



## FCC Part 15.247

### TEST REPORT

For

## Audio-Technica Corporation

2-46-1 Nishi-naruse, Machida Tokyo 194-8666 Japan

|                                                                                                                                                                                                                             |                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Report Type                                                                                                                                                                                                                 | Original Report                  |
| FCC Identity:                                                                                                                                                                                                               | FCC ID: JFZM50XBT2               |
| Product Name                                                                                                                                                                                                                | Wireless Headphones              |
| Model Name                                                                                                                                                                                                                  | ATH-M50xBT2                      |
| Report Number                                                                                                                                                                                                               | RXZ200926002-00A                 |
| Report Date                                                                                                                                                                                                                 | 2020/11/16                       |
| Reviewed By                                                                                                                                                                                                                 | Flight Hsieh <i>Flight Hsieh</i> |
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**Note:** This test report is prepared for the customer shown above and for the device described herein.  
It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Linkou Laboratory)

## Revision History

| Revision | Report Number    | Issue Date | Description     |
|----------|------------------|------------|-----------------|
| 1.0      | RXZ200926002-00A | 2020/11/16 | Original Report |

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## 1 General Information

### 1.1 Product Description for Equipment under Test (EUT)

|                               |                                                                                 |
|-------------------------------|---------------------------------------------------------------------------------|
| Applicant                     | Audio-Technica Corporation<br>2-46-1 Nishi-naruse, Machida Tokyo 194-8666 Japan |
| Manufacturer                  | Audio-Technica Corporation<br>2-46-1 Nishi-naruse, Machida Tokyo 194-8666 Japan |
| Brand Name                    | audio-technica                                                                  |
| Product (Equipment)           | Wireless Headphones                                                             |
| Model Name                    | ATH-M50xBT2                                                                     |
| Frequency Range               | BLE: 2402 - 2480 MHz                                                            |
| Number of Channels            | BLE: 40 Channels                                                                |
| Output Power                  | BLE-1M: 4.00 dBm (0.0025 W)                                                     |
| Modulation Type               | BLE: GFSK                                                                       |
| Related Submittal(s)/Grant(s) | FCC Part 15.247 DSS with FCC ID: JFZM50XBT2                                     |
| Received Date                 | 2020/09/26                                                                      |
| Date of Test                  | 2020/10/21 - 2020/10/27                                                         |

\*All measurement and test data in this report was gathered from production sample serial number: 200612001. Assigned by Bay Area Compliance Laboratories Corp. (Linkou Laboratory)

### 1.2 Operation Condition of EUT

|                                    |                                                                                                                                                                                                                                                      |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power Operation<br>(Voltage Range) | <input type="checkbox"/> AC 120 V/60 Hz<br><input type="checkbox"/> Adapter<br><input type="checkbox"/> By Power Cord.                                                                                                                               |
|                                    | <input checked="" type="checkbox"/> DC Type<br><input type="checkbox"/> DC Power<br><input checked="" type="checkbox"/> Battery: 3.7V<br><input checked="" type="checkbox"/> External from USB Cable<br><input type="checkbox"/> External DC Adapter |

### 1.3 Objective and Test Methodology

The Objective of this Test Report was to document the compliance of the Audio-Technica Corporation. Appliance (Model: ATH-M50xBT2) to the requirements of the following Standards:

- Part 2, Subpart J, Part 15, Subparts A and C, section 15.247 of the Federal Communication Commission's rules.
- ANSI C63.10-2013 of the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

### 1.4 Measurement Uncertainty

| Parameter                        | Expanded Measurement uncertainty |
|----------------------------------|----------------------------------|
| RF output power with Power Meter | $\pm 1.488$ dB                   |
| Occupied Channel Bandwidth       | $\pm 453.927$ Hz                 |
| RF Conducted test with Spectrum  | $\pm 2.77$ dB                    |
| AC Power Line Conducted Emission | $\pm 2.66$ dB                    |
| Radiated Below 1G                | $\pm 3.57$ dB                    |
| Radiated Above 1G                | $\pm 5.32$ dB                    |

The test results with statement of conformity, the decision rules are based on the specifications and standards. The test results will not take the measurement uncertainty into account.

### 1.5 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Linkou Laboratory) to collect test data is located on

☒ No.6, Wende 2Rd., Guishan Dist., Taoyuan City 33382, Taiwan (R.O.C.).

Bay Area Compliance Laboratories Corp. (Linkou Laboratory) Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3546) by Mutual Recognition Agreement (MRA). The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database. The FCC Registration No.: 0027578244. Designation No.: TW3546. The Test Firm Registration No.: 181430.

## 2 System Test Configuration

### 2.1 Test Channels and Description of Worst Test Configuration

The system was configured for testing in testing mode which was provided by manufacturer. No special accessory, No modification was made to the EUT and No special equipment used during test.

For BLE, there are totally 40 channels.

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 0       | 2402            | 20      | 2442            |
| 1       | 2404            | --      | --              |
| 2       | 2406            | --      | --              |
| 3       | 2408            | 37      | 2476            |
| --      | --              | 38      | 2478            |
| 19      | 2440            | 39      | 2480            |

For BLE: Channel **0**, **19** and **39** were tested.

The worst-case data rates are determined to be as follows for each mode based upon investigation by measuring the Peak power and PSD across all data rates bandwidths, and modulations. Radiated below 1G were tested worst output power.

| Modulation Used for Conformance Test |     |                 |                 |
|--------------------------------------|-----|-----------------|-----------------|
| Configuration                        | NTX | Data Rate       | Worst Data Rate |
| BLE-1M Mode                          | 1   | 125 kbps-1 Mbps | 1 Mbps          |

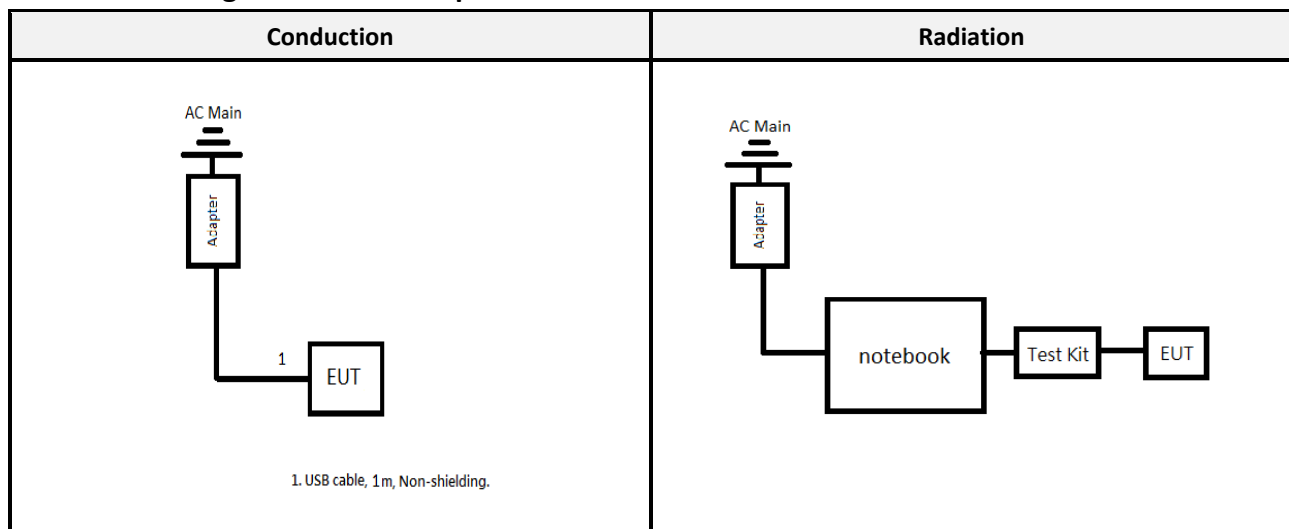
| Worst Case of Power Setting |     |                        |         |         |
|-----------------------------|-----|------------------------|---------|---------|
| EUT Exercise Software       |     | Bluetooth RF Test Tool |         |         |
| Configuration               | NTX | Low CH                 | Mid CH  | High CH |
| BLE-1M Mode                 | 1   | Default                | Default | Default |

