# TEST REPORT

## CERTIFICATE OF CONFORMITY

| | |
|---|---|
| **Standard:** | **47 CFR FCC Part 15, Subpart C (Section 15.247)** |
| **Report No.:** | RFBEIU-WTW-P23010256-3 |
| **FCC ID:** | 2AUS4-NFH1 |
| **Product:** | Video conferencing device |
| **Brand:** | neat. |
| **Model No.:** | NF-H1 |
| **Received Date:** | 2023/1/11 |
| **Test Date:** | 2023/1/12 ~ 2023/5/18 |
| **Issued Date:** | 2023/7/4 |
| **Applicant:** | Neatframe Limited |
| **Address:** | Cannon Green 27 Bush Lane, London, EC4R0AA, UK |
| **Issued By:** | Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories |
| **Lab Address:** | No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan |
| **Test Location:** | No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan |
| **FCC Registration / Designation Number:** | 198487 / TW2021 |

**Approved by:** Jeremy Lin , **Date:** 2023/7/4

Jeremy Lin / Project Engineer

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Prepared by : Annie Chang / Senior Specialist

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# Release Control Record

| Issue No. | Description | Date Issued |
|---|---|---|
| RFBEIU-WTW-P23010256-3 | Original release. | 2023/7/4 |

# 1 Certificate

| | |
|---|---|
| **Product:** | Video conferencing device |
| **Brand:** | neat. |
| **Test Model:** | NF-H1 |
| **Sample Status:** | Engineering sample |
| **Applicant:** | Neatframe Limited |
| **Test Date:** | 2023/1/12 ~ 2023/5/18 |
| **Standard:** | 47 CFR FCC Part 15, Subpart C (Section 15.247) |
| **Measurement procedure:** | ANSI C63.10-2013<br>KDB 558074 D01 15.247 Meas Guidance v05r02 |

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 RF characteristics under the conditions specified in this report.

# 2 Summary of Test Results

| 47 CFR FCC Part 15, Subpart C (Section 15.247) | | | |
|---|---|---|---|
| Standard / Clause | Test Item | Result | Remark |
| 15.247 (a)(1) | RF Output Power | Pass | Meet the requirement of limit. |
| 15.247(a)(1) (iii) | Number of Hopping Frequency Used | Pass | Meet the requirement of limit. |
| 15.247(a)(1) (iii) | Dwell Time on Each Channel | Pass | Meet the requirement of limit. |
| 15.247(a)(1) | Hopping Channel Separation | Pass | Meet the requirement of limit. |
| 15.247(a)(1) | 20 dB Bandwidth | - | Refer to Note 1 |
| 15.247(d) | Conducted Out of Band Emissions | Pass | Meet the requirement of limit. |
| 15.207 | AC Power Conducted Emissions | Pass | Minimum passing margin is -10.92 dB at 7.79493 MHz |
| 15.205 / 15.209 / 15.247(d) | Unwanted Emissions below 1 GHz | Pass | Minimum passing margin is -1.9 dB at 113.66 MHz |
| 15.205 / 15.209 / 15.247(d) | Unwanted Emissions above 1 GHz | Pass | Minimum passing margin is -12.1 dB at 2390.00 MHz |
| 15.203 | Antenna Requirement | Pass | No antenna connector is used. |

Notes:

1. If the Frequency Hopping System operating in 2400-2483.5 MHz band and the output power less than 125 mW. The hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of hopping channel whichever is greater.
2. 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 | Specification | Expanded Uncertainty (k=2) (±) |
|---|---|---|
| Conducted Out of Band Emissions | 9 kHz ~ 40 GHz | 2.63 dB |
| AC Power Conducted Emissions | 150 kHz ~ 30 MHz | 3.00 dB |
| Unwanted Emissions below 1 GHz | 9 kHz ~ 30 MHz | 2.38 dB |
| | 30 MHz ~ 1 GHz | 5.7 dB |
| Unwanted Emissions above 1 GHz | 1 GHz ~ 6 GHz | 4.83 dB |
| | 6 GHz ~ 18 GHz | 5.37 dB |
| | 18 GHz ~ 40 GHz | 5.24 dB |

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

## 2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

# 3 General Information

## 3.1 General Description

| | |
|---|---|
| Product | Video conferencing device |
| Brand | neat. |
| Test Model | NF-H1 |
| Status of EUT | Engineering sample |
| Power Supply Rating | AC I/P: 100-240Vac, 50/60Hz |
| Modulation Type | GFSK, π/4-DQPSK, 8DPSK |
| Modulation Technology | FHSS |
| Transfer Rate | Up to 3 Mbps |
| Operating Frequency | 2.402 GHz ~ 2.48 GHz |
| Number of Channel | 79 |
| Output Power | 2.495 mW (3.97 dBm) |

Note:

1. The EUT uses following accessories.

| Item | Brand | Model | Specification |
|---|---|---|---|
| Neat Pen | neat. | NF-H2 | - |
| LAN Cable | - | - | Shielded 5m |
| Power cord | - | - | Non-shielded 3m |

2. There are Bluetooth and WLAN (2.4 GHz & 5 GHz) technology used for the EUT.
3. WLAN 2.4 GHz & WLAN 5 GHz & Bluetooth technology cannot transmit at same time.
4. 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 Antenna Description of EUT

The antenna information is listed as below.

| Gain (dBi) | Antenna Type | Connector Type |
|---|---|---|
| 3.91 | PCB Dipole | ipex(MHF) |

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

### 3.3 Channel List

79 channels are provided for BT-EDR:

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

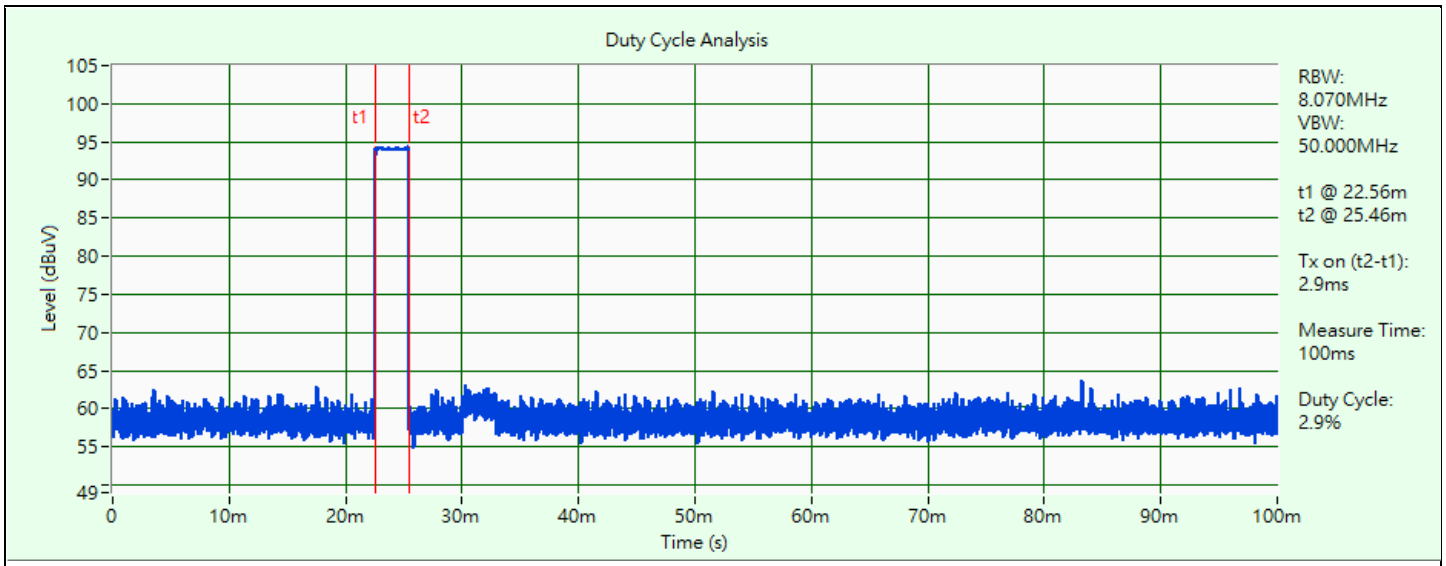
### 3.4 Test Mode Applicability and Tested Channel Detail

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

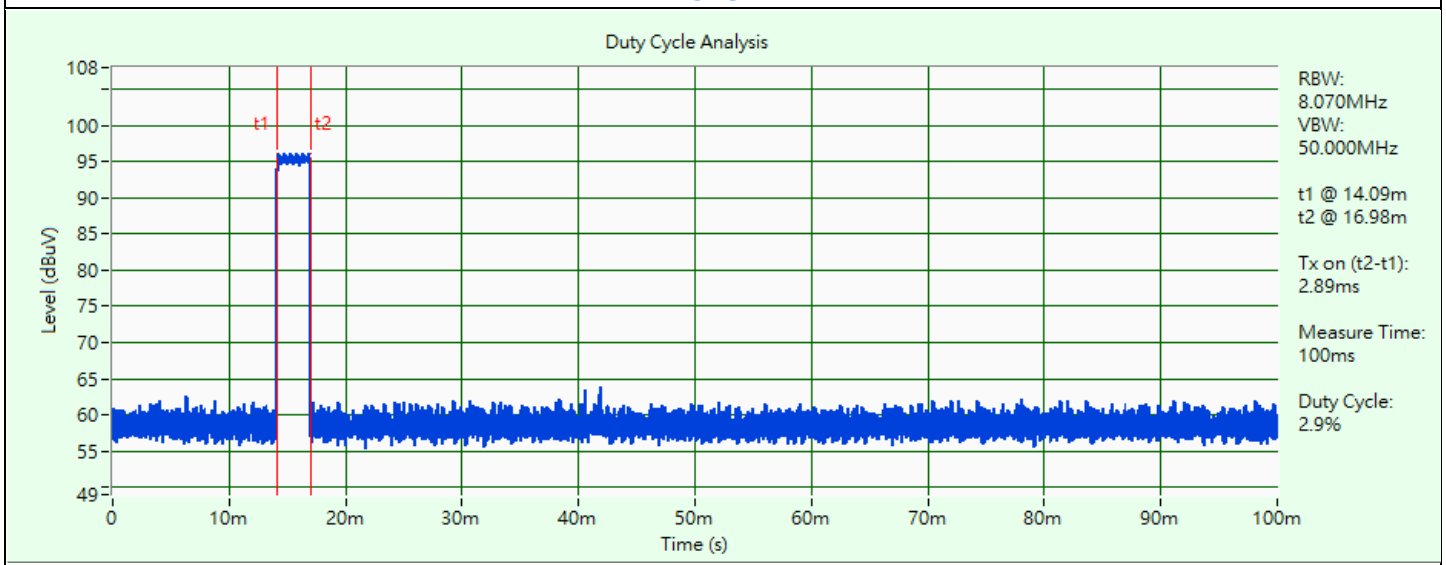
| Test Item | Tested Channel | Modulation | Data Rate Parameter |
|---|---|---|---|
| RF Output Power | 0, 39, 78 | GFSK | DH5 |
| | | 8DPSK | 3DH5 |
| Number of Hopping Frequency Used | Hopping | GFSK | DH5 |
| | | 8DPSK | 3DH5 |
| Dwell Time on Each Channel | Hopping | GFSK | DH1/DH3/DH5 |
| | | 8DPSK | 3DH1/3DH3/3DH5 |
| Hopping Channel Separation / 20 dB Bandwidth | 0, 39, 78 | GFSK | DH5 |
| | | 8DPSK | 3DH5 |
| Conducted Out of Band Emissions | Hopping<br>0, 78 | GFSK | DH5 |
| | | 8DPSK | 3DH5 |
| AC Power Conducted Emissions | 39 | GFSK | DH5 |
| Unwanted Emissions below 1 GHz | 39 | GFSK | DH5 |
| Unwanted Emissions above 1 GHz | 0, 39, 78 | GFSK | DH5 |
| | | 8DPSK | 3DH5 |

