

# **RADIO TEST REPORT**

**Product** : Gaming Headset

**Model Name** : PRO-HS

**FCC ID** : 2AYYS-PRO-HS

**Test Regulation** : FCC 47 CFR Part 15 Subpart C (Section 15.247)

**Received Date** : 2024/3/4

**Test Date** : 2024/3/12 ~ 2024/3/18

**Issued Date** : 2024/4/15

**Applicant** : Luxshare Precision Industry Co., Ltd.  
Floor 2,Block A,Sanyo New Industrial Area, West Haoyi  
Community,Shajing Subdistrict Office, Bao an District  
Shenzhen, P. R. China

**Issued By** : Underwriters Laboratories Taiwan Co., Ltd.  
Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd.,  
Zhudong Township, Hsinchu County, Taiwan



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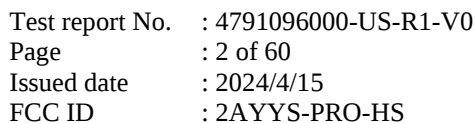
**Underwriters Laboratories Taiwan Co., Ltd.**

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Doc No: Form-ULID-004737 (DCS:17-EM-F0876) / 6.1



**Original Test Report No.: 4791096000-US-R1-V0**

[illegible]

Doc No: Form-ULID-004737 (DCS:17-EM-F0876) / 6.1

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## 1. Attestation of Test Results

**APPLICANT:** Luxshare Precision Industry Co., Ltd.  
Floor 2,Block A,Sanyo New Industrial Area, West Haoyi  
Community,Shajing Subdistrict Office, Bao an District Shenzhen, P.  
R. China

**MANUFACTURER:** Luxshare Precision Industry Co., Ltd.  
2nd floor,A building,Sanyo New Industrial Area,West of  
Maoyi,Shajing Street,Ban'an District,Shenzhen City,Guangdong  
Province,China

**EUT DESCRIPTION:** Gaming Headset

**BRAND:** ALIENWARE

**MODEL:** PRO-HS

**SAMPLE STAGE:** Engineering Verification Test sample

**DATE of TESTED:** 2024/3/12 ~ 2024/3/18

### APPLICABLE STANDARDS

| STANDARD                                      | Test Results |
|-----------------------------------------------|--------------|
| FCC 47 CFR PART 15 Subpart C (Section 15.247) | PASS         |

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:



Sally Lu  
Project Handler

Date : 2024/4/15

Approved and Authorized By:



Eric Lee  
Senior Laboratory Engineer

Date : 2024/4/15

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## 2. Summary of Test Results

| Summary of Test Results        |                                                 |        |
|--------------------------------|-------------------------------------------------|--------|
| FCC Clause                     | Test Items                                      | Result |
| 15.247(a)(2)                   | 6dB Bandwidth                                   | PASS   |
| 15.247(b)                      | Conducted Output Power                          | PASS   |
| 15.247(e)                      | Power Spectral Density                          | PASS   |
| 15.247(d)                      | Antenna Port Emission                           | PASS   |
| 15.205 / 15.209 /<br>15.247(d) | Radiated Emissions and<br>Band Edge Measurement | PASS   |
| 15.207                         | AC Power Conducted Emission                     | PASS   |
| 15.203                         | Antenna Requirement                             | PASS   |

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### 3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB558074 D01 Meas Guidance v05r02, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013.

### 4. Facilities and Accreditation

|                                  |                                                                                                 |
|----------------------------------|-------------------------------------------------------------------------------------------------|
| <b>Test Location</b>             | Underwriters Laboratories Taiwan Co., Ltd.                                                      |
| <b>Address</b>                   | Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan |
| <b>Accreditation Certificate</b> | Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.          |

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## 5. Measurement Uncertainty

For statement of conformity, Simple acceptance (Section 3.1.4 of IEC Guide 115) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor  $k=2$ .

Determining compliance based on the results of the compliance measurement, not considering measurement instrumentation uncertainty.

| Measurement                                    | Frequency      | Uncertainty |
|------------------------------------------------|----------------|-------------|
| Conducted disturbance at mains terminals ports | 150kHz ~ 30MHz | 3.1 dB      |
| RF Conducted                                   | 9 kHz - 40GHz  | 2.3 dB      |
| Radiated disturbance below 30MHz               | 9 kHz - 30 MHz | 3.2 dB      |
| Radiated disturbance below 1 GHz               | 30MHz ~ 1GHz   | 6.1 dB      |
| Radiated disturbance above 1 GHz               | 1GHz ~ 40GHz   | 5.1 dB      |

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## 6. Equipment under Test

### 6.1. Description of EUT

|                       |                                       |
|-----------------------|---------------------------------------|
| <b>Product</b>        | Gaming Headset                        |
| <b>Brand Name</b>     | ALIENWARE                             |
| <b>Model Name</b>     | PRO-HS                                |
| <b>Normal Voltage</b> | 5Vdc from host<br>3.7Vdc from battery |

|                             |                                                   |
|-----------------------------|---------------------------------------------------|
| <b>Operating Frequency</b>  | 2402MHz ~ 2480MHz                                 |
| <b>Modulation</b>           | GFSK                                              |
| <b>Transfer Rate</b>        | Up to 2 Mbps                                      |
| <b>Maximum Output Power</b> | 7.32 dBm                                          |
| <b>Sample ID</b>            | Conducted Test: 6998225<br>Radiated Test: 6998225 |

Note:

1. The EUT contains following accessory devices:

| <b>Product</b>    | <b>Brand</b>          | <b>Model</b>      | <b>Description</b>                        |
|-------------------|-----------------------|-------------------|-------------------------------------------|
| FT573439P Battery | Hangzhou Future Power | FT573439P         | 3.7Vdc, 750 mAh                           |
| Charging cable    | LUXSHARE              | HW7RR             | Length: 2m                                |
| USB Dongle        | ALIENWARE             | UD2202u           | Compliance Approval ID:<br>CCAQ22LP0250T6 |
| USB-C adapter     | DELL                  | LX001             | -                                         |
| Microphone        | ALIENWARE             | Pro-HS microphone | -                                         |

2. The EUT may have a lot of colors for marketing requirement.

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual, the laboratory shall not be held responsible.

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## 6.2. Channel List

40 channels are provided for BT-LE mode:

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

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### 6.3. Test Condition

| Test Item                          | Test Site No. | Environmental Condition | Input Power      | Test Date                 | Tested by |
|------------------------------------|---------------|-------------------------|------------------|---------------------------|-----------|
| Antenna Port Conducted Measurement | SR4           | 22~26°C/<br>62~68%RH    | 5Vdc &<br>3.7Vdc | 2024/03/15~<br>2024/03/18 | Rex Chen  |
| Radiated Spurious Emission         | 966-2         | 22~26°C/<br>62~68%RH    | 5Vdc &<br>3.7Vdc | 2024/03/12~<br>2024/03/15 | Rex Chen  |
| AC power Line Conducted Emission   | SR1           | 22~26°C/<br>62~68%RH    | 5Vdc &<br>3.7Vdc | 2024/03/14~<br>2024/03/15 | Rex Chen  |

FCC Test Firm Registration Number: 498077

IC Company Number: 23421

### Sample Calculation:

#### Antenna Port Conducted Measurement:

- Where relevant, the follow sample calculation is provided:  
Result Value (dBm) = Reading Value (dBm) + Attenuator Factor (dB) + Cable Loss (dB).  
Example: Result Value (10dBm) = Reading Value (-2dBm) + Attenuator Factor (10dB) + Cable Loss(2dB).  
\*Test plot only shown the “Result Value”.

#### Radiated Spurious Emission:

- Where relevant, the follow sample calculation is provided:  
Result Value (dBuV/m) = Reading Value (dBuV) + Correction Factor (dB/m).  
Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) - Preamp Factor (dB).  
Example: Result Value (34.5dBuV/m) = Reading Value (40.1dBuV) + Antenna Factor (18.7dB/m) + Cable Loss (4.2dB) - Preamp Factor (28.5dB).

#### AC power Line Conducted Emission:

- Where relevant, the follow sample calculation is provided:  
Result Value (dBuV) = Reading Value (dBuV) + Correction Factor (dB).  
Correction Factor (dB) = Insertion loss(dB) + Cable loss(dB).  
Example: Result Value (53.7dBuV) = Reading Value (35.1dBuV) + Insertion loss(18.1dB) + Cable loss(0.5dB).

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#### 6.4. Description of Available Antennas

| Ant. No. | Transmitter Circuit | Brand Name | Model Name | Ant. Type | Frequency Band (MHz) | Maximum Gain (dBi) |
|----------|---------------------|------------|------------|-----------|----------------------|--------------------|
| 0        | Chain 0             | Top-link   | 24001136   | Monopole  | 2400~2500            | 1.24               |

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual, the laboratory shall not be held responsible.

## 6.5. Test Mode Applicability and Tested Channel Detail

- The fundamental of the EUT was investigated in three orthogonal axes X-Y/Y-Z/X-Z, it was determined that X-Y plane was worst-case. Therefore, all final radiated testing was performed with the EUT in X-Y plane.
- For Antenna Port Conducted Measurement, this item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.
- For below 1 GHz radiated emission and AC power line conducted emission have performed all modes of operation were investigated and the worst-case emissions are reported.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

| Test Item                          | Modulation Type | Available Channel | Test Channel | Data Rate |
|------------------------------------|-----------------|-------------------|--------------|-----------|
| Radiated Emissions                 | GFSK            | 0 to 39           | 0,19,39      | 1 Mbps    |
|                                    | GFSK            | 1 to 38           | 1,19,38      | 2 Mbps    |
| Radiated Emissions (Below 1GHz)    | GFSK            | 0 to 39           | 0            | 1 Mbps    |
| AC Power Line Conducted Emission   | GFSK            | 0 to 39           | 0            | 1 Mbps    |
|                                    |                 |                   |              | 2 Mbps    |
| Antenna Port Conducted Measurement | GFSK            | 0 to 39           | 0,19,39      | 1 Mbps    |
|                                    | GFSK            | 1 to 38           | 1,19,38      | 2 Mbps    |

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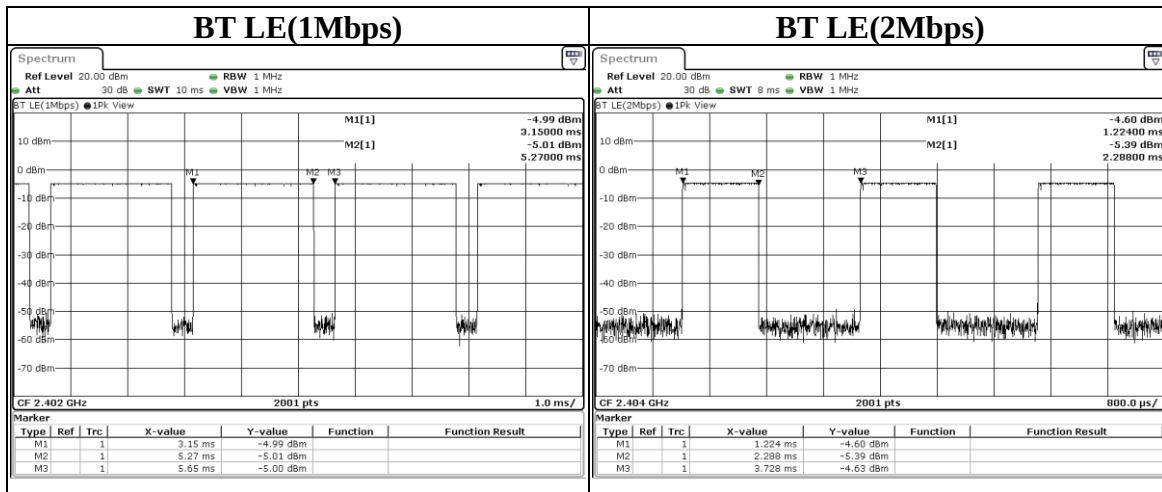
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## 6.6. Duty cycle

| Mode         | On Time (ms) | On+Off Time (ms) | Duty Cycle | Duty Factor (dB) | VBW Set (above 1GHz) |
|--------------|--------------|------------------|------------|------------------|----------------------|
| BT LE(1Mbps) | 2.120        | 2.500            | 0.8480     | 0.72             | 510Hz                |
| BT LE(2Mbps) | 1.064        | 2.504            | 0.4249     | 3.72             | 1kHz                 |



## 7. Test Equipment

| Test Equipment List                          |                    |                         |                     |            |              |
|----------------------------------------------|--------------------|-------------------------|---------------------|------------|--------------|
| Equipment                                    | Manufacturer       | Model No.               | Serial No.          | Cal. Date  | Expired date |
| Radiated Spurious Emission                   |                    |                         |                     |            |              |
| Spectrum Analyzer                            | Keysight           | N9010A                  | MY56070827          | 2023/4/7   | 2024/4/6     |
| EMI Test Receiver                            | Rohde & Schwarz    | ESR7                    | 101754              | 2023/11/22 | 2024/11/21   |
| Loop Antenna                                 | ETS lindgren       | 6502                    | 00213440            | 2023/12/13 | 2024/12/12   |
| Trilog-Broadband Antenna with 5dB Attenuator | Schwarzbeck & EMCI | VULB 9168 & N-6-05      | 774 & AT-N0538      | 2024/1/5   | 2025/1/4     |
| Horn Antenna (1-18 GHz)                      | Schwarzbeck        | BBHA 9120 D             | 01690               | 2023/12/8  | 2024/12/7    |
| Horn Antenna (18-40 GHz)                     | Schwarzbeck        | BBHA 9170               | 781                 | 2023/12/27 | 2024/12/26   |
| Preamplifier (30-1000 MHz)                   | EMCI               | EMC330E                 | 980405              | 2023/6/7   | 2024/6/6     |
| Preamplifier (1-18 GHz)                      | EMCI               | EMC051835BE             | 980406              | 2024/1/23  | 2025/1/22    |
| Preamplifier (18-40GHz)                      | EMCI               | EMC184040SEE            | 980426              | 2023/5/9   | 2024/5/8     |
| Cables (9k-18 GHz)                           | Hanyitek           | K1K50-UP0264-K1K50-2500 | 170214-4 & 170425-2 | 2023/11/29 | 2024/11/28   |
| Cables (18-40GHz)                            | Hanyitek           | K1K50-UP0264-K1K50-2500 | 170214-1 & 170214-2 | 2023/11/29 | 2024/11/28   |

