# TEST REPORT

For

## 25 Watt VHF/FM Marine Transceiver

In conformity with

## IEC 60945 : 2002

**Model:** GX1850GPS / GX1850 / GX1800GPS / GX1800

**FCC ID:** K6630643X3D

**ISED:** 511B-30643X3D

**Report No:** WE180821BC1-13

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**Prepared for**

YAESU MUSEN CO., LTD.
Tennozu Parkside Building 2-5-8 Higashi-Shinagawa,
Shinagawa-ku, Tokyo 140-0002 JAPAN
Telephone: +81+(0) 3-6711-4121
FAX: +81+(0) 3-6711-4278

**Prepared by**

SGS Japan Inc.
3-5-23, Kitayamata, Tsuzuki-ku, Yokohama, 224-0021, Japan
Telephone: +81+ (0)45 - 550 - 3520
FAX: +81+ (0)45 - 592 - 7506

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# History

| Report No | Date | Revisions | Issued by |
|---|---|---|---|
| WE180821BC1-11 | 26 Sep. 2018 | Initial Issue | T.Kato |
| WE180821BC1-12 | 30 Oct. 2018 | Change the model name of "GX1860" and "GX1800G" | T. Kato |
| WE180821BC1-13 | 14 Nov. 2018 | Add FCC ID and ISED Cert. No. | T. Kato |

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# 1 General information

## 1.1 Product description

| | |
|---|---|
| Test item | : 25 Watt VHF/FM Marine Transceiver |
| Manufacturer | : QUANZHOU QIXIANG ELECTRON & TECHNOLOGY CO., LTD. |
| Address | : Tangxi inductrial Zone, Luojiang District, Quanzhou, Fujian, China |
| Model | : GX1850GPS |
| Serial number | : 8J000001 |
| Operating frequency | : 156.025 - 161.600 MHz (TX)<br>156.050 - 163.275 MHz (RX) |
| Modulation | : G3E, G2B |
| Output power | : 25 W |
| Hardware Version | : SPP1 / SPP1.1 / SPP1.2 |
| Software Version | : V0.00.09 |
| FCC ID | : K6630643X3D |
| ISED Cert. No. | : 511B-30643X3D |
| Equipment Classification | : Exposed Equipment |
| Receipt date of EUT | : 06 Sep. 2018 |
| Nominal power voltages | : DC 13.8V (DC Power supply) |
| Family model | : GX1850 / GX1800GPS / GX1800 |

| Model | GPS | NMEA2000 |
|---|---|---|
| GX1850GPS | ON | ON |
| GX1850 | OFF | ON |
| GX1800GPS | ON | OFF |
| GX1800 | OFF | OFF |

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## 1.2 Test(s) performed / Summary of test result

| | |
|---|---|
| Applicable Standard(s) | : IEC 60945 : 2002 |
| Test(s) started | : 06 Sep. 2018 |
| Test(s) completed | : 20 Sep. 2018 |
| Purpose of test(s) | : Verification of compliance with the applicable standards |

Summary of test result : *Complied*

Note: The above judgment is only based on the measurement data and it does not include the measurement uncertainty. Accordingly, the statement below is applied to the test result.
The EUT complies with the limit required in the standard in case that the margin is not less than the measurement uncertainty in the Laboratory.
Compliance of the EUT is more probable than non-compliance is case that the margin is less than the measurement uncertainty in the Laboratory.

Test engineer : T. Kato
(Wireless testing Lab.)

Reviewer : K. Onishi
(Testing Leader, Wireless Testing Lab.)

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## 1.3 Applicable basic standards

### 1.3.1 EMI test

| Basic Standard | Title |
|---|---|
| IEC 60945 (2002) + Corr.1 | "Maritime navigation and radio communication equipment and systems - General requirements - Methods of testing and required test results |
| CISPR 16-1-1 (2015) | Specification for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity measuring apparatus |

### 1.3.2 EMS test

| Basic Standard | Title |
|---|---|
| IEC 60945 (2002) + Corr.1 | "Maritime navigation and radio communication equipment and systems - General requirements - Methods of testing and required test results |
| IEC 61000-4-2 (2008) | Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test |
| IEC 61000-4-3 (2006) +A1/A2 | Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test |
| IEC 61000-4-4 (2012) | Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test |
| IEC 61000-4-5 (2014) | Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test |
| IEC 61000-4-6 (2013) | Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields |

## 1.4 Test facility

Test Site : SGS Japan Inc.
Address : 472, Nippa-cho, Kohoku-ku, Yokohama, 223-0057, Japan
TEL : +81-45-534-0645
FAX : +81-45-534-0646

Accredited by The Japan Accreditation Board for Conformity Assessment (JAB) for EMC tests stated in the scope of the certificate under Certificate Number RTL02770

Accredited by National Voluntary Laboratory Accreditation Program (NVLAP) for the emission tests stated in the scope of the certificate under Certificate Number 200780-0

Registered by Industry Canada (IC): The registered facility number is as follows
Test site No.1 (Semi-Anechoic chamber 3m): 6974A-1

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## 1.5 Measurement uncertainty

The treatment of uncertainty is based on the general matters on the definition of uncertainty in "Guide to the expression of uncertainty in measurement (GUM)" published by ISO. The Lab's uncertainty is determined by referring UKAS Publication LAB34: 2002 "The Expression of Uncertainty in EMC Testing" and CISPR16-4-2: 2011 "Uncertainty in EMC Measurements".
The uncertainty of the measurement result in the level of confidence of approximately 95% (k=2) is as follows;

| | |
|---|---|
| Conducted emissions (10 kHz – 30 MHz): | ± 3.7 dB |
| Radiated emissions (150 kHz - 30 MHz): | ± 3.2 dB |
| Radiated emissions (30 MHz - 1000 MHz): | ± 6.1 dB |
| Radiated emissions (1000 MHz - 2000 MHz): | ± 4.4 dB |
| Electrostatic discharge: | Within the tolerance specified by the standard |
| Radiated disturbance: | ±2.6 dB |
| Fast transients (bursts): | Within the tolerance specified by the standard |
| Conducted radio frequency disturbance: | ± 1.3 dB |
| Slow transients (surges): | Within the tolerance specified by the standard |

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## 1.6 Description of essencial requirements and test results

This section refers to the standard IEC 60945 clause 9.1 and 10.1

### 1.6.1 EMC emission measurements

| Phenomena | Equipment test requirement | | Applied in this report | Result (Tested HW version) |
|---|---|---|---|---|
| | **Exposed Equipment** | Portable Equipment | | |
| Radiated emissions | **Applicable** | Applicable | Yes | Complied (SPP1) |
| Conducted emissions | **Applicable** | Not applicable | Yes | Complied (SPP1) |

### 1.6.2 Immunity tests

| Phenomenon | Application | Equipment test requirement | | Applicable for the EUT | Result (tested HW version) |
|---|---|---|---|---|---|
| | | **Exposed Equipment** | Portable Equipment | | |
| Radiated Disturbance | Enclosure | **Applicable** | Applicable | Yes | Complied (SPP1.1) |
| Electrostatic discharge | Enclosure | **Applicable** | Applicable | Yes | Complied (SPP1.1) |
| Fast transients (bursts) | Signal and control ports, DC and AC power port | **Applicable** | Not applicable | Yes | Complied (SPP1.1) |
| Conducted radio frequency disturbance | Signal and control ports, DC and AC power port | **Applicable** | Not applicable | Yes | Complied (SPP1.2) |
| Power supply short term variation | AC power input ports | **Applicable** | Not Applicable | No (Note 1) | - |
| Power supply failure | DC and AC power input ports | **Applicable** | Not applicable | Yes | Complied (SPP1.1) |
| Slow transients (surges) | AC power input ports | **Applicable** | Not applicable | No (Note 1) | - |

Note 1: The EUT have no AC power port

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## 1.7 Performance Criteria

For the immunity tests, the results are evaluated against performance criteria relating to the operating conditions and functional specifications of the EUT, and defined as follows.

### 1.7.1 Performance criteria A

The EUT shall continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specification published by the manufacturer.

### 1.7.2 Performance criteria B

The EUT shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed, as defined in the relevant equipment standard and in the technical specification published by the manufacturer. During the test, degradation or loss of function or performance which is self-recoverable is however, allowed, but no change of actual operating state or stored data is allowed.

### 1.7.3 Performance criteria C

Temporary degradation or loss of function performance is allowed during the test, provided the function is self-recoverable, or can be restored at the end of the test by the operation of the controls, as defined in the relevant equipment standard and in the technical specification published by the manufacturer.

### 1.7.4 Judgment Method

Volume knob position is set to approximately center position.
When the EUT shall be amplified by 1 kHz sinusoidal tone, the SINAD of the audio output measured during each individual exposure in the test sequence shall not deteriorate below a level of 20 dB.

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## 1.8 Setup of equipment under test (EUT)

### 1.8.1 Test configuration of EUT

The test configuration of the equipment under test (EUT) refers to tables and figure below.

