

## FCC Test Report

**Report No.:** RFBCFP-WTW-P21050667A

**FCC ID:** PPQ-MS4

**Test Model:** MS4

**Received Date:** 2023/6/29

**Test Date:** 2023/7/21 ~ 2023/8/10

**Issued Date:** 2023/10/24

**Applicant:** LITE-ON Technology Corp.

**Address:** Bldg. C, 90, Chien 1 Rd., Chung-Ho, New Taipei City, 23585, Taiwan

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

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

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

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



This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at <http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/> and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

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### Release Control Record

| Issue No.             | Description       | Date Issued |
|-----------------------|-------------------|-------------|
| RFBCFP-WTW-P21050667A | Original release. | 2023/10/24  |

## 1 Certificate of Conformity

**Product:** MS4 Module

**Test Model:** MS4

**Sample Status:** Engineering sample

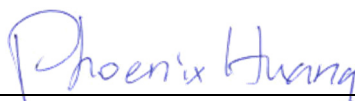
**Applicant:** LITE-ON Technology Corp.

**Test Date:** 2023/7/21 ~ 2023/8/10

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.249)  
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 :**

  
Phoenix Huang / Specialist

**Date:**

2023/10/24

**Approved by :**

  
May Chen / Manager

**Date:**

2023/10/24

## 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (SECTION 15.249) |                                                                                                                                                                    |        |                                                                                    |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------|
| FCC Clause                                     | Test Item                                                                                                                                                          | Result | Remarks                                                                            |
| 15.207                                         | AC Power Conducted Emission                                                                                                                                        | Pass   | Meet the requirement of limit. Minimum passing margin is -15.36 dB at 0.15000 MHz. |
| 15.209<br>15.249<br>15.249 (d)                 | Radiated Emission Test<br>Band Edge Measurement<br>Limit: 50dB less than the peak value of fundamental frequency or meet radiated emission limit in section 15.209 | Pass   | Meet the requirement of limit. Minimum passing margin is -4.7 dB at 39.41 MHz      |
| 15.215 (c)                                     | 20dB Bandwidth                                                                                                                                                     | Pass   | Meet the requirement of limit                                                      |
| 15.203                                         | Antenna Requirement                                                                                                                                                | Pass   | No antenna connector is used.                                                      |

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

### 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) (±) |
|--------------------------------|------------------|--------------------------------|
| AC Power Conducted Emissions   | 150 kHz ~ 30 MHz | 1.9 dB                         |
| Radiated Emissions up to 1 GHz | 9 kHz ~ 30 MHz   | 3.1 dB                         |
|                                | 30 MHz ~ 1 GHz   | 5.5 dB                         |
| Radiated Emissions above 1 GHz | 1 GHz ~ 18 GHz   | 5.1 dB                         |
|                                | 18 GHz ~ 40 GHz  | 5.3 dB                         |

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

|                                  |                                                                               |
|----------------------------------|-------------------------------------------------------------------------------|
| Product                          | MS4 Module                                                                    |
| Test Model                       | MS4                                                                           |
| Status of EUT                    | Engineering sample                                                            |
| Power Supply Rating              | 5 Vdc from host equipment or<br>3.7 Vdc from rechargeable lithium ion battery |
| Modulation Technology            | GFSK                                                                          |
| Transfer Rate                    | 1 Mbps                                                                        |
| Operating Frequency              | 2.415 GHz ~ 2.459 GHz                                                         |
| Number of Channel                | 3                                                                             |
| Output Power<br>(Field Strength) | 93.2 dBuV/m (Peak) at 3m                                                      |
| Antenna Type                     | Refer to Note                                                                 |
| Antenna Connector                | Refer to Note                                                                 |
| Accessory Device                 | NA                                                                            |
| Data Cable Supplied              | NA                                                                            |

Note:

- This is a supplementary report of Report No.: RF180718D12. The differences between them are as below information:
  - ◆ Add PCB 2<sup>nd</sup> source (same layout)
  - ◆ Add antenna 2<sup>nd</sup> source (same type)
  - ◆ Add 2<sup>nd</sup> source Change supplier (same specifications)
  - ◆ Add crystal 2<sup>nd</sup> source (same oscillating frequency)
- The mentioned above has been approved and is electronically and mechanically identical to the original instructions and requirements. Except for the changes mentioned above, no other modification is performed.
- The antenna information is listed as below.

#### Original

| Brand    | Model  | Antenna Gain<br>(dBi) | Frequency Range<br>(GHz) | Antenna Type | Connector Type |
|----------|--------|-----------------------|--------------------------|--------------|----------------|
| Unictron | AA055A | 2.5                   | 2.4-2.4835               | Chip         | None           |

#### Newly

| Brand    | Model  | Antenna Gain<br>(dBi) | Frequency Range<br>(GHz) | Antenna Type | Connector Type |
|----------|--------|-----------------------|--------------------------|--------------|----------------|
| Unictron | AA055U | 3.1                   | 2.4-2.4835               | Chip         | None           |

- Due to radiated measurements are made and the antenna gain is already accounted for this device, so provide an antenna datasheet and/or antenna measurement report is not required. The antenna dimensions and pictures (include antenna wire length if have) are stated in EUT photo exhibit.

## 5. Component information is as following:

| Item            | 1 <sup>st</sup> Model        | 2 <sup>nd</sup> Brand | 2 <sup>nd</sup> Model               |
|-----------------|------------------------------|-----------------------|-------------------------------------|
| PCB             | -                            | KINWONG               | PCB,Motor Board,4,101*28*1.2,FR4    |
|                 | -                            | KINWONG               | PCB,KEY,2,32*18*1,FR4               |
|                 | -                            | KINWONG               | PCB,Encoder Board,2,15.5*30.5*1,FR4 |
|                 | -                            | KINWONG               | PCB,Arm,2,11*22*1.0,FR4             |
| Bead / Inductor | QT1005RL120HC060-LF          | MURATA                | BLM15AX121SN1D                      |
|                 |                              | SPORTON               | GCB1005K-121T08                     |
|                 | QT1608RL600HC1AFL            | MURATA                | BLM18KG601SN1D                      |
|                 |                              | SPORTON               | LCB1608K-601T10                     |
|                 | QT2012RL600HC2ALF            | MURATA                | BLM21SP601SN1D                      |
|                 |                              | SPORTON               | LCB2012K-601T20                     |
|                 | QT2012RL300HC3A-LF           | SPORTON               | LCB2012K-301T30                     |
|                 | QTL1608-100K-LF              | SPORTON               | MCH1608TF-100K-T-I0.12              |
|                 | QHL100505CS-15NJ-LF          | MURATA                | LQG15HS15NJ02D                      |
|                 |                              | SPORTON               | HCI1005Q-15NJ-T                     |
| TVS / Diode     | WSRPG0503-R68M-AG            | SPORTON               | TMPD0503HG-R68M-G4                  |
|                 | -                            | MURATA                | DFE252012P-2R2M=P2                  |
|                 |                              | SPORTON               | LQH252012DF-2R2M-T                  |
|                 | TPD1E10B09DPYR               | Nichtek               | D2315-7R0                           |
|                 | DFT8V0A-7                    | Nichtek               | D6314-8R0UA                         |
|                 | SBR3U30P1-7                  | Nichtek               | S6314-400CB                         |
| Chip Antenna    | BZT52HC6V8WF-7               | Nichtek               | Z6114-6R8B                          |
|                 | PMEG4030ER                   | Nichtek               | S6314-400C                          |
|                 | 1N4148WT-7                   | Nichtek               | Y4114-750                           |
|                 |                              |                       |                                     |
| Fuse            | H2U34W1H1Z0400/AA055A        | UNICTRON              | H2U34W1H1Z0700/AA055U               |
| Xtal            | 0805L260SLTHYR               | PTTC                  | SMD0805P260SLRT                     |
|                 | X2C032000BC1H-HS             | Hosonic               | E1SB32E00000PE                      |
| NTC             | RT2012-32.768-12.5-20-EXT-TR | SIWARD                | XTL741-S999-377                     |
| Photo Interrupt | MTR06GTH440B104              | MURATA                | NCP18WF104F12RB                     |
| MOS             | RPI-0352E                    | LITEON                | LTH-339-02                          |
|                 |                              |                       |                                     |
|                 | AO3401L                      | Nichtek               | MSL3401PT2G-P                       |
|                 |                              | AOS                   | AOSS21311C                          |
|                 | AO3400A                      | Sinpower              | SM2316NSA                           |
|                 | MMBT3904-7-F                 | Nichtek               | GT9921-600N                         |
|                 | DMN1019USN-7                 | Sinpower              | SM2320NSA                           |
| Connector       | DMN2022UNS-7                 | Sinpower              | SM9989DSQA                          |
|                 | DMG4413LSS-13                | Sinpower              | SM4501PSKCTRG                       |
|                 | A1501WV-S-04PNLNT1N00L       | JCTC                  | 11502W00-04-S-HF                    |
| MOSFET          | USB-CON-USB00211LG           | SHENG DA              | 122-0525NA0244                      |
|                 | B2B-PH-SM4-TBT(LF)(SN)       | JST                   | B2B-PH-SM4-TB1(LF)(SN)              |
| Conn,Header     | DMN1019USN-7                 | Sinopower             | SM2320NSAC-TRG                      |
|                 | 11002W00-8P-S-HF             | JOINT TECH            | A1001WV-S-08PN6BT1T00L              |

6. For Radiated Emission test, the EUT was pre-tested under following test modes:

| Pre-test Mode                                                                                                                                                     | Power                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| <b>Mode A</b>                                                                                                                                                     | <b>5Vdc from host equipment (USB Adapter)</b> |
| Mode B                                                                                                                                                            | 3.7 Vdc from rechargeable lithium ion battery |
| Note: In original report, from the above modes, the worse case was found in <b>Mode A</b> . Therefore only the test data of the mode was recorded in this report. |                                               |

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.

