

Dates of Tests: June 17, 2021 ~ July 14, 2021

Test Report S/N: LR500112109G

Test Site : LTA CO., LTD.

## CERTIFICATION OF COMPLIANCE

FCC ID.

**2AZKWREBE-TZ29L**

APPLICANT

**ATEC IoT CO., LTD**

|                           |   |                                                |
|---------------------------|---|------------------------------------------------|
| Equipment Class           | : | Digital Transmission System (DTS)              |
| Manufacturing Description | : | Electronic Shelf Label                         |
| Manufacturer              | : | SUZHOU NIHONE Electronics Technology Co., LTD  |
| Model name                | : | REBE-TZ29L                                     |
| Test Device Serial No.:   | : | Identical prototype                            |
| Rule Part(s)              | : | FCC Part 15.247 Subpart C ; ANSI C63.10 - 2013 |
| Frequency Range           | : | Zigbee 2405 ~ 2480 MHz                         |
| Max. Output Power         | : | Max 2.87 dBm - Conducted                       |
| Data of issue             | : | September 10, 2021                             |

This test report is issued under the authority of:



Ja-Beom Koo, Manager

The test was supervised by:



Jae-Huem, Yun, Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.



NVLAP LAB Code.: 200723-0

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## 1. General information

### 1-1 Test Performed

Company name : LTA Co., Ltd.  
 Address : 243, Jubug-ri, Yangji-Myeon, Youngin-Si, Kyunggi-Do, Korea. 17159  
 Web site : <http://www.ltalab.com>  
 E-mail : [chahn@ltalab.com](mailto:chahn@ltalab.com)  
 Telephone : +82-31-323-6008  
 Facsimile : +82-31-323-6010

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competents of calibration and testing laboratory”.

### 1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

| Agency | Country | Accreditation No. | Validity   | Reference             |
|--------|---------|-------------------|------------|-----------------------|
| NVLAP  | U.S.A   | 200723-0          | 2021-09-30 | ECT accredited Lab.   |
| RRA    | KOREA   | KR0049            | -          | EMC accredited Lab.   |
| FCC    | U.S.A   | 649054            | 2023-01-15 | FCC CAB               |
| VCCI   | JAPAN   | C-4948,           | 2023-09-10 | VCCI registration     |
| VCCI   | JAPAN   | T-2416,           | 2023-09-10 | VCCI registration     |
| VCCI   | JAPAN   | R-4483(10 m),     | 2023-08-15 | VCCI registration     |
| VCCI   | JAPAN   | G-847             | 2021-12-13 | VCCI registration     |
| IC     | CANADA  | 5799A-1           | 2022-10-18 | IC filing             |
| KOLAS  | KOREA   | NO.551            | Updating   | KOLAS accredited Lab. |

## 2. Information about test item

### 2-1 Client & Manufacturer

Client Company name : ATEC IoT CO., LTD.

Address : 289, Pangyo-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, 13488, South Korea

Tel / Fax : +82-10-5790-6171 / +82-31-696-1534

Manufacturer : SUZHOU NIHONE Electronics Technology Co., LTD

Address : No. 185, Xiaoxiang Road, Suzhou New District, Suzhou City, Jiangsu Province, P.R. China

Tel / Fax : +82-10-5790-6171 / +82-31-696-1534

### 2-2 Equipment Under Test (EUT)

Model name : ATEC IoT CO., LTD.

Serial number : Identical prototype

Date of receipt : June 17, 2021

EUT condition : Pre-production, not damaged

Antenna type : FPCB Antenna (Max Gain : -5.36 dBi)

Frequency Range : Zigbee 2405 ~ 2480 MHz

RF output power : Max 2.87 dBm – Conducted

Type of Modulation : Pi/4 DQPSK, 8DPSK

Power Source : DC 3.0 V

### 2-3 Tested frequency

|                        | LOW  | MID  | HIGH |
|------------------------|------|------|------|
| Frequency (MHz) Zigbee | 2405 | 2440 | 2480 |

### 2-4 Ancillary Equipment

| Equipment | Model No. | Serial No. | Manufacturer |
|-----------|-----------|------------|--------------|
| Notebook  | -         | MS-1736    | MSI          |

### 3. Test Report

#### 3.1 Summary of tests

| FCC Part Section(s) | Parameter                               | Test Condition | Status (note 1) |
|---------------------|-----------------------------------------|----------------|-----------------|
| 15.247(a)           | 6 dB Bandwidth                          | Conducted      | C               |
| 15.247(b)           | Transmitter Peak Output Power           |                | C               |
| 15.247(e)           | Transmitter Power Spectral Density      |                | C               |
| 15.247(d)           | Band Edge & Conducted Spurious emission |                | C               |
| 15.209              | Transmitter emission                    | Radiated       | C               |
| 15.207              | AC Conducted Emissions                  | Conducted      | N/A             |
| 15.203              | Antenna requirement                     | -              | C               |

N/A : This product is battery-enabled and excludes the test.

The above equipment was tested by LTA Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10-2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.247 The test results of this report relate only to the tested sample identified in this report.

The tests were performed according to the method of measurements prescribed in KDB No.558074.

#### → Antenna Requirement

ATEC IoT CO., LTD. FCC ID: 2AZKWREBE-TZ29L unit complies with the requirement of §15.203.

The antenna type is PCB Antenna

## 3.2 Technical Characteristics Test

### 3.2.1 6 dB Bandwidth

#### Procedure:

The bandwidth at 6 dB below the highest in-band spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 6 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is ( as close as possible to ) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

Span = 3 X RBW

VBW = 3 X RBW

Sweep = auto

Trace = max hold

Detector function = peak

**Measurement Data : Complies**

#### Zigbee Mode

| Frequency (MHz) | Test Results             |          |
|-----------------|--------------------------|----------|
|                 | Measured Bandwidth (MHz) | Result   |
| 2405            | 1.693                    | Complies |
| 2440            | 1.700                    | Complies |
| 2480            | 1.693                    | Complies |

- See next pages for actual measured spectrum plots.

#### Minimum Standard:

6 dB Bandwidth  $\geq$  500 kHz

#### Measurement Setup

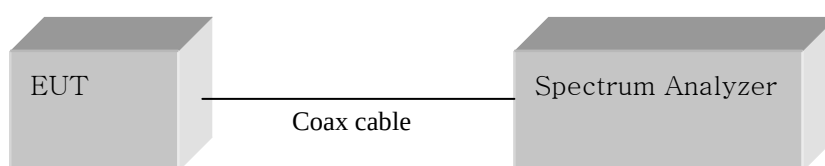
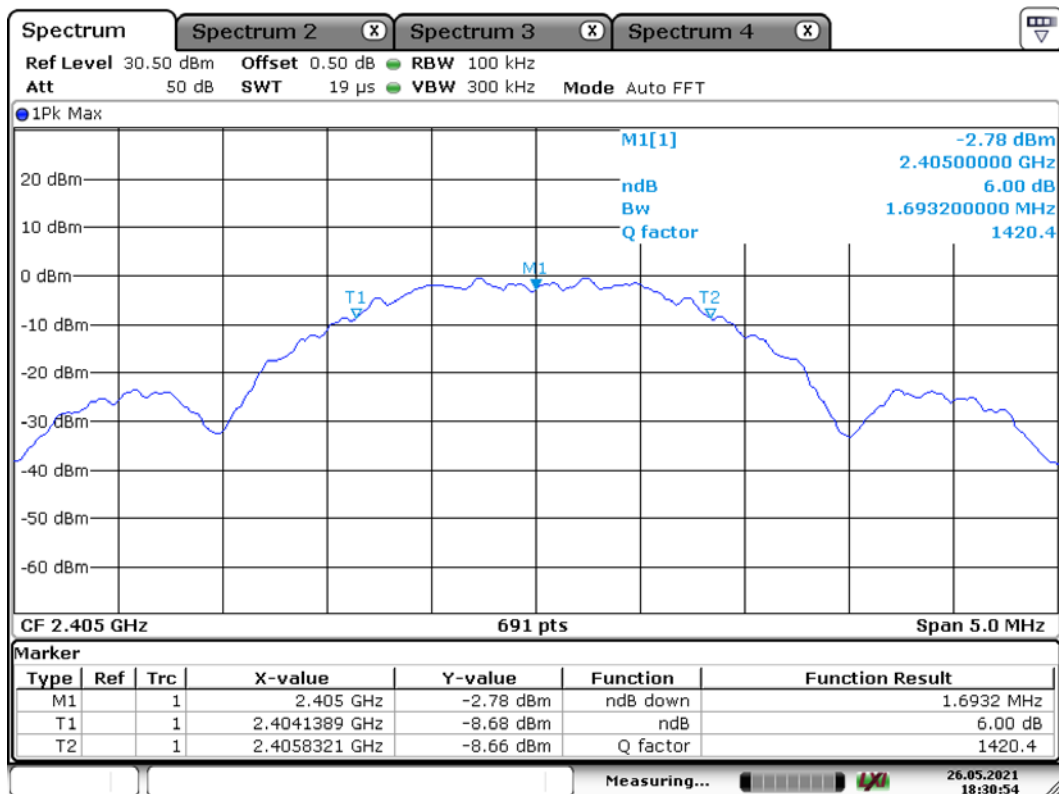


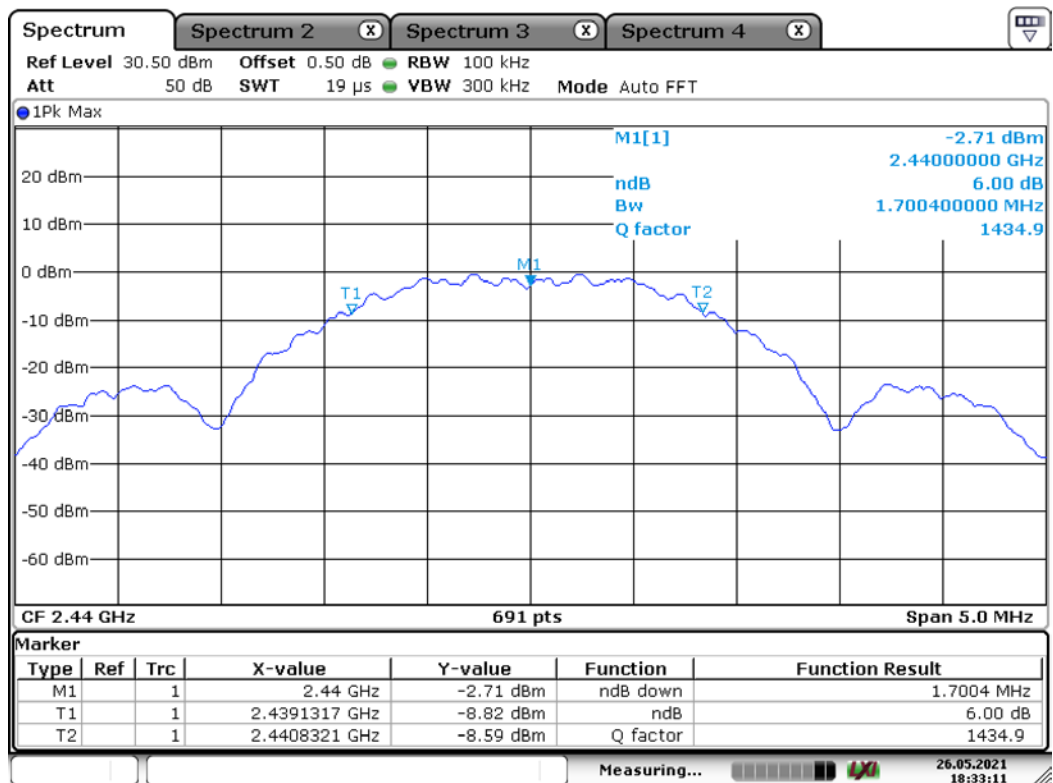
Figure 1: Measurement setup for the carrier frequency separation

## Low Channel



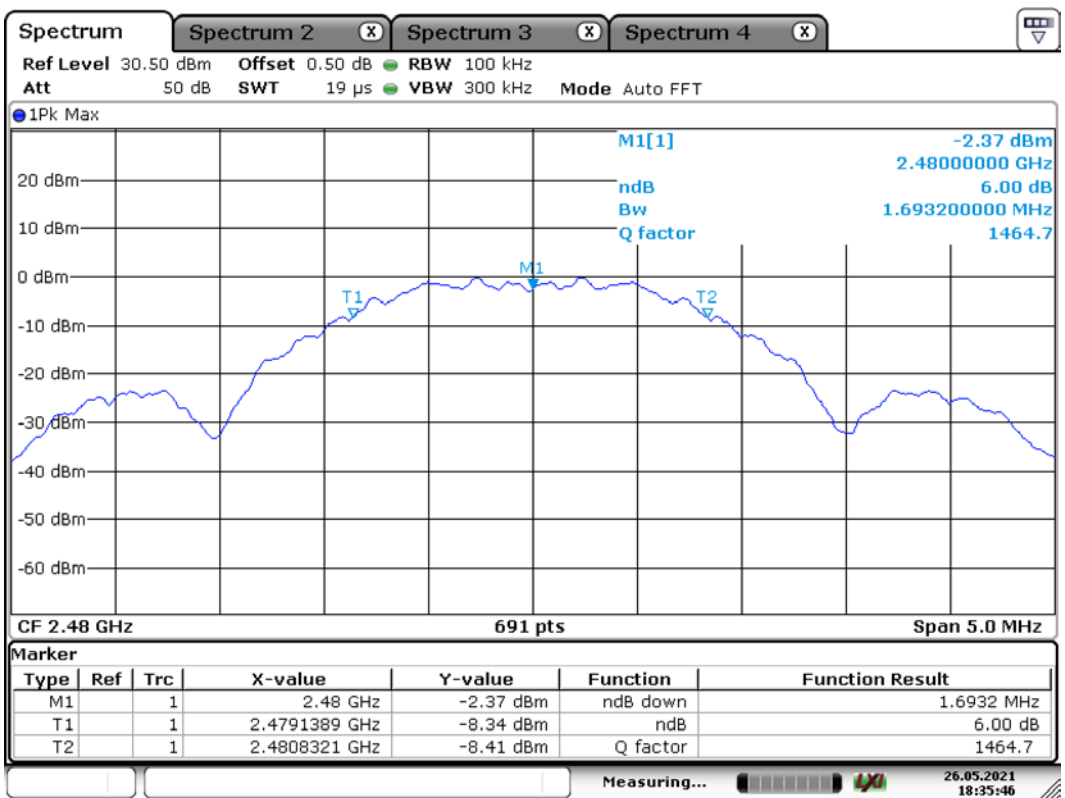
Date: 26.MAY.2021 18:30:54

## Middle Channel



Date: 26.MAY.2021 18:33:11

High Channel



Date: 26.MAY.2021 18:35:47

### 3.2.2 Peak Output Power Measurement

#### Procedure:

The following procedure can be used when the maximum available RBW of the instrument is less than the DTS bandwidth :

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW  $\geq$  DTS Bandwidth

Span  $\geq 3 \times$  RBW

VBW =  $3 \times$  RBW

Sweep = auto

Detector function = peak

**Measurement Data : Complies**

#### Zigbee Mode

| Frequency<br>(MHz) | Test Results        |          |
|--------------------|---------------------|----------|
|                    | Measured data (dBm) | Result   |
| 2405               | 2.62                | Complies |
| 2440               | 2.69                | Complies |
| 2480               | 2.87                | Complies |

- See next pages for actual measured spectrum plots.

