

**ELECTROMAGNETIC EMISSIONS  
COMPLIANCE REPORT**

**Applicant:** Wacom Co., Ltd.  
2-510-1 Toyonodai, Kazo-shi, Saitama, 349-1148, Japan  
**Product Name:** Active Pen  
**Brand Name:** HP  
**Model No.:** HSN-W004P  
**Model Difference:** N/A  
**Report Number:** E2/2022/10046-01  
**FCC ID** HV4-HSNW004P  
**Issue Date:** May 12, 2022  
**Date of Test:** January 21 2022~February 16, 2022  
**Date of EUT Received:** January 12, 2022

Approved By

Vito Pei

Vito Pei

**We hereby certify that:**

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab 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 comply with FCC rule part §15.225.

The results of this report relate only to the sample identified in this report.

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## Revision History

| Report Number    | Revision | Description         | Issue Date   | Revised By | Remark |
|------------------|----------|---------------------|--------------|------------|--------|
| E2/2022/10046-01 | 00       | Update product name | May 12, 2022 | Susan Lin  |        |
|                  |          |                     |              |            |        |
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|                  |          |                     |              |            |        |

**Note:**

- 1、The remark "" indicates modification of the report upon requests from certification body.
- 2、Test results of the original test report E2/2022/10046 are fully leveraged in this report in order to correct the product name, the original test report is replaced by this report.

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## 1 GENERAL INFORMATION

### 1.1 Product Description

|                                  |             |
|----------------------------------|-------------|
| Product Name:                    | Active Pen  |
| Brand Name:                      | HP          |
| Model No.:                       | HSN-W004P   |
| Model Difference:                | N/A         |
| Hardware Version:                | N/A         |
| Firmware Version:                | N/A         |
| EUT Series No.:                  | PJ221065037 |
| Power Supply:                    | 2Vdc        |
| Test Software<br>(Name/Version): | Default     |

### 1.2 RF specification

|                     |                      |
|---------------------|----------------------|
| Radio Technology:   | NFC                  |
| Operating Frequency | 13.56MHz             |
| Transmit Power      | < 6.95dBuV/m at 30m. |
| Number of Channels  | 1                    |
| Modulation Type     | ASK                  |
| Antenna Type        | Loop                 |

**Note:** Antenna information is provided by the applicant.

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### 1.3 Test Methodology

FCC Part 15, Subpart C §15.225

ANSI C63.10:2013.

### 1.4 Test Facility

| Laboratory                                            | Test Site Address                                                                         | Test Site Name | FCC Designation number | IC CAB identifier |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------|------------------------|-------------------|
| SGS Taiwan Ltd.<br>Central RF Lab.<br>(TAF code 3702) | No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan. | SAC 1          | TW0027                 | TW3702            |
|                                                       |                                                                                           | SAC 3          |                        |                   |
|                                                       |                                                                                           | Conduction 1   |                        |                   |
|                                                       |                                                                                           | Conducted 1    |                        |                   |
|                                                       |                                                                                           | Conducted 2    |                        |                   |
|                                                       |                                                                                           | Conducted 3    |                        |                   |
|                                                       |                                                                                           | Conducted 4    |                        |                   |
|                                                       |                                                                                           | Conducted 5    |                        |                   |
|                                                       |                                                                                           | Conducted 6    |                        |                   |
|                                                       | No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333                            | Conduction C   | TW0028                 |                   |
|                                                       |                                                                                           | SAC C          |                        |                   |
|                                                       |                                                                                           | SAC D          |                        |                   |
|                                                       |                                                                                           | SAC G          |                        |                   |
|                                                       |                                                                                           | Conducted A    |                        |                   |
|                                                       |                                                                                           | Conducted B    |                        |                   |
|                                                       |                                                                                           | Conducted C    |                        |                   |
|                                                       |                                                                                           | Conducted D    |                        |                   |
|                                                       |                                                                                           | Conducted E    |                        |                   |
|                                                       |                                                                                           | Conducted F    |                        |                   |
| Conducted G                                           |                                                                                           |                |                        |                   |

**Note:** Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

### 1.5 Special Accessories

There is no other accessory attached. This is the worst case condition.

### 1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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## 2 SYSTEM TEST CONFIGURATION

### 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### 2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The Tx frequency was fixed which was for the purpose of the measurements.

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

#### 2.3.2 Radiated Emissions

The EUT is placed on a 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 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.

#### 2.3.3 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m\*6m\*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

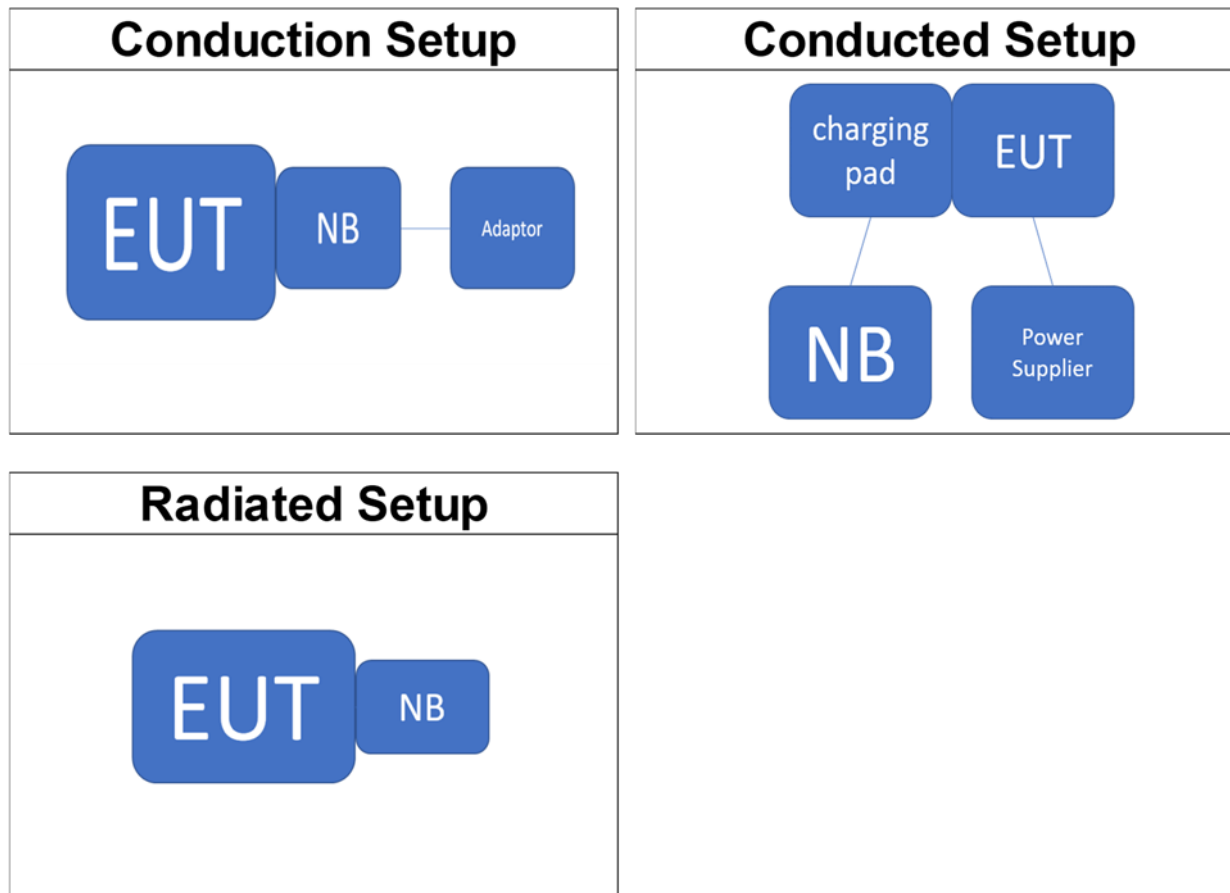
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

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## 2.4 Test Configuration



## 2.5 Control Unit(s)

| AC Power-Line Conducted Emission Test Site: Conduction C |     |              |               |           |          |
|----------------------------------------------------------|-----|--------------|---------------|-----------|----------|
| EQUIPMENT TYPE                                           | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| Adapter                                                  | HP  | TPN-CA10     | N/A           | N.C.R     | N.C.R    |
| Notebook                                                 | HP  | Ultra        | 000176135B    | N/A       | N/A      |

| Conducted Emission Test Site: Conducted D |                       |              |               |           |          |
|-------------------------------------------|-----------------------|--------------|---------------|-----------|----------|
| EQUIPMENT TYPE                            | MFR                   | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| charging pad                              | Lanto Electronic Ltd. | HSN-L01NFM   | N/A           | N.C.R     | N.C.R    |
| Notebook                                  | Lenovo                | T420         | S0012599      | N/A       | N/A      |

| Radiated Emission Test Site: SAC D |     |              |               |           |          |
|------------------------------------|-----|--------------|---------------|-----------|----------|
| EQUIPMENT TYPE                     | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| Notebook                           | HP  | Ultra        | 000176135B    | N/A       | N/A      |

