



FCC RADIO TEST REPORT

FCC ID : UZ7MC330X
Equipment : Mobile Computer
Brand Name : Zebra
Model Name : MC330X
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 Apr. 06, 2021 and testing was started from Apr. 15, 2021 and completed on Jun. 01, 2021. 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 of Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

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.)



Table of Contents

| | |
|---|-----------|
| History of this test report..... | 3 |
| Summary of Test Result..... | 4 |
| 1 General Description..... | 5 |
| 1.1 Product Feature of Equipment Under Test..... | 5 |
| 1.2 Product Specification of Equipment Under Test..... | 6 |
| 1.3 Modification of EUT | 6 |
| 1.4 Testing Location | 7 |
| 1.5 Applicable Standards..... | 7 |
| 2 Test Configuration of Equipment Under Test..... | 8 |
| 2.1 Carrier Frequency Channel | 8 |
| 2.2 Test Mode..... | 9 |
| 2.3 Connection Diagram of Test System..... | 12 |
| 2.4 Support Unit used in test configuration and system | 13 |
| 2.5 EUT Operation Test Setup | 13 |
| 2.6 Measurement Results Explanation Example..... | 13 |
| 3 Test Result..... | 14 |
| 3.1 Number of Channel Measurement | 14 |
| 3.2 Hopping Channel Separation Measurement | 16 |
| 3.3 Dwell Time Measurement..... | 21 |
| 3.4 20dB and 99% Bandwidth Measurement | 23 |
| 3.5 Output Power Measurement..... | 32 |
| 3.6 Conducted Band Edges Measurement..... | 34 |
| 3.7 Conducted Spurious Emission Measurement | 39 |
| 3.8 Radiated Band Edges and Spurious Emission Measurement | 46 |
| 3.9 AC Conducted Emission Measurement..... | 50 |
| 3.10 Antenna Requirements | 52 |
| 4 List of Measuring Equipment | 53 |
| 5 Uncertainty of Evaluation..... | 54 |
| Appendix A. AC Conducted Emission Test Result | |
| Appendix B. Radiated Spurious Emission | |
| Appendix C. Radiated Spurious Emission Plots | |
| Appendix D. Duty Cycle Plots | |
| Appendix E. Setup Photographs | |



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) | 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 | Under limit 7.58 dB at 48.430 MHz |
| 3.9 | 15.207 | AC Conducted Emission | Pass | Under limit 13.76 dB at 13.560 MHz |
| 3.10 | 15.203 & 15.247(b) | Antenna Requirement | Pass | - |

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wei Chen

Report Producer: Vivian Hsu



1 General Description

1.1 Product Feature of Equipment Under Test

| Product Feature | |
|---------------------------------|---|
| Equipment | Mobile Computer |
| Brand Name | Zebra |
| Model Name | MC330X |
| FCC ID | UZ7MC330X |
| SKU 1 | Gun 29key |
| SKU 2 | Gun 38key |
| SKU 3 | Gun 47key |
| SKU 4 | Brick 29key SE4850 |
| SKU 5 | Brick 38key |
| SKU 6 | Brick 47key |
| SKU 7 | Brick 29key SE4770 |
| EUT supports Radios application | NFC WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 WLAN 11ax HE20/HE40/HE80 Bluetooth BR/EDR/LE |
| HW Version | EV |
| SW Version | Android Version 11 |
| FW Version | 11-10-12.00-RG-U00-PRD-HEL-04 |
| MFD | 20MAR21 |
| EUT Stage | Identical Prototype |

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

| Specification of Accessories | | | | |
|--|------------|--------|--------------|--------------------|
| Adapter | Brand Name | Zebra | Part Number | PWR-WUA5V12W0US |
| U cable | Brand Name | Symbol | Model Name | CBL-MC33-USBCHG-01 |
| MC33 1X battery (Inventus) | Brand Name | ZEBRA | Model Number | BT-000338 |
| MC33 2X battery (Inventus) | Brand Name | ZEBRA | Model Number | BT-000337 |
| MC33 2X battery (TWS) | Brand Name | ZEBRA | Model Number | BT-000337A |
| MC33 7000mA 2X (Inventus) | Brand Name | ZEBRA | Model Number | BT-000375 |
| MC33 Extended Capacity Battery (BT Battery) | Brand Name | ZEBRA | Model Number | BT-000444 |
| Holster for MC3XXX Gun configuration | Brand Name | Zebra | Model Number | SG-MC3021212-01R |
| Rigid holster for MC3XXX Gun configuration | Brand Name | Zebra | Model Number | SG-MC33-RDHLST-01 |
| Holster for MC3XXXX Brick configuration | Brand Name | Zebra | Model Number | 11-69293-01R |
| Rigid holster for MC3XXX Brick configuration | Brand Name | Zebra | Model Number | SG-MC33-RDHLST-01 |



1.2 Product Specification of Equipment Under Test

| Product Specification subjective to this standard | |
|---|---|
| Tx/Rx Frequency Range | 2402 MHz ~ 2480 MHz |
| Number of Channels | 79 |
| Carrier Frequency of Each Channel | 2402+n*1 MHz; n=0~78 |
| Maximum Output Power to Antenna | Bluetooth BR (1Mbps): 6.53 dBm / 0.0045 W Bluetooth EDR (2Mbps): 9.19 dBm / 0.0083 W Bluetooth EDR (3Mbps): 9.65 dBm / 0.0092 W |
| 99% Occupied Bandwidth | Bluetooth BR (1Mbps): 0.900MHz Bluetooth EDR (2Mbps): 1.198MHz Bluetooth EDR (3Mbps): 1.195MHz |
| Antenna Type / Gain | Patch Antenna with gain 3.10 dBi |
| Type of Modulation | Bluetooth BR (1Mbps) : GFSK Bluetooth EDR (2Mbps) : $\pi/4$ -DQPSK Bluetooth EDR (3Mbps) : 8-DPSK |

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 are made to the EUT during all test items.



1.4 Testing Location

| | |
|---------------------------|--|
| 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, 03CH16-HY, CO07-HY |

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

FCC designation No.: TW3786

1.5 Applicable Standards

According to the specifications of 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 test items were verified and recorded according to the standards and without any deviation during the test.
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

| Channel | Frequency | Bluetooth Average Output Power | | |
|---------|-----------|--------------------------------|----------|----------|
| | | GFSK / 1Mbps | | |
| | | DH1 | DH3 | DH5 |
| Ch00 | 2402MHz | 5.83 dBm | 5.90 dBm | 5.88 dBm |
| Ch39 | 2441MHz | 6.05 dBm | 6.19 dBm | 6.07 dBm |
| Ch78 | 2480MHz | 5.73 dBm | 5.79 dBm | 5.76 dBm |

| Channel | Frequency | Bluetooth Average Output Power | | |
|---------|-----------|--------------------------------|----------|----------|
| | | $\pi/4$ -DQPSK / 2Mbps | | |
| | | 2DH1 | 2DH3 | 2DH5 |
| Ch00 | 2402MHz | 5.58 dBm | 5.78 dBm | 5.74 dBm |
| Ch39 | 2441MHz | 6.50 dBm | 6.72 dBm | 6.70 dBm |
| Ch78 | 2480MHz | 5.70 dBm | 5.90 dBm | 5.81 dBm |

| Channel | Frequency | Bluetooth Average Output Power | | |
|---------|-----------|--------------------------------|----------|----------|
| | | 8-DPSK / 3Mbps | | |
| | | 3DH1 | 3DH3 | 3DH5 |
| Ch00 | 2402MHz | 5.70 dBm | 5.78 dBm | 5.75 dBm |
| Ch39 | 2441MHz | 6.59 dBm | 6.65 dBm | 6.62 dBm |
| Ch78 | 2480MHz | 5.80 dBm | 5.91 dBm | 5.81 dBm |



| Channel | Frequency | Bluetooth Peak Output Power | | |
|---------|-----------|-----------------------------|----------|----------|
| | | GFSK / 1Mbps | | |
| | | DH1 | DH3 | DH5 |
| Ch00 | 2402MHz | 6.21 dBm | 6.26 dBm | 6.24 dBm |
| Ch39 | 2441MHz | 6.43 dBm | 6.53 dBm | 6.44 dBm |
| Ch78 | 2480MHz | 6.12 dBm | 6.14 dBm | 6.10 dBm |

| Channel | Frequency | Bluetooth Peak Output Power | | |
|---------|-----------|-----------------------------|----------|----------|
| | | $\pi/4$ -DQPSK / 2Mbps | | |
| | | 2DH1 | 2DH3 | 2DH5 |
| Ch00 | 2402MHz | 8.20 dBm | 8.32 dBm | 8.31 dBm |
| Ch39 | 2441MHz | 9.12 dBm | 9.19 dBm | 9.18 dBm |
| Ch78 | 2480MHz | 8.36 dBm | 8.46 dBm | 8.40 dBm |

| Channel | Frequency | Bluetooth Peak Output Power | | |
|---------|-----------|-----------------------------|----------|----------|
| | | 8-DPSK / 3Mbps | | |
| | | 3DH1 | 3DH3 | 3DH5 |
| Ch00 | 2402MHz | 8.73 dBm | 8.80 dBm | 8.78 dBm |
| Ch39 | 2441MHz | 9.57 dBm | 9.65 dBm | 9.63 dBm |
| Ch78 | 2480MHz | 8.83 dBm | 8.92 dBm | 8.88 dBm |

Remark: The data rate was set in 3Mbps for all the test items due to the highest RF output power.



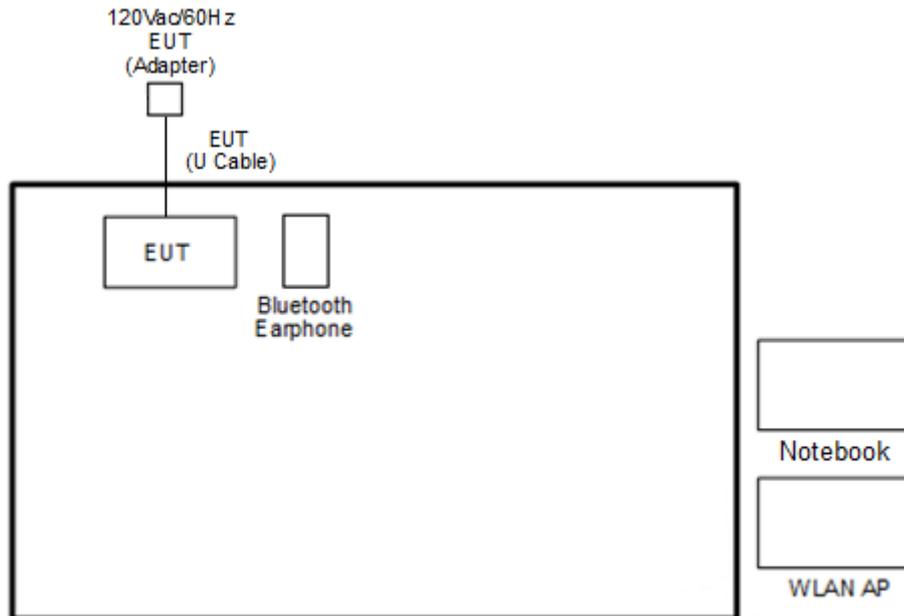
- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report, and the worst mode of radiated spurious emissions is Bluetooth 3Mbps 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.

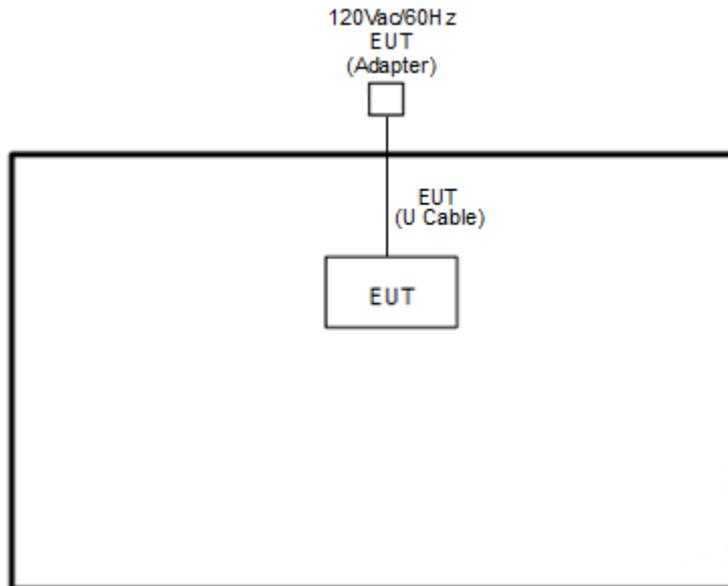
| Summary table of Test Cases | | | |
|--|---|---|-----------------------------------|
| Test Item | Data Rate / Modulation | | |
| Conducted Test Cases | Bluetooth BR 1Mbps GFSK | Bluetooth EDR 2Mbps $\pi/4$-DQPSK | Bluetooth EDR 3Mbps 8-DPSK |
| | Mode 1: CH00_2402 MHz | Mode 4: CH00_2402 MHz | Mode 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 EDR 3Mbps 8-DPSK | | |
| | Mode 1: CH00_2402 MHz | | |
| | Mode 2: CH39_2441 MHz | | |
| | Mode 3: CH78_2480 MHz | | |
| AC Conducted Emission | Mode 1 :WLAN (2.4GHz) Link + Bluetooth Link + Play MP3 + NFC On + MC33 Extended Capacity Battery (BT Battery) + USB Cable (Charging from Adapter) for SKU 7 | | |
| Remark: | | | |
| 1. For Radiated Test Cases, the worst mode data rate 3Mbps 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 3Mbps, and no other significantly frequencies found in conducted spurious emission. | | | |
| 2. For Radiated Test Cases, the tests were performed with MC33 1X battery (Inventus) and SKU 3. | | | |

2.3 Connection Diagram of Test System

<AC Conducted Emission Mode>



<Bluetooth Tx Mode>



2.4 Support Unit used in test configuration and system

| Item | Equipment | Brand Name | Model Name | FCC ID | Data Cable | Power Cord |
|------|--------------------|------------|---------------|-------------|------------|--|
| 1. | Bluetooth Earphone | Levovo | LBH301 | FCC DoC | N/A | N/A |
| 2. | WLAN AP | ASUS | RT-AC66U | MSQ-RTAC66U | N/A | Unshielded, 1.8 m |
| 3. | SD Card | SanDisk | MicroSD HC | FCC DoC | N/A | N/A |
| 4. | Notebook | DELL | Latitude 3400 | FCC DoC | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |

2.5 EUT Operation Test Setup

The RF test items, utility “Command V10.0.16299.1087” 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.

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

3 Test Result

3.1 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.

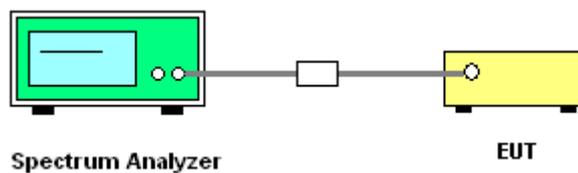
3.1.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was 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 \geq 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

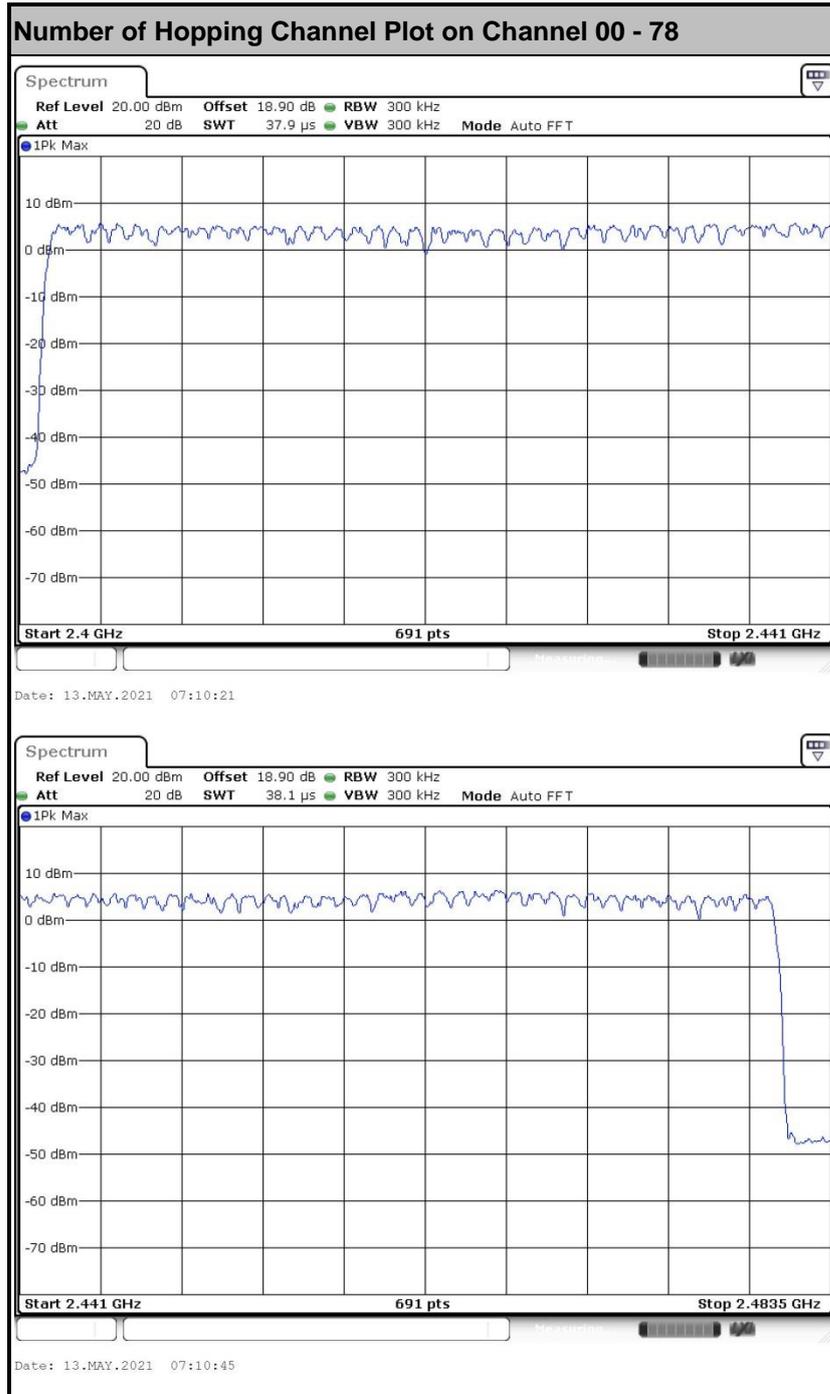




3.1.5 Test Result of Number of Hopping Frequency

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

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



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.

