
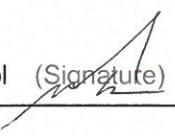



# TEST REPORT

|   |  |  |
|---|--|--|
| <b>KOSTEC Co., Ltd.</b><br>28(175-20, Annyeong-dong) 406-gil sejaro,<br>Hwaseong-si, Gyeonggi-do, Korea<br>Tel:031-222-4251, Fax:031-222-4252   | Report No.: KST-FCR-190004   |  <b>KOSTEC Co., Ltd.</b><br><a href="http://www.kostec.org">http://www.kostec.org</a> |
| <p>1. Applicant</p> <ul style="list-style-type: none"><li>• Name : Dogtra Co., Ltd.</li><li>• Address : #715-2(146BL-3L) Gojan-dong, Namdong-gu, Incheon, Korea</li></ul> <p>2. Test Item</p> <ul style="list-style-type: none"><li>• Product Name: DOG TRAINING DEVICE</li><li>• Model Name: 280C</li><li>• Brand: None</li><li>• FCC ID: SWN-280C</li></ul> <p>3. Manufacturer</p> <ul style="list-style-type: none"><li>• Name : Dogtra Co., Ltd.</li><li>• Address : #715-2(146BL-3L) Gojan-dong, Namdong-gu, Incheon, Korea</li></ul> <p>4. Date of Test : 2019. 03. 18. ~ 2019. 03. 19.</p> <p style="padding-left: 200px;">FCC CFR 47, Part 15. Subpart C-15.227</p> <p>5. Test Method Used : RSS-310 Issue 4<br/>RSS-GEN Issue 5<br/>ANSI C63.10:2013</p> <p>6. Test Result : Compliance</p> <p>7. Note: Request for family model name by manufacturer. Family model name: 282C</p> |  |  |
| <p><b>Supplementary Information</b></p> <p>The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with measurement procedures specified in <u>ANSI C 63.10-2013</u>.</p> <p>We attest to the accuracy of data and all measurements reported herein were performed by KOSTEC Co., Ltd. and were made under Chief Engineer's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.</p>  |  |  |
| <p>The results shown in this test report refer only to the sample(s) tested unless otherwise stated.<br/>This test report is not related to KOLAS accreditation.</p>  |  |  |
| Affirmation   | Tested by<br>Name : Choo, Kwang-Yeol (Signature)  | Technical Manager<br>Name : Park, Gyeong-Hyeon (Signature)                          |
| <p>2019. 03. 29.</p>  |  |  |
| <p><b>KOSTEC Co., Ltd.</b></p>  |  |  |

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## 1. GENERAL INFORMATION

### 1.1 Test Facility

#### Test laboratory and address

KOSTEC Co., Ltd.

128(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

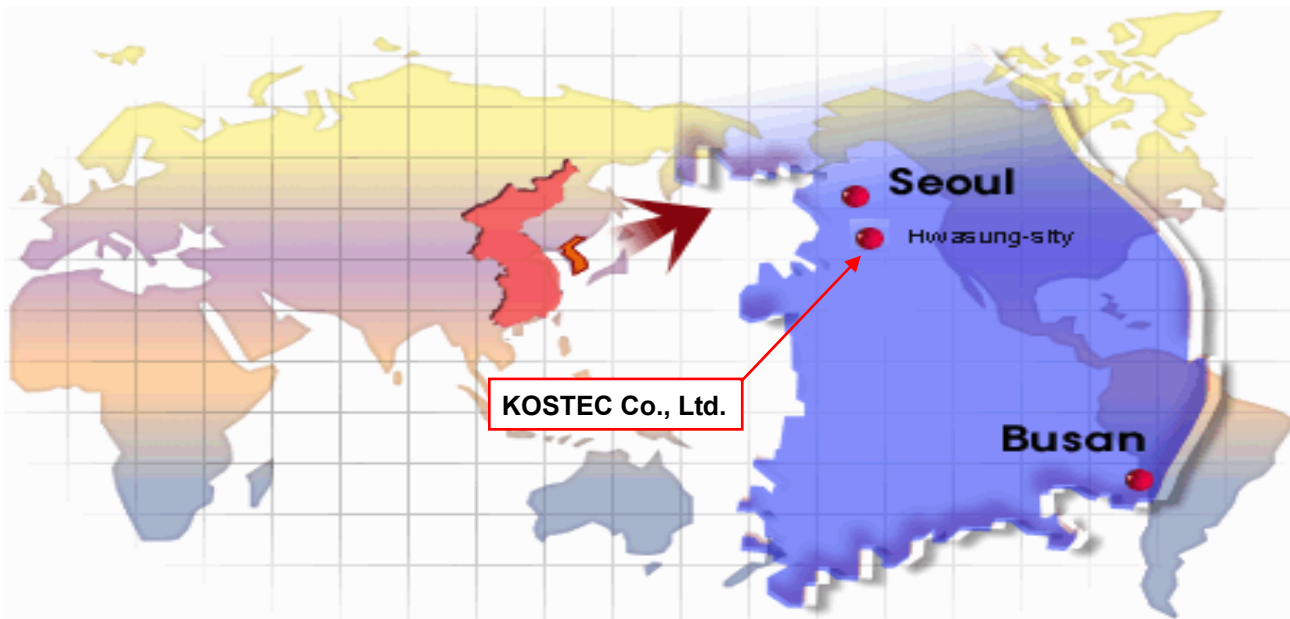
#### Registration information

KOLAS No. : 232

FCC Designation No. : KR0041

IC Registration Site No. : 8305A-1

### 1.2 Location



### 1.3 Revision History of test report

| Rev. | Revisions     | Effect page | Reviewed           | Date          |
|------|---------------|-------------|--------------------|---------------|
| -    | Initial issue | All         | Gyeong Hyeon, Park | 2019. 03. 29. |
|      |               |             |                    |               |

## 2. EQUIPMENT DESCRIPTION

The product specification described herein was declared by manufacturer. And refer to user's manual for the details.

|                                |  |
|--------------------------------|--|
| Equipment Name                 | DOG TRAINING DEVICE  |
| Model No                       | 280C   |
| Family model name              | 282C   |
| Usage                          | DOG TRAINING DEVICE  |
| Serial Number                  | Proto type   |
| Modulation type                | FSK  |
| Emission Type                  | F1D  |
| Operated Frequency             | 27.195 MHz   |
| Max fundamental field strength | 70.62 dB $\mu$ V/m   |
| Channel Number                 | 1  |
| Operation temperature          | -20 °C ~ 55 °C   |
| Power Source                   | DC 3.7 V Rechargeable Lithium-Polymer Battery  |
| Antenna Description            | Special screw type, Monopole Antenna, gain : 0 dBi   |
| Remark                         | <ol style="list-style-type: none"> <li>1. The device was operating at its maximum output power for all measurements.</li> <li>2. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case (X) is shown in the report.</li> <li>3. The above DUT's information was declared by manufacturer. Please refer to the specifications or user manual for more detailed description.</li> </ol> |
| FCC ID                         | SWN-280C   |

### 3. SYSTEM CONFIGURATION FOR TEST

#### 3.1 Characteristics of equipment

Dog training device.