## 3.5 Duty Cycle of Test Signal

**GFSK:** Duty cycle = 2.9 ms / 100 ms x 100% = 2.9%
**8DPSK:** Duty cycle = 2.9 ms / 100 ms x 100% = 2.9%




GFSK

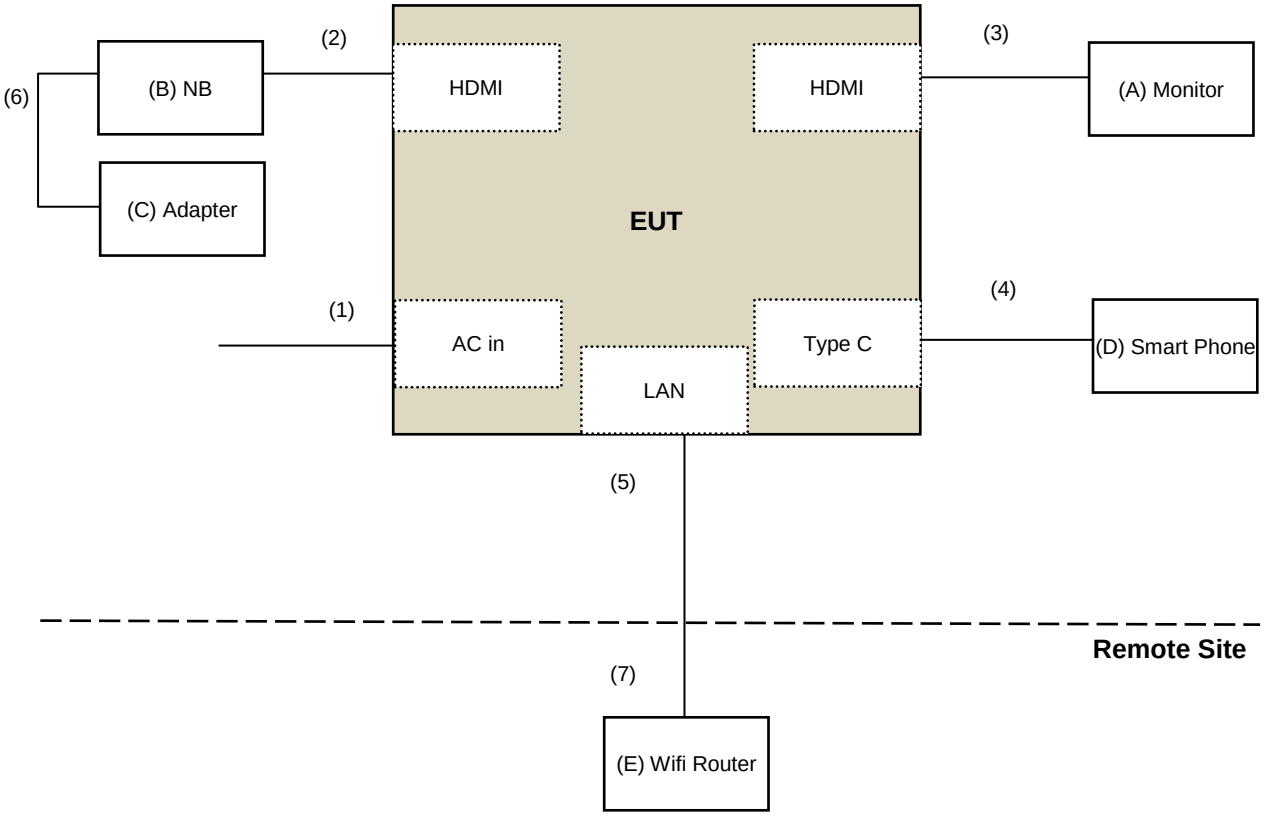



8DPSK

### 3.6 Test Program Used and Operation Descriptions

Controlling software (QRCT 4.0.204.0) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

### 3.7 Connection Diagram of EUT and Peripheral Devices




### 3.8 Configuration of Peripheral Devices and Cable Connections

| ID | Product | Brand | Model No. | Serial No. | FCC ID | Remarks |
|---|---|---|---|---|---|---|
| A | Monitor | ASUS | PA279CV | M7LMTF235956 | DoC | Provided by Lab |
| B | NB | LENOVO | IdeaPad 5 15ITL05 | N/A | N/A | Provided by Lab |
| C | Adapter | LENOVO | ADLX65CLGU2A | N/A | N/A | Provided by Lab |
| D | Smart Phone | Samsung | Galaxy A50 | N/A | N/A | Provided by Lab |
| E | Wifi Router | NETGEAR | R6350 | 58E798B00017E | DoC | Provided by Lab |

| ID | Cable Descriptions | Qty. | Length (m) | Shielding (Yes/No) | Cores (Qty.) | Remarks |
|---|---|---|---|---|---|---|
| 1 | AC Power Cable | 1 | 3 | N | 0 | Supplied by applicant |
| 2 | HDMI Cable | 1 | 2 | Y | 0 | Provided by Lab |
| 3 | HDMI Cable | 1 | 2 | Y | 0 | Provided by Lab |
| 4 | Type-C Cable | 1 | 1 | Y | 0 | Provided by Lab |
| 5 | LAN Cable | 1 | 5 | Y | 0 | Supplied by applicant |
| 6 | DC Cable | 1 | 1.8 | Y | 0 | Provided by Lab |
| 7 | LAN Cable | 1 | 10 | N | 0 | Provided by Lab |

# 4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

## 4.1 RF Output Power

| Description<br>Manufacturer | Model No. | Serial No. | Calibrated Date | Calibrated Until |
|---|---|---|---|---|
| MIMO Power measurement Test set (4X4)<br>KEYSIGHT | U2021XA | U2021XA_001 | 2022/6/13 | 2023/6/12 |
| MXG Vector Signal Generator<br>KEYSIGHT | N5182B | MY53052658 | 2022/5/9 | 2023/5/8 |
| Peak Power meter<br>Anritsu | ML2495A | 0842014 | 2022/4/27 | 2023/4/26 |
| Pulse Power Sensor<br>Anritsu | MA2411B | 0738404 | 2022/4/27 | 2023/4/26 |
| Signal Analyzer<br>R&S | FSV40 | 101042 | 2022/9/5 | 2023/9/4 |
| | | 101544 | 2022/5/9 | 2023/5/8 |
| Spectrum Analyzer<br>KEYSIGHT | N9030A | MY54490260 | 2022/7/14 | 2023/7/13 |
| Temperature & Humidity Chamber<br>TERCHY | MHU-225AU | 920409 | 2022/6/27 | 2023/6/26 |
| Voltage Meter<br>FLUKE | 179 | 89610322 | 2022/10/3 | 2023/10/2 |

Notes:

1. The test was performed in LK - Oven
2. Tested Date: 2023/2/1

## 4.2 Number of Hopping Frequency Used

Refer to section 4.1 to get information of the instruments.

## 4.3 Dwell Time on Each Channel

Refer to section 4.1 to get information of the instruments.

## 4.4 Hopping Channel Separation

Refer to section 4.1 to get information of the instruments.

## 4.5 20 dB Bandwidth

Refer to section 4.1 to get information of the instruments.

## 4.6 Conducted Out of Band Emissions

Refer to section 4.1 to get information of the instruments.

## 4.7 AC Power Conducted Emissions

| Description<br>Manufacturer | Model No. | Serial No. | Calibrated Date | Calibrated Until |
|---|---|---|---|---|
| 50 ohm terminal<br>LYNICS | 0900510 | E1-011285 | 2022/9/19 | 2023/9/18 |
| | | E1-011286 | 2022/9/19 | 2023/9/18 |
| 50 Ohms Terminator<br>LYNICS | 0900510 | E1-01-305 | 2023/2/13 | 2024/2/12 |
| DC LISN<br>R&S | ESH3-Z6 | 100219 | 2022/8/2 | 2023/8/1 |
| | | 844950/018 | 2022/8/2 | 2023/8/1 |
| DC LISN<br>Schwarzbeck | NNLK 8121 | 8121-808 | 2023/5/2 | 2024/5/1 |
| EMI Test Receiver<br>R&S | ESR3 | 102412 | 2022/12/21 | 2023/12/20 |
| Fixed Attenuator<br>STI | STI02-2200-10 | NO.4 | 2022/9/2 | 2023/9/1 |
| High Voltage Probe<br>Schwarzbeck | TK9420 | 00982 | 2022/12/14 | 2023/12/13 |
| Isolation Transformer<br>Erika Fiedler | D-65396 | 017 | 2022/9/8 | 2023/9/7 |
| LISN<br>R&S | ENV216 | 101196 | 2022/5/24 | 2023/5/23 |
| LISN<br>Schwarzbeck | NNLK 8121 | 8121-00759 | 2022/8/18 | 2023/8/17 |
| | | 8121-731 | 2022/5/26 | 2023/5/25 |
| | NNLK8129 | 8129229 | 2022/6/8 | 2023/6/7 |
| | NSLK 8128 | 8128-244 | 2022/11/8 | 2023/11/7 |
| RF Coaxial Cable<br>Commate | 5D-FB | Cable-CO5-01 | 2023/1/19 | 2024/1/18 |
| Software<br>BVADT | Cond_V7.3.7.4 | N/A | N/A | N/A |

Notes:

1. The test was performed in Linkou Conduction 5.
2. Tested Date: 2023/5/18

## 4.8 Unwanted Emissions below 1 GHz

| Description<br>Manufacturer | Model No. | Serial No. | Calibrated Date | Calibrated Until |
|---|---|---|---|---|
| * LOOP ANTENNA<br>EMCI | LPA600 | 270 | 2021/9/2 | 2023/9/1 |
| Bi_Log Antenna<br>Schwarzbeck | VULB 9168 | 137 | 2022/10/21 | 2023/10/20 |
| Coupling/Dcoupling Network<br>Schwarzbeck | CDNE-M2 | 00097 | 2022/6/1 | 2023/5/31 |
| | CDNE-M3 | 00091 | 2022/6/1 | 2023/5/31 |
| Pre_Amplifier<br>EMCI | EMC001340 | 980269 | 2022/6/28 | 2023/6/27 |
| Pre_Amplifier<br>HP | 8447D | 2432A03504 | 2023/2/16 | 2024/2/15 |
| RF Coaxial Cable<br>Pacific | 8D-FB | Cable-CH6-02 | 2022/6/30 | 2023/6/29 |
| Signal Analyzer<br>R&S | FSV40 | 101544 | 2023/5/9 | 2024/5/8 |
| Software<br>BVADT | Radiated_V7.7.1.1.1 | N/A | N/A | N/A |
| | Radiated_V8.7.08 | N/A | N/A | N/A |
| Test Receiver<br>Agilent | N9038A | MY51210129 | 2023/3/24 | 2024/3/23 |
| | | MY51210137 | 2022/6/9 | 2023/6/8 |
| Tower<br>ADT | AT100 | 0306 | N/A | N/A |
| Turn Table<br>ADT | TT100 | 0306 | N/A | N/A |

Notes:

1. * The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA
2. The test was performed in Linkou 966 Chamber 6 (CH 6).
3. Tested Date: 2023/5/18

## 4.9 Unwanted Emissions above 1 GHz

| Description<br>Manufacturer | Model No. | Serial No. | Calibrated Date | Calibrated Until |
|---|---|---|---|---|
| Band Pass Filter<br>MICRO-TRONICS | BRM17690 | 005 | 2022/5/26 | 2023/5/25 |
| Boresight antenna tower fixture<br>BV | BAF-02 | 6 | N/A | N/A |
| High Pass Filter<br>Wainwright Instruments | WHK 3.1/18G-10SS | SN 8 | 2022/5/26 | 2023/5/25 |
| Horn Antenna<br>EMCO | 3115 | 00028257 | 2022/11/13 | 2023/11/12 |
| Horn Antenna<br>ETS-Lindgren | 3117-PA | 00215857 | 2022/11/13 | 2023/11/12 |
| Horn Antenna<br>Schwarzbeck | BBHA 9170 | 212 | 2022/10/20 | 2023/10/19 |
| Notch Filter<br>MICRO-TRONICS | BRC50703-01 | 010 | 2022/5/26 | 2023/5/25 |
| Pre-amplifier<br>HP | 8449B | 3008A01201 | 2022/2/17 | 2023/2/16 |
| Pre-amplifier (18GHz-40GHz)<br>EMCI | EMC184045B | 980175 | 2022/9/3 | 2023/9/2 |
| Pre_Amplifier<br>EMCI | EMC0126545 | 980076 | 2022/2/17 | 2023/2/16 |
| | EMC184045B | 980235 | 2022/2/17 | 2023/2/16 |
| RF Coaxial Cable<br>EM | EM102-KMKM-3.5+1M | EM102-KMKM-3.5+1M-01 | 2022/7/7 | 2023/7/6 |
| RF Coaxial Cable<br>EMCI | EMC104 | 190801 | 2022/9/20 | 2023/9/19 |
| | | 190804 | 2022/9/20 | 2023/9/19 |
| RF Coaxial Cable<br>HUBER SUHNER | SF-104 | Cable-CH6-01 | 2022/9/20 | 2023/9/19 |
| Signal Analyzer<br>R&S | FSV40 | 101544 | 2022/5/9 | 2023/5/8 |
| Software<br>BVADT | Radiated_V7.7.1.1.1 | N/A | N/A | N/A |
| | Radiated_V8.7.08 | N/A | N/A | N/A |
| Spectrum Analyzer<br>R&S | FSV40 | 101042 | 2022/9/5 | 2023/9/4 |
| Test Receiver<br>Agilent | N9038A | MY51210129 | 2022/4/8 | 2023/4/7 |
| | | MY51210137 | 2022/6/9 | 2023/6/8 |
| Tower<br>ADT | AT100 | 0306 | N/A | N/A |
| Turn Table<br>ADT | TT100 | 0306 | N/A | N/A |

Notes:

1. The test was performed in Linkou 966 Chamber 6 (CH 6).
2. Tested Date: 2023/1/12

# 5 Limits of Test Items

## 5.1 RF Output Power

The Maximum Output Power Measurement is 125 mW (21 dBm).

## 5.2 Number of Hopping Frequency Used

At least 15 channels frequencies, and should be equally spaced.

## 5.3 Dwell Time on Each Channel

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

## 5.4 Hopping Channel Separation

At least 25 kHz or two-third of 20 dB hopping channel bandwidth (whichever is greater).

## 5.5 20 dB Bandwidth

Maximum bandwidth is not specified.

## 5.6 Conducted Out of Band Emissions

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

## 5.7 AC Power Conducted Emissions

| 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 |

Notes:

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 0.50 MHz.

## 5.8 Unwanted Emissions below 1 GHz

Radiated emissions up to 1 GHz which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

| 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 |

Notes:

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

## 5.9 Unwanted Emissions above 1 GHz

Radiated emissions above 1 GHz which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| Above 960 | 500 | 3 |

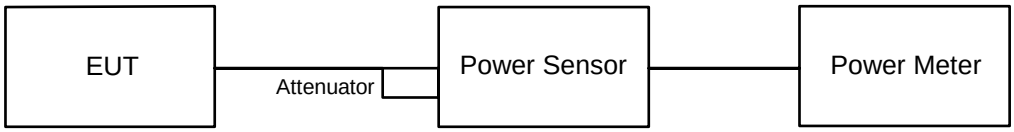
Notes:

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 1000 MHz, 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 20 dB under any condition of modulation.

