



FCC RADIO TEST REPORT

FCC ID : UZ7CC6000
Equipment : Customer Concierge
Brand Name : ZEBRA
Model Name : CC6000
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 Jan. 11, 2019 and testing was started from Jan. 22, 2019 and completed on Feb. 20, 2019. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Jones Tsai

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory

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



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History of this test report



Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---------------|--------------------|--|--------------------|------------------------------------|
| 3.1 | 15.247(a)(2) | 6dB Bandwidth | Pass | - |
| 3.1 | 2.1049 | 99% Occupied Bandwidth | Reporting only | - |
| 3.2 | 15.247(b)(3) | Output Power | Pass | - |
| 3.3 | 15.247(e) | Power Spectral Density | Pass | - |
| 3.4 | 15.247(d) | Conducted Band Edges and Spurious Emission | Pass | - |
| 3.5 | 15.247(d) | Radiated Band Edges and Spurious Emission | Pass | Under limit 3.92 dB at 118.830 MHz |
| 3.6 | 15.207 | AC Conducted Emission | Pass | Under limit 5.73 dB at 0.564 MHz |
| 3.7 | 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: Wii Chang

Report Producer: Polly Tsai



1 General Description

1.1 Product Feature of Equipment Under Test

| Product Feature | |
|--|---|
| Equipment | Customer Concierge |
| Brand Name | ZEBRA |
| Model Name | CC6000 |
| FCC ID | UZ7CC6000 |
| EUT supports Radios application | NFC WLAN 11a/b/g/n HT20/HT40 WLAN 11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE |
| HW Version | DV |
| SW Version | 01-15-05.00.0G-U00-PRD |
| FW Version | 01-15-05.00.0G-U00-PRD |
| MFD | 21DEC18 |
| EUT Stage | Engineering Sample |

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

<Sample Information>

| | Sample 1 | Sample 2 | Sample 3 |
|-----------------------------|--------------------------------------|-------------------------------------|-------------------------------------|
| Component Category | CC6000 Landscape Display with Camera | CC6000 Landscape Display, No Camera | CC6000 Portrait Display with Camera |
| Data capture options | SE4710 | SE4710 | SE4710 |
| Camera | Front Facing ≥5 Mp | None | Front Facing ≥5 Mp |

| Supported Unit Used in Test Configuration and System | | | | |
|--|-------------------|-----------|--------------------|-----------------|
| AC Adaptor | Brand Name | ZEBRA | Part Number | PWR-BUA5V16W0WW |
| DC Cable | Brand Name | ZEBRA | Part Number | CBL-DC-383A1-01 |
| AC Cable | Brand Name | ZEBRA | Part Number | 50-16000-182R |
| POE | Brand Name | Microsemi | Part Number | PD-9501GR/AC |



1.2 Product Specification of Equipment Under Test

| Standards-related Product Specification | |
|--|--|
| Tx/Rx Frequency Range | 2402 MHz ~ 2480 MHz |
| Number of Channels | 40 |
| Carrier Frequency of Each Channel | 40 Channel(37 hopping + 3 advertising channel) |
| Maximum Output Power to Antenna | 1.95 dBm (0.0016 W) for 1Mbps 1.85 dBm (0.0015 W) for 2Mbps |
| 99% Occupied Bandwidth | 1.030 MHz for 1Mbps 2.052 MHz for 2Mbps |
| Antenna Type / Gain | PIFA Antenna type with gain 3.86 dBi |
| Type of Modulation | Bluetooth LE : GFSK |

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. | |
| Test Site Location | No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978 | |
| Test Site No. | Sporton Site No. | |
| | TH05-HY | CO05-HY |

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

| | | |
|---------------------------|---|--|
| Test Site | SPORTON INTERNATIONAL INC. | |
| Test Site Location | No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855 | |
| Test Site No. | Sporton Site No. | |
| | 03CH15-HY | |

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

FCC Designation No.: TW1190 and TW0007



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 v05
- ♦ 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. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

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



2.2 Test Mode

| Channel | Frequency | Bluetooth – LE 1Mbps RF Average Output Power |
|---------|-----------|--|
| | | Data Rate / Modulation |
| | | GFSK |
| | | 1Mbps |
| Ch00 | 2402MHz | 1.85 dBm |
| Ch19 | 2440MHz | 1.95 dBm |
| Ch39 | 2480MHz | 1.55 dBm |

| Channel | Frequency | Bluetooth – LE 2Mbps RF Average Output Power |
|---------|-----------|--|
| | | Data Rate / Modulation |
| | | GFSK |
| | | 2Mbps |
| Ch00 | 2402MHz | 1.75 dBm |
| Ch19 | 2440MHz | 1.85 dBm |
| Ch39 | 2480MHz | 1.45 dBm |

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

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

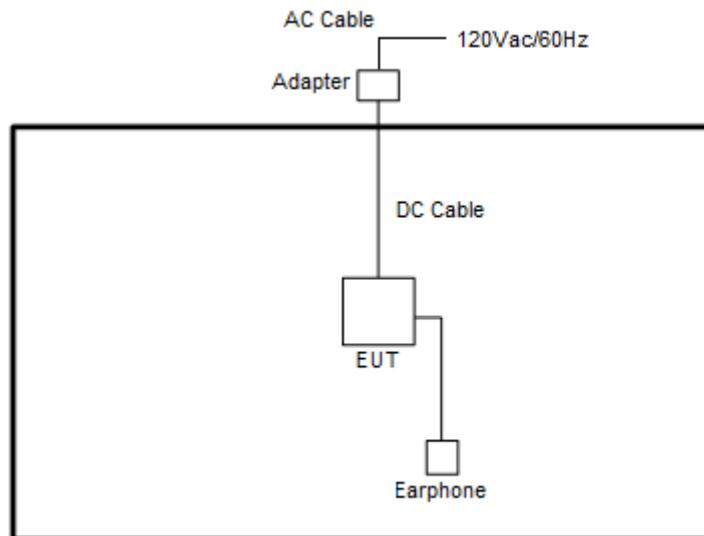


The following summary table is showing all test modes to demonstrate in compliance with the standard.

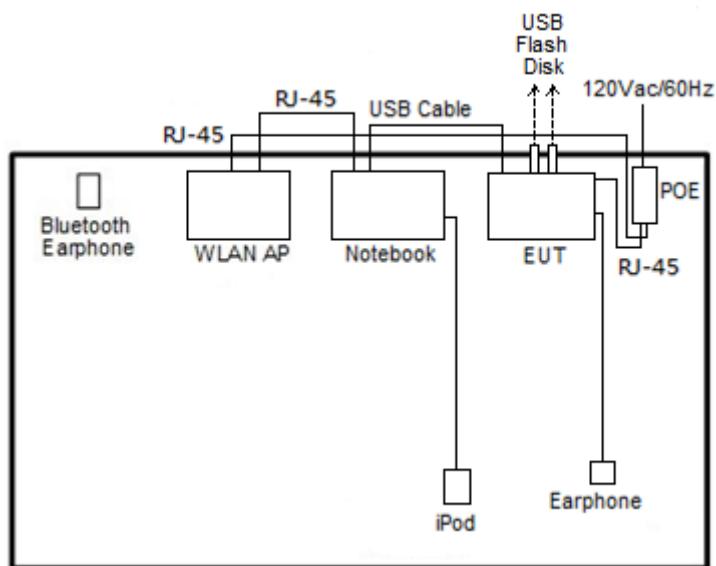
| Summary table of Test Cases | |
|---|--|
| Test Item | Data Rate / Modulation |
| | Bluetooth – LE / GFSK |
| Conducted Test Cases | Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps |
| Radiated Test Cases | Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps |
| AC Conducted Emission | Mode 1: Bluetooth Link + WLAN (2.4GHz) Link + Scanner + USB (3.1/Type C) Data Link with Notebook (Notebook to eMMC) + USB (2.0/Type A) USB Flash Disk Load + USB (2.0/Type A) USB Flash Disk Load + POE + LAN Load with AP + Headset for Sample 3 |
| Remark: For Radiated Test Cases, the tests were performed with Sample 2. | |

2.3 Connection Diagram of Test System

<Bluetooth – LE Tx Mode>



<AC Conducted Emission Mode>





2.4 Support Unit used in test configuration and system

| Item | Equipment | Trade Name | Model Name | FCC ID | Data Cable | Power Cord |
|------|--------------------|---------------|----------------------|--|-------------------|--|
| 1. | WLAN AP | ASUS | RT-AC66U | MSQ-RTAC66U | N/A | Unshielded, 1.8 m |
| 2. | Bluetooth Earphone | Sony Ericsson | MW600 | PY7DDA-2029 | N/A | N/A |
| 3. | iPod | Apple | A1285 | FCC DoC | Shielded, 1.0 m | N/A |
| 4. | iPod Earphone | Apple | N/A | Verification | Unshielded, 1.0 m | N/A |
| 5. | Notebook | ASUS | P2430U | FCC DoC | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 6. | Notebook | DELL | Latitude E6320 | FCC DoC/ Contains FCC ID: QDS-BRCM1054 | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 7. | Notebook | Lenovo | L570 | FCC DoC | N/A | AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m |
| 8. | USB Flash Disk | TOSHIBA | TOSHIBA 32G | FCC DoC | N/A | N/A |
| 9. | USB Flash Disk | SanDisk | Cruzer Glide 3.0 16G | FCC DoC | N/A | N/A |
| 10. | SD Card | SanDisk | MicroSD HC | FCC DoC | N/A | N/A |

2.5 EUT Operation Test Setup

The RF test items, utility "QRCT" 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 10dB attenuator.

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

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

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

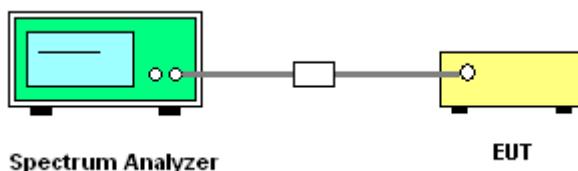
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW) $\geq 3 * \text{RBW}$.
6. Measure and record the results in the test report.

3.1.4 Test Setup



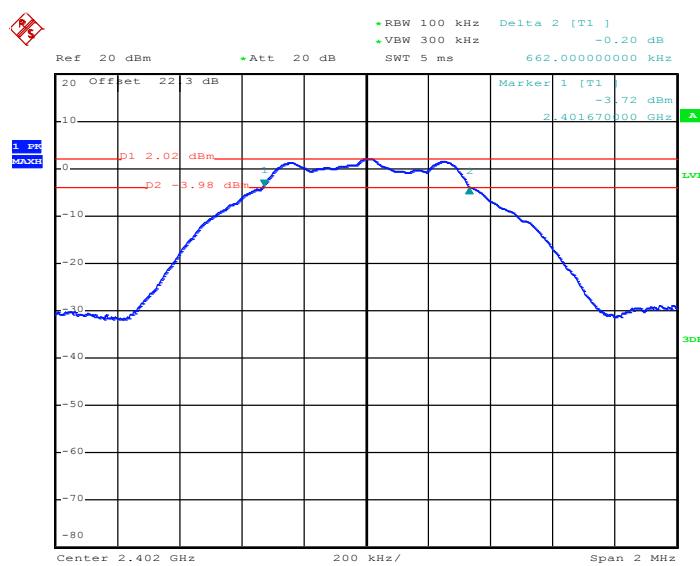
3.1.5 Test Result of 6dB Bandwidth

| | | | | |
|-----------------|-------------------------|---------------------|--|---------|
| Test Engineer : | Luffy Lin and Allen Lin | Temperature : | | 21~25°C |
| | | Relative Humidity : | | 51~54% |

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 6dB BW (MHz) | 6dB BW Limit (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|--------------|--------------------|-----------|
| BLE | 1Mbps | 1 | 0 | 2402 | 0.662 | 0.50 | Pass |
| BLE | 1Mbps | 1 | 19 | 2440 | 0.660 | 0.50 | Pass |
| BLE | 1Mbps | 1 | 39 | 2480 | 0.662 | 0.50 | Pass |
| BLE | 2Mbps | 1 | 0 | 2402 | 1.124 | 0.50 | Pass |
| BLE | 2Mbps | 1 | 19 | 2440 | 1.144 | 0.50 | Pass |
| BLE | 2Mbps | 1 | 39 | 2480 | 1.128 | 0.50 | Pass |

<1Mbps>

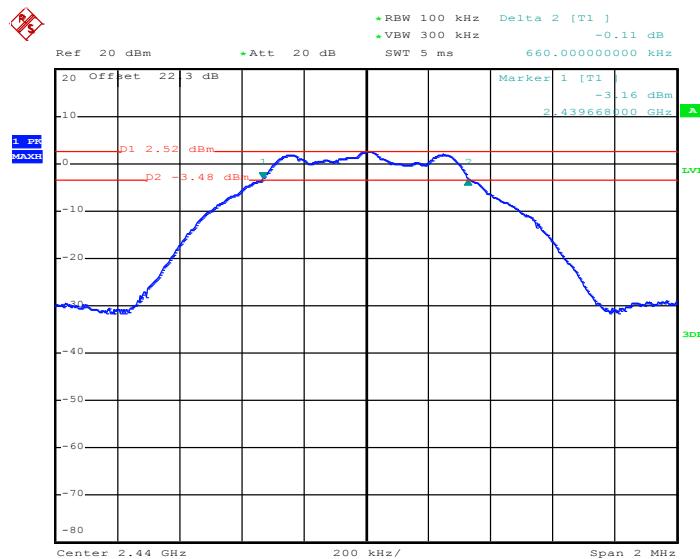
6 dB Bandwidth Plot on Channel 00



Date: 31.JAN.2019 15:02:05

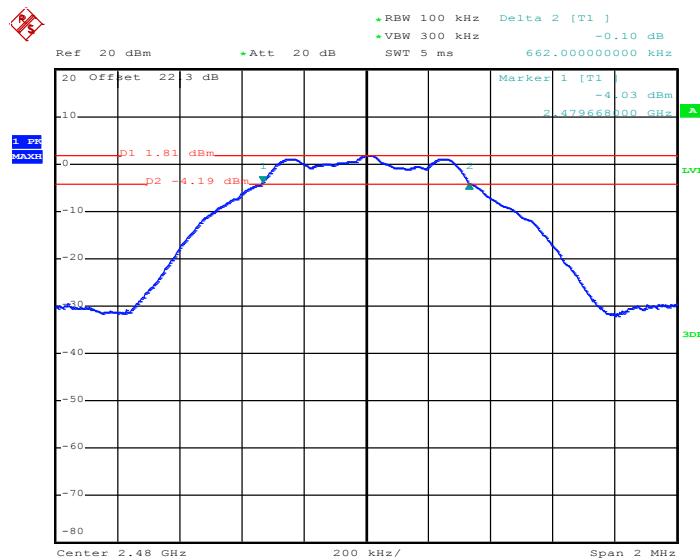


6 dB Bandwidth Plot on Channel 19



Date: 31.JAN.2019 15:06:51

6 dB Bandwidth Plot on Channel 39

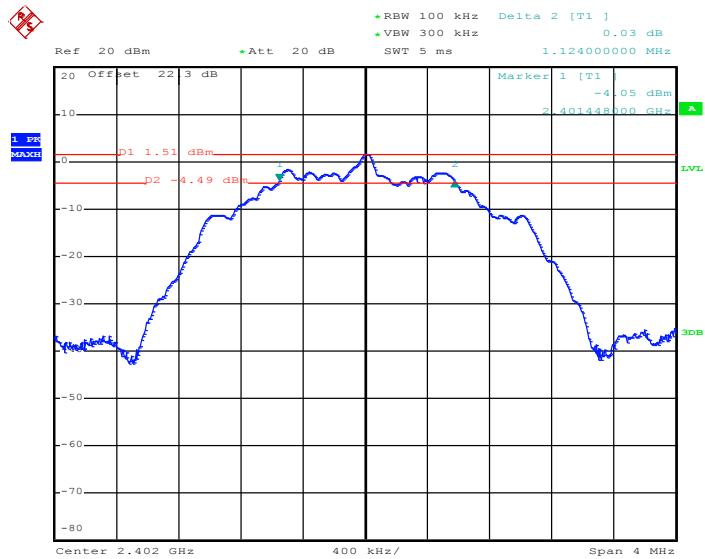


Date: 31.JAN.2019 15:11:11



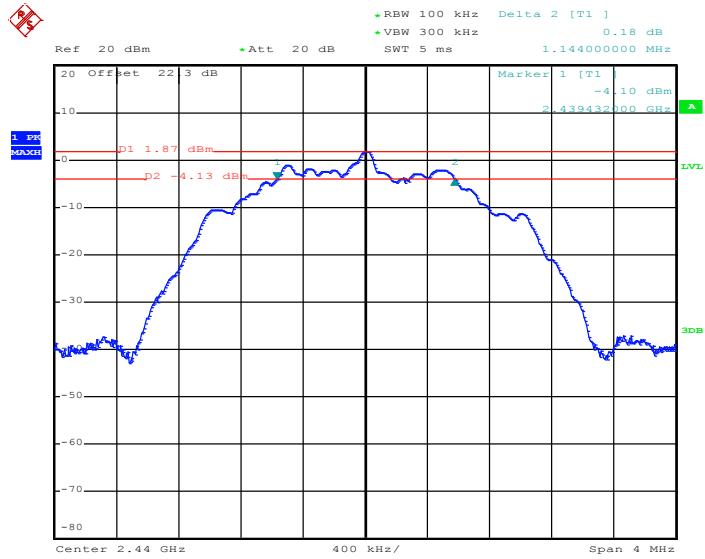
<2Mbps>

6 dB Bandwidth Plot on Channel 00



Date: 31.JAN.2019 15:19:19

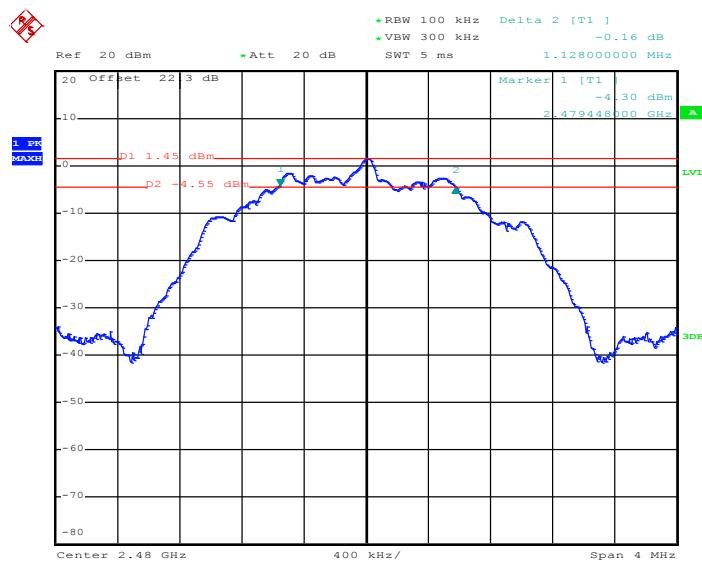
6 dB Bandwidth Plot on Channel 19



Date: 31.JAN.2019 15:24:04



6 dB Bandwidth Plot on Channel 39



Date: 31.JAN.2019 15:27:25



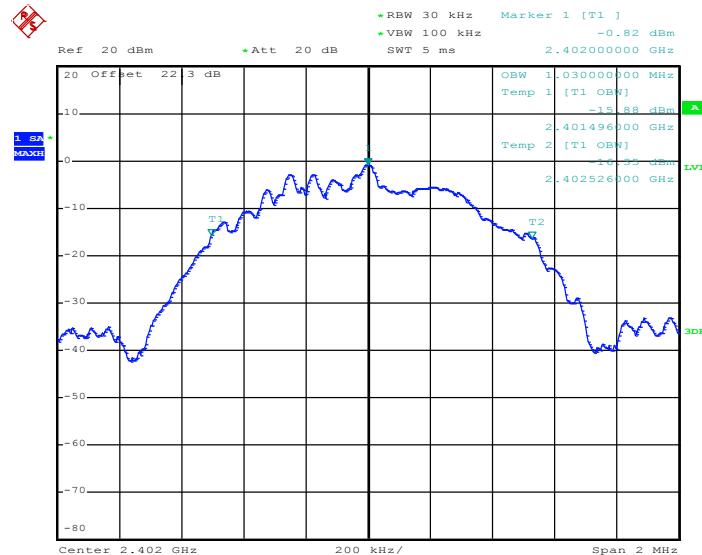
3.1.6 Test Result of 99% Occupied Bandwidth

| | | | | |
|-----------------|-------------------------|---------------------|--|---------|
| Test Engineer : | Luffy Lin and Allen Lin | Temperature : | | 21~25°C |
| | | Relative Humidity : | | 51~54% |

| Mod. | Data Rate | Ntx | CH. | Freq. (MHz) | 99% Occupied BW (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|-----------------------|-----------|
| BLE | 1Mbps | 1 | 0 | 2402 | 1.030 | Pass |
| BLE | 1Mbps | 1 | 19 | 2440 | 1.030 | Pass |
| BLE | 1Mbps | 1 | 39 | 2480 | 1.030 | Pass |
| BLE | 2Mbps | 1 | 0 | 2402 | 2.044 | Pass |
| BLE | 2Mbps | 1 | 19 | 2440 | 2.044 | Pass |
| BLE | 2Mbps | 1 | 39 | 2480 | 2.052 | Pass |

