

# TEST REPORT

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**Test Report Number: SKT-RFC-200001****Date of issue: Aug 28, 2020****Applicant:****KYUNGWOO SYSTECH, INC.**#401, Daeryung Post Tower 5, 68, Digital-ro 9, Geumcheon-gu, Seoul,  
South Korea**Manufacturer:****KYUNGWOO SYSTECH, INC.**#401, Daeryung Post Tower 5, 68, Digital-ro 9, Geumcheon-gu, Seoul,  
South Korea**Product:**

SMK READER

**Model:****SMK-HXV-10****FCC ID:**

ZE8- SMK-HXV-10

**Project number:**

SKTEU20-0470

**EUT received:**

April 28, 2020

**Applied standards:**

ANSI C63.10-2013 and ANSI C63.4-2014

**Rule parts:**

FCC Part 15 Subpart C - Intentional radiators

**Equipment Class:****DSC - Part 15 Security/Remote Control Transmitter****Remarks to the standards:** None

The above equipment has been tested by SK Tech Co., Ltd., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product or system, which was tested.

Ahn downon / **Testing Engineer**Changmin Kim / **Technical Manager**

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### Revision History of Test Report

| Rev. | Revisions     | Effect page | Approved by  | Date         |
|------|---------------|-------------|--------------|--------------|
| -    | Initial issue | All         | Changmin Kim | Aug 28, 2020 |



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## 1 Summary of test results

| Requirement  | CFR 47 Section                  | Result                 |
|--|---------------------------------|------------------------|
| Antenna Requirement                                | 15.203                          | Meets the requirements |
| 20dB Emission Bandwidth                            | 15.231(c)                       | Meets the requirements |
| Transmission Time                                  | 15.231(a)                       | Meets the requirements |
| Spurious Emission, Band Edge, and Restricted bands | 15.231(b), 15.205(a), 15.209(a) | Meets the requirements |
| AC power line Conducted emissions                  | 15.207(a)                       | N/A                    |

**Note:** *The EUT is operated from the battery (DC 12 V or DC 24 V) in a vehicle, and therefore the test suites related to AC Mains port were not applicable.*



## 2 Description of equipment under test (EUT)

Product: SMK READER  
 Model: SMK-HXV-10  
 Serial number: None (prototype)

### Model differences:

| Model name | Difference  | Tested (checked)                    |
|------------|---|-------------------------------------|
| SMK-HXV-10 | fully tested model that was provided by the applicant | <input checked="" type="checkbox"/> |

### Technical data:

|                           |   |  |
|---------------------------|---|--|
| Power source              | DC 12 V / DC 24 V (powered from the battery in a vehicle) |  |
| Local Oscillator or X-Tal | 8 MHz, 26 MHz   |  |
| Transmit Frequency        | 433.96 MHz  | 125 kHz                                    |
| Antenna Type              | Integral chip antenna                                     | Integral loop coil antenna                 |
| Type of Modulation        | GFSK  | ASK  |
| RF Output power           | 86.4 dB $\mu$ V/m (PEAK)<br>(measured @ 3m)               | 89.3 dB $\mu$ V/m(PEAK)<br>(measured @ 3m) |

**Note:** \* The test report for Equipment Class DCD was issued with other test report number.

\*\* The test report for the compliance with FCC Part 15B as a digital device was issued with other test report number.

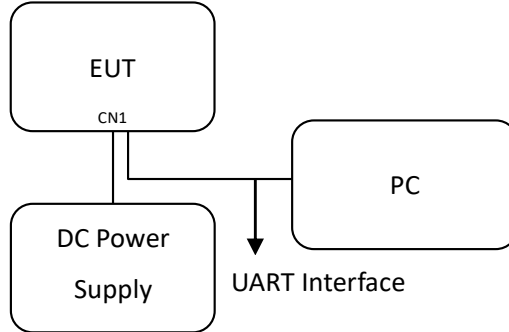
| I/O port | Type   | Q'ty | Remark |
|----------|--|------|--------|
| CN1      | 12-pin connector (DC IN, ACC, Actuator etc.) | 1    |        |



### 3 Test and measurement conditions

#### 3.1. Test configuration (arrangement of EUT)

The EUT was operated from DC Power Supply (12 V or 24 V).



#### 3.2. Description of support units (accessory equipment)

The following support units or accessories were used to form a representative test configuration during the tests.

| # | Equipment       | Manufacturer | Model No. | Serial No.  |
|---|-----------------|--------------|-----------|-------------|
| 1 | DC Power Supply | HP           | 6633A     | 2838A-01000 |

#### 3.3. Interconnection and I/O cables

The following support units or accessories were used to form a representative test configuration during the tests.

| # | Start |          | End             |          | Cable      |                |
|---|-------|----------|-----------------|----------|------------|----------------|
|   | Name  | I/O port | Name            | I/O port | length (m) | shielded (Y/N) |
| 1 | EUT   | DC IN    | DC Power Supply | DC OUT   | 2.0        | N              |

#### 3.4. Measurement Uncertainty (U)

| Measurement Item                        | Combined Standard Uncertainty<br>$U_c$ | Expanded Uncertainty<br>$U = k \times U_c (k = 2)$ |
|---|--|--|
| Conducted RF power                      | 0.64 ± dB                              | 1.28 ± dB  |
| Conducted emissions                     | 1.4 ± dB                               | 2.8 ± dB   |
| Radiated emissions (9 kHz to 30 MHz)    | 1.45 ± dB                              | 2.9 ± dB   |
| Radiated emissions (30 MHz to 1000 MHz) | 2.5 ± dB                               | 5.0 ± dB   |
| Radiated emissions (1 GHz to 6 GHz)     | 2.5 ± dB                               | 5.0 ± dB   |

0

#### 3.5. Test date

|             |                                |
|-------------|--------------------------------|
| Date Tested | July 15, 2020 – August 3, 2020 |
|-------------|--------------------------------|



## 4 Facilities and accreditations

### 4.1. Facilities

All of the measurements described in this report were performed at SK Tech Co., Ltd

Site I: 88, Geulgaetul-ro 81beon-gil, Wabu-eup, Namyangju-si, Gyeonggi-do, Korea

Site II: 124-8, Geulgaetul-ro, Wabu-eup, Namyangju-si, Gyeonggi-do, Korea

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-4. The sites comply with the Normalized Site Attenuation requirements given in ANSI C63.4, and site VSWR requirements specified in CISPR 16-1-4. The measuring apparatus and ancillary equipment conform to CISPR 16-1 series.

### 4.2. Accreditations

The laboratory has been also notified to FCC by RRA as a Conformity Assessment Body, and designated to perform compliance testing on equipment subject to Supplier's Declaration of Conformity (SDoC) and Certification under Parts 15 and 18 of the FCC Rules.

Designation No. KR0007

### 4.3. List of test and measurement instruments

| No | Description                    | Model                     | Manufacturer   | Serial No.  | Cal. due   | Use                                 |
|----|--------------------------------|---------------------------|----------------|-------------|------------|-------------------------------------|
| 1  | EMI Test Receiver              | ESR26                     | Rohde&Schwarz  | 101441      | 2021.07.24 | <input checked="" type="checkbox"/> |
| 2  | EMI Test Receiver              | ESIB40                    | Rohde&Schwarz  | 100277      | 2021.02.25 | <input checked="" type="checkbox"/> |
| 3  | Pre-amplifier (30 MHz - 1 GHz) | MLA-10K01-B01-27          | TSJ            | 2005350     | 2021.06.08 | <input checked="" type="checkbox"/> |
| 4  | Pre-amplifier (1 GHz - 18 GHz) | MLA-100M18-B02-38         | TSJ            | 1539546     | 2021.02.03 | <input checked="" type="checkbox"/> |
| 5  | Attenuator (6dB)               | 18N5W                     | API Technology | -           | 2021.07.06 | <input checked="" type="checkbox"/> |
| 6  | High Pass Filter               | WHKE3-500.2-610-4000-40SS | Wainwright     | 1           | 2021.06.09 | <input checked="" type="checkbox"/> |
| 7  | Loop Antenna                   | HFH2-Z2                   | Schwarzbeck    | 863048/019  | 2021.12.20 | <input checked="" type="checkbox"/> |
| 8  | BILOG Broadband Antenna        | VULB9168                  | Schwarzbeck    | 9168-230    | 2021.07.06 | <input checked="" type="checkbox"/> |
| 9  | Horn Antenna (1 GHz - 18 GHz)  | BBHA 9120D                | Schwarzbeck    | 9120D-816   | 2021.05.22 | <input checked="" type="checkbox"/> |
| 10 | DC Power Supply                | 6633A                     | HP             | 2838A-01000 | 2021.06.09 | <input checked="" type="checkbox"/> |
| 11 | Signal Generator               | SMB100A                   | R & S          | 180704      | 2021-02-25 | <input checked="" type="checkbox"/> |
| 12 | Digital Thermo-Hygrometer      | 608-H1                    | Testo          | -           | 2021.06.11 | <input checked="" type="checkbox"/> |
| 13 | High Pass Filter               | WHKX 1.0/15G-12SS         | Wainwright     | 17          | 2021.06.08 | <input checked="" type="checkbox"/> |



## 5 Test and measurements

### 5.1. Antenna requirement

#### 5.1.1 Regulation

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

#### 5.1.2 Result:

**PASS**

The EUT has an internal chip antenna and meets the requirements of this section.





**5.2. 20 dB Emission Bandwidth**

**5.2.1 Regulation**

According to §15.231(c), The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

**5.2.2 Test Procedure**

The EUT repeatedly transmitted RF signals and the small antenna, to which the Spectrum Analyzer was connected, placed in the vicinity of the EUT. The Occupied Bandwidth (99 %) and 20 dB emission bandwidth were measured with the following setting according to ANSI C63.10, 12.4.