Table: Equipment

| No. | Item | Manufacturer | Model No. | Serial No. |
|---|---|---|---|---|
| 1 | 25 Watt VHF/FM Marine Transceiver | YAESU MUSEN CO., LTD | GX1850GPS | 8J000001 |

Table: Support equipment

| No. | Item | Manufacturer | Model No. | Serial No. |
|---|---|---|---|---|
| 2 | Remote Access Microphone | YAESU MUSEN CO., LTD | SSM-70H | 8F040122 |
| 3 | External GPS Antenna | YAESU MUSEN CO., LTD | SCU-38 | ES1 |

Table: The following cables were used and connected to the EUT

| No. | Cable Name | From | To | Length [m] | Shielded | Ferrite |
|---|---|---|---|---|---|---|
| A | Mic. Cable | EUT (Main) | EUT (Mic) | 0.4 | No | No |
| B | RAM Cable | EUT | 2 | 7.7 | Yes | Yes |
| C | GPS Cable | EUT | 3 | 5.0 | Yes | No |
| D | DC Cable | EUT | DC | 1.3 | No | Yes |
| E | ACC Cable | EUT | Load | 3.0 | No | Yes |
| F | EX SP Cable | EUT | Load | 1.5 | No | Yes |
| G | NMEA2000 Cable | EUT | Load | 1.0 | Yes | No |
| H | GND Cable | EUT | GND | 2.0 | No | No |

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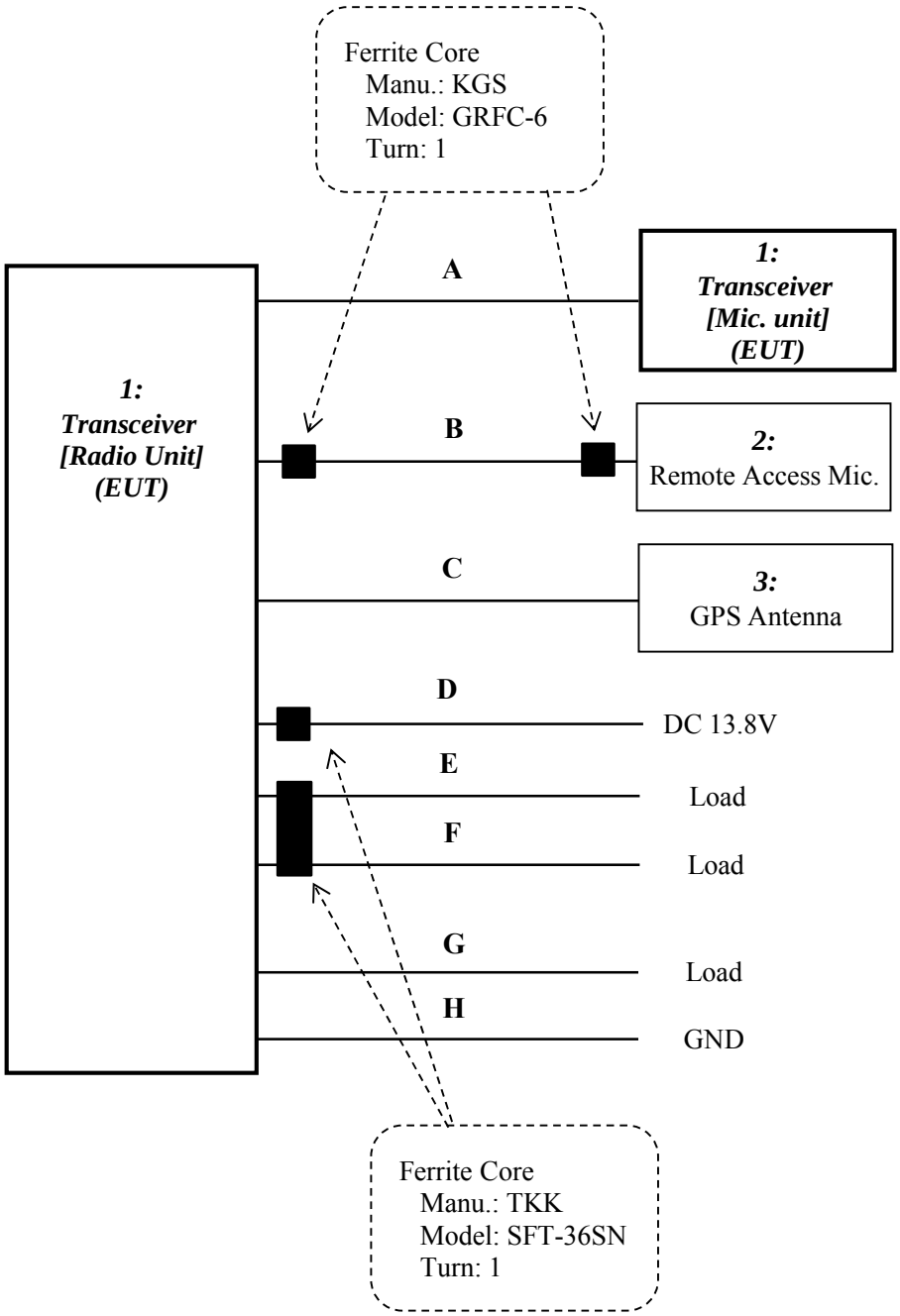


Figure: Test Configuration

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### 1.8.2 Operating condition:

- Rx 16ch: Receiving mode @ 16ch (156.800 MHz)
- Rx 70ch: Receiving mode @ 70ch (156.525 MHz)
- Tx 16ch: Transmitting mode @ 16ch (156.800 MHz)

## 1.9 Equipment modifications

No modifications have been made to the equipment in order to achieve compliance with the applicable standards described in clause 1.2.

## 1.10 Deviation from the standard

No deviations from the standards described in clause 1.2.

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# 2 Test result and procedure

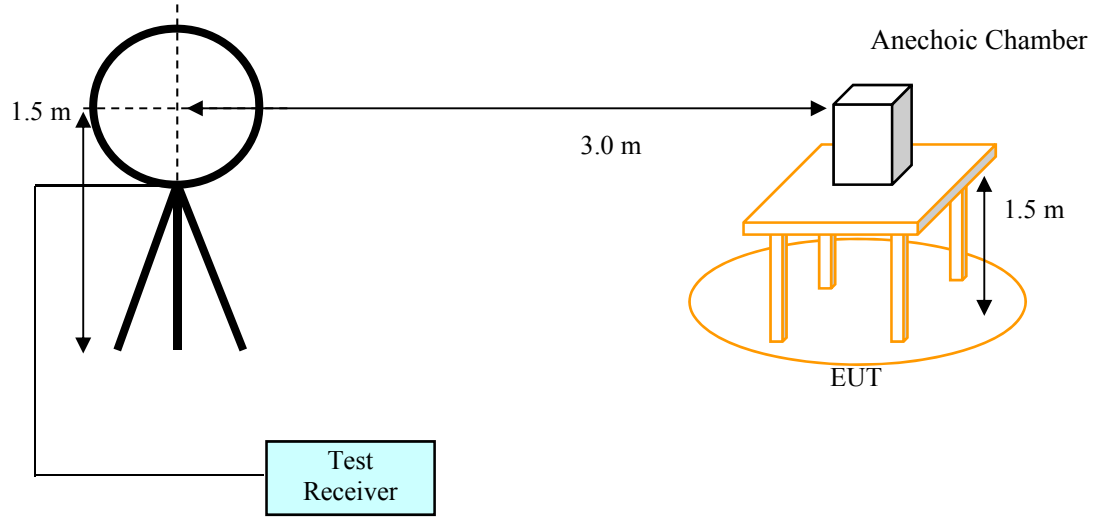
## 2.1 EMI requirement

### 2.1.1 Radiated emissions

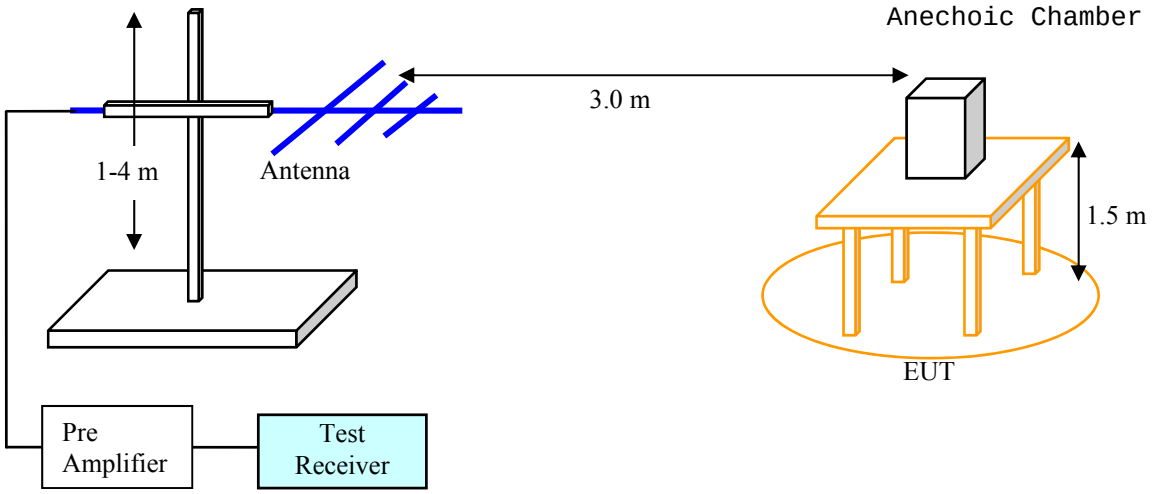
[Test setup]

Test setup is implemented according to the method of IEC 60945 "Radiated measurements".

*150 kHz - 30 MHz*




*30 MHz - 2 GHz*

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[Test method]

The test method shall be in accordance with IEC 60945.
The ancillary equipment shall be tested under operational conditions typical for its normal use. If these conditions cannot be achieved without connection to the radio equipment, then the ancillary equipment shall be tested in combination with the radio equipment to the related requirements for the enclosure radiation in the relevant radio product standard for the effective use of the radio spectrum.

The EUT shall be placed on a non-conductive support with a height of 1.5 m. The measuring distance between the centre of the test antenna and the EUT shall be 3 m. A test site in accordance with IEC 60945 and CISPR 16-1-1 shall be used.

The measuring bandwidth shall be in accordance with a table below.

Table: Measuring bandwidth for radiated emissions

| Frequency Range | Measuring bandwidth |
|---|---|
| 30 MHz to 2 GHz | 120 kHz |
| 156 MHz to 165 MHz | 9 kHz |
| 150 kHz to 30 MHz | 9 kHz |

The setting of controls which may affect the level of radiated interference shall be varied in order to ascertain the maximum emission level.