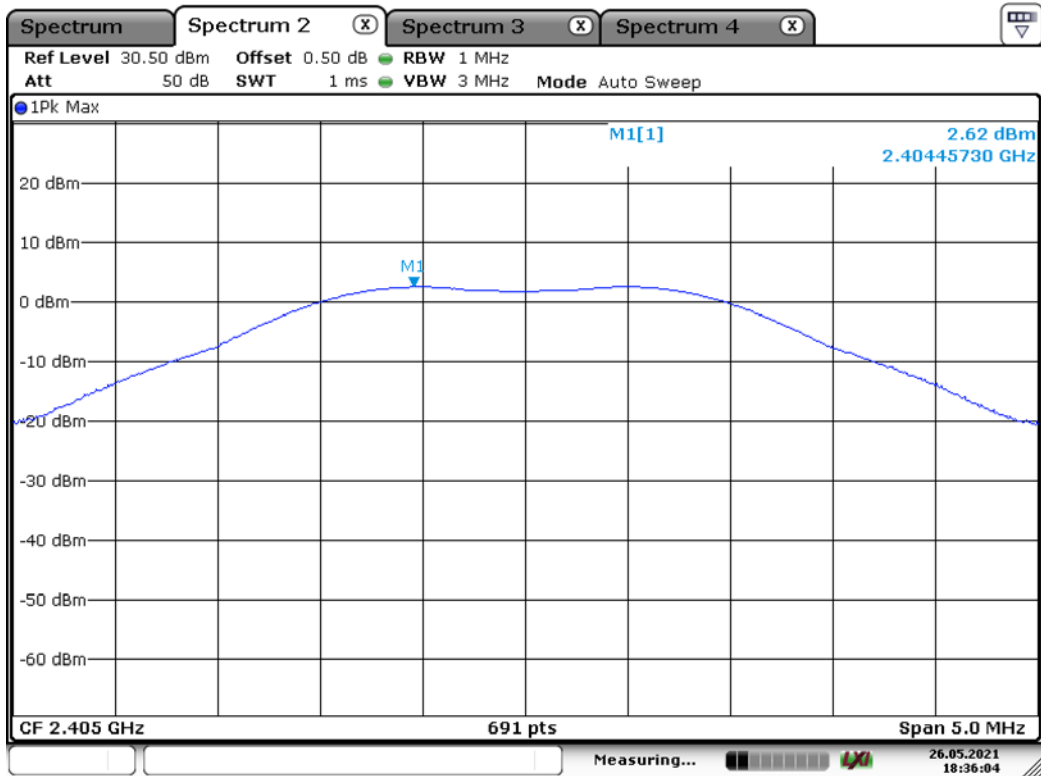
#### Minimum Standard:

|                   |                                    |
|-------------------|------------------------------------|
| Peak output power | $\leq 1 \text{ W}(30 \text{ dBm})$ |
|-------------------|------------------------------------|

#### Measurement Setup

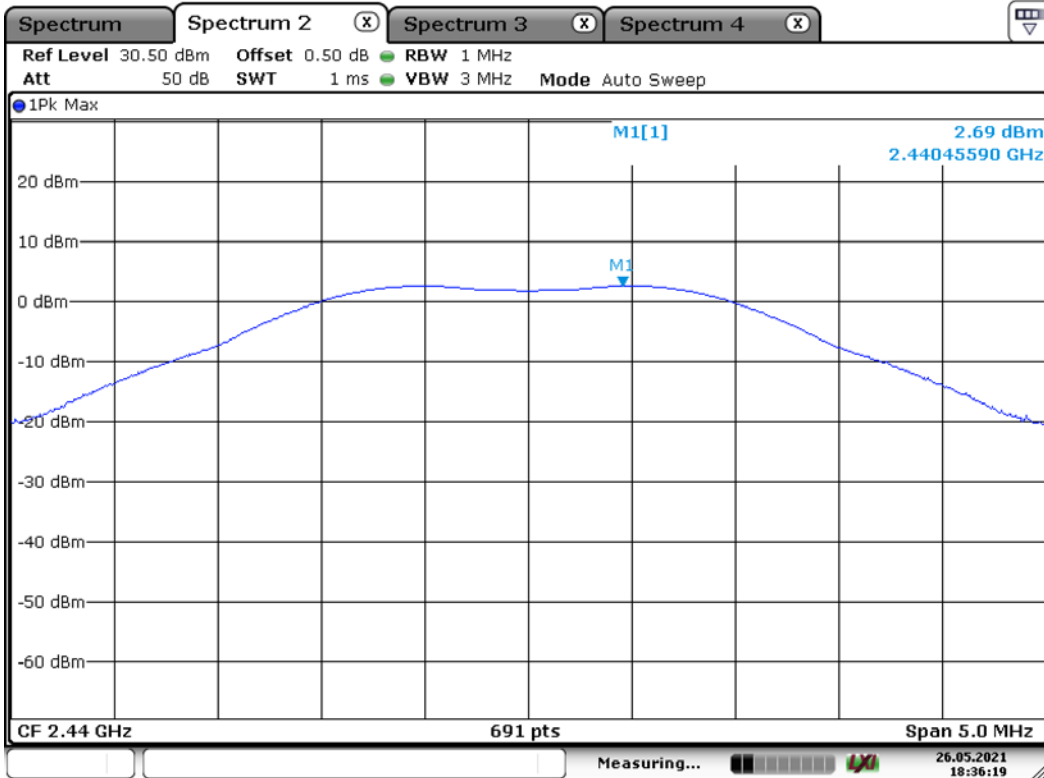
Same as the Chapter 3.2.1 (Figure 1)

Low Zigbee



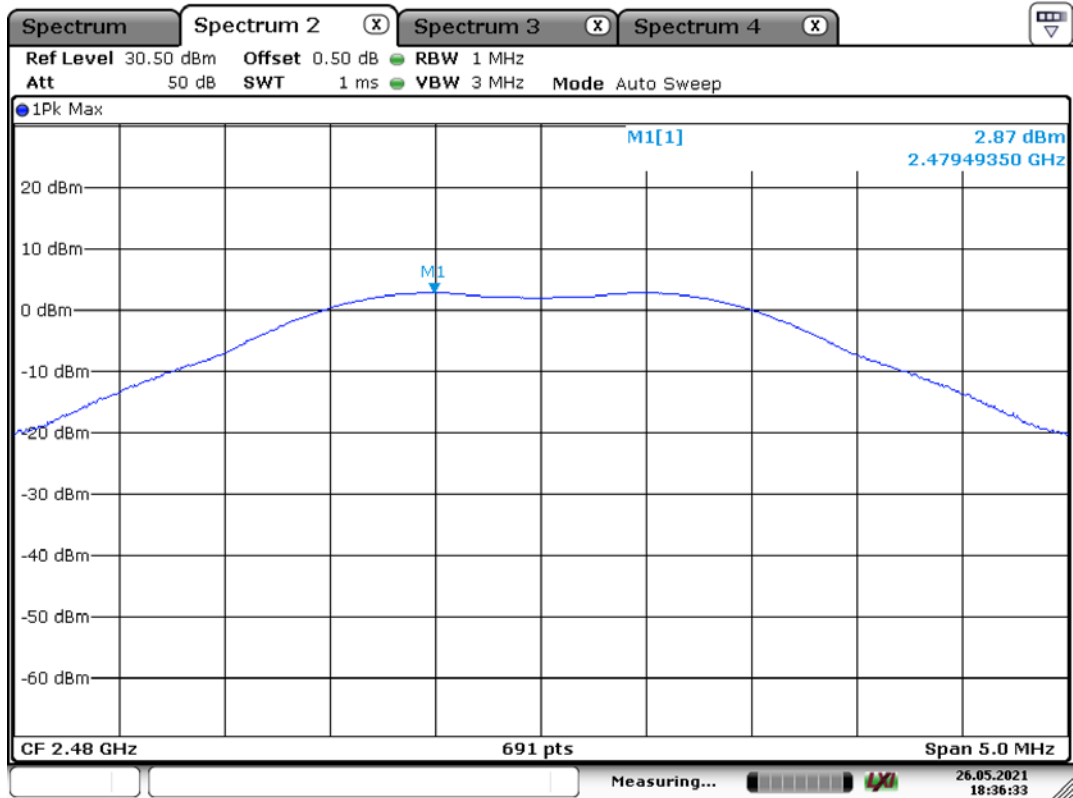
Date: 26.MAY.2021 18:36:04

Middle Zigbee



Date: 26.MAY.2021 18:36:19

# High Zigbee



Date: 26.MAY.2021 18:36:34

### 3.2.3 Power Spectral Density

#### Procedure:

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance.

The spectrum analyzer is set to:

RBW = 3 kHz ( $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ )

Span  $\geq 1.5$  times the DTS bandwidth

VBW = 3 X RBW

Sweep = auto

Detector function = peak

Trace = max hold

**Measurement Data : Complies**

#### Zigbee Mode-Ant 1

| Frequency<br>(MHz) | Test Results   |          |
|--------------------|----------------|----------|
|                    | dBm / 3 kHz BW | Result   |
| 2405               | -12.61         | Complies |
| 2440               | -12.43         | Complies |
| 2480               | -12.31         | Complies |

- See next pages for actual measured spectrum plots.

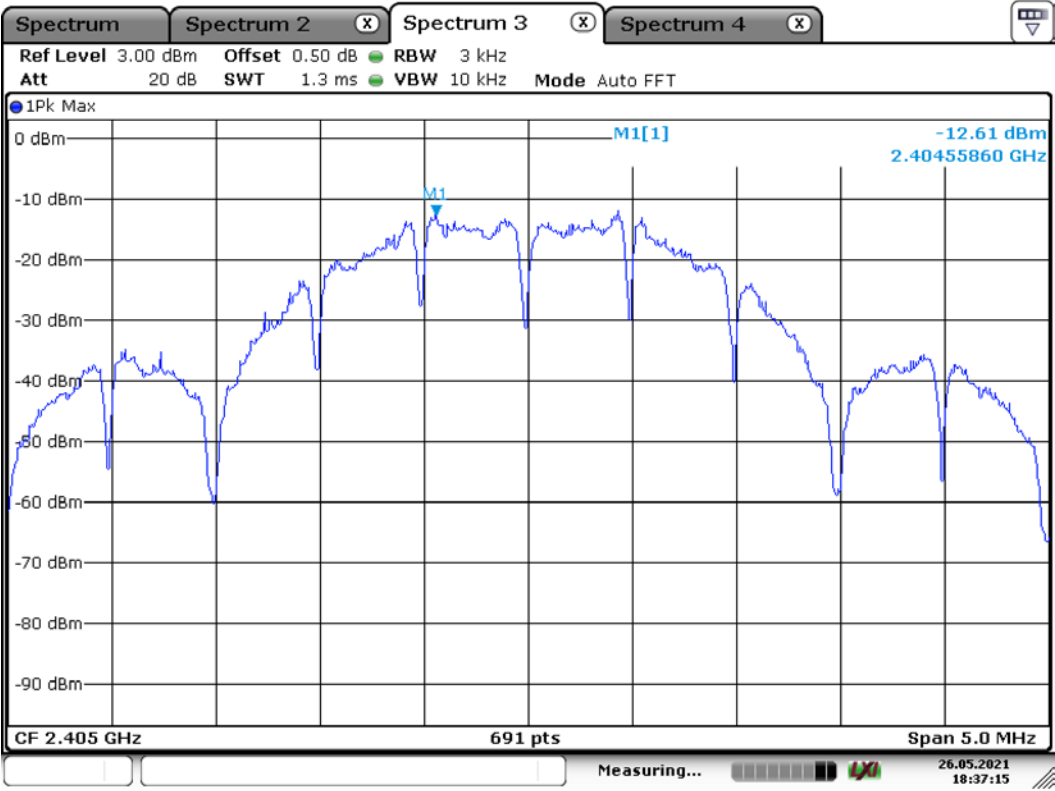
#### Minimum Standard:

|                        |                                          |
|------------------------|------------------------------------------|
| Power Spectral Density | $\leq 8 \text{ dBm @ } 3 \text{ kHz BW}$ |
|------------------------|------------------------------------------|

