



FCC RADIO TEST REPORT

FCC ID : UZ7BT000442B
Equipment : Rechargeable Li-Ion Battery
Brand Name : Zebra
Model Name : BT-000442B
Applicant : Zebra Technologies Corporation
1 Zebra Plaza, Holtsville, NY 11742
Manufacturer : Zebra Technologies Corporation
1 Zebra Plaza, Holtsville, NY 11742
Standard : FCC Part 15 Subpart C §15.247

The product was received on May 13, 2022 and testing was performed from May 21, 2022 to May 26, 2022. We, Sporton International Inc. EMC & Wireless Communications 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. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)



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History of this test report

| Report No. | Version | Description | Issue Date |
|------------|---------|-------------------------|---------------|
| FR221044 | 01 | Initial issue of report | Jun. 21, 2022 |
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Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---------------|--------------------|--|--------------------|---|
| 3.1 | 15.247(a)(2) | 6dB Bandwidth | Pass | - |
| 3.1 | 2.1049 | 99% Occupied Bandwidth | Reporting only | - |
| 3.2 | 15.247(b)(3) | Output Power | Pass | - |
| 3.3 | 15.247(e) | Power Spectral Density | Pass | - |
| 3.4 | 15.247(d) | Conducted Band Edges and Spurious Emission | Pass | - |
| 3.5 | 15.247(d) | Radiated Band Edges and Spurious Emission | Pass | 3.17 dB under the limit at 4804.000 MHz |
| 3.6 | 15.207 | AC Conducted Emission | Pass | 14.76 dB under the limit at 0.175 MHz |
| 3.7 | 15.203 & 15.247(b) | Antenna Requirement | Pass | - |

Declaration of Conformity:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Wei Chen

Report Producer: Kaye Yang



1 General Description

1.1 Product Feature of Equipment Under Test

| Product Feature | |
|---------------------------------|-----------------------------|
| Equipment | Rechargeable Li-Ion Battery |
| Brand Name | Zebra |
| Model Name | BT-000442B |
| FCC ID | UZ7BT000442B |
| EUT supports Radios application | Bluetooth - LE |
| HW Version | DV REV 05 |
| SW Version | V3.14 |
| MFD | 13APR22 |
| EUT Stage | Identical Prototype |

Remark: The above EUT's information was declared by manufacturer.

| Supported Unit Used in Test Configuration and System | | | | |
|--|------------|-------|-------------|-----------------|
| Terminal | Brand Name | Zebra | Model Name | TC5301 |
| Adapter | Brand Name | Zebra | Part Number | PWR-WUA5V12W0US |

1.2 Product Specification of Equipment Under Test

| Product Specification is subject to this standard | |
|---|--|
| Tx/Rx Frequency Range | 2402 MHz ~ 2480 MHz |
| Number of Channels | 40 |
| Carrier Frequency of Each Channel | 40 Channel (37 hopping + 3 advertising channel) |
| Maximum Output Power to Antenna | Bluetooth – LE (1Mbps): 0.60 dBm / 0.0011 W Bluetooth – LE (2Mbps): 0.60 dBm / 0.0011 W |
| 99% Occupied Bandwidth | 1.037 MHz for 1Mbps 2.050 MHz for 2Mbps |
| Antenna Type / Gain | PIFA Antenna type with gain 3.61 dBi |
| Type of Modulation | Bluetooth LE : GFSK |

Remark: The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

1.3 Modification of EUT

No modifications made to the EUT during the testing.



1.4 Testing Location

| | |
|---------------------------|---|
| Test Site | Sporton International Inc. EMC & Wireless Communications Laboratory |
| Test Site Location | No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978 |
| Test Site No. | Sporton Site No. CO05-HY, 03CH07-HY |

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., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855 |
| Test Site No. | Sporton Site No. TH05-HY (TAF Code: 3786) |
| Remark | The RF Conducted Measurement test item subcontracted to Sporton International Inc. Wensan Laboratory. |

FCC designation No.: TW1190 and TW3786

1.5 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 DTS 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) |
|-----------------|---------|-------------|---------|-------------|
| 2400-2483.5 MHz | 0 | 2402 | 21 | 2444 |
| | 1 | 2404 | 22 | 2446 |
| | 2 | 2406 | 23 | 2448 |
| | 3 | 2408 | 24 | 2450 |
| | 4 | 2410 | 25 | 2452 |
| | 5 | 2412 | 26 | 2454 |
| | 6 | 2414 | 27 | 2456 |
| | 7 | 2416 | 28 | 2458 |
| | 8 | 2418 | 29 | 2460 |
| | 9 | 2420 | 30 | 2462 |
| | 10 | 2422 | 31 | 2464 |
| | 11 | 2424 | 32 | 2466 |
| | 12 | 2426 | 33 | 2468 |
| | 13 | 2428 | 34 | 2470 |
| | 14 | 2430 | 35 | 2472 |
| | 15 | 2432 | 36 | 2474 |
| | 16 | 2434 | 37 | 2476 |
| | 17 | 2436 | 38 | 2478 |
| | 18 | 2438 | 39 | 2480 |
| | 19 | 2440 | - | - |
| 20 | 2442 | - | - | |



2.2 Test Mode

| Channel | Frequency | Bluetooth – LE RF Average Output Power | |
|---------|-----------|--|--|
| | | Data Rate / Modulation | |
| | | GFSK | |
| | | 1Mbps | |
| Ch00 | 2402MHz | 0.30 dBm | |
| Ch19 | 2440MHz | 0.50 dBm | |
| Ch39 | 2480MHz | 0.60 dBm | |

| Channel | Frequency | Bluetooth – LE RF Average Output Power | |
|---------|-----------|--|--|
| | | Data Rate / Modulation | |
| | | GFSK | |
| | | 2Mbps | |
| Ch00 | 2402MHz | 0.30 dBm | |
| Ch19 | 2440MHz | 0.50 dBm | |
| Ch39 | 2480MHz | 0.60 dBm | |

- 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 find Z plane as worst plane.

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

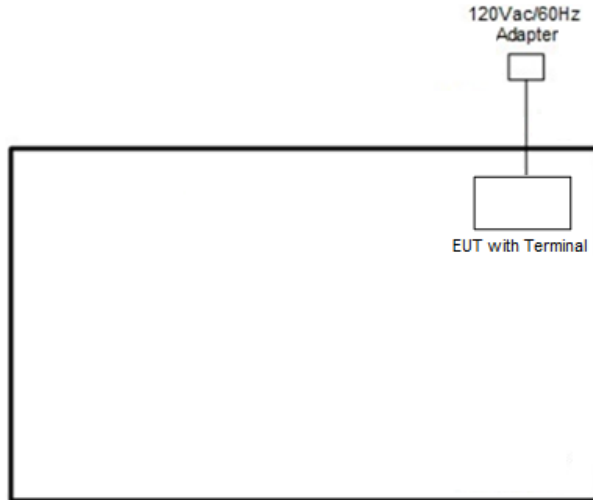


The following summary table is showing all test modes to demonstrate in compliance with the standard.

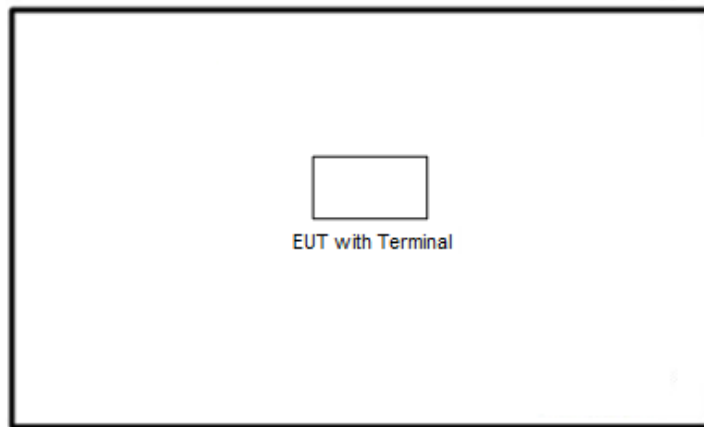
| Summary table of Test Cases | |
|------------------------------|---|
| Test Item | Data Rate / Modulation |
| Conducted Test Cases | Bluetooth – LE / GFSK |
| | Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps |
| | Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps |
| | Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps |
| | Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps |
| | Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps |
| | Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps |
| Radiated Test Cases | Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps |
| | Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps |
| | Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps |
| | Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps |
| | Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps |
| | Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps |
| AC Conducted Emission | Mode 1: EUT with Terminal + Bluetooth - LE Link + Adapter |

2.3 Connection Diagram of Test System

<AC Conducted Emission Mode>



<Bluetooth – LE Tx Mode>





2.4 EUT Operation Test Setup

The RF test items, utility “Cmd Version 1.0.39” 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.

2.5 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.

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
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. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) $\geq 3 * RBW$.
6. Measure and record the results in the test report.

3.1.4 Test Setup





3.1.5 Test Result of 6dB Bandwidth

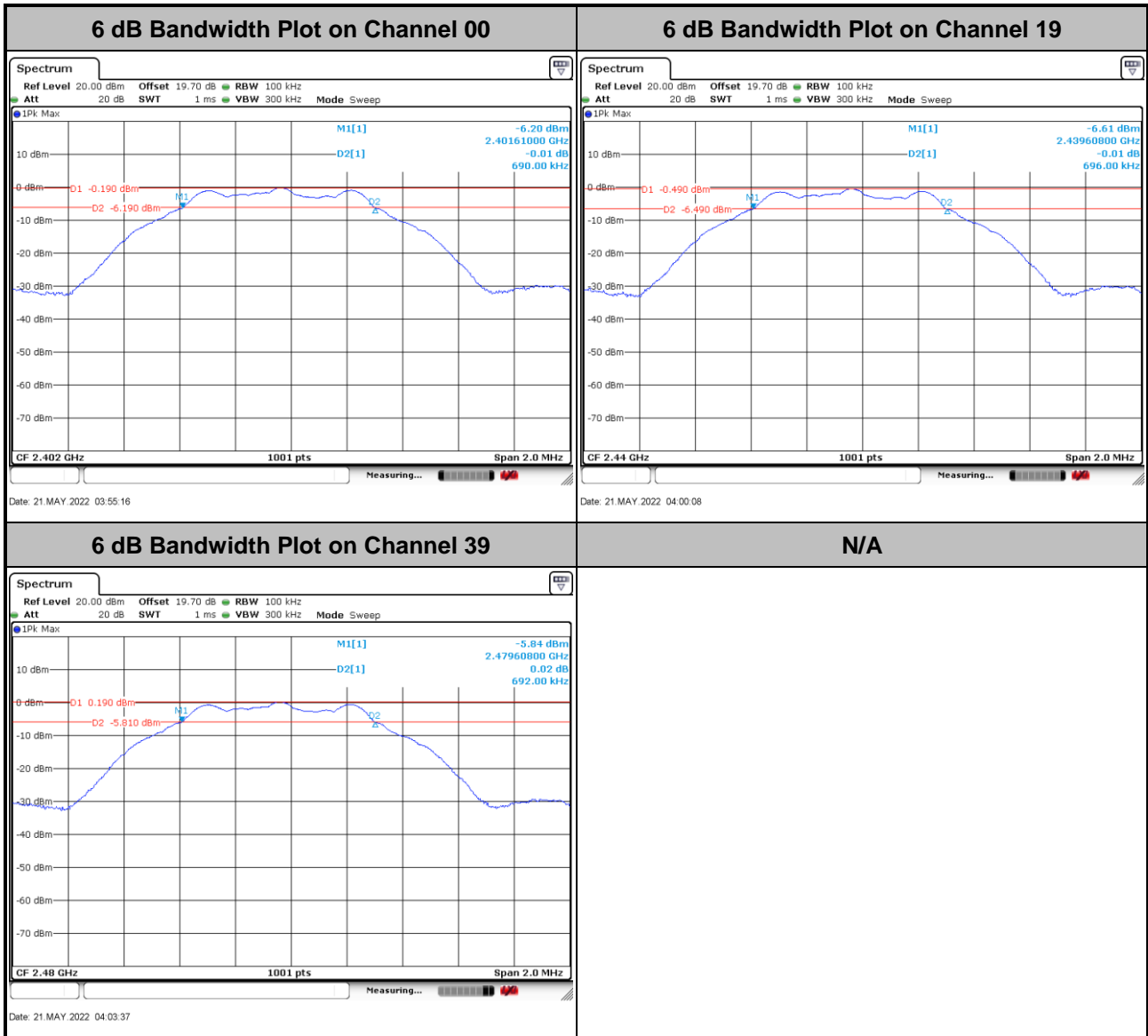
| | | | |
|-----------------|----------|---------------------|---------|
| Test Engineer : | Hank Hsu | Temperature : | 21~25°C |
| | | Relative Humidity : | 51~54% |

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 6dB BW (MHz) | 6dB BW Limit (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|--------------|--------------------|-----------|
| BLE | 1Mbps | 1 | 0 | 2402 | 0.690 | 0.50 | Pass |
| BLE | 1Mbps | 1 | 19 | 2440 | 0.696 | 0.50 | Pass |
| BLE | 1Mbps | 1 | 39 | 2480 | 0.692 | 0.50 | Pass |

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 6dB BW (MHz) | 6dB BW Limit (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|--------------|--------------------|-----------|
| BLE | 2Mbps | 1 | 0 | 2402 | 1.144 | 0.50 | Pass |
| BLE | 2Mbps | 1 | 19 | 2440 | 1.144 | 0.50 | Pass |
| BLE | 2Mbps | 1 | 39 | 2480 | 1.148 | 0.50 | Pass |

