

# 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-160011 |  <b>KOSTEC Co., Ltd.</b><br><a href="http://www.kostec.org">http://www.kostec.org</a> |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## 1. Applicant

- Name : Dogtra Co., Ltd.
- Address : #715-2(146BL-3L) Gojan-dong, Namdong-gu, Incheon, Korea

## 2. Test Item

- Product Name: DOG TRAINING DEVICE
- Model Name: E-Fence 3500
- Brand: -
- FCC ID: SWN-E-FENCE3500

## 3. Manufacturer

- Name : Dogtra Co., Ltd.
- Address : #715-2(146BL-3L) Gojan-dong, Namdong-gu, Incheon, Korea

4. Date of Test : 2016. 11. 07. ~ 2016. 11. 08.

5. Test Method Used : FCC CFR 47, Part 15. Subpart C-15.207 and 15.209

6. Test Result : Compliance

7. Note: None

## Supplementary Information

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 ANSI C 63.10-2013.

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.

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

|             |                                               |                                                            |
|-------------|-----------------------------------------------|------------------------------------------------------------|
| Affirmation | Tested by<br>Name : Lee, Mi-Young (Signature) | Technical Manager<br>Name : Park, Gyeong-Hyeon (Signature) |
|-------------|-----------------------------------------------|------------------------------------------------------------|

2016. 11. 14.

**KOSTEC Co., Ltd.**

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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

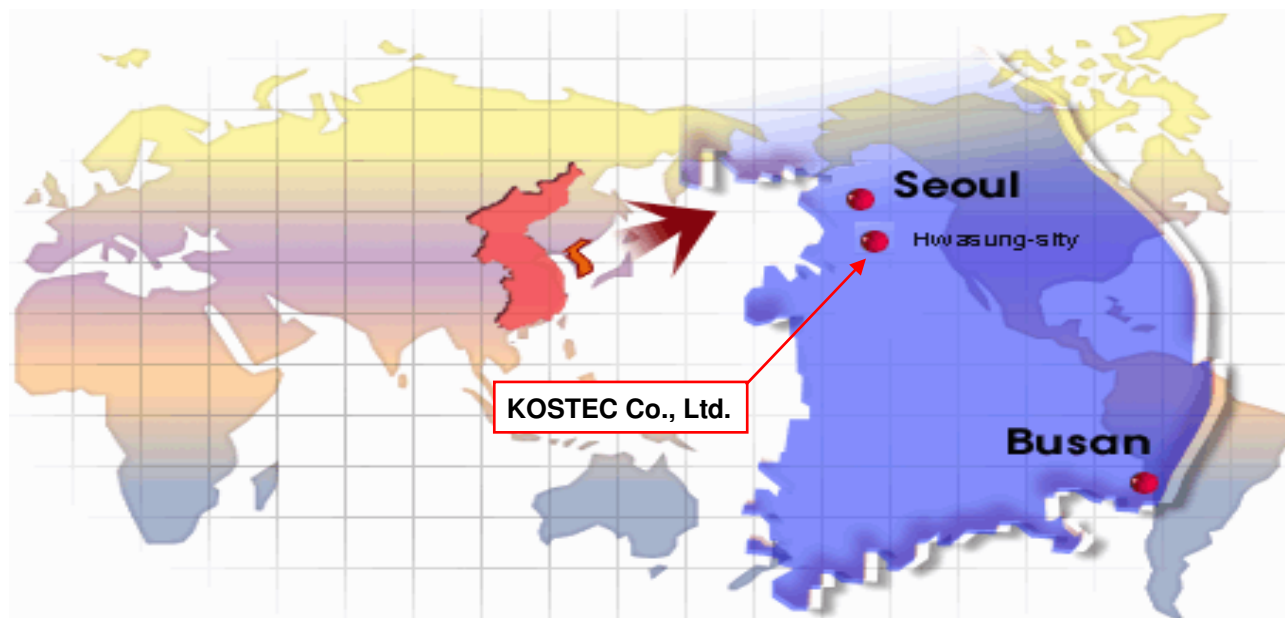
#### Registration information

KOLAS No. : 232

FCC Designation No. : KR0041

IC Registration Site No. : 8305A

### 1.2 Location



### 1.3 Revision History of test report

| Rev. | Revisions     | Effect page | Reviewed           | Date          |
|------|---------------|-------------|--------------------|---------------|
| -    | Initial issue | All         | Gyeong Hyeon, Park | 2016. 11. 14. |
|      |               |             |                    |               |

## 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              | E-Fence 3500                                                                                                                                                                                                                                                                                                                                                                                                             |
| Usage                 | Electronic fence for dog                                                                                                                                                                                                                                                                                                                                                                                                 |
| Serial Number         | Proto type                                                                                                                                                                                                                                                                                                                                                                                                               |
| Modulation type       | ASK                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Emission Type         | A1D                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Operated Frequency    | 10 kHz                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Channel Number        | 1                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Operation temperature | -10 °C ~ 55 °C                                                                                                                                                                                                                                                                                                                                                                                                           |
| Power Source          | AC/DC Adapter<br>Input: AC 100 - 240 V. 50/60 Hz<br>Output: DC 24 V, 500mA                                                                                                                                                                                                                                                                                                                                               |
| Antenna Description   | Wire Loop Antenna                                                                                                                                                                                                                                                                                                                                                                                                        |
| 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-E-FENCE3500                                                                                                                                                                                                                                                                                                                                                                                                          |

### 3. SYSTEM CONFIGURATION FOR TEST

#### 3.1 Characteristics of equipment

Electronic fence for dog

#### 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

The measurements were taken in continuous transmit mode.