- (a) Set RBW = approximately 1 % of the emission bandwidth
- (b) Set the VBW > RBW
- (c) Detector = peak
- (d) Trace mode = max hold

**5.2.3 Test Results: PASS**

**Table 1: Measured values of the 20 dB Emission Bandwidth**

Operated from DC 12 V

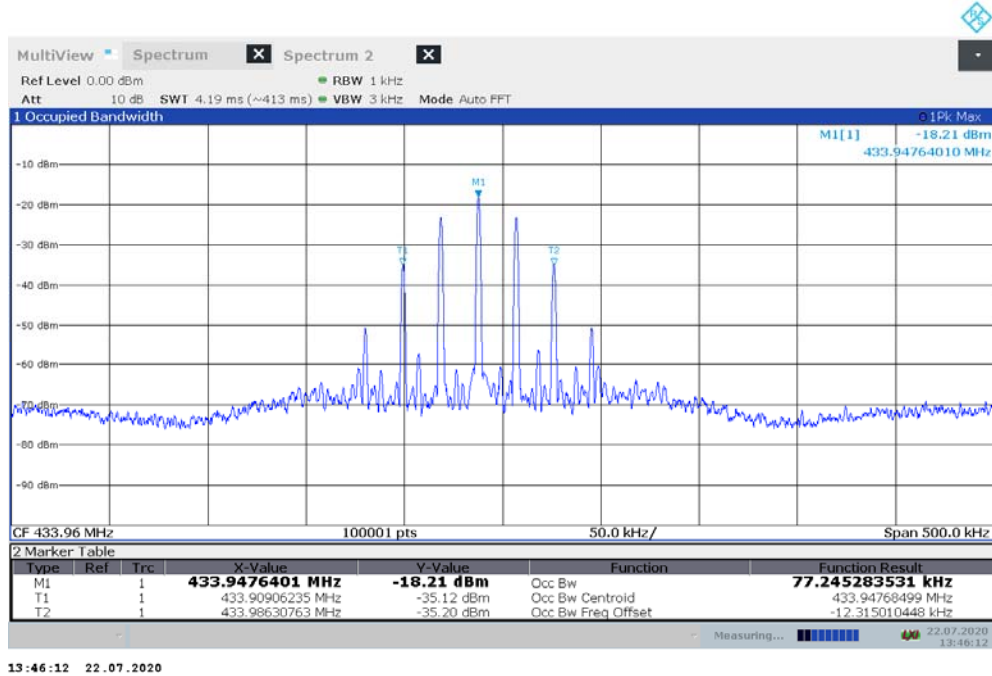
| Operating frequency | Occupied Bandwidth (99 %) | 20 dB Emission Bandwidth | Limit        |
|---------------------|---------------------------|--------------------------|--------------|
| 433.96 MHz          | 77.3 kHz                  | 77.9 kHz                 | < 1084.9 kHz |

Operated from DC 24 V

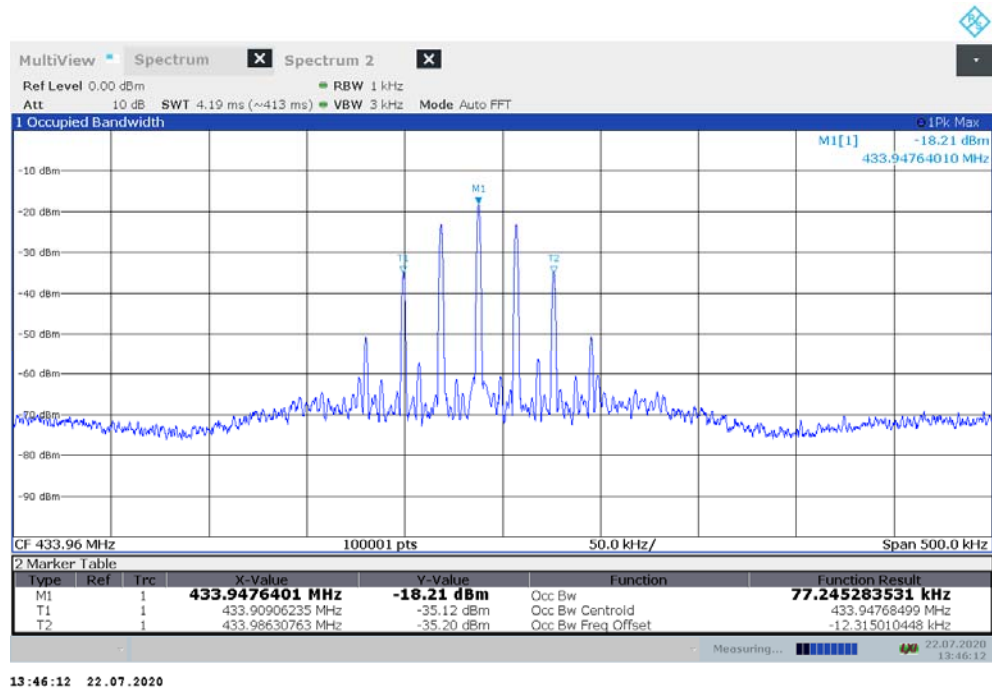
| Operating frequency | Occupied Bandwidth (99 %) | 20 dB Emission Bandwidth | Limit        |
|---------------------|---------------------------|--------------------------|--------------|
| 433.96 MHz          | 77.3 kHz                  | 77.9 kHz                 | < 1084.9 kHz |

**Figure 1. Plot of the 20 dB Emission Bandwidth & Occupied Bandwidth**

Operated from DC 12 V(Occupied Bandwidth)

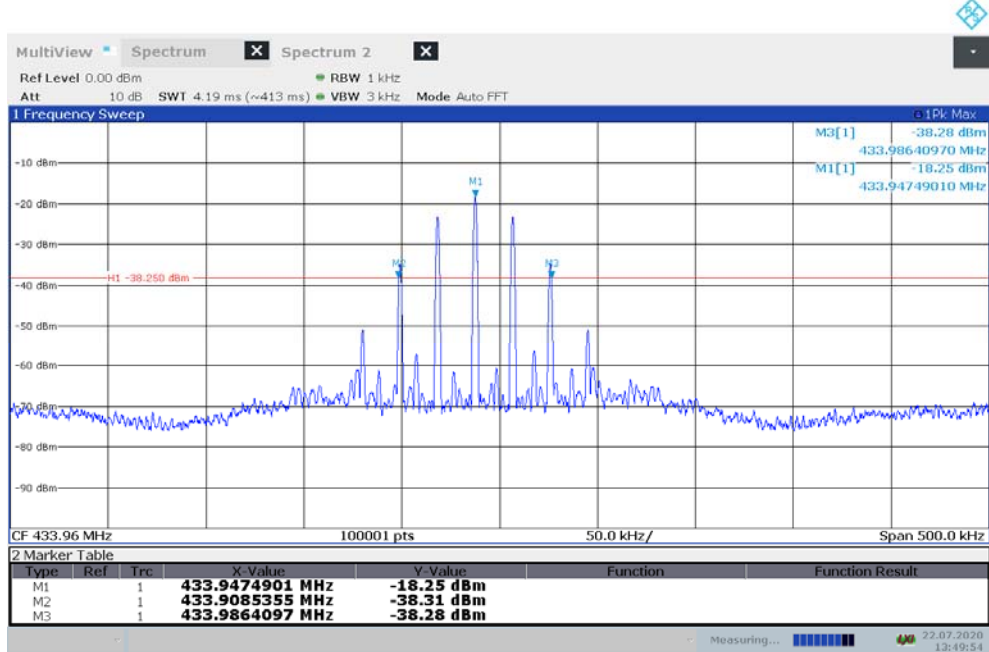


Operated from DC 24 V(Occupied Bandwidth)



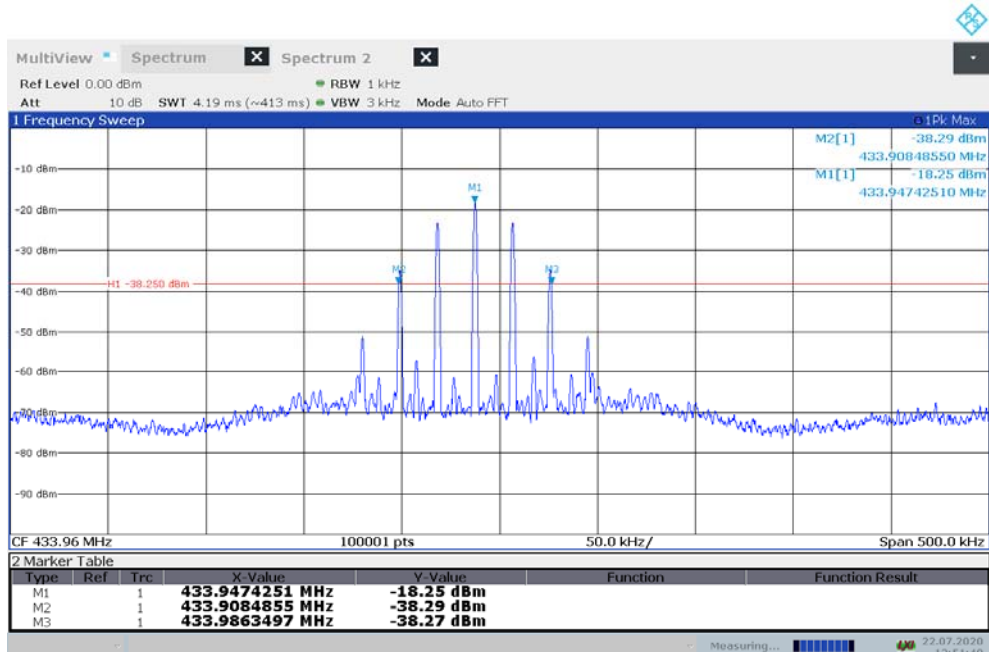


Operated from DC 12 V(20 dB Emission Bandwidth)



13:49:55 22.07.2020

Operated from DC 24 V(20 dB Emission Bandwidth)



13:51:41 22.07.2020



### 5.3. Transmission Time

#### 5.3.1 Regulation

- (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

#### 5.3.2 Test Procedure

The Transmission Time was measured in the normal operating conditions for pairing after sending the RF command by the software. The Spectrum Analyzer was set as below:

