



FCC RADIO TEST REPORT

FCC ID : 2AFZZ16UG
Equipment : Mobile Phone
Brand Name : Redmi
Model Name : 21091116UG
Applicant : Xiaomi Communications Co., Ltd.
#019, 9th Floor, Building 6, 33 Xi'erqi Middle
Road, Haidian District, Beijing, China, 100085
Manufacturer : Xiaomi Communications Co., Ltd.
#019, 9th Floor, Building 6, 33 Xi'erqi Middle
Road, Haidian District, Beijing, China, 100085
Standard : FCC Part 15 Subpart C §15.247

The product was received on Sep. 13, 2021 and testing was started from Sep. 23, 2021 and completed on Oct. 19, 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.

Louis Wu

Reviewed by: Louis Wu

Sporton International Inc. Wensan Laboratory

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)



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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 11.83 dB at 31.940 MHz |
| 3.9 | 15.207 | AC Conducted Emission | Pass | Under limit 22.02 dB at 2.720 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: Danny Lee

Report Producer: Lucy Wu



1 General Description

1.1 Product Feature of Equipment Under Test

GSM/WCDMA/LTE/5G NR, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ax, Wi-Fi 5GHz 802.11a/n/ac/ax, NFC, FM Receiver, and GNSS.

| Product Specification subjective to this standard | | |
|---|--|-------|
| Sample 1 | 6G+128GB | |
| Sample 2 | 8G+128GB | |
| Sample 3 | 8G+256GB | |
| Antenna Type | WWAN: Fixed Internal Antenna WLAN <Ant. 8>: PIFA Antenna <Ant. 9>: PIFA Antenna Bluetooth: PIFA Antenna GPS / Glonass / BDS / Galileo / SBAS / QZSS: PIFA Antenna NFC: Coil Antenna FM: Using earphone as Antenna | |
| Antenna information | | |
| 2400 MHz ~ 2483.5 MHz | Peak Gain (dBi) | -2.12 |

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

1.2 Modification of EUT

No modifications are made to the EUT during all test items.



1.3 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, CO07-HY, 03CH15-HY |

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

FCC designation No.: TW3786

1.4 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.



2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

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



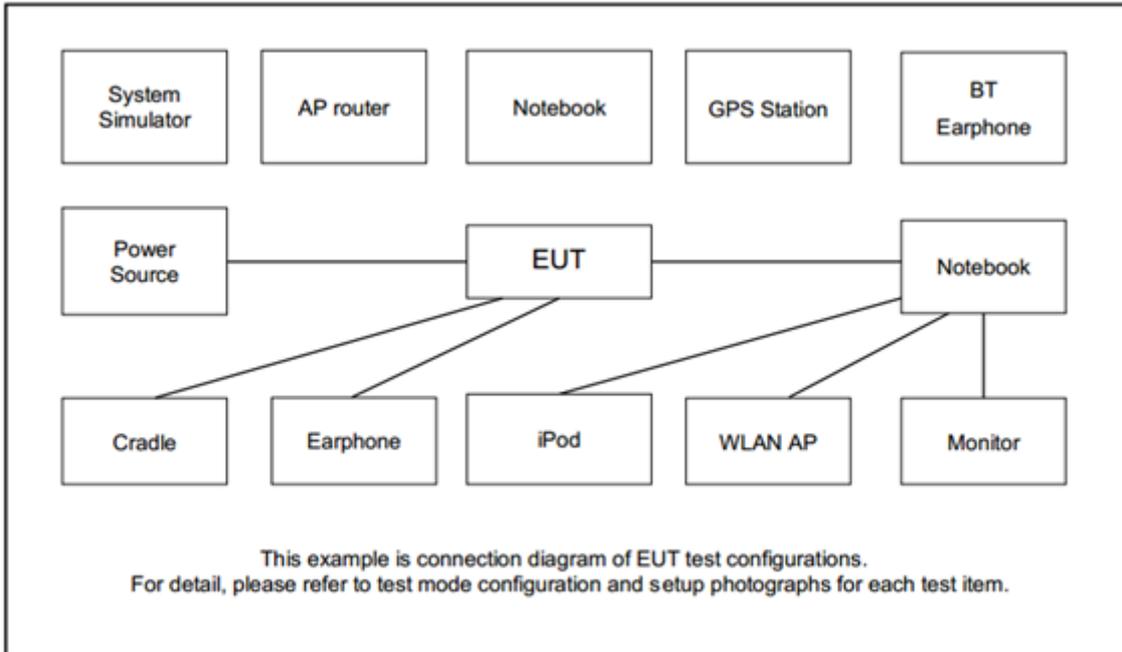
2.2 Test Mode

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and find Y Plane as worst plane, 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:LTE Band 17 Idle (High Channel) + Bluetooth Link + WLAN (2.4GHz) Link + GNSS Rx + Earphone + Battery + USB Cable (Data Link with Notebook) for Sample 3 | | |
| 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 Adapter 1 and Sample 1 | | | |
| 3. Data Link with Notebook means data application transferred mode between EUT and Notebook. | | | |

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

| Item | Equipment | Brand Name | Model Name | FCC ID | Data Cable | Power Cord |
|------|--------------------|---------------|---------------|-------------|------------------|--|
| 1. | System Simulator | Anritsu | MT8820C | N/A | N/A | Unshielded, 1.8 m |
| 2. | GPS Station | Pendulum | GSG-54 | N/A | N/A | Unshielded, 1.8 m |
| 3. | Bluetooth Earphone | Sony Ericsson | MW600 | PY7DDA-2029 | N/A | N/A |
| 4. | WLAN AP | ASUS | RT-AC66U | MSQ-RTAC66U | N/A | Unshielded, 1.8 m |
| 5. | iPod | Apple | A1285 | FCC DoC | Shielded, 1.0 m | N/A |
| 6. | Notebook | DELL | Latitude 3400 | FCC DoC | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 7. | SD Card | SanDisk | MicroSD HC | FCC DoC | N/A | N/A |
| 8. | Earphone | MI | EM023 | N/A | Unshielded, 1.2m | N/A |



2.5 EUT Operation Test Setup

The RF test items, make the EUT (SW: MIUI 12.5 Global 0.0.0) 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.

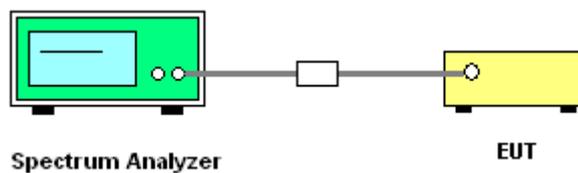
3.1.2 Measuring Instruments

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.

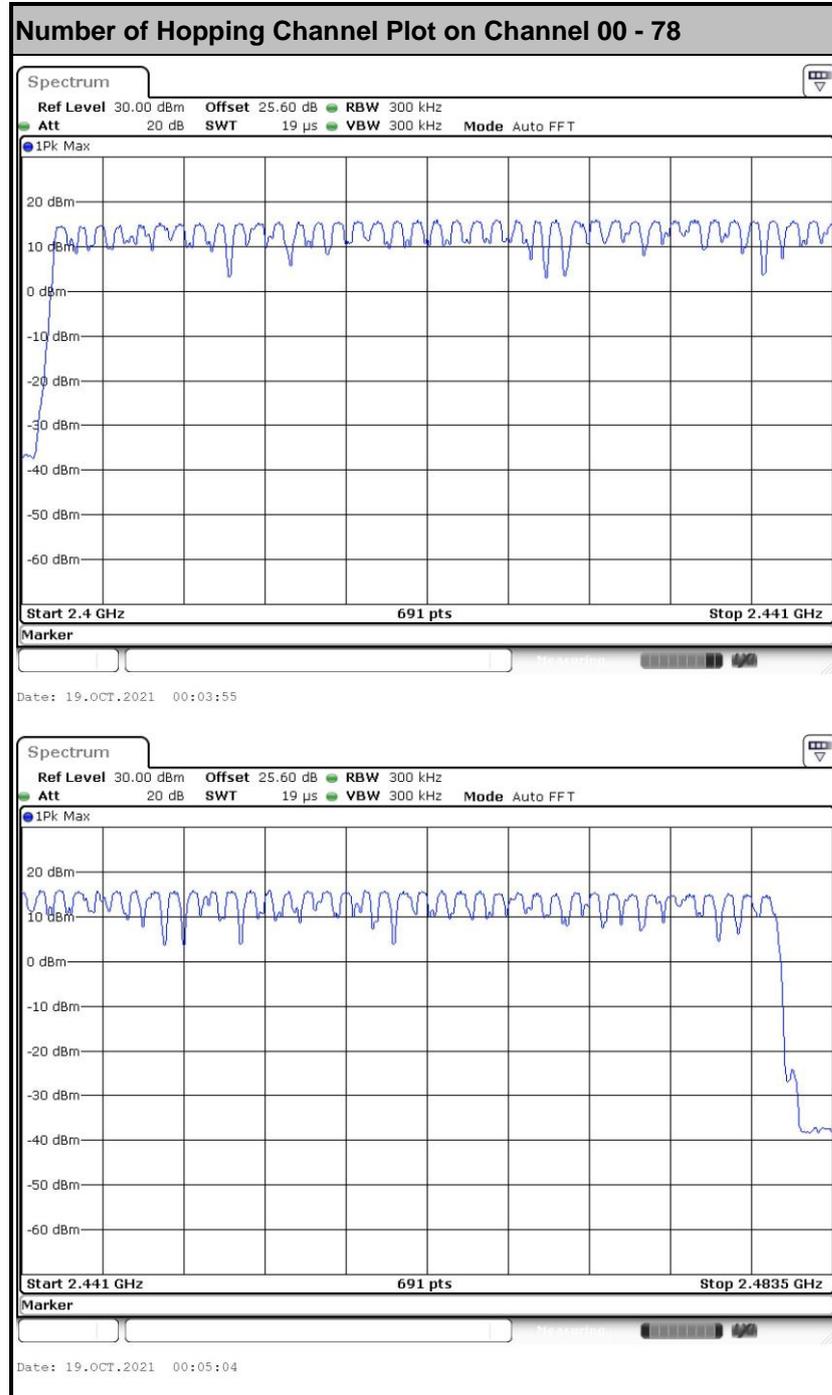
3.1.4 Test Setup





3.1.5 Test Result of Number of Hopping Frequency

Please refer to Appendix A.



3.2 Hopping Channel Separation Measurement

3.2.1 Limit of Hopping Channel Separation

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

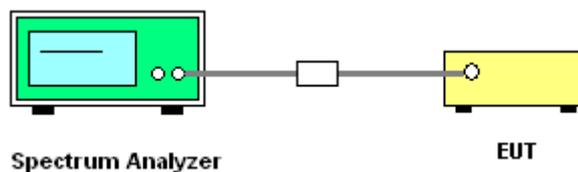
3.2.2 Measuring Instruments

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

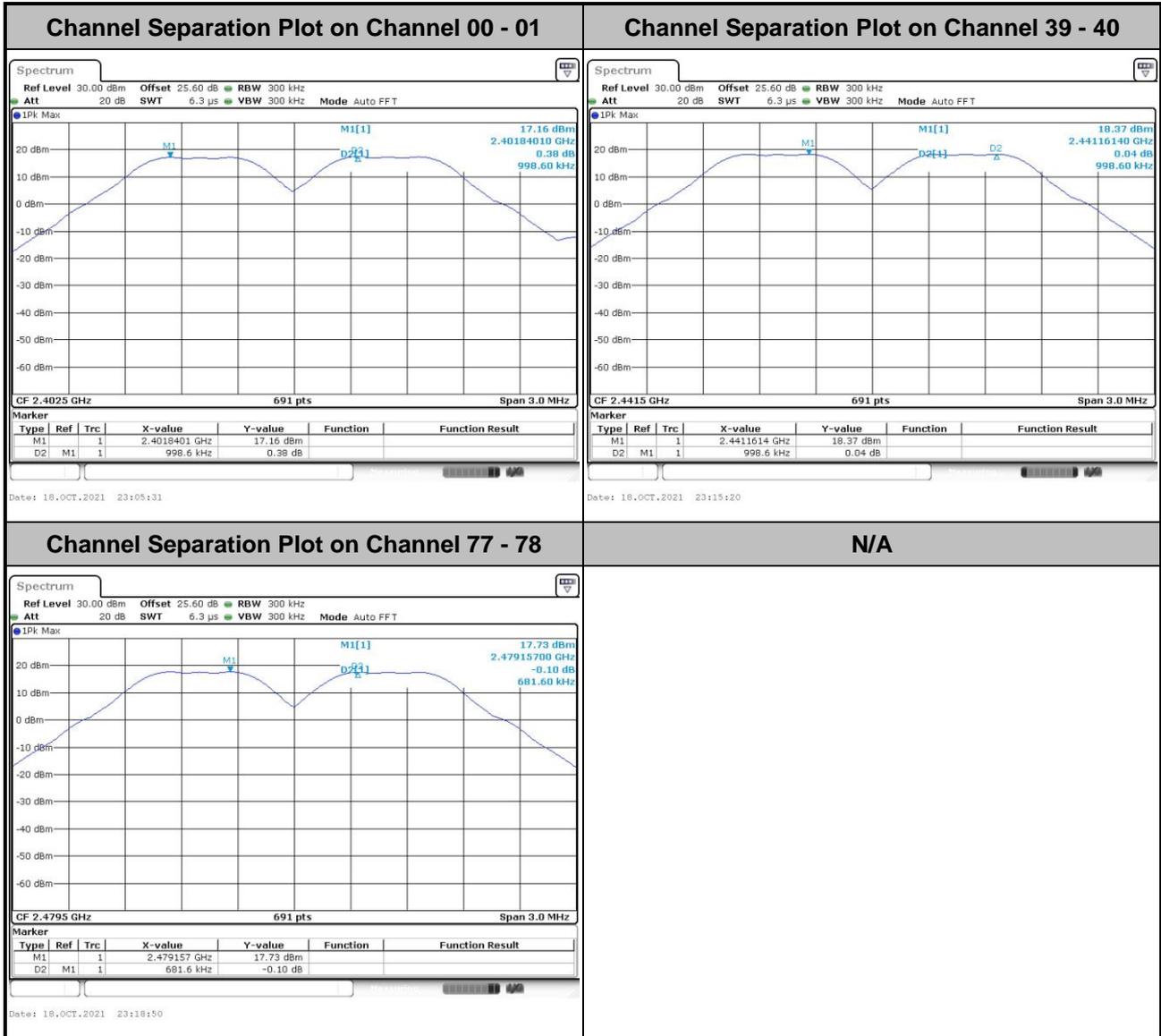


3.2.5 Test Result of Hopping Channel Separation

Please refer to Appendix A.