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### 3 SUMMARY OF TEST RESULTS

| FCC Rules              | Description Of Test                           | Result    |
|------------------------|-----------------------------------------------|-----------|
| §15.207                | AC Power Line Conducted Emission              | Compliant |
| §15.225 (a)-(d)        | Radiated Emission                             | Compliant |
| §15.209                | Radiated Emission Limits, general requirement | Compliant |
| §15.225 (e)            | Frequency Stability                           | Compliant |
| §2.1049<br>§15.215 (c) | Emission Bandwidth                            | Compliant |
| §15.203                | Antenna Requirement                           | Compliant |

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## 4 DESCRIPTION OF TEST MODES

### 4.1 The Worst Test Modes and Channel Details

1. The EUT stay in continuous transmission mode.
2. The frequency 13.56 MHz is the default channel to test, where it is the only manipulative channel as this application supports.
3. Only one configuration is supported/applicable as follows.

| RADIATED EMISSION TEST |                   |                |            |
|------------------------|-------------------|----------------|------------|
| MODE                   | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION |
| NFC                    | 1                 | 1              | ASK        |
| FREQUENCY STABILITY    |                   |                |            |
| MODE                   | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION |
| NFC                    | 1                 | 1              | ASK        |
| 20dB BANDWIDTH         |                   |                |            |
| MODE                   | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION |
| NFC                    | 1                 | 1              | ASK        |

The field strength of radiated emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.

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## 5 MEASUREMENT UNCERTAINTY

| Test Items                       | Uncertainty |
|----------------------------------|-------------|
| AC Power Line Conducted Emission | +/- 2.34 dB |
| Frequency Stability              | +/- 1.53 Hz |
| Emission Bandwidth               | +/- 1.53 Hz |
| Temperature                      | +/- 0.4 °C  |
| Humidity                         | +/- 3.5 %   |
| DC / AC Power Source             | +/- 1 %     |

| Radiated Spurious Emission Measurement Uncertainty |     |         |                 |
|----------------------------------------------------|-----|---------|-----------------|
| Polarization: Vertical                             | +/- | 2.57 dB | 9kHz~30MHz      |
|                                                    | +/- | 4.85 dB | 30MHz - 1000MHz |
|                                                    | +/- | 4.45 dB | 1GHz - 18GHz    |
|                                                    | +/- | 4.24 dB | 18GHz - 40GHz   |
| Polarization: Horizontal                           | +/- | 2.57 dB | 9kHz~30MHz      |
|                                                    | +/- | 4.37 dB | 30MHz - 1000MHz |
|                                                    | +/- | 4.45 dB | 1GHz - 18GHz    |
|                                                    | +/- | 4.24 dB | 18GHz - 40GHz   |

### Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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## 6 MEASUREMENT EQUIPMENT USED

### 6.1 Emission from AC power line

| AC Power-Line Conducted Emission Test Site: Conduction C |                                     |                   |                             |            |            |
|----------------------------------------------------------|-------------------------------------|-------------------|-----------------------------|------------|------------|
| EQUIPMENT TYPE                                           | MFR                                 | MODEL NUMBER      | SERIAL NUMBER               | LAST CAL.  | CAL DUE.   |
| LISN                                                     | SCHWARZBEC<br>K Mess-<br>Elektronik | NSLK8127          | 973                         | 03/25/2021 | 03/24/2022 |
| EMI Test Receiver                                        | R&S                                 | ESCI              | 101342                      | 04/28/2021 | 04/27/2022 |
| Coaxial Cable                                            | EC Lab                              | RF-HY-CAB-<br>250 | RF-HY-CAB-<br>250-01        | 03/27/2021 | 03/26/2022 |
| Pulse Limiter                                            | EC Lab                              | VTSD<br>9561F-N   | 485                         | 03/27/2021 | 03/26/2022 |
| Test Software                                            | audix                               | e3                | E3 20923 SGS<br>Ver.9 ( C ) | N.C.R      | N.C.R      |

### 6.2 Conducted Measurement

| Conducted Emission Test Site: Conducted D |                        |                   |               |            |            |
|-------------------------------------------|------------------------|-------------------|---------------|------------|------------|
| EQUIPMENT TYPE                            | MFR                    | MODEL NUMBER      | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| H-Loop Near Field<br>Antenna              | LANGER EMV-<br>Technik | LF-R 400          | 02-1597       | N.C.R      | N.C.R      |
| Spectrum Analyzer                         | KEYSIGHT               | N9010A            | MY51440113    | 07/13/2021 | 07/12/2022 |
| Temperature Chamber                       | TERCHY                 | MHK-120LK         | 1020582       | 07/01/2021 | 06/30/2022 |
| DC Power Supply                           | Agilent                | E3640A            | MY53170008    | 09/18/2021 | 09/17/2022 |
| Attenuator                                | Marvelous              | WATT-218FS-<br>10 | RF15          | 11/18/2021 | 11/17/2022 |
| DC Block                                  | PASTERNAK              | PE8210            | RF158         | 11/18/2021 | 11/17/2022 |

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## 6.3 Radiated Measurement

| Radiated Emission Test Site: SAC D |                 |                   |                          |            |            |
|------------------------------------|-----------------|-------------------|--------------------------|------------|------------|
| EQUIPMENT TYPE                     | MFR             | MODEL NUMBER      | SERIAL NUMBER            | LAST CAL.  | CAL DUE.   |
| Broadband Antenna                  | SCHWARZBECK     | VULB 9168         | 9168-617                 | 11/12/2021 | 11/11/2022 |
| Horn Antenna                       | Schwarzbeck     | BBHA9170          | 185                      | 08/06/2021 | 08/05/2022 |
| Horn Antenna                       | Schwarzbeck     | BBHA9120D         | 1341                     | 06/04/2021 | 06/03/2022 |
| Loop Antenna                       | ETS.LINDGREN    | 6502              | 143303                   | 05/07/2021 | 05/06/2022 |
| 3m Site NSA                        | SGS             | 966 chamber D     | N/A                      | 07/12/2021 | 07/11/2022 |
| Test Software                      | audix           | e3                | E3 20923 SGS Ver.9 ( C ) | N.C.R      | N.C.R      |
| Spectrum Analyzer                  | KEYSIGHT        | N9010A            | MY57120200               | 03/22/2021 | 03/21/2022 |
| Pre-Amplifier                      | EMC Instruments | EMC184045B        | 980135                   | 10/27/2021 | 10/26/2022 |
| Pre-Amplifier                      | EMC Instruments | EMC9135           | 980234                   | 11/18/2021 | 11/17/2022 |
| Pre-Amplifier                      | EMC Instruments | EMC12630SE        | 980273                   | 11/18/2021 | 11/17/2022 |
| Coaxial Cable                      | Huber+Suhner    | RG 214/U          | W21.01                   | 11/18/2021 | 11/17/2022 |
| Coaxial Cable                      | Huber Suhner    | EMC106-SM-SM-7200 | 150703                   | 11/18/2021 | 11/17/2022 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 104      | MY17413/4                | 11/18/2021 | 11/17/2022 |
| Attenuator                         | Marvelous       | WATT-218FS-10     | RF17                     | 11/18/2021 | 11/17/2022 |
| Lowpass Filter                     | Woken           | EWT-56-0019       | RF173                    | 11/18/2021 | 11/17/2022 |
| High Pass Filter                   | R&S             | F13 HPF 3GHz      | RF175                    | 11/18/2021 | 11/17/2022 |
| Band Rejection Filter              | Micro-Tronics   | BRM50701-01       | RF201                    | 11/18/2021 | 11/17/2022 |

**NOTE:** N.C.R refers to Not Calibrated Required.

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## 7 CONDUCTED EMISSIONS TEST

## 6.1 Standard Applicable

According to §15.207 and frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

| Frequency range<br>MHz | Limits<br>(dBuV) |          |
|------------------------|------------------|----------|
|                        | Quasi-peak       | Average  |
| 0.15 to 0.50           | 66 to 56         | 56 to 46 |
| 0.50 to 5              | 56               | 46       |
| 5 to 30                | 60               | 50       |

