode and WPC Rx Charging mode) were verified. It is determined that the adaptor mode is the worst case for official test.

## 2.3 Connection Diagram of Test System




## 2.4 Support Unit used in test configuration and system

| Item | Equipment | Brand Name | Model Name | FCC ID | Data Cable | Power Cord |
|---|---|---|---|---|---|---|
| 1. | System Simulator | Anritsu | MT8820C | N/A | N/A | Unshielded, 1.8m |
| 2. | GPS Station | Pendulum | GSG-54 | N/A | N/A | Unshielded, 1.8m |
| 3. | Bluetooth Earphone | Sony Ericsson | MW600 | PY700A2029 | N/A | N/A |
| 4. | WLAN AP | ASUS | GT-AXE11000 | FCC DoC | N/A | Unshielded, 1.8m |
| 5. | Notebook | DELL | Latitude 3400 | FCC DoC | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 6. | SD Card | ADATA | MicroSD HC | FCC DoC | N/A | N/A |
| 7. | NFC Card | Metro Taipei | Easy Card | N/A | N/A | N/A |

## 2.5 EUT Operation Test Setup

The RF test items, utility “QRCT 4.0.00206.0” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

## 2.6 Measurement Results Explanation Example

**For all conducted test items:**

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

*Offset = RF cable loss + attenuator factor.*

Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

*Offset(dB) = RF cable loss(dB) + attenuator factor(dB).*

= 4.2 + 10 = 14.2 (dB)

# 3 Test Result

## 3.1 Number of Channel Measurement

### 3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

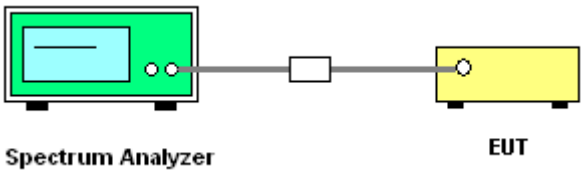
### 3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

### 3.1.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.3.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW = 300 kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

### 3.1.4 Test Setup




### 3.1.5 Test Result of Number of Hopping Frequency

Please refer to Appendix A.

## 3.2 Hopping Channel Separation Measurement

### 3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

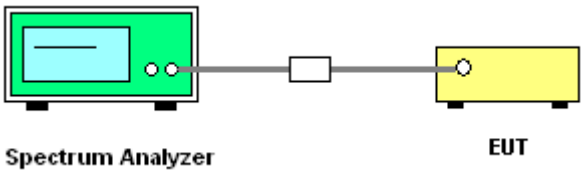
### 3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

### 3.2.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.2.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels;
   RBW = 300 kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

### 3.2.4 Test Setup




### 3.2.5 Test Result of Hopping Channel Separation

Please refer to Appendix A.

## 3.3 Dwell Time Measurement

### 3.3.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

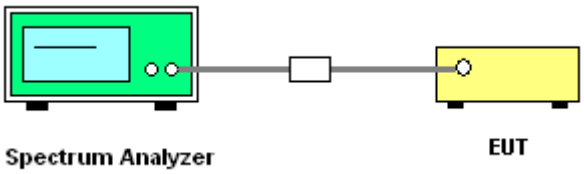
### 3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

### 3.3.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.4.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW ≥ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

### 3.3.4 Test Setup




### 3.3.5 Test Result of Dwell Time

Please refer to Appendix A.

## 3.4 20dB and 99% Bandwidth Measurement

### 3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

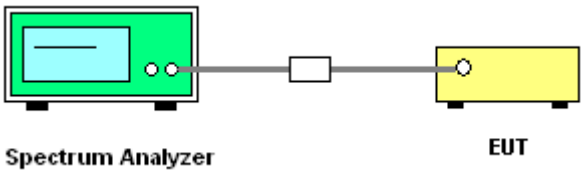
### 3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

### 3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Use the following spectrum analyzer settings for 20 dB Bandwidth measurement.
   Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
   RBW ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
5. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
   Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel;
   RBW ≥ 1-5% of the 99% bandwidth; VBW ≥ 3 * RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
6. Measure and record the results in the test report.

### 3.4.4 Test Setup




### 3.4.5 Test Result of 20dB Bandwidth

Please refer to Appendix A.

### 3.4.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

## 3.5 Output Power Measurement

### 3.5.1 Limit of Output Power

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi.

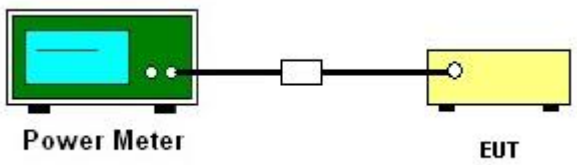
### 3.5.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

### 3.5.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
2. The RF output of EUT is connected to the power meter by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

### 3.5.4 Test Setup




### 3.5.5 Test Result of Peak Output Power

Please refer to Appendix A.

### 3.5.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.

## 3.6 Conducted Band Edges Measurement

### 3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

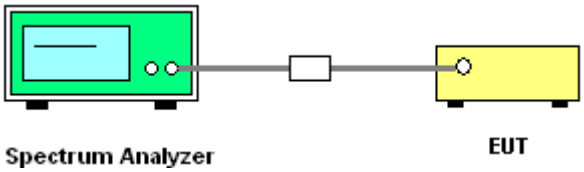
### 3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

### 3.6.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.6.
2. Set the maximum power setting and enable the EUT to transmit continuously.
3. Set RBW = 100 kHz, VBW = 300 kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2 and 3.
5. Measure and record the results in the test report.

### 3.6.4 Test Setup




### 3.6.5 Test Result of Conducted Band Edges

Please refer to Appendix A.

### 3.6.6 Test Result of Conducted Hopping Mode Band Edges

Please refer to Appendix A.

## 3.7 Conducted Spurious Emission Measurement

### 3.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

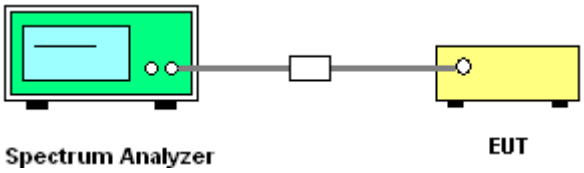
### 3.7.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

### 3.7.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.8.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Set RBW = 100 kHz, VBW = 300 kHz, scan up through 10th harmonic. All harmonics / spurious must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

### 3.7.4 Test Setup




### 3.7.5 Test Result of Conducted Spurious Emission

Please refer to Appendix A.

## 3.8 Radiated Band Edges and Spurious Emission Measurement

### 3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics / spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

### 3.8.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

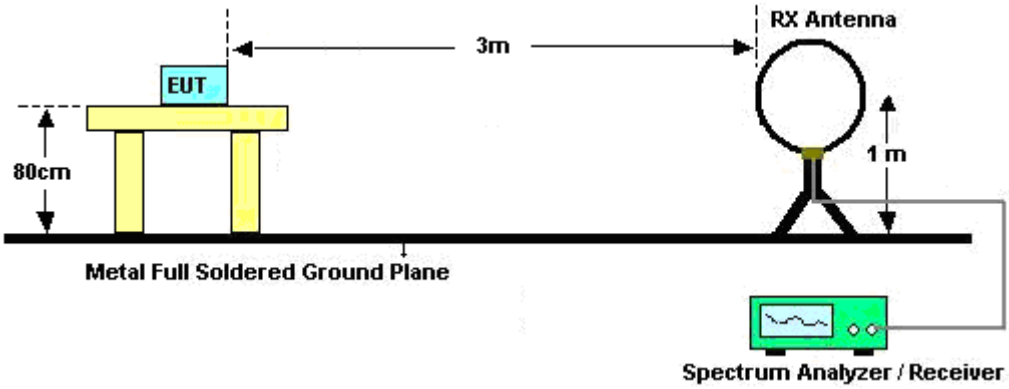
### 3.8.3 Test Procedures

1. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
2. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT is arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set the maximum power setting and enable the EUT to transmit continuously.
5. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW = 100 kHz for f < 1 GHz, RBW = 1 MHz for f>1 GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement: use duty cycle correction factor method per 15.35(c).
   Duty cycle = On time/100 milliseconds
   On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+N_n*L_n$
   Where $N_1$ is number of type 1 pulses, $L_1$ is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log (Duty cycle)
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as "-".
8. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".

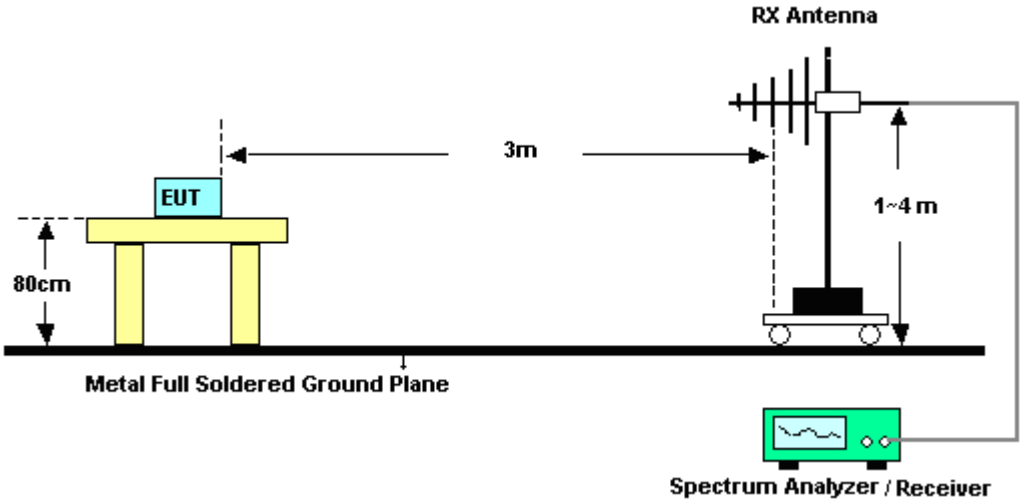
Note: The average levels are calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

### 3.8.4 Test Setup

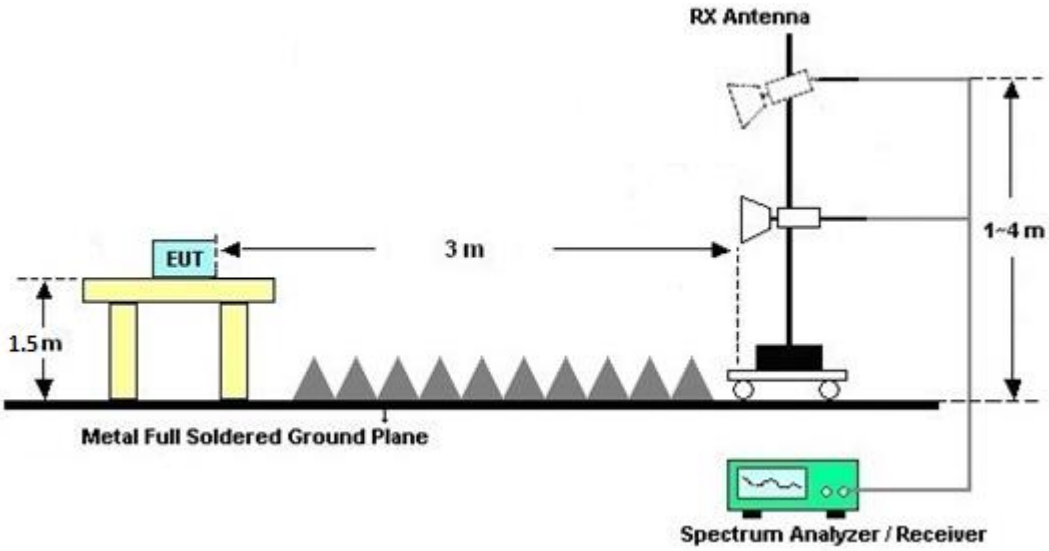
**For radiated test below 30MHz**



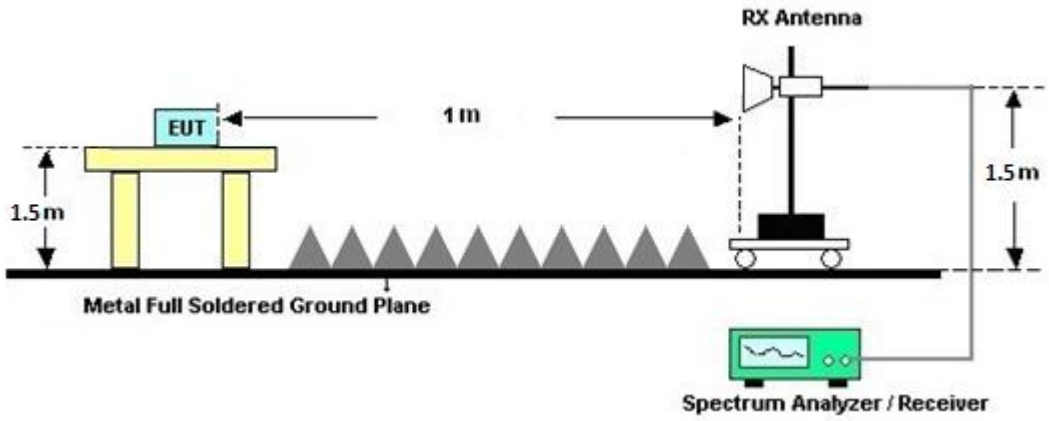

**For radiated test from 30MHz to 1GHz**




**For radiated test from 1GHz to 18GHz**



**For radiated test above 18GHz**




### 3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

### 3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

### 3.8.7 Duty Cycle

Please refer to Appendix E.

### 3.8.8 Test Result of Radiated Spurious Emission (30MHz ~ 10$^{th}$ Harmonic)

Please refer to Appendix C and D.

## 3.9 AC Conducted Emission Measurement

### 3.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

| Frequency of emission (MHz) | Conducted limit (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56* | 56 to 46* |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

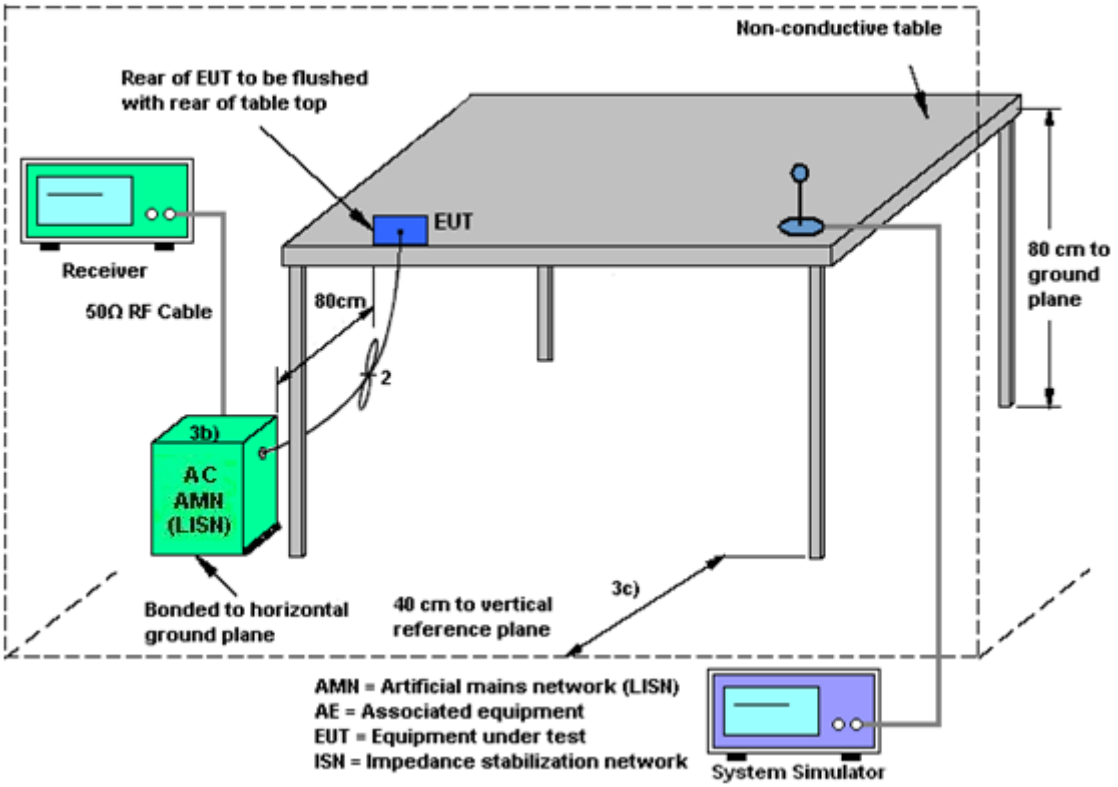
### 3.9.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

### 3.9.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9 kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

### 3.9.4 Test Setup




### 3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

## 3.10 Antenna Requirements

### 3.10.1 Standard Applicable

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 rule.