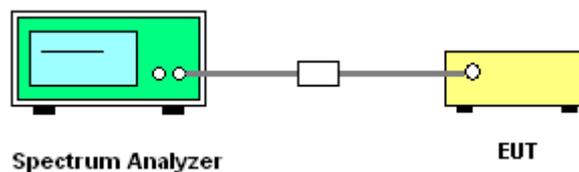
3.2.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was 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 \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.2.4 Test Setup





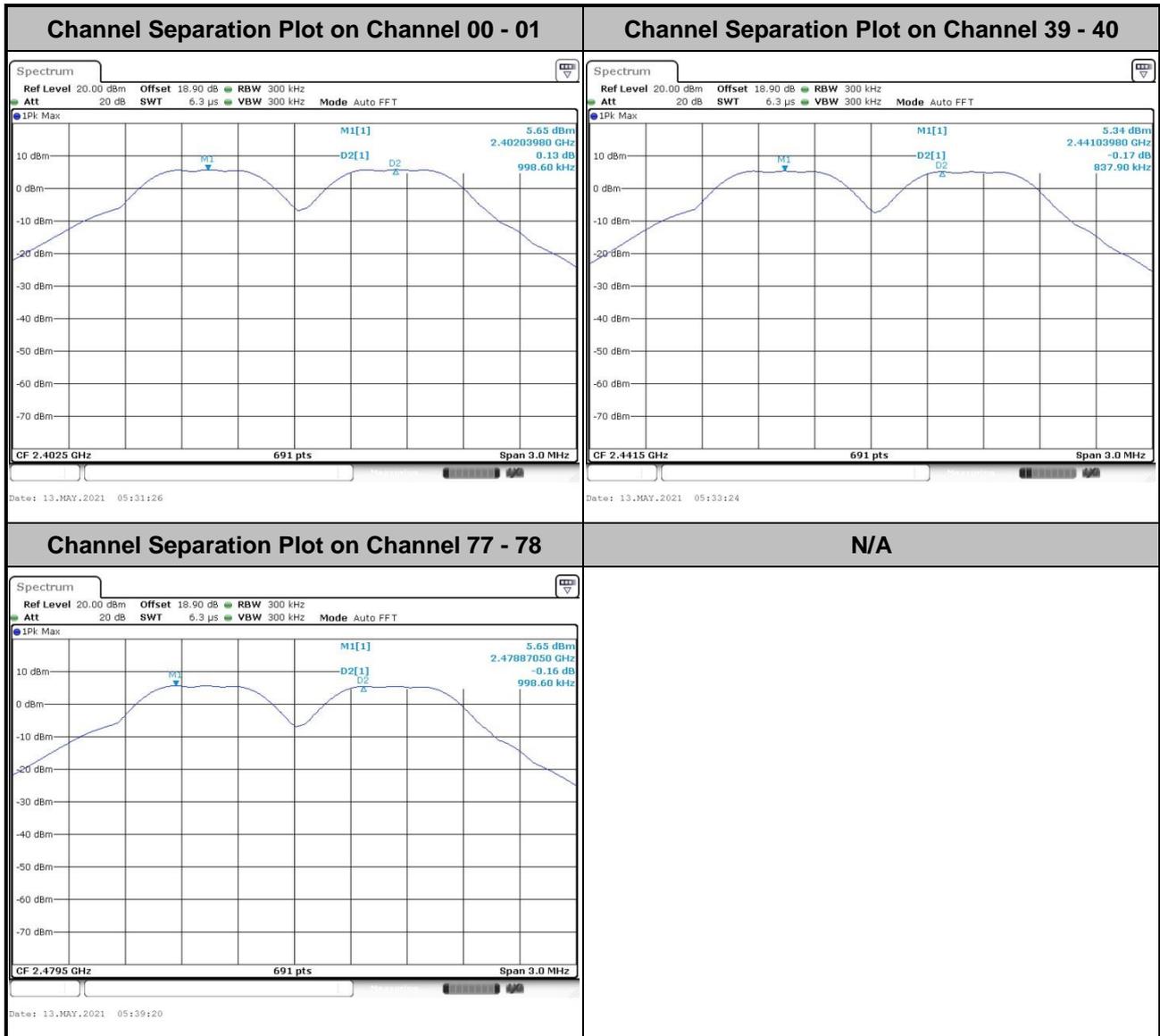
3.2.5 Test Result of Hopping Channel Separation

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

| Mod. | Data Rate | N _{TX} | CH. | Freq. (MHz) | Hopping Channel Separation Measurement (MHz) | Hopping Channel Separation Measurement Limit (MHz) | Pass/Fail |
|------|-----------|-----------------|-----|-------------|--|--|-----------|
| DH | 1Mbps | 1 | 0 | 2402 | 0.998 | 0.6827 | Pass |
| DH | 1Mbps | 1 | 39 | 2441 | 0.837 | 0.6807 | Pass |
| DH | 1Mbps | 1 | 78 | 2480 | 0.998 | 0.6827 | Pass |
| 2DH | 2Mbps | 1 | 0 | 2402 | 0.998 | 0.8967 | Pass |
| 2DH | 2Mbps | 1 | 39 | 2441 | 0.998 | 0.8967 | Pass |
| 2DH | 2Mbps | 1 | 78 | 2480 | 1.002 | 0.8967 | Pass |
| 3DH | 3Mbps | 1 | 0 | 2402 | 1.002 | 0.8853 | Pass |
| 3DH | 3Mbps | 1 | 39 | 2441 | 0.998 | 0.8880 | Pass |
| 3DH | 3Mbps | 1 | 78 | 2480 | 0.998 | 0.8853 | Pass |

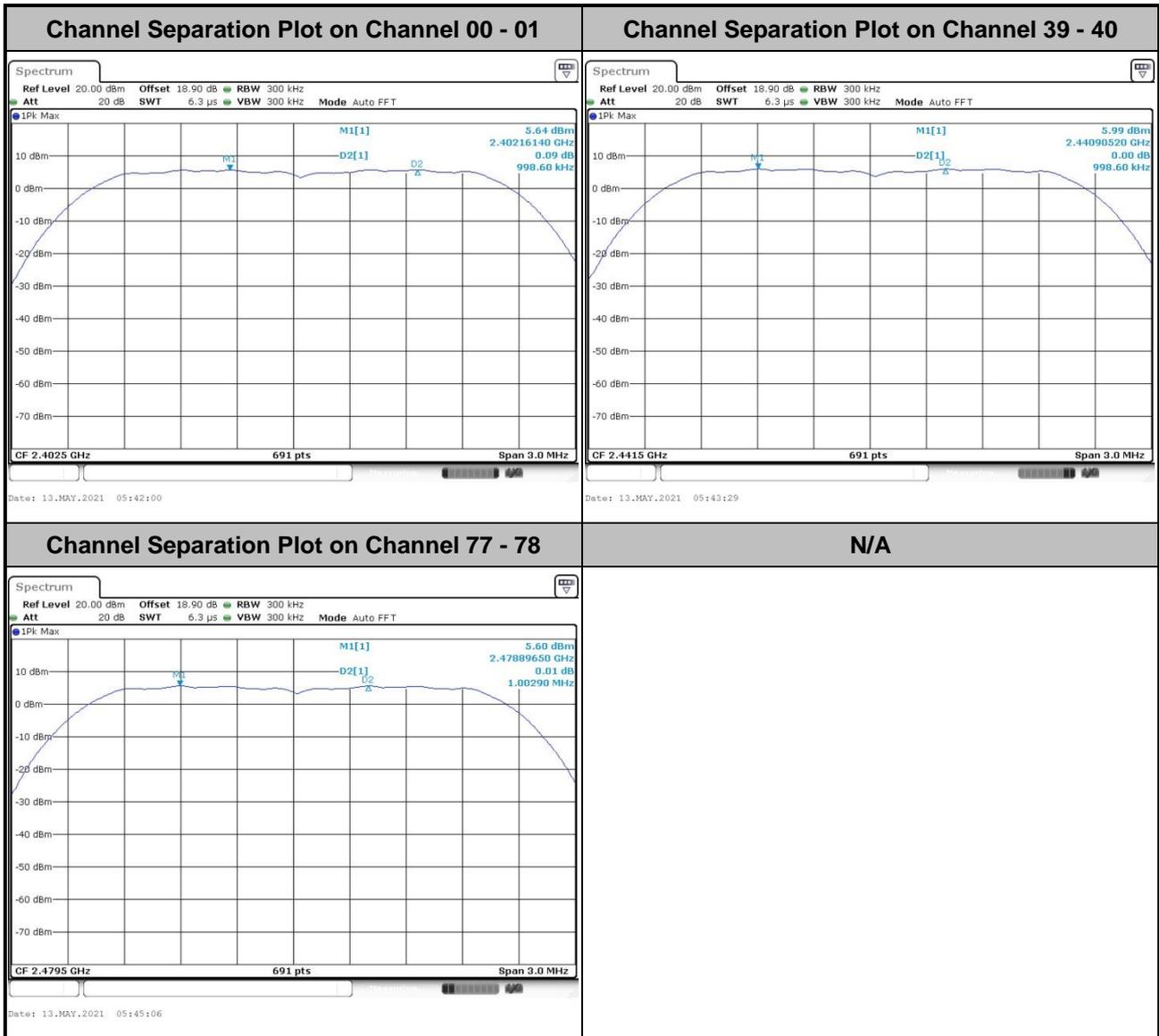


<1Mbps>



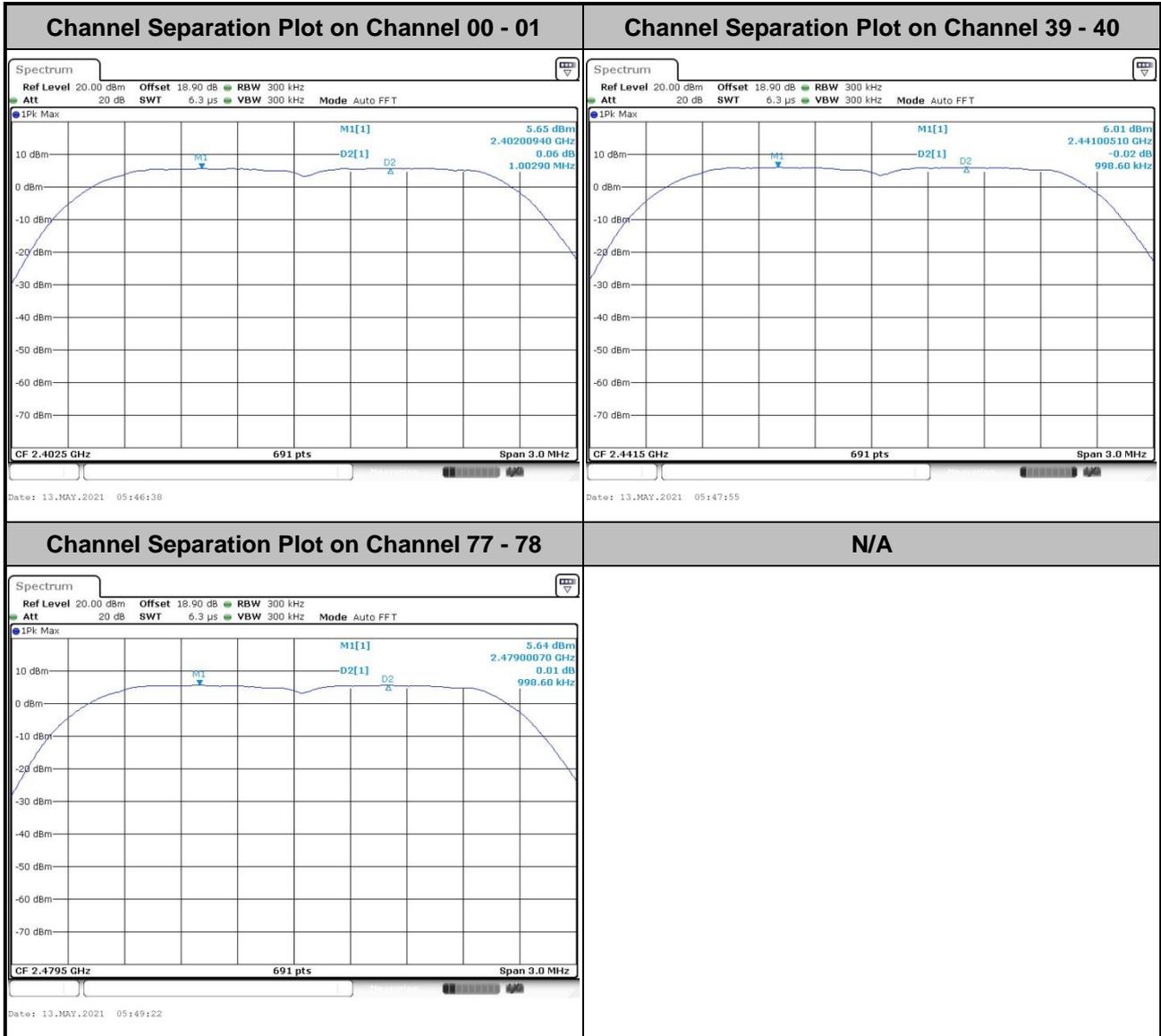


<2Mbps>





<3Mbps>



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.

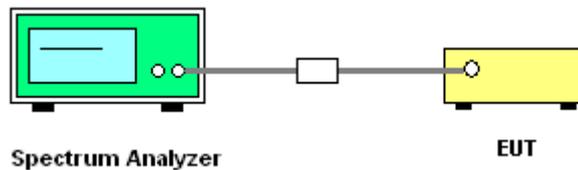
3.3.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was 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 \geq 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

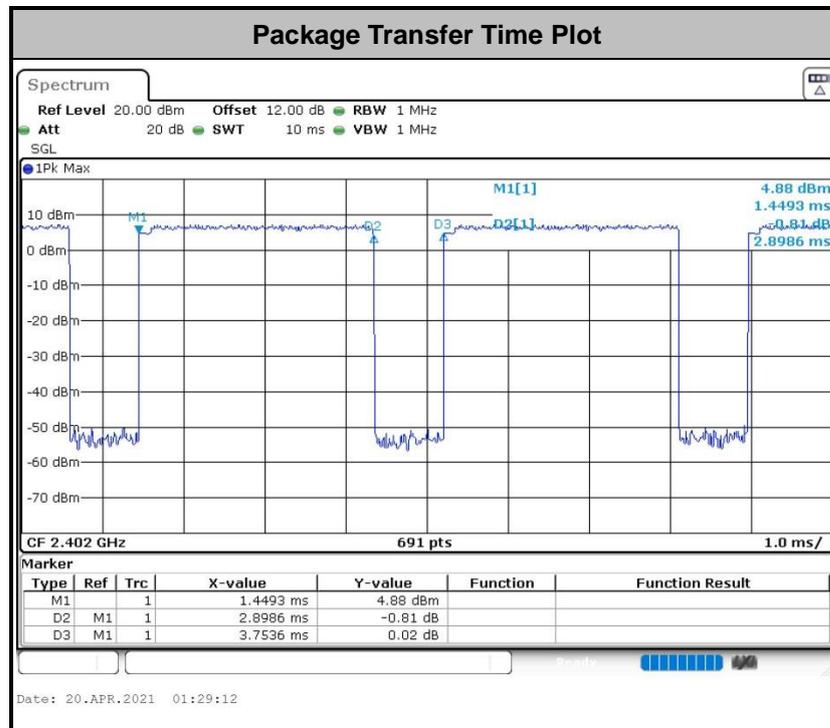




3.3.5 Test Result of Dwell Time

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

| Mod. | Hopping Channel Number Rate | Hops Over Occupancy Time(hops) | Package Transfer Time (msec) (MHz) | Dwell Time (sec) | Limits (sec) | Pass/Fail |
|-------|-----------------------------|--------------------------------|------------------------------------|------------------|--------------|-----------|
| Nomal | 79 | 106.67 | 2.90 | 0.31 | 0.4 | Pass |
| AFH | 20 | 53.33 | 2.90 | 0.15 | 0.4 | Pass |



Remark:

- In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels. With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s), Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.
- In AFH mode, hopping rate is 800 hops/s with 6 slots in 20 hopping channels. With channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 x 20) (s), Hops Over Occupancy Time comes to (800 / 6 / 20) x (0.4 x 20) = 53.33 hops.
- Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