- (a) Set the center frequency to the operating frequency
- (b) Set RBW > 20 dB Emission Bandwidth (or Occupied Bandwidth)
- (c) Set Trigger level to start the measurement when the EUT transmitted RF signals
- (d) Set Sweep time to capture the pulse trains and/or to capture the burst ON time

#### 5.3.3 Test Results: **PASS**

**Table 2: Measured values of the Transmission Time**

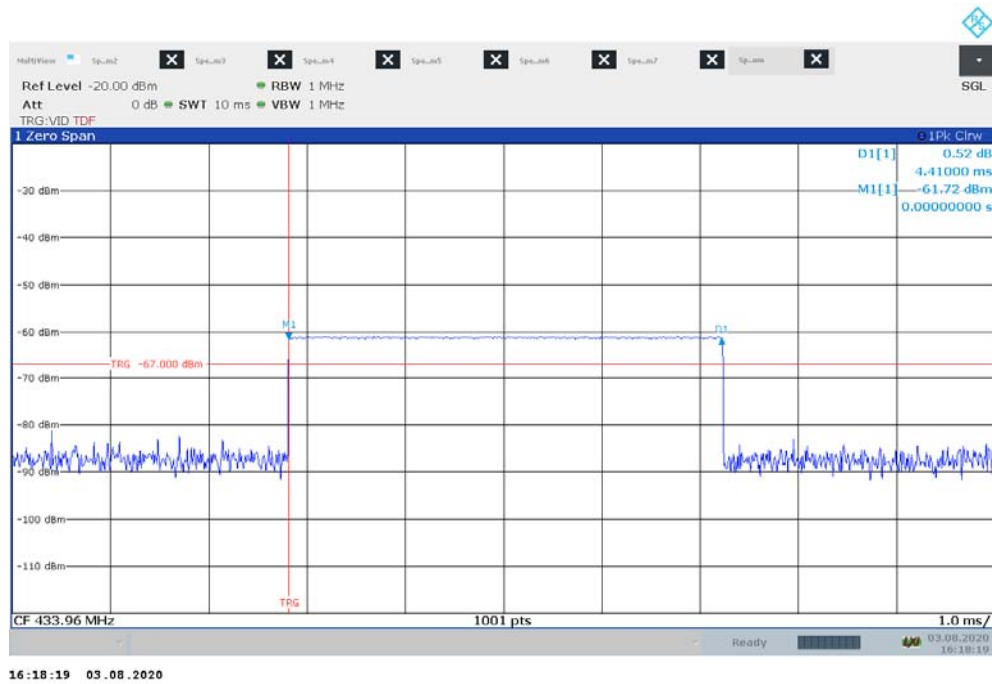
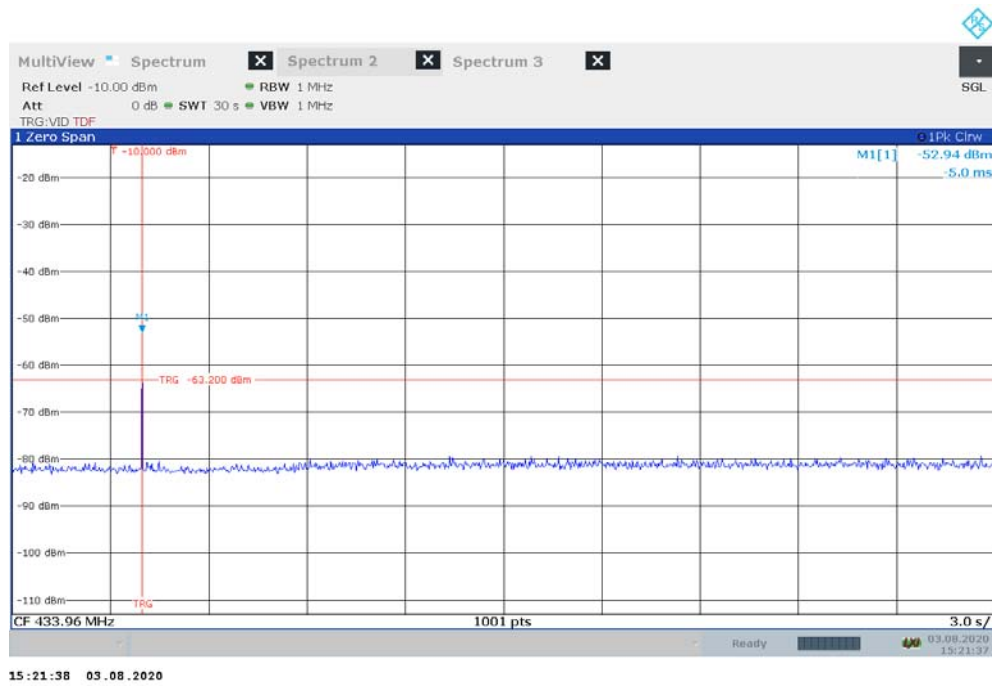
Operated from DC 12 V

| Operating frequency | Transmission Type | Transmission Time | Limit |
|---------------------|-------------------|-------------------|-------|
|                     |                   | [ms]              | [s]   |
| 433.96 MHz          | Automatically     | 4.41              | 5     |

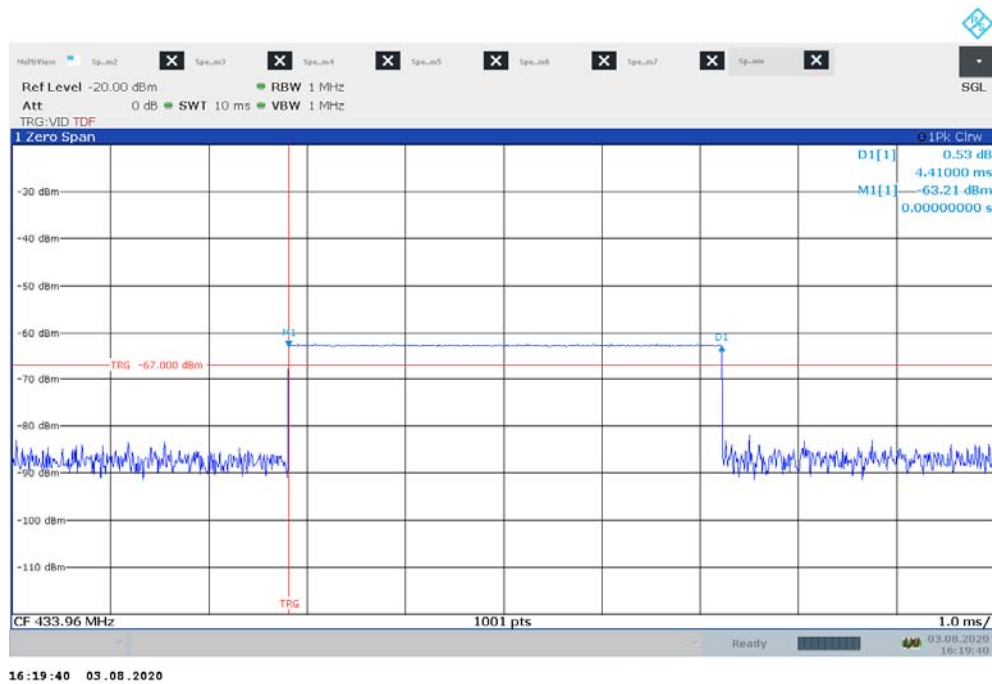
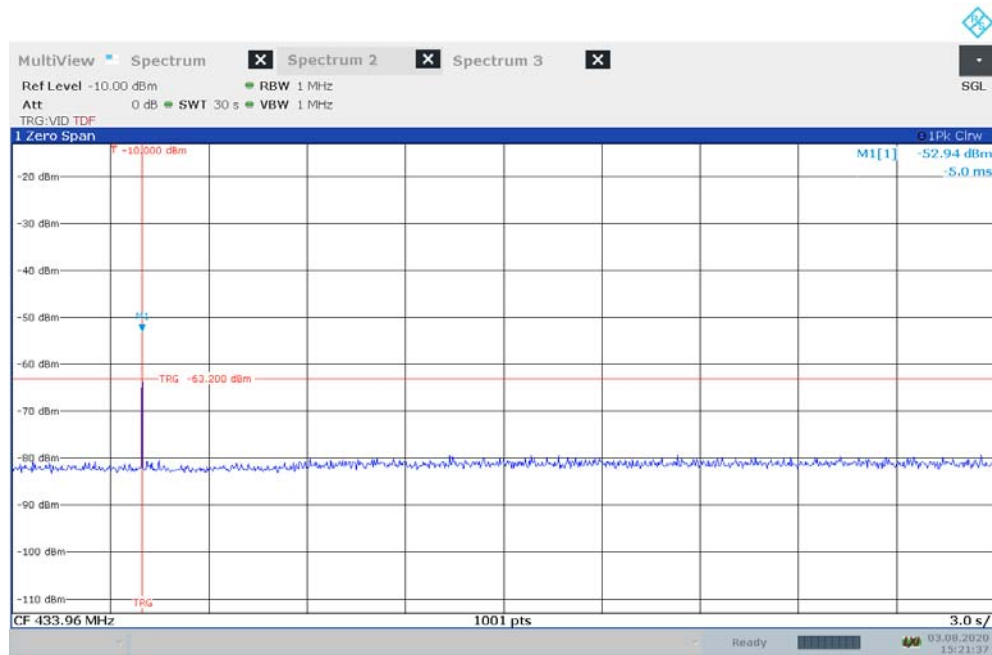
Operated from DC 24 V

| Operating frequency | Transmission Type | Transmission Time | Limit |
|---------------------|-------------------|-------------------|-------|
|                     |                   | [ms]              | [s]   |
| 433.96 MHz          | Automatically     | 4.41              | 5     |

**Figure 2. Plot of the Transmission Time (Operated from DC 12 V)**



**Figure 2. Plot of the Transmission Time (Operated from DC 24 V)**





5.4. Radiated emissions

5.4.1 Regulation

FCC 47CFR15 – 15.231

According to §15.231(b), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

| Fundamental frequency (MHz) | Field strength of fundamental (µV/m) @ 3 m | Field strength of spurious emissions (µV/m) @ 3 m |
|-----------------------------|--|---|
| 40.66 – 40.70               | 2,250                                      | 225   |
| 70 – 130                    | 1,250                                      | 125   |
| 130 – 174                   | 1,250 to 3,750**                           | 125 to 375**                                      |
| 174 – 260                   | 3,750                                      | 375   |
| 260 – 470                   | 3,750 to 12,500**                          | 375 to 1,250**                                    |
| Above 470                   | 12,500                                     | 1,250   |

\*\* linear interpolations

Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

FCC 47CFR15 – 15.209

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

| Frequency (MHz) | Field strength limit (µV/m) | Field strength limit (dBµV/m) | Measurement Distance (m) |
|-----------------|-----------------------------|-------------------------------|--------------------------|
| 0.009 – 0.490   | 2400/F (kHz) = 266.7 – 4.9  | 48.5 – 13.8                   | 300                      |
| 0.490 – 1.705   | 24000/F (kHz) = 49.0 – 14.1 | 33.8 – 23.0                   | 30                       |
| 1.705 – 30.0    | 30                          | 29.5                          | 30                       |
| 30 – 88         | 100                         | 40.0                          | 3                        |
| 88 – 216        | 150                         | 43.5                          | 3                        |
| 216 – 960       | 200                         | 46.0                          | 3                        |
| Above 960       | 500                         | 54.0                          | 3                        |

The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.