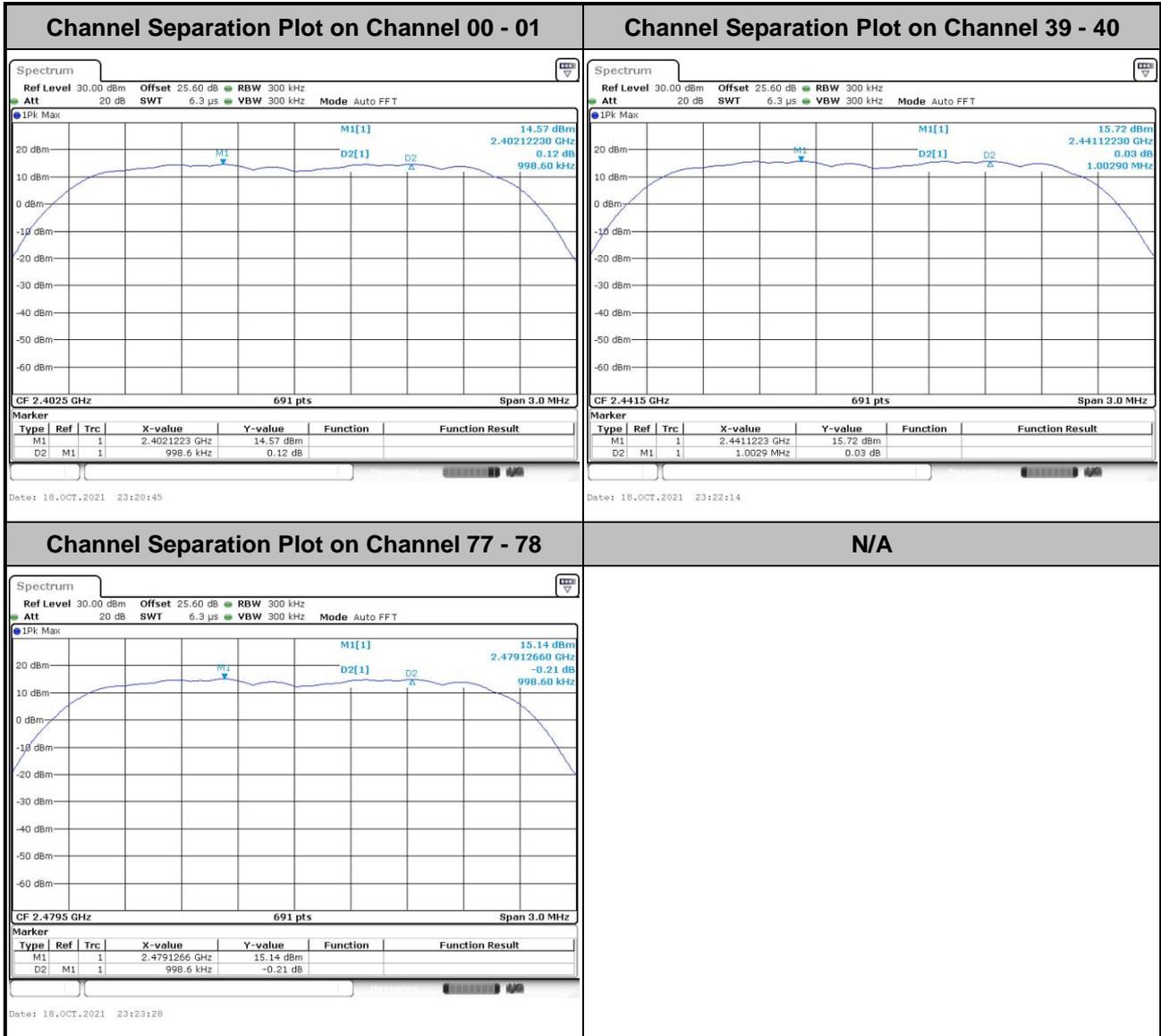


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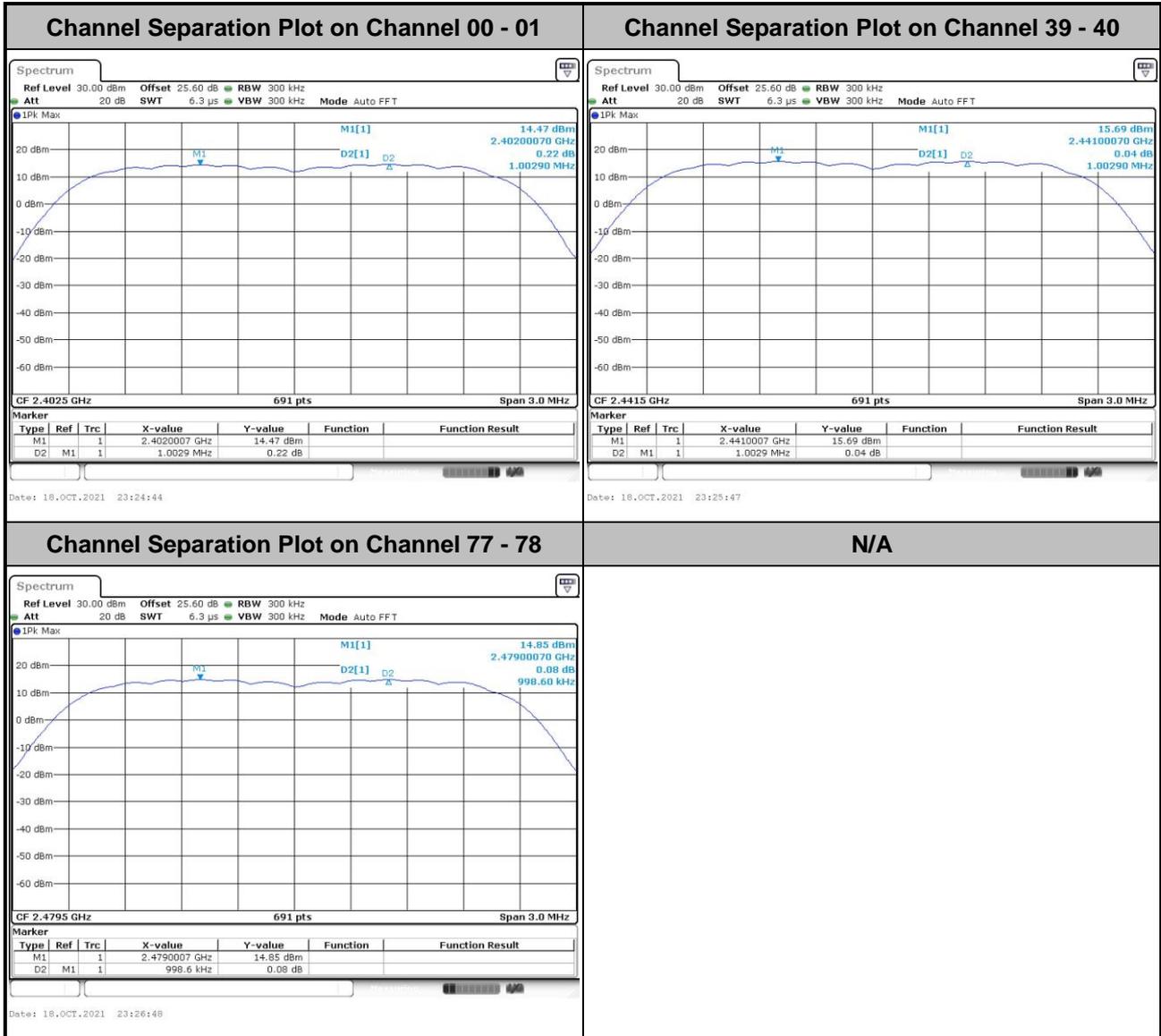


<2Mbps>





<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.

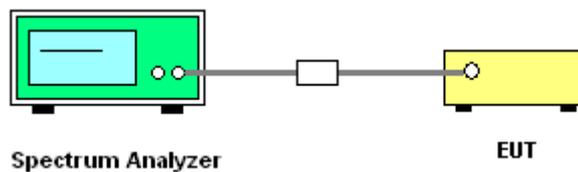
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

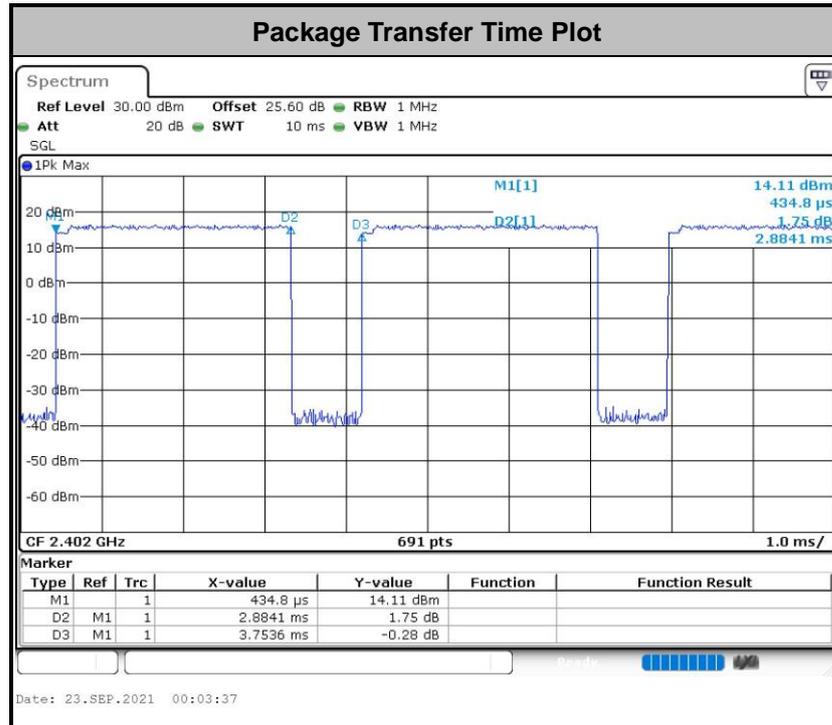
1. The testing follows ANSI C63.10-2013 clause 7.8.4.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Enable the 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

Please refer to Appendix A.



Remark:

1. 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.
2. 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.
3. 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

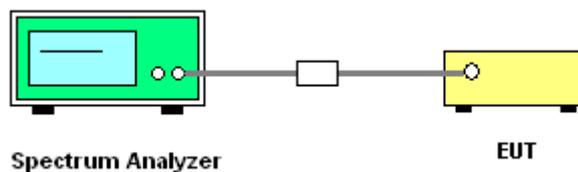
3.4.2 Measuring Instruments

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

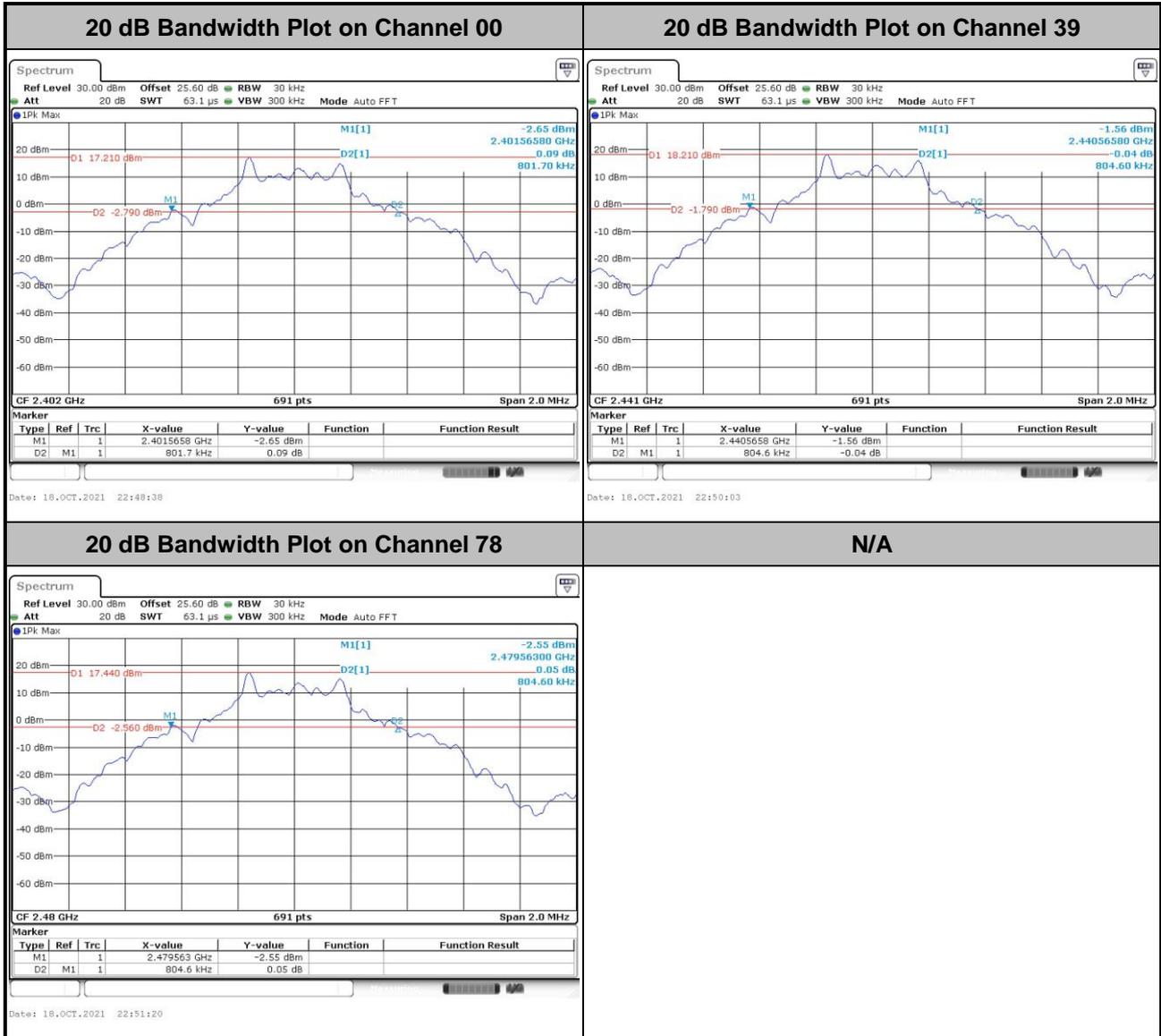


3.4.5 Test Result of 20dB Bandwidth

Please refer to Appendix A.

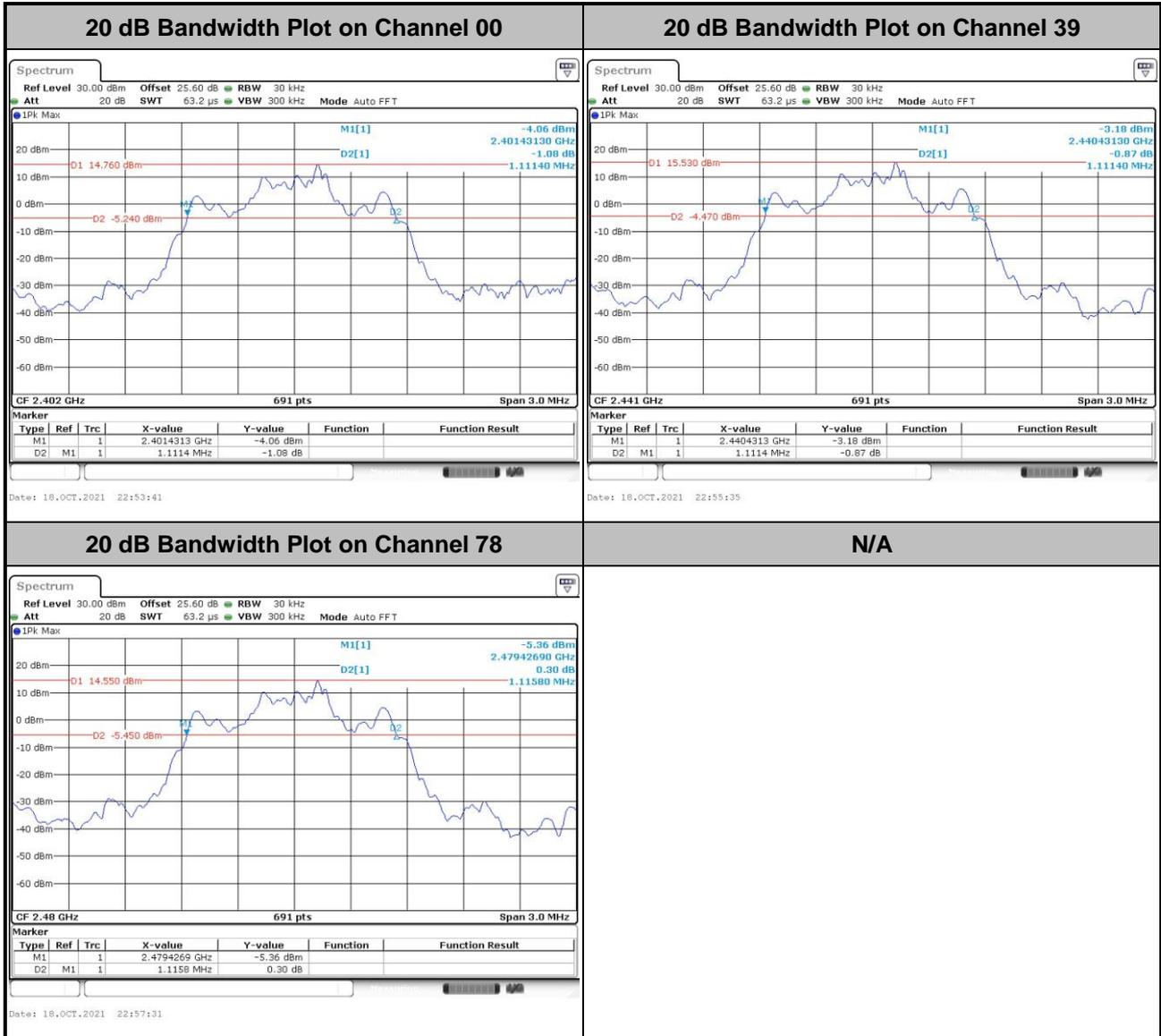


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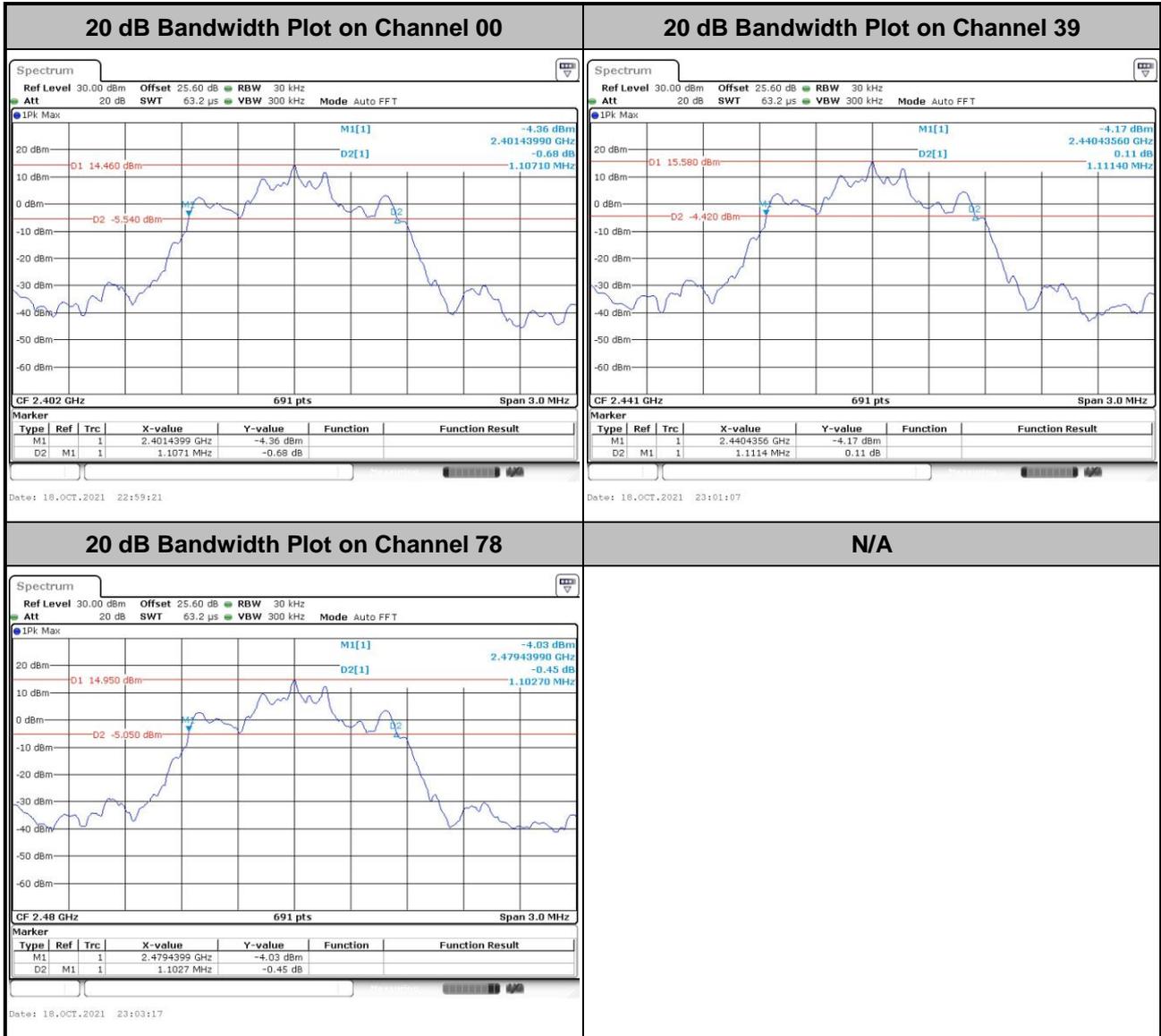