EUT  
(Standalone)

### 3.8 Used Test Equipment List

| No. | Instrument                    | Model        | S/N          | Manufacturer               | Due to cal date | Cal interval | used                                |
|-----|-------------------------------|--------------|--------------|----------------------------|-----------------|--------------|-------------------------------------|
| 1   | T & H Chamber                 | EY-101       | 90E14260     | TABAI ESPEC                | 2017.09.07      | 1 year       | <input type="checkbox"/>            |
| 2   | T & H Chamber                 | SH-641       | 92006831     | ESPEC CORP                 | 2017.02.04      | 1 year       | <input type="checkbox"/>            |
| 3   | Spectrum Analyzer             | 8563E        | 3846A10662   | Agilent Technology         | 2017.02.02      | 1 year       | <input type="checkbox"/>            |
| 4   | Spectrum Analyzer             | 8593E        | 3710A02859   | Agilent Technology         | 2017.02.02      | 1 year       | <input type="checkbox"/>            |
| 5   | Spectrum Analyzer             | FSV30        | 20-353063    | Rohde & Schwarz            | 2017.02.02      | 1 year       | <input type="checkbox"/>            |
| 6   | Signal Analyzer               | N9010A       | MY50410369   | Agilent Technologies       | 2017.05.04      | 1 year       | <input type="checkbox"/>            |
| 7   | EMI Test Receiver             | ESCI7        | 100823       | Rohde & Schwarz            | 2017.02.02      | 1 year       | <input checked="" type="checkbox"/> |
| 8   | EMI Test Receiver             | ESI          | 837514/004   | Rohde & Schwarz            | 2017.09.07      | 1 year       | <input type="checkbox"/>            |
| 9   | Vector Signal Analyzer        | 89441A       | 3416A02620   | Agilent Technology         | 2017.02.04      | 1 year       | <input type="checkbox"/>            |
| 10  | Network Analyzer              | 8753ES       | US39172348   | AGILENT                    | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 11  | EPM Series Power meter        | E4418B       | GB39512547   | Agilent Technology         | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 12  | RF Power Sensor               | E9300A       | MY41496631   | Agilent Technology         | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 13  | Microwave Frequency Counter   | 5352B        | 2908A00480   | Agilent Technology         | 2017.02.01      | 1 year       | <input type="checkbox"/>            |
| 14  | Modulation Analyzer           | 8901A        | 3538A07071   | Agilent Technology         | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 15  | Audio Analyzer                | 8903B        | 3514A16919   | Agilent Technology         | 2017.02.01      | 1 year       | <input type="checkbox"/>            |
| 16  | Audio Telephone Analyzer      | DD-5601CID   | 520010281    | CREDIX                     | 2017.02.04      | 1 year       | <input type="checkbox"/>            |
| 17  | Digital storage Oscilloscope  | TDS3052      | B015962      | Tektronix                  | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 18  | ESG-D Series Signal Generator | E4436B       | US39260458   | Agilent Technology         | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 19  | Vector Signal Generator       | SMBV100A     | 257557       | Rohde & Schwarz            | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 20  | Signal Generator              | SMB100A      | 179628       | Rohde & Schwarz            | 2017.06.02      | 1 year       | <input type="checkbox"/>            |
| 21  | Tracking Source               | 85645A       | 070521-A1    | Agilent Technology         | 2017.02.02      | 1 year       | <input type="checkbox"/>            |
| 22  | SLIDAC                        | None         | 0207-4       | Myoung sung Ele.           | 2017.02.01      | 1 year       | <input type="checkbox"/>            |
| 23  | DC Power supply               | DRP-5030     | 9028029      | Digital Electronic Co.,Ltd | 2017.02.01      | 1 year       | <input type="checkbox"/>            |
| 24  | DC Power supply               | 6038A        | 3440A12674   | Agilent Technology         | 2017.02.01      | 1 year       | <input type="checkbox"/>            |
| 25  | DC Power supply               | E3610A       | KR24104505   | Agilent Technology         | 2017.02.01      | 1 year       | <input type="checkbox"/>            |
| 26  | DC Power supply               | UP-3005T     | 68           | Unicon Co.,Ltd             | 2017.02.01      | 1 year       | <input type="checkbox"/>            |
| 27  | DC Power Supply               | SM 3004-D    | 114701000117 | DELTA ELEKTRONIKA          | 2017.02.01      | 1 year       | <input type="checkbox"/>            |
| 28  | Dummy Load                    | 8173         | 3780         | Bird Electronic Co., Corp  | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 29  | Attenuator                    | 50FH-030-500 | 140410 9433  | JEW Industries Inc.        | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 30  | Attenuator                    | 765-20       | 9703         | Narda                      | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 31  | Attenuator                    | 24-30-34     | BX5630       | Aeroflex / Weinschel       | 2016.12.30      | 1 year       | <input type="checkbox"/>            |
| 32  | Attenuator                    | 8498A        | 3318A09485   | HP                         | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 33  | Step Attenuator               | 8494B        | 3308A32809   | HP                         | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 34  | Attenuator                    | 18B50W-20F   | 64671        | INMET                      | 2017.02.17      | 1 year       | <input type="checkbox"/>            |
| 35  | Attenuator                    | 10 dB        | 1            | Rohde & Schwarz            | 2017.05.31      | 1 year       | <input type="checkbox"/>            |
| 36  | Attenuator                    | 54A-10       | 74564        | WEINSCHTEL                 | 2017.06.02      | 1 year       | <input type="checkbox"/>            |
| 37  | Attenuator                    | 56-10        | 66920        | WEINSCHTEL                 | 2017.06.17      | 1 year       | <input type="checkbox"/>            |
| 38  | Power divider                 | 11636B       | 51212        | HP                         | 2017.02.02      | 1 year       | <input type="checkbox"/>            |
| 39  | 3Way Power divider            | KPDSU3W      | 00070365     | KMW                        | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 40  | 4Way Power divider            | 70052651     | 173834       | KRYTAR                     | 2017.02.02      | 1 year       | <input type="checkbox"/>            |
| 41  | 3Way Power divider            | 1580         | SQ361        | WEINSCHTEL                 | 2017.06.02      | 1 year       | <input type="checkbox"/>            |
| 42  | White noise audio filter      | ST31EQ       | 101902       | SoundTech                  | 2017.09.07      | 1 year       | <input type="checkbox"/>            |
| 43  | Dual directional coupler      | 778D         | 17693        | HEWLETT PACKARD            | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 44  | Dual directional coupler      | 772D         | 2839A00924   | HEWLETT PACKARD            | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 45  | Band rejection filter         | 3TNF-0006    | 26           | DOVER Tech                 | 2017.02.04      | 1 year       | <input type="checkbox"/>            |
| 46  | Band rejection filter         | 3TNF-0008    | 317          | DOVER Tech                 | 2017.02.04      | 1 year       | <input type="checkbox"/>            |
| 47  | Band rejection filter         | 3TNF-0007    | 311          | DOVER Tech                 | 2017.02.04      | 1 year       | <input type="checkbox"/>            |