#### **5.4.2 Measurement Procedure**

The EUT repeatedly transmitted RF signals and the following measurement procedure specified in ANSI C63.10-2013 was used.

##### **Radiated Emissions Test, 9 kHz to 30 MHz (Magnetic Field Test)**

- (a) The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at a distance of 3 meters according to Section 15.31(f)(2).
- (b) The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table.
- (c) Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable.
- (d) To obtain the final measurement data, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
- (e) The EUT was situated in three orthogonal planes (if appropriate).

##### **Radiated Emissions Test, above 30 MHz**

- (a) The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters.
- (b) The EUT was placed on the top of the 0.8-meter height (or 1.5 meter height for above 1 GHz), 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
- (c) The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 to 1000 MHz using the Bilog broadband antenna, and from 1 GHz to tenth harmonic of the highest fundamental frequency using the horn antenna.
- (d) Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
- (e) The EUT was situated in three orthogonal planes (if appropriate).





**5.4.3 Test Results:**

**PASS**

**Table 3: Measured values of the Field strength**

X-axis is worst-case configuration among 3 axis(The highest output value was determined at 12V).

For the measurements under below 30 MHz (DC 12 V)

| Freq. (kHz) | RBW (kHz) | Reading (dB $\mu$ V) |     | AF (dB/m) | Cable Loss (dB) | Actual (dB $\mu$ V/m) |      | Limit (at 3m) (dB $\mu$ V/m) |      | Margin (dB) |      | Remark |
|-------------|-----------|----------------------|-----|-----------|-----------------|-----------------------|------|------------------------------|------|-------------|------|--------|
|             |           | PK                   | AV  |           |                 | PK                    | AV   | PK                           | AV   | PK          | AV   |        |
| 280.0       | 0.2       | 20.8                 | 7.7 | 20.1      | 0.1             | 41.0                  | 27.9 | 118.7                        | 98.7 | 77.7        | 70.8 | X-axis |

For the measurements under below 30 MHz (DC 24 V)

| Freq. (kHz) | RBW (kHz) | Reading (dB $\mu$ V) |     | AF (dB/m) | Cable Loss (dB) | Actual (dB $\mu$ V/m) |      | Limit (at 3m) (dB $\mu$ V/m) |      | Margin (dB) |      | Remark |
|-------------|-----------|----------------------|-----|-----------|-----------------|-----------------------|------|------------------------------|------|-------------|------|--------|
|             |           | PK                   | AV  |           |                 | PK                    | AV   | PK                           | AV   | PK          | AV   |        |
| 280.0       | 0.2       | 21.1                 | 8.2 | 20.1      | 0.1             | 41.3                  | 28.4 | 118.7                        | 98.7 | 77.4        | 70.3 | X-axis |

Actual (dB $\mu$ V/m) = Reading + AF + Cable Loss

Margin (dB) = Limit – Actual

Note: These test results were measured at the 3 m distance.

For the measurements from 30 MHz to 1 GHz (for X-axis, 12 V), except for the emissions in 15.205

| Frequency (MHz) | Pol. (V/H) | Height (m) | Reading (dB $\mu$ V) | AMP (dB) | AF (dB/m) | CL (dB) | DCCF (dB) | Actual (dB $\mu$ V/m) |      | Limit (dB $\mu$ V/m) |      | Margin (dB) |      |
|-----------------|------------|------------|----------------------|----------|-----------|---------|-----------|-----------------------|------|----------------------|------|-------------|------|
|                 |            |            | PK                   |          |           |         |           | PK                    | AV   | PK                   | AV   | PK          | AV   |
| 433.964         | H          | 1.00       | 91.6                 | 30.3     | 22.3      | 2.8     | -27.1     | 86.4                  | 59.3 | 100.8                | 80.8 | 14.4        | 21.5 |
| 433.964         | V          | 1.00       | 86.6                 | 30.3     | 22.3      | 2.8     | -27.1     | 81.4                  | 54.3 | 100.8                | 80.8 | 19.4        | 26.5 |

For the measurements from 30 MHz to 1 GHz (for X-axis, 24 V), except for the emissions in 15.205

| Frequency (MHz) | Pol. (V/H) | Height (m) | Reading (dB $\mu$ V) | AMP (dB) | AF (dB/m) | CL (dB) | DCCF (dB) | Actual (dB $\mu$ V/m) |      | Limit (dB $\mu$ V/m) |      | Margin (dB) |      |
|-----------------|------------|------------|----------------------|----------|-----------|---------|-----------|-----------------------|------|----------------------|------|-------------|------|
|                 |            |            | PK                   |          |           |         |           | PK                    | AV   | PK                   | AV   | PK          | AV   |
| 433.964         | H          | 1.00       | 91.1                 | 30.3     | 22.3      | 2.8     | -27.1     | 85.9                  | 58.8 | 100.8                | 80.8 | 14.9        | 22.0 |
| 433.964         | V          | 1.00       | 86.4                 | 30.3     | 22.3      | 2.8     | -27.1     | 81.2                  | 54.1 | 100.8                | 80.8 | 19.6        | 26.7 |

For the measurements from 30 MHz to 1 GHz (for Y-axis, 12 V), except for the emissions in 15.205

| Frequency (MHz) | Pol. (V/H) | Height (m) | Reading (dB $\mu$ V) | AMP (dB) | AF (dB/m) | CL (dB) | DCCF (dB) | Actual (dB $\mu$ V/m) |      | Limit (dB $\mu$ V/m) |      | Margin (dB) |      |
|-----------------|------------|------------|----------------------|----------|-----------|---------|-----------|-----------------------|------|----------------------|------|-------------|------|
|                 |            |            | PK                   |          |           |         |           | PK                    | AV   | PK                   | AV   | PK          | AV   |
| 433.964         | H          | 1.00       | 90.2                 | 30.3     | 22.3      | 2.8     | -27.1     | 85.0                  | 57.9 | 100.8                | 80.8 | 15.8        | 22.9 |
| 433.964         | V          | 1.00       | 88.4                 | 30.3     | 22.3      | 2.8     | -27.1     | 83.2                  | 56.1 | 100.8                | 80.8 | 17.6        | 24.7 |

For the measurements from 30 MHz to 1 GHz (for Z-axis, 12 V), except for the emissions in 15.205

| Frequency (MHz) | Pol. (V/H) | Height (m) | Reading (dB $\mu$ V) | AMP (dB) | AF (dB/m) | CL (dB) | DCCF (dB) | Actual (dB $\mu$ V/m) |      | Limit (dB $\mu$ V/m) |      | Margin (dB) |      |
|-----------------|------------|------------|----------------------|----------|-----------|---------|-----------|-----------------------|------|----------------------|------|-------------|------|
|                 |            |            | PK                   |          |           |         |           | PK                    | AV   | PK                   | AV   | PK          | AV   |
| 433.964         | H          | 1.00       | 83.0                 | 30.3     | 22.3      | 2.8     | -27.1     | 77.8                  | 50.7 | 100.8                | 80.8 | 23.0        | 30.1 |
| 433.964         | V          | 1.00       | 80.4                 | 30.3     | 22.3      | 2.8     | -27.1     | 75.2                  | 48.1 | 100.8                | 80.8 | 25.6        | 32.7 |

V/H: Vertical / Horizontal polarization



AMP, AF and CL: pre-amplifier gain, antenna factor and cable loss including an attenuator/filter if used

Peak Actual = Peak Reading - AMP + AF + CL

AV Actual = Peak Reading - AMP + AF + CL+ DCCF

DCCF = 20\*LOG(Transmission Time/100)

Margin = Limit - Actual

For the measurements from 30 MHz to 1 GHz with quasi-peak detector  
(emissions in the restricted bands specified in 15.205)

Operated from DC 12 V

| Frequency (MHz) | Pol. (V/H) | Height (m) | Reading (dBμV) | AMP (dB) | AF (dB/m) | CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Remark |
|-----------------|------------|------------|----------------|----------|-----------|---------|-----------------|----------------|-------------|--------|
| 44.842          | H          | 1.00       | 39.3           | 30.6     | 19.7      | 0.9     | 29.3            | 40.0           | 10.7        | X-axis |
| 59.461          | V          | 2.00       | 39.3           | 30.0     | 19.1      | 1.0     | 28.9            | 40.0           | 11.1        |        |
| 288.015         | H          | 1.00       | 40.3           | 30.0     | 19.0      | 2.3     | 31.6            | 46.0           | 14.4        |        |
| 392.028         | H          | 1.00       | 37.5           | 30.2     | 21.4      | 2.7     | 31.4            | 46.0           | 14.6        |        |