<1Mbps>

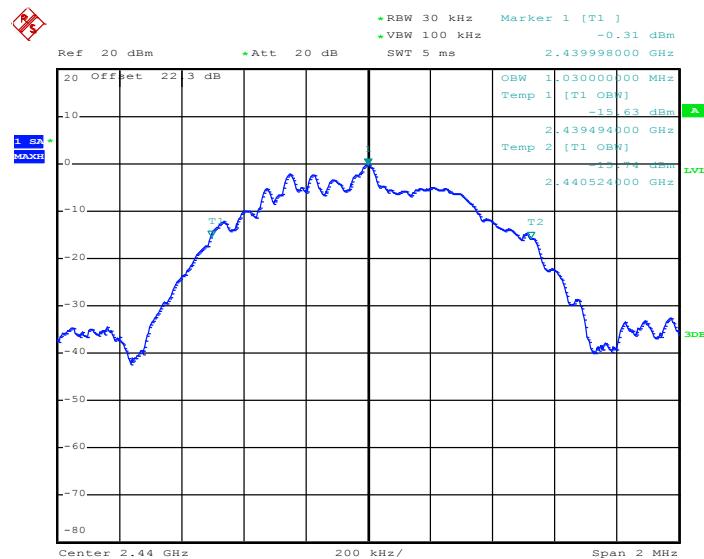
99% Bandwidth Plot on Channel 00



Date: 31.JAN.2019 15:05:08

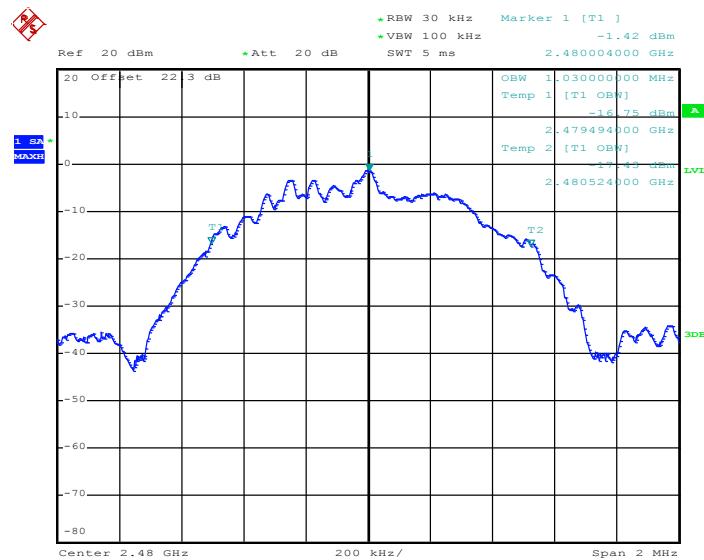


99% Occupied Bandwidth Plot on Channel 19



Date: 31.JAN.2019 15:09:11

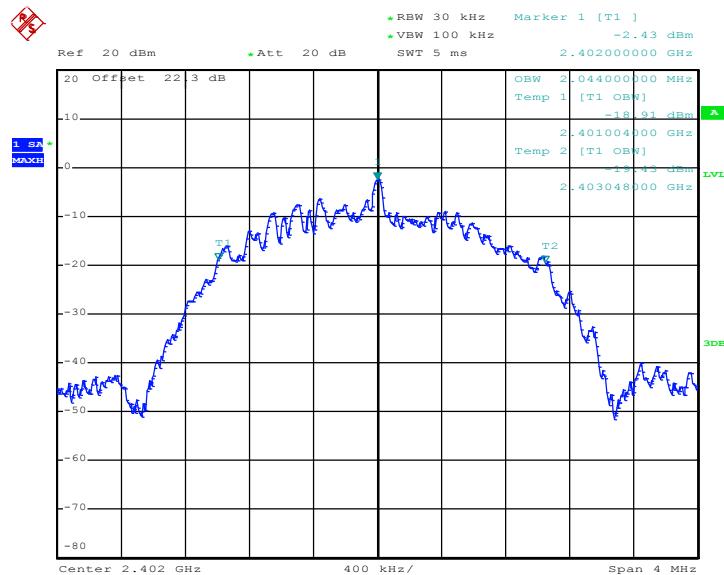
99% Occupied Bandwidth Plot on Channel 39



Date: 31.JAN.2019 15:14:36

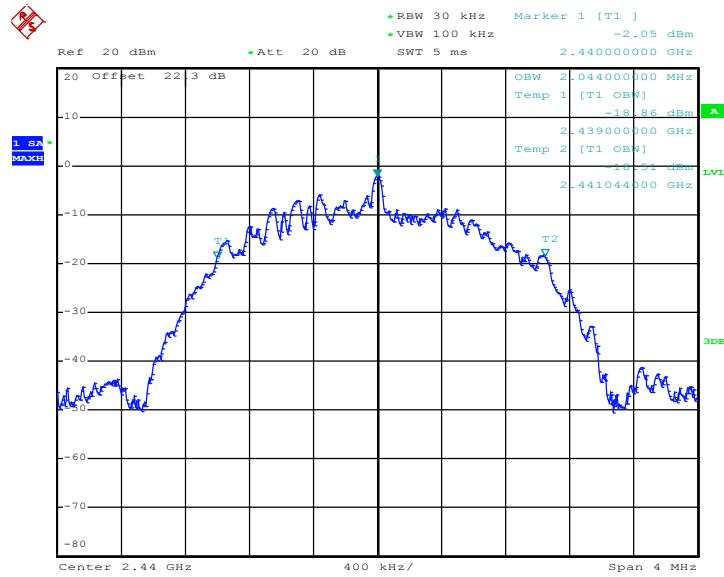
<2Mbps>

99% Bandwidth Plot on Channel 00



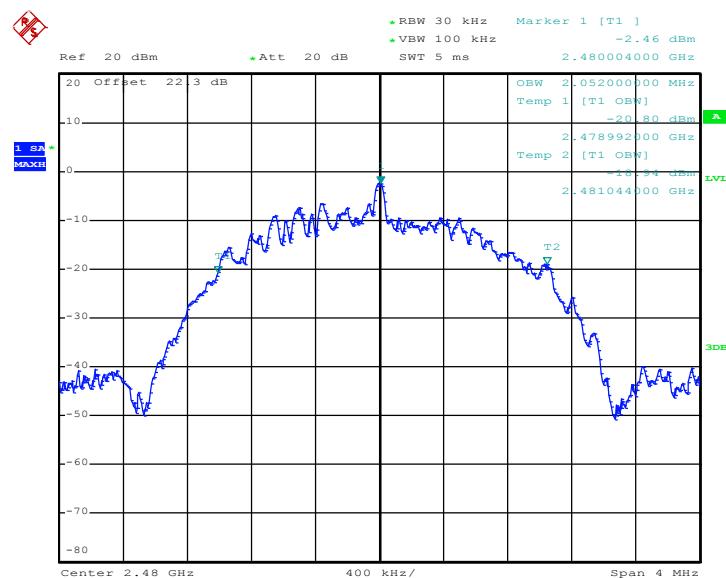
Date: 31.JAN.2019 15:22:14

99% Occupied Bandwidth Plot on Channel 19



Date: 31.JAN.2019 15:26:15

99% Occupied Bandwidth Plot on Channel 39



Date: 31.JAN.2019 15:29:21

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



3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm.

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

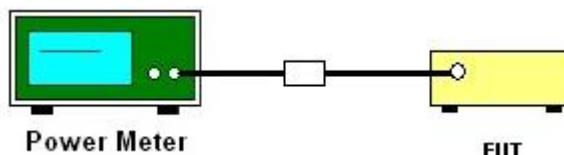
3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

3.2.3 Test Procedures

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

3.2.4 Test Setup



3.2.5 Test Result of Average Output Power

| Test Engineer : | | | | Temperature : | | 21~25°C |
|-----------------|-----------|-----------------|-----|---------------------|------------------|-------------------------------|
| | | | | Relative Humidity : | | 51~54% |
| Mod. | Data Rate | N _{TX} | CH. | Freq. (MHz) | Duty Factor (dB) | Average Conducted Power (dBm) |
| BLE | 1Mbps | 1 | 0 | 2402 | 2.06 | 1.85 |
| BLE | 1Mbps | 1 | 19 | 2440 | 2.06 | 1.95 |
| BLE | 1Mbps | 1 | 39 | 2480 | 2.06 | 1.55 |
| BLE | 2Mbps | 1 | 0 | 2402 | 4.90 | 1.75 |
| BLE | 2Mbps | 1 | 19 | 2440 | 4.90 | 1.85 |
| BLE | 2Mbps | 1 | 39 | 2480 | 4.90 | 1.45 |

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

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

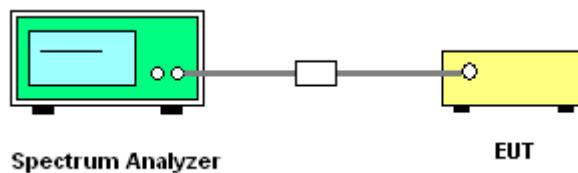
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

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

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

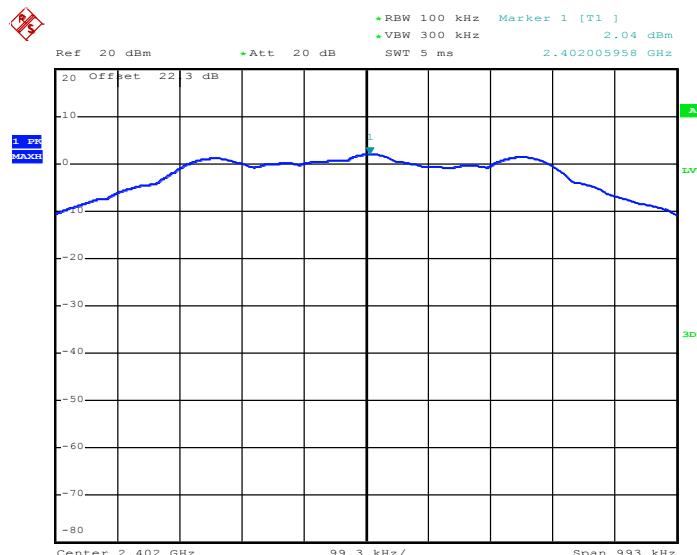
| Test Engineer : | | | | | Temperature : | | 21~25°C | | |
|-----------------|-----------|-----|-----|-------------|------------------------|----------------------|----------|----------------------------|-----------|
| | | | | | Relative Humidity : | | 51~54% | | |
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Peak PSD (dBm /100kHz) | Peak PSD (dBm /3kHz) | DG (dBi) | Peak PSD Limit (dBm /3kHz) | Pass/Fail |
| BLE | 1Mbps | 1 | 0 | 2402 | 2.04 | -12.77 | 3.86 | 8.00 | Pass |
| BLE | 1Mbps | 1 | 19 | 2440 | 2.53 | -12.24 | 3.86 | 8.00 | Pass |
| BLE | 1Mbps | 1 | 39 | 2480 | 1.45 | -13.01 | 3.86 | 8.00 | Pass |
| BLE | 2Mbps | 1 | 0 | 2402 | 1.50 | -16.81 | 3.86 | 8.00 | Pass |
| BLE | 2Mbps | 1 | 19 | 2440 | 1.86 | -16.40 | 3.86 | 8.00 | Pass |
| BLE | 2Mbps | 1 | 39 | 2480 | 1.45 | -16.85 | 3.86 | 8.00 | Pass |

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

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

<1Mbps>

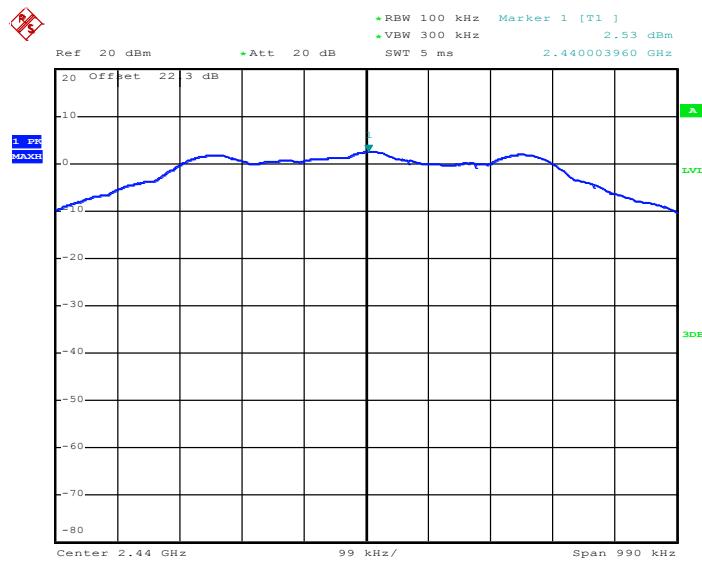
PSD 100kHz Plot on Channel 00



Date: 31.JAN.2019 15:03:41

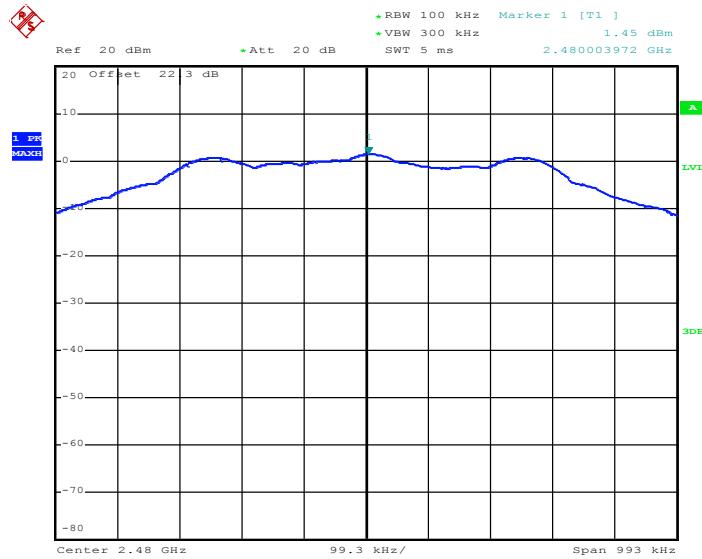


PSD 100kHz Plot on Channel 19



Date: 31.JAN.2019 15:07:40

PSD 100kHz Plot on Channel 39

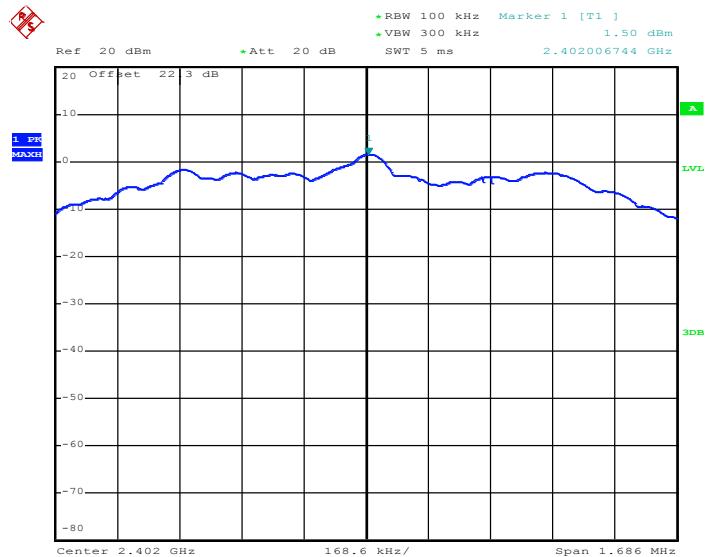


Date: 31.JAN.2019 15:12:47



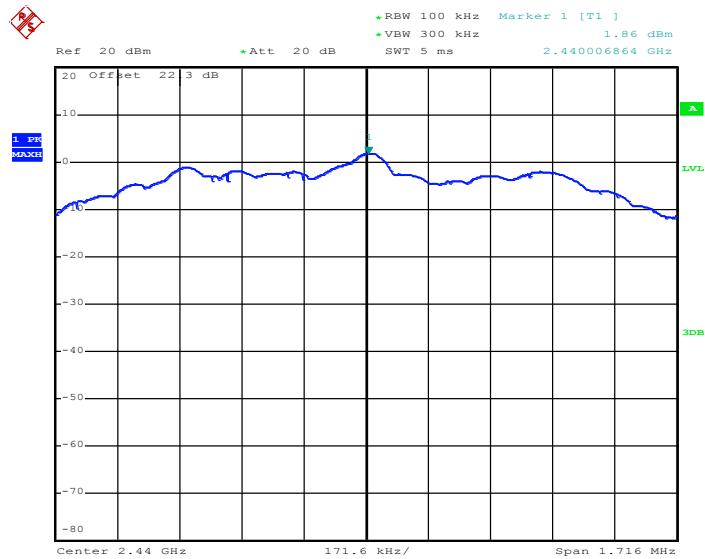
<2Mbps>

PSD 100kHz Plot on Channel 00



Date: 31.JAN.2019 15:20:20

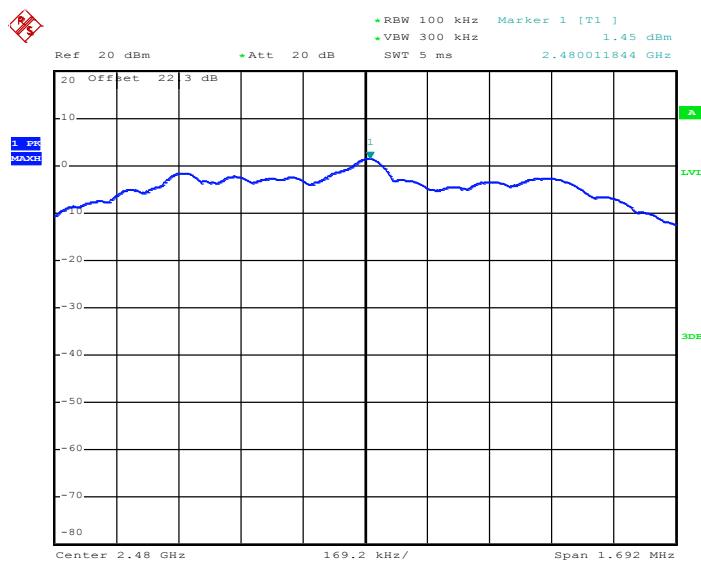
PSD 100kHz Plot on Channel 19



Date: 31.JAN.2019 15:24:55



PSD 100kHz Plot on Channel 39



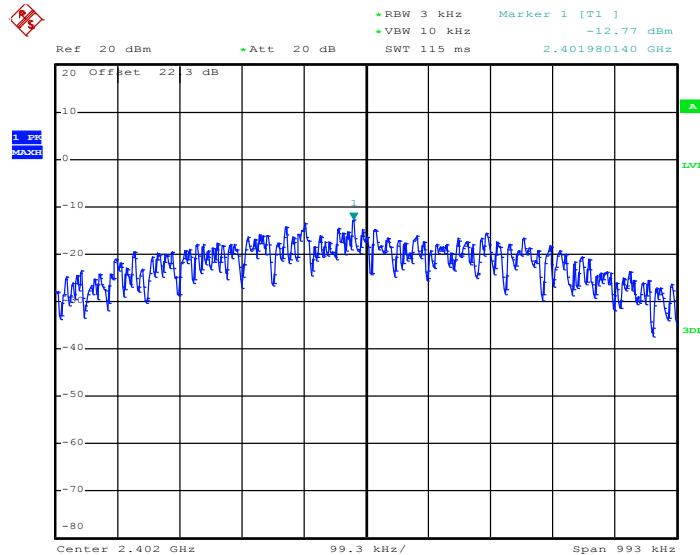
Date: 31.JAN.2019 15:28:16

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

| | | | |
|-----------------|-------------------------|---------------------|---------|
| Test Engineer : | Luffy Lin and Allen Lin | Temperature : | 21~25°C |
| | | Relative Humidity : | 51~54% |