### 3.2 Description of Test Modes

3 channels are provided to this EUT:

| Channel | Frequency | Channel | Frequency |
|---------|-----------|---------|-----------|
| 15      | 2415      | 39      | 2439      |
| 59      | 2459      |         |           |

### 3.2.1 Test Mode Applicability and Tested Channel Detail

| EUT CONFIGURE MODE | APPLICABLE TO |       |     |      | DESCRIPTION            |
|--------------------|---------------|-------|-----|------|------------------------|
|                    | RE $\geq$ 1G  | RE<1G | PLC | APCM |                        |
| 1                  | √             | √     | √   | √    | Power from USB Adapter |
| 2                  | -             | -     | √   | -    | Power from Laptop      |

Where **RE $\geq$ 1G**: Radiated Emission above 1GHz & Bandedge Measurement **RE<1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission **APCM**: Antenna Port Conducted Measurement

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

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

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

| Available Channel | Tested Channel | Modulation Type |
|-------------------|----------------|-----------------|
| 15 to 59          | 15, 39, 59     | GFSK            |

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

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

| Available Channel | Tested Channel | Modulation Type |
|-------------------|----------------|-----------------|
| 15 to 59          | 15             | GFSK            |

#### **Power Line Conducted Emission Test:**

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

| Available Channel | Tested Channel | Modulation Type |
|-------------------|----------------|-----------------|
| 15 to 59          | 15             | GFSK            |

#### **Antenna Port Conducted Measurement:**

- ☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- ☒ 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).
- ☒ Following channel(s) was (were) selected for the final test as listed below.

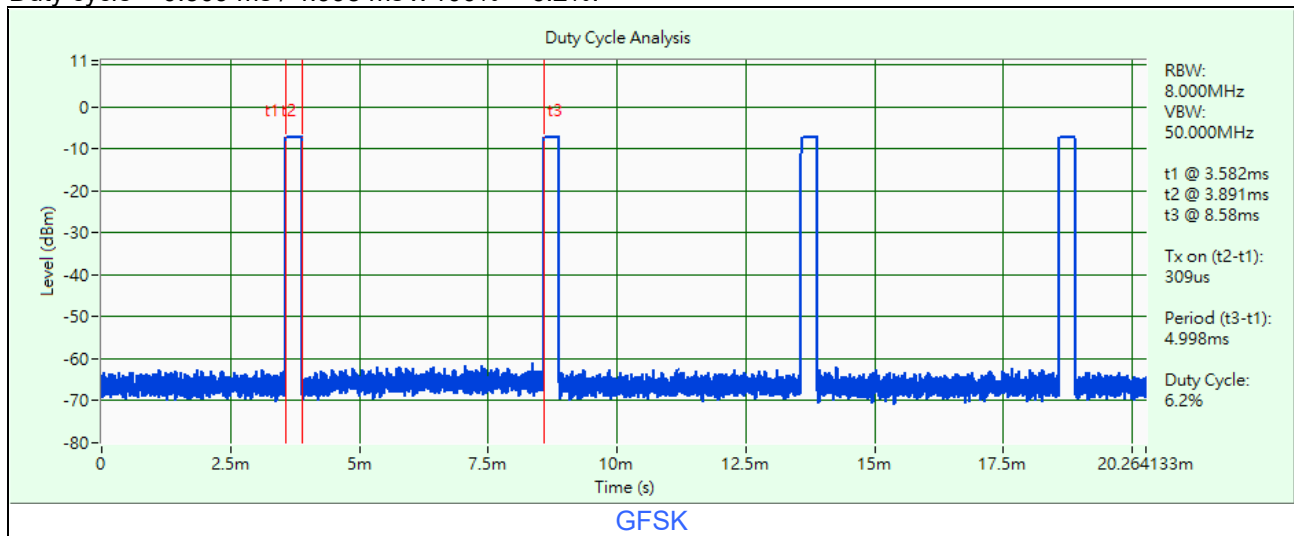
| Available Channel | Tested Channel | Modulation Type |
|-------------------|----------------|-----------------|
| 15 to 59          | 15, 39, 59     | GFSK            |

**Test Condition:**

| Applicable to | Environmental Conditions | Input Power           | Tested By    |
|---------------|--------------------------|-----------------------|--------------|
| RE $\geq$ 1G  | 22deg. C, 67%RH          | 120Vac, 60Hz (System) | Sampson Chen |
| RE<1G         | 25deg. C, 76%RH          | 120Vac, 60Hz (System) | William Su   |
| PLC           | 24deg. C, 73%RH          | 120Vac, 60Hz (System) | Andy Ho      |
| APCM          | 25deg. C, 76%RH          | 5 Vdc                 | Waydi Tuan   |

### 3.3 Duty Cycle of Test Signal

Duty cycle =  $0.309 \text{ ms} / 4.998 \text{ ms} \times 100\% = 6.2\%$ .



### 3.4 Description of Support Units

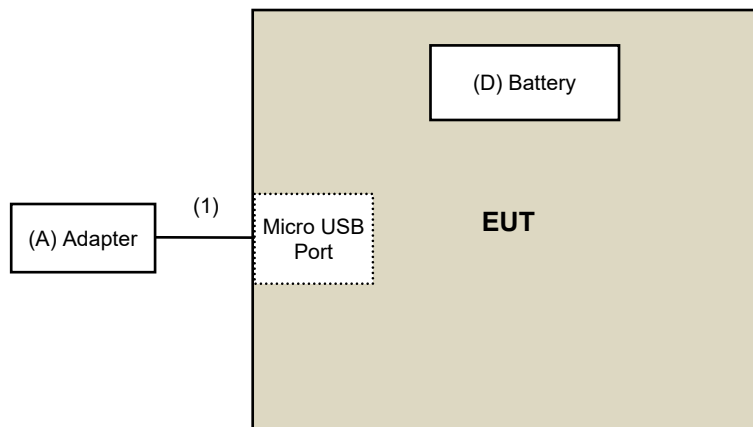
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| ID | Product    | Brand         | Model No.          | Serial No. | FCC ID  | Remarks               |
|----|------------|---------------|--------------------|------------|---------|-----------------------|
| A. | Adapter    | Shenzhen Keyu | KA0601A-0501000USU | NA         | NA      | Supplied by applicant |
| B. | Laptop     | DELL          | E6420              | B92T3R1    | FCC Doc | Provided by Lab       |
| C. | Adapter    | DELL          | LLA65NS2-01        | NA         | NA      | Provided by Lab       |
| D. | Battery x2 | Panasonic     | NCR18650BF         | N/A        | N/A     | Supplied by applicant |

| ID | Cable Descriptions | Qty. | Length (m) | Shielding (Yes/No) | Cores (Qty.) | Remarks               |
|----|--------------------|------|------------|--------------------|--------------|-----------------------|
| 1  | USB Cable          | 1    | 1          | Yes                | 0            | Supplied by applicant |
| 2  | DC Cable           | 1    | 1.5        | No                 | 0            | Provided by Lab       |
| 3  | AC Cable           | 1    | 1          | No                 | 0            | Provided by Lab       |

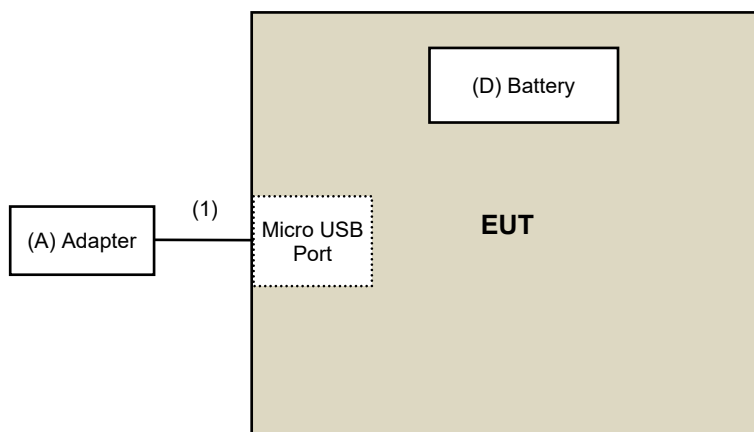
#### 3.4.1 Configuration of System under Test