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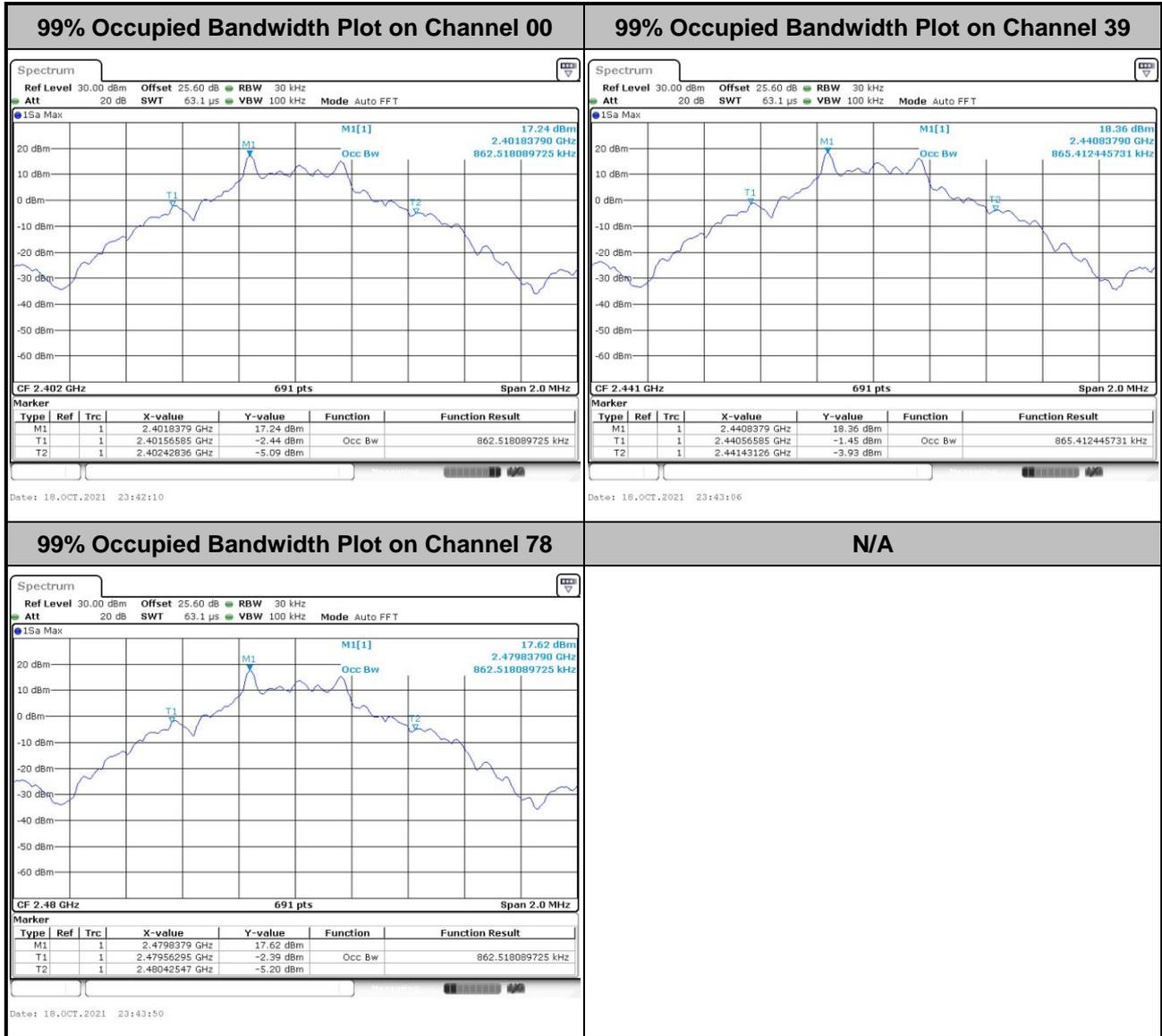




3.4.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

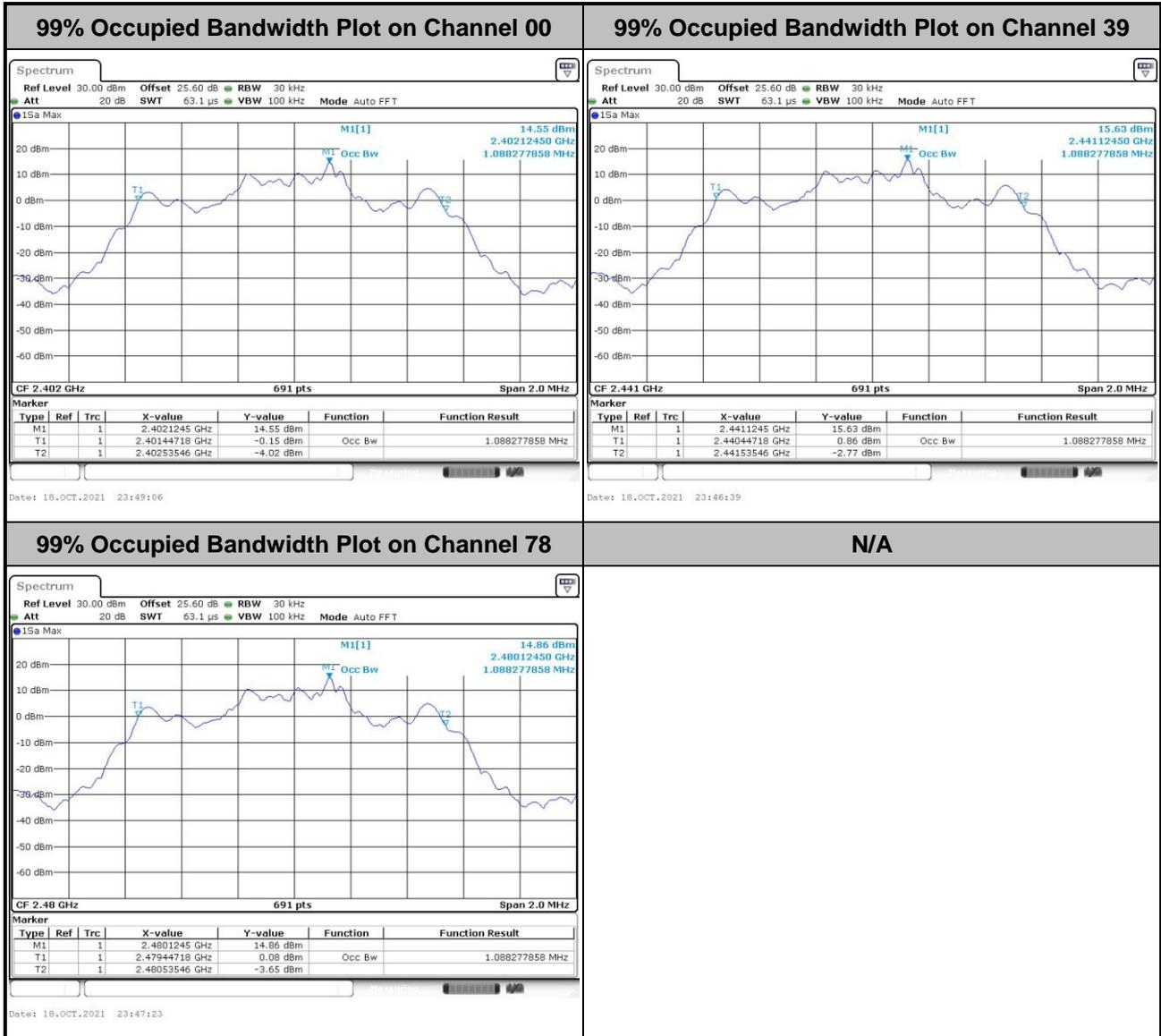
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Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



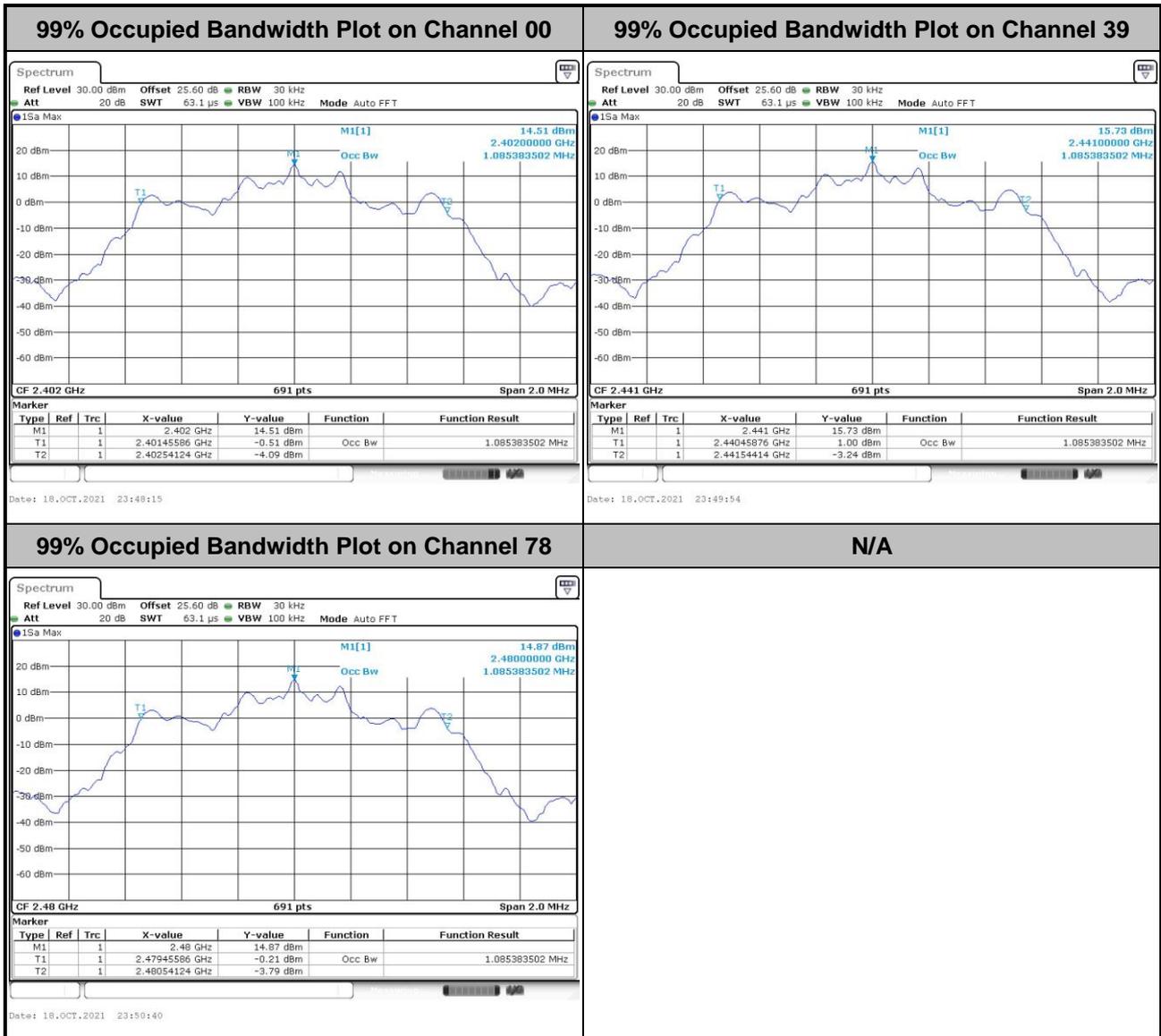
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Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



<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.

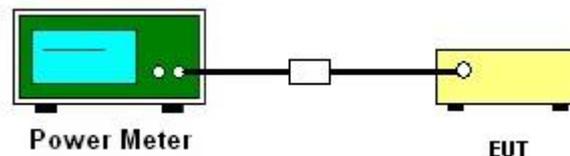
3.5.2 Measuring Instruments

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

Please refer to Appendix A.

3.5.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.

3.6 Conducted Band Edges Measurement

3.6.1 Limit of Band Edges

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

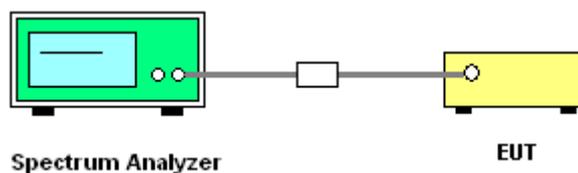
3.6.2 Measuring Instruments

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.