#### 3.2 Used peripherals list

| Description | Model No. | Serial No. | Manufacture | Remark |
|-------------|-----------|------------|-------------|--------|
|             |           |            |             |        |
|             |           |            |             |        |

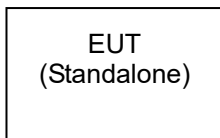
#### 3.3 Product Modification

N/A

#### 3.4 Operating Mode

Constantly transmitting with a modulated carrier at maximum power.

#### 3.5 Test Setup of EUT



### 3.7 Used Test Equipment List

| No. | Instrument                    | Model        | S/N          | Manufacturer               | Due to cal date | Cal interval | used                                |
|-----|-------------------------------|--------------|--------------|----------------------------|-----------------|--------------|-------------------------------------|
| 1   | T & H Chamber                 | PL-3J        | 15003623     | ESPEC                      | 2019.11.12      | 1 year       | <input type="checkbox"/>            |
| 2   | T & H Chamber                 | SH-662       | 93000067     | ESPEC CORP                 | 2019.09.28      | 1 year       | <input type="checkbox"/>            |
| 3   | Spectrum Analyzer             | 8563EC       | 3046A00527   | Agilent Technology         | 2020.01.25      | 1 year       | <input type="checkbox"/>            |
| 4   | Signal Analyzer               | FSV13        | 101247       | Rohde & Schwarz            | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 5   | Spectrum Analyzer             | FSV30        | 20-353063    | Rohde& Schwarz             | 2020.01.25      | 1 year       | <input type="checkbox"/>            |
| 6   | Signal Analyzer               | N9010A       | MY56070441   | Agilent Technologies       | 2019.05.25      | 1 year       | <input checked="" type="checkbox"/> |
| 7   | EMI Test Receiver             | ESCI7        | 100823       | Rohde& Schwarz             | 2020.01.22      | 1 year       | <input checked="" type="checkbox"/> |
| 8   | EMI Test Receiver             | ESI          | 837514/004   | Rohde& Schwarz             | 2019.09.03      | 1 year       | <input type="checkbox"/>            |
| 9   | Vector Signal Analyzer        | 89441A       | 3416A02620   | Agilent Technology         | 2020.01.25      | 1 year       | <input type="checkbox"/>            |
| 10  | Network Analyzer              | 8753ES       | US39172348   | AGILENT                    | 2019.09.03      | 1 year       | <input type="checkbox"/>            |
| 11  | EPM Series Power meter        | E4418B       | GB39512547   | Agilent Technology         | 2020.01.23      | 1 year       | <input type="checkbox"/>            |
| 12  | RF Power Sensor               | E9300A       | MY41496631   | Agilent Technology         | 2020.01.23      | 1 year       | <input type="checkbox"/>            |
| 13  | Microwave Frequency Counter   | 5352B        | 2908A00480   | Agilent Technology         | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 14  | Audio Analyzer                | 8903B        | 3514A16919   | Agilent Technology         | 2020.01.23      | 1 year       | <input type="checkbox"/>            |
| 15  | Audio Telephone Analyzer      | DD-5601CID   | 520010281    | CREDIX                     | 2020.01.23      | 1 year       | <input type="checkbox"/>            |
| 16  | Modulation Analyzer           | 8901A        | 3041A0576    | H.P                        | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 17  | Digital storage Oscilloscope  | TDS3052      | B015962      | Tektronix                  | 2019.09.04      | 1 year       | <input type="checkbox"/>            |
| 18  | ESG-D Series Signal Generator | E4436B       | US39260458   | Agilent Technology         | 2020.01.25      | 1 year       | <input type="checkbox"/>            |
| 19  | Vector Signal Generator       | SMBV100A     | 257557       | Rohde & Schwarz            | 2020.01.25      | 1 year       | <input type="checkbox"/>            |
| 20  | GNSS Signal Generator         | TC-2800A     | 2800A000494  | TESCOM CO., LTD.           | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 21  | Signal Generator              | SMB100A      | 179628       | Rohde & Schwarz            | 2019.05.09      | 1 year       | <input type="checkbox"/>            |
| 22  | SLIDAC                        | None         | 0207-4       | Myoung sung Ele.           | 2020.01.23      | 1 year       | <input type="checkbox"/>            |
| 23  | DC Power supply               | DRP-5030     | 9028029      | Digital Electronic Co.,Ltd | 2020.01.23      | 1 year       | <input type="checkbox"/>            |
| 24  | DC Power supply               | E3610A       | KR24104505   | Agilent Technology         | 2020.01.23      | 1 year       | <input type="checkbox"/>            |
| 25  | DC Power supply               | UP-3005T     | 68           | Unicon Co.,Ltd             | 2020.01.23      | 1 year       | <input type="checkbox"/>            |
| 26  | DC Power Supply               | SM 3400-D    | 114701000117 | DELTAELEKTRONIKA           | 2020.01.22      | 1 year       | <input type="checkbox"/>            |
| 27  | DC Power supply               | 6632B        | MY43004005   | Agilent Technology         | 2020.01.23      | 1 year       | <input type="checkbox"/>            |
| 28  | DC Power Supply               | 6632B        | MY43004137   | Agilent Technology         | 2020.01.23      | 1 year       | <input checked="" type="checkbox"/> |
| 29  | Termination                   | 1433-3       | LM718        | WEINSCHEL                  | 2019.07.09      | 1 year       | <input type="checkbox"/>            |
| 30  | Termination                   | 1432-3       | QR946        | AEROFLEX/WEINSCHEL         | 2019.07.09      | 1 year       | <input checked="" type="checkbox"/> |
| 31  | Attenuator                    | 24-30-34     | BX5630       | Aeroflex / Weinschel       | 2019.12.19      | 1 year       | <input type="checkbox"/>            |
| 32  | Attenuator                    | 8498A        | 3318A09485   | HP                         | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 33  | Step Attenuator               | 8494B        | 3308A32809   | HP                         | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 34  | RF Step Attenuator            | RSP          | 100091       | Rohde & Schwarz            | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 35  | Attenuator                    | 18B50W-20F   | 64671        | INMET                      | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 36  | Attenuator                    | 10 dB        | 1            | Rohde & Schwarz            | 2019.05.04      | 1 year       | <input type="checkbox"/>            |
| 37  | Attenuator                    | 10 dB        | 2            | Rohde & Schwarz            | 2019.05.04      | 1 year       | <input type="checkbox"/>            |
| 38  | Attenuator                    | 10 dB        | 3            | Rohde & Schwarz            | 2019.05.04      | 1 year       | <input type="checkbox"/>            |
| 39  | Attenuator                    | 10 dB        | 4            | Rohde & Schwarz            | 2019.05.04      | 1 year       | <input type="checkbox"/>            |
| 40  | Attenuator                    | 54A-10       | 74564        | WEINSCHEL                  | 2019.09.04      | 1 year       | <input type="checkbox"/>            |
| 41  | Attenuator                    | 56-10        | 66920        | WEINSCHEL                  | 2019.05.09      | 1 year       | <input type="checkbox"/>            |
| 42  | Attenuator                    | 48-20-11     | BV2658       | Aeroflex/Weinschel         | 2019.08.06      | 1 year       | <input type="checkbox"/>            |
| 43  | Attenuator                    | 48-30-33-LIM | BL5350       | Weinschel Corp.            | 2019.07.09      | 1 year       | <input type="checkbox"/>            |
| 44  | Power divider                 | 11636B       | 51212        | HP                         | 2019.02.01      | 1 year       | <input type="checkbox"/>            |
| 45  | 3Way Power divider            | KPDSU3W      | 00070365     | KMW                        | 2019.09.03      | 1 year       | <input type="checkbox"/>            |
| 46  | 4Way Power divider            | 70052651     | 173834       | KRYTAR                     | 2019.02.01      | 1 year       | <input type="checkbox"/>            |
| 47  | 3Way Power divider            | 1580         | SQ361        | WEINSCHEL                  | 2019.05.09      | 1 year       | <input type="checkbox"/>            |
| 48  | OSP                           | OSP120       | 101577       | Rohde & Schwarz            | 2019.05.04      | 1 year       | <input type="checkbox"/>            |
| 49  | White noise audio filter      | ST31EQ       | 101902       | SoundTech                  | 2019.09.04      | 1 year       | <input type="checkbox"/>            |