3.4 20dB and 99% Bandwidth Measurement

3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

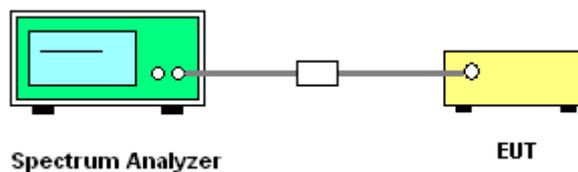
3.4.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was 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 \geq 1% of the 20 dB bandwidth; VBW \geq 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 \geq 1-5% of the 99% bandwidth; VBW \geq 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



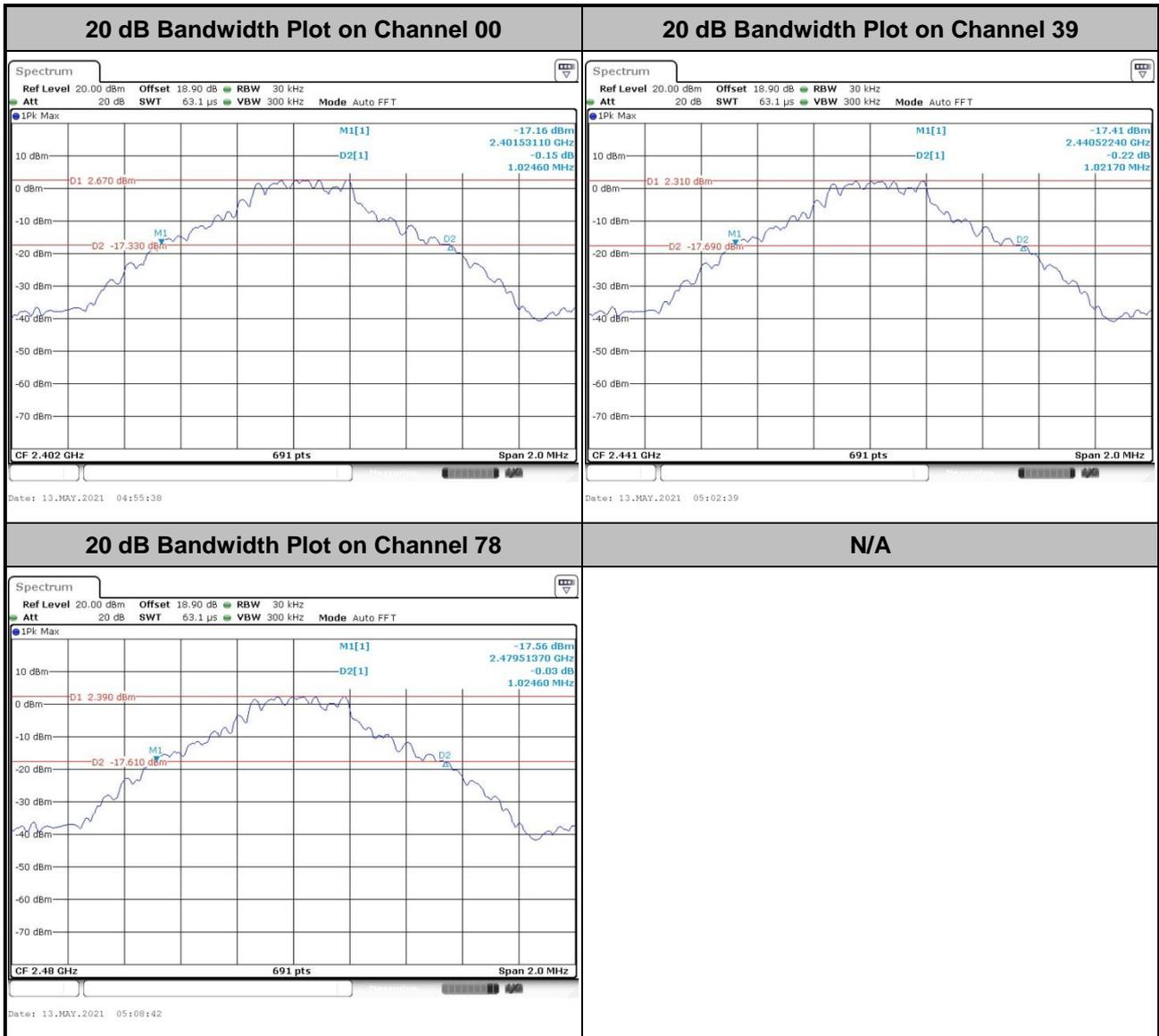
**3.4.5 Test Result of 20dB Bandwidth**

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

| Mod. | Data Rate | N _{TX} | CH. | Freq. (MHz) | 20db BW (MHz) | Pass/Fail |
|------|-----------|-----------------|-----|-------------|---------------|-----------|
| DH | 1Mbps | 1 | 0 | 2402 | 1.024 | Pass |
| DH | 1Mbps | 1 | 39 | 2441 | 1.021 | Pass |
| DH | 1Mbps | 1 | 78 | 2480 | 1.024 | Pass |
| 2DH | 2Mbps | 1 | 0 | 2402 | 1.345 | Pass |
| 2DH | 2Mbps | 1 | 39 | 2441 | 1.345 | Pass |
| 2DH | 2Mbps | 1 | 78 | 2480 | 1.345 | Pass |
| 3DH | 3Mbps | 1 | 0 | 2402 | 1.328 | Pass |
| 3DH | 3Mbps | 1 | 39 | 2441 | 1.332 | Pass |
| 3DH | 3Mbps | 1 | 78 | 2480 | 1.328 | Pass |

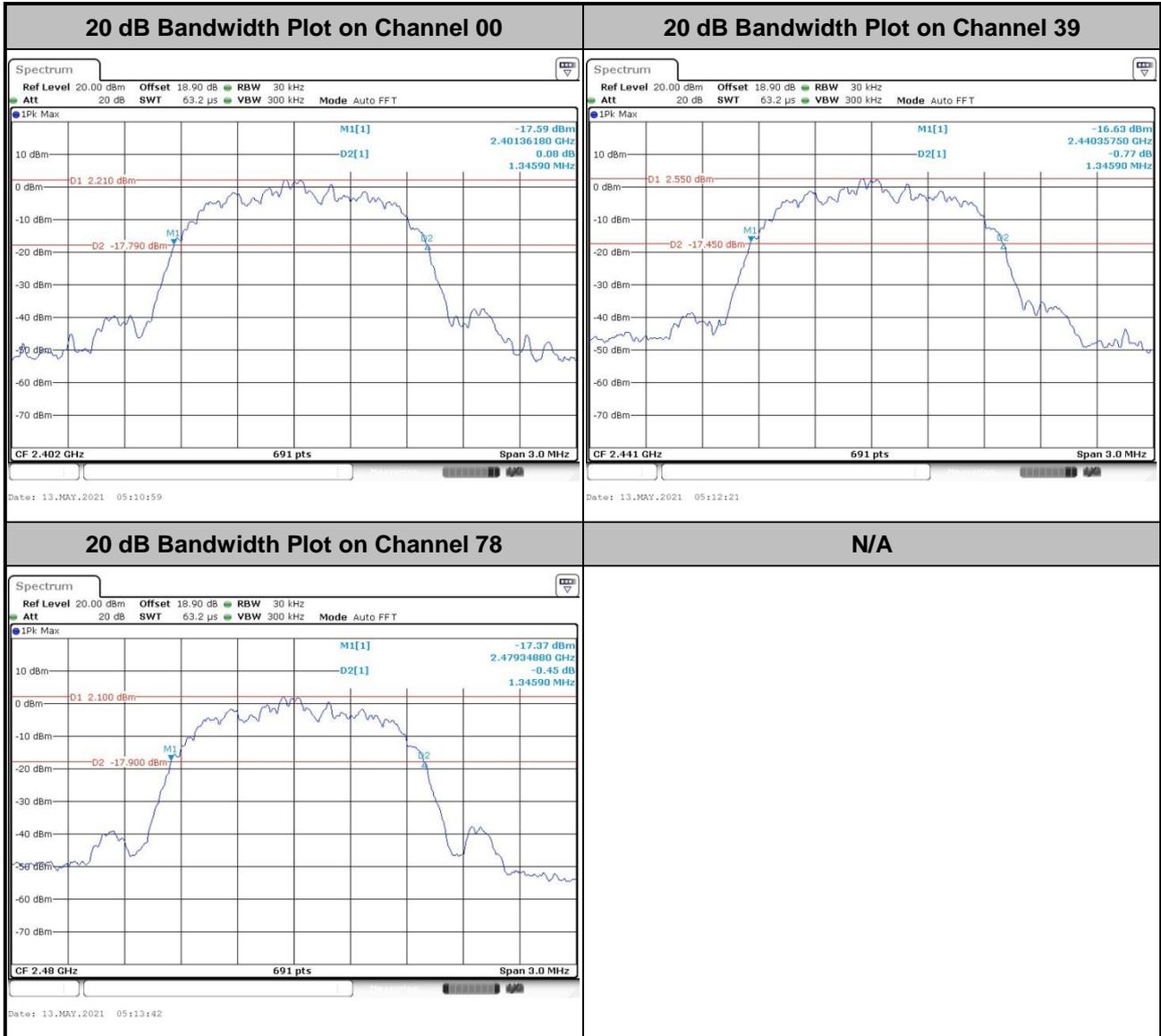


<1Mbps>



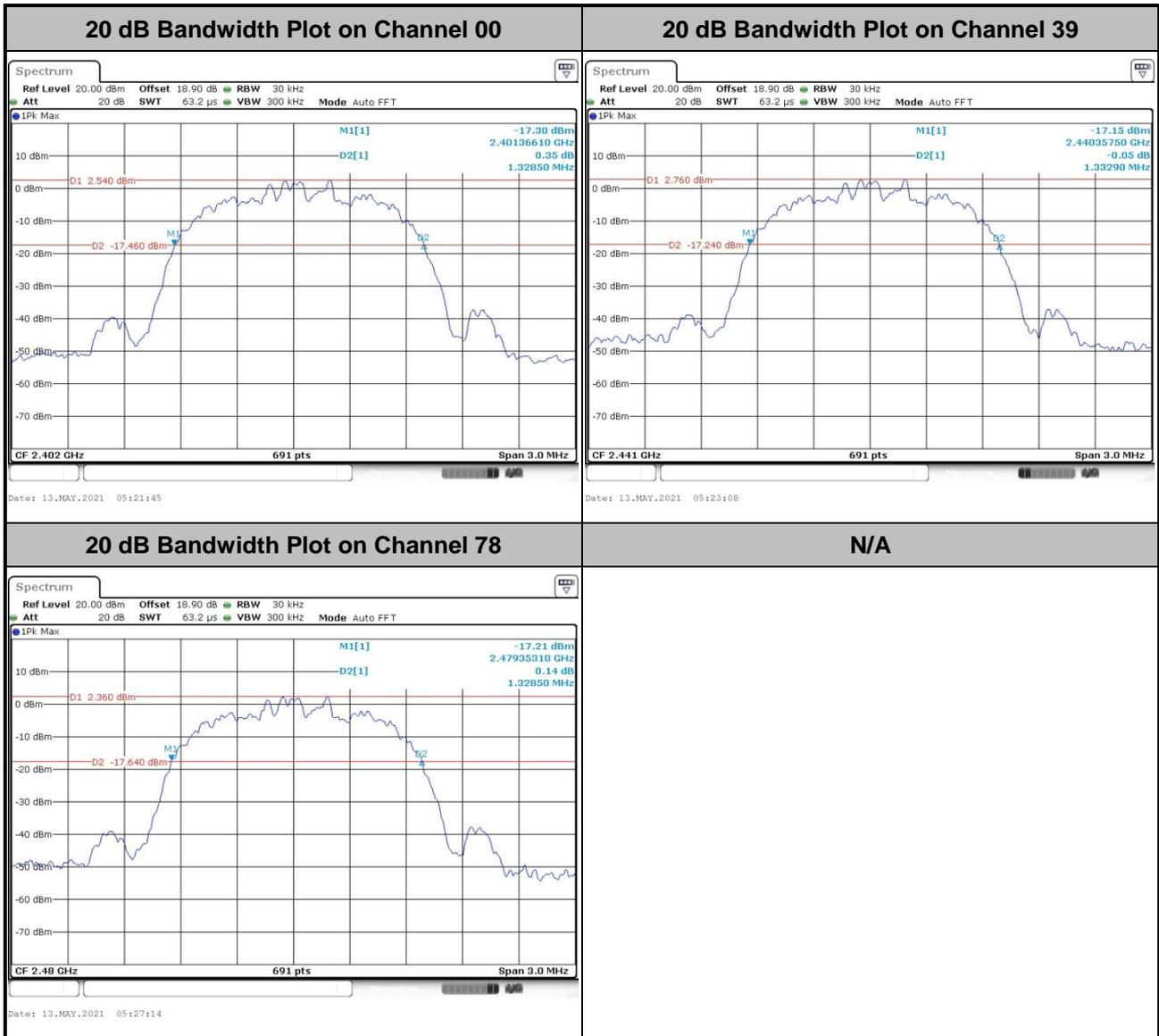


<2Mbps>





<3Mbps>



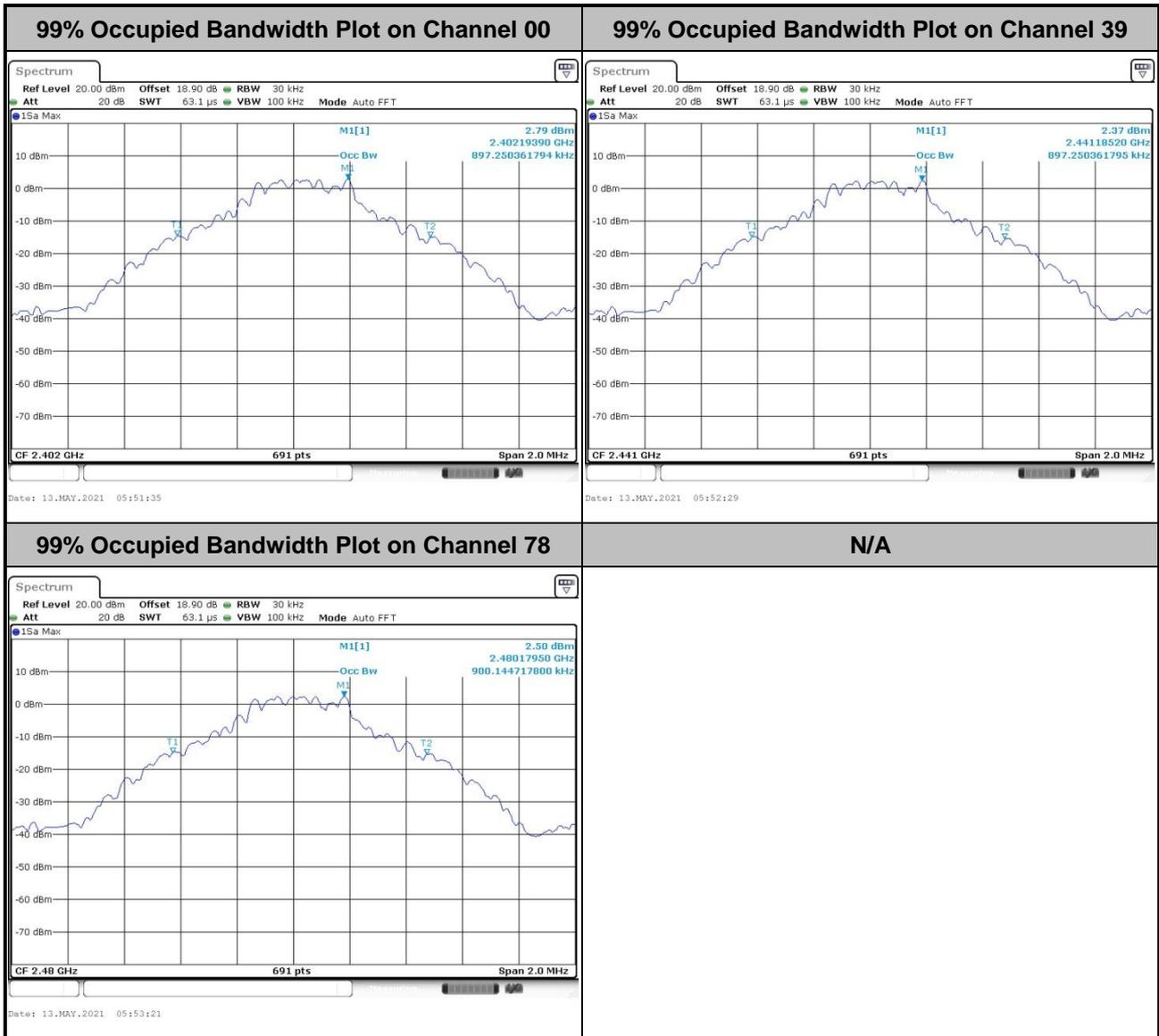
**3.4.6 Test Result of 99% Occupied Bandwidth**

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

| Mod. | Data Rate | N _{TX} | CH. | Freq. (MHz) | 99% Bandwidth (MHz) | Pass/Fail |
|------|-----------|-----------------|-----|-------------|---------------------|-----------|
| DH | 1Mbps | 1 | 0 | 2402 | 0.897 | Pass |
| DH | 1Mbps | 1 | 39 | 2441 | 0.897 | Pass |
| DH | 1Mbps | 1 | 78 | 2480 | 0.900 | Pass |
| 2DH | 2Mbps | 1 | 0 | 2402 | 1.195 | Pass |
| 2DH | 2Mbps | 1 | 39 | 2441 | 1.195 | Pass |
| 2DH | 2Mbps | 1 | 78 | 2480 | 1.198 | Pass |
| 3DH | 3Mbps | 1 | 0 | 2402 | 1.192 | Pass |
| 3DH | 3Mbps | 1 | 39 | 2441 | 1.195 | Pass |
| 3DH | 3Mbps | 1 | 78 | 2480 | 1.195 | Pass |