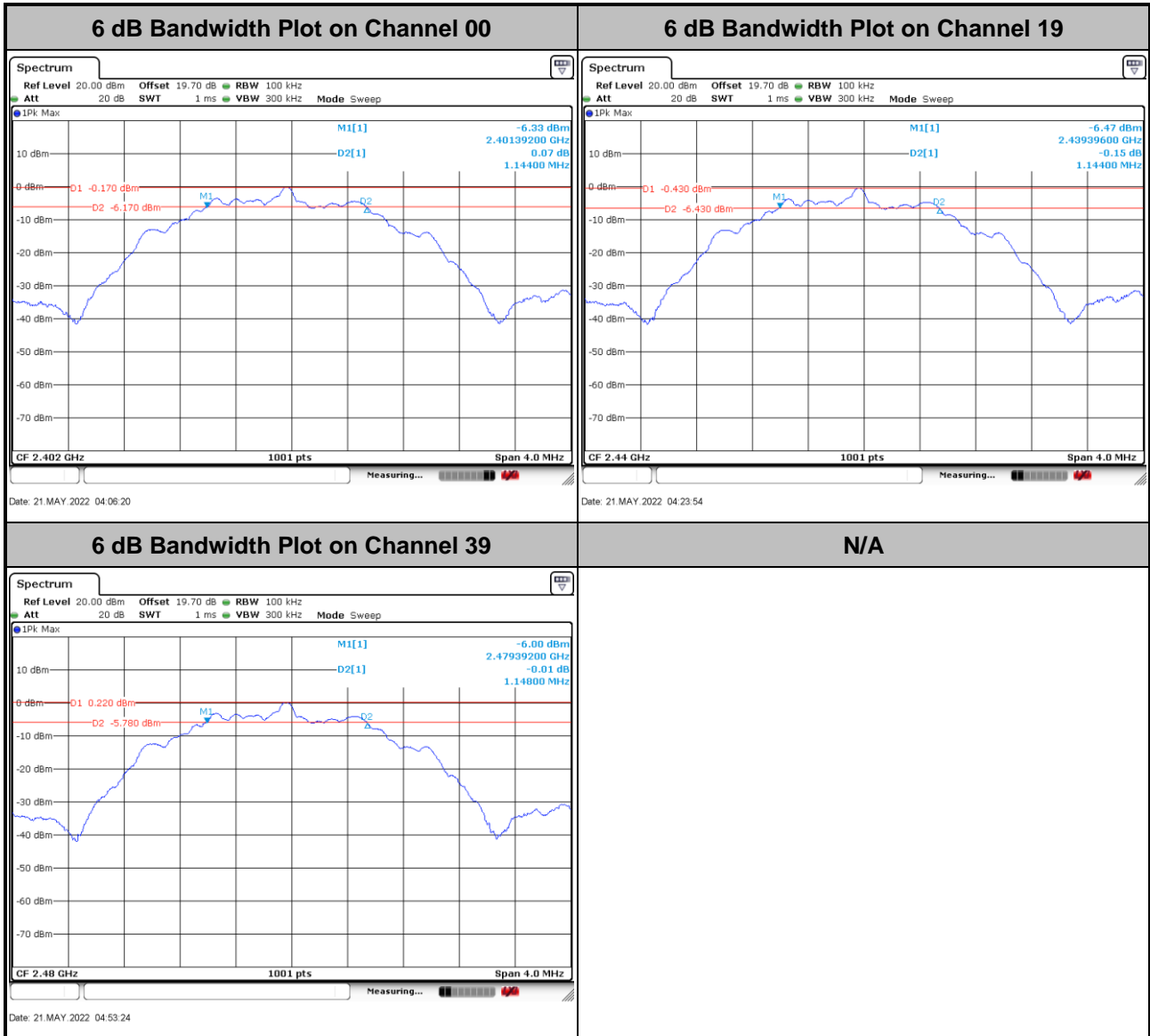


<1Mbps>





<2Mbps>





3.1.6 Test Result of 99% Occupied Bandwidth

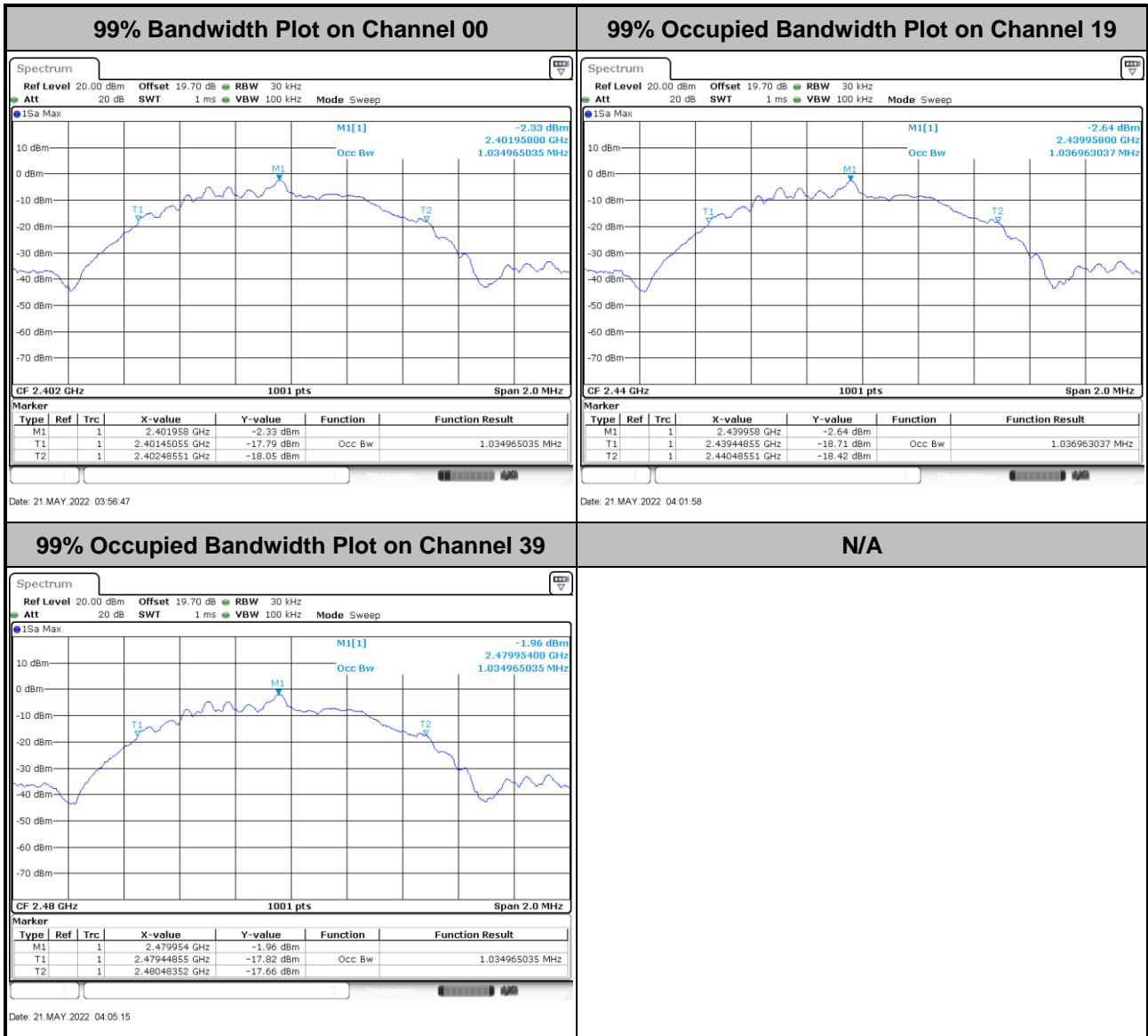
| | | | |
|-----------------|----------|---------------------|---------|
| Test Engineer : | Hank Hsu | Temperature : | 21~25°C |
| | | Relative Humidity : | 51~54% |

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 99% Occupied BW (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|-----------------------|-----------|
| BLE | 1Mbps | 1 | 0 | 2402 | 1.035 | Pass |
| BLE | 1Mbps | 1 | 19 | 2440 | 1.037 | Pass |
| BLE | 1Mbps | 1 | 39 | 2480 | 1.035 | Pass |

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 99% Occupied BW (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|-----------------------|-----------|
| BLE | 2Mbps | 1 | 0 | 2402 | 2.038 | Pass |
| BLE | 2Mbps | 1 | 19 | 2440 | 2.038 | Pass |
| BLE | 2Mbps | 1 | 39 | 2480 | 2.050 | Pass |



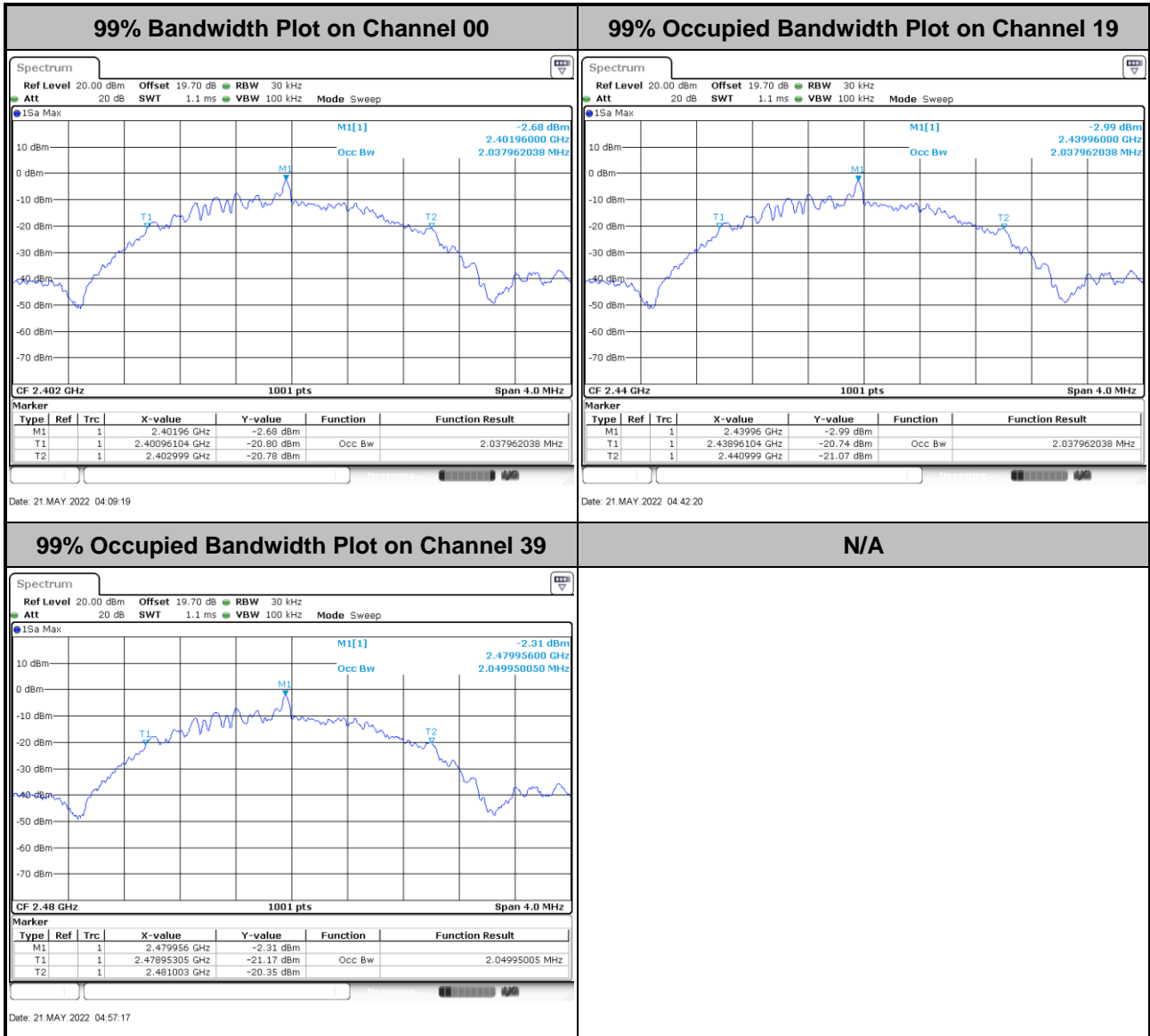
<1Mbps>



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



<2Mbps>



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5 MHz, the limit for output power is 30 dBm. If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

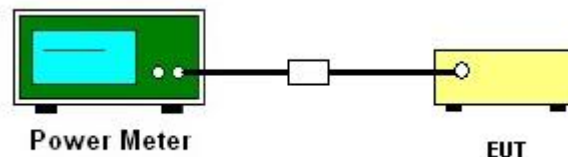
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT is connected to the power meter by RF cable and attenuator.
3. The path loss is compensated to the results for each measurement.
4. Set the maximum power setting and enable the EUT to transmit continuously.
5. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup





3.2.5 Test Result of Average Output Power

| | | | |
|-----------------|----------|---------------------|---------|
| Test Engineer : | Hank Hsu | Temperature : | 21~25°C |
| | | Relative Humidity : | 51~54% |

| Mod. | Data Rate | N _{TX} | CH. | Freq. (MHz) | Average Conducted Power (dBm) | Conducted Power Limit (dBm) | DG (dBi) | EIRP Power (dBm) | EIRP Power Limit (dBm) | Pass /Fail |
|------|-----------|-----------------|-----|-------------|-------------------------------|-----------------------------|----------|------------------|------------------------|------------|
| BLE | 1Mbps | 1 | 0 | 2402 | 0.30 | 30.00 | 3.61 | 3.91 | 36.00 | Pass |
| BLE | 1Mbps | 1 | 19 | 2440 | 0.50 | 30.00 | 3.61 | 4.11 | 36.00 | Pass |
| BLE | 1Mbps | 1 | 39 | 2480 | 0.60 | 30.00 | 3.61 | 4.21 | 36.00 | Pass |

| Mod. | Data Rate | N _{TX} | CH. | Freq. (MHz) | Average Conducted Power (dBm) | Conducted Power Limit (dBm) | DG (dBi) | EIRP Power (dBm) | EIRP Power Limit (dBm) | Pass /Fail |
|------|-----------|-----------------|-----|-------------|-------------------------------|-----------------------------|----------|------------------|------------------------|------------|
| BLE | 2Mbps | 1 | 0 | 2402 | 0.30 | 30.00 | 3.61 | 3.91 | 36.00 | Pass |
| BLE | 2Mbps | 1 | 19 | 2440 | 0.50 | 30.00 | 3.61 | 4.11 | 36.00 | Pass |
| BLE | 2Mbps | 1 | 39 | 2480 | 0.60 | 30.00 | 3.61 | 4.21 | 36.00 | Pass |

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

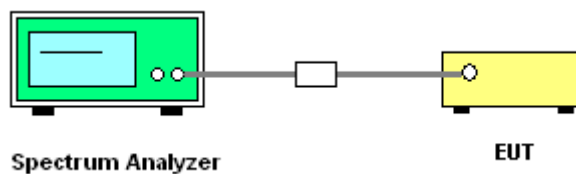
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
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. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth (VBW) = 10 kHz. In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6 dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. The Measured power density (dBm)/ 100 kHz is a reference level and is used as 20 dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

3.3.4 Test Setup





3.3.5 Test Result of Power Spectral Density

| | | | |
|-----------------|----------|---------------------|---------|
| Test Engineer : | Hank Hsu | Temperature : | 21~25°C |
| | | Relative Humidity : | 51~54% |

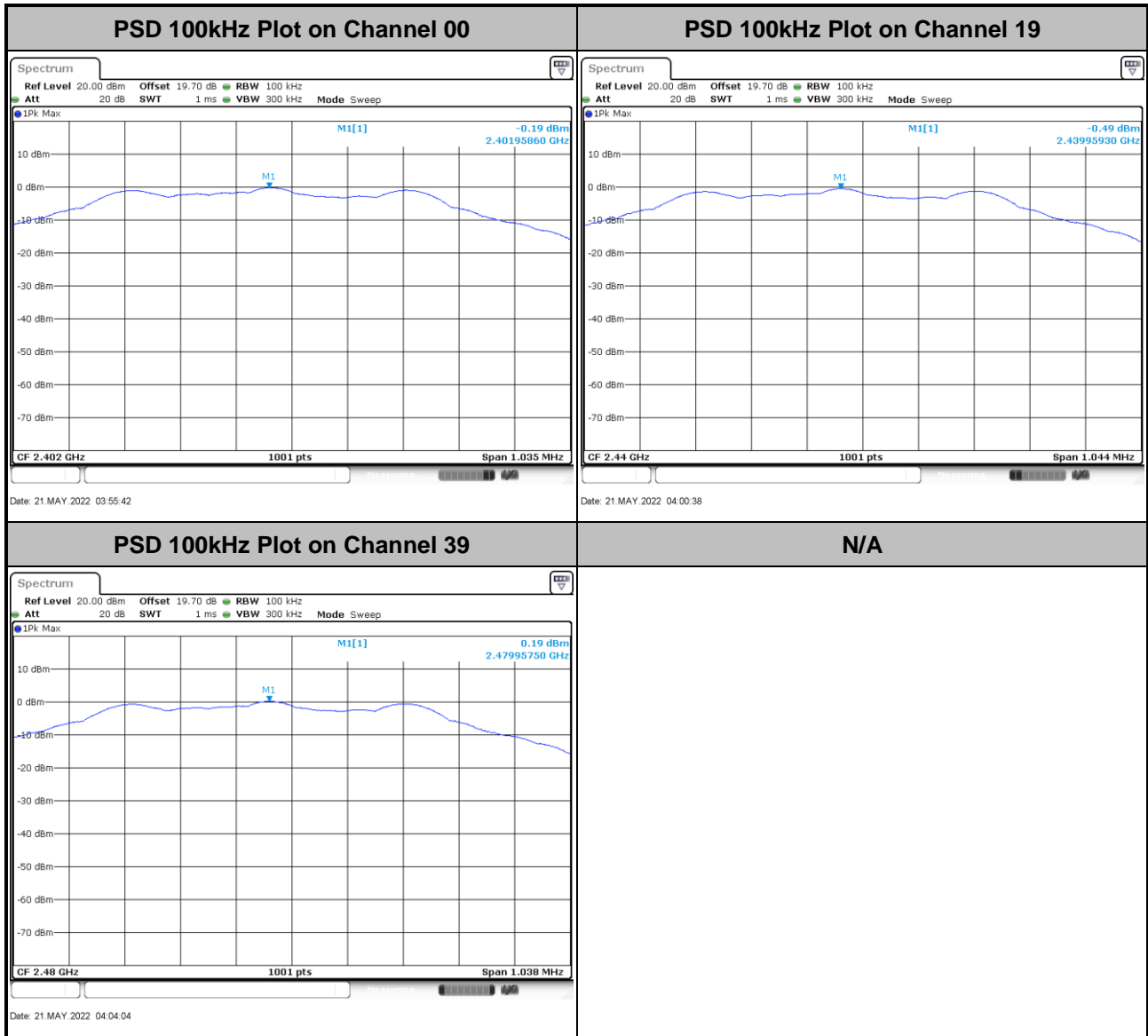
| Mod. | Data Rate | N _{TX} | CH. | Freq. (MHz) | Peak PSD (dBm /100kHz) | Peak PSD (dBm /3kHz) | DG (dBi) | Peak PSD Limit (dBm /3kHz) | Pass/Fail |
|------|-----------|-----------------|-----|-------------|------------------------|----------------------|----------|----------------------------|-----------|
| BLE | 1Mbps | 1 | 0 | 2402 | -0.19 | -15.43 | 3.61 | 8.00 | Pass |
| BLE | 1Mbps | 1 | 19 | 2440 | -0.49 | -15.66 | 3.61 | 8.00 | Pass |
| BLE | 1Mbps | 1 | 39 | 2480 | 0.19 | -14.96 | 3.61 | 8.00 | Pass |

| Mod. | Data Rate | N _{TX} | CH. | Freq. (MHz) | Peak PSD (dBm /100kHz) | Peak PSD (dBm /3kHz) | DG (dBi) | Peak PSD Limit (dBm /3kHz) | Pass/Fail |
|------|-----------|-----------------|-----|-------------|------------------------|----------------------|----------|----------------------------|-----------|
| BLE | 2Mbps | 1 | 0 | 2402 | -0.19 | -17.85 | 3.61 | 8.00 | Pass |
| BLE | 2Mbps | 1 | 19 | 2440 | -0.46 | -18.20 | 3.61 | 8.00 | Pass |
| BLE | 2Mbps | 1 | 39 | 2480 | 0.19 | -17.54 | 3.61 | 8.00 | Pass |