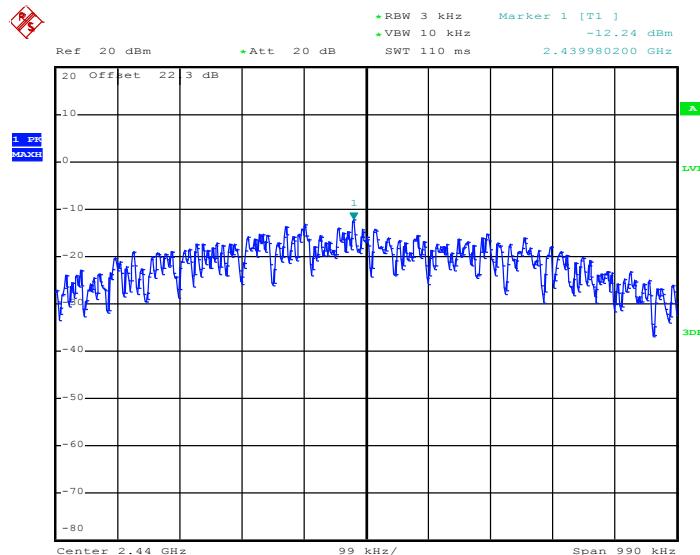
<1Mbps>

PSD 3kHz Plot on Channel 00



Date: 31.JAN.2019 15:03:02

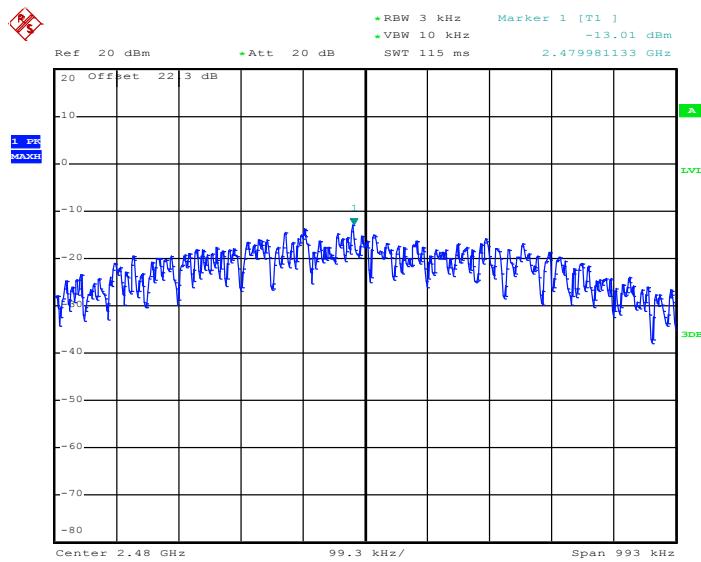
PSD 3kHz Plot on Channel 19



Date: 31.JAN.2019 15:07:24



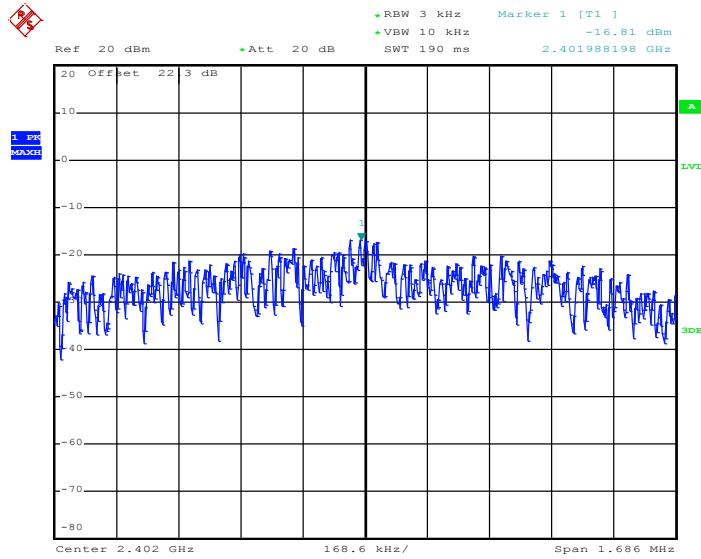
PSD 3kHz Plot on Channel 39



Date: 31.JAN.2019 15:12:08

<2Mbps>

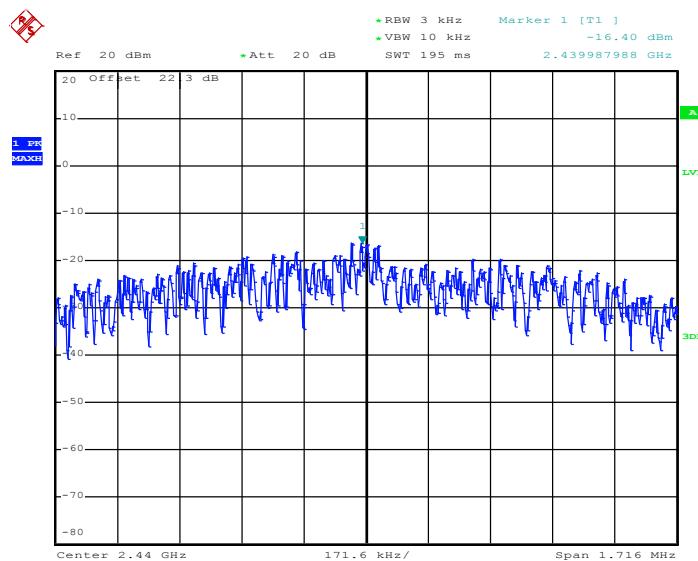
PSD 3kHz Plot on Channel 00



Date: 31.JAN.2019 15:19:52

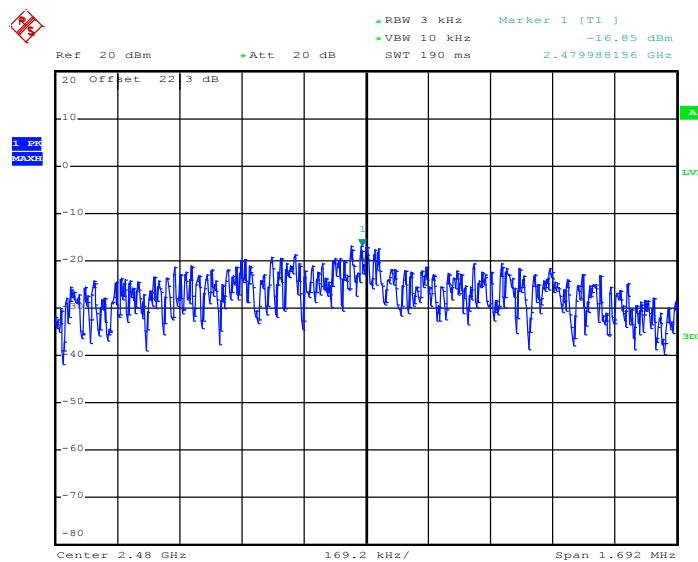


PSD 3kHz Plot on Channel 19



Date: 31.JAN.2019 15:24:39

PSD 3kHz Plot on Channel 39



Date: 31.JAN.2019 15:27:56



3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission

All harmonics/spurious must be at least 30 dB down from the highest emission level within the authorized band.

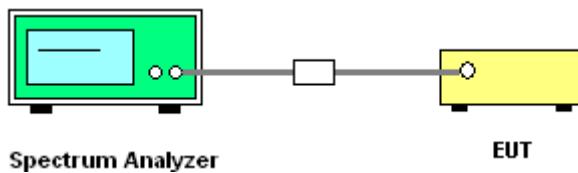
3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedure

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup

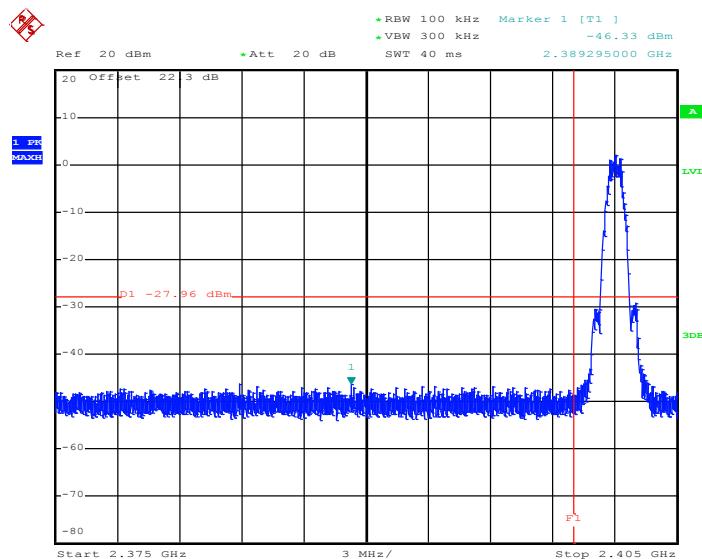


3.4.5 Test Result of Conducted Band Edges Plots

| | | | |
|------------------------|-------------------------|----------------------------|---------|
| Test Engineer : | Luffy Lin and Allen Lin | Temperature : | 21~25°C |
| | | Relative Humidity : | 51~54% |

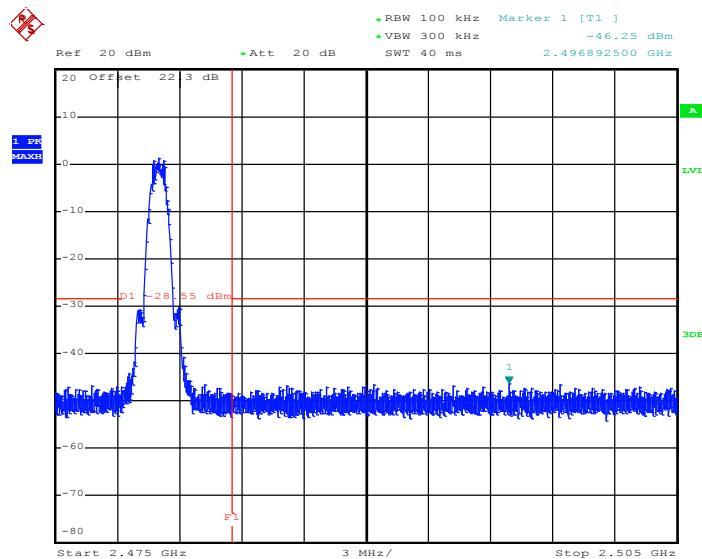
<1Mbps>

Low Band Edge Plot on Channel 00



Date: 31.JAN.2019 15:03:59

High Band Edge Plot on Channel 39

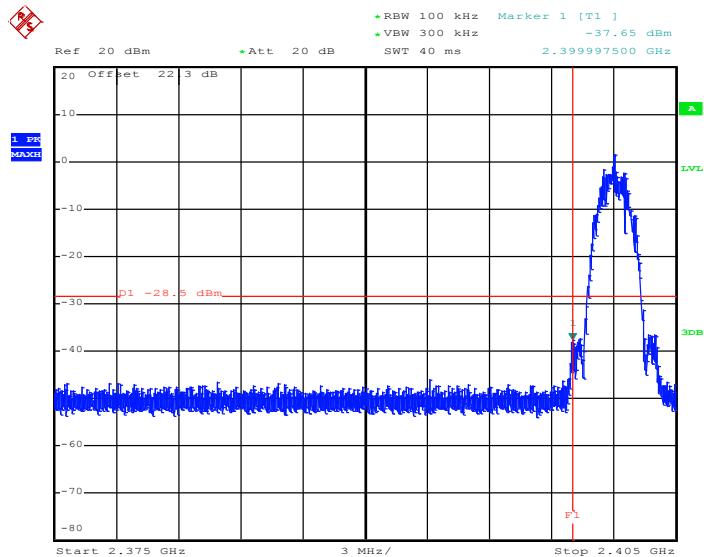


Date: 31.JAN.2019 15:13:00



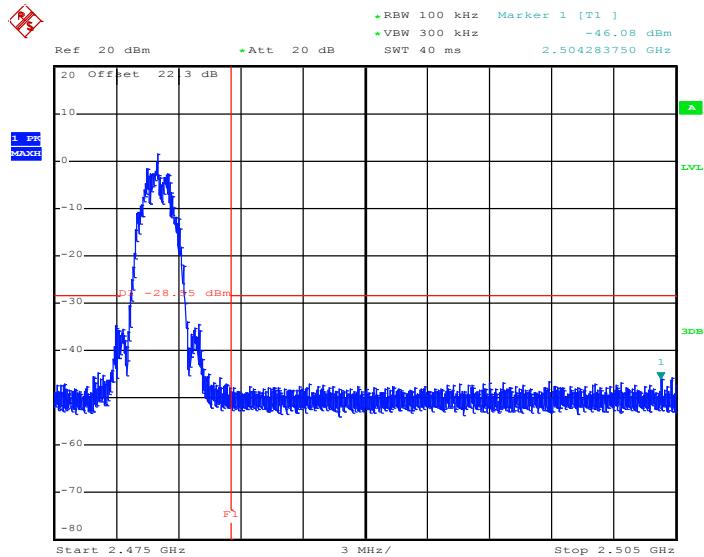
<2Mbps>

Low Band Edge Plot on Channel 00



Date: 31.JAN.2019 15:22:31

High Band Edge Plot on Channel 39



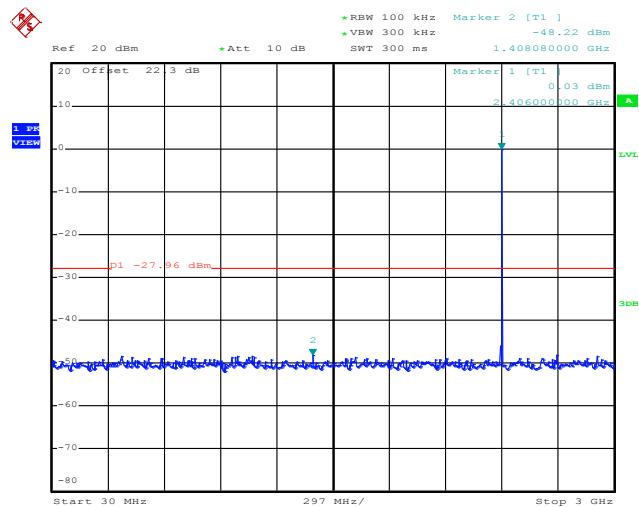
Date: 31.JAN.2019 15:28:30

3.4.6 Test Result of Conducted Spurious Emission Plots

| | | | |
|-----------------|-------------------------|---------------------|---------|
| Test Engineer : | Luffy Lin and Allen Lin | Temperature : | 21~25°C |
| | | Relative Humidity : | 51~54% |

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

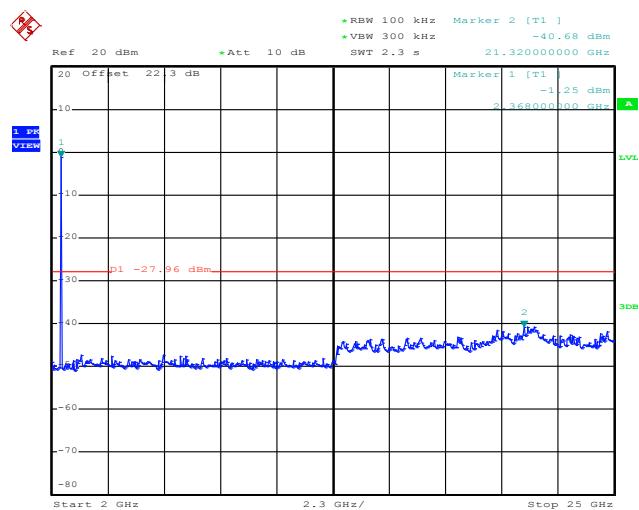
GFSK Channel 00



Date: 31.JAN.2019 15:04:26

Conducted Spurious Emission Plot on Bluetooth LE 1Mbps

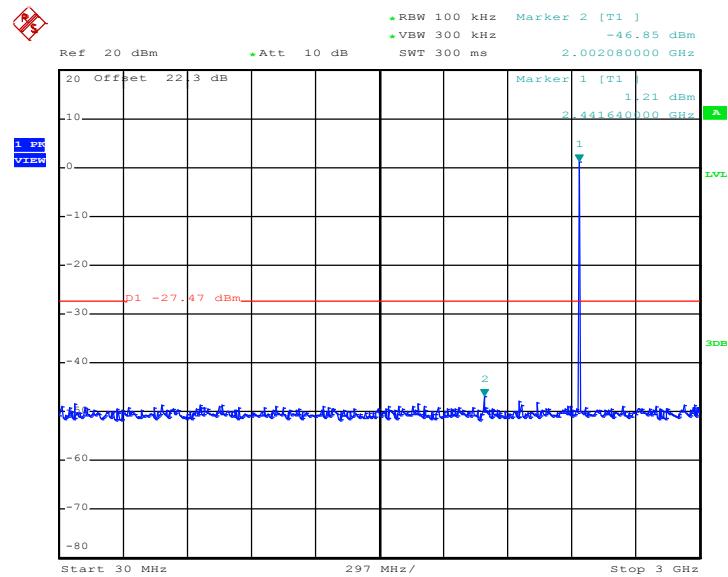
GFSK Channel 00



Date: 31.JAN.2019 15:04:47

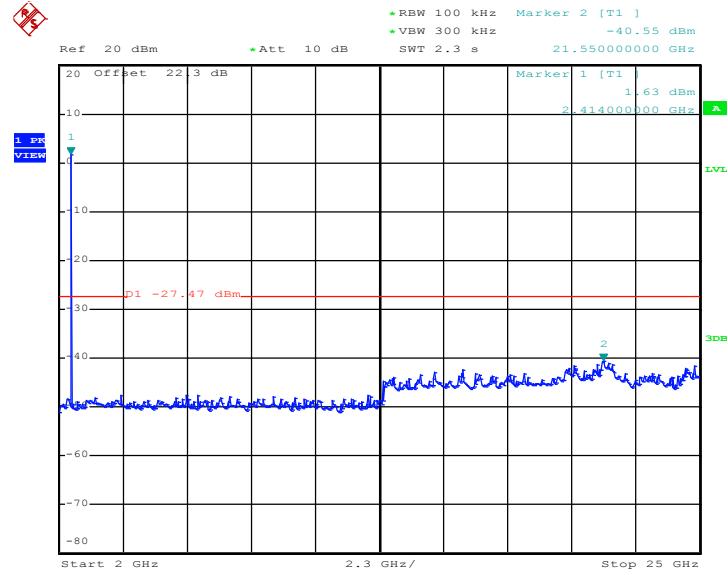


**Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 19**



Date: 31.JAN.2019 15:08:19

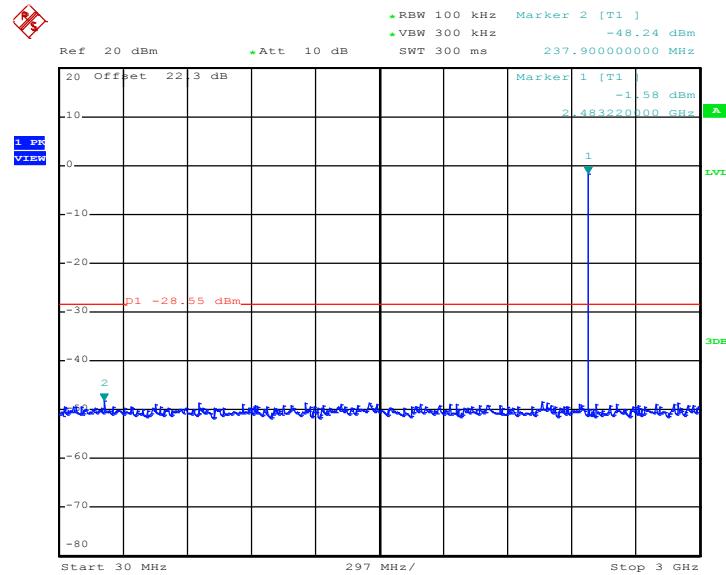
**Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 19**