# 6 Test Arrangements

## 6.1 RF Output Power

### 6.1.1 Test Setup



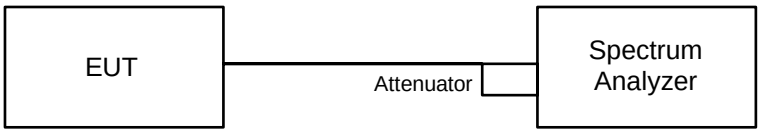

### 6.1.2 Test Procedure

Peak Power:
A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Average Power:
Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

## 6.2 Number of Hopping Frequency Used

### 6.2.1 Test Setup

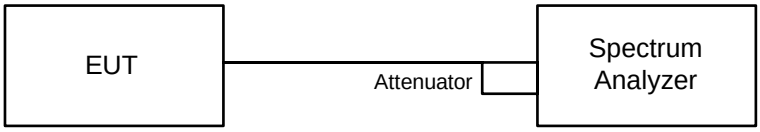



### 6.2.2 Test Procedure

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
c. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
d. Set the SA on View mode and then plot the result on SA screen.
e. Repeat above procedures until all frequencies measured were complete.

## 6.3 Dwell Time on Each Channel

### 6.3.1 Test Setup

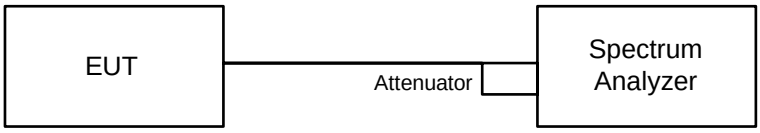



### 6.3.2 Test Procedure

a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
c. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
e. Repeat above procedures until all different time-slot modes have been completed.

## 6.4 Hopping Channel Separation

### 6.4.1 Test Setup

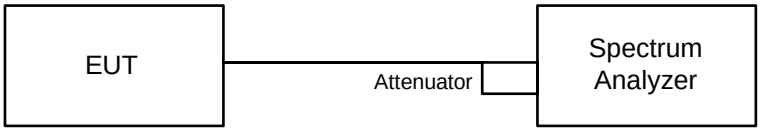



### 6.4.2 Test Procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
c. By using the MaxHold function record the separation of two adjacent channels.
d. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
e. Repeat above procedures until all frequencies measured were complete.

## 6.5 20 dB Bandwidth

### 6.5.1 Test Setup

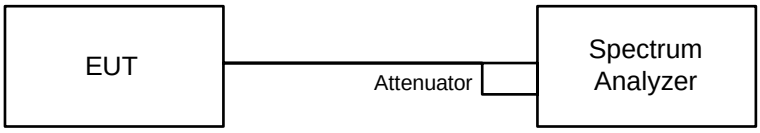



### 6.5.2 Test Procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
d. Repeat above procedures until all frequencies measured were complete.

## 6.6 Conducted Out of Band Emissions

### 6.6.1 Test Setup




### 6.6.2 Test Procedure

**MEASUREMENT PROCEDURE REF**

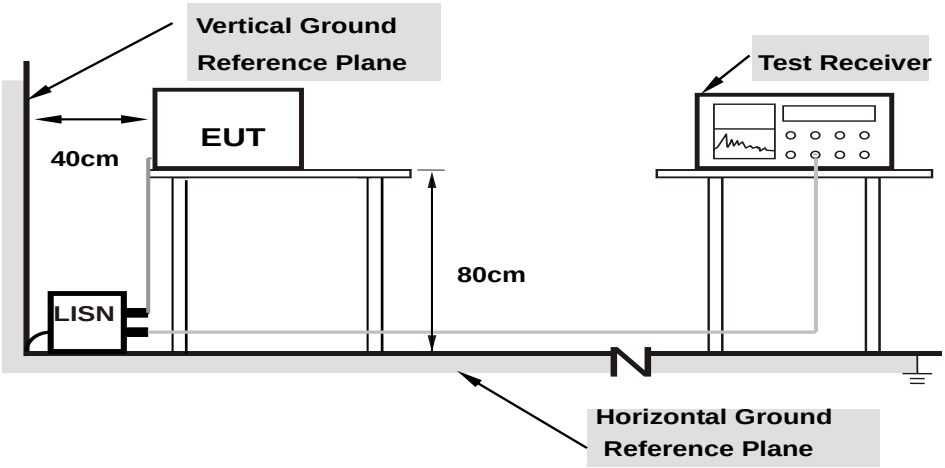
a. Set the RBW = 100 kHz.
b. Set the VBW ≥ 300 kHz.
c. Detector = peak.
d. Sweep time = auto couple.
e. Trace mode = max hold.
f. Allow trace to fully stabilize.
g. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

**MEASUREMENT PROCEDURE OOBE**

a. Set RBW = 100 kHz.
b. Set VBW ≥ 300 kHz.
c. Detector = peak.
d. Sweep = auto couple.
e. Trace Mode = max hold.
f. Allow trace to fully stabilize.
g. Use the peak marker function to determine the maximum amplitude level.

## 6.7 AC Power Conducted Emissions

### 6.7.1 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).

### 6.7.2 Test Procedure

a. The EUT was placed on a 0.8 meter to the top of table and 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/ 50 uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

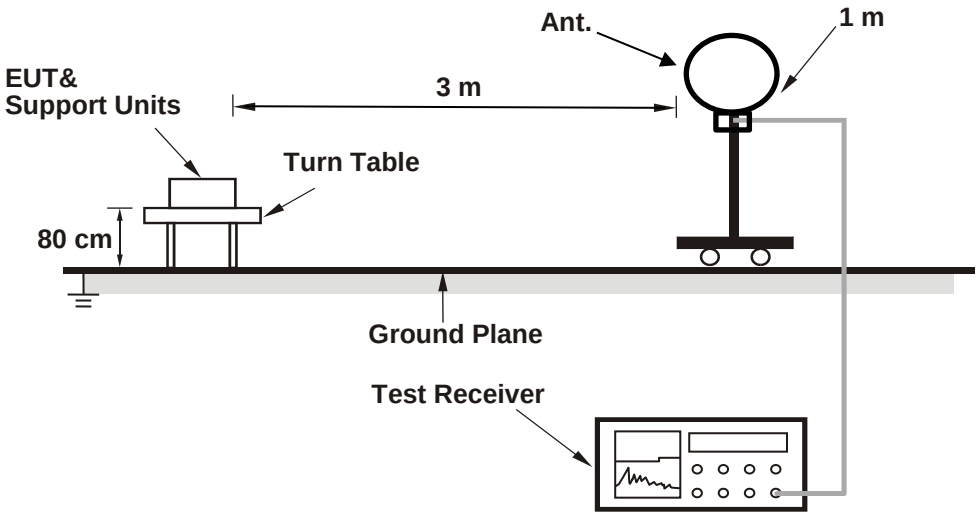
c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz-30 MHz.

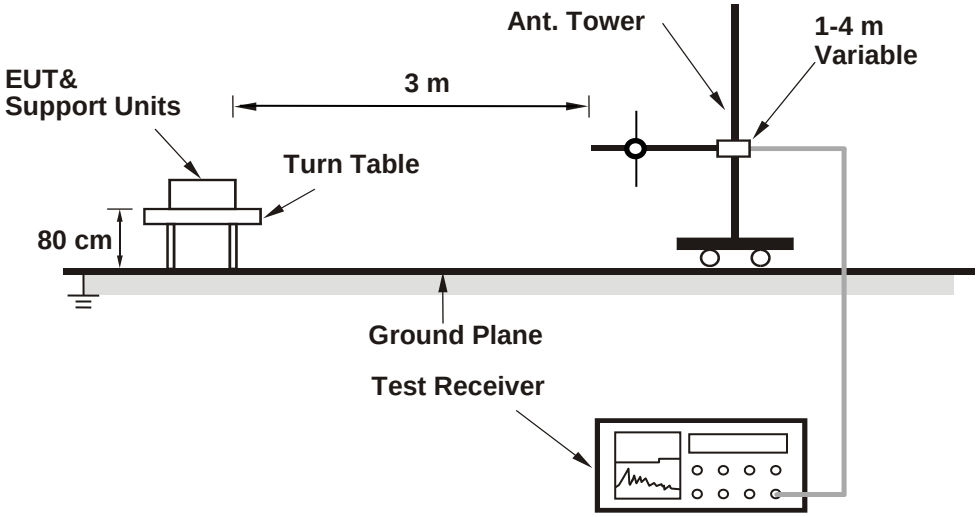
## 6.8 Unwanted Emissions below 1 GHz

### 6.8.1 Test Setup

**For Radiated emission below 30 MHz**




**For Radiated emission above 30 MHz**




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

### 6.8.2 Test Procedure

**For Radiated emission below 30 MHz**

a. The EUT was placed on the top of a rotating table 0.8 meters 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. 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, except for the frequency band (9 kHz to 90 kHz and 110 kHz to 490 kHz) set to average detect function and peak detect function.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200 Hz at frequency below 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz or 10 kHz at frequency (150 kHz to 30 MHz).
3. All modes of operation were investigated and the worst-case emissions are reported.

**For Radiated emission above 30 MHz**

a. The EUT was placed on the top of a rotating table 0.8 meters 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.

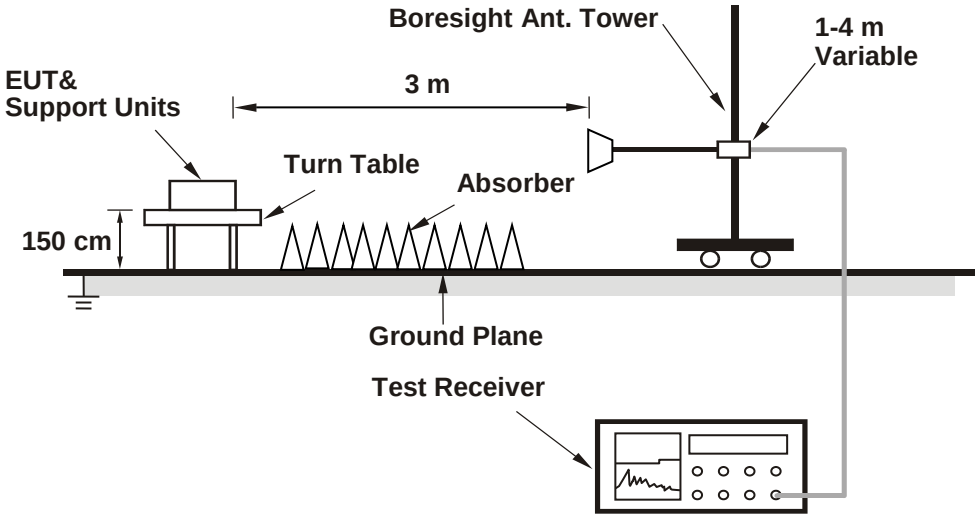
e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

Notes:

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

## 6.9 Unwanted Emissions above 1 GHz

### 6.9.1 Test Setup




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

### 6.9.2 Test Procedure

a. The EUT was placed on the top of a rotating table 1.5 meters 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 peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Notes:

1. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection (AV) at frequency above 1 GHz.
2. According to ANSI C63.10 section 6.6.4 and 4.1.4.2.2. For fundamental and harmonic signal measurement, according to ANSI C63.10 section 7.5, the average value = peak value + duty cycle correction factor. For duty cycle correction factor values, see the Test Signal Duty Cycle section in this report.
3. All modes of operation were investigated and the worst-case emissions are reported.

# 7 Test Results of Test Item

## 7.1 RF Output Power

| Input Power: | 120 Vac, 60 Hz | Environmental Conditions: | 25°C, 76% RH | Tested By: | Waydi Tuan |
|---|---|---|---|---|---|

### For Peak Power

### GFSK

| Chan. | Chan. Freq. (MHz) | Peak Power (mW) | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|---|---|---|---|---|---|
| 0 | 2402 | 2.123 | 3.27 | 21 | Pass |
| 39 | 2441 | 2.495 | 3.97 | 21 | Pass |
| 78 | 2480 | 1.959 | 2.92 | 21 | Pass |

Note: The antenna gain is 3.91 dBi < 6 dBi, so the output power limit shall not be reduced.

### 8DPSK

| Chan. | Chan. Freq. (MHz) | Peak Power (mW) | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|---|---|---|---|---|---|
| 0 | 2402 | 0.9977 | -0.01 | 21 | Pass |
| 39 | 2441 | 1.268 | 1.03 | 21 | Pass |
| 78 | 2480 | 0.9594 | -0.18 | 21 | Pass |

Note: The antenna gain is 3.91 dBi < 6 dBi, so the output power limit shall not be reduced.