## 2.2 Support Equipment List and External Cable List

| No. | Description | Manufacturer | Model Number   | Serial Number |
|-----|-------------|--------------|----------------|---------------|
| A   | Adapter     | APPLE        | A1385          | N/A           |
| B   | NoteBook    | DELL         | Latitude E6410 | PP27LA001     |

| No. | Description             | Manufacturer   | Model Number |
|-----|-------------------------|----------------|--------------|
| 1   | USB Cable (Type A to C) | audio-technica | ATH-M50xBT2  |
| 2   | 3.5@Audio Calbe         | audio-technica | ATH-M50xBT2  |

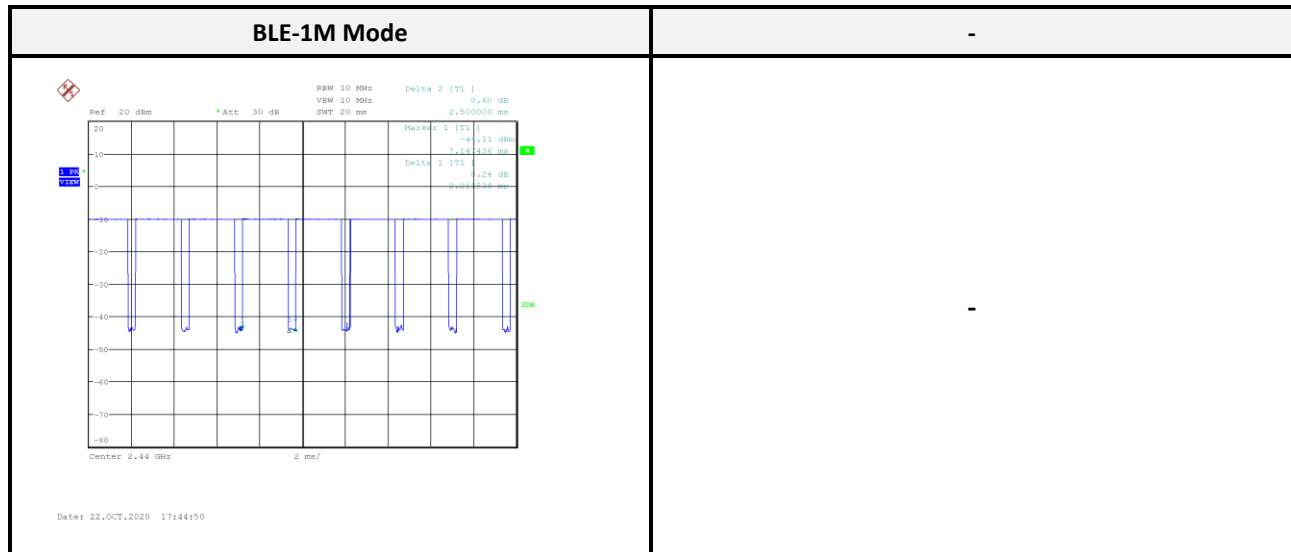
## 2.3 Block Diagram of Test Setup



## 2.4 Duty Cycle

All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum power transmission duration, T, are required for each tested mode of operation.

| Configuration | On Time (ms) | Period (ms) | Duty Cycle (%) | Duty Factor (dB) |
|---------------|--------------|-------------|----------------|------------------|
| BLE-1M Mode   | 2.21         | 2.50        | 88.46          | 0.53             |



\*Note: Duty Factor =  $10 \cdot \log(1/\text{Duty cycle})$

## 2.5 Environmental Conditions and Test Date

| Test Site           | Test Date               | Temperature (°C) | Relative Humidity (% RH) | Test Engineer |
|---------------------|-------------------------|------------------|--------------------------|---------------|
| Conduction (Con-01) | 2020/10/22              | 22.1             | 55                       | Brian Chang   |
| Radiated (966B)     | 2020/10/26 - 2020/10/27 | 22.0 - 23.0      | 50 - 57                  | Brian Chang   |
| Conducted (TH-02)   | 2020/10/21-2020/10/22   | 22.6             | 58                       | Rui Zhan      |

### 3 Summary of Test Results

| FCC Rules                     | Description of Test                      | Result     |
|-------------------------------|------------------------------------------|------------|
| §15.247(i), §1.1307, § 2.1093 | RF Exposure                              | Compliance |
| §15.203                       | Antenna Requirement                      | Compliance |
| §15.207(a)                    | AC Line Conducted Emissions              | Compliance |
| §15.205, §15.209, §15.247(d)  | Spurious Emissions                       | Compliance |
| §15.247(a)(2)                 | 6 dB Emission Bandwidth                  | Compliance |
| §15.247(b)(3)                 | Maximum Peak Output Power                | Compliance |
| §15.247(d)                    | 100 kHz Bandwidth of Frequency Band Edge | Compliance |
| §15.247(e)                    | Power Spectral Density                   | Compliance |

## 4 FCC§15.247(i), §1.1307, § 2.1093 – RF Exposure

### 4.1 Applicable Standard

According to FCC §2.1093 and §1.1307(b) (1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB 447498 D01 General RF Exposure Guidance v06

The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot$$

$[\text{vf(GHz)}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

1. f(GHz) is the RF channel transmit frequency in GHz.
2. Power and distance are rounded to the nearest mW and mm before calculation.
3. The result is rounded to one decimal place for comparison.
4. 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

### 4.2 RF Exposure Evaluation Result

**RF Exposure Evaluation:**

| Frequency<br>(MHz) | Turn-up Power |      | Evaluation Distance<br>(mm) | SAR Exclusion<br>Result | Extremity SAR<br>Exclusion Limit<br>(1g SAR) |
|--------------------|---------------|------|-----------------------------|-------------------------|----------------------------------------------|
|                    | (dBm)         | (mW) |                             |                         |                                              |
| 2402-2480          | 5.00          | 3.16 | 5.00                        | 1.00                    | 3                                            |

**Result:** SAR evaluation is not necessary.

## 5 FCC §15.203 - Antenna Requirements

### 5.1 Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna does not exceed 6dBi

### 5.2 Antenna List and Details

| Brand    | Model | Antenna Type                | Antenna Gain | Result     |
|----------|-------|-----------------------------|--------------|------------|
| Unictron | CW337 | Polarization Pillar Antenna | -0.40 dBi    | Compliance |

The EUT has an internal antennas arrangement and fulfill the requirement of this section.

## 6 FCC §15.207 - AC Line Conducted Emissions

### 6.1 Applicable Standard

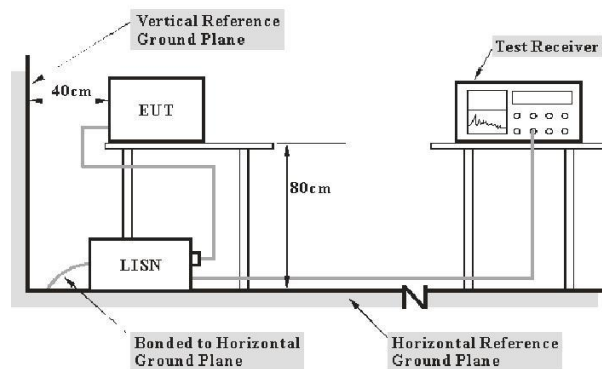
According to FCC §15.207,

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

| Frequency (MHz) | Conducted Limit (dBuV)     |                            |
|-----------------|----------------------------|----------------------------|
|                 | Quasi-Peak                 | Average                    |
| 0.15-0.5        | 66 to 56 <sup>Note 1</sup> | 56 to 46 <sup>Note 2</sup> |
| 0.5-5           | 56                         | 46                         |
| 5-30            | 60                         | 50                         |