Date: 31.JAN.2019 15:08:49

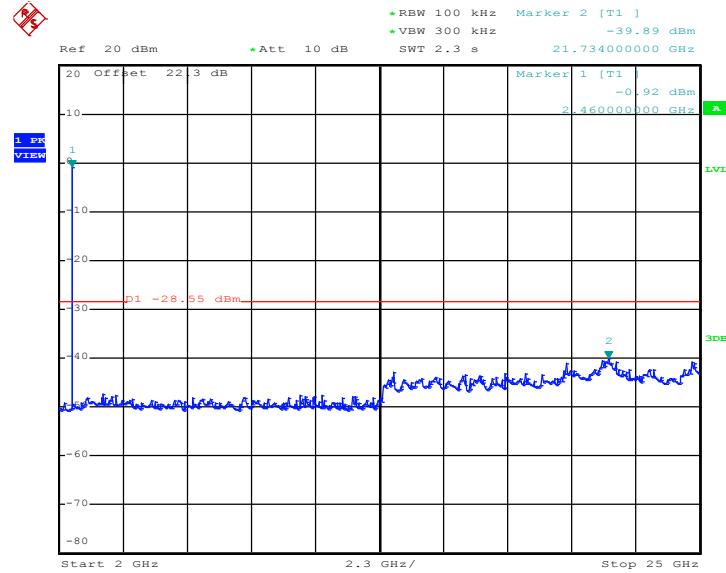


**Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 39**



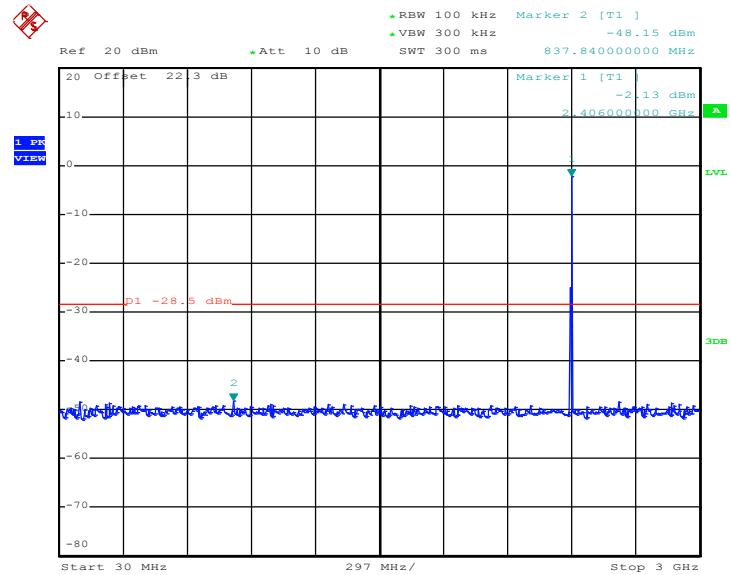
Date: 31.JAN.2019 15:13:21

**Conducted Spurious Emission Plot on Bluetooth LE 1Mbps
GFSK Channel 39**



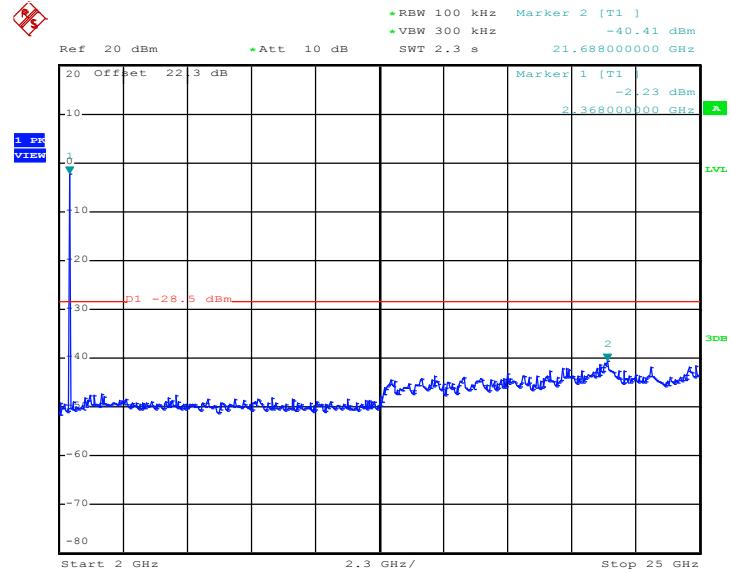
Date: 31.JAN.2019 15:14:18

**Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 00**



Date: 31.JAN.2019 15:21:06

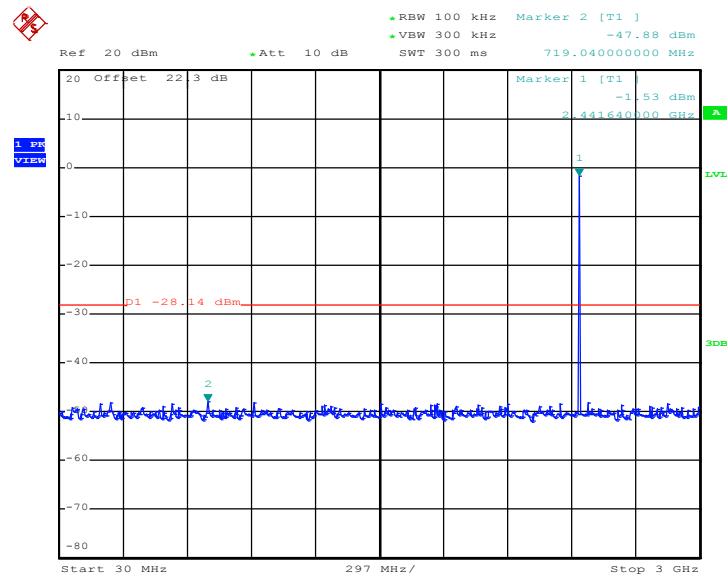
**Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 00**



Date: 31.JAN.2019 15:21:54

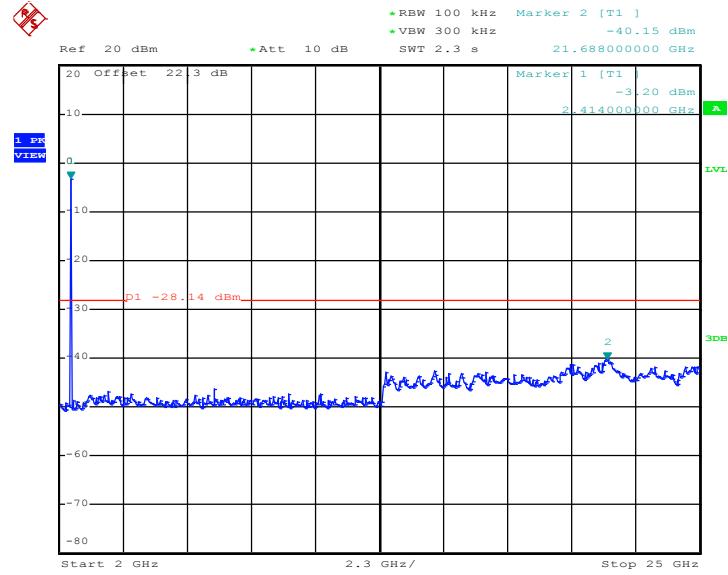


**Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 19**



Date: 31.JAN.2019 15:25:11

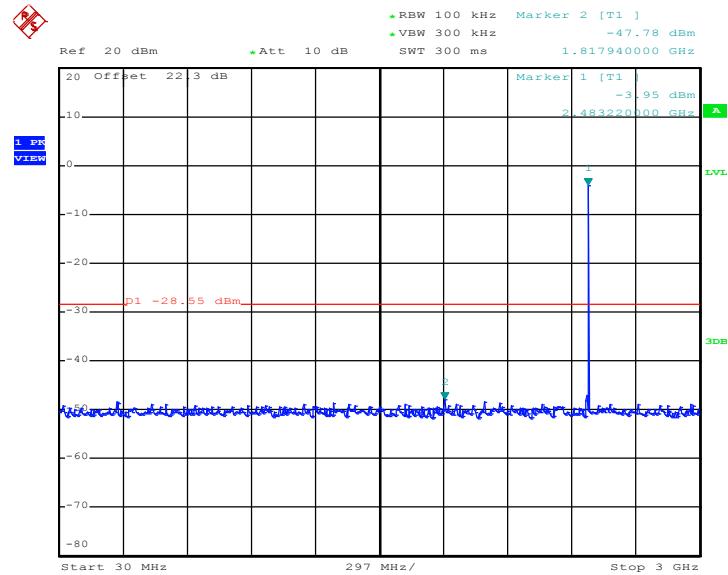
**Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 19**



Date: 31.JAN.2019 15:25:57

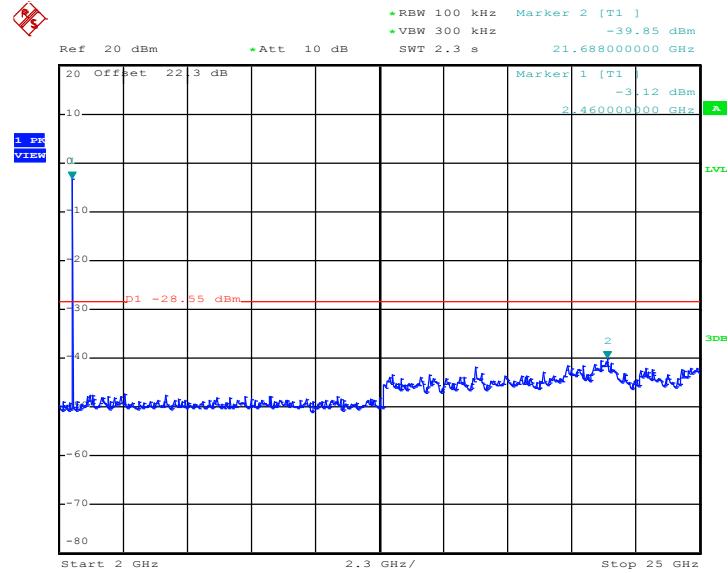


**Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 39**



Date: 31.JAN.2019 15:28:49

**Conducted Spurious Emission Plot on Bluetooth LE 2Mbps
GFSK Channel 39**



Date: 31.JAN.2019 15:29:05



3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

3.5.2 Measuring Instruments

See list of measuring equipment of this test report.



3.5.3 Test Procedures

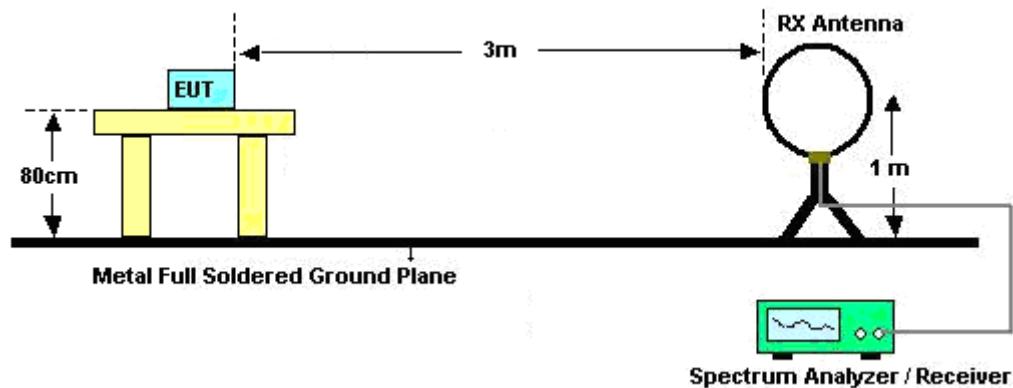
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, 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.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB 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.
8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.

For average measurement:

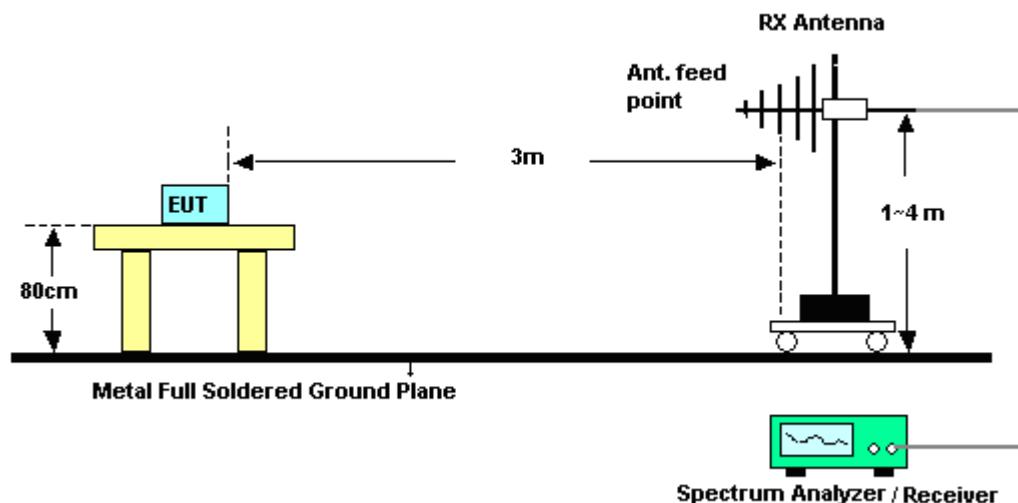
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

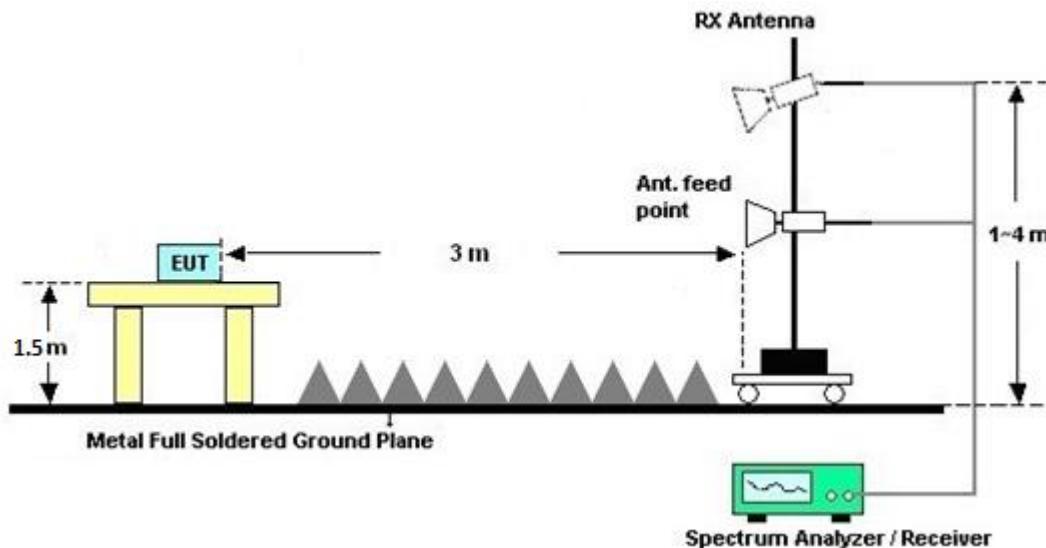
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.5.5 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 a comparison data 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.

3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.5.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.



3.6 AC Conducted Emission Measurement

3.6.1 Limit of AC Conducted Emission

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

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

*Decreases with the logarithm of the frequency.

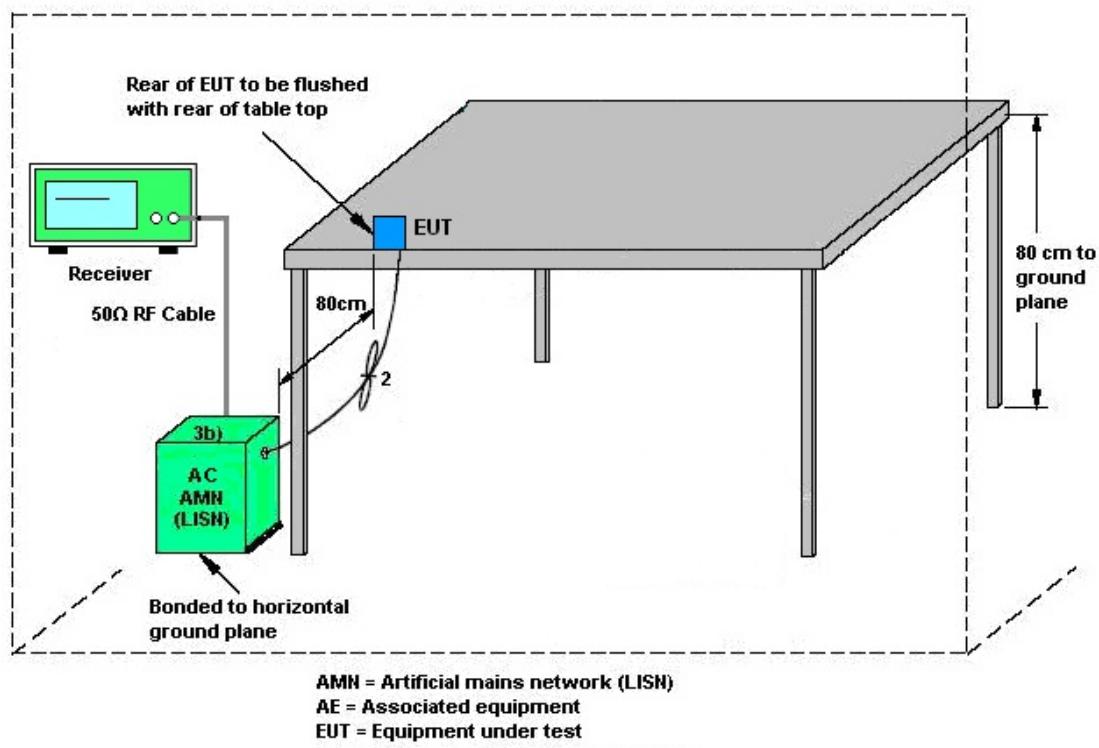
3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

3.6.3 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 should 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.

3.6.4 Test Setup



3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix A.



3.7 Antenna Requirements

3.7.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.7.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.7.3 Antenna Gain

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



4 List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|-----------------------|-----------------|--------------------------|-------------------------|-----------------|------------------|-----------------------------|---------------|-----------------------|
| Power Sensor | DARE | RadiPower | 15I00041S NO09 | 10MHz~6GHz | May 07, 2018 | Jan. 22, 2019~Jan. 31, 2019 | May 06, 2019 | Conducted (TH05-HY) |
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 100057 | 9kHz-40GHz | Nov. 21, 2018 | Jan. 22, 2019~Jan. 31, 2019 | Nov. 20, 2019 | Conducted (TH05-HY) |
| Switch Box & RF Cable | Burgeon | ETF-058 | EC130048 4 | N/A | Mar. 01, 2018 | Jan. 22, 2019~Jan. 31, 2019 | Feb. 28, 2019 | Conducted (TH05-HY) |
| AC Power Source | ChainTek | APC-1000W | N/A | N/A | N/A | Feb. 20, 2019 | N/A | Conduction (CO05-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESR3 | 102388 | 9KHz~3.6GHz | Nov. 12, 2018 | Feb. 20, 2019 | Nov. 11, 2019 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100080 | 9kHz~30MHz | Nov. 14, 2018 | Feb. 20, 2019 | Nov. 13, 2019 | Conduction (CO05-HY) |
| LISN | Rohde & Schwarz | ENV216 | 100081 | 9kHz~30MHz | Nov. 09, 2018 | Feb. 20, 2019 | Nov. 08, 2019 | Conduction (CO05-HY) |
| Software | Rohde & Schwarz | EMC32 V10.30 | N/A | N/A | N/A | Feb. 20, 2019 | N/A | Conduction (CO05-HY) |
| LF Cable | HUBER + SUHNER | RG-214/U | LF01 | N/A | Dec. 31, 2018 | Feb. 20, 2019 | Dec. 30, 2019 | Conduction (CO05-HY) |
| Pulse Limiter | Rohde & Schwarz | ESH3-Z2 | 100851 | N/A | Dec. 31, 2018 | Feb. 20, 2019 | Dec. 30, 2019 | Conduction (CO05-HY) |
| Loop Antenna | TESEQ | HLA 6120 | 31244 | 9 kHz~30 MHz | Mar. 29, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Mar. 28, 2019 | Radiation (03CH15-HY) |
| Preamplifier | EMEC | EM18G40G | 060715 | 18GHz ~ 40GHz | Dec. 06, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Dec. 05, 2019 | Radiation (03CH15-HY) |
| Bilog Antenna | TESEQ | CBL6111D&0-0802N1D01N-06 | 47020806 | 30MHz to 1GHz | Oct. 13, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Oct. 12, 2019 | Radiation (03CH15-HY) |
| Horn Antenna | SCHWARZBECK | BBHA 9120D | 9120D-1620 | 1G~18GHz | Oct. 17, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Oct. 16, 2019 | Radiation (03CH15-HY) |
| SHF-EHF Horn Antenna | SCHWARZBECK | BBHA 9170 | BBHA9170 576 | 18GHz ~ 40GHz | May 08, 2018 | Jan. 23, 2019~Feb. 19, 2019 | May 07, 2019 | Radiation (03CH15-HY) |
| Amplifier | SONOMA | 310N | 363440 | 9kHz~1GHz | Dec. 28, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Dec. 27, 2019 | Radiation (03CH15-HY) |
| Preamplifier | Jet-Power | JPA0118-55-303 | 171000180 00550006 | 1GHz~18GHz | Jul. 10, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Jul. 09, 2019 | Radiation (03CH15-HY) |
| Preamplifier | Keysight | 83017A | MY532701 95 | 1GHz~26.5GHz | Aug. 23, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Aug. 22, 2019 | Radiation (03CH15-HY) |
| EMI Test Receiver | Keysight | N9038A (MXE) | MY541300 85 | 20Hz ~ 8.4GHz | Nov. 01, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Oct. 31, 2019 | Radiation (03CH15-HY) |
| Spectrum Analyzer | Agilent | E4446A | MY501801 36 | 3Hz~44GHz | Apr. 25, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Apr. 24, 2019 | Radiation (03CH15-HY) |
| Antenna Mast | ChainTek | MBS-520-1 | N/A | 1m~4m | N/A | Jan. 23, 2019~Feb. 19, 2019 | N/A | Radiation (03CH15-HY) |
| Turn Table | ChainTek | T-200-S-1 | N/A | 0~360 Degree | N/A | Jan. 23, 2019~Feb. 19, 2019 | N/A | Radiation (03CH15-HY) |
| Software | Audix | E3 6.2009-8-24 | RK-00045 1 | N/A | N/A | Jan. 23, 2019~Feb. 19, 2019 | N/A | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY36980/4 | 30M-18G | Apr. 16, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Apr. 15, 2019 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 104 | MY9838/4 | 30M-18G | Apr. 16, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Apr. 15, 2019 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | MTJ | 000000-M T18A-100 D3210 | 30M-18G | Apr. 16, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Apr. 15, 2019 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | MY2859/2 | 30MHz-40GHz | Mar. 14, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Mar. 13, 2019 | Radiation (03CH15-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | MY4274/2 | 30MHz-40GHz | Mar. 14, 2018 | Jan. 23, 2019~Feb. 19, 2019 | Mar. 13, 2019 | Radiation (03CH15-HY) |



| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|------------|--------------|-------------------------------------|------------|-------------------|------------------|---------------------------------|---------------|--------------------------|
| Filter | Wainwright | WHKX12-270 0-3000-18000 -60SS | SN2 | 3.0 GHz High pass | Jul. 16, 2018 | Jan. 23, 2019~ Feb. 19, 2019 | Jul. 15, 2019 | Radiation (03CH15-HY) |
| Filter | Wainwright | WLK4-1000-1 530-8000-40S S | SN11 | 1G Low Pass | Sep. 16, 2018 | Jan. 23, 2019~ Feb. 19, 2019 | Sep. 15, 2019 | Radiation (03CH15-HY) |