When the EUT consists of more than one unit the interconnecting cables shall have the maximum length and type as indicated by the manufacturer. Available input and output ports of the ancillary equipment under test shall be connected to the maximum length of cable as indicated by the manufacturer and terminated to simulate the impedance of the relevant ports of the radio equipment. These cables shall be bundled at the approximate centre of the cable with the bundles of 30 cm to 40 cm in length running in the horizontal plane from the port to which it is connected. If it is impractical to do so because of cable bulk or stiffness, the disposition of the excess cable shall be precisely noted in the test report.
The emissions shall be measured in the frequency range of 150 kHz to 2 GHz in accordance with CISPR 16-1-1 using the measuring receiver or a comparable spectrum analyzer. During the measurements up to 2 GHz the quasi-peak detector shall be used.

In addition, for the frequency band 156 MHz to 165 MHz, the measurement shall be repeated with a receiver bandwidth of 9 kHz to 10 kHz. The equipment shall meet both, the quasi peak and the peak emission limits set out in table below.

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[Limits]

The levels of field strength of any radiated emission from the enclosure of the EUT in the frequency range 150 kHz to 2 GHz shall not exceed the values given in table below.

Table: EMC emission limits

| Frequency range | Limit (QP) [dBμV/m] | Limit (PK) [dBμV/m] | Measuring distance |
|---|---|---|---|
| 150 kHz - 300 kHz | 80 - 52 | - | 3 m |
| 300 kHz - 30 MHz | 52 - 34 | - | 3 m |
| 30 MHz - 1 GHz | 54 | - | 3 m |
| 1 GHz - 2 GHz | 54 | - | 3 m |
| 156 MHz - 165 MHz | 24 | 30 | 3 m |

[Test equipment used (refer to List of utilized test equipment)]

| | | | | | |
|---|---|---|---|---|---|
| AC01(EM) | AC01(EG) | BA07 | CL11 | CL30 | CL38 |
| LP06 | PR21 | PR12 | TR06 | DH06 | |

[Test result] - ***Complied with requirement***

[Test Date]

Tested Date: 06 Sep. 2018 Temperature: 20 degC
Humidity: 52 % Atmos. Press: 1008 hPa

[Test Result] Tested HW version: SPP1

*Range 1: 150 kHz - 30 MHz*

*Operating mode: Rx 16ch*

| No. | Frequency [MHz] | Reading [dBμV] | Antenna [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant. [deg] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.43829 | 31.5 | 11.4 | 0.1 | 0.0 | 43.0 | 50.5 | 7.5 | 0deg |
| 2 | 21.23761 | 3.5 | 9.0 | 0.8 | 0.0 | 13.3 | 35.4 | 22.1 | 0deg |
| 3 | 24.03751 | 3.7 | 8.6 | 0.9 | 0.0 | 13.2 | 34.9 | 21.7 | 0deg |
| 4 | 29.37618 | 4.8 | 7.5 | 1.0 | 0.0 | 13.3 | 34.1 | 20.8 | 0deg |
| 5 | 0.30000 | 34.9 | 11.4 | 0.1 | 0.0 | 46.4 | 52.0 | 5.6 | 90deg |
| 6 | 4.22061 | 10.6 | 11.1 | 0.4 | 0.0 | 22.1 | 41.7 | 19.6 | 90deg |

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*Operating mode: Rx 70ch*

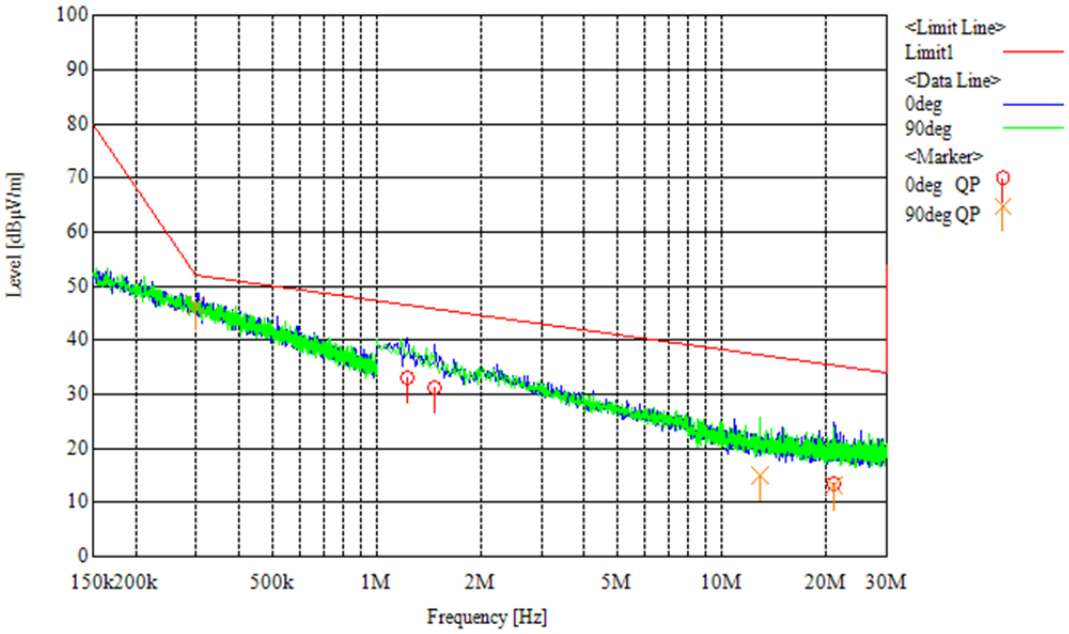
| No. | Frequency [MHz] | Reading [dBμV] | Antenna [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant. [deg] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.30733 | 34.8 | 11.4 | 0.1 | 0.0 | 46.3 | 51.9 | 5.6 | 0deg |
| 2 | 1.14507 | 22.2 | 11.4 | 0.2 | 0.0 | 33.8 | 46.8 | 13.0 | 0deg |
| 3 | 22.77538 | 3.5 | 8.8 | 0.9 | 0.0 | 13.2 | 35.1 | 21.9 | 0deg |
| 4 | 0.26353 | 36.0 | 11.4 | 0.1 | 0.0 | 47.5 | 57.2 | 9.7 | 90deg |
| 5 | 0.30733 | 34.7 | 11.4 | 0.1 | 0.0 | 46.2 | 51.9 | 5.7 | 90deg |
| 6 | 1.10155 | 22.7 | 11.4 | 0.2 | 0.0 | 34.3 | 46.9 | 12.6 | 90deg |

*Operating mode: Tx 16ch*

| No. | Frequency [MHz] | Reading [dBμV] | Antenna [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant. [deg] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.23212 | 21.4 | 11.4 | 0.2 | 0.0 | 33.0 | 46.5 | 13.5 | 0deg |
| 2 | 1.47874 | 19.7 | 11.4 | 0.2 | 0.0 | 31.3 | 45.8 | 14.5 | 0deg |
| 3 | 21.23761 | 3.8 | 9.0 | 0.8 | 0.0 | 13.6 | 35.4 | 21.8 | 0deg |
| 4 | 0.30000 | 35.1 | 11.4 | 0.1 | 0.0 | 46.6 | 52.0 | 5.4 | 90deg |
| 5 | 12.89594 | 4.1 | 10.1 | 0.7 | 0.0 | 14.9 | 37.3 | 22.4 | 90deg |
| 6 | 21.16508 | 3.4 | 9.0 | 0.8 | 0.0 | 13.2 | 35.4 | 22.2 | 90deg |

[Graph]

*Operating mode: Tx 16ch*

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*Range 2: 30 MHz - 1000 MHz*

*Operating mode: Rx 16ch*

| No. | Freq. [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 405.300 | 42.9 | 16.2 | 10.2 | 30.2 | 39.1 | 54.0 | 14.9 | Hori. |
| 2 | 540.400 | 40.5 | 17.7 | 11.0 | 30.1 | 39.0 | 54.0 | 15.0 | Hori. |
| 3 | 675.500 | 36.8 | 18.6 | 11.6 | 30.2 | 36.8 | 54.0 | 17.2 | Hori. |
| 4 | 945.699 | 32.1 | 20.8 | 12.8 | 28.8 | 36.9 | 54.0 | 17.1 | Hori. |
| 5 | 135.100 | 45.3 | 12.4 | 8.1 | 30.2 | 35.6 | 54.0 | 18.4 | Vert. |
| 6 | 675.500 | 37.4 | 18.6 | 11.6 | 30.2 | 37.4 | 54.0 | 16.6 | Vert. |

*Operating mode: Rx 70ch*

| No. | Freq. [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 404.475 | 39.4 | 16.1 | 10.2 | 30.2 | 35.5 | 54.0 | 18.5 | Hori. |
| 2 | 539.300 | 41.4 | 17.7 | 10.9 | 30.1 | 39.9 | 54.0 | 14.1 | Hori. |
| 3 | 674.125 | 35.8 | 18.6 | 11.6 | 30.2 | 35.8 | 54.0 | 18.2 | Hori. |
| 4 | 943.774 | 33.2 | 20.8 | 12.8 | 28.8 | 38.0 | 54.0 | 16.0 | Hori. |
| 5 | 539.300 | 38.2 | 17.7 | 10.9 | 30.1 | 36.7 | 54.0 | 17.3 | Vert. |
| 6 | 943.746 | 28.7 | 20.8 | 12.8 | 28.8 | 33.5 | 54.0 | 20.5 | Vert. |

*Operating mode: Tx 16ch*

| No. | Freq. [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 627.200 | 40.1 | 18.5 | 11.4 | 30.2 | 39.8 | 54.0 | 14.2 | Hori. |
| 2 | 783.999 | 46.9 | 19.6 | 12.1 | 30.1 | 48.5 | 54.0 | 5.5 | Hori. |
| 3 | 940.799 | 37.1 | 20.8 | 12.8 | 28.8 | 41.9 | 54.0 | 12.1 | Hori. |
| 4 | 627.200 | 38.2 | 18.5 | 11.4 | 30.2 | 37.9 | 54.0 | 16.1 | Vert. |
| 5 | 784.000 | 46.8 | 19.6 | 12.1 | 30.1 | 48.4 | 54.0 | 5.6 | Vert. |
| 6 | 940.800 | 34.2 | 20.8 | 12.8 | 28.8 | 39.0 | 54.0 | 15.0 | Vert. |