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| Test Equipment List                 |                 |                   |                       |            |              |
|-------------------------------------|-----------------|-------------------|-----------------------|------------|--------------|
| Equipment                           | Manufacturer    | Model No.         | Serial No.            | Cal. Date  | Expired date |
| Antenna Port Conducted Measurement  |                 |                   |                       |            |              |
| Signal Analyzer                     | Rohde & Schwarz | FSVA3044          | 101281                | 2023/3/21  | 2024/3/20    |
| Signal Analyzer                     | Rohde & Schwarz | FSV40             | 101490                | 2023/9/13  | 2024/9/12    |
| Attenuator                          | EMCI            | EMC-40ATK2W10     | 17002                 | 2023/11/15 | 2024/11/14   |
| USB Power Sensor                    | Anritsu         | MA24408A          | 12031                 | 2023/7/12  | 2024/7/11    |
| Temperature & Humidity Test Chamber | GIANT FORCE     | GTH-150- 40-CP-AR | MAA1701-010           | 2024/3/6   | 2025/3/5     |
| AC power Line Conducted Emission    |                 |                   |                       |            |              |
| EMI Test Receiver                   | Rohde & Schwarz | ESR7              | 101753                | 2023/10/23 | 2024/10/22   |
| Two-Line V-Network                  | Rohde & Schwarz | ENV216            | 102136                | 2023/5/24  | 2024/5/23    |
| Impuls-Begrenzer Pulse Limiter      | Rohde & Schwarz | ESH3-Z2           | 102219-Qt             | 2023/9/7   | 2024/9/6     |
| Cables                              | TITAN           | CFD200            | T0732ACFD 20020A300-2 | 2023/5/23  | 2024/5/22    |

| UL Software                      |                        |               |
|----------------------------------|------------------------|---------------|
| Description                      | Name                   | Version       |
| Radiated measurement             | e3                     | 6.191211 (V6) |
| Conducted measurement            | RF-Conducted-FCC 15247 | ver 1.0       |
| AC power Line Conducted Emission | EZ_EMG                 | UL-3A1.2      |

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## 8. Description of Test Setup

### Normal Mode

#### Support Equipment

| ID | Equipment  | Brand Name | Model Name        | S/N     | Remark            |
|----|------------|------------|-------------------|---------|-------------------|
| A  | Laptop     | DELL       | Latitude E5470    | CXSKWF2 | Provide by Lab    |
| B  | Microphone | ALIENWARE  | Pro-HS microphone | NA      | Provide by Client |

#### I/O Cables

| ID | Equipment      | Brand Name | Model Name | Length (m) | Remark            |
|----|----------------|------------|------------|------------|-------------------|
| 1  | Charging cable | LUXSHARE   | HW7RR      | 2          | Provide by Client |

### Charging Mode

#### Support Equipment

| ID | Equipment  | Brand Name | Model Name        | S/N          | Remark            |
|----|------------|------------|-------------------|--------------|-------------------|
| A  | Adapter    | HTC        | TCP900-US         | 79H00130-01M | Provide by Lab    |
| B  | Microphone | ALIENWARE  | Pro-HS microphone | NA           | Provide by Client |

#### I/O Cables

| ID | Equipment      | Brand Name | Model Name | Length (m) | Remark            |
|----|----------------|------------|------------|------------|-------------------|
| 1  | Charging cable | LUXSHARE   | HW7RR      | 2          | Provide by Client |

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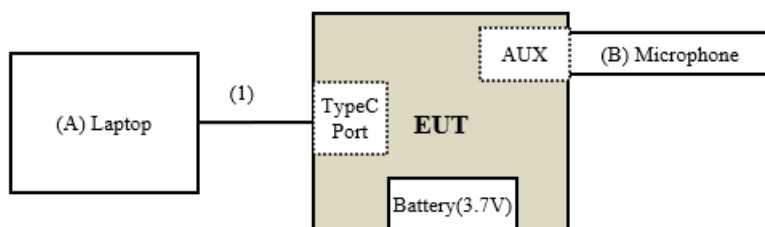
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## Test Setup

Controlled using a bespoke application (Airoha Tool Kit – V3.8.0.6) on a test Notebook. The application was used to enable a continuous transmission mode and to select the test channels, data rates, modulation schemes and power setting as required.

## Setup Diagram for Test

### Normal Mode



-----  
**Under Table**

-----  
**Remote Site**

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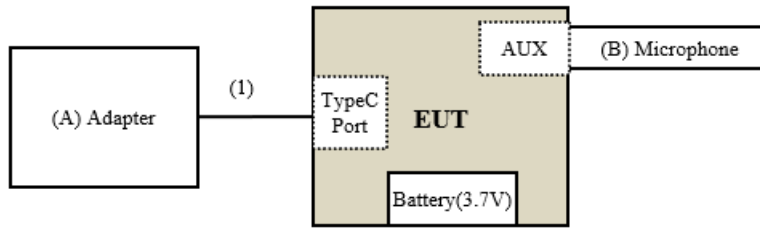
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## Charging Mode



Under Table

Remote Site

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## 9. Test Results

### 9.1. 6dB Bandwidth

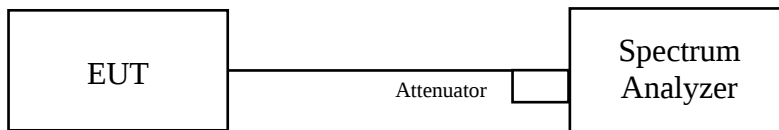
#### Requirements

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

#### Test procedure

- Set resolution bandwidth (RBW) = 100kHz.
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

#### Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

**Test Data**

| Mode            | CH | Freq<br>(MHz) | 6dB BW<br>(MHz) | Limit<br>(MHz) | Result |
|-----------------|----|---------------|-----------------|----------------|--------|
| BT<br>LE(1Mbps) | 0  | 2402          | 0.664           | 0.5            | PASS   |
| BT<br>LE(1Mbps) | 19 | 2440          | 0.659           | 0.5            | PASS   |
| BT<br>LE(1Mbps) | 39 | 2480          | 0.655           | 0.5            | PASS   |
| BT<br>LE(2Mbps) | 1  | 2404          | 1.241           | 0.5            | PASS   |
| BT<br>LE(2Mbps) | 19 | 2440          | 1.238           | 0.5            | PASS   |
| BT<br>LE(2Mbps) | 38 | 2478          | 1.241           | 0.5            | PASS   |

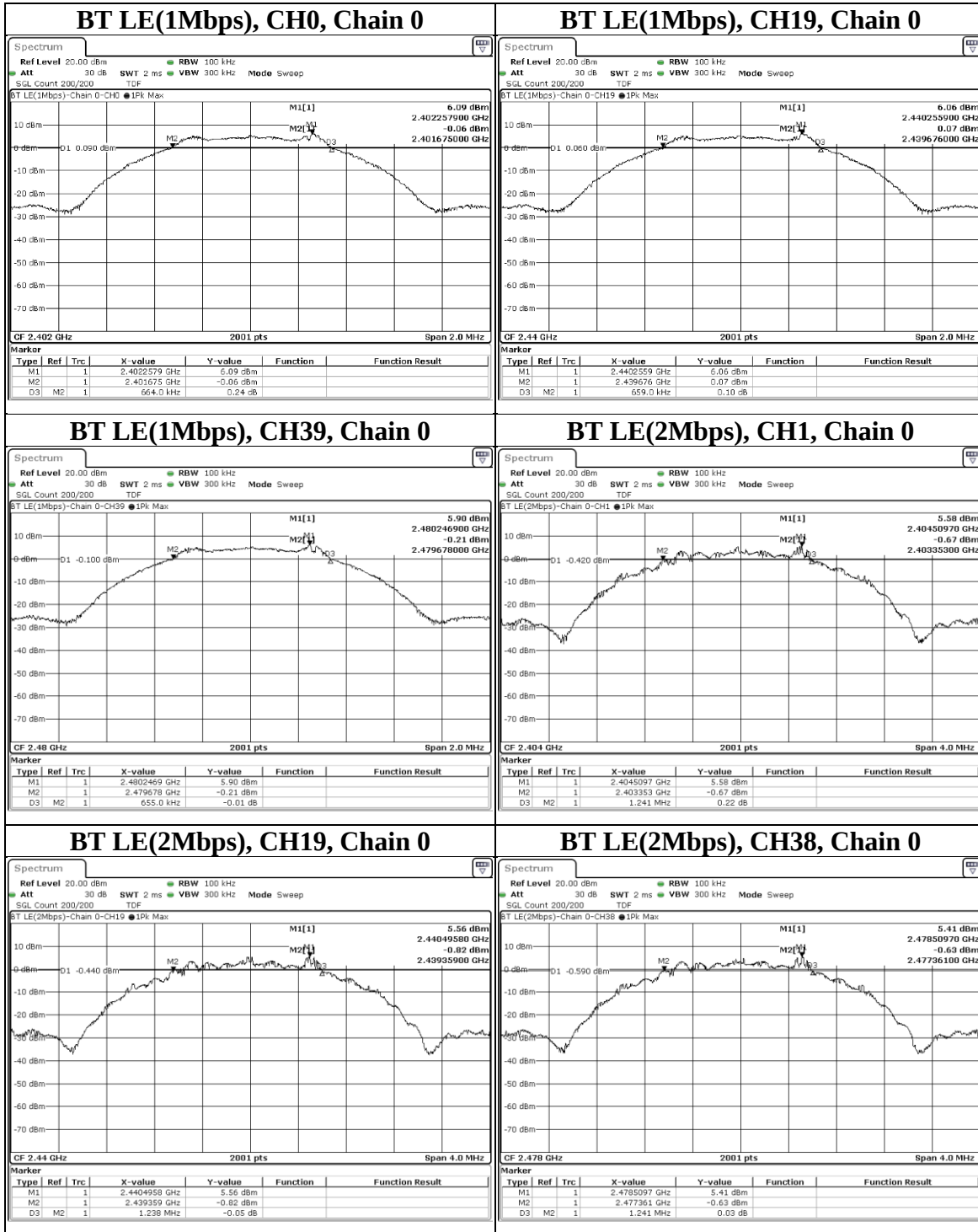
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## 9.2. Conducted Output Power

### Requirements

For systems using digital modulation in the 2400-2483.5 MHz bands: 1 Watt.

Note:

1.  $P_{\text{Out}}$  = maximum conducted output power in dBm,  $G_{\text{TX}}$  = the maximum transmitting antenna directional gain in dBi, B is the 26 dB emission bandwidth in megahertz
2. If EUT with Multiple Transmitter Output:
  - a. Directional Gain =  $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{Gn/20})^2 / \text{Nant}]$  dBi.  
Nant: Number of Transmit Antennas  
G1, G2,..., Gn: Gain of Individual Antennas  
Example: two antenna and gain 5 dBi / 3dBi, so if it was used for TxBF power measurement  
Directional Gain =  $10 \log[(105/20 + 103/20)^2 / 2]$  dBi = 7.07 dBi
  - b. Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices, CDD  
Array Gain = 0 dB (i.e., no array gain) for  $\text{NANT} \leq 4$ ;  
Array Gain = 0 dB (i.e., no array gain) for channel widths  $\geq 40$  MHz for any NANT;  
Array Gain =  $5 \log(\text{NANT}/\text{NSS})$  dB or 3 dB, whichever is less for 20-MHz channel widths with  $\text{NANT} \geq 5$ .  
Example: Maximum antenna gain = 5 dBi and  $\text{NANT} \leq 4$ , so if it was used for CDD power measurement  
Directional Gain = 5 dBi + Array Gain = 5 dBi + 0 dB = 5 dBi
  - c. For power measurement of KDB 662911 is used with multiple transmitter output. Total conducted power is the sum of the conducted power levels measured at the various output ports.

### Test Procedure

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.  
added to measured value.

- a. Set the RBW  $\geq$  DTS bandwidth.
- b. Set VBW  $\geq 3 \times$  RBW.
- c. Set span  $\geq 3 \times$  RBW.
- d. Sweep time = auto couple.
- e. Detector = peak.
- f. Trace mode = max hold.
- g. Allow trace to fully stabilize.
- h. Use peak marker function to determine the peak amplitude level.

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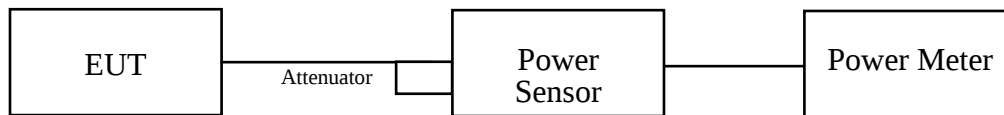
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### Test Setup



The loss between RF output port of the EUT and the input port of the Power Meter has been taken into consideration.

**Test Data****Peak Power****BT LE\_1Mbps**

| Channel | Frequency (MHz) | Peak Power (mW) | Peak Power (dBm) | Limit (dBm) | Pass/Fail |
|---------|-----------------|-----------------|------------------|-------------|-----------|
| 0       | 2402            | 5.395           | 7.32             | 30          | PASS      |
| 19      | 2440            | 5.297           | 7.24             | 30          | PASS      |
| 39      | 2480            | 5.176           | 7.14             | 30          | PASS      |

**BT LE\_2Mbps**

| Channel | Frequency (MHz) | Peak Power (mW) | Peak Power (dBm) | Limit (dBm) | Pass/Fail |
|---------|-----------------|-----------------|------------------|-------------|-----------|
| 1       | 2404            | 5.37            | 7.30             | 30          | PASS      |
| 19      | 2440            | 5.297           | 7.24             | 30          | PASS      |
| 38      | 2478            | 5.164           | 7.13             | 30          | PASS      |

**Average Power (Reference Only)****BT LE\_1Mbps**

| Channel | Frequency (MHz) | Average Power (mW) | Average Power (dBm) |
|---------|-----------------|--------------------|---------------------|
| 0       | 2402            | 5.248              | 7.20                |
| 19      | 2440            | 5.164              | 7.13                |
| 39      | 2480            | 5.047              | 7.03                |

**BT LE\_2Mbps**

| Channel | Frequency (MHz) | Average Power (mW) | Average Power (dBm) |
|---------|-----------------|--------------------|---------------------|
| 1       | 2404            | 5.224              | 7.18                |
| 19      | 2440            | 5.14               | 7.11                |
| 38      | 2478            | 5.023              | 7.01                |

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## 9.3. Power Spectral Density

### Requirements

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz (If  $G_{TX} > 6$  dBi, then  $PSD = 8 - (G_{TX} - 6)$ ).