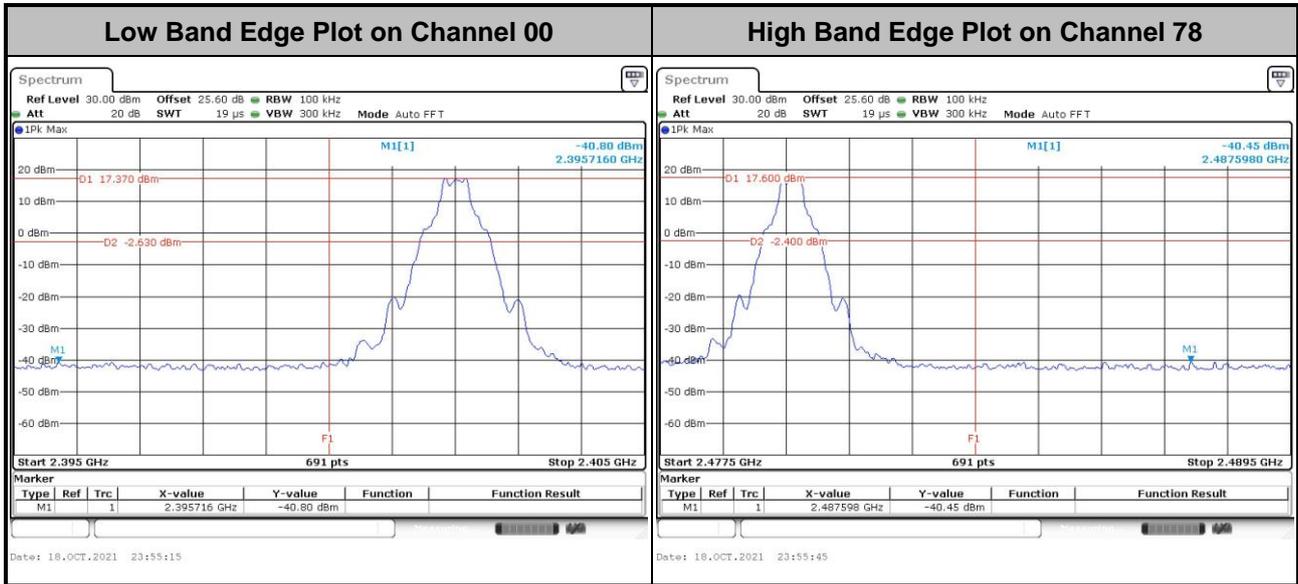
3.6.4 Test Setup



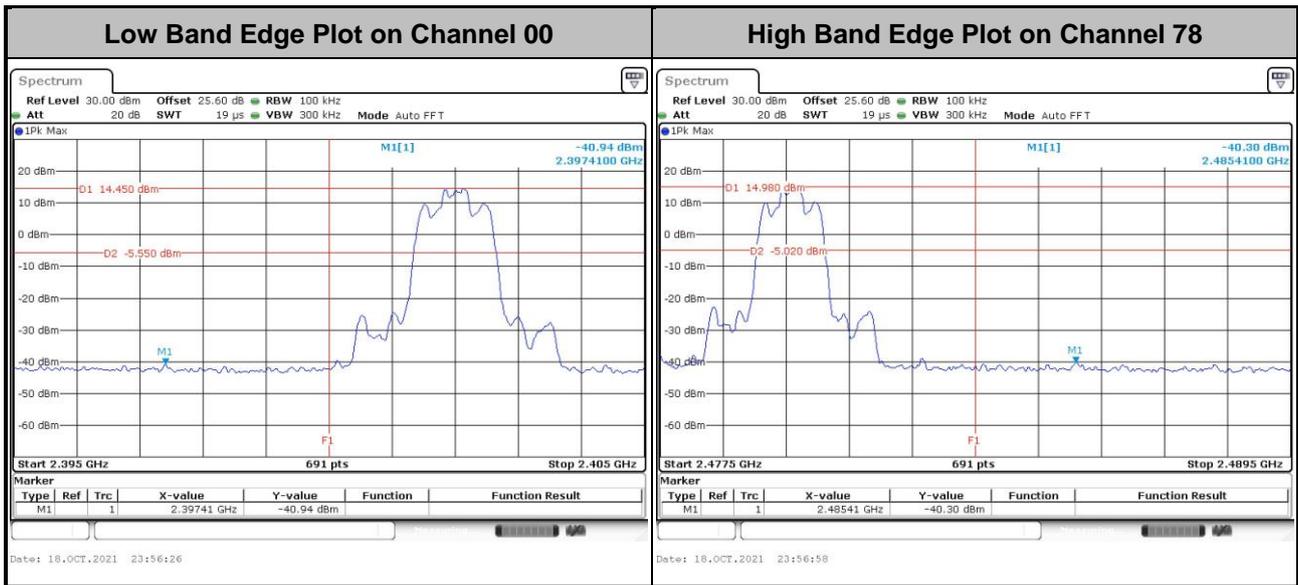


3.6.5 Test Result of Conducted Band Edges

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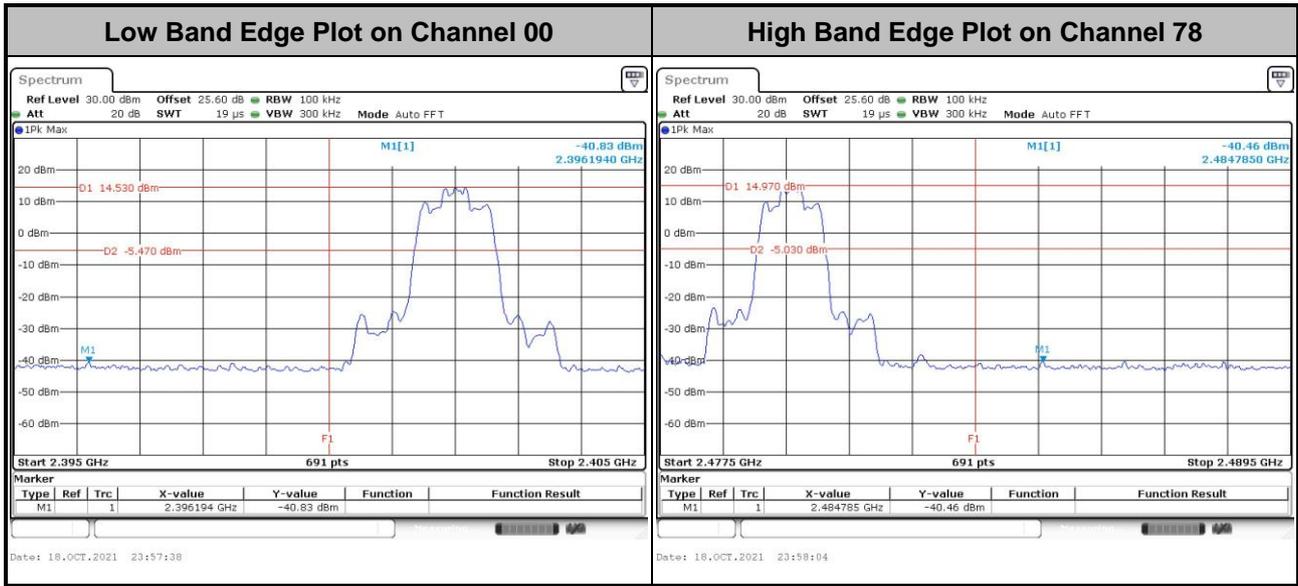


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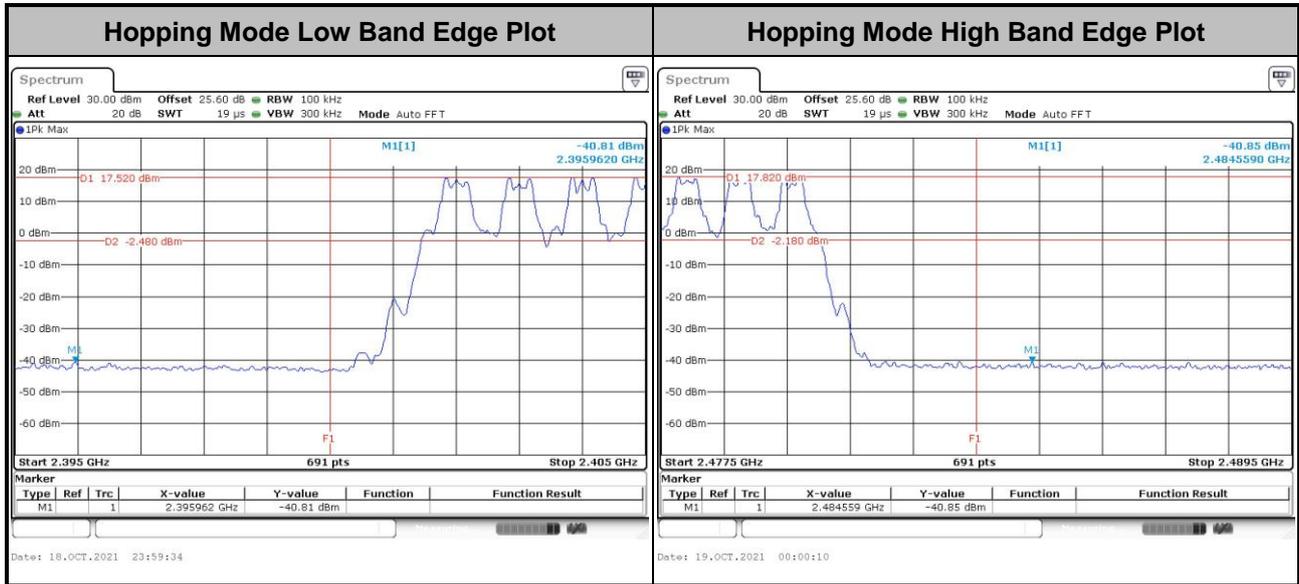
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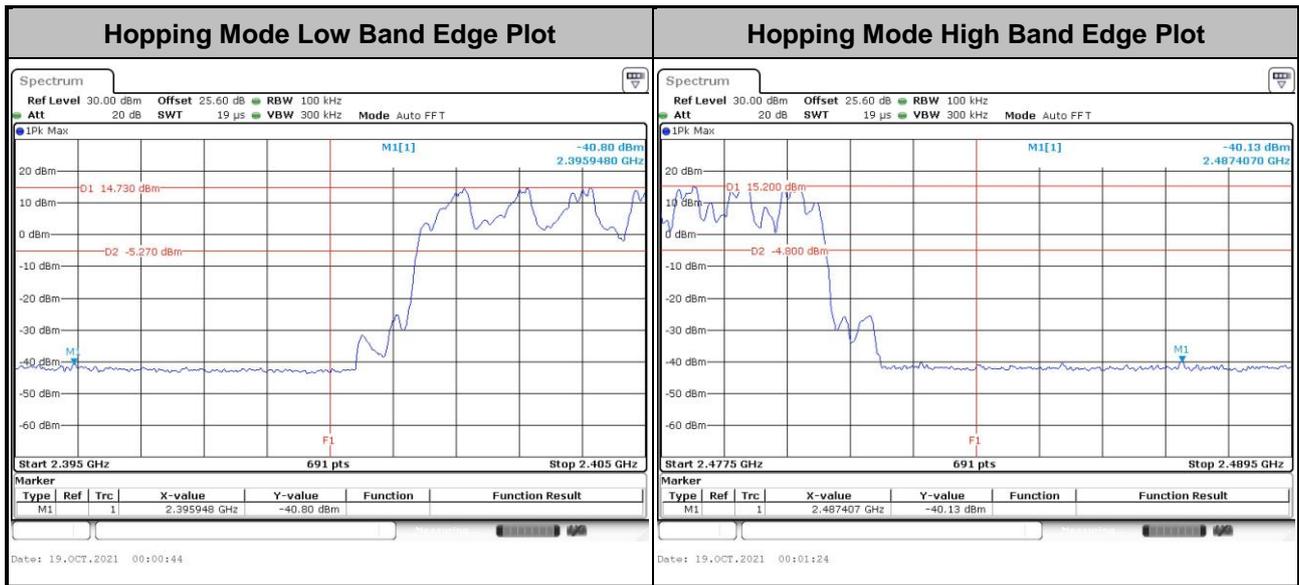


3.6.6 Test Result of Conducted Hopping Mode Band Edges

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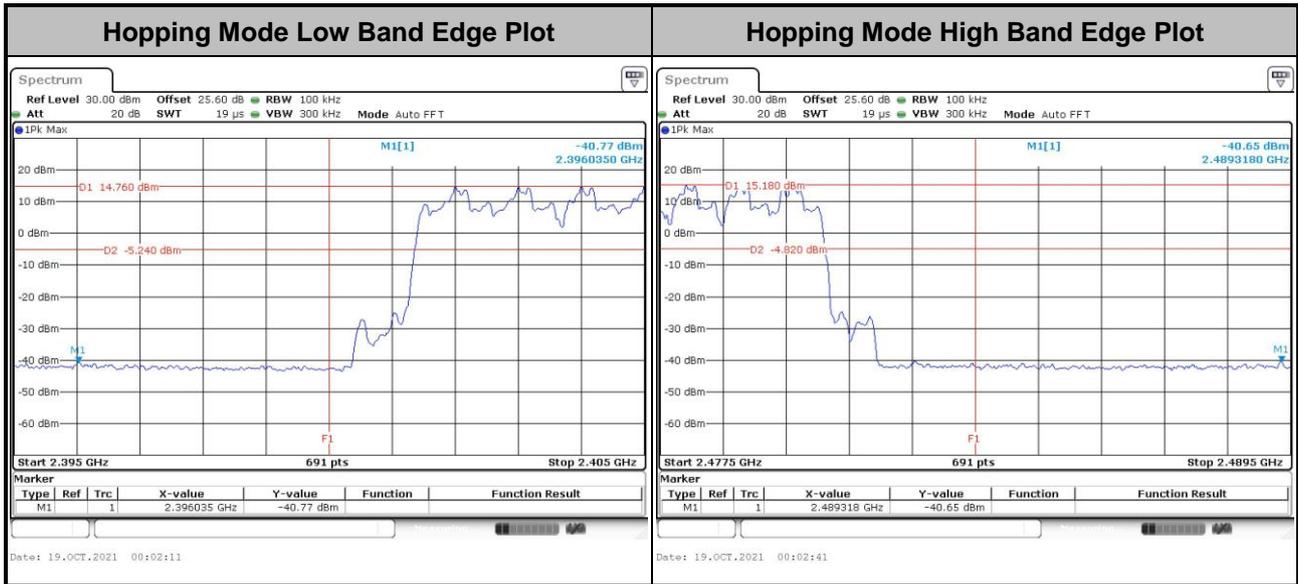


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3.7 Conducted Spurious Emission Measurement

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.

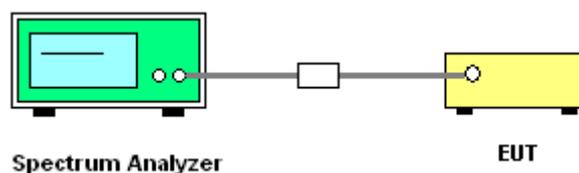
3.7.2 Measuring Instruments

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.