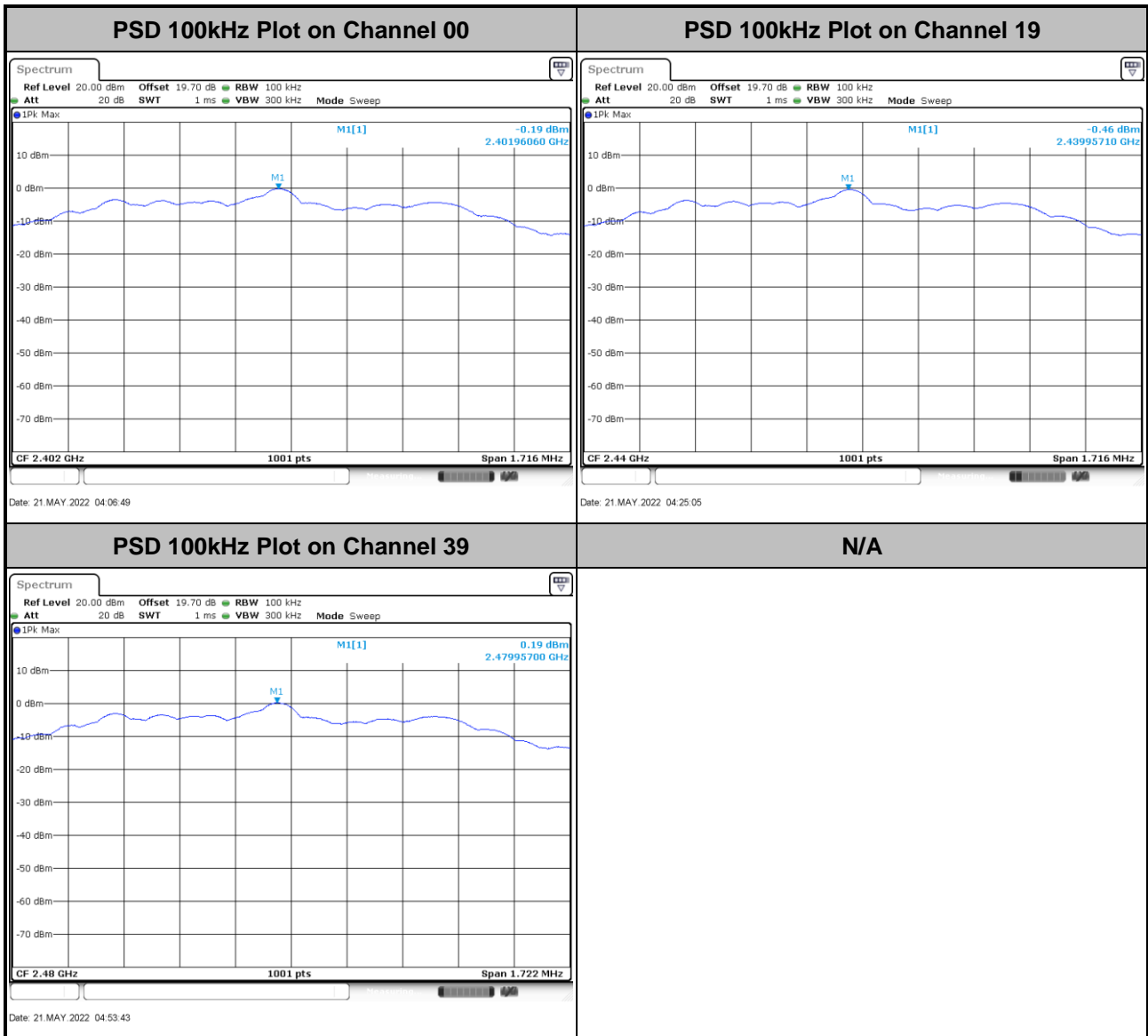
3.3.6 Test Result of Power Spectral Density Plots (100kHz)

<1Mbps>





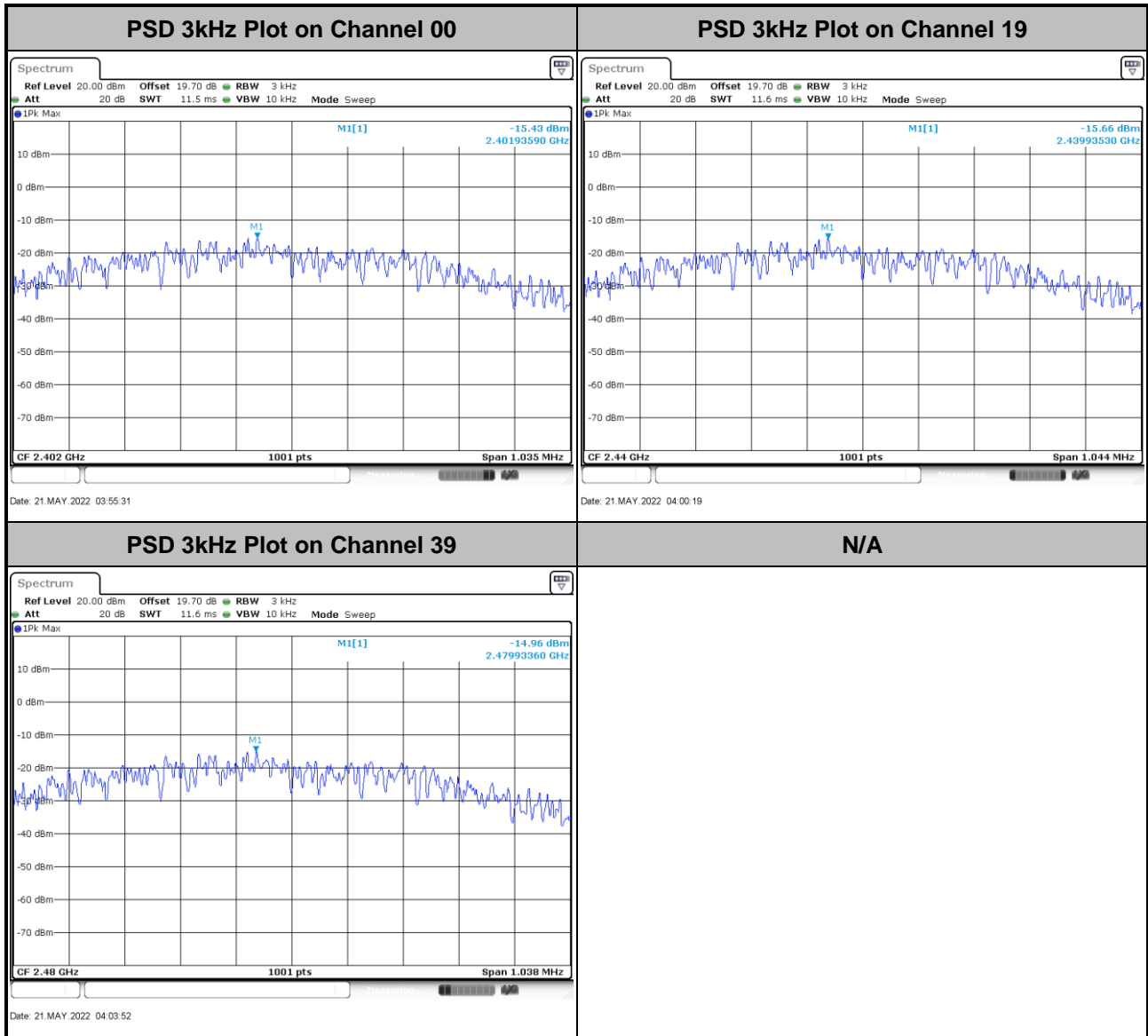
<2Mbps>





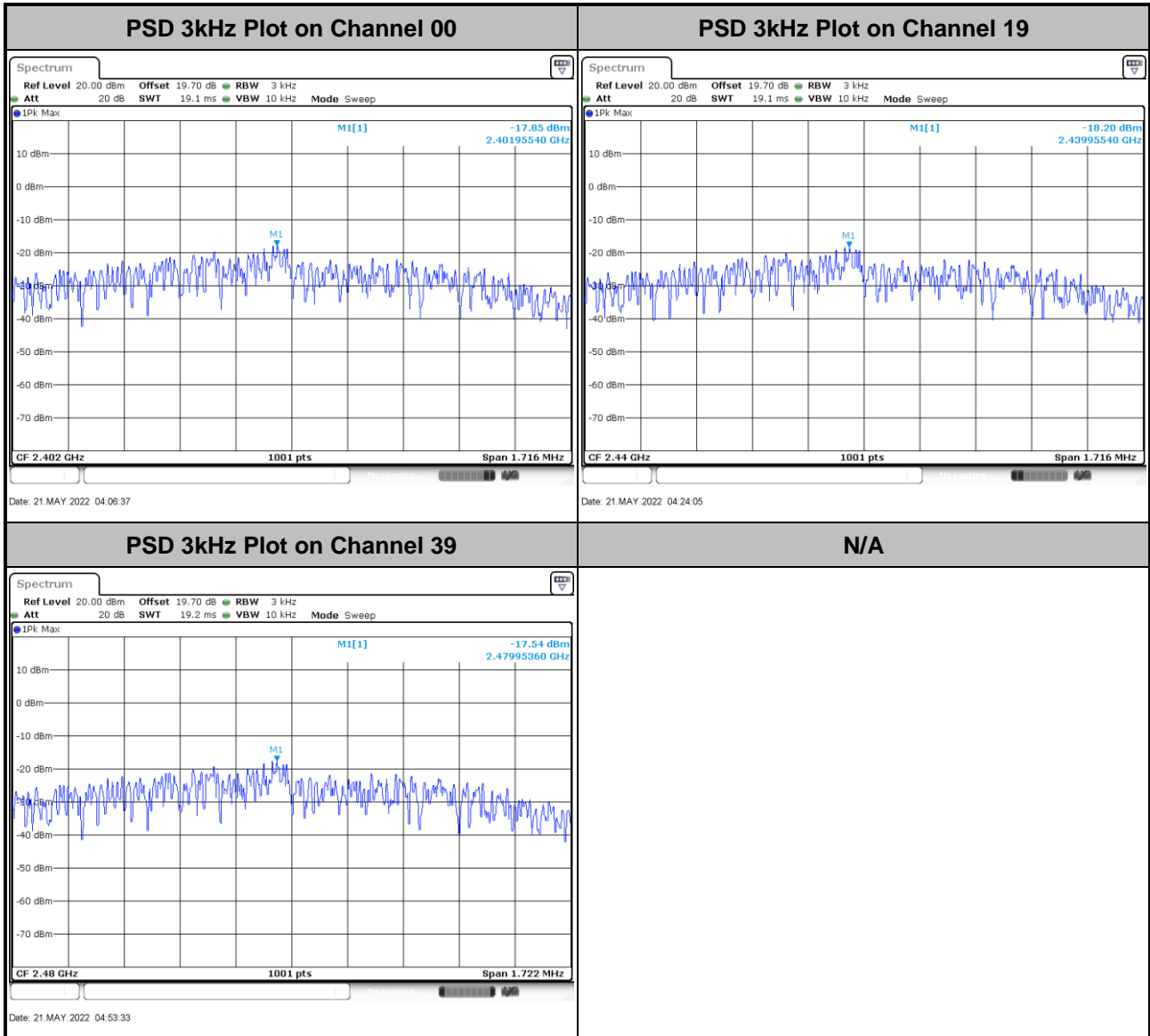
3.3.7 Test Result of Power Spectral Density Plots (3kHz)

<1Mbps>





<2Mbps>



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

3.4.2 Measuring Instruments

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

3.4.3 Test Procedure

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
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, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
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.

3.4.4 Test Setup

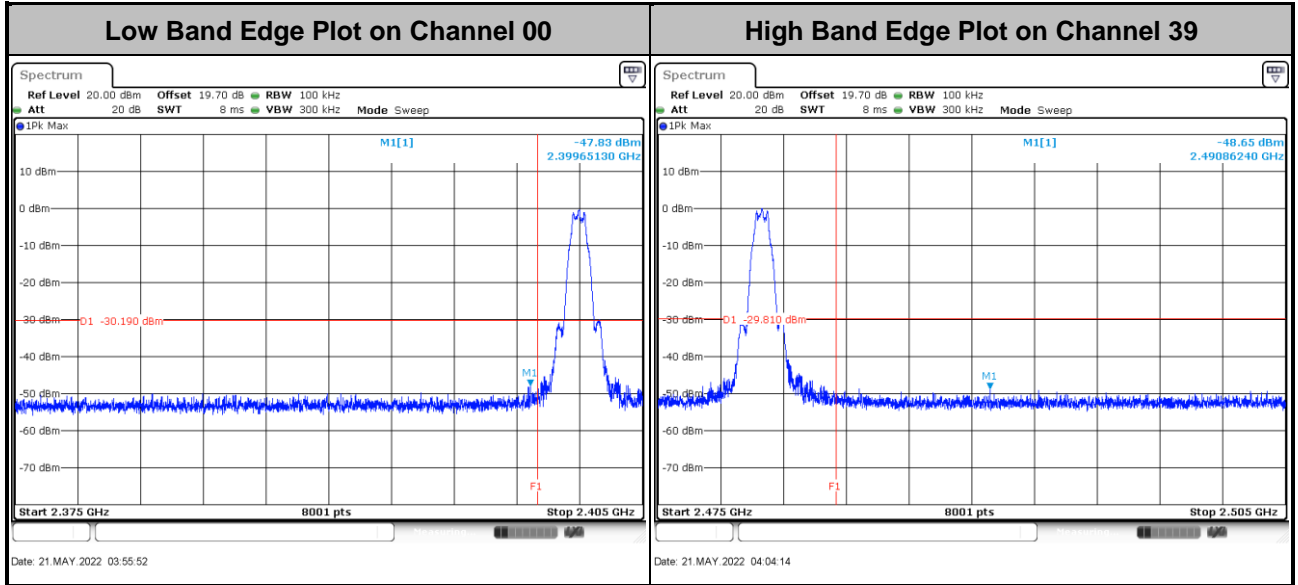




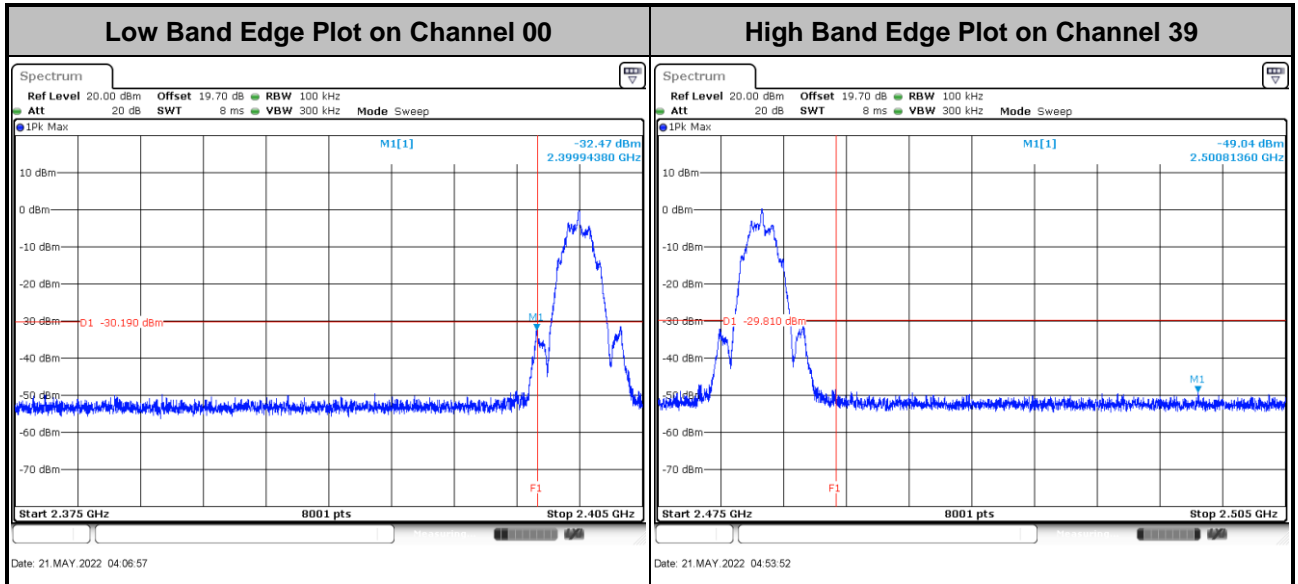
3.4.5 Test Result of Conducted Band Edges Plots

| | | | |
|-----------------|----------|---------------------|---------|
| Test Engineer : | Hank Hsu | Temperature : | 21~25°C |
| | | Relative Humidity : | 51~54% |