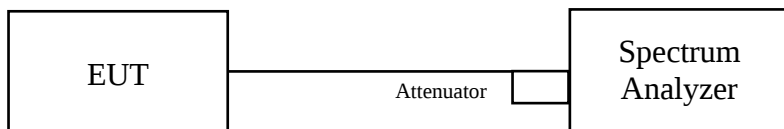
Note:

1. PSD = power spectral density that he same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz.
2.  $G_{TX}$  = the maximum transmitting antenna directional gain in dBi.
3. If EUT with Multiple Transmitter Output:
  - a. Directional Gain =  $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{Gn/20})^2 / Nant]$  dBi.  
Nant: Number of Transmit Antennas  
G1, G2,..., Gn: Gain of Individual Antennas  
Example: two antenna and gain 5 dBi / 3dBi, so if it was used for power density measurement  
Directional Gain =  $10 \log[(10^{5/20} + 10^{3/20})^2 / 2]$  dBi = 7.07 dBi
  - b. "PSD per chain" of the report shown is maximum value for each chain, at the "Total PSD" is summing entire spectra across corresponding frequency bins on the various outputs by computer, refer KDB 662911 Method a) for calculating total power density.
  - c. Method a) of power density measurement of KDB 662911 is used for calculating total power density with multiple transmitter output. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.

### Test procedure

- a. Set analyzer center frequency to DTS channel center frequency.
- b. Set the span to 1.5 times the DTS bandwidth.
- c. Set the RBW to:  $3 \text{ kHz} \leq RBW \leq 100 \text{ kHz}$ .
- d. Set the VBW  $\geq 3 \times RBW$ .
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level within the RBW.

### Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

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**Test Data**

| Mode            | CH | Freq<br>(MHz) | PSD<br>(dBm/3kHz) | Limit<br>(dBm/3kHz) | Result |
|-----------------|----|---------------|-------------------|---------------------|--------|
| BT<br>LE(1Mbps) | 0  | 2402          | -10.52            | 8                   | PASS   |
| BT<br>LE(1Mbps) | 19 | 2440          | -10.84            | 8                   | PASS   |
| BT<br>LE(1Mbps) | 39 | 2480          | -11.05            | 8                   | PASS   |
| BT<br>LE(2Mbps) | 1  | 2404          | -12.69            | 8                   | PASS   |
| BT<br>LE(2Mbps) | 19 | 2440          | -13.24            | 8                   | PASS   |
| BT<br>LE(2Mbps) | 38 | 2478          | -12.64            | 8                   | PASS   |

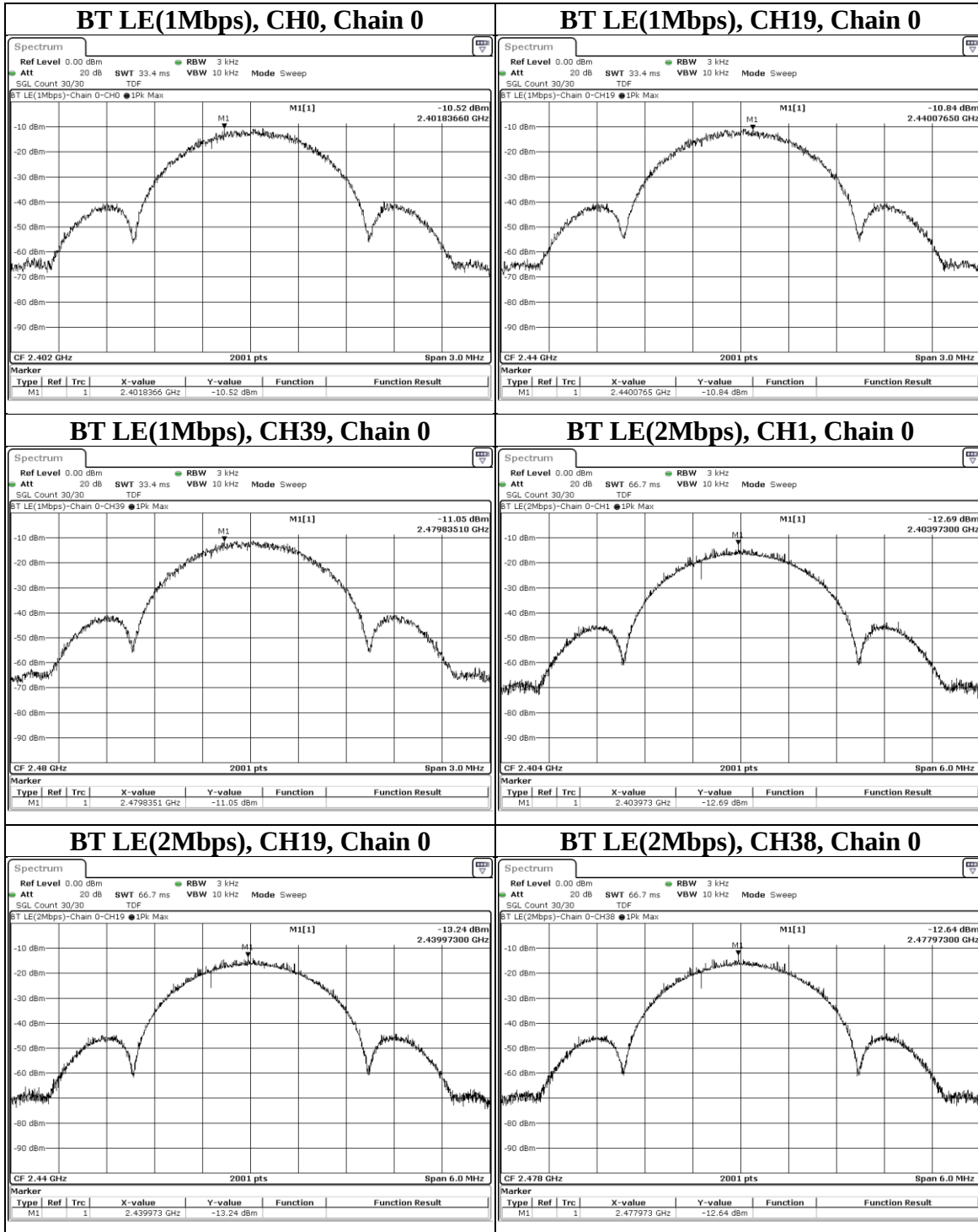
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## 9.4. Conducted Out of Band Emission

### Requirements

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b) (3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209 (a) is not required.

### Test procedure

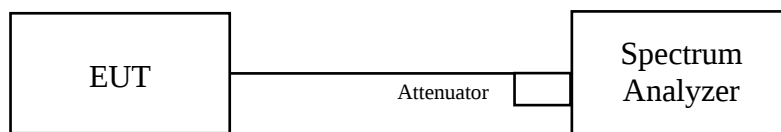
Measurement Procedure REF

1. Set the RBW = 100 kHz.
2. Set the VBW  $\geq$  300 kHz.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Measurement Procedure OOBE

1. Set RBW = 100 kHz.
2. Set VBW  $\geq$  300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

### Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

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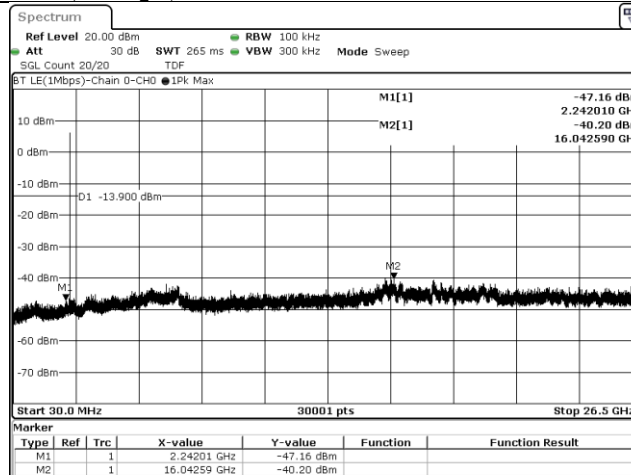
Doc No: Form-ULID-004737 (DCS:17-EM-F0876) / 6.1

## Test Data

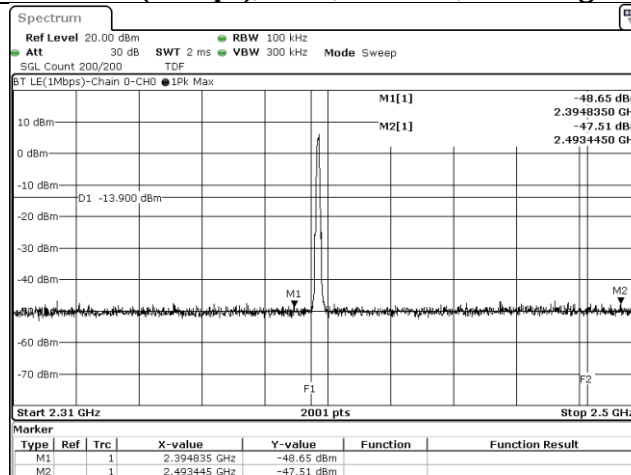
### BT LE(1Mbps), CH0, Chain 0, Reference



### BT LE(1Mbps), CH0, Chain 0, Conducted Emission



### BT LE(1Mbps), CH0, Chain 0, Bandedge



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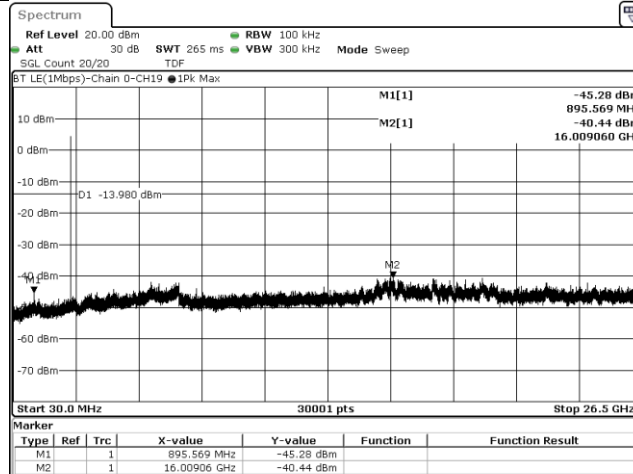
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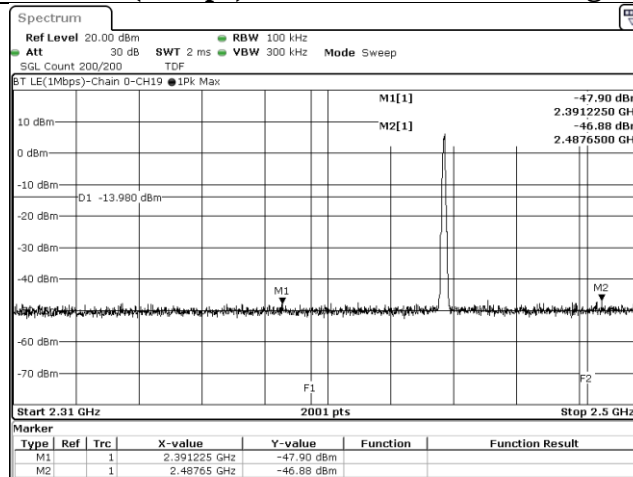
### BT LE(1Mbps), CH19, Chain 0, Reference



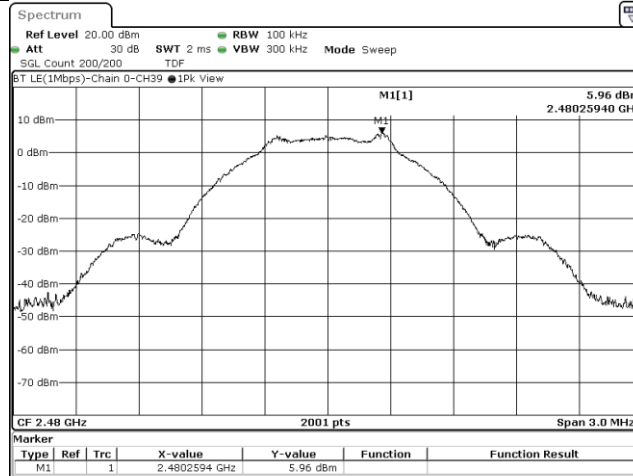
### BT LE(1Mbps), CH19, Chain 0, Conducted Emission



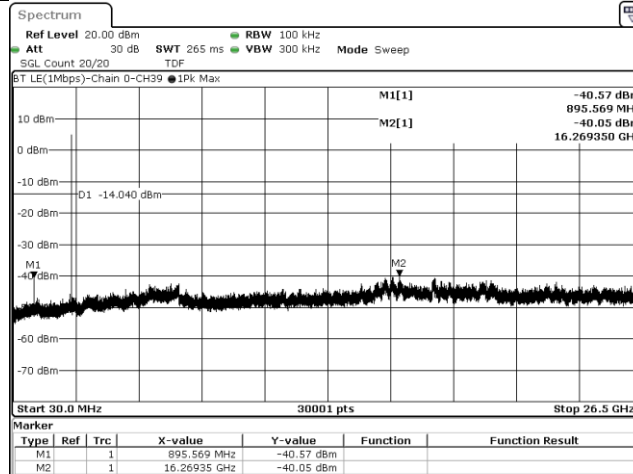
### BT LE(1Mbps), CH19, Chain 0, Bandedge



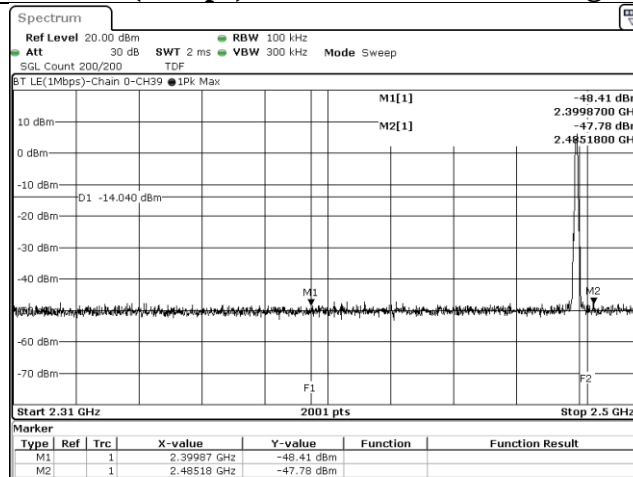
### BT LE(1Mbps), CH39, Chain 0, Reference