| No. | Instrument                          | Model                            | S/N         | Manufacturer                | Due to cal date | Cal interval | used                                |
|-----|-------------------------------------|----------------------------------|-------------|-----------------------------|-----------------|--------------|-------------------------------------|
| 50  | Dual directional coupler            | 778D                             | 17693       | HEWLETT PACKARD             | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 51  | Dual directional coupler            | 772D                             | 2839A00924  | HEWLETT PACKARD             | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 52  | Band rejection filter               | 3TNF-0006                        | 26          | DOVER Tech                  | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 53  | Band rejection filter               | 3TNF-0007                        | 311         | DOVER Tech                  | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 54  | Band rejection filter               | WTR-BRF2442-84NN                 | 09020001    | WAVE TECH Co.,LTD           | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 55  | Band rejection filter               | WRCJV12-5695-5725-5825-5855-50SS | 1           | Wainwright Instruments GmbH | 2019.05.04      | 1 year       | <input type="checkbox"/>            |
| 56  | Band rejection filter               | WRCJV12-5120-5150-5350-5380-40SS | 4           | Wainwright Instruments GmbH | 2019.05.04      | 1 year       | <input type="checkbox"/>            |
| 57  | Band rejection filter               | WRCGV10-2360-2400-2500-2540-50SS | 2           | Wainwright Instruments GmbH | 2019.05.04      | 1 year       | <input type="checkbox"/>            |
| 58  | Band rejection filter               | CTF-155M-S1                      | 001         | RF One Electronics          | 2019.09.06      | 1 year       | <input type="checkbox"/>            |
| 59  | Band rejection filter               | CTF-435M-S1                      | 001         | RF One Electronics          | 2019.09.06      | 1 year       | <input type="checkbox"/>            |
| 60  | Highpass Filter                     | WHJS1100-10EF                    | 1           | WAINWRIGHT                  | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 61  | Highpass Filter                     | WHJS3000-10EF                    | 1           | WAINWRIGHT                  | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 62  | Highpass Filter                     | WHNX6-5530-7000-26500-40CC       | 2           | Wainwright Instruments GmbH | 2019.05.09      | 1 year       | <input type="checkbox"/>            |
| 63  | Highpass Filter                     | WHNX6-2370-3000-26500-40CC       | 4           | Wainwright Instruments GmbH | 2019.05.09      | 1 year       | <input type="checkbox"/>            |
| 64  | WideBand Radio Communication Tester | CMW500                           | 102276      | Rohde & Schwarz             | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 65  | Bluetooth Tester                    | TC-3000B                         | 3000B6A0166 | TESCOM CO., LTD.            | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 66  | Loop Antenna                        | 6502                             | 9203-0493   | EMCO                        | 2019.05.29      | 2 year       | <input checked="" type="checkbox"/> |
| 67  | BiconiLog Antenna                   | 3142B                            | 1745        | EMCO                        | 2020.05.10      | 2 year       | <input checked="" type="checkbox"/> |
| 68  | Biconical Antenna                   | VUBA9117                         | 9117-342    | Schwarz beck                | 2020.03.12      | 2 year       | <input type="checkbox"/>            |
| 69  | Trilog-Broadband Antenna            | VULB 9168                        | 9168-606    | SCHWARZBECK                 | 2020.09.14      | 2 year       | <input type="checkbox"/>            |
| 70  | Horn Antenna                        | 3115                             | 2996        | EMCO                        | 2020.02.14      | 2 year       | <input type="checkbox"/>            |
| 71  | Horn Antenna                        | 3115                             | 9605-4834   | EMCO                        | 2020.03.12      | 2 year       | <input type="checkbox"/>            |
| 72  | Horn Antenna                        | BBHA9170                         | 743         | SCHWARZBECK                 | 2021.01.22      | 2 year       | <input type="checkbox"/>            |
| 73  | PREAMPLIFIER(3)                     | 8449B                            | 3008A00149  | Agilent                     | 2019.09.05      | 1 year       | <input type="checkbox"/>            |
| 74  | AMPLIFIER(10)                       | TK-PA6S                          | 120009      | TESTEK                      | 2020.01.22      | 1 year       | <input checked="" type="checkbox"/> |
| 75  | AMPLIFIER                           | TK-PA18                          | 150003      | TESTEK                      | 2020.01.24      | 1 year       | <input type="checkbox"/>            |
| 76  | AMPLIFIER                           | TK-PA1840H                       | 160010-L    | TESTEK                      | 2020.01.22      | 1 year       | <input type="checkbox"/>            |
| 77  | AMPLIFIER                           | 8447D                            | 2944A07881  | H.P                         | 2020.01.24      | 1 year       | <input type="checkbox"/>            |