Note 1: Decreases with the logarithm of the frequency. Note 2: A linear average detector is required

### 6.2 EUT Setup and Test Procedure



Note: 1. Support units were connected to second LISN.  
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz. During the conducted emission test, the EMI test receiver was set with the following configurations

| Frequency Range  | Receiver RBW |
|------------------|--------------|
| 150 kHz - 30 MHz | 9 kHz        |

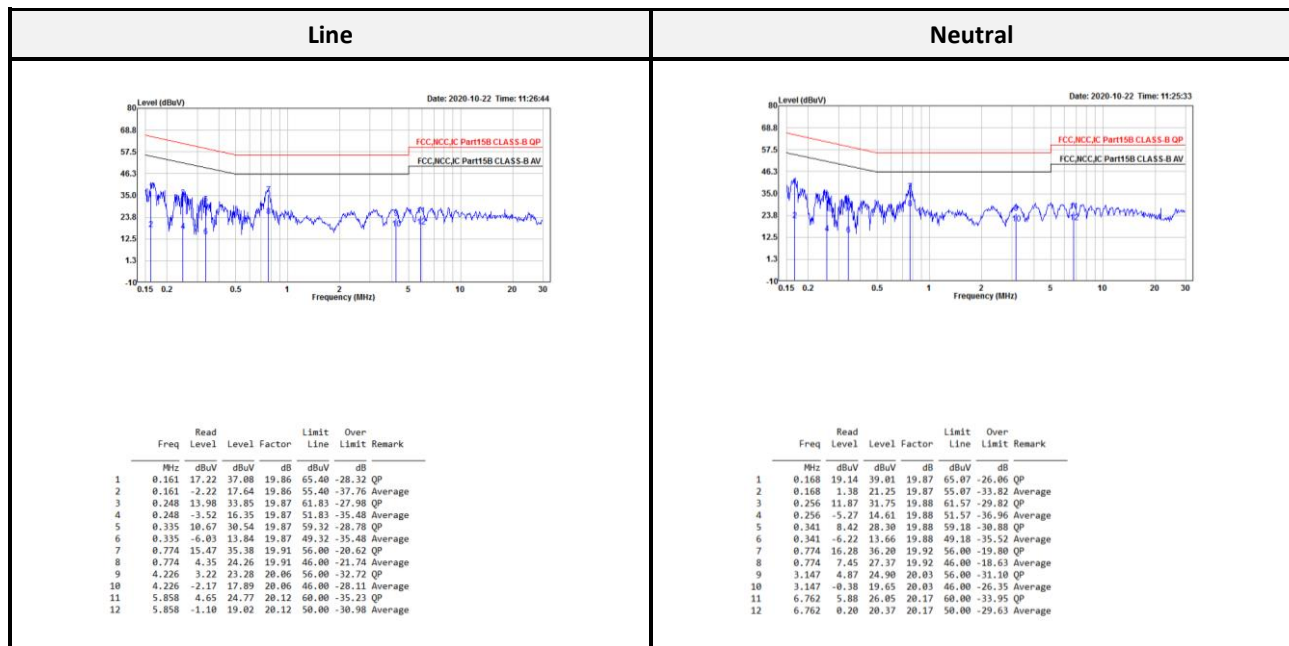
During the conducted emission test, the adapter was connected to the outlet of the LISN. Maximizing procedure was performed on the six (6) highest emissions of the EUT. All data was recorded in the Quasi-peak and average detection mode.

### 6.3 Test Equipment List and Details

| Description                      | Manufacture     | Model                | Serial No. | Cal. Date. | Cal. Due.  |
|----------------------------------|-----------------|----------------------|------------|------------|------------|
| AC Line Conduction Room (CON-01) |                 |                      |            |            |            |
| Two-Line V-Network               | Rohde & Schwarz | ENV216               | 100010     | 2020/09/14 | 2021/09/13 |
| Pulse Limiter                    | SCHWARZBECK     | VSTD 9561-F          | 00432      | 2020/09/11 | 2021/09/10 |
| ESR EMI Test Receiver            | Rohde & Schwarz | ESR3                 | 102430     | 2020/05/07 | 2021/05/06 |
| RF Cable                         | EMCI            | EMCCFD300-BM-BM-8000 | 180526     | 2020/08/18 | 2021/08/17 |
| Software                         | Audix           | e3 v9                | E3LK-03    | N.C.R      | N.C.R      |

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

### 6.4 Test Result



Note::

Level = Read Level + Factor

Over Limit (Margin) = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

## 7 FCC §15.209, §15.205, §15.247(d) – Spurious Emissions

### 7.1 Applicable Standard

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function.

Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1MHz.

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz               | MHz                 | MHz           | GHz         |
|-------------------|---------------------|---------------|-------------|
| 0.090-0.110       | 13.36-13.41         | 399.9-410     | 4.5-5.15    |
| 0.495-0.505       | 16.42-16.423        | 608-614       | 5.35-5.46   |
| 2.1735-2.1905     | 16.69475-16.69525   | 960-1240      | 7.25-7.75   |
| 4.125-4.128       | 25.5-25.67          | 1300-1427     | 8.025-8.5   |
| 4.17725-4.17775   | 37.5-38.25          | 1435-1626.5   | 9.0-9.2     |
| 4.20725-4.20775   | 73-74.6             | 1645.5-1646.5 | 9.3-9.5     |
| 6.215-6.218       | 74.8-75.2           | 1660-1710     | 10.6-12.7   |
| 6.26775-6.26825   | 108-121.94          | 1718.8-1722.2 | 13.25-13.4  |
| 6.31175-6.31225   | 123-138             | 2200-2300     | 14.47-14.5  |
| 8.291-8.294       | 149.9-150.05        | 2310-2390     | 15.35-16.2  |
| 8.362-8.366       | 156.52475-156.52525 | 2483.5-2500   | 17.7-21.4   |
| 8.37625-8.38675   | 156.7-156.9         | 2690-2900     | 22.01-23.12 |
| 8.41425-8.41475   | 162.0125-167.17     | 3260-3267     | 23.6-24.0   |
| 12.29-12.293      | 167.72-173.2        | 3332-3339     | 31.2-31.8   |
| 12.51975-12.52025 | 240-285             | 3345.8-3358   | 36.43-36.5  |
| 12.57675-12.57725 | 322-335.4           | 3600-4400     | Above 38.6  |

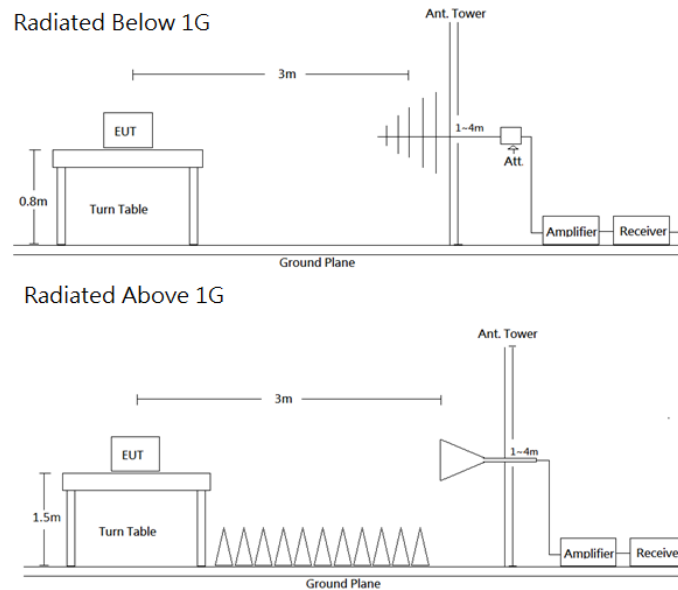
As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

## 7.2 EUT Setup and Test Procedure



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part 15.209 and FCC 15.247 Limits.