#### Measurement Setup

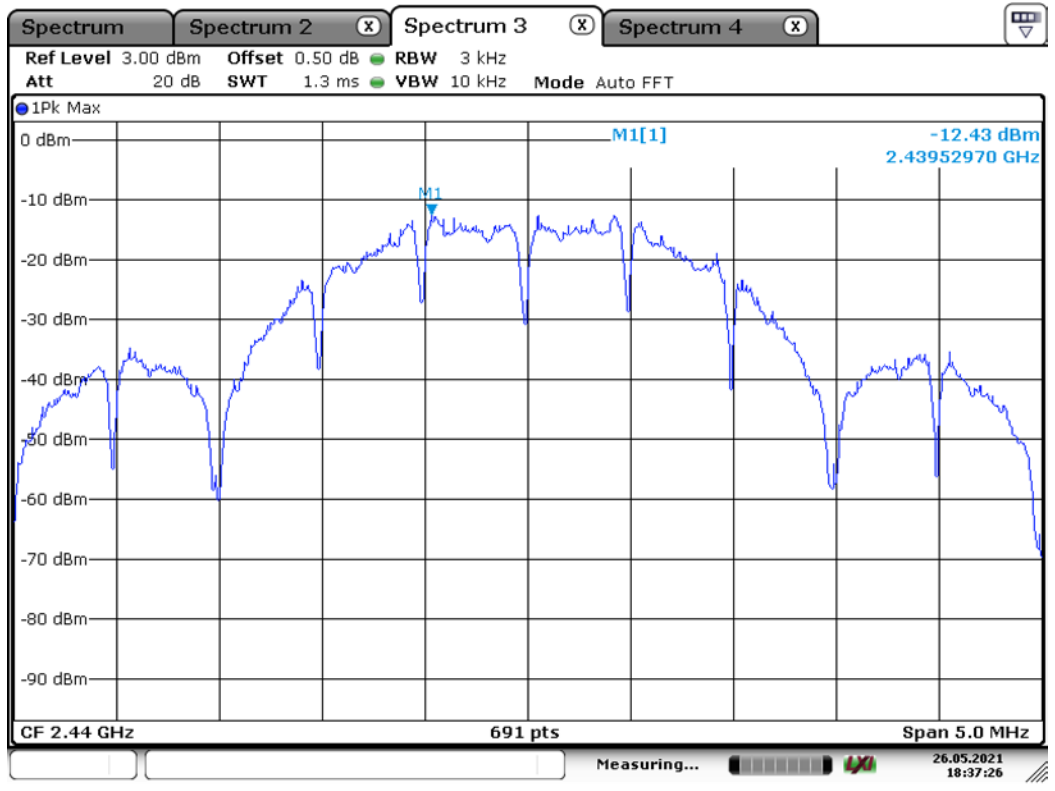
Same as the Chapter 3.2.1 (Figure 1)

Low Zigbee



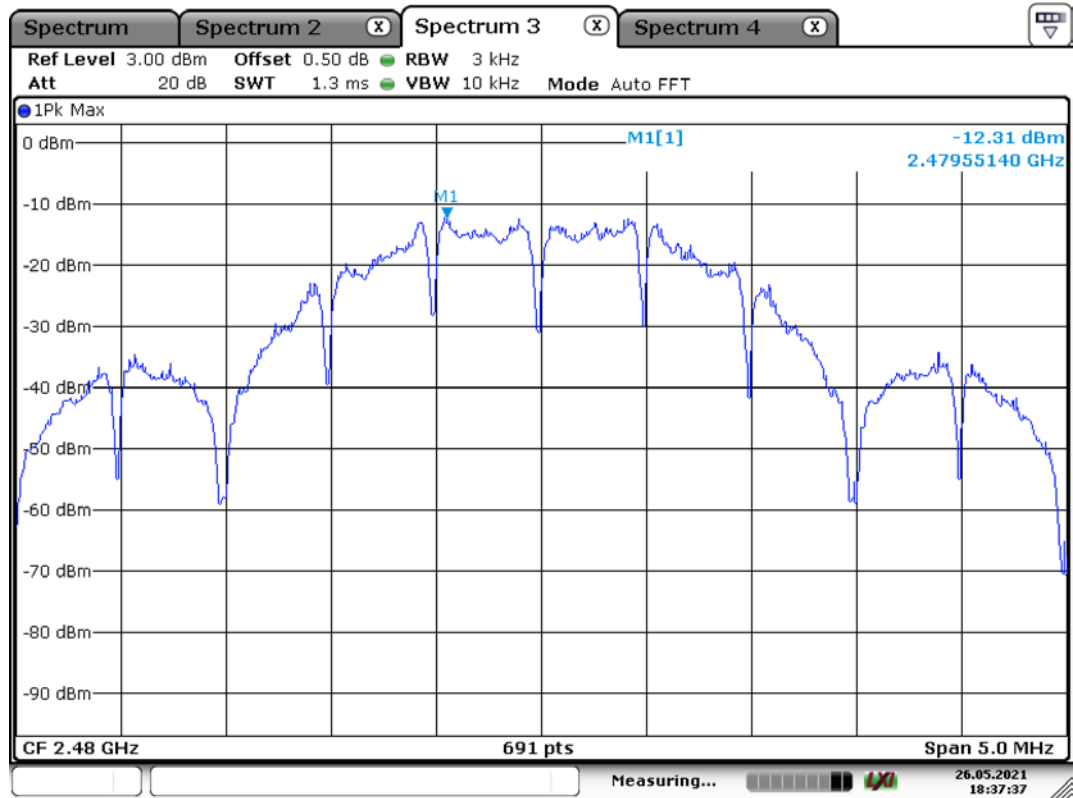
Date: 26.MAY.2021 18:37:16

Middle Zigbee



Date: 26.MAY.2021 18:37:27

High Zigbee



Date: 26.MAY.2021 18:37:37

### 3.2.4 Band Edge

#### Procedure:

The Unwanted emission from the EUT were measured according to the dictates PKPSD measurement procedure in section 11.11 of ANSI C63.10-2013.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB..

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 1 MHz

VBW  $\geq 3 \times$  RBW

Detector function = peak

Trace = max hold

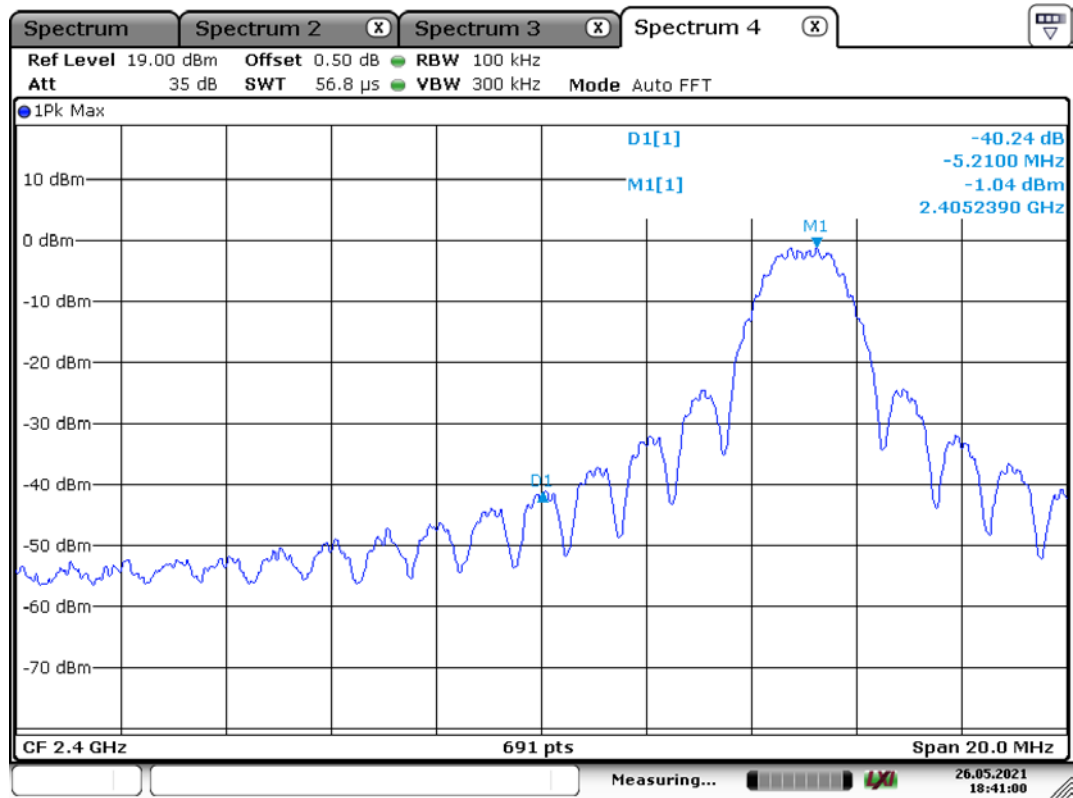
Sweep = auto

#### Measurement Data: Complies

- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

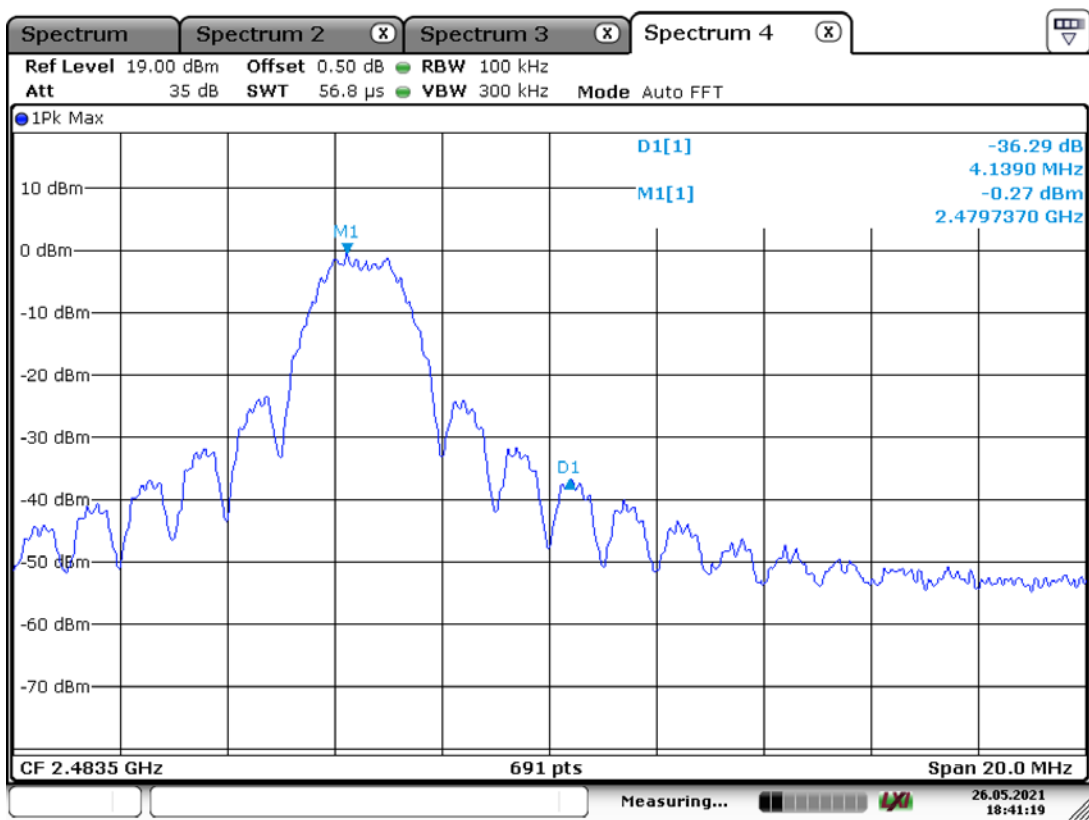
|                          |               |
|--------------------------|---------------|
| <b>Minimum Standard:</b> | $\leq 20$ dBc |
|--------------------------|---------------|

Lower edge



Date: 26.MAY.2021 18:41:01

Upper edge



Date: 26.MAY.2021 18:41:19

### 3.2.5 Conducted Spurious Emissions

**Procedure:**

The test follows KDB558074. The conducted spurious emissions were measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

After the trace being stable, set the marker on the peak of any spurious emission recorded.

The spectrum analyzer is set to:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions

RBW = 100 kHz

Sweep = auto

VBW = 100 kHz

Detector function = peak

Trace = max hold

**Measurement Data: Complies**

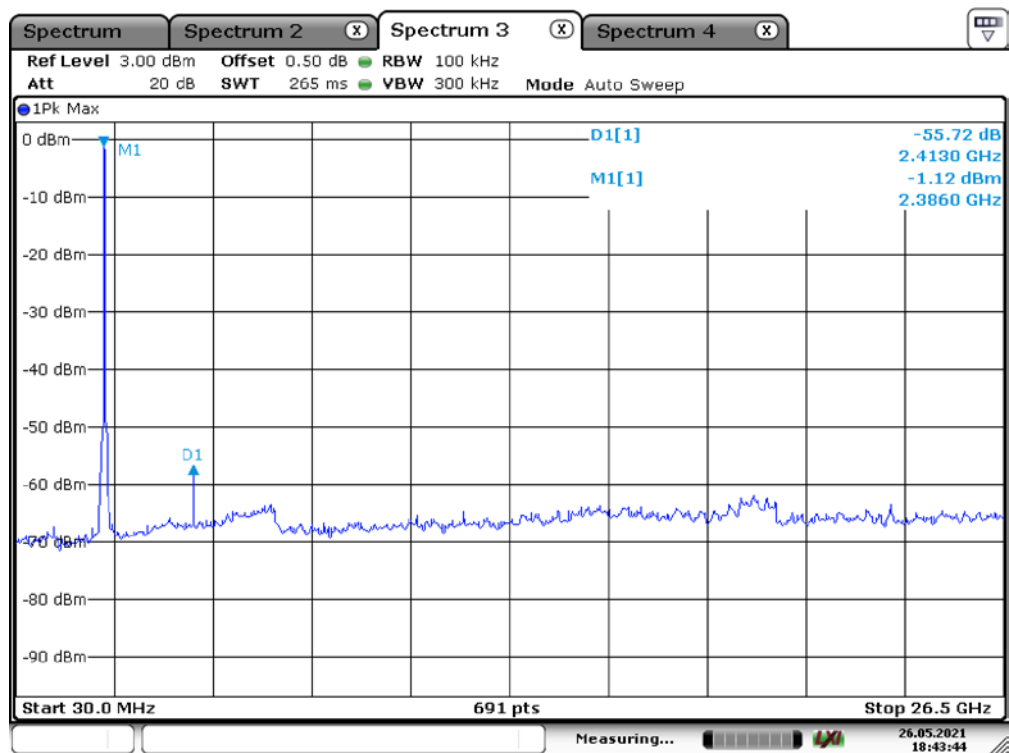
- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20 dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

|                          |               |
|--------------------------|---------------|
| <b>Minimum Standard:</b> | $\geq 20$ dBc |
|--------------------------|---------------|