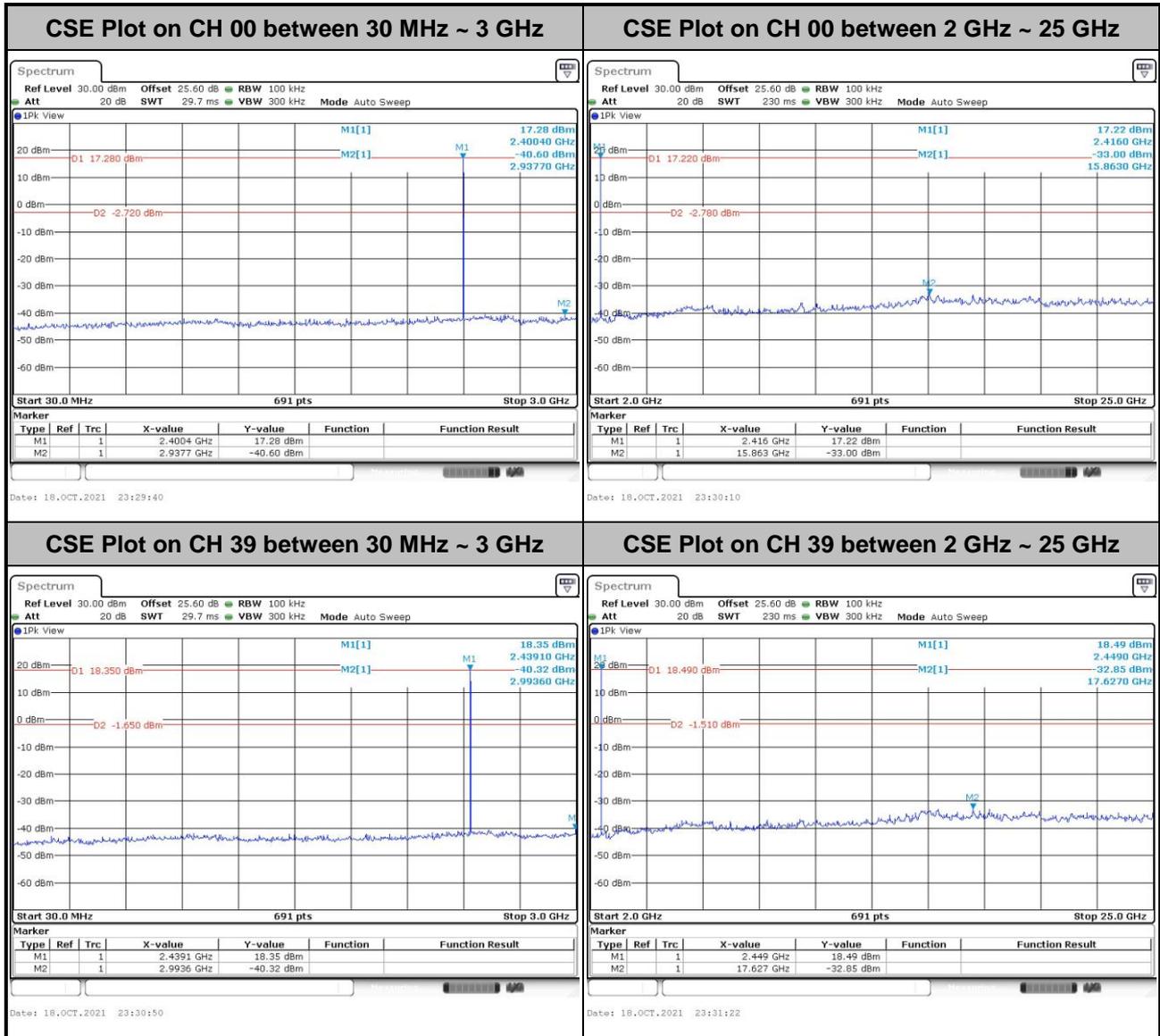
3.7.4 Test Setup

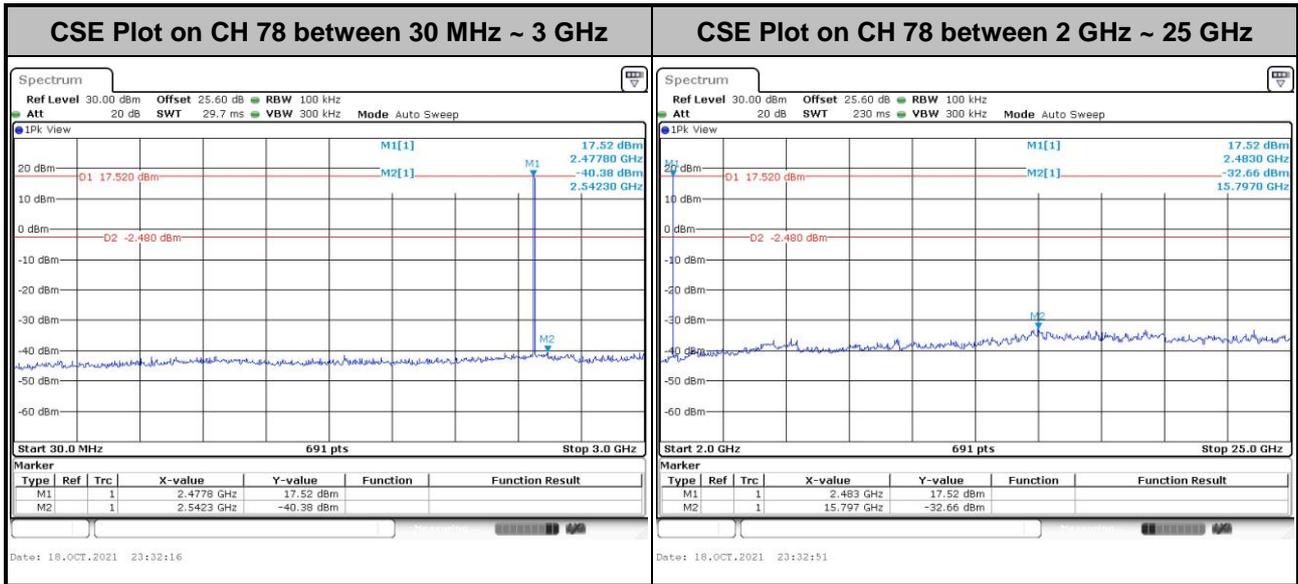




3.7.5 Test Result of Conducted Spurious Emission

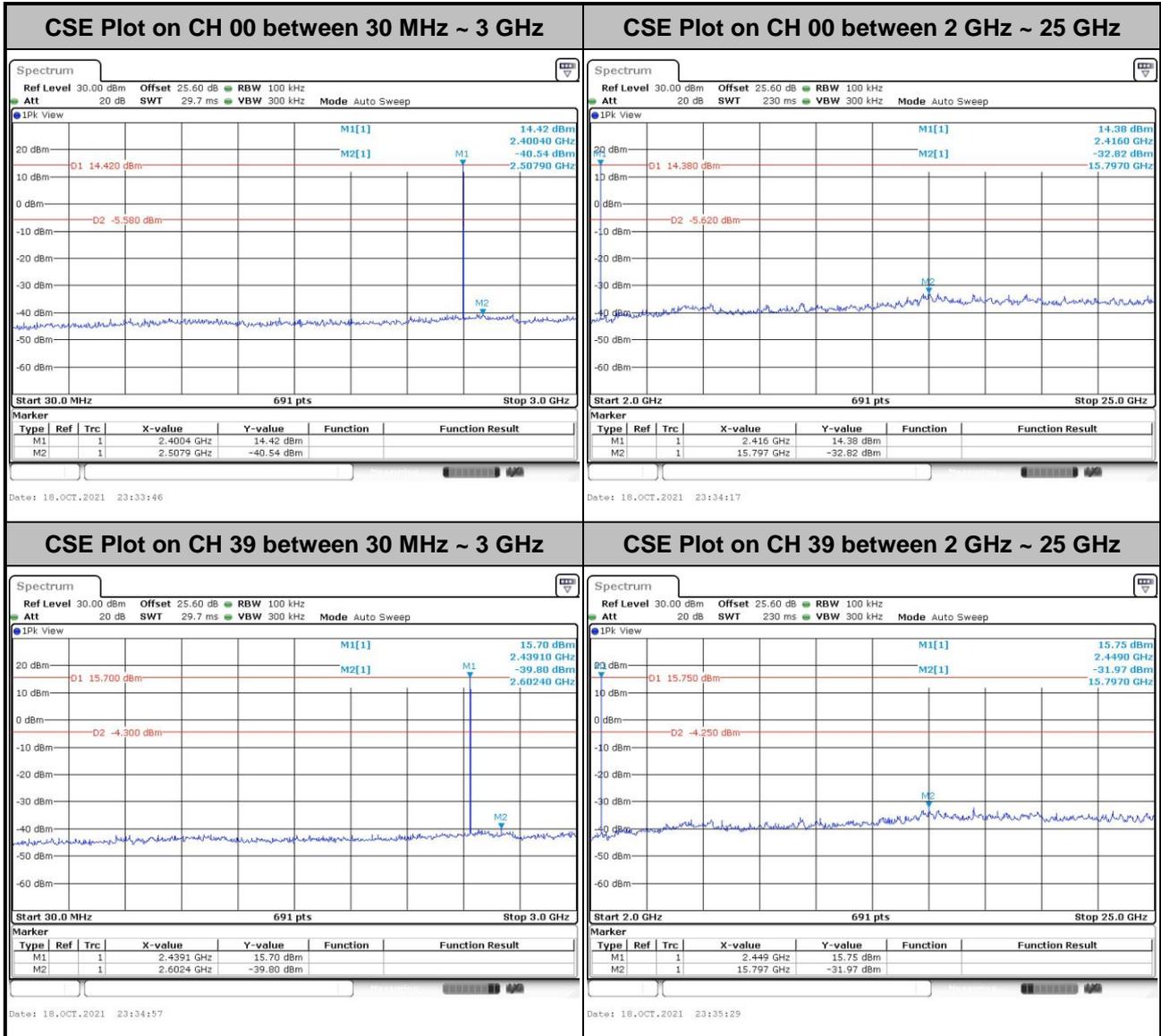
<1Mbps>

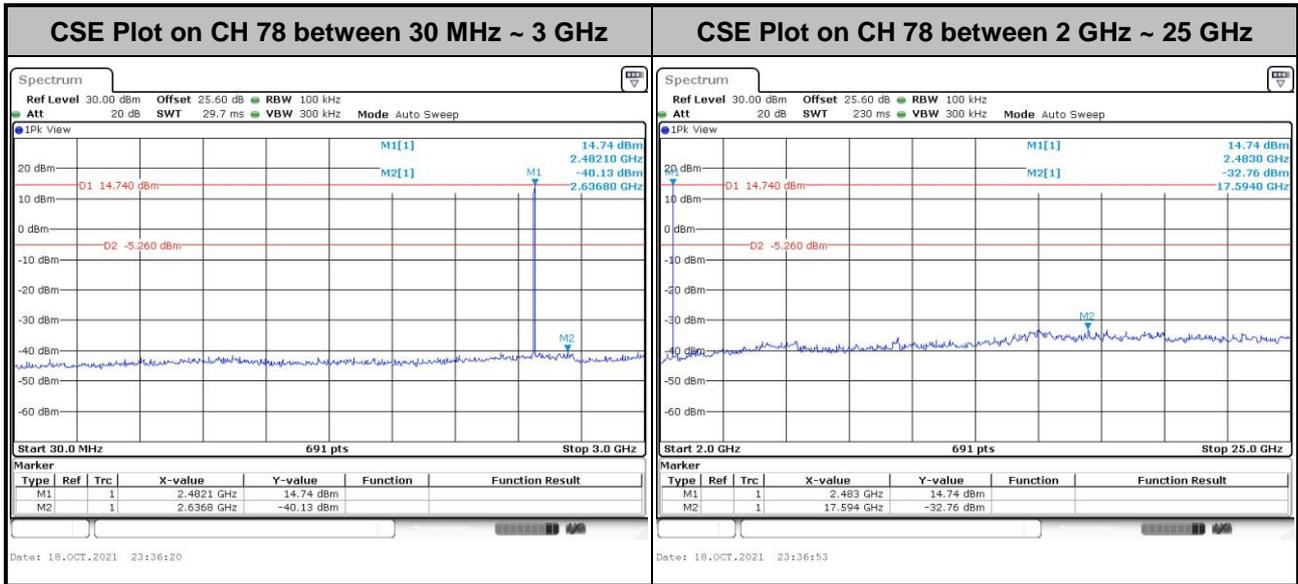






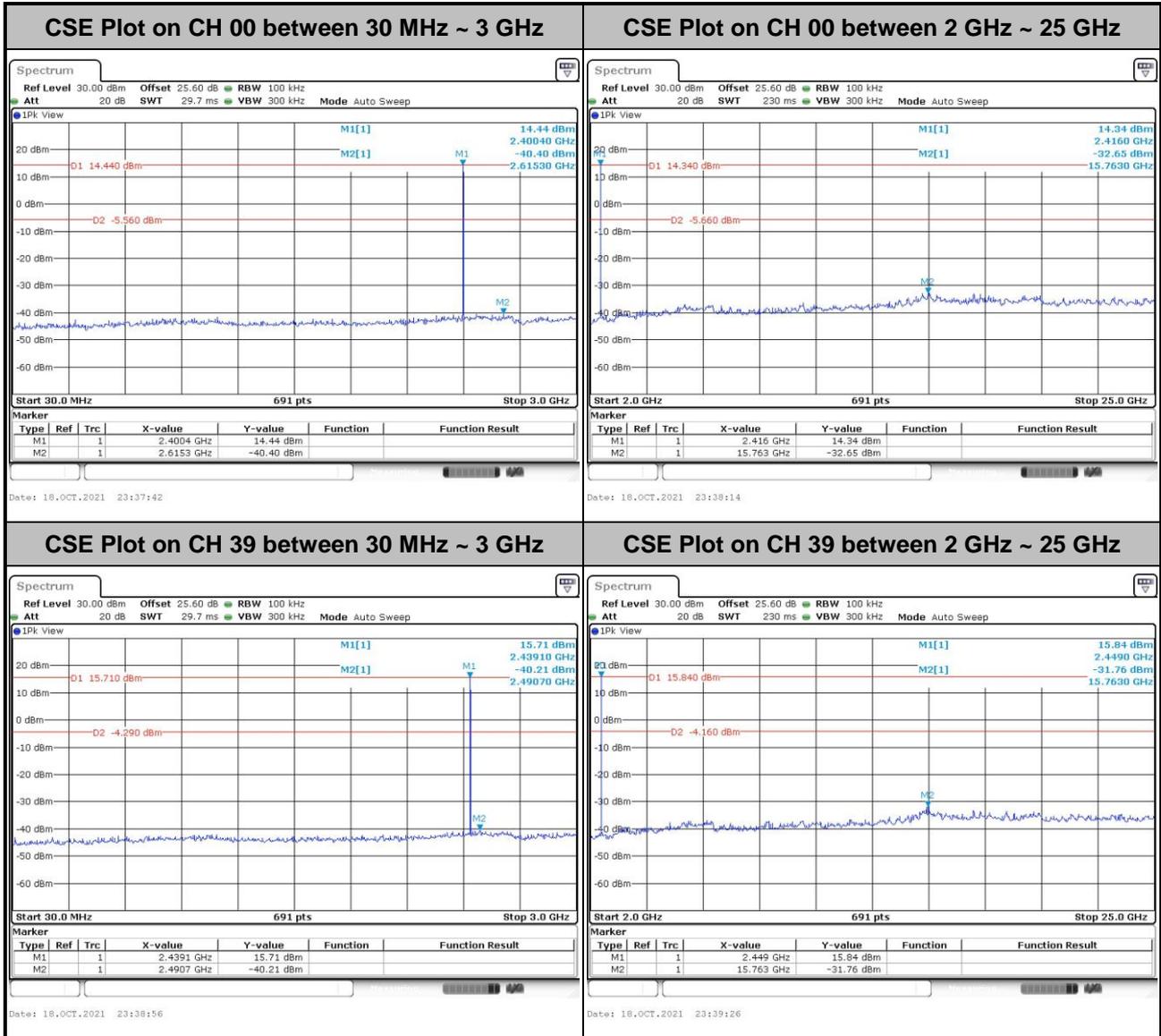
<2Mbps>

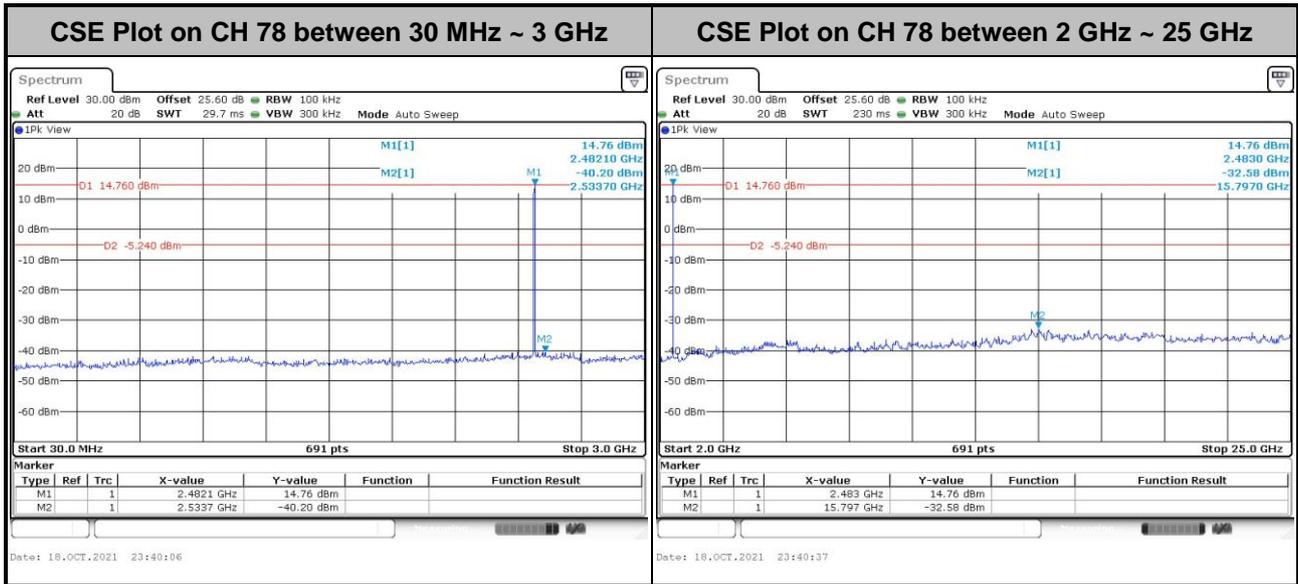






<3Mbps>







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.



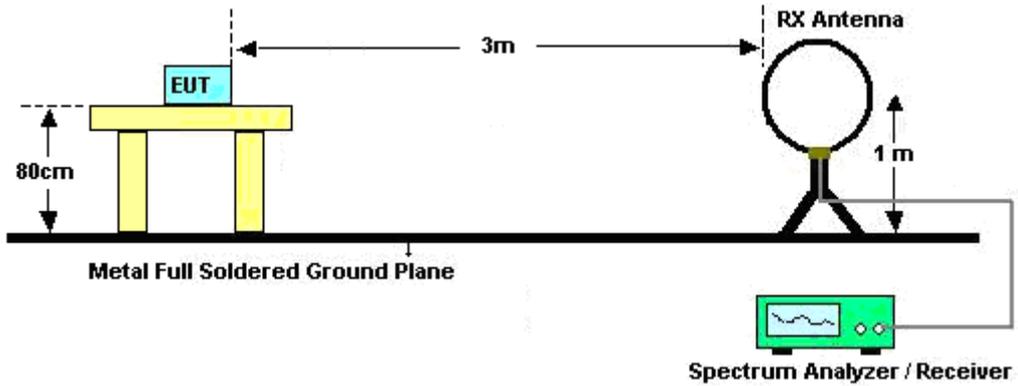
3.8.3 Test Procedures

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. Radiated testing below 1GHz was performed by adjusting the antenna tower from 1m to 4m and by rotating the turn table from 0degree to 360 degree to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6dB margin against QP limit line, the position is marked as "-".
8. Radiated testing above 1GHz was performed by adjusting the antenna tower from 1m to 4m and by rotating the turn table from 0degree to 360 degree 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 6dB margin against average limit line, the position is marked as "-".