| No. | Instrument                          | Model                            | S/N          | Manufacturer                | Due to cal date | Cal interval | used                                |
|-----|-------------------------------------|----------------------------------|--------------|-----------------------------|-----------------|--------------|-------------------------------------|
| 48  | Band rejection filter               | WTR-BRF2442-84NN                 | 09020001     | WAVE TECH Co.,LTD           | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 49  | Band rejection filter               | WRCJV12-5695-5725-5825-5855-50SS | 1            | Wainwright Instruments GmbH | 2017.05.31      | 1 year       | <input type="checkbox"/>            |
| 50  | Band rejection filter               | WRCJV12-5120-5150-5350-5380-40SS | 4            | Wainwright Instruments GmbH | 2017.05.31      | 1 year       | <input type="checkbox"/>            |
| 51  | Band rejection filter               | WRCGV10-2360-2400-2500-2540-50SS | 2            | Wainwright Instruments GmbH | 2017.05.31      | 1 year       | <input checked="" type="checkbox"/> |
| 52  | Highpass Filter                     | WHJS1100-10EF                    | 1            | WAINWRIGHT                  | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 53  | Highpass Filter                     | WHJS3000-10EF                    | 1            | WAINWRIGHT                  | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 54  | Highpass Filter                     | WHNX6-5530-3000-26500-40CC       | 2            | Wainwright Instruments GmbH | 2017.06.17      | 1 year       | <input type="checkbox"/>            |
| 55  | Highpass Filter                     | WHNX6-2370-7000-26500-40CC       | 4            | Wainwright Instruments GmbH | 2017.06.17      | 1 year       | <input type="checkbox"/>            |
| 56  | WideBand Radio Communication Tester | CMW500                           | 102276       | Rohde & Schwarz             | 2017.02.04      | 1 year       | <input type="checkbox"/>            |
| 57  | Radio Communication Tester          | CMU 200                          | 112026       | Rohde & Schwarz             | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 58  | Bluetooth Tester                    | TC-3000B                         | 3000B6A0166  | TESCOM CO., LTD.            | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 59  | RF Up/Down Converter                | DCP-1780                         | 980901003    | CREDIX                      | 2017.02.03      | 1 year       | <input type="checkbox"/>            |
| 60  | DECT Test set                       | 8923B                            | 3829U00364   | HP                          | 2017.02.04      | 1 year       | <input type="checkbox"/>            |
| 61  | DECT Test set                       | CMD60                            | 840677/005   | Rohde & Schwarz             | 2017.09.06      | 1 year       | <input type="checkbox"/>            |
| 62  | Loop Antenna                        | 6502                             | 9203-0493    | EMCO                        | 2017.06.04      | 2 year       | <input checked="" type="checkbox"/> |
| 63  | BiconiLog Antenna                   | 3142B                            | 9910-1432    | EMCO                        | 2018.04.25      | 2 year       | <input checked="" type="checkbox"/> |
| 64  | Horn Antenna                        | 3115                             | 2996         | EMCO                        | 2018.02.11      | 2 year       | <input type="checkbox"/>            |
| 65  | Horn Antenna                        | 3160-09                          | 061591-21907 | ETS LINDGREN                | 2018.05.03      | 2 year       | <input type="checkbox"/>            |
| 66  | Horn Antenna                        | 3160-10                          | 061221-022   | ETS LINDGREN                | 2018.05.03      | 2 year       | <input type="checkbox"/>            |
| 67  | Antenna Master(3)                   | AT13                             | None         | AUDIX                       | N/A             | N/A          | <input type="checkbox"/>            |
| 68  | Turn Table(3)                       | None                             | None         | AUDIX                       | N/A             | N/A          | <input type="checkbox"/>            |
| 69  | PREAMPLIFIER(3)                     | 8449B                            | 3008A02577   | Agilent                     | 2017.02.01      | 1 year       | <input type="checkbox"/>            |
| 70  | Low noise Amplifier                 | TK-PA1840H                       | 160010-L     | TESKTEK                     | 2017.07.05      | 1 year       | <input type="checkbox"/>            |
| 71  | Antenna Master(10)                  | MA4000-EP                        | None         | inno systems GmbH           | N/A             | N/A          | <input checked="" type="checkbox"/> |
| 72  | Turn Table(10)                      | None                             | None         | inno systems GmbH           | N/A             | N/A          | <input checked="" type="checkbox"/> |
| 73  | AMPLIFIER(10)                       | TK-PA6S                          | 120009       | TESTEK                      | 2017.02.02      | 1 year       | <input checked="" type="checkbox"/> |