<1Mbps>



<2Mbps>

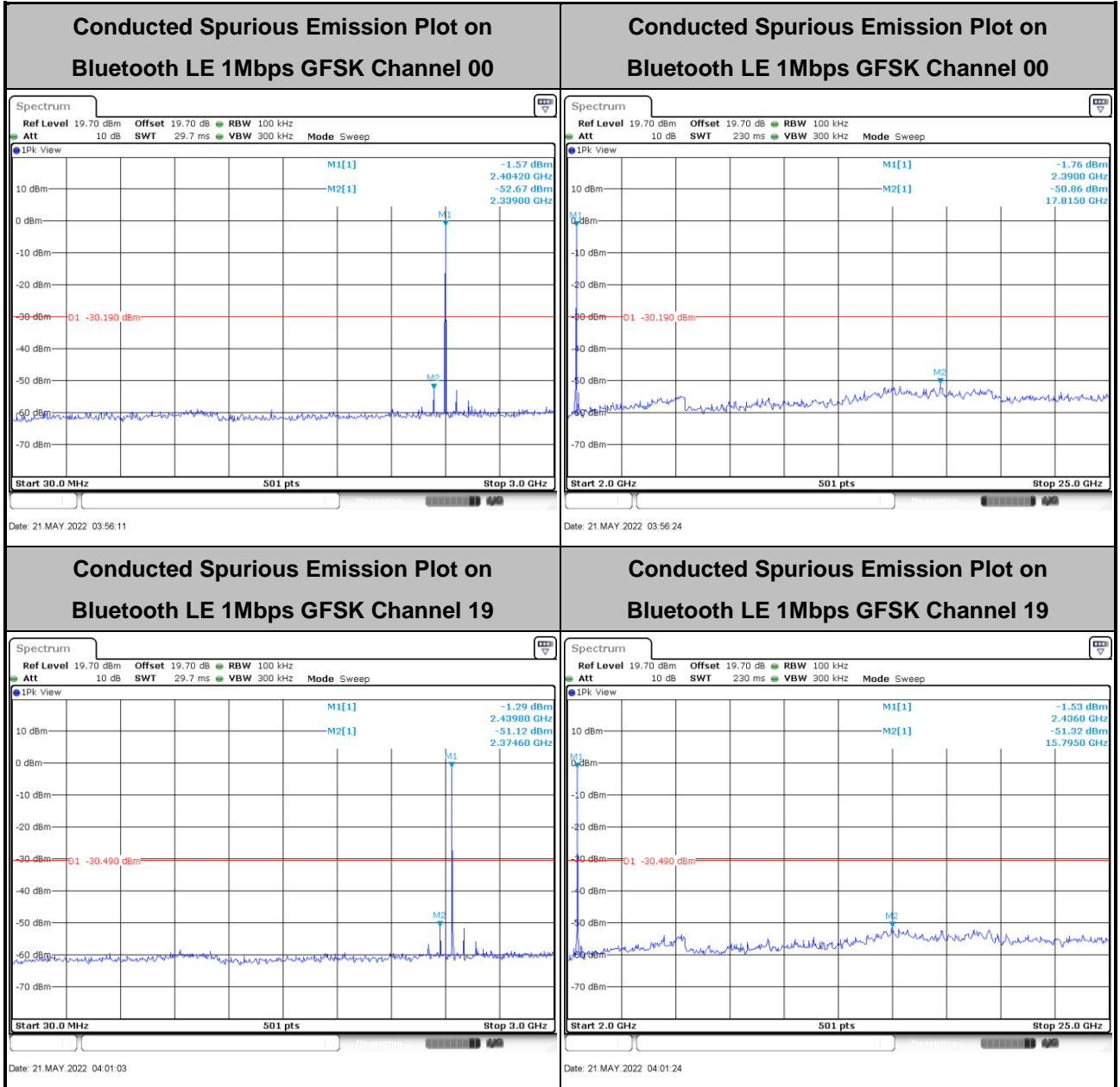


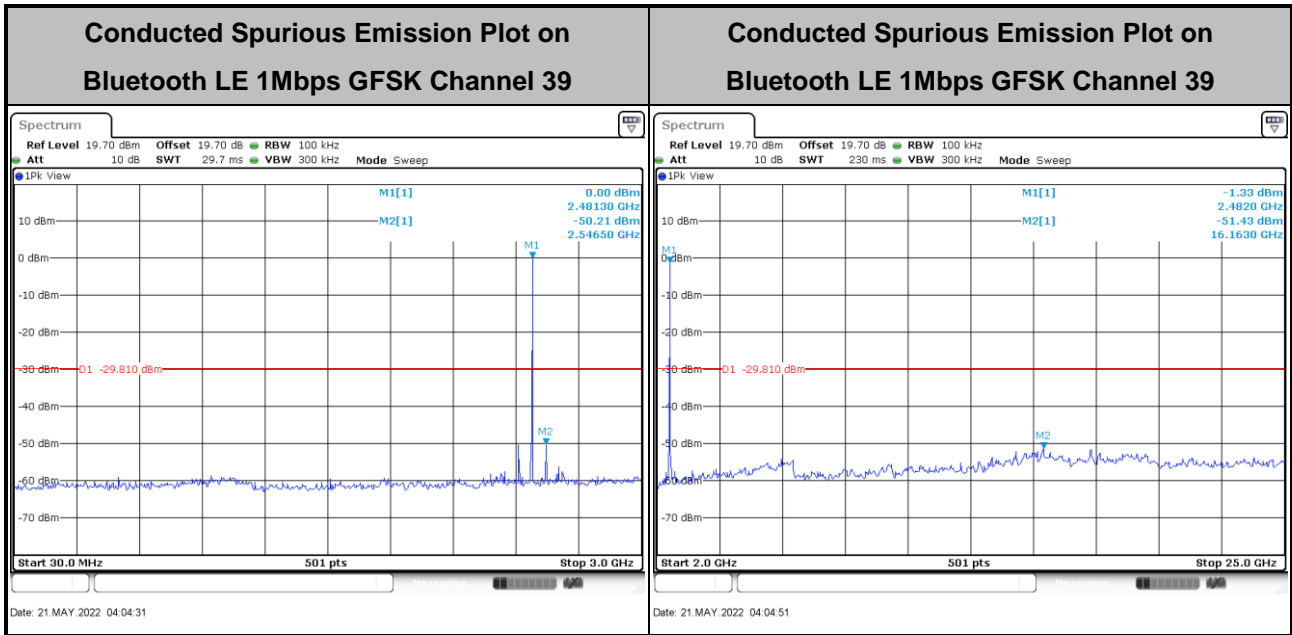


3.4.6 Test Result of Conducted Spurious Emission Plots

| | | | |
|-----------------|----------|---------------------|---------|
| Test Engineer : | Hank Hsu | Temperature : | 21~25°C |
| | | Relative Humidity : | 51~54% |

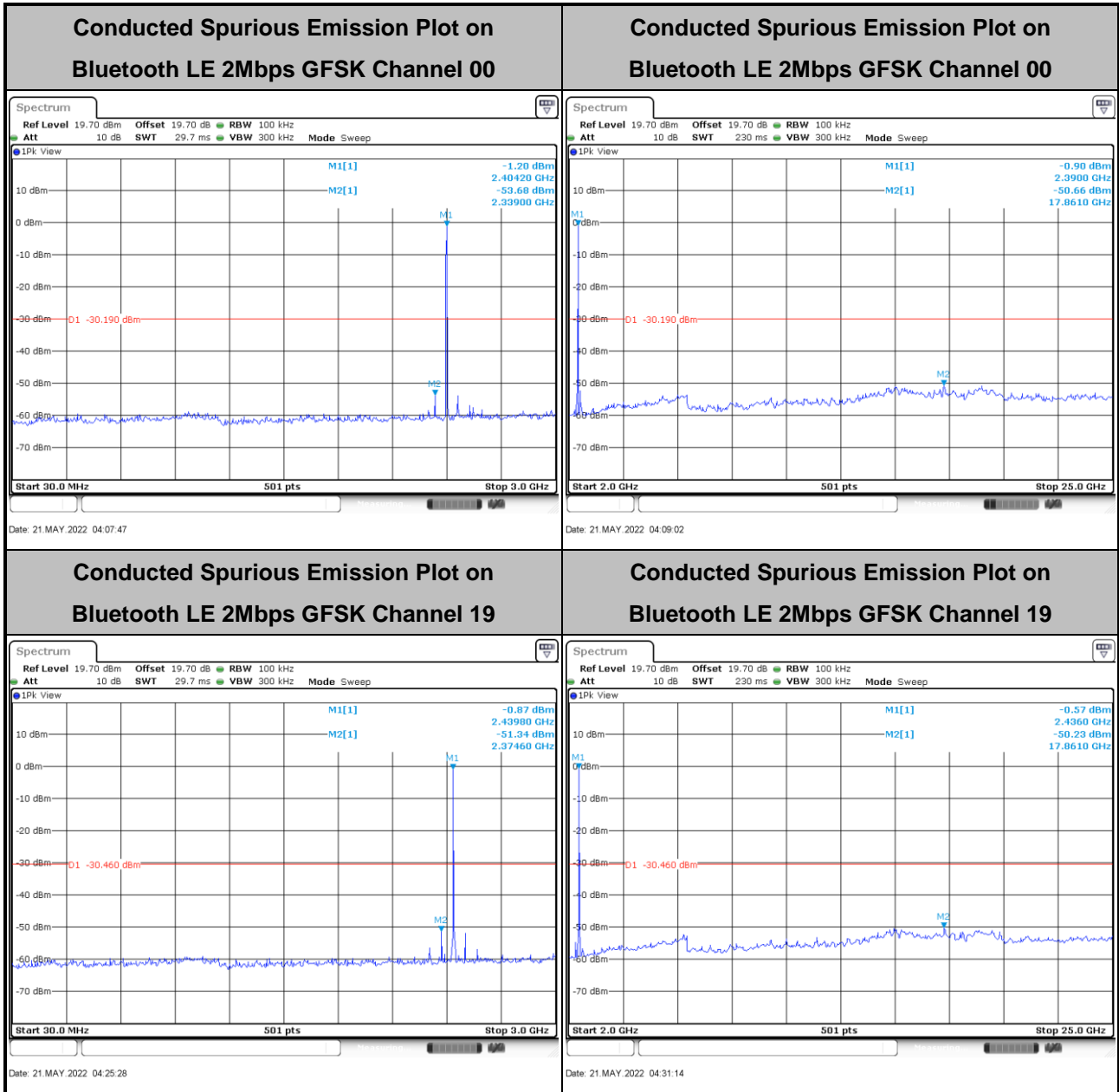
<1Mbps>

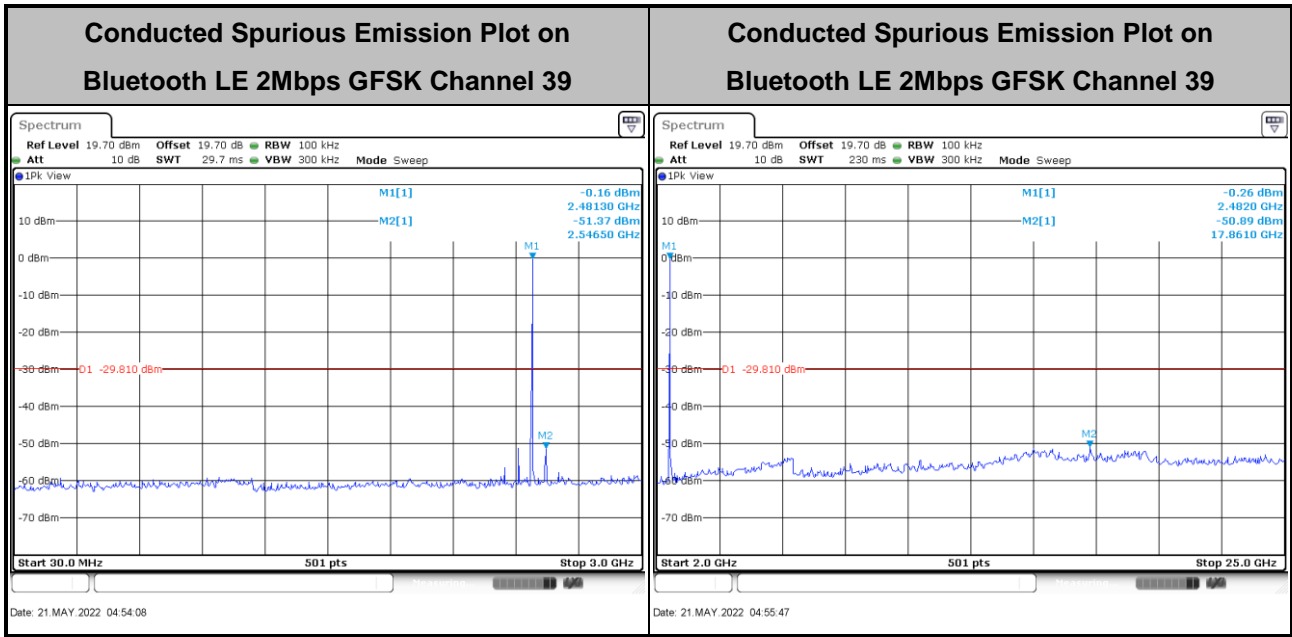






<2Mbps>







3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 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. If the output power of this device is measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. 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 |

3.5.2 Measuring Instruments

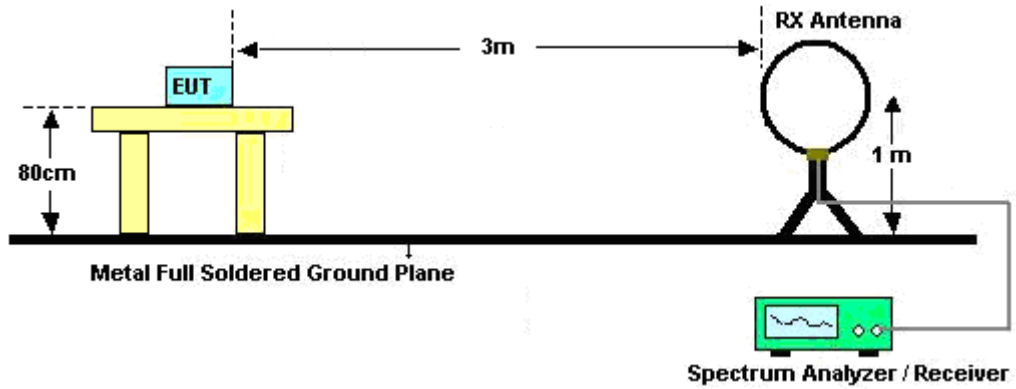
Please refer to the measuring equipment list in this test report.