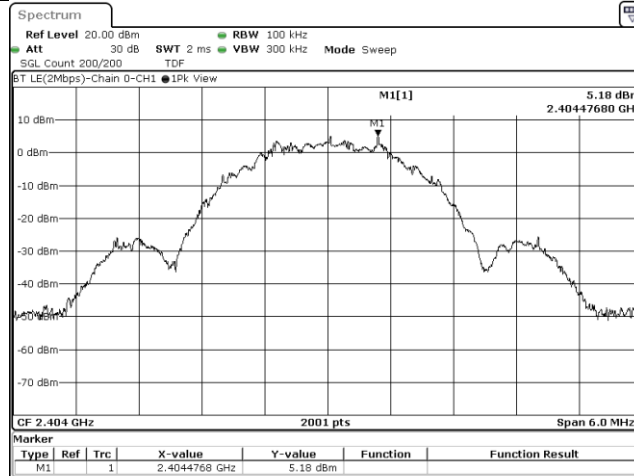
### BT LE(1Mbps), CH39, Chain 0, Conducted Emission



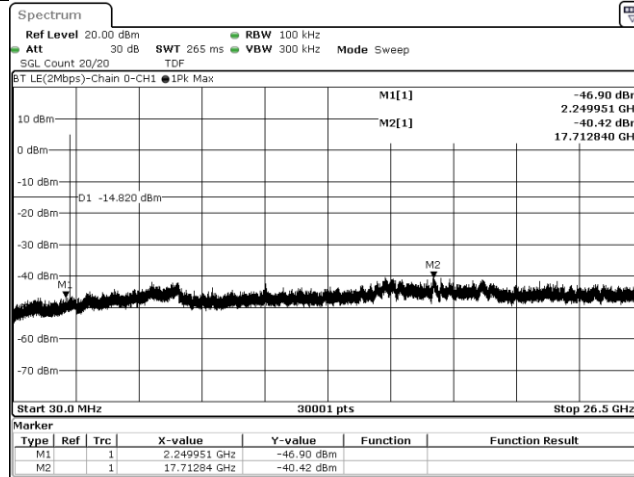
### BT LE(1Mbps), CH39, Chain 0, Bandedge



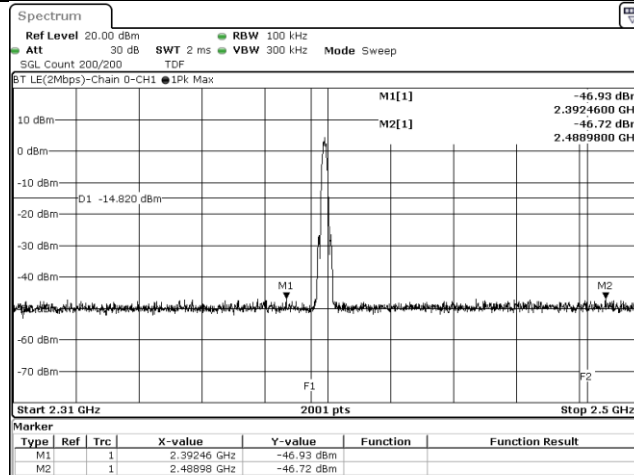
### BT LE(2Mbps), CH1, Chain 0, Reference



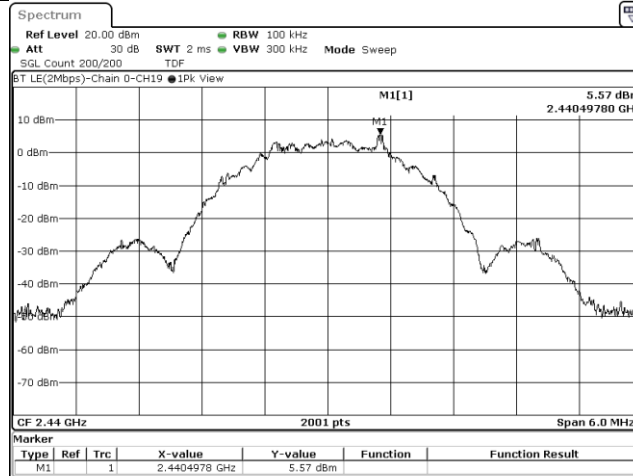
### BT LE(2Mbps), CH1, Chain 0, Conducted Emission



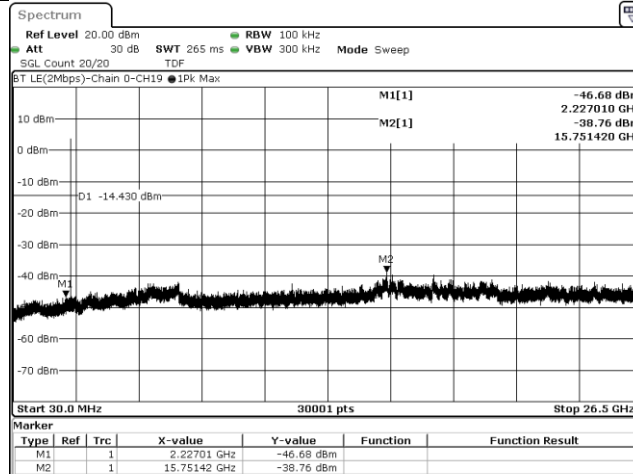
### BT LE(2Mbps), CH1, Chain 0, Bandedge



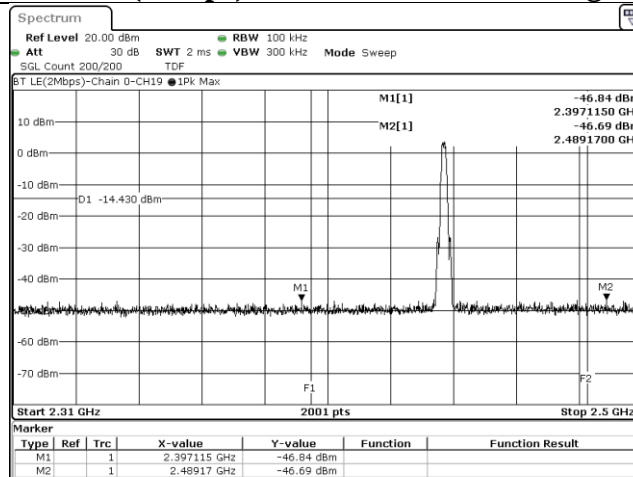
### BT LE(2Mbps), CH19, Chain 0, Reference



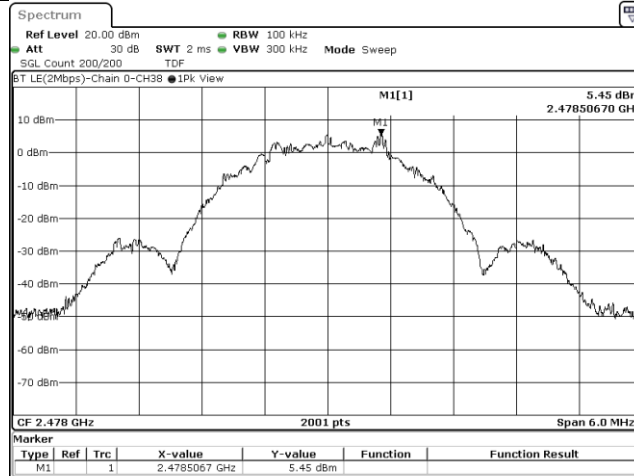
### BT LE(2Mbps), CH19, Chain 0, Conducted Emission



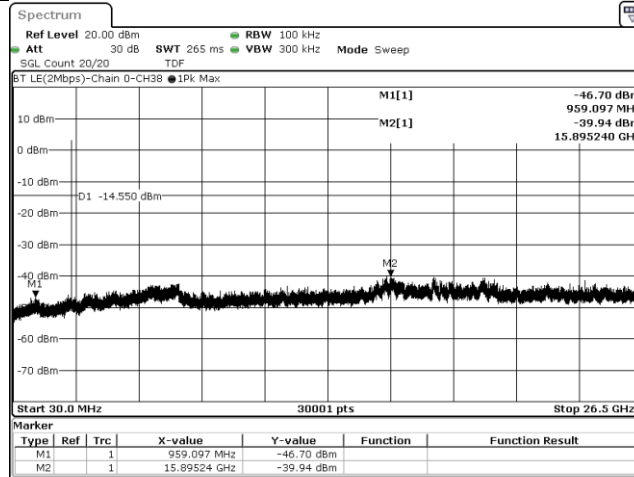
### BT LE(2Mbps), CH19, Chain 0, Bandedge



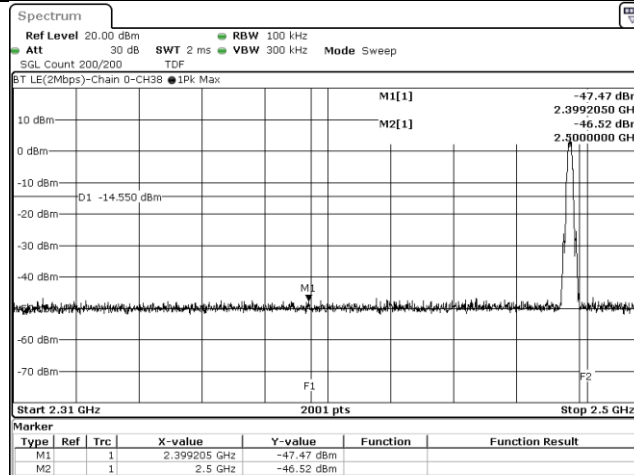
### BT LE(2Mbps), CH38, Chain 0, Reference



### BT LE(2Mbps), CH38, Chain 0, Conducted Emission



### BT LE(2Mbps), CH38, Chain 0, Bandedge



## 9.5. Radiated Spurious Emission

### Requirements

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

| Frequency(MHz) | Field strength<br>(microvolts/meter) | Measurement distance<br>(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                                |

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

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## **Test Procedures**

[For 9 kHz ~ 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

**NOTE:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

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**Note:**

- a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- b. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is  $\geq 1/T$  (Duty cycle  $< 98\%$ ) or 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.

**Peak**

| Frequency      | RBW     | VBW     |
|----------------|---------|---------|
| 9 kHz~150 kHz  | 200 Hz  | 600 Hz  |
| 150 kHz~30 MHz | 10 kHz  | 30 kHz  |
| 30 MHz~1 GHz   | 120 kHz | 360 kHz |
| Above 1GHz     | 1 MHz   | 3 MHz   |

**Average for above 1GHz**

| RBW  | VBW                                  |
|------|--------------------------------------|
| 1MHz | Refer to section 6.6 for duty cycle. |

- d. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported, the other emission levels were low against the limit.
- e. Test data of Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
- f. Test data of Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
- g. Test data of Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) - Preamp Factor (dB).
- h. Test data of Notation "@" = Fundamental Frequency
- i. Test data of Notation "\*" = The peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.

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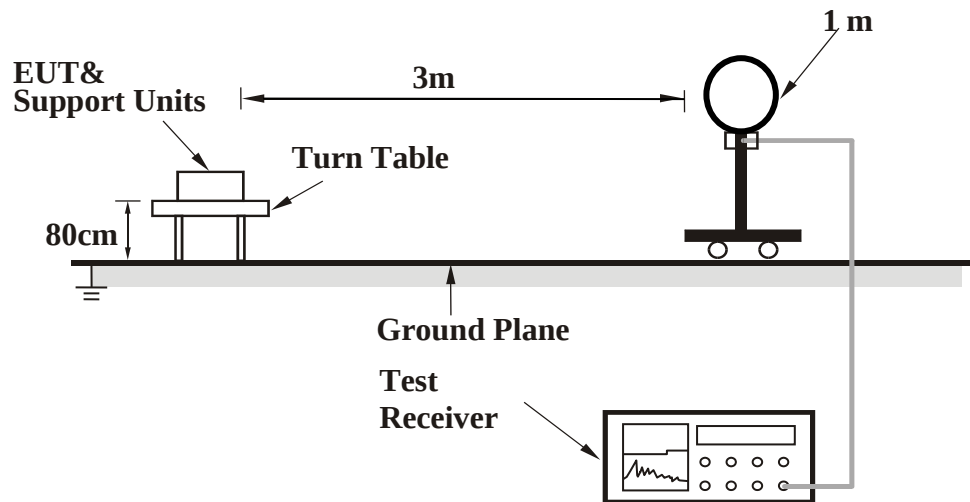
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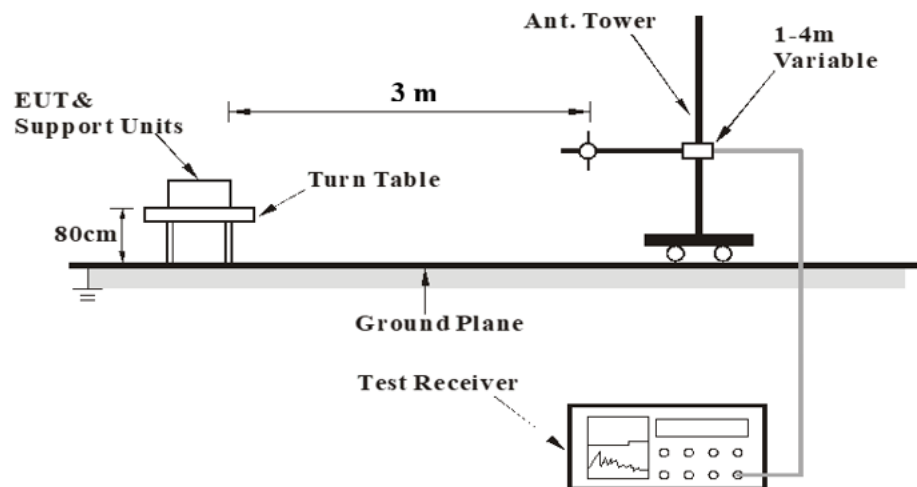
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## Test Setup

<Frequency Range 9 kHz ~ 30 MHz>



<Frequency Range 30 MHz ~ 1 GHz >



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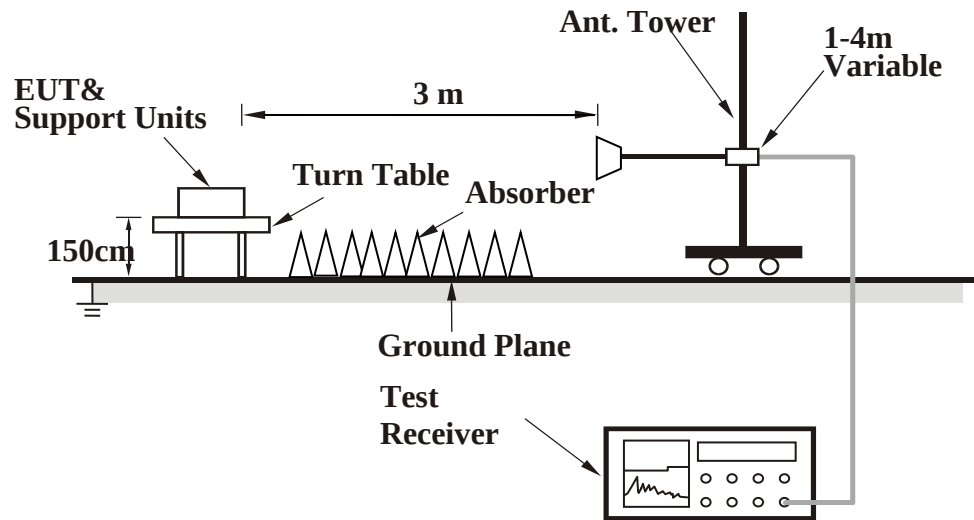
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<Frequency Range above 1 GHz>



For the actual test configuration, please refer to the Setup Configurations.

