

## Supplemental “Transmit Simultaneously” Test Report

**Report No.:** RFBENL-WTW-P21090472A-4

**FCC ID:** RYK-WNFQ261ACNIBT

**Test Model:** WNFQ-261ACNI(BT)

**Received Date:** 2023/6/30

**Test Date:** 2023/7/21 ~ 2023/10/11

**Issued Date:** 2023/11/6

**Applicant:** SparkLAN Communications, Inc.

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**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Hsin Chu Laboratory

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Taiwan

**Test Location:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,  
Taiwan

**FCC Registration /  
Designation Number:** 723255 / TW2022



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### Release Control Record

| Issue No.               | Description       | Date Issued |
|-------------------------|-------------------|-------------|
| RFBENL-WTW-P21090472A-4 | Original release. | 2023/11/6   |

## 1 Certificate of Conformity

**Product:** 802.11ac/a/b/g/n 2T2R Industrial-graded Wi-Fi / Bluetooth 4.2 Combo M.2 2230 Module

**Brand:** Sparklan

**Test Model:** WNFQ-261ACNI(BT)

**Sample Status:** Engineering sample

**Applicant:** SparkLAN Communications, Inc.

**Test Date:** 2023/7/21 ~ 2023/10/11

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)  
47 CFR FCC Part 15, Subpart E (Section 15.407)  
ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Vito Lung , Date: 2023/11/6  
Vito Lung / Specialist

Approved by : May Chen , Date: 2023/11/6  
May Chen / Manager

## 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C, E (SECTION 15.247, 15.407)        |                                              |        |                                                                                    |
|------------------------------------------------------------------|----------------------------------------------|--------|------------------------------------------------------------------------------------|
| FCC Clause                                                       | Test Item                                    | Result | Remarks                                                                            |
| 15.207<br>15.407(b)(6)                                           | AC Power Conducted Emission                  | N/A    | Refer to Note 2                                                                    |
| 15.205 / 15.209 /<br>15.247(d)<br>15.407(b)<br>(1/2/3/4(i/ii)/8) | Radiated Emissions and Band Edge Measurement | PASS   | Meet the requirement of limit.<br>Minimum passing margin is -3.3 dB at 299.29 MHz. |

Note:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. Only Radiated Emissions were performed for this addendum. Other test items data refer to original test report.
3. N/A: Not Applicable.

### 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement                    | Frequency     | Expanded Uncertainty (k=2) (±) |
|--------------------------------|---------------|--------------------------------|
| Conducted emissions            | -             | 2.63 dB                        |
| Radiated Emissions up to 1 GHz | 9kHz ~ 30MHz  | 2.38 dB                        |
|                                | 30MHz ~ 1GHz  | 5.7 dB                         |
| Radiated Emissions above 1 GHz | 1 GHz ~ 6 GHz | 4.83 dB                        |
|                                | 1GHz ~ 18GHz  | 5.37 dB                        |
|                                | 18GHz ~ 40GHz | 5.24 dB                        |

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

|                       |                                                                                                                                                                                                                                                                                                                              |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product               | 802.11ac/a/b/g/n 2T2R Industrial-graded Wi-Fi / Bluetooth 4.2 Combo M.2 2230 Module                                                                                                                                                                                                                                          |
| Brand                 | Sparklan                                                                                                                                                                                                                                                                                                                     |
| Test Model            | WNFQ-261ACNI(BT)                                                                                                                                                                                                                                                                                                             |
| Status of EUT         | Engineering sample                                                                                                                                                                                                                                                                                                           |
| Power Supply Rating   | 3.3 Vdc form host equipment                                                                                                                                                                                                                                                                                                  |
| Modulation Type       | <b>WLAN:</b><br>CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM<br>256QAM for OFDM in VHT mode<br><b>BT-EDR:</b> GFSK, $\pi/4$ -DQPSK, 8DPSK<br><b>BT-LE:</b> GFSK                                                                                                                                           |
| Modulation Technology | <b>WLAN:</b> DSSS, OFDM<br><b>BT-EDR:</b> FHSS<br><b>BT-LE:</b> DTS                                                                                                                                                                                                                                                          |
| Transfer Rate         | <b>WLAN:</b><br>802.11b: up to 11 Mbps<br>802.11a/g: up to 54 Mbps<br>802.11n: up to 300 Mbps<br>802.11ac: up to 866.7 Mbps<br><b>BT-EDR:</b> up to 3 Mbps<br><b>BT-LE:</b> up to 2 Mbps                                                                                                                                     |
| Operating Frequency   | <b>2.4GHz:</b> 2.412GHz ~ 2.472GHz<br><b>5GHz:</b> 5.18 ~ 5.24GHz, 5.26 ~ 5.32GHz, 5.50 ~ 5.72GHz, 5.745 ~ 5.825GHz<br><b>BT-EDR:</b> 2.402 ~ 2.480 GHz<br><b>BT-LE:</b> 2.402 ~ 2.480 GHz                                                                                                                                   |
| Number of Channel     | <b>2.4GHz:</b><br>802.11b, 802.11g, 802.11n (HT20), VHT20: 13<br>802.11n (HT40), VHT40: 9<br><b>5GHz:</b><br>802.11a, 802.11n (HT20), 802.11ac (VHT20): 25<br>802.11n (HT40), 802.11ac (VHT40): 12<br>802.11ac (VHT80): 6<br><b>BT-EDR:</b> 79<br><b>BT-LE:</b> 40                                                           |
| Output Power          | <b>2.4GHz:</b> 483.703 mW (26.85 dBm)<br><b>5GHz:</b><br>5.18 GHz ~ 5.24 GHz: 114.057 mW (20.57 dBm)<br>5.26 GHz ~ 5.32 GHz: 113.446 mW (20.55 dBm)<br>5.5 GHz ~ 5.72 GHz: 110.038 mW (20.42 dBm)<br>5.745 GHz ~ 5.825 GHz: 110.229 mW (20.42 dBm)<br><b>BT-EDR:</b> 5.998 mW (7.78 dBm)<br><b>BT-LE:</b> 1.34 mW (1.27 dBm) |
| Antenna Type          | Refer to Note                                                                                                                                                                                                                                                                                                                |
| Antenna Connector     | Refer to Note                                                                                                                                                                                                                                                                                                                |
| Accessory Device      | NA                                                                                                                                                                                                                                                                                                                           |