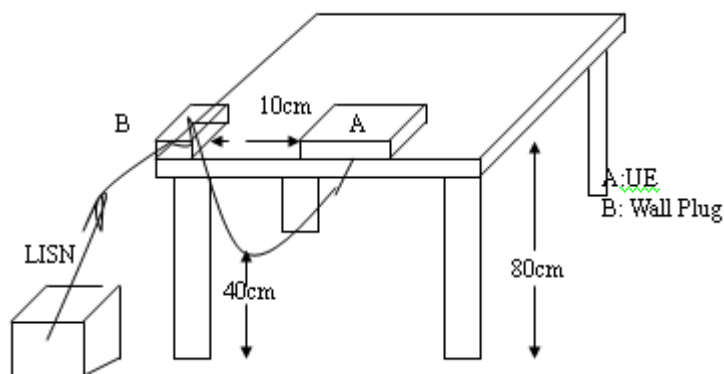
Note

- 1.The lower limit shall apply at the transition frequencies
- 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

## 6.2 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

### 6.3 Test SET-UP (Block Diagram of Configuration)



## 6.4 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

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## 6.5 Measurement Result

Note: Refer to next page for measurement data and plots.

Note2: The \* reveals the worst-case results that closet to the limit.

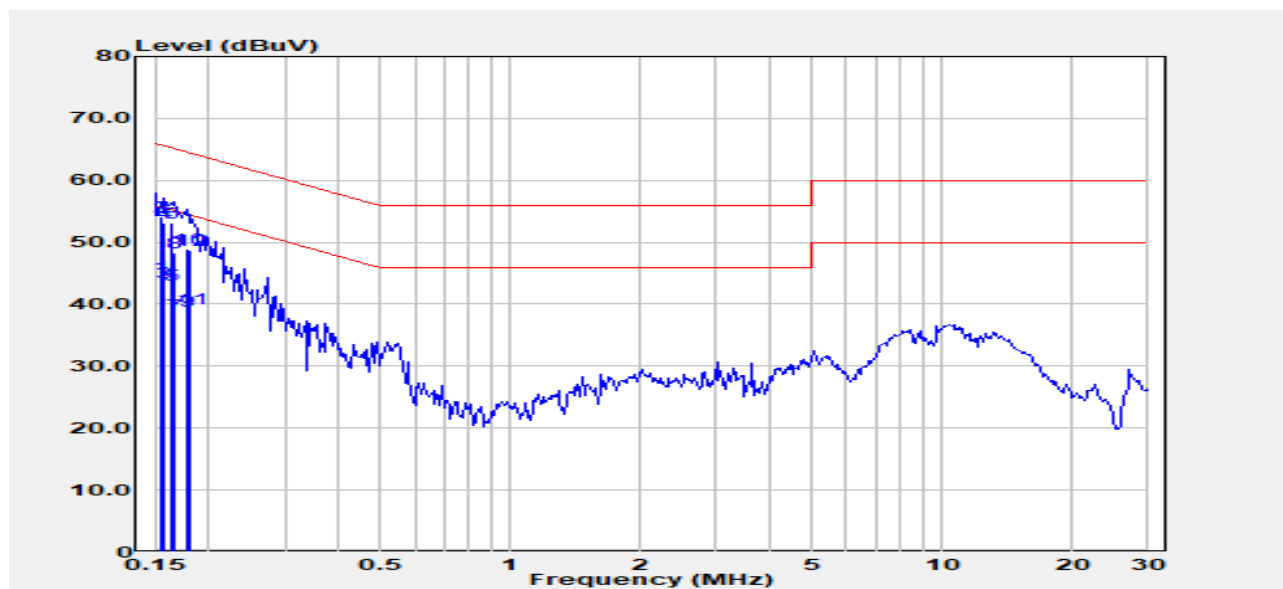
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## AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :E2/2022/10046 Test Site :Conduction C  
 Test Mode :NFC Test Date :2022-02-16  
 Power :120V/60Hz Temp./Humi. :21/59  
 Probe :L1 Engineer :Andy Wang  
 Note: : TPN-CA10



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV | Limit<br>dBμV | Margin<br>dB |
|--------------|------------------------------|-----------------------------------|--------------|----------------------|---------------|--------------|
| 0.155        | Average                      | 34.30                             | 10.30        | 44.60                | 55.74         | -11.14       |
| 0.155        | QP                           | 43.90                             | 10.30        | 54.20                | 65.74         | -11.54       |
| 0.158        | Average                      | 33.30                             | 10.30        | 43.60                | 55.56         | -11.96       |
| 0.158        | QP                           | 42.90                             | 10.30        | 53.20                | 65.56         | -12.36       |
| 0.163        | Average                      | 32.80                             | 10.30        | 43.10                | 55.30         | -12.20       |
| 0.163        | QP                           | 42.80                             | 10.30        | 53.10                | 65.30         | -12.20       |
| 0.167        | Average                      | 28.00                             | 10.30        | 38.30                | 55.12         | -16.82       |
| 0.167        | QP                           | 38.00                             | 10.30        | 48.30                | 65.12         | -16.82       |
| 0.178        | Average                      | 28.60                             | 10.30        | 38.90                | 54.59         | -15.69       |
| 0.178        | QP                           | 38.70                             | 10.30        | 49.00                | 64.59         | -15.59       |
| 0.182        | Average                      | 28.90                             | 10.30        | 39.20                | 54.42         | -15.22       |
| 0.182        | QP                           | 38.40                             | 10.30        | 48.70                | 64.42         | -15.72       |

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Report Number :E2/2022/10046

Test Site :Conduction C

Test Mode :NFC

Test Date :2022-02-16

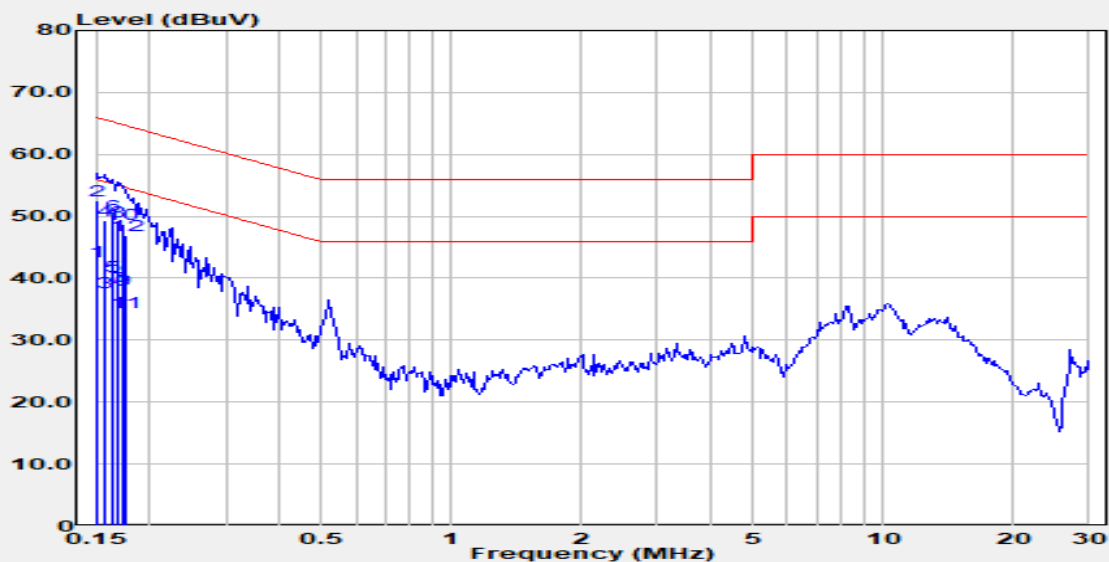
Power :120V/60Hz

Temp./Humi. :21/59

Probe :N

Engineer :Andy Wang

Note: : TPN-CA10



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBuV | Factor<br>dB | Actual<br>FS<br>dBuV | Limit<br>dBuV | Margin<br>dB |
|--------------|------------------------------|-----------------------------------|--------------|----------------------|---------------|--------------|
| 0.152        | Average                      | 32.40                             | 10.31        | 42.71                | 55.91         | -13.20       |
| 0.152        | QP                           | 42.20                             | 10.31        | 52.51                | 65.91         | -13.40       |
| 0.158        | Average                      | 27.30                             | 10.31        | 37.61                | 55.56         | -17.95       |
| 0.158        | QP                           | 39.00                             | 10.31        | 49.31                | 65.56         | -16.25       |
| 0.163        | Average                      | 30.00                             | 10.31        | 40.31                | 55.30         | -14.99       |
| 0.163        | QP                           | 39.80                             | 10.31        | 50.11                | 65.30         | -15.19       |
| 0.169        | Average                      | 28.10                             | 10.31        | 38.41                | 55.03         | -16.63       |
| 0.169        | QP                           | 38.90                             | 10.31        | 49.21                | 65.03         | -15.83       |
| 0.172        | Average                      | 27.70                             | 10.31        | 38.01                | 54.86         | -16.85       |
| 0.172        | QP                           | 38.50                             | 10.31        | 48.81                | 64.86         | -16.05       |
| 0.176        | Average                      | 24.20                             | 10.30        | 34.50                | 54.68         | -20.18       |
| 0.176        | QP                           | 36.60                             | 10.30        | 46.90                | 64.68         | -17.78       |