## Test Data

### Above 1 GHz

|      |             |         |   |
|------|-------------|---------|---|
| Mode | BT-LE-1Mbps | Channel | 0 |
|------|-------------|---------|---|

| Polarization | Notation | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>(dB/m) | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|--------------|----------|--------------------|-------------------|-------------------|--------------------|-------------------|----------------|--------|
| Horizontal   |          | 2313.04            | 28.3              | 12.81             | 41.11              | 54                | -12.89         | AVG    |
|              |          | 2343.82            | 40.15             | 12.68             | 52.83              | 74                | -21.17         | PK     |
|              | @        | 2402               | 90.61             | 12.43             | 103.04             | N/A               | N/A            | PK     |
|              | @        | 2402               | 90.25             | 12.43             | 102.68             | N/A               | N/A            | AVG    |
|              | *        | 4804               | 36                | 2.88              | 38.88              | 74                | -35.12         | PK     |
| Vertical     |          | 2335.27            | 40.32             | 12.72             | 53.04              | 74                | -20.96         | PK     |
|              |          | 2338.31            | 29.1              | 12.71             | 41.81              | 54                | -12.19         | AVG    |
|              | @        | 2402               | 100.04            | 12.43             | 112.47             | N/A               | N/A            | PK     |
|              | @        | 2402               | 99.26             | 12.43             | 111.69             | N/A               | N/A            | AVG    |
|              | *        | 4804               | 37.02             | 2.88              | 39.9               | 74                | -34.1          | PK     |

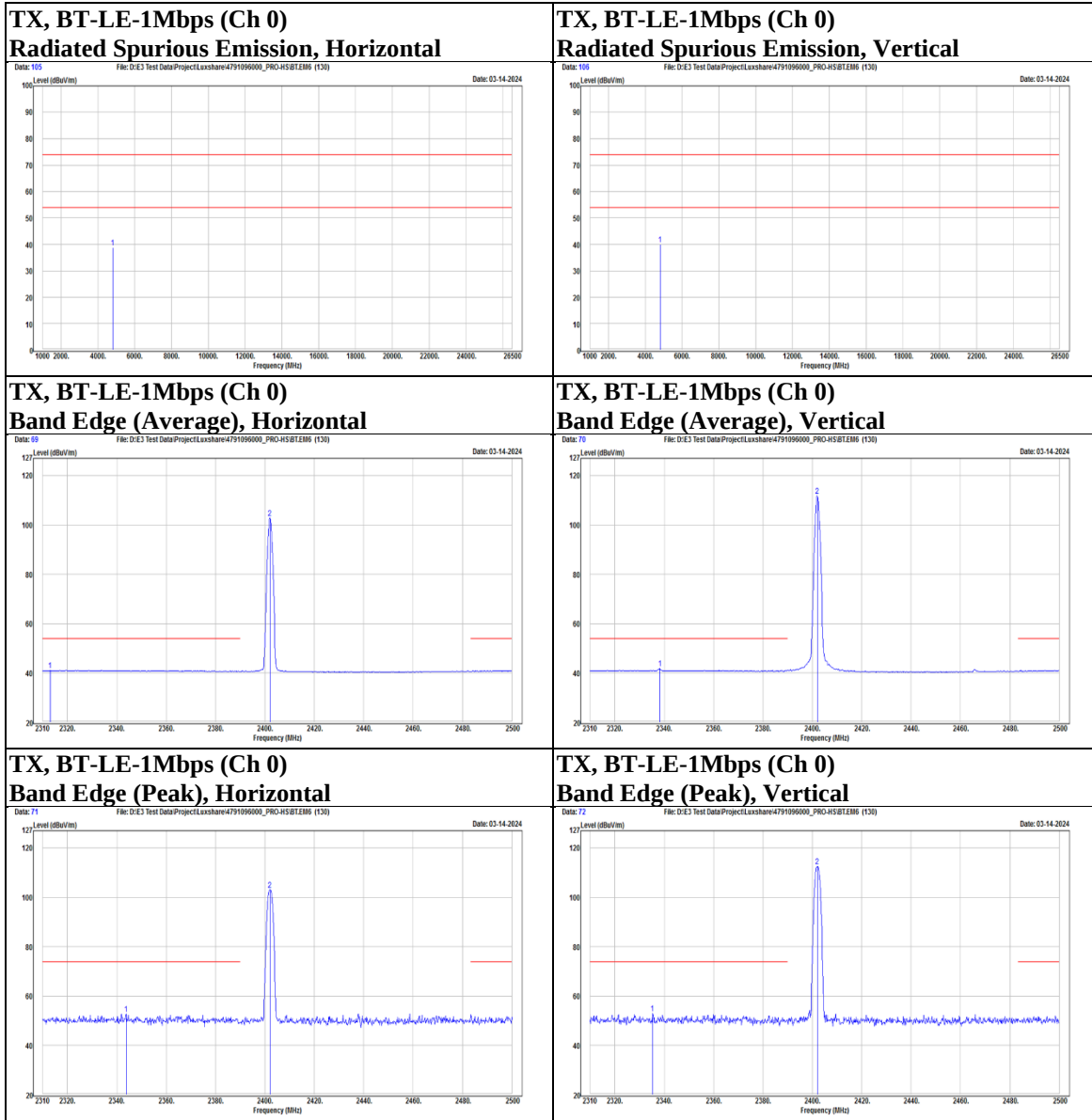
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|      |             |         |    |
|------|-------------|---------|----|
| Mode | BT-LE-1Mbps | Channel | 19 |
|------|-------------|---------|----|

| Polarization | Notation | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>(dB/m) | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|--------------|----------|--------------------|-------------------|-------------------|--------------------|-------------------|----------------|--------|
| Horizontal   |          | 2326.72            | 28.34             | 12.76             | 41.1               | 54                | -12.9          | AVG    |
|              |          | 2331.28            | 40.47             | 12.74             | 53.21              | 74                | -20.79         | PK     |
|              | @        | 2440               | 91.14             | 12.19             | 103.33             | N/A               | N/A            | PK     |
|              | @        | 2440               | 90.44             | 12.19             | 102.63             | N/A               | N/A            | AVG    |
|              |          | 2496.01            | 28.54             | 12.48             | 41.02              | 54                | -12.98         | AVG    |
|              |          | 2498.29            | 39.65             | 12.5              | 52.15              | 74                | -21.85         | PK     |
|              | *        | 4880               | 36.58             | 3.06              | 39.64              | 74                | -34.36         | PK     |
| Vertical     |          | 2323.11            | 40.07             | 12.77             | 52.84              | 74                | -21.16         | PK     |
|              |          | 2376.31            | 29.22             | 12.54             | 41.76              | 54                | -12.24         | AVG    |
|              | @        | 2440               | 99.55             | 12.19             | 111.74             | N/A               | N/A            | PK     |
|              | @        | 2440               | 98.66             | 12.19             | 110.85             | N/A               | N/A            | AVG    |
|              |          | 2485.75            | 40.13             | 12.39             | 52.52              | 74                | -21.48         | PK     |
|              |          | 2492.02            | 28.58             | 12.45             | 41.03              | 54                | -12.97         | AVG    |
|              | *        | 4880               | 36.34             | 3.06              | 39.4               | 74                | -34.6          | PK     |

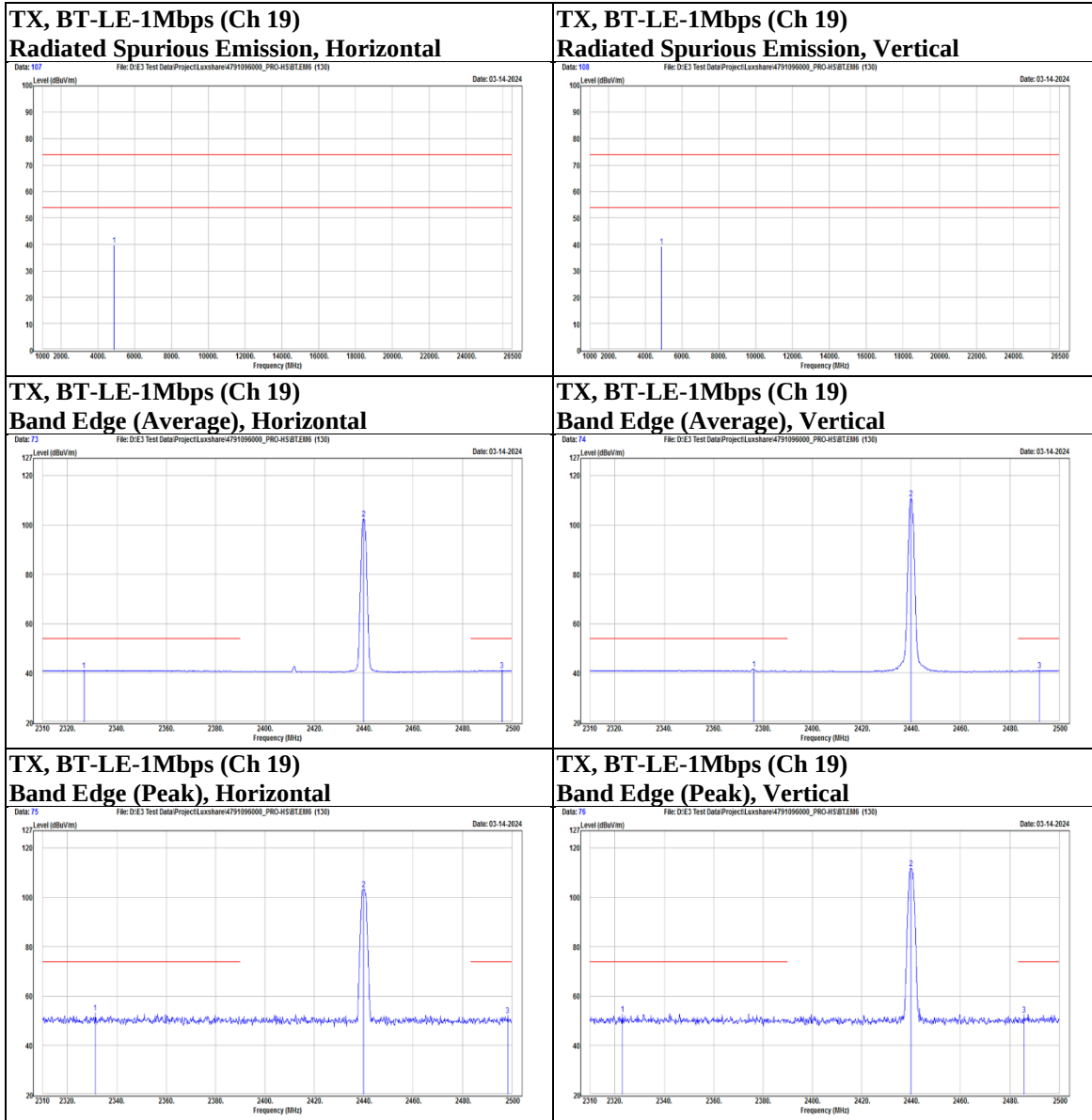
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|      |             |         |    |
|------|-------------|---------|----|
| Mode | BT-LE-1Mbps | Channel | 39 |
|------|-------------|---------|----|

| Polarization | Notation | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>(dB/m) | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|--------------|----------|--------------------|-------------------|-------------------|--------------------|-------------------|----------------|--------|
| Horizontal   | @        | 2480               | 91.37             | 12.35             | 103.72             | N/A               | N/A            | PK     |
|              | @        | 2480               | 90.83             | 12.35             | 103.18             | N/A               | N/A            | AVG    |
|              |          | 2483.66            | 29.15             | 12.38             | 41.53              | 54                | -12.47         | AVG    |
|              |          | 2495.82            | 39.8              | 12.47             | 52.27              | 74                | -21.73         | PK     |
|              | *        | 4960               | 35.94             | 3.2               | 39.14              | 74                | -34.86         | PK     |
| Vertical     | @        | 2480               | 98.23             | 12.35             | 110.58             | N/A               | N/A            | PK     |
|              | @        | 2480               | 97.65             | 12.35             | 110                | N/A               | N/A            | AVG    |
|              |          | 2483.66            | 31.58             | 12.38             | 43.96              | 54                | -10.04         | AVG    |
|              |          | 2498.48            | 39.83             | 12.5              | 52.33              | 74                | -21.67         | PK     |
|              | *        | 4960               | 38.76             | 3.2               | 41.96              | 74                | -32.04         | PK     |