Note:

1. This is a supplementary report of Report No.: RFBENL-WTW-P21051124-4. The differences between them are as below information:

◆ Added new antennas as below table:

| Original  |                        |          |                                             |           |                                   |                                 |                                  |                     |                                                         |                   |
|-----------|------------------------|----------|---------------------------------------------|-----------|-----------------------------------|---------------------------------|----------------------------------|---------------------|---------------------------------------------------------|-------------------|
| Ant. Set. | Transmitter Circuit    | Brand    | Model                                       | Ant. Type | 2.4GHz Gain with cable loss (dBi) | 5GHz Gain with cable loss (dBi) | 2.4GHz Cable Loss (dBi)          | 5G Cable Loss (dBi) | Connector Type                                          | Cable Length (mm) |
| 1         | Chain (0)              | WNC      | 81-EBJ15.005                                | PIFA      | 3.00                              | Band 1&2: 2.56                  | 1.15                             | Band 1&2: 1.70      | IPEX                                                    | 300               |
|           |                        |          |                                             |           |                                   | Band 3: 4.76                    |                                  | Band 3: 1.74        |                                                         |                   |
|           |                        |          |                                             |           |                                   | Band 4: 4.76                    |                                  | Band 4: 1.79        |                                                         |                   |
|           | Chain (1)              | WNC      | 81-EBJ15.005                                | PIFA      | 3.62                              | Band 1&2: 3.08                  | 1.15                             | Band 1&2: 1.70      | IPEX                                                    | 300               |
|           |                        |          |                                             |           |                                   | Band 3: 3.31                    |                                  | Band 3: 1.74        |                                                         |                   |
|           |                        |          |                                             |           |                                   | Band 4: 2.42                    |                                  | Band 4: 1.79        |                                                         |                   |
| Ant. Set. | Transmitter Circuit    | Brand    | Model                                       | Ant. Type | 2.4GHz Gain with cable loss (dBi) | 5GHz Gain with cable loss (dBi) | 2.4GHz Cable Loss (dBi)          | 5G Cable Loss (dBi) | Connector Type                                          | Cable Length (mm) |
| 2         | Chain (0)              | INPAQ    | DAM-I6-H-DB-800-10-17                       | Dipole    | 1.13                              | Band 1&2: 1.33                  | NA                               | NA                  | SMA RP Plug                                             | 900               |
|           |                        |          |                                             |           |                                   | Band 3: -0.63                   |                                  |                     |                                                         |                   |
|           |                        |          |                                             |           |                                   | Band 4: -0.97                   |                                  |                     |                                                         |                   |
|           | Chain (1)              | INPAQ    | DAM-I6-H-DB-800-10-17                       | Dipole    | 1.29                              | Band 1&2: 1.94                  | NA                               | NA                  | SMA RP Plug                                             | 900               |
|           |                        |          |                                             |           |                                   | Band 3: -0.49                   |                                  |                     |                                                         |                   |
|           |                        |          |                                             |           |                                   | Band 4: -0.93                   |                                  |                     |                                                         |                   |
| Ant. Set. | Transmitter Circuit    | Brand    | Model                                       | Ant. Type | 2.4GHz Gain with cable loss (dBi) |                                 | 5GHz Gain with cable loss (dBi)  |                     | Connector Type                                          | Cable Length (mm) |
| 3         | Chain (0)<br>Chain (1) | Sparklan | AD-301N                                     | Dipole    | 4.4                               |                                 | Band 1&2: 5.2<br>Band 3&4: 5.8   |                     | IPEX MHF 4 at modular side & RP-SMA (M) at antenna side | 150               |
| 4         | Chain (0)<br>Chain (1) | Sparklan | AD-103AG                                    | Dipole    | 2.02                              |                                 | Band 1&2: 1.93<br>Band 3&4: 2.03 |                     |                                                         | 150               |
| 5         | Chain (0)<br>Chain (1) | Sparklan | AD-305N                                     | Dipole    | 5.0                               |                                 | 5.0                              |                     |                                                         | 150               |
| 6         | Chain (0)<br>Chain (1) | Sparklan | AD-303N                                     | Dipole    | 3.0                               |                                 | 3.0                              |                     |                                                         | 150               |
| 7         | Chain (0)<br>Chain (1) | Sparklan | AD-302N                                     | Dipole    | 3.0                               |                                 | 2.0                              |                     |                                                         | 150               |
| Ant. Set. | Transmitter Circuit    | Brand    | Model                                       | Ant. Type | 2.4GHz Gain with cable loss (dBi) |                                 | 5GHz Gain with cable loss (dBi)  |                     | Connector Type                                          | Cable Length (mm) |
| 8         | Chain (0)<br>Chain (1) | SANAV    | GEPH-023<br>401GEPH16-022G00<br>0000032-001 | PCB       | 4.78                              |                                 | 4.73                             |                     | IPEX4L MHF                                              | 320               |