5 Uncertainty of Evaluation

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

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$) | 2.2 |
|---|-----|

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

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$) | 5.2 |
|---|-----|

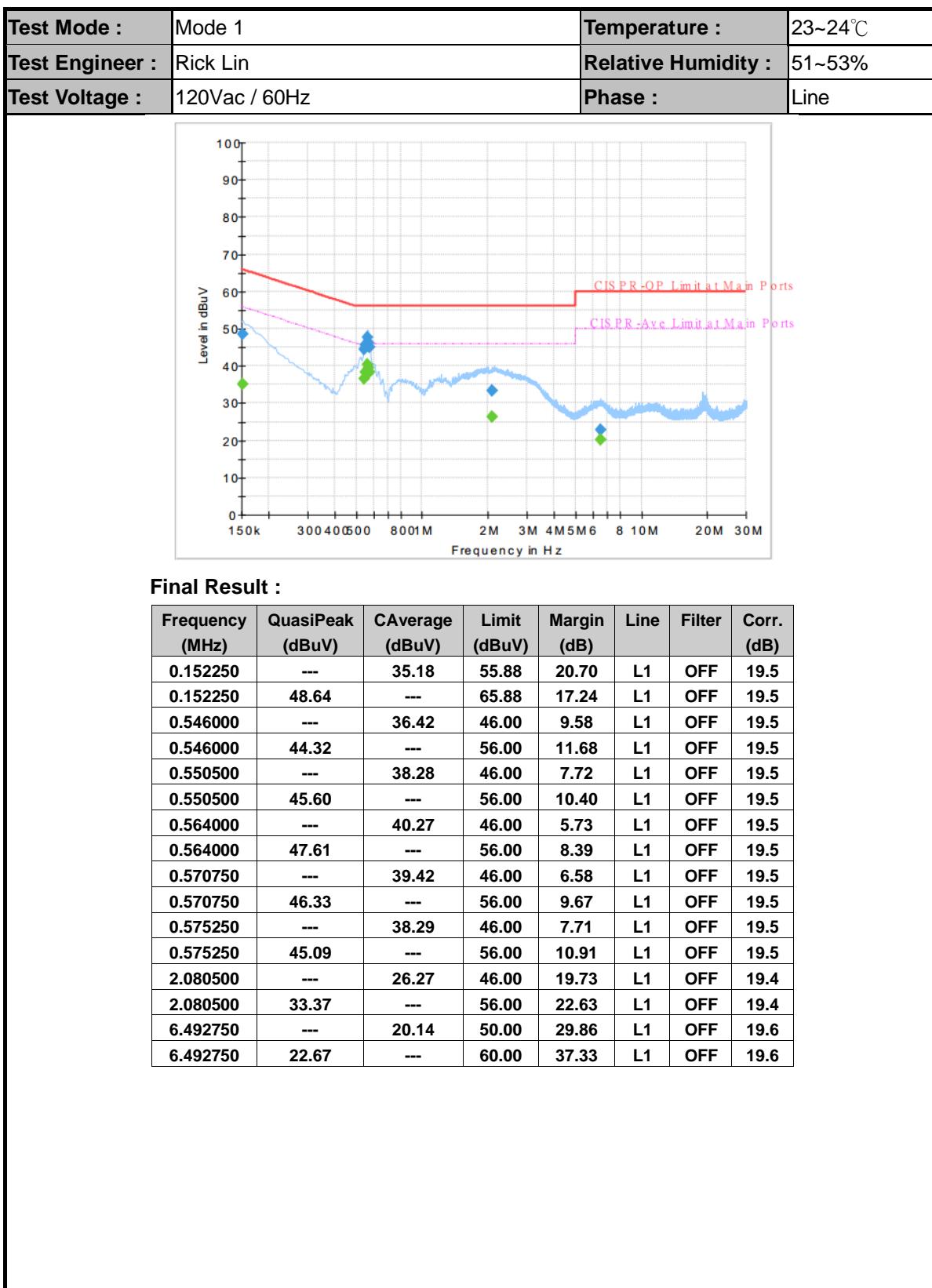
Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$) | 5.5 |
|---|-----|

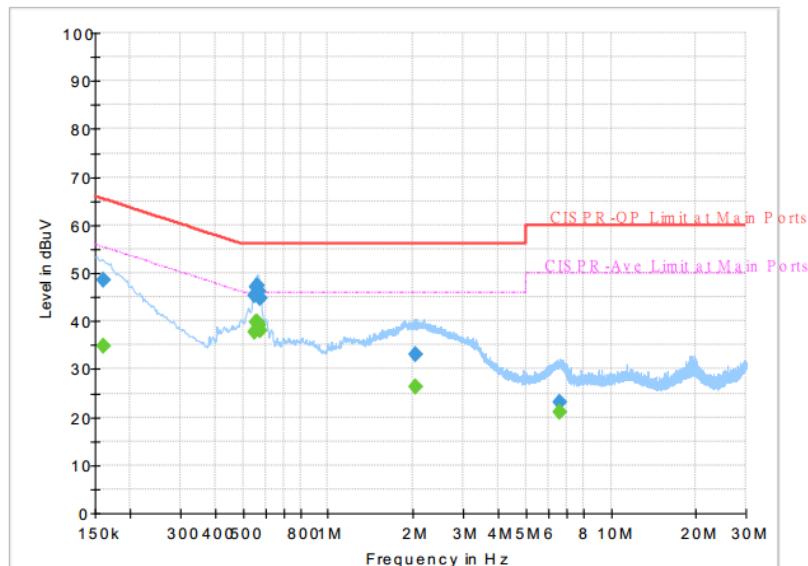
Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

| | |
|---|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ($U = 2U_{C(y)}$) | 5.2 |
|---|-----|

Appendix A. AC Conducted Emission Test Results



| | | | |
|------------------------|---------------|----------------------------|---------|
| Test Mode : | Mode 1 | Temperature : | 23~24°C |
| Test Engineer : | Rick Lin | Relative Humidity : | 51~53% |
| Test Voltage : | 120Vac / 60Hz | Phase : | Neutral |

**Final Result :**

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.161250 | --- | 34.91 | 55.40 | 20.49 | N | OFF | 19.5 |
| 0.161250 | 48.51 | --- | 65.40 | 16.89 | N | OFF | 19.5 |
| 0.548250 | --- | 37.70 | 46.00 | 8.30 | N | OFF | 19.5 |
| 0.548250 | 45.32 | --- | 56.00 | 10.68 | N | OFF | 19.5 |
| 0.557250 | --- | 39.78 | 46.00 | 6.22 | N | OFF | 19.5 |
| 0.557250 | 47.01 | --- | 56.00 | 8.99 | N | OFF | 19.5 |
| 0.564000 | --- | 39.74 | 46.00 | 6.26 | N | OFF | 19.5 |
| 0.564000 | 47.24 | --- | 56.00 | 8.76 | N | OFF | 19.5 |
| 0.570750 | --- | 39.32 | 46.00 | 6.68 | N | OFF | 19.5 |
| 0.570750 | 46.30 | --- | 56.00 | 9.70 | N | OFF | 19.5 |
| 0.575250 | --- | 38.09 | 46.00 | 7.91 | N | OFF | 19.5 |
| 0.575250 | 44.82 | --- | 56.00 | 11.18 | N | OFF | 19.5 |
| 2.037750 | --- | 26.25 | 46.00 | 19.75 | N | OFF | 19.5 |
| 2.037750 | 33.16 | --- | 56.00 | 22.84 | N | OFF | 19.5 |
| 6.609750 | --- | 21.02 | 50.00 | 28.98 | N | OFF | 19.6 |
| 6.609750 | 23.09 | --- | 60.00 | 36.91 | N | OFF | 19.6 |



Appendix B. Radiated Spurious Emission

| | | | | | |
|-----------------|--|---------------------|--|---------|--|
| Test Engineer : | Watt Tseng, Karl Hou, and Bigshow Wang | Temperature : | | 23~26°C | |
| | | Relative Humidity : | | 50~57% | |

2.4GHz 2400~2483.5MHz

BLE 1Mbps (Band Edge @ 3m)

| BLE | Note | Frequency | Level | Over | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. |
|-------------------------|------|-----------|------------------|--------|------------------|----------------|----------|--------|--------|--------|---------|-------|-------|
| | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| | | (MHz) | (dB μ V/m) | (dB) | (dB μ V/m) | (dB μ V) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) |
| BLE CH 00 2402MHz | | 2358.615 | 53.88 | -20.12 | 74 | 41.36 | 27.67 | 15.73 | 30.88 | 394 | 308 | P | H |
| | | 2376.36 | 44.77 | -9.23 | 54 | 32.25 | 27.63 | 15.75 | 30.86 | 394 | 308 | A | H |
| | * | 2402 | 95.49 | - | - | 82.95 | 27.6 | 15.79 | 30.85 | 394 | 308 | P | H |
| | * | 2402 | 94.85 | - | - | 82.31 | 27.6 | 15.79 | 30.85 | 394 | 308 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 2334.885 | 54.12 | -19.88 | 74 | 41.62 | 27.7 | 15.69 | 30.89 | 349 | 341 | P | V |
| | | 2326.38 | 44.61 | -9.39 | 54 | 32.05 | 27.77 | 15.68 | 30.89 | 349 | 341 | A | V |
| | * | 2402 | 98.83 | - | - | 86.29 | 27.6 | 15.79 | 30.85 | 349 | 341 | P | V |
| | * | 2402 | 98.28 | - | - | 85.74 | 27.6 | 15.79 | 30.85 | 349 | 341 | A | V |
| BLE CH 19 2440MHz | | | | | | | | | | | | | V |
| | | 2333.1 | 53.64 | -20.36 | 74 | 41.07 | 27.77 | 15.69 | 30.89 | 365 | 243 | P | H |
| | | 2371.74 | 44.67 | -9.33 | 54 | 32.15 | 27.63 | 15.75 | 30.86 | 365 | 243 | A | H |
| | * | 2440 | 95.33 | - | - | 82.72 | 27.6 | 15.85 | 30.84 | 365 | 243 | P | H |
| | * | 2440 | 94.73 | - | - | 82.12 | 27.6 | 15.85 | 30.84 | 365 | 243 | A | H |
| | | 2486.98 | 52.68 | -21.32 | 74 | 40.12 | 27.47 | 15.91 | 30.82 | 365 | 243 | P | H |
| | | 2484.04 | 44.41 | -9.59 | 54 | 31.85 | 27.47 | 15.91 | 30.82 | 365 | 243 | A | H |
| | | 2337.58 | 53.77 | -20.23 | 74 | 41.26 | 27.7 | 15.7 | 30.89 | 338 | 343 | P | V |
| | | 2319.38 | 44.6 | -9.4 | 54 | 32.05 | 27.77 | 15.67 | 30.89 | 338 | 343 | A | V |
| | * | 2440 | 98.29 | - | - | 85.68 | 27.6 | 15.85 | 30.84 | 338 | 343 | P | V |
| | * | 2440 | 97.73 | - | - | 85.12 | 27.6 | 15.85 | 30.84 | 338 | 343 | A | V |
| | | 2487.12 | 53.12 | -20.88 | 74 | 40.56 | 27.47 | 15.91 | 30.82 | 338 | 343 | P | V |
| | | 2492.65 | 44.44 | -9.56 | 54 | 31.93 | 27.4 | 15.92 | 30.81 | 338 | 343 | A | V |



| BLE CH 39 2480MHz | * | 2480 | 96.27 | - | - | 83.72 | 27.47 | 15.9 | 30.82 | 318 | 243 | P | H |
|-------------------------|---|---------|-------|--------|----|-------|-------|-------|-------|-----|-----|---|---|
| | * | 2480 | 95.75 | - | - | 83.2 | 27.47 | 15.9 | 30.82 | 318 | 243 | A | H |
| | | 2493.92 | 53.27 | -20.73 | 74 | 40.76 | 27.4 | 15.92 | 30.81 | 318 | 243 | P | H |
| | | 2487.04 | 44.38 | -9.62 | 54 | 31.82 | 27.47 | 15.91 | 30.82 | 318 | 243 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 99.77 | - | - | 87.22 | 27.47 | 15.9 | 30.82 | 367 | 333 | P | V |
| | * | 2480 | 99.24 | - | - | 86.69 | 27.47 | 15.9 | 30.82 | 367 | 333 | A | V |
| | | 2497.68 | 53.3 | -20.7 | 74 | 40.78 | 27.4 | 15.93 | 30.81 | 367 | 333 | P | V |
| | | 2487.52 | 44.61 | -9.39 | 54 | 32.12 | 27.4 | 15.91 | 30.82 | 367 | 333 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz

BLE 1Mbps (Harmonic @ 3m)

| BLE | Note | Frequency (MHz) | Level (dB μ V/m) | Over Limit (dB) | Limit Line (dB μ V/m) | Read Level (dB μ V) | Antenna Factor (dB/m) | Path Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|-------------------------|---|----------------------|---------------------------|-------------------------|-----------------------------------|---------------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-----------------------|---------------|
| BLE CH 00 2402MHz | | 4804 | 39.63 | -34.37 | 74 | 57.93 | 31.3 | 8.44 | 58.04 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4804 | 39.97 | -34.03 | 74 | 58.27 | 31.3 | 8.44 | 58.04 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| BLE CH 19 2440MHz | | 4880 | 39.8 | -34.2 | 74 | 57.93 | 31.3 | 8.67 | 58.1 | 100 | 0 | P | H |
| | | 7320 | 44.03 | -29.97 | 74 | 54.87 | 36.23 | 11.27 | 58.34 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4880 | 39.71 | -34.29 | 74 | 57.84 | 31.3 | 8.67 | 58.1 | 100 | 0 | P | V |
| | | 7320 | 43.98 | -30.02 | 74 | 54.82 | 36.23 | 11.27 | 58.34 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| BLE CH 39 2480MHz | | 4960 | 40.42 | -33.58 | 74 | 58.22 | 31.47 | 8.9 | 58.17 | 100 | 0 | P | H |
| | | 7440 | 44.5 | -29.5 | 74 | 54.88 | 36.6 | 11.33 | 58.31 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4960 | 40.18 | -33.82 | 74 | 57.98 | 31.47 | 8.9 | 58.17 | 100 | 0 | P | V |
| | | 7440 | 45.75 | -28.25 | 74 | 56.13 | 36.6 | 11.33 | 58.31 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Emission below 1GHz

2.4GHz BLE 1Mbps (LF)



2.4GHz 2400~2483.5MHz

BLE 2Mbps (Band Edge @ 3m)

| BLE | Note | Frequency | Level | Over | Limit | Read | Antenna | Path | Preamp | Ant | Table | Peak | Pol. | | |
|-------------------------|------|-----------|------------------|--------|------------------|----------------|----------|--------|--------|--------|---------|---------|---------|------|--|
| | | | | | | | | | | | | | | Avg. | |
| | | (MHz) | (dB μ V/m) | (dB) | (dB μ V/m) | (dB μ V) | (dB/m) | (dB) | (dB) | (cm) | (deg) | (P/A) | (H/V) | | |
| BLE CH 00 2402MHz | | 2352.945 | 53.77 | -20.23 | 74 | 41.26 | 27.67 | 15.72 | 30.88 | 348 | 308 | P | H | | |
| | | 2358.195 | 46.47 | -7.53 | 54 | 33.95 | 27.67 | 15.73 | 30.88 | 348 | 308 | A | H | | |
| | * | 2402 | 95.42 | - | - | 82.88 | 27.6 | 15.79 | 30.85 | 348 | 308 | P | H | | |
| | * | 2402 | 94.18 | - | - | 81.64 | 27.6 | 15.79 | 30.85 | 348 | 308 | A | H | | |
| | | | | | | | | | | | | | H | | |
| | | | | | | | | | | | | | H | | |
| | | 2363.76 | 54.07 | -19.93 | 74 | 41.54 | 27.67 | 15.74 | 30.88 | 393 | 342 | P | V | | |
| | | 2334.99 | 46.22 | -7.78 | 54 | 33.72 | 27.7 | 15.69 | 30.89 | 393 | 342 | A | V | | |
| | * | 2402 | 97.69 | - | - | 85.15 | 27.6 | 15.79 | 30.85 | 393 | 342 | P | V | | |
| | * | 2402 | 96.48 | - | - | 83.94 | 27.6 | 15.79 | 30.85 | 393 | 342 | A | V | | |
| BLE CH 19 2440MHz | | | | | | | | | | | | | V | | |
| | | 2313.08 | 53.45 | -20.55 | 74 | 40.86 | 27.83 | 15.66 | 30.9 | 324 | 242 | P | H | | |
| | | 2318.54 | 46.39 | -7.61 | 54 | 33.84 | 27.77 | 15.67 | 30.89 | 324 | 242 | A | H | | |
| | * | 2440 | 96.35 | - | - | 83.74 | 27.6 | 15.85 | 30.84 | 324 | 242 | P | H | | |
| | * | 2440 | 94.66 | - | - | 82.05 | 27.6 | 15.85 | 30.84 | 324 | 242 | A | H | | |
| | | 2488.73 | 53.18 | -20.82 | 74 | 40.69 | 27.4 | 15.91 | 30.82 | 324 | 242 | P | H | | |
| | | 2489.71 | 46.06 | -7.94 | 54 | 33.56 | 27.4 | 15.92 | 30.82 | 324 | 242 | A | H | | |
| | | 2310.98 | 53.36 | -20.64 | 74 | 40.77 | 27.83 | 15.66 | 30.9 | 343 | 340 | P | V | | |
| | | 2310.7 | 46.67 | -7.33 | 54 | 34.08 | 27.83 | 15.66 | 30.9 | 343 | 340 | A | V | | |
| | * | 2440 | 97.1 | - | - | 84.49 | 27.6 | 15.85 | 30.84 | 343 | 340 | P | V | | |
| | * | 2440 | 95.96 | - | - | 83.35 | 27.6 | 15.85 | 30.84 | 343 | 340 | A | V | | |
| | | 2489.29 | 53.83 | -20.17 | 74 | 41.33 | 27.4 | 15.92 | 30.82 | 343 | 340 | P | V | | |
| | | 2490.41 | 45.74 | -8.26 | 54 | 33.24 | 27.4 | 15.92 | 30.82 | 343 | 340 | A | V | | |



| BLE CH 39 2480MHz | * | 2480 | 95.43 | - | - | 82.88 | 27.47 | 15.9 | 30.82 | 391 | 251 | P | H |
|-------------------------|---|---------|-------|--------|----|-------|-------|-------|-------|-----|-----|---|---|
| | * | 2480 | 94.15 | - | - | 81.6 | 27.47 | 15.9 | 30.82 | 391 | 251 | A | H |
| | | 2498.68 | 53.51 | -20.49 | 74 | 40.99 | 27.4 | 15.93 | 30.81 | 391 | 251 | P | H |
| | | 2493.12 | 45.89 | -8.11 | 54 | 33.38 | 27.4 | 15.92 | 30.81 | 391 | 251 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | * | 2480 | 99.24 | - | - | 86.69 | 27.47 | 15.9 | 30.82 | 371 | 328 | P | V |
| | * | 2480 | 97.92 | - | - | 85.37 | 27.47 | 15.9 | 30.82 | 371 | 328 | A | V |
| | | 2494.08 | 54.48 | -19.52 | 74 | 41.97 | 27.4 | 15.92 | 30.81 | 371 | 328 | P | V |
| | | 2497.92 | 45.96 | -8.04 | 54 | 33.44 | 27.4 | 15.93 | 30.81 | 371 | 328 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