### For Average Power

### GFSK

| Chan. | Chan. Freq. (MHz) | Average Power (mW) | Average Power (dBm) |
|---|---|---|---|
| 0 | 2402 | 1.923 | 2.84 |
| 39 | 2441 | 2.355 | 3.72 |
| 78 | 2480 | 1.811 | 2.58 |

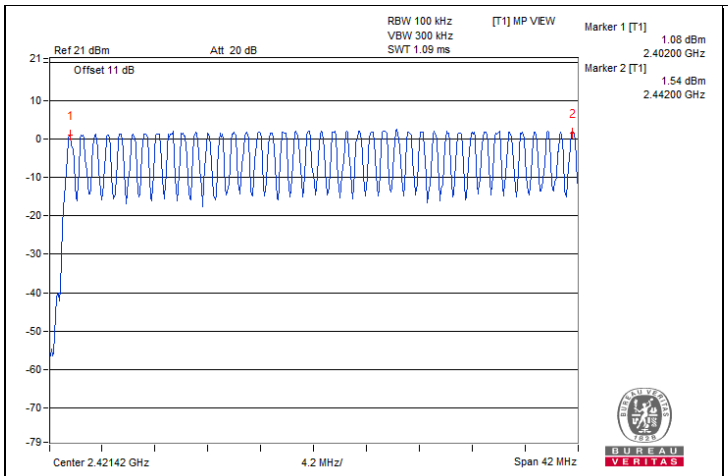
### 8DPSK

| Chan. | Chan. Freq. (MHz) | Average Power (mW) | Average Power (dBm) |
|---|---|---|---|
| 0 | 2402 | 0.9226 | -0.35 |
| 39 | 2441 | 1.167 | 0.67 |
| 78 | 2480 | 0.8954 | -0.48 |

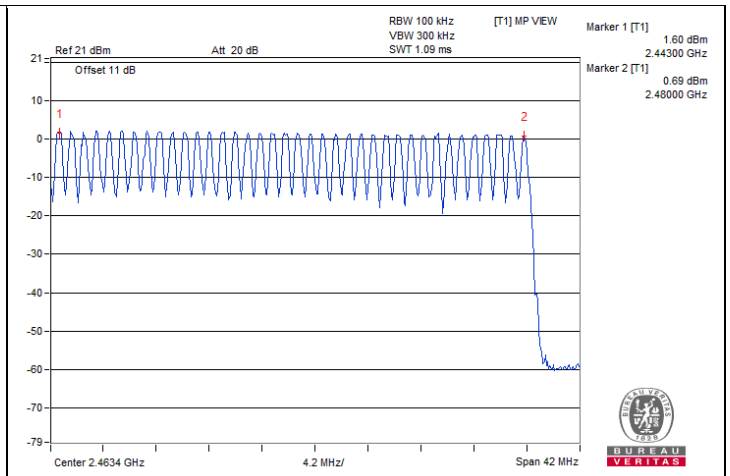
## 7.2 Number of Hopping Frequency Used

| Input Power: | 120 Vac, 60 Hz | Environmental Conditions: | 25°C, 76% RH | Tested By: | Waydi Tuan |
|---|---|---|---|---|---|

### GFSK



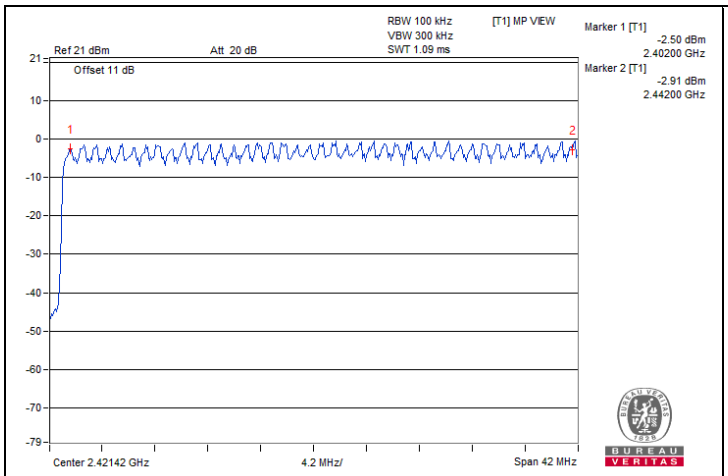

(Left side)



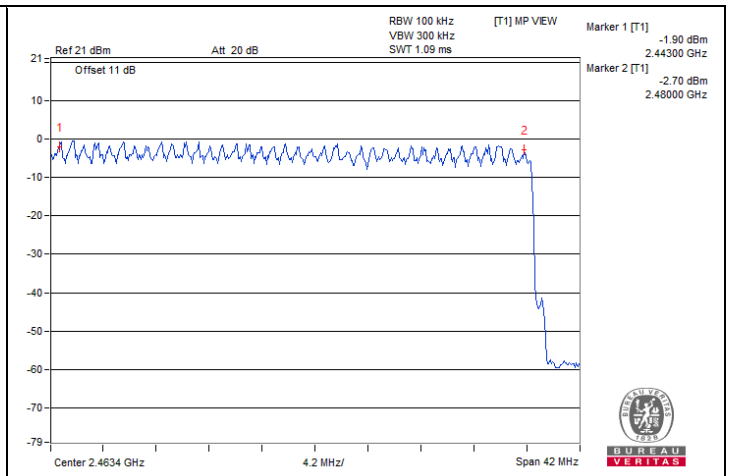

(Right side)

Note: There are 79 hopping frequencies in the hopping mode. On the plots, it shows that the hopping frequencies are equally spaced.

### 8DPSK




(Left side)




(Right side)

Note: There are 79 hopping frequencies in the hopping mode. On the plots, it shows that the hopping frequencies are equally spaced.

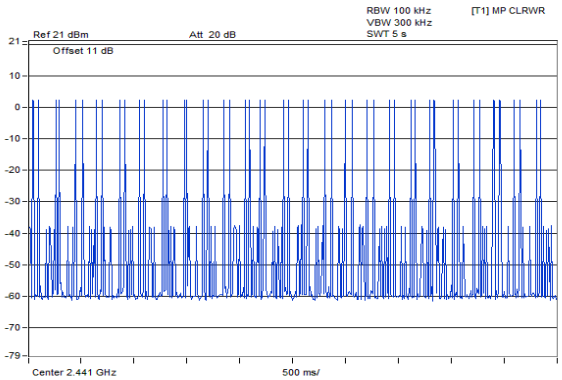
## 7.3 Dwell Time on Each Channel

| Input Power: | 120 Vac, 60 Hz | Environmental Conditions: | 25°C, 76% RH | Tested By: | Waydi Tuan |
|---|---|---|---|---|---|

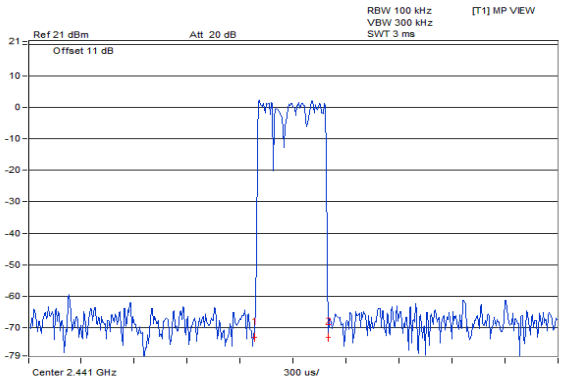
### GFSK

| Mode | Number of transmission in 31.6 sec | Length of transmission time (msec) | Result (msec) | Limit (msec) | Test Result |
|---|---|---|---|---|---|
| DH1 | 50 (times / 5 sec) * 6.32 = 316 times | 0.42 | 132.72 | 400 | Pass |
| DH3 | 26 (times / 5 sec) * 6.32 = 165 times | 1.68 | 277.2 | 400 | Pass |
| DH5 | 17 (times / 5 sec) * 6.32 = 108 times | 2.944 | 317.95 | 400 | Pass |

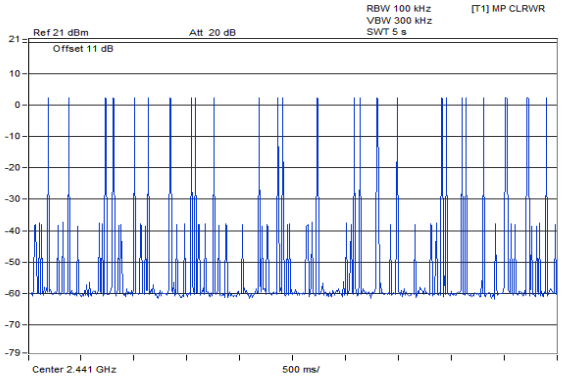
Spectrum plots of Dwell Time



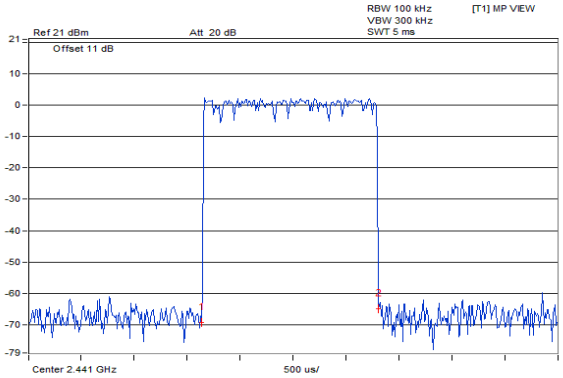

GFSK DH1



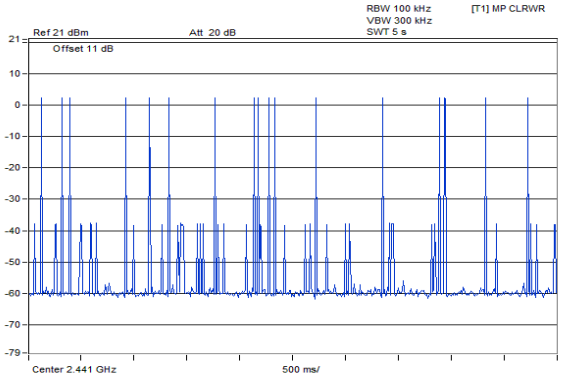

GFSK DH1



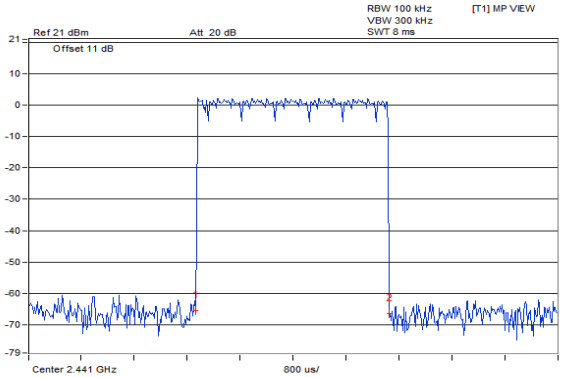

GFSK DH3




GFSK DH3




GFSK DH5

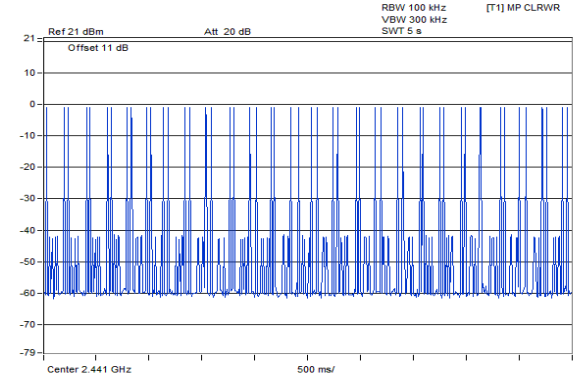



GFSK DH5

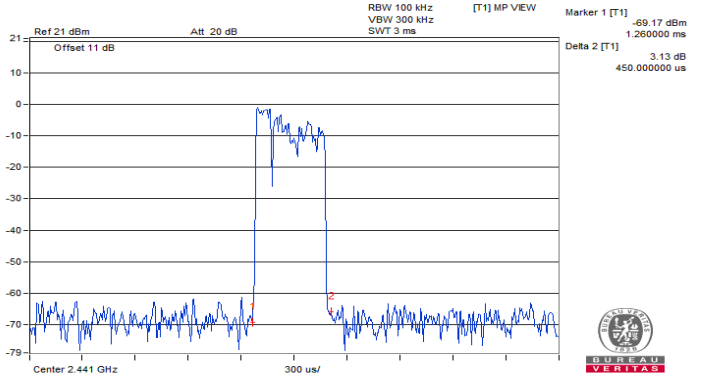
## 8DPSK

| Mode | Number of transmission in 31.6 sec | Length of transmission time (msec) | Result (msec) | Limit (msec) | Test Result |
|---|---|---|---|---|---|
| 3DH1 | 50 (times / 5 sec) * 6.32 = 316 times | 0.45 | 142.2 | 400 | Pass |
| 3DH3 | 26 (times / 5 sec) * 6.32 = 165 times | 1.69 | 278.85 | 400 | Pass |
| 3DH5 | 17 (times / 5 sec) * 6.32 = 108 times | 2.992 | 323.14 | 400 | Pass |