### 3.10 Used Test Cable List

| No. | Model                    | S/N        | Manufacturer | Specifications         | Due to cal date | Cal interval | used                                |
|-----|--------------------------|------------|--------------|------------------------|-----------------|--------------|-------------------------------------|
| 1   | SMS112-GL200sD-SMS112-1M | None       | GigaLane     | 9 kHz ~ 26.5 GHz(1 M)  | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 2   | SMS112-GL200sD-SMS112-1M | None       | GigaLane     | 9 kHz ~ 26.5 GHz(1 M)  | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 3   | SMS112-GL200sD-SMS112-1M | None       | GigaLane     | 9 kHz ~ 26.5 GHz(1 M)  | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 4   | L-502W                   | None       | CANARE       | 9 kHz ~ 3 GHz(1 M)     | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 5   | L-502W                   | None       | CANARE       | 9 kHz ~ 3 GHz(1 M)     | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 6   | L-502W                   | None       | CANARE       | 9 kHz ~ 3 GHz(1 M)     | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 7   | SUCOFLEX 126E            | MY2202/26E | SUHNER       | 9 kHz ~ 26.5 GHz(1 M)  | 2019.01.02      | 6 months     | <input checked="" type="checkbox"/> |
| 8   | SUCOFLEX 126E            | MY2203/26E | SUHNER       | 9 kHz ~ 26.5 GHz(1 M)  | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 9   | SUCOFLEX 126E            | MY2204/26E | SUHNER       | 9 kHz ~ 26.5 GHz(1 M)  | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 10  | SUCOFLEX 126E            | MY2205/26E | SUHNER       | 9 kHz ~ 26.5 GHz(1 M)  | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 11  | SUCOFLEX 126E            | MY2206/26E | SUHNER       | 9 kHz ~ 26.5 GHz(1 M)  | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 12  | SUCOFLEX 126E            | MY2207/26E | SUHNER       | 9 kHz ~ 26.5 GHz(1 M)  | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 13  | SUCOFLEX 102             | MY5433/2   | SUHNER       | 9 kHz ~ 40 GHz(1 M)    | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 14  | SUCOFLEX 102             | MY5434/2   | SUHNER       | 9 kHz ~ 40 GHz(1 M)    | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 15  | SUCOFLEX 102             | MY5435/2   | SUHNER       | 9 kHz ~ 40 GHz(1 M)    | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 16  | SUCOFLEX 102             | MY5436/2   | SUHNER       | 9 kHz ~ 40 GHz(1 M)    | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 17  | SUCOFLEX 100             | None       | SUHNER       | 9 kHz ~ 26.5 GHz(8 M)  | 2019.01.27      | 1 year       | <input checked="" type="checkbox"/> |
| 18  | SUCOFLEX 102             | 801434/2   | SUHNER       | 9 kHz ~ 40 GHz(2 M)    | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 19  | SUCOFLEX 102             | 801435/2   | SUHNER       | 9 kHz ~ 40 GHz(2 M)    | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 20  | SUCOFLEX 102             | 801436/2   | SUHNER       | 9 kHz ~ 40 GHz(2 M)    | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 21  | SUCOFLEX 102             | 801437/2   | SUHNER       | 9 kHz ~ 40 GHz(2 M)    | 2019.01.02      | 6 months     | <input type="checkbox"/>            |
| 22  | SUCOFLEX 104             | 802060/4   | SUHNER       | 9 kHz ~ 26.5 GHz(10 M) | 2019.01.02      | 6 months     | <input type="checkbox"/>            |

#### 4. SUMMARY TEST RESULTS

| Description of Test  | FCC Rule                                | IC Rule                                | Reference Clause | Used | Test Result |
|--|---|--|------------------|------|-------------|
| 20 dB Bandwidth & occupied Bandwidth   | 15.215(c)                               | RSS-GEN<br>6.7                         | Clause 5.1       | ☒    | Compliance  |
| Spurious RF radiated emissions & Field strength of fundamental   | 15.205(a) &<br>15.209(a) &<br>15.227(a) | RSS-GEN<br>8.9, 8.10<br>RSS-310<br>3.8 | Clause 5.2       | ☒    | Compliance  |
| Antenna requirement  | 15.203                                  | -                                      | Clause 5.3       | ☒    | Compliance  |
| AC Power Conducted emissions   | 15.207                                  | RSS-GEN<br>8.8                         | Clause 5.4       | ☒    | Compliance  |
| Compliance/pass : The EUT complies with the essential requirements in the standard.<br>Not Compliance : The EUT does not comply with the essential requirements in the standard.<br>N/A : The test was not applicable in the standard. |   |  |                  |      |             |

#### Procedure Reference

FCC CFR 47, Part 15. Subpart C-15.227

RSS-310 Issue 4

RSS-GEN Issue 5

ANSI C63.10:2013

## 5. MEASUREMENT RESULTS

### 5.1 20 dB Bandwidth

#### 5.1.1 Standard Applicable [FCC §15.215(c) & RSS-GEN 6.7]

(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

#### 5.1.2 Test Environment conditions

- Ambient temperature : 22 °C • Relative Humidity : (49 ~ 51) % R.H.

#### 5.1.3 Measurement Procedure

The 20 dB bandwidth is measured with a spectrum analyzer connected via a receive antenna placed near the EUT while the EUT is operating in transmission mode.

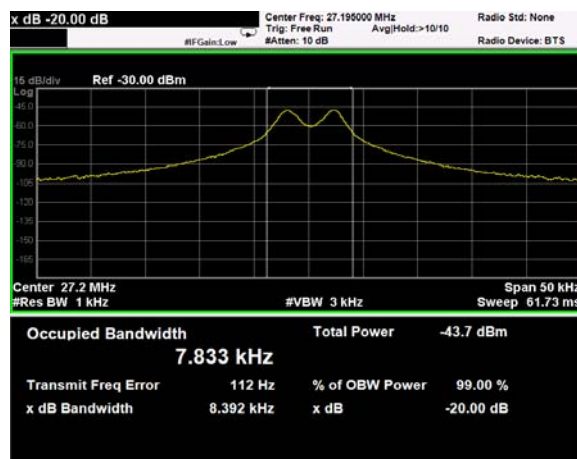
The spectrum analyzer is set to the as follows :

- Set RBW = 1 kHz.
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

#### 5.1.4 Measurement Result

| Channel | Frequency [MHz] | 20 dB Bandwidth [KHz] | 99 % Bandwidth [KHz] | Test Results                    |
|---------|-----------------|-----------------------|----------------------|---------------------------------|
| -       | 27.195          | 8.392                 | 7.833                | No limit (for information only) |

#### 5.1.5 Test Plot



## 5.2 Spurious RF Radiated emissions & Field strength of fundamental

### 5.2.1 Standard Applicable [ FCC §15.227(a) RSS-GEN 8.9, 8.10, RSS-310 3.8]

(a) The field strength of any emission within this band shall not exceed 10,000 microvolts/meter at 3 meters. The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply.