### 3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

# 4 List of Measuring Equipment

| Instrument | Brand Name | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|---|---|---|---|---|---|---|---|---|
| AC Power Source | ChainTek | APC-1000W | N/A | N/A | N/A | May 15, 2024~ May 28, 2024 | N/A | Conduction (CO05-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESR3 | 102388 | 9kHz~3.6GHz | Dec. 06, 2023 | May 15, 2024~ May 28, 2024 | Dec. 05, 2024 | Conduction (CO05-HY) |
| Hygrometer | Testo | 608-H1 | 34913912 | N/A | Oct. 26, 2023 | May 15, 2024~ May 28, 2024 | Oct. 25, 2024 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100081 | 9kHz~30MHz | Nov. 22, 2023 | May 15, 2024~ May 28, 2024 | Nov. 21, 2024 | Conduction (CO05-HY) |
| Software | Rohde & Schwarz | EMC32 | N/A | N/A | N/A | May 15, 2024~ May 28, 2024 | N/A | Conduction (CO05-HY) |
| Pulse Limiter | SCHWARZBECK | VTSD 9561-F N | 00691 | N/A | Jul. 28, 2023 | May 15, 2024~ May 28, 2024 | Jul. 27, 2024 | Conduction (CO05-HY) |
| LISN Cable | MVE | RG-400 | 260260 | N/A | Dec. 28, 2023 | May 15, 2024~ May 28, 2024 | Dec. 27, 2024 | Conduction (CO05-HY) |
| Hygrometer | TECPEL | DTM-303A | TP201996 | N/A | Nov. 07, 2023 | May 14, 2024~ May 27, 2024 | Nov. 06, 2024 | Conducted (TH05-HY) |
| Power Meter | Anritsu | ML2495A | 1036004 | N/A | Jul. 27, 2023 | May 14, 2024~ May 27, 2024 | Jul. 26, 2024 | Conducted (TH05-HY) |
| Power Sensor | Anritsu | MA2411B | 1027253 | 300MHz~40GHz | Jul. 27, 2023 | May 14, 2024~ May 27, 2024 | Jul. 26, 2024 | Conducted (TH05-HY) |
| Signal Analyzer | Rohde & Schwarz | FSV3044 | 101466 | 10HZ~44GHZ | Jan. 24, 2024 | May 14, 2024~ May 27, 2024 | Jan. 23, 2025 | Conducted (TH05-HY) |
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100488 | 9 kHz~30 MHz | Sep. 12, 2023 | Apr. 25, 2024~ May 29, 2024 | Sep. 11, 2024 | Radiation (03CH16-HY) |
| SHF-EHF Horn Antenna | SCHWARZBECK | BBHA9170 | 1224 | 18GHz-40GHz | Jul. 10, 2023 | Apr. 25, 2024~ May 29, 2024 | Jul. 09, 2024 | Radiation (03CH16-HY) |
| Bilog Antenna | TESEQ | CBL 6111D & 00802N1D01N-06 | 47020 & 06 | 30MHz to 1GHz | Oct. 07, 2023 | Apr. 25, 2024~ May 29, 2024 | Oct. 06, 2024 | Radiation (03CH16-HY) |
| Horn Antenna | SCHWARZBECK | BBHA 9120 D | 9120D-1522 | 1G~18GHz | Mar. 28, 2024 | Apr. 25, 2024~ May 29, 2024 | Mar. 27, 2025 | Radiation (03CH16-HY) |
| Amplifier | SONOMA | 310N | 371607 | 9kHz~1GHz | Jul. 03, 2023 | Apr. 25, 2024~ May 29, 2024 | Jul. 02, 2024 | Radiation (03CH16-HY) |
| Preamplifier | Keysight | 83017A | MY53270264 | 1GHz~26.5GHz | Dec. 07, 2023 | Apr. 25, 2024~ May 29, 2024 | Dec. 06, 2024 | Radiation (03CH16-HY) |
| Preamplifier | EMEC | EM1G18G | 060812 | 1GHz~18GHz | Dec. 25, 2023 | Apr. 25, 2024~ May 29, 2024 | Dec. 24, 2024 | Radiation (03CH16-HY) |
| Preamplifier | EMEC | EM18G40G | 060801 | 18GHz~40GHz | Jun. 27, 2023 | Apr. 25, 2024~ May 29, 2024 | Jun. 26, 2024 | Radiation (03CH16-HY) |
| Filter | Wainwright | WLK4-1000-1530-8000-40SS | SN17 | 1.53GHz Low Pass Filter | Jan. 15, 2024 | Apr. 25, 2024~ May 29, 2024 | Jan. 14, 2025 | Radiation (03CH16-HY) |
| Filter | Wainwright | WHKX12-2700-3000-18000-60ST | SN3 | 3GHz High Pass Filter | Jun. 29, 2023 | Apr. 25, 2024~ May 29, 2024 | Jun. 28, 2024 | Radiation (03CH16-HY) |
| Filter | Wainwright | WHKX8-5872.5-6750-18000-40ST | SN27 | 6.75GHz High Pass Filter | Nov. 13, 2023 | Apr. 25, 2024~ May 29, 2024 | Nov. 12, 2024 | Radiation (03CH16-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 803951/2 | 9K~30M | Mar. 06, 2024 | Apr. 25, 2024~ May 29, 2024 | Mar. 05, 2025 | Radiation (03CH16-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102/SUCOFLEX 104 | EC-A5-300-5757,805935/4,802434/4 | 30MHz~18GHz | Aug. 08, 2023 | Apr. 25, 2024~ May 29, 2024 | Aug. 07, 2024 | Radiation (03CH16-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 804011/2,804012/2 | 18-40GHz | Jan. 02, 2024 | Apr. 25, 2024~ May 29, 2024 | Jan. 01, 2025 | Radiation (03CH16-HY) |
| Software | Audix | E3 6.2009-8-24 | RK-001136 | N/A | N/A | Apr. 25, 2024~ May 29, 2024 | N/A | Radiation (03CH16-HY) |
| Controller | ChainTek | 3000-1 | N/A | Control Turn table & Ant Mast | N/A | Apr. 25, 2024~ May 29, 2024 | N/A | Radiation (03CH16-HY) |
| Antenna Mast | ChainTek | MBS-520-1 | N/A | 1m~4m | N/A | Apr. 25, 2024~ May 29, 2024 | N/A | Radiation (03CH16-HY) |
| Turn Table | ChainTek | T-200-S-1 | N/A | 0~360 Degree | N/A | Apr. 25, 2024~ May 29, 2024 | N/A | Radiation (03CH16-HY) |

# 5 Measurement Uncertainty

**Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)**

| | |
|---|---|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 3.5 dB |

**Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)**

| | |
|---|---|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 6.5 dB |

**Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)**

| | |
|---|---|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 4.5 dB |

**Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)**

| | |
|---|---|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 4.5 dB |

**Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)**

| | |
|---|---|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 5.5 dB |

Report Number : FR440146A

# Appendix A. Test Result of Conducted Test Items

| | | | | |
|---|---|---|---|---|
| Test Engineer: | Ju Chang | Temperature: | 21~25 | °C |
| Test Date: | 2024/05/14-2024/05/27 | Relative Humidity: | 51~54 | % |

## TEST RESULTS DATA
## 20dB and 99% Occupied Bandwidth and Hopping Channel Separation

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 20db BW (MHz) | 99% Bandwidth (MHz) | Hopping Channel Separation Measurement (MHz) | Hopping Channel Separation Measurement Limit (MHz) | Pass/Fail |
|---|---|---|---|---|---|---|---|---|---|
| DH | 1Mbps | 1 | 0 | 2402 | 0.871 | 0.798 | 0.994 | 0.5806 | Pass |
| DH | 1Mbps | 1 | 39 | 2441 | 0.872 | 0.797 | 0.994 | 0.5810 | Pass |
| DH | 1Mbps | 1 | 78 | 2480 | 0.865 | 0.797 | 1.003 | 0.5764 | Pass |
| 2DH | 2Mbps | 1 | 0 | 2402 | 1.258 | 1.168 | 1.007 | 0.8388 | Pass |
| 2DH | 2Mbps | 1 | 39 | 2441 | 1.256 | 1.167 | 0.994 | 0.8376 | Pass |
| 2DH | 2Mbps | 1 | 78 | 2480 | 1.258 | 1.168 | 1.003 | 0.8386 | Pass |
| 3DH | 3Mbps | 1 | 0 | 2402 | 1.242 | 1.151 | 1.003 | 0.8278 | Pass |
| 3DH | 3Mbps | 1 | 39 | 2441 | 1.242 | 1.150 | 0.999 | 0.8280 | Pass |
| 3DH | 3Mbps | 1 | 78 | 2480 | 1.245 | 1.152 | 0.999 | 0.8302 | Pass |

## TEST RESULTS DATA
## Dwell Time

| Mod. | Hopping Channel Number Rate | Hops Over Occupancy Time (hops) | Package Transfer Time (msec) | Dwell Time (sec) | Limits (sec) | Pass/Fail |
|---|---|---|---|---|---|---|
| 3DH5 | 79 | 106.670 | 2.90 | 0.31 | 0.4 | Pass |
| 3DH5 (AFH) | 20 | 53.330 | 2.90 | 0.15 | 0.4 | Pass |

## TEST RESULTS DATA
## Peak Power Table

| DH | CH. | NTX | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|---|---|---|---|---|---|
| DH1 | 0 | 1 | **6.26** | 20.97 | Pass |
| | 39 | 1 | 5.77 | 20.97 | Pass |
| | 78 | 1 | 5.55 | 20.97 | Pass |
| 2DH1 | 0 | 1 | **6.01** | 20.97 | Pass |
| | 39 | 1 | 5.26 | 20.97 | Pass |
| | 78 | 1 | 5.00 | 20.97 | Pass |
| 3DH1 | 0 | 1 | **6.10** | 20.97 | Pass |
| | 39 | 1 | 5.60 | 20.97 | Pass |
| | 78 | 1 | 5.10 | 20.97 | Pass |

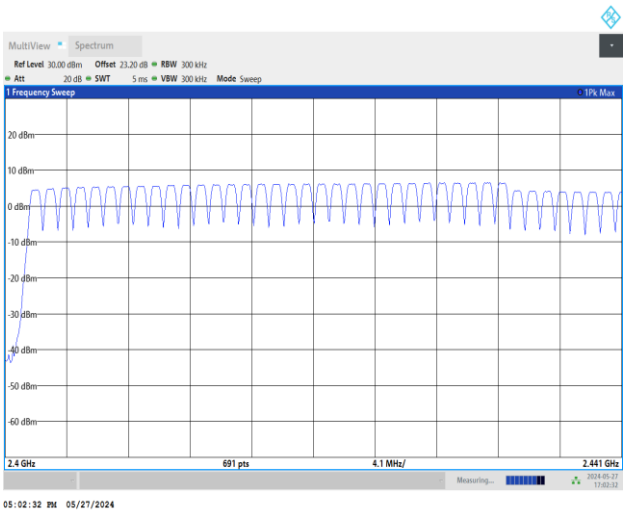
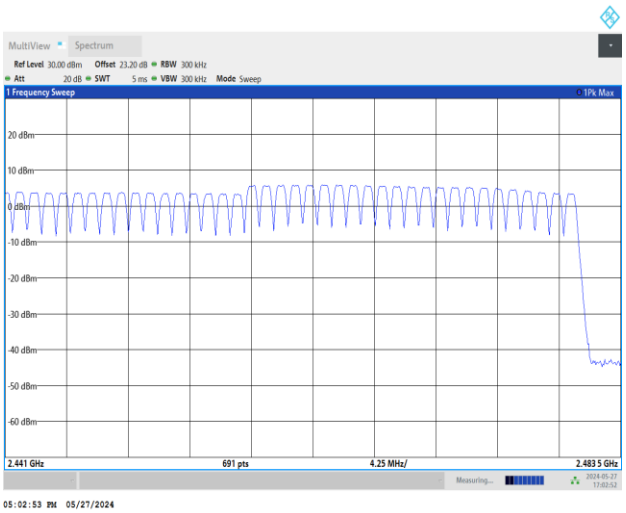
## TEST RESULTS DATA
## Average Power Table
## (Reporting Only)

| DH | CH. | NTX | Average Power (dBm) | Duty Factor (dB) |
|---|---|---|---|---|
| DH1 | 0 | 1 | **5.59** | 5.19 |
| | 39 | 1 | 4.57 | 5.19 |
| | 78 | 1 | 4.41 | 5.19 |
| 2DH1 | 0 | 1 | **4.03** | 5.11 |
| | 39 | 1 | 3.50 | 5.11 |
| | 78 | 1 | 3.27 | 5.11 |
| 3DH1 | 0 | 1 | **4.05** | 5.11 |
| | 39 | 1 | 3.55 | 5.11 |
| | 78 | 1 | 3.32 | 5.11 |

## TEST RESULTS DATA
## Number of Hopping Frequency

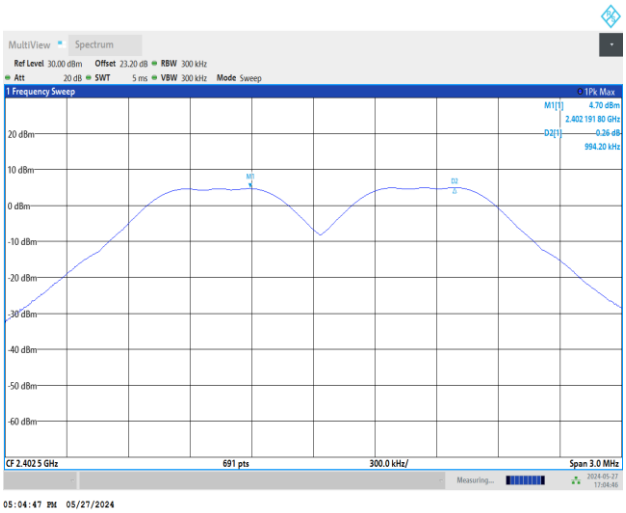
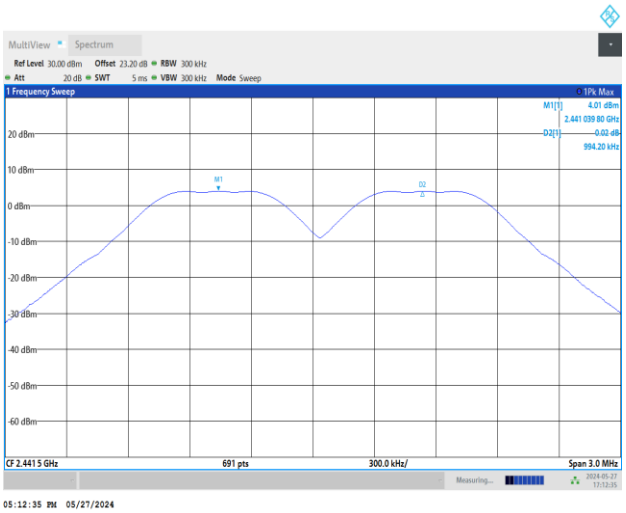
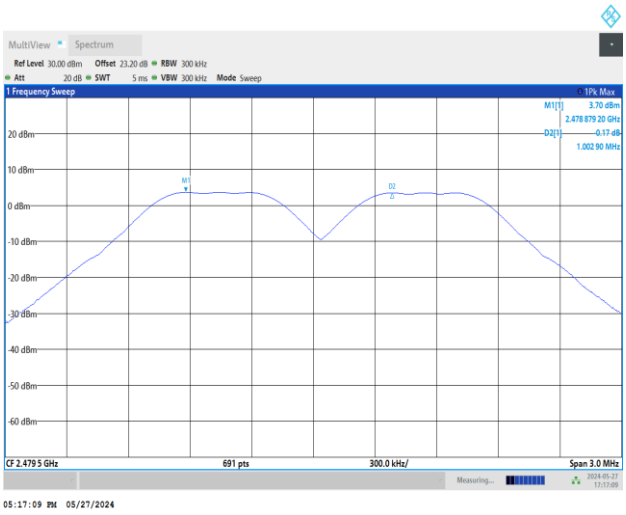
| Number of Hopping (Channel) | Adaptive Frequency Hopping (Channel) | Limits (Channel) | Pass/Fail |
|---|---|---|---|
| 79 | 20 | > 15 | Pass |

## Number of Hopping Frequency

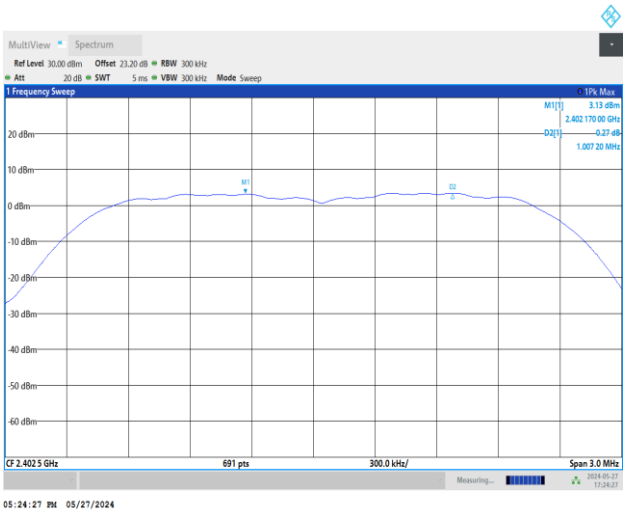
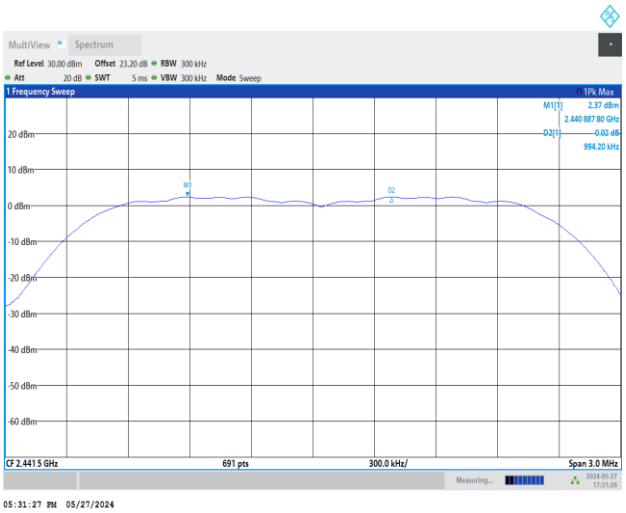
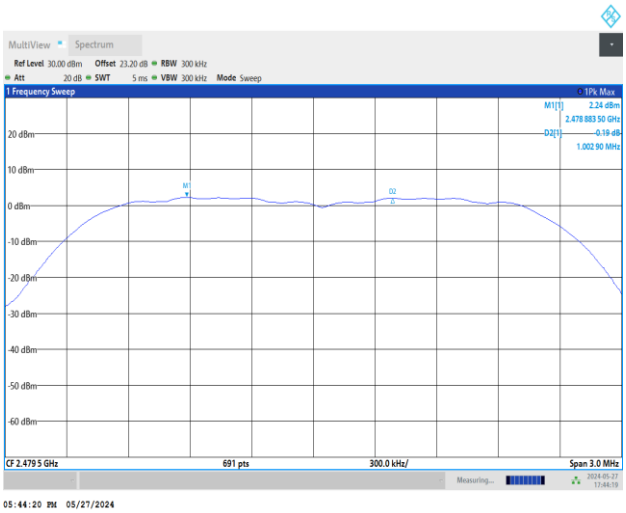
| Number of Hopping Channel Plot | |
|---|---|
| Channel 00 - 39 | Channel 39 - 78 |
|  |  |