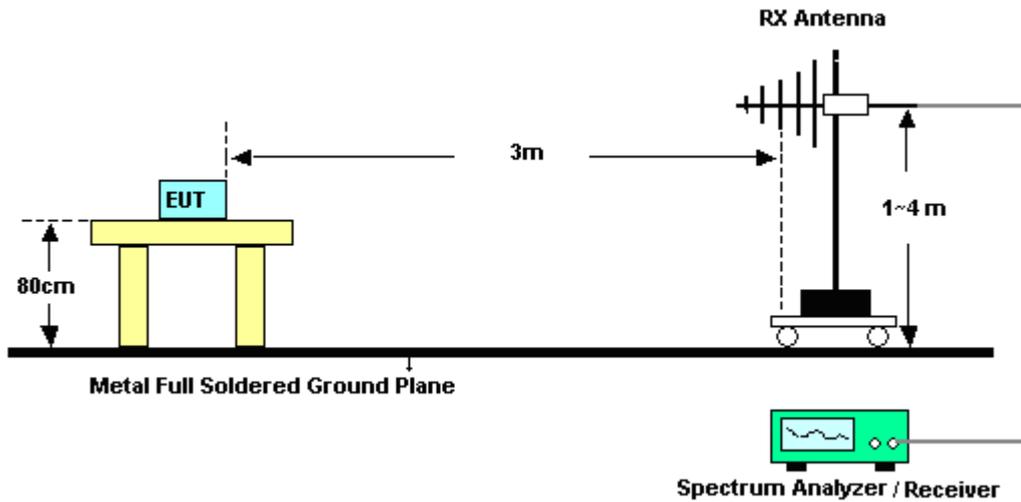
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from $20 \log(\text{dwell time}/100\text{ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals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

3.8.4 Test Setup

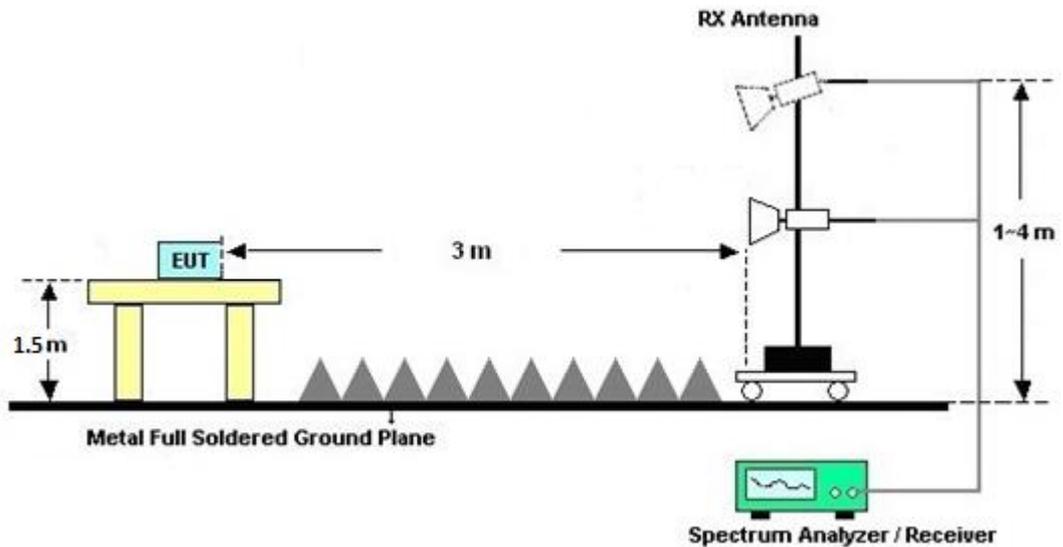
For radiated test below 30MHz



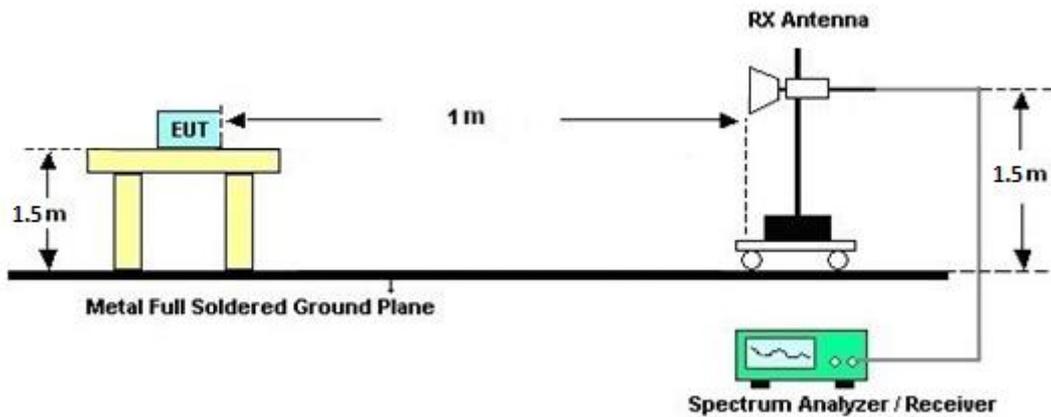
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



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

The low frequency, which 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 C and D.

3.8.7 Duty Cycle

Please refer to Appendix E.

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

Please refer to Appendix C and D.



3.9 AC Conducted Emission Measurement

3.9.1 Limit of AC Conducted Emission

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

| Frequency of emission (MHz) | Conducted limit (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.

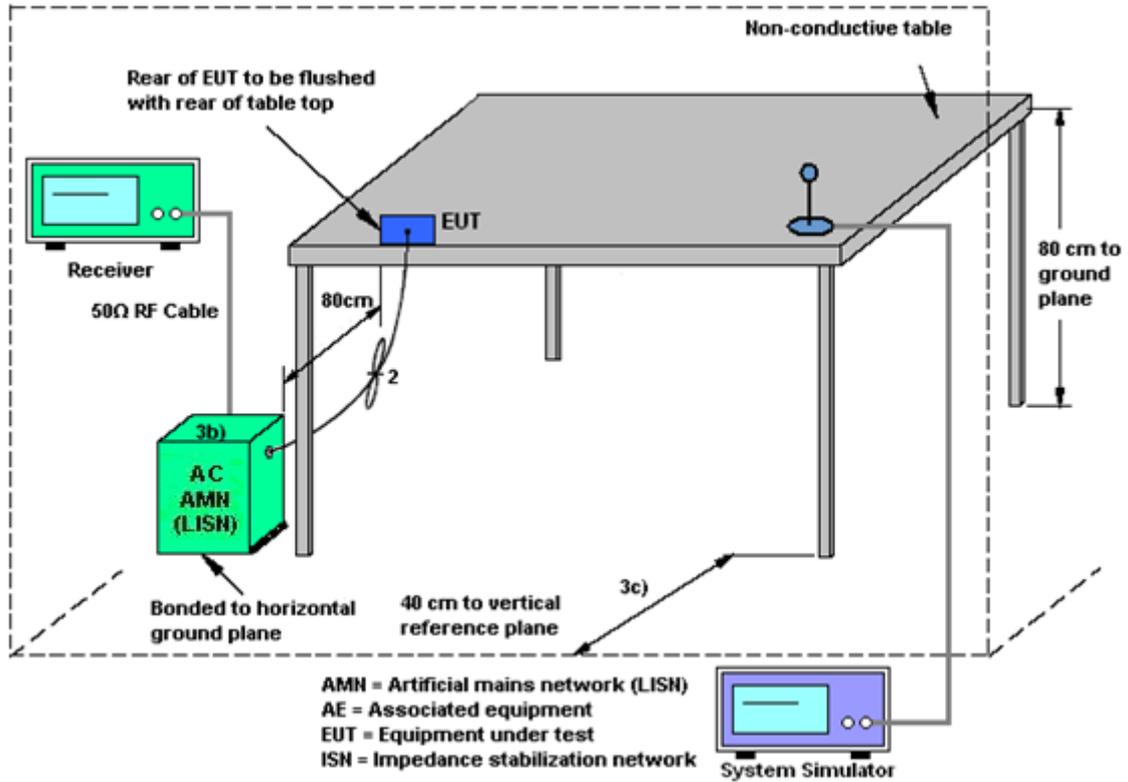
3.9.2 Measuring Instruments

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 B.



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 | 100315 | 9 kHz~30 MHz | Jan. 04, 2021 | Sep. 23, 2021~ Oct. 14, 2021 | Jan. 03, 2022 | Radiation (03CH15-HY) |
| Bilog Antenna | TESEQ | CBL 6111D & 00800N1D01N -06 | 41912 & 05 | 30MHz~1GHz | Feb. 08, 2021 | Sep. 23, 2021~ Oct. 14, 2021 | Feb. 07, 2022 | Radiation (03CH15-HY) |
| Amplifier | SONOMA | 310N | 363440 | 9kHz~1GHz | Dec. 28, 2020 | Sep. 23, 2021~ Oct. 14, 2021 | Dec. 27, 2021 | Radiation (03CH15-HY) |
| Horn Antenna | SCHWARZBE CK | BBHA 9120 D | 9120D-01620 | 1GHz~18GHz | Nov. 03, 2020 | Sep. 23, 2021~ Oct. 14, 2021 | Nov. 02, 2021 | Radiation (03CH15-HY) |
| SHF-EHF Horn Antenna | SCHWARZBE CK | BBHA 9170 | BBHA917025 1 | 18GHz~40GHz | Dec. 02, 2020 | Sep. 23, 2021~ Oct. 14, 2021 | Dec. 01, 2021 | Radiation (03CH15-HY) |
| Preamplifier | Jet-Power | JPA0118-55-30 3 | 17100018000 55006 | 1GHz~18GHz | May 06, 2021 | Sep. 23, 2021~ Oct. 14, 2021 | May 05, 2022 | Radiation (03CH15-HY) |
| Preamplifier | Keysight | 83017A | MY53270195 | 1GHz~26.5GHz | Aug. 19, 2021 | Sep. 23, 2021~ Oct. 14, 2021 | Aug. 18, 2022 | Radiation (03CH15-HY) |
| Preamplifier | EMEC | EM18G40G | 060801 | 18-40GHz | Jun. 22, 2021 | Sep. 23, 2021~ Oct. 14, 2021 | Jun. 21, 2022 | Radiation (03CH15-HY) |
| EMI Test Receiver | Keysight | N9038A(MXE) | MY54130085 | 20MHz~8.4GHz | Nov. 02, 2020 | Sep. 23, 2021~ Oct. 14, 2021 | Nov. 01, 2021 | Radiation (03CH15-HY) |
| Spectrum Analyzer | Agilent | E4446A | MY50180136 | 3Hz~44GHz | May 07, 2021 | Sep. 23, 2021~ Oct. 14, 2021 | May 06, 2022 | Radiation (03CH15-HY) |
| Antenna Mast | ChainTek | MBS-520-1 | N/A | 1m~4m | N/A | Sep. 23, 2021~ Oct. 14, 2021 | N/A | Radiation (03CH15-HY) |
| Turn Table | ChainTek | T-200-S-1 | N/A | 0~360 Degree | N/A | Sep. 23, 2021~ Oct. 14, 2021 | N/A | Radiation (03CH15-HY) |
| Software | Audix | E3 6.2009-8-24(k5) | RK-000451 | N/A | N/A | Sep. 23, 2021~ Oct. 14, 2021 | N/A | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104, 102E | MY36980/4, MY9838/4PE, 508405/2E | 30MHz~18G | Nov. 16, 2020 | Sep. 23, 2021~ Oct. 14, 2021 | Nov. 15, 2021 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 505134/2 | 30MHz-40GHz | Feb. 22, 2021 | Sep. 23, 2021~ Oct. 14, 2021 | Feb. 21, 2022 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 800740/2 | 30MHz-40GHz | Feb. 22, 2021 | Sep. 23, 2021~ Oct. 14, 2021 | Feb. 21, 2022 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY9837/4PE | 9kHz~30MHz | Mar. 11, 2021 | Sep. 23, 2021~ Oct. 14, 2021 | Mar. 10, 2022 | Radiation (03CH15-HY) |
| Filter | Wainwright | WLJ4-1000-15 30-6000-40ST | SN4 | 1.53GHz Low Pass Filter | Jul. 02, 2021 | Sep. 23, 2021~ Oct. 14, 2021 | Jul. 01, 2022 | Radiation (03CH15-HY) |
| Filter | Wainwright | WHKX12-2700 -3000-18000-6 0ST | SN4 | 3GHz High Pass Filter | Sep. 15, 2021 | Sep. 23, 2021~ Oct. 14, 2021 | Sep. 14, 2022 | Radiation (03CH15-HY) |



| Instrument | Brand Name | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|-----------------------|-----------------|------------------|------------------|-----------------|------------------|---------------------------------|---------------|-------------------------|
| Power Meter | Agilent | E4416A | GB41292344 | N/A | Jan. 14, 2021 | Sep. 23, 2021~ Oct. 19, 2021 | Jan. 13, 2022 | Conducted (TH05-HY) |
| Power Sensor | Agilent | E9327A | US40441548 | 50MHz~18GHz | Jan. 14, 2021 | Sep. 23, 2021~ Oct. 19, 2021 | Jan. 13, 2022 | Conducted (TH05-HY) |
| Signal Analyzer | Rohde & Schwarz | FSV40 | 101397 | 10Hz~40GHz | Nov. 27, 2020 | Sep. 23, 2021~ Oct. 19, 2021 | Nov. 26, 2021 | Conducted (TH05-HY) |
| Switch Box & RF Cable | EM Electronics | EMSW18SE | SW200302 | N/A | Mar. 17, 2021 | Sep. 23, 2021~ Oct. 19, 2021 | Mar. 16, 2022 | Conducted (TH05-HY) |
| AC Power Source | ACPOWER | AFC-11003G | F317040033 | N/A | N/A | Sep. 24, 2021 | N/A | Conduction (CO07-HY) |
| Software | Rohde & Schwarz | EMC32 V10.30 | N/A | N/A | N/A | Sep. 24, 2021 | N/A | Conduction (CO07-HY) |
| Pulse Limiter | SCHWARZBECK | VTSD 9561-F N | 9561-F N00373 | 9kHz-200MHz | Nov. 02, 2020 | Sep. 24, 2021 | Nov. 01, 2021 | Conduction (CO07-HY) |
| RF Cable | HUBER + SUHNER | RG 214/U | 1358175 | 9kHz~30MHz | N/A | Sep. 24, 2021 | N/A | Conduction (CO07-HY) |
| Two-Line V-Network | TESEQ | NNB 51 | 45051 | N/A | Feb. 01, 2021 | Sep. 24, 2021 | Jan. 31, 2022 | Conduction (CO07-HY) |
| Two-Line V-Network | TESEQ | NNB 52 | 36122 | N/A | Feb. 01, 2021 | Sep. 24, 2021 | Jan. 31, 2022 | Conduction (CO07-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESR3 | 102388 | 9kHz~3.6GHz | Nov. 30, 2020 | Sep. 24, 2021 | Nov. 29, 2021 | Conduction (CO07-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% ($U = 2Uc(y)$) | 5.8 dB |
|---|--------|

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

| | |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.3 dB |
|---|--------|

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

| | |
|---|--------|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$) | 5.6 dB |
|---|--------|

Appendix A. Test Result of Conducted Test Items

| | | | | |
|----------------|----------------------|--------------------|-----------|----|
| Test Engineer: | Hank Hsu | Temperature: | 22.5~25.9 | °C |
| Test Date: | 2021/9/23~2021/10/19 | Relative Humidity: | 45.1~58.7 | % |

| TEST RESULTS DATA | | | | | | | | | |
|---|-----------|-----|-----|-------------|---------------|---------------------|--|--|-----------|
| 20dB and 99% Occupied Bandwidth and Hopping Channel Separation | | | | | | | | | |
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 20db BW (MHz) | 99% Bandwidth (MHz) | Hopping Channel Separation Measurement (MHz) | Hopping Channel Separation Measurement Limit (MHz) | Pass/Fail |
| DH | 1Mbps | 1 | 0 | 2402 | 0.802 | 0.863 | 0.999 | 0.5347 | Pass |
| DH | 1Mbps | 1 | 39 | 2441 | 0.805 | 0.865 | 0.999 | 0.5367 | Pass |
| DH | 1Mbps | 1 | 78 | 2480 | 0.805 | 0.863 | 0.682 | 0.5367 | Pass |
| 2DH | 2Mbps | 1 | 0 | 2402 | 1.111 | 1.088 | 0.999 | 0.7407 | Pass |
| 2DH | 2Mbps | 1 | 39 | 2441 | 1.111 | 1.088 | 1.003 | 0.7407 | Pass |
| 2DH | 2Mbps | 1 | 78 | 2480 | 1.116 | 1.088 | 0.999 | 0.7439 | Pass |
| 3DH | 3Mbps | 1 | 0 | 2402 | 1.107 | 1.085 | 1.003 | 0.7380 | Pass |
| 3DH | 3Mbps | 1 | 39 | 2441 | 1.111 | 1.085 | 1.003 | 0.7407 | Pass |
| 3DH | 3Mbps | 1 | 78 | 2480 | 1.103 | 1.085 | 0.999 | 0.7351 | Pass |

| TEST RESULTS DATA | | | | | | |
|--------------------------|-----------------------------|----------------------------|------------------------------|------------------|--------------|-----------|
| Dwell Time | | | | | | |
| Mod. | Hopping Channel Number Rate | Hops Occupancy Time (hops) | Package Transfer Time (msec) | Dwell Time (sec) | Limits (sec) | Pass/Fail |
| 2DH5 | 79 | 106.670 | 2.88 | 0.31 | 0.4 | Pass |
| 2DH5 (AFH) | 20 | 53.330 | 2.88 | 0.15 | 0.4 | Pass |

| TEST RESULTS DATA | | | | | |
|--------------------------|-----|-----|------------------|-------------------|-------------|
| Peak Power Table | | | | | |
| DH | CH. | NTX | Peak Power (dBm) | Power Limit (dBm) | Test Result |
| DH5 | 0 | 1 | 17.75 | 30.00 | Pass |
| | 39 | 1 | 18.97 | 30.00 | Pass |
| | 78 | 1 | 17.85 | 30.00 | Pass |
| 2DH5 | 0 | 1 | 17.59 | 20.97 | Pass |
| | 39 | 1 | 18.83 | 20.97 | Pass |
| | 78 | 1 | 17.78 | 20.97 | Pass |
| 3DH5 | 0 | 1 | 18.04 | 20.97 | Pass |
| | 39 | 1 | 19.40 | 20.97 | Pass |
| | 78 | 1 | 18.13 | 20.97 | Pass |

| TEST RESULTS DATA | | | | |
|----------------------------|-----|-----|---------------------|------------------|
| Average Power Table | | | | |
| (Reporting Only) | | | | |
| DH | CH. | NTX | Average Power (dBm) | Duty Factor (dB) |
| DH5 | 0 | 1 | 17.29 | 1.17 |
| | 39 | 1 | 18.41 | 1.17 |
| | 78 | 1 | 17.25 | 1.17 |
| 2DH5 | 0 | 1 | 14.44 | 1.14 |
| | 39 | 1 | 15.64 | 1.14 |
| | 78 | 1 | 14.59 | 1.14 |
| 3DH5 | 0 | 1 | 14.53 | 1.14 |
| | 39 | 1 | 15.74 | 1.14 |
| | 78 | 1 | 14.59 | 1.14 |