Operated from DC 24 V

| Frequency (MHz) | Pol. (V/H) | Height (m) | Reading (dBμV) | AMP (dB) | AF (dB/m) | CL (dB) | Actual (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Remark |
|-----------------|------------|------------|----------------|----------|-----------|---------|-----------------|----------------|-------------|--------|
| 45.368          | V          | 1.00       | 36.0           | 30.6     | 19.7      | 0.9     | 26.0            | 40.0           | 14.0        | X-axis |
| 63.458          | V          | 1.00       | 34.9           | 30.5     | 18.6      | 1.1     | 24.1            | 40.0           | 15.9        |        |
| 288.018         | H          | 2.00       | 40.5           | 30.0     | 19.0      | 2.3     | 20.7            | 46.0           | 25.3        |        |

V/H: Vertical / Horizontal polarization

AMP, AF and CL: pre-amplifier gain, antenna factor and cable loss including an attenuator/filter if used

Actual = Reading - AMP + AF + CL

Margin = Limit - Actual



For the measurements above 1 GHz (for X-axis, 12 V)

| Frequency (MHz) | Pol. (V/H) | Height (m) | Reading (dBμV) |      | AMP (dB) | AF (dB/m) | CL (dB) | Actual (dBμV/m) |      | Limit (dBμV/m) |      | Margin (dB) |      |
|-----------------|------------|------------|----------------|------|----------|-----------|---------|-----------------|------|----------------|------|-------------|------|
|                 |            |            | PK             | AV   |          |           |         | PK              | AV   | PK             | AV   | PK          | AV   |
| 1157.012        | V          | 1.9        | 45.5           | 35.0 | 39.5     | 24.9      | 5.1     | 36.0            | 25.5 | 74             | 54   | 38.0        | 28.5 |
| 1849.107        | V          | 2.26       | 54.4           | 35.1 | 39.6     | 25.9      | 5.3     | 46.0            | 26.7 | 74             | 54   | 28.0        | 27.3 |
| 2166.644        | H          | 1.49       | 49.9           | 35.1 | 39.4     | 26.8      | 5.6     | 42.9            | 29.1 | 80.8           | 60.8 | 37.9        | 31.7 |
| 2242.395        | V          | 2.18       | 45.0           | 31.8 | 39.4     | 27.1      | 5.7     | 38.4            | 25.2 | 74             | 54   | 35.6        | 28.8 |
| 4730.618        | V          | 1.54       | 44.7           | 34.5 | 39.4     | 31.3      | 8.1     | 44.7            | 34.5 | 74             | 54   | 29.3        | 19.5 |

For the measurements above 1 GHz (for X-axis, 24 V)

| Frequency (MHz) | Pol. (V/H) | Height (m) | Reading (dBμV) |      | AMP (dB) | AF (dB/m) | CL (dB) | Actual (dBμV/m) |      | Limit (dBμV/m) |      | Margin (dB) |      |
|-----------------|------------|------------|----------------|------|----------|-----------|---------|-----------------|------|----------------|------|-------------|------|
|                 |            |            | PK             | AV   |          |           |         | PK              | AV   | PK             | AV   | PK          | AV   |
| 1251.000        | V          | 1.26       | 44.9           | 35.2 | 39.5     | 25.0      | 4.9     | 35.3            | 25.6 | 74             | 54   | 38.7        | 28.4 |
| 1465.599        | V          | 2.97       | 36.1           | 25.6 | 39.6     | 25.1      | 5.0     | 36.1            | 25.6 | 74             | 54   | 37.9        | 28.4 |
| 1845.513        | V          | 1.03       | 50.6           | 36.3 | 39.6     | 25.9      | 5.3     | 42.2            | 27.9 | 74             | 54   | 31.8        | 26.1 |
| 2060.161        | V          | 1.30       | 45.8           | 35.0 | 39.5     | 26.5      | 5.6     | 38.4            | 27.6 | 74             | 54   | 35.6        | 26.4 |
| 2188.428        | V          | 1.31       | 44.7           | 34.4 | 39.4     | 26.9      | 5.6     | 37.8            | 27.5 | 80.8           | 60.8 | 43.0        | 33.3 |
| 2235.973        | V          | 1.04       | 44.9           | 34.6 | 39.4     | 27.1      | 5.7     | 38.3            | 28.0 | 74             | 54   | 35.7        | 26.0 |
| 2347.903        | V          | 2.64       | 45.0           | 34.9 | 39.4     | 27.4      | 5.8     | 38.8            | 28.7 | 74             | 54   | 35.2        | 25.3 |

V/H: Vertical / Horizontal polarization

AMP, AF and CL: pre-amplifier gain, antenna factor and cable loss including an attenuator/filter if used

Actual = Reading - AMP + AF + CL

Margin = Limit - Actual

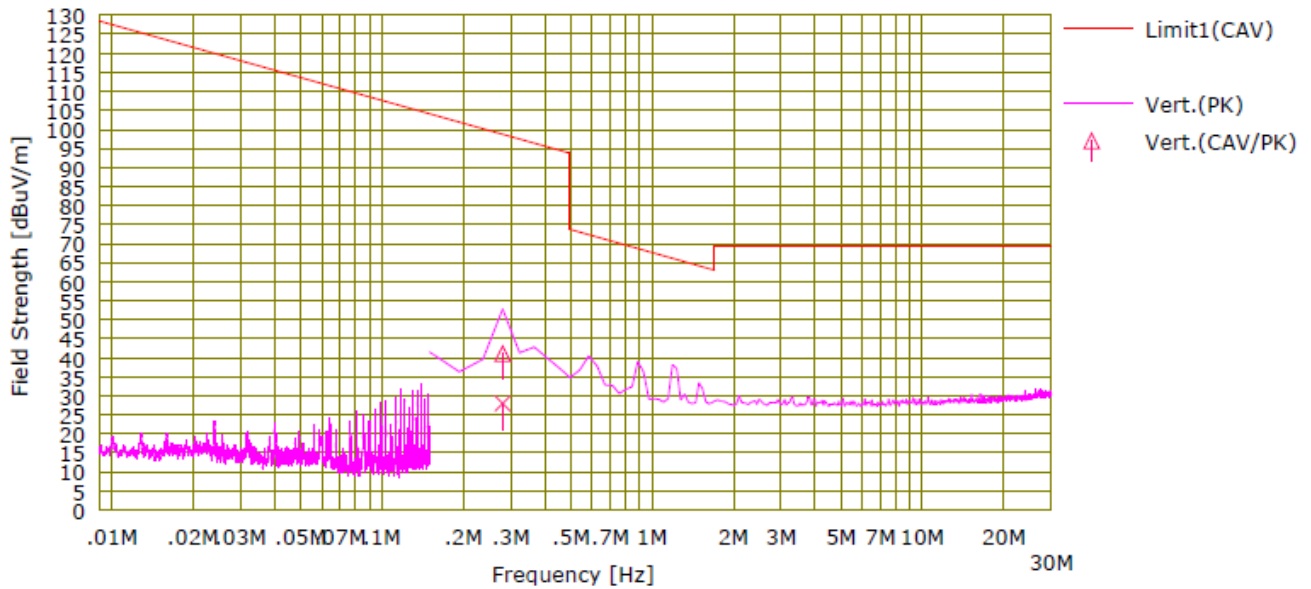
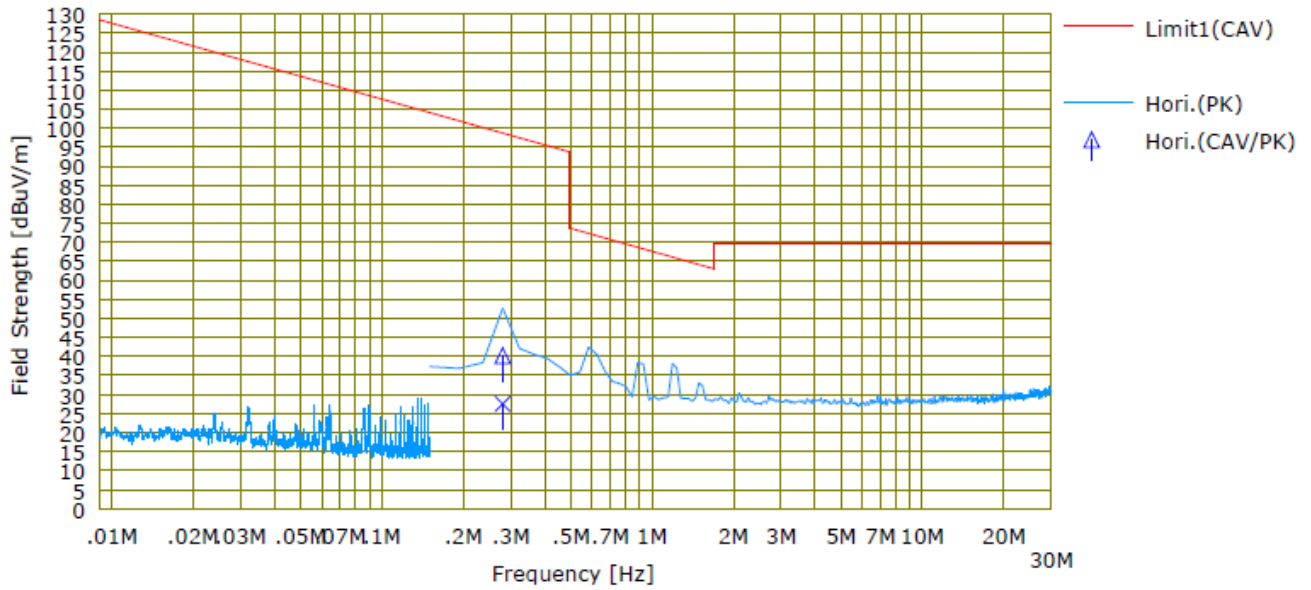


Figure 4. Emission plot for the preliminary radiated measurements

The worst-case plots were attached.