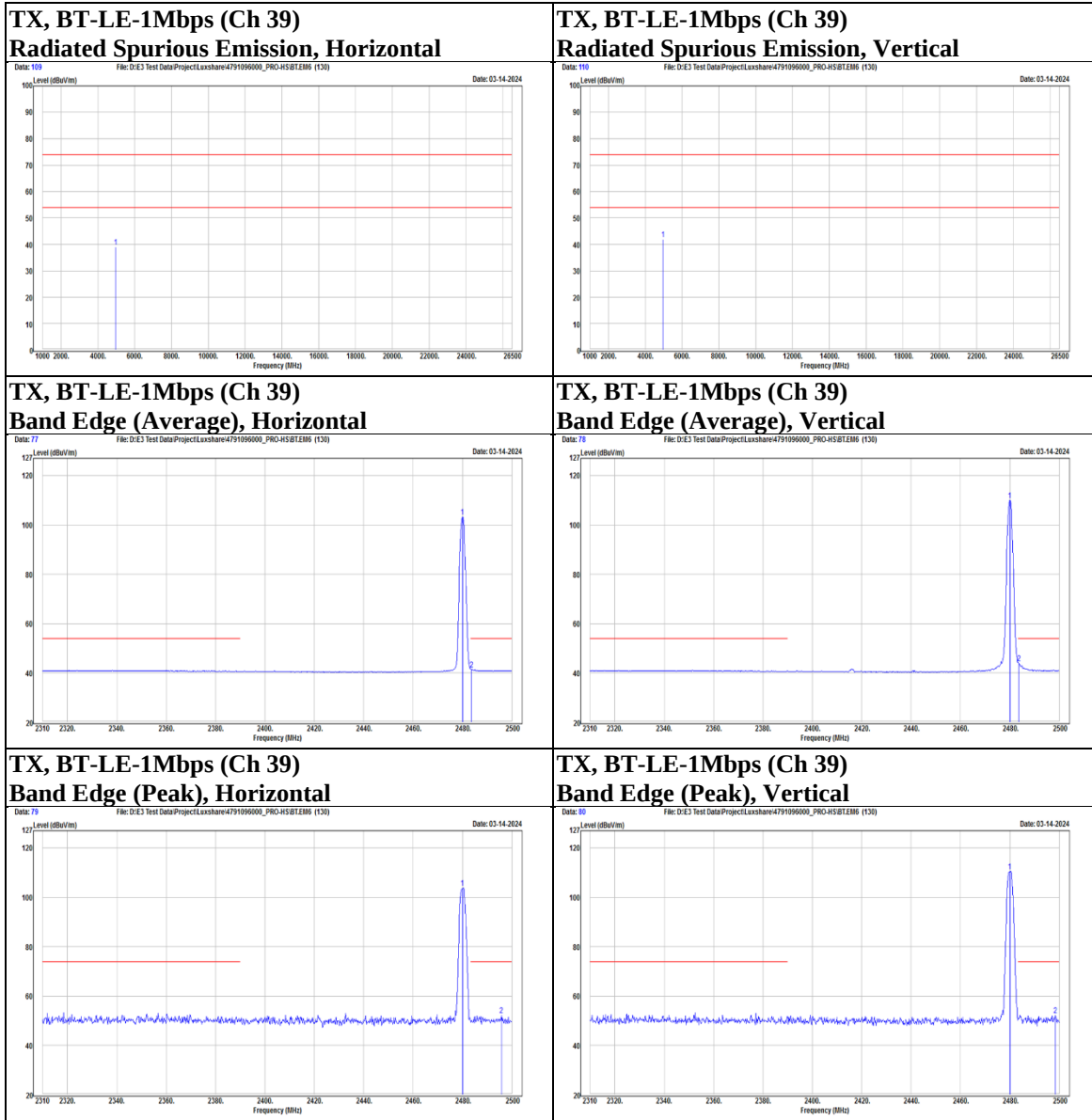
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|      |             |         |   |
|------|-------------|---------|---|
| Mode | BT-LE-2Mbps | Channel | 1 |
|------|-------------|---------|---|

| Polarization | Notation | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>(dB/m) | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|--------------|----------|--------------------|-------------------|-------------------|--------------------|-------------------|----------------|--------|
| Horizontal   |          | 2334.7             | 40.29             | 12.72             | 53.01              | 74                | -20.99         | PK     |
|              |          | 2340.59            | 28.7              | 12.7              | 41.4               | 54                | -12.6          | AVG    |
|              | @        | 2404               | 90.47             | 12.42             | 102.89             | N/A               | N/A            | PK     |
|              | @        | 2404               | 88.31             | 12.42             | 100.73             | N/A               | N/A            | AVG    |
|              | *        | 4808               | 36.22             | 2.9               | 39.12              | 74                | -34.88         | PK     |
| Vertical     |          | 2310.19            | 40.94             | 12.83             | 53.77              | 74                | -20.23         | PK     |
|              |          | 2340.59            | 30.4              | 12.7              | 43.1               | 54                | -10.9          | AVG    |
|              | @        | 2404               | 100.1             | 12.42             | 112.52             | N/A               | N/A            | PK     |
|              | @        | 2404               | 97.29             | 12.42             | 109.71             | N/A               | N/A            | AVG    |
|              | *        | 4808               | 36.32             | 2.9               | 39.22              | 74                | -34.78         | PK     |

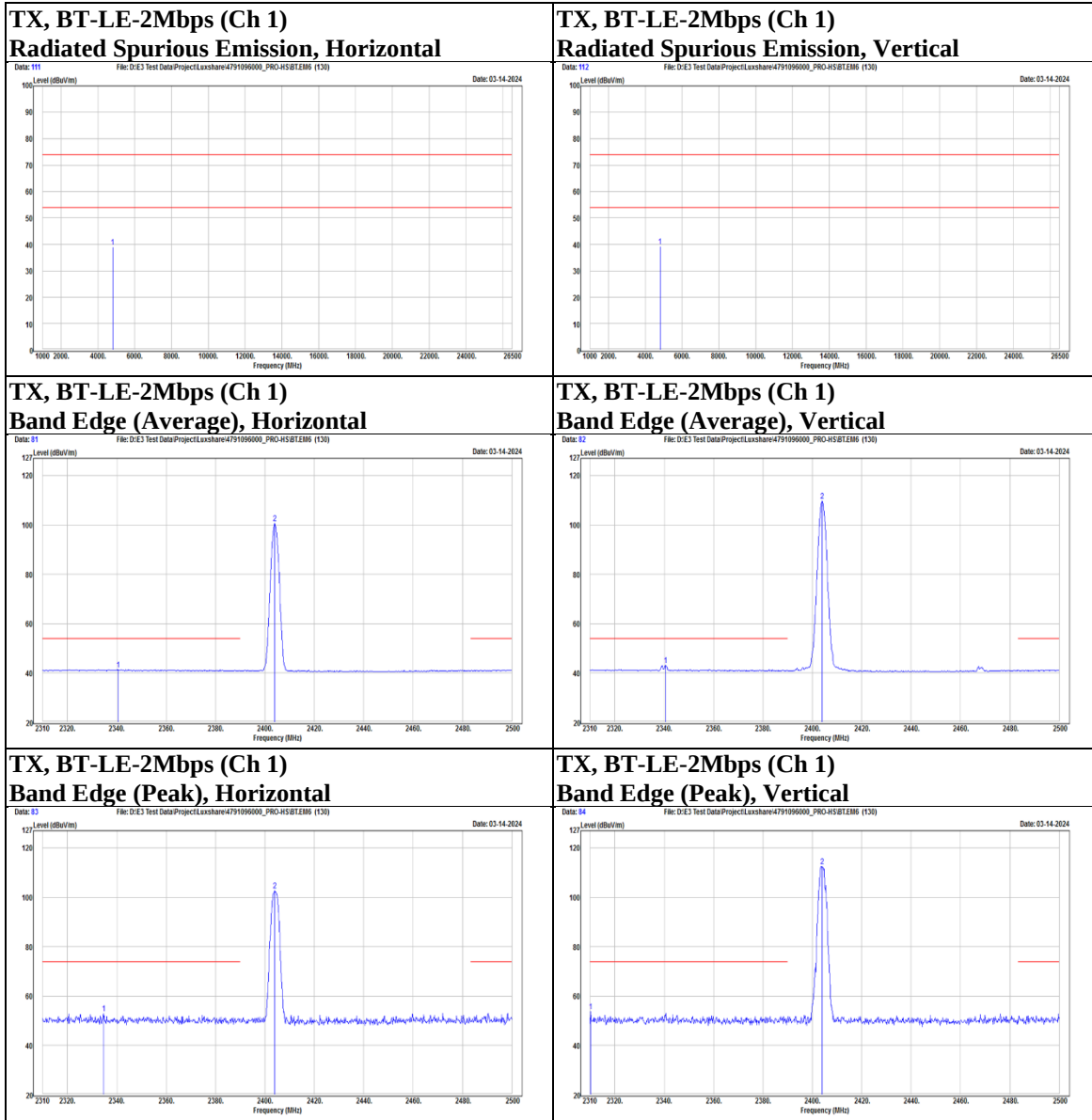
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|      |             |         |    |
|------|-------------|---------|----|
| Mode | BT-LE-2Mbps | Channel | 19 |
|------|-------------|---------|----|

| Polarization | Notation | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>(dB/m) | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|--------------|----------|--------------------|-------------------|-------------------|--------------------|-------------------|----------------|--------|
| Horizontal   |          | 2311.71            | 28.62             | 12.82             | 41.44              | 54                | -12.56         | AVG    |
|              |          | 2350.66            | 40.13             | 12.65             | 52.78              | 74                | -21.22         | PK     |
|              | @        | 2440               | 90.72             | 12.19             | 102.91             | N/A               | N/A            | PK     |
|              | @        | 2440               | 89.16             | 12.19             | 101.35             | N/A               | N/A            | AVG    |
|              |          | 2486.32            | 39.61             | 12.41             | 52.02              | 74                | -21.98         | PK     |
|              |          | 2498.86            | 28.9              | 12.5              | 41.4               | 54                | -12.6          | AVG    |
|              | *        | 4880               | 36.73             | 3.06              | 39.79              | 74                | -34.21         | PK     |
| Vertical     |          | 2339.83            | 40.81             | 12.7              | 53.51              | 74                | -20.49         | PK     |
|              |          | 2376.5             | 30.93             | 12.54             | 43.47              | 54                | -10.53         | AVG    |
|              | @        | 2440               | 97.5              | 12.19             | 109.69             | N/A               | N/A            | PK     |
|              | @        | 2440               | 97.31             | 12.19             | 109.5              | N/A               | N/A            | AVG    |
|              |          | 2494.3             | 39.76             | 12.47             | 52.23              | 74                | -21.77         | PK     |
|              |          | 2499.43            | 28.81             | 12.51             | 41.32              | 54                | -12.68         | AVG    |
|              | *        | 4880               | 36.94             | 3.06              | 40                 | 74                | -34            | PK     |

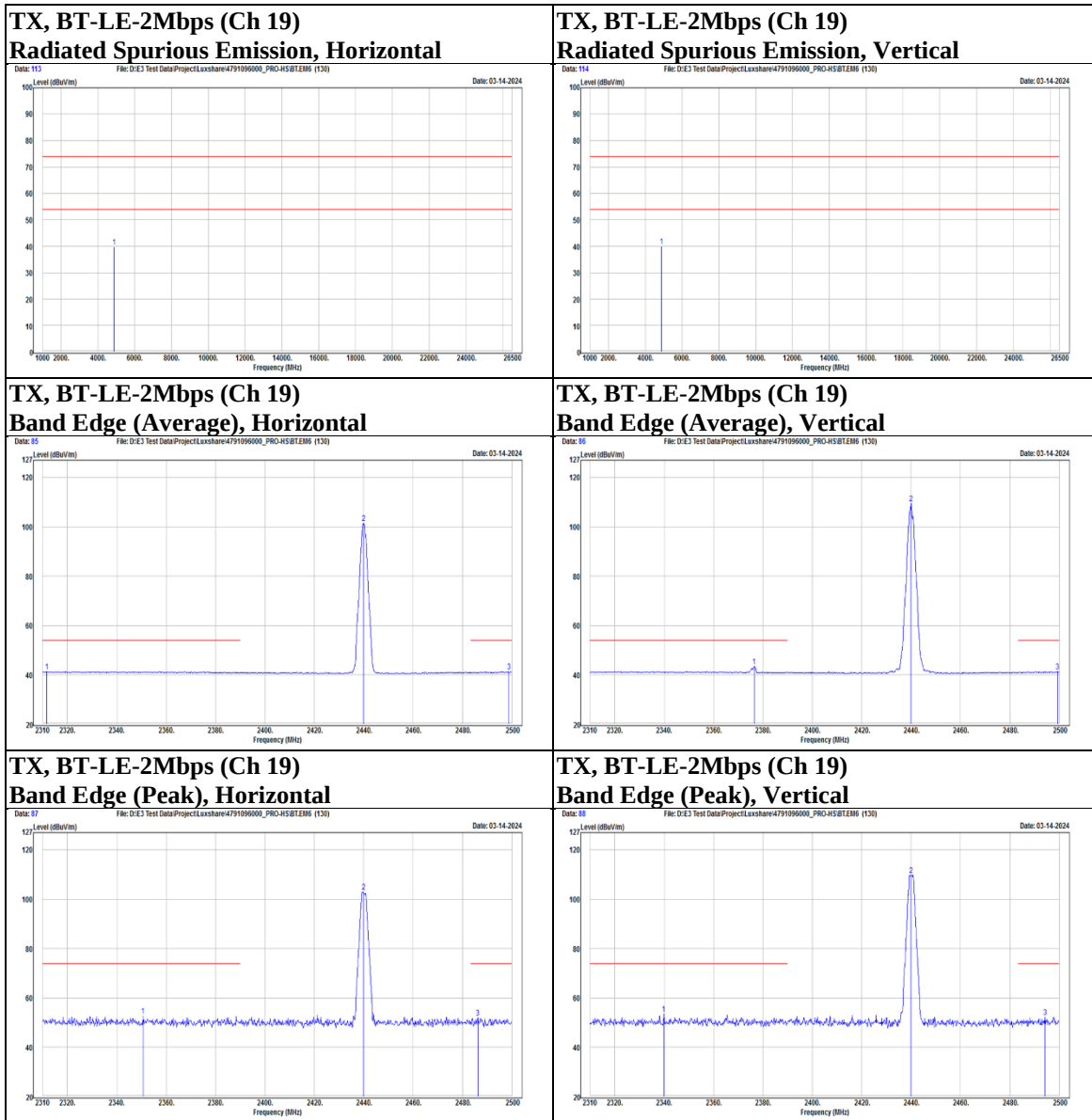
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|      |             |         |    |
|------|-------------|---------|----|
| Mode | BT-LE-2Mbps | Channel | 37 |
|------|-------------|---------|----|

| Polarization | Notation | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>(dB/m) | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|--------------|----------|--------------------|-------------------|-------------------|--------------------|-------------------|----------------|--------|
| Horizontal   | @        | 2476               | 91.18             | 12.33             | 103.51             | N/A               | N/A            | PK     |
|              | @        | 2476               | 89.4              | 12.33             | 101.73             | N/A               | N/A            | AVG    |
|              |          | 2484.8             | 40.15             | 12.39             | 52.54              | 74                | -21.46         | PK     |
|              |          | 2498.67            | 28.83             | 12.5              | 41.33              | 54                | -12.67         | AVG    |
|              | *        | 4952               | 35.8              | 3.14              | 38.94              | 74                | -35.06         | PK     |
| Vertical     | @        | 2476               | 98.19             | 12.33             | 110.52             | N/A               | N/A            | PK     |
|              | @        | 2476               | 94.56             | 12.33             | 106.89             | N/A               | N/A            | AVG    |
|              |          | 2483.85            | 29.5              | 12.38             | 41.88              | 54                | -12.12         | AVG    |
|              |          | 2496.96            | 39.93             | 12.48             | 52.41              | 74                | -21.59         | PK     |
|              | *        | 4952               | 35.79             | 3.14              | 38.93              | 74                | -35.07         | PK     |