The system was investigated from 30 MHz to 26.5 GHz. During the radiated emission test, the EMI test receiver was set with the following configurations measurement method 6.3 in ANSI C63.10.

| Frequency Range | RBW     | VBW   | Duty cycle | Measurement method |
|-----------------|---------|-------|------------|--------------------|
| 30-1000 MHz     | 120 kHz | /     | -          | QP                 |
| Above 1 GHz     | 1 MHz   | 3 MHz | -          | PK                 |
|                 | 1 MHz   | 10 Hz | >98%       | PK                 |
|                 | 1 MHz   | 1/T   | <98%       | Ave                |

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations. All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

### 7.3 Test Equipment List and Details

| Description                     | Manufacture                 | Model                 | Serial No.           | Cal. Date. | Cal. Due.  |
|---------------------------------|-----------------------------|-----------------------|----------------------|------------|------------|
| <b>Radiation 3M Room (966B)</b> |                             |                       |                      |            |            |
| Active Loop                     | EMCO                        | 6502                  | 0001-3322            | 2020/03/16 | 2021/03/15 |
| Bilog Antenna/6 dB Attenuator   | SUNOL SCIENCES & EMEC /EMCI | JB3/N-6-06            | A111513/AT-N0668     | 2020/03/19 | 2021/03/18 |
| Signal and Spectrum Analyzer    | Rohde & Schwarz             | FSV40                 | 101434               | 2020/05/07 | 2021/05/06 |
| Horn Antenna                    | ETS-Lindgren                | 3115                  | 00109141             | 2020/07/15 | 2021/07/14 |
| Horn Antenna                    | ETS-Lindgren                | 3160-09               | 00123852             | 2020/07/07 | 2021/07/06 |
| Preamplifier                    | A.H. Systems                | PAM-1840VH            | 174                  | 2020/03/25 | 2021/03/24 |
| Preamplifier                    | A.H. Systems                | PAM-0118              | 478                  | 2020/05/05 | 2021/05/04 |
| Microflex Cable (1m)            | EMCI                        | EMC102-KM-KM-1000     | 180524               | 2020/08/06 | 2021/08/05 |
| Microflex Cable (2m)            | EMCI                        | EMC106-SM-SM-2000     | 180516               | 2020/08/06 | 2021/08/05 |
| Microflex Cable (8m)            | UTIFLEX                     | UFA210A-1-3149-300300 | MFR 64639 232490-002 | 2020/08/06 | 2021/08/05 |
| Turn Table                      | Chaintek                    | T-200-S-1             | 003501               | N.C.R      | N.C.R      |
| Antenna Tower                   | Chaintek                    | MBD-400-1             | 003504               | N.C.R      | N.C.R      |
| Controller                      | Chaintek                    | 3000-1                | 003507               | N.C.R      | N.C.R      |
| Software                        | Audix                       | e3 v9                 | E3LK-01              | N.C.R      | N.C.R      |
| <b>Conducted Room (TH-02)</b>   |                             |                       |                      |            |            |
| Spectrum Analyzer               | Rohde & Schwarz             | FSU26                 | 100406               | 2020/03/11 | 2021/03/10 |
| Cable                           | MTJ                         | MT40S                 | 620620-MT40S-100     | Each Use   | -          |

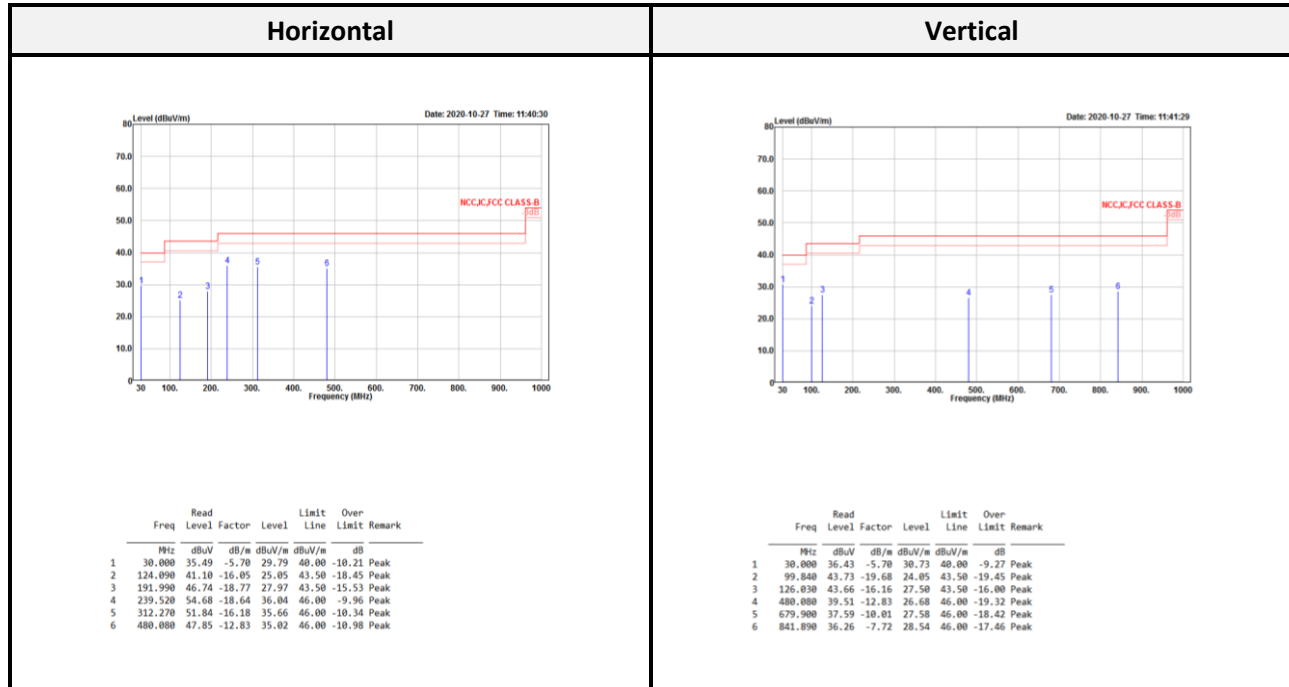
**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