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



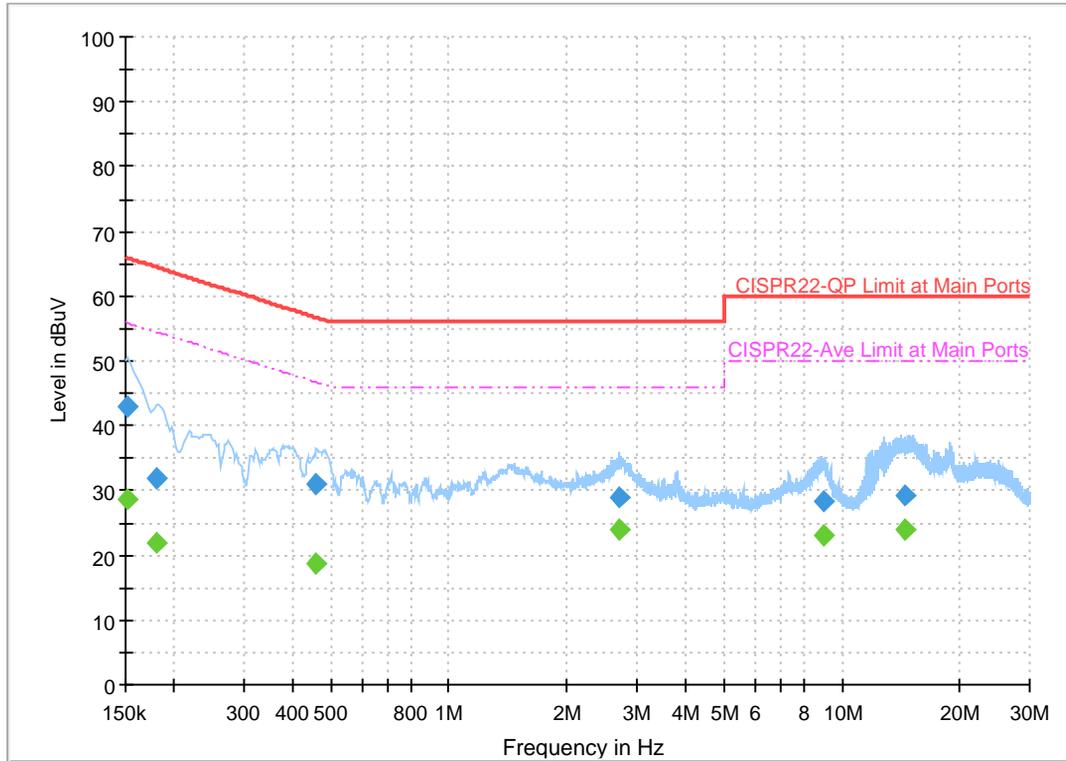
Appendix B. AC Conducted Emission Test Results

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

EUT Information

Report NO : 190910
 Test Mode : Mode 1
 Test Voltage : Power From System
 Phase : Line

Full Spectrum



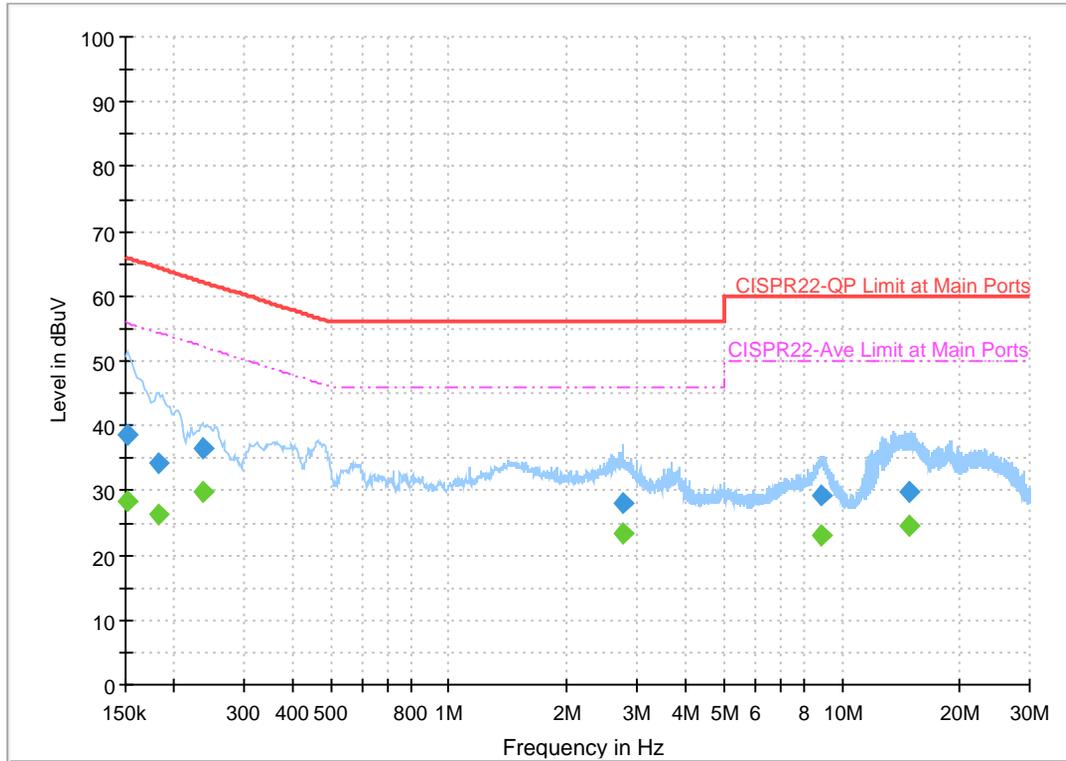
Final Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.152250 | --- | 28.67 | 55.88 | 27.20 | L1 | OFF | 20.0 |
| 0.152250 | 42.93 | --- | 65.88 | 22.94 | L1 | OFF | 20.0 |
| 0.179250 | --- | 21.79 | 54.52 | 32.73 | L1 | OFF | 20.0 |
| 0.179250 | 31.94 | --- | 64.52 | 32.58 | L1 | OFF | 20.0 |
| 0.460500 | --- | 18.81 | 46.68 | 27.88 | L1 | OFF | 20.0 |
| 0.460500 | 30.93 | --- | 56.68 | 25.76 | L1 | OFF | 20.0 |
| 2.719500 | --- | 23.98 | 46.00 | 22.02 | L1 | OFF | 20.1 |
| 2.719500 | 28.97 | --- | 56.00 | 27.03 | L1 | OFF | 20.1 |
| 8.967750 | --- | 23.13 | 50.00 | 26.87 | L1 | OFF | 20.1 |
| 8.967750 | 28.37 | --- | 60.00 | 31.63 | L1 | OFF | 20.1 |
| 14.545500 | --- | 24.09 | 50.00 | 25.91 | L1 | OFF | 20.2 |
| 14.545500 | 29.20 | --- | 60.00 | 30.80 | L1 | OFF | 20.2 |

EUT Information

Report NO : 190910
 Test Mode : Mode 1
 Test Voltage : Power From System
 Phase : Neutral

Full Spectrum



Final Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.152250 | --- | 28.37 | 55.88 | 27.51 | N | OFF | 20.0 |
| 0.152250 | 38.53 | --- | 65.88 | 27.35 | N | OFF | 20.0 |
| 0.181500 | --- | 26.27 | 54.42 | 28.15 | N | OFF | 20.0 |
| 0.181500 | 34.15 | --- | 64.42 | 30.27 | N | OFF | 20.0 |
| 0.235500 | --- | 29.90 | 52.25 | 22.35 | N | OFF | 20.0 |
| 0.235500 | 36.43 | --- | 62.25 | 25.82 | N | OFF | 20.0 |
| 2.780250 | --- | 23.30 | 46.00 | 22.70 | N | OFF | 20.1 |
| 2.780250 | 28.20 | --- | 56.00 | 27.80 | N | OFF | 20.1 |
| 8.868750 | --- | 23.03 | 50.00 | 26.97 | N | OFF | 20.1 |
| 8.868750 | 29.38 | --- | 60.00 | 30.62 | N | OFF | 20.1 |
| 14.802000 | --- | 24.57 | 50.00 | 25.43 | N | OFF | 20.2 |
| 14.802000 | 29.78 | --- | 60.00 | 30.22 | N | OFF | 20.2 |



Appendix C. Radiated Spurious Emission

| | | | |
|-----------------|--------------------------------------|---------------------|-------------|
| Test Engineer : | Leo Lee, Mancy Chou and Bigshow Wang | Temperature : | 23.2~24.6°C |
| | | Relative Humidity : | 42~56% |

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 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 CH00 2402MHz | | 2348.955 | 44.95 | -29.05 | 74 | 41.56 | 27.7 | 6.58 | 30.89 | 159 | 17 | P | H | |
| | | 2348.955 | 20.16 | -33.84 | 54 | - | - | - | - | - | - | A | H | |
| | * | 2402 | 105.31 | - | - | 102.03 | 27.5 | 6.66 | 30.88 | 159 | 17 | P | H | |
| | * | 2402 | 80.52 | - | - | - | - | - | - | - | - | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | | H |
| | | | 2329.53 | 44.97 | -29.03 | 74 | 41.59 | 27.74 | 6.54 | 30.9 | 154 | 353 | P | V |
| | | | 2329.53 | 20.18 | -33.82 | 54 | - | - | - | - | - | - | A | V |
| | * | | 2402 | 102.46 | - | - | 99.18 | 27.5 | 6.66 | 30.88 | 154 | 353 | P | V |
| | * | | 2402 | 77.67 | - | - | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V |
| BT CH 39 2441MHz | | 2365.02 | 44.76 | -29.24 | 74 | 41.41 | 27.64 | 6.6 | 30.89 | 200 | 20 | P | H | |
| | | 2365.02 | 19.97 | -34.03 | 54 | - | - | - | - | - | - | A | H | |
| | * | 2441 | 108.42 | - | - | 105.06 | 27.5 | 6.72 | 30.86 | 200 | 20 | P | H | |
| | * | 2441 | 83.63 | - | - | - | - | - | - | - | - | A | H | |
| | | | 2487.47 | 45.6 | -28.4 | 74 | 42.21 | 27.43 | 6.8 | 30.84 | 200 | 20 | P | H |
| | | | 2487.47 | 20.81 | -33.19 | 54 | - | - | - | - | - | - | A | H |
| | | | 2336.04 | 44.35 | -29.65 | 74 | 40.97 | 27.73 | 6.55 | 30.9 | 188 | 2 | P | V |
| | | | 2336.04 | 19.56 | -34.44 | 54 | - | - | - | - | - | - | A | V |
| | * | | 2441 | 104.82 | - | - | 101.46 | 27.5 | 6.72 | 30.86 | 188 | 2 | P | V |
| | * | | 2441 | 80.03 | - | - | - | - | - | - | - | - | A | V |
| | | | 2486.21 | 44.04 | -29.96 | 74 | 40.66 | 27.43 | 6.79 | 30.84 | 188 | 2 | P | V |
| | | | 2486.21 | 19.25 | -34.75 | 54 | - | - | - | - | - | - | A | V |



| | | | | | | | | | | | | | |
|---------------------------------|---|---------|--------|--------|----|-------|-------|------|-------|-----|----|---|---|
| BT CH 78 2480MHz | * | 2480 | 106.07 | - | - | 102.7 | 27.44 | 6.78 | 30.85 | 170 | 24 | P | H |
| | * | 2480 | 81.28 | - | - | - | - | - | - | - | - | A | H |
| | | 2484.64 | 44.87 | -29.13 | 74 | 41.5 | 27.43 | 6.79 | 30.85 | 170 | 24 | P | H |
| | | 2484.64 | 20.08 | -33.92 | 54 | - | - | - | - | - | - | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 102.96 | - | - | 99.59 | 27.44 | 6.78 | 30.85 | 160 | 14 | P | V |
| | * | 2480 | 78.17 | - | - | - | - | - | - | - | - | A | V |
| | | 2495.72 | 44.74 | -29.26 | 74 | 41.36 | 27.41 | 6.81 | 30.84 | 160 | 14 | P | V |
| | | 2495.72 | 19.95 | -34.05 | 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 | 46.89 | -27.11 | 74 | 64.51 | 31.1 | 10.13 | 58.85 | - | - | P | H | |
| | | 4804 | 22.1 | -31.9 | 54 | - | - | - | - | - | - | A | H | |
| | | 10000 | 48.76 | -25.24 | 74 | 56.26 | 38.7 | 14.26 | 60.46 | - | - | P | H | |
| | | 10000 | 23.97 | -30.03 | 54 | - | - | - | - | - | - | A | H | |
| | | 14000 | 50.91 | -23.09 | 74 | 56.88 | 40.8 | 16.63 | 63.4 | - | - | P | H | |
| | | 14000 | 26.12 | -27.88 | 54 | - | - | - | - | - | - | A | H | |
| | | 17985 | 59.52 | -14.48 | 74 | 49.12 | 48.73 | 18.94 | 57.27 | - | - | P | H | |
| | | 17985 | 34.73 | -19.27 | 54 | - | - | - | - | - | - | A | H | |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | H |
| | | | 4804 | 46.9 | -27.1 | 74 | 64.52 | 31.1 | 10.13 | 58.85 | - | - | P | V |
| | | | 4804 | 22.11 | -31.89 | 54 | - | - | - | - | - | - | A | V |
| | | | 10000 | 47.99 | -26.01 | 74 | 55.49 | 38.7 | 14.26 | 60.46 | - | - | P | V |
| | | | 10000 | 23.2 | -30.8 | 54 | - | - | - | - | - | - | A | V |
| | | | 14000 | 51.27 | -22.73 | 74 | 57.24 | 40.8 | 16.63 | 63.4 | - | - | P | V |
| | | | 14000 | 26.48 | -27.52 | 54 | - | - | - | - | - | - | A | V |
| | | | 18000 | 59.71 | -14.29 | 74 | 49 | 49 | 18.95 | 57.24 | - | - | P | V |
| | | | 18000 | 34.92 | -19.08 | 54 | - | - | - | - | - | - | A | V |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |



| 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 39 2441MHz | | 4882 | 46.21 | -27.79 | 74 | 63.87 | 31.04 | 10.21 | 58.91 | - | - | P | H | |
| | | 4882 | 21.42 | -32.58 | 54 | - | - | - | - | - | - | A | H | |
| | | 7323 | 44.32 | -29.68 | 74 | 54 | 36.3 | 12.43 | 58.41 | - | - | P | H | |
| | | 7323 | 19.53 | -34.47 | 54 | - | - | - | - | - | - | A | H | |
| | | 10000 | 48.62 | -25.38 | 74 | 56.12 | 38.7 | 14.26 | 60.46 | - | - | P | H | |
| | | 10000 | 23.83 | -30.17 | 54 | - | - | - | - | - | - | A | H | |
| | | 14000 | 51.23 | -22.77 | 74 | 57.2 | 40.8 | 16.63 | 63.4 | - | - | P | H | |
| | | 14000 | 26.44 | -27.56 | 54 | - | - | - | - | - | - | A | H | |
| | | 18000 | 59.6 | -14.4 | 74 | 48.89 | 49 | 18.95 | 57.24 | - | - | P | H | |
| | | 18000 | 34.81 | -19.19 | 54 | - | - | - | - | - | - | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | 4882 | 45.71 | -28.29 | 74 | 63.37 | 31.04 | 10.21 | 58.91 | - | - | P | V |
| | | | 4882 | 20.92 | -33.08 | 54 | - | - | - | - | - | - | A | V |
| | | | 7323 | 44.57 | -29.43 | 74 | 54.25 | 36.3 | 12.43 | 58.41 | - | - | P | V |
| | | | 7323 | 19.78 | -34.22 | 54 | - | - | - | - | - | - | A | V |
| | | | 10000 | 47.16 | -26.84 | 74 | 54.66 | 38.7 | 14.26 | 60.46 | - | - | P | V |
| | | | 10000 | 22.37 | -31.63 | 54 | - | - | - | - | - | - | A | V |
| | | | 14000 | 51.05 | -22.95 | 74 | 57.02 | 40.8 | 16.63 | 63.4 | - | - | P | V |
| | | | 14000 | 26.26 | -27.74 | 54 | - | - | - | - | - | - | A | V |
| | | 18000 | 59.27 | -14.73 | 74 | 48.56 | 49 | 18.95 | 57.24 | - | - | P | V | |
| | | 18000 | 34.48 | -19.52 | 54 | - | - | - | - | - | - | A | V | |
| | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | V | |



| BT | Note | Frequency (MHz) | Level (dBμV/m) | Over Limit (dB) | Limit Line (dBμV/m) | Read Level (dBμV) | Antenna Factor (dB/m) | Path Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) | |
|------------------------|--|----------------------|---------------------|-------------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|---|
| BT CH 78 2480MHz | | 4960 | 46.24 | -27.76 | 74 | 63.72 | 31.22 | 10.28 | 58.98 | - | - | P | H | |
| | | 4960 | 21.45 | -32.55 | 54 | - | - | - | - | - | - | A | H | |
| | | 7440 | 45.43 | -28.57 | 74 | 54.85 | 36.3 | 12.48 | 58.2 | - | - | P | H | |
| | | 7440 | 20.64 | -33.36 | 54 | - | - | - | - | - | - | A | H | |
| | | 10000 | 47.74 | -26.26 | 74 | 55.24 | 38.7 | 14.26 | 60.46 | - | - | P | H | |
| | | 10000 | 22.95 | -31.05 | 54 | - | - | - | - | - | - | A | H | |
| | | 14000 | 50.86 | -23.14 | 74 | 56.83 | 40.8 | 16.63 | 63.4 | - | - | P | H | |
| | | 14000 | 26.07 | -27.93 | 54 | - | - | - | - | - | - | A | H | |
| | | 18000 | 58.84 | -15.16 | 74 | 48.13 | 49 | 18.95 | 57.24 | - | - | P | H | |
| | | 18000 | 34.05 | -19.95 | 54 | - | - | - | - | - | - | A | H | |
| | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | H | |
| | | | 4960 | 46.98 | -27.02 | 74 | 64.46 | 31.22 | 10.28 | 58.98 | - | - | P | V |
| | | | 4960 | 22.19 | -31.81 | 54 | - | - | - | - | - | - | A | V |
| | | | 7440 | 45.83 | -28.17 | 74 | 55.25 | 36.3 | 12.48 | 58.2 | - | - | P | V |
| | | | 7440 | 21.04 | -32.96 | 54 | - | - | - | - | - | - | A | V |
| | | | 10000 | 47.79 | -26.21 | 74 | 55.29 | 38.7 | 14.26 | 60.46 | - | - | P | V |
| | | | 10000 | 23 | -31 | 54 | - | - | - | - | - | - | A | V |
| | | | 14000 | 50.46 | -23.54 | 74 | 56.43 | 40.8 | 16.63 | 63.4 | - | - | P | V |
| | | | 14000 | 25.67 | -28.33 | 54 | - | - | - | - | - | - | A | V |
| | | 18000 | 60.12 | -13.88 | 74 | 49.41 | 49 | 18.95 | 57.24 | - | - | P | V | |
| | | 18000 | 35.33 | -18.67 | 54 | - | - | - | - | - | - | A | 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. The emission level close to 18GHz is checked that the average emission level is noise floor only. | | | | | | | | | | | | | |