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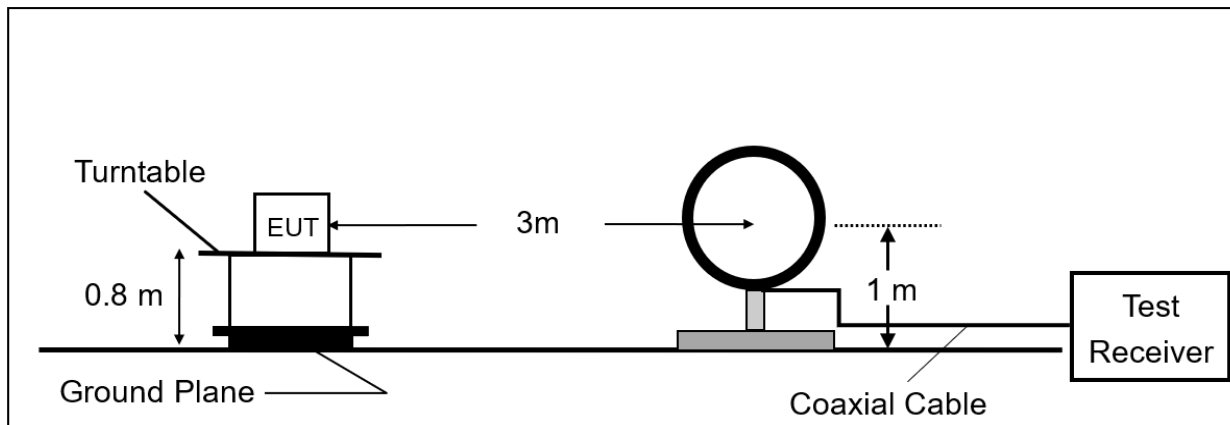
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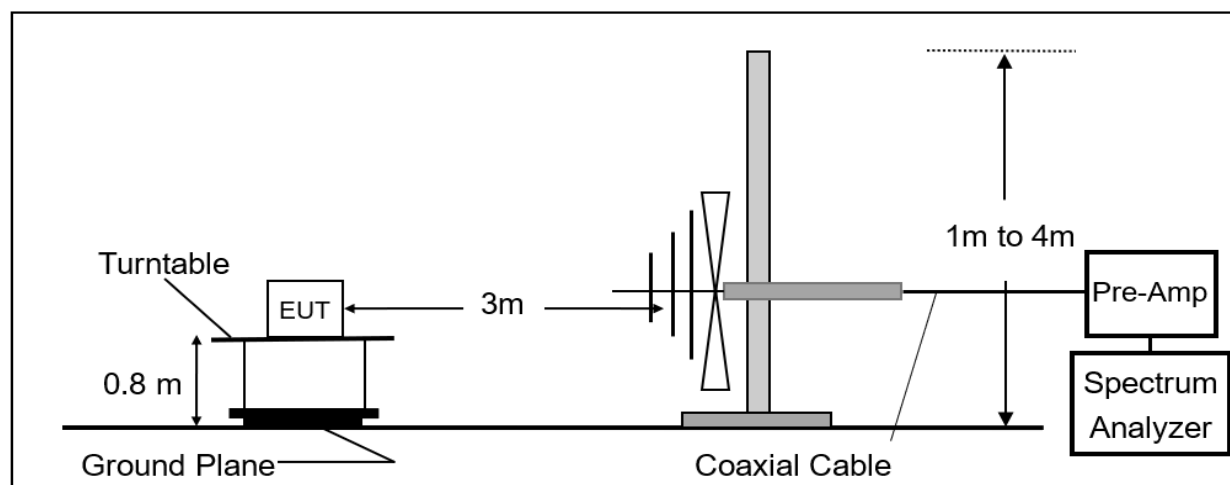
## 8 RADIATED EMISSION TEST

### 8.1 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency From 30MHz to 1000MHz.



### 8.2 Measurement Procedure

1. Configure the EUT according to ANSI C63.10.
2. The EUT was placed on a turn table which is 0.8m above ground plane and been measured in the frequency range between 0.009MHz to 30MHz and 30MHz to 1GHz.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all default test channel measured were complete.

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### 8.3 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

|       |                        |                                            |
|-------|------------------------|--------------------------------------------|
| Where | FS = Field Strength    | CL = Cable Attenuation Factor (Cable Loss) |
|       | RA = Reading Amplitude | AG = Amplifier Gain                        |
|       | AF = Antenna Factor    |                                            |

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## 8.4 Field Strength of Fundamental Emission

### 8.4.1 Applicable standard

| Rules and specifications    | CFR 47 Part 15 section 15.225(a)-(d)      |                                                    |
|-----------------------------|-------------------------------------------|----------------------------------------------------|
| Frequency of Emission (MHz) | Field Strength ( $\mu\text{V/m}$ ) at 30m | Field Strength ( $\text{dB}\mu\text{V/m}$ ) at 30m |
| 1.705~13.110                | 30                                        | 29.5                                               |
| 13.110~13.410               | 106                                       | 40.5                                               |
| 13.410~13.553               | 334                                       | 50.5                                               |
| 13.553~13.567               | 15848                                     | 84                                                 |
| 13.567~13.710               | 334                                       | 50.5                                               |
| 13.710~14.010               | 106                                       | 40.5                                               |
| 14.010~30.00                | 30                                        | 29.5                                               |

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#### 8.4.2 Distance Extrapolation Factor

##### 30m to 3m

Distance extrapolation =  $40 \cdot \log(30/3) = 40 \text{ dB}$

##### 30m to 10m

Distance extrapolation =  $40 \cdot \log(30/10) = 19.08 \text{ dB}$

##### 10m to 3m

Distance extrapolation =  $40 \cdot \log(10/3) = 20.92 \text{ dB}$

#### Note:

1. Distance extrapolation factor =  $40 \log(\text{required distance} / \text{test distance}) \text{ (dB)}$
2. The lower limit shall apply at the transition frequencies.
3. KDB 414788 D01 OATS and 3m semi-anechoic chamber Justification:  
Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. OATS and 3m SAC chamber testing had been performed and 3m SAC measured test result is the worst case test result.

Actual FS(dBμV/m) = Spectrum. Reading level(dBμV) + Factor(dB)

Below 30 MHz of Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Distance Factor (dB)

Above 30 MHz of Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre\_Amp Gain (dB)

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

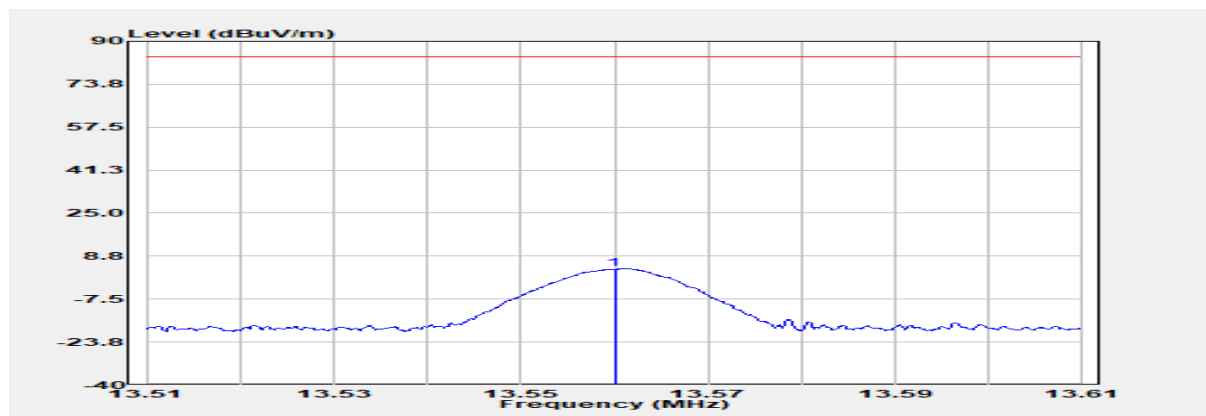
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### 8.4.3 Field Strength of Fundamental Emission Measurement Result

|                |                |              |             |
|----------------|----------------|--------------|-------------|
| Report Number  | :E2/2022/10046 | Test Site    | :SAC D      |
| Operation Mode | :NFC           | Test Date    | :2022-02-16 |
| Test Frequency | :13.56 MHz     | Temp./Humi.  | :18.9/64    |
| Test Mode      | :Main          | Antenna Pol. | :Vertical   |
| EUT Pol        | :E1 Plane      | Engineer     | :Andy Wang  |



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBuV | Factor<br>dB | Actual<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------|-----------------|--------------|
| 13.560       | Peak                         | 32.16                             | -28.24       | 3.92             | 84.00           | -80.08       |

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre\_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.