(b) The field strength of any emissions which appear outside of this band shall not exceed the general radiated emission limits in §15.209.

§15.209 and RSS-Gen limits for radiated emissions measurements (distance at 3 m)

| Frequency Band [MHz] | DISTANCE [Meters] | Limit [ $\mu\text{V}/\text{m}$ ]  | Limit [dB $\mu\text{V}/\text{m}$ ] | Detector   |
|----------------------|-------------------|---|------------------------------------|------------|
| 0.009 ~ 0.490        | 300               | 2400/F(kHz)   | 67.6-20log(F)                      | Peak       |
| 0.490 ~ 1.705        | 30                | 24000/F(kHz)  | 87.6-20log(F)                      | Peak       |
| 1.705 ~ 30.0         | 30                | 30  | 29.54                              | Peak       |
| 30 - 88              | 3                 | 100 **  | 40.00                              | Quasi peak |
| 88 - 216             | 3                 | 150 **  | 43.52                              | Quasi peak |
| 216 - 960            | 3                 | 200 **  | 46.02                              | Quasi peak |
| Above 960            | 3                 | 500   | 54.00                              | Average    |
| Above 1000           | 3                 | 74.0 dB $\mu\text{V}/\text{m}$ (Peak), 54.0 dB $\mu\text{V}/\text{m}$ (Average) |                                    |            |

\*\* fundamental emissions from intentional radiators operation 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 Section 15.231 and 15.241

§15.205. Restrict Band of Operation

| [MHz]                 | [MHz]                   | [MHz]             | [GHz]         |
|-----------------------|-------------------------|-------------------|---------------|
| 0.090 - 0.110         | 16.42 - 16.423          | 399.9 - 410       | 4.5 - 5.15    |
| 0.495 - 0.505**       | 16.694 75 - 16.695 25   | 608 - 614         | 5.35 - 5.46   |
| 2.173 5 - 2.190 5     | 16.804 25 - 16.804 75   | 960 - 1 240       | 7.25 - 7.75   |
| 4.125 - 4.128         | 25.5 - 25.67            | 1 300 - 1 427     | 8.025 - 8.    |
| 4.177 25 - 4.177 75   | 37.5 -38.25             | 1 435 - 1 626.5   | 9.0 - 9.2     |
| 4.207 25 - 4.207 75   | 73 - 74.6               | 1 645.5 - 1 646.5 | 9.3 - 9.5     |
| 6.215 - 6.218         | 74.8 - 75.2             | 1 660 - 1 710     | 10.6 - 12.7   |
| 6.267 75 - 6.268 25   | 108 - 121.94            | 1 718.8 - 1 722.2 | 13.25 - 13.4  |
| 6.311 75 - 6.312 25   | 123 - 138               | 2 200 - 2 300     | 14.47 - 14.5  |
| 8.291 - 8.294         | 149.9 - 150.05          | 2 310 - 2 390     | 15.35 - 16.2  |
| 8.362 - 8.366         | 156.524 75 - 156.525 25 | 2 483.5 - 2 500   | 17.7 - 21.4   |
| 8.376 25 - 8.38 6 75  | 156.7 - 156.9           | 2 690 - 2 900     | 22.01 - 23.12 |
| 8.414 25 - 8.414 75   | 162.012 5 - 167.17      | 3 260 - 3 267     | 23.6 - 24.0   |
| 12.29 - 12.293        | 167.72 - 173.2          | 3 332 - 3 339     | 31.2 - 31.8   |
| 12.519 75 - 12.520 25 | 240 - 285               | 3 345.8 - 3 358   | 36.43 - 36.5  |
| 12.576 75 - 12.577 25 | 322 - 335.4             | 3 600 - 4 400     | Above 38.6    |
| 13.36 - 13.41         |                         |                   |               |

\*\* Until February 1, 1999, this restricted band shall be 0.490-0.510

§RSS-GEN 8.10 Restrict Band of Operation for IC

| [MHz]                | [MHz]                   | [MHz]             | [GHz]         |
|----------------------|-------------------------|-------------------|---------------|
| 0.090 - 0.110        | 12.519 75 - 12.520 25   | 399.9 - 410       | 5.35 - 5.46   |
| 2.173 5 - 2.190 5    | 12.576 75 - 12.577 25   | 608 - 614         | 7.25 - 7.75   |
| 3.020 - 3.026        | 13.36 - 13.41           | 960 - 1 427       | 8.025 - 8.    |
| 4.125 - 4.128        | 16.42 - 16.423          | 1 435 - 1 626.5   | 9.0 - 9.2     |
| 4.177 25 - 4.177 75  | 16.694 75 - 16.695 25   | 1 645.5 - 1 646.5 | 9.3 - 9.5     |
| 4.207 25 - 4.207 75  | 16.804 25 - 16.804 75   | 1 660 - 1 710     | 10.6 - 12.7   |
| 5.677 - 5.683        | 25.5 - 25.67            | 1 718.8 - 1 722.2 | 13.25 - 13.4  |
| 6.215 - 6.218        | 37.5 - 38.25            | 2 200 - 2 300     | 14.47 - 14.5  |
| 6.26775-6.26825      | 73 - 74.6               | 2 310 - 2 390     | 15.35 - 16.2  |
| 6.31175-6.31225      | 74.8 - 75.2             | 2 655 - 2 900     | 17.7 - 21.4   |
| 8.291 - 8.294        | 108 - 138               | 3 260 - 3 267     | 22.01 - 23.12 |
| 8.362 - 8.366        | 156.524 75 - 156.525 25 | 3 332 - 3 339     | 23.6 - 24.0   |
| 8.376 25 - 8.38 6 75 | 156.7 - 156.9           | 3 345.8 - 3 358   | 31.2 - 31.8   |
| 8.414 25 - 8.414 75  | 240 - 285               | 3 500 - 4 400     | 36.43 - 36.5  |
| 12.29 - 12.293       | 322 - 335.4             | 4 500 - 5 150     | Above 38.6    |

### 5.2.2 Test Environment conditions

- Ambient temperature : 22 °C • Relative Humidity : (49 ~ 51) % R.H.

### 5.2.3 Measurement Procedure

The measurements procedure of the Spurious RF Radiated emissions is as following describe method.