##### For Rsdiated Emission test

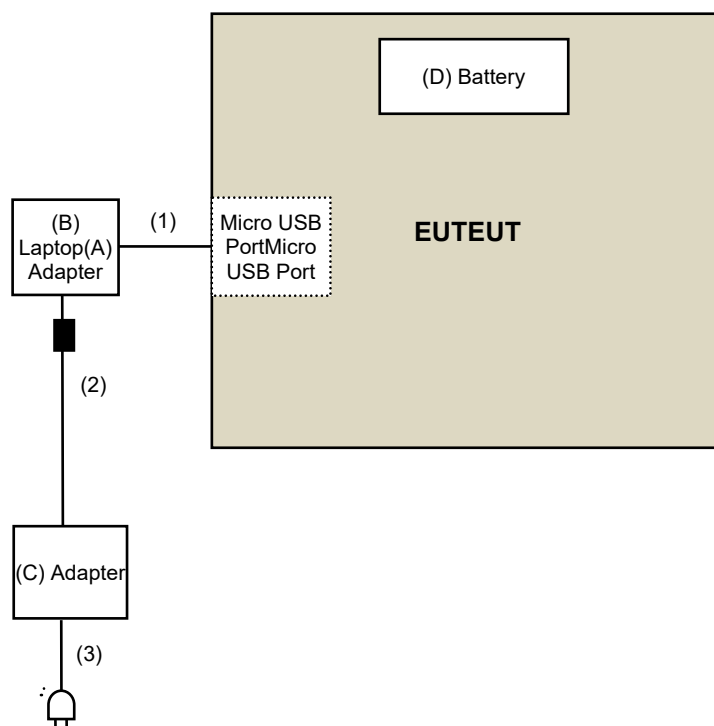


## For AC Power Conducted Emission test

### Adapter mode



### Laptop mode



### 3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C (15.249)**

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

## 4 Test Types and Results

### 4.1 Radiated Emission and Bandedge Measurement

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

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following

| Fundamental Frequency | Field Strength of Fundamental (millivolts/meter) | Field Strength of Harmonics (microvolts/meter) |
|-----------------------|--------------------------------------------------|------------------------------------------------|
| 902 ~ 928 MHz         | 50                                               | 500                                            |
| 2400 ~ 2483.5 MHz     | 50                                               | 500                                            |
| 5725 ~ 5875 MHz       | 50                                               | 500                                            |
| 24 ~ 24.25 GHz        | 250                                              | 2500                                           |

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits as below table, whichever is the lesser attenuation

| 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:

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.

#### 4.1.2 Test Instruments

##### For Radiated Emission test:

| Description & Manufacturer                          | Model No.                | Serial No.      | Calibrated Date | Calibrated Until |
|-----------------------------------------------------|--------------------------|-----------------|-----------------|------------------|
| MXA Signal Analyzer<br>Keysight                     | N9020B                   | MY60112408      | 2023/3/6        | 2024/3/5         |
| MXE EMI Receiver<br>Keysight                        | N9038A                   | MY59050100      | 2023/6/13       | 2024/6/12        |
| Software                                            | ADT_Radiated_V8.7.0<br>8 | NA              | NA              | NA               |
| Boresight Antenna Tower & Turn<br>Table<br>Max-Full | MF-7802BS                | MF780208530     | NA              | NA               |
| Preamplifier<br>Agilent                             | 8447D                    | 2944A10636      | 2023/3/12       | 2024/3/11        |
| Loop Antenna<br>Electro-Metrics                     | EM-6879                  | 264             | 2023/2/21       | 2024/2/20        |
| RF Coaxial Cable<br>JYEBAO                          | 5D-FB                    | LOOPCAB-00<br>1 | 2022/12/19      | 2023/12/18       |
| RF Coaxial Cable<br>JYEBAO                          | 5D-FB                    | LOOPCAB-00<br>2 | 2022/12/19      | 2023/12/18       |
| Preamplifier<br>EMCI                                | EMC330N                  | 980701          | 2023/2/18       | 2024/2/17        |
| Bi_Log Antenna<br>Schwarzbeck                       | VULB 9168                | 9168-406        | 2022/10/21      | 2023/10/20       |
| RF Coaxial Cable<br>PEWC                            | 8D                       | 966-4-1         | 2023/2/18       | 2024/2/17        |
| RF Coaxial Cable<br>PEWC                            | 8D                       | 966-4-2         | 2023/2/18       | 2024/2/17        |
| RF Coaxial Cable<br>PEWC                            | 8D                       | 966-4-3         | 2023/2/18       | 2024/2/17        |
| Fixed Attenuator<br>Mini-Circuits                   | UNAT-5+                  | PAD-ATT5-03     | 2022/12/28      | 2023/12/27       |
| Horn Antenna<br>Schwarzbeck                         | BBHA 9120D               | 9120D-783       | 2022/11/13      | 2023/11/12       |
| Preamplifier<br>EMCI                                | EMC12630SE               | 980688          | 2022/10/4       | 2023/10/3        |
| RF Coaxial Cable<br>EMCI                            | EMC104-SM-SM-1200        | 160922          | 2022/12/15      | 2023/12/14       |
| RF Coaxial Cable<br>EMCI                            | EMC104-SM-SM-2000        | 180502          | 2023/3/27       | 2024/3/26        |
| RF Coaxial Cable<br>EMCI                            | EMC104-SM-SM-6000        | 210704          | 2022/11/4       | 2023/11/3        |
| Preamplifier<br>EMCI                                | EMC184045SE              | 980387          | 2022/12/28      | 2023/12/27       |
| Horn Antenna<br>Schwarzbeck                         | BBHA 9170                | 9170-739        | 2022/11/13      | 2023/11/12       |
| RF Coaxial Cable<br>EMCI                            | EMC102-KM-KM-1200        | 160924          | 2022/12/28      | 2023/12/27       |
| RF Coaxial Cable<br>EMCI                            | EMC-KM-KM-4000           | 200214          | 2023/2/20       | 2024/2/19        |

##### Notes:

1. The test was performed in 966 Chamber No. 4.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: 2023/7/21 ~ 2023/8/10

**For other test items:**

| Description & Manufacturer      | Model No.                        | Serial No.    | Calibrated Date | Calibrated Until |
|---------------------------------|----------------------------------|---------------|-----------------|------------------|
| MXA Signal Analyzer<br>Keysight | N9020B                           | MY60112409    | 2023/2/18       | 2024/2/17        |
| Fixed Attenuator<br>Woken       | MDCS18N-10                       | MDCS18N-10-01 | 2023/3/27       | 2024/3/26        |
| Software                        | ADT_RF Test<br>Software V6.6.5.4 | NA            | NA              | NA               |

## Notes:

1. The test was performed in Oven room 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: 2023/7/21

#### 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:**

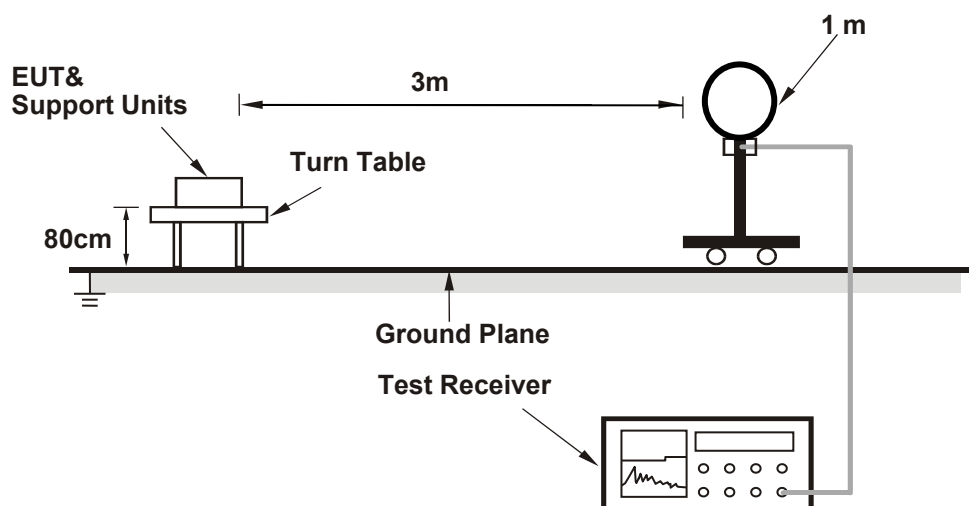
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. According to ANSI C63.10 section 7.5. For fundamental and harmonic signal measurement, the average value = peak value + duty cycle correction factor. The duty cycle measurement refer to FCC 47 CFR Part 15C section 15.35 (c). For duty cycle correction factor values, see the Test Signal Duty Cycle section in this report.
4. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

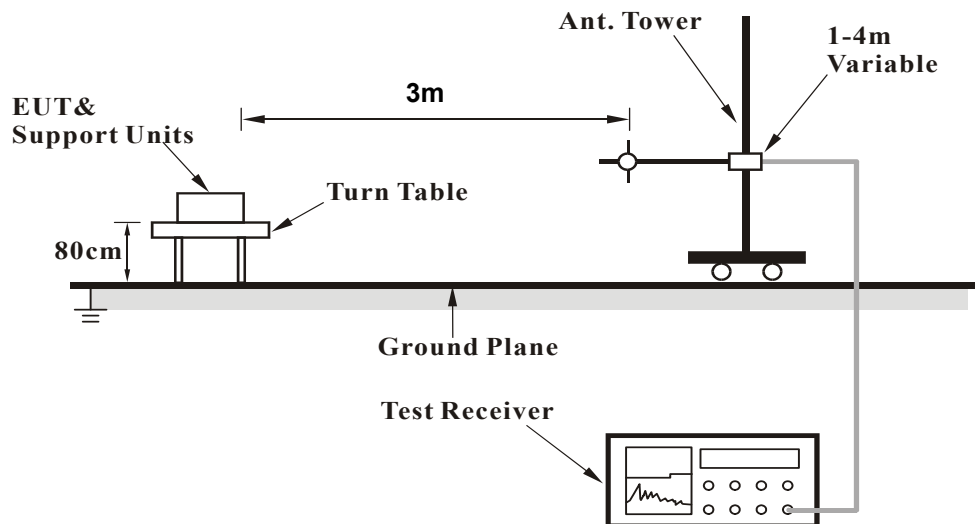
No deviation.