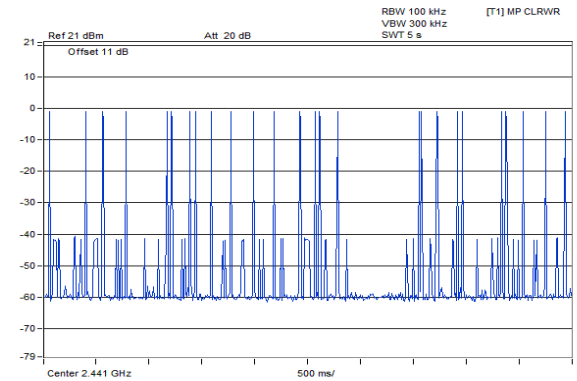
Spectrum plots of Dwell Time



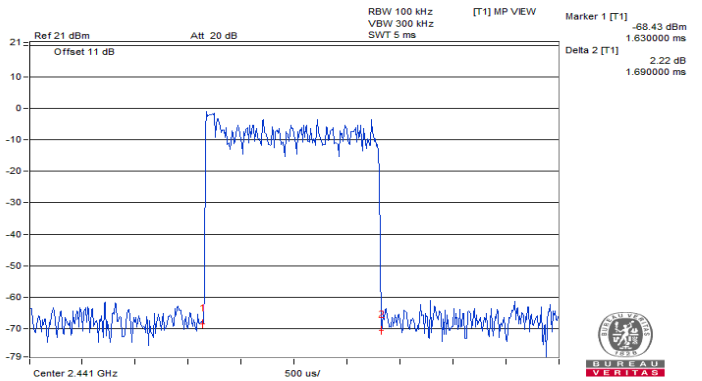

8DPSK 3DH1



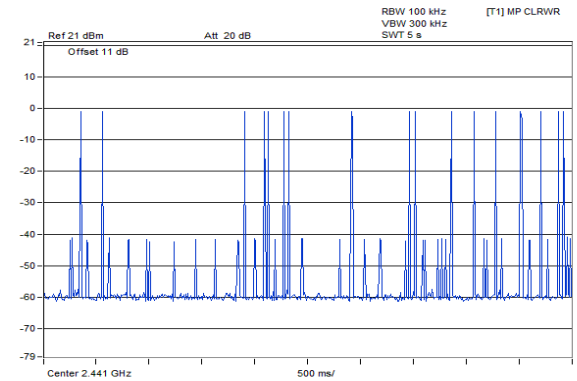

8DPSK 3DH1



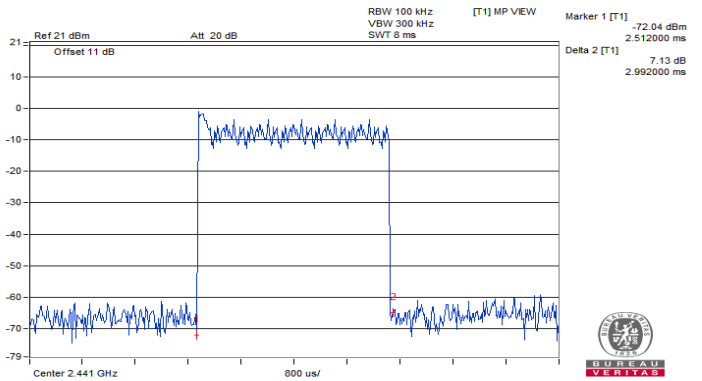

8DPSK 3DH3




8DPSK 3DH3




8DPSK 3DH5




8DPSK 3DH5

## 7.4 Hopping Channel Separation

| Input Power: | 120 Vac, 60 Hz | Environmental Conditions: | 25°C, 76% RH | Tested By: | Waydi Tuan |
|---|---|---|---|---|---|

### GFSK

| Channel | Frequency (MHz) | Hopping Channel Separation (MHz) | Minimum Limit (MHz) | Test Result |
|---|---|---|---|---|
| 0 | 2402 | 1 | 0.63 | Pass |
| 39 | 2441 | 1 | 0.63 | Pass |
| 78 | 2480 | 1 | 0.64 | Pass |

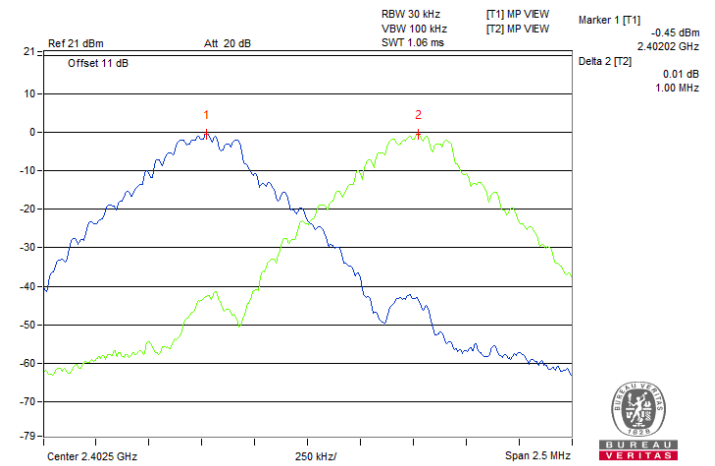
Note: The minimum limit is two-third 20dB bandwidth.

### 8DPSK

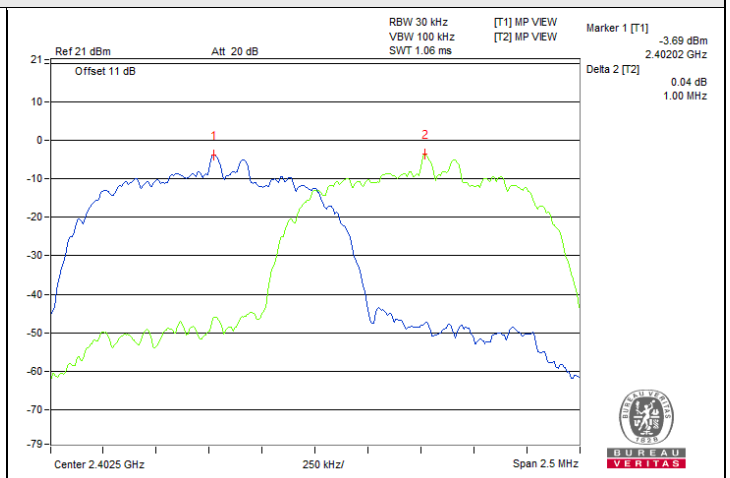
| Channel | Frequency (MHz) | Hopping Channel Separation (MHz) | Minimum Limit (MHz) | Test Result |
|---|---|---|---|---|
| 0 | 2402 | 1 | 0.87 | Pass |
| 39 | 2441 | 1 | 0.87 | Pass |
| 78 | 2480 | 1 | 0.87 | Pass |

Note: The minimum limit is two-third 20dB bandwidth.

Spectrum Plot of Minimum Value




GFSK : CH 0




8DPSK : CH 0

## 7.5 20 dB Bandwidth

| Input Power: | 120 Vac, 60 Hz | Environmental Conditions: | 25°C, 76% RH | Tested By: | Waydi Tuan |
|---|---|---|---|---|---|

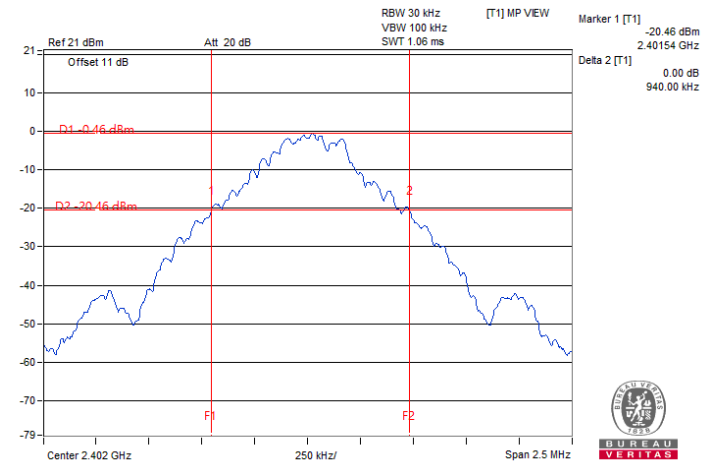
### GFSK

| Channel | Frequency (MHz) | 20dB Bandwidth (MHz) |
|---|---|---|
| 0 | 2402 | 0.94 |
| 39 | 2441 | 0.94 |
| 78 | 2480 | 0.95 |

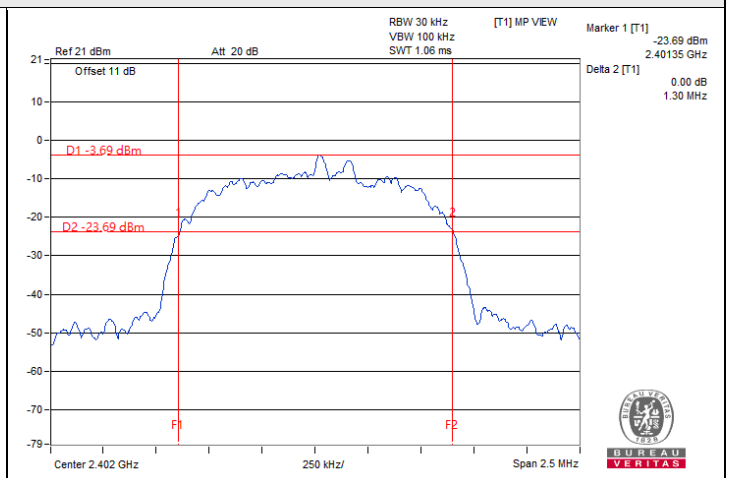
### 8DPSK

| Channel | Frequency (MHz) | 20dB Bandwidth (MHz) |
|---|---|---|
| 0 | 2402 | 1.3 |
| 39 | 2441 | 1.3 |
| 78 | 2480 | 1.3 |

Spectrum Plot of Minimum Value




GFSK : CH 0

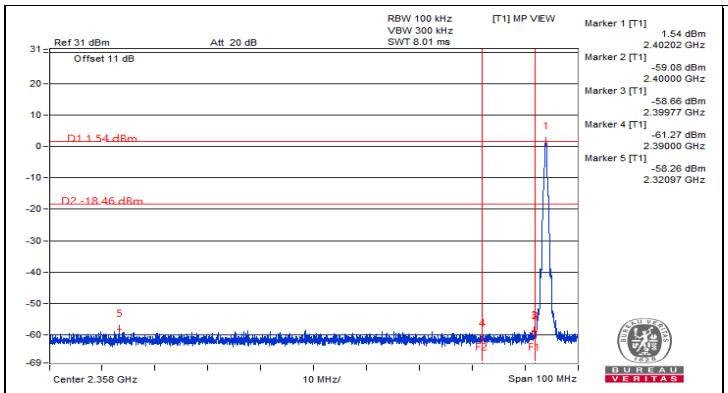



8DPSK : CH 0

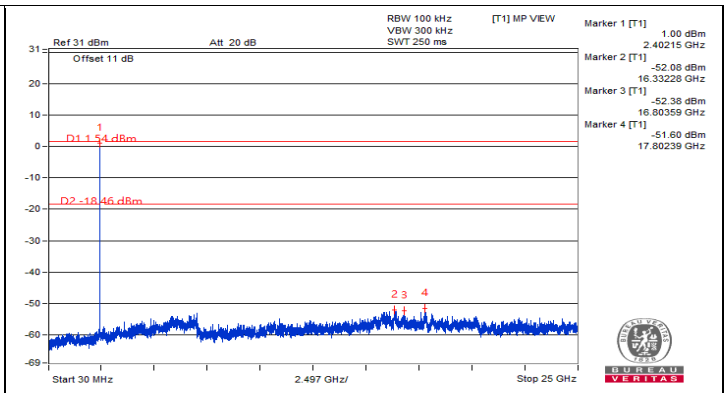
## 7.6 Conducted Out of Band Emissions

| Input Power: | 120 Vac, 60 Hz | Environmental Conditions: | 25°C, 76% RH | Tested By: | Waydi Tuan |
|---|---|---|---|---|---|

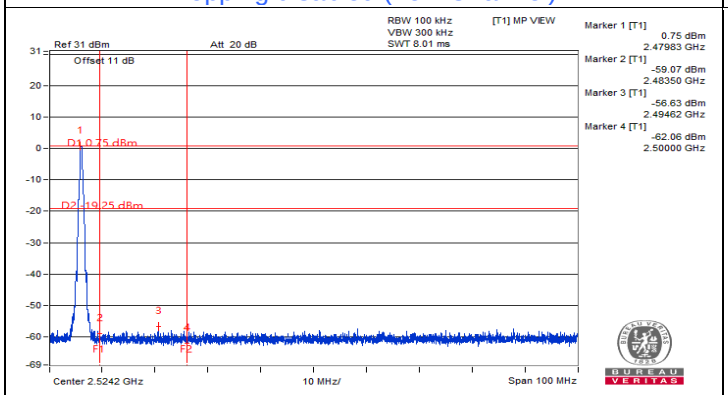
### GFSK



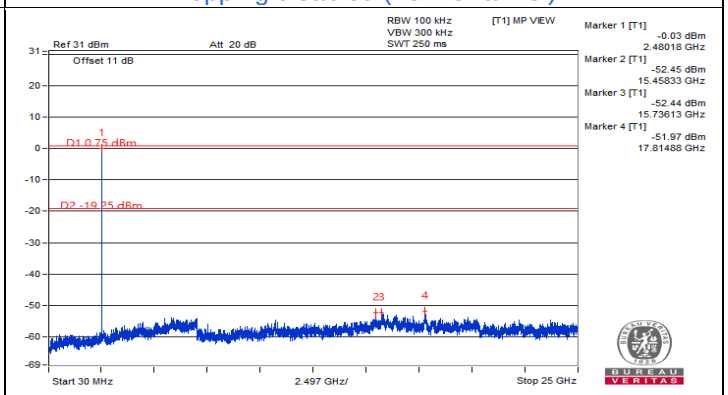

Hopping disabled (Low Channel)