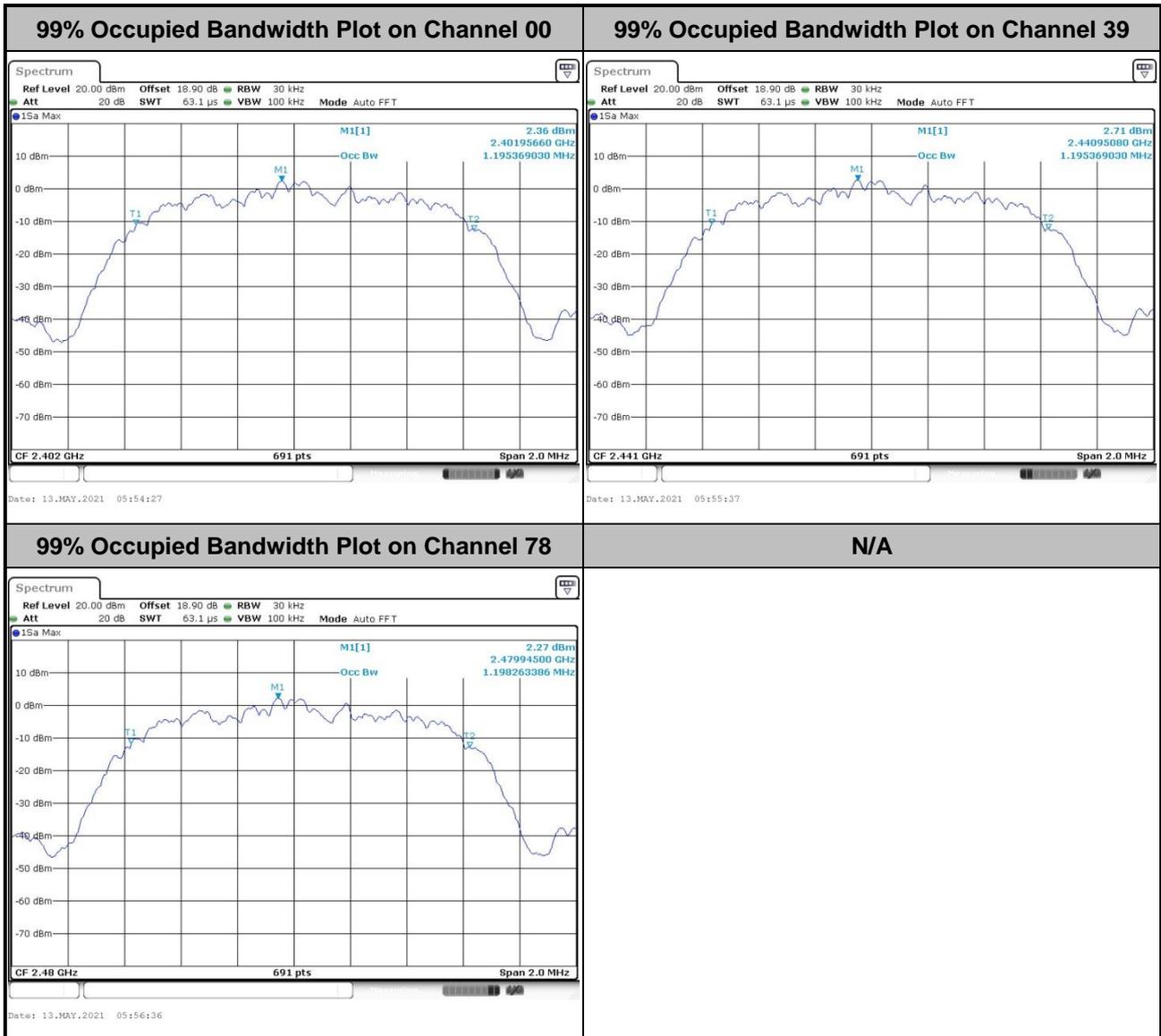
<1Mbps>



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



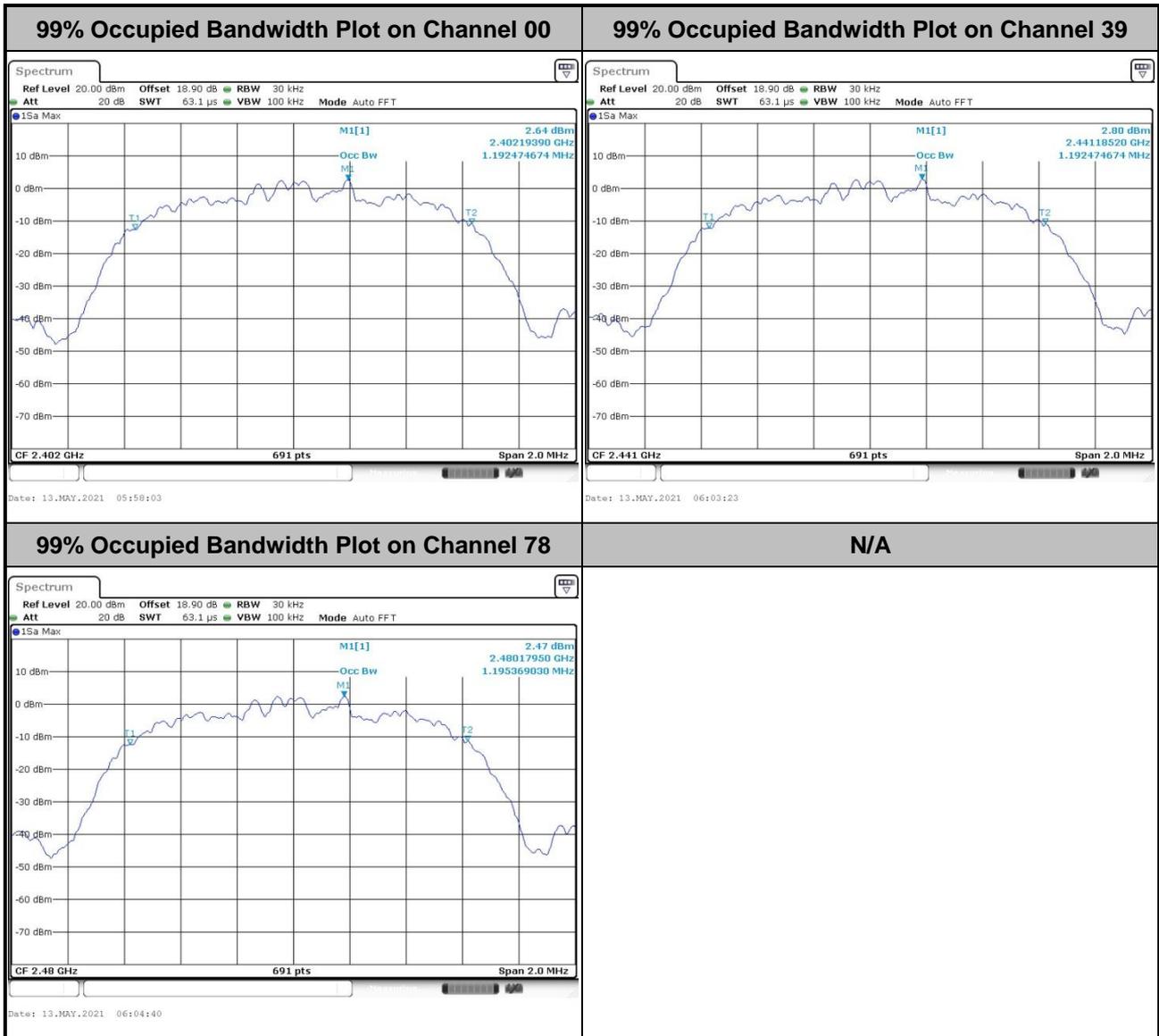
<2Mbps>



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



<3Mbps>



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

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.

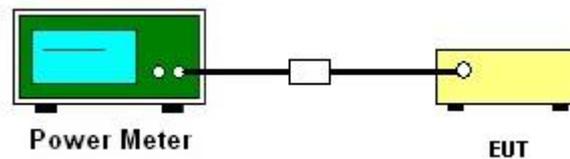
3.5.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the power meter by RF cable and attenuator. The path loss was 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

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

| DH | CH. | N _{TX} | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|-----|-----|-----------------|------------------|-------------------|-------------|
| DH3 | 0 | 1 | 6.26 | 20.97 | Pass |
| | 39 | 1 | 6.53 | 20.97 | Pass |
| | 78 | 1 | 6.14 | 20.97 | Pass |

| 2DH | CH. | N _{TX} | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|------|-----|-----------------|------------------|-------------------|-------------|
| 2DH3 | 0 | 1 | 8.32 | 20.97 | Pass |
| | 39 | 1 | 9.19 | 20.97 | Pass |
| | 78 | 1 | 8.46 | 20.97 | Pass |

| 3DH | CH. | N _{TX} | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|------|-----|-----------------|------------------|-------------------|-------------|
| 3DH3 | 0 | 1 | 8.80 | 20.97 | Pass |
| | 39 | 1 | 9.65 | 20.97 | Pass |
| | 78 | 1 | 8.92 | 20.97 | Pass |

3.5.6 Test Result of Average Output Power (Reporting Only)

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

| DH | CH. | N _{TX} | Average Power (dBm) | Duty Factor (dB) |
|-----|-----|-----------------|---------------------|------------------|
| DH3 | 0 | 1 | 5.90 | 1.84 |
| | 39 | 1 | 6.19 | 1.84 |
| | 78 | 1 | 5.79 | 1.84 |

| 2DH | CH. | N _{TX} | Average Power (dBm) | Duty Factor (dB) |
|------|-----|-----------------|---------------------|------------------|
| 2DH3 | 0 | 1 | 5.78 | 1.84 |
| | 39 | 1 | 6.72 | 1.84 |
| | 78 | 1 | 5.90 | 1.84 |

| 3DH | CH. | N _{TX} | Average Power (dBm) | Duty Factor (dB) |
|------|-----|-----------------|---------------------|------------------|
| 3DH3 | 0 | 1 | 5.78 | 1.84 |
| | 39 | 1 | 6.65 | 1.84 |
| | 78 | 1 | 5.91 | 1.84 |

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.

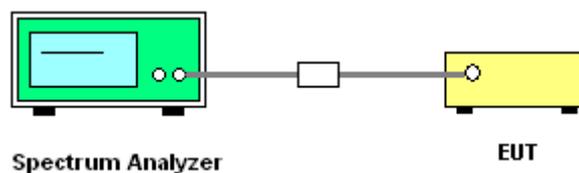
3.6.2 Measuring Instruments

See list of measuring equipment of 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

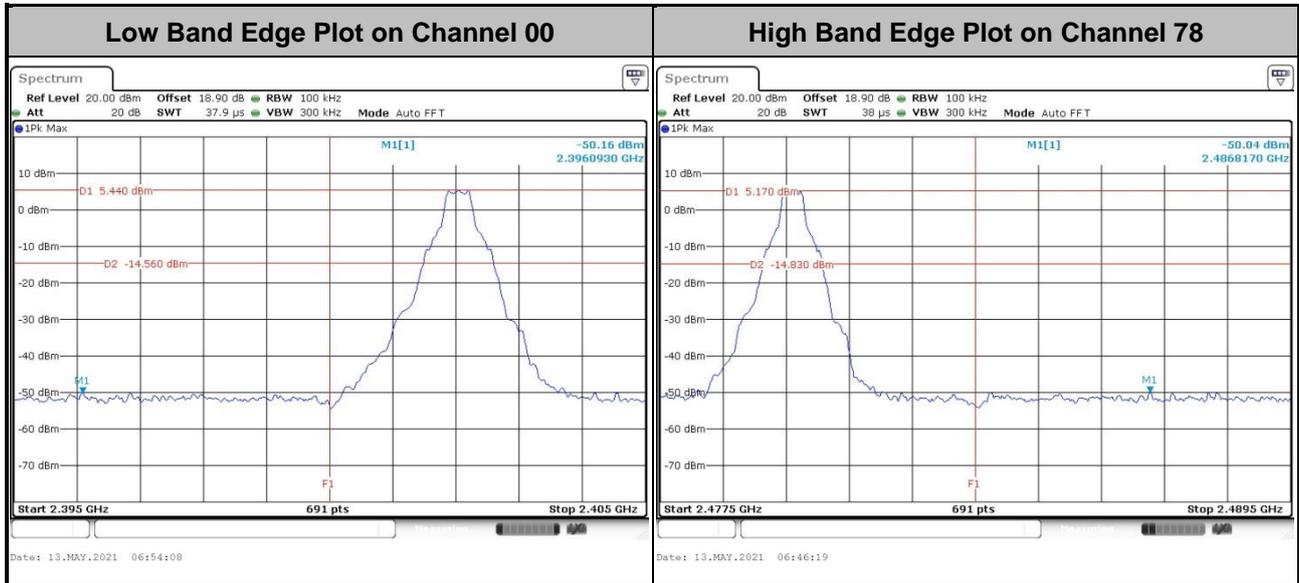




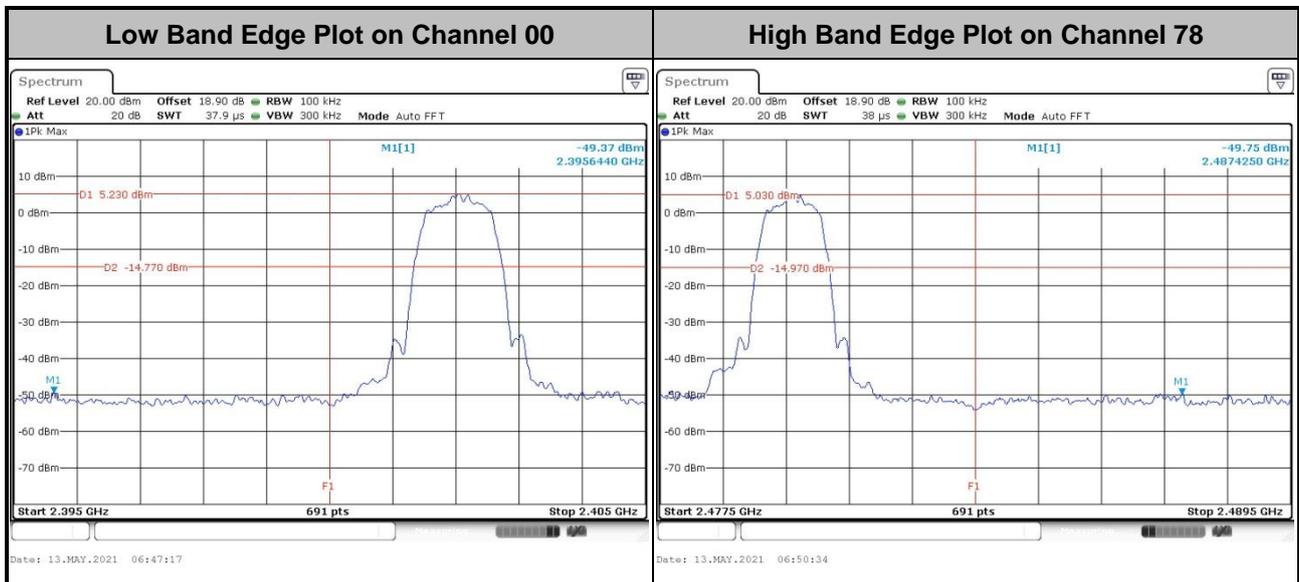
3.6.5 Test Result of Conducted Band Edges