#### 4.1.5 Test Setup

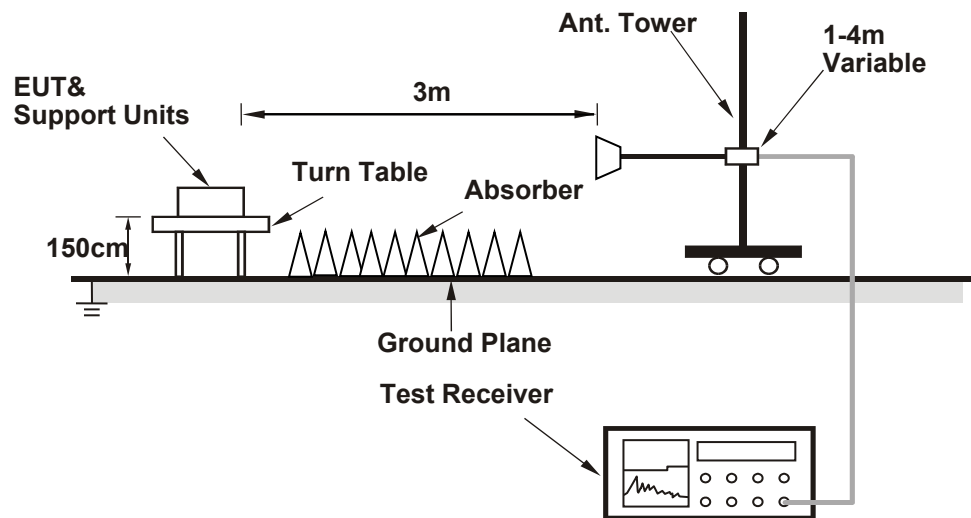
##### For Radiated emission below 30MHz



##### 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

- Placed the EUT on the testing table.
- Controlling software (RF Sample push the button) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

#### 4.1.7 Test Results

##### Above 1GHz Data:

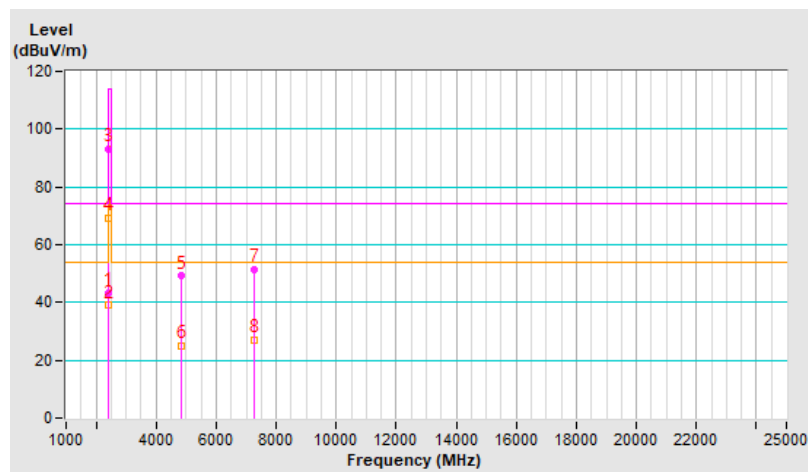
|                        |                |                                          |                                                                     |
|------------------------|----------------|------------------------------------------|---------------------------------------------------------------------|
| <b>RF Mode</b>         | GFSK           | <b>Channel</b>                           | CH 15 : 2415 MHz                                                    |
| <b>Frequency Range</b> | 1 GHz ~ 25 GHz | <b>Detector Function &amp; Bandwidth</b> | PK: RB=1 MHz, VB=3 MHz, DET=Peak<br>AV: RB=1 MHz, VB=3 MHz, DET=RMS |

| 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                                                    | 2400.00         | 43.1 PK                 | 74.0           | -30.9       | 1.66 H             | 118                  | 43.2             | -0.1                     |
| 2                                                    | 2400.00         | 38.9 AV                 | 54.0           | -15.1       | 1.66 H             | 118                  | 39.0             | -0.1                     |
| 3                                                    | *2415.00        | 93.2 PK                 | 114.0          | -20.8       | 1.66 H             | 118                  | 93.3             | -0.1                     |
| 4                                                    | *2415.00        | 69.0 AV                 | 94.0           | -25.0       | 1.66 H             | 118                  | 69.1             | -0.1                     |
| 5                                                    | 4830.00         | 49.1 PK                 | 74.0           | -24.9       | 1.63 H             | 248                  | 44.6             | 4.5                      |
| 6                                                    | 4830.00         | 24.9 AV                 | 54.0           | -29.1       | 1.63 H             | 248                  | 20.4             | 4.5                      |
| 7                                                    | 7245.00         | 51.4 PK                 | 74.0           | -22.6       | 2.08 H             | 326                  | 40.2             | 11.2                     |
| 8                                                    | 7245.00         | 27.2 AV                 | 54.0           | -26.8       | 2.08 H             | 326                  | 16.0             | 11.2                     |

##### 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. " \* ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  

$$20 \log(\text{Duty cycle}) = 20 \log(0.309 \text{ ms} / 4.998 \text{ ms}) = -24.2 \text{ dB}$$

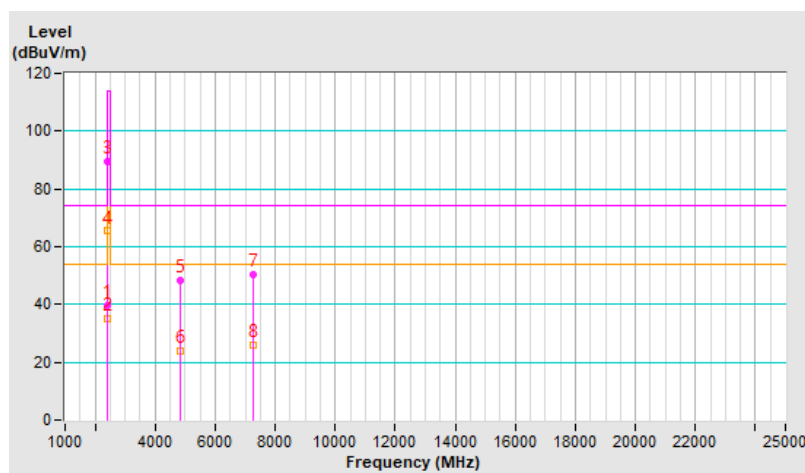


|                        |                |                                          |                                                                     |
|------------------------|----------------|------------------------------------------|---------------------------------------------------------------------|
| <b>RF Mode</b>         | GFSK           | <b>Channel</b>                           | CH 15 : 2415 MHz                                                    |
| <b>Frequency Range</b> | 1 GHz ~ 25 GHz | <b>Detector Function &amp; Bandwidth</b> | PK: RB=1 MHz, VB=3 MHz, DET=Peak<br>AV: RB=1 MHz, VB=3 MHz, DET=RMS |

| 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                                                  | 2400.00         | 39.5 PK                 | 74.0           | -34.5       | 2.61 V             | 271                  | 39.6             | -0.1                     |
| 2                                                  | 2400.00         | 35.3 AV                 | 54.0           | -18.7       | 2.61 V             | 271                  | 35.4             | -0.1                     |
| 3                                                  | *2415.00        | 89.6 PK                 | 114.0          | -24.4       | 2.61 V             | 271                  | 89.7             | -0.1                     |
| 4                                                  | *2415.00        | 65.4 AV                 | 94.0           | -28.6       | 2.61 V             | 271                  | 65.5             | -0.1                     |
| 5                                                  | 4830.00         | 48.3 PK                 | 74.0           | -25.7       | 1.30 V             | 232                  | 43.8             | 4.5                      |
| 6                                                  | 4830.00         | 24.1 AV                 | 54.0           | -29.9       | 1.30 V             | 232                  | 19.6             | 4.5                      |
| 7                                                  | 7245.00         | 50.2 PK                 | 74.0           | -23.8       | 1.53 V             | 88                   | 39.0             | 11.2                     |
| 8                                                  | 7245.00         | 26.0 AV                 | 54.0           | -28.0       | 1.53 V             | 88                   | 14.8             | 11.2                     |

**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. " \* ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(0.309 \text{ ms} / 4.998 \text{ ms}) = -24.2 \text{ dB}$