**Measurement Setup**

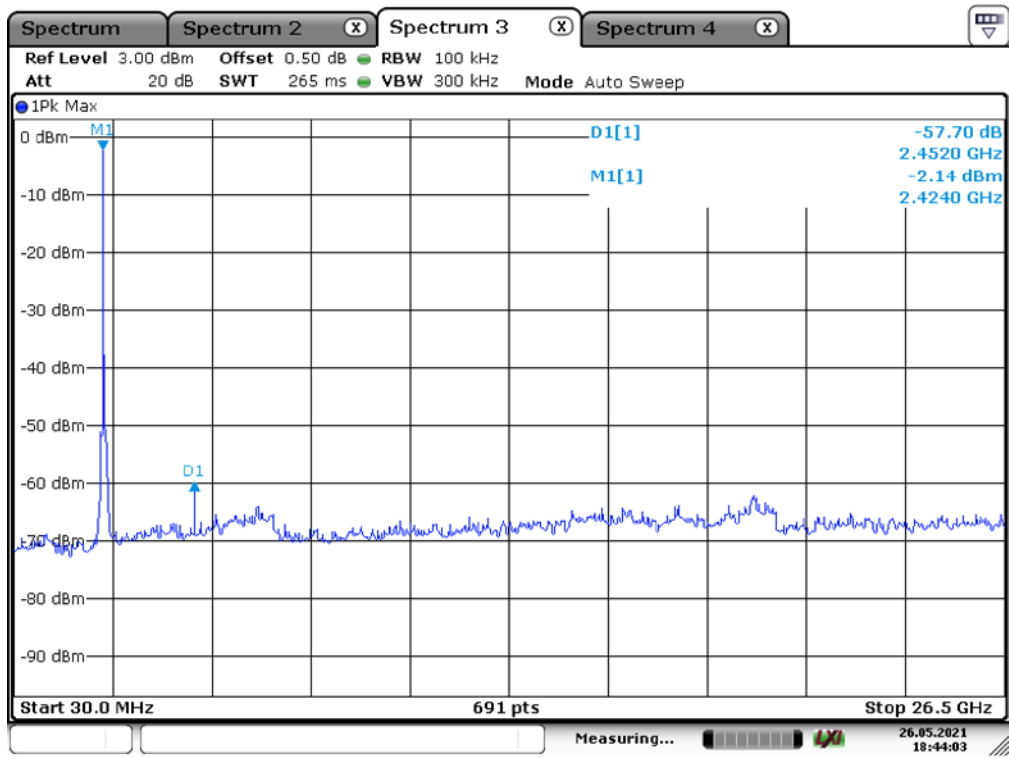
Same as the Chapter 3.2.1 (Figure 1)

**Unwanted Emission – Low Channel**  
**Frequency Range = 30 MHz ~ 26.5 GHz**



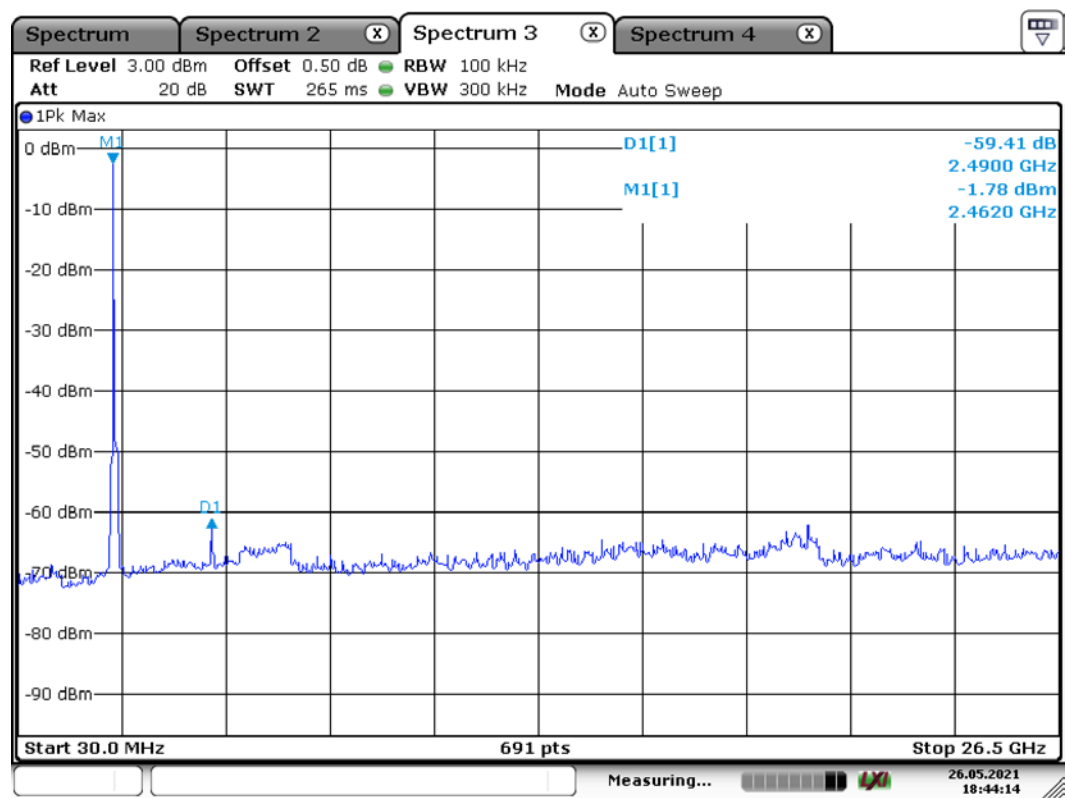
Date: 26.MAY.2021 18:43:44

**Unwanted Emission – Middle Channel**  
**Frequency Range = 30 MHz ~ 26.5 GHz**



Date: 26.MAY.2021 18:44:03

**Unwanted Emission – High Channel**  
**\Frequency Range = 30 MHz ~ 26.5 GHz**



Date: 26.MAY.2021 18:44:14

### 3.2.6 Radiated Spurious Emissions

#### Procedure:

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defines in ANSI C63.10-2013. The EUT is a placed on as turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 9 kHz ~ 10<sup>th</sup> harmonic.

RBW = 120 kHz ( 30 MHz ~ 1 GHz)

VBW  $\geq$  RBW

= 1 MHz (1 GHz ~ 10<sup>th</sup> harmonic )

Trace = max hold

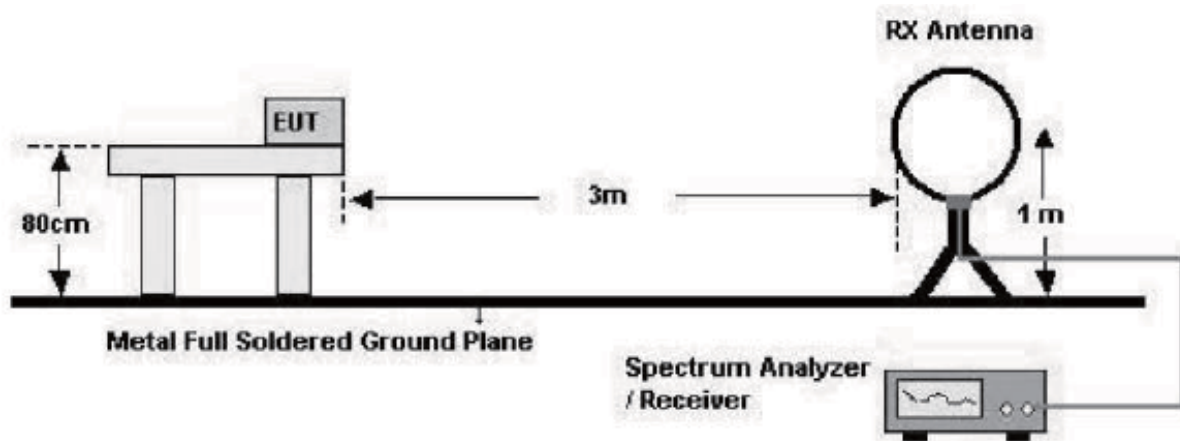
Detector function = peak

Sweep = auto

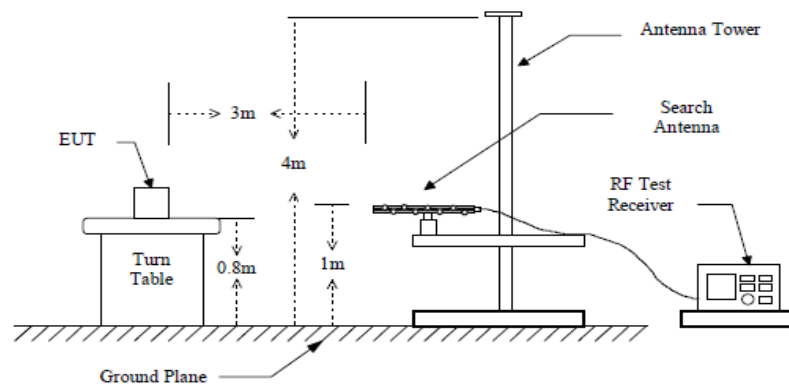
**Duty cycle : 98.89 %**

**The EUT configureal to transmit continuously(D  $\geq$  98%)/ Duty Factor = 0**

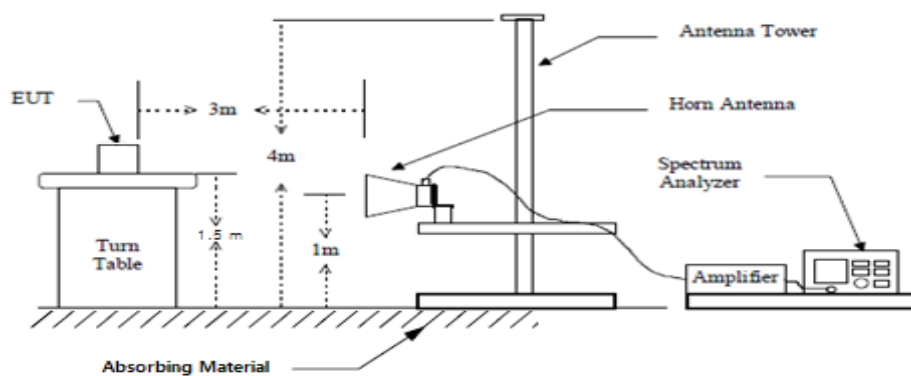
**below 30 MHz**



below 1 GHz (30 MHz to 1 GHz)



above 1 GHz



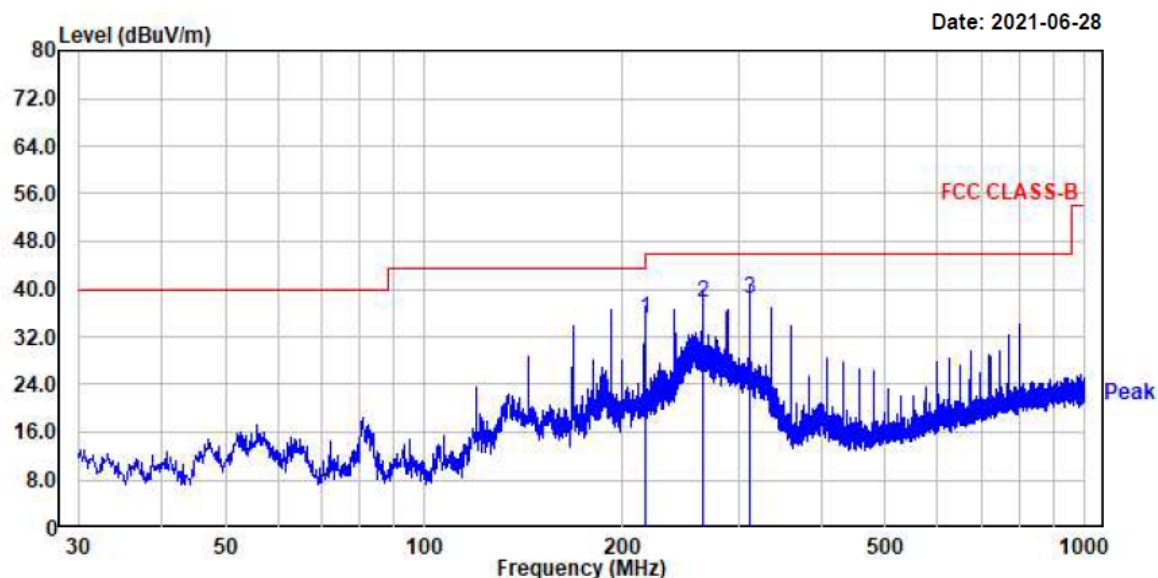
**Measurement Data: Complies**

- See next pages for actual measured data.
- No other emissions were detected at a level greater than 20 dB below limit include from 9 kHz to 30MHz.
- The test results for the worst of the various operating modes are presented in accordance with 6.3.4 of ANSI C63.10.
- Checked with a red circle is the fundamental frequency.