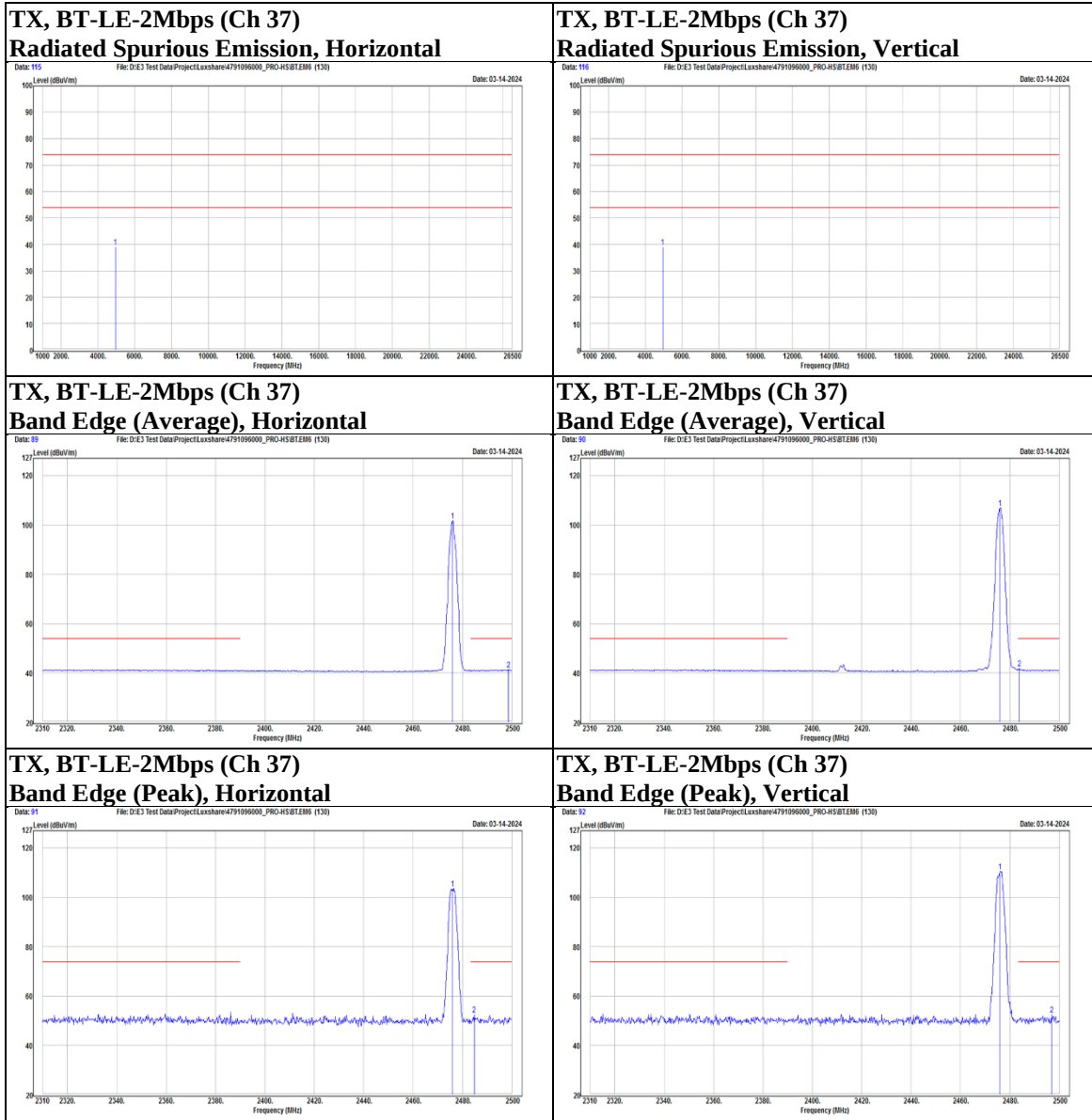
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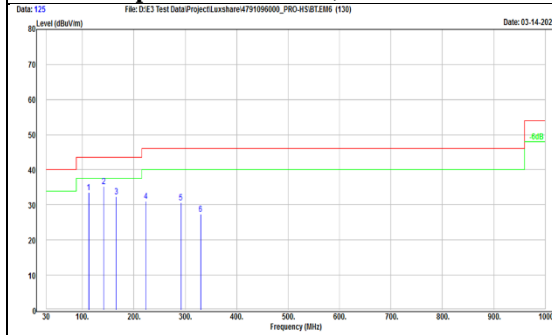
### Below 1 GHz

|      |             |         |   |
|------|-------------|---------|---|
| Mode | BT-LE-1Mbps | Channel | 0 |
|------|-------------|---------|---|

| Polarization | Notation | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>(dB/m) | Result<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Remark |
|--------------|----------|--------------------|-------------------|-------------------|--------------------|-------------------|----------------|--------|
| Horizontal   |          | 112.45             | 48.08             | -14.55            | 33.53              | 43.5              | -9.97          | PK     |
|              |          | 141.55             | 47.57             | -12.36            | 35.21              | 43.5              | -8.29          | PK     |
|              |          | 165.8              | 44.08             | -11.65            | 32.43              | 43.5              | -11.07         | PK     |
|              |          | 223.03             | 45.16             | -14.15            | 31.01              | 46                | -14.99         | PK     |
|              |          | 291.9              | 41.37             | -10.7             | 30.67              | 46                | -15.33         | PK     |
|              |          | 329.73             | 36.74             | -9.4              | 27.34              | 46                | -18.66         | PK     |
| Vertical     |          | 114.39             | 53.02             | -14.44            | 38.58              | 43.5              | -4.92          | PK     |
|              |          | 159.98             | 40.95             | -11.68            | 29.27              | 43.5              | -14.23         | PK     |
|              |          | 191.99             | 41.99             | -14.35            | 27.64              | 43.5              | -15.86         | PK     |
|              |          | 221.09             | 41.06             | -14.21            | 26.85              | 46                | -19.15         | PK     |
|              |          | 291.9              | 40.06             | -10.7             | 29.36              | 46                | -16.64         | PK     |
|              |          | 307.42             | 39.09             | -10.39            | 28.7               | 46                | -17.3          | PK     |

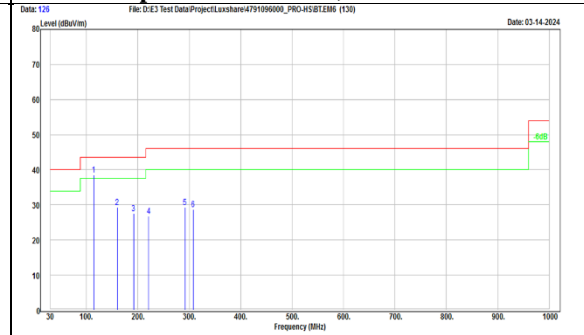
#### TX, BT-LE-1Mbps (Ch 0)

##### Radiated Spurious Emission, Horizontal



#### TX, BT-LE-1Mbps (Ch 0)

##### Radiated Spurious Emission, Vertical

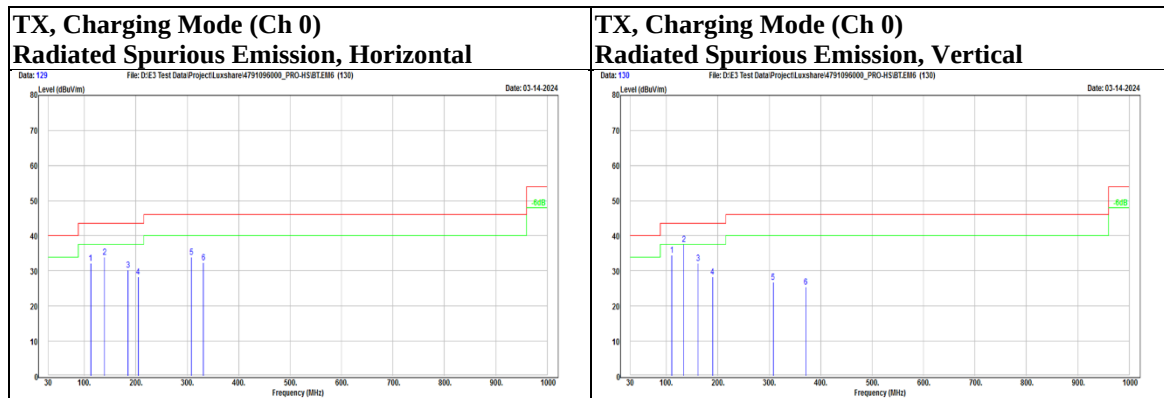


## Charging Mode

### Below 1 GHz

|      |               |         |   |
|------|---------------|---------|---|
| Mode | Charging Mode | Channel | 0 |
|------|---------------|---------|---|

| Polarization | Notation @ | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|--------------|------------|-----------------|----------------|----------------|-----------------|----------------|-------------|--------|
| Horizontal   |            | 112.45          | 46.8           | -14.55         | 32.25           | 43.5           | -11.25      | PK     |
|              |            | 139.61          | 46.45          | -12.6          | 33.85           | 43.5           | -9.65       | PK     |
|              |            | 185.2           | 43.73          | -13.55         | 30.18           | 43.5           | -13.32      | PK     |
|              |            | 204.6           | 42.99          | -14.66         | 28.33           | 43.5           | -15.17      | PK     |
|              |            | 308.39          | 44.3           | -10.35         | 33.95           | 46             | -12.05      | PK     |
|              |            | 331.67          | 41.85          | -9.37          | 32.48           | 46             | -13.52      | PK     |
| Vertical     |            | 110.51          | 49.22          | -14.81         | 34.41           | 43.5           | -9.09       | PK     |
|              |            | 133.79          | 50.81          | -13.23         | 37.58           | 43.5           | -5.92       | PK     |
|              |            | 161.92          | 44             | -11.75         | 32.25           | 43.5           | -11.25      | PK     |
|              |            | 190.05          | 42.44          | -14.17         | 28.27           | 43.5           | -15.23      | PK     |
|              |            | 307.42          | 37.14          | -10.39         | 26.75           | 46             | -19.25      | PK     |
|              |            | 371.44          | 33.85          | -8.45          | 25.4            | 46             | -20.6       | PK     |



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**9 kHz ~ 30 MHz Data:**

For 9 kHz to 30 MHz radiated emission have performed all modes of operation were investigated. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

No non-compliance noted:

**KDB 414788 D01 OATS and Chamber Correlation Justification**

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

- OATs and chamber correlation testing had been performed and chamber measured test results is the worst case test result.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

## 9.6. AC Power Line Conducted Emission

### Requirements

| Frequency (MHz) | Conducted limit (dBμV) |         |
|-----------------|------------------------|---------|
|                 | Quasi-peak             | Average |
| 0.15 - 0.5      | 66 - 56                | 56 - 46 |
| 0.50 - 5.0      | 56                     | 46      |
| 5.0 - 30        | 60                     | 50      |

Note:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.
2. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported, the other emission levels were low against the limit.
3. Test data of Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB).
4. Test data of Margin(dB) = Result value (dBuV) - Limit value (dBuV).
5. Test data of Correction Factor (dB) = Insertion loss(dB) + Cable loss(dB).

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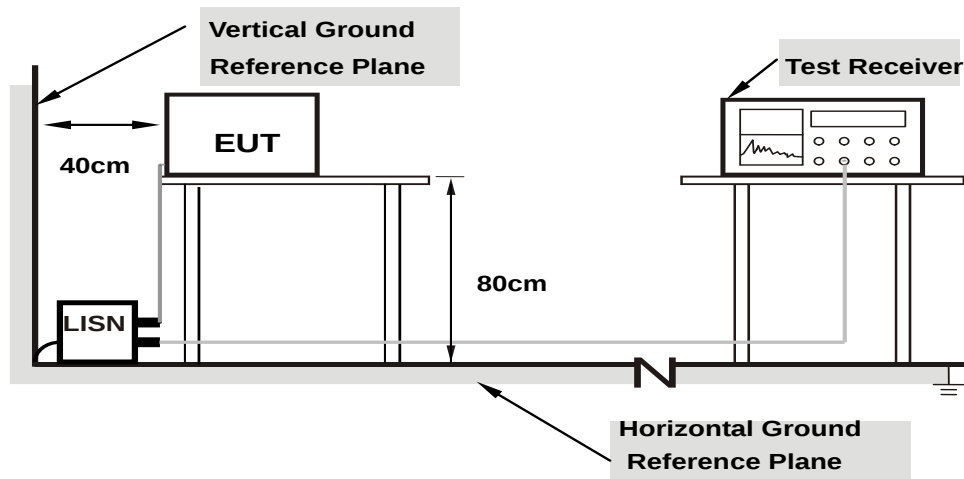
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### Test Setup

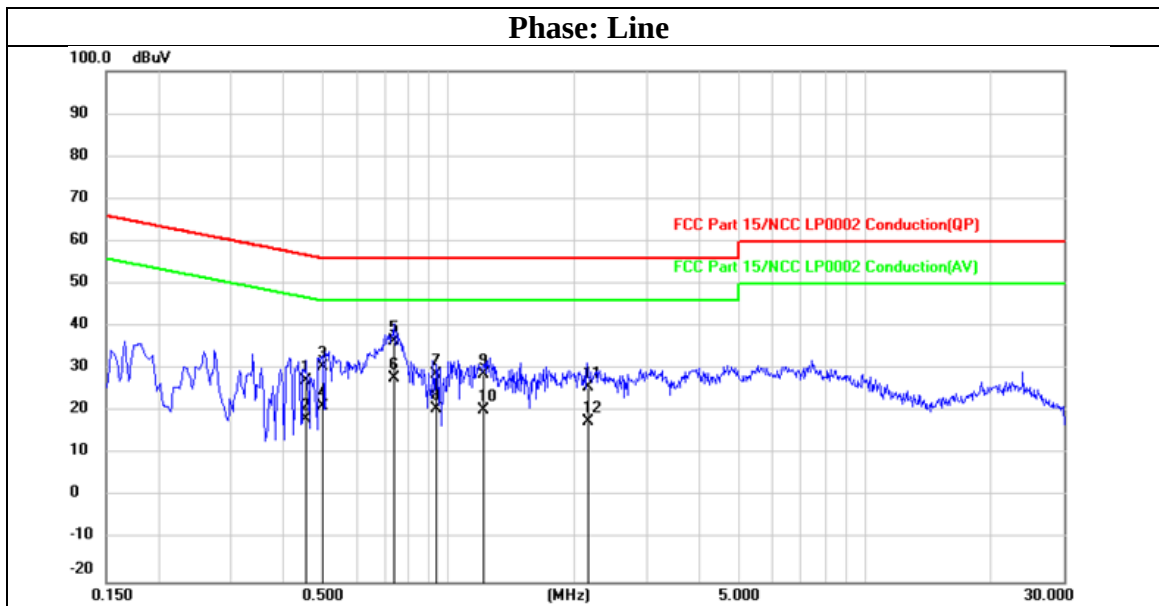


**Note: 1.Support units were connected to second LISN.**

For the actual test configuration, please refer to the Setup Configurations.