**3.5.3 Test Procedures**

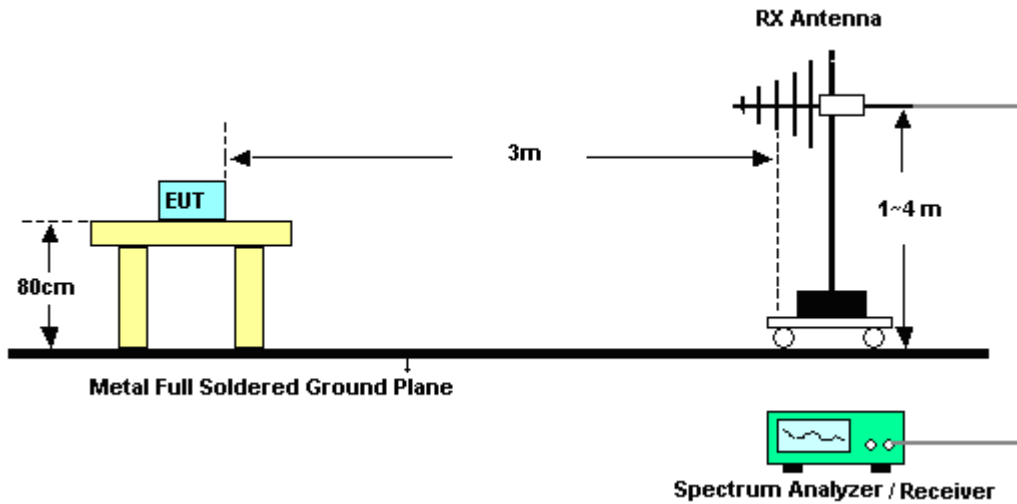
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. 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.
4. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. 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 “-”.
7. 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 “-”.
8. 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; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW = 3 MHz for $f \geq 1$ GHz for peak measurement.
For average measurement:
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

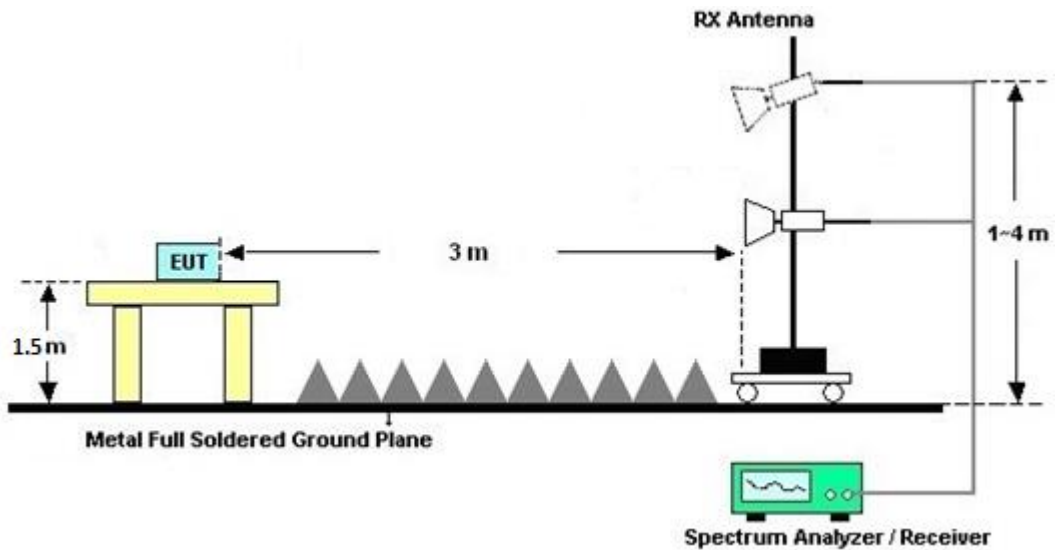
For radiated test below 30MHz



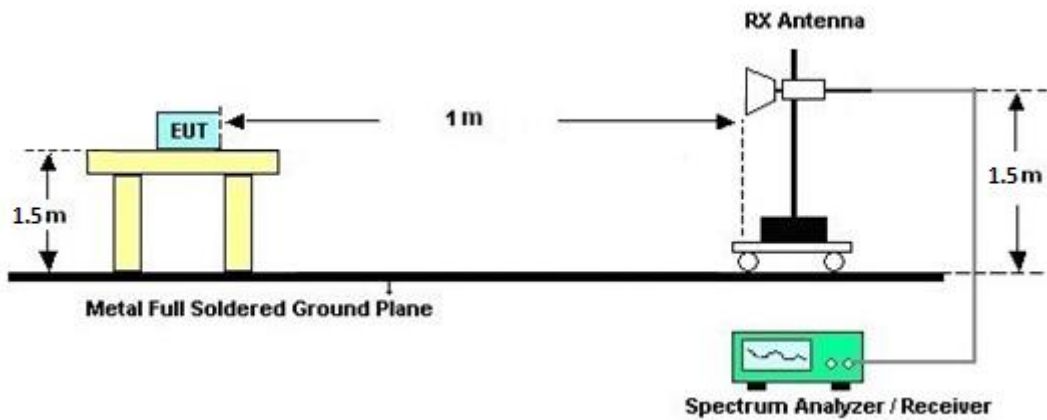
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.5.5 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.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.5.7 Duty Cycle

Please refer to Appendix D.

3.5.8 Test Result of Radiated Spurious Emission (30 MHz ~ 10th Harmonic)

Please refer to Appendix B and C.



3.6 AC Conducted Emission Measurement

3.6.1 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 (dB μ V) | |
|-----------------------------|------------------------------|-----------|
| | 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.

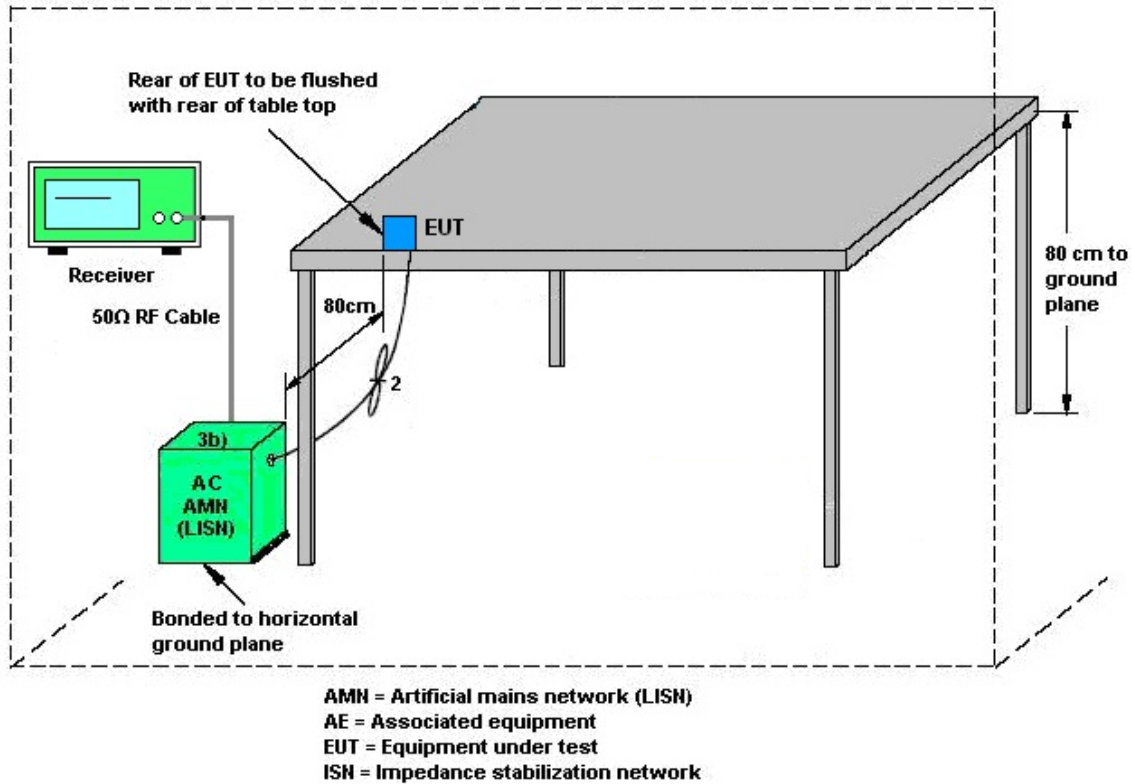
3.6.2 Measuring Instruments

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

3.6.3 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.

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix A.



3.7 Antenna Requirements

3.7.1 Standard Applicable

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. 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.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.



4 List of Measuring Equipment

| Instrument | Brand Name | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|---------------------------|-----------------|-----------------------------------|----------------------------|----------------------|------------------|--------------|---------------|-----------------------|
| Hygrometer | TECEPEL | DTM-303A | TP201996 | N/A | Nov. 16, 2021 | May 21, 2022 | Nov. 15, 2022 | Conducted (TH05-HY) |
| Power Sensor | DARE | RPR3006W | 16I00054SNO 12 (NO:113) | 10MHz~6GHz | Dec. 16, 2021 | May 21, 2022 | Dec. 15, 2022 | Conducted (TH05-HY) |
| Signal Analyzer | Rohde & Schwarz | FSV40 | 101566 | 10Hz~40GHz | Aug. 30, 2021 | May 21, 2022 | Aug. 29, 2022 | Conducted (TH05-HY) |
| Switch Control Mainframe | E-IUSTRUMENT | ETF-1405-0 | EC1900067 (BOX7) | N/A | Aug. 12, 2021 | May 21, 2022 | Aug. 11, 2022 | Conducted (TH05-HY) |
| Bilog Antenna | TESEQ | CBL 6111D & 00800N1D01N -06 | 35419 & 03 | 30MHz~1GHz | Apr. 24, 2022 | May 23, 2022 | Apr. 23, 2023 | Radiation (03CH07-HY) |
| Double Ridge Horn Antenna | ESCO | 3117 | 00075962 | 1GHz ~ 18GHz | Dec. 03, 2021 | May 23, 2022 | Dec. 02, 2022 | Radiation (03CH07-HY) |
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100315 | 9 kHz~30 MHz | Jan. 07, 2022 | May 23, 2022 | Jan. 06, 2023 | Radiation (03CH07-HY) |
| Preamplifier | MITEQ | AMF-7D-0010 1800-30-10P | 1590075 | 1GHz~18GHz | Apr. 21, 2022 | May 23, 2022 | Apr. 20, 2023 | Radiation (03CH07-HY) |
| Preamplifier | COM-POWER | PA-103A | 161241 | 10MHz~1GHz | Oct. 04, 2021 | May 23, 2022 | Oct. 03, 2022 | Radiation (03CH07-HY) |
| Preamplifier | Agilent | 8449B | 3008A02362 | 1GHz~26.5GHz | Oct. 04, 2021 | May 23, 2022 | Oct. 03, 2022 | Radiation (03CH07-HY) |
| Preamplifier | EMEC | EM18G40G | 0600789 | 18-40GHz | Jul. 23, 2021 | May 23, 2022 | Jul. 22, 2022 | Radiation (03CH07-HY) |
| Spectrum Analyzer | Agilent | N9030A | MY52350276 | 3Hz~44GHz | Jul. 22, 2021 | May 23, 2022 | Jul. 21, 2022 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY15682/4 | 30MHz to 18GHz | Feb. 23, 2022 | May 23, 2022 | Feb. 22, 2023 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY24971/4 | 9kHz to 18GHz | Feb. 23, 2022 | May 23, 2022 | Feb. 22, 2023 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY28655/4 | 9kHz to 18GHz | Feb. 23, 2022 | May 23, 2022 | Feb. 22, 2023 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 126 | 532078/126E | 30MHz~18GHz | Sep. 17, 2021 | May 23, 2022 | Sep. 16, 2022 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | MY2858/2 | 18GHz~40GHz | Feb. 23, 2022 | May 23, 2022 | Feb. 22, 2023 | Radiation (03CH07-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 801606/2 | 9KHz ~ 40GHz | Apr. 14, 2022 | May 23, 2022 | Apr. 13, 2023 | Radiation (03CH07-HY) |
| Controller | EMEC | EM1000 | N/A | Control Ant Mast | N/A | May 23, 2022 | N/A | Radiation (03CH07-HY) |
| Controller | MF | MF-7802 | N/A | Control Turn table | N/A | May 23, 2022 | N/A | Radiation (03CH07-HY) |
| Antenna Mast | EMEC | AM-BS-4500E | N/A | Boresight mast 1M~4M | N/A | May 23, 2022 | N/A | Radiation (03CH07-HY) |
| Turn Table | ChainTek | Chaintek 3000 | N/A | 0~360 Degree | N/A | May 23, 2022 | N/A | Radiation (03CH07-HY) |
| Software | Audix | E3 | N/A | N/A | N/A | May 23, 2022 | N/A | Radiation (03CH07-HY) |



| Instrument | Brand Name | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|----------------------|-----------------|--------------|-------------|-----------------|------------------|--------------|---------------|-----------------------|
| USB Data Logger | TECPEL | TR-32 | HE17XB2495 | N/A | Mar. 07, 2022 | May 23, 2022 | Mar. 06, 2023 | Radiation (03CH07-HY) |
| SHF-EHF Horn Antenna | SCHWARZBECK | BBHA 9170 | BBHA9170251 | 18GHz~40GHz | Nov. 30, 2021 | May 23, 2022 | Nov. 29, 2022 | Radiation (03CH07-HY) |
| AC Power Source | ChainTek | APC-1000W | N/A | N/A | N/A | May 26, 2022 | N/A | Conduction (CO05-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESR3 | 102388 | 9kHz~3.6GHz | Dec. 01, 2021 | May 26, 2022 | Nov. 30, 2022 | Conduction (CO05-HY) |
| Hygrometer | Testo | 608-H1 | 34913912 | N/A | Nov. 17, 2021 | May 26, 2022 | Nov. 16, 2022 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100080 | 9kHz~30MHz | Dec. 03, 2021 | May 26, 2022 | Dec. 02, 2022 | Conduction (CO05-HY) |
| Software | Rohde & Schwarz | EMC32 | N/A | N/A | N/A | May 26, 2022 | N/A | Conduction (CO05-HY) |
| Pulse Limiter | SCHWARZBECK | VTSD 9561-FN | 00691 | N/A | Jul. 28, 2021 | May 26, 2022 | Jul. 27, 2022 | Conduction (CO05-HY) |
| LISN Cable | MVE | RG-400 | 260260 | N/A | Dec. 30, 2021 | May 26, 2022 | Dec. 29, 2022 | Conduction (CO05-HY) |



5 Uncertainty of Evaluation

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

| | |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 3.1 dB |
|---|--------|

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

| | |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.1 dB |
|---|--------|

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

| | |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.8 dB |
|---|--------|

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

| | |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 4.0 dB |
|---|--------|



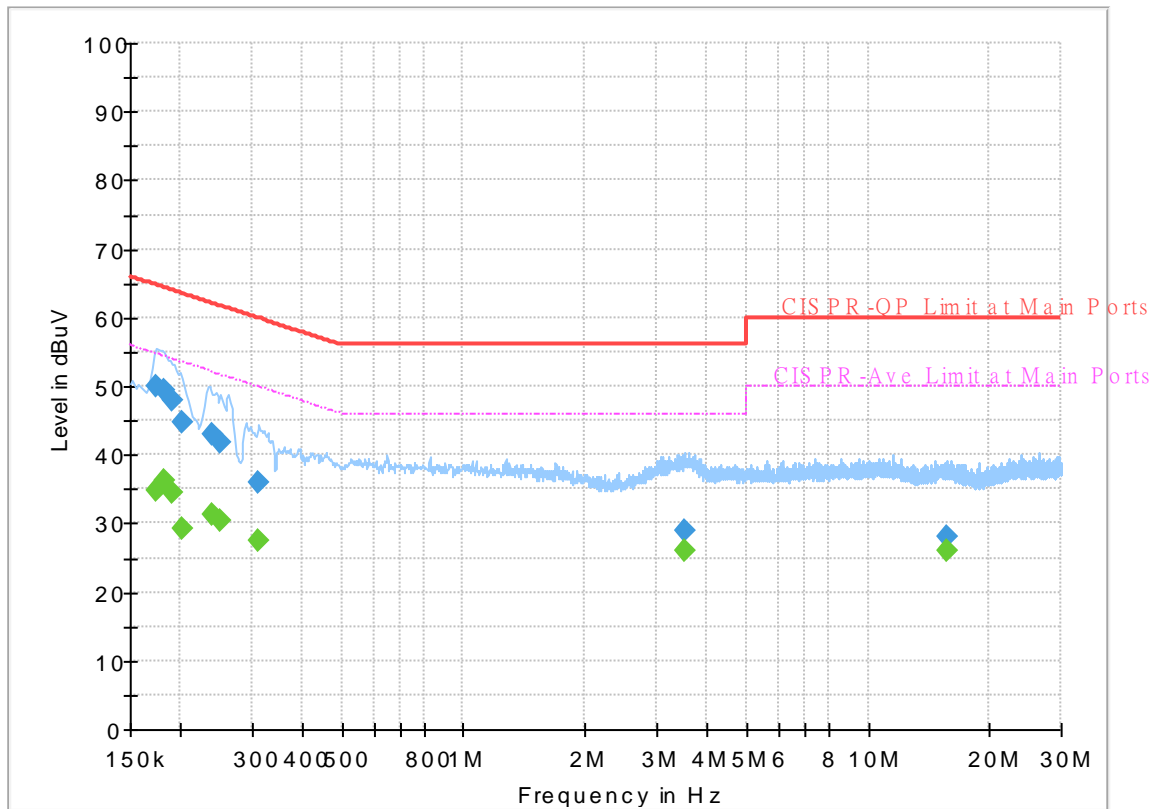
Appendix A. AC Conducted Emission Test Results