### Newly

| Ant. Set. | Transmitter Circuit    | Brand | Model        | Ant. Type | 2.4GHz Gain with cable loss (dBi) | 5GHz Gain with cable loss (dBi) | Frequency range              | Connect or Type | Cable Length (mm) |
|-----------|------------------------|-------|--------------|-----------|-----------------------------------|---------------------------------|------------------------------|-----------------|-------------------|
| 9         | Chain (0)<br>Chain (1) | Pulse | W3334BD0150B | FPC       | 4                                 | 5.5                             | 2400~2500MHz<br>5150~5850MHz | MHF4            | 150               |

2. According to above conditions, only Radiated Emissions test item need to be performed. And all data were verified to meet the requirements.

3. There are Bluetooth technology and WLAN technology used for the EUT.

4. WLAN/BT coexistence mode:

◆ 2x2 WLAN + BT:

➤ 5GHz 802.11a/an (or 11ac) transmit concurrent with BT.

➤ 2.4GHz: timely shared coexistence.

5. The emission (conducted & radiated emission) of the simultaneous operation (WiFi <5GHz> & Bluetooth) have been evaluated and no non-compliance found. The detail combinations of transmitters / frequencies / modes as below table

| Mode                             | Available Channel | Tested Channel | Modulation Technology |
|----------------------------------|-------------------|----------------|-----------------------|
| 5 GHz<br>(802.11ac (VHT20))<br>+ | 36 to 165         | 48             | OFDM                  |
| Bluetooth (EDR)                  | 0 to 39           | 78             | 8DPSK                 |

6. The EUT incorporates a MIMO function:

| 2.4 GHz Band     |                       |     |
|------------------|-----------------------|-----|
| Modulation Mode  | TX & RX Configuration |     |
| 802.11b          | 2TX                   | 2RX |
| 802.11g          | 2TX                   | 2RX |
| 802.11n (HT20)   | 2TX                   | 2RX |
| 802.11n (HT40)   | 2TX                   | 2RX |
| VHT20            | 2TX                   | 2RX |
| VHT40            | 2TX                   | 2RX |
| 5 GHz Band       |                       |     |
| Modulation Mode  | TX & RX Configuration |     |
| 802.11a          | 2TX                   | 2RX |
| 802.11n (HT20)   | 2TX                   | 2RX |
| 802.11n (HT40)   | 2TX                   | 2RX |
| 802.11ac (VHT20) | 2TX                   | 2RX |
| 802.11ac (VHT40) | 2TX                   | 2RX |
| 802.11ac (VHT80) | 2TX                   | 2RX |

7. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

8. Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

### 3.1.1 Test Mode Applicability and Tested Channel Detail

| EUT CONFIGURE MODE | APPLICABLE TO |       |     |    | DESCRIPTION |
|--------------------|---------------|-------|-----|----|-------------|
|                    | RE≥1G         | RE<1G | PLC | OB |             |
| -                  | √             | √     | -   | -  | -           |

Where **RE≥1G**: Radiated Emission above 1GHz & Bandedge Measurement

**RE<1G**: Radiated Emission below 1GHz

**PLC**: Power Line Conducted Emission

**OB**: Conducted Out-Band Emission Measurement

Note: The EUT's FPC antenna had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.

#### **Radiated Emission Test (Above 1GHz):**

☒ The tested configurations represent the worst-case mode from all possible combinations by the maximum power.

☒ Following channel(s) was (were) selected for the final test as listed below.

| MODE                                  | AVAILABLE CHANNEL                                 | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE |
|---------------------------------------|---------------------------------------------------|----------------|-----------------------|-----------------|
| 5GHz: 802.11ac (VHT20)<br>+<br>BT_EDR | 36 to 48,<br>52 to 64<br>100 to 144<br>149 to 165 | 48             | OFDM                  | BPSK            |
|                                       | 0 to 78                                           | 78             | FHSS                  | 8DPSK           |

#### **Radiated Emission Test (Below 1GHz):**

☒ The tested configurations represent the worst-case mode from all possible combinations by the maximum power.

☒ Following channel(s) was (were) selected for the final test as listed below.

| MODE                                  | AVAILABLE CHANNEL                                 | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE |
|---------------------------------------|---------------------------------------------------|----------------|-----------------------|-----------------|
| 5GHz: 802.11ac (VHT20)<br>+<br>BT_EDR | 36 to 48,<br>52 to 64<br>100 to 144<br>149 to 165 | 48             | OFDM                  | BPSK            |
|                                       | 0 to 78                                           | 78             | FHSS                  | 8DPSK           |

#### **Test Condition:**

| APPLICABLE TO   | ENVIRONMENTAL CONDITIONS | INPUT POWER  | TESTED BY   |
|-----------------|--------------------------|--------------|-------------|
| <b>RE≥1G</b>    | 25deg. C, 75%RH          | 120Vac, 60Hz | Sapson Chen |
| <b>RE&lt;1G</b> | 24deg. C, 68%RH          | 120Vac, 60Hz | Nick Tsou   |