## 7.4 Test Result

### BLE Mode:

**Transmitting mode** (Pre-scan with three orthogonal axis, and worse case as X axis)

**Below 1G (30 MHz-1 GHz) test the worst mode**



*Result = Reading + Correct Factor*

*Margin = Result – Limit*

*Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain*

*Spurious emissions more than 20 dB below the limit were not reported*

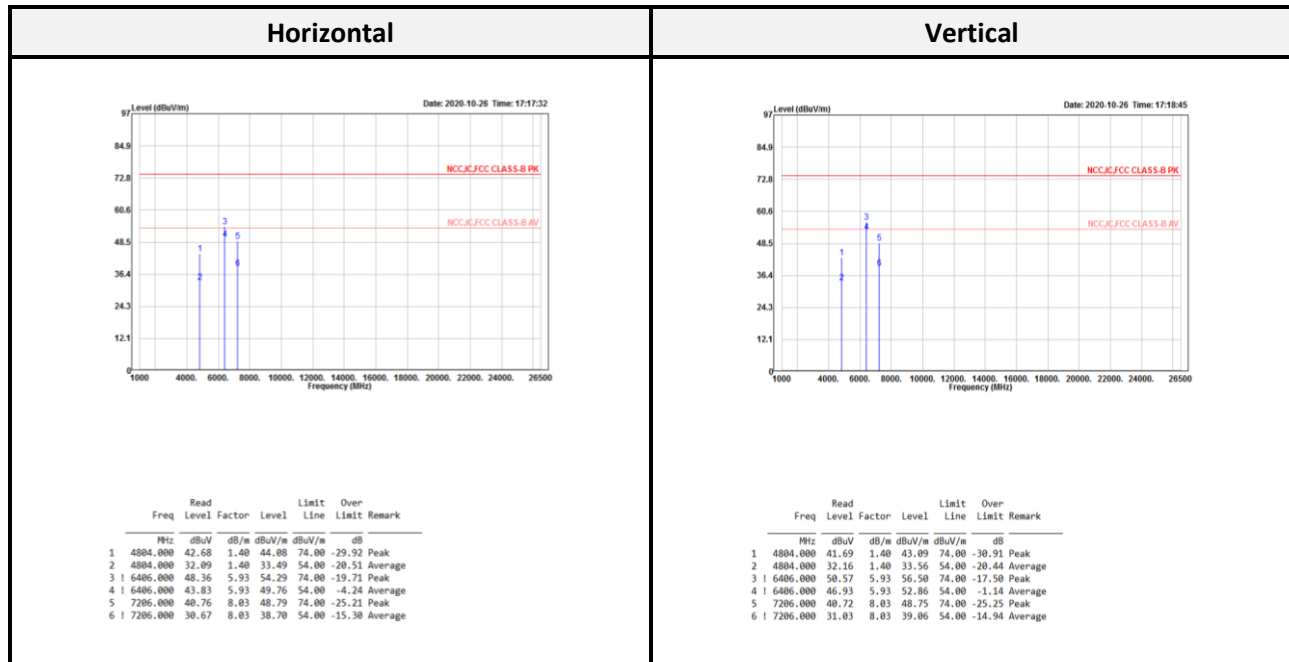
**Above 1G (1 GHz-26.5 GHz)****BLE mode:**

| Low CH       |        |        |        |        |        |         |              |        |        |        |        |        |         |
|--------------|--------|--------|--------|--------|--------|---------|--------------|--------|--------|--------|--------|--------|---------|
| Horizontal   |        |        |        |        |        |         | Vertical     |        |        |        |        |        |         |
| Read         | Limit  | Over   |        |        |        |         | Read         | Limit  | Over   |        |        |        |         |
| Freq         | Level  | Factor | Level  | Line   | Limit  | Remark  | Freq         | Level  | Factor | Level  | Line   | Limit  | Remark  |
| MHz          | dBuV   | dB/m   | dBuV/m | dBuV/m | dB     |         | MHz          | dBuV   | dB/m   | dBuV/m | dBuV/m | dB     |         |
| 1 2356.700   | 55.04  | -5.86  | 49.18  | 74.00  | -24.82 | Peak    | 1 2379.400   | 54.17  | -5.81  | 48.36  | 74.00  | -25.64 | Peak    |
| 2 ! 2356.700 | 44.10  | -5.86  | 38.24  | 54.00  | -15.76 | Average | 2 ! 2379.400 | 43.91  | -5.81  | 38.10  | 54.00  | -15.90 | Average |
| 3 * 2402.100 | 106.13 | -5.75  | 100.38 |        |        | Peak    | 3 * 2402.100 | 105.75 | -5.75  | 100.00 |        |        | Peak    |
| 4 * 2402.100 | 105.51 | -5.75  | 99.76  |        |        | Average | 4 * 2402.100 | 105.16 | -5.75  | 99.41  |        |        | Average |
| 1 4804.000   | 42.68  | 1.40   | 44.08  | 74.00  | -29.92 | Peak    | 1 4804.000   | 41.69  | 1.40   | 43.09  | 74.00  | -30.91 | Peak    |
| 2 4804.000   | 32.09  | 1.40   | 33.49  | 54.00  | -20.51 | Average | 2 4804.000   | 32.16  | 1.40   | 33.56  | 54.00  | -20.44 | Average |
| 3 ! 6406.000 | 48.36  | 5.93   | 54.29  | 74.00  | -19.71 | Peak    | 3 ! 6406.000 | 50.57  | 5.93   | 56.50  | 74.00  | -17.50 | Peak    |
| 4 ! 6406.000 | 43.83  | 5.93   | 49.76  | 54.00  | -4.24  | Average | 4 ! 6406.000 | 46.93  | 5.93   | 52.86  | 54.00  | -1.14  | Average |
| 5 7206.000   | 40.76  | 8.03   | 48.79  | 74.00  | -25.21 | Peak    | 5 7206.000   | 40.72  | 8.03   | 48.75  | 74.00  | -25.25 | Peak    |
| 6 ! 7206.000 | 30.67  | 8.03   | 38.70  | 54.00  | -15.30 | Average | 6 ! 7206.000 | 31.03  | 8.03   | 39.06  | 54.00  | -14.94 | Average |

| Middle CH    |        |        |        |        |        |         |              |        |        |        |        |        |         |
|--------------|--------|--------|--------|--------|--------|---------|--------------|--------|--------|--------|--------|--------|---------|
| Horizontal   |        |        |        |        |        |         | Vertical     |        |        |        |        |        |         |
| Read         | Limit  | Over   |        |        |        |         | Read         | Limit  | Over   |        |        |        |         |
| Freq         | Level  | Factor | Level  | Line   | Limit  | Remark  | Freq         | Level  | Factor | Level  | Line   | Limit  | Remark  |
| MHz          | dBuV   | dB/m   | dBuV/m | dBuV/m | dB     |         | MHz          | dBuV   | dB/m   | dBuV/m | dBuV/m | dB     |         |
| 1 2366.144   | 54.46  | -5.84  | 48.62  | 74.00  | -25.38 | Peak    | 1 2374.130   | 54.55  | -5.82  | 48.73  | 74.00  | -25.27 | Peak    |
| 2 ! 2366.144 | 43.61  | -5.84  | 37.77  | 54.00  | -16.23 | Average | 2 ! 2374.130 | 43.61  | -5.82  | 37.79  | 54.00  | -16.21 | Average |
| 3 * 2440.196 | 106.58 | -5.40  | 101.18 |        |        | Peak    | 3 * 2440.196 | 106.21 | -5.40  | 100.81 |        |        | Peak    |
| 4 * 2440.196 | 105.99 | -5.40  | 100.59 |        |        | Average | 4 * 2440.196 | 105.73 | -5.40  | 100.33 |        |        | Average |
| 5 2506.746   | 54.83  | -4.93  | 49.90  | 74.00  | -24.10 | Peak    | 5 2541.594   | 54.14  | -4.86  | 49.28  | 74.00  | -24.72 | Peak    |
| 6 ! 2506.746 | 43.68  | -4.93  | 38.75  | 54.00  | -15.25 | Average | 6 ! 2541.594 | 43.61  | -4.86  | 38.75  | 54.00  | -15.25 | Average |
| 1 4880.000   | 41.75  | 1.71   | 43.46  | 74.00  | -30.54 | Peak    | 1 4880.000   | 40.88  | 1.71   | 42.59  | 74.00  | -31.41 | Peak    |
| 2 4880.000   | 31.66  | 1.71   | 33.37  | 54.00  | -20.63 | Average | 2 4880.000   | 31.66  | 1.71   | 33.37  | 54.00  | -20.63 | Average |
| 3 ! 6508.000 | 48.24  | 6.24   | 54.48  | 74.00  | -19.52 | Peak    | 3 ! 6508.000 | 49.89  | 6.24   | 56.13  | 74.00  | -17.87 | Peak    |
| 4 ! 6508.000 | 42.67  | 6.24   | 48.91  | 54.00  | -5.09  | Average | 4 ! 6508.000 | 45.64  | 6.24   | 51.88  | 54.00  | -2.12  | Average |
| 5 7320.000   | 39.67  | 8.39   | 48.06  | 74.00  | -25.94 | Peak    | 5 7320.000   | 40.06  | 8.39   | 48.45  | 74.00  | -25.55 | Peak    |
| 6 ! 7320.000 | 30.37  | 8.39   | 38.76  | 54.00  | -15.24 | Average | 6 ! 7320.000 | 30.98  | 8.39   | 39.37  | 54.00  | -14.63 | Average |