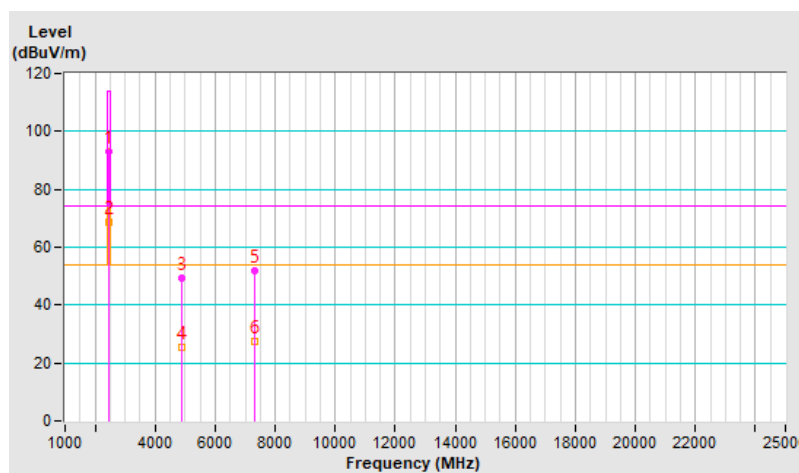


|                        |                |                                          |                                                                     |
|------------------------|----------------|------------------------------------------|---------------------------------------------------------------------|
| <b>RF Mode</b>         | GFSK           | <b>Channel</b>                           | CH 39 : 2439 MHz                                                    |
| <b>Frequency Range</b> | 1 GHz ~ 25 GHz | <b>Detector Function &amp; Bandwidth</b> | PK: RB=1 MHz, VB=3 MHz, DET=Peak<br>AV: RB=1 MHz, VB=3 MHz, DET=RMS |

| 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                                                    | *2439.00        | 92.9 PK                 | 114.0          | -21.1       | 1.48 H             | 113                  | 93.0             | -0.1                     |
| 2                                                    | *2439.00        | 68.7 AV                 | 94.0           | -25.3       | 1.48 H             | 113                  | 68.8             | -0.1                     |
| 3                                                    | 4878.00         | 49.5 PK                 | 74.0           | -24.5       | 1.62 H             | 273                  | 44.9             | 4.6                      |
| 4                                                    | 4878.00         | 25.3 AV                 | 54.0           | -28.7       | 1.62 H             | 273                  | 20.7             | 4.6                      |
| 5                                                    | 7317.00         | 51.7 PK                 | 74.0           | -22.3       | 2.11 H             | 329                  | 40.0             | 11.7                     |
| 6                                                    | 7317.00         | 27.5 AV                 | 54.0           | -26.5       | 2.11 H             | 329                  | 15.8             | 11.7                     |

#### 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. " \* ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(0.309 \text{ ms} / 4.998 \text{ ms}) = -24.2 \text{ dB}$

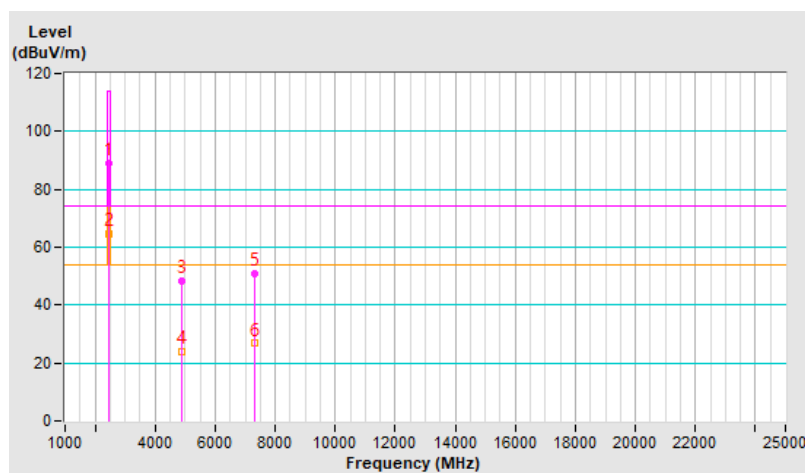


|                        |                |                                          |                                                                     |
|------------------------|----------------|------------------------------------------|---------------------------------------------------------------------|
| <b>RF Mode</b>         | GFSK           | <b>Channel</b>                           | CH 39 : 2439 MHz                                                    |
| <b>Frequency Range</b> | 1 GHz ~ 25 GHz | <b>Detector Function &amp; Bandwidth</b> | PK: RB=1 MHz, VB=3 MHz, DET=Peak<br>AV: RB=1 MHz, VB=3 MHz, DET=RMS |

| 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                                                  | *2439.00        | 89.0 PK                 | 114.0          | -25.0       | 2.83 V             | 265                  | 89.1             | -0.1                     |
| 2                                                  | *2439.00        | 64.8 AV                 | 94.0           | -29.2       | 2.83 V             | 265                  | 64.9             | -0.1                     |
| 3                                                  | 4878.00         | 48.3 PK                 | 74.0           | -25.7       | 1.68 V             | 255                  | 43.7             | 4.6                      |
| 4                                                  | 4878.00         | 24.1 AV                 | 54.0           | -29.9       | 1.68 V             | 255                  | 19.5             | 4.6                      |
| 5                                                  | 7317.00         | 50.9 PK                 | 74.0           | -23.1       | 1.41 V             | 75                   | 39.2             | 11.7                     |
| 6                                                  | 7317.00         | 26.7 AV                 | 54.0           | -27.3       | 1.41 V             | 75                   | 15.0             | 11.7                     |

**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. " \* ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(0.309 \text{ ms} / 4.998 \text{ ms}) = -24.2 \text{ dB}$

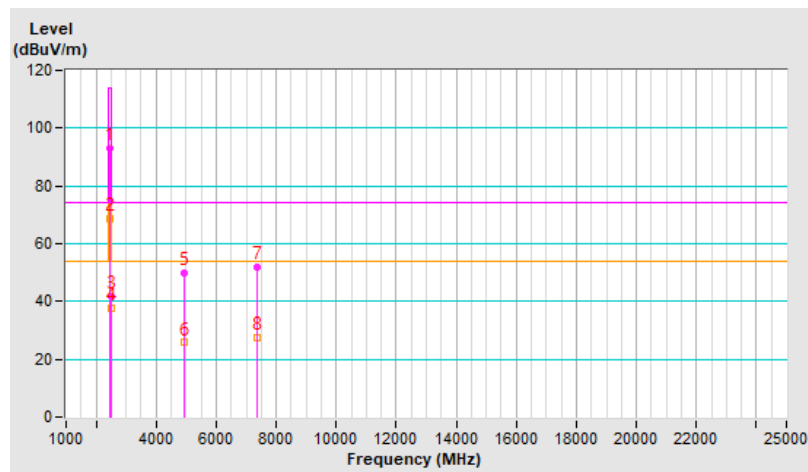


|                        |                |                                          |                                                                     |
|------------------------|----------------|------------------------------------------|---------------------------------------------------------------------|
| <b>RF Mode</b>         | GFSK           | <b>Channel</b>                           | CH 59 : 2459 MHz                                                    |
| <b>Frequency Range</b> | 1 GHz ~ 25 GHz | <b>Detector Function &amp; Bandwidth</b> | PK: RB=1 MHz, VB=3 MHz, DET=Peak<br>AV: RB=1 MHz, VB=3 MHz, DET=RMS |

| 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                                                    | *2459.00        | 93.0 PK                 | 114.0          | -21.0       | 1.15 H             | 127                  | 93.0             | 0.0                      |
| 2                                                    | *2459.00        | 68.8 AV                 | 94.0           | -25.2       | 1.15 H             | 127                  | 68.8             | 0.0                      |
| 3                                                    | 2483.50         | 41.8 PK                 | 74.0           | -32.2       | 1.15 H             | 127                  | 42.0             | -0.2                     |
| 4                                                    | 2483.50         | 37.6 AV                 | 54.0           | -16.4       | 1.15 H             | 127                  | 37.8             | -0.2                     |
| 5                                                    | 4918.00         | 49.9 PK                 | 74.0           | -24.1       | 1.59 H             | 142                  | 45.2             | 4.7                      |
| 6                                                    | 4918.00         | 25.7 AV                 | 54.0           | -28.3       | 1.59 H             | 142                  | 21.0             | 4.7                      |
| 7                                                    | 7377.00         | 51.7 PK                 | 74.0           | -22.3       | 2.10 H             | 329                  | 40.1             | 11.6                     |
| 8                                                    | 7377.00         | 27.5 AV                 | 54.0           | -26.5       | 2.10 H             | 329                  | 15.9             | 11.6                     |

**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. " \* ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(0.309 \text{ ms} / 4.998 \text{ ms}) = -24.2 \text{ dB}$