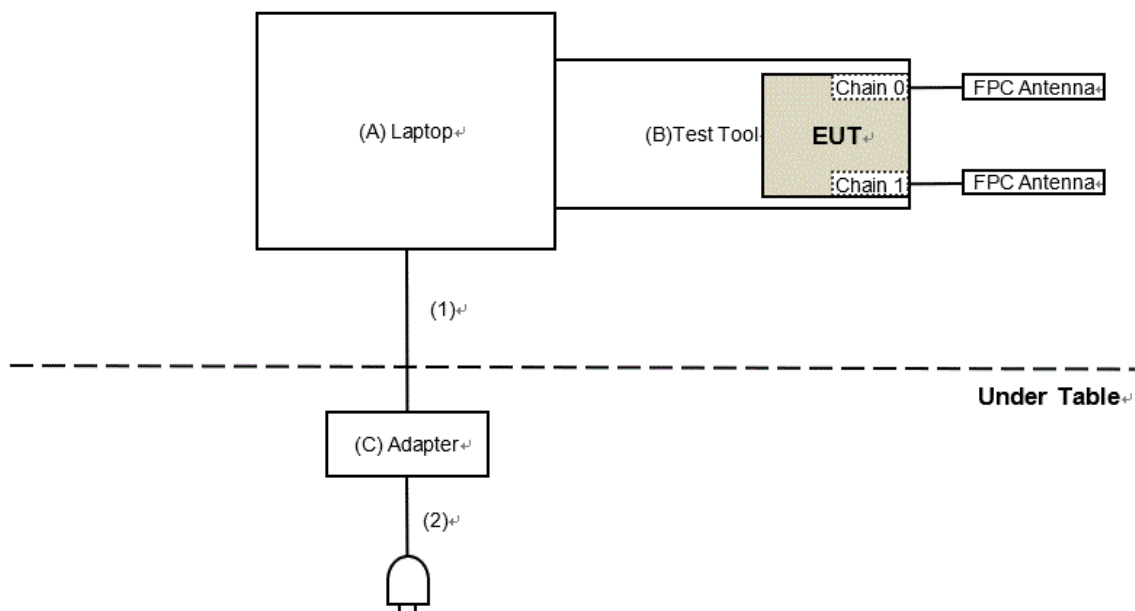
### 3.2 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| ID | Product   | Brand               | Model No.  | Serial No. | FCC ID | Remarks               |
|----|-----------|---------------------|------------|------------|--------|-----------------------|
| A  | Laptop    | DELL                | E5430      | HYV4VY1    | DoC    | Provided by Lab       |
| B  | Test Tool | Qualcomm<br>Atheros | N/A        | N/A        | N/A    | Supplied by applicant |
| C  | Adapter   | Dell                | FA65NE0-00 | N/A        | N/A    | Provided by Lab       |

| ID | Cable Descriptions | Qty. | Length<br>(m) | Shielding<br>(Yes/No) | Cores<br>(Qty.) | Remarks         |
|----|--------------------|------|---------------|-----------------------|-----------------|-----------------|
| 1  | DC Cable           | 1    | 1.8           | No                    | 0               | Provided by Lab |
| 2  | AC Cable           | 1    | 1             | No                    | 0               | Provided by Lab |

### 3.2.1 Configuration of System under Test



## 4 Test Types and Results

### 4.1 Radiated Emission and Bandedge Measurement

#### 4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

| Frequencies (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                             |

#### Note:

- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 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.

Limits of unwanted emission out of the restricted bands

| Applicable To                                                                                                                                                                                                                                                                                                                                                                   |                 | Limit                                                                                                                                   |                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 789033 D02 General UNII Test Procedure<br>New Rules v02r01                                                                                                                                                                                                                                                                                                                      |                 | Field Strength at 3m                                                                                                                    |                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                 |                 | PK:74 (dBμV/m)                                                                                                                          | AV:54 (dBμV/m)                                                                                                                            |
| Frequency Band                                                                                                                                                                                                                                                                                                                                                                  | Applicable To   | EIRP Limit                                                                                                                              | Equivalent Field Strength at 3m                                                                                                           |
| 5150~5250 MHz                                                                                                                                                                                                                                                                                                                                                                   | 15.407(b)(1)    | PK:-27 (dBm/MHz)                                                                                                                        | PK:68.2(dBμV/m)                                                                                                                           |
| 5250~5350 MHz                                                                                                                                                                                                                                                                                                                                                                   | 15.407(b)(2)    |                                                                                                                                         |                                                                                                                                           |
| 5470~5725 MHz                                                                                                                                                                                                                                                                                                                                                                   | 15.407(b)(3)    |                                                                                                                                         |                                                                                                                                           |
| 5725~5850 MHz                                                                                                                                                                                                                                                                                                                                                                   | 15.407(b)(4)(i) | PK: -27 (dBm/MHz) <sup>*1</sup><br>PK: 10 (dBm/MHz) <sup>*2</sup><br>PK: 15.6 (dBm/MHz) <sup>*3</sup><br>PK: 27 (dBm/MHz) <sup>*4</sup> | PK: 68.2(dBμV/m) <sup>*1</sup><br>PK: 105.2 (dBμV/m) <sup>*2</sup><br>PK: 110.8(dBμV/m) <sup>*3</sup><br>PK: 122.2 (dBμV/m) <sup>*4</sup> |
| 5725~5850 MHz                                                                                                                                                                                                                                                                                                                                                                   | 15.407(b)(4)(i) | PK: -27 (dBm/MHz) <sup>*1</sup><br>PK: 10 (dBm/MHz) <sup>*2</sup><br>PK: 15.6 (dBm/MHz) <sup>*3</sup><br>PK: 27 (dBm/MHz) <sup>*4</sup> | PK: 68.2(dBμV/m) <sup>*1</sup><br>PK: 105.2 (dBμV/m) <sup>*2</sup><br>PK: 110.8(dBμV/m) <sup>*3</sup><br>PK: 122.2 (dBμV/m) <sup>*4</sup> |
| <sup>*1</sup> beyond 75 MHz or more above of the band edge.<br><sup>*2</sup> below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.<br><sup>*3</sup> below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.<br><sup>*4</sup> from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge. |                 |                                                                                                                                         |                                                                                                                                           |