2.4GHz 2400~2483.5MHz

BLE 2Mbps (Harmonic @ 3m)

| BLE | Note | Frequency (MHz) | Level (dB μ V/m) | Over Limit (dB) | Limit Line (dB μ V/m) | Read Level (dB μ V) | Antenna Factor (dB/m) | Path Loss (dB) | Preamp Factor (dB) | Ant Pos (cm) | Table Pos (deg) | Peak Avg. (P/A) | Pol. (H/V) |
|-------------------------|---|----------------------|---------------------------|-------------------------|-----------------------------------|---------------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-----------------------|---------------|
| BLE CH 00 2402MHz | | 4804 | 39.38 | -34.62 | 74 | 57.68 | 31.3 | 8.44 | 58.04 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4804 | 38.87 | -35.13 | 74 | 57.17 | 31.3 | 8.44 | 58.04 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| BLE CH 19 2440MHz | | 4880 | 39.27 | -34.73 | 74 | 57.4 | 31.3 | 8.67 | 58.1 | 100 | 0 | P | H |
| | | 7320 | 45.92 | -28.08 | 74 | 56.76 | 36.23 | 11.27 | 58.34 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4880 | 39.13 | -34.87 | 74 | 57.26 | 31.3 | 8.67 | 58.1 | 100 | 0 | P | V |
| | | 7320 | 43.38 | -30.62 | 74 | 54.22 | 36.23 | 11.27 | 58.34 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| BLE CH 39 2480MHz | | 4960 | 39.53 | -34.47 | 74 | 57.33 | 31.47 | 8.9 | 58.17 | 100 | 0 | P | H |
| | | 7440 | 43.95 | -30.05 | 74 | 54.33 | 36.6 | 11.33 | 58.31 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4960 | 40.35 | -33.65 | 74 | 58.15 | 31.47 | 8.9 | 58.17 | 100 | 0 | P | V |
| | | 7440 | 44.02 | -29.98 | 74 | 54.4 | 36.6 | 11.33 | 58.31 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found. 2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |



Emission below 1GHz

2.4GHz BLE 2Mbps (LF)



Note symbol

| | |
|-----|--|
| * | Fundamental Frequency which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. |
| ! | Test result is over limit line. |
| P/A | Peak or Average |
| H/V | Horizontal or Vertical |



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

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

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)

2. Level(dB μ V/m) =

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

3. Over Limit(dB) = Level(dB μ V/m) – Limit Line(dB μ V/m)

For Peak Limit @ 2390MHz:

1. Level(dB μ V/m)

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

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

= 55.45 (dB μ V/m)

2. Over Limit(dB)

= Level(dB μ V/m) – Limit Line(dB μ V/m)

= 55.45(dB μ V/m) – 74(dB μ V/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dB μ V/m)

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

= 32.22(dB/m) + 4.58(dB) + 42.6(dB μ V) – 35.86 (dB)

= 43.54 (dB μ V/m)

2. Over Limit(dB)

= Level(dB μ V/m) – Limit Line(dB μ V/m)

= 43.54(dB μ V/m) – 54(dB μ V/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 : | Watt Tseng, Karl Hou, and Bigshow Wang | Temperature : | 23~26°C |
| | | Relative Humidity : | 50~57% |

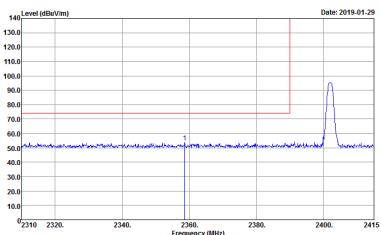
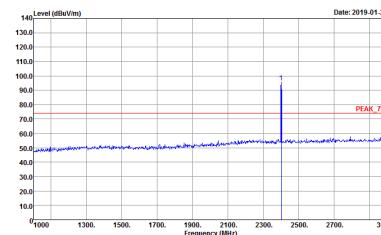
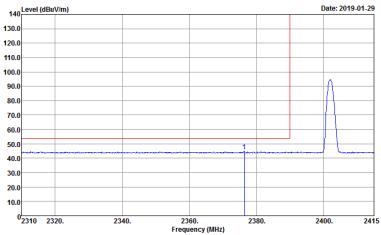
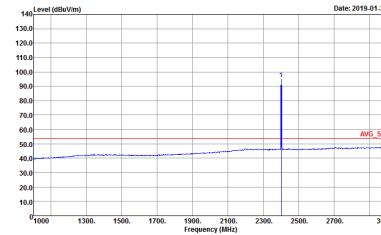
Note symbol

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

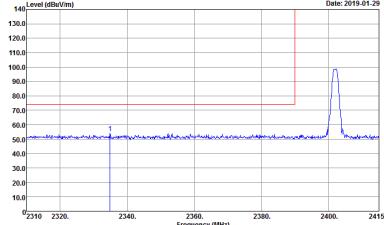
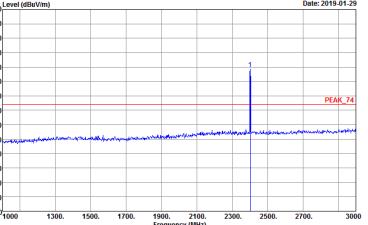
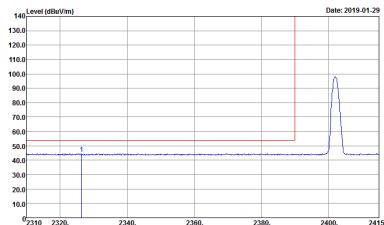


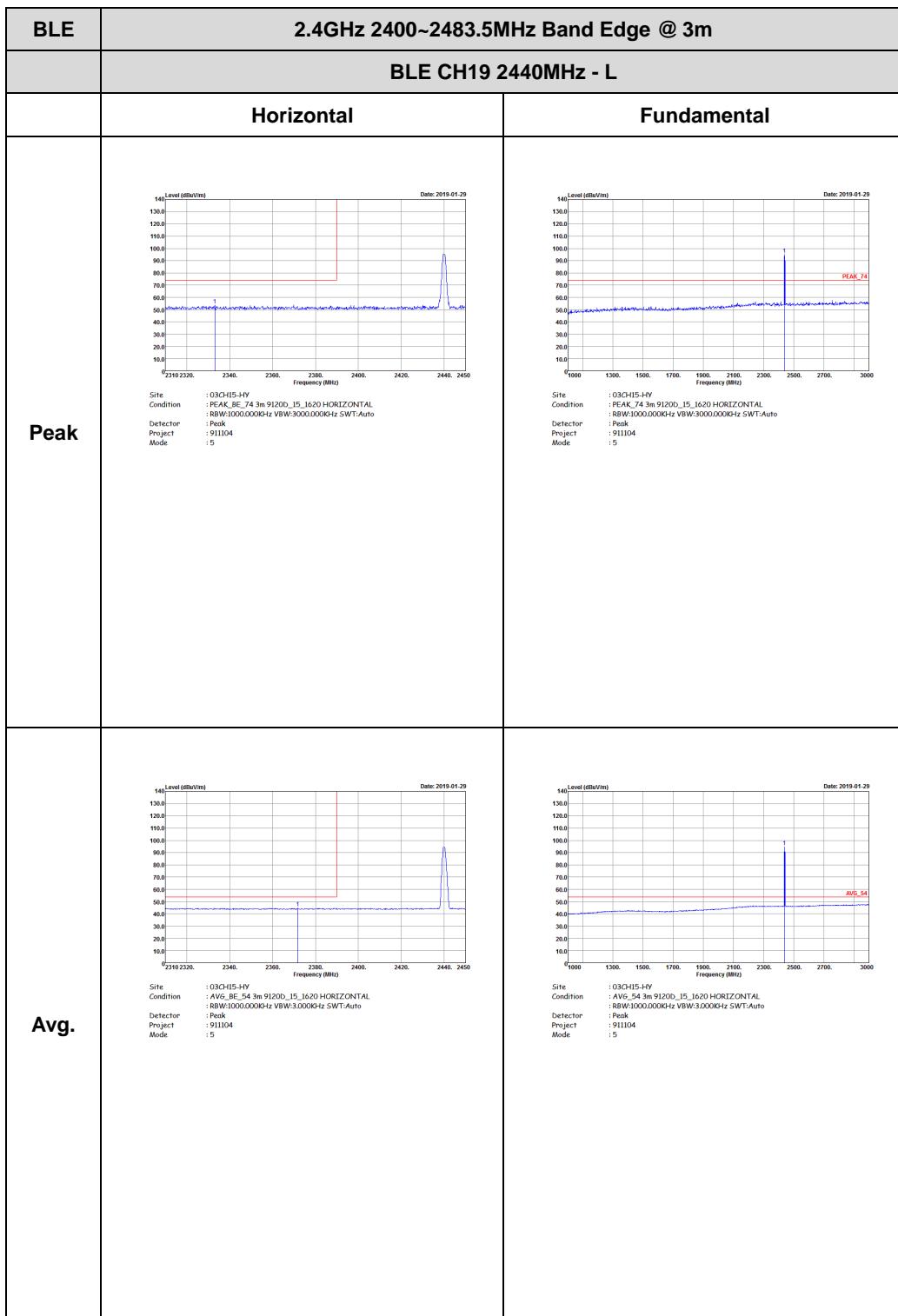
2.4GHz 2400~2483.5MHz

BLE 1Mbps (Band Edge @ 3m)

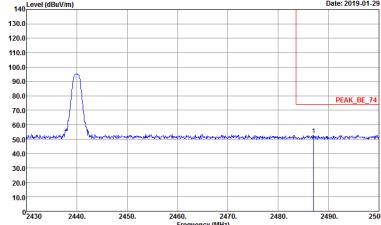
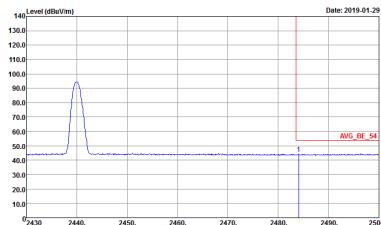
| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|---|
| | BLE CH00 2402MHz | |
| | Horizontal | Fundamental |
| Peak |  <p>Site : 03G115-HY Condition : PEAK_BE_74_3m_91200_I5_1620 HORIZONTAL Detector : R8W:1000.000kHz VBW:3000.000Hz SWT:Auto Project : 911104 Mode : 4</p> |  <p>Site : 03G115-HY Condition : PEAK_74_3m_91200_I5_1620 HORIZONTAL Detector : R8W:1000.000kHz VBW:3000.000Hz SWT:Auto Project : 911104 Mode : 4</p> |
| Avg. |  <p>Site : 03G115-HY Condition : AVG_BE_54_3m_91200_I5_1620 HORIZONTAL Detector : R8W:1000.000kHz VBW:3.000kHz SWT:Auto Project : 911104 Mode : 4</p> |  <p>Site : 03G115-HY Condition : AVG_54_3m_91200_I5_1620 HORIZONTAL Detector : R8W:1000.000kHz VBW:3.000kHz SWT:Auto Project : 911104 Mode : 4</p> |



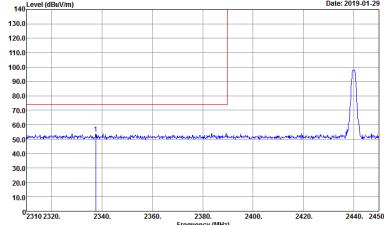
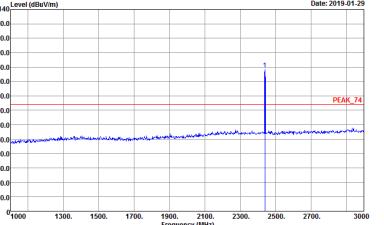
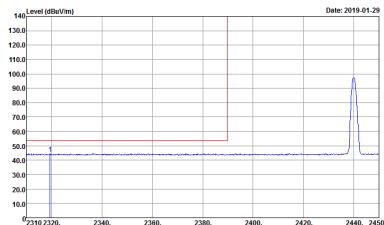
| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|---|
| | BLE CH00 2402MHz | |
| | Vertical | Fundamental |
| Peak |  <p>14 Level (dBuV/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_15_1620 VERTICAL Detector : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 4</p> |  <p>14 Level (dBuV/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_15_1620 VERTICAL Detector : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 4</p> |
| Avg |  <p>14 Level (dBuV/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_15_1620 VERTICAL Detector : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 4</p> |  <p>14 Level (dBuV/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_15_1620 VERTICAL Detector : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 4</p> |



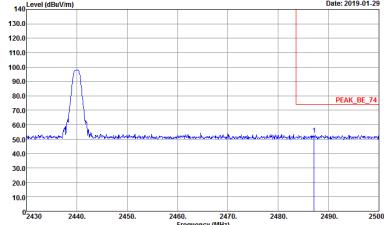
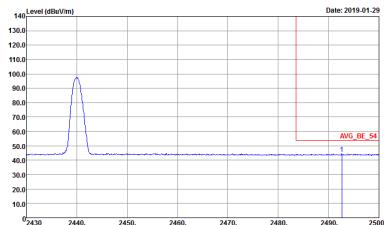


| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|-------------|
| | BLE CH19 2440MHz - R | |
| | Horizontal | Fundamental |
| Peak |  <p>Level (dBm/V/m)</p> <p>Frequency (MHz)</p> <p>Date: 2019-01-29</p> <p>PEAK_BE_74</p> <p>Site : 03CH15-HV Condition : PCMK_BE_74 3m 91200_I5_1620 HORIZONTAL Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 5</p> | Left blank |
| Avg. |  <p>Level (dBm/V/m)</p> <p>Frequency (MHz)</p> <p>Date: 2019-01-29</p> <p>AVG_BE_54</p> <p>Site : 03CH15-HV Condition : AVG_BE_54 3m 91200_I5_1620 HORIZONTAL Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 5</p> | Left blank |

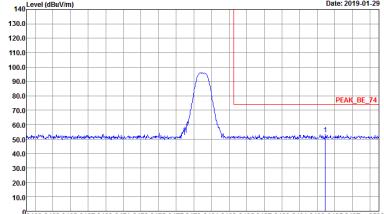
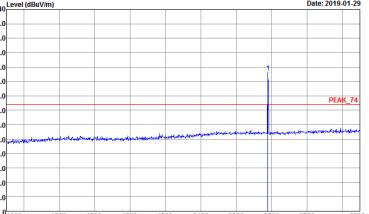
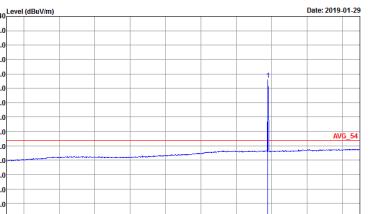


| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|--|
| | BLE CH19 2440MHz - L | |
| | Vertical | Fundamental |
| Peak |  <p>14 Level (dBm/V/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 5</p> |  <p>14 Level (dBm/V/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : PCAK_I74 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 5</p> |
| Avg. |  <p>14 Level (dBm/V/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 5</p> |  <p>14 Level (dBm/V/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : AVG_I54 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 5</p> |

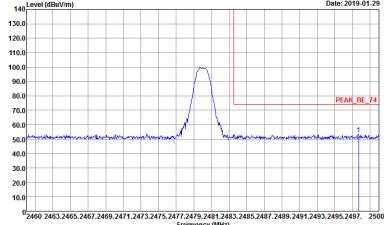
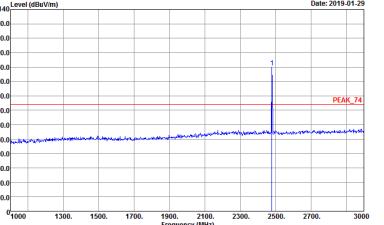
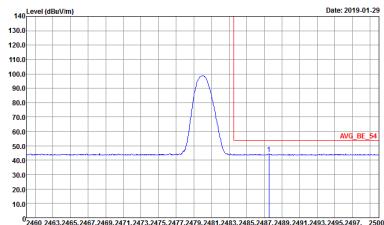


| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|-------------|
| | BLE CH19 2440MHz - R | |
| | Vertical | Fundamental |
| Peak |  <p>Site : 03CH15-HV Condition : PCMK_BE_74 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3.000KHz SWF:Auto Project : 911104 Mode : 5</p> | Left blank |
| Avg. |  <p>Site : 03CH15-HV Condition : AVG_BE_54 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3.000KHz SWF:Auto Project : 911104 Mode : 5</p> | Left blank |



| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|---|
| | BLE CH39 2480MHz | |
| | Horizontal | Fundamental |
| Peak |  <p>140 Level (dBm/V/m) Date: 2019-01-29</p> <p>130.0 120.0 110.0 100.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0</p> <p>2400 2463.2465.2467.2469.2471.2473.2475.2477.2479.2481.2483.2485.2487.2489.2491.2493.2495.2497. 2500</p> <p>Frequency (MHz)</p> <p>Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_I5_1620 HORIZONTAL Detector : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 6</p> |  <p>140 Level (dBm/V/m) Date: 2019-01-29</p> <p>130.0 120.0 110.0 100.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0</p> <p>1000 1300. 1500. 1700. 1900. 2100. 2300. 2500. 2700. 3000</p> <p>Frequency (MHz)</p> <p>Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_I5_1620 HORIZONTAL Detector : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 6</p> |
| Avg. |  <p>140 Level (dBm/V/m) Date: 2019-01-29</p> <p>130.0 120.0 110.0 100.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0</p> <p>2400 2463.2465.2467.2469.2471.2473.2475.2477.2479.2481.2483.2485.2487.2489.2491.2493.2495.2497. 2500</p> <p>Frequency (MHz)</p> <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_I5_1620 HORIZONTAL Detector : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 6</p> |  <p>140 Level (dBm/V/m) Date: 2019-01-29</p> <p>130.0 120.0 110.0 100.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0</p> <p>1000 1300. 1500. 1700. 1900. 2100. 2300. 2500. 2700. 3000</p> <p>Frequency (MHz)</p> <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_I5_1620 HORIZONTAL Detector : RBW:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 6</p> |

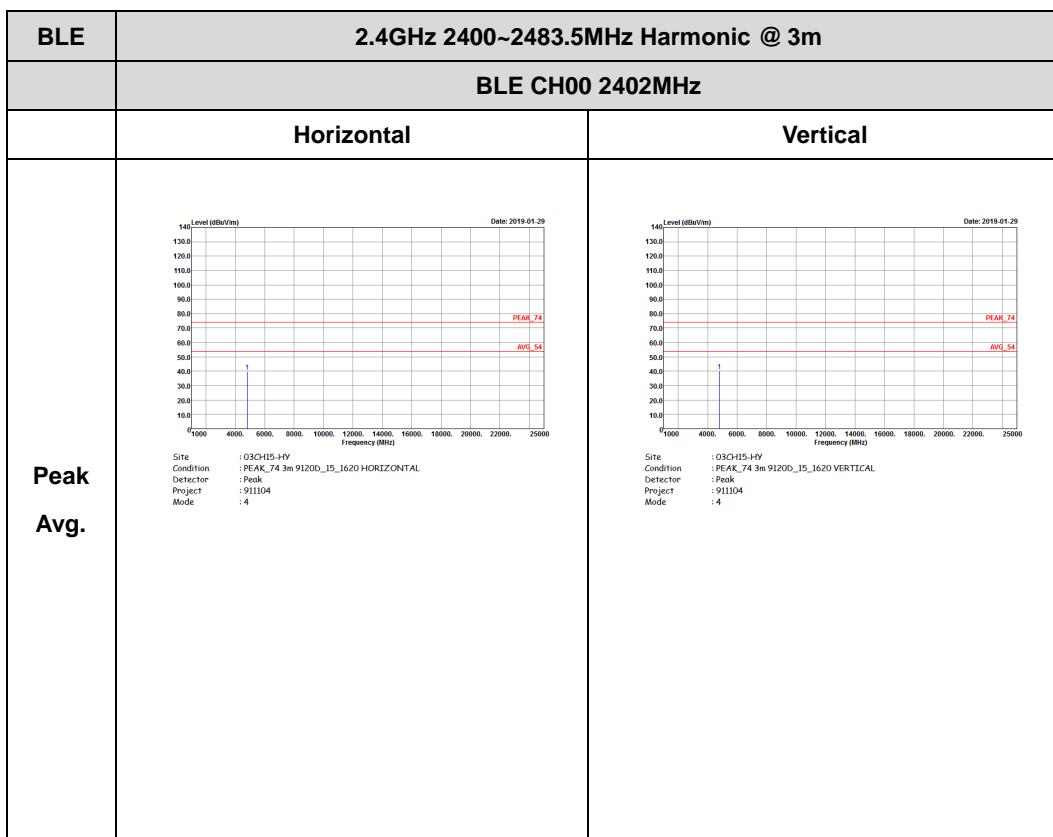


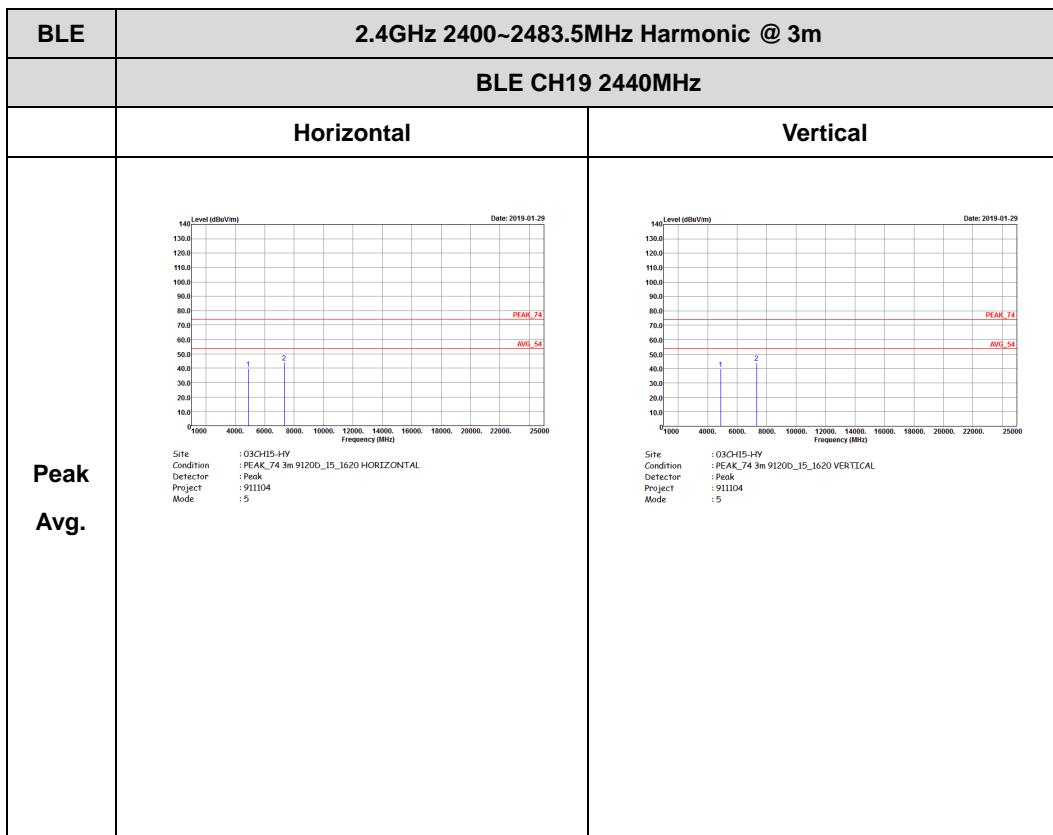
| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|-------------|
| | BLE CH39 2480MHz | |
| | Vertical | Fundamental |
| Peak |  Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 6  Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 6 | |
| Avg. |  Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 6  Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3.000KHz SWT:Auto Project : 911104 Mode : 6 | |