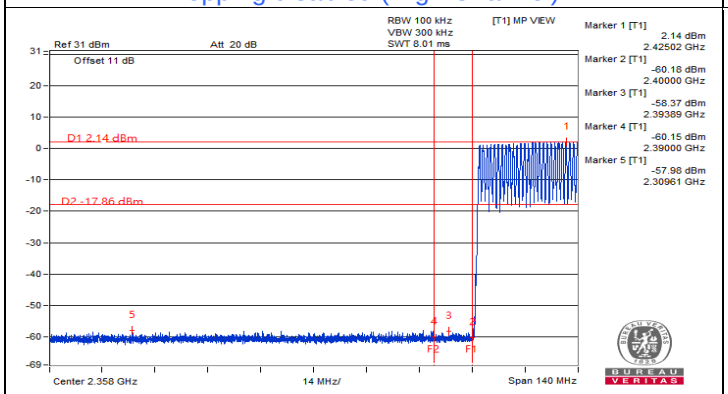

Hopping disabled (Low Channel)



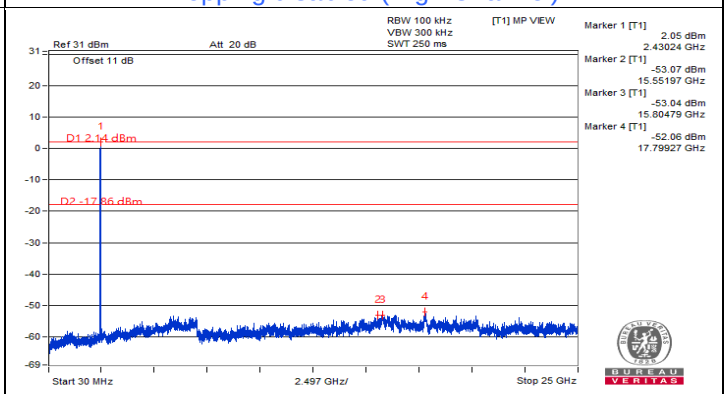

Hopping disabled (High Channel)



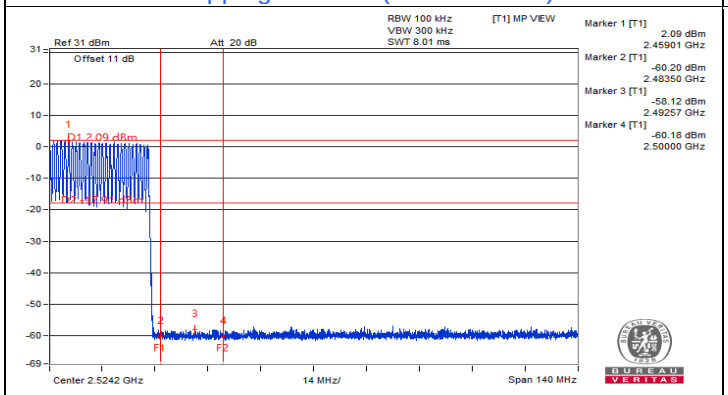

Hopping disabled (High Channel)



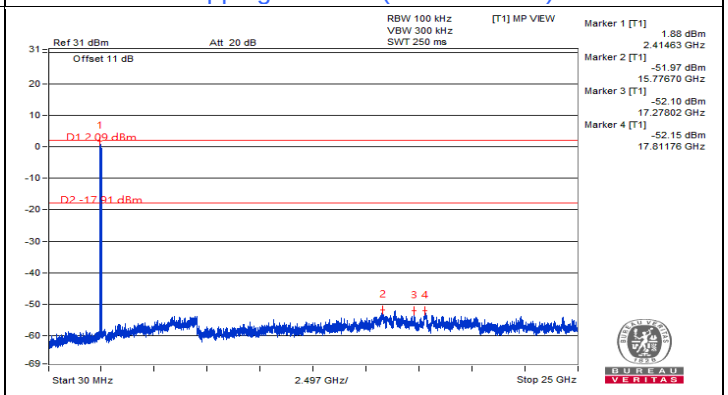

Hopping enabled (Low Channel)




Hopping enabled (Low Channel)

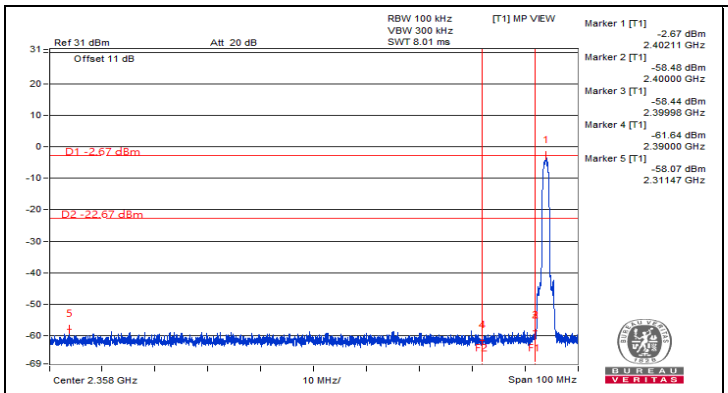



Hopping enabled (High Channel)

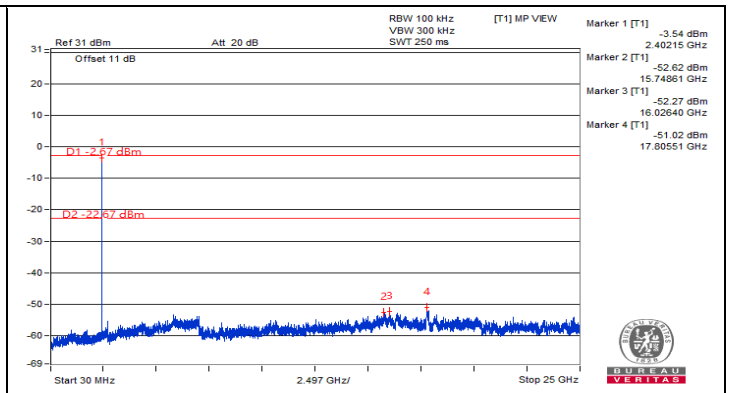



Hopping enabled (High Channel)

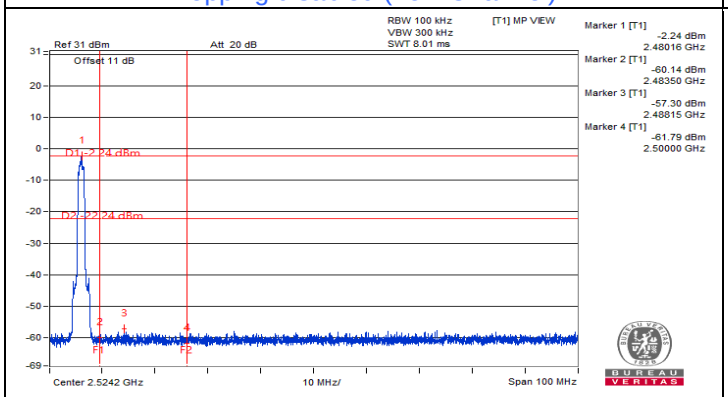
## 8DPSK



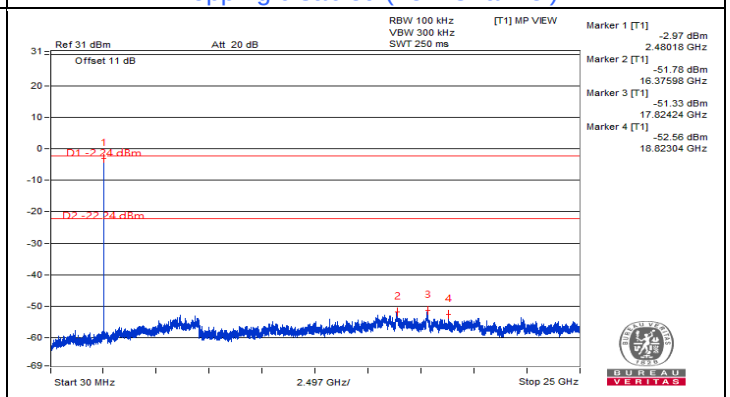

Hopping disabled (Low Channel)



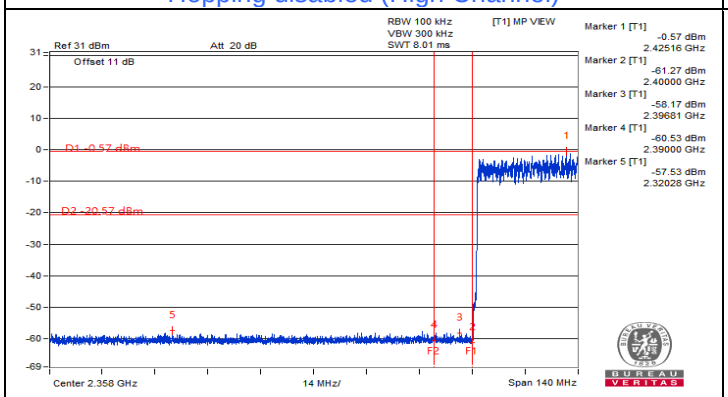

Hopping disabled (Low Channel)



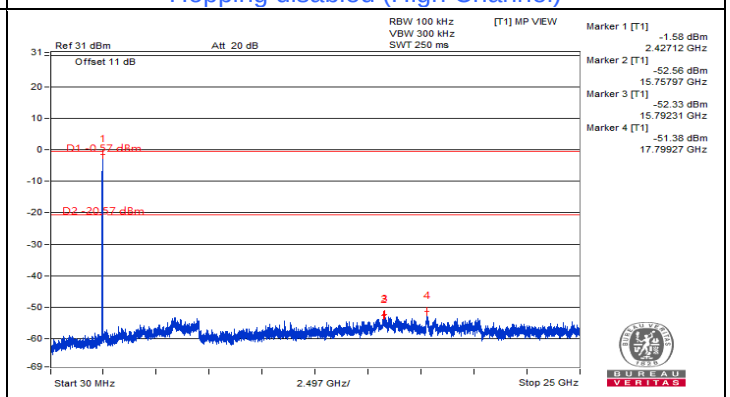

Hopping disabled (High Channel)



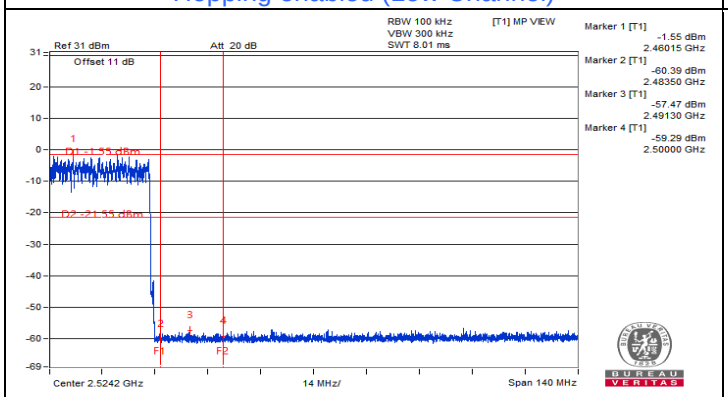

Hopping disabled (High Channel)



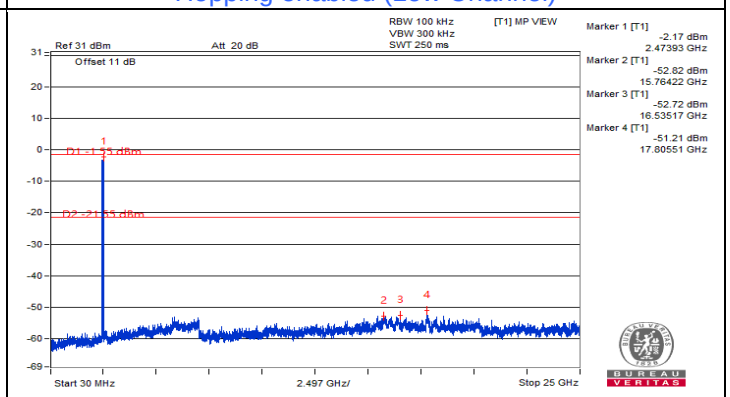

Hopping enabled (Low Channel)




Hopping enabled (Low Channel)




Hopping enabled (High Channel)




Hopping enabled (High Channel)

## 7.7 AC Power Conducted Emissions

| | | | |
|---|---|---|---|
| **RF Mode** | BT GFSK | **Channel** | CH 39：2441 MHz |
| **Frequency Range** | 150kHz ~ 30MHz | **Detector Function & Resolution Bandwidth** | Quasi-Peak (QP) / Average (AV), 9 kHz |
| **Input Power** | 120 Vac, 60 Hz | **Environmental Conditions** | 25°C, 75% RH |
| **Tested By** | Jed Wu | | |

| 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 | 10.04 | 40.18 | 30.15 | 50.22 | 40.19 | 66.00 | 56.00 | -15.78 | -15.81 |
| 2 | 0.43350 | 10.10 | 26.57 | 18.89 | 36.67 | 28.99 | 57.19 | 47.19 | -20.52 | -18.20 |
| 3 | 0.73428 | 10.12 | 26.83 | 17.22 | 36.95 | 27.34 | 56.00 | 46.00 | -19.05 | -18.66 |
| 4 | 1.32480 | 10.14 | 26.59 | 19.85 | 36.73 | 29.99 | 56.00 | 46.00 | -19.27 | -16.01 |
| 5 | 5.54726 | 10.26 | 35.41 | 26.83 | 45.67 | 37.09 | 60.00 | 50.00 | -14.33 | -12.91 |
| 6 | 23.87265 | 10.52 | 34.14 | 25.44 | 44.66 | 35.96 | 60.00 | 50.00 | -15.34 | -14.04 |