## 4. SUMMARY TEST RESULTS

| Description of Test                                                                                                                                                                                                                                   | FCC Rule       | Reference Clause | Used                                | Test Result |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------|-------------------------------------|-------------|
| Spurious RF radiated emissions                                                                                                                                                                                                                        | 15.205, 15.209 | Clause 5.1       | <input checked="" type="checkbox"/> | Compliance  |
| AC Power Conducted emissions                                                                                                                                                                                                                          | 15.207         | Clause 5.2       | <input checked="" type="checkbox"/> | Compliance  |
| 20 dB Bandwidth & 99% Occupied Bandwidth                                                                                                                                                                                                              | 15.215         | Clause 5.3       | <input checked="" type="checkbox"/> | Compliance  |
| <p>Compliance/pass : The EUT complies with the essential requirements in the standard.</p> <p>Not Compliance : The EUT does not comply with the essential requirements in the standard.</p> <p>N/A : The test was not applicable in the standard.</p> |                |                  |                                     |             |

### Procedure Reference

FCC CFR 47, Part 15. Subpart C-15.205 & 15.207

ANSI C 63.10-2013

## 5. MEASUREMENT RESULTS

### 5.1 Spurious RF Radiated emissions

#### 5.1.1 Standard Applicable [ FCC §15.209]

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table;

§15.209 limits for radiated emissions measurements (distance at 3 m)

| Frequency Band [MHz] | DISTANCE[Meters] | Limit [ $\mu\text{V}/\text{m}$ ]                                                            | Limit [ $\text{dB}\mu\text{V}/\text{m}$ ] | 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 1 000          | 3                | 74.0 $\text{dB}\mu\text{V}/\text{m}$ (Peak), 54.0 $\text{dB}\mu\text{V}/\text{m}$ (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 for FCC

| [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

### 5.1.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C • Relative Humidity : (50 ~ 52) % R.H.

### 5.1.3 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:  
$$\text{Result(dB } \mu\text{V/m)} = \text{Reading(dB } \mu\text{V)} + \text{Antenna factor(dB/m)} + \text{CL(dB)} + \text{other applicable factor (dB)}$$
  - 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.