## Hopping Channel Separation

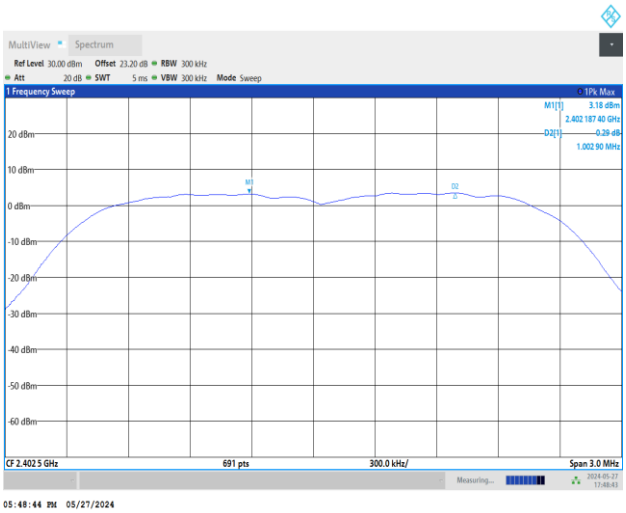
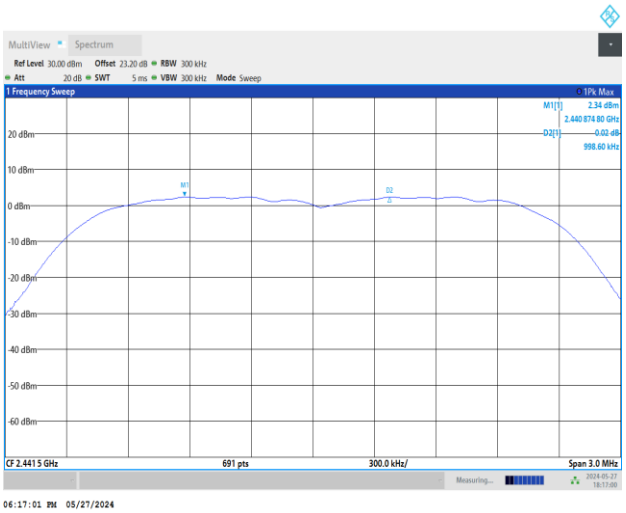
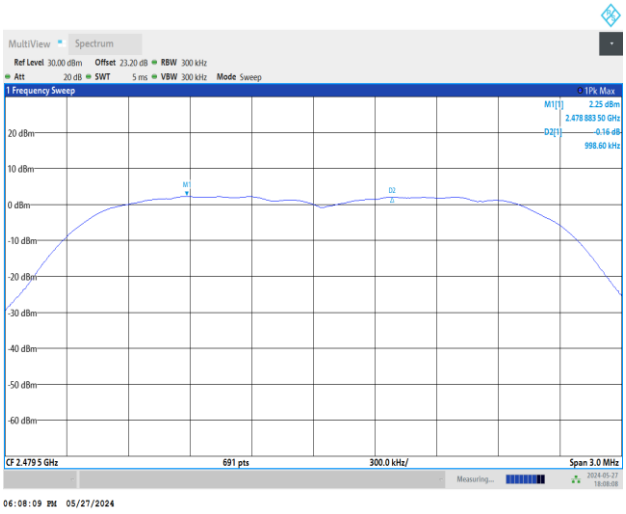
**<1Mbps>**

| Channel Separation Plot on Channel 00 - 01 | Channel Separation Plot on Channel 39 - 40 |
|---|---|
|  |  |
| **Channel Separation Plot on Channel 77 - 78** | |
|  | |

**<2Mbps>**

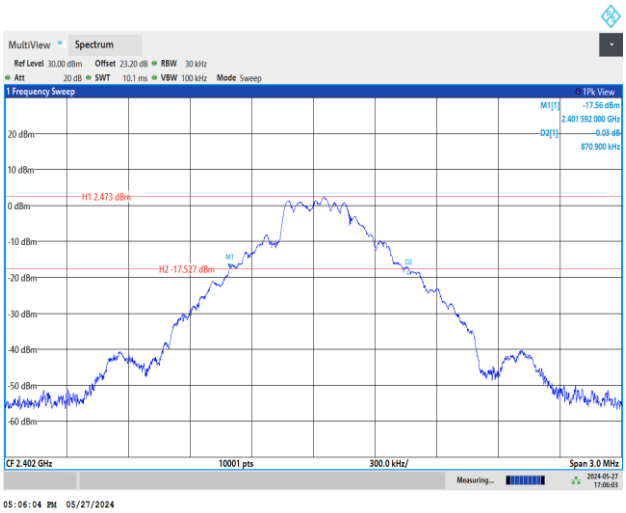
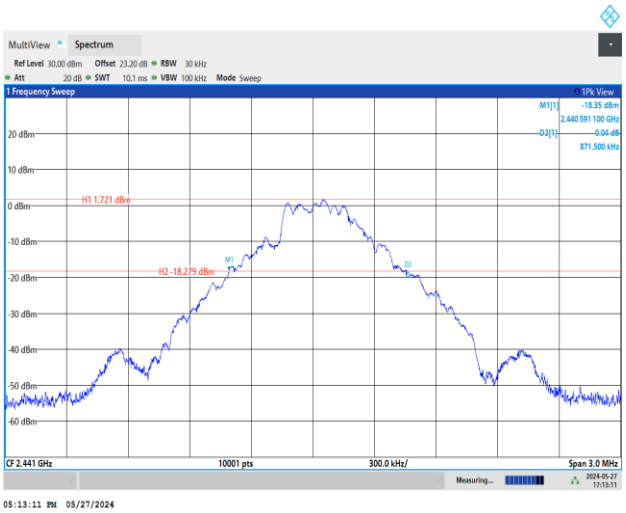
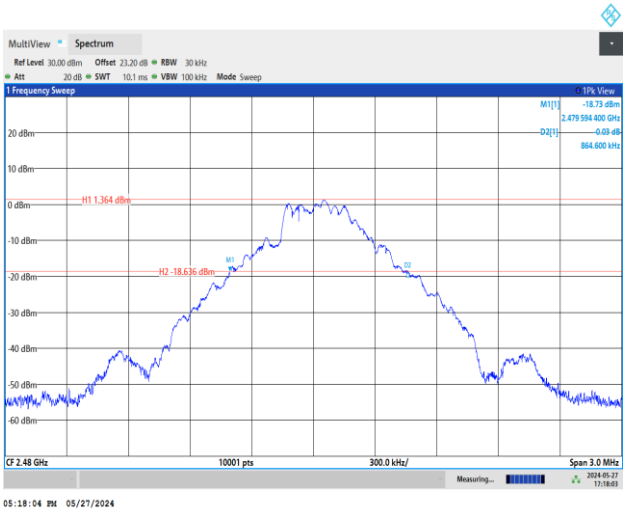
| Channel Separation Plot on Channel 00 - 01 | Channel Separation Plot on Channel 39 - 40 |
|---|---|
|  |  |
| **Channel Separation Plot on Channel 77 - 78** | |
|  | |

**<3Mbps>**

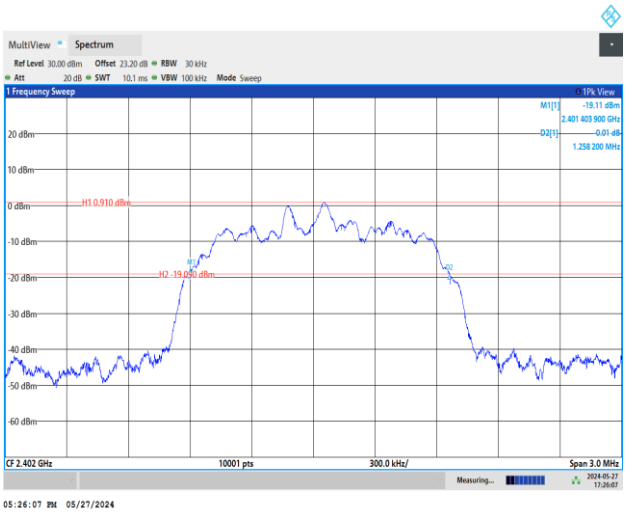
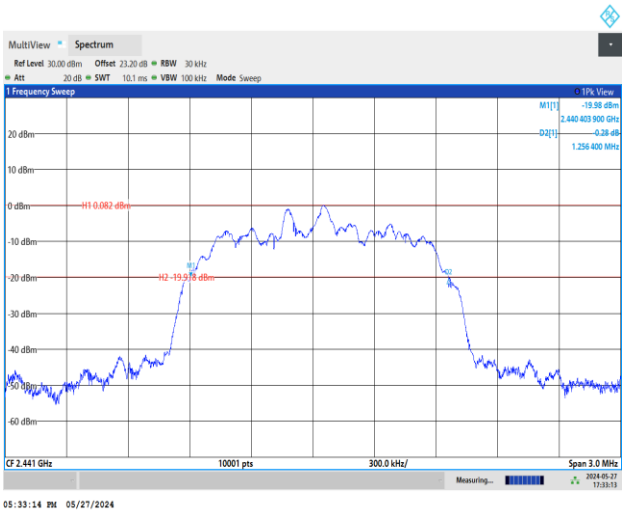
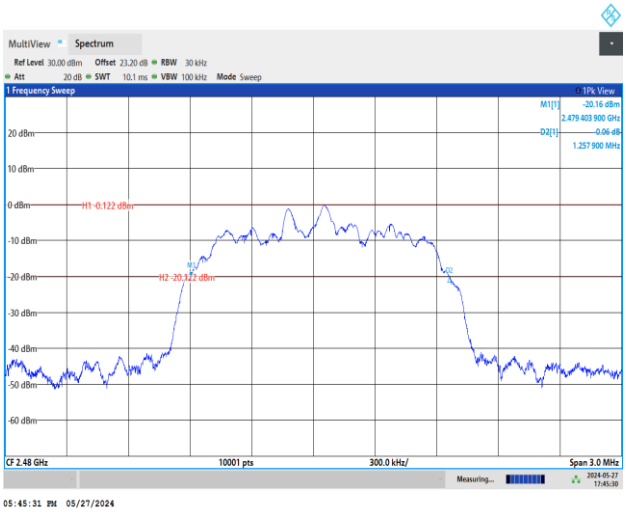
| Channel Separation Plot on Channel 00 - 01 | Channel Separation Plot on Channel 39 - 40 |
|---|---|
|  |  |
| **Channel Separation Plot on Channel 77 - 78** | |
|  | |

## 20dB Bandwidth

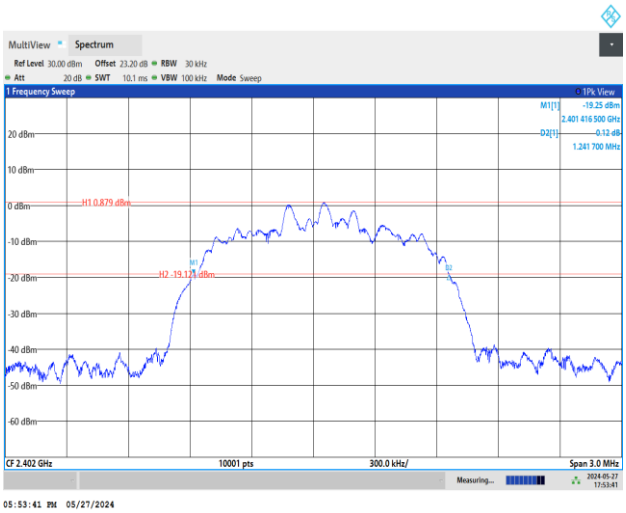
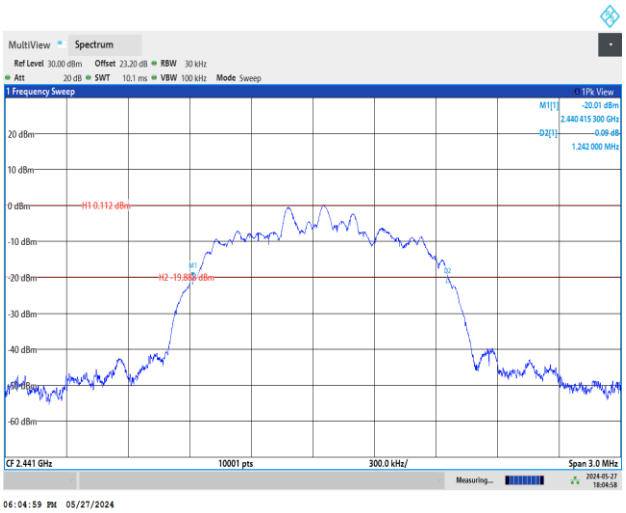
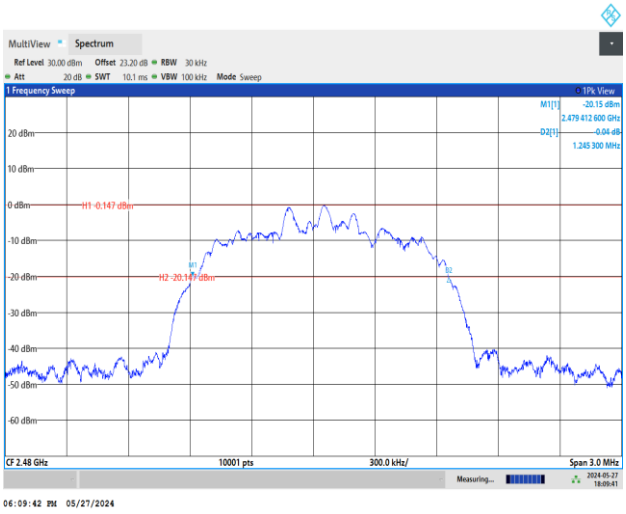
**<1Mbps>**

| 20 dB Bandwidth Plot in Channel 00 | 20 dB Bandwidth Plot in Channel 39 |
|---|---|
|  |  |
| **20 dB Bandwidth Plot in Channel 78** | |
|  | |

**<2Mbps>**

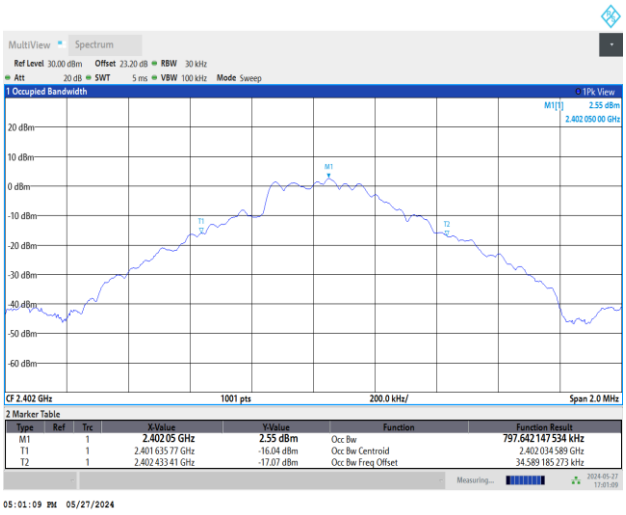
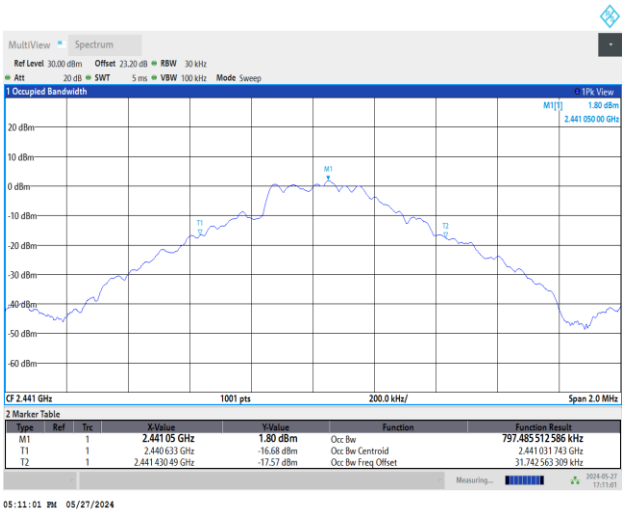
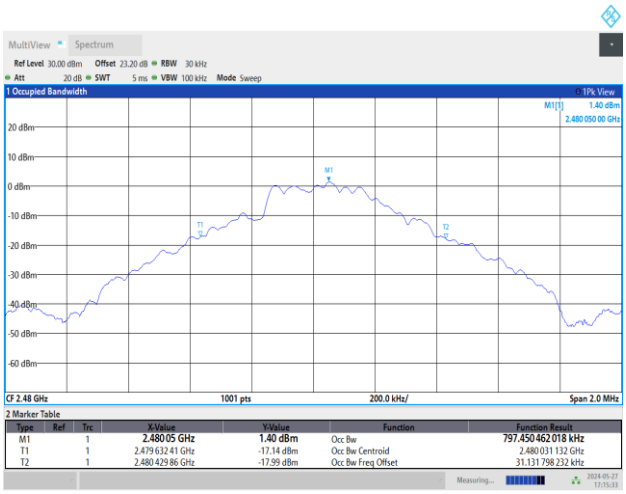
| 20 dB Bandwidth Plot in Channel 00 | 20 dB Bandwidth Plot in Channel 39 |
|---|---|
|  |  |
| **20 dB Bandwidth Plot in Channel 78** | |
|  | |