**Minimum Standard: FCC Part 15.209(a)**

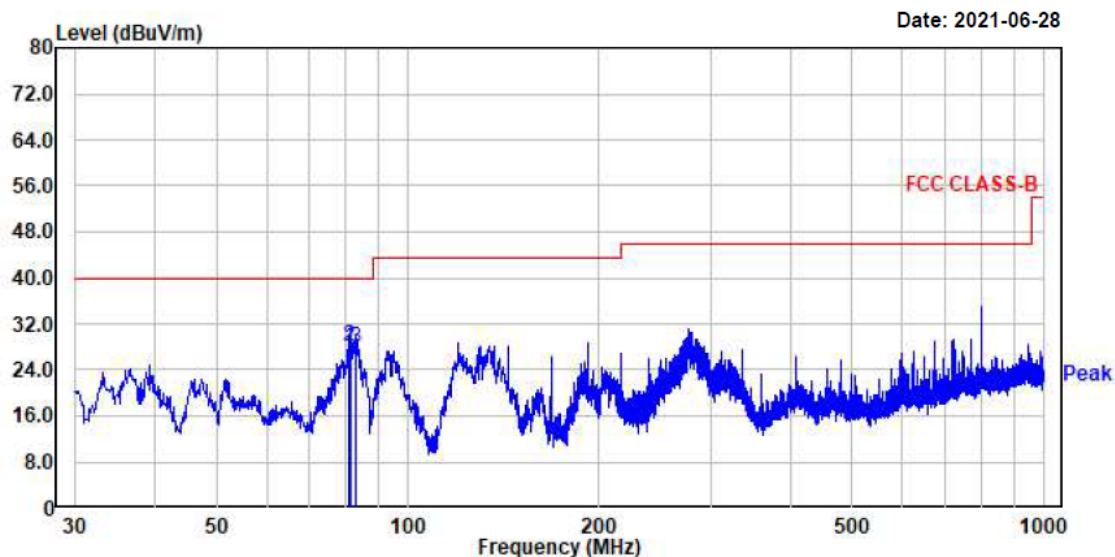
| <b>Frequency (MHz)</b> | <b>Limit (uV/m) @ 3 m</b> |
|------------------------|---------------------------|
| 0.009 ~ 0.490          | 2400/F(kHz) (@ 300 m)     |
| 0.490 ~ 1.705          | 24000/F(kHz) (@ 30 m)     |
| 1.705 ~ 30             | 30(@ 30 m)                |
| 30 ~ 88                | 100 **                    |
| 88 ~ 216               | 150 **                    |
| 216 ~ 960              | 200 **                    |
| Above 960              | 500                       |

\*\* Except as provided in 15.209(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 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

**Radiated Emissions – Zigbee(Low)**

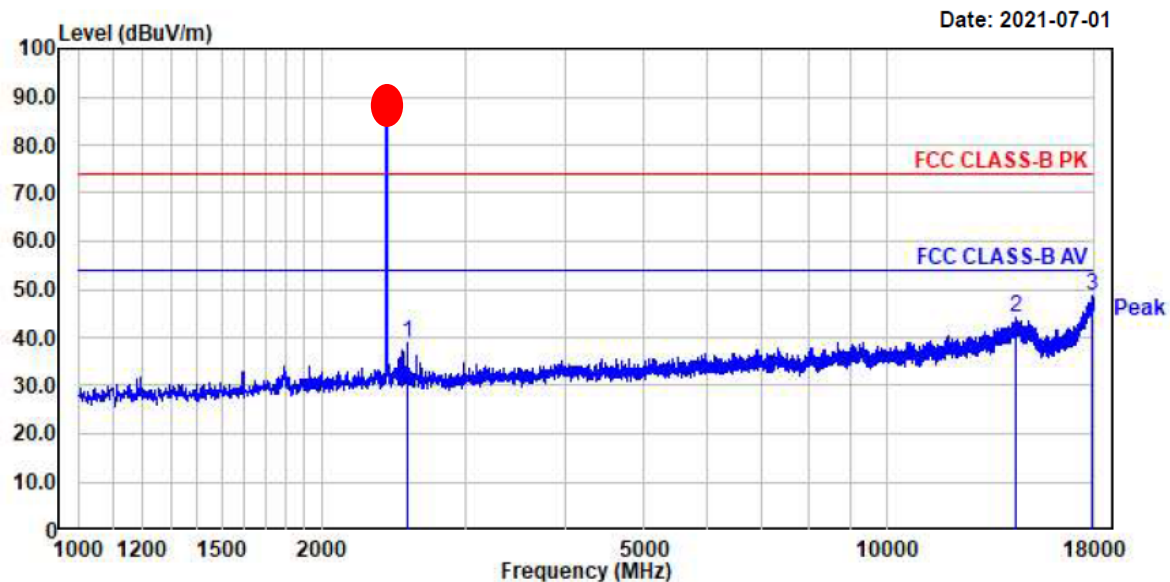
| No. | Freq<br>MHz | Reading<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity   |
|-----|-------------|-----------------|-----------|------------------------|-----------------|--------------|--------------|--------------|------------|
| 1.  | 216.00      | 54.28           | -19.21    | 35.07                  | 43.50           | 8.43         | 100          | 0            | horizontal |
| 2.  | 264.01      | 54.70           | -16.93    | 37.77                  | 46.00           | 8.23         | 100          | 0            | horizontal |
| 3.  | 312.03      | 53.52           | -15.06    | 38.46                  | 46.00           | 7.54         | 100          | 14           | horizontal |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



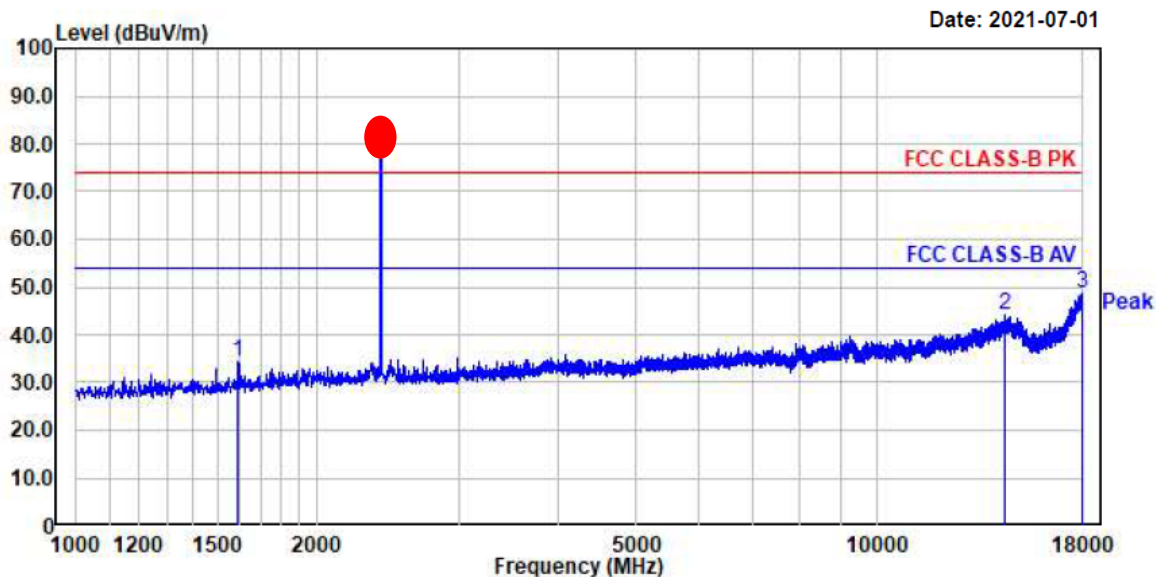
| No. | Freq<br>MHz | Reading<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity |
|-----|-------------|-----------------|-----------|------------------------|-----------------|--------------|--------------|--------------|----------|
| 1.  | 80.80       | 48.84           | -21.02    | 27.82                  | 40.00           | 12.18        | 100          | 96           | vertical |
| 2.  | 81.05       | 49.05           | -21.09    | 27.96                  | 40.00           | 12.04        | 100          | 179          | vertical |
| 3.  | 82.87       | 49.35           | -21.53    | 27.82                  | 40.00           | 12.18        | 100          | 96           | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



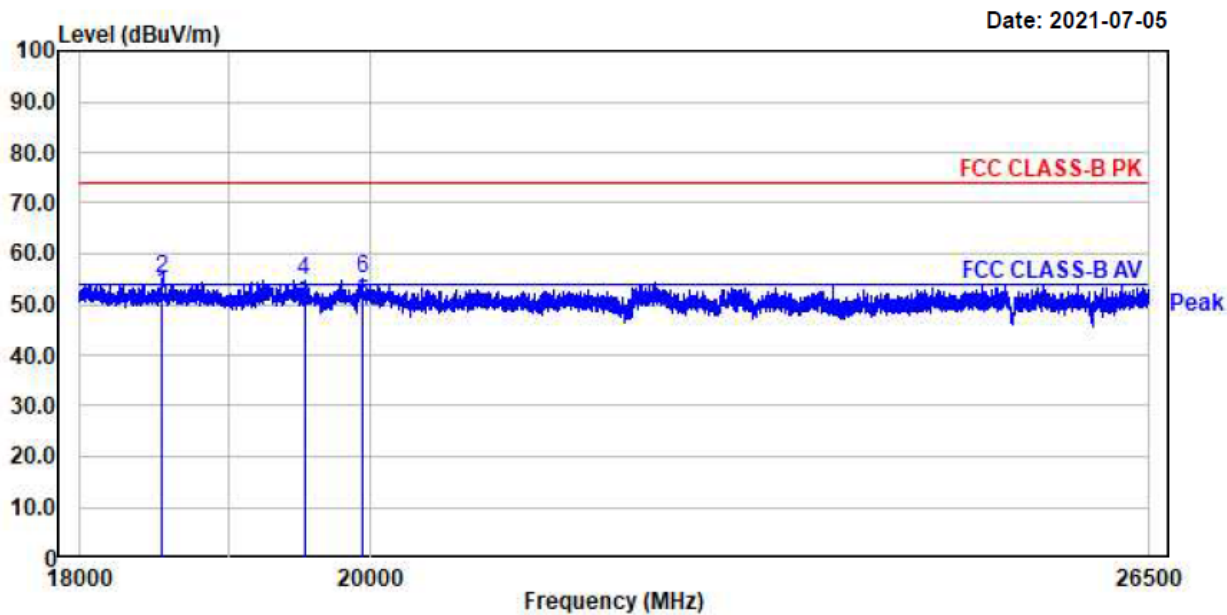
| No. | Freq<br>MHz | Reading<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity   |
|-----|-------------|-----------------|-----------|------------------------|-----------------|--------------|--------------|--------------|------------|
| 1.  | 2544.88     | 46.14           | -7.36     | 38.78                  | 74.00           | 35.22        | 277          | 284          | horizontal |
| 2.  | 14410.88    | 33.98           | 10.14     | 44.12                  | 74.00           | 29.88        | 309          | 316          | horizontal |
| 3.  | 17889.50    | 34.31           | 14.40     | 48.71                  | 74.00           | 25.29        | 360          | 360          | horizontal |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



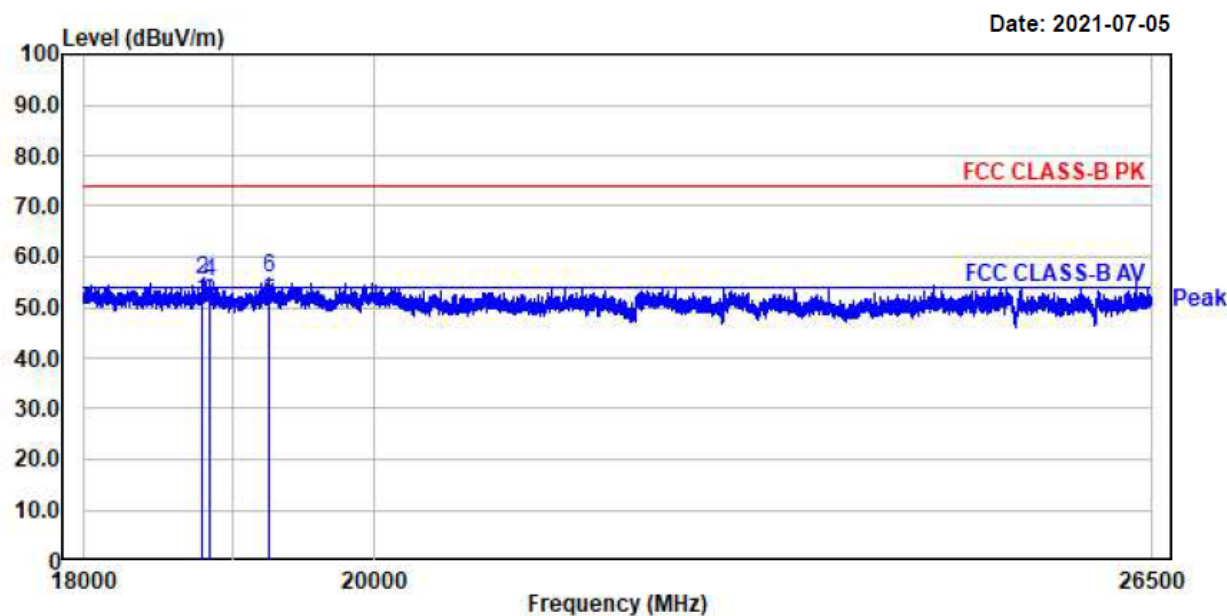
| No. | Freq<br>MHz | Reading<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity |
|-----|-------------|-----------------|-----------|------------------------|-----------------|--------------|--------------|--------------|----------|
| 1.  | 1592.88     | 45.98           | -11.60    | 34.38                  | 74.00           | 39.62        | 2            | 0            | vertical |
| 2.  | 14408.75    | 34.00           | 10.14     | 44.14                  | 74.00           | 29.86        | 305          | 300          | vertical |
| 3.  | 17987.25    | 33.85           | 14.97     | 48.82                  | 74.00           | 25.18        | 360          | 360          | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



| No. | Freq     | RD    | RD    | C.F   | Result | Result | Limit | Limit | Margin | Margin | Height | Angle | Polarity   |
|-----|----------|-------|-------|-------|--------|--------|-------|-------|--------|--------|--------|-------|------------|
|     | MHz      | PK    | AV    | dB    | PK     | AV     | PK    | AV    | PK     | AV     | cm     | deg   |            |
| 2.  | 18540.81 | 37.97 | 34.97 | 16.96 | 54.93  | 51.93  | 74.00 | 54.00 | 19.07  | 2.07   | 182    | 174   | horizontal |
| 4.  | 19523.63 | 38.78 | 33.78 | 16.06 | 54.84  | 49.84  | 74.00 | 54.00 | 19.16  | 4.16   | 23     | 17    | horizontal |
| 6.  | 19936.94 | 39.40 | 34.40 | 15.60 | 55.00  | 50.00  | 74.00 | 54.00 | 19.00  | 4.00   | 118    | 111   | horizontal |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