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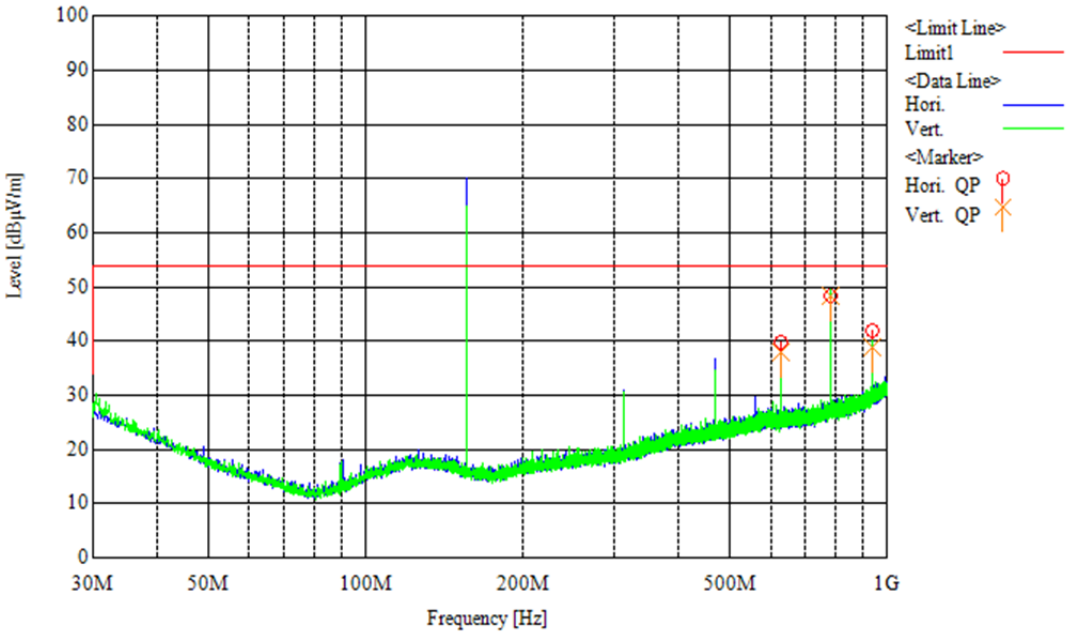
[Graph]

*Operating mode: Tx 16ch*




Note: Spectrum @ 156.8MHz is a Tx carrier. This is not spurious emission.

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*Range 3: 1000 MHz - 2000 MHz*

*Operating mode: Rx 16ch*

| No. | Freq. [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1080.800 | 44.4 | 24.1 | 2.0 | 37.0 | 33.5 | 54.0 | 20.5 | Hori. |
| 2 | 1621.199 | 38.5 | 24.9 | 2.5 | 36.1 | 29.8 | 54.0 | 24.2 | Hori. |
| 3 | 1080.800 | 40.5 | 24.1 | 2.0 | 37.0 | 29.6 | 54.0 | 24.4 | Vert. |
| 4 | 1621.199 | 40.2 | 24.9 | 2.5 | 36.1 | 31.5 | 54.0 | 22.5 | Vert. |

Note: All emissions are below noise floor.

*Operating mode: Rx 70ch*

| No. | Freq. [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1078.599 | 41.2 | 24.1 | 2.0 | 37.0 | 30.3 | 54.0 | 23.7 | Hori. |
| 2 | 1078.599 | 37.6 | 24.1 | 2.0 | 37.0 | 26.7 | 54.0 | 27.3 | Vert. |

Note: All emissions are below noise floor.

*Operating mode: Tx 16ch*

| No. | Freq. [MHz] | Reading [dBμV] | Factor [dB/m] | Loss [dB] | Gain [dB] | Result [dBμV/m] | Limit [dBμV/m] | Margin [dB] | Ant. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1097.599 | 45.0 | 24.4 | 2.0 | 37.0 | 34.4 | 54.0 | 19.6 | Hori. |
| 2 | 1724.799 | 44.6 | 24.8 | 2.6 | 36.1 | 35.9 | 54.0 | 18.1 | Hori. |
| 3 | 1881.599 | 48.9 | 25.4 | 2.7 | 36.0 | 41.0 | 54.0 | 13.0 | Hori. |
| 4 | 1097.599 | 44.9 | 24.4 | 2.0 | 37.0 | 34.3 | 54.0 | 19.7 | Vert. |
| 5 | 1724.799 | 46.6 | 24.8 | 2.6 | 36.1 | 37.9 | 54.0 | 16.1 | Vert. |
| 6 | 1881.599 | 46.7 | 25.4 | 2.7 | 36.0 | 38.8 | 54.0 | 15.2 | Vert. |

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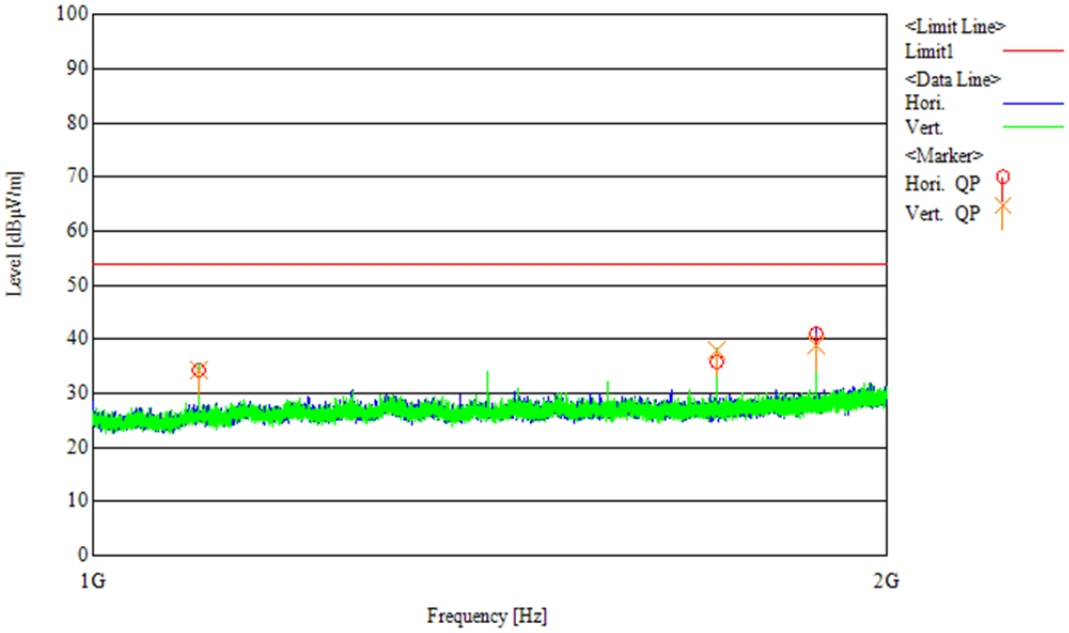
[Graph]

*Operating mode: Tx 16ch*

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*Range 4: 156 MHz - 165 MHz*

*Operating mode: Rx 16ch*

| No. | Freq. [MHz] | Reading PK [dBμV] | Reading QP [dBμV] | Correct. Factor [dB/m] | Result PK [dBμV/m] | Result QP [dBμV/m] | Limit PK [dBμV/m] | Limit QP [dBμV/m] | Margin PK [dB] | Margin QP [dB] | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 161.294 | 32.3 | 25.5 | -11.2 | 21.1 | 14.3 | 30.0 | 24.0 | 8.9 | 9.7 | Hori. |
| 2 | 161.294 | 30.0 | 23.9 | -11.2 | 18.8 | 12.7 | 30.0 | 24.0 | 11.2 | 11.3 | Vert. |

*Operating mode: Rx 70ch*

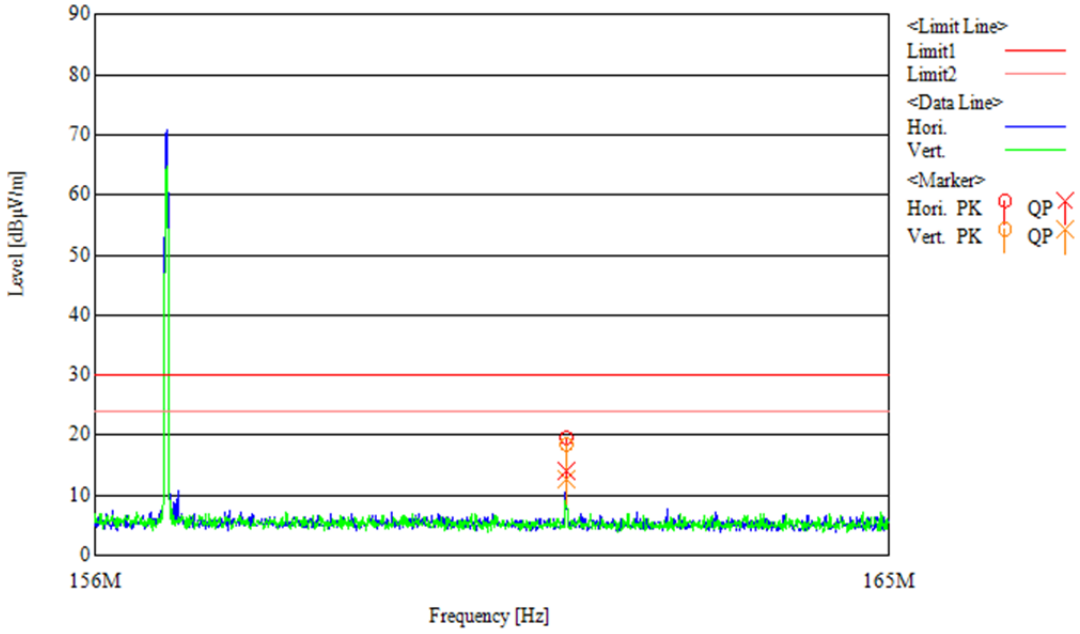
| No. | Freq. [MHz] | Reading PK [dBμV] | Reading QP [dBμV] | Correct. Factor [dB/m] | Result PK [dBμV/m] | Result QP [dBμV/m] | Limit PK [dBμV/m] | Limit QP [dBμV/m] | Margin PK [dB] | Margin QP [dB] | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 161.293 | 31.1 | 25.4 | -11.2 | 19.9 | 14.2 | 30.0 | 24.0 | 10.1 | 9.8 | Hori. |
| 2 | 161.293 | 28.9 | 22.4 | -11.2 | 17.7 | 11.2 | 30.0 | 24.0 | 12.3 | 12.8 | Vert. |