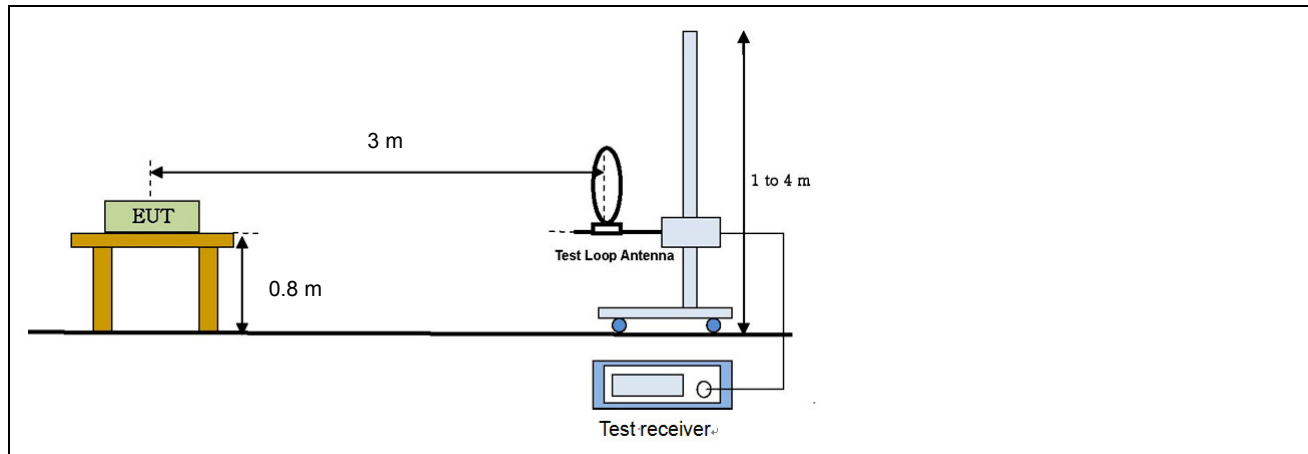
### 5.1.4 Measurement Uncertainty

All measurements involve certain levels of uncertainties. The factors contributing to uncertainties are test receiver, Cable loss, Antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, Antenna frequency interpolation, measurement distance variation, Site imperfection, mismatch, and system repeatability based on NIS 80,81.

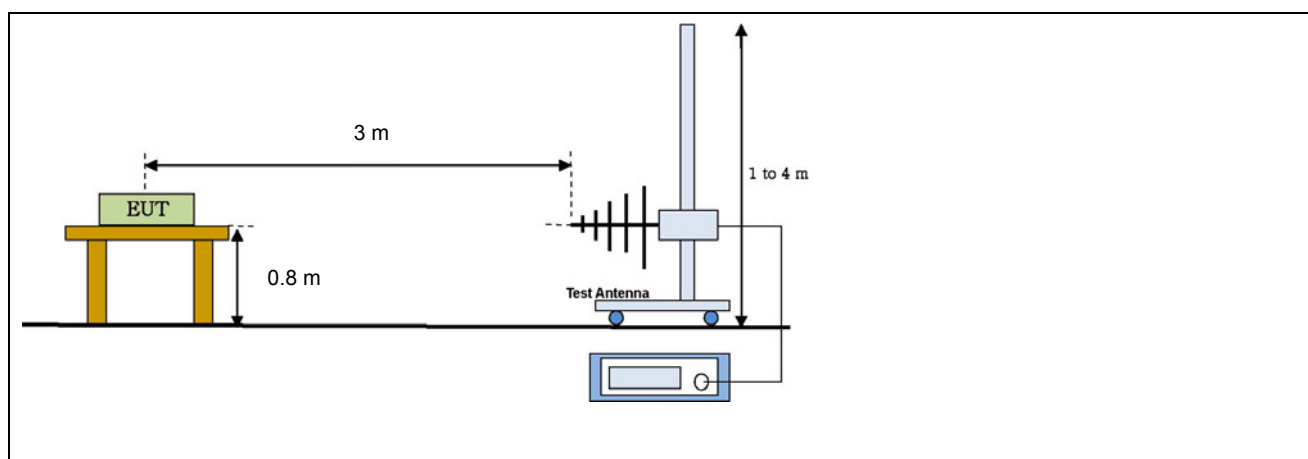
Radiated Emission measurement: 30 - 1000 MHz: 4.4 dB (CL: Approx 95 %,  $k=2$ )  
Above 1 GHz: 4.88 dB (CL: Approx 95 %,  $k=2$ )

### 5.1.5 Test Configuration

#### Radiated emission setup, Below 30 MHz



#### Radiated emission setup, Below 1 000 MHz



## 5.1.6 Measurement Result

### Below 30 MHz

| Freq.<br>(MHz) | Reading<br>(dBμV/m) | Table<br>(Deg) | Antenna       |      |                 | CL<br>(dB) | AMP<br>(dB) | Meas<br>Result<br>(dBμV/m) | Limit<br>(dBμV/m) | Mgn<br>(dB) | Detector<br>Mode |
|----------------|---------------------|----------------|---------------|------|-----------------|------------|-------------|----------------------------|-------------------|-------------|------------------|
|                |                     |                | Height<br>(m) | Pol. | Fctr.<br>(dB/m) |            |             |                            |                   |             |                  |
| 0.01*          | 23.17               | 180            | 1.0           | X    | 18.71           | 0.07       | -           | 41.95                      | 127.6             | 85.65       | PK               |
| 0.05           | 10.67               | 180            | 1.0           | X    | 10.29           | 0.13       | -           | 21.09                      | 127.6             | 106.51      | PK               |
| 0.07           | 21.46               | 180            | 1.0           | X    | 10.82           | 0.10       | -           | 32.38                      | 127.6             | 95.22       | PK               |
| 0.11           | 23.76               | 180            | 1.0           | X    | 10.52           | 0.13       | -           | 34.41                      | 127.6             | 93.19       | PK               |
| 0.37           | 24.68               | 180            | 1.0           | X    | 10.35           | 0.13       | -           | 35.16                      | 127.6             | 92.44       | PK               |
| 13.17          | 17.50               | 180            | 1.0           | X    | 9.95            | 0.61       | -           | 28.06                      | 69.5              | 41.44       | QP               |
| Result         | Compliance          |                |               |      |                 |            |             |                            |                   |             |                  |

\* is fundamental frequency

**Note1.** above measured frequency have been done at 3 m distance

∴ 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  $40 / \text{decade} = 40 \log_{10}^{(MRD/MD)}$ )

MRD is Mandatory requirement distance and MD is Measured distance

∴ Extrapolation distance factor :  $40\log(3/300) = 80$  dB (If Measurement distance is 3 m and Mandatory requirement distance is 300 m)

**Note2.** All measurements were performed using a loop antenna. The antenna was positioned in three orthogonal positions (X front, Y side, Z top) and the position with the highest emission level was recorded.