**Remarks:**

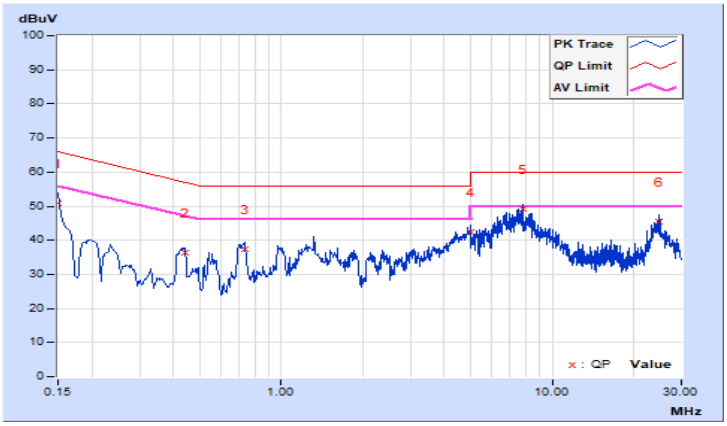
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

| | | | |
|---|---|---|---|
| **RF Mode** | BT GFSK | **Channel** | CH 39：2441 MHz |
| **Frequency Range** | 150kHz ~ 30MHz | **Detector Function & Resolution Bandwidth** | Quasi-Peak (QP) / Average (AV), 9 kHz |
| **Input Power** | 120 Vac, 60 Hz | **Environmental Conditions** | 25°C, 75% RH |
| **Tested By** | Jed Wu | | |

| **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 | 10.04 | 40.86 | 31.06 | 50.90 | 41.10 | 66.00 | 56.00 | -15.10 | -14.90 |
| 2 | 0.43925 | 10.10 | 26.28 | 17.77 | 36.38 | 27.87 | 57.08 | 47.08 | -20.70 | -19.21 |
| 3 | 0.73042 | 10.12 | 27.31 | 18.90 | 37.43 | 29.02 | 56.00 | 46.00 | -18.57 | -16.98 |
| 4 | 4.99535 | 10.24 | 32.11 | 21.65 | 42.35 | 31.89 | 56.00 | 46.00 | -13.65 | -14.11 |
| **5** | **7.79493** | **10.31** | **38.77** | **27.45** | **49.08** | **37.76** | **60.00** | **50.00** | **-10.92** | **-12.24** |
| 6 | 24.88117 | 10.51 | 35.05 | 27.57 | 45.56 | 38.08 | 60.00 | 50.00 | -14.44 | -11.92 |

**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



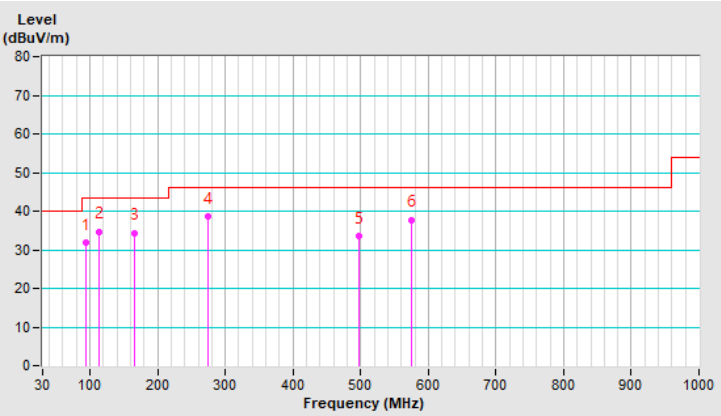
## 7.8 Unwanted Emissions below 1 GHz

| | | | |
|---|---|---|---|
| **RF Mode** | BT GFSK | **Channel** | CH 39：2441 MHz |
| **Frequency Range** | 30 MHz ~ 1 GHz | **Detector Function & Bandwidth** | (QP) RB = 120kHz |
| **Input Power** | 120 Vac, 60 Hz | **Environmental Conditions** | 25°C, 73% RH |
| **Tested By** | William Su | | |

| **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 | 94.21 | 31.7 QP | 43.5 | -11.8 | 2.01 H | 210 | 45.6 | -13.9 |
| 2 | 113.66 | 34.5 QP | 43.5 | -9.0 | 2.18 H | 143 | 46.2 | -11.7 |
| 3 | 165.90 | 34.2 QP | 43.5 | -9.3 | 1.54 H | 210 | 42.7 | -8.5 |
| 4 | 275.26 | 38.5 QP | 46.0 | -7.5 | 1.06 H | 224 | 45.3 | -6.8 |
| 5 | 497.88 | 33.4 QP | 46.0 | -12.6 | 1.27 H | 120 | 35.2 | -1.8 |
| 6 | 575.72 | 37.7 QP | 46.0 | -8.3 | 1.49 H | 125 | 37.5 | 0.2 |

**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 of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

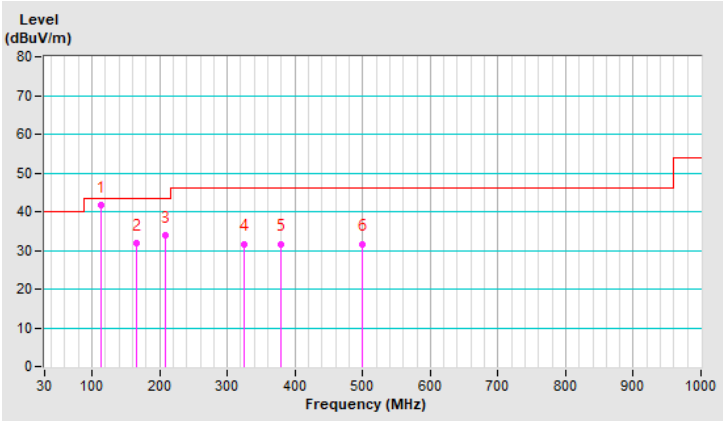


| | | | |
|---|---|---|---|
| **RF Mode** | BT GFSK | **Channel** | CH 39：2441 MHz |
| **Frequency Range** | 30 MHz ~ 1 GHz | **Detector Function & Bandwidth** | (QP) RB = 120kHz |
| **Input Power** | 120 Vac, 60 Hz | **Environmental Conditions** | 25°C, 73% RH |
| **Tested By** | William Su | | |

| **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** | **113.66** | **41.6 QP** | **43.5** | **-1.9** | **1.36 V** | **344** | **53.3** | **-11.7** |
| 2 | 165.90 | 31.7 QP | 43.5 | -11.8 | 1.58 V | 222 | 40.2 | -8.5 |
| 3 | 208.92 | 33.8 QP | 43.5 | -9.7 | 1.64 V | 360 | 44.6 | -10.8 |
| 4 | 324.10 | 31.6 QP | 46.0 | -14.4 | 1.12 V | 265 | 36.9 | -5.3 |
| 5 | 378.28 | 31.5 QP | 46.0 | -14.5 | 1.27 V | 193 | 35.8 | -4.3 |
| 6 | 499.92 | 31.5 QP | 46.0 | -14.5 | 1.96 V | 91 | 33.2 | -1.7 |

**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 of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



## 7.9 Unwanted Emissions above 1 GHz

| | | | |
|---|---|---|---|
| **RF Mode** | BT GFSK | **Channel** | CH 0：2402 MHz |
| **Frequency Range** | 1 GHz ~ 25 GHz | **Detector Function & Bandwidth** | (PK) RB = 1 MHz, VB = 3 MHz<br>(AV) RB = 1 MHz, VB = 3 MHz (RMS) |
| **Input Power** | 120 Vac, 60 Hz | **Environmental Conditions** | 23°C, 67% RH |
| **Tested By** | Ian Chang | | |

| **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 | 2390.00 | 53.0 PK | 74.0 | -21.0 | 2.15 H | 108 | 54.3 | -1.3 |
| 2 | 2390.00 | 40.7 AV | 54.0 | -13.3 | 2.15 H | 108 | 42.0 | -1.3 |
| 3 | *2402.00 | 96.6 PK | | | 2.15 H | 108 | 97.9 | -1.3 |
| 4 | *2402.00 | 65.8 AV | | | 2.15 H | 108 | 67.1 | -1.3 |
| 5 | 4804.00 | 46.7 PK | 74.0 | -27.3 | 1.60 H | 124 | 40.1 | 6.6 |
| 6 | 4804.00 | 15.9 AV | 54.0 | -38.1 | 1.60 H | 124 | 9.3 | 6.6 |
| **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 | 2390.00 | 54.2 PK | 74.0 | -19.8 | 2.07 V | 157 | 55.5 | -1.3 |
| **2** | **2390.00** | **41.9 AV** | **54.0** | **-12.1** | **2.07 V** | **157** | **43.2** | **-1.3** |
| 3 | *2402.00 | 100.1 PK | | | 2.07 V | 157 | 101.4 | -1.3 |
| 4 | *2402.00 | 69.3 AV | | | 2.07 V | 157 | 70.6 | -1.3 |
| 5 | 4804.00 | 46.9 PK | 74.0 | -27.1 | 1.60 V | 260 | 40.3 | 6.6 |
| 6 | 4804.00 | 16.1 AV | 54.0 | -37.9 | 1.60 V | 260 | 9.5 | 6.6 |

**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, the limit was restricted at the RF Output Power.
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(Duty cycle) = 20 log(2.9 ms / 100 ms) = -30.8 dB

| | | | |
|---|---|---|---|
| **RF Mode** | BT GFSK | **Channel** | CH 39：2441 MHz |
| **Frequency Range** | 1 GHz ~ 25 GHz | **Detector Function & Bandwidth** | (PK) RB = 1 MHz, VB = 3 MHz<br>(AV) RB = 1 MHz, VB = 3 MHz (RMS) |
| **Input Power** | 120 Vac, 60 Hz | **Environmental Conditions** | 23°C, 67% RH |
| **Tested By** | Ian Chang | | |

| **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 | *2441.00 | 96.6 PK | | | 1.30 H | 71 | 97.7 | -1.1 |
| 2 | *2441.00 | 65.8 AV | | | 1.30 H | 71 | 66.9 | -1.1 |
| 3 | 4882.00 | 46.9 PK | 74.0 | -27.1 | 1.68 H | 261 | 40.1 | 6.8 |
| 4 | 4882.00 | 16.1 AV | 54.0 | -37.9 | 1.68 H | 261 | 9.3 | 6.8 |
| **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 | *2441.00 | 101.2 PK | | | 1.50 V | 251 | 102.3 | -1.1 |
| 2 | *2441.00 | 70.4 AV | | | 1.50 V | 251 | 71.5 | -1.1 |
| 3 | 4882.00 | 47.4 PK | 74.0 | -26.6 | 1.66 V | 241 | 40.6 | 6.8 |
| 4 | 4882.00 | 16.6 AV | 54.0 | -37.4 | 1.66 V | 241 | 9.8 | 6.8 |

**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, the limit was restricted at the RF Output Power.
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(Duty cycle) = 20 log(2.9 ms / 100 ms) = -30.8 dB

| | | | |
|---|---|---|---|
| **RF Mode** | BT GFSK | **Channel** | CH 78：2480 MHz |
| **Frequency Range** | 1 GHz ~ 25 GHz | **Detector Function & Bandwidth** | (PK) RB = 1 MHz, VB = 3 MHz<br>(AV) RB = 1 MHz, VB = 3 MHz (RMS) |
| **Input Power** | 120 Vac, 60 Hz | **Environmental Conditions** | 23°C, 67% RH |
| **Tested By** | Ian Chang | | |

| **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 | *2480.00 | 95.9 PK | | | 1.09 H | 71 | 97.0 | -1.1 |
| 2 | *2480.00 | 65.1 AV | | | 1.09 H | 71 | 66.2 | -1.1 |
| 3 | 2483.50 | 52.6 PK | 74.0 | -21.4 | 1.09 H | 71 | 53.6 | -1.0 |
| 4 | 2483.50 | 21.8 AV | 54.0 | -32.2 | 1.09 H | 71 | 22.8 | -1.0 |
| 5 | 4960.00 | 47.6 PK | 74.0 | -26.4 | 1.52 H | 128 | 40.8 | 6.8 |
| 6 | 4960.00 | 16.8 AV | 54.0 | -37.2 | 1.52 H | 128 | 10.0 | 6.8 |
| **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 | *2480.00 | 98.9 PK | | | 1.50 V | 250 | 100.0 | -1.1 |
| 2 | *2480.00 | 68.1 AV | | | 1.50 V | 250 | 69.2 | -1.1 |
| 3 | 2483.50 | 53.3 PK | 74.0 | -20.7 | 1.50 V | 250 | 54.3 | -1.0 |
| 4 | 2483.50 | 22.5 AV | 54.0 | -31.5 | 1.50 V | 250 | 23.5 | -1.0 |
| 5 | 4960.00 | 48.0 PK | 74.0 | -26.0 | 1.69 V | 231 | 41.2 | 6.8 |
| 6 | 4960.00 | 17.2 AV | 54.0 | -36.8 | 1.69 V | 231 | 10.4 | 6.8 |