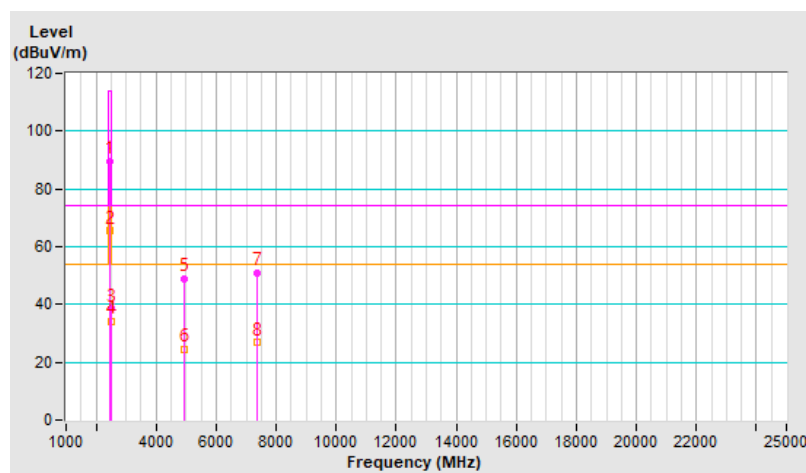


|                        |                |                                          |                                                                     |
|------------------------|----------------|------------------------------------------|---------------------------------------------------------------------|
| <b>RF Mode</b>         | GFSK           | <b>Channel</b>                           | CH 59 : 2459 MHz                                                    |
| <b>Frequency Range</b> | 1 GHz ~ 25 GHz | <b>Detector Function &amp; Bandwidth</b> | PK: RB=1 MHz, VB=3 MHz, DET=Peak<br>AV: RB=1 MHz, VB=3 MHz, DET=RMS |

| 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                                                  | *2459.00        | 89.6 PK                 | 114.0          | -24.4       | 3.06 V             | 266                  | 89.6             | 0.0                      |
| 2                                                  | *2459.00        | 65.4 AV                 | 94.0           | -28.6       | 3.06 V             | 266                  | 65.4             | 0.0                      |
| 3                                                  | 2483.50         | 38.4 PK                 | 74.0           | -35.6       | 3.06 V             | 266                  | 38.6             | -0.2                     |
| 4                                                  | 2483.50         | 34.2 AV                 | 54.0           | -19.8       | 3.06 V             | 266                  | 34.4             | -0.2                     |
| 5                                                  | 4918.00         | 48.7 PK                 | 74.0           | -25.3       | 1.16 V             | 212                  | 44.0             | 4.7                      |
| 6                                                  | 4918.00         | 24.5 AV                 | 54.0           | -29.5       | 1.16 V             | 212                  | 19.8             | 4.7                      |
| 7                                                  | 7377.00         | 50.9 PK                 | 74.0           | -23.1       | 1.45 V             | 66                   | 39.3             | 11.6                     |
| 8                                                  | 7377.00         | 26.7 AV                 | 54.0           | -27.3       | 1.45 V             | 66                   | 15.1             | 11.6                     |

**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. " \* ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:  
 $20 \log(\text{Duty cycle}) = 20 \log(0.309 \text{ ms} / 4.998 \text{ ms}) = -24.2 \text{ dB}$



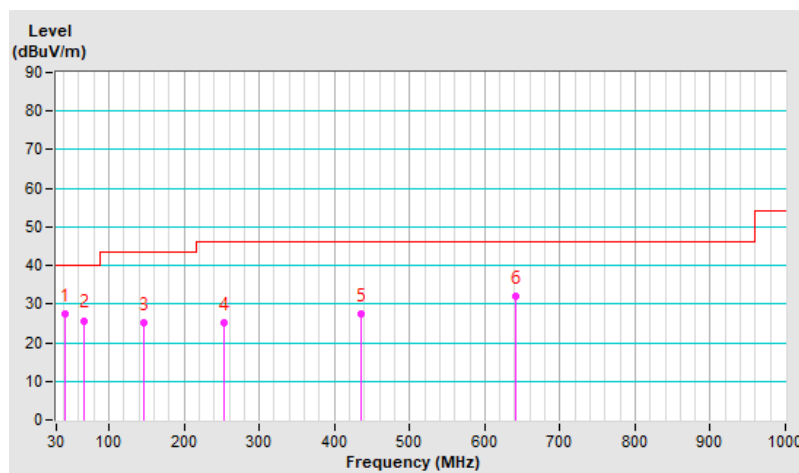
### Below 1GHz Data:

|                        |                |                                          |                               |
|------------------------|----------------|------------------------------------------|-------------------------------|
| <b>RF Mode</b>         | GFSK           | <b>Channel</b>                           | CH 15 : 2415 MHz              |
| <b>Frequency Range</b> | 30 MHz ~ 1 GHz | <b>Detector Function &amp; Bandwidth</b> | QP: RB=120kHz, DET=Quasi-Peak |

| 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                                                    | 40.77           | 27.4 QP                 | 40.0           | -12.6       | 1.23 H             | 133                  | 40.9             | -13.5                    |
| 2                                                    | 66.62           | 25.7 QP                 | 40.0           | -14.3       | 1.14 H             | 359                  | 40.3             | -14.6                    |
| 3                                                    | 146.21          | 25.1 QP                 | 43.5           | -18.4       | 1.05 H             | 186                  | 38.2             | -13.1                    |
| 4                                                    | 252.52          | 25.1 QP                 | 46.0           | -20.9       | 1.11 H             | 162                  | 39.2             | -14.1                    |
| 5                                                    | 434.49          | 27.3 QP                 | 46.0           | -18.7       | 1.08 H             | 339                  | 36.0             | -8.7                     |
| 6                                                    | 641.78          | 31.9 QP                 | 46.0           | -14.1       | 1.24 H             | 196                  | 36.0             | -4.1                     |

### 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 30 MHz ~ 1 GHz.
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.

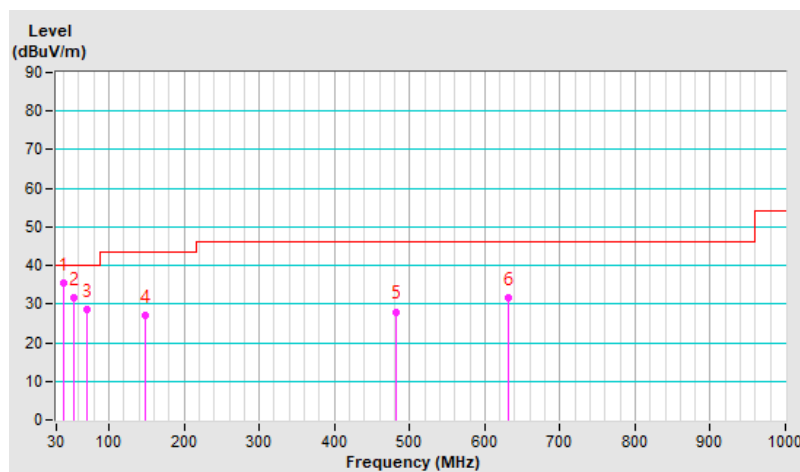


|                        |                |                                          |                               |
|------------------------|----------------|------------------------------------------|-------------------------------|
| <b>RF Mode</b>         | GFSK           | <b>Channel</b>                           | CH 15 : 2415 MHz              |
| <b>Frequency Range</b> | 30 MHz ~ 1 GHz | <b>Detector Function &amp; Bandwidth</b> | QP: RB=120kHz, DET=Quasi-Peak |

| 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                                                  | 39.41           | 35.3 QP                 | 40.0           | -4.7        | 1.33 V             | 150                  | 48.8             | -13.5                    |
| 2                                                  | 52.60           | 31.7 QP                 | 40.0           | -8.3        | 1.15 V             | 23                   | 44.7             | -13.0                    |
| 3                                                  | 71.08           | 28.6 QP                 | 40.0           | -11.4       | 1.06 V             | 313                  | 44.3             | -15.7                    |
| 4                                                  | 148.39          | 27.1 QP                 | 43.5           | -16.4       | 1.10 V             | 212                  | 40.2             | -13.1                    |
| 5                                                  | 482.36          | 28.0 QP                 | 46.0           | -18.0       | 1.04 V             | 5                    | 36.1             | -8.1                     |
| 6                                                  | 631.50          | 31.7 QP                 | 46.0           | -14.3       | 1.00 V             | 97                   | 36.1             | -4.4                     |

**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 30 MHz ~ 1 GHz.
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 Emission Measurement

### 4.2.1 Limits of Conducted Emission Measurement

| Frequency (MHz) | Conducted Limit (dBuV) |         |
|-----------------|------------------------|---------|
|                 | Quasi-peak             | Average |
| 0.15 - 0.5      | 66 - 56                | 56 - 46 |
| 0.50 - 5.0      | 56                     | 46      |
| 5.0 - 30.0      | 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.

### 4.2.2 Test Instruments

| Description & Manufacturer       | Model No.           | Serial No. | Calibrated Date | Calibrated Until |
|----------------------------------|---------------------|------------|-----------------|------------------|
| EMI Test Receiver<br>R&S         | ESCS 30             | 847124/029 | 2022/10/14      | 2023/10/13       |
| LISN<br>R&S                      | ESH3-Z5             | 848773/004 | 2022/10/18      | 2023/10/17       |
| 50 ohm terminal resistance<br>NA | NA                  | EMC-01     | 2022/9/27       | 2023/9/26        |
| RF Coaxial Cable<br>JYEBAO       | 5D-FB               | COCCAB-001 | 2022/8/24       | 2023/8/23        |
| Fixed Attenuator<br>STI          | STI02-2200-10       | 005        | 2022/8/24       | 2023/8/23        |
| Software<br>BVADT                | BVADT_Cond_V7.3.7.4 | NA         | NA              | NA               |

Notes:

1. The test was performed in Conduction 1.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: 2023/8/10

#### 4.2.3 Test Procedures

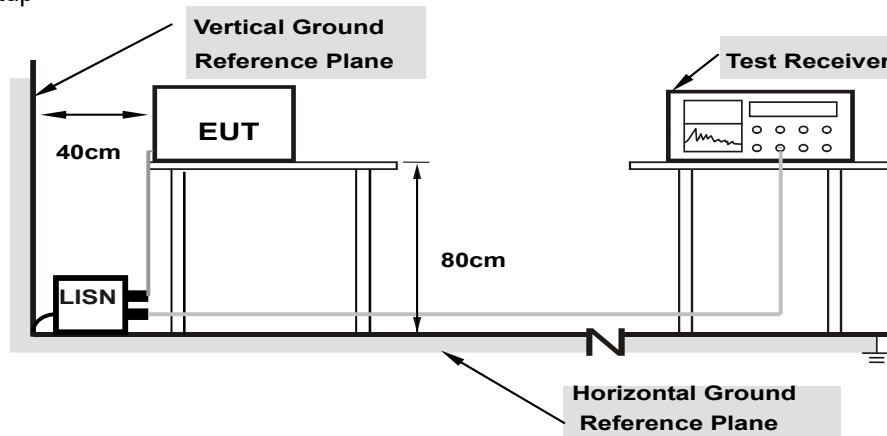
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

**Note:** 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.

#### 4.2.4 Deviation from Test Standard

No deviation.