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

<1Mbps>

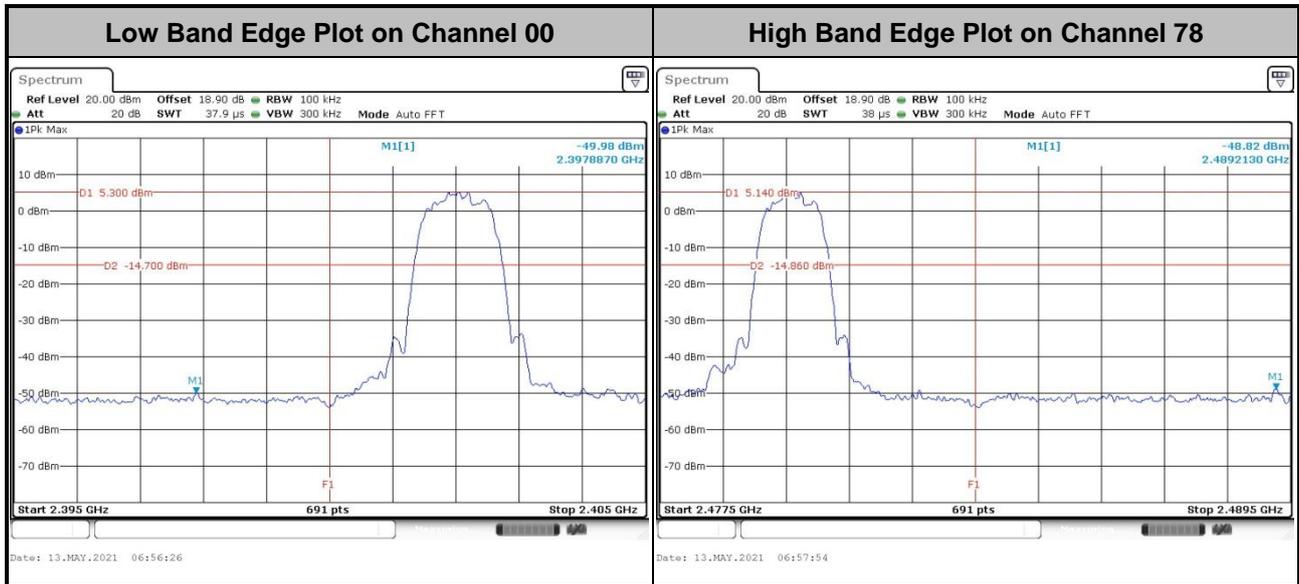


<2Mbps>





<3Mbps>

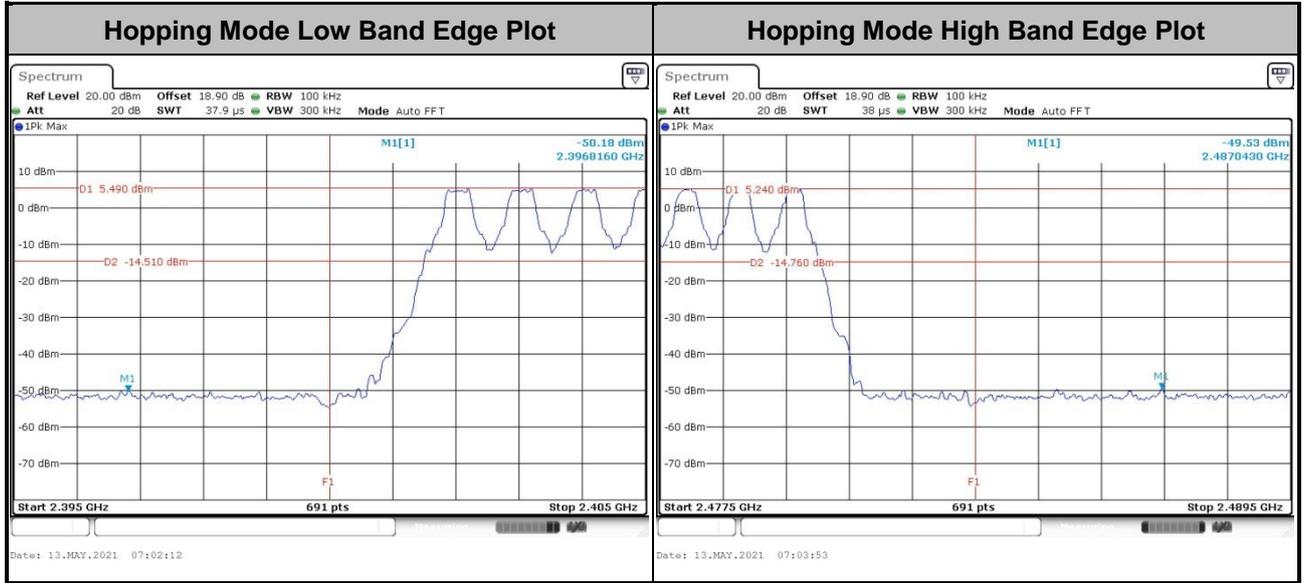




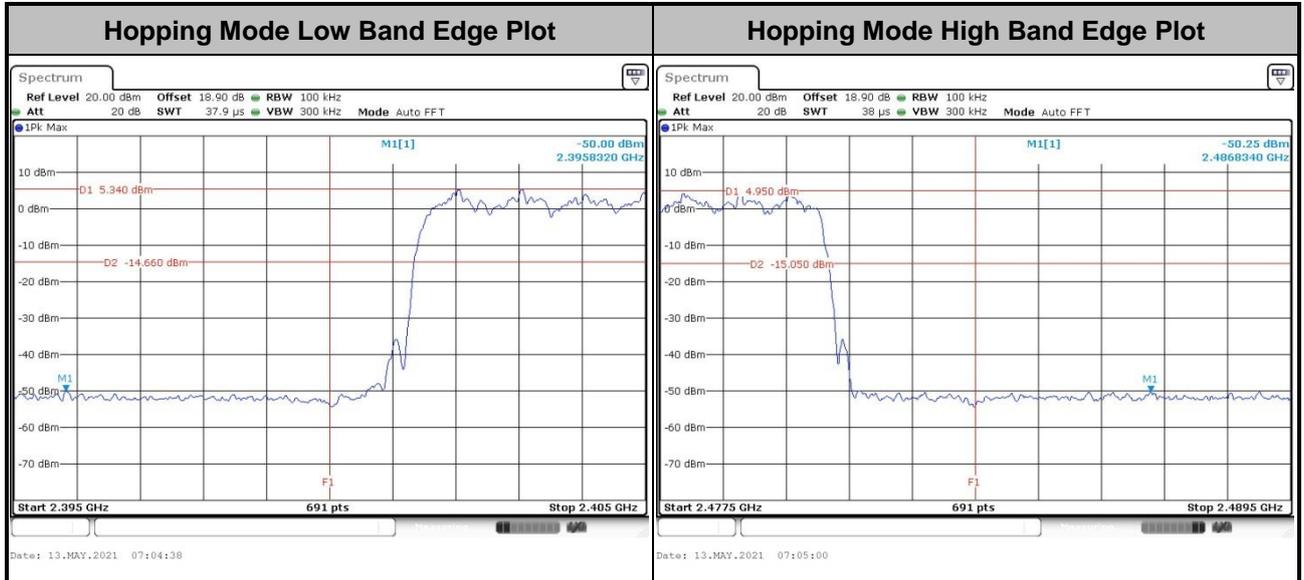
3.6.6 Test Result of Conducted Hopping Mode Band Edges

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

<1Mbps>

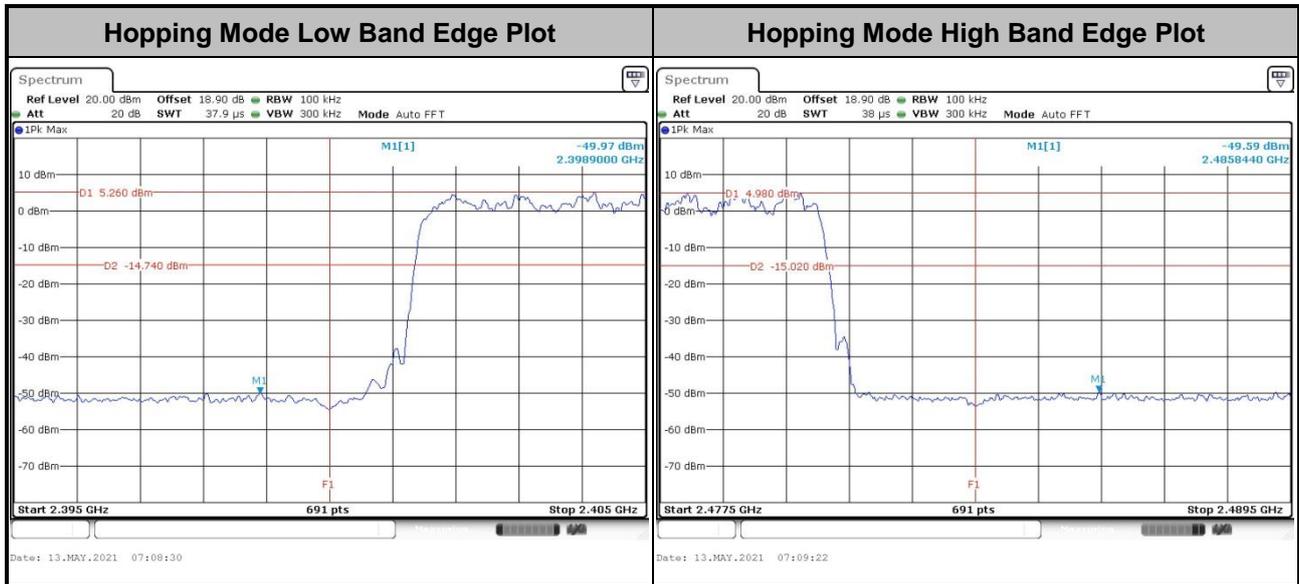


<2Mbps>





<3Mbps>



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.

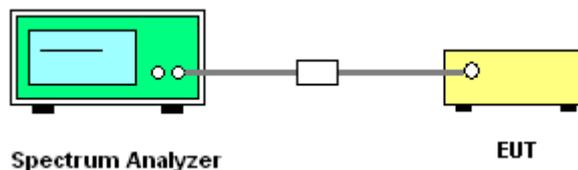
3.7.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was 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