*Operating mode: Tx 16ch*

| No. | Freq. [MHz] | Reading PK [dBμV] | Reading QP [dBμV] | Correct. Factor [dB/m] | Result PK [dBμV/m] | Result QP [dBμV/m] | Limit PK [dBμV/m] | Limit QP [dBμV/m] | Margin PK [dB] | Margin QP [dB] | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 161.294 | 30.9 | 25.3 | -11.2 | 19.7 | 14.1 | 30.0 | 24.0 | 10.3 | 9.9 | Hori. |
| 2 | 161.294 | 29.7 | 23.8 | -11.2 | 18.5 | 12.6 | 30.0 | 24.0 | 11.5 | 11.4 | Vert. |

[Graph]

*Operating mode: Tx 16ch*




Note: Spectrum @ 156.8MHz is a Tx carrier. This is not spurious emission.

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### 2.1.2 Conducted emissions

[Test Method]

The test method shall be in accordance with IEC 60945.

This test shall be performed on a representative configuration of the EUT in both, the receive and the transmit mode of operation, as appropriate.

The power input cable between DC input ports of the EUT and the Artificial Mains Network (AMN) shall be screened and not exceed 0.8 m in length.

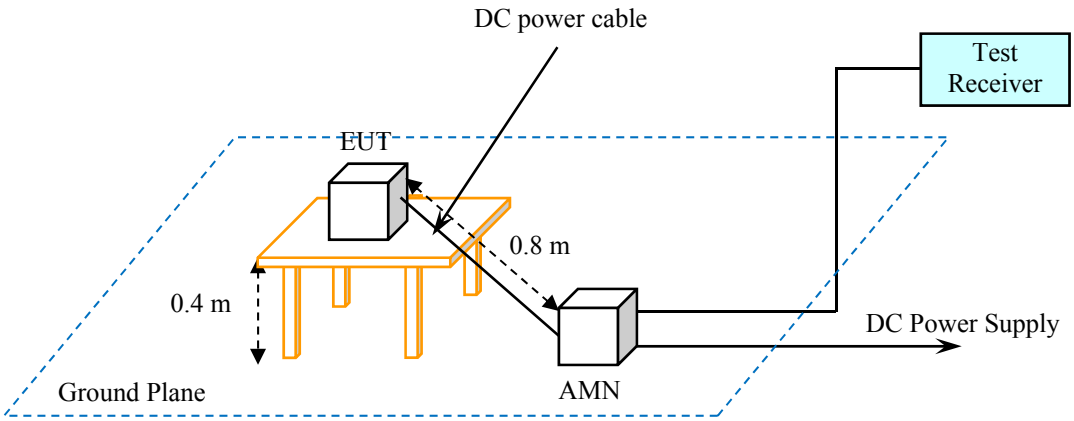
If the EUT consists of more than one unit with individual DC power input ports, power input ports of identical nominal supply voltages shall be connected in parallel to the artificial mains network.

The setting of controls which may affect the level of conducted interference shall be varied in order to ascertain the maximum emission level.

The measuring bandwidth shall be:
- 200 Hz in the frequency range 10 kHz to 150 kHz
- 9 kHz in the frequency range 150 kHz to 30 MHz.

The measurement frequency range extends from 10 kHz to 30 MHz. When the EUT is a transmitter operating at frequencies below 30 MHz, then the exclusion band for transmitters applies (see clause 4.3) for measurements in the transmit mode of operation.

Test setup is implemented according to the method of IEC 60945 "Conducted measurements".

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[Limits]

The level of any conducted spurious signal shall not exceed the values given in below table.

| Frequency range | Limit (QP) [dBμV] |
|---|---|
| 10 kHz - 150 kHz | 96 - 50 |
| 150 kHz - 350 kHz | 60 - 50 |
| 350 kHz - 30 MHz | 50 |

[Test equipment used (refer to List of utilized test equipment)]

| | | | | | |
|---|---|---|---|---|---|
| TR06 | LN18 | CL11 | | | |

[Test result] - ***Complied with requirement***

[Test Date]

Tested Date: 06 Sep. 2018 Temperature: 20 degC
Humidity: 52 % Atmos. Press: 1008 hPa

[Test Data] Tested HW version: SPP1

*Tested line: DC power line*

*Operating mode: Rx 16ch*

| No. | Frequency [MHz] | Reading [dB] | LISN [dB] | Loss [dB] | Gain [dB] | Result [dBμV] | Limit [dBμV] | Margin [dB] | Phase |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.02960 | 28.1 | 10.9 | 0.1 | 0.0 | 39.1 | 77.6 | 38.5 | Va |
| 2 | 0.03531 | 28.8 | 10.7 | 0.1 | 0.0 | 39.6 | 74.6 | 35.0 | Va |
| 3 | 21.25001 | 12.2 | 10.0 | 0.8 | 0.0 | 23.0 | 50.0 | 27.0 | Va |
| 4 | 0.02960 | 21.3 | 10.9 | 0.1 | 0.0 | 32.3 | 77.6 | 45.3 | Vb |
| 5 | 0.03531 | 28.8 | 10.7 | 0.1 | 0.0 | 39.6 | 74.6 | 35.0 | Vb |
| 6 | 21.25000 | 12.1 | 10.0 | 0.8 | 0.0 | 22.9 | 50.0 | 27.1 | Vb |

The power line conducted emission voltage is calculated by adding the LISN factor and the cable loss attenuation from the measured reading. The calculation is as follows:

Result = Reading + C. F
where C.F = LISN Factor + Cable Loss + Gain [dB]

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*Operating mode: Rx 70ch*

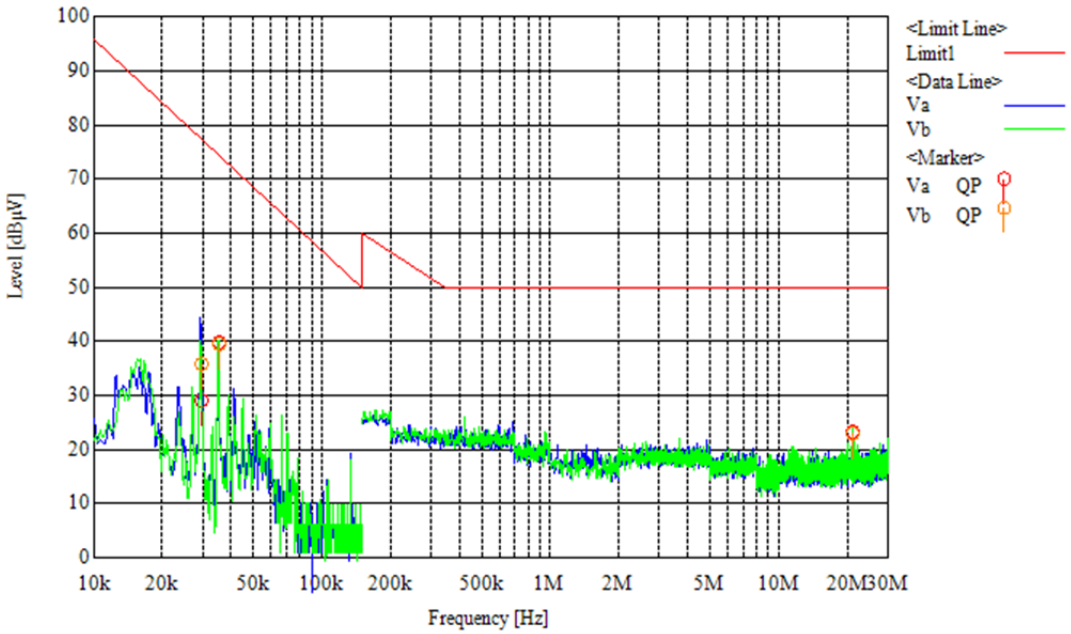
| No. | Frequency [MHz] | Reading [dB] | LISN [dB] | Loss [dB] | Gain [dB] | Result [dBμV] | Limit [dBμV] | Margin [dB] | Phase |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.02971 | 26.6 | 10.9 | 0.1 | 0.0 | 37.6 | 77.5 | 39.9 | Va |
| 2 | 0.03531 | 27.8 | 10.7 | 0.1 | 0.0 | 38.6 | 74.6 | 36.0 | Va |
| 3 | 21.25022 | 12.2 | 10.0 | 0.8 | 0.0 | 23.0 | 50.0 | 27.0 | Va |
| 4 | 0.02965 | 31.3 | 10.9 | 0.1 | 0.0 | 42.3 | 77.5 | 35.2 | Vb |
| 5 | 0.03531 | 27.9 | 10.7 | 0.1 | 0.0 | 38.7 | 74.6 | 35.9 | Vb |
| 6 | 21.25002 | 12.1 | 10.0 | 0.8 | 0.0 | 22.9 | 50.0 | 27.1 | Vb |