**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, the limit was restricted at the RF Output Power.
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(Duty cycle) = 20 log(2.9 ms / 100 ms) = -30.8 dB

| RF Mode | BT 8DPSK | Channel | CH 0：2402 MHz |
|---|---|---|---|
| Frequency Range | 1 GHz ~ 25 GHz | Detector Function & Bandwidth | (PK) RB = 1 MHz, VB = 3 MHz<br>(AV) RB = 1 MHz, VB = 3 MHz (RMS) |
| Input Power | 120 Vac, 60 Hz | Environmental Conditions | 23°C, 67% RH |
| Tested By | Ian Chang | | |

| 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 | 2390.00 | 52.8 PK | 74.0 | -21.2 | 1.32 H | 70 | 54.1 | -1.3 |
| 2 | 2390.00 | 40.6 AV | 54.0 | -13.4 | 1.32 H | 70 | 41.9 | -1.3 |
| 3 | *2402.00 | 94.3 PK | | | 1.32 H | 70 | 95.6 | -1.3 |
| 4 | *2402.00 | 63.5 AV | | | 1.32 H | 70 | 64.8 | -1.3 |
| 5 | 4804.00 | 46.4 PK | 74.0 | -27.6 | 1.74 H | 207 | 39.8 | 6.6 |
| 6 | 4804.00 | 15.6 AV | 54.0 | -38.4 | 1.74 H | 207 | 9.0 | 6.6 |
| 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 | 2390.00 | 54.0 PK | 74.0 | -20.0 | 2.06 V | 156 | 55.3 | -1.3 |
| 2 | 2390.00 | 40.9 AV | 54.0 | -13.1 | 2.06 V | 156 | 42.2 | -1.3 |
| 3 | *2402.00 | 98.5 PK | | | 2.06 V | 157 | 99.8 | -1.3 |
| 4 | *2402.00 | 67.7 AV | | | 2.06 V | 157 | 69.0 | -1.3 |
| 5 | 4804.00 | 46.6 PK | 74.0 | -27.4 | 2.09 V | 235 | 40.0 | 6.6 |
| 6 | 4804.00 | 15.8 AV | 54.0 | -38.2 | 2.09 V | 235 | 9.2 | 6.6 |

**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, the limit was restricted at the RF Output Power.
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(Duty cycle) = 20 log(2.9 ms / 100 ms) = -30.8 dB

| | | | |
|---|---|---|---|
| **RF Mode** | BT 8DPSK | **Channel** | CH 39：2441 MHz |
| **Frequency Range** | 1 GHz ~ 25 GHz | **Detector Function & Bandwidth** | (PK) RB = 1 MHz, VB = 3 MHz<br>(AV) RB = 1 MHz, VB = 3 MHz (RMS) |
| **Input Power** | 120 Vac, 60 Hz | **Environmental Conditions** | 23°C, 67% RH |
| **Tested By** | Ian Chang | | |

| **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 | *2441.00 | 90.7 PK | | | 2.25 H | 270 | 91.8 | -1.1 |
| 2 | *2441.00 | 59.9 AV | | | 2.25 H | 270 | 61.0 | -1.1 |
| 3 | 4882.00 | 47.0 PK | 74.0 | -27.0 | 1.66 H | 213 | 40.2 | 6.8 |
| 4 | 4882.00 | 16.2 AV | 54.0 | -37.8 | 1.66 H | 213 | 9.4 | 6.8 |
| **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 | *2441.00 | 99.2 PK | | | 1.52 V | 251 | 100.3 | -1.1 |
| 2 | *2441.00 | 68.4 AV | | | 1.52 V | 251 | 69.5 | -1.1 |
| 3 | 4882.00 | 47.3 PK | 74.0 | -26.7 | 1.88 V | 225 | 40.5 | 6.8 |
| 4 | 4882.00 | 16.5 AV | 54.0 | -37.5 | 1.88 V | 225 | 9.7 | 6.8 |

**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, the limit was restricted at the RF Output Power.
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(Duty cycle) = 20 log(2.9 ms / 100 ms) = -30.8 dB

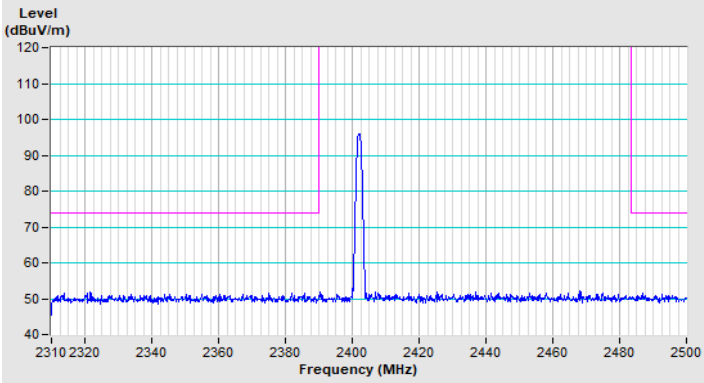
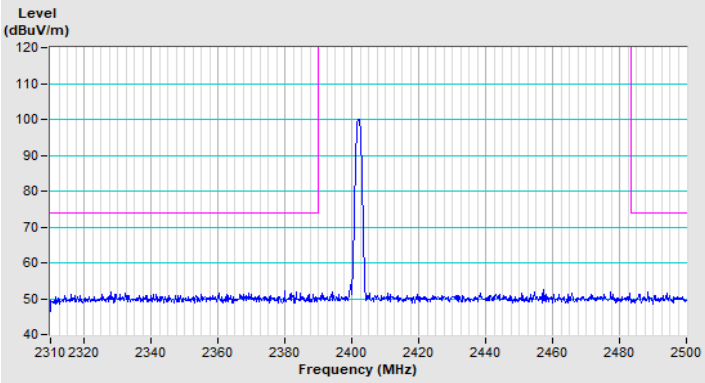
| | | | |
|---|---|---|---|
| **RF Mode** | BT 8DPSK | **Channel** | CH 78：2480 MHz |
| **Frequency Range** | 1 GHz ~ 25 GHz | **Detector Function & Bandwidth** | (PK) RB = 1 MHz, VB = 3 MHz<br>(AV) RB = 1 MHz, VB = 3 MHz (RMS) |
| **Input Power** | 120 Vac, 60 Hz | **Environmental Conditions** | 23°C, 67% RH |
| **Tested By** | Ian Chang | | |

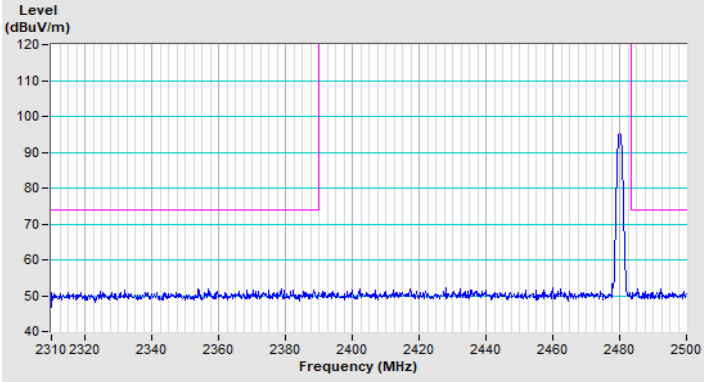
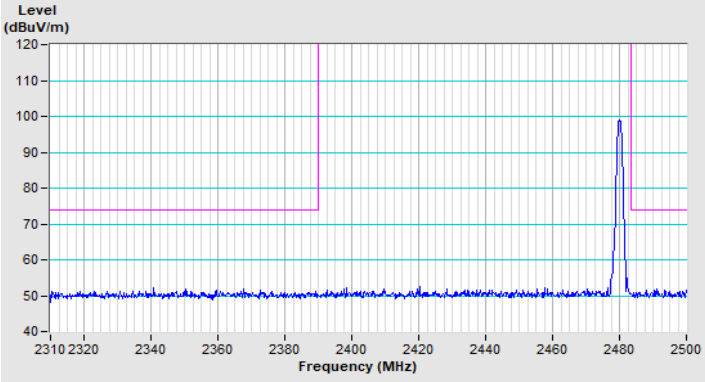
| **Antenna Polarity & Test Distance : Horizontal at 3 m** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **No** | **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Antenna Height (m)** | **Table Angle (Degree)** | **Raw Value (dBuV)** | **Correction Factor (dB/m)** |
| 1 | *2480.00 | 90.8 PK | | | 1.33 H | 96 | 91.9 | -1.1 |
| 2 | *2480.00 | 60.0 AV | | | 1.33 H | 96 | 61.1 | -1.1 |
| 3 | 2483.50 | 52.4 PK | 74.0 | -21.6 | 1.33 H | 96 | 53.4 | -1.0 |
| 4 | 2483.50 | 21.6 AV | 54.0 | -32.4 | 1.33 H | 96 | 22.6 | -1.0 |
| 5 | 4960.00 | 47.0 PK | 74.0 | -27.0 | 1.64 H | 198 | 40.2 | 6.8 |
| 6 | 4960.00 | 16.2 AV | 54.0 | -37.8 | 1.64 H | 198 | 9.4 | 6.8 |
| **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 | *2480.00 | 96.9 PK | | | 1.51 V | 249 | 98.0 | -1.1 |
| 2 | *2480.00 | 66.1 AV | | | 1.51 V | 249 | 67.2 | -1.1 |
| 3 | 2483.50 | 53.4 PK | 74.0 | -20.6 | 1.51 V | 249 | 54.4 | -1.0 |
| 4 | 2483.50 | 22.6 AV | 54.0 | -31.4 | 1.51 V | 249 | 23.6 | -1.0 |
| 5 | 4960.00 | 47.4 PK | 74.0 | -26.6 | 1.87 V | 241 | 40.6 | 6.8 |
| 6 | 4960.00 | 16.6 AV | 54.0 | -37.4 | 1.87 V | 241 | 9.8 | 6.8 |

**Remarks:**

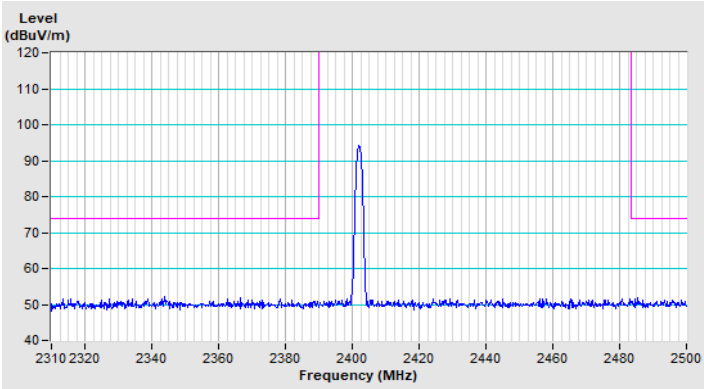
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.
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(Duty cycle) = 20 log(2.9 ms / 100 ms) = -30.8 dB

## Plot of Band Edge

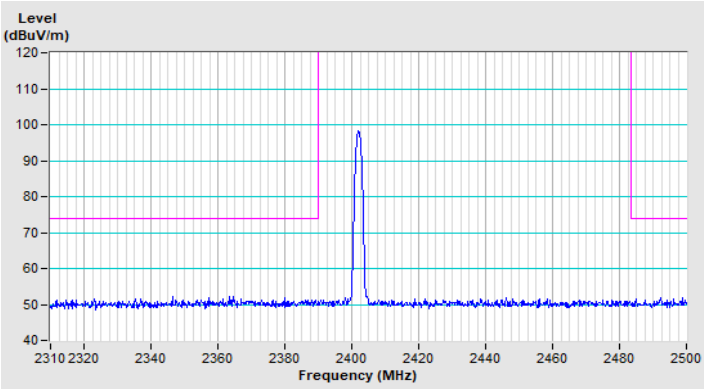
| BT GFSK Channel 0 | |
|---|---|
|   |   |
| Horizontal (Peak) | Vertical (Peak) |

| BT GFSK Channel 78 | |
|---|---|
|   |   |
| Horizontal (Peak) | Vertical (Peak) |

## BT 8DPSK Channel 0

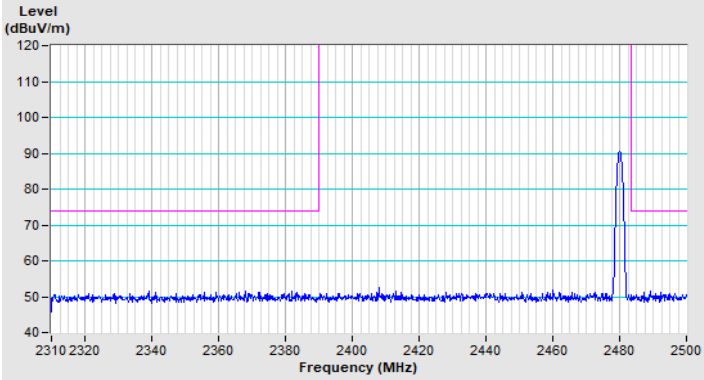



Horizontal (Peak)

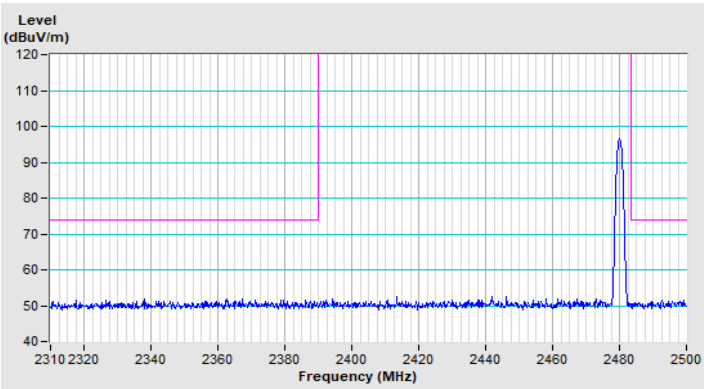



Vertical (Peak)

## BT 8DPSK Channel 78




Horizontal (Peak)




Vertical (Peak)

# 8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

# 9 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.

If you have any comments, please feel free to contact us at the following: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**Web Site:** http://ee.bureauveritas.com.tw


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

**--- END ---**