**<3Mbps>**

| 20 dB Bandwidth Plot in Channel 00 | 20 dB Bandwidth Plot in Channel 39 |
|---|---|
|  |  |
| **20 dB Bandwidth Plot in Channel 78** | |
|  | |

## 99% Occupied Bandwidth

**<1Mbps>**

| 99% Occupied Bandwidth on Channel 00 | 99% Occupied Bandwidth on Channel 39 |
|---|---|
|  |  |
| **99% Occupied Bandwidth on Channel 78** | |
|  | |

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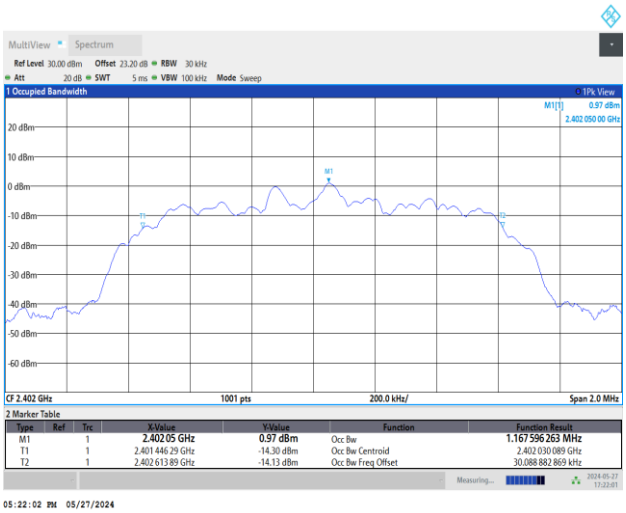
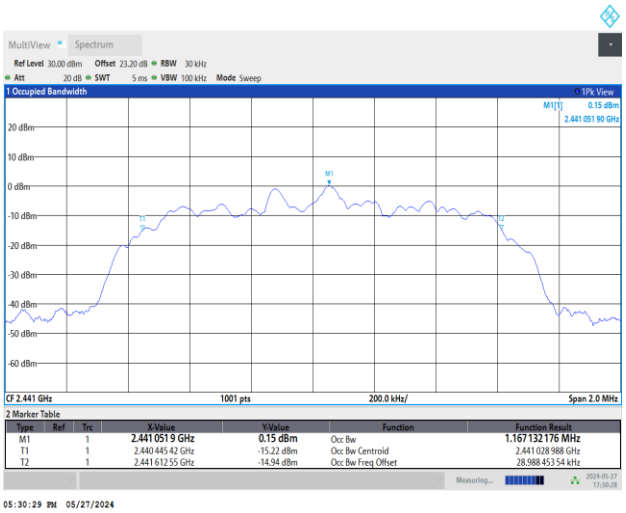
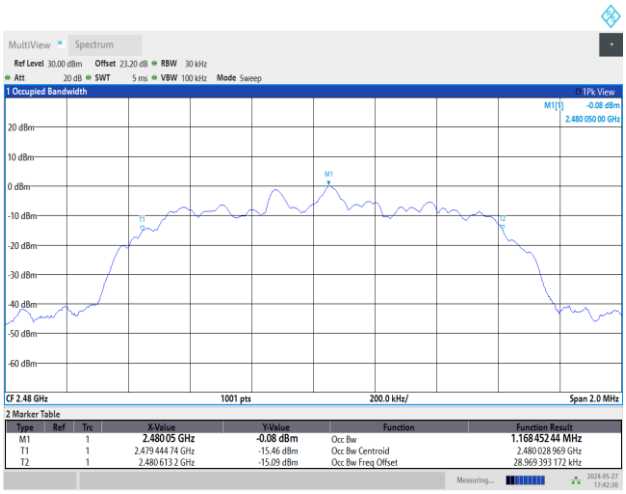
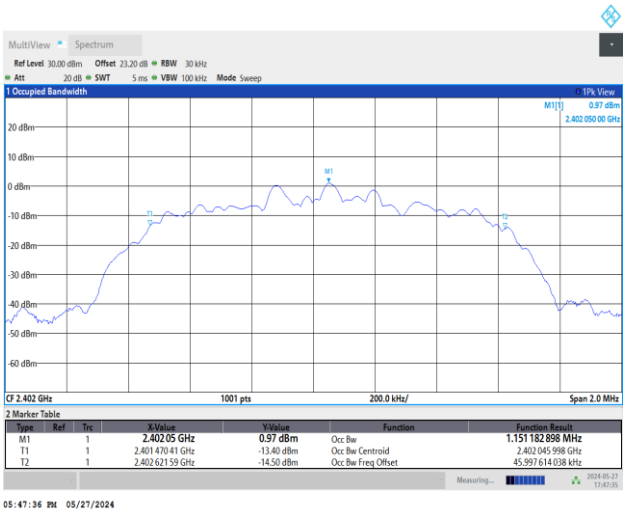
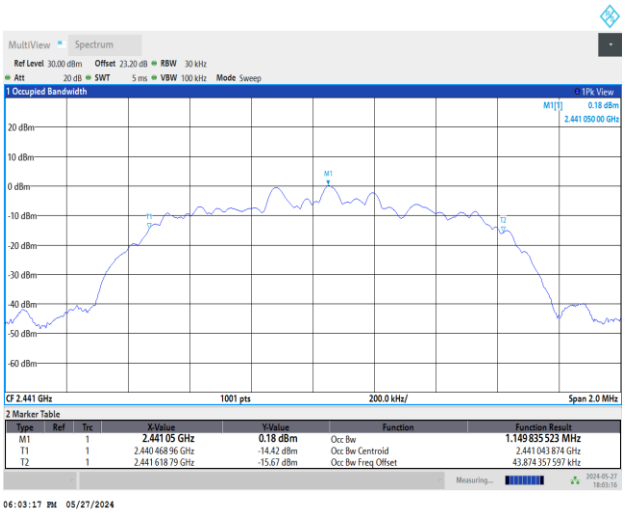
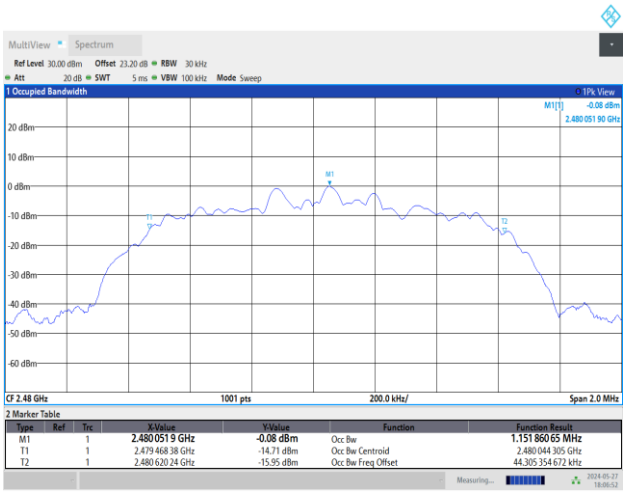
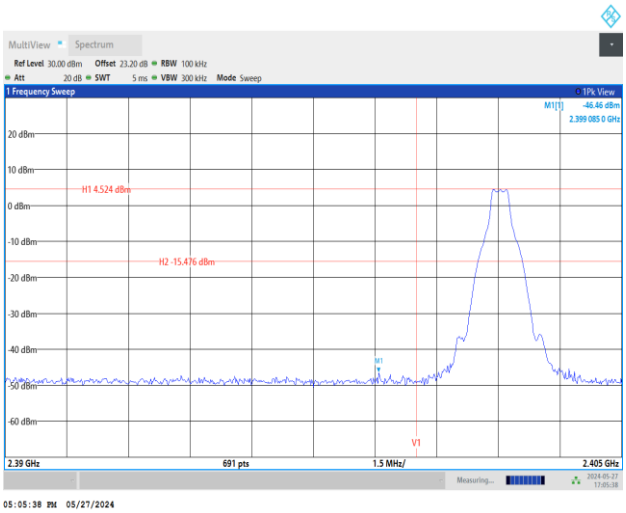
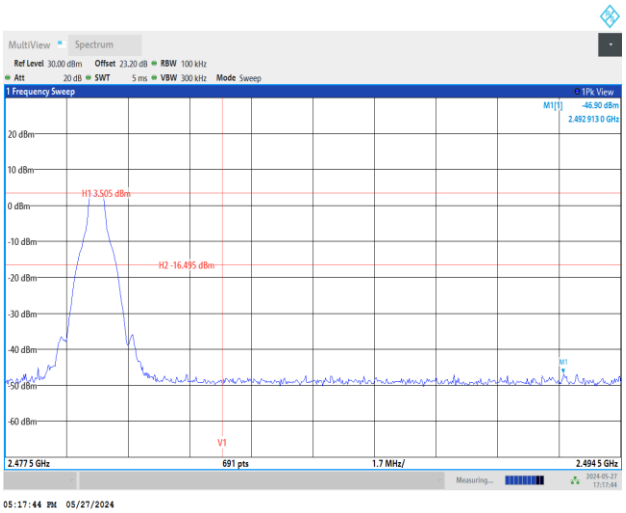
| 99% Occupied Bandwidth on Channel 00 | 99% Occupied Bandwidth on Channel 39 |
|---|---|
|  |  |
| **99% Occupied Bandwidth on Channel 78** | |
|  | |

**<3Mbps>**

| 99% Occupied Bandwidth on Channel 00 | 99% Occupied Bandwidth on Channel 39 |
|---|---|
|  |  |
| **99% Occupied Bandwidth on Channel 78** | |
|  | |

## Band Edges

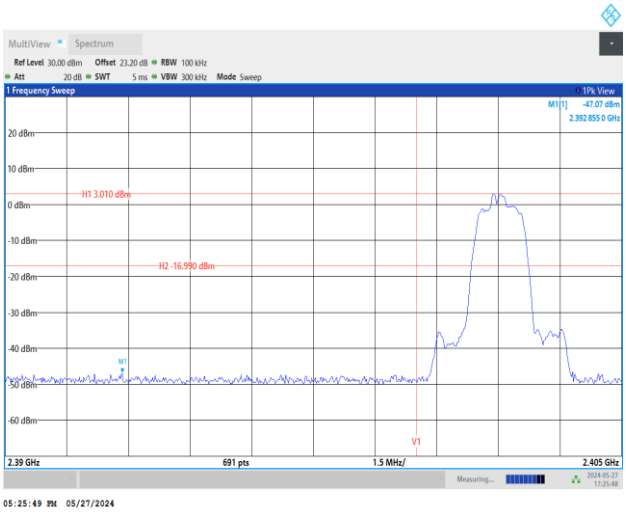
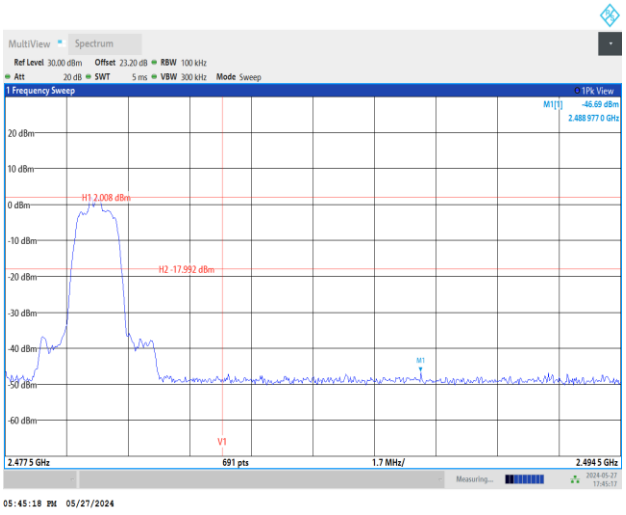
**<1Mbps>**

| Low Band Edge Plot on Channel 00 | High Band Edge Plot on Channel 78 |
|---|---|
|  |  |

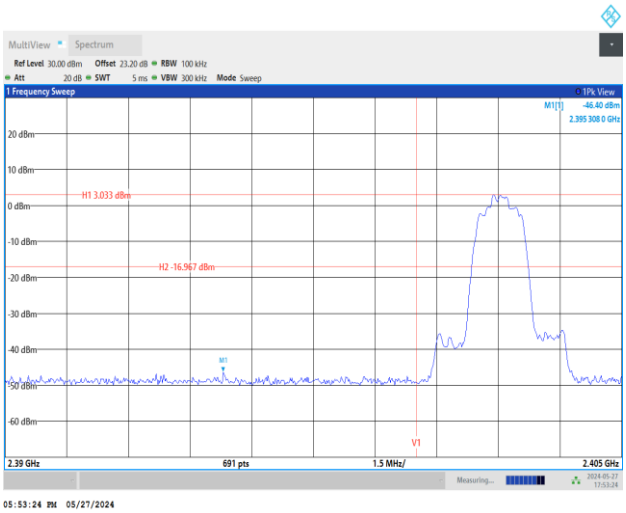
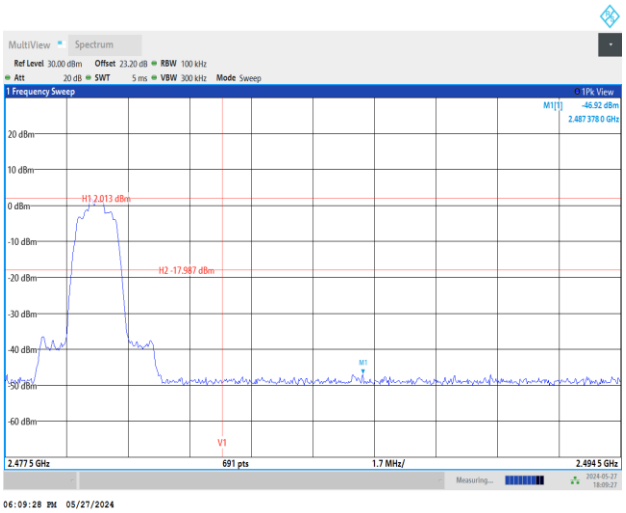




**<2Mbps>**

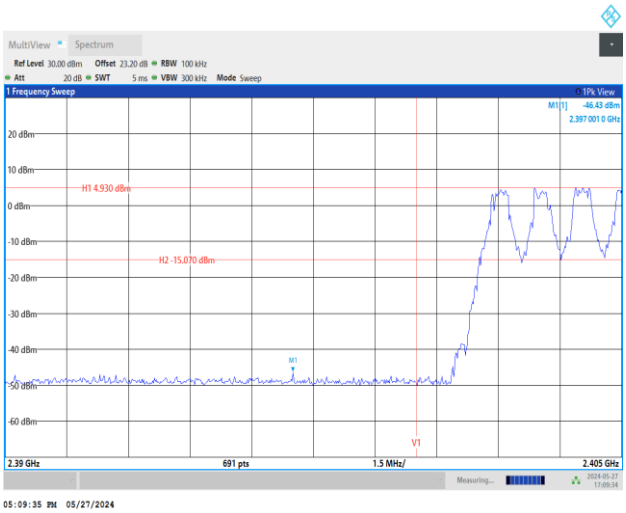
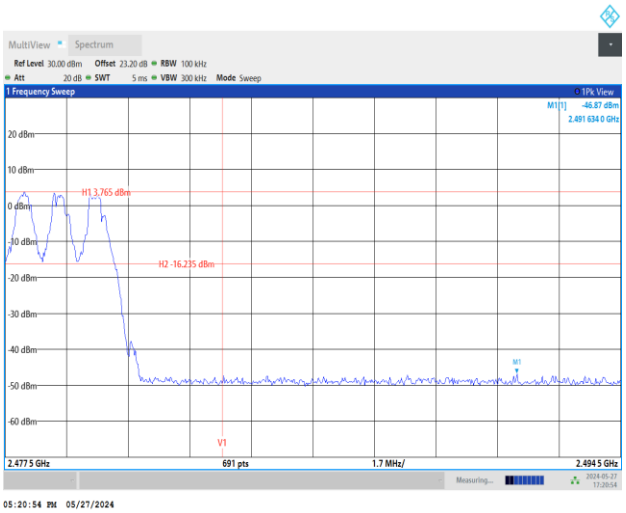
| Low Band Edge Plot on Channel 00 | High Band Edge Plot on Channel 78 |
|---|---|
|  |  |

**<3Mbps>**

| Low Band Edge Plot on Channel 00 | High Band Edge Plot on Channel 78 |
|---|---|
|  |  |