*Operating mode: Tx 16ch*

| No. | Frequency [MHz] | Reading [dB] | LISN [dB] | Loss [dB] | Gain [dB] | Result [dBμV] | Limit [dBμV] | Margin [dB] | Phase |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.02979 | 18.2 | 10.9 | 0.1 | 0.0 | 29.2 | 77.5 | 48.3 | Va |
| 2 | 0.03532 | 28.9 | 10.7 | 0.1 | 0.0 | 39.7 | 74.6 | 34.9 | Va |
| 3 | 21.24998 | 12.4 | 10.0 | 0.8 | 0.0 | 23.2 | 50.0 | 26.8 | Va |
| 4 | 0.02968 | 24.9 | 10.9 | 0.1 | 0.0 | 35.9 | 77.5 | 41.6 | Vb |
| 5 | 0.03533 | 28.7 | 10.7 | 0.1 | 0.0 | 39.5 | 74.6 | 35.1 | Vb |
| 6 | 21.25000 | 12.1 | 10.0 | 0.8 | 0.0 | 22.9 | 50.0 | 27.1 | Vb |

[Graph]

*Operating mode: Tx 16ch*

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## 2.2 EMS requirement

### 2.2.1 Radiated disturbance

[Test Condition]

| | |
|---|---|
| Test level: | 10 V/m |
| Frequency range: | 80 - 2000 MHz |
| Modulation: | Amplitude, 400 Hz, 80 % |
| Frequency step size: | 1.0 % |
| Dwell time: | 3 s (80 - 1000 MHz), 9 s (1000 - 2000 MHz) |
| Field orientation: | Horizontal and vertical |
| Performance criteria: | A |

[Test equipment used (refer to List of utilized test equipment)]

| | | | | | | |
|---|---|---|---|---|---|---|
| AC01(IM) | AC01(IG) | EM10 | LA03 | SL02 | SG05 | RP07 |
| RP13 | CL19 | RC05 | | | | |

[Test result] - ***Complied with requirement***

[Test Date 1]

| | | | |
|---|---|---|---|
| Tested Date: | 07 Sep. 2018 | Temperature: | 22 degC |
| Humidity: | 52 % | Atmos. Press: | 1010 hPa |

[Test Date 2]

| | | | |
|---|---|---|---|
| Tested Date: | 10 Sep. 2018 | Temperature: | 23 degC |
| Humidity: | 54 % | Atmos. Press: | 1014 hPa |

[Test Date 3]

| | | | |
|---|---|---|---|
| Tested Date: | 11 Sep. 2018 | Temperature: | 22 degC |
| Humidity: | 52 % | Atmos. Press: | 1019 hPa |

[Test Data] Tested HW version: SPP1.1

| Operating Mode | Frequency | Test voltage | Criteria | Antenna Polarization | Result |
|---|---|---|---|---|---|
| Rx 16ch | 80 MHz – 2.0GHz | 10 V/m | A | Hori./Vert. | Pass |
| Rx 70ch | 80 MHz – 2.0GHz | 10 V/m | A | Hori./Vert. | Pass |
| Tx 16ch | 80 MHz – 2.0GHz | 10 V/m | A | Hori./Vert. | Pass |

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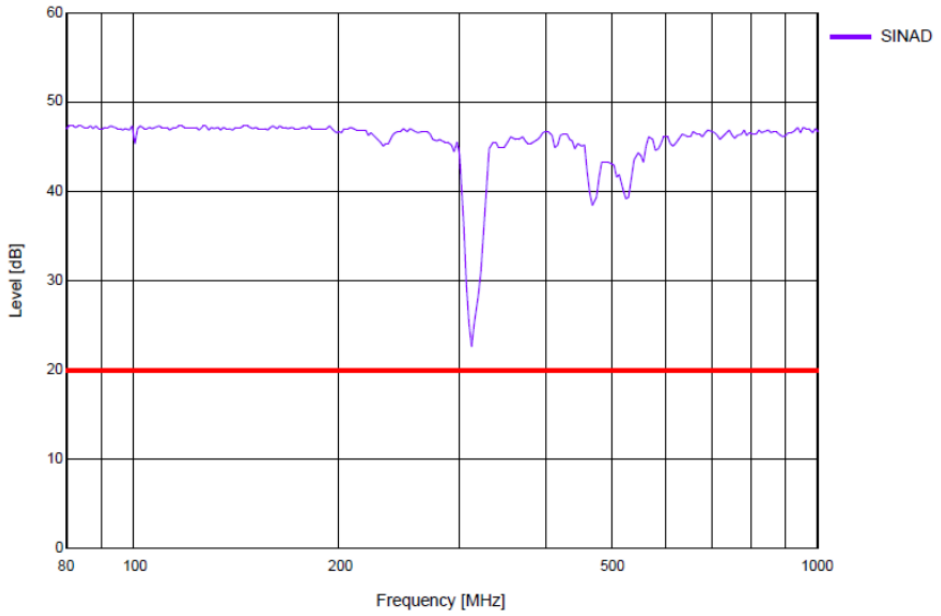
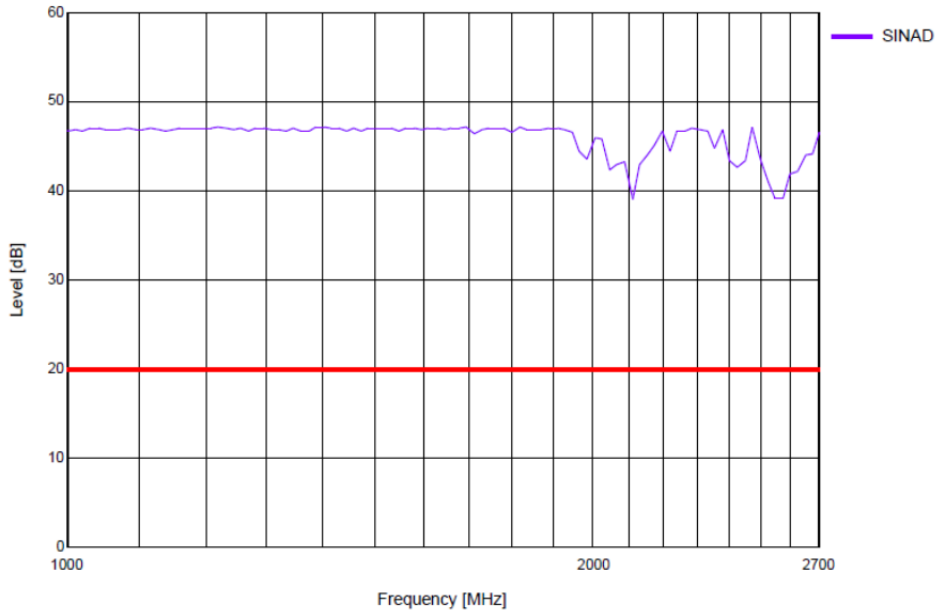
[Graph (Worst) ]

Operating condition: Tx 16ch
Test condition: Front / Horizontal




Note: This test was applied up to 2700 MHz since the result will be used in common with EN 301 843-2 testing.

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### 2.2.2 Electrostatic discharge

[Test condition]

Test levels: ± 6.0 kV (Contact discharge)
± 8.0 kV (Air discharge)
Number of discharges: 10 for each polarity
Performance criteria: B

[Test equipment used (refer to List of utilized test equipment)]

| | | | | | |
|---|---|---|---|---|---|
| ES04 | | | | | |

[Test result] - ***Complied with requirement***

[Test Date]

Tested Date: 13 Sep. 2018 Temperature: 23 degC
Humidity: 44 % Atmos. Press: 1022 hPa

[Test Data] Tested HW version: SPP1.1

*Operating mode: Rx 16ch*

| Discharge method | Coupling of interference | Test voltage | Criteria | Result |
|---|---|---|---|---|
| Contact discharge | VCP / HCP | ± 2 kV, ± 4 kV,± 6 kV | B | Pass |
| Air discharge | EUT | ± 2 kV, ± 4 kV,± 8 kV | B | Pass |
| Contact discharge | EUT | ± 2 kV, ± 4 kV,± 6 kV | B | Pass |

VCP: Vertical coupling panel
HCP: Horizontal coupling panel
The discharge points of the EUT show the following photographs. (Refer to Sec 3.2.3)

*Operating mode: Rx 70ch*

| Discharge method | Coupling of interference | Test voltage | Criteria | Result |
|---|---|---|---|---|
| Contact discharge | VCP / HCP | ± 2 kV, ± 4 kV,± 6 kV | B | Pass |
| Air discharge | EUT | ± 2 kV, ± 4 kV,± 8 kV | B | Pass |
| Contact discharge | EUT | ± 2 kV, ± 4 kV,± 6 kV | B | Pass |

*Operating mode: Tx 16ch*

| Discharge method | Coupling of interference | Test voltage | Criteria | Result |
|---|---|---|---|---|
| Contact discharge | VCP / HCP | ± 2 kV, ± 4 kV,± 6 kV | B | Pass |
| Air discharge | EUT | ± 2 kV, ± 4 kV,± 8 kV | B | Pass |
| Contact discharge | EUT | ± 2 kV, ± 4 kV,± 6 kV | B | Pass |

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### 2.2.3 Fast transients (bursts)

[Test condition]

| | |
|---|---|
| Test level: | ± 1.0 kV (DC cable, GND/Signal Cable) |
| Repetition rate: | 5.0 kHz |
| Duration of each test: | 180 s |
| Application method: | CDN (DC Cable), Capacitive Clamp (GND/Signal Cable) |
| Performance criterion: | B |

[Test equipment]

| | | | | | | |
|---|---|---|---|---|---|---|
| IM04 | BC56 | | | | | |

[Test result] - ***Complied with requirement***

[Test Date]

| | | | |
|---|---|---|---|
| Tested Date: | 13 Sep. 2018 | Temperature: | 23 degC |
| Humidity: | 44 % | Atmos. Press: | 1022 hPa |