#### Note:

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts).}$$

#### 4.1.2 Test Instruments

##### For Radiated Emission below 1GHz test:

| Description<br>Manufacturer                         | Model No.            | Serial No.  | Calibrated<br>Date | Calibrated<br>Until |
|-----------------------------------------------------|----------------------|-------------|--------------------|---------------------|
| Bi_Log Antenna<br>Schwarzbeck                       | VULB 9168            | 9168-0942   | 2022/10/20         | 2023/10/19          |
| Boresight Antenna Tower & Turn<br>Table<br>Max-Full | MF-7802BS            | MF780208530 | N/A                | N/A                 |
| Fixed Attenuator<br>Mini-Circuits                   | UNAT-5+              | PAD-ATT5-01 | 2022/12/28         | 2023/12/27          |
| Loop Antenna<br>Electro-Metrics                     | EM-6879              | 264         | 2023/2/21          | 2024/2/20           |
| MXA Signal Analyzer<br>Keysight                     | N9020B               | MY60112410  | 2023/3/6           | 2024/3/5            |
| MXE EMI Receiver<br>Keysight                        | N9038A               | MY59050100  | 2023/6/13          | 2024/6/12           |
| Preamplifier<br>EMCI                                | EMC330N              | 980852      | 2023/2/20          | 2024/2/19           |
|                                                     | EMC001340            | 980142      | 2023/5/8           | 2024/5/7            |
| RF Coaxial Cable<br>JYEBAO                          | 5D-FB                | LOOPCAB-001 | 2022/12/19         | 2023/12/18          |
|                                                     |                      | LOOPCAB-002 | 2022/12/19         | 2023/12/18          |
| RF Coaxial Cable<br>PEWC                            | 8D                   | 966-6-1     | 2023/4/6           | 2024/4/5            |
|                                                     |                      | 966-6-2     | 2023/4/6           | 2024/4/5            |
|                                                     |                      | 966-6-3     | 2023/4/6           | 2024/4/5            |
| Software                                            | ADT_Radiated_V8.7.08 | N/A         | N/A                | N/A                 |

##### Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 6.
3. Tested Date: 2023/7/21

**For Radiated Emission above 1GHz test:**

| Description<br>Manufacturer                         | Model No.            | Serial No.  | Calibrated<br>Date | Calibrated<br>Until |
|-----------------------------------------------------|----------------------|-------------|--------------------|---------------------|
| Boresight Antenna Tower &<br>Turn Table<br>Max-Full | MF-7802BS            | MF780208530 | N/A                | N/A                 |
| Horn Antenna<br>Schwarzbeck                         | BBHA 9120D           | 9120D-2035  | 2022/11/13         | 2023/11/12          |
|                                                     | BBHA 9170            | BBHA9170519 | 2022/11/13         | 2023/11/12          |
| MXA Signal Analyzer<br>Keysight                     | N9020B               | MY60112410  | 2023/3/6           | 2024/3/5            |
| MXE EMI Receiver<br>Keysight                        | N9038A               | MY59050100  | 2023/6/13          | 2024/6/12           |
| Preamplifier<br>EMCI                                | EMC12630SE           | 980385      | 2023/8/10          | 2024/8/9            |
|                                                     | EMC184045SE          | 980387      | 2023/8/9           | 2024/8/8            |
| RF Coaxial Cable<br>EMCI                            | EMC-KM-KM-4000       | 200214      | 2023/2/20          | 2024/2/19           |
|                                                     | EMC101G-KM-KM-10000  | 210708      | 2022/11/4          | 2023/11/3           |
|                                                     | EMC102-KM-KM-1200    | 160924      | 2023/8/9           | 2024/8/8            |
|                                                     | EMC104-SM-SM-1300    | 210205      | 2023/5/8           | 2024/5/7            |
| Software                                            | ADT_Radiated_V8.7.08 | N/A         | N/A                | N/A                 |

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 6.
3. Tested Date: 2023/10/11

#### 4.1.3 Test Procedures

##### For Radiated emission below 30MHz

- 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. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

##### Note:

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

##### For Radiated emission above 30MHz

- 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. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect 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.