## Hopping Mode Band Edges

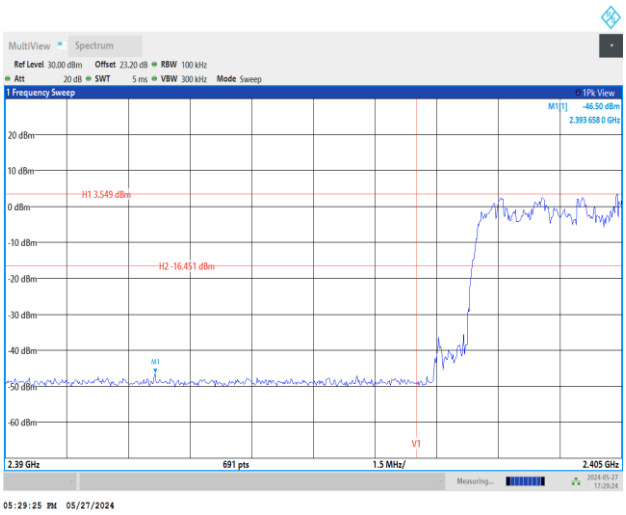
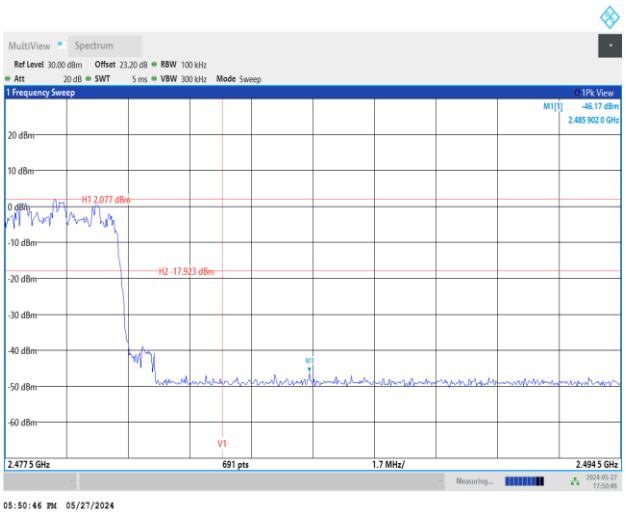
**<1Mbps>**

| Hopping Mode Low Band Edge Plot | Hopping Mode High Band Edge Plot |
|---|---|
|  |  |

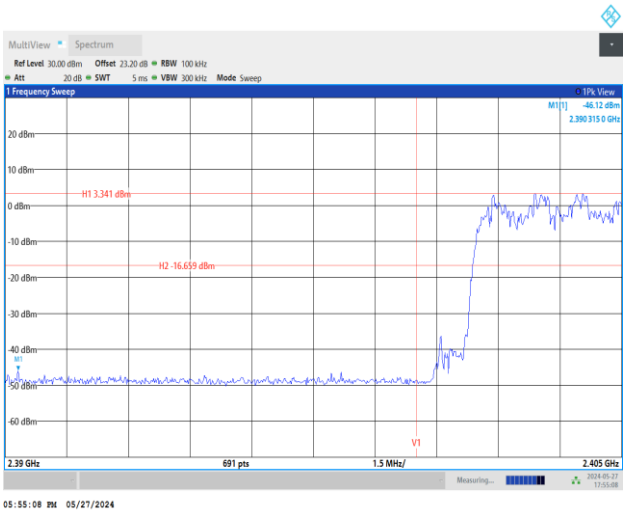
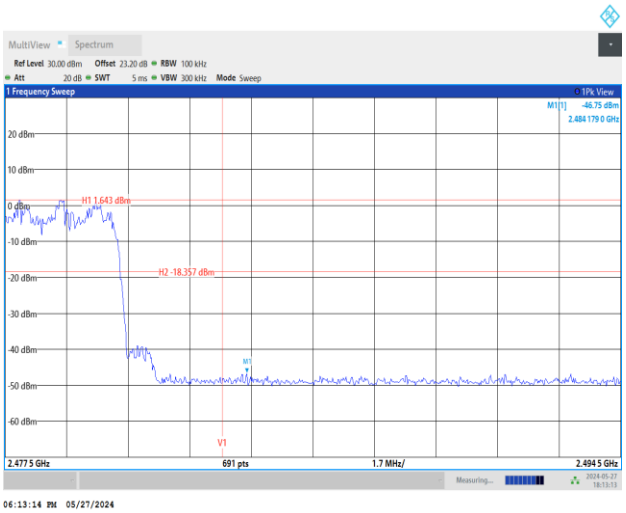




**<2Mbps>**

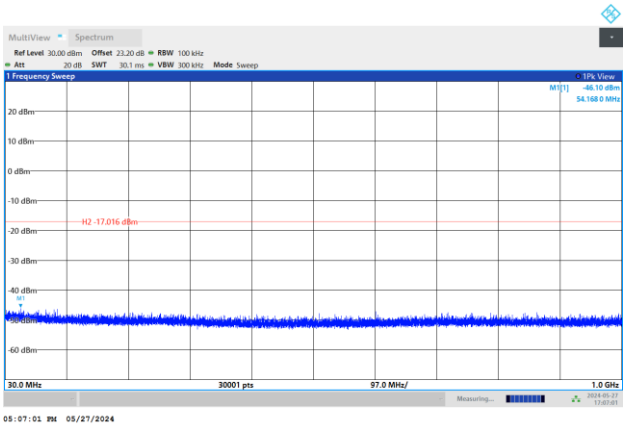
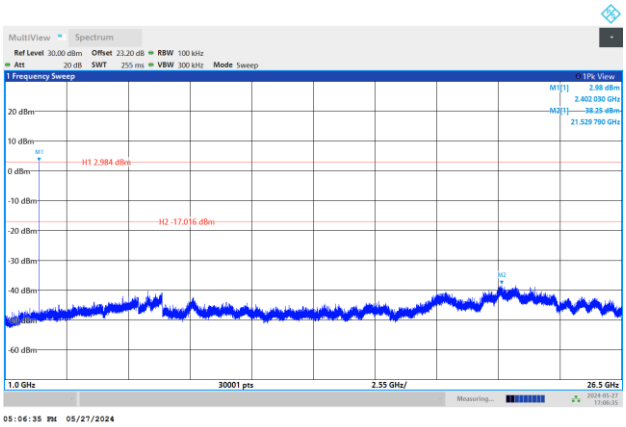
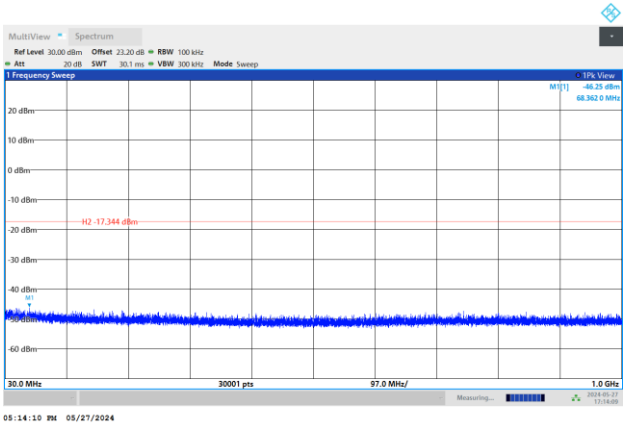
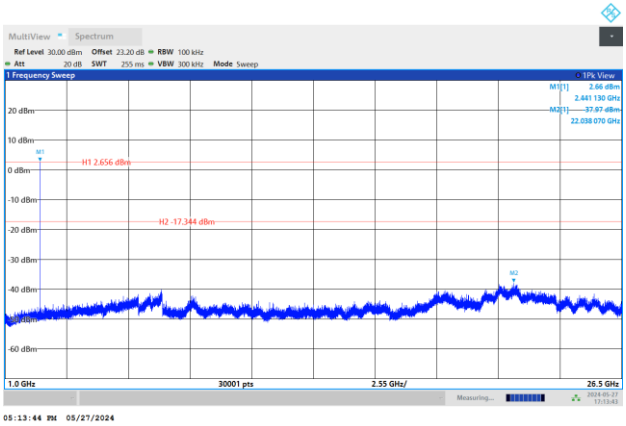
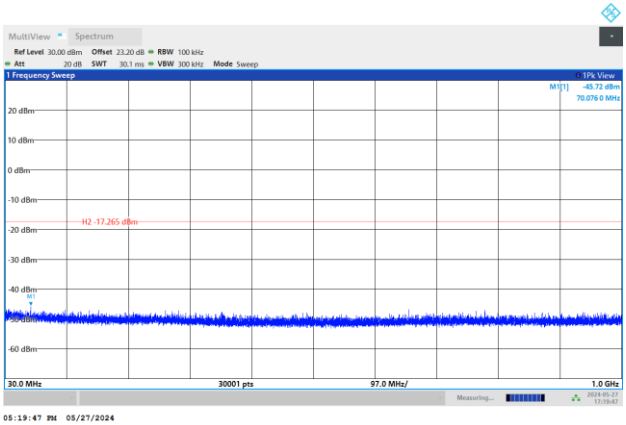
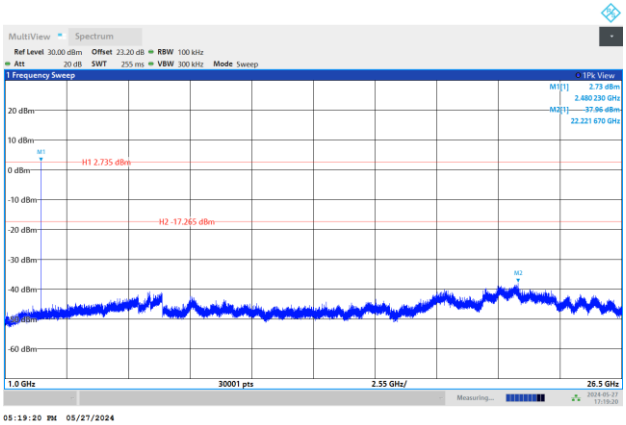
| Hopping Mode Low Band Edge Plot | Hopping Mode High Band Edge Plot |
|---|---|
|  |  |

**<3Mbps>**

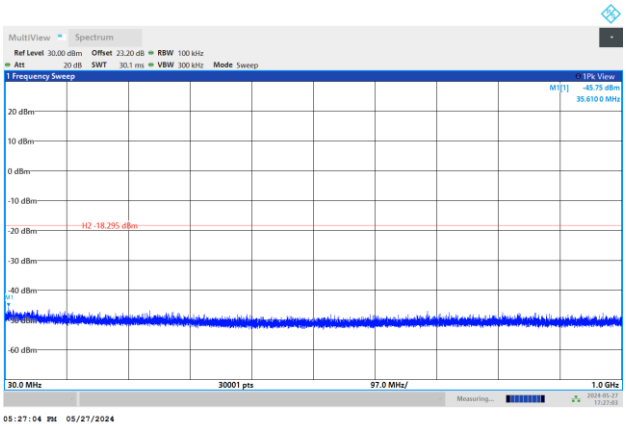
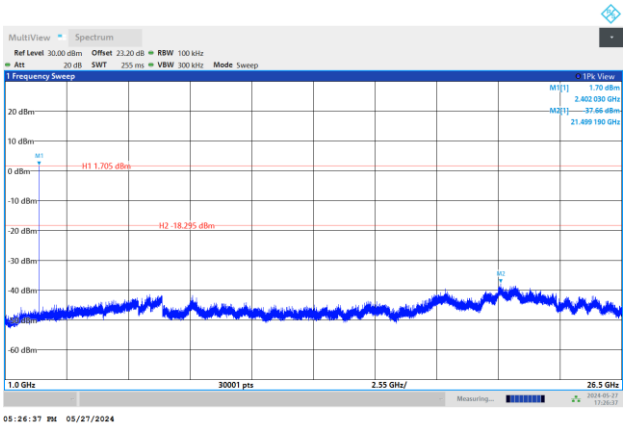
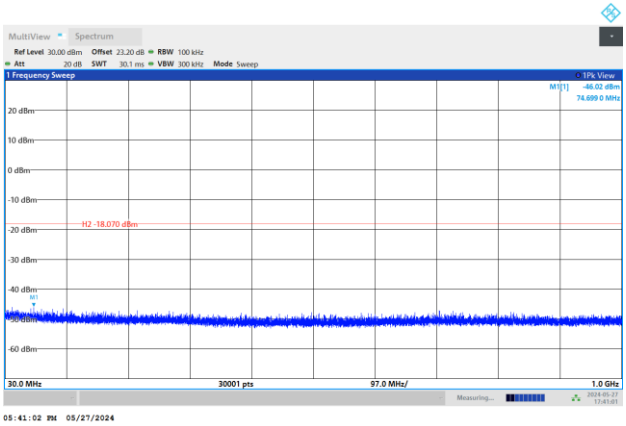
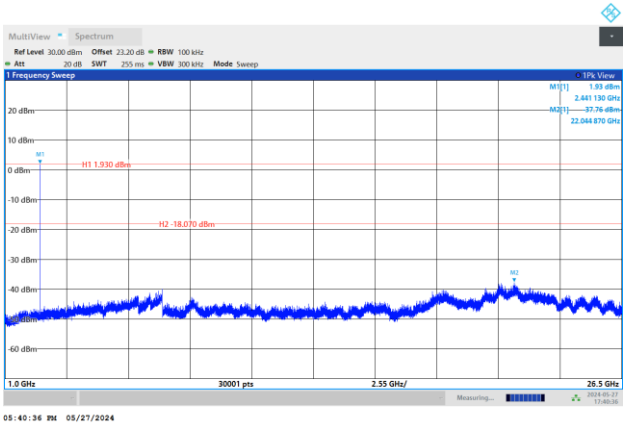
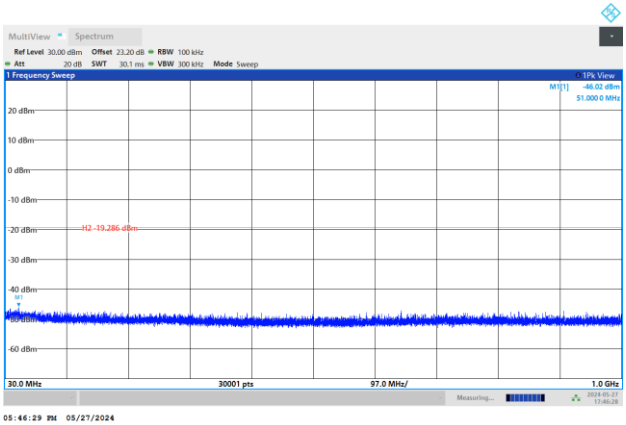
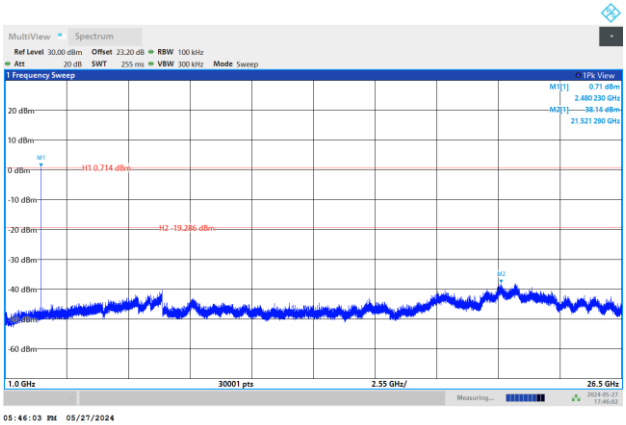
| Hopping Mode Low Band Edge Plot | Hopping Mode High Band Edge Plot |
|---|---|
|  |  |

## Conducted Spurious Emission

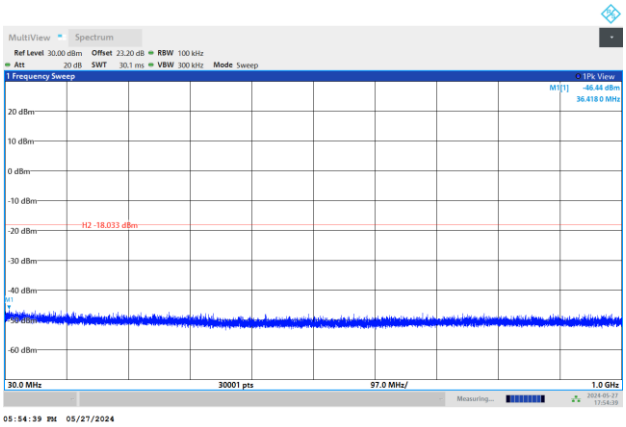
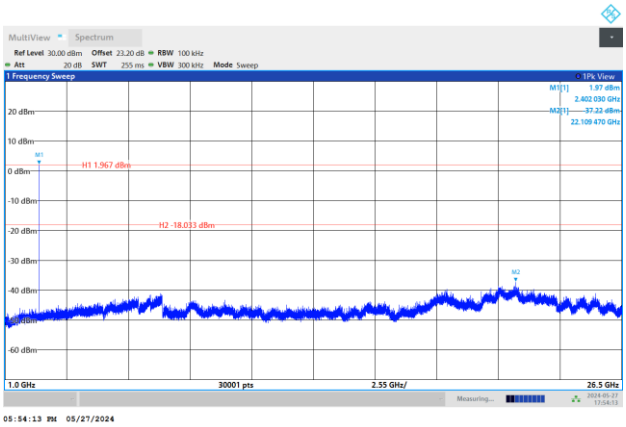
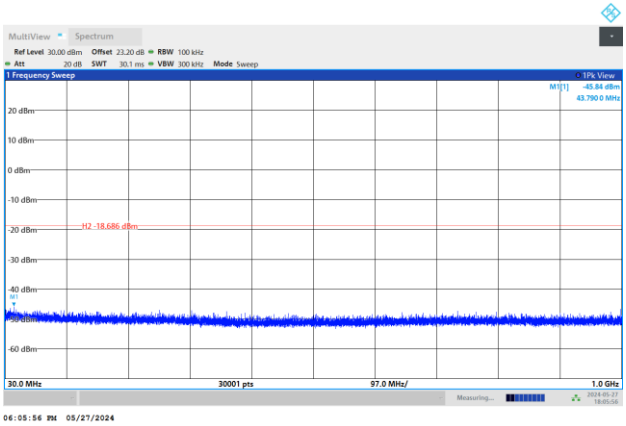
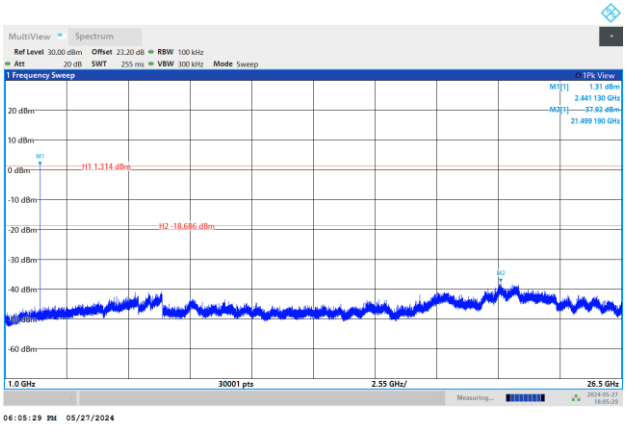
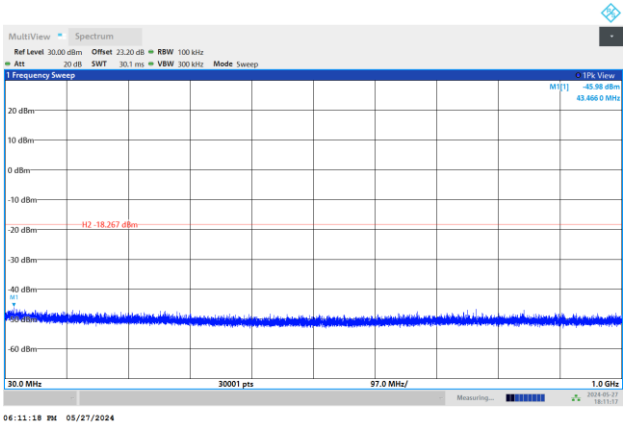
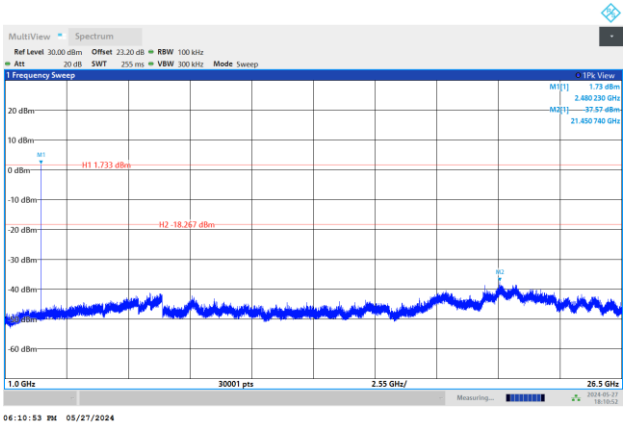
**<1Mbps>**