Frequency Range: 9 kHz ~ 30 MHz

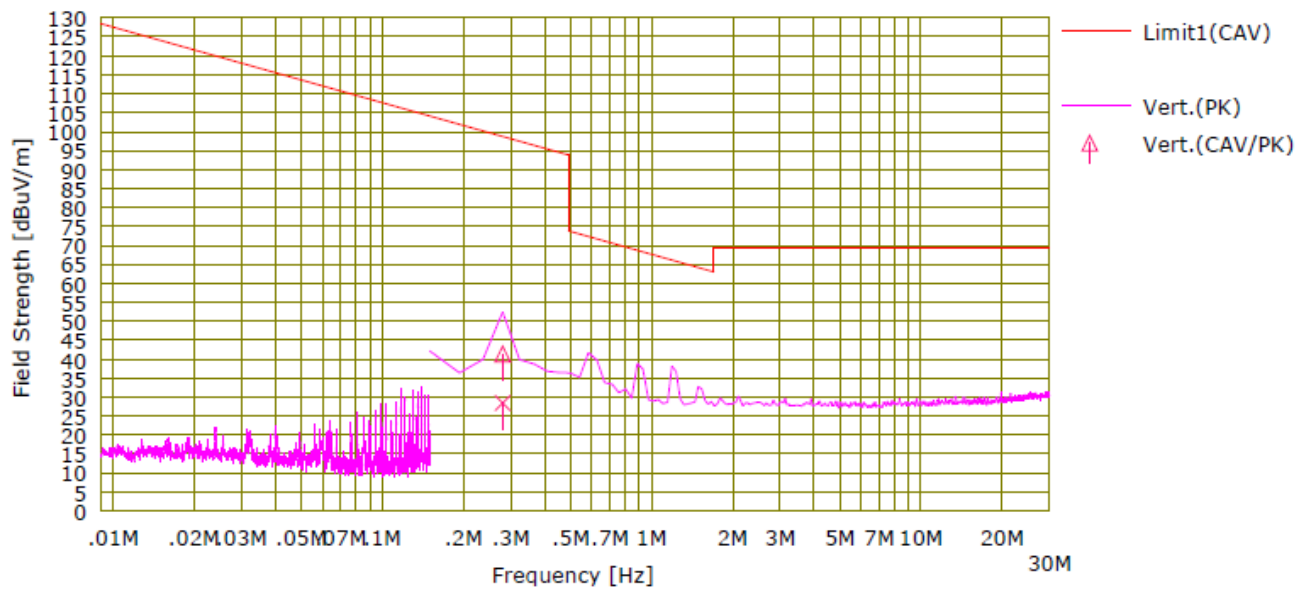
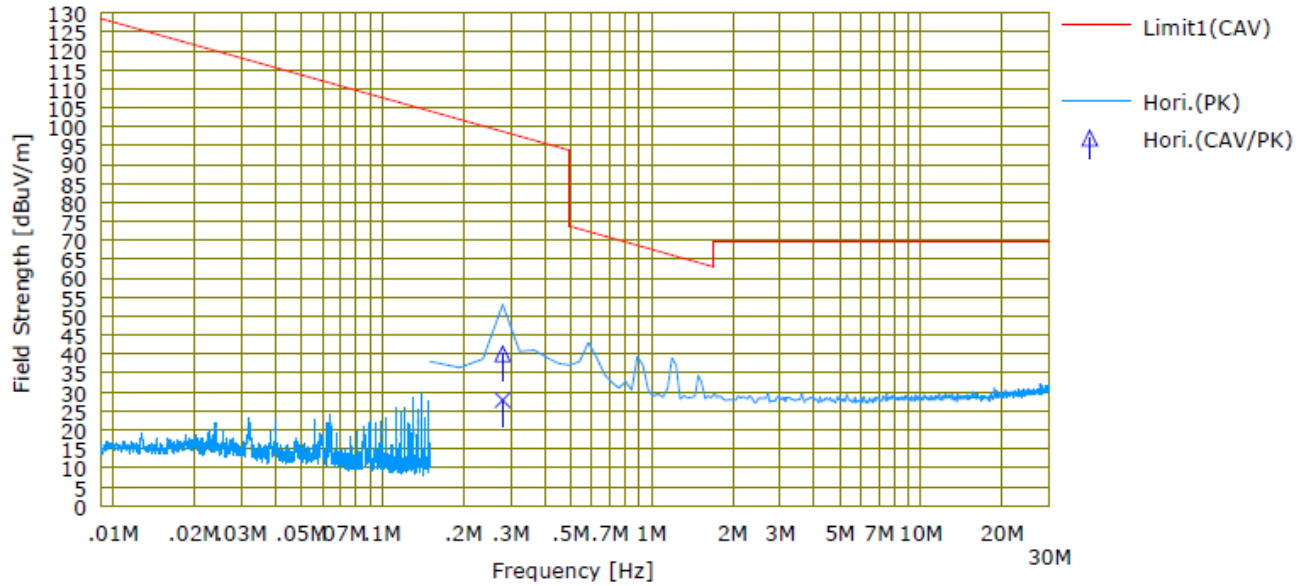
Operated from DC 12 V





Frequency Range: 9 kHz ~ 30 MHz

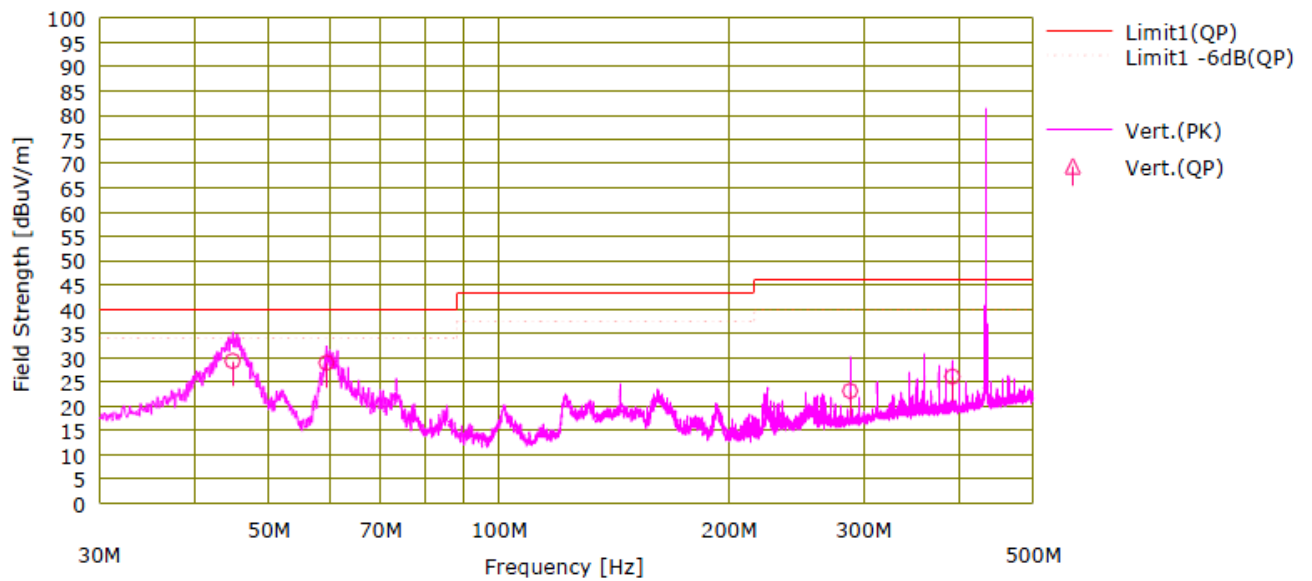
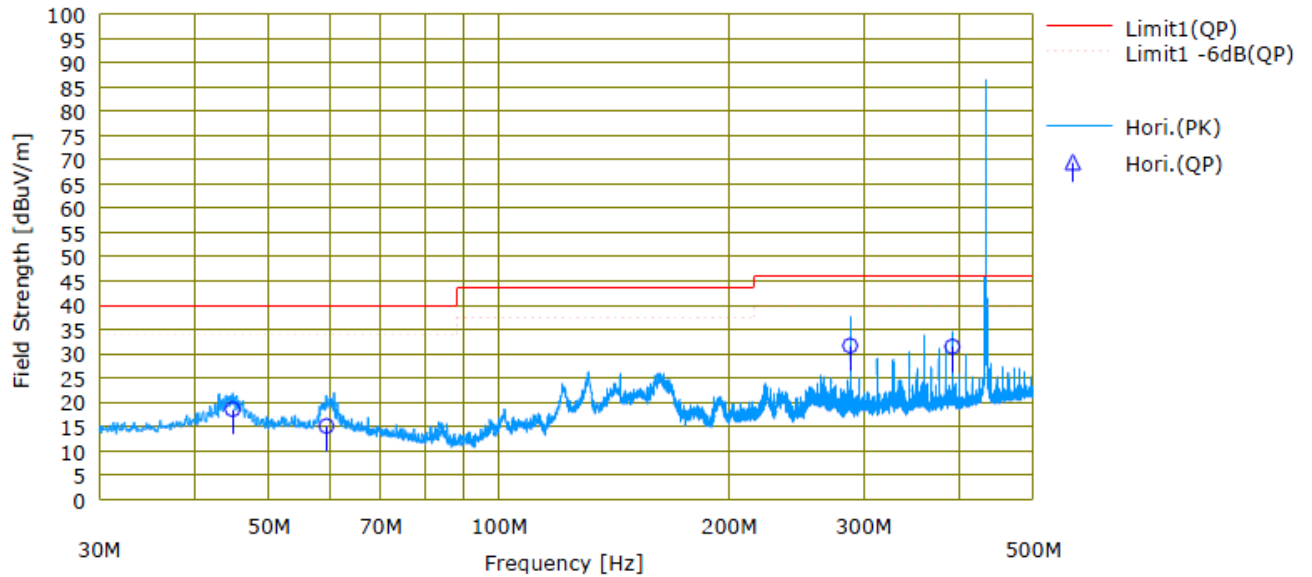
Operated from DC 24 V