Emission above 18GHz

2.4GHz BT (SHF)

| 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 SHF | | 24090 | 40.82 | -33.18 | 74 | 58.32 | 39.09 | -2.86 | 53.73 | - | - | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
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| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | 20121 | 39.83 | -34.17 | 74 | 60.1 | 38.15 | -3.52 | 54.9 | - | - | P |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
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| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against limit line. 3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only. | | | | | | | | | | | | |



Emission below 1GHz

2.4GHz BT (LF)

| BT | Note | Frequency | Level | 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 | | 30.97 | 25.77 | -14.23 | 40 | 33.44 | 24.21 | 0.62 | 32.5 | - | - | P | H | | |
| | | 192.96 | 29.08 | -14.42 | 43.5 | 44.87 | 14.77 | 1.89 | 32.45 | - | - | P | H | | |
| | | 209.45 | 30.31 | -13.19 | 43.5 | 45.61 | 15.13 | 2 | 32.43 | - | - | P | H | | |
| | | 557.68 | 25.88 | -20.12 | 46 | 29.42 | 25.86 | 3.21 | 32.61 | - | - | P | H | | |
| | | 849.65 | 30.36 | -15.64 | 46 | 29.27 | 28.98 | 3.99 | 31.88 | - | - | P | H | | |
| | | 966.05 | 33.73 | -20.27 | 54 | 29.49 | 31.06 | 4.3 | 31.12 | - | - | P | H | | |
| | | | | | | | | | | | | | | H | |
| | | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | | | H |
| | | | 31.94 | 28.17 | -11.83 | 40 | 36.4 | 23.65 | 0.63 | 32.51 | - | - | P | V | |
| | | | 57.16 | 22.14 | -17.86 | 40 | 41.64 | 12.07 | 0.99 | 32.56 | - | - | P | V | |
| | | | 176.47 | 27.45 | -16.05 | 43.5 | 42.98 | 15.14 | 1.81 | 32.48 | - | - | P | V | |
| | | | 212.36 | 27.84 | -15.66 | 43.5 | 43.22 | 15.04 | 2.01 | 32.43 | - | - | P | V | |
| | | | 612.97 | 26.74 | -19.26 | 46 | 30.38 | 25.41 | 3.38 | 32.43 | - | - | P | V | |
| | | | 959.26 | 33.24 | -12.76 | 46 | 29.15 | 31 | 4.29 | 31.2 | - | - | P | V | |
| | | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | | V | |
| | | | | | | | | | | | | | | V | |
| Remark | <ol style="list-style-type: none"> No other spurious found. All results are PASS against limit line. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only. | | | | | | | | | | | | | | |



Note symbol

| | |
|-----|--|
| * | Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. |
| ! | Test result is 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 D. Radiated Spurious Emission Plots

| | | | |
|-----------------|--------------------------------------|---------------------|-------------|
| Test Engineer : | Leo Lee, Mancy Chou and Bigshow Wang | Temperature : | 23.2~24.6°C |
| | | Relative Humidity : | 42~56% |

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 : 03CH15-HY Condition : PEAK_BE_74 3m 91200_15_1620 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Detector : Peak Project : 190910</p> | <p>Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Detector : Peak Project : 190910</p> |



| | | |
|------|--|---|
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
| | BT CH00 2402MHz | |
| | Vertical | Fundamental |
| Peak | <p>Site : 03CH15-11Y Condition : PEAK_BE_74 3m 91200_15_1620 VERTICAL Detector : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Project : 190910</p> | <p>Site : 03CH15-11Y Condition : PEAK_74 3m 91200_15_1620 VERTICAL Detector : RBW:1000.000kHz VBW:3000.000kHz SWT:Auto Project : 190910</p> |

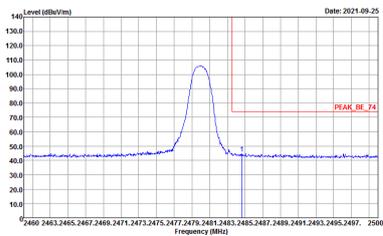
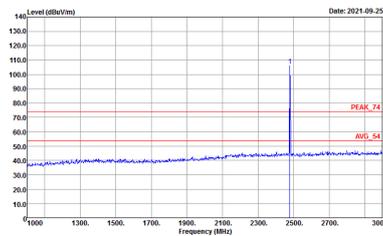


| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|--------------------|--|---|
| | BT CH39 2441MHz | |
| | Horizontal | Fundamental |
| <p>Peak</p> | <p>Site : 03CH15-HY Condition : PEAK_BE_74 3m 91200_15_1620 HORIZONTAL Detector : Peak Project : 190910</p> | <p>Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL Detector : Peak Project : 190910</p> |
| <p>Peak</p> | <p>Site : 03CH15-HY Condition : PEAK_BE_74 3m 91200_15_1620 HORIZONTAL Detector : Peak Project : 190910</p> | <p>Left blank</p> |

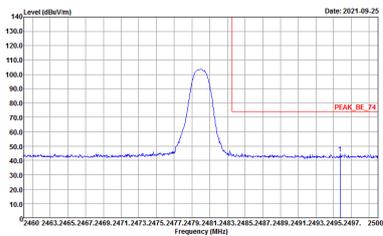
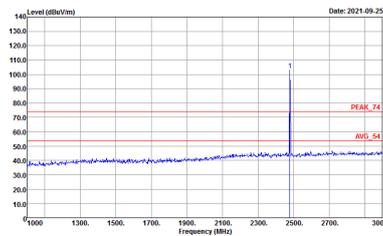


| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|--------------------|--|---|
| | BT CH39 2441MHz | |
| | Vertical | Fundamental |
| <p>Peak</p> | <p>Site : 03CH15-HY Condition : PEAK_BE_74 3m 91200_15_1620 VERTICAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : Peak Project : 190910</p> | <p>Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 VERTICAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : Peak Project : 190910</p> |
| <p>Peak</p> | <p>Site : 03CH15-HY Condition : PEAK_BE_74 3m 91200_15_1620 VERTICAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : Peak Project : 190910</p> | <p>Left blank</p> |



| | | |
|-----------------|---|---|
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
| BT CH78 2480MHz | | |
| Horizontal | | Fundamental |
| Peak |  <p>Date: 2021.09.25</p> <p>Site : 03CH15-11Y Condition : PEAK_BE_74 3m 91200_15_1620 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190910</p> |  <p>Date: 2021.09.25</p> <p>Site : 03CH15-11Y Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190910</p> |

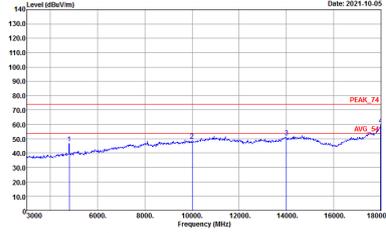
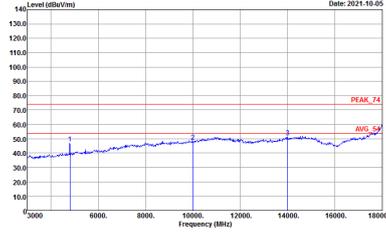


| | | |
|------|---|---|
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
| | BT CH78 2480MHz | |
| | Vertical | Fundamental |
| Peak |  <p>Date: 2021.09.25</p> <p>Site : 03CH15-11Y Condition : PEAK_BE_74 3m 91200_15_1620 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190910</p> |  <p>Date: 2021.09.25</p> <p>Site : 03CH15-11Y Condition : PEAK_74 3m 91200_15_1620 VERTICAL : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Detector : Peak Project : 190910</p> |

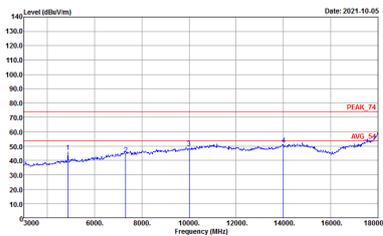
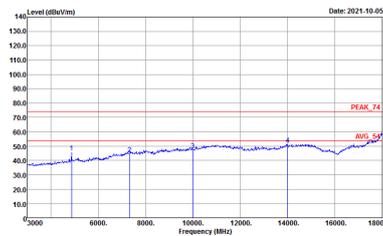


2.4GHz 2400~2483.5MHz

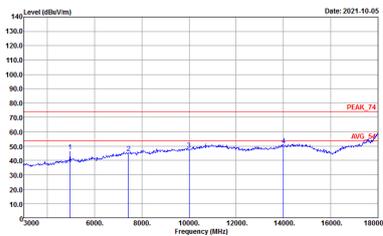
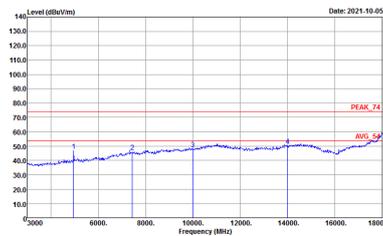
BT (Harmonic @ 3m)

| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|----------------------|--|---|
| | BT CH00 2402MHz | |
| | Horizontal | Vertical |
| <p>Peak Avg.</p> |  <p>Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL Detector : Peak Project : 190910</p> |  <p>Site : 03CH15-HY Condition : PEAK_74 3m 91200_15_1620 VERTICAL Detector : Peak Project : 190910</p> |



| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|------------------|---|---|
| BT CH39 2441MHz | | |
| Horizontal | | Vertical |
| Peak Avg. |  <p data-bbox="430 728 686 784">Site : 03CH15-11Y Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL Detector : Peak Project : 190910</p> |  <p data-bbox="901 728 1157 784">Site : 03CH15-11Y Condition : PEAK_74 3m 91200_15_1620 VERTICAL Detector : Peak Project : 190910</p> |

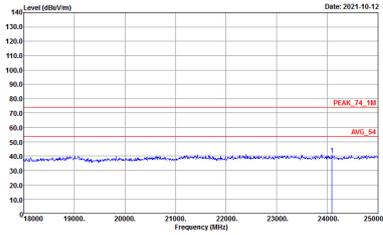
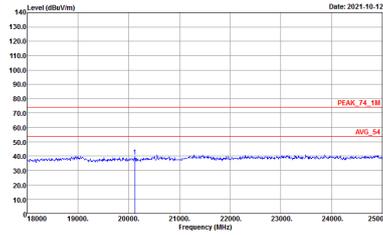


| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|------------------|---|---|
| BT CH78 2480MHz | | |
| Horizontal | | Vertical |
| Peak Avg. |  <p data-bbox="430 728 686 784">Site : 03CH15-11Y Condition : PEAK_74 3m 91200_15_1620 HORIZONTAL Detector : Peak Project : 190910</p> |  <p data-bbox="901 728 1157 784">Site : 03CH15-11Y Condition : PEAK_74 3m 91200_15_1620 VERTICAL Detector : Peak Project : 190910</p> |



Emission above 18GHz

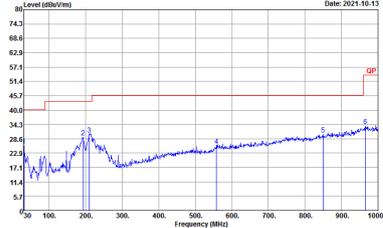
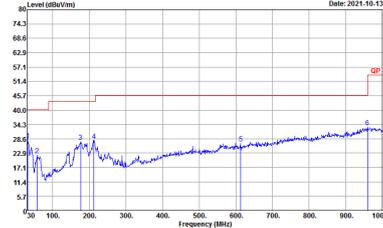
2.4GHz BT (SHF @ 1m)

| | | |
|----------------------------|---|--|
| BT | 2.4GHz 2400~2483.5MHz | |
| | BT SHF | |
| | Horizontal | Vertical |
| Peak Avg. |  <p>Site : 03CH15-HY Condition : PEAK_74_1M 1m SHF_BBH4917000993 HORIZONTAL Detector : Peak Project : 190910</p> |  <p>Site : 03CH15-HY Condition : PEAK_74_1M 1m SHF_BBH4917000993 VERTICAL Detector : Peak Project : 190910</p> |



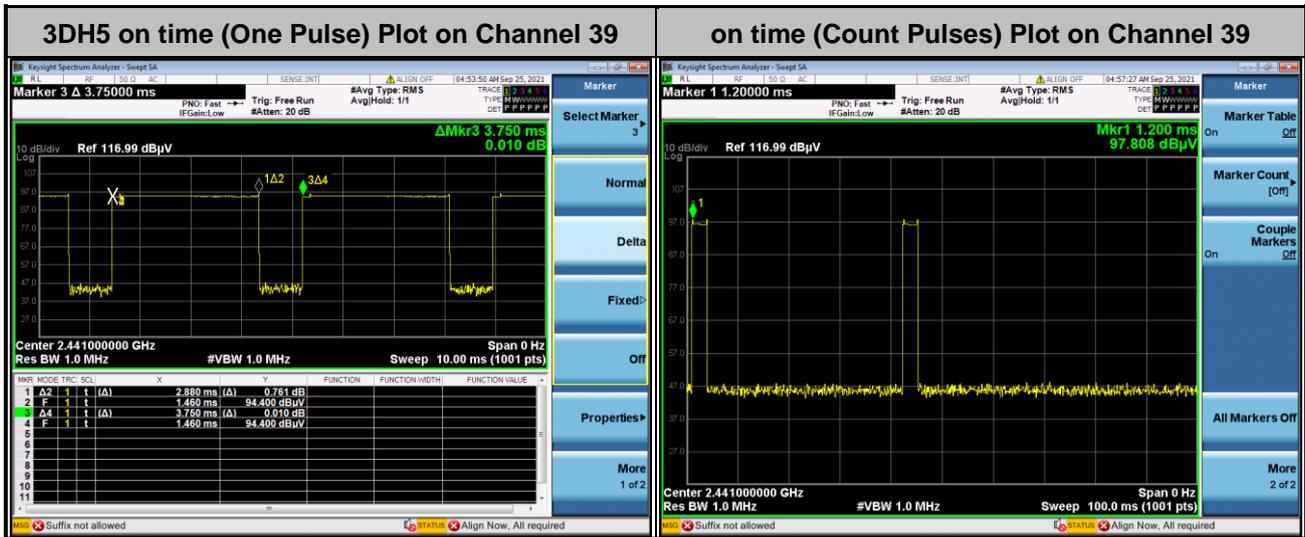
Emission below 1GHz

2.4GHz BT (LF)

| | | |
|--------------|--|---|
| BT | 2.4GHz 2400~2483.5MHz | |
| | BT LF | |
| | Horizontal | Vertical |
| QP / Peak |  <p>Site : 03CH15-HY Condition : QP 3m BILLOG_41912_20210208 HORIZONTAL Detector : Peak Project : 190910</p> |  <p>Site : 03CH15-HY Condition : QP 3m BILLOG_41912_20210208 VERTICAL Detector : Peak Project : 190910</p> |



Appendix E. Duty Cycle Plots



Note:

1. Worst case Duty cycle = on time/100 milliseconds = 2 * 2.88 / 100 = 5.76 %
2. Worst case Duty cycle correction factor = 20*log(Duty cycle) = -24.79 dB
3. 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

$$2.88 \text{ ms} \times 20 \text{ channels} = 57.6 \text{ ms}$$

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 ms / 57.6 ms] = 2 hops

Thus, the maximum possible ON time:

$$2.88 \text{ ms} \times 2 = 5.76 \text{ ms}$$

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

$$20 \times \log(5.76 \text{ ms}/100 \text{ ms}) = -24.79 \text{ dB}$$