| High CH      |        |        |        |        |        |         |              |        |        |        |        |        |         |
|--------------|--------|--------|--------|--------|--------|---------|--------------|--------|--------|--------|--------|--------|---------|
| Horizontal   |        |        |        |        |        |         | Vertical     |        |        |        |        |        |         |
| Read         | Limit  | Over   |        |        |        |         | Read         | Limit  | Over   |        |        |        |         |
| Freq         | Level  | Factor | Level  | Line   | Limit  | Remark  | Freq         | Level  | Factor | Level  | Line   | Limit  | Remark  |
| MHz          | dBuV   | dB/m   | dBuV/m | dBuV/m | dB     |         | MHz          | dBuV   | dB/m   | dBuV/m | dBuV/m | dB     |         |
| 1 * 2480.004 | 104.28 | -5.09  | 99.19  |        |        | Peak    | 1 * 2480.004 | 104.26 | -5.09  | 99.17  |        |        | Peak    |
| 2 * 2480.004 | 103.68 | -5.09  | 98.59  |        |        | Average | 2 * 2480.004 | 103.64 | -5.09  | 98.55  |        |        | Average |
| 3 2489.352   | 53.30  | -5.01  | 48.29  | 74.00  | -25.71 | Peak    | 3 2484.514   | 55.47  | -5.05  | 50.42  | 74.00  | -23.58 | Peak    |
| 4 ! 2489.352 | 44.70  | -5.01  | 39.69  | 54.00  | -14.31 | Average | 4 ! 2484.514 | 44.14  | -5.05  | 39.09  | 54.00  | -14.91 | Average |
| 1 4960.000   | 40.48  | 1.87   | 42.35  | 74.00  | -31.65 | Peak    | 1 4960.000   | 40.06  | 1.87   | 41.93  | 74.00  | -32.07 | Peak    |
| 2 4960.000   | 31.62  | 1.87   | 33.49  | 54.00  | -20.51 | Average | 2 4960.000   | 31.63  | 1.87   | 33.50  | 54.00  | -20.50 | Average |
| 3 6610.000   | 46.92  | 6.79   | 53.71  | 74.00  | -20.29 | Peak    | 3 ! 6610.000 | 49.13  | 6.79   | 55.92  | 74.00  | -18.08 | Peak    |
| 4 ! 6610.000 | 40.64  | 6.79   | 47.43  | 54.00  | -6.57  | Average | 4 ! 6610.000 | 44.62  | 6.79   | 51.41  | 54.00  | -2.59  | Average |
| 5 7440.000   | 38.47  | 8.57   | 47.04  | 74.00  | -26.96 | Peak    | 5 7440.000   | 39.55  | 8.57   | 48.12  | 74.00  | -25.88 | Peak    |
| 6 ! 7440.000 | 29.55  | 8.57   | 38.12  | 54.00  | -15.88 | Average | 6 ! 7440.000 | 29.70  | 8.57   | 38.27  | 54.00  | -15.73 | Average |

**Above 1G (1 GHz-26.5 GHz): The worst mode is BLE Low CH.**



$Level = Read\ Level + Factor$

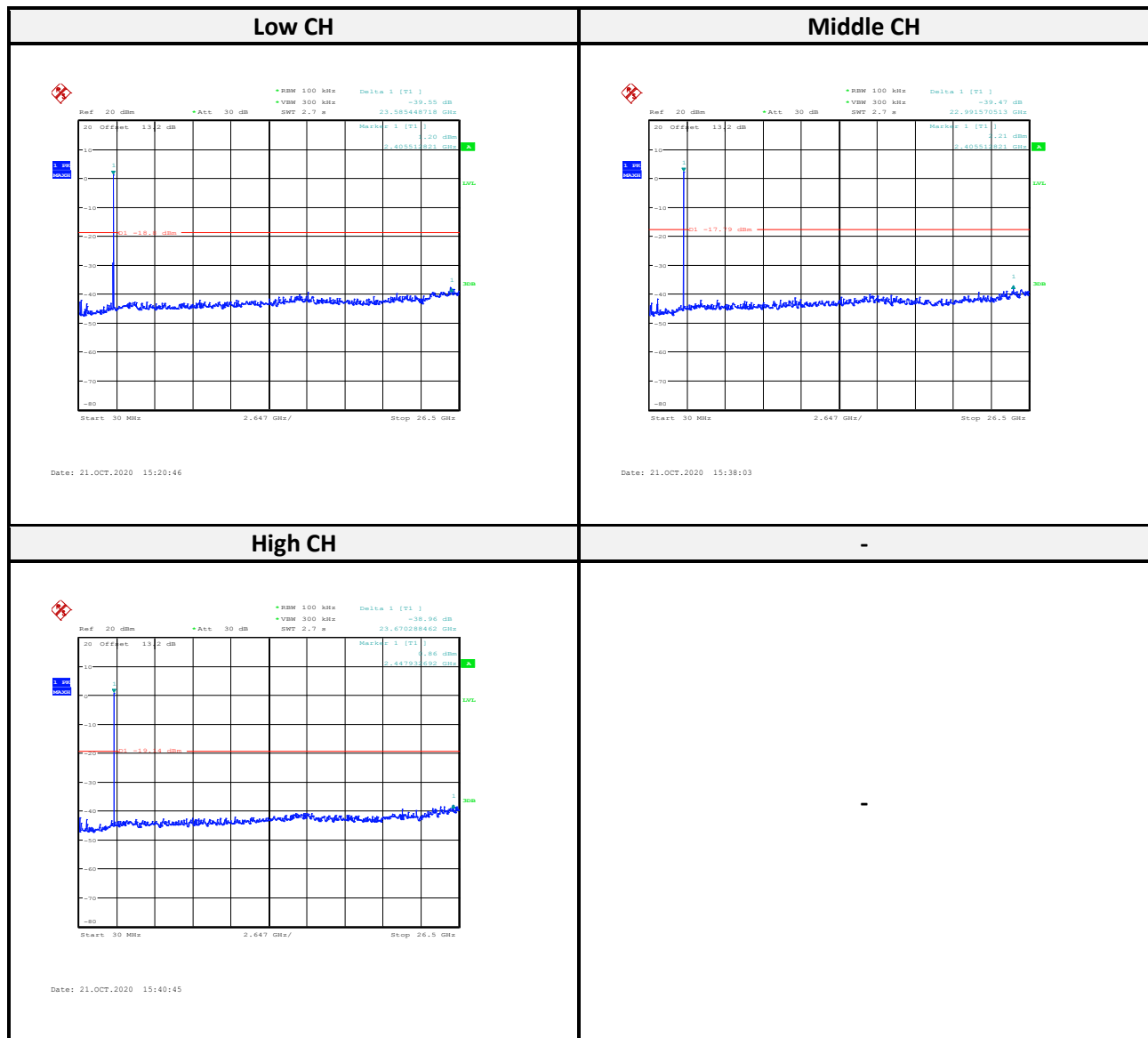
$Over\ Limit = Level - Limit$

$Correct\ Factor = Antenna\ Factor + Cable\ Loss - Amplifier\ Gain$

*Spurious emissions more than 20 dB below the limit were not reported*

# Conducted Spurious Emissions:

| Channel | Frequency (MHz) | Delta Peak to Band Emission (dBc) | Limit (dBc) | Result     |
|---------|-----------------|-----------------------------------|-------------|------------|
| Low     | 2402            | 39.55                             | $\geq 20$   | Compliance |
| Mid     | 2440            | 39.47                             | $\geq 20$   | Compliance |
| High    | 2480            | 38.96                             | $\geq 20$   | Compliance |



## 8 FCC §15.247(a)(2) – 6 dB Emission Bandwidth

### 8.1 Applicable Standard

According to FCC §15.247(a) (2),

Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### 8.2 Test Procedure

According to ANSI C63.10-2013, the steps for the first option are as follows:

- (1) Set RBW = 100 kHz. (2) Set the VBW  $\geq [3 \times \text{RBW}]$ . (3) Detector = peak. (4) Trace mode = max hold.  
(5) Sweep = auto couple. (6) Allow the trace to stabilize. (7) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 8.3 Test Equipment List and Details

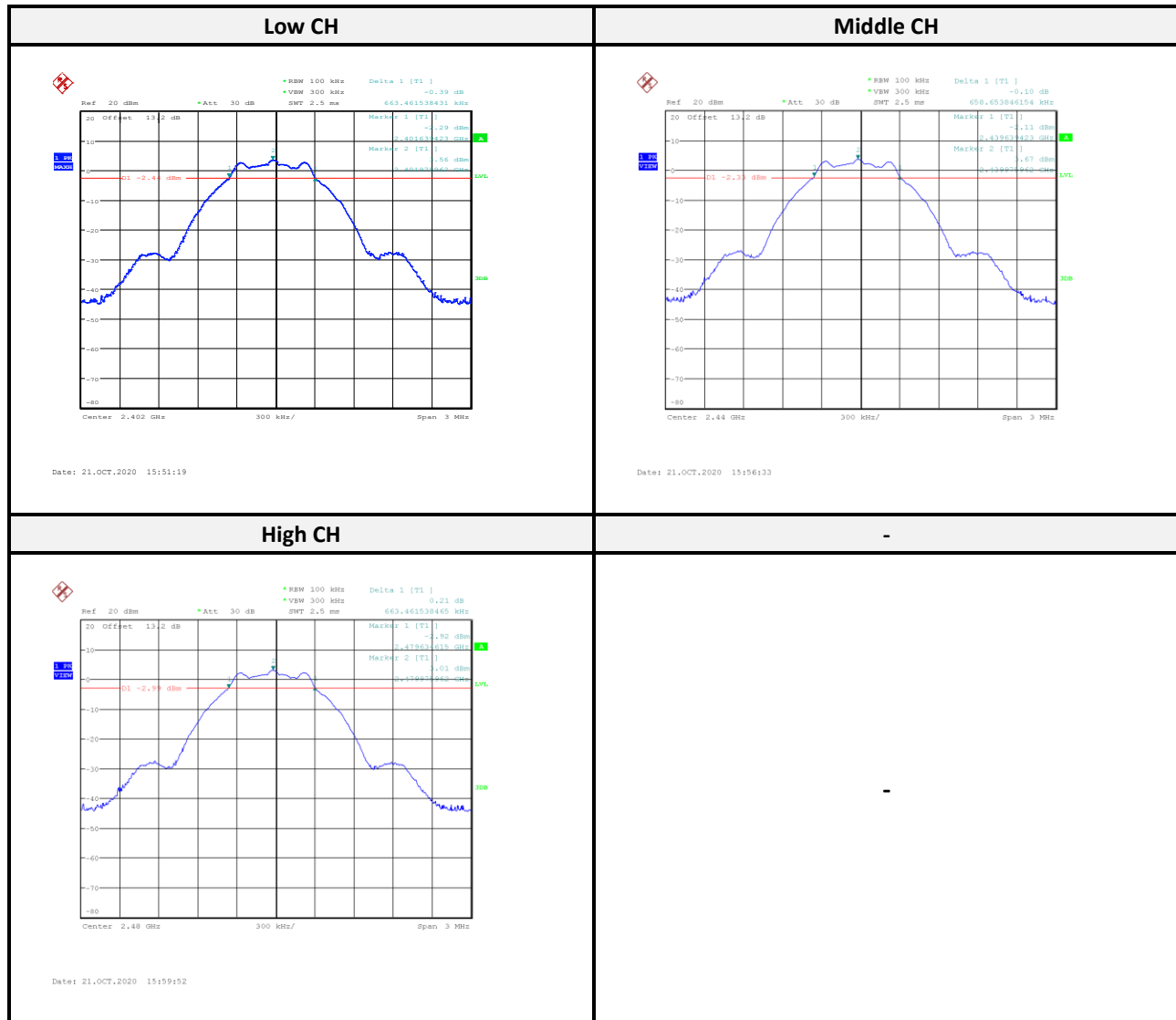
| Description           | Manufacture     | Model | Serial No.       | Cal. Date. | Cal. Due.  |
|-----------------------|-----------------|-------|------------------|------------|------------|
| Conducted Room(TH-02) |                 |       |                  |            |            |
| Spectrum Analyzer     | Rohde & Schwarz | FSU26 | 100406           | 2020/03/11 | 2021/03/10 |
| Cable                 | MTJ             | MT40S | 620620-MT40S-100 | Each Use   | -          |

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

## 8.4 Test Results

| Channel | Frequency (MHz) | 6 dB BW (MHz) | 6dB Limit (MHz) | Result     |
|---------|-----------------|---------------|-----------------|------------|
| Low     | 2402            | 0.66          | > 0.5           | Compliance |
| Middle  | 2440            | 0.66          | > 0.5           | Compliance |
| High    | 2480            | 0.66          | > 0.5           | Compliance |

### BLE-1M Mode



## 9 FCC §15.247(b) (3) – Maximum Output Power

### 9.1 Applicable Standard

According to FCC §15.247(b) (3),

Systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

### 9.2 Test Procedure

- (1) Place the EUT on a bench and set it in transmitting mode.
- (2) Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to measuring equipment.
- (3). Add a correction factor to the display.

### 9.3 Test Equipment List and Details

| Description               | Manufacture | Model   | Serial No.       | Cal. Date. | Cal. Due.  |
|---------------------------|-------------|---------|------------------|------------|------------|
| Conducted Room(TH-02)     |             |         |                  |            |            |
| USB Wideband Power Sensor | Agilent     | U2021XA | MY52500008       | 2020/01/06 | 2021/01/05 |
| Cable                     | MTJ         | MT40S   | 620620-MT40S-100 | Each Use   | -          |

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

### 9.4 Test Results

| Channel | Frequency (MHz) | Maximum Peak Output Power (dBm) | Maximum Peak Output Power (W) | Limit (dBm) | Result     |
|---------|-----------------|---------------------------------|-------------------------------|-------------|------------|
| Low     | 2402            | 3.95                            | 0.0025                        | 30          | Compliance |
| Middle  | 2440            | 4.00                            | 0.0025                        | 30          | Compliance |
| High    | 2480            | 3.37                            | 0.0022                        | 30          | Compliance |

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## 10 FCC §15.247(d) – 100 kHz Bandwidth of Frequency Band Edge

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### 10.1 Applicable Standard

According to FCC §15.247(d),

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

### 10.2 Test Procedure

- (1) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- (2) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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.
- (3) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- (4) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

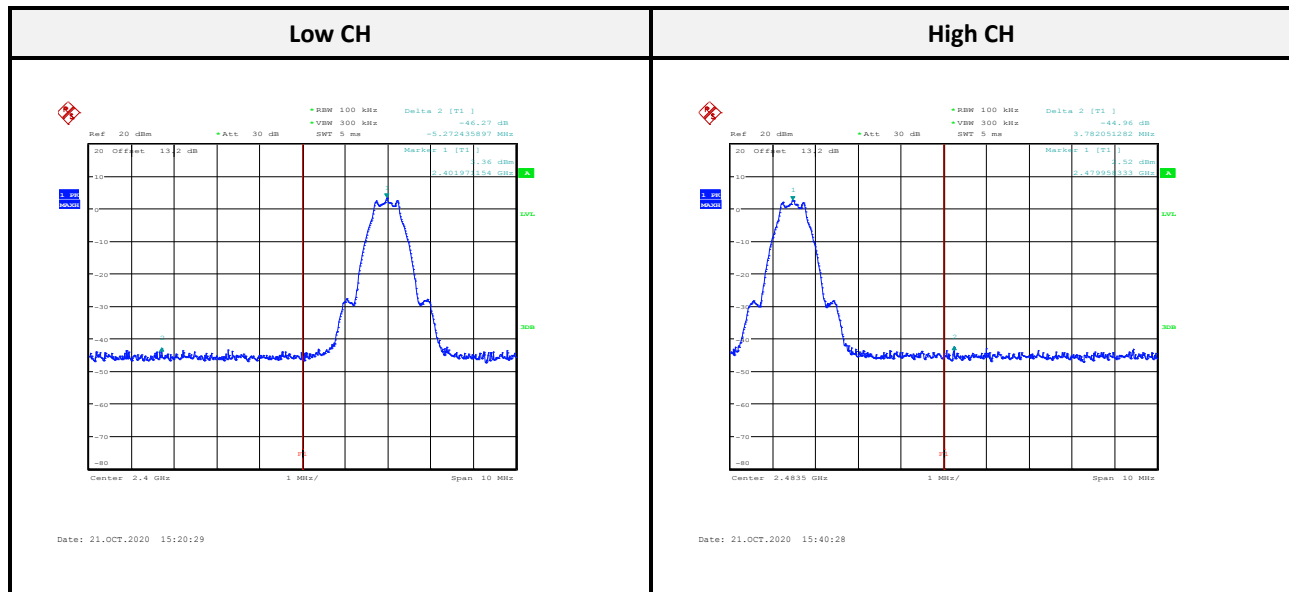
### 10.3 Test Equipment List and Details