| CSE Plot on Low Ch between 30MHz ~ 1 GHz | CSE Plot on Low Ch between 1GHz ~ 26.5GHz |
|---|---|
|  |  |
| **CSE Plot on Mid. Ch between 30MHz ~ 1 GHz** | **CSE Plot on Mid. Ch between 1GHz ~ 26.5GHz** |
|  |  |
| **CSE Plot on High Ch between 30MHz ~ 1 GHz** | **CSE Plot on High Ch between 1GHz ~ 26.5GHz** |
|  |  |

**<2Mbps>**

| CSE Plot on Low Ch between 30MHz ~ 1 GHz | CSE Plot on Low Ch between 1GHz ~ 26.5GHz |
|---|---|
|  |  |
| **CSE Plot on Mid. Ch between 30MHz ~ 1 GHz** | **CSE Plot on Mid. Ch between 1GHz ~ 26.5GHz** |
|  |  |
| **CSE Plot on High Ch between 30MHz ~ 1 GHz** | **CSE Plot on High Ch between 1GHz ~ 26.5GHz** |
|  |  |

**<3Mbps>**

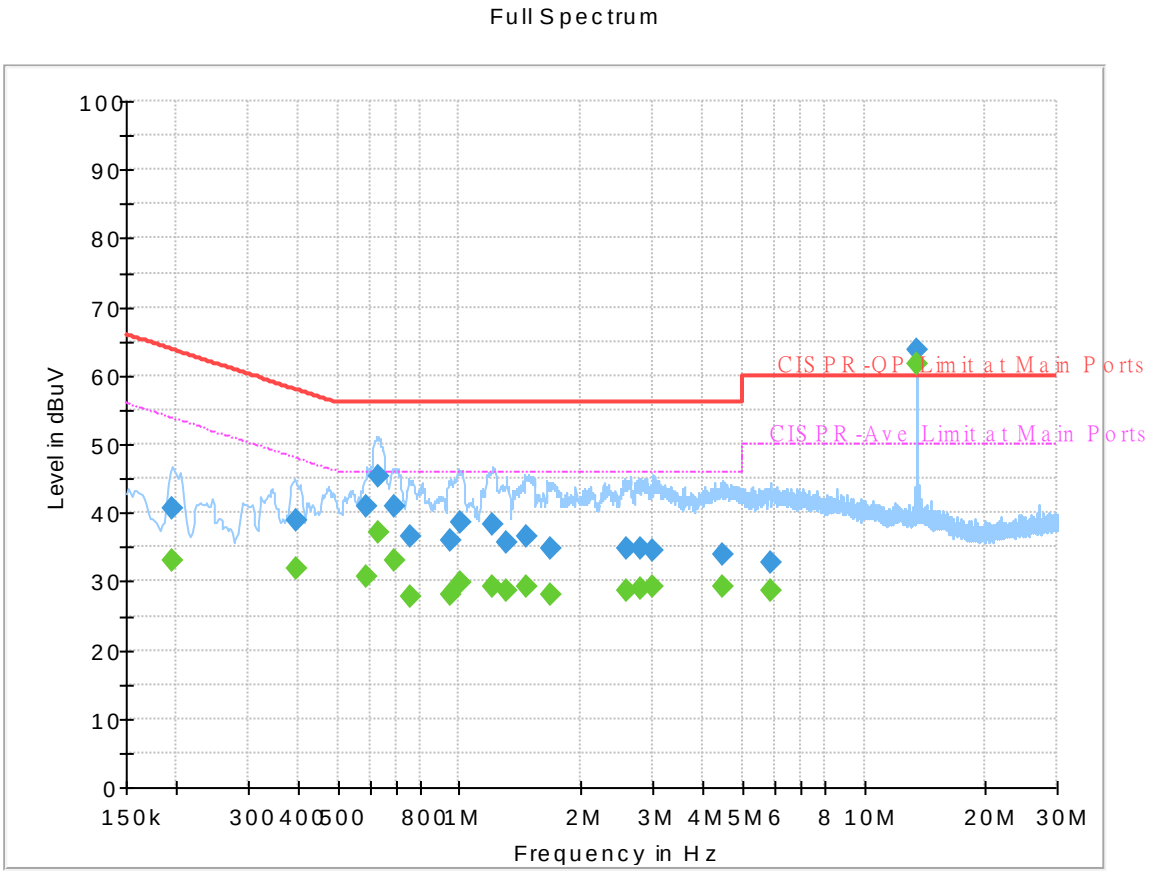
| CSE Plot on Low Ch between 30MHz ~ 1 GHz | CSE Plot on Low Ch between 1GHz ~ 26.5GHz |
|---|---|
|  |  |
| **CSE Plot on Mid. Ch between 30MHz ~ 1 GHz** | **CSE Plot on Mid. Ch between 1GHz ~ 26.5GHz** |
|  |  |
| **CSE Plot on High Ch between 30MHz ~ 1 GHz** | **CSE Plot on High Ch between 1GHz ~ 26.5GHz** |
|  |  |

# Appendix B. AC Conducted Emission Test Results

| | | | |
|---|---|---|---|
| **Test Engineer :** | Calvin Wang | **Temperature :** | 23~26℃ |
| | | **Relative Humidity :** | 45~55% |

## Oringinal

| | |
|---|---|
| Report NO : | 440146 |
| Test Mode : | Mode 1 |
| Test Voltage : | 120Vac/60Hz |
| Phase : | Line |

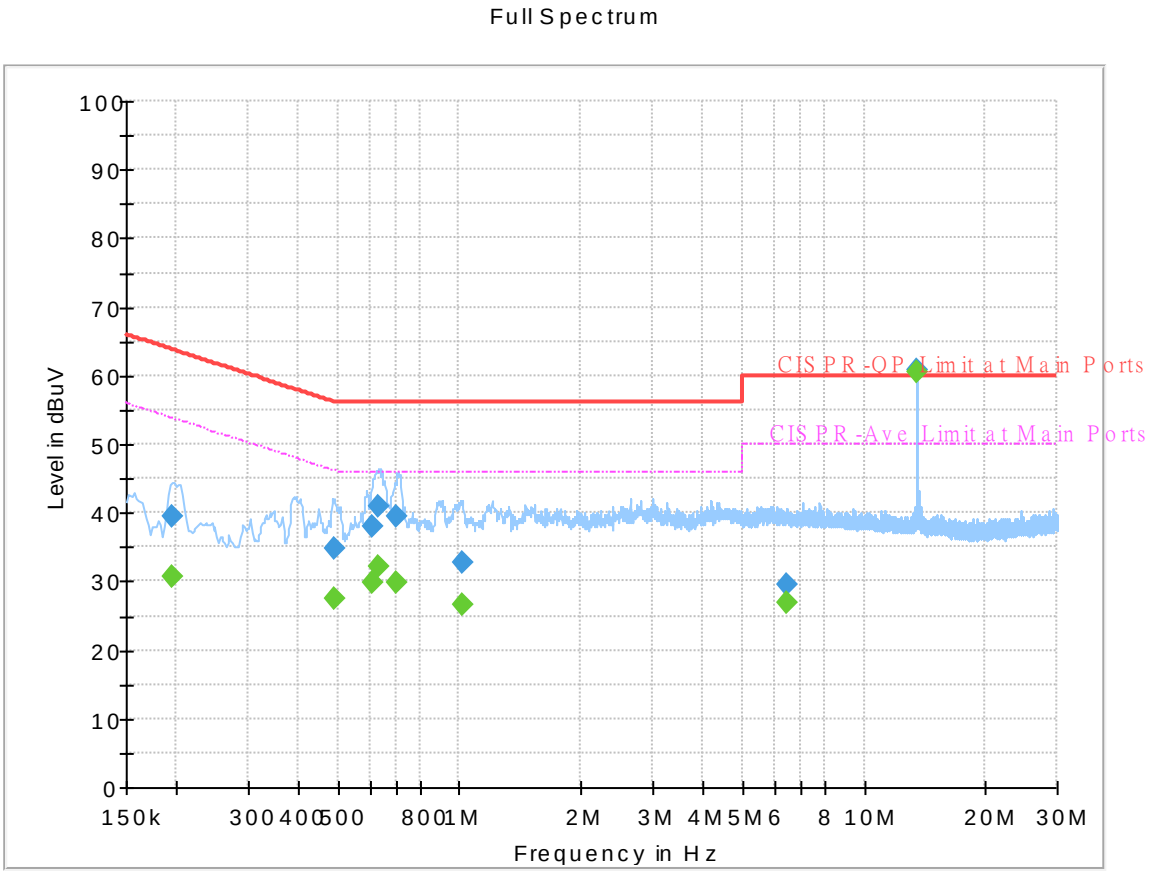



## Final_Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|---|---|---|---|---|---|---|---|
| 0.195000 | --- | 33.01 | 53.82 | 20.81 | L1 | OFF | 19.8 |
| 0.195000 | 40.73 | --- | 63.82 | 23.09 | L1 | OFF | 19.8 |
| 0.393000 | --- | 31.78 | 48.00 | 16.22 | L1 | OFF | 19.8 |
| 0.393000 | 38.79 | --- | 58.00 | 19.21 | L1 | OFF | 19.8 |
| 0.588750 | --- | 30.61 | 46.00 | 15.39 | L1 | OFF | 19.8 |
| 0.588750 | 41.07 | --- | 56.00 | 14.93 | L1 | OFF | 19.8 |
| 0.627000 | --- | 37.22 | 46.00 | 8.78 | L1 | OFF | 19.8 |
| 0.627000 | 45.41 | --- | 56.00 | 10.59 | L1 | OFF | 19.8 |
| 0.690000 | --- | 33.09 | 46.00 | 12.91 | L1 | OFF | 19.8 |
| 0.690000 | 40.89 | --- | 56.00 | 15.11 | L1 | OFF | 19.8 |
| 0.759750 | --- | 27.70 | 46.00 | 18.30 | L1 | OFF | 19.8 |
| 0.759750 | 36.48 | --- | 56.00 | 19.52 | L1 | OFF | 19.8 |
| 0.951000 | --- | 28.12 | 46.00 | 17.88 | L1 | OFF | 19.8 |
| 0.951000 | 35.89 | --- | 56.00 | 20.11 | L1 | OFF | 19.8 |
| 1.009500 | --- | 29.77 | 46.00 | 16.23 | L1 | OFF | 19.8 |
| 1.009500 | 38.69 | --- | 56.00 | 17.31 | L1 | OFF | 19.8 |
| 1.209750 | --- | 29.34 | 46.00 | 16.66 | L1 | OFF | 19.8 |
| 1.209750 | 38.27 | --- | 56.00 | 17.73 | L1 | OFF | 19.8 |
| 1.304250 | --- | 28.57 | 46.00 | 17.43 | L1 | OFF | 19.9 |
| 1.304250 | 35.69 | --- | 56.00 | 20.31 | L1 | OFF | 19.9 |
| 1.473000 | --- | 29.20 | 46.00 | 16.80 | L1 | OFF | 19.9 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1.473000 | 36.47 | --- | 56.00 | 19.53 | L1 | OFF | 19.9 |
| 1.680000 | --- | 28.14 | 46.00 | 17.86 | L1 | OFF | 19.9 |
| 1.680000 | 34.80 | --- | 56.00 | 21.20 | L1 | OFF | 19.9 |
| 2.602500 | --- | 28.62 | 46.00 | 17.38 | L1 | OFF | 19.9 |
| 2.602500 | 34.83 | --- | 56.00 | 21.17 | L1 | OFF | 19.9 |
| 2.802750 | --- | 28.85 | 46.00 | 17.15 | L1 | OFF | 19.9 |
| 2.802750 | 34.93 | --- | 56.00 | 21.07 | L1 | OFF | 19.9 |
| 3.005250 | --- | 29.13 | 46.00 | 16.87 | L1 | OFF | 19.9 |
| 3.005250 | 34.45 | --- | 56.00 | 21.55 | L1 | OFF | 19.9 |
| 4.456500 | --- | 29.13 | 46.00 | 16.87 | L1 | OFF | 20.0 |
| 4.456500 | 33.99 | --- | 56.00 | 22.01 | L1 | OFF | 20.0 |
| 5.905500 | --- | 28.79 | 50.00 | 21.21 | L1 | OFF | 20.1 |
| 5.905500 | 32.81 | --- | 60.00 | 27.19 | L1 | OFF | 20.1 |
| 13.560000 | --- | 61.78 | 50.00 | -11.78 | L1 | OFF | 20.5 |
| 13.560000 | 63.63 | --- | 60.00 | -3.63 | L1 | OFF | 20.5 |

Report NO : 440146
Test Mode : Mode 1
Test Voltage : 120Vac/60Hz
Phase : Neutral

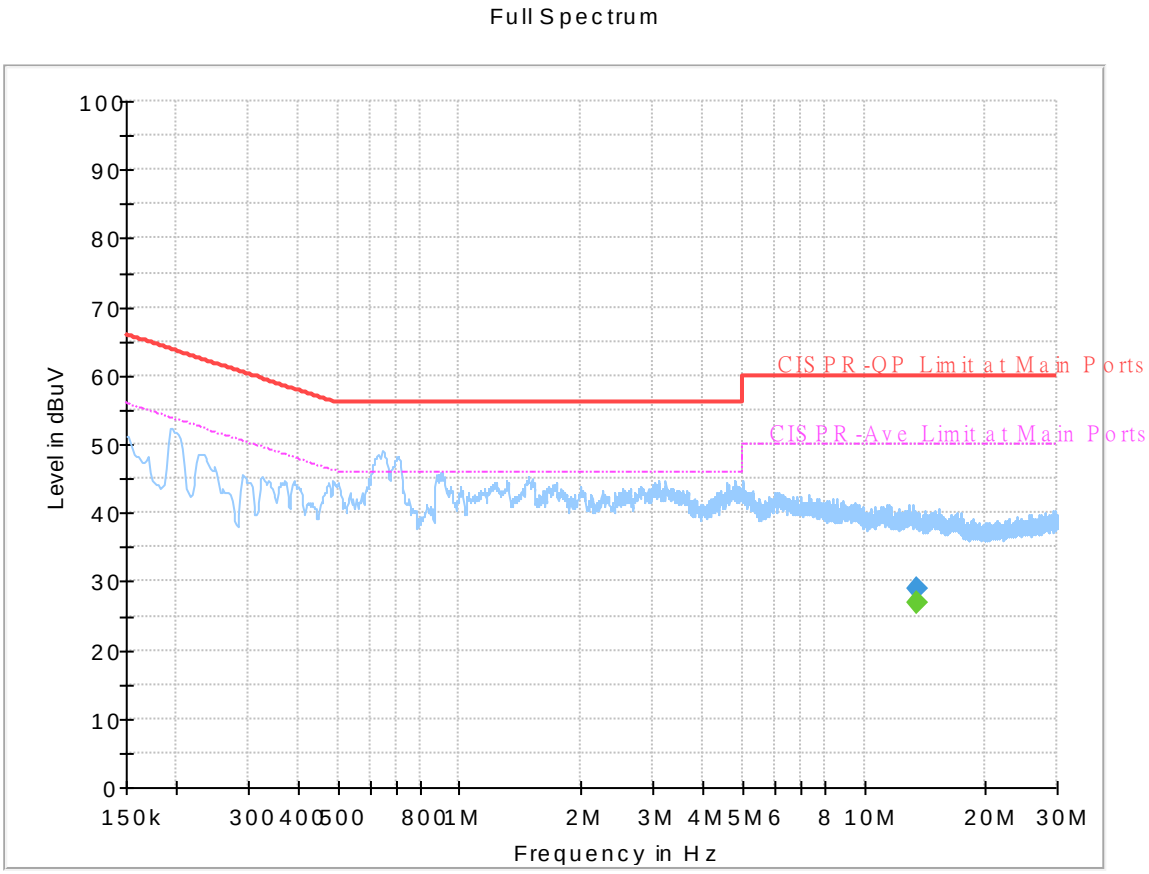



## Final_Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|---|---|---|---|---|---|---|---|
| 0.195000 | --- | 30.75 | 53.82 | 23.07 | N | OFF | 19.8 |
| 0.195000 | 39.40 | --- | 63.82 | 24.42 | N | OFF | 19.8 |
| 0.489750 | --- | 27.40 | 46.17 | 18.77 | N | OFF | 19.8 |
| 0.489750 | 34.78 | --- | 56.17 | 21.39 | N | OFF | 19.8 |
| 0.609000 | --- | 29.77 | 46.00 | 16.23 | N | OFF | 19.8 |
| 0.609000 | 38.09 | --- | 56.00 | 17.91 | N | OFF | 19.8 |
| 0.633750 | --- | 32.27 | 46.00 | 13.73 | N | OFF | 19.8 |
| 0.633750 | 40.86 | --- | 56.00 | 15.14 | N | OFF | 19.8 |
| 0.701250 | --- | 29.83 | 46.00 | 16.17 | N | OFF | 19.8 |
| 0.701250 | 39.33 | --- | 56.00 | 16.67 | N | OFF | 19.8 |
| 1.014000 | --- | 26.68 | 46.00 | 19.32 | N | OFF | 19.8 |
| 1.014000 | 32.77 | --- | 56.00 | 23.23 | N | OFF | 19.8 |
| 6.441000 | --- | 26.97 | 50.00 | 23.03 | N | OFF | 20.1 |
| 6.441000 | 29.48 | --- | 60.00 | 30.52 | N | OFF | 20.1 |
| 13.560000 | --- | 60.57 | 50.00 | -10.57 | N | OFF | 20.5 |
| 13.560000 | 60.95 | --- | 60.00 | -0.95 | N | OFF | 20.5 |