[Test Data] Tested HW version: SPP1.1

*Operating mode: Rx 16ch*

| Tested Port | Injection | Test voltage | Criteria | Result |
|---|---|---|---|---|
| DC Cable | CDN | ± 1.0 kV | B | Pass |
| GND Cable | Clamp | ± 1.0 kV | B | Pass |
| Mic. Cable (Radio unit side) | Clamp | ± 1.0 kV | B | Pass |
| Mic. Cable (Mic. unit side) | Clamp | ± 1.0 kV | B | Pass |
| RAM Cable | Clamp | ± 1.0 kV | B | Pass |
| GPS Cable | Clamp | ± 1.0 kV | B | Pass |
| ACC Cable | Clamp | ± 1.0 kV | B | Pass |
| EX SP Cable | Clamp | ± 1.0 kV | B | Pass |
| NMEA2000 Cable | Clamp | ± 1.0 kV | B | Pass |

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*Operating mode: Rx 70ch*

| Tested Port | Injection | Test voltage | Criteria | Result |
|---|---|---|---|---|
| DC Cable | CDN | ± 1.0 kV | B | Pass |
| GND Cable | Clamp | ± 1.0 kV | B | Pass |
| Mic. Cable (Radio unit side) | Clamp | ± 1.0 kV | B | Pass |
| Mic. Cable (Mic. unit side) | Clamp | ± 1.0 kV | B | Pass |
| RAM Cable | Clamp | ± 1.0 kV | B | Pass |
| GPS Cable | Clamp | ± 1.0 kV | B | Pass |
| ACC Cable | Clamp | ± 1.0 kV | B | Pass |
| EX SP Cable | Clamp | ± 1.0 kV | B | Pass |
| NMEA2000 Cable | Clamp | ± 1.0 kV | B | Pass |

*Operating mode: Tx 16ch*

| Tested Port | Injection | Test voltage | Criteria | Result |
|---|---|---|---|---|
| DC Cable | CDN | ± 1.0 kV | B | Pass |
| GND Cable | Clamp | ± 1.0 kV | B | Pass |
| Mic. Cable (Radio unit side) | Clamp | ± 1.0 kV | B | Pass |
| Mic. Cable (Mic. unit side) | Clamp | ± 1.0 kV | B | Pass |
| RAM Cable | Clamp | ± 1.0 kV | B | Pass |
| GPS Cable | Clamp | ± 1.0 kV | B | Pass |
| ACC Cable | Clamp | ± 1.0 kV | B | Pass |
| EX SP Cable | Clamp | ± 1.0 kV | B | Pass |
| NMEA2000 Cable | Clamp | ± 1.0 kV | B | Pass |

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### 2.2.4 Conducted radio frequency disturbance

[Test condition (sweep)]

| | |
|---|---|
| Test level: | 3 Vrms |
| Frequency range: | 0.15 - 80 MHz |
| Modulation: | Amplitude, 400 Hz, 80 % |
| Frequency step size: | 1.0 % |
| Dwell time: | 3.0 s |
| Application method: | CDN (DC/GND Cable), EM clamp (Signal cable) |
| Performance criterion: | A |

[Test condition (spot)]

| | |
|---|---|
| Test level: | 10 V rms |
| Test Frequency: | 2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25 MHz |
| Modulation: | Amplitude, 400 Hz, 80 % |
| Dwell time: | 3.0 s |
| Application method: | CDN (DC/GND Cable), EM clamp (Signal cable) |
| Performance criterion: | A |

[Test equipment]

| | | | | | | |
|---|---|---|---|---|---|---|
| CD21 | CL65 | SG13 | RP04 | EC01 | RC05 | CD25 |

[Test result] - ***Complied with requirement***

[Test Date 1]

| | | | |
|---|---|---|---|
| Tested Date: | 18 Sep. 2018 | Temperature: | 24 degC |
| Humidity: | 47 % | Atmos. Press: | 1014 hPa |

[Test Date 2]

| | | | |
|---|---|---|---|
| Tested Date: | 19 Sep 2018 | Temperature: | 25 degC |
| Humidity: | 41 % | Atmos. Press: | 1016 hPa |

[Test Date 3]

| | | | |
|---|---|---|---|
| Tested Date: | 20 Sep. 2018 | Temperature: | 25 degC |
| Humidity: | 51 % | Atmos. Press: | 1016 hPa |

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[Test Data (Sweep_3V)] Tested HW version: SPP1.2

*Operating mode: Rx 16ch*

| Tested Port | Injection | Test voltage | Criteria | Result |
|---|---|---|---|---|
| DC Cable | CDN | 3 Vrms | A | Pass |
| GND Cable | CDN | 3 Vrms | A | Pass |
| Mic. Cable (Radio unit side) | EM Clamp | 3 Vrms | A | Pass |
| Mic. Cable (Mic. unit side) | EM Clamp | 3 Vrms | A | Pass |
| RAM Cable | EM Clamp | 3 Vrms | A | Pass |
| GPS Cable | EM Clamp | 3 Vrms | A | Pass |
| ACC Cable | EM Clamp | 3 Vrms | A | Pass |
| EX SP Cable | EM Clamp | 3 Vrms | A | Pass |
| NMEA2000 Cable | EM Clamp | 3 Vrms | A | Pass |

*Operating mode: Rx 70ch*

| Tested Port | Injection | Test voltage | Criteria | Result |
|---|---|---|---|---|
| DC Cable | CDN | 3 Vrms | A | Pass |
| GND Cable | CDN | 3 Vrms | A | Pass |
| Mic. Cable (Radio unit side) | EM Clamp | 3 Vrms | A | Pass |
| Mic. Cable (Mic. unit side) | EM Clamp | 3 Vrms | A | Pass |
| RAM Cable | EM Clamp | 3 Vrms | A | Pass |
| GPS Cable | EM Clamp | 3 Vrms | A | Pass |
| ACC Cable | EM Clamp | 3 Vrms | A | Pass |
| EX SP Cable | EM Clamp | 3 Vrms | A | Pass |
| NMEA2000 Cable | EM Clamp | 3 Vrms | A | Pass |

*Operating mode: Tx 16ch*

| Tested Port | Injection | Test voltage | Criteria | Result |
|---|---|---|---|---|
| DC Cable | CDN | 3 Vrms | A | Pass |
| GND Cable | CDN | 3 Vrms | A | Pass |
| Mic. Cable (Radio unit side) | EM Clamp | 3 Vrms | A | Pass |
| Mic. Cable (Mic. unit side) | EM Clamp | 3 Vrms | A | Pass |
| RAM Cable | EM Clamp | 3 Vrms | A | Pass |
| GPS Cable | EM Clamp | 3 Vrms | A | Pass |
| ACC Cable | EM Clamp | 3 Vrms | A | Pass |
| EX SP Cable | EM Clamp | 3 Vrms | A | Pass |
| NMEA2000 Cable | EM Clamp | 3 Vrms | A | Pass |

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[Test Data (Spot_10V)] Tested HW version: SPP1.2

*Operating mode: Rx 16ch*

| Tested Port | Injection | Test voltage | Criteria | Result |
|---|---|---|---|---|
| DC Cable | CDN | 10 Vrms | A | Pass |
| GND Cable | CDN | 10 Vrms | A | Pass |
| Mic. Cable (Radio unit side) | EM Clamp | 10 Vrms | A | Pass |
| Mic. Cable (Mic. unit side) | EM Clamp | 10 Vrms | A | Pass |
| RAM Cable | EM Clamp | 10 Vrms | A | Pass |
| GPS Cable | EM Clamp | 10 Vrms | A | Pass |
| ACC Cable | EM Clamp | 10 Vrms | A | Pass |
| EX SP Cable | EM Clamp | 10 Vrms | A | Pass |
| NMEA2000 Cable | EM Clamp | 10 Vrms | A | Pass |

*Operating mode: Rx 70ch*

| Tested Port | Injection | Test voltage | Criteria | Result |
|---|---|---|---|---|
| DC Cable | CDN | 10 Vrms | A | Pass |
| GND Cable | CDN | 10 Vrms | A | Pass |
| Mic. Cable (Radio unit side) | EM Clamp | 10 Vrms | A | Pass |
| Mic. Cable (Mic. unit side) | EM Clamp | 10 Vrms | A | Pass |
| RAM Cable | EM Clamp | 10 Vrms | A | Pass |
| GPS Cable | EM Clamp | 10 Vrms | A | Pass |
| ACC Cable | EM Clamp | 10 Vrms | A | Pass |
| EX SP Cable | EM Clamp | 10 Vrms | A | Pass |
| NMEA2000 Cable | EM Clamp | 10 Vrms | A | Pass |

*Operating mode: Tx 16ch*

| Tested Port | Injection | Test voltage | Criteria | Result |
|---|---|---|---|---|
| DC Cable | CDN | 10 Vrms | A | Pass |
| GND Cable | CDN | 10 Vrms | A | Pass |
| Mic. Cable (Radio unit side) | EM Clamp | 10 Vrms | A | Pass |
| Mic. Cable (Mic. unit side) | EM Clamp | 10 Vrms | A | Pass |
| RAM Cable | EM Clamp | 10 Vrms | A | Pass |
| GPS Cable | EM Clamp | 10 Vrms | A | Pass |
| ACC Cable | EM Clamp | 10 Vrms | A | Pass |
| EX SP Cable | EM Clamp | 10 Vrms | A | Pass |
| NMEA2000 Cable | EM Clamp | 10 Vrms | A | Pass |