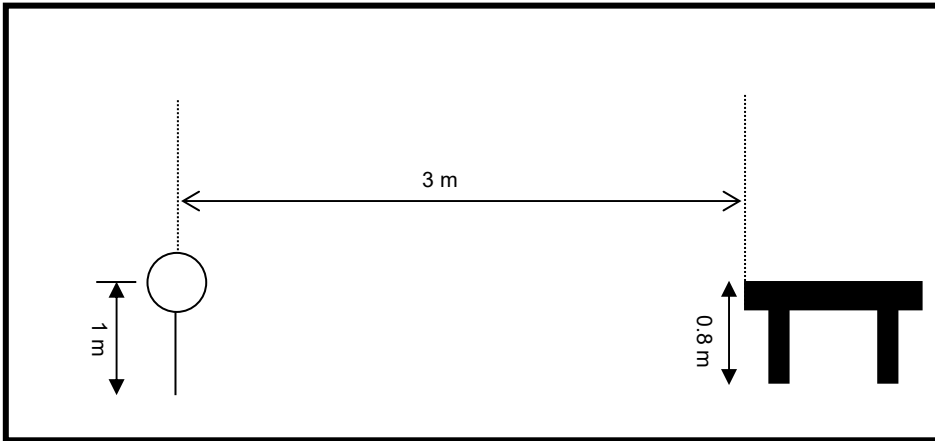
1. The EUT was placed on the top of a rotating table (0.8 meters for below 1 GHz and 1.5 meters for above 1 GHz) above the ground at a 3 meter camber. The table was rotated 360 degree to determine the position of the highest radiation.
  2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna master.
  3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both Horizontal and vertical polarizations of the antenna are set to make the measurement.
  4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotating table was turned from 0 - 360 degrees to find the maximum reading.
  5. The measuring receiver was set to peak detector and specified bandwidth with max hold function.
  6. Low, Middle and high channels were measured, and radiation measurements are performed in X, Y, Z axis positioning. And found the worst axis position and only the test worst case mode is recorded in the report.
- The measurement results are obtained as described below:  
Result(dBμV/m) = Reading(dBμV) + Antenna factor(dB/m)+ CL(dB) + other applicable factor (dB)
  - The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for RMS Average (Duty cycle < 98 %) for Average detection (AV) at frequency above 1 GHz, then the measurement results was added to a correction factor (10 log(1/duty cycle)).
  - The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
  - According to §15.33 (a)(1), Frequency range of radiated measurement is performed the tenth harmonic.

### 5.2.4 Measurement Uncertainty

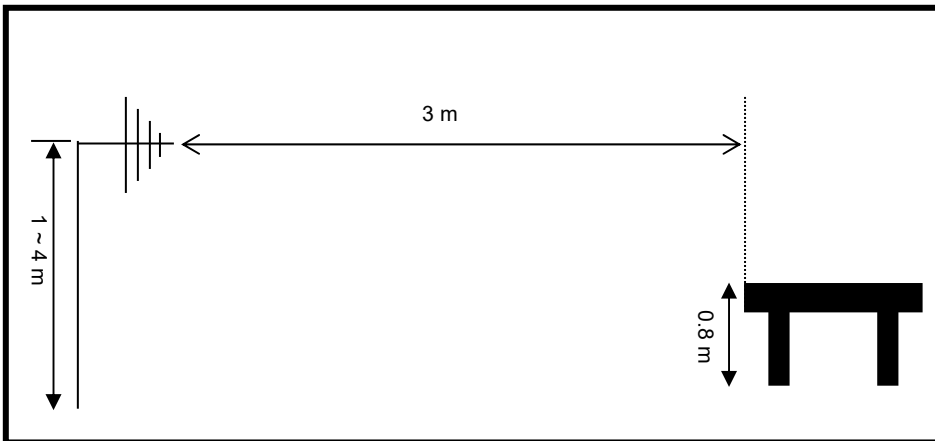
Radiated Emission measurement: Below 1 GHz: 3.56 dB (CL: Approx 95 %, k=2)  
Above 1 GHz: 3.60 dB (CL: Approx 95 %, k=2)

### 5.2.5 Test Configuration

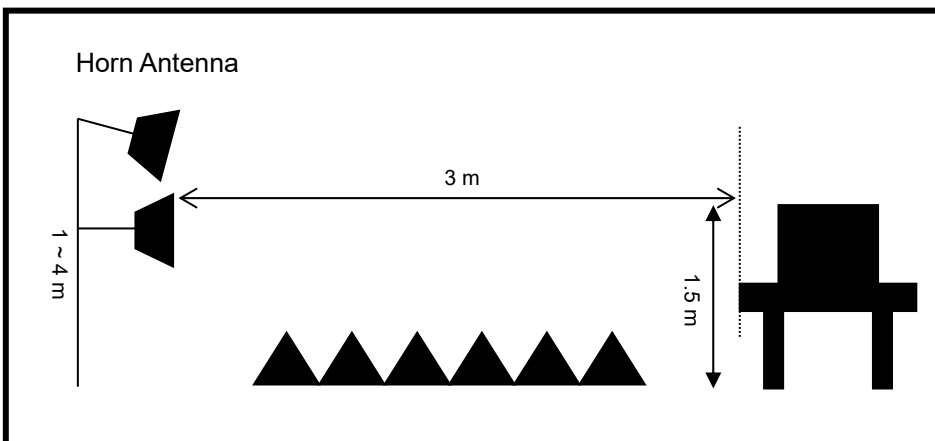
Radiated emission setup, below 30 MHz



Radiated emission setup, below 1 000 MHz



Radiated emission setup, above 1 GHz



## 5.2.6 Measurement Result

### Field strength of fundamental

| Freq. (MHz) | Detect Mode | Reading (dB $\mu$ V/m) | Table (Deg) | Antenna    |            |              | CL (dB) | Meas Result (dB $\mu$ V /m) | Limit (dB $\mu$ V/m ) | Mgn (dB) | Result     |
|-------------|-------------|------------------------|-------------|------------|------------|--------------|---------|-----------------------------|-----------------------|----------|------------|
|             |             |                        |             | Height (m) | Pol. (H/V) | Fctr. (dB/m) |         |                             |                       |          |            |
| 27.195      | PK          | 62.85                  | 170         | 1.5        | H          | 6.98         | 0.79    | 70.62                       | 100                   | 29.38    | Compliance |
| 27.195      | AV          | 61.58                  | 170         | 1.5        | H          | 6.98         | 0.79    | 69.35                       | 80                    | 10.65    | Compliance |

Note1. Above measured frequency have been done at 3 m distance and corrected according to required FCC 15.209. e)