##### Note:

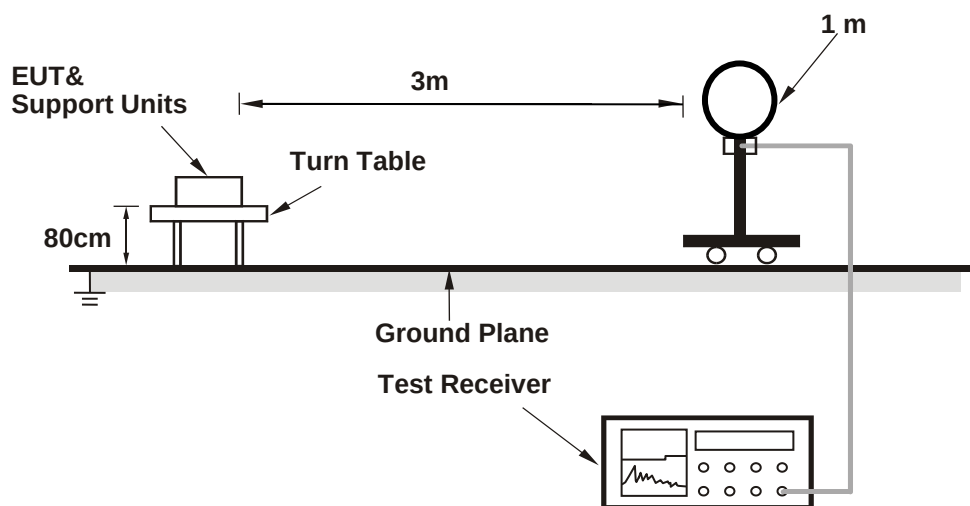
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. 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.
4. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

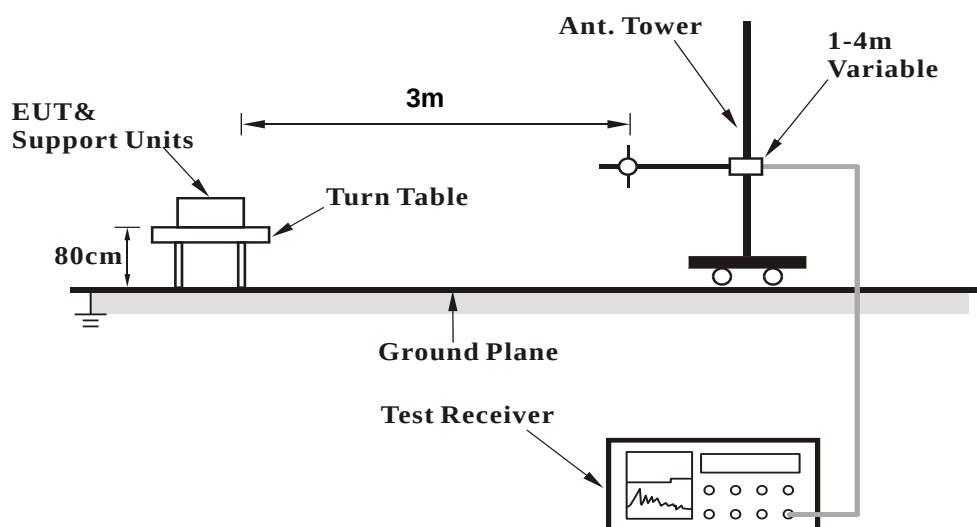
No deviation.

#### 4.1.5 Test Setup

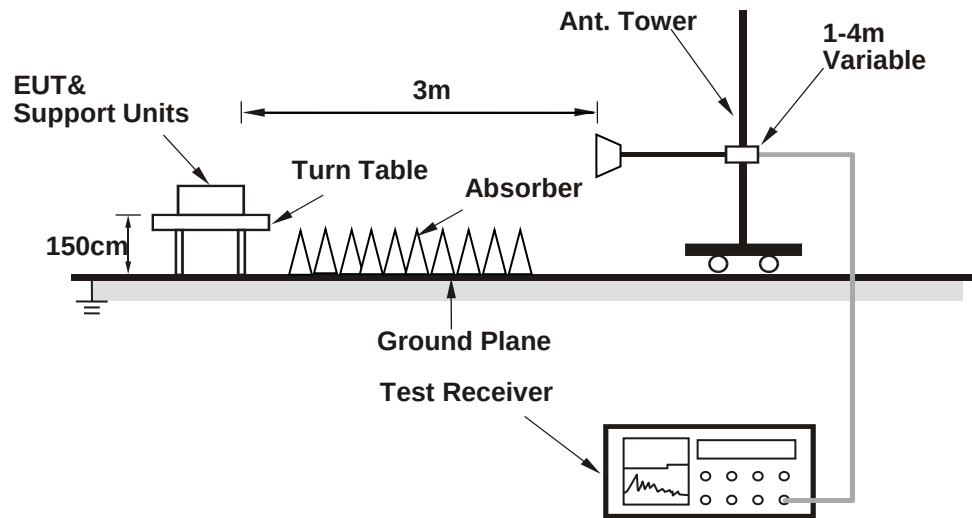
##### For Radiated emission below 30MHz



##### For Radiated emission 30MHz to 1GHz



### For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT Operating Conditions

- Connected the EUT with the Laptop which is placed on on remote site.
- Controlling software (QDART 1.0.38) has been activated to set the EUT under transmission condition continuously.