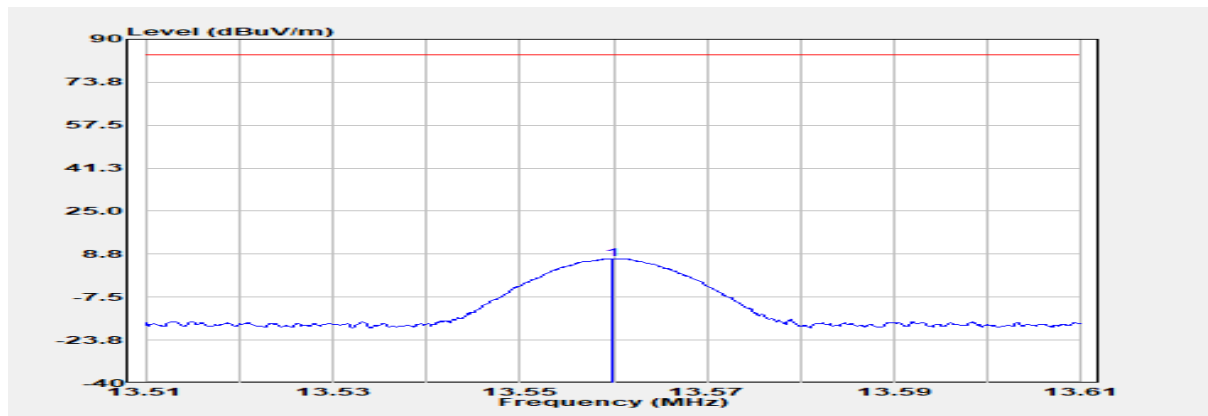
Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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|                |                |              |             |
|----------------|----------------|--------------|-------------|
| Report Number  | :E2/2022/10046 | Test Site    | :SAC D      |
| Operation Mode | :NFC           | Test Date    | :2022-02-16 |
| Test Frequency | :13.56 MHz     | Temp./Humi.  | :18.9/64    |
| Test Mode      | :Main          | Antenna Pol. | :Horizontal |
| EUT Pol        | :E1 Plane      | Engineer     | :Andy Wang  |



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBuV | Factor<br>dB | Actual<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------|-----------------|--------------|
| 13.560       | Peak                         | 35.19                             | -28.24       | 6.95             | 84.00           | -77.05       |

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre\_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.

Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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## 8.5 Radiated Spurious Emission Measurement

### 8.5.1 Standard Applicable

The field strength of any emissions appearing outside of the 13.110-14.010 MHz shall not exceed the general radiated emission limits in section 15.209 as below.

| Frequency (MHz) | Field strength ( $\mu\text{V/m}$ ) | Distance (meters) |
|-----------------|------------------------------------|-------------------|
| 0.009~0.490     | 2400/F(kHz)                        | 300               |
| 0.490~1.705     | 24000/F(kHz)                       | 30                |
| 1.705-30        | 30                                 | 30                |
| 30-88           | 100                                | 3                 |
| 88-216          | 150                                | 3                 |
| 216-960         | 200                                | 3                 |
| Above 960       | 500                                | 3                 |

**Note:**

1. Emission level in  $\text{dB}\mu\text{V/m} = 20 \log (\mu\text{V/m})$
2. Distance extrapolation factor =  $40 \log (\text{required distance/ test distance})$  (dB)
3.  $20 \cdot \log(30 \mu\text{V/m}) = 29.54 \text{ dB}\mu\text{V/m}$
4. The lower limit shall apply at the transition frequencies.
5. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.
6. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of §15.205.
7. The general radiated emission limits in §15.209 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.

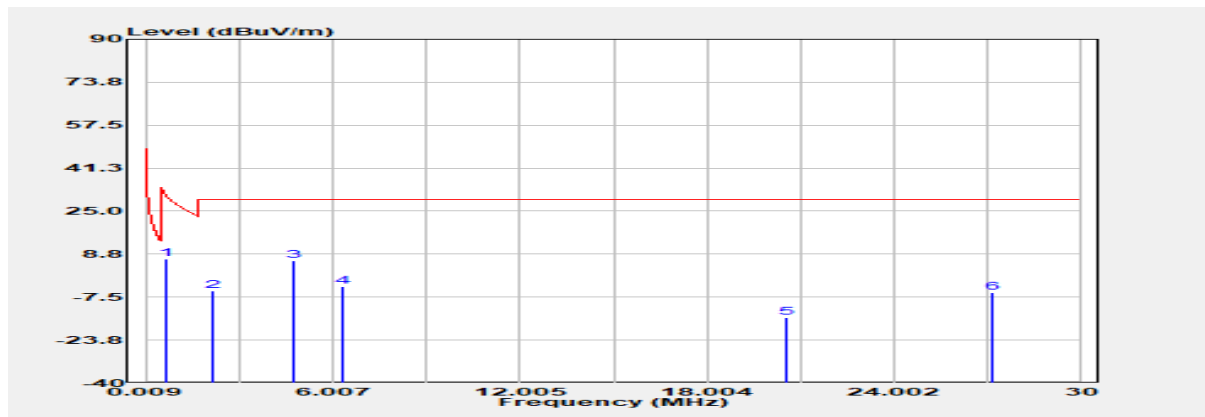
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### 8.5.2 Radiated Spurious Emission Measurement Result

|                |                |              |             |
|----------------|----------------|--------------|-------------|
| Report Number  | :E2/2022/10046 | Test Site    | :SAC D      |
| Operation Mode | :NFC           | Test Date    | :2022-02-16 |
| Test Frequency | :13.56 MHz     | Temp./Humi.  | :18.9/64    |
| Test Mode      | :TX            | Antenna Pol. | :Vertical   |
| EUT Pol        | :E1 Plane      | Engineer     | :Andy Wang  |



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBuV | Factor<br>dB | Actual<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------|-----------------|--------------|
| 0.682        | Peak                         | 35.49                             | -28.61       | 6.88             | 30.94           | -24.06       |
| 2.172        | Peak                         | 23.81                             | -28.81       | -5.00            | 29.54           | -34.54       |
| 4.767        | Peak                         | 35.16                             | -28.93       | 6.23             | 29.54           | -23.31       |
| 6.353        | Peak                         | 24.99                             | -28.57       | -3.58            | 29.54           | -33.12       |
| 20.580       | Peak                         | 13.47                             | -28.81       | -15.34           | 29.54           | -44.88       |
| 27.120       | Peak                         | 24.11                             | -30.00       | -5.89            | 29.54           | -35.43       |

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre\_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.

Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :E2/2022/10046

Test Site :SAC D

Operation Mode :NFC

Test Date :2022-02-16

Test Frequency :13.56 MHz

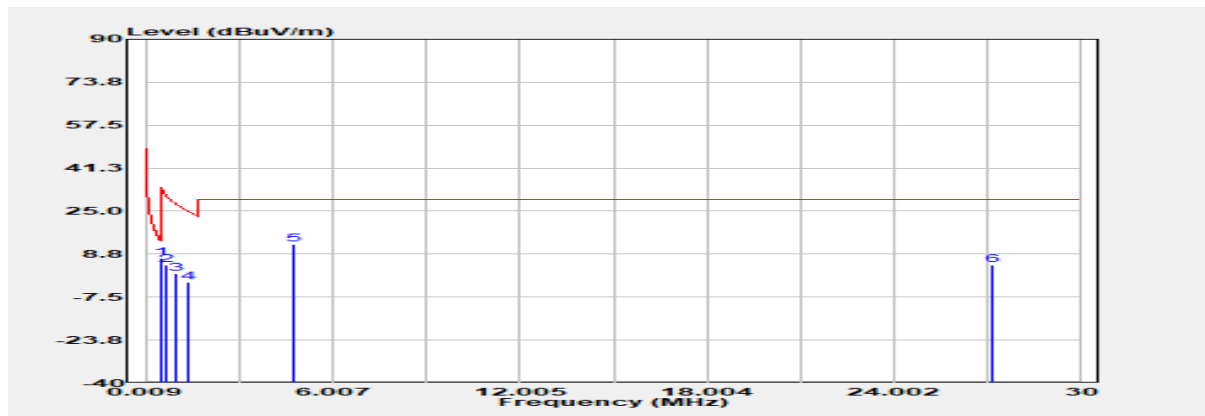
Temp./Humi. : 18.9/64

Test Mode :TX

Antenna Pol. :Horizontal

EUT Pol :E1 Plane

Engineer :Andy Wang



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBuV | Factor<br>dB | Actual<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------|-----------------|--------------|
| 0.538        | Peak                         | 35.98                             | -28.69       | 7.29             | 33.00           | -25.71       |
| 0.682        | Peak                         | 33.18                             | -28.61       | 4.57             | 30.94           | -26.37       |
| 1.018        | Peak                         | 29.81                             | -28.49       | 1.32             | 27.45           | -26.13       |
| 1.403        | Peak                         | 26.87                             | -28.63       | -1.75            | 24.66           | -26.42       |
| 4.767        | Peak                         | 41.38                             | -28.93       | 12.46            | 29.54           | -17.08       |
| 27.120       | Peak                         | 34.71                             | -30.00       | 4.70             | 29.54           | -24.84       |

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – Pre\_Amplifier Gain – distance factor

Test distance= 3m

For Actual level and limit:

Field strength (dBuV/m) at 300m, within the band 9 kHz - 490 kHz.

Field strength (dBuV/m) at 30m, within the band 490 kHz - 30 MHz.

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Report Number :E2/2022/10046

Test Site :SAC D

Operation Mode :NFC

Test Date :2022-02-16

Test Frequency :13.56 MHz

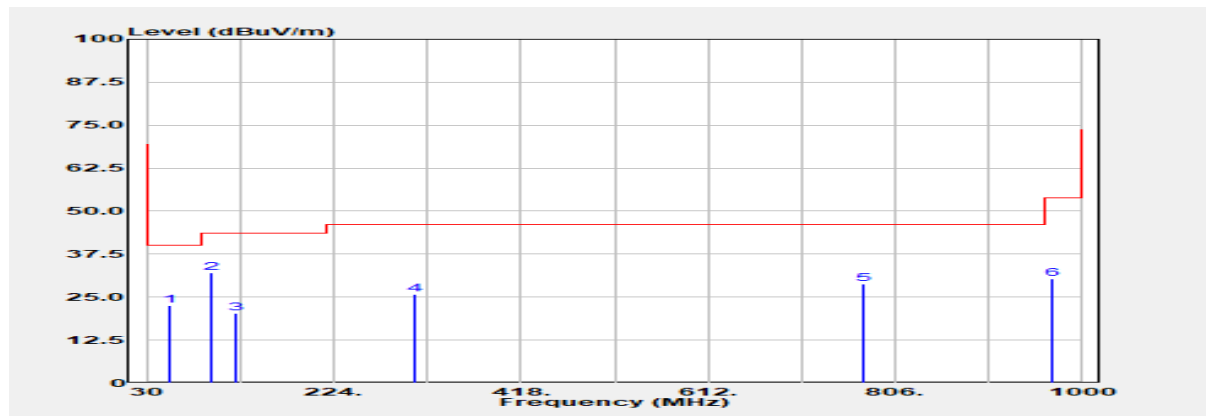
Temp./Humi. :18.9/64

Test Mode :TX

Antenna Pol. :Vertical

EUT Pol :E1 Plane

Engineer :Andy Wang



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Margin<br>dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 54.250       | Peak                         | 40.03                             | -17.48       | 22.55                  | 40.00                  | -17.45       |
| 97.900       | Peak                         | 53.83                             | -21.81       | 32.02                  | 43.50                  | -11.48       |
| 123.120      | Peak                         | 39.52                             | -19.17       | 20.36                  | 43.50                  | -23.14       |
| 308.390      | Peak                         | 41.52                             | -15.70       | 25.82                  | 46.00                  | -20.18       |
| 773.020      | Peak                         | 35.47                             | -6.58        | 28.89                  | 46.00                  | -17.11       |
| 967.990      | Peak                         | 34.70                             | -4.48        | 30.23                  | 54.00                  | -23.77       |

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Report Number :E2/2022/10046

Test Site :SAC D

Operation Mode :NFC

Test Date :2022-02-16

Test Frequency :13.56 MHz

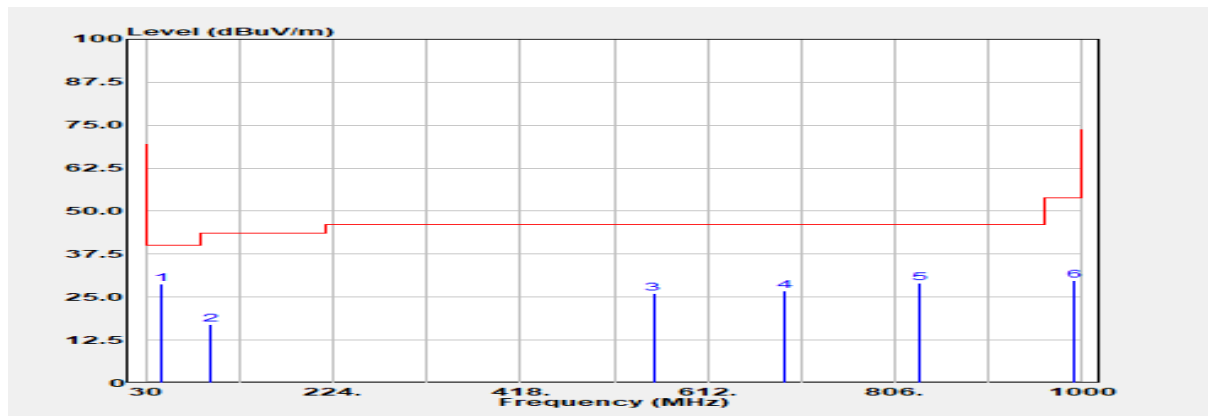
Temp./Humi. :18.9/64

Test Mode :TX

Antenna Pol. :Horizontal

EUT Pol :E1 Plane

Engineer :Andy Wang



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBμV | Factor<br>dB | Actual<br>FS<br>dBμV/m | Limit<br>@3m<br>dBμV/m | Margin<br>dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 45.520       | Peak                         | 46.49                             | -17.76       | 28.73                  | 40.00                  | -11.27       |
| 97.900       | Peak                         | 38.96                             | -21.81       | 17.15                  | 43.50                  | -26.35       |
| 555.740      | Peak                         | 36.47                             | -10.47       | 26.00                  | 46.00                  | -20.00       |
| 691.540      | Peak                         | 35.93                             | -9.15        | 26.78                  | 46.00                  | -19.22       |
| 831.220      | Peak                         | 35.48                             | -6.30        | 29.18                  | 46.00                  | -16.82       |
| 990.300      | Peak                         | 34.52                             | -4.61        | 29.91                  | 54.00                  | -24.09       |

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## 9 FREQUENCY STABILITY

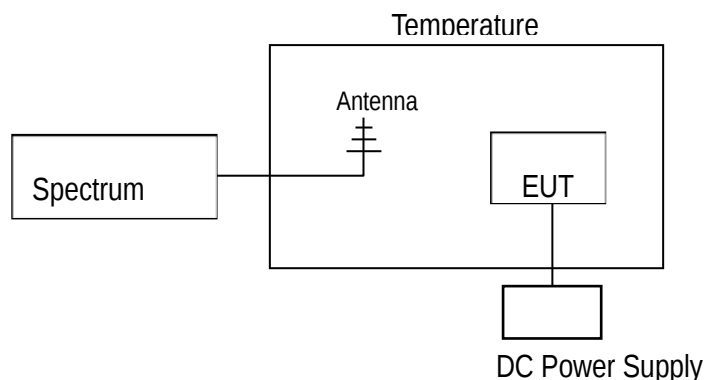
### 9.1 Applicable Standard

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $+50$  degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### 9.2 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 10kHz, Span =100kHz.
4. Set SPA Max hold. Mark peak.