## Terminal

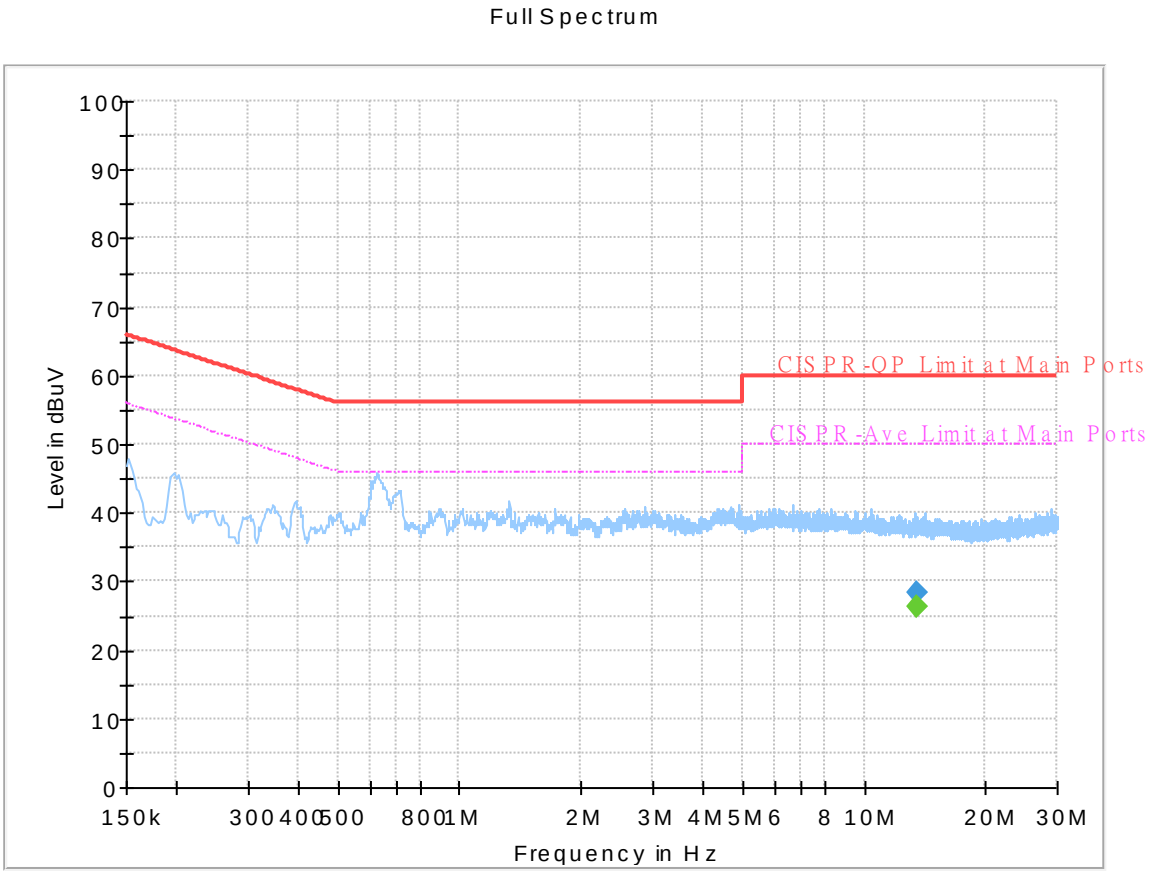
| | |
|---|---|
| Report NO : | 440146 |
| Test Mode : | Mode 1 |
| Test Voltage : | 120Vac/60Hz |
| Phase : | Line |




## Final_Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|---|---|---|---|---|---|---|---|
| 13.560000 | --- | 26.83 | 50.00 | 23.17 | L1 | OFF | 20.5 |
| 13.560000 | 29.08 | --- | 60.00 | 30.92 | L1 | OFF | 20.5 |

Report NO : 440146
Test Mode : Mode 1
Test Voltage : 120Vac/60Hz
Phase : Neutral




## Final_Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|---|---|---|---|---|---|---|---|
| 13.560000 | --- | 26.43 | 50.00 | 23.57 | N | OFF | 20.5 |
| 13.560000 | 28.43 | --- | 60.00 | 31.57 | N | OFF | 20.5 |

# Appendix C. Radiated Spurious Emission

| Test Engineer : | Bill Chang, Gary Guo, and Steven Wu | Temperature : | 18.2~20.2°C |
|---|---|---|---|
| | | Relative Humidity : | 54.2~56.1% |

**<Sample 1>**

**2.4GHz 2400~2483.5MHz**

**BT (Band Edge @ 3m)**

| BT | Note | Frequency | Level | Margin | Limit Line | Read Level | Antenna Factor | Path Loss | Preamp Factor | Ant Pos | Table Pos | Peak Avg. | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ( MHz ) | ( dBµV/m ) | ( dB ) | ( dBµV/m ) | ( dBµV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| BT CH00 2402MHz | | 2360.085 | 45.73 | -28.27 | 74 | 40.81 | 27.2 | 7.64 | 29.92 | 100 | 78 | P | H |
| | | 2360.085 | 20.94 | -33.06 | 54 | - | - | - | - | - | - | A | H |
| | * | 2402 | 96.92 | - | - | 91.72 | 27.4 | 7.71 | 29.91 | 100 | 78 | P | H |
| | * | 2402 | 72.13 | 18.13 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | 2373.21 | 45.96 | -28.04 | 74 | 41.02 | 27.2 | 7.66 | 29.92 | 107 | 65 | P | V |
| | | 2373.21 | 21.17 | -32.83 | 54 | - | - | - | - | - | - | A | V |
| | * | 2402 | 93.24 | - | - | 88.04 | 27.4 | 7.71 | 29.91 | 107 | 65 | P | V |
| | ** | 2402 | 68.45 | 14.45 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| BT CH 39 2441MHz | | 2359 | 45.79 | -28.21 | 74 | 40.88 | 27.19 | 7.64 | 29.92 | 100 | 77 | P | H |
| | | 2359 | 21 | -33 | 54 | - | - | - | - | - | - | A | H |
| | * | 2441 | 95.98 | - | - | 90.55 | 27.6 | 7.73 | 29.9 | 100 | 77 | P | H |
| | * | 2441 | 71.19 | 17.19 | 54 | - | - | - | - | - | - | A | H |
| | | 2490.97 | 45.95 | -28.05 | 74 | 40.37 | 27.7 | 7.76 | 29.88 | 100 | 77 | P | H |
| | | 2490.97 | 21.16 | -32.84 | 54 | - | - | - | - | - | - | A | H |
| | | 2374.68 | 45.09 | -28.91 | 74 | 40.14 | 27.2 | 7.67 | 29.92 | 312 | 143 | P | V |
| | | 2374.68 | 20.3 | -33.7 | 54 | - | - | - | - | - | - | A | V |
| | * | 2441 | 93.49 | - | - | 88.06 | 27.6 | 7.73 | 29.9 | 312 | 143 | P | V |
| | | 2441 | 68.7 | 14.7 | 54 | - | - | - | - | - | - | A | V |
| | | 2498.04 | 45.7 | -28.3 | 74 | 40.12 | 27.7 | 7.76 | 29.88 | 312 | 143 | P | V |
| | | 2498.04 | 20.91 | -33.09 | 54 | - | - | - | - | - | - | A | V |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT CH 78 2480MHz | * | 2480 | 96.42 | - | - | 90.86 | 27.7 | 7.75 | 29.89 | 100 | 76 | P | H |
| | * | 2480 | 71.63 | 17.63 | 54 | - | - | - | - | - | - | A | H |
| | | 2486.48 | 46.14 | -27.86 | 74 | 40.56 | 27.7 | 7.76 | 29.88 | 100 | 76 | P | H |
| | | 2486.48 | 21.35 | -32.65 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 93.12 | - | - | 87.56 | 27.7 | 7.75 | 29.89 | 400 | 8 | P | V |
| | * | 2480 | 68.33 | 14.33 | 54 | - | - | - | - | - | - | A | V |
| | | 2487.36 | 46.13 | -27.87 | 74 | 40.55 | 27.7 | 7.76 | 29.88 | 400 | 8 | P | V |
| | | 2487.36 | 21.34 | -32.66 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line.<br>3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only. | | | | | | | | | | | | |

## 2.4GHz 2400~2483.5MHz

## BT (Harmonic @ 3m)

| BT | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Margin ( dB ) | Limit Line ( dBμV/m ) | Read Level ( dBμV ) | Antenna Factor ( dB/m ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT CH 00 2402MHz | | 4804 | 38.95 | -35.05 | 74 | 61.67 | 32.32 | 11.12 | 66.16 | - | - | P | H |
| | | 4804 | 14.16 | -39.84 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
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| | | | | | | | | | | | | | H |
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| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4804 | 39.2 | -34.8 | 74 | 61.92 | 32.32 | 11.12 | 66.16 | - | - | P | V |
| | | 4804 | 14.41 | -39.59 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
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| | | | | | | | | | | | | | V |

| BT | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Margin ( dB ) | Limit Line ( dBμV/m ) | Read Level ( dBμV ) | Antenna Factor ( dB/m ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT CH 39 2441MHz | | 4882 | 40.08 | -33.92 | 74 | 62.15 | 32.63 | 11.32 | 66.02 | - | - | P | H |
| | | 4882 | 15.29 | -38.71 | 54 | - | - | - | - | - | - | A | H |
| | | 7323 | 44.91 | -29.09 | 74 | 59.81 | 36.76 | 13.8 | 65.46 | - | - | P | H |
| | | 7323 | 20.12 | -33.88 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
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| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4882 | 39.7 | -34.3 | 74 | 61.77 | 32.63 | 11.32 | 66.02 | - | - | P | V |
| | | 4882 | 14.91 | -39.09 | 54 | - | - | - | - | - | - | A | V |
| | | 7323 | 43.98 | -30.02 | 74 | 58.88 | 36.76 | 13.8 | 65.46 | - | - | P | V |
| | | 7323 | 19.19 | -34.81 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
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| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |

| BT | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Margin ( dB ) | Limit Line ( dBμV/m ) | Read Level ( dBμV ) | Antenna Factor ( dB/m ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT CH 78 2480MHz | | 4960 | 40.73 | -33.27 | 74 | 62.04 | 33.02 | 11.54 | 65.87 | - | - | P | H |
| | | 4960 | 15.94 | -38.06 | 54 | - | - | - | - | - | - | A | H |
| | | 7440 | 43.76 | -30.24 | 74 | 59 | 36.32 | 13.91 | 65.47 | - | - | P | H |
| | | 7440 | 18.97 | -35.03 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
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| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4960 | 40.79 | -33.21 | 74 | 62.1 | 33.02 | 11.54 | 65.87 | - | - | P | V |
| | | 4960 | 16 | -38 | 54 | - | - | - | - | - | - | A | V |
| | | 7440 | 43.46 | -30.54 | 74 | 58.7 | 36.32 | 13.91 | 65.47 | - | - | P | V |
| | | 7440 | 18.67 | -35.33 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
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| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line.<br>3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only. | | | | | | | | | | | | |

## Emission above 18GHz

## 2.4GHz BT (SHF)

| BT | Note | Frequency | Level | Margin | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| | | ( MHz ) | ( dBµV/m ) | ( dB ) | ( dBµV/m ) | (dBµV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| 2.4GHz BT SHF | | 23509 | 40.36 | -33.64 | 74 | 57.29 | 38.7 | -2.63 | 53 | - | - | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
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| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 23180 | 39.42 | -34.58 | 74 | 56.5 | 38.88 | -2.83 | 53.13 | - | - | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
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| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against limit line.<br>3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only. | | | | | | | | | | | | |

## Emission below 1GHz

## 2.4GHz BT (LF)

| BT | Note | Frequency | Level | Margin | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| | | ( MHz ) | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | (dBμV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| 2.4GHz BT LF | | 30 | 23.11 | -16.89 | 40 | 30.4 | 24.4 | 0.75 | 32.44 | - | - | P | H |
| | | 123.42 | 31.79 | -11.71 | 43.5 | 45.03 | 17.51 | 1.64 | 32.39 | - | - | P | H |
| | | 216.57 | 26.33 | -19.67 | 46 | 41.54 | 15.1 | 2.09 | 32.4 | - | - | P | H |
| | | 563.9 | 27.64 | -18.36 | 46 | 30.65 | 26.07 | 3.53 | 32.61 | - | - | P | H |
| | | 629 | 29.27 | -16.73 | 46 | 31.82 | 26.28 | 3.85 | 32.68 | - | - | P | H |
| | | 935.6 | 33.87 | -12.13 | 46 | 30.49 | 30.23 | 4.79 | 31.64 | - | - | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 57.54 | 30.49 | -9.51 | 40 | 49.74 | 12.06 | 1.11 | 32.42 | - | - | P | V |
| | | 123.96 | 30.46 | -13.04 | 43.5 | 43.7 | 17.51 | 1.64 | 32.39 | - | - | P | V |
| | | 217.38 | 25.53 | -20.47 | 46 | 40.66 | 15.18 | 2.09 | 32.4 | - | - | P | V |
| | | 635.3 | 29.15 | -16.85 | 46 | 31.54 | 26.39 | 3.88 | 32.66 | - | - | P | V |
| | | 717.2 | 32.1 | -13.9 | 46 | 33.58 | 26.99 | 4.2 | 32.67 | - | - | P | V |
| | | 944 | 34.29 | -11.71 | 46 | 30.5 | 30.53 | 4.83 | 31.57 | - | - | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against limit line.<br>3. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only. | | | | | | | | | | | | |

**<Sample 2>**

**2.4GHz 2400~2483.5MHz**

**BT (Band Edge @ 3m)**

| BT | Note | Frequency | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Path Loss | Preamp Factor | Ant Pos | Table Pos | Peak Avg. | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ( MHz ) | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| BT CH 78 2480MHz | * | 2480 | 96.67 | - | - | 91.11 | 27.7 | 7.75 | 29.89 | 201 | 340 | P | H |
| | * | 2480 | 71.88 | 17.88 | 54 | - | - | - | - | - | - | A | H |
| | | 2492.4 | 46.14 | -27.86 | 74 | 40.56 | 27.7 | 7.76 | 29.88 | 201 | 340 | P | H |
| | | 2492.4 | 21.35 | -32.65 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 94.63 | - | - | 89.07 | 27.7 | 7.75 | 29.89 | 202 | 78 | P | V |
| | * | 2480 | 69.84 | 15.84 | 54 | - | - | - | - | - | - | A | V |
| | | 2488.88 | 46.32 | -27.68 | 74 | 40.74 | 27.7 | 7.76 | 29.88 | 202 | 78 | P | V |
| | | 2488.88 | 21.53 | -32.47 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line.<br>3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only. | | | | | | | | | | | | |

## 2.4GHz 2400~2483.5MHz

## BT (Harmonic @ 3m)

| BT | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Over Limit ( dB ) | Limit Line ( dBμV/m ) | Read Level ( dBμV ) | Antenna Factor ( dB/m ) | Path Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT CH 78 2480MHz | | 4960 | 40.94 | -33.06 | 74 | 62.25 | 33.02 | 11.54 | 65.87 | - | - | P | H |
| | | 4960 | 16.15 | -37.85 | 54 | - | - | - | - | - | - | A | H |
| | | 7440 | 43.99 | -30.01 | 74 | 59.23 | 36.32 | 13.91 | 65.47 | - | - | P | H |
| | | 7440 | 19.2 | -34.8 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4960 | 40.93 | -33.07 | 74 | 62.24 | 33.02 | 11.54 | 65.87 | - | - | P | V |
| | | 4960 | 16.14 | -37.86 | 54 | - | - | - | - | - | - | A | V |
| | | 7440 | 44.05 | -29.95 | 74 | 59.29 | 36.32 | 13.91 | 65.47 | - | - | P | V |
| | | 7440 | 19.26 | -34.74 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line.<br>3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only. | | | | | | | | | | | | |