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

EUT Information

Report NO : 221044
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Line

Full Spectrum



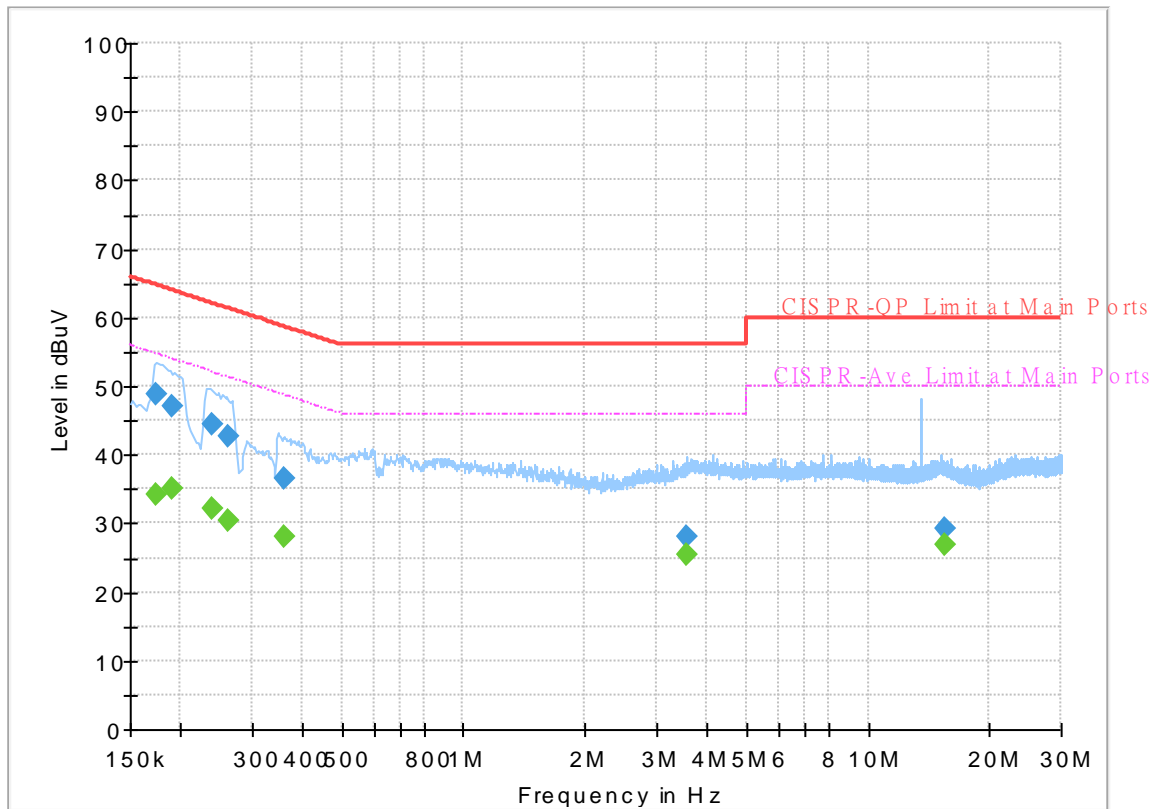
Final_Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.174750 | --- | 34.70 | 54.73 | 20.03 | L1 | OFF | 19.6 |
| 0.174750 | 49.97 | --- | 64.73 | 14.76 | L1 | OFF | 19.6 |
| 0.181500 | --- | 36.23 | 54.42 | 18.19 | L1 | OFF | 19.6 |
| 0.181500 | 49.52 | --- | 64.42 | 14.90 | L1 | OFF | 19.6 |
| 0.190500 | --- | 34.58 | 54.02 | 19.44 | L1 | OFF | 19.6 |
| 0.190500 | 48.02 | --- | 64.02 | 16.00 | L1 | OFF | 19.6 |
| 0.201750 | --- | 29.38 | 53.54 | 24.16 | L1 | OFF | 19.6 |
| 0.201750 | 44.65 | --- | 63.54 | 18.89 | L1 | OFF | 19.6 |
| 0.240000 | --- | 31.23 | 52.10 | 20.87 | L1 | OFF | 19.6 |
| 0.240000 | 42.85 | --- | 62.10 | 19.25 | L1 | OFF | 19.6 |
| 0.251250 | --- | 30.42 | 51.72 | 21.30 | L1 | OFF | 19.6 |
| 0.251250 | 41.89 | --- | 61.72 | 19.83 | L1 | OFF | 19.6 |
| 0.312000 | --- | 27.48 | 49.92 | 22.44 | L1 | OFF | 19.6 |
| 0.312000 | 36.04 | --- | 59.92 | 23.88 | L1 | OFF | 19.6 |
| 3.534000 | --- | 25.92 | 46.00 | 20.08 | L1 | OFF | 19.8 |
| 3.534000 | 29.06 | --- | 56.00 | 26.94 | L1 | OFF | 19.8 |
| 15.654750 | --- | 25.91 | 50.00 | 24.09 | L1 | OFF | 20.3 |
| 15.654750 | 28.15 | --- | 60.00 | 31.85 | L1 | OFF | 20.3 |

EUT Information

Report NO : 221044
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Neutral

Full Spectrum



Final Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.174750 | --- | 34.35 | 54.73 | 20.38 | N | OFF | 19.6 |
| 0.174750 | 48.70 | --- | 64.73 | 16.03 | N | OFF | 19.6 |
| 0.190500 | --- | 34.96 | 54.02 | 19.06 | N | OFF | 19.6 |
| 0.190500 | 47.20 | --- | 64.02 | 16.82 | N | OFF | 19.6 |
| 0.240000 | --- | 32.25 | 52.10 | 19.85 | N | OFF | 19.6 |
| 0.240000 | 44.36 | --- | 62.10 | 17.74 | N | OFF | 19.6 |
| 0.262500 | --- | 30.34 | 51.35 | 21.01 | N | OFF | 19.6 |
| 0.262500 | 42.62 | --- | 61.35 | 18.73 | N | OFF | 19.6 |
| 0.359250 | --- | 28.04 | 48.75 | 20.71 | N | OFF | 19.6 |
| 0.359250 | 36.60 | --- | 58.75 | 22.15 | N | OFF | 19.6 |
| 3.576750 | --- | 25.38 | 46.00 | 20.62 | N | OFF | 19.8 |
| 3.576750 | 27.96 | --- | 56.00 | 28.04 | N | OFF | 19.8 |
| 15.411750 | --- | 26.84 | 50.00 | 23.16 | N | OFF | 20.3 |
| 15.411750 | 29.30 | --- | 60.00 | 30.70 | N | OFF | 20.3 |



Appendix B. Radiated Spurious Emission

| | | | |
|-----------------|------------------------|---------------------|-------------|
| Test Engineer : | Jesse Wang, Stan Hsieh | Temperature : | 23.1~25.5°C |
| | | Relative Humidity : | 58.3~60.6% |



<1Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

| BLE | 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) | |
| BLE CH 00 2402MHz | | 2385.81 | 54.46 | -19.54 | 74 | 40.03 | 31.4 | 18.44 | 35.41 | 123 | 46 | P | H | |
| | | 2338.14 | 46.31 | -7.69 | 54 | 31.96 | 31.45 | 18.29 | 35.39 | 123 | 46 | A | H | |
| | * | 2402 | 96.89 | - | - | 82.41 | 31.42 | 18.48 | 35.42 | 123 | 46 | P | H | |
| | * | 2402 | 96.43 | - | - | 81.95 | 31.42 | 18.48 | 35.42 | 123 | 46 | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | | H |
| | | | 2338.14 | 54.34 | -19.66 | 74 | 39.99 | 31.45 | 18.29 | 35.39 | 241 | 94 | P | V |
| | | | 2337.93 | 46.03 | -7.97 | 54 | 31.68 | 31.45 | 18.29 | 35.39 | 241 | 94 | A | V |
| | * | | 2402 | 92.86 | - | - | 78.38 | 31.42 | 18.48 | 35.42 | 241 | 94 | P | V |
| | * | | 2402 | 92.25 | - | - | 77.77 | 31.42 | 18.48 | 35.42 | 241 | 94 | A | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V | |
| BLE CH 19 2440MHz | | 2363.48 | 54.02 | -19.98 | 74 | 39.66 | 31.4 | 18.36 | 35.4 | 100 | 46 | P | H | |
| | | 2375.8 | 47.58 | -6.42 | 54 | 33.19 | 31.4 | 18.4 | 35.41 | 100 | 46 | A | H | |
| | * | 2440 | 95.98 | - | - | 81.15 | 31.72 | 18.54 | 35.43 | 100 | 46 | P | H | |
| | * | 2440 | 95.33 | - | - | 80.5 | 31.72 | 18.54 | 35.43 | 100 | 46 | A | H | |
| | | | 2492.23 | 54.63 | -19.37 | 74 | 39.34 | 32.14 | 18.61 | 35.46 | 100 | 46 | P | H |
| | | | 2497.48 | 45.7 | -8.3 | 54 | 30.36 | 32.18 | 18.62 | 35.46 | 100 | 46 | A | H |
| | | | 2318.68 | 54.3 | -19.7 | 74 | 39.93 | 31.53 | 18.23 | 35.39 | 256 | 81 | P | V |
| | | | 2376.08 | 45.57 | -8.43 | 54 | 31.18 | 31.4 | 18.4 | 35.41 | 256 | 81 | A | V |
| | * | | 2440 | 93.28 | - | - | 78.45 | 31.72 | 18.54 | 35.43 | 256 | 81 | P | V |
| | * | | 2440 | 92.68 | - | - | 77.85 | 31.72 | 18.54 | 35.43 | 256 | 81 | A | V |
| | | | 2496.15 | 54.01 | -19.99 | 74 | 38.68 | 32.17 | 18.62 | 35.46 | 256 | 81 | P | V |
| | | 2497.69 | 46.02 | -7.98 | 54 | 30.68 | 32.18 | 18.62 | 35.46 | 256 | 81 | A | V | |



| | | | | | | | | | | | | | |
|----------------------------------|---|---------|-------|--------|----|-------|-------|-------|-------|-----|----|---|---|
| BLE CH 39 2480MHz | * | 2480 | 96.29 | - | - | 81.1 | 32.04 | 18.6 | 35.45 | 115 | 45 | P | H |
| | * | 2480 | 95.72 | - | - | 80.53 | 32.04 | 18.6 | 35.45 | 115 | 45 | A | H |
| | | 2484.52 | 59.17 | -14.83 | 74 | 43.93 | 32.08 | 18.61 | 35.45 | 115 | 45 | P | H |
| | | 2483.88 | 46.58 | -7.42 | 54 | 31.36 | 32.07 | 18.6 | 35.45 | 115 | 45 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 93.33 | - | - | 78.14 | 32.04 | 18.6 | 35.45 | 198 | 81 | P | V |
| | * | 2480 | 92.51 | - | - | 77.32 | 32.04 | 18.6 | 35.45 | 198 | 81 | P | V |
| | | 2484.84 | 55.48 | -18.52 | 74 | 40.24 | 32.08 | 18.61 | 35.45 | 198 | 81 | P | V |
| | | 2487.16 | 45.93 | -8.07 | 54 | 30.68 | 32.1 | 18.6 | 35.45 | 198 | 81 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz
BLE (Harmonic @ 3m)

| BLE | 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) |
|-------------------------|------|----------------------|---------------------|------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|
| BLE CH 00 2402MHz | | 4804 | 53.08 | -20.92 | 74 | 65.37 | 34.01 | 12.7 | 59 | 100 | 26 | P | H |
| | | 4804 | 49.86 | -4.14 | 54 | 62.15 | 34.01 | 12.7 | 59 | 100 | 26 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
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| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | 4804 | 51.52 | -22.48 | 74 | 63.81 | 34.01 | 12.7 | 59 | 100 | 297 | P |
| | | 4804 | 47.97 | -6.03 | 54 | 60.26 | 34.01 | 12.7 | 59 | 100 | 297 | A | V |
| | | | | | | | | | | | | | V |
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| | | | | | | | | | | | | | V |



| BLE | 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) | |
|-------------------------|------|----------------------|---------------------|------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|---|
| BLE CH 19 2440MHz | | 4880 | 51.27 | -22.73 | 74 | 63.34 | 34.04 | 12.75 | 58.86 | 100 | 27 | P | H | |
| | | 4880 | 48.63 | -5.37 | 54 | 60.7 | 34.04 | 12.75 | 58.86 | 100 | 27 | A | H | |
| | | 7320 | 54.36 | -19.64 | 74 | 61.15 | 35.68 | 15.03 | 57.5 | 231 | 347 | P | H | |
| | | 7320 | 50.04 | -3.96 | 54 | 56.83 | 35.68 | 15.03 | 57.5 | 231 | 347 | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
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| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | 4880 | 52.25 | -21.75 | 74 | 64.32 | 34.04 | 12.75 | 58.86 | 100 | 292 | P | V |
| | | | 4880 | 48.71 | -5.29 | 54 | 60.78 | 34.04 | 12.75 | 58.86 | 100 | 292 | A | V |
| | | | 7320 | 52.3 | -21.7 | 74 | 59.09 | 35.68 | 15.03 | 57.5 | 324 | 348 | P | V |
| | | | 7320 | 47.98 | -6.02 | 54 | 54.77 | 35.68 | 15.03 | 57.5 | 324 | 348 | A | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
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| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |



| BLE | 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) |
|-------------------------|---|----------------------|---------------------|------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|
| BLE CH 39 2480MHz | | 4960 | 52.64 | -21.36 | 74 | 64.43 | 34.1 | 12.82 | 58.71 | 392 | 41 | P | H |
| | | 4960 | 49.54 | -4.46 | 54 | 61.33 | 34.1 | 12.82 | 58.71 | 392 | 41 | A | H |
| | | 7440 | 54.71 | -19.29 | 74 | 61.45 | 35.82 | 15.03 | 57.59 | 100 | 327 | P | H |
| | | 7440 | 50.63 | -3.37 | 54 | 57.37 | 35.82 | 15.03 | 57.59 | 100 | 327 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
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| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | 4960 | 50.21 | -23.79 | 74 | 62 | 34.1 | 12.82 | 58.71 | 100 | 298 | P |
| | | 4960 | 46.01 | -7.99 | 54 | 57.8 | 34.1 | 12.82 | 58.71 | 100 | 298 | A | V |
| | | 7440 | 51.1 | -22.9 | 74 | 57.84 | 35.82 | 15.03 | 57.59 | 377 | 348 | P | V |
| | | 7440 | 46.36 | -7.64 | 54 | 53.1 | 35.82 | 15.03 | 57.59 | 377 | 348 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
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| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

| BLE | 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) | |
| BLE CH 00 2402MHz | | 2347.485 | 53.91 | -20.09 | 74 | 39.58 | 31.41 | 18.32 | 35.4 | 227 | 28 | P | H | |
| | | 2337.51 | 47.52 | -6.48 | 54 | 33.17 | 31.45 | 18.29 | 35.39 | 227 | 28 | A | H | |
| | * | 2402 | 96.21 | - | - | 81.73 | 31.42 | 18.48 | 35.42 | 227 | 28 | P | H | |
| | * | 2402 | 94.88 | - | - | 80.4 | 31.42 | 18.48 | 35.42 | 227 | 28 | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | 2337.93 | 54.34 | -19.66 | 74 | 39.99 | 31.45 | 18.29 | 35.39 | 300 | 99 | P | V |
| | | | 2383.08 | 46.99 | -7.01 | 54 | 32.57 | 31.4 | 18.43 | 35.41 | 300 | 99 | A | V |
| | * | | 2402 | 94.61 | - | - | 80.13 | 31.42 | 18.48 | 35.42 | 300 | 99 | P | V |
| | * | | 2402 | 93.41 | - | - | 78.93 | 31.42 | 18.48 | 35.42 | 300 | 99 | A | V |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | V | | |
| BLE CH 19 2440MHz | | 2322.88 | 54.43 | -19.57 | 74 | 40.06 | 31.51 | 18.25 | 35.39 | 223 | 27 | P | H | |
| | | 2375.8 | 47.51 | -6.49 | 54 | 33.12 | 31.4 | 18.4 | 35.41 | 223 | 27 | A | H | |
| | * | 2440 | 96.48 | - | - | 81.65 | 31.72 | 18.54 | 35.43 | 223 | 27 | P | H | |
| | * | 2440 | 95.25 | - | - | 80.42 | 31.72 | 18.54 | 35.43 | 223 | 27 | A | H | |
| | | | 2492.02 | 55.26 | -18.74 | 74 | 39.97 | 32.14 | 18.61 | 35.46 | 223 | 27 | P | H |
| | | | 2487.96 | 47.52 | -6.48 | 54 | 32.27 | 32.1 | 18.6 | 35.45 | 223 | 27 | A | H |
| | | | 2322.6 | 54.99 | -19.01 | 74 | 40.62 | 31.51 | 18.25 | 35.39 | 371 | 99 | P | V |
| | | | 2368.52 | 46.81 | -7.19 | 54 | 32.43 | 31.4 | 18.39 | 35.41 | 371 | 99 | A | V |
| | * | | 2440 | 93.97 | - | - | 79.14 | 31.72 | 18.54 | 35.43 | 371 | 99 | P | V |
| | * | | 2440 | 92.7 | - | - | 77.87 | 31.72 | 18.54 | 35.43 | 371 | 99 | A | V |
| | | | 2498.6 | 54.31 | -19.69 | 74 | 38.95 | 32.19 | 18.63 | 35.46 | 371 | 99 | P | V |
| | | 2496.22 | 47.85 | -6.15 | 54 | 32.52 | 32.17 | 18.62 | 35.46 | 371 | 99 | A | V | |