| Description           | Manufacture     | Model | Serial No.       | Cal. Date. | Cal. Due.  |
|-----------------------|-----------------|-------|------------------|------------|------------|
| Conducted Room(TH-02) |                 |       |                  |            |            |
| Spectrum Analyzer     | Rohde & Schwarz | FSU26 | 100406           | 2020/03/11 | 2021/03/10 |
| Cable                 | MTJ             | MT40S | 620620-MT40S-100 | Each Use   | -          |

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

### 10.4 Test Results

| Channel | Frequency (MHz) | Delta Peak to Band Emission (dBc) | Limit (dBc) | Result     |
|---------|-----------------|-----------------------------------|-------------|------------|
| Low     | 2402            | 46.27                             | $\geq 20$   | Compliance |
| High    | 2480            | 44.96                             | $\geq 20$   | Compliance |



## 11 FCC §15.247(e) – Power Spectral Density

### 11.1 Applicable Standard

According to FCC §15.247(e),

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### 11.2 Test Procedure

According to ANSI C63.10-2013,

- (1) Set analyzer center frequency to DTS channel center frequency.
- (2) Set the span to 1.5 times the DTS bandwidth. (3) Set the RBW to  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- (4) Set the VBW  $\geq [3 \times \text{RBW}]$ . (5) Detector = peak. (6) Sweep time = auto couple.
- (7) Trace mode = max hold. (8) Allow trace to fully stabilize.
- (9) Use the peak marker function to determine the maximum amplitude level within the RBW.
- (10) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat.

### 11.3 Test Equipment List and Details

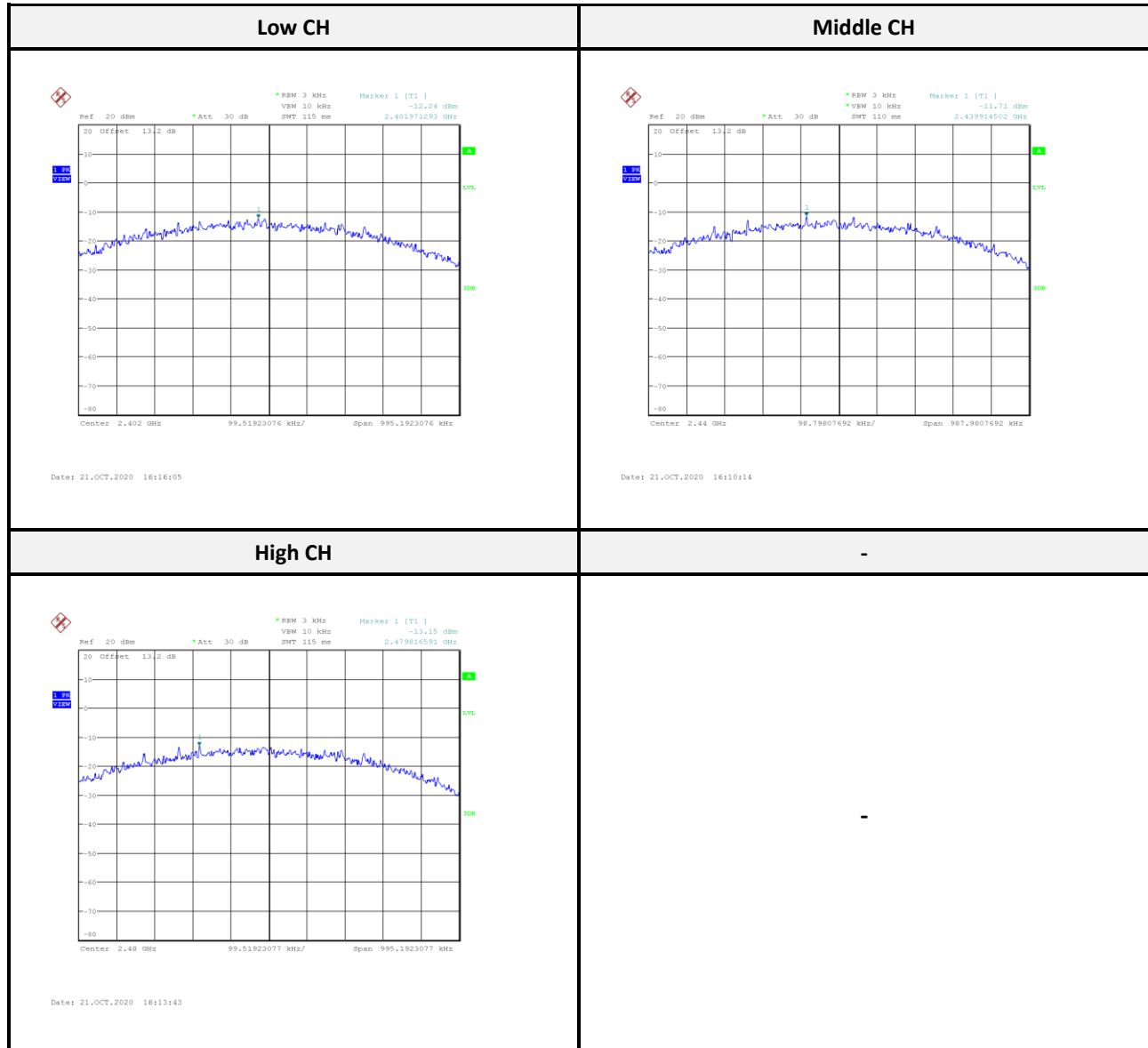
| Description           | Manufacture     | Model | Serial No.       | Cal. Date. | Cal. Due.  |
|-----------------------|-----------------|-------|------------------|------------|------------|
| Conducted Room(TH-02) |                 |       |                  |            |            |
| Spectrum Analyzer     | Rohde & Schwarz | FSU26 | 100406           | 2020/03/11 | 2021/03/10 |
| Cable                 | MTJ             | MT40S | 620620-MT40S-100 | Each Use   | -          |

**\*Statement of Traceability:** The testing equipment's listed above have finished the calibration by Electronics Testing Center, Taiwan (ETC) or other laboratories which were accredited by TAF or equivalent organizations. The calibration result could be traceable to the International System of Units (SI).

# 11.4 Test Results

| Channel | Frequency (MHz) | PSD (dBm/3 kHz) | Limit (dBm/3 kHz) | Result     |
|---------|-----------------|-----------------|-------------------|------------|
| Low     | 2402            | -12.24          | 8                 | Compliance |
| Middle  | 2440            | -11.71          | 8                 | Compliance |
| High    | 2480            | -13.15          | 8                 | Compliance |

## BLE-1M Mode



----- END OF REPORT -----