## Test Data

|      |                |         |   |
|------|----------------|---------|---|
| Mode | BLE(1M)_TX2402 | Channel | 0 |
|------|----------------|---------|---|



| No. | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>(dB) | Result<br>(dBuV) | Limit<br>(dBuV) | Margin<br>(dB) | Remark |
|-----|--------------------|-------------------|-----------------|------------------|-----------------|----------------|--------|
| 1   | 0.4535             | 17.39             | 9.95            | 27.34            | 56.81           | -29.47         | QP     |
| 2   | 0.4535             | 8.27              | 9.95            | 18.22            | 46.81           | -28.59         | AVG    |
| 3   | 0.4993             | 20.67             | 9.95            | 30.62            | 56.01           | -25.39         | QP     |
| 4   | 0.4993             | 11.27             | 9.95            | 21.22            | 46.01           | -24.79         | AVG    |
| 5   | 0.7403             | 26.56             | 9.96            | 36.52            | 56.00           | -19.48         | QP     |
| 6   | 0.7403             | 18.00             | 9.96            | 27.96            | 46.00           | -18.04         | AVG    |
| 7   | 0.9295             | 18.75             | 9.98            | 28.73            | 56.00           | -27.27         | QP     |
| 8   | 0.9295             | 10.69             | 9.98            | 20.67            | 46.00           | -25.33         | AVG    |
| 9   | 1.2109             | 18.69             | 9.98            | 28.67            | 56.00           | -27.33         | QP     |
| 10  | 1.2109             | 10.24             | 9.98            | 20.22            | 46.00           | -25.78         | AVG    |
| 11  | 2.1645             | 15.83             | 10.01           | 25.84            | 56.00           | -30.16         | QP     |
| 12  | 2.1645             | 7.64              | 10.01           | 17.65            | 46.00           | -28.35         | AVG    |

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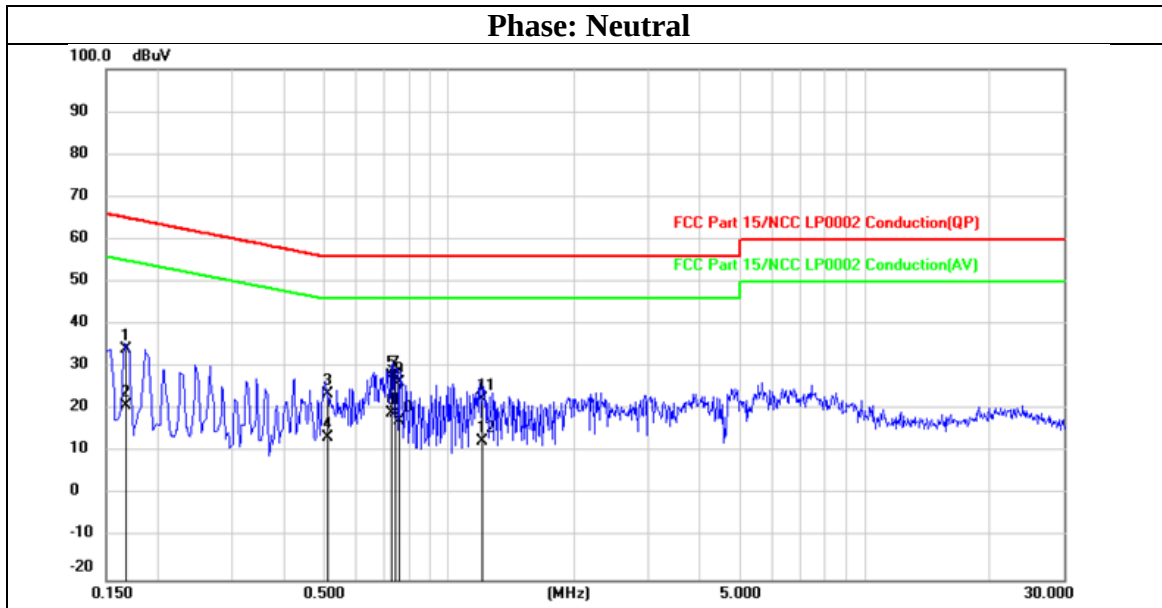
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Doc No: Form-ULID-004737 (DCS:17-EM-F0876) / 6.1

|      |                |         |   |
|------|----------------|---------|---|
| Mode | BLE(1M)_TX2402 | Channel | 0 |
|------|----------------|---------|---|



| No. | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>(dB) | Result<br>(dBuV) | Limit<br>(dBuV) | Margin<br>(dB) | Remark |
|-----|--------------------|-------------------|-----------------|------------------|-----------------|----------------|--------|
| 1   | 0.1669             | 24.32             | 9.95            | 34.27            | 65.11           | -30.84         | QP     |
| 2   | 0.1669             | 11.08             | 9.95            | 21.03            | 55.11           | -34.08         | AVG    |
| 3   | 0.5105             | 13.67             | 9.95            | 23.62            | 56.00           | -32.38         | QP     |
| 4   | 0.5105             | 3.45              | 9.95            | 13.40            | 46.00           | -32.60         | AVG    |
| 5   | 0.7296             | 17.84             | 9.96            | 27.80            | 56.00           | -28.20         | QP     |
| 6   | 0.7296             | 9.06              | 9.96            | 19.02            | 46.00           | -26.98         | AVG    |
| 7   | 0.7454             | 17.90             | 9.96            | 27.86            | 56.00           | -28.14         | QP     |
| 8   | 0.7454             | 9.06              | 9.96            | 19.02            | 46.00           | -26.98         | AVG    |
| 9   | 0.7591             | 16.48             | 9.97            | 26.45            | 56.00           | -29.55         | QP     |
| 10  | 0.7591             | 7.36              | 9.97            | 17.33            | 46.00           | -28.67         | AVG    |
| 11  | 1.1963             | 12.34             | 9.97            | 22.31            | 56.00           | -33.69         | QP     |
| 12  | 1.1963             | 2.56              | 9.97            | 12.53            | 46.00           | -33.47         | AVG    |

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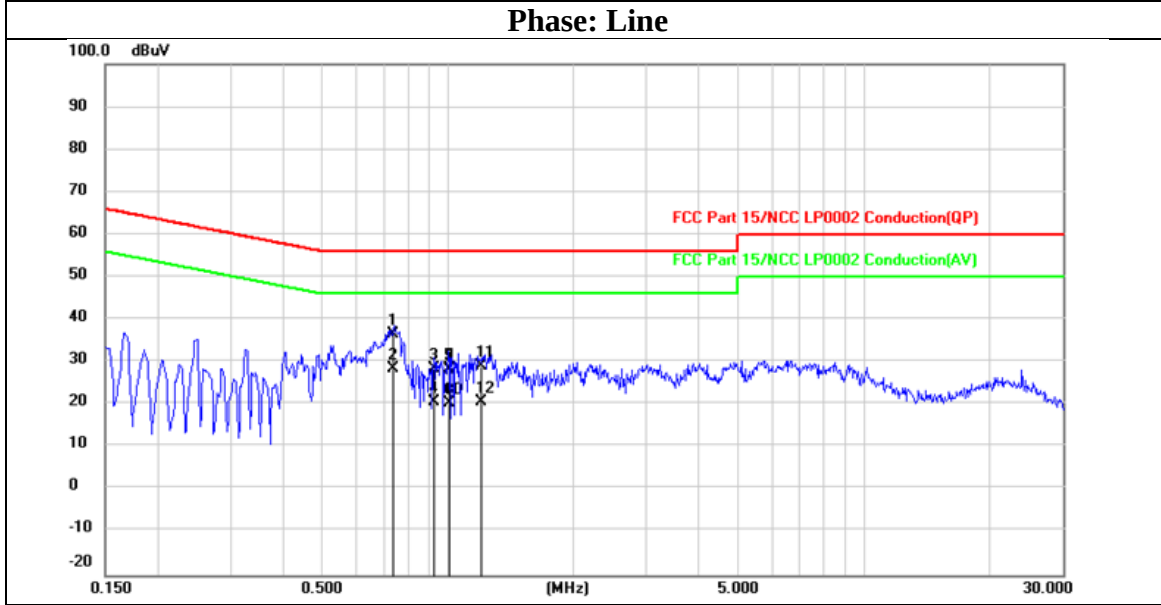
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## Charging Mode

|      |               |         |     |
|------|---------------|---------|-----|
| Mode | Charging Mode | Channel | N/A |
|------|---------------|---------|-----|



| No. | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>(dB) | Result<br>(dBuV) | Limit<br>(dBuV) | Margin<br>(dB) | Remark |
|-----|--------------------|-------------------|-----------------|------------------|-----------------|----------------|--------|
| 1   | 0.7398             | 26.62             | 9.96            | 36.58            | 56.00           | -19.42         | QP     |
| 2   | 0.7398             | 18.37             | 9.96            | 28.33            | 46.00           | -17.67         | AVG    |
| 3   | 0.9271             | 18.53             | 9.98            | 28.51            | 56.00           | -27.49         | QP     |
| 4   | 0.9271             | 10.78             | 9.98            | 20.76            | 46.00           | -25.24         | AVG    |
| 5   | 1.0109             | 18.37             | 9.98            | 28.35            | 56.00           | -27.65         | QP     |
| 6   | 1.0109             | 10.29             | 9.98            | 20.27            | 46.00           | -25.73         | AVG    |
| 7   | 1.0112             | 18.25             | 9.98            | 28.23            | 56.00           | -27.77         | QP     |
| 8   | 1.0112             | 10.25             | 9.98            | 20.23            | 46.00           | -25.77         | AVG    |
| 9   | 1.0114             | 18.20             | 9.98            | 28.18            | 56.00           | -27.82         | QP     |
| 10  | 1.0114             | 10.29             | 9.98            | 20.27            | 46.00           | -25.73         | AVG    |
| 11  | 1.1970             | 18.94             | 9.98            | 28.92            | 56.00           | -27.08         | QP     |
| 12  | 1.1970             | 10.76             | 9.98            | 20.74            | 46.00           | -25.26         | AVG    |

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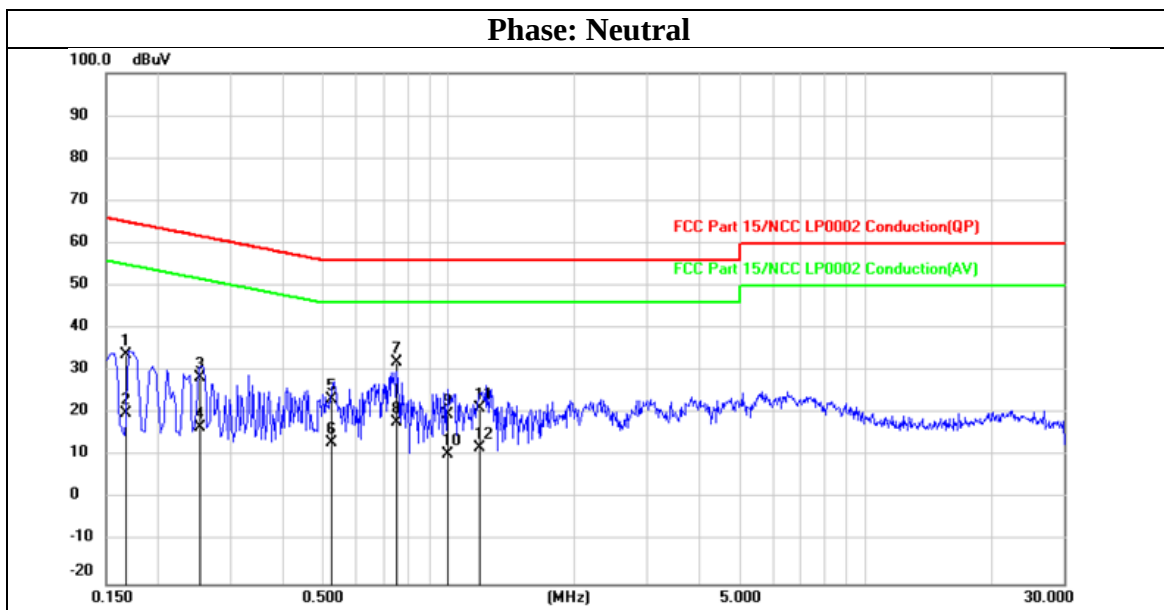
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|      |               |         |     |
|------|---------------|---------|-----|
| Mode | Charging Mode | Channel | N/A |
|------|---------------|---------|-----|



| No. | Frequency<br>(MHz) | Reading<br>(dBuV) | Correct<br>(dB) | Result<br>(dBuV) | Limit<br>(dBuV) | Margin<br>(dB) | Remark |
|-----|--------------------|-------------------|-----------------|------------------|-----------------|----------------|--------|
| 1   | 0.1663             | 23.76             | 9.95            | 33.71            | 65.14           | -31.43         | QP     |
| 2   | 0.1663             | 10.24             | 9.95            | 20.19            | 55.14           | -34.95         | AVG    |
| 3   | 0.2513             | 18.60             | 9.94            | 28.54            | 61.71           | -33.17         | QP     |
| 4   | 0.2513             | 6.68              | 9.94            | 16.62            | 51.71           | -35.09         | AVG    |
| 5   | 0.5192             | 13.34             | 9.95            | 23.29            | 56.00           | -32.71         | QP     |
| 6   | 0.5192             | 3.21              | 9.95            | 13.16            | 46.00           | -32.84         | AVG    |
| 7   | 0.7463             | 22.00             | 9.96            | 31.96            | 56.00           | -24.04         | QP     |
| 8   | 0.7463             | 8.12              | 9.96            | 18.08            | 46.00           | -27.92         | AVG    |
| 9   | 0.9989             | 9.74              | 9.97            | 19.71            | 56.00           | -36.29         | QP     |
| 10  | 0.9989             | 0.60              | 9.97            | 10.57            | 46.00           | -35.43         | AVG    |
| 11  | 1.1914             | 11.38             | 9.97            | 21.35            | 56.00           | -34.65         | QP     |
| 12  | 1.1914             | 2.09              | 9.97            | 12.06            | 46.00           | -33.94         | AVG    |

## END OF REPORT

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