### 30 MHz ~ 1 GHz

| Freq.<br>(MHz) | Reading<br>(dBμV/m) | Table<br>(Deg) | Antenna       |               |                 | CL<br>(dB) | AMP<br>(dB) | Meas<br>Result<br>(dBμV/m) | Limit<br>(dBμV/m) | Mgn<br>(dB) | Result     |
|----------------|---------------------|----------------|---------------|---------------|-----------------|------------|-------------|----------------------------|-------------------|-------------|------------|
|                |                     |                | Height<br>(m) | Pol.<br>(H/V) | Fctr.<br>(dB/m) |            |             |                            |                   |             |            |
| 41.42          | 53.09               | 180            | 1.0           | V             | 10.90           | 1.02       | -40.74      | 24.26                      | 40.0              | 15.74       | Compliance |
| 60.01          | 52.26               | 180            | 1.0           | V             | 6.38            | 1.22       | -42.02      | 17.84                      | 40.0              | 22.16       | Compliance |
| 63.98          | 46.83               | 180            | 2.0           | H             | 6.06            | 1.26       | -42.02      | 12.13                      | 40.0              | 27.87       | Compliance |
| 385.28         | 48.21               | 170            | 2.0           | H             | 17.02           | 2.62       | -40.99      | 26.86                      | 46.0              | 19.14       | Compliance |
| 787.85         | 40.42               | 170            | 2.0           | H             | 23.79           | 3.85       | -38.75      | 29.31                      | 46.0              | 16.69       | Compliance |
| 919.28         | 39.91               | 180            | 1.8           | H             | 25.39           | 4.09       | -38.26      | 31.13                      | 46.0              | 14.87       | Compliance |

Freq.(MHz) : Measurement frequency

Reading(dBμV /m) : Indicated value for test receiver

Table (Deg) : Directional degree of Turn table

Antenna (Height, Pol, Fctr) : Antenna Height, Polarization and Factor

CL(dB) : Cable loss

AMP(dB) : Preamplifier gain(dB)

Meas Result (dBμV /m) : Reading(dBμV /m) + Antenna factor.(dB/m) + CL(dB) - AMP(dB)

Limit(dBμV /m) : Limit value specified with FCC Rule

Mgn(dB) : FCC Limit (dBμV /m) – Meas Result(dBμV /m)

## 5.2 AC Power Conducted emissions

### 5.2.1 Standard Applicable [FCC §15.207(a)]

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

### 5.2.2 Test Environment conditions

• Ambient temperature : (21 ~ 22) °C • Relative Humidity : (50 ~ 52) % R.H.

### 5.2.3 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.

### 5.2.4 Used equipment

| Equipment     | Model No. | Serial No. | Manufacturer    | Next cal date | Cal interval | Used                                |
|---------------|-----------|------------|-----------------|---------------|--------------|-------------------------------------|
| Test receiver | ESCS30    | 100111     | Rohde & Schwarz | 2017. 02. 02  | 1 year       | <input checked="" type="checkbox"/> |
| LISN          | ESH2-Z5   | 100044     | R&S             | 2017. 02. 02  | 1 year       | <input type="checkbox"/>            |
|               | ESH3-Z5   | 100147     | R&S             | 2017. 02. 02  | 1 year       | <input checked="" type="checkbox"/> |

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

Measurement uncertainty

Conducted Emission measurement: 3.5 dB (CL: Approx 95%,  $k=2$ )