$\therefore$  Extrapolation distance factor :  $40\log(3/30) = -40$  dB

If Measurement distance is 3 m and Mandatory requirement distance is 30 m at 30 MHz or less,

extrapolation distance factor(dB) is  $40 / \text{decade} = 40 \log_{10}(\text{MRD}/\text{MD})$

MRD is Mandatory requirement distance and MD is Measured distance

### Harmonic

| Freq. (MHz) | Reading (dB $\mu$ V/m) | Table (Deg) | Antenna    |            |              | CL (dB) | AMP (dB) | Meas Result (dB $\mu$ V /m) | Limit (dB $\mu$ V/m ) | Mgn (dB) | Result     |
|-------------|------------------------|-------------|------------|------------|--------------|---------|----------|-----------------------------|-----------------------|----------|------------|
|             |                        |             | Height (m) | Pol. (H/V) | Fctr. (dB/m) |         |          |                             |                       |          |            |
| 54.38       | 62.98                  | 180         | 1.5        | H          | 8.09         | 0.86    | -42.41   | 29.52                       | 40                    | 10.48    | Compliance |
| 54.40       | 69.09                  | 170         | 1.5        | V          | 8.08         | 0.86    | -42.41   | 35.63                       | 40                    | 4.37     | Compliance |
| 135.98      | 67.18                  | 180         | 1.0        | H          | 8.05         | 1.51    | -41.86   | 34.87                       | 43.5                  | 8.63     | Compliance |
| 135.98      | 65.32                  | 180         | 1.0        | V          | 8.05         | 1.51    | -41.86   | 33.01                       | 43.5                  | 10.49    | Compliance |
| 163.18      | 62.12                  | 210         | 1.5        | V          | 9.42         | 1.66    | -41.68   | 31.52                       | 43.5                  | 11.98    | Compliance |
| 380.75      | 58.60                  | 170         | 2.0        | H          | 16.44        | 2.77    | -40.97   | 36.84                       | 46.0                  | 9.16     | Compliance |
| 380.91      | 57.11                  | 180         | 1.5        | V          | 16.44        | 2.77    | -40.97   | 35.35                       | 46.0                  | 10.65    | Compliance |

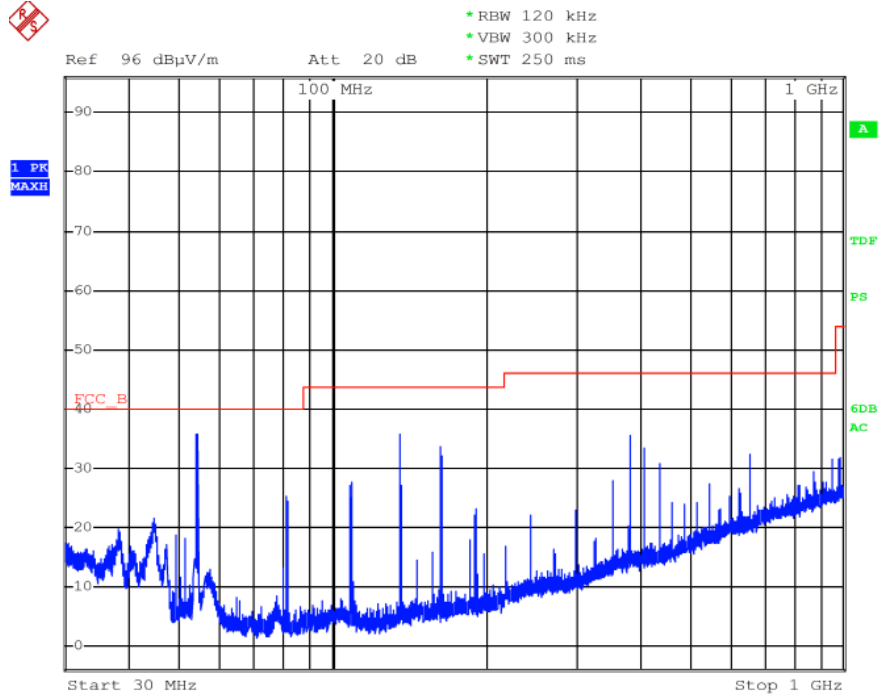
Note: quasi-peak was used.

#### ※Note

- It is not recorded on the report that the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to measured.
- For the below 30 MHz, any other signal is not detected on test receiver
- The transmitter radiated spectrum was investigated from 9 kHz to 1 GHz.

### 5.2.7 Plots

Radiated emissions (Below 1 000 MHz)



\* The worst case only.



## 5.3 Antenna requirement

### 5.3.1 Standard applicable [FCC §15.203]

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by responsible party shall be used with the device.

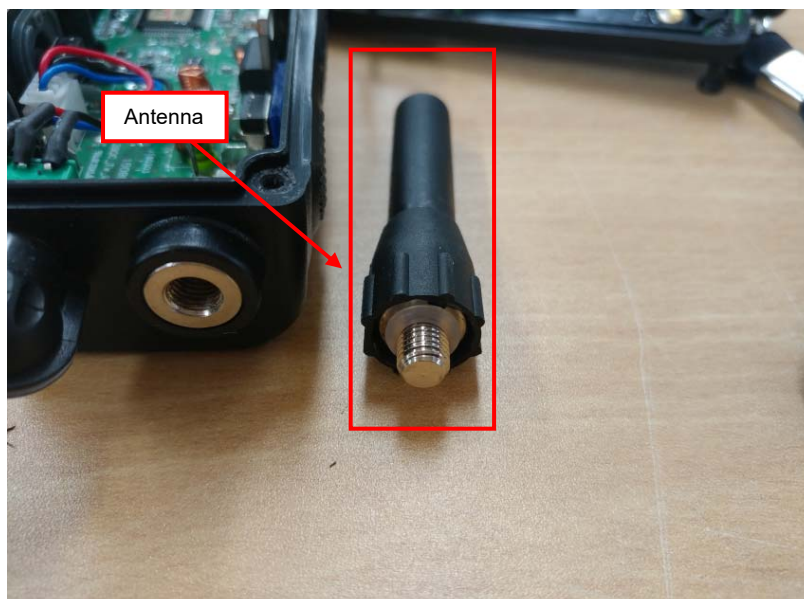
The use of a permanently attached antenna or of an antenna that user a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

The manufacturer may design the unit so that broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

### 5.3.2 Antenna details

| Frequency Band | Antenna Type     | Gain [dBi] | Results    |
|----------------|------------------|------------|------------|
| 27 MHz         | Monopole antenna | 0          | Compliance |

The EUT has a screw-type connector which is a unique antenna coupling. Therefore, The EUT meets the Part15.203 requirement.