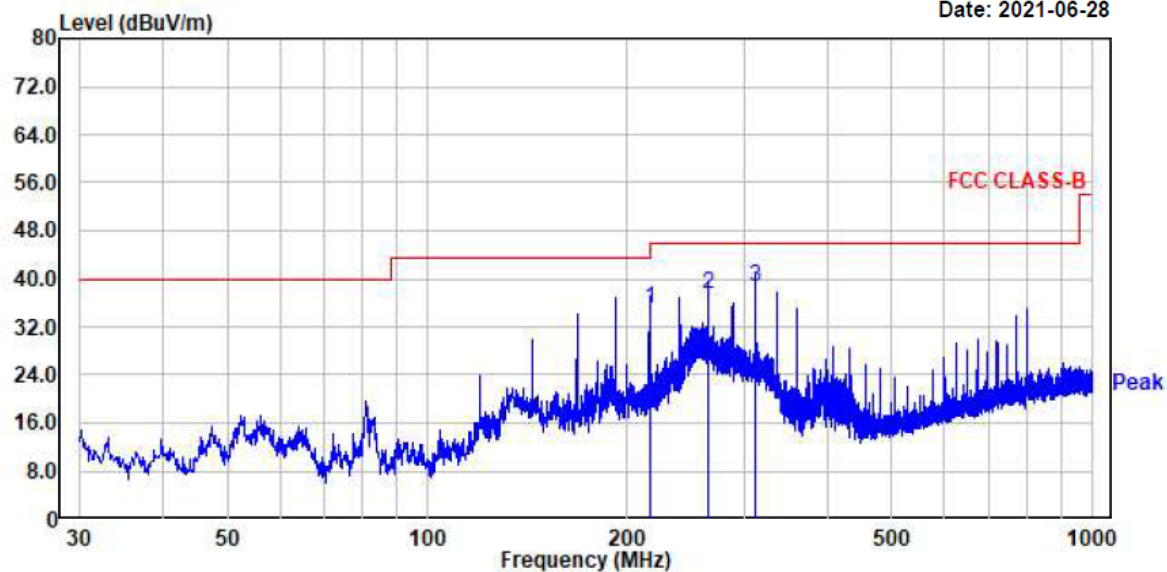


| No. | Freq     | RD    | RD    | C.F   | Result | Result | Limit | Limit | Margin | Margin | Height | Angle | Polarity |
|-----|----------|-------|-------|-------|--------|--------|-------|-------|--------|--------|--------|-------|----------|
|     | MHz      | PK    | AV    | dB    | PK     | AV     | PK    | AV    | PK     | AV     | cm     | deg   |          |
| 2.  | 18789.44 | 38.62 | 34.62 | 16.73 | 55.35  | 51.35  | 74.00 | 54.00 | 18.65  | 2.65   | 0      | 0     | vertical |
| 4.  | 18845.75 | 38.27 | 34.27 | 16.66 | 54.93  | 50.93  | 74.00 | 54.00 | 19.07  | 3.07   | 213    | 220   | vertical |
| 6.  | 19250.56 | 39.45 | 34.45 | 16.40 | 55.85  | 50.85  | 74.00 | 54.00 | 18.15  | 3.15   | 0      | 0     | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

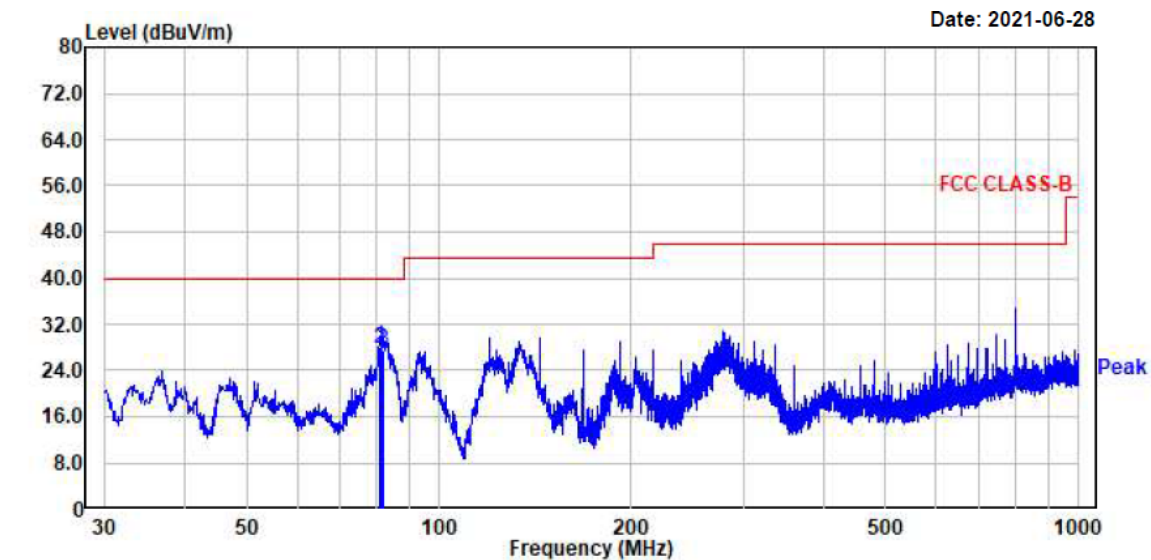
**Radiated Emissions – Zigbee(Middle)**

Date: 2021-06-28



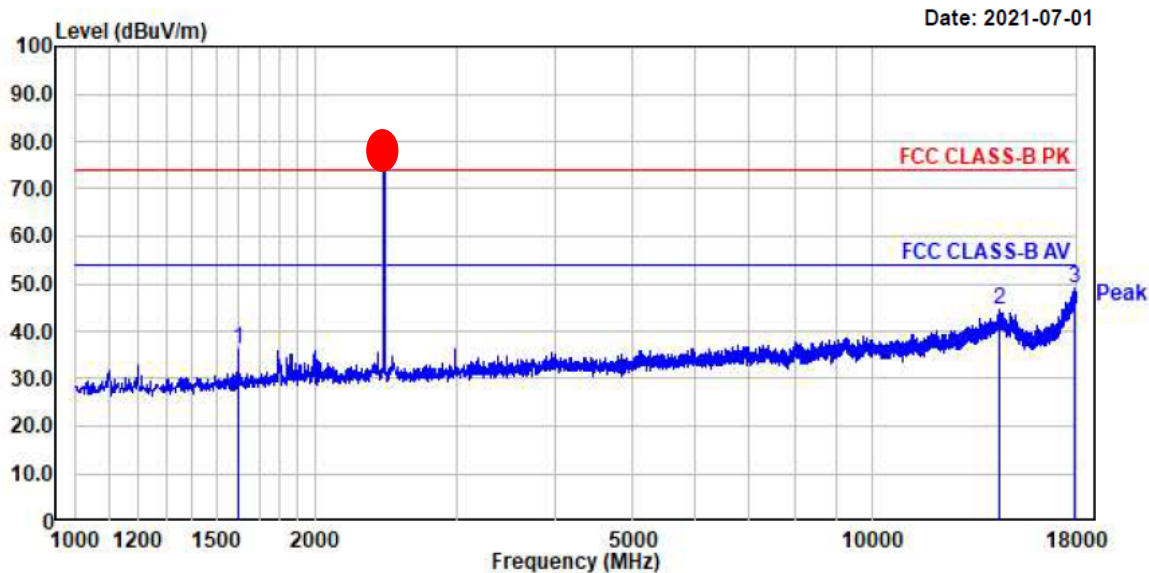
| No. | Freq<br>MHz | Reading<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity   |
|-----|-------------|-----------------|-----------|------------------------|-----------------|--------------|--------------|--------------|------------|
| 1.  | 216.00      | 54.28           | -19.21    | 35.07                  | 43.50           | 8.43         | 100          | 159          | horizontal |
| 2.  | 264.01      | 54.27           | -16.93    | 37.34                  | 46.00           | 8.66         | 108          | 0            | horizontal |
| 3.  | 312.03      | 53.69           | -15.06    | 38.63                  | 46.00           | 7.37         | 100          | 0            | horizontal |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



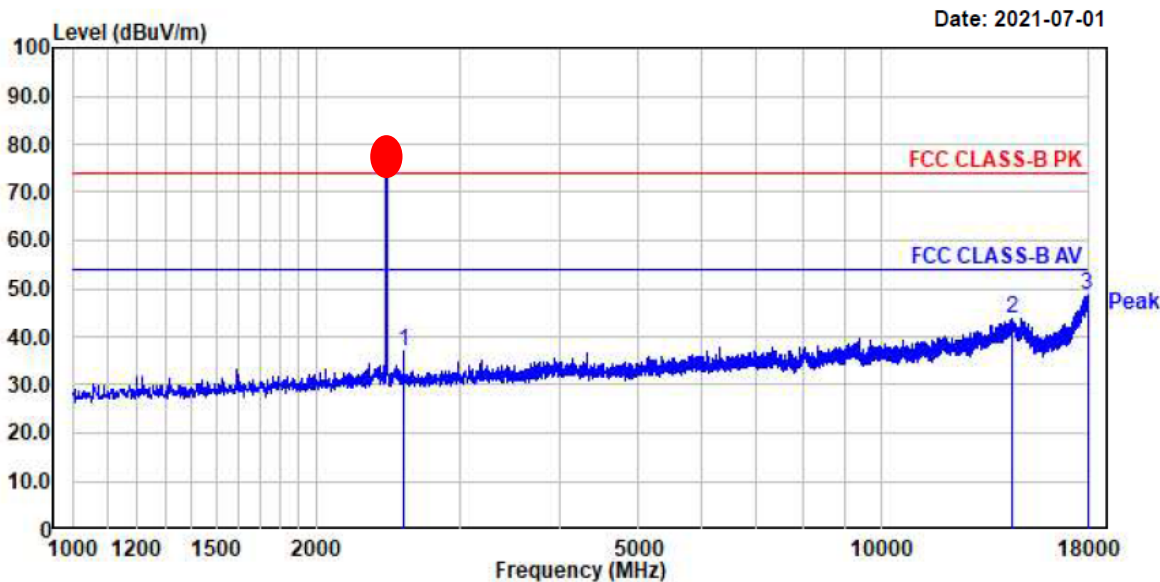
| No. | Freq<br>MHz | Reading<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity |
|-----|-------------|-----------------|-----------|------------------------|-----------------|--------------|--------------|--------------|----------|
| 1.  | 80.80       | 48.94           | -21.02    | 27.92                  | 40.00           | 12.08        | 100          | 129          | vertical |
| 2.  | 81.05       | 48.77           | -21.09    | 27.68                  | 40.00           | 12.32        | 100          | 129          | vertical |
| 3.  | 82.02       | 48.98           | -21.37    | 27.61                  | 40.00           | 12.39        | 100          | 165          | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



| No. | Freq<br>MHz | Reading<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity   |
|-----|-------------|-----------------|-----------|------------------------|-----------------|--------------|--------------|--------------|------------|
| 1.  | 1599.25     | 47.77           | -11.56    | 36.21                  | 74.00           | 37.79        | 360          | 360          | horizontal |
| 2.  | 14427.88    | 34.14           | 10.20     | 44.34                  | 74.00           | 29.66        | 359          | 360          | horizontal |
| 3.  | 17929.88    | 34.46           | 14.63     | 49.09                  | 74.00           | 24.91        | 9            | 13           | horizontal |

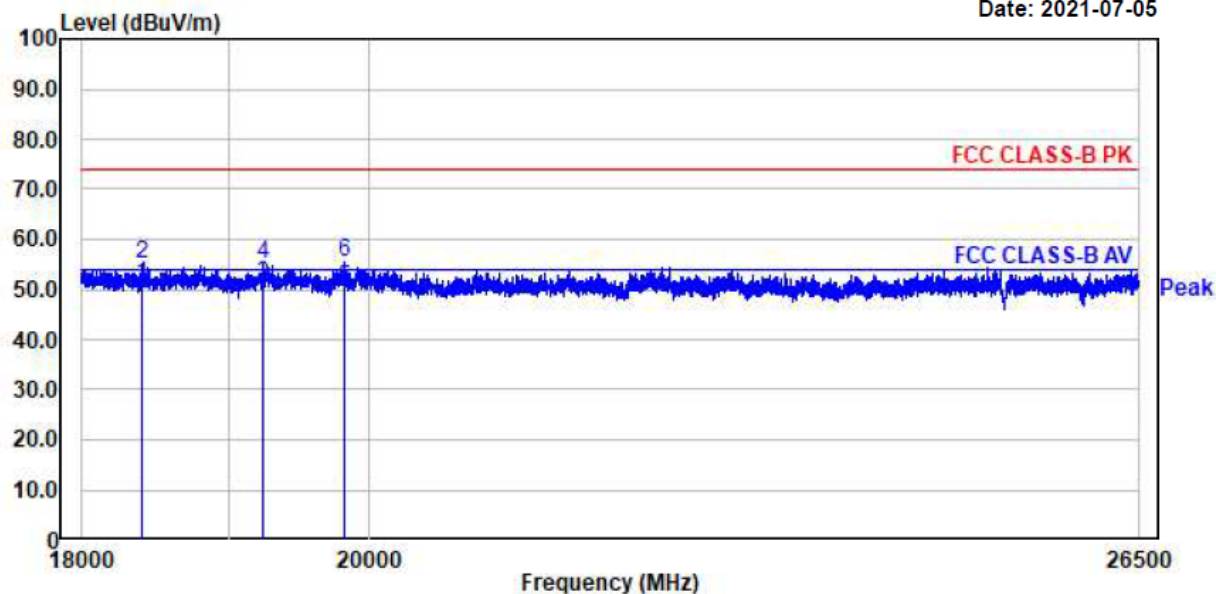
Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



| No. | Freq<br>MHz | Reading<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity |
|-----|-------------|-----------------|-----------|------------------------|-----------------|--------------|--------------|--------------|----------|
| 1.  | 2561.88     | 44.13           | -7.30     | 36.83                  | 74.00           | 37.17        | 305          | 298          | vertical |
| 2.  | 14485.25    | 33.43           | 10.35     | 43.78                  | 74.00           | 30.22        | 360          | 360          | vertical |
| 3.  | 17972.38    | 33.89           | 14.89     | 48.78                  | 74.00           | 25.22        | 19           | 13           | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