Frequency Range: 30 MHz ~ 500 MHz

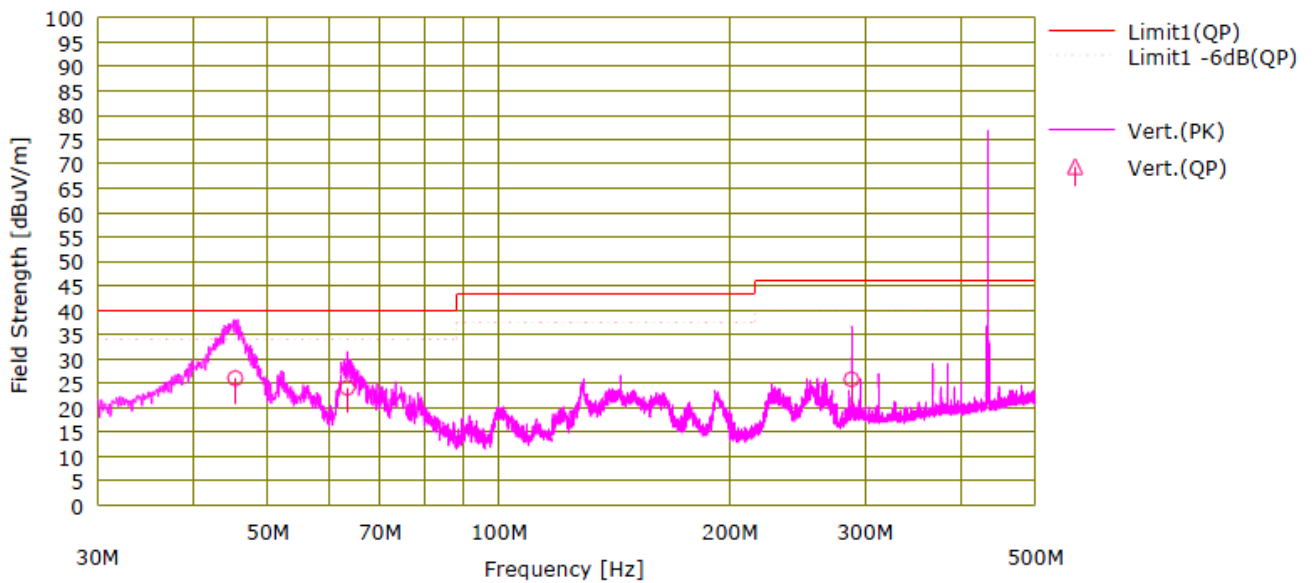
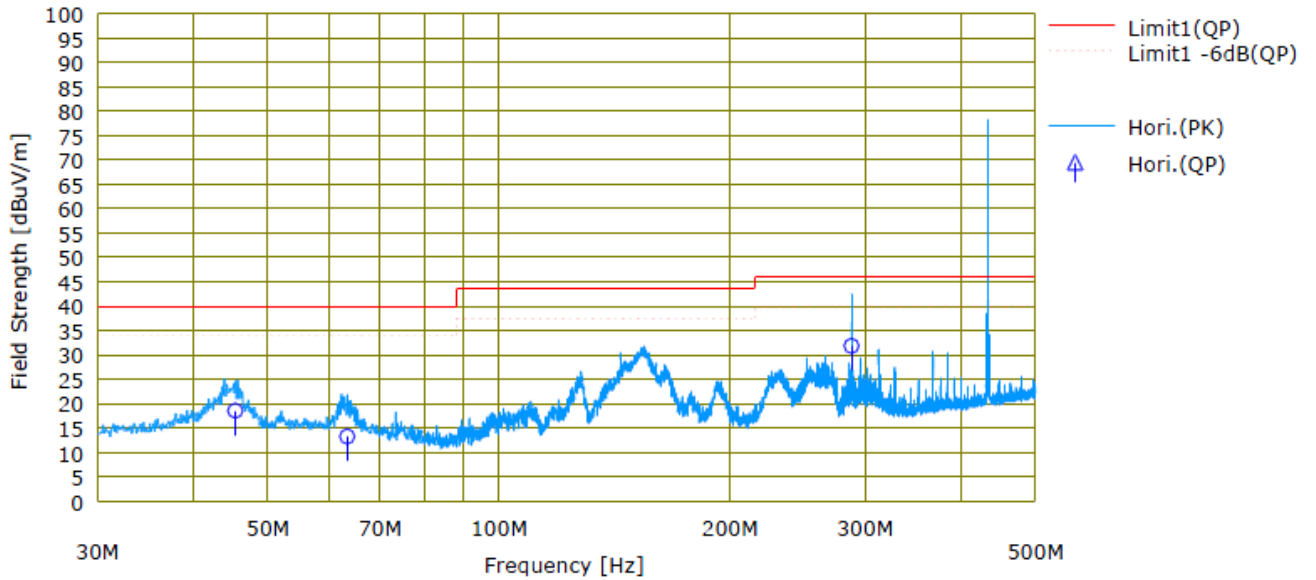
Operated from DC 12 V





Frequency Range: 30 MHz ~ 500 MHz

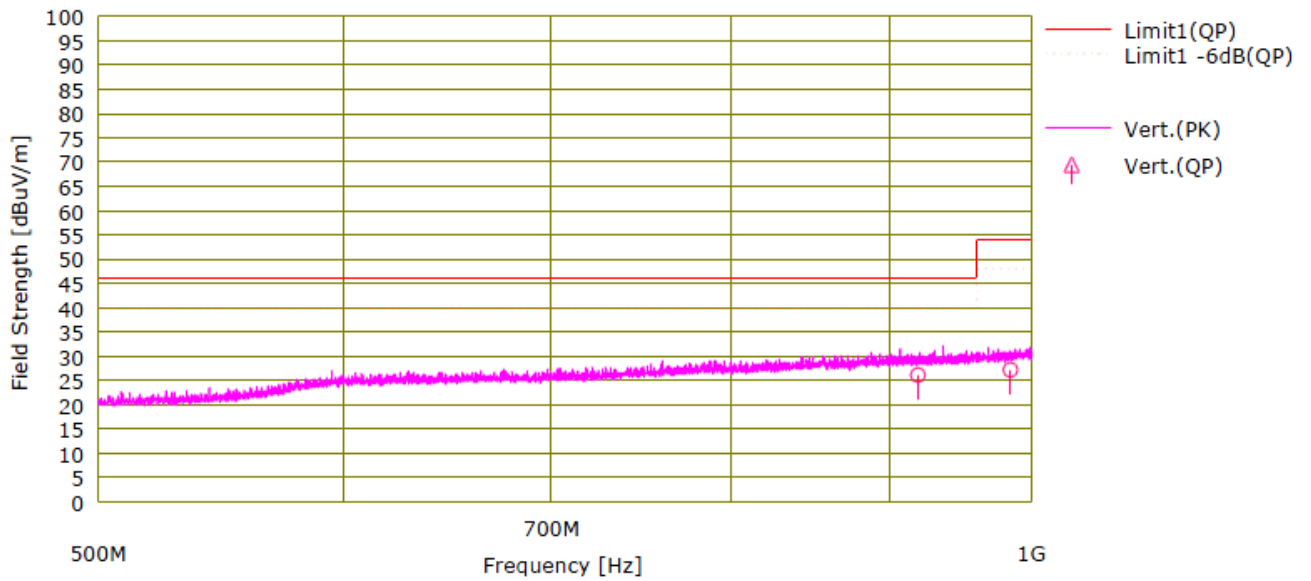
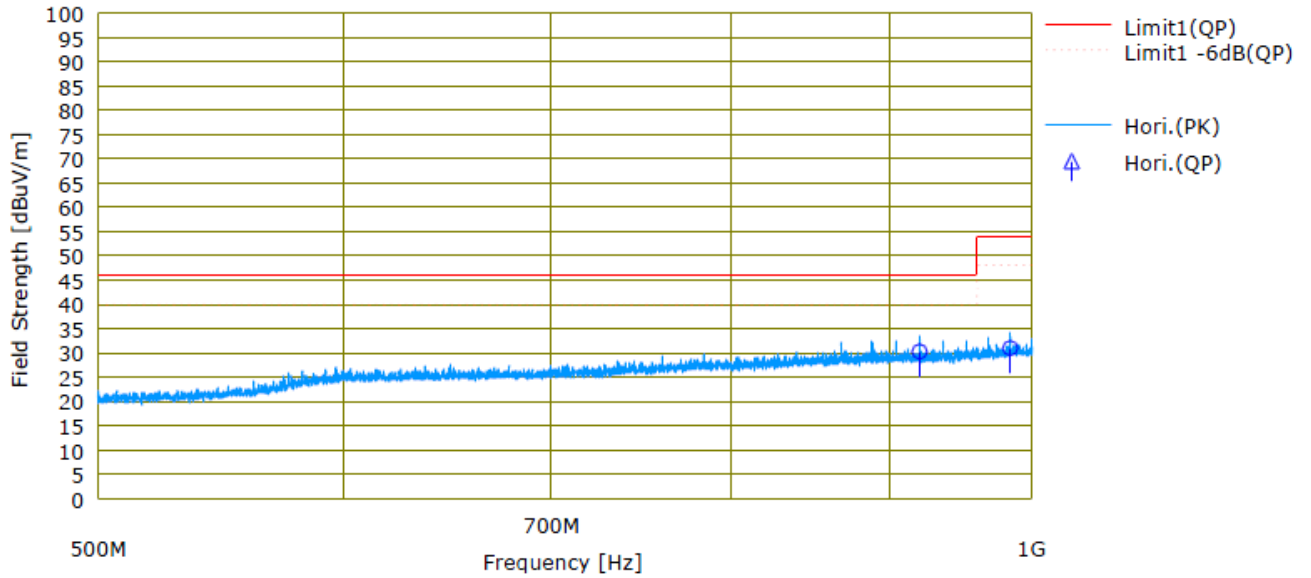
Operated from DC 24 V