| | | | | | | | | | | | | | |
|----------------------------------|---|---------|-------|--------|----|-------|-------|-------|-------|-----|-----|---|---|
| BLE CH 39 2480MHz | * | 2480 | 96.18 | - | - | 80.99 | 32.04 | 18.6 | 35.45 | 187 | 28 | P | H |
| | * | 2480 | 94.9 | - | - | 79.71 | 32.04 | 18.6 | 35.45 | 187 | 28 | A | H |
| | | 2483.52 | 60.16 | -13.84 | 74 | 44.94 | 32.07 | 18.6 | 35.45 | 187 | 28 | P | H |
| | | 2483.68 | 49.58 | -4.42 | 54 | 34.36 | 32.07 | 18.6 | 35.45 | 187 | 28 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 94.22 | - | - | 79.03 | 32.04 | 18.6 | 35.45 | 284 | 106 | P | V |
| | * | 2480 | 92.64 | - | - | 77.45 | 32.04 | 18.6 | 35.45 | 284 | 106 | A | V |
| | | 2484 | 56.69 | -17.31 | 74 | 41.47 | 32.07 | 18.6 | 35.45 | 284 | 106 | P | V |
| | | 2492.96 | 48.5 | -5.5 | 54 | 33.21 | 32.14 | 18.61 | 35.46 | 284 | 106 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz
BLE (Harmonic @ 3m)

| BLE | 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) | |
|-------------------------|------|----------------------|---------------------|------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|---|
| BLE CH 00 2402MHz | | 4804 | 53.07 | -20.93 | 74 | 65.36 | 34.01 | 12.7 | 59 | 100 | 27 | P | H | |
| | | 4804 | 50.83 | -3.17 | 54 | 63.12 | 34.01 | 12.7 | 59 | 100 | 27 | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
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| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | 4804 | 51.27 | -22.73 | 74 | 63.56 | 34.01 | 12.7 | 59 | 100 | 296 | P | V |
| | | | 4804 | 47.76 | -6.24 | 54 | 60.05 | 34.01 | 12.7 | 59 | 100 | 296 | A | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V | |



| BLE | 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) | |
|-------------------------|------|----------------------|---------------------|------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-----------------------|---------------|---|
| BLE CH 19 2440MHz | | 4880 | 51.03 | -22.97 | 74 | 63.1 | 34.04 | 12.75 | 58.86 | 101 | 27 | P | H | |
| | | 4880 | 49.47 | -4.53 | 54 | 61.54 | 34.04 | 12.75 | 58.86 | 101 | 27 | A | H | |
| | | 7320 | 53.53 | -20.47 | 74 | 60.32 | 35.68 | 15.03 | 57.5 | 227 | 347 | P | H | |
| | | 7320 | 49.79 | -4.21 | 54 | 56.58 | 35.68 | 15.03 | 57.5 | 227 | 347 | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | 4880 | 51.36 | -22.64 | 74 | 63.43 | 34.04 | 12.75 | 58.86 | 100 | 290 | P | V |
| | | | 4880 | 47.73 | -6.27 | 54 | 59.8 | 34.04 | 12.75 | 58.86 | 100 | 290 | A | V |
| | | | 7320 | 51.88 | -22.12 | 74 | 58.67 | 35.68 | 15.03 | 57.5 | 346 | 347 | P | V |
| | | | 7320 | 46.77 | -7.23 | 54 | 53.56 | 35.68 | 15.03 | 57.5 | 346 | 347 | A | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |



| BLE | 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) | |
|-------------------------|---|----------------------|---------------------|------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|---|
| BLE CH 39 2480MHz | | 4960 | 47.89 | -26.11 | 74 | 59.68 | 34.1 | 12.82 | 58.71 | - | - | P | H | |
| | | 7440 | 54.13 | -19.87 | 74 | 60.87 | 35.82 | 15.03 | 57.59 | 100 | 329 | P | H | |
| | | 7440 | 50.08 | -3.92 | 54 | 56.82 | 35.82 | 15.03 | 57.59 | 100 | 329 | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | 4960 | 46.98 | -27.02 | 74 | 58.77 | 34.1 | 12.82 | 58.71 | - | - | P | V |
| | | | 7440 | 47.78 | -26.22 | 74 | 54.52 | 35.82 | 15.03 | 57.59 | - | - | P | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| Remark | <ol style="list-style-type: none"> No other spurious found. All results are PASS against Peak and Average limit line. 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 BLE (LF)

| BLE | Note | Frequency | Level | Margin | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. | |
|---------------------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|---|
| | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) | |
| 2.4GHz BLE LF | | 30.54 | 22.2 | -17.8 | 40 | 27.18 | 24.17 | 0.96 | 30.11 | - | - | P | H | |
| | | 38.91 | 18.64 | -21.36 | 40 | 27.78 | 20 | 0.92 | 30.06 | - | - | P | H | |
| | | 63.21 | 11.83 | -28.17 | 40 | 28.85 | 11.8 | 1.21 | 30.03 | - | - | P | H | |
| | | 773.2 | 29.92 | -16.08 | 46 | 26.83 | 27.78 | 4.66 | 29.35 | - | - | P | H | |
| | | 862.1 | 32.06 | -13.94 | 46 | 27.26 | 28.87 | 4.93 | 29 | - | - | P | H | |
| | | 955.9 | 33.42 | -12.58 | 46 | 26.26 | 30.59 | 5.2 | 28.63 | - | - | P | H | |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | 30 | 30.54 | -9.46 | 40 | 35.11 | 24.57 | 0.97 | 30.11 | - | - | P | V |
| | | | 42.96 | 19.8 | -20.2 | 40 | 31.12 | 17.75 | 0.98 | 30.05 | - | - | P | V |
| | | | 81.3 | 17.83 | -22.17 | 40 | 32.82 | 13.6 | 1.45 | 30.04 | - | - | P | V |
| | | | 769.7 | 30.38 | -15.62 | 46 | 27.35 | 27.75 | 4.64 | 29.36 | - | - | P | V |
| | | | 856.5 | 31.44 | -14.56 | 46 | 26.74 | 28.82 | 4.91 | 29.03 | - | - | P | V |
| | | | 949.6 | 33.24 | -12.76 | 46 | 26.42 | 30.29 | 5.18 | 28.65 | - | - | P | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |

Remark

- No other spurious found.
- All results are PASS against limit line.
- 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.



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 over limit line. |
| P/A | Peak or Average |
| H/V | Horizontal or Vertical |



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

| BLE | Note | Frequency | Level | Over | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. |
|-------------------------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
| | | (MHz) | (dBμV/m) | (dB) | (dBμV/m) | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| BLE CH 00 2402MHz | | 2390 | 55.45 | -18.55 | 74 | 54.51 | 32.22 | 4.58 | 35.86 | 103 | 308 | P | H |
| | | 2390 | 43.54 | -10.46 | 54 | 42.6 | 32.22 | 4.58 | 35.86 | 103 | 308 | A | 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. Over Limit(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. Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 55.45(dBμV/m) – 74(dBμV/m)
= -18.55(dB)

For Average 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) + 42.6(dBμV) – 35.86 (dB)
= 43.54 (dBμV/m)
2. Over Limit(dB)
= Level(dBμV/m) – Limit Line(dBμV/m)
= 43.54(dBμV/m) – 54(dBμV/m)
= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.



Appendix C. Radiated Spurious Emission Plots

| | | | |
|-----------------|------------------------|---------------------|-------------|
| Test Engineer : | Jesse Wang, Stan Hsieh | Temperature : | 23.1~25.5°C |
| | | Relative Humidity : | 58.3~60.6% |

Note symbol

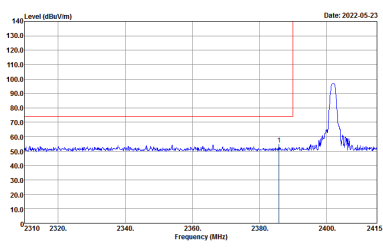
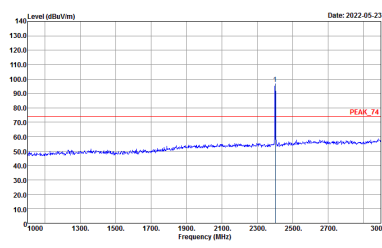
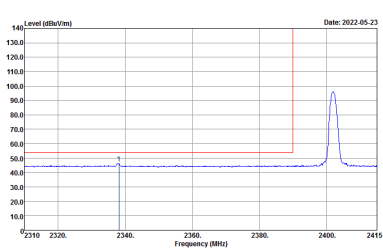
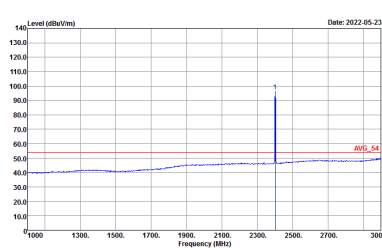
| | |
|----|-----------------------|
| -L | Low channel location |
| -R | High channel location |



<1Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------------------|---|---|
| BLE CH00 2402MHz | | |
| Horizontal | | Fundamental |
| Peak |  <p>Site Condition : 03CH07-HY : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p> |  <p>Site Condition : 03CH07-HY : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p> |
| Avg. |  <p>Site Condition : 03CH07-HY : AVG_BE_S4 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto</p> |  <p>Site Condition : 03CH07-HY : AVG_S4 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWT:Auto</p> |

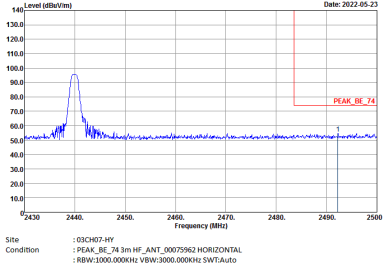
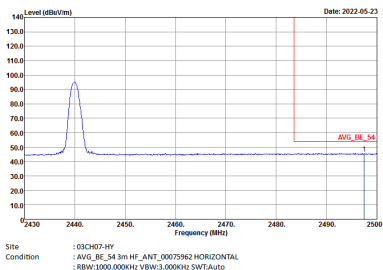


| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|--|
| | BLE CH00 2402MHz | |
| | Vertical | Fundamental |
| Peak | <p>Vertical Peak Spectrum Plot: The y-axis is Level (dBuV/m) from 10.0 to 140.0. The x-axis is Frequency (MHz) from 2310 to 2415. A sharp peak is visible at approximately 2402 MHz. A red horizontal line indicates the peak level at approximately 95 dBuV/m. The plot is dated 2022-05-23.</p> <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p> | <p>Fundamental Peak Spectrum Plot: The y-axis is Level (dBuV/m) from 10.0 to 140.0. The x-axis is Frequency (MHz) from 1000 to 3000. A sharp peak is visible at approximately 2402 MHz. A red horizontal line indicates the peak level at approximately 95 dBuV/m. The plot is dated 2022-05-23.</p> <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p> |
| Avg | <p>Vertical Avg Spectrum Plot: The y-axis is Level (dBuV/m) from 10.0 to 140.0. The x-axis is Frequency (MHz) from 2310 to 2415. A peak is visible at approximately 2402 MHz. A red horizontal line indicates the average level at approximately 55 dBuV/m. The plot is dated 2022-05-23.</p> <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWTA:Auto</p> | <p>Fundamental Avg Spectrum Plot: The y-axis is Level (dBuV/m) from 10.0 to 140.0. The x-axis is Frequency (MHz) from 1000 to 3000. A peak is visible at approximately 2402 MHz. A red horizontal line indicates the average level at approximately 55 dBuV/m. The plot is dated 2022-05-23.</p> <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWTA:Auto</p> |

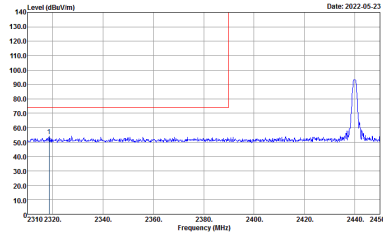
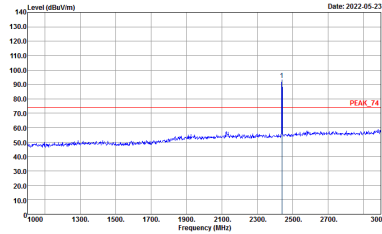
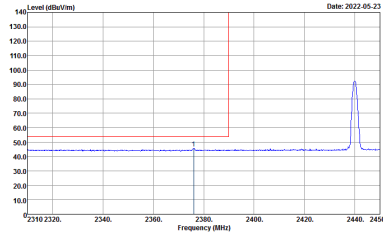
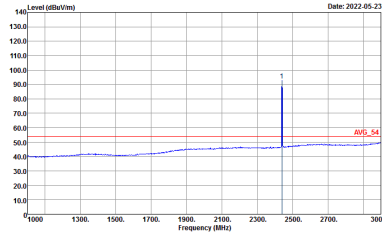


| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|--|
| | BLE CH19 2440MHz - L | |
| | Horizontal | Fundamental |
| Peak | <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p> | <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p> |
| Avg. | <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p> | <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3.000KHz SWT:Auto</p> |

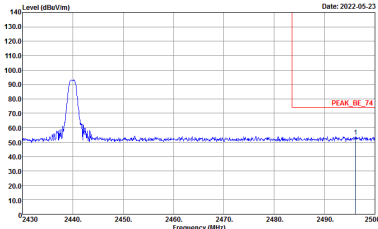
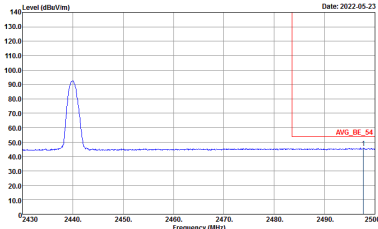


| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|-------------|
| | BLE CH19 2440MHz - R | |
| | Horizontal | Fundamental |
| Peak |  | Left blank |
| Avg. |  | Left blank |



| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|----------------------|--|--|
| BLE CH19 2440MHz - L | | |
| | Vertical | Fundamental |
| Peak |  <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p> |  <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p> |
| Avg. |  <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWTA:Auto</p> |  <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWTA:Auto</p> |

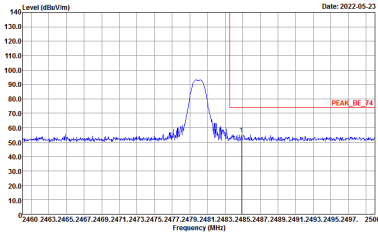
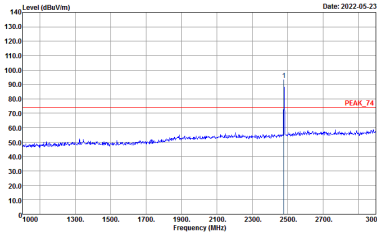
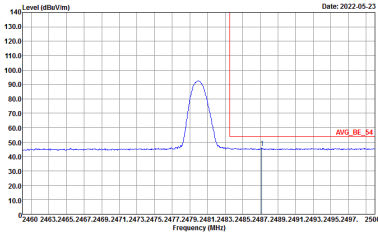
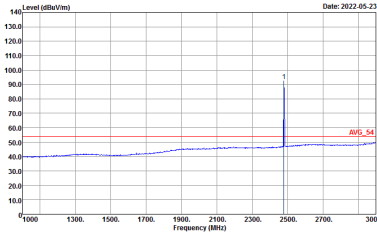


| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|----------------------|--|-------------------|
| BLE CH19 2440MHz - R | | |
| | Vertical | Fundamental |
| <p>Peak</p> |  <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWFAuto</p> | <p>Left blank</p> |
| <p>Avg.</p> |  <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWFAuto</p> | <p>Left blank</p> |



| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------------------|--|---|
| BLE CH39 2480MHz | | |
| | Horizontal | Fundamental |
| Peak | <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p> | <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p> |
| Avg. | <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWTA:Auto</p> | <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3.000kHz SWTA:Auto</p> |



| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------------------|--|--|
| BLE CH39 2480MHz | | |
| | Vertical | Fundamental |
| Peak |  <p>Level (dBuV/m) vs Frequency (MHz) plot showing a peak at 2480 MHz. The peak level is approximately 95 dBuV/m. The plot includes a red line indicating the peak level and a blue line for the spectrum. The x-axis ranges from 2400 to 2500 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m.</p> <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p> |  <p>Level (dBuV/m) vs Frequency (MHz) plot showing a peak at 2480 MHz. The peak level is approximately 95 dBuV/m. The plot includes a red line indicating the peak level and a blue line for the spectrum. The x-axis ranges from 1000 to 3000 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m.</p> <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTA:Auto</p> |
| Avg. |  <p>Level (dBuV/m) vs Frequency (MHz) plot showing the average spectrum. The average level is approximately 55 dBuV/m. The plot includes a red line indicating the average level and a blue line for the spectrum. The x-axis ranges from 2400 to 2500 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m.</p> <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWTA:Auto</p> |  <p>Level (dBuV/m) vs Frequency (MHz) plot showing the average spectrum. The average level is approximately 55 dBuV/m. The plot includes a red line indicating the average level and a blue line for the spectrum. The x-axis ranges from 1000 to 3000 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m.</p> <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3.000kHz SWTA:Auto</p> |