#### 4.2.5 Test Setup



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

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

#### 4.2.6 EUT Operating Conditions

Same as 4.1.6.

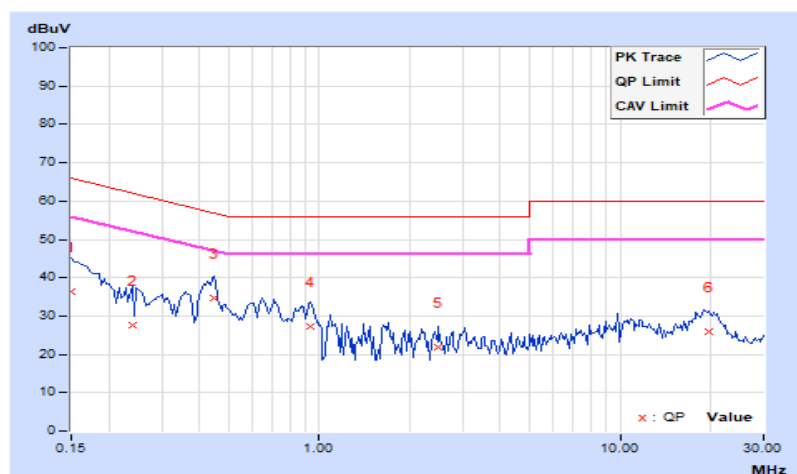
#### 4.2.7 Test Results (Mode 1)

|                        |                  |                                                     |                                       |
|------------------------|------------------|-----------------------------------------------------|---------------------------------------|
| <b>RF Mode</b>         | GFSK             | <b>Channel</b>                                      | CH 15 : 2415 MHz                      |
| <b>Frequency Range</b> | 150 kHz ~ 30 MHz | <b>Detector Function &amp; Resolution Bandwidth</b> | Quasi-Peak (QP) / Average (AV), 9 kHz |

| Phase Of Power : Line (L) |                 |                        |                      |       |                       |       |              |       |             |        |
|---------------------------|-----------------|------------------------|----------------------|-------|-----------------------|-------|--------------|-------|-------------|--------|
| No                        | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) |       | Emission Level (dBuV) |       | Limit (dBuV) |       | Margin (dB) |        |
|                           |                 |                        | Q.P.                 | AV.   | Q.P.                  | AV.   | Q.P.         | AV.   | Q.P.        | AV.    |
| 1                         | 0.15000         | 9.95                   | 26.56                | 1.05  | 36.51                 | 11.00 | 66.00        | 56.00 | -29.49      | -45.00 |
| 2                         | 0.23984         | 9.94                   | 17.56                | -5.09 | 27.50                 | 4.85  | 62.10        | 52.10 | -34.60      | -47.25 |
| 3                         | 0.44688         | 9.95                   | 24.68                | 4.11  | 34.63                 | 14.06 | 56.93        | 46.93 | -22.30      | -32.87 |
| 4                         | 0.93516         | 9.98                   | 17.13                | -2.49 | 27.11                 | 7.49  | 56.00        | 46.00 | -28.89      | -38.51 |
| 5                         | 2.49219         | 10.04                  | 11.76                | -6.54 | 21.80                 | 3.50  | 56.00        | 46.00 | -34.20      | -42.50 |
| 6                         | 19.71484        | 10.97                  | 14.91                | -4.36 | 25.88                 | 6.61  | 60.00        | 50.00 | -34.12      | -43.39 |

#### Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

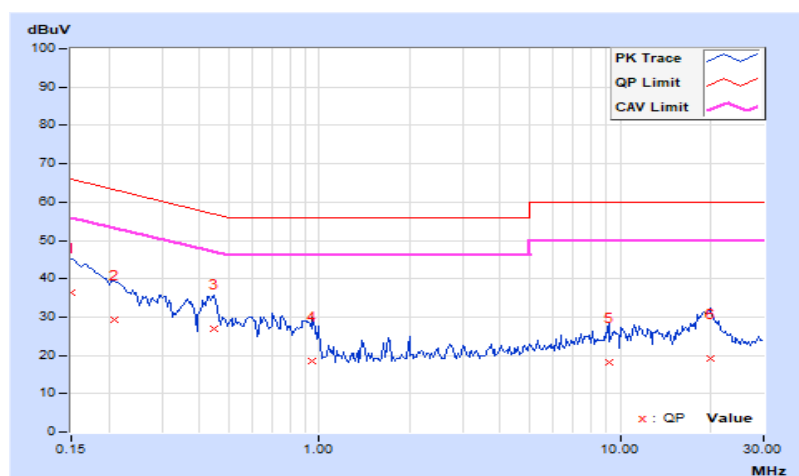


|                        |                  |                                                     |                                       |
|------------------------|------------------|-----------------------------------------------------|---------------------------------------|
| <b>RF Mode</b>         | GFSK             | <b>Channel</b>                                      | CH 15 : 2415 MHz                      |
| <b>Frequency Range</b> | 150 kHz ~ 30 MHz | <b>Detector Function &amp; Resolution Bandwidth</b> | Quasi-Peak (QP) / Average (AV), 9 kHz |

| Phase Of Power : Neutral (N) |                 |                        |                      |       |                       |       |              |       |             |        |
|------------------------------|-----------------|------------------------|----------------------|-------|-----------------------|-------|--------------|-------|-------------|--------|
| No                           | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) |       | Emission Level (dBuV) |       | Limit (dBuV) |       | Margin (dB) |        |
|                              |                 |                        | Q.P.                 | AV.   | Q.P.                  | AV.   | Q.P.         | AV.   | Q.P.        | AV.    |
| 1                            | 0.15000         | 9.99                   | 26.46                | 0.49  | 36.45                 | 10.48 | 66.00        | 56.00 | -29.55      | -45.52 |
| 2                            | 0.20861         | 9.99                   | 19.26                | -2.12 | 29.25                 | 7.87  | 63.26        | 53.26 | -34.01      | -45.39 |
| 3                            | 0.44686         | 10.00                  | 16.91                | -2.43 | 26.91                 | 7.57  | 56.93        | 46.93 | -30.02      | -39.36 |
| 4                            | 0.95075         | 10.03                  | 8.55                 | -6.35 | 18.58                 | 3.68  | 56.00        | 46.00 | -37.42      | -42.32 |
| 5                            | 9.21874         | 10.41                  | 7.75                 | -7.30 | 18.16                 | 3.11  | 60.00        | 50.00 | -41.84      | -46.89 |
| 6                            | 19.88280        | 10.78                  | 8.36                 | -9.61 | 19.14                 | 1.17  | 60.00        | 50.00 | -40.86      | -48.83 |

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



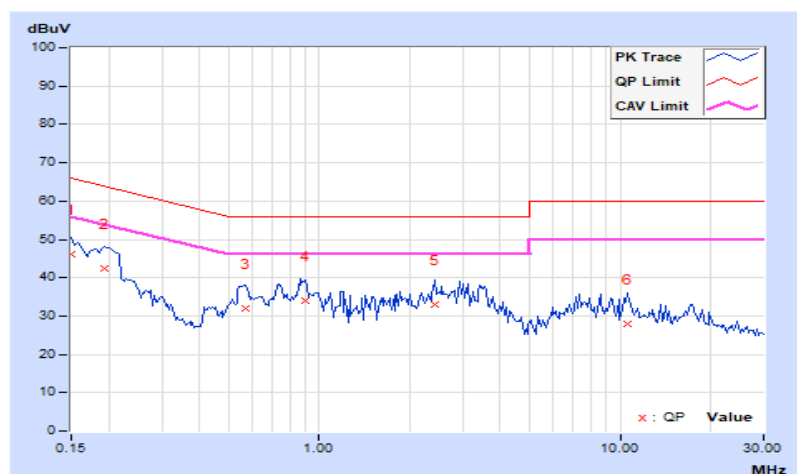
#### 4.2.8 Test Results (Mode 2)

|                        |                  |                                                     |                                       |
|------------------------|------------------|-----------------------------------------------------|---------------------------------------|
| <b>RF Mode</b>         | GFSK             | <b>Channel</b>                                      | CH 15 : 2415 MHz                      |
| <b>Frequency Range</b> | 150 kHz ~ 30 MHz | <b>Detector Function &amp; Resolution Bandwidth</b> | Quasi-Peak (QP) / Average (AV), 9 kHz |

| Phase Of Power : Line (L) |                 |                        |                      |       |                       |       |              |       |             |        |
|---------------------------|-----------------|------------------------|----------------------|-------|-----------------------|-------|--------------|-------|-------------|--------|
| No                        | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) |       | Emission Level (dBuV) |       | Limit (dBuV) |       | Margin (dB) |        |
|                           |                 |                        | Q.P.                 | AV.   | Q.P.                  | AV.   | Q.P.         | AV.   | Q.P.        | AV.    |
| 1                         | 0.15000         | 9.95                   | 36.12                | 17.71 | 46.07                 | 27.66 | 66.00        | 56.00 | -19.93      | -28.34 |
| 2                         | 0.19297         | 9.94                   | 32.65                | 13.36 | 42.59                 | 23.30 | 63.91        | 53.91 | -21.32      | -30.61 |
| 3                         | 0.56797         | 9.96                   | 22.02                | 9.05  | 31.98                 | 19.01 | 56.00        | 46.00 | -24.02      | -26.99 |
| 4                         | 0.90000         | 9.98                   | 23.96                | 8.49  | 33.94                 | 18.47 | 56.00        | 46.00 | -22.06      | -27.53 |
| 5                         | 2.43359         | 10.04                  | 22.82                | 12.31 | 32.86                 | 22.35 | 56.00        | 46.00 | -23.14      | -23.65 |
| 6                         | 10.58984        | 10.49                  | 17.44                | 10.41 | 27.93                 | 20.90 | 60.00        | 50.00 | -32.07      | -29.10 |

#### Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

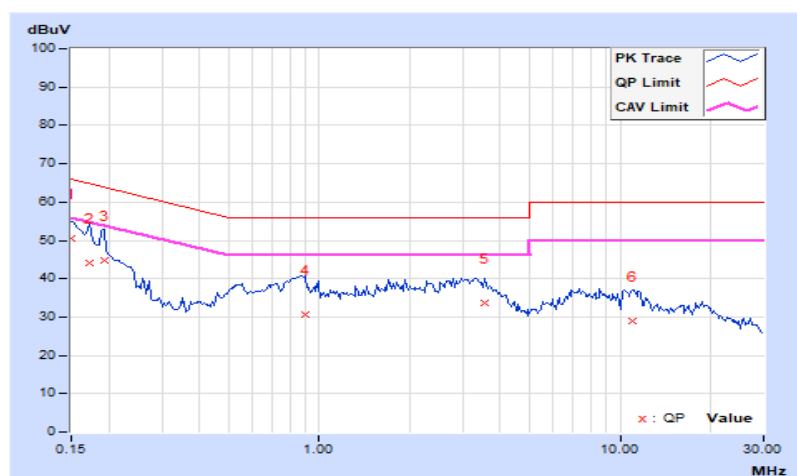


|                        |                  |                                                     |                                       |
|------------------------|------------------|-----------------------------------------------------|---------------------------------------|
| <b>RF Mode</b>         | GFSK             | <b>Channel</b>                                      | CH 15 : 2415 MHz                      |
| <b>Frequency Range</b> | 150 kHz ~ 30 MHz | <b>Detector Function &amp; Resolution Bandwidth</b> | Quasi-Peak (QP) / Average (AV), 9 kHz |

| Phase Of Power : Neutral (N) |                 |                        |                      |       |                       |       |              |       |             |        |
|------------------------------|-----------------|------------------------|----------------------|-------|-----------------------|-------|--------------|-------|-------------|--------|
| No                           | Frequency (MHz) | Correction Factor (dB) | Reading Value (dBuV) |       | Emission Level (dBuV) |       | Limit (dBuV) |       | Margin (dB) |        |
|                              |                 |                        | Q.P.                 | AV.   | Q.P.                  | AV.   | Q.P.         | AV.   | Q.P.        | AV.    |
| 1                            | 0.15000         | 9.99                   | 40.65                | 20.66 | 50.64                 | 30.65 | 66.00        | 56.00 | -15.36      | -25.35 |
| 2                            | 0.17344         | 9.99                   | 34.13                | 10.74 | 44.12                 | 20.73 | 64.79        | 54.79 | -20.67      | -34.06 |
| 3                            | 0.19297         | 9.99                   | 34.76                | 20.12 | 44.75                 | 30.11 | 63.91        | 53.91 | -19.16      | -23.80 |
| 4                            | 0.89609         | 10.02                  | 20.49                | 3.72  | 30.51                 | 13.74 | 56.00        | 46.00 | -25.49      | -32.26 |
| 5                            | 3.53125         | 10.15                  | 23.49                | 14.36 | 33.64                 | 24.51 | 56.00        | 46.00 | -22.36      | -21.49 |
| 6                            | 10.97656        | 10.47                  | 18.56                | 8.12  | 29.03                 | 18.59 | 60.00        | 50.00 | -30.97      | -31.41 |

**Remarks:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



### 4.3 20dB Bandwidth Measurement

#### 4.3.1 Limits of 20dB Bandwidth Measurement

The 20dB bandwidth shall be specified in operating frequency band.

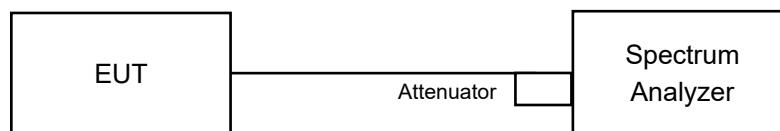
#### 4.3.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.3.3 Test Procedure

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

#### 4.3.4 Test Setup



#### 4.3.5 Deviation from Test Standard

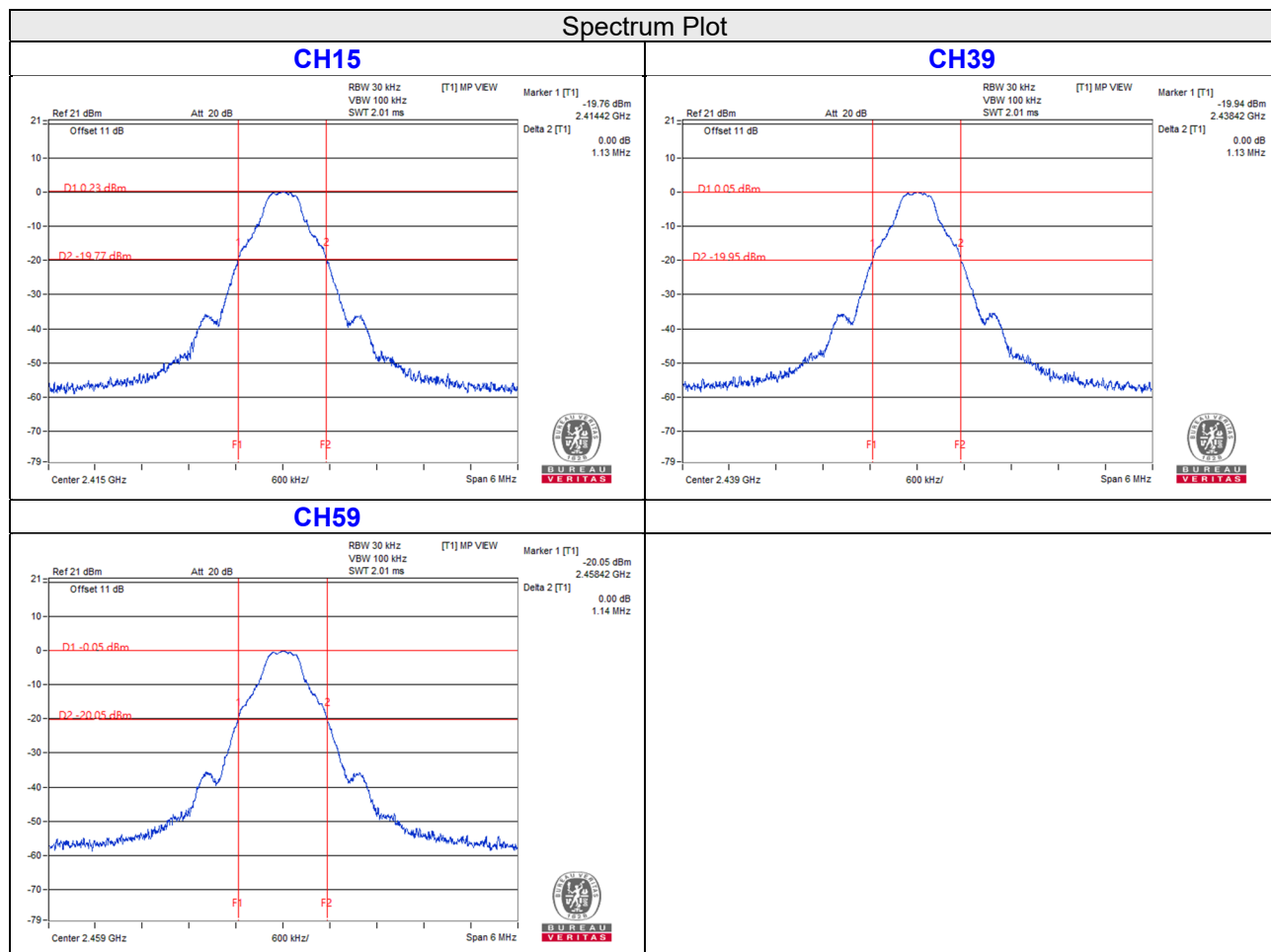
No deviation.

#### 4.3.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

#### 4.3.7 Test Results

| Channel | Frequency (MHz) | 20dB Bandwidth (MHz) |
|---------|-----------------|----------------------|
| 15      | 2415            | 1.13                 |
| 39      | 2439            | 1.13                 |
| 59      | 2459            | 1.14                 |



## 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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