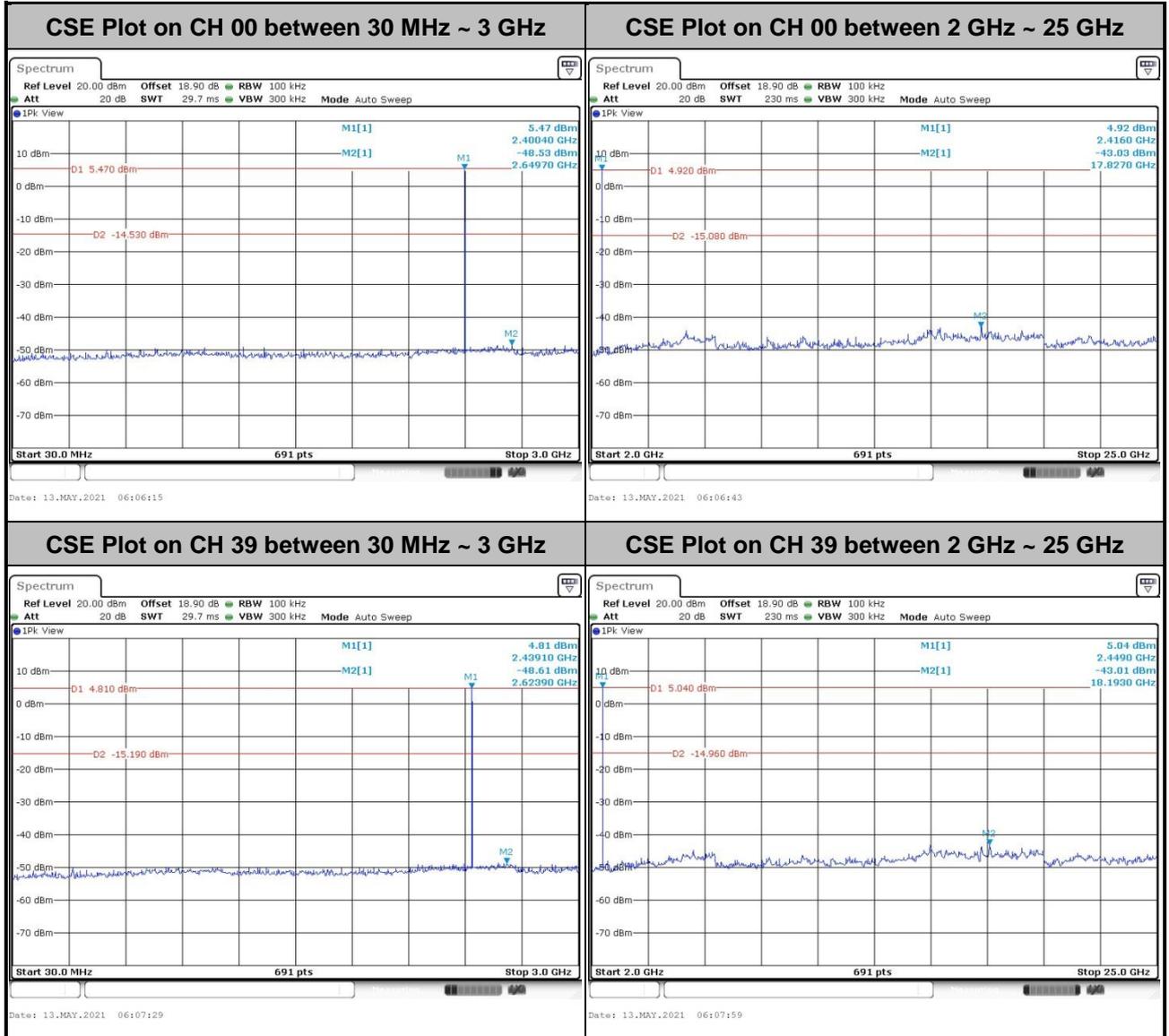


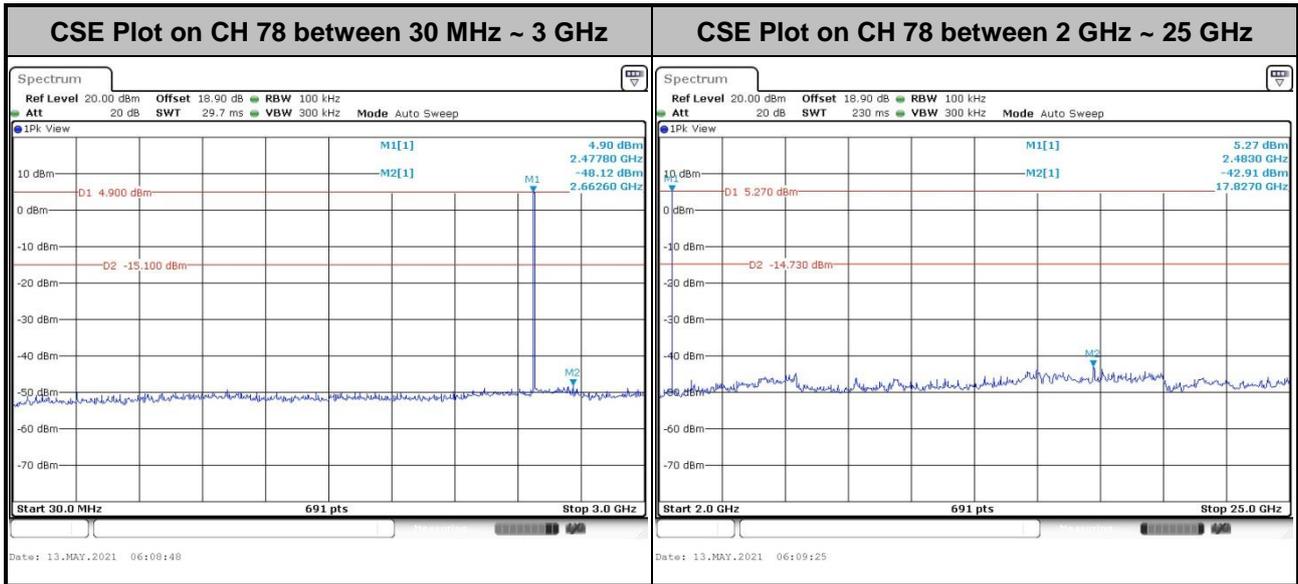


3.7.5 Test Result of Conducted Spurious Emission

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

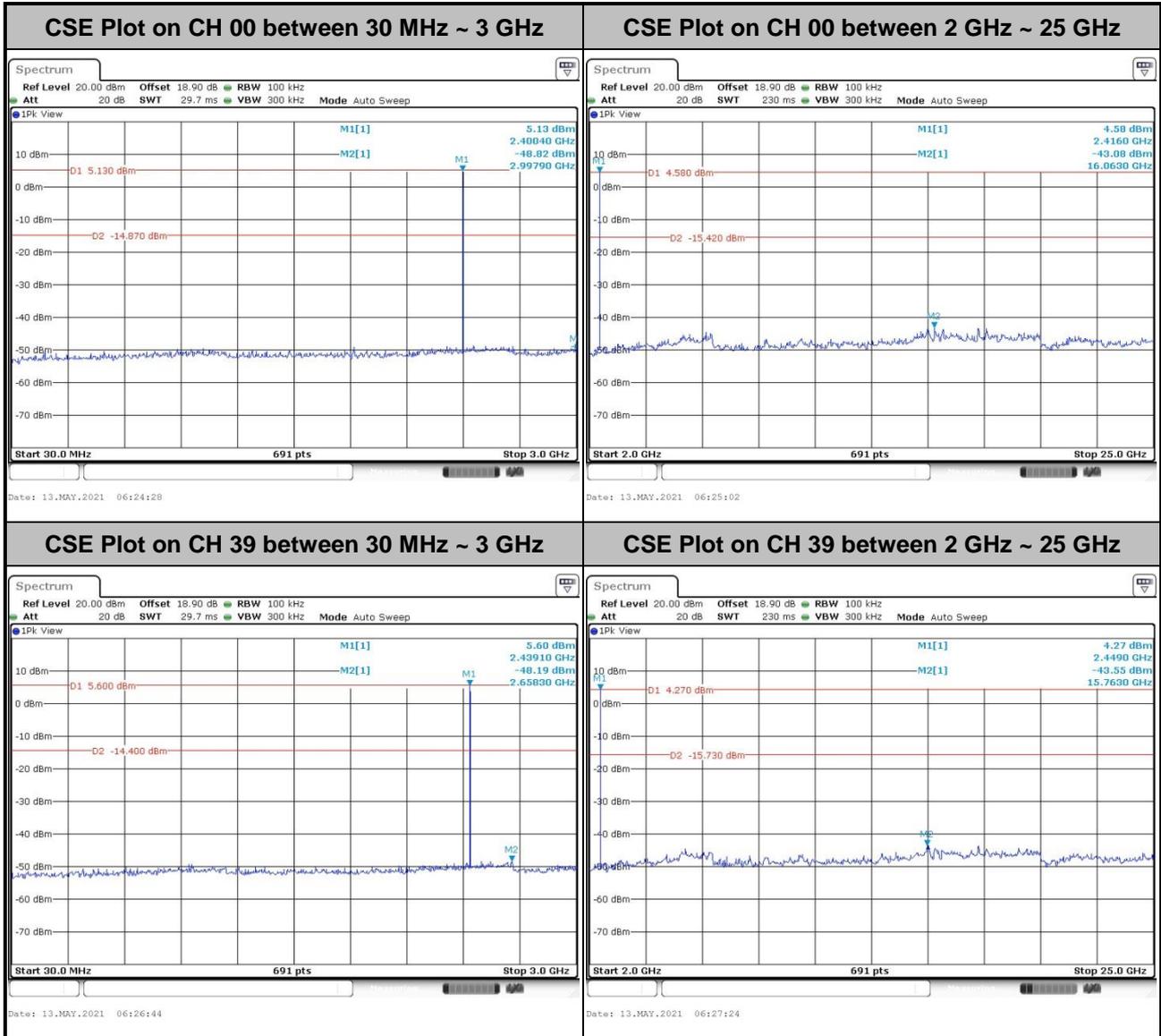
<1Mbps>

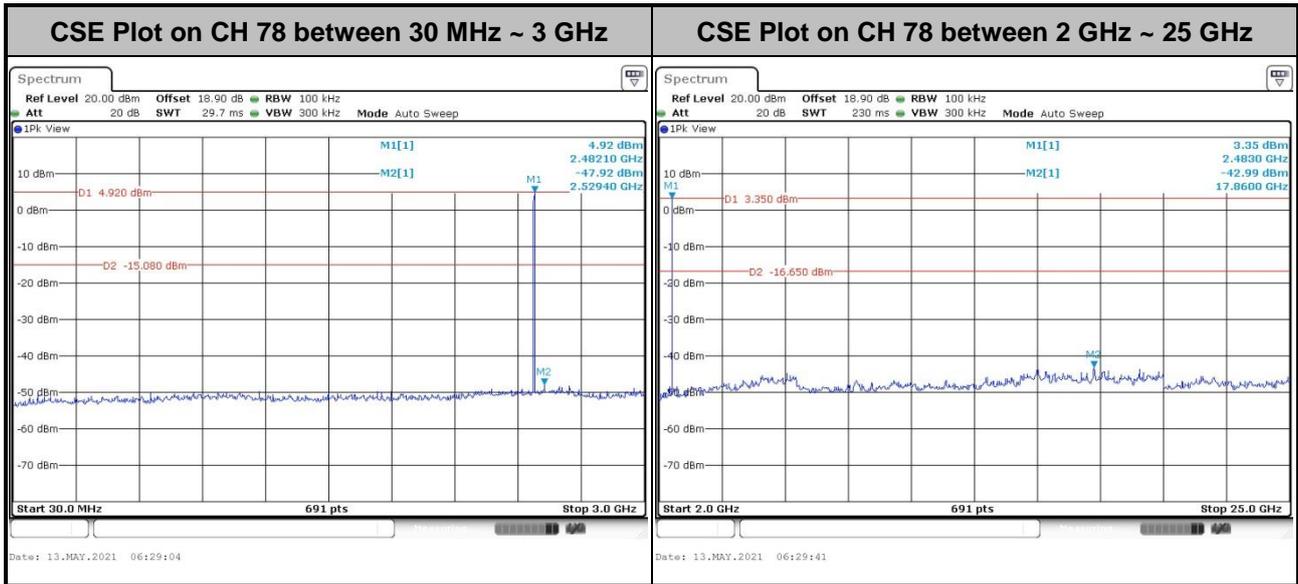






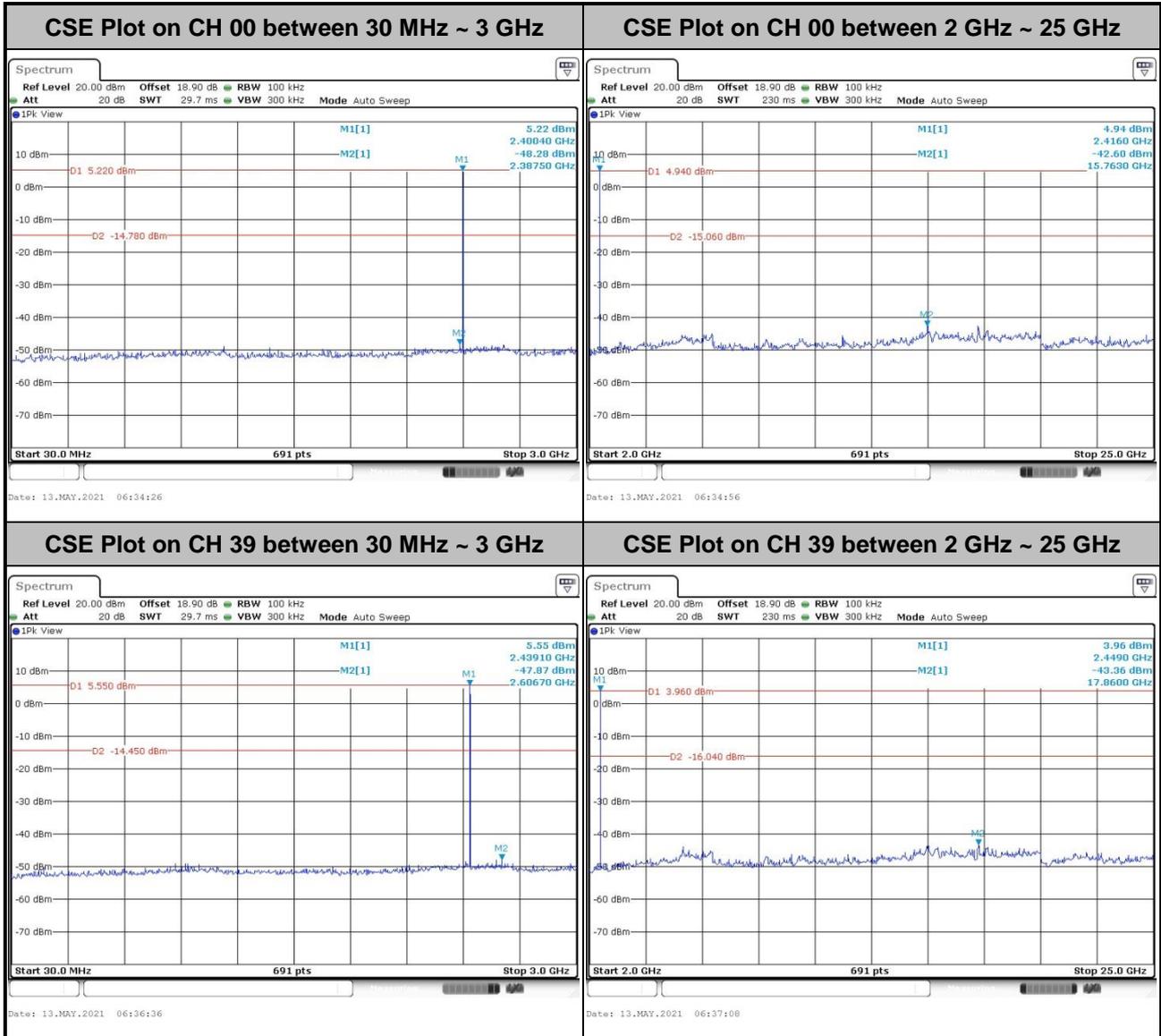
<2Mbps>

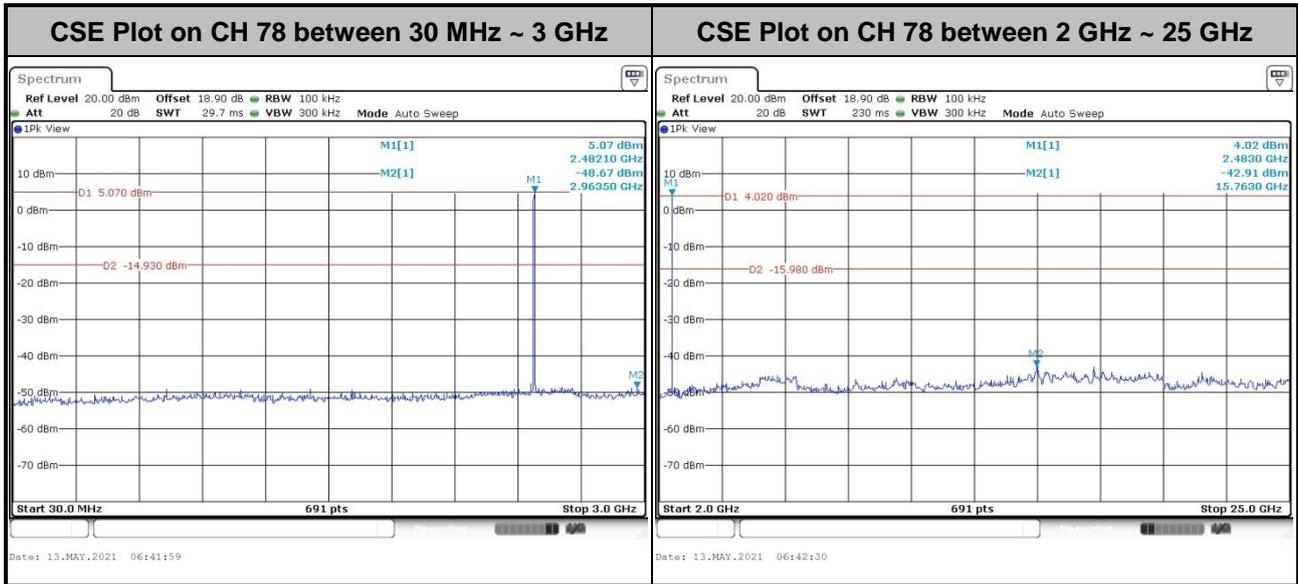






<3Mbps>







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

See list of measuring equipment of this test report.



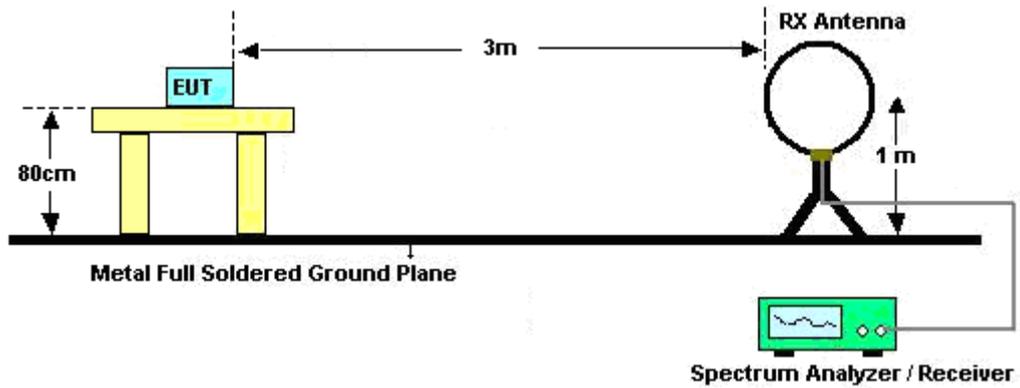
3.8.3 Test Procedures

1. The EUT was 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 was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was 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 \geq 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 = $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$
Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
Average Emission Level = Peak Emission Level + $20 * \log(\text{Duty cycle})$
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. For testing below 1 GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
8. For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

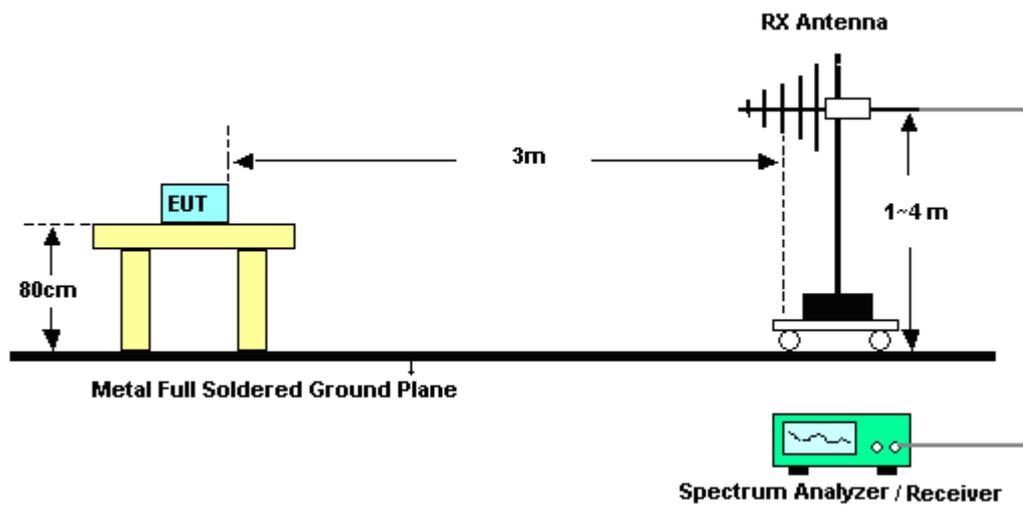
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.76dB) derived from $20 \log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

3.8.4 Test Setup

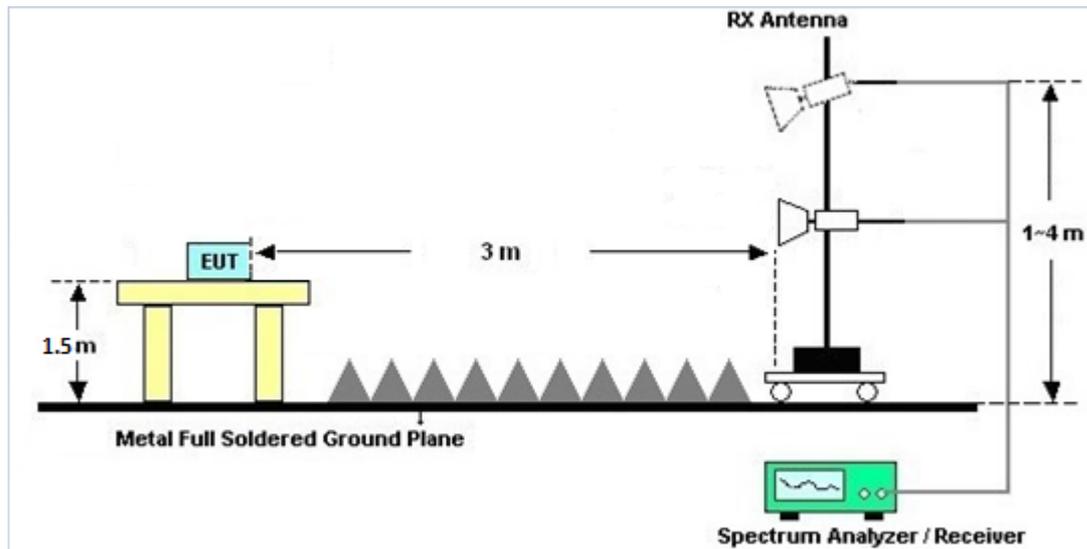
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



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

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was 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 came out very similar.

3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.8.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.



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 (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.

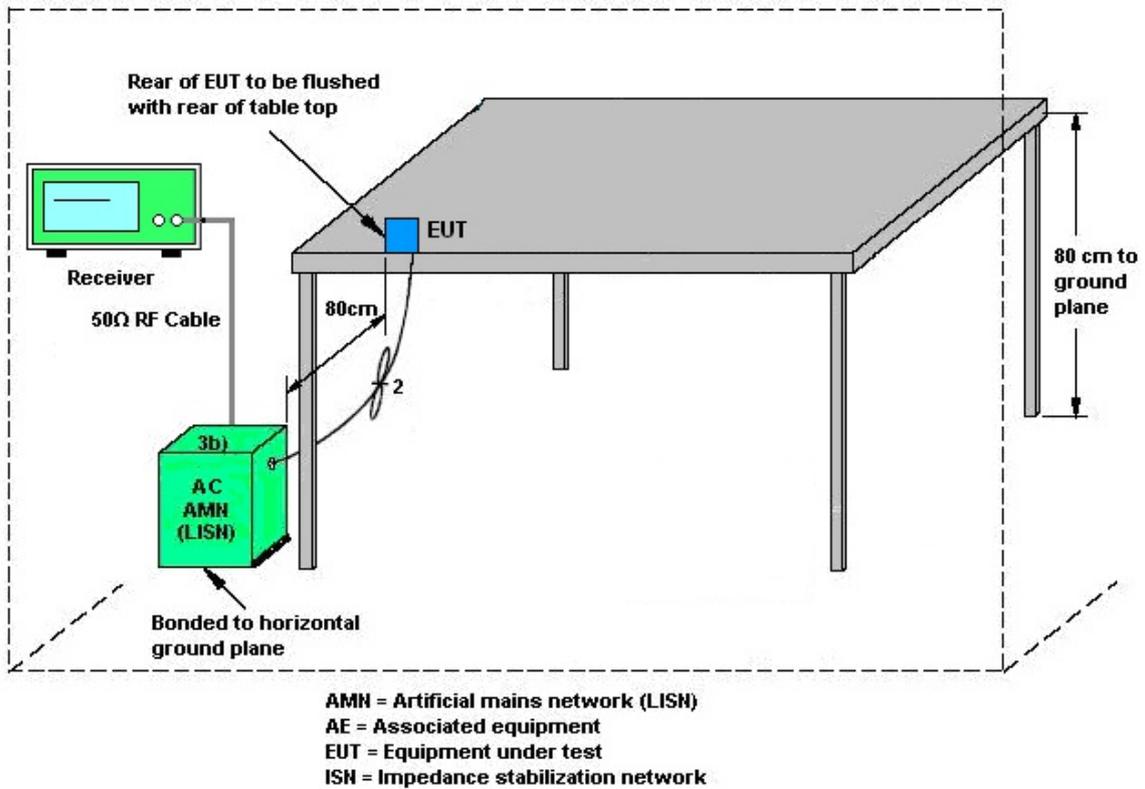
3.9.2 Measuring Instruments

See list of measuring equipment of this test report.