Frequency Range: 500 MHz ~ 1 GHz

Operated from DC 12 V

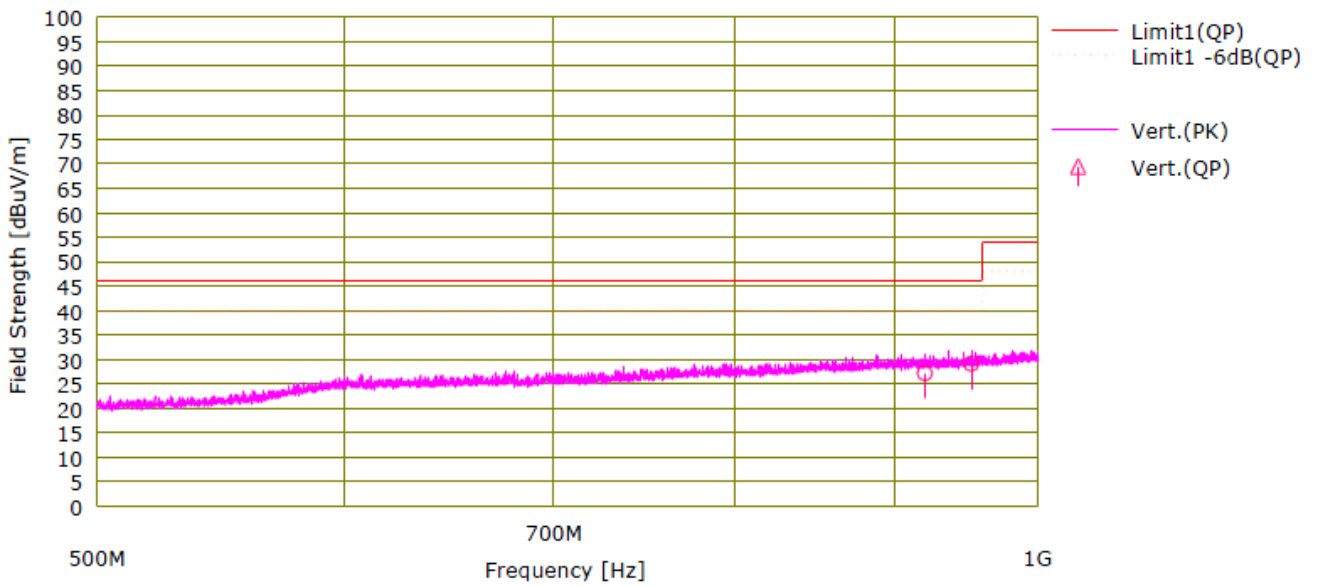
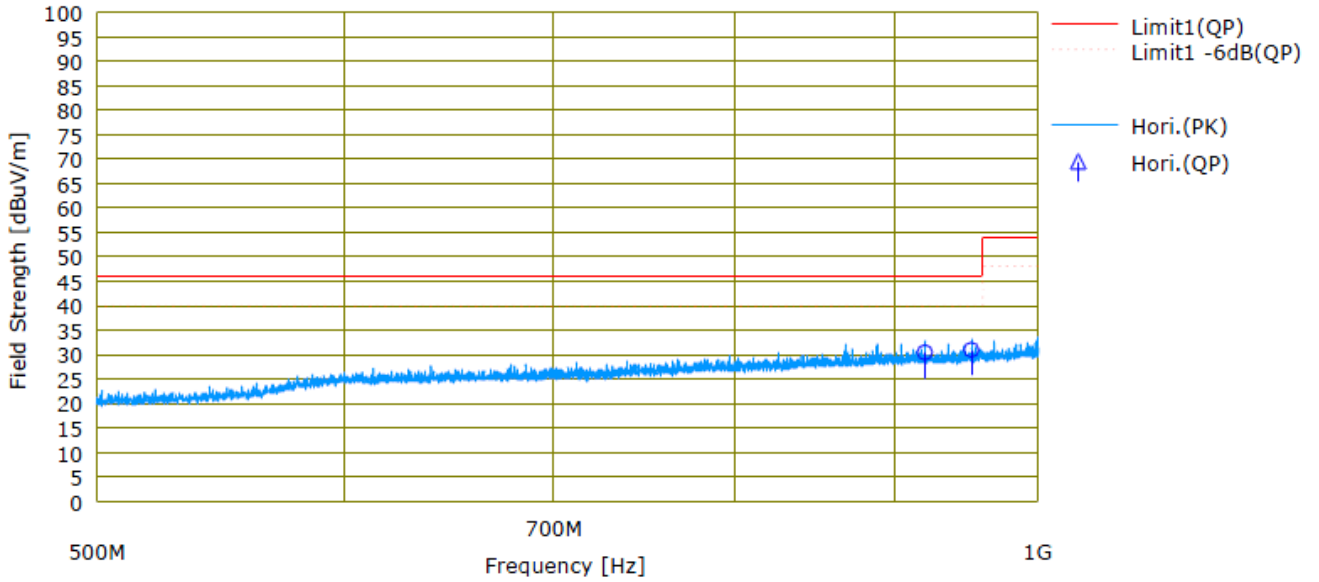






Frequency Range: 500 MHz ~ 1 GHz

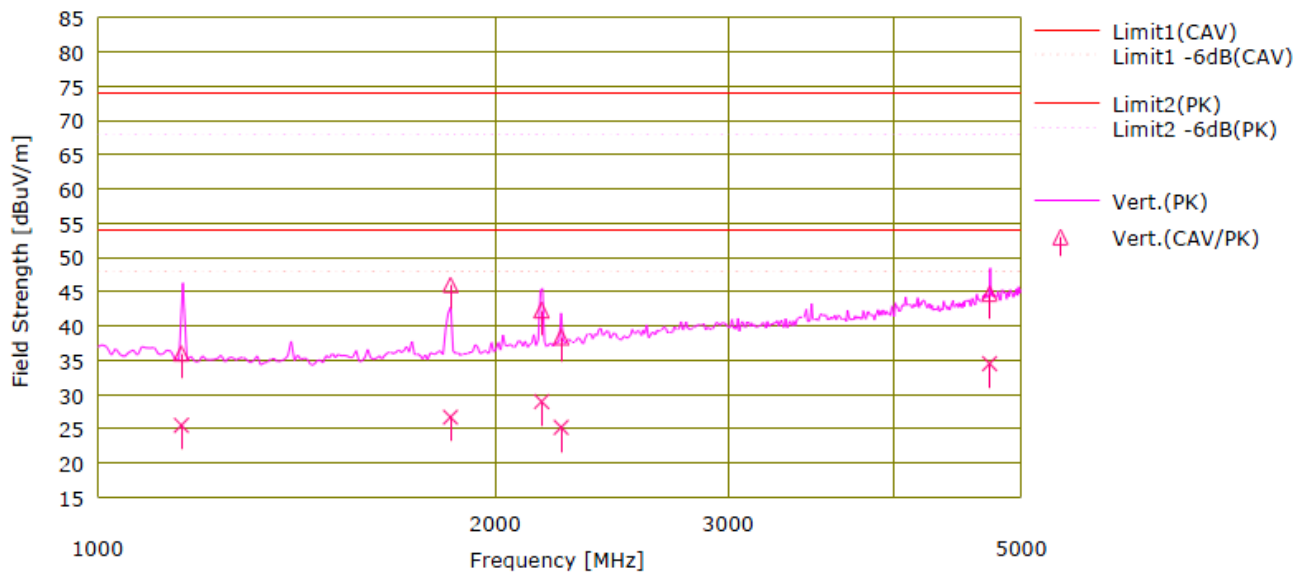
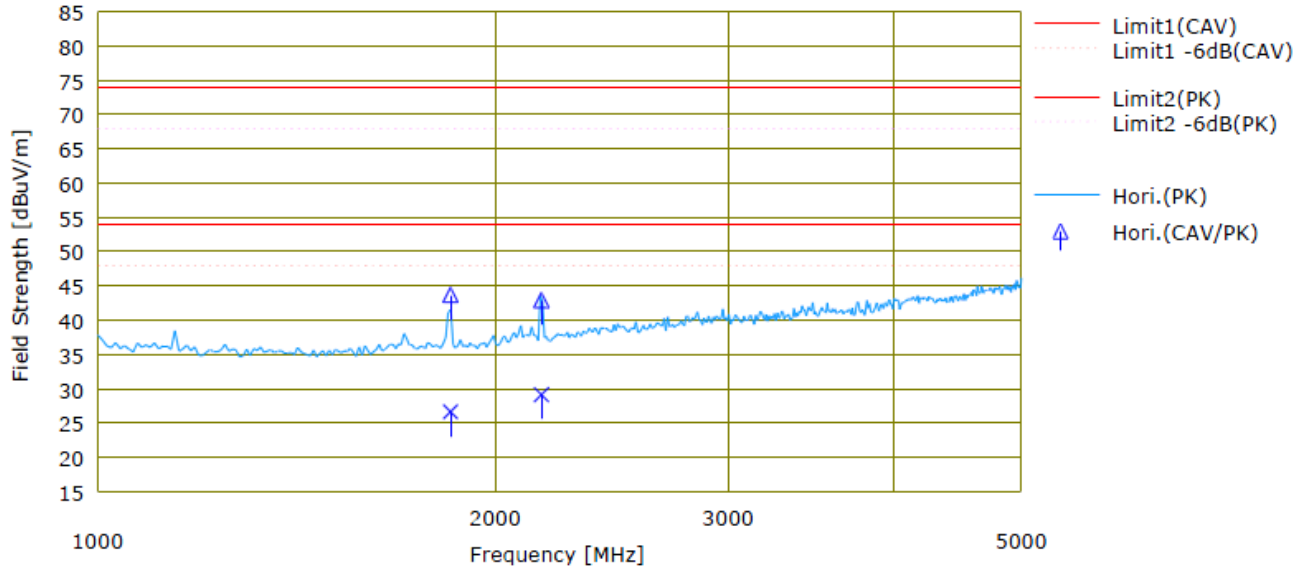
Operated from DC 24 V





Frequency Range: 1 GHz ~ 5 GHz

Operated from DC 12 V





Frequency Range: 1 GHz ~ 5 GHz

Operated from DC 24 V