## Note symbol

| | |
|---|---|
| * | **Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. |
| ! | Test result is **Margin** line. |
| P/A | **P**eak or **A**verage |
| H/V | **H**orizontal or **V**ertical |

## A calculation example for radiated spurious emission is shown as below:

| BT | Note | Frequency | Level | Margin | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| | | ( MHz ) | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| BT CH 00 2402MHz | | 2390 | 55.45 | -18.55 | 74 | 54.51 | 32.22 | 4.58 | 35.86 | 103 | 308 | P | H |

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

3. Margin (dB) = Level(dBμV/m) – Limit Line(dBμV/m)

**For Peak Limit @ 2390MHz:**

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Margin (dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

**Peak measured complies with the limit line, so test result is “PASS”.**

# Appendix D. Radiated Spurious Emission Plots

| | | | |
|---|---|---|---|
| **Test Engineer :** | Bill Chang, Gary Guo, and Steven Wu | **Temperature :** | 18.2~20.2°C |
| | | **Relative Humidity :** | 54.2~56.1% |

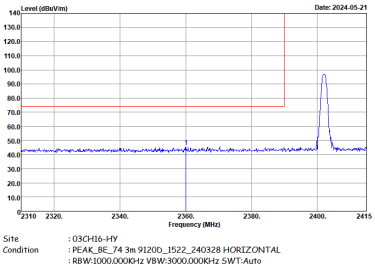
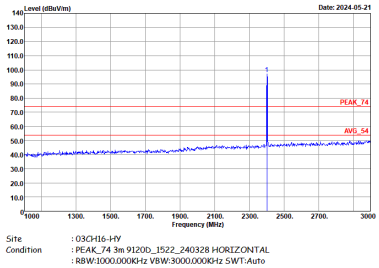
**Note symbol**

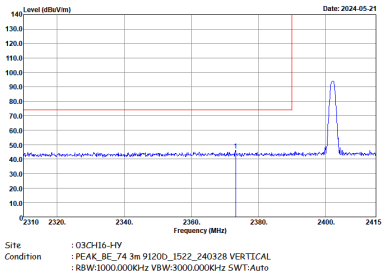
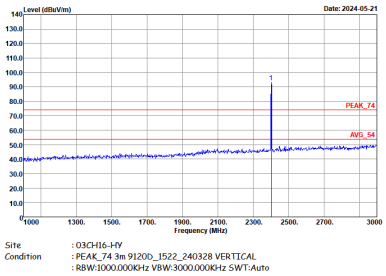
| | |
|---|---|
| -L | **Low channel location** |
| -R | **High channel location** |

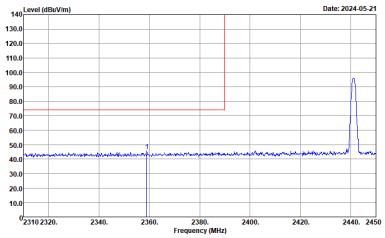
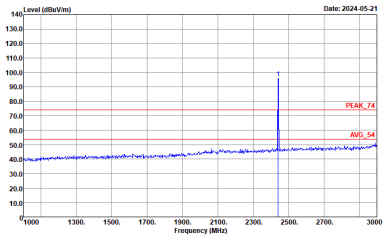
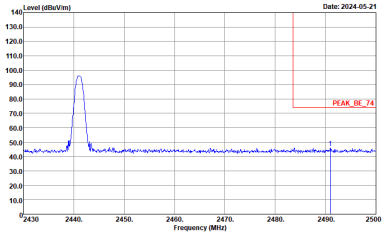
**<Sample 1>**

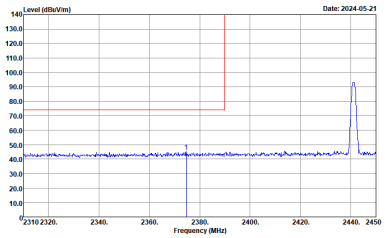
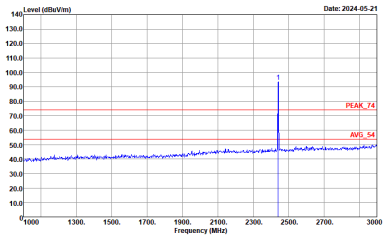
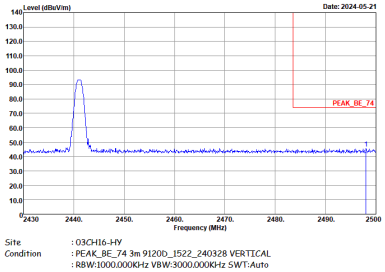
## 2.4GHz 2400~2483.5MHz

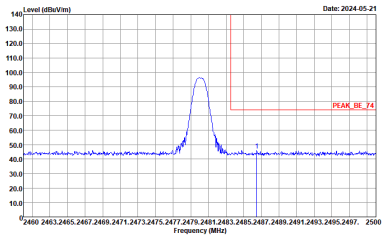
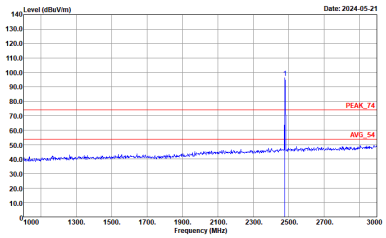
## BT (Band Edge @ 3m)

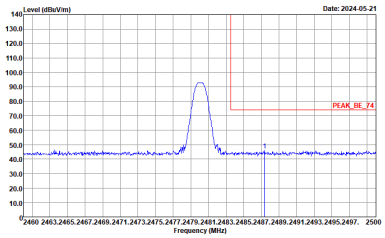
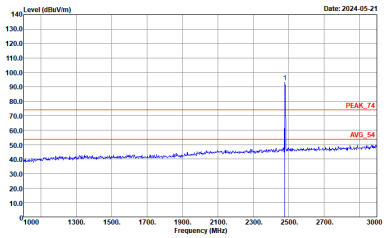
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH00 2402MHz | |
| | Horizontal | Fundamental |
| Peak |  |  |

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH00 2402MHz | |
| | Vertical | Fundamental |
| Peak |  |  |

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH39 2441MHz | |
| | Horizontal | Fundamental |
| Peak |  <br>Site : 03CH16-HY<br>Condition : PEAK_BE_74 3m 9120D_1522_240328 HORIZONTAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto |  <br>Site : 03CH16-HY<br>Condition : PEAK_74 3m 9120D_1522_240328 HORIZONTAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto |
| Peak |  <br>Site : 03CH16-HY<br>Condition : PEAK_BE_74 3m 9120D_1522_240328 HORIZONTAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto | Left blank |

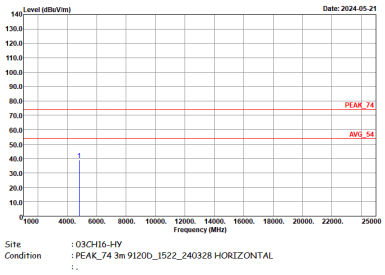
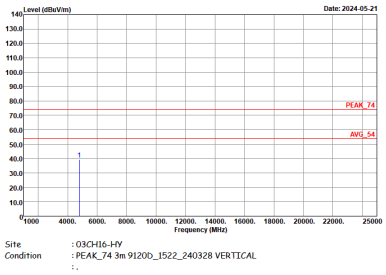
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH39 2441MHz | |
| | Vertical | Fundamental |
| Peak |  |  |
| Peak |  | Left blank |

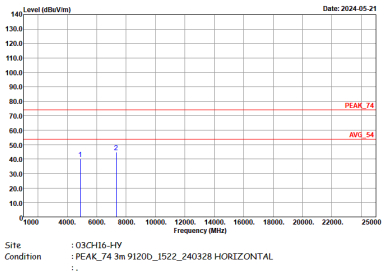
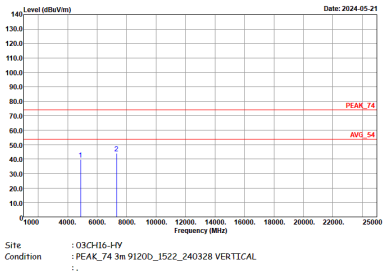
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH78 2480MHz | |
| | Horizontal | Fundamental |
| Peak |  |  |

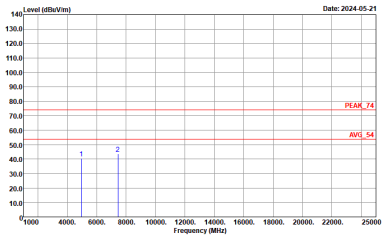
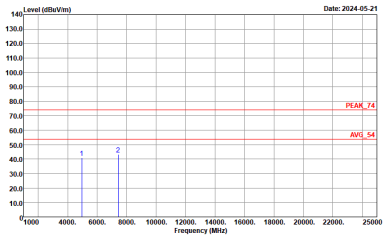
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH78 2480MHz | |
| | Vertical | Fundamental |
| Peak |  |  |

## 2.4GHz 2400~2483.5MHz

## BT (Harmonic @ 3m)

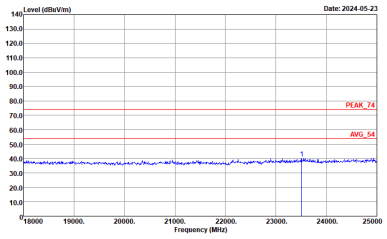
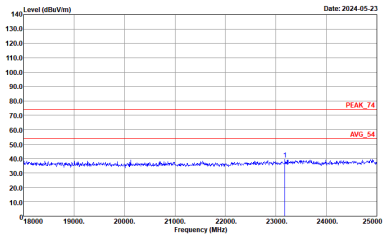
| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| ANT | BT CH00 2402MHz | |
| | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| ANT | BT CH39 2441MHz | |
| | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| ANT | BT CH78 2480MHz | |
| | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

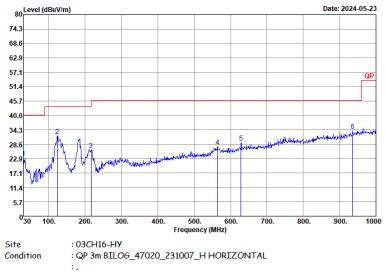
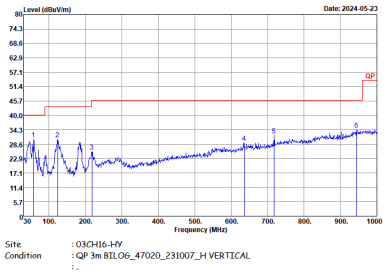
## Emission above 18GHz

## 2.4GHz BT (SHF @ 1m)

| BT | 2.4GHz 2400~2483.5MHz | |
|---|---|---|
| ANT | BT SHF | |
| | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

## Emission below 1GHz

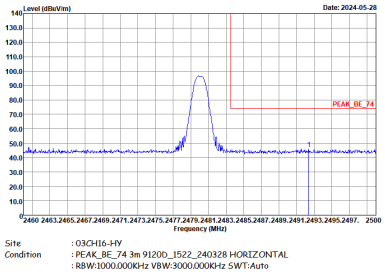
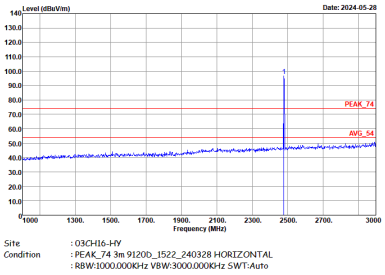
## 2.4GHz BT (LF)

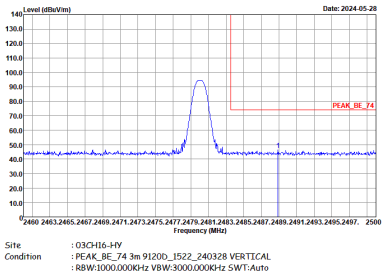
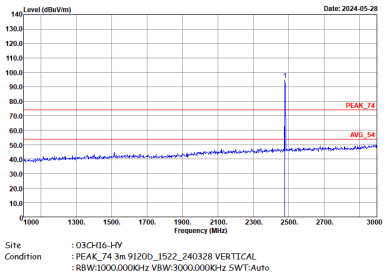
| BT | 2.4GHz 2400~2483.5MHz | |
|---|---|---|
| ANT | BT LF | |
| | Horizontal | Vertical |
| QP / Peak |  |  |

**<Sample 2>**

## 2.4GHz 2400~2483.5MHz

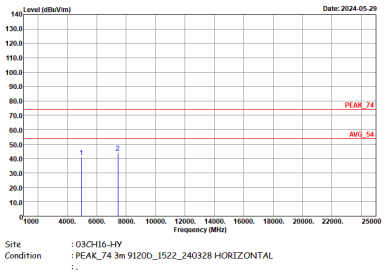
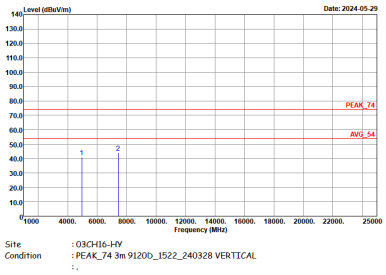
## BT (Band Edge @ 3m)

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH78 2480MHz | |
| | Horizontal | Fundamental |
| Peak |  |  |

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH78 2480MHz | |
| | Vertical | Fundamental |
| Peak |  |  |

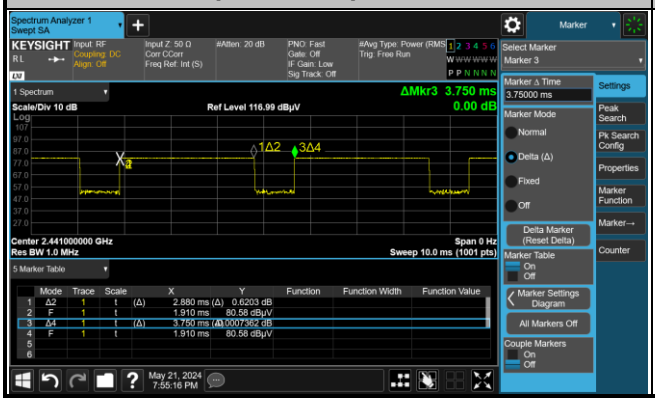
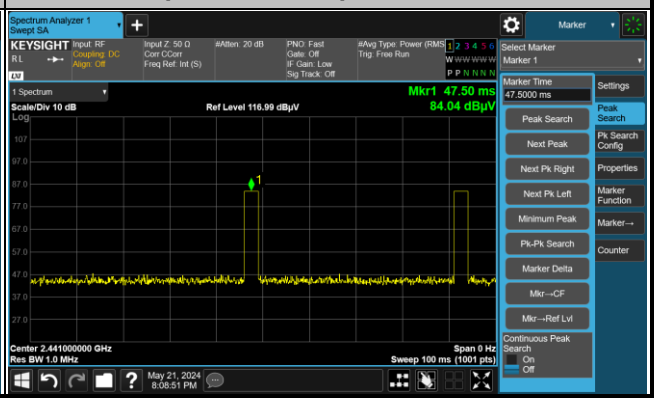
## 2.4GHz 2400~2483.5MHz

## BT (Harmonic @ 3m)

| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| ANT | BT CH78 2480MHz | |
| | Horizontal | Vertical |
| Peak<br>Avg. |  |  |

# Appendix E. Duty Cycle Plots

**<Sample 1>**

| DH5 on time (One Pulse) Plot on Channel 39 | on time (Count Pulses) Plot on Channel 39 |
|---|---|
|  |  |

**Note:**

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.88 / 100 = 5.76 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.79 dB
3. **DH5** has the highest duty cycle worst case and is reported.

**Duty Cycle Correction Factor Consideration for AFH mode:**

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the on time period to have DH5 packet completing one hopping sequence is

*2.88 ms x 20 channels = 57.6 ms*

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms / 57.6 ms ] = 2 hops

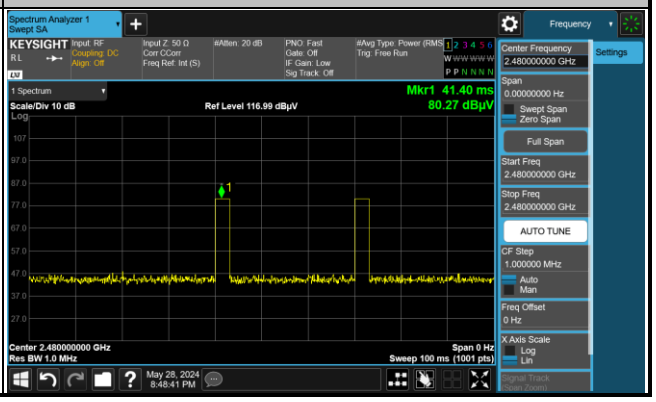
Thus, the maximum possible ON time:

*2.88 ms x 2 = 5.76 ms*

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

*20 x log(5.76 ms/100 ms) = -24.79 dB*

**<Sample 2>**

| DH5 on time (One Pulse) Plot on Channel 78 | on time (Count Pulses) Plot on Channel 78 |
|---|---|
| |  |



**Note:**

4. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.88 / 100 = 5.76 %
5. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.79 dB
6. **DH5** has the highest duty cycle worst case and is reported.

**Duty Cycle Correction Factor Consideration for AFH mode:**

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the on time period to have DH5 packet completing one hopping sequence is

*2.88 ms x 20 channels = 57.6 ms*

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms / 57.6 ms ] = 2 hops

Thus, the maximum possible ON time:

*2.88 ms x 2 = 5.76 ms*

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

*20 x log(5.76 ms/100 ms) = -24.79 dB*