#### 4.1.7 Test Results

##### Above 1GHz Data:

|                 |              |                   |                           |
|-----------------|--------------|-------------------|---------------------------|
| Frequency Range | 1GHz ~ 40GHz | Detector Function | Peak (PK)<br>Average (AV) |
|-----------------|--------------|-------------------|---------------------------|

| Antenna Polarity & Test Distance : Horizontal at 3 m |                 |                         |                |             |                    |                      |                  |                          |
|------------------------------------------------------|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No                                                   | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1                                                    | 4960.00         | 43.9 PK                 | 74.0           | -30.1       | 3.79 H             | 220                  | 41.2             | 2.7                      |
| 2                                                    | 4960.00         | 42.3 AV                 | 54.0           | -11.7       | 3.79 H             | 220                  | 39.6             | 2.7                      |
| 3                                                    | 7440.00         | 42.0 PK                 | 74.0           | -32.0       | 1.48 H             | 138                  | 32.8             | 9.2                      |
| 4                                                    | 7440.00         | 30.0 AV                 | 54.0           | -24.0       | 1.48 H             | 138                  | 20.8             | 9.2                      |
| 5                                                    | #10480.00       | 46.4 PK                 | 68.2           | -21.8       | 1.90 H             | 167                  | 32.4             | 14.0                     |
| 6                                                    | 15720.00        | 45.2 PK                 | 74.0           | -28.8       | 2.47 H             | 254                  | 31.0             | 14.2                     |
| 7                                                    | 15720.00        | 33.1 AV                 | 54.0           | -20.9       | 2.47 H             | 254                  | 18.9             | 14.2                     |
| Antenna Polarity & Test Distance : Vertical at 3 m   |                 |                         |                |             |                    |                      |                  |                          |
| No                                                   | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1                                                    | 4960.00         | 46.1 PK                 | 74.0           | -27.9       | 3.44 V             | 274                  | 43.4             | 2.7                      |
| 2                                                    | 4960.00         | 44.2 AV                 | 54.0           | -9.8        | 3.44 V             | 274                  | 41.5             | 2.7                      |
| 3                                                    | 7440.00         | 41.5 PK                 | 74.0           | -32.5       | 1.52 V             | 136                  | 32.3             | 9.2                      |
| 4                                                    | 7440.00         | 29.3 AV                 | 54.0           | -24.7       | 1.52 V             | 136                  | 20.1             | 9.2                      |
| 5                                                    | #10480.00       | 47.2 PK                 | 68.2           | -21.0       | 2.20 V             | 268                  | 33.2             | 14.0                     |
| 6                                                    | 15720.00        | 45.6 PK                 | 74.0           | -28.4       | 2.50 V             | 232                  | 31.4             | 14.2                     |
| 7                                                    | 15720.00        | 32.8 AV                 | 54.0           | -21.2       | 2.50 V             | 232                  | 18.6             | 14.2                     |

##### Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " # ": The radiated frequency is out of the restricted band.

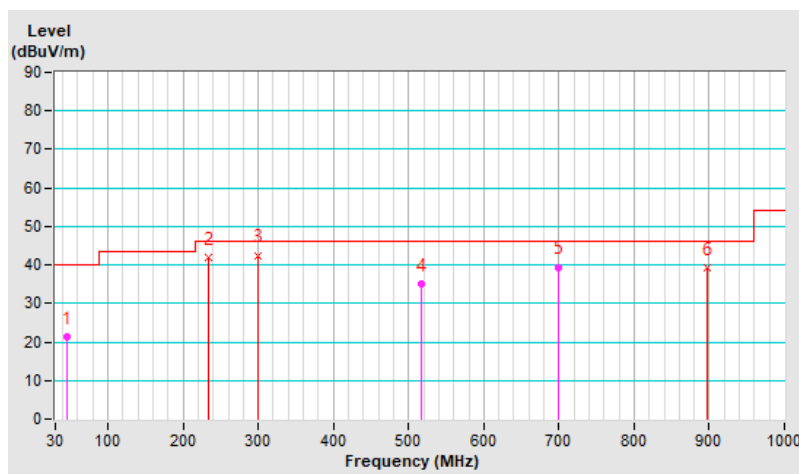
#### Below 1GHz Data:

|                 |              |                   |                 |
|-----------------|--------------|-------------------|-----------------|
| Frequency Range | 30MHz ~ 1GHz | Detector Function | Quasi-Peak (QP) |
|-----------------|--------------|-------------------|-----------------|

| Antenna Polarity & Test Distance : Horizontal at 3 m |                 |                         |                |             |                    |                      |                  |                          |
|------------------------------------------------------|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No                                                   | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1                                                    | 44.65           | 21.5 QP                 | 40.0           | -18.5       | 3.00 H             | 64                   | 34.1             | -12.6                    |
| 2                                                    | 232.79          | 42.0 QP                 | 46.0           | -4.0        | 1.00 H             | 0                    | 56.9             | -14.9                    |
| 3                                                    | 299.29          | 42.5 QP                 | 46.0           | -3.5        | 2.50 H             | 31                   | 54.7             | -12.2                    |
| 4                                                    | 516.04          | 35.1 QP                 | 46.0           | -10.9       | 1.50 H             | 243                  | 42.2             | -7.1                     |
| 5                                                    | 698.46          | 39.5 QP                 | 46.0           | -6.5        | 1.00 H             | 149                  | 43.0             | -3.5                     |
| 6                                                    | 898.00          | 39.4 QP                 | 46.0           | -6.6        | 2.50 H             | 120                  | 40.3             | -0.9                     |

#### Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

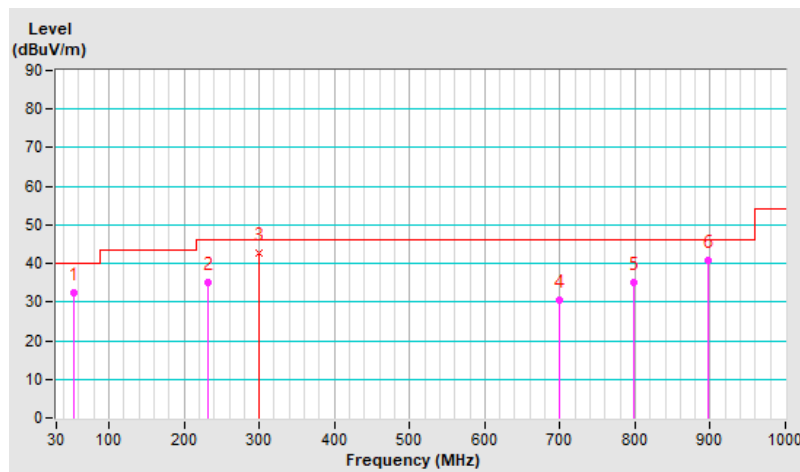


|                 |              |                   |                 |
|-----------------|--------------|-------------------|-----------------|
| Frequency Range | 30MHz ~ 1GHz | Detector Function | Quasi-Peak (QP) |
|-----------------|--------------|-------------------|-----------------|

| Antenna Polarity & Test Distance : Vertical at 3 m |                 |                         |                |             |                    |                      |                  |                          |
|----------------------------------------------------|-----------------|-------------------------|----------------|-------------|--------------------|----------------------|------------------|--------------------------|
| No                                                 | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Correction Factor (dB/m) |
| 1                                                  | 52.41           | 32.4 QP                 | 40.0           | -7.6        | 1.00 V             | 322                  | 44.7             | -12.3                    |
| 2                                                  | 232.35          | 35.1 QP                 | 46.0           | -10.9       | 2.00 V             | 62                   | 50.0             | -14.9                    |
| 3                                                  | 299.29          | 42.7 QP                 | 46.0           | -3.3        | 3.00 V             | 83                   | 54.9             | -12.2                    |
| 4                                                  | 698.46          | 30.4 QP                 | 46.0           | -15.6       | 2.00 V             | 49                   | 33.9             | -3.5                     |
| 5                                                  | 798.23          | 35.1 QP                 | 46.0           | -10.9       | 1.50 V             | 351                  | 37.2             | -2.1                     |
| 6                                                  | 898.00          | 40.8 QP                 | 46.0           | -5.2        | 1.50 V             | 110                  | 41.7             | -0.9                     |

#### Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

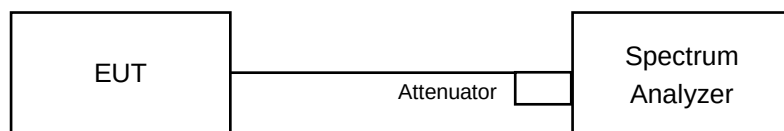


## 4.2 Conducted Out of Band Emission Measurement

### 4.2.1 Limits of Conducted Out of Band Emission Measurement

Below 20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

### 4.2.2 Test Setup



### 4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.2.4 Test Procedures

#### MEASUREMENT PROCEDURE REF

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

#### MEASUREMENT PROCEDURE OOB

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.

### 4.2.5 Deviation from Test Standard

No deviation.

### 4.2.6 EUT Operating Conditions

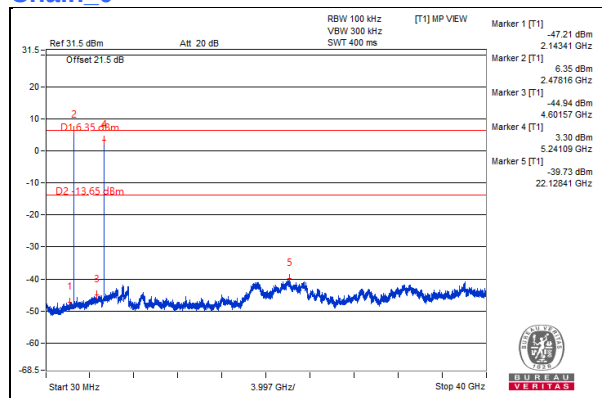
The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

### 4.2.7 Test Results

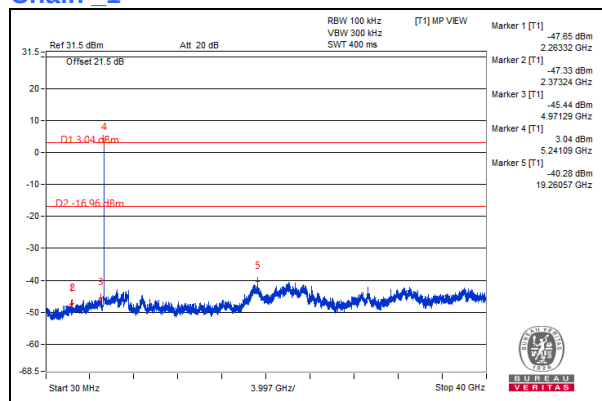
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

## 5GHz: 802.11ac (VHT20)\_CH48 + BT-EDR\_CH78

### Chain\_0



### Chain\_1



## 5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

## Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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The address and road map of all our labs can be found in our web site also.

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