3.9.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was 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 sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) 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 A.



3.10 Antenna Requirements

3.10.1 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.

3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.10.3 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 |
|--------------------------|--------------------|-----------------------------------|--------------------|----------------------------------|------------------|---------------------------------|---------------|--------------------------|
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100488 | 9 kHz~30 MHz | Jul. 14, 2020 | Apr. 15, 2021~ May 12, 2021 | Jul. 13, 2021 | Radiation (03CH16-HY) |
| Bilog Antenna | TESEQ | CBL 6111D & 00802N1D01N -06 | 47020 & 06 | 30MHz to 1GHz | Oct. 11, 2020 | Apr. 15, 2021~ May 12, 2021 | Oct. 10, 2021 | Radiation (03CH16-HY) |
| Amplifier | SONOMA | 310N | 371607 | 9kHz~1G | Sep. 30, 2020 | Apr. 15, 2021~ May 12, 2021 | Sep. 29, 2021 | Radiation (03CH16-HY) |
| Horn Antenna | SCHWARZBE CK | BBHA 9120 D | 9120D-1522 | 1G~18GHz | Sep. 29, 2020 | Apr. 15, 2021~ May 12, 2021 | Sep. 28, 2021 | Radiation (03CH16-HY) |
| Amplifier | EMCI | EMC051845S E | 980729 | 1-18GHz | Jul. 10, 2020 | Apr. 15, 2021~ May 12, 2021 | Jul. 09, 2021 | Radiation (03CH16-HY) |
| SHF-EHF Horn Antenna | SCHWARZBE CK | BBHA 9170 | BBHA917058 4 | 18GHz ~40GHz | Dec. 11, 2020 | Apr. 15, 2021~ May 12, 2021 | Dec. 10, 2021 | Radiation (03CH16-HY) |
| Preamplifier | EMEC | EM18G40G | 060715 | 18GHz~40GHz | Dec. 11, 2020 | Apr. 15, 2021~ May 12, 2021 | Dec. 10, 2021 | Radiation (03CH16-HY) |
| Preamplifier | Keysight | 83017A | MY53270264 | 1GHz~26.5GHz | Dec. 10, 2020 | Apr. 15, 2021~ May 12, 2021 | Dec. 09, 2021 | Radiation (03CH16-HY) |
| EMI Test Receiver | Keysight | N9038A | MY59053012 | 3Hz~26.5GHz | Nov. 18, 2020 | Apr. 15, 2021~ May 12, 2021 | Nov. 17, 2021 | Radiation (03CH16-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY11680/4P E | NA | Aug. 29, 2020 | Apr. 15, 2021~ May 12, 2021 | Aug. 28, 2021 | Radiation (03CH16-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY11688/4P E | NA | Aug. 29, 2020 | Apr. 15, 2021~ May 12, 2021 | Aug. 28, 2021 | Radiation (03CH16-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | EC-A5-300-5 757 | NA | Aug. 29, 2020 | Apr. 15, 2021~ May 12, 2021 | Aug. 28, 2021 | Radiation (03CH16-HY) |
| Software | Audix | E3 6.2009-8-24 | RK-001136 | N/A | N/A | Apr. 15, 2021~ May 12, 2021 | N/A | Radiation (03CH16-HY) |
| Controller | ChainTek | 3000-1 | N/A | Control Turn table & Ant Mast | N/A | Apr. 15, 2021~ May 12, 2021 | N/A | Radiation (03CH16-HY) |
| Antenna Mast | ChainTek | MBS-520-1 | N/A | 1m~4m | N/A | Apr. 15, 2021~ May 12, 2021 | N/A | Radiation (03CH16-HY) |
| Turn Table | ChainTek | T-200-S-1 | N/A | 0~360 Degree | N/A | Apr. 15, 2021~ May 12, 2021 | N/A | Radiation (03CH16-HY) |
| AC Power Source | ACPOWER | AFC-11003G | F317040033 | N/A | N/A | Apr. 30, 2021 | N/A | Conduction (CO07-HY) |
| Software | Rohde & Schwarz | EMC32 V10.30 | N/A | N/A | N/A | Apr. 30, 2021 | N/A | Conduction (CO07-HY) |
| Pulse Limiter | SCHWARZBE CK | VTSD 9561-F N | 9561-F N00373 | 9kHz-200MHz | Nov. 02, 2020 | Apr. 30, 2021 | Nov. 01, 2021 | Conduction (CO07-HY) |
| RF Cable | HUBER + SUHNER | RG 214/U | 1358175 | 9kHz~30MHz | N/A | Apr. 30, 2021 | N/A | Conduction (CO07-HY) |
| Two-Line V-Network | TESEQ | NNB 51 | 45051 | N/A | Feb. 01, 2021 | Apr. 30, 2021 | Jan. 31, 2022 | Conduction (CO07-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESR3 | 102317 | 9kHz~3.6GHz | Sep. 11, 2020 | Apr. 30, 2021 | Sep. 10, 2021 | Conduction (CO07-HY) |
| Power Meter | Agilent | E4416A | GB41292344 | N/A | Jan. 14, 2021 | Apr. 20, 2021~ Jun. 01, 2021 | Jan. 13, 2022 | Conducted (TH05-HY) |
| Power Sensor | Agilent | E9327A | US40441548 | 50MHz~18GHz | Jan. 14, 2021 | Apr. 20, 2021~ Jun. 01, 2021 | Jan. 13, 2022 | Conducted (TH05-HY) |
| Signal Analyzer | Rohde & Schwarz | FSV40 | 101566 | 10Hz ~ 40GHz | Jul. 22, 2020 | Apr. 20, 2021~ Jun. 01, 2021 | Jul. 21, 2021 | Conducted (TH05-HY) |
| Switch Box & RF Cable | EM Electronics | EMSW18SE | SW200302 | N/A | Mar. 17, 2021 | Apr. 20, 2021~ Jun. 01, 2021 | Mar. 16, 2022 | Conducted (TH05-HY) |



5 Uncertainty of Evaluation

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

| | |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 2.2 dB |
|---|--------|

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

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

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

| | |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 6.3 dB |
|---|--------|

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

| | |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 4.7 dB |
|---|--------|



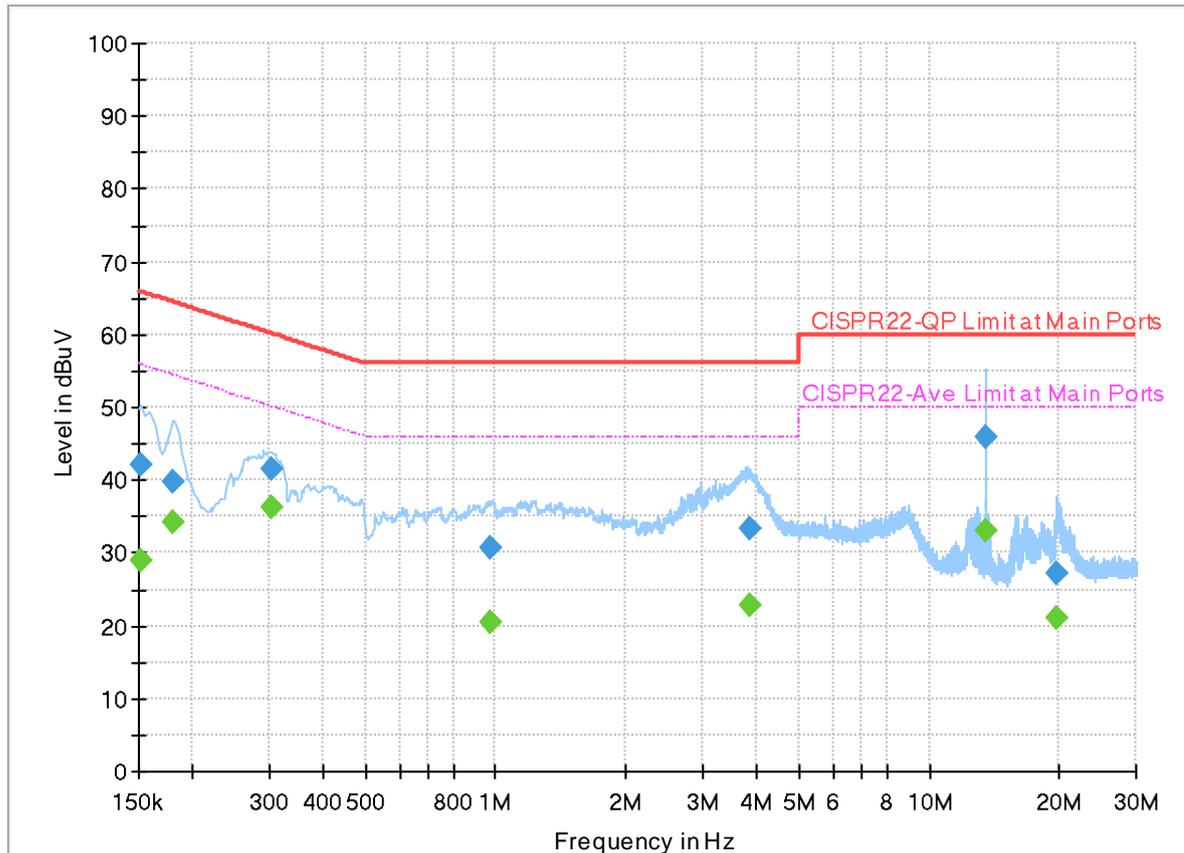
Appendix A. AC Conducted Emission Test Results

| | | | |
|-----------------|---------|---------------------|---------|
| Test Engineer : | Tom Lee | Temperature : | 23~26°C |
| | | Relative Humidity : | 40~50% |

EUT Information

Report NO : 131009-01
 Test Mode : Mode 1
 Test Voltage : 120Vac/60Hz
 Phase : Line

Full Spectrum



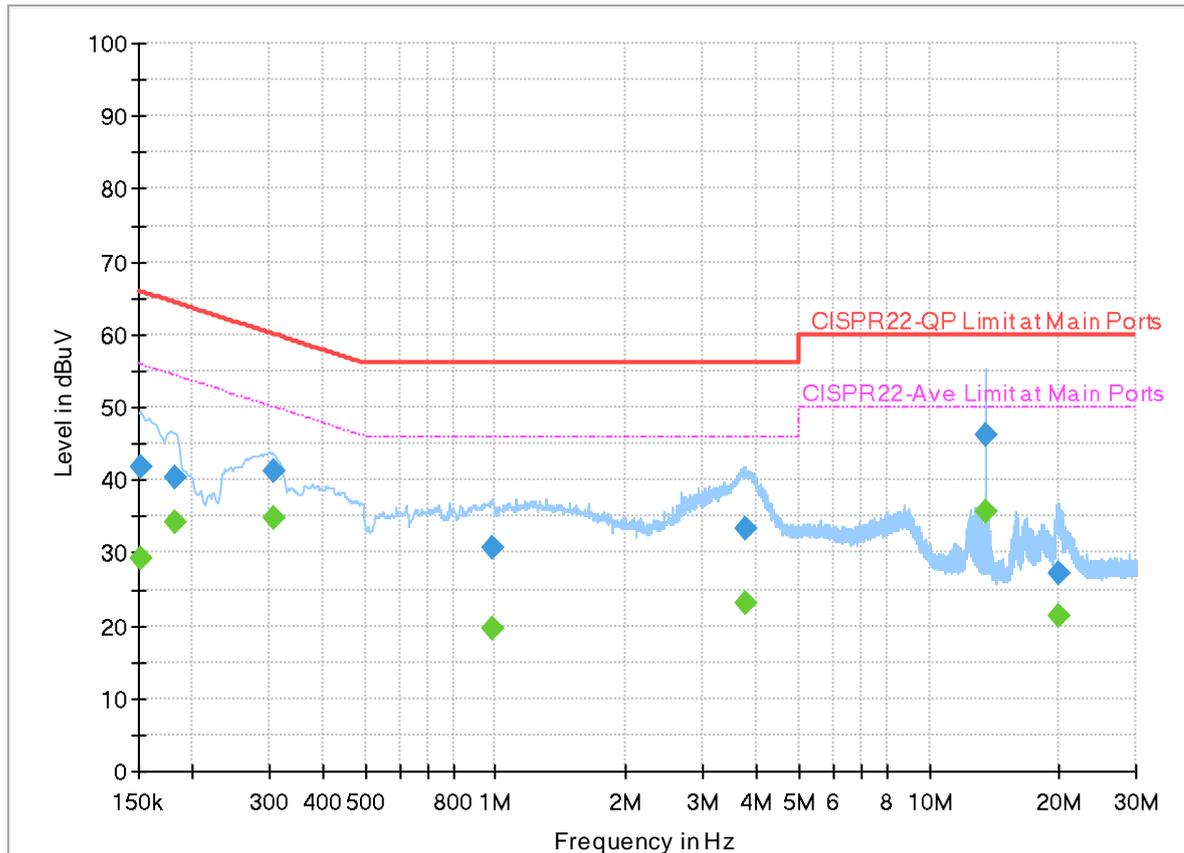
Final_Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.152250 | --- | 28.93 | 55.88 | 26.95 | L1 | OFF | 20.0 |
| 0.152250 | 42.03 | --- | 65.88 | 23.85 | L1 | OFF | 20.0 |
| 0.179250 | --- | 34.32 | 54.52 | 20.20 | L1 | OFF | 20.0 |
| 0.179250 | 39.77 | --- | 64.52 | 24.75 | L1 | OFF | 20.0 |
| 0.303000 | --- | 36.29 | 50.16 | 13.87 | L1 | OFF | 20.0 |
| 0.303000 | 41.65 | --- | 60.16 | 18.51 | L1 | OFF | 20.0 |
| 0.966750 | --- | 20.48 | 46.00 | 25.52 | L1 | OFF | 20.0 |
| 0.966750 | 30.73 | --- | 56.00 | 25.27 | L1 | OFF | 20.0 |
| 3.849000 | --- | 22.77 | 46.00 | 23.23 | L1 | OFF | 20.1 |
| 3.849000 | 33.21 | --- | 56.00 | 22.79 | L1 | OFF | 20.1 |
| 13.560000 | --- | 32.96 | 50.00 | 17.04 | L1 | OFF | 20.2 |
| 13.560000 | 45.84 | --- | 60.00 | 14.16 | L1 | OFF | 20.2 |
| 19.677750 | --- | 21.03 | 50.00 | 28.97 | L1 | OFF | 20.2 |
| 19.677750 | 27.29 | --- | 60.00 | 32.71 | L1 | OFF | 20.2 |

EUT Information

Report NO : 131009-01
 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) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.152250 | --- | 29.20 | 55.88 | 26.68 | N | OFF | 20.0 |
| 0.152250 | 41.92 | --- | 65.88 | 23.96 | N | OFF | 20.0 |
| 0.181500 | --- | 34.28 | 54.42 | 20.14 | N | OFF | 20.0 |
| 0.181500 | 40.38 | --- | 64.42 | 24.04 | N | OFF | 20.0 |
| 0.307500 | --- | 34.81 | 50.04 | 15.23 | N | OFF | 20.0 |
| 0.307500 | 41.09 | --- | 60.04 | 18.95 | N | OFF | 20.0 |
| 0.980250 | --- | 19.65 | 46.00 | 26.35 | N | OFF | 20.0 |
| 0.980250 | 30.71 | --- | 56.00 | 25.29 | N | OFF | 20.0 |
| 3.770250 | --- | 22.97 | 46.00 | 23.03 | N | OFF | 20.1 |
| 3.770250 | 33.43 | --- | 56.00 | 22.57 | N | OFF | 20.1 |
| 13.560000 | --- | 35.62 | 50.00 | 14.38 | N | OFF | 20.2 |
| 13.560000 | 46.24 | --- | 60.00 | 13.76 | N | OFF | 20.2 |
| 19.864500 | --- | 21.42 | 50.00 | 28.58 | N | OFF | 20.3 |
| 19.864500 | 27.20 | --- | 60.00 | 32.80 | N | OFF | 20.3 |



Appendix B. Radiated Spurious Emission

| | | | |
|-----------------|-------------------------------------|---------------------|---------|
| Test Engineer : | Karl Hou, Caster Liao and Andy Yang | Temperature : | 20~25°C |
| | | Relative Humidity : | 50~60% |