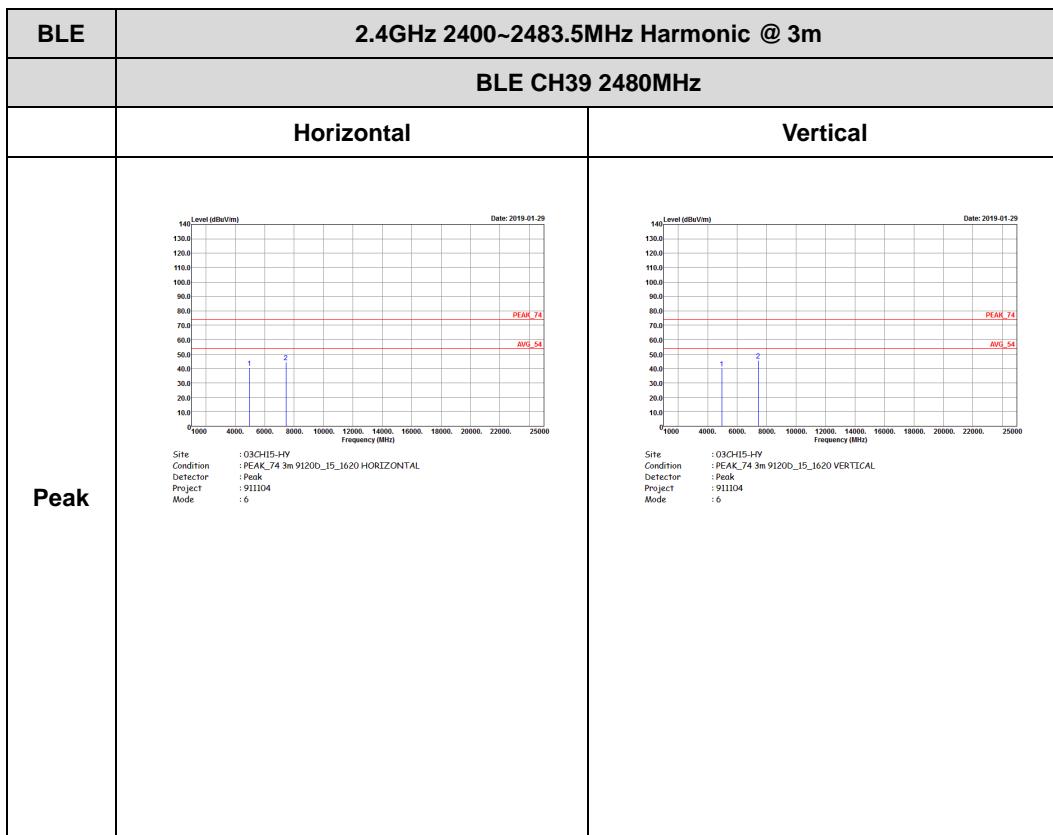


2.4GHz 2400~2483.5MHz

BLE 1Mbps (Harmonic @ 3m)



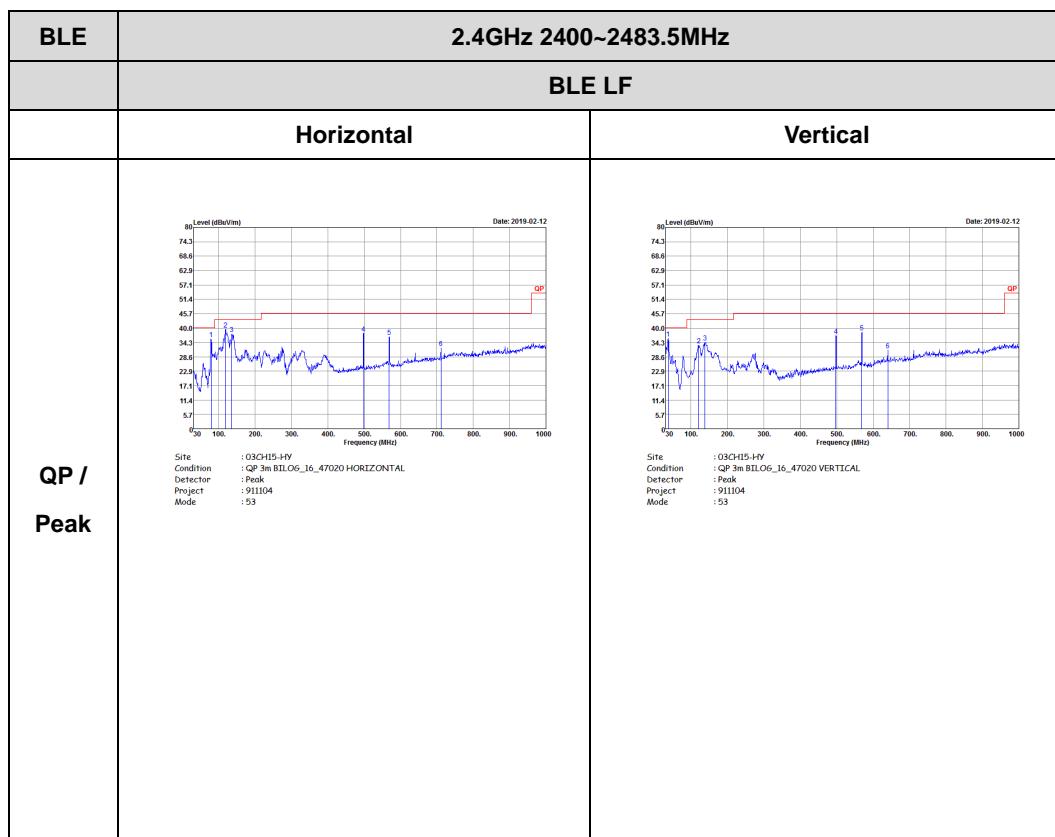






Emission below 1GHz

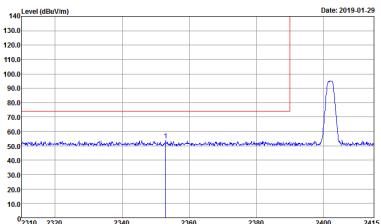
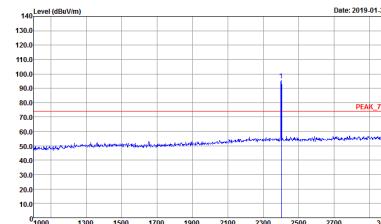
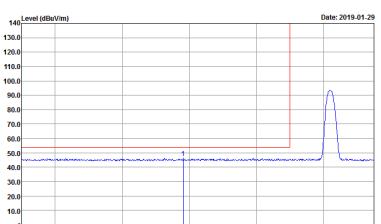
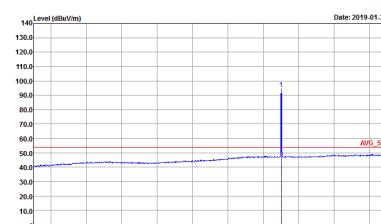
2.4GHz BLE 1Mbps (LF)



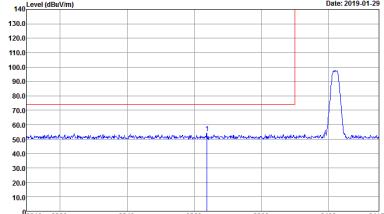
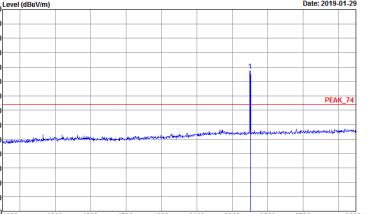
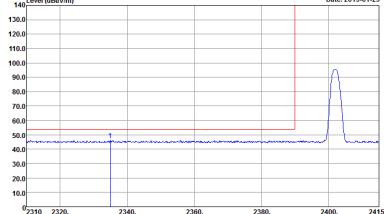
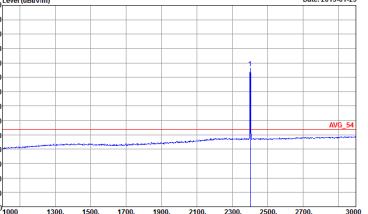


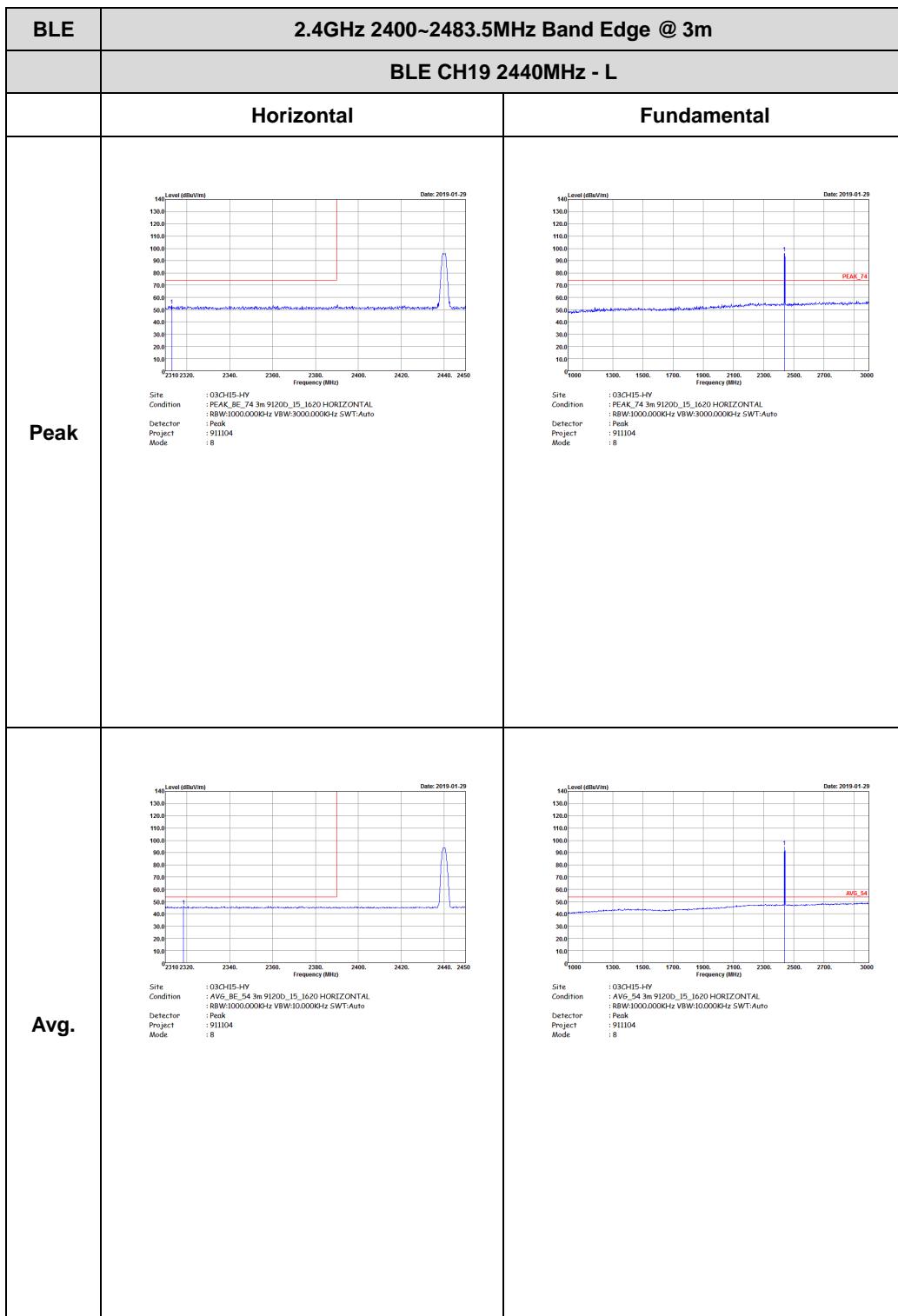
2.4GHz 2400~2483.5MHz

BLE 2Mbps (Band Edge @ 3m)

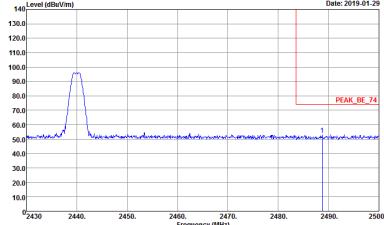
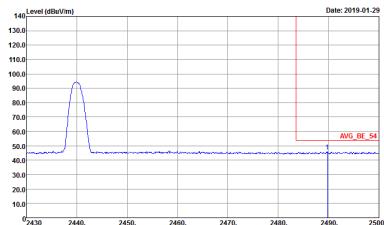
| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|--|
| | BLE CH00 2402MHz | |
| | Horizontal | Fundamental |
| Peak |  <p>14 Level (dBuV/m) Date: 2019-01-29 2310 2320. 2340. 2360. 2380. 2400. 2415 Frequency (MHz) Site : 03CH15-HY Condition : PEAK_BE_74_3m_91200_15_1620_HORIZONTAL Detector : R8W:1000.000kHz VBW:3000.000Hz SWT:Auto Project : 911104 Mode : 7</p> |  <p>14 Level (dBuV/m) Date: 2019-01-29 1000 1300. 1500. 1700. 1900. 2100. 2300. 2500. 2700. 3000 Frequency (MHz) Site : 03CH15-HY Condition : PEAK_74_3m_91200_15_1620_HORIZONTAL Detector : R8W:1000.000kHz VBW:3000.000Hz SWT:Auto Project : 911104 Mode : 7</p> |
| Avg. |  <p>14 Level (dBuV/m) Date: 2019-01-29 2310 2320. 2340. 2360. 2380. 2400. 2415 Frequency (MHz) Site : 03CH15-HY Condition : AVG_BE_54_3m_91200_15_1620_HORIZONTAL Detector : R8W:1000.000kHz VBW:10.000kHz SWT:Auto Project : 911104 Mode : 7</p> |  <p>14 Level (dBuV/m) Date: 2019-01-29 1000 1300. 1500. 1700. 1900. 2100. 2300. 2500. 2700. 3000 Frequency (MHz) Site : 03CH15-HY Condition : AVG_54_3m_91200_15_1620_HORIZONTAL Detector : R8W:1000.000kHz VBW:10.000kHz SWT:Auto Project : 911104 Mode : 7</p> |



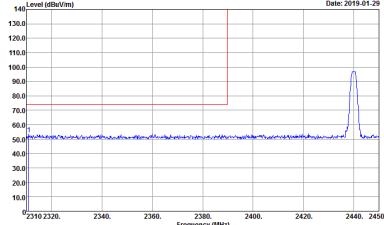
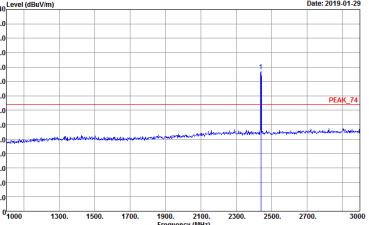
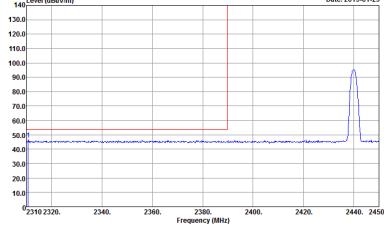
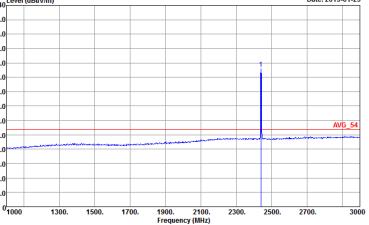
| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|---|
| | BLE CH00 2402MHz | |
| | Vertical | Fundamental |
| Peak |  <p>Level (dBuV/m) vs Frequency (MHz) for Peak Vertical. The plot shows a sharp peak at 2402MHz. The x-axis ranges from 2310 to 2415 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m. The peak is labeled '1'. The plot is dated 2019-01-29.</p> <p>Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_I5_1620 VERTICAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : 911104 Mode : 7</p> |  <p>Level (dBuV/m) vs Frequency (MHz) for Peak Fundamental. The plot shows a sharp peak at 2402MHz. The x-axis ranges from 1000 to 3000 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m. The peak is labeled 'PEAK_74'. The plot is dated 2019-01-29.</p> <p>Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_I5_1620 VERTICAL Detector : RBW:1000.000KHz VBW:3000.000KHz SWT:Auto Project : 911104 Mode : 7</p> |
| Avg |  <p>Level (dBuV/m) vs Frequency (MHz) for Avg Vertical. The plot shows a sharp peak at 2402MHz. The x-axis ranges from 2310 to 2415 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m. The peak is labeled '1'. The plot is dated 2019-01-29.</p> <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_I5_1620 VERTICAL Detector : RBW:1000.000KHz VBW:10.000KHz SWT:Auto Project : 911104 Mode : 7</p> |  <p>Level (dBuV/m) vs Frequency (MHz) for Avg Fundamental. The plot shows a sharp peak at 2402MHz. The x-axis ranges from 1000 to 3000 MHz, and the y-axis ranges from 10.0 to 140.0 dBuV/m. The peak is labeled 'AVG_54'. The plot is dated 2019-01-29.</p> <p>Site : 03CH15-HY Condition : PCAK_BE_54 3m 91200_I5_1620 VERTICAL Detector : RBW:1000.000KHz VBW:10.000KHz SWT:Auto Project : 911104 Mode : 7</p> |



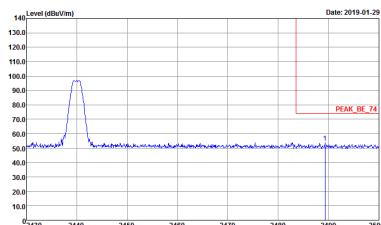
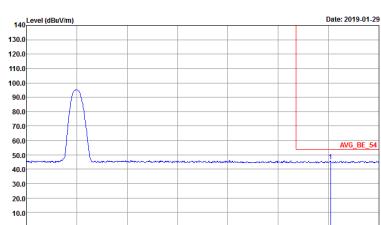