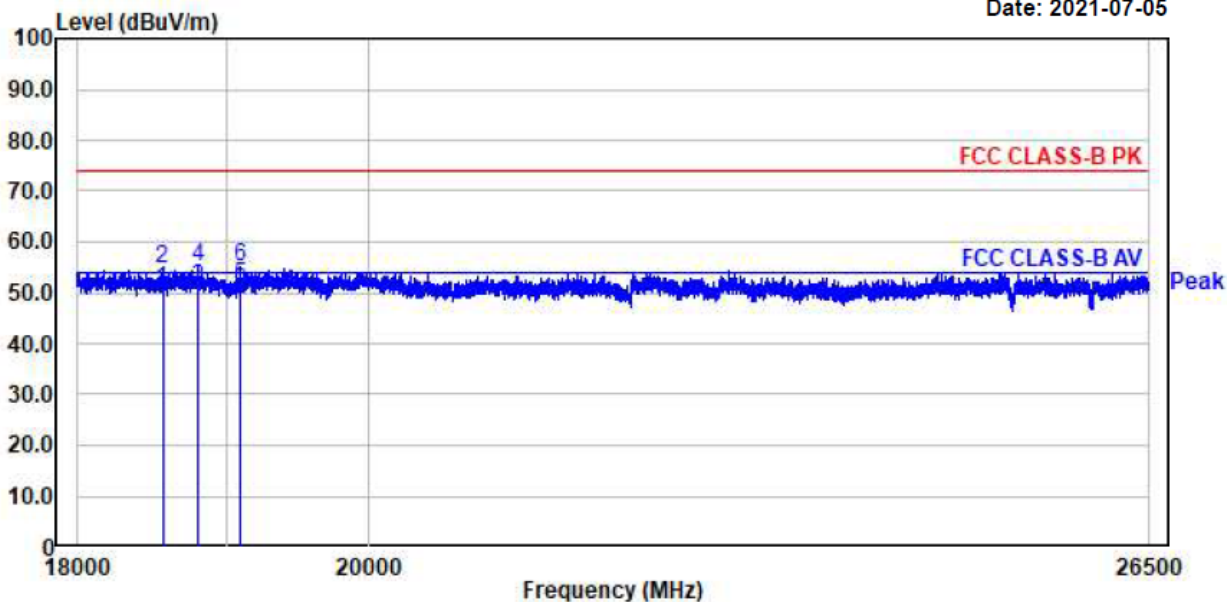
Date: 2021-07-05



| No. | Freq<br>MHz | RD<br>PK<br>dBμV | RD<br>AV<br>dBμV | C.F<br>dB | Result<br>PK<br>dBμV | Result<br>AV<br>dBμV | Limit<br>PK<br>dBμV | Limit<br>AV<br>dBμV | Margin<br>PK<br>dB | Margin<br>AV<br>dB | Height<br>cm | Angle<br>deg | Polarity   |
|-----|-------------|------------------|------------------|-----------|----------------------|----------------------|---------------------|---------------------|--------------------|--------------------|--------------|--------------|------------|
| 2.  | 18398.44    | 38.04            | 34.04            | 17.00     | 55.04                | 51.04                | 74.00               | 54.00               | 18.96              | 2.96               | 360          | 360          | horizontal |
| 4.  | 19234.63    | 38.57            | 34.57            | 16.42     | 54.99                | 50.99                | 74.00               | 54.00               | 19.01              | 3.01               | 0            | 0            | horizontal |
| 6.  | 19820.06    | 39.61            | 34.61            | 15.69     | 55.30                | 50.30                | 74.00               | 54.00               | 18.70              | 3.70               | 21           | 14           | horizontal |

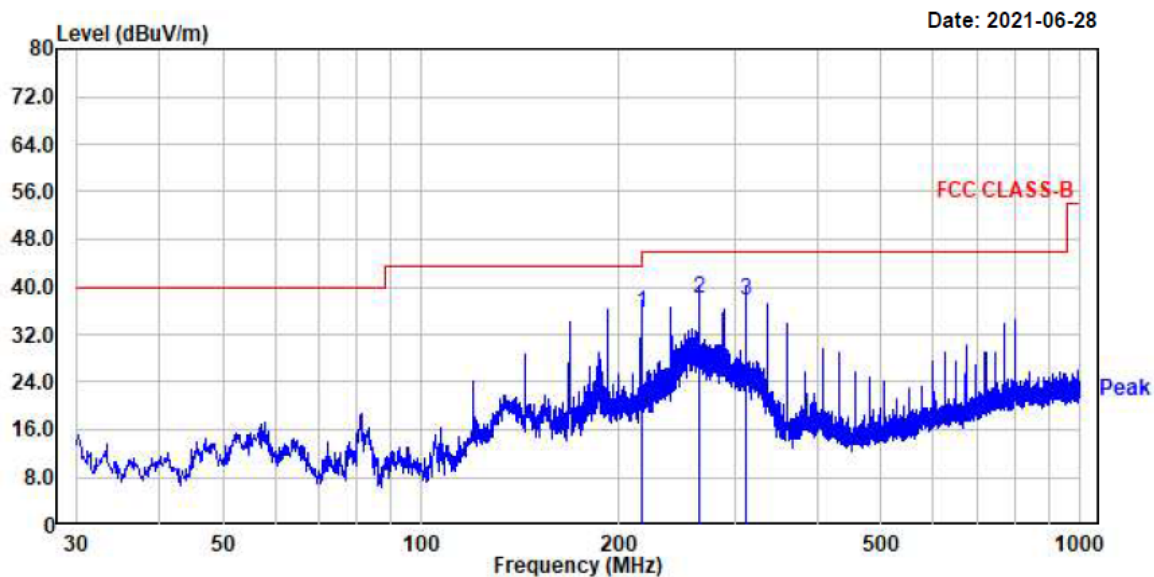
Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

Date: 2021-07-05



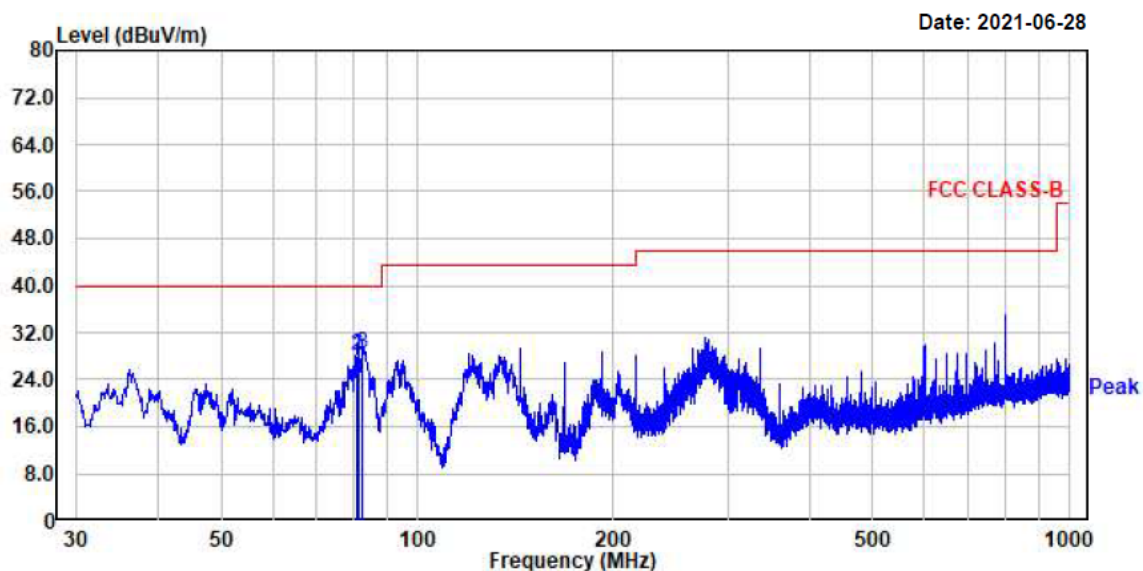
| No. | Freq<br>MHz | RD<br>PK<br>dBμV | RD<br>AV<br>dBμV | C.F<br>dB | Result<br>PK<br>dBμV | Result<br>AV<br>dBμV | Limit<br>PK<br>dBμV | Limit<br>AV<br>dBμV | Margin<br>PK<br>dB | Margin<br>AV<br>dB | Height<br>cm | Angle<br>deg | Polarity |
|-----|-------------|------------------|------------------|-----------|----------------------|----------------------|---------------------|---------------------|--------------------|--------------------|--------------|--------------|----------|
| 2.  | 18561.00    | 37.62            | 33.62            | 16.94     | 54.56                | 50.56                | 74.00               | 54.00               | 19.44              | 3.44               | 0            | 0            | vertical |
| 4.  | 18801.13    | 38.35            | 34.35            | 16.71     | 55.06                | 51.06                | 74.00               | 54.00               | 18.94              | 2.94               | 166          | 172          | vertical |
| 6.  | 19085.88    | 38.79            | 34.79            | 16.46     | 55.25                | 51.25                | 74.00               | 54.00               | 18.75              | 2.75               | 120          | 126          | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

**Radiated Emissions – Zigbee(High)**

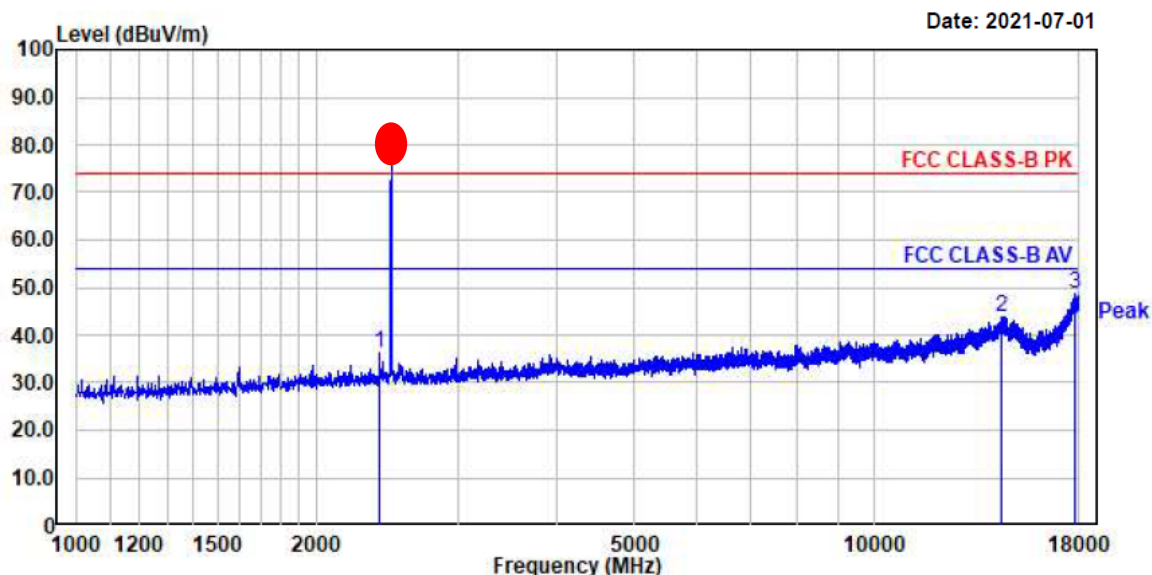
| No. | Freq<br>MHz | Reading<br>d $\mu$ V | C.F<br>dB | Result<br>QP<br>d $\mu$ V/m | Limit<br>d $\mu$ V/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity   |
|-----|-------------|----------------------|-----------|-----------------------------|----------------------|--------------|--------------|--------------|------------|
| 1.  | 216.00      | 54.88                | -19.21    | 35.67                       | 43.50                | 7.83         | 172          | 0            | horizontal |
| 2.  | 264.01      | 54.96                | -16.93    | 38.03                       | 46.00                | 7.97         | 100          | 356          | horizontal |
| 3.  | 312.03      | 52.84                | -15.06    | 37.78                       | 46.00                | 8.22         | 100          | 360          | horizontal |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



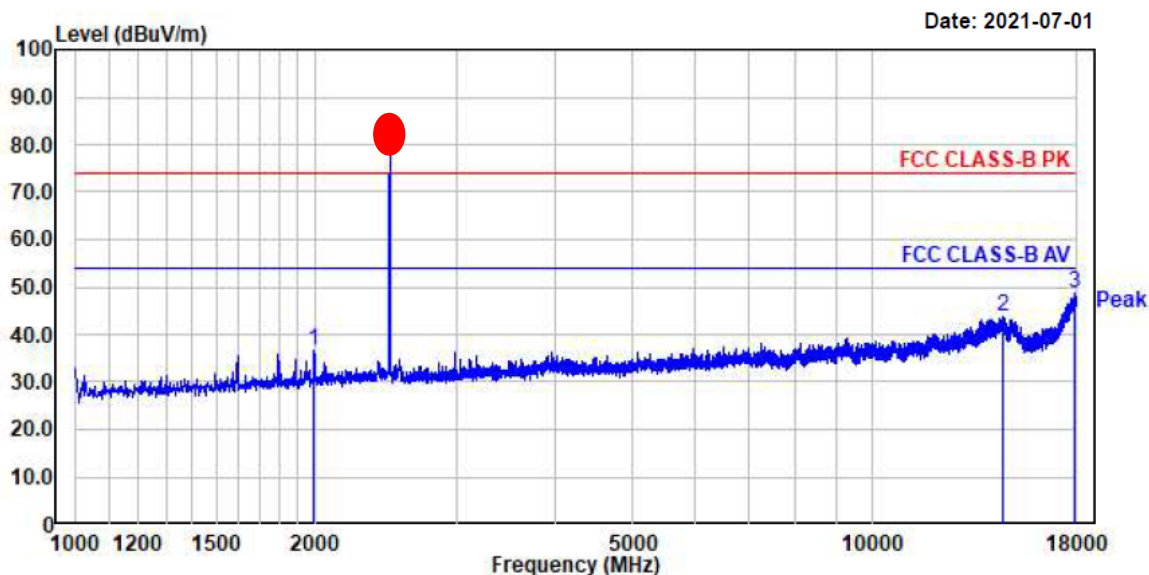
| No. | Freq<br>MHz | Reading<br>d $\mu$ V | C.F<br>dB | Result<br>QP<br>d $\mu$ V/m | Limit<br>d $\mu$ V/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity |
|-----|-------------|----------------------|-----------|-----------------------------|----------------------|--------------|--------------|--------------|----------|
| 1.  | 80.80       | 49.10                | -21.02    | 28.08                       | 40.00                | 11.92        | 100          | 145          | vertical |
| 2.  | 81.05       | 49.17                | -21.09    | 28.08                       | 40.00                | 11.92        | 100          | 98           | vertical |
| 3.  | 82.50       | 49.90                | -21.47    | 28.43                       | 40.00                | 11.57        | 100          | 145          | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



| No. | Freq<br>MHz | Reading<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity   |
|-----|-------------|-----------------|-----------|------------------------|-----------------|--------------|--------------|--------------|------------|
| 1.  | 2391.88     | 44.27           | -7.88     | 36.39                  | 74.00           | 37.61        | 360          | 360          | horizontal |
| 2.  | 14444.88    | 33.64           | 10.24     | 43.88                  | 74.00           | 30.12        | 84           | 89           | horizontal |
| 3.  | 17836.38    | 34.66           | 14.09     | 48.75                  | 74.00           | 25.25        | 117          | 122          | horizontal |