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

| BT | Note | Frequency | Level | Over | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. | |
|------------------------|------|-----------|------------|--------|--------|----------|----------|--------|--------|--------|---------|---------|---------|---|
| | | (MHz) | (dBμV/m) | (dB) | Limit | Level | Factor | Loss | Factor | Pos | Pos | Avg. | | |
| | | | | | Line | (dBμV) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) | |
| BT CH00 2402MHz | | 2313.045 | 48 | -26 | 74 | 42.01 | 27.87 | 8.42 | 30.3 | 276 | 309 | P | H | |
| | | 2313.045 | 23.24 | -30.76 | 54 | - | - | - | - | - | - | A | H | |
| | * | 2402 | 99.6 | - | - | 93.8 | 27.5 | 8.58 | 30.28 | 276 | 309 | P | H | |
| | * | 2402 | 74.84 | - | - | - | - | - | - | - | - | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | | H |
| | | | 2335.83 | 46.22 | -27.78 | 74 | 40.23 | 27.83 | 8.46 | 30.3 | 189 | 7 | P | V |
| | | | 2335.83 | 21.46 | -32.54 | 54 | - | - | - | - | - | - | A | V |
| | * | | 2402 | 105.58 | - | - | 99.78 | 27.5 | 8.58 | 30.28 | 189 | 7 | P | V |
| | * | | 2402 | 80.82 | - | - | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| BT CH 39 2441MHz | | 2369.64 | 46.39 | -27.61 | 74 | 40.48 | 27.68 | 8.52 | 30.29 | 273 | 310 | P | H | |
| | | 2369.64 | 21.63 | -32.37 | 54 | - | - | - | - | - | - | A | H | |
| | * | 2441 | 101.49 | - | - | 95.68 | 27.42 | 8.66 | 30.27 | 273 | 310 | P | H | |
| | * | 2441 | 76.73 | - | - | - | - | - | - | - | - | A | H | |
| | | | 2493 | 46.4 | -27.6 | 74 | 40.49 | 27.4 | 8.76 | 30.25 | 273 | 310 | P | H |
| | | | 2493 | 21.64 | -32.36 | 54 | - | - | - | - | - | - | A | H |
| | | | 2354.66 | 46.85 | -27.15 | 74 | 40.87 | 27.77 | 8.5 | 30.29 | 176 | 9 | P | V |
| | | | 2354.66 | 22.09 | -31.91 | 54 | - | - | - | - | - | - | A | V |
| | * | | 2441 | 107.75 | - | - | 101.94 | 27.42 | 8.66 | 30.27 | 176 | 9 | P | V |
| | * | | 2441 | 82.99 | - | - | - | - | - | - | - | - | A | V |
| | | | 2494.54 | 46.62 | -27.38 | 74 | 40.71 | 27.4 | 8.76 | 30.25 | 176 | 9 | P | V |
| | | | 2494.54 | 21.86 | -32.14 | 54 | - | - | - | - | - | - | A | V |



| | | | | | | | | | | | | | |
|---------------------------------|---|---------|--------|--------|----|--------|------|------|-------|-----|-----|---|---|
| BT CH 78 2480MHz | * | 2480 | 102.02 | - | - | 96.14 | 27.4 | 8.74 | 30.26 | 255 | 309 | P | H |
| | * | 2480 | 77.26 | - | - | - | - | - | - | - | - | A | H |
| | | 2483.6 | 48.43 | -25.57 | 74 | 42.54 | 27.4 | 8.74 | 30.25 | 255 | 309 | P | H |
| | | 2483.6 | 23.67 | -30.33 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 108.16 | - | - | 102.28 | 27.4 | 8.74 | 30.26 | 199 | 59 | P | V |
| | * | 2480 | 83.4 | - | - | - | - | - | - | - | - | A | V |
| | | 2483.88 | 53.04 | -20.96 | 74 | 47.15 | 27.4 | 8.74 | 30.25 | 199 | 59 | P | V |
| | | 2483.88 | 28.28 | -25.72 | 54 | - | - | - | - | - | - | 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
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 00 2402MHz | | 4804 | 40.23 | -33.77 | 74 | 51.12 | 31.11 | 13.36 | 55.36 | 100 | 0 | P | H |
| | | 4804 | 15.47 | -38.53 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4804 | 39.98 | -34.02 | 74 | 50.87 | 31.11 | 13.36 | 55.36 | 100 | 0 | P | V |
| | | 4804 | 15.22 | -38.78 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| BT CH 39 2441MHz | | 4882 | 41.72 | -32.28 | 74 | 52.6 | 31.14 | 13.36 | 55.38 | 100 | 0 | P | H |
| | | 4882 | 16.96 | -37.04 | 54 | - | - | - | - | - | - | A | H |
| | | 7323 | 45.74 | -28.26 | 74 | 49.36 | 36.45 | 16.19 | 56.26 | 100 | 0 | P | H |
| | | 7323 | 20.98 | -33.02 | 54 | - | - | - | - | - | - | A | H |
| | | 4882 | 41.5 | -32.5 | 74 | 52.38 | 31.14 | 13.36 | 55.38 | 100 | 0 | P | V |
| | | 4882 | 16.74 | -37.26 | 54 | - | - | - | - | - | - | A | V |
| | | 7323 | 45.73 | -28.27 | 74 | 49.35 | 36.45 | 16.19 | 56.26 | 100 | 0 | P | V |
| | | 7323 | 20.97 | -33.03 | 54 | - | - | - | - | - | - | A | V |
| BT CH 78 2480MHz | | 4960 | 45.21 | -28.79 | 74 | 55.9 | 31.34 | 13.36 | 55.39 | 100 | 0 | P | H |
| | | 4960 | 20.45 | -33.55 | 54 | - | - | - | - | - | - | A | H |
| | | 7440 | 46.45 | -27.55 | 74 | 49.95 | 36.4 | 16.39 | 56.29 | 100 | 0 | P | H |
| | | 7440 | 21.69 | -32.31 | 54 | - | - | - | - | - | - | A | H |
| | | 4960 | 47.42 | -26.58 | 74 | 58.11 | 31.34 | 13.36 | 55.39 | 100 | 0 | P | V |
| | | 4960 | 22.66 | -31.34 | 54 | - | - | - | - | - | - | A | V |
| | | 7440 | 45.57 | -28.43 | 74 | 49.07 | 36.4 | 16.39 | 56.29 | 100 | 0 | P | V |
| | | 7440 | 20.81 | -33.19 | 54 | - | - | - | - | - | - | A | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Emission below 1GHz

2.4GHz BT (LF)

| BT | 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) | |
| 2.4GHz BT LF | | 73.65 | 25.52 | -14.48 | 40 | 44.25 | 12.73 | 1.27 | 32.73 | - | - | P | H | |
| | | 124.09 | 30.93 | -12.57 | 43.5 | 44.21 | 17.64 | 1.75 | 32.67 | 100 | 0 | P | H | |
| | | 188.11 | 21.15 | -22.35 | 43.5 | 36.74 | 15.03 | 2.35 | 32.87 | - | - | P | H | |
| | | 259.89 | 19.71 | -26.29 | 46 | 29.71 | 19.97 | 2.72 | 32.69 | - | - | P | H | |
| | | 407.33 | 26.74 | -19.26 | 46 | 33.35 | 22.36 | 3.44 | 32.39 | - | - | P | H | |
| | | 730.34 | 31.19 | -14.81 | 46 | 31.3 | 27.78 | 4.69 | 32.54 | - | - | P | H | |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | 48.43 | 32.42 | -7.58 | 40 | 49.39 | 14.93 | 0.94 | 32.84 | 100 | 0 | P | V |
| | | | 64.92 | 30.22 | -9.78 | 40 | 49.9 | 11.92 | 1.18 | 32.78 | - | - | P | V |
| | | | 125.06 | 27.79 | -15.71 | 43.5 | 41.1 | 17.6 | 1.77 | 32.68 | - | - | P | V |
| | | | 179.38 | 22.85 | -20.65 | 43.5 | 38.32 | 15.18 | 2.2 | 32.85 | - | - | P | V |
| | | | 590.66 | 28.19 | -17.81 | 46 | 30.98 | 25.7 | 4.18 | 32.67 | - | - | P | V |
| | | | 842.86 | 31.82 | -14.18 | 46 | 30.35 | 29.08 | 5.06 | 32.67 | - | - | P | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| Remark | 1. No other spurious found. 2. All results are PASS against limit line. | | | | | | | | | | | | | |



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:

| BT | 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) |
| BT 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 : | Karl Hou, Caster Liao and Andy Yang | Temperature : | 20~25°C |
| | | Relative Humidity : | 50~60% |

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|---|
| | BT CH00 2402MHz | |
| | Horizontal | Fundamental |
| Peak | <p> Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 131009-01 </p> | <p> Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 131009-01 </p> |

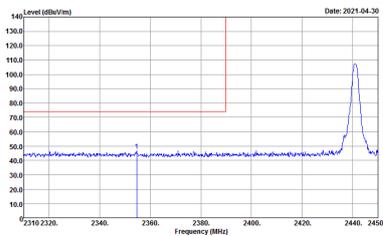
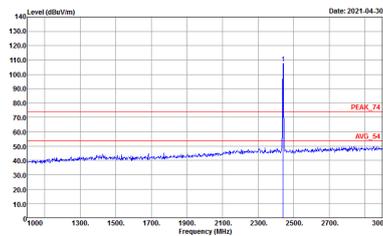
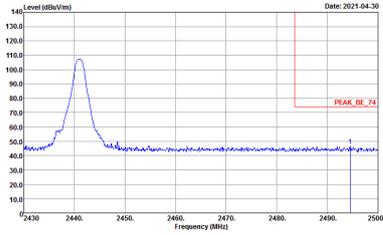


| | | |
|------|---|--|
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
| | BT CH00 2402MHz | |
| | Vertical | Fundamental |
| Peak | <p>Site : 03CH6-11Y Condition : PEAK_BE_74 3m 91200_1522 VERTICAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 131009-01</p> | <p>Site : 03CH6-11Y Condition : PEAK_74 3m 91200_1522 VERTICAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 131009-01</p> |

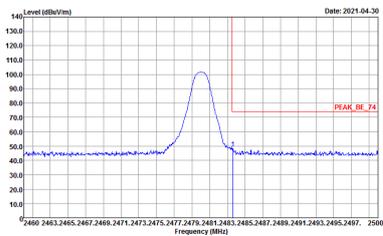
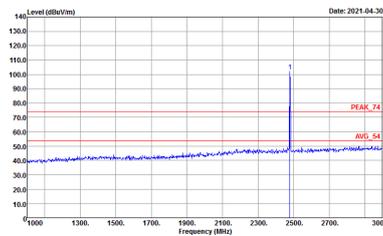


| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|--------------------|--|---|
| | BT CH39 2441MHz | |
| | Horizontal | Fundamental |
| <p>Peak</p> | <p>Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 131009-01</p> | <p>Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 131009-01</p> |
| <p>Peak</p> | <p>Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 131009-01</p> | <p>Left blank</p> |



| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|--|--|
| BT CH39 2441MHz | | |
| Vertical | | Fundamental |
| Peak |  <p>Date: 2021-04-30</p> <p>Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 131009-01</p> |  <p>Date: 2021-04-30</p> <p>Site : 03CH16-HY Condition : PEAK_74 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 131009-01</p> |
| Peak |  <p>Date: 2021-04-30</p> <p>Site : 03CH16-HY Condition : PEAK_BE_74 3m 91200_1522 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 131009-01</p> | Left blank |



| | | |
|------|---|---|
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
| | BT CH78 2480MHz | |
| | Horizontal | Fundamental |
| Peak |  <p>Site : 03CH16-11Y Condition : PEAK_BE_74 3m 91200_1522 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 131009-01</p> |  <p>Site : 03CH16-11Y Condition : PEAK_74 3m 91200_1522 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 131009-01</p> |

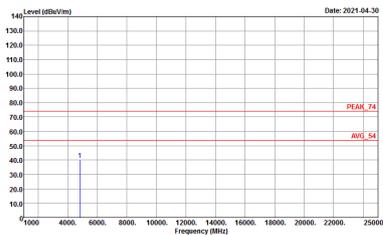
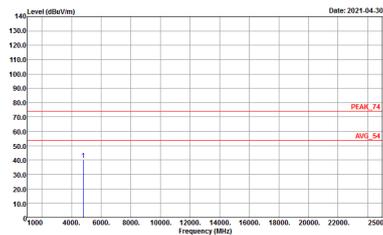


| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|-----------------|--|---|
| BT CH78 2480MHz | | |
| Vertical | | Fundamental |
| Peak | <p>Site : 03CH6-11Y Condition : PEAK_BE_74 3m 91200_1522 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 131009-01</p> | <p>Site : 03CH6-11Y Condition : PEAK_74 3m 91200_1522 VERTICAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 131009-01</p> |

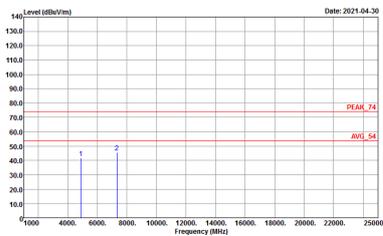
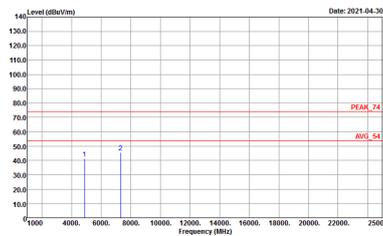


2.4GHz 2400~2483.5MHz

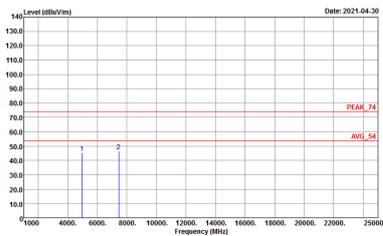
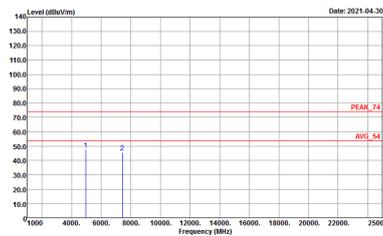
BT (Harmonic @ 3m)

| | | |
|-------------------------|---|--|
| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
| | BT CH00 2402MHz | |
| | Horizontal | Vertical |
| <p>Peak</p> <p>Avg.</p> |  <p>Site : 03CH16-FY Condition : PEAK_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 131009-01</p> |  <p>Site : 03CH16-FY Condition : PEAK_74 3m 91200_1522 VERTICAL Detector : Peak Project : 131009-01</p> |



| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---------------------------------------|---|--|
| BT CH39 2441MHz | | |
| | Horizontal | Vertical |
| <p>Peak</p> <p>Avg.</p> |  <p>Site : 03CH16-11Y Condition : PEAK_74 3m 9120D_1522 HORIZONTAL Detector : Peak Project : 131009-01</p> |  <p>Site : 03CH16-11Y Condition : PEAK_74 3m 9120D_1522 VERTICAL Detector : Peak Project : 131009-01</p> |



| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---------------------------------------|---|--|
| | BT CH78 2480MHz | |
| | Horizontal | Vertical |
| <p>Peak</p> <p>Avg.</p> |  <p>Site : 03CH16-11Y Condition : PEAK_74 3m 91200_1522 HORIZONTAL Detector : Peak Project : 131009-01</p> |  <p>Site : 03CH16-11Y Condition : PEAK_74 3m 91200_1522 VERTICAL Detector : Peak Project : 131009-01</p> |



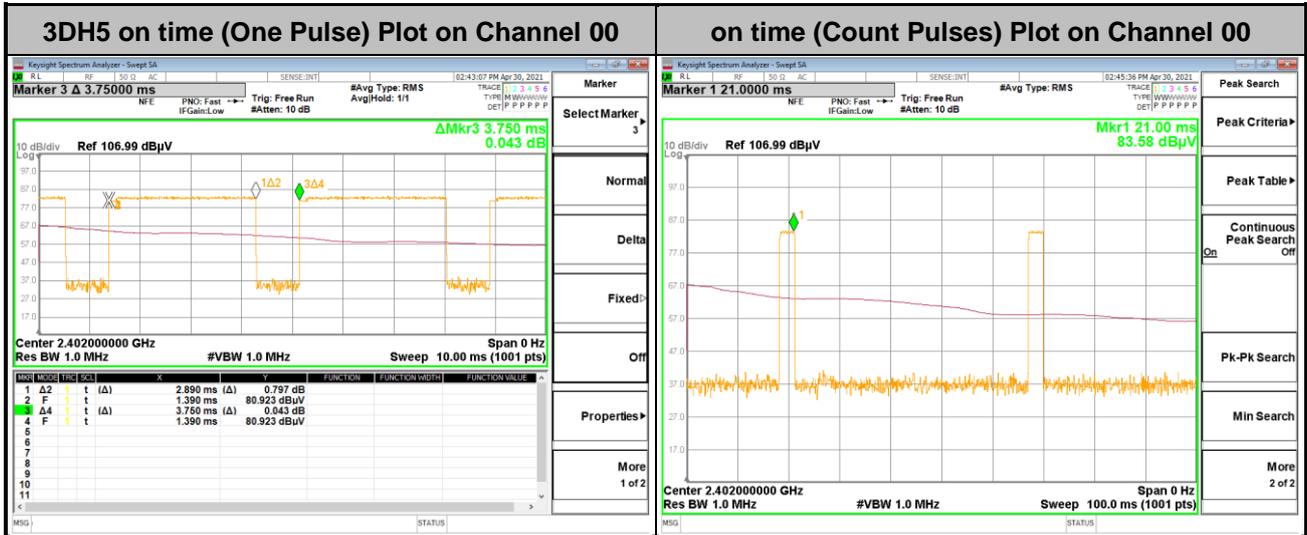
Emission below 1GHz

2.4GHz BT (LF)

| | | |
|--------------|---|--|
| BT | 2.4GHz 2400~2483.5MHz | |
| | BT LF | |
| | Horizontal | Vertical |
| QP / Peak |  <p>Site : 03CH16-HY Condition : QP 3m BELOG_47020406 HORIZONTAL Detector : Peak Project : 131009-01</p> |  <p>Site : 03CH16-HY Condition : QP 3m BELOG_47020406 VERTICAL Detector : Peak Project : 131009-01</p> |



Appendix D. Duty Cycle Plots



Note:

1. Worst case Duty cycle = on time/100 milliseconds = $2 * 2.89 / 100 = 5.78 \%$
2. Worst case Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.76 \text{ dB}$
3. **3DH5** 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 period to have DH5 packet completing one hopping sequence is

$$2.89 \text{ ms} \times 20 \text{ channels} = 57.8 \text{ ms}$$

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. $[100 \text{ ms} / 57.8 \text{ ms}] = 2 \text{ hops}$

Thus, the maximum possible ON time:

$$2.89 \text{ ms} \times 2 = 5.78 \text{ ms}$$

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

$$20 \times \log(5.78 \text{ ms}/100 \text{ ms}) = -24.76 \text{ dB}$$