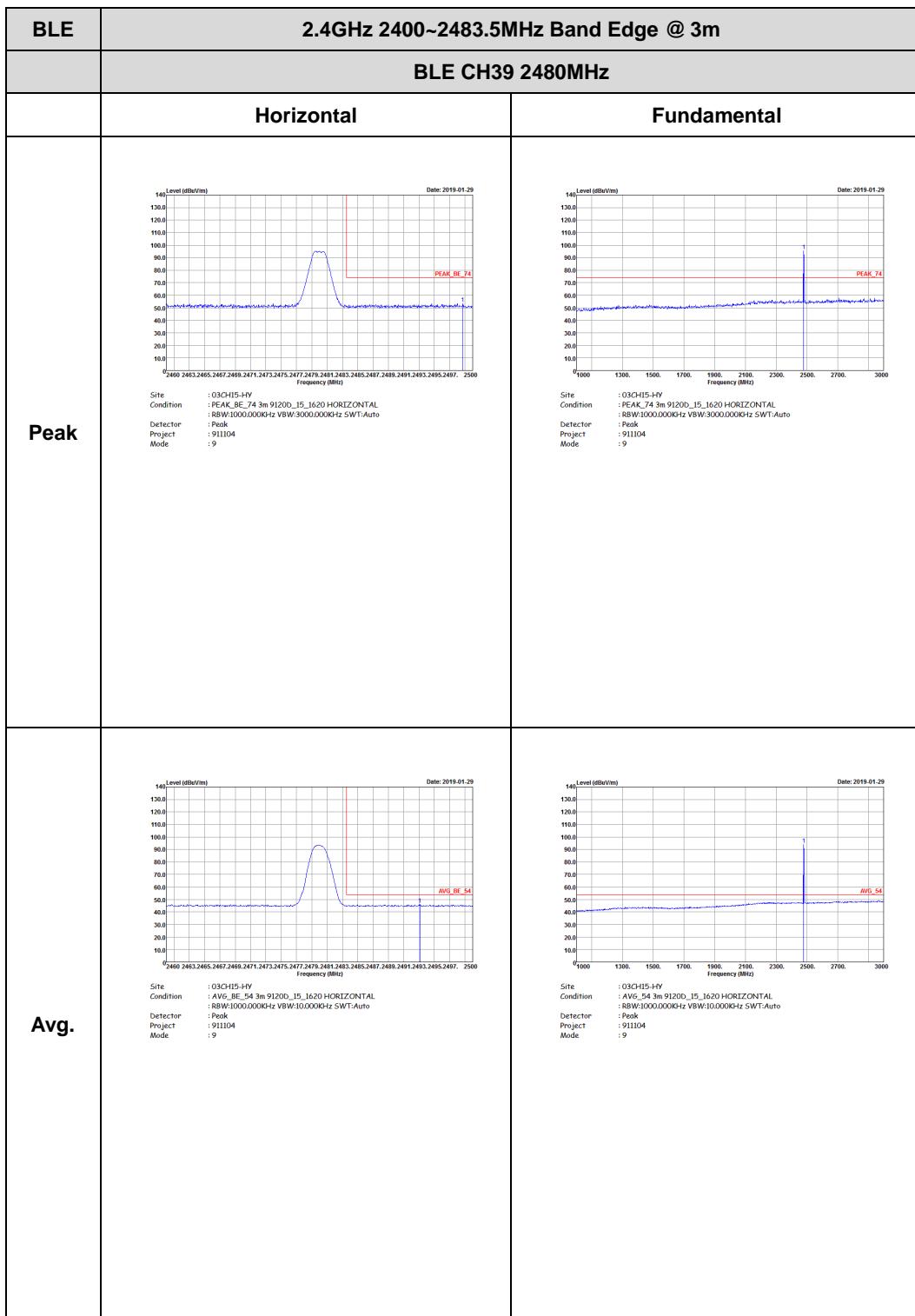
| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|-------------|
| | BLE CH19 2440MHz - R | |
| | Horizontal | Fundamental |
| Peak |  <p>Site : 03CH15-HV Condition : PCMK_BE_74 3m 91200_I5_1620 HORIZONTAL Detector : R8W:1000.000KHz VBW:3000.000KHz SWT:Auto Project : 911104 Mode : 8</p> | Left blank |
| Avg. |  <p>Site : 03CH15-HV Condition : AVG_BE_54 3m 91200_I5_1620 HORIZONTAL Detector : R8W:1000.000KHz VBW:10.000KHz SWT:Auto Project : 911104 Mode : 8</p> | Left blank |



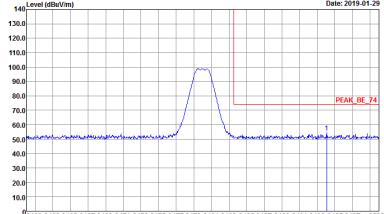
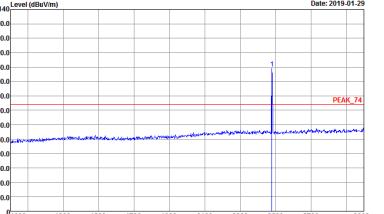
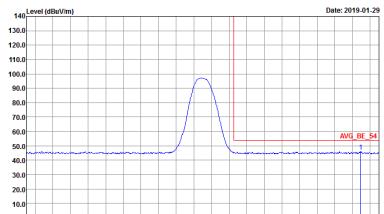
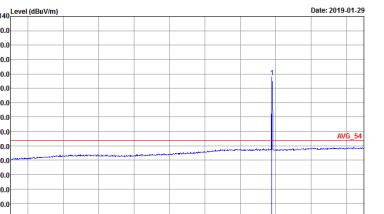
| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|---|--|
| | BLE CH19 2440MHz - L | |
| | Vertical | Fundamental |
| Peak |  <p>14 Level (dBm/V/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3000.000KHz SWT:Auto Project : 911104 Mode : 8</p> |  <p>14 Level (dBm/V/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3000.000KHz SWT:Auto Project : 911104 Mode : 8</p> |
| Avg. |  <p>14 Level (dBm/V/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:10.000KHz SWT:Auto Project : 911104 Mode : 8</p> |  <p>14 Level (dBm/V/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:10.000KHz SWT:Auto Project : 911104 Mode : 8</p> |



| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|-------------|
| | BLE CH19 2440MHz - R | |
| | Vertical | Fundamental |
| Peak |  <p>Level (dBm/1m) vs Frequency (MHz) plot. The x-axis ranges from 2430 to 2500 MHz, and the y-axis ranges from 10.0 to 140.0 dBm. A sharp peak is visible at approximately 2440 MHz, reaching about 95 dBm. A red step function highlights the peak. The plot is dated 2019-01-29.</p> <p>Site : 03CH15-HY Condition : PCMK_BE_74 3m 91200_I5_1620 VERTICAL Detector : R8W1000.000KHz VBW:3000.000KHz SWT:Auto Project : 911104 Mode : 8</p> | Left blank |
| Avg. |  <p>Level (dBm/1m) vs Frequency (MHz) plot. The x-axis ranges from 2430 to 2500 MHz, and the y-axis ranges from 10.0 to 140.0 dBm. A sharp peak is visible at approximately 2440 MHz, reaching about 95 dBm. A red step function highlights the peak. The plot is dated 2019-01-29.</p> <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_I5_1620 VERTICAL Detector : R8W1000.000KHz VBW:10.000KHz SWT:Auto Project : 911104 Mode : 8</p> | Left blank |



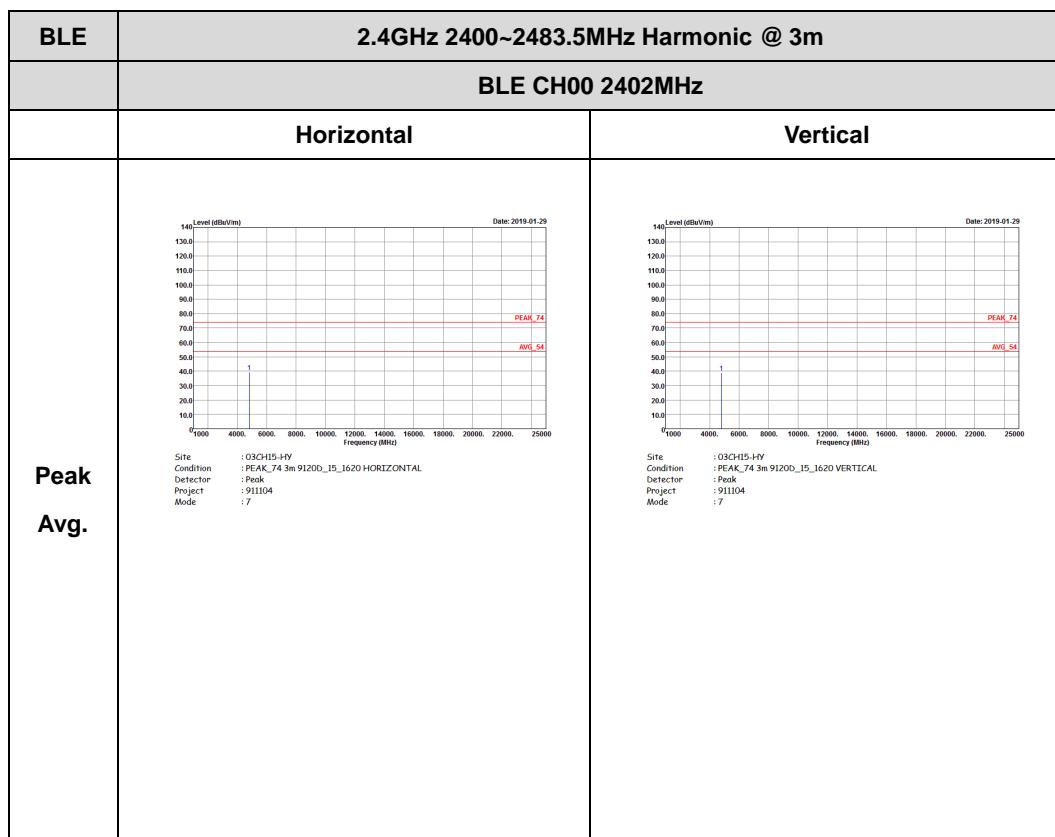


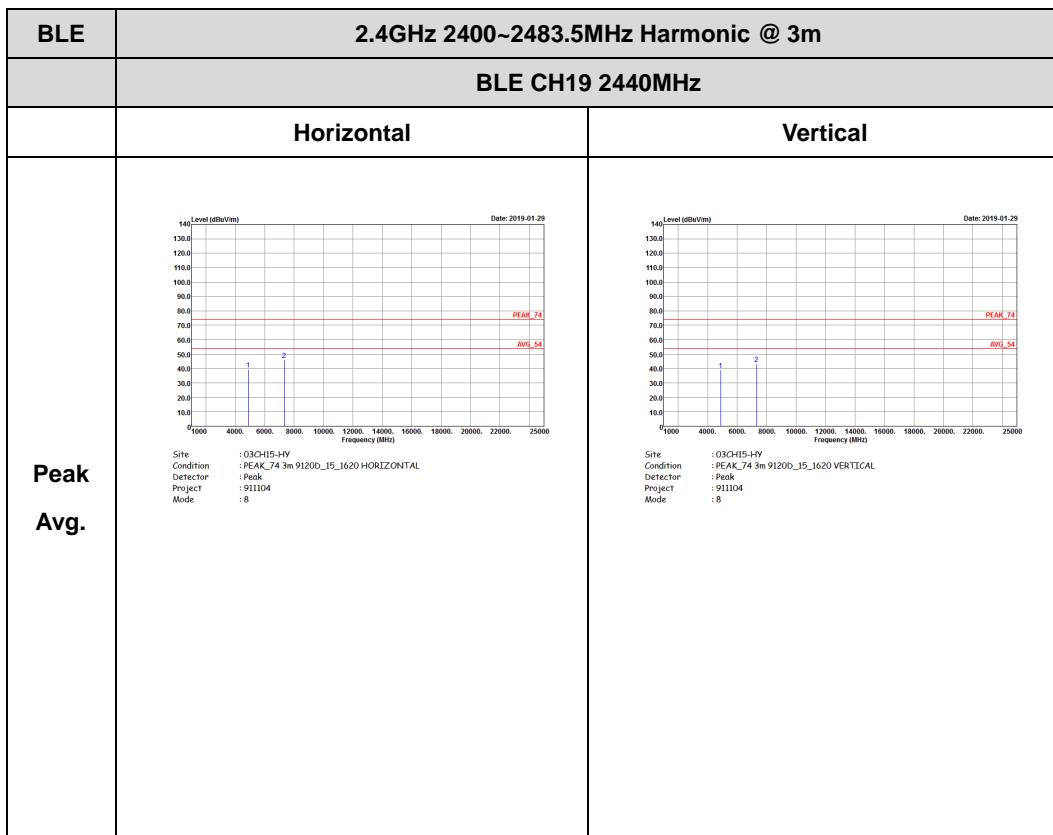
| BLE | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|------|--|---|
| | BLE CH39 2480MHz | |
| | Vertical | Fundamental |
| Peak |  <p>14 Level (dBuV/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3000.000KHz SWT:Auto Project : 911104 Mode : 9</p> |  <p>14 Level (dBuV/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : PCAK_BE_74 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:3000.000KHz SWT:Auto Project : 911104 Mode : 9</p> |
| Avg. |  <p>14 Level (dBuV/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:10.000KHz SWT:Auto Project : 911104 Mode : 9</p> |  <p>14 Level (dBuV/m) Date: 2019-01-29</p> <p>Site : 03CH15-HY Condition : AVG_BE_54 3m 91200_I5_1620 VERTICAL Detector : R8W:1000.000KHz VBW:10.000KHz SWT:Auto Project : 911104 Mode : 9</p> |

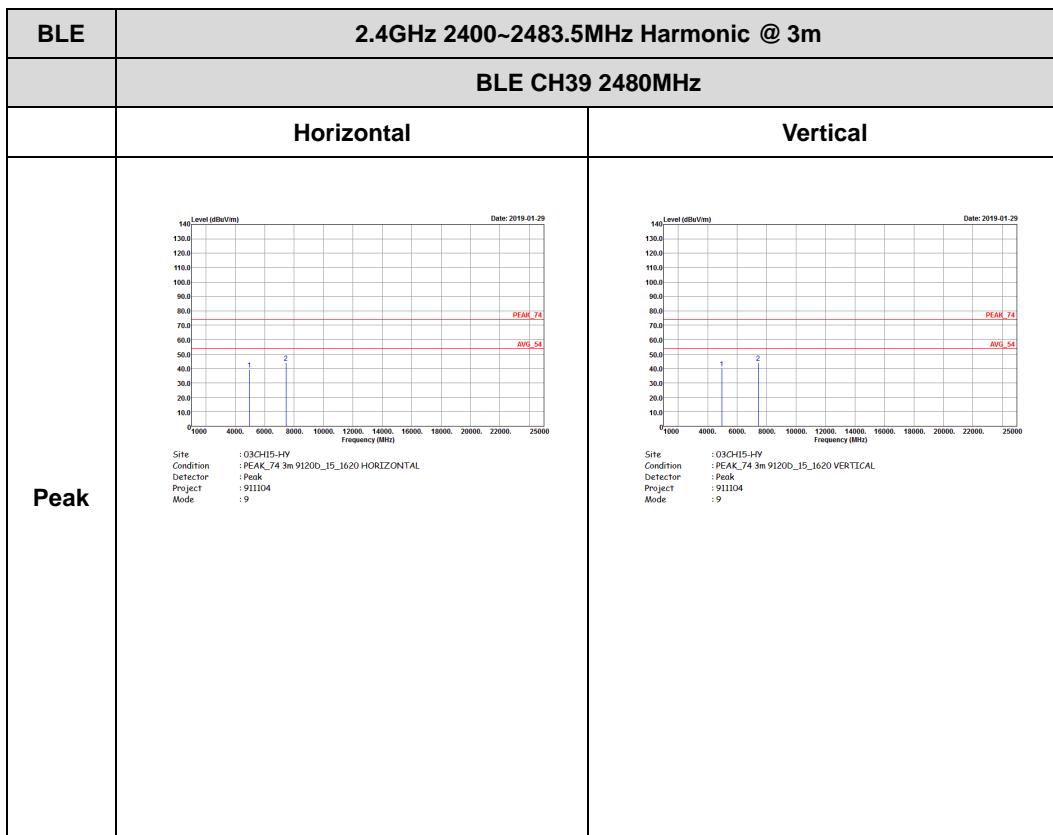


2.4GHz 2400~2483.5MHz

BLE 2Mbps (Harmonic @ 3m)



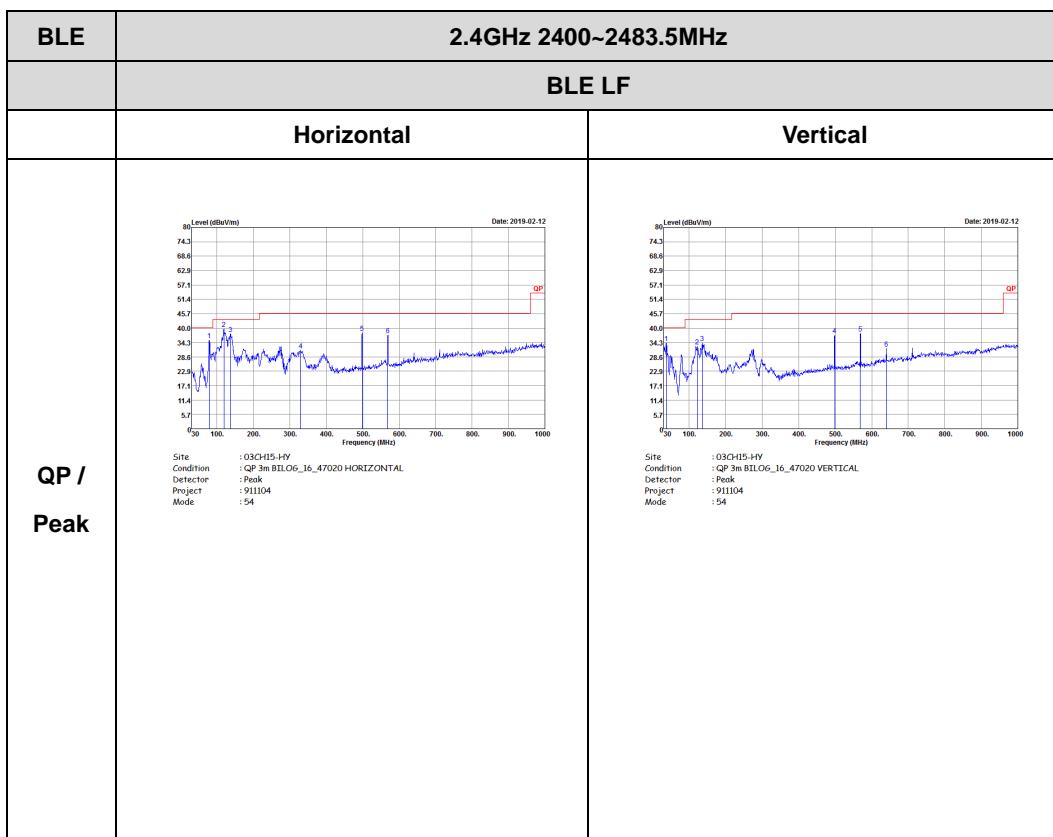






Emission below 1GHz

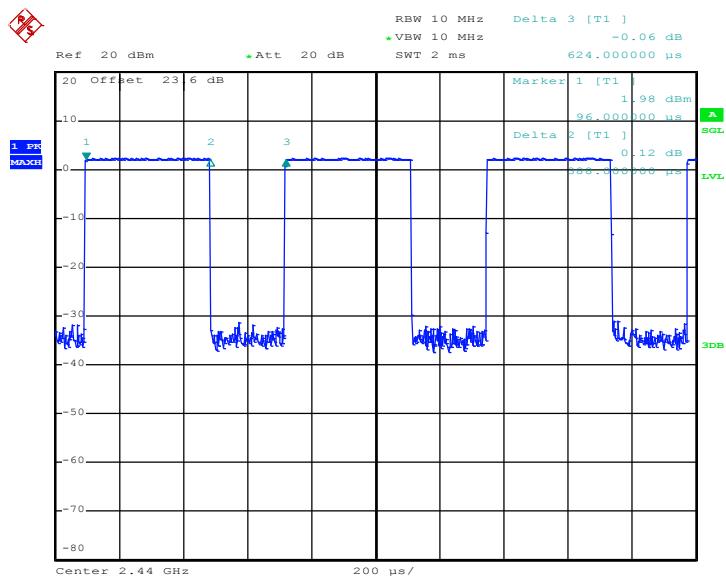
2.4GHz BLE 2Mbps (LF)



Appendix D. Duty Cycle Plots

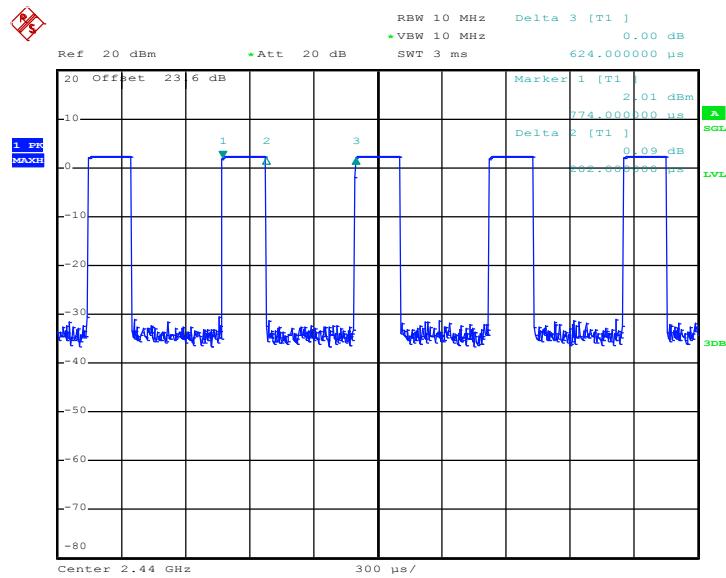
| Band | Duty Cycle (%) | T(us) | 1/T(kHz) | VBW Setting | Duty Factor (dB) |
|--------------------------|----------------|--------|----------|-------------|------------------|
| Bluetooth – LE for 1Mbps | 62.18 | 388.00 | 2.58 | 3kHz | 2.06 |
| Bluetooth – LE for 2Mbps | 32.37 | 202.00 | 4.81 | 10kHz | 4.90 |

Bluetooth – LE for 1Mbps



Date: 22.JAN.2019 21:25:48

Bluetooth – LE for 2Mbps



Date: 22.JAN.2019 21:28:36