### 9.3 Test SET-UP (Block Diagram of Configuration)



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## 9.4 Measurement Results

## Startup

## A. Temperature Variation

| Power Supply | Environment      | Frequency | Delta (kHz) | Limit (kHz) |
|--------------|------------------|-----------|-------------|-------------|
| Vdc          | Temperature (°C) | (MHz)     |             |             |
| 2            | -20              | 13.55959  | -0.41000    | +/- 1.356   |
| 2            | -10              | 13.55942  | -0.58000    | +/- 1.356   |
| 2            | 0                | 13.55945  | -0.55000    | +/- 1.356   |
| 2            | 10               | 13.55929  | -0.71000    | +/- 1.356   |
| 2            | 20               | 13.5603   | 0.30000     | +/- 1.356   |
| 2            | 30               | 13.55981  | -0.19000    | +/- 1.356   |
| 2            | 40               | 13.55938  | -0.62000    | +/- 1.356   |
| 2            | 50               | 13.55996  | -0.04000    | +/- 1.356   |

## B. Supply Voltage Variation

| Power Supply | Environment      | Frequency | Delta (kHz) | Limit (kHz) |
|--------------|------------------|-----------|-------------|-------------|
| Vdc          | Temperature (°C) | (MHz)     |             |             |
| 2.3          | 20               | 13.55939  | -0.61000    | +/- 1.356   |
| 2            | 20               | 13.5603   | 0.30000     | +/- 1.356   |
| 1.7          | 20               | 13.55936  | -0.64000    | +/- 1.356   |

## 2 minutes

## A. Temperature Variation

| Power Supply | Environment      | Frequency | Delta (kHz) | Limit (kHz) |
|--------------|------------------|-----------|-------------|-------------|
| Vdc          | Temperature (°C) | (MHz)     |             |             |
| 2            | -20              | 13.5593   | -0.70000    | +/- 1.356   |
| 2            | -10              | 13.55939  | -0.61000    | +/- 1.356   |
| 2            | 0                | 13.55973  | -0.27000    | +/- 1.356   |
| 2            | 10               | 13.55971  | -0.29000    | +/- 1.356   |
| 2            | 20               | 13.55994  | -0.06000    | +/- 1.356   |
| 2            | 30               | 13.55951  | -0.49000    | +/- 1.356   |
| 2            | 40               | 13.55976  | -0.24000    | +/- 1.356   |
| 2            | 50               | 13.55969  | -0.31000    | +/- 1.356   |

## B. Supply Voltage Variation

| Power Supply | Environment      | Frequency | Delta (kHz) | Limit (kHz) |
|--------------|------------------|-----------|-------------|-------------|
| Vdc          | Temperature (°C) | (MHz)     |             |             |
| 2.3          | 20               | 13.55969  | -0.31000    | +/- 1.356   |
| 2            | 20               | 13.55994  | -0.06000    | +/- 1.356   |
| 1.7          | 20               | 13.55936  | -0.64000    | +/- 1.356   |

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**5 minutes****A. Temperature Variation**

| Power Supply | Environment      | Frequency | Delta (kHz) | Limit (kHz) |
|--------------|------------------|-----------|-------------|-------------|
| Vdc          | Temperature (°C) | (MHz)     |             |             |
| 2            | -20              | 13.55936  | -0.64000    | +/- 1.356   |
| 2            | -10              | 13.5594   | -0.60000    | +/- 1.356   |
| 2            | 0                | 13.55937  | -0.63000    | +/- 1.356   |
| 2            | 10               | 13.55941  | -0.59000    | +/- 1.356   |
| 2            | 20               | 13.55948  | -0.52000    | +/- 1.356   |
| 2            | 30               | 13.5593   | -0.70000    | +/- 1.356   |
| 2            | 40               | 13.55939  | -0.61000    | +/- 1.356   |
| 2            | 50               | 13.55942  | -0.58000    | +/- 1.356   |

**B. Supply Voltage Variation**

| Power Supply | Environment      | Frequency | Delta (kHz) | Limit (kHz) |
|--------------|------------------|-----------|-------------|-------------|
| Vdc          | Temperature (°C) | (MHz)     |             |             |
| 2.3          | 20               | 13.55933  | -0.67000    | +/- 1.356   |
| 2            | 20               | 13.55948  | -0.52000    | +/- 1.356   |
| 1.7          | 20               | 13.55938  | -0.62000    | +/- 1.356   |

**10 minutes****A. Temperature Variation**

| Power Supply | Environment      | Frequency | Delta (kHz) | Limit (kHz) |
|--------------|------------------|-----------|-------------|-------------|
| Vdc          | Temperature (°C) | (MHz)     |             |             |
| 2            | -20              | 13.55958  | -0.42000    | +/- 1.356   |
| 2            | -10              | 13.55971  | -0.29000    | +/- 1.356   |
| 2            | 0                | 13.55937  | -0.63000    | +/- 1.356   |
| 2            | 10               | 13.55961  | -0.39000    | +/- 1.356   |
| 2            | 20               | 13.55993  | -0.07000    | +/- 1.356   |
| 2            | 30               | 13.55973  | -0.27000    | +/- 1.356   |
| 2            | 40               | 13.55948  | -0.52000    | +/- 1.356   |
| 2            | 50               | 13.55921  | -0.79000    | +/- 1.356   |

**B. Supply Voltage Variation**

| Power Supply | Environment      | Frequency | Delta (kHz) | Limit (kHz) |
|--------------|------------------|-----------|-------------|-------------|
| Vdc          | Temperature (°C) | (MHz)     |             |             |
| 2.3          | 20               | 13.55925  | -0.75000    | +/- 1.356   |
| 2            | 20               | 13.55993  | -0.07000    | +/- 1.356   |
| 1.7          | 20               | 13.55931  | -0.69000    | +/- 1.356   |

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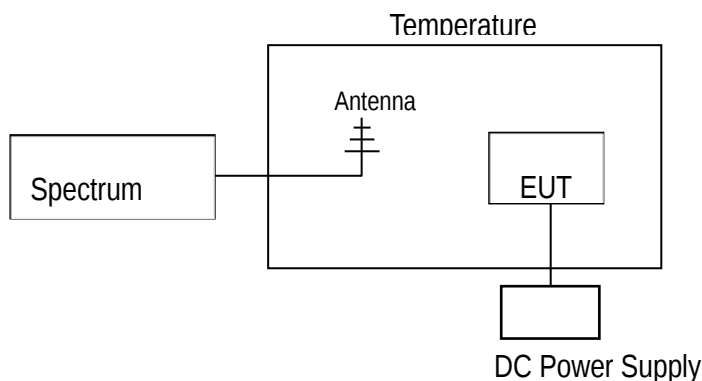
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## 10 EMISSION BANDWIDTH MEASUREMENT

### 10.1 Applicable Standard:

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

### 10.2 Test Set-up



### 10.3 Measurement Procedure

1. Placed the EUT on the testing table.
2. Set the EUT under transmission condition continuously at specific channel frequency.
3. The resolution bandwidth of 1 kHz and the video bandwidth of 3 kHz were used.
4. Measured the spectrum width with power higher than 20dB below carrier.