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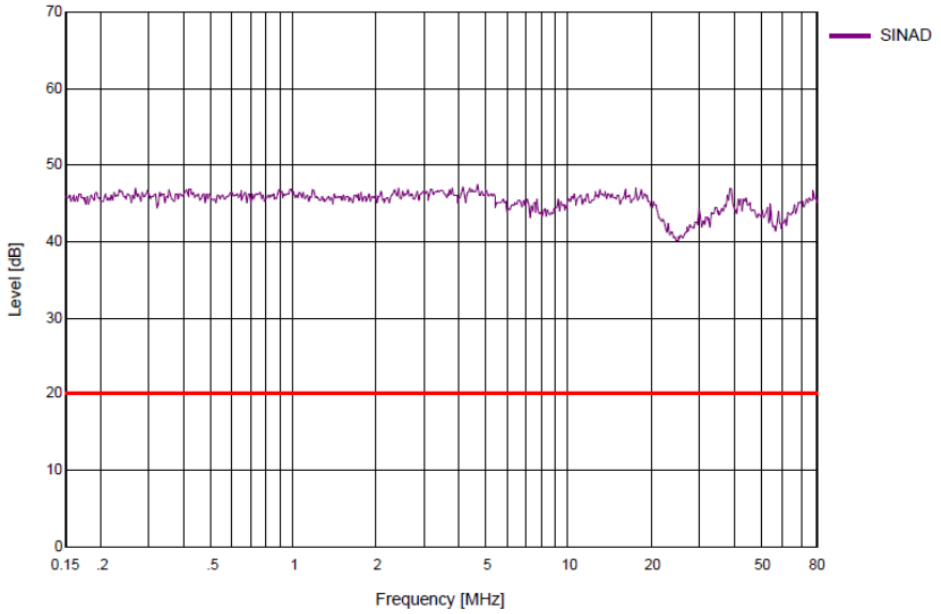
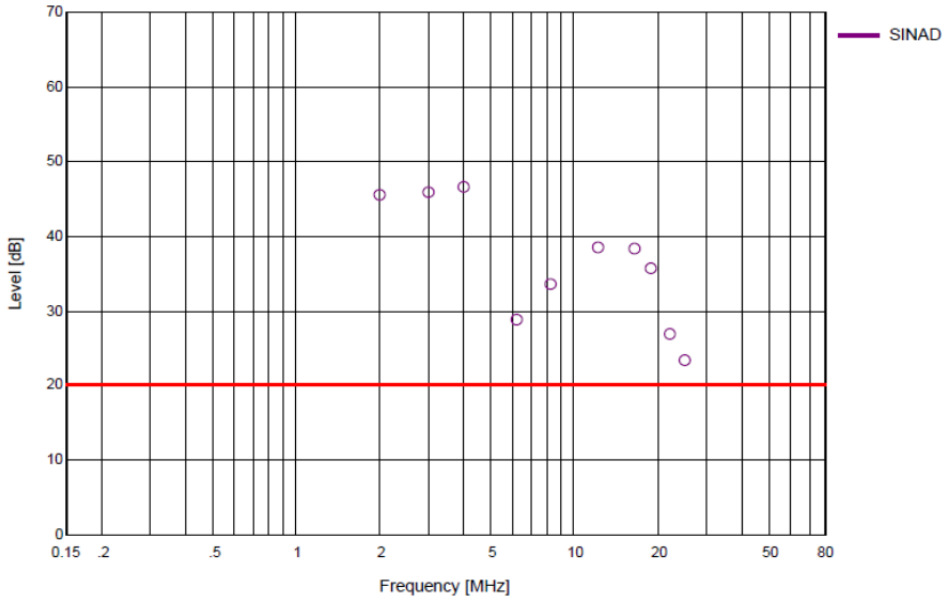
[Graph]

Operating mode: Rx 16ch
Tested port: ACC Cable

*Sweep test*




*Spot test*

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### 2.2.5 Power supply short term variation

[Test condition]

| | |
|---|---|
| Variation A: | Voltage (1.2 times), Frequency (1.1 times) |
| Variation B: | Voltage (0.8 times), Frequency (0.9 times) |
| Duration: | 1.5 s per minute (Voltage), 5.0 s per minute (Frequency) |
| Test time: | 10 min |
| Performance criterion: | B |

[Test equipment]

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |

[Test result] - ***This item was not tested.***

[Test Data]

| Variation | Voltage | Frequency | Criteria | Result |
|---|---|---|---|---|
| A | 1.2 times | 1.1 times | B | - |
| B | 0.8 times | 0.9 times | B | - |

[Test Date]

| | | | |
|---|---|---|---|
| Tested Date: | - | Temperature: | - degC |
| Humidity: | - % | Atmos. Press: | - hPa |

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### 2.2.6 Power supply failure

[Test condition]

Break time: 60 s
Number of Break: 3
Performance criterion: C

[Test equipment]

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |

[Test result] - ***Complied with requirement***

[Test Date]

Tested Date: 13 Sep. 2018 Temperature: 23 degC
Humidity: 44 % Atmos. Press: 1022 hPa

[Test Data] Tested HW version: SPP1.1

| Tested Line | Operating mode | Criteria | Result |
|---|---|---|---|
| DC power | Rx 16ch | C | Pass |
| | Rx 70ch | C | Pass |
| | Tx 16ch | C | Pass |

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### 2.2.7 Slow transients (surges)

[Test Condition]

Test levels: ± 0.5 kV (Line to Line; AC port)
± 1.0 kV (Line to GND; AC port)
Number of discharge: 18 (each polarity)
Repetition rate: 6 per minute

[Test equipment]

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |

[Test result] - ***This item was not tested.***

[Test Date]

Tested Date: - Temperature: - degC
Humidity: - % Atmos. Press: - hPa

[Test Data]

| Discharge Point | Test level [kV] | Phase | Criteria | Result |
|---|---|---|---|---|
| L - N (Line to Line) | ± 0.5 | 0/90/180/270 deg | B | - |
| | ± 1.0 | 0/90/180/270 deg | B | - |

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### 3.2.6 Power supply short term variation

This item was not tested.

### 3.2.7 Slow transients (surges)

This item was not tested.

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# 4 List of utilized test equipment/ calibration

| ID No. | Kind of Equipment | Manufacturer | Model No. | Serial Number | Cal. Date | Cal. until |
|---|---|---|---|---|---|---|
| AC01(EM) | Anechoic Chamber (1st test room) | JSE | 203397C | - | 2018/4/14 | 2019/4/30 |
| AC01(EG) | Anechoic Chamber (1st test room) | JSE | 203397C | - | 2018/3/21 | 2019/3/31 |
| BA07 | Bilogical Antenna | TESEQ | CBL6143A | 26670 | 2017/12/5 | 2018/12/31 |
| CL11 | RF Cable for RE | RFT | - | - | 2018/3/26 | 2019/3/31 |
| CL30 | RF Cable 5 m | SUHNER | SUCOFLEX104PE | MY3599 | 2018/1/29 | 2019/1/31 |
| CL38 | RF Cable 2 m | Junkosha | MWX221 | 1603S626 | 2018/1/29 | 2019/1/31 |
| DH06 | DRG Horn Antenna | A.H. Systems | SAS-571 | 1339 | 2018/6/19 | 2020/6/30 |
| LN18 | LISN (9kHz) | Kyoritsu | TNW-242F2 | 12-15-54 | 2018/3/24 | 2019/3/31 |
| LP06 | Loop Antenna | ETS-Lindgren | 6502 | 00164299 | 2018/4/3 | 2019/4/30 |
| PR12 | Pre. Amplifier (1-26G) | Agilent Technologies | 8449B | 3008A02513 | 2018/1/29 | 2019/1/31 |
| PR21 | Pre. Amplifier | Anritsu | MH648A | 6200467119 | 2017/12/4 | 2018/12/31 |
| TR06 | Test Receiver (F/W : 4.73 SP4) | Rohde & Schwarz | ESU26 | 100002 | 2017/10/17 | 2018/10/31 |
| AC01(IM) | Anechoic Chamber | JSE | 203397C | - | 2017/11/21 | 2018/11/30 |
| AC01(IG) | Anechoic Chamber | JSE | 203397C | - | 2017/10/27 | 2018/10/31 |
| BC56 | Burst Clamp | EM Test | HFK | 1112-125 | 2018/4/11 | 2019/4/30 |
| CD21 | CDN (M2) | FCC | FCC-801-M2-16A | 141672 | 2018/4/3 | 2019/4/30 |
| CD25 | CDN (M1) | FCC | FCC-801-M1-16A | 141671 | 2018/4/3 | 2019/4/30 |
| CL19 | RF Cable for RS | SUCOFLEX | — | — | 2017/11/21 | 2018/11/30 |
| CL65 | RF Cable for CS | RFT | — | — | 2018/5/1 | 2019/5/31 |
| EC01 | EM Injection Clamp | FCC | TSIC-32 | 472 | 2018/4/11 | 2019/4/30 |
| EM10 | EM Probe/Monitor | AR | FL7006 | 0334662 | 2017/11/2 | 2018/11/30 |
| ES04 | ESDTester | EMC Partner | ESD3000 | 374 | 2018/5/28 | 2019/5/31 |
| IM04 | Surge/Burst/Dip Simulator | EM Test | UCS500N5 | P1304111117 | 2018/4/10 | 2019/4/30 |
| LA03 | Logperiodic Antenna (High Power) | SCHWARZBECK | VULP9118-D | 613 | 2017/11/21 | 2018/11/30 |

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| ID No. | Kind of Equipment | Manufacturer | Model No. | Serial Number | Cal. Date | Cal. until |
|---|---|---|---|---|---|---|
| RP04 | RF Power Amplifier | PRANA | AP32DT120 | 0509-688 | 2018/5/1 | 2019/5/31 |
| RP07 | RF Power Amplifier 350W | PRANA | AP32LT235 | 0604-740 | 2018/6/11 | 2019/6/30 |
| RP13 | RF Power AMP 0.8-4.2GHz 50W | AR | 50S1G4A | 0326341 | 2017/12/15 | 2018/12/31 |
| SL02 | Stacked logperiodic Antenna | SCHWARZBECK | STLP9149 | 507 | 2017/10/27 | 2018/10/31 |
| RC05 | Radio communication tester | Agilent Technologies | 8920B | US35240529 | 2017/11/20 | 2018/11/30 |
| SG05 | Signal Generator | Rohde & Schwarz | SMR20 | 100905 | 2018/2/6 | 2019/2/28 |
| SG13 | Signal Generator | Agilent Technologies | N5181A | MY47420721 | 2017/8/1 | 2018/8/31 |

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

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