## 5.2.5 Measurement Result

| Freq.<br>[MHz] | Factor<br>[dB] |       | POL | QP              |                   |                  | CISPR AV        |                   |                  |
|----------------|----------------|-------|-----|-----------------|-------------------|------------------|-----------------|-------------------|------------------|
|                |                |       |     | Limit<br>[dBμV] | Reading<br>[dBμV] | Result<br>[dBμV] | Limit<br>[dBμV] | Reading<br>[dBμV] | Result<br>[dBμV] |
| 0.162          | 0.10           | 10.05 | L   | 65.38           | 46.36             | 46.46            | 55.38           | 22.02             | 22.12            |
| 0.173          | 0.10           | 10.05 | L   | 64.79           | 42.46             | 42.56            | 54.79           | 19.33             | 19.43            |
| 0.185          | 0.10           | 10.04 | L   | 64.25           | 43.56             | 43.66            | 54.25           | 21.62             | 21.72            |
| 0.271          | 0.10           | 10.05 | L   | 61.08           | 43.05             | 43.15            | 51.08           | 31.52             | 31.62            |
| 0.357          | 0.10           | 10.05 | L   | 58.80           | 30.98             | 31.08            | 48.80           | 19.10             | 19.20            |
| 0.814          | 0.11           | 10.08 | L   | 56.00           | 24.76             | 24.87            | 46.00           | 17.05             | 17.16            |
| 1.771          | 0.13           | 10.13 | L   | 56.00           | 27.16             | 27.29            | 46.00           | 21.36             | 21.49            |
| 5.060          | 0.24           | 10.25 | L   | 60.00           | 24.62             | 24.86            | 50.00           | 19.33             | 19.57            |
| 0.158          | 0.09           | 10.05 | N   | 65.58           | 46.22             | 46.31            | 55.58           | 21.34             | 21.43            |
| 0.185          | 0.09           | 10.04 | N   | 64.25           | 43.06             | 43.15            | 54.25           | 20.94             | 21.03            |
| 0.275          | 0.09           | 10.05 | N   | 60.97           | 41.67             | 41.76            | 50.97           | 29.85             | 29.94            |
| 0.310          | 0.09           | 10.05 | N   | 59.97           | 28.94             | 29.03            | 49.97           | 14.33             | 14.42            |
| 0.408          | 0.10           | 10.06 | N   | 57.69           | 27.37             | 27.47            | 47.69           | 18.87             | 18.97            |
| 1.052          | 0.11           | 10.09 | N   | 56.00           | 26.17             | 26.28            | 46.00           | 18.56             | 18.67            |
| 1.724          | 0.13           | 10.12 | N   | 56.00           | 27.62             | 27.75            | 46.00           | 23.21             | 23.34            |
| 8.720          | 0.35           | 10.34 | N   | 60.00           | 21.81             | 22.16            | 50.00           | 17.13             | 17.48            |

- \* 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

Kostec Co., Ltd.

07 Nov 2016 16:17

### Conducted Emission

EUT:

Manuf:

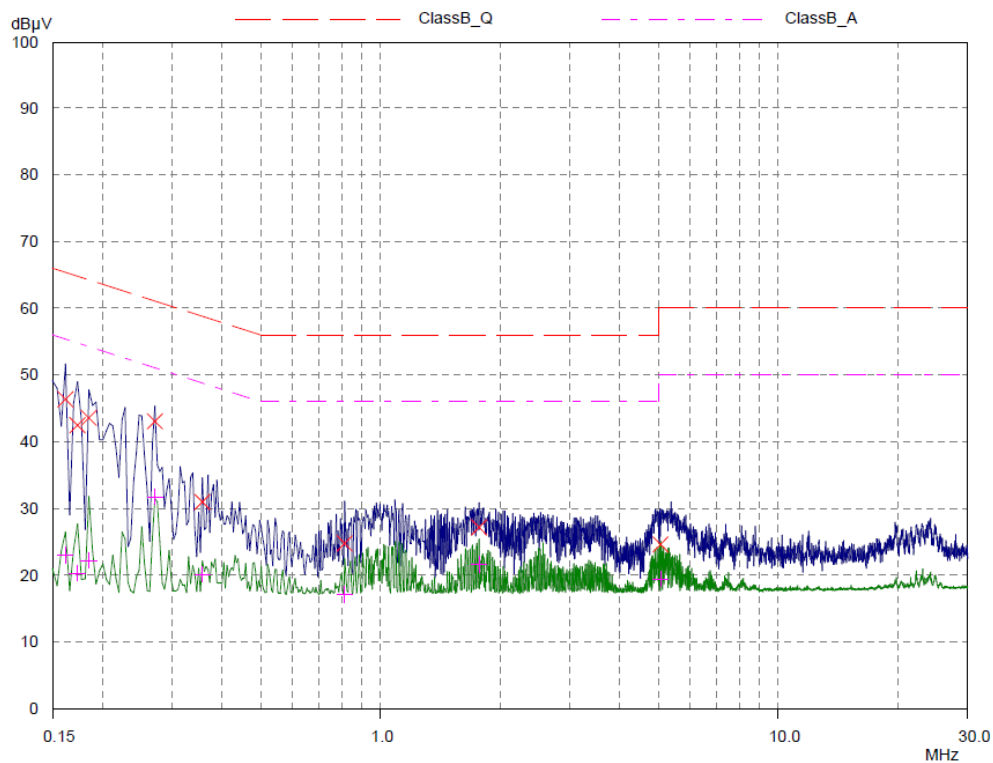
Op Cond: A.C. 120 V, 60 Hz

Operator:

Test Spec: FCC

Comment: Live

| Scan Settings      |       | (1 Range)   |             |           |                   |       |        |       |  |
|--------------------|-------|-------------|-------------|-----------|-------------------|-------|--------|-------|--|
| Frequencies        |       |             |             |           | Receiver Settings |       |        |       |  |
| Start              | Stop  | Step        | IF BW       | Detector  | M-Time            | Atten | Preamp | OpRge |  |
| 150kHz             | 30MHz | 3.9063kHz   | 9kHz        | PK+AV     | 10msec            | 15 dB | OFF    | 60dB  |  |
| Transducer         | No.   | Start       | Stop        | Name      |                   |       |        |       |  |
|                    | 12    | 9kHz        | 30MHz       | CNEFactor |                   |       |        |       |  |
| Final Measurement: |       | Detectors:  | X QP / + AV |           |                   |       |        |       |  |
|                    |       | Meas Time:  | 1sec        |           |                   |       |        |       |  |
|                    |       | Subranges:  | 25          |           |                   |       |        |       |  |
|                    |       | Acc Margin: | 50 dB       |           |                   |       |        |       |  |



Line. Neutral

Kostec Co., Ltd.