### 10.4 Measurement Result

|               |
|---------------|
| 20dB BW (kHz) |
| 2.697         |

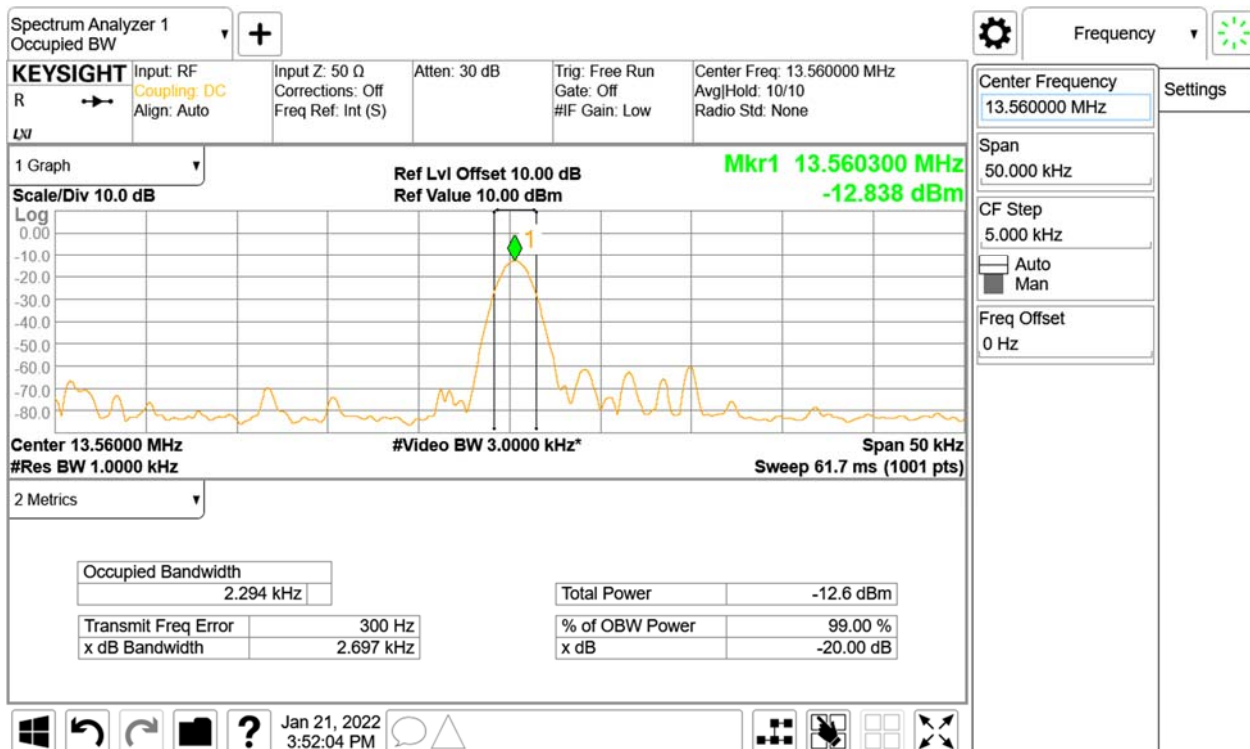
| Opration range | Frequency (MHz) | Limit (MHz) |
|----------------|-----------------|-------------|
| Low            | 13.55915        | >13.11      |
| High           | 13.56150        | <14.01      |

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## Bandwidth

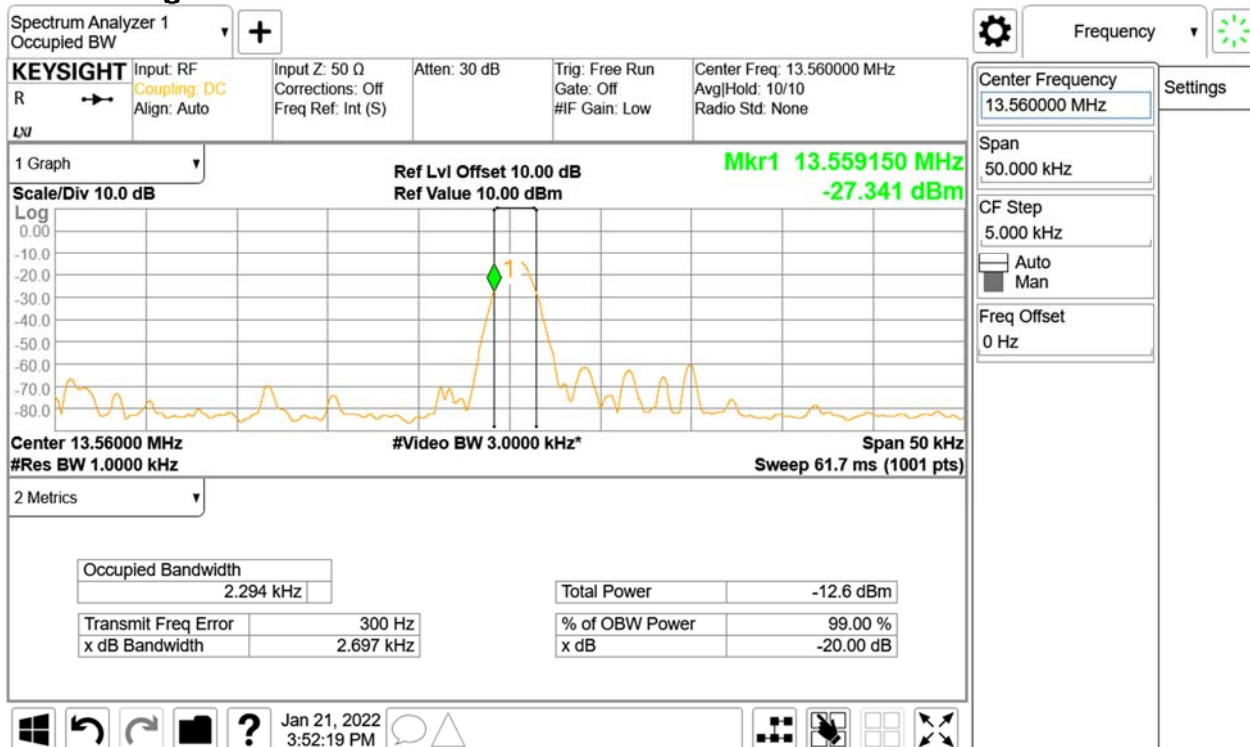


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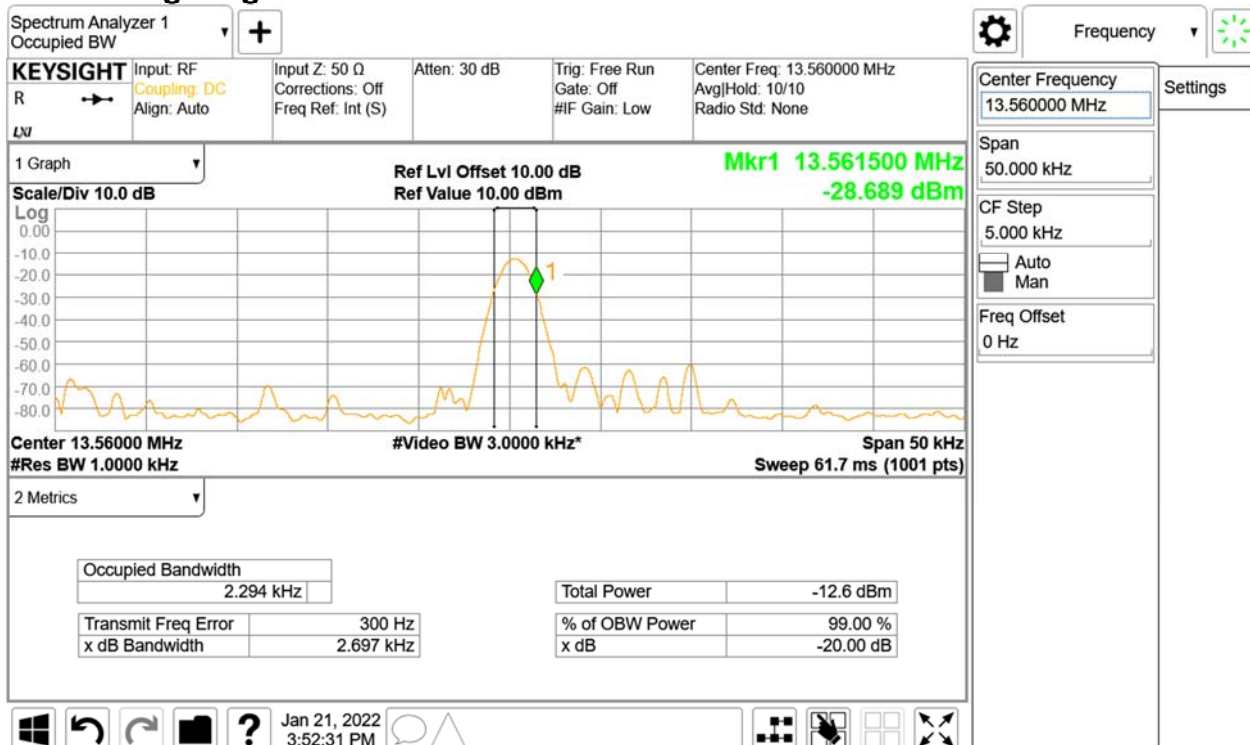
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## Operation range Left



## Operation range Right



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## 11 ANTENNA REQUIREMENT

### 11.1 Standard Applicable:

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 use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

### 11.2 Antenna Connected Construction:

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

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## 12 PHOTOGRAPHS OF EUT

Please refer to the attached file (EUT Photo)

*~ End of Report ~*

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