## 5.4 AC Power Conducted emissions

### 5.4.1 Standard Applicable [ FCC §15.207(a), RSS-GEN 8.8]

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

§15.207 limits for AC line conducted emissions;

| Frequency of Emission(MHz) | Conducted Limit (dB $\mu$ V) |            |
|----------------------------|------------------------------|------------|
|                            | 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

### 5.4.2 Test Environment conditions

- Ambient temperature : 22 °C • Relative Humidity : (49 ~ 51) % R.H.

### 5.4.3 Measurement Procedure

EUT was placed on a non- metallic table height of 0.8 m above the reference ground plane. Cables connected to EUT were fixed to cause maximum emission. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the Maximum signal strength.

### 5.4.4 Used equipment

| Equipment     | Model No. | Serial No. | Manufacturer    | Next cal date | Cal interval | Used                                |
|---------------|-----------|------------|-----------------|---------------|--------------|-------------------------------------|
| Test receiver | ESCS30    | 100111     | Rohde & Schwarz | 2020. 01. 22  | 1 year       | <input checked="" type="checkbox"/> |
| Pulse Limiter | ESH3-Z2   | 100097     | Rohde & Schwarz | 2020. 01. 22  | 1 year       | <input checked="" type="checkbox"/> |
| LISN          | ESH2-Z5   | 100044     | R&S             | 2020. 01. 22  | 1 year       | <input type="checkbox"/>            |
|               | ESH3-Z5   | 100147     | R&S             | 2020. 01. 22  | 1 year       | <input checked="" type="checkbox"/> |

\*Test Program: " ESXS-K1 V2.2"

#### Measurement uncertainty

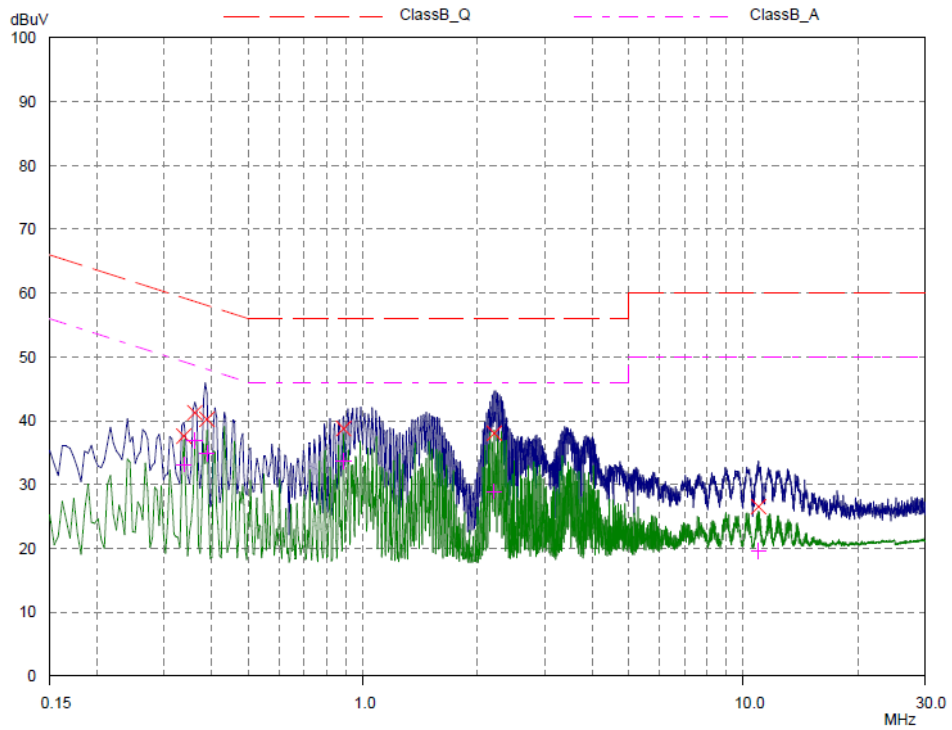
0.15 ~ 30 MHz :  $\pm 3.34$  (CL: Approx 95 %,  $k=2$ )

### 5.4.5 Measurement Result

| Freq.<br>[MHz] | Factor<br>[dB] |               | POL | QP                    |                         |                        | CISPR AV              |                         |                        |
|----------------|----------------|---------------|-----|-----------------------|-------------------------|------------------------|-----------------------|-------------------------|------------------------|
|                | LISN           | CABLE<br>+P/L |     | Limit<br>[dB $\mu$ V] | Reading<br>[dB $\mu$ V] | Result<br>[dB $\mu$ V] | Limit<br>[dB $\mu$ V] | Reading<br>[dB $\mu$ V] | Result<br>[dB $\mu$ V] |
| 0.338          | 0.08           | 10.01         | L   | 59.26                 | 37.61                   | 37.69                  | 49.26                 | 32.64                   | 32.72                  |
| 0.361          | 0.08           | 10.02         | L   | 58.71                 | 41.25                   | 41.33                  | 48.71                 | 36.25                   | 36.33                  |
| 0.388          | 0.08           | 10.02         | L   | 58.10                 | 40.24                   | 40.32                  | 48.10                 | 34.49                   | 34.57                  |
| 0.888          | 0.09           | 10.05         | L   | 56.00                 | 38.79                   | 38.88                  | 46.00                 | 33.21                   | 33.30                  |
| 2.213          | 0.13           | 10.08         | L   | 56.00                 | 38.03                   | 38.16                  | 46.00                 | 28.32                   | 28.45                  |
| 10.963         | 0.45           | 10.40         | L   | 60.00                 | 26.55                   | 27.00                  | 50.00                 | 19.18                   | 19.63                  |
| 0.380          | 0.09           | 10.02         | N   | 58.27                 | 35.44                   | 35.53                  | 48.27                 | 29.95                   | 30.04                  |
| 0.408          | 0.09           | 10.02         | N   | 57.69                 | 30.99                   | 31.08                  | 47.69                 | 24.78                   | 24.87                  |
| 0.931          | 0.11           | 10.06         | N   | 56.00                 | 32.74                   | 32.85                  | 46.00                 | 25.06                   | 25.17                  |
| 2.173          | 0.13           | 10.08         | N   | 56.00                 | 33.40                   | 33.53                  | 46.00                 | 25.84                   | 25.97                  |
| 5.611          | 0.23           | 10.23         | N   | 60.00                 | 22.47                   | 22.70                  | 50.00                 | 14.36                   | 14.59                  |

- \* LISN: LISN insertion Loss, Cable: Cable Loss, P/L:pulse limiter factor
- \* L: Line. Live, N: Line. Neutral
- \* Reading: test receiver reading value (with cable loss & pulse limiter factor)
- \* Result = LISN + Reading

Line. Live



Line. Neutral