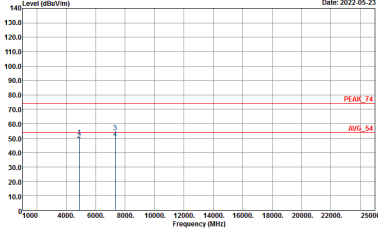
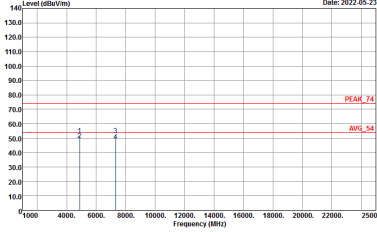


2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

| BLE | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|--------------|--|--|
| | BLE CH00 2402MHz | |
| | Horizontal | Vertical |
| Peak Avg. | <p>Horizontal spectrum plot showing a peak at 2402 MHz. The y-axis is Level (dBuV/m) from 0 to 140. The x-axis is Frequency (MHz) from 1900 to 2500. A peak is labeled '1' at approximately 50 dBuV/m. A red line indicates 'PEAK_74' at 74 dBuV/m and 'AVG_54' at 54 dBuV/m. Date: 2022-05-23. Site: :03CH07-HY. Condition: :PEAK_74 3m HF_ANT_00075962 HORIZONTAL.</p> | <p>Vertical spectrum plot showing a peak at 2402 MHz. The y-axis is Level (dBuV/m) from 0 to 140. The x-axis is Frequency (MHz) from 1900 to 2500. A peak is labeled '1' at approximately 50 dBuV/m. A red line indicates 'PEAK_74' at 74 dBuV/m and 'AVG_54' at 54 dBuV/m. Date: 2022-05-23. Site: :03CH07-HY. Condition: :PEAK_74 3m HF_ANT_00075962 VERTICAL.</p> |



| BLE | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|------------------|---|--|
| BLE CH19 2440MHz | | |
| | Horizontal | Vertical |
| Peak Avg. |  <p>Site : 03CH07-HY Condition : 1-PEAK_74 3m HF_ANT_00075962 HORIZONTAL</p> |  <p>Site : 03CH07-HY Condition : 1-PEAK_74 3m HF_ANT_00075962 VERTICAL</p> |



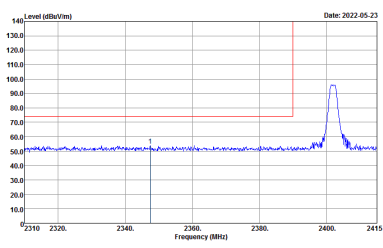
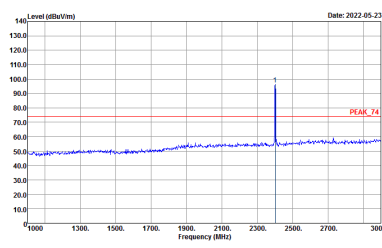
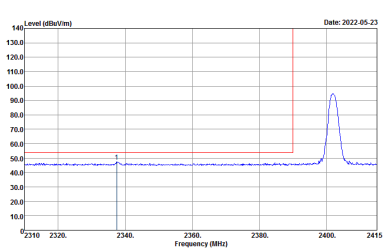
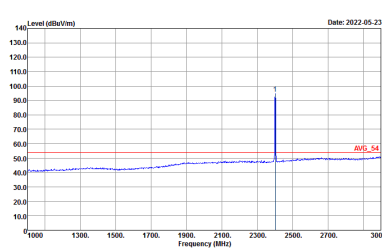
| BLE | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|----------------------------|--|--|
| | BLE CH39 2480MHz | |
| | Horizontal | Vertical |
| Peak Avg. | <p>Site : 03CH07-HY Condition : :PEAK_74 3m HF_ANT_00075962 HORIZONTAL</p> | <p>Site : 03CH07-HY Condition : :PEAK_74 3m HF_ANT_00075962 VERTICAL</p> |



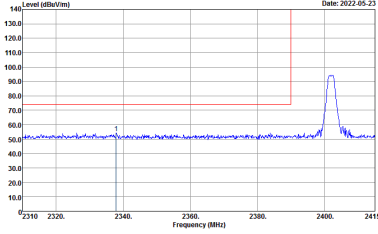
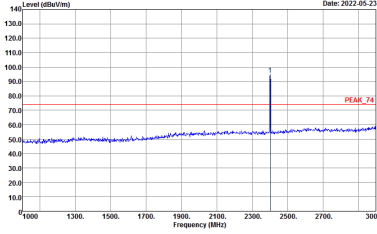
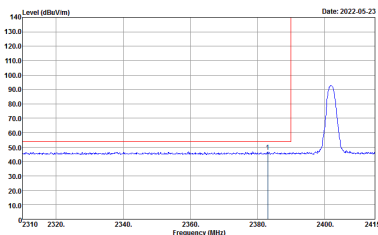
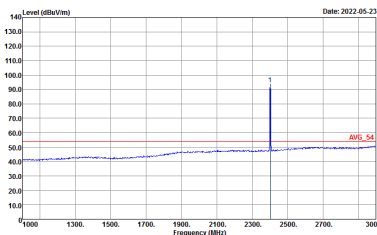
<2Mbps>

2.4GHz 2400~2483.5MHz

BLE (Band Edge @ 3m)

| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------------------|---|---|
| BLE CH00 2402MHz | | |
| Horizontal | | Fundamental |
| Peak |  <p>Site Condition : 03CH07-HY : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p> |  <p>Site Condition : 03CH07-HY : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p> |
| Avg. |  <p>Site Condition : 03CH07-HY : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p> |  <p>Site Condition : 03CH07-HY : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p> |

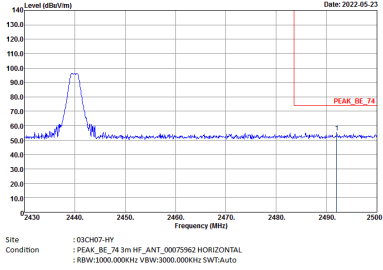
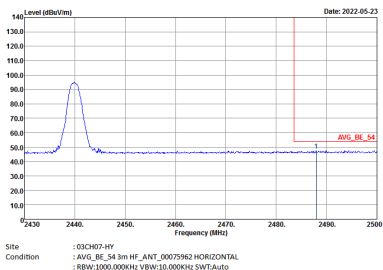


| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------------------|--|--|
| BLE CH00 2402MHz | | |
| Vertical | | Fundamental |
| Peak |  <p>Date: 2022-05-23</p> <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTAuto</p> |  <p>Date: 2022-05-23</p> <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTAuto</p> |
| |  <p>Date: 2022-05-23</p> <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWTAuto</p> |  <p>Date: 2022-05-23</p> <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWTAuto</p> |
| Avg | | |



| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|----------------------|---|--|
| BLE CH19 2440MHz - L | | |
| | Horizontal | Fundamental |
| Peak | <p>Date: 2022-05-23</p> <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p> | <p>Date: 2022-05-23</p> <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto</p> |
| Avg. | <p>Date: 2022-05-23</p> <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p> | <p>Date: 2022-05-23</p> <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000KHz VBW:10.000KHz SWT:Auto</p> |



| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|-------------|
| | BLE CH19 2440MHz - R | |
| | Horizontal | Fundamental |
| Peak |  | Left blank |
| Avg. |  | Left blank |

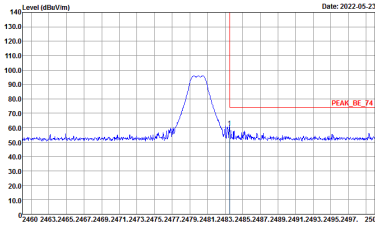
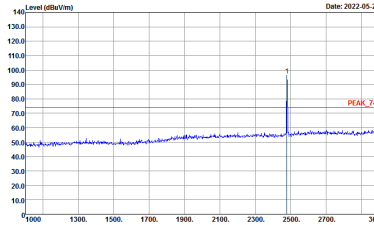
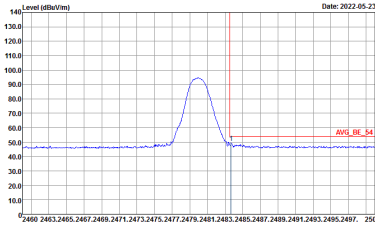
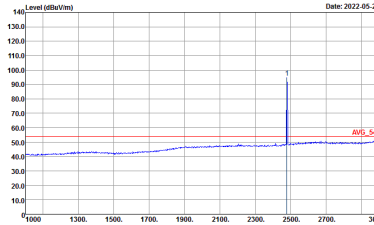


| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|---|
| | BLE CH19 2440MHz - L | |
| | Vertical | Fundamental |
| Peak | <p>Vertical Peak Spectrum Plot showing Level (dBV/m) vs Frequency (MHz) for the Vertical polarization. The plot shows a peak at approximately 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBV/m, and the x-axis ranges from 2310 to 2450 MHz. A red horizontal line is drawn at approximately 75 dBV/m. The peak is labeled 'PEAK 74'.</p> <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTAuto</p> | <p>Fundamental Peak Spectrum Plot showing Level (dBV/m) vs Frequency (MHz) for the Fundamental polarization. The plot shows a peak at approximately 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBV/m, and the x-axis ranges from 1000 to 3000 MHz. A red horizontal line is drawn at approximately 75 dBV/m. The peak is labeled 'PEAK 74'.</p> <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWTAuto</p> |
| Avg. | <p>Vertical Average Spectrum Plot showing Level (dBV/m) vs Frequency (MHz) for the Vertical polarization. The plot shows a peak at approximately 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBV/m, and the x-axis ranges from 2310 to 2450 MHz. A red horizontal line is drawn at approximately 55 dBV/m. The peak is labeled 'Avg 54'.</p> <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWTAuto</p> | <p>Fundamental Average Spectrum Plot showing Level (dBV/m) vs Frequency (MHz) for the Fundamental polarization. The plot shows a peak at approximately 2440 MHz. The y-axis ranges from 10.0 to 140.0 dBV/m, and the x-axis ranges from 1000 to 3000 MHz. A red horizontal line is drawn at approximately 55 dBV/m. The peak is labeled 'Avg 54'.</p> <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWTAuto</p> |

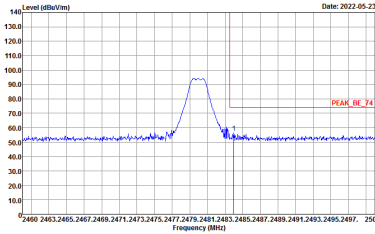
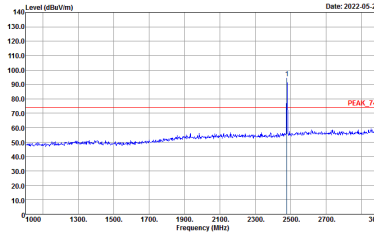
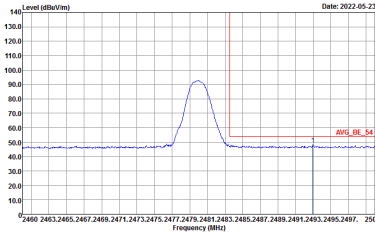
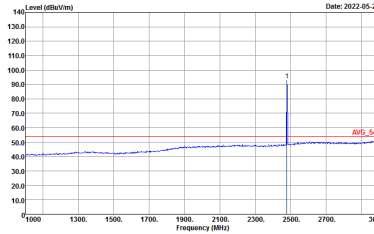


| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|-------------|
| | BLE CH19 2440MHz - R | |
| | Vertical | Fundamental |
| Peak | <p>Site : 03CH07-HP Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p> | Left blank |
| Avg. | <p>Site : 03CH07-HP Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p> | Left blank |



| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------------------|---|---|
| BLE CH39 2480MHz | | |
| | Horizontal | Fundamental |
| Peak |  <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p> |  <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p> |
| Avg. |  <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p> |  <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 HORIZONTAL : RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p> |



| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------------------|---|--|
| BLE CH39 2480MHz | | |
| | Vertical | Fundamental |
| Peak |  <p>Level (dBuV/m) vs Frequency (MHz) plot showing a peak at 2480 MHz. The peak level is approximately 95 dBuV/m. The plot includes a red horizontal line labeled 'PEAK_BE_74' at the peak level. The x-axis ranges from 2400 to 2500 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m.</p> <p>Site : 03CH07-HY Condition : PEAK_BE_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p> |  <p>Level (dBuV/m) vs Frequency (MHz) plot showing a peak at 2480 MHz. The peak level is approximately 95 dBuV/m. The plot includes a red horizontal line labeled 'PEAK_74' at the peak level. The x-axis ranges from 1000 to 3000 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m.</p> <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto</p> |
| Avg. |  <p>Level (dBuV/m) vs Frequency (MHz) plot showing the average level. The average level is approximately 55 dBuV/m. The plot includes a red horizontal line labeled 'AVG_BE_54' at the average level. The x-axis ranges from 2400 to 2500 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m.</p> <p>Site : 03CH07-HY Condition : AVG_BE_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p> |  <p>Level (dBuV/m) vs Frequency (MHz) plot showing the average level. The average level is approximately 55 dBuV/m. The plot includes a red horizontal line labeled 'AVG_54' at the average level. The x-axis ranges from 1000 to 3000 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m.</p> <p>Site : 03CH07-HY Condition : AVG_54 3m HF_ANT_00075962 VERTICAL : RBW:1000.000kHz VBW:10.000kHz SWT:Auto</p> |



2.4GHz 2400~2483.5MHz

BLE (Harmonic @ 3m)

| BLE | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|--------------|---|---|
| | BLE CH00 2402MHz | |
| | Horizontal | Vertical |
| Peak Avg. | <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 HORIZONTAL</p> | <p>Site : 03CH07-HY Condition : PEAK_74 3m HF_ANT_00075962 VERTICAL</p> |



| BLE | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|----------------------------|---|---|
| | BLE CH19 2440MHz | |
| | Horizontal | Vertical |
| Peak Avg. | <p>Site : 03CH07-HY Condition : 1-PEAK_74 3m HF_ANT_00075962 HORIZONTAL</p> | <p>Site : 03CH07-HY Condition : 1-PEAK_74 3m HF_ANT_00075962 VERTICAL</p> |



| BLE | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|--------------|--|--|
| | BLE CH39 2480MHz | |
| | Horizontal | Vertical |
| Peak Avg. | <p>Horizontal spectrum plot showing Level (dBuV/m) vs Frequency (MHz). The plot includes two horizontal reference lines: a red line at 74 dBuV/m labeled 'PEAK_74' and a red line at 54 dBuV/m labeled 'AVG_54'. Two peaks are visible at approximately 5.5 MHz and 7.5 MHz, both reaching the 54 dBuV/m level. The x-axis ranges from 1000 to 25000 MHz, and the y-axis ranges from 0 to 140 dBuV/m. Date: 2022-05-23.</p> <p>Site : 03CH07-HY Condition : :PEAK_74 3m HF_ANT_00075962 HORIZONTAL</p> | <p>Vertical spectrum plot showing Level (dBuV/m) vs Frequency (MHz). The plot includes two horizontal reference lines: a red line at 74 dBuV/m labeled 'PEAK_74' and a red line at 54 dBuV/m labeled 'AVG_54'. Two peaks are visible at approximately 5.5 MHz and 7.5 MHz, both reaching the 54 dBuV/m level. The x-axis ranges from 1000 to 25000 MHz, and the y-axis ranges from 0 to 140 dBuV/m. Date: 2022-05-23.</p> <p>Site : 03CH07-HY Condition : :PEAK_74 3m HF_ANT_00075962 VERTICAL</p> |



Emission below 1GHz
2.4GHz BLE (LF)

| BLE | 2.4GHz 2400~2483.5MHz | |
|--------------|--|--|
| | BLE LF | |
| | Horizontal | Vertical |
| QP / Peak | <p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) HORIZONTAL</p> | <p>Site : 03CH07-HY Condition : QP 3m LF-ANT-35419(6) VERTICAL</p> |



Appendix D. Duty Cycle Plots

| Band | Duty Cycle(%) | T(us) | 1/T(kHz) | VBW Setting |
|--------------------------|---------------|-------|----------|-------------|
| Bluetooth - LE for 1Mbps | 62.62 | 392 | 2.55 | 3kHz |
| Bluetooth - LE for 2Mbps | 32.91 | 206 | 4.85 | 10kHz |