07 Nov 2016 16:24

Conducted Emission

EUT:

Manuf:

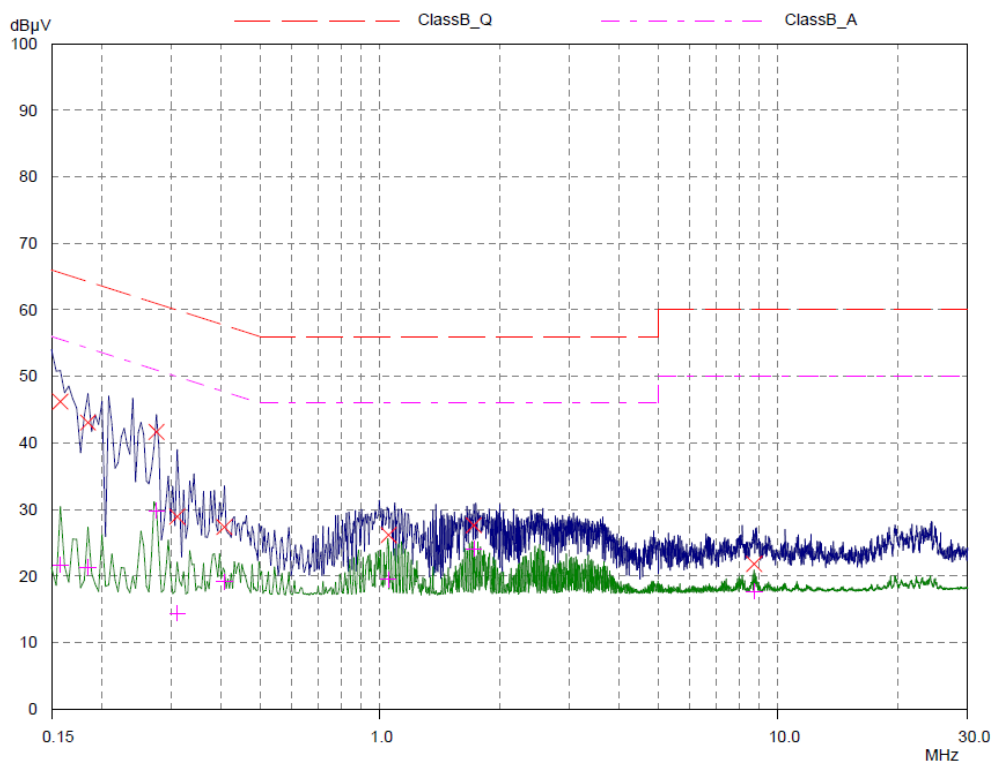
Op Cond: A.C. 120 V, 60 Hz

Operator:

Test Spec: FCC

Comment: N

| Scan Settings      |       | (1 Range)   |             |           | Receiver Settings |       |        |       |  |
|--------------------|-------|-------------|-------------|-----------|-------------------|-------|--------|-------|--|
| Frequencies        |       | Step        | IF BW       | Detector  | M-Time            | Atten | Preamp | OpRge |  |
| Start              | Stop  | Step        | IF BW       | Detector  | M-Time            | Atten | Preamp | OpRge |  |
| 150kHz             | 30MHz | 3.9063kHz   | 9kHz        | PK+AV     | 10msec            | 15 dB | OFF    | 60dB  |  |
| Transducer         | No.   | Start       | Stop        | Name      |                   |       |        |       |  |
|                    | 12    | 9kHz        | 30MHz       | CNEFactor |                   |       |        |       |  |
| Final Measurement: |       | Detectors:  | X QP / + AV |           |                   |       |        |       |  |
|                    |       | Meas Time:  | 1sec        |           |                   |       |        |       |  |
|                    |       | Subranges:  | 25          |           |                   |       |        |       |  |
|                    |       | Acc Margin: | 50 dB       |           |                   |       |        |       |  |



## 5.3 20 dB bandwidth measurement

### 5.3.1 Standard applicable [FCC §2.1049]

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.

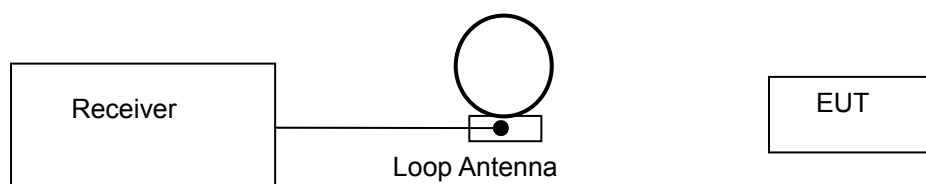
### 5.3.2 Test Environment conditions

- Ambient temperature : (21 ~ 22) °C • Relative Humidity : (50 ~ 52) % R.H.

### 5.3.3 Measurement Procedure

Refer 5.3.1

### 5.3.4 Test setup



### 5.3.5 Measurement Result

| Frequency<br>(kHz) | 20 dB bandwidth<br>(kHz) |
|--------------------|--------------------------|
| 10                 | 2.6                      |

### 5.3.6 Test plot