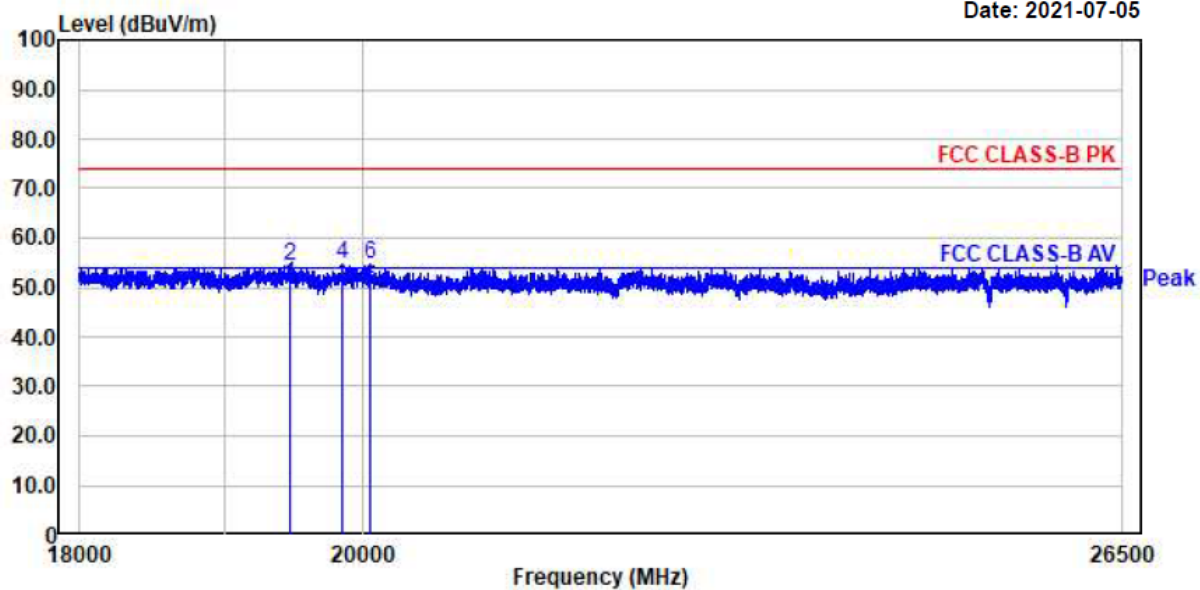
Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



| No. | Freq<br>MHz | Reading<br>dBμV | C.F<br>dB | Result<br>QP<br>dBμV/m | Limit<br>dBμV/m | Margin<br>dB | Height<br>cm | Angle<br>deg | Polarity |
|-----|-------------|-----------------|-----------|------------------------|-----------------|--------------|--------------|--------------|----------|
| 1.  | 1988.13     | 45.96           | -9.38     | 36.58                  | 74.00           | 37.42        | 34           | 30           | vertical |
| 2.  | 14542.63    | 33.47           | 10.26     | 43.73                  | 74.00           | 30.27        | 323          | 317          | vertical |
| 3.  | 17944.75    | 33.83           | 14.72     | 48.55                  | 74.00           | 25.45        | 258          | 250          | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

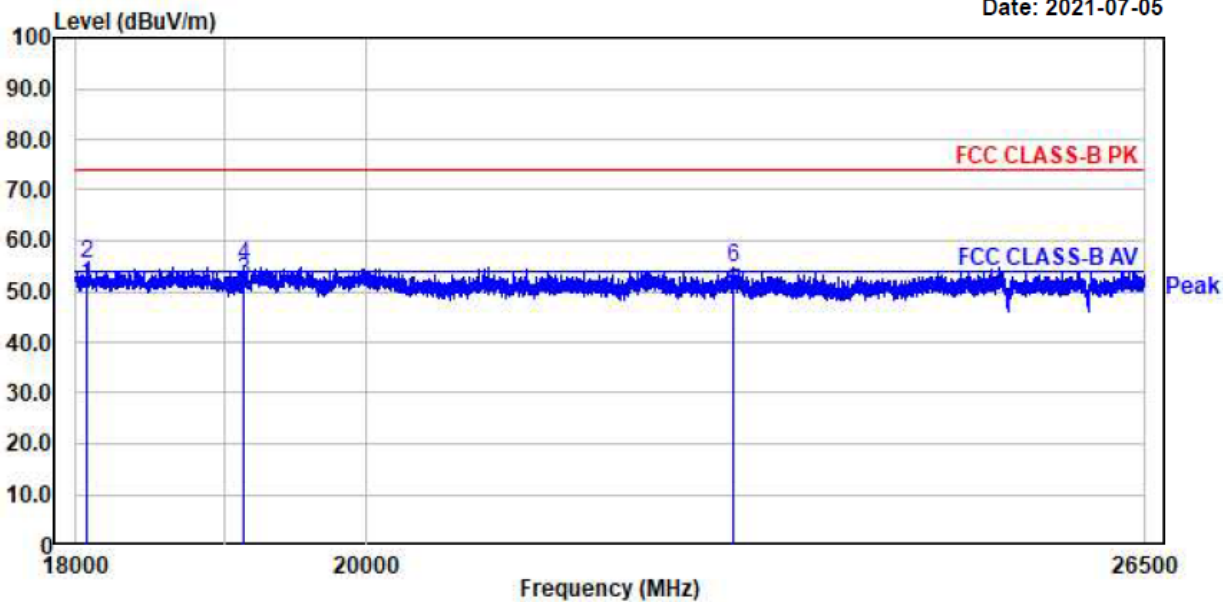
Date: 2021-07-05



| No. | Freq     | RD    | RD    | C.F   | Result | Result | Limit | Limit | Margin | Margin | Height | Angle | Polarity   |
|-----|----------|-------|-------|-------|--------|--------|-------|-------|--------|--------|--------|-------|------------|
|     | MHz      | PK    | AV    | dB    | PK     | AV     | PK    | AV    | PK     | AV     | cm     | deg   |            |
| 2.  | 19458.81 | 38.37 | 34.37 | 16.15 | 54.52  | 50.52  | 74.00 | 54.00 | 19.48  | 3.48   | 360    | 360   | horizontal |
| 4.  | 19840.25 | 39.05 | 34.05 | 15.68 | 54.73  | 49.73  | 74.00 | 54.00 | 19.27  | 4.27   | 128    | 123   | horizontal |
| 6.  | 20044.25 | 39.26 | 34.26 | 15.40 | 54.66  | 49.66  | 74.00 | 54.00 | 19.34  | 4.34   | 358    | 356   | horizontal |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

Date: 2021-07-05



| No. | Freq     | RD    | RD    | C.F   | Result | Result | Limit | Limit | Margin | Margin | Height | Angle | Polarity |
|-----|----------|-------|-------|-------|--------|--------|-------|-------|--------|--------|--------|-------|----------|
|     | MHz      | PK    | AV    | dB    | PK     | AV     | PK    | AV    | PK     | AV     | cm     | deg   |          |
| 2.  | 18074.38 | 38.28 | 34.28 | 17.02 | 55.30  | 51.30  | 74.00 | 54.00 | 18.70  | 2.70   | 322    | 330   | vertical |
| 4.  | 19125.19 | 38.71 | 35.71 | 16.46 | 55.17  | 52.17  | 74.00 | 54.00 | 18.83  | 1.83   | 39     | 45    | vertical |
| 6.  | 22843.94 | 39.46 | 34.46 | 15.36 | 54.82  | 49.82  | 74.00 | 54.00 | 19.18  | 4.18   | 0      | 0     | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

### 3.2.7 AC Conducted Emissions

**Procedure:**

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

**Minimum Standard: FCC Part 15.207(a)**

**Measurement Data: N/A**

Class B

| Frequency Range | quasi-peak | Average    |
|-----------------|------------|------------|
| 0.15 ~ 0.5      | 66 to 56 * | 56 to 46 * |
| 0.5 ~ 5         | 56         | 46         |
| 5 ~ 30          | 60         | 50         |

\* Decreases with the logarithm of the frequency

## APPENDIX

### TEST EQUIPMENT USED FOR TESTS

|    | Use | Description                          | Model No.        | Serial No.  | Manufacturer           | Interval | Next Cal. Date |
|----|-----|--------------------------------------|------------------|-------------|------------------------|----------|----------------|
| 1  | ■   | Signal Analyzer (9 kHz ~ 30 GHz)     | FSV30            | 100757      | R&S                    | 1 year   | 2021-09-06     |
| 2  | ■   | Signal Generator (~3.2 GHz)          | 8648C            | 3623A02597  | HP                     | 1 year   | 2022-03-16     |
| 3  |     | SYNTHESIZED CW GENERATOR             | 83711B           | US34490456  | HP                     | 1 year   | 2022-03-16     |
| 4  |     | Attenuator (3 dB)                    | 8491A            | 37822       | HP                     | 1 year   | 2021-09-06     |
| 5  |     | Attenuator (10 dB)                   | 8491A            | 63196       | HP                     | 1 year   | 2021-09-06     |
| 6  | ■   | EMI Test Receiver (~7 GHz)           | ESCI7            | 100722      | R&S                    | 1 year   | 2021-09-06     |
| 7  |     | RF Amplifier (~1.3 GHz)              | 8447D OPT 010    | 2944A07684  | HP                     | 1 year   | 2021-09-06     |
| 8  |     | RF Amplifier (1~26.5 GHz)            | 8449B            | 3008A02126  | HP                     | 1 year   | 2022-03-16     |
| 9  | ■   | Horn Antenna (1~18 GHz)              | 3115             | 00114105    | ETS                    | 2 year   | 2022-09-06     |
| 10 | ■   | DRG Horn (Small)                     | 3116B            | 81109       | ETS-Lindgren           | 2 year   | 2022-03-18     |
| 11 |     | DRG Horn (Small)                     | 3116B            | 133350      | ETS-Lindgren           | 2 year   | 2022-03-18     |
| 12 | ■   | TRILOG Antenna                       | VULB 9160        | 9160-3237   | SCHWARZBECK            | 2 year   | 2023-03-20     |
| 13 |     | Temp.Humidity Data Logger            | SK-L200TH II A   | 00801       | SATO                   | 1 year   | 2022-03-16     |
| 14 |     | Splitter (SMA)                       | ZFSC-2-2500      | SF617800326 | Mini-Circuits          | -        | -              |
| 15 | ■   | DC Power Supply                      | 6674A            | 3637A01657  | Agilent                | -        | -              |
| 17 | ■   | Power Meter                          | EPM-441A         | GB32481702  | HP                     | 1 year   | 2022-03-16     |
| 18 | ■   | Power Sensor                         | 8481A            | 3318A94972  | HP                     | 1 year   | 2021-09-06     |
| 19 |     | Audio Analyzer                       | 8903B            | 3729A18901  | HP                     | 1 year   | 2021-09-06     |
| 20 |     | Modulation Analyzer                  | 8901B            | 3749A05878  | HP                     | 1 year   | 2021-09-06     |
| 21 |     | TEMP & HUMIDITY Chamber              | YJ-500           | LTAS06041   | JinYoung Tech          | 1 year   | 2021-09-06     |
| 22 |     | Stop Watch                           | HS-3             | 812Q08R     | CASIO                  | 2 year   | 2022-03-18     |
| 23 |     | LISN                                 | KNW-407          | 8-1430-1    | Kyoritsu               | 1 year   | 2021-09-06     |
| 24 |     | Two-Lime V-Network                   | ESH3-Z5          | 893045/017  | R&S                    | 1 year   | 2022-03-16     |
| 25 |     | UNIVERSAL RADIO COMMUNICATION TESTER | CMU200           | 106243      | R&S                    | 1 year   | 2022-03-16     |
| 26 |     | Highpass Filter                      | WHKX1.5/15G-10SS | 74          | Wainwright Instruments | 1 year   | 2022-03-16     |
| 27 |     | Highpass Filter                      | WHKX3.0/18G-10SS | 118         | Wainwright Instruments | 1 year   | 2022-03-16     |
| 28 |     | OSP120 BASE UNIT                     | OSP120           | 101230      | R&S                    | 1 year   | 2022-03-16     |
| 29 |     | Signal Generator(100 kHz ~ 40 GHz)   | SMB100A03        | 177621      | R&S                    | 1 year   | 2022-03-16     |
| 30 |     | Signal Analyzer (10 Hz ~ 40 GHz)     | FSV40            | 101367      | R&S                    | 1 year   | 2022-03-16     |
| 31 | ■   | Active Loop Antenna                  | FMZB 1519        | 1519-031    | SCHWARZBECK            | 2 year   | 2023-02-26     |