

TEST REPORT

For

MARINE VHF RADIOTELEPHONE

In conformity with

IEC 60945 : 2002

Model: GX1300

Test Item: MARINE VHF RADIOTELEPHONE

Report No: ERY1410P20R2

Issue Date: 20 Oct. 2014

Prepared for

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SGS RF Technologies Inc. is managed to ISO17025 and has the necessary knowledge and test facilities for testing according to the referenced standards. The test results in this report apply only to the sample tested.

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History

Report Number	Issue Date	Revisions	Issued by
ERY1410P20R2	20 Oct. 2014	Initial Issue	T.Kato
ERY1410P20R2	20 Oct. 2014	Revise the S/N of EUT (Sec 1.1) Revise the scale of chart (Sec 2.1.2) Revise the writing error (Sec 2.2.2)	T.Kato

1 General information

1.1 Product description

Test item : MARINE VHF RADIOTELEPHONE
Manufacturer : VTech (Dongguan) Communications Limited
Address : Xia Ling Bei Management Zone, Liaobu, Dongguan, Guangdong, China
Model : GX1300
Serial number : L74C010001
Operating frequency : 156.025 - 157.425 MHz
Modulation : GE3, G2B
Output power : 25 W
Hardware Version : 002 / 003 / 004
Software Version : V0.02
Equipment Classification : Exposed Equipment
Receipt date of EUT : 10 Sep. 2014
Nominal power voltages : DC 13.8V

1.2 Test(s) performed / Summary of test result

Applicable Directive/ Low : -
Applicable Standard(s) : IEC 60945 : 2002
Test(s) started : 10 Sep. 2014
Test(s) completed : 14 Oct. 2014
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 (EMC Testing Department)

Reviewer

: 
K. Onishi (Manager, EMC Testing Department)

1.3 Applicable basic standards

1.3.1 EMI test

Basic Standard	Title
IEC 60945 (2002)	"Maritime navigation and radio communication equipment and systems - General requirements - Methods of testing and required test results"
CISPR 16-1-1 (2006)	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)	"Maritime navigation and radio communication equipment and systems - General requirements - Methods of testing and required test results"
IEC 61000-4-2 (2001)	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test
IEC 61000-4-3 (2006)	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-4 (2004)	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
IEC 61000-4-5 (2005)	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
IEC 61000-4-6 (2006)	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 RF Technologies 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

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):	± 3.8 dB
Radiated emissions (150 kHz - 30 MHz):	± 3.8 dB
Radiated emissions (30 MHz - 1000 MHz):	± 6.2 dB
Radiated emissions (1000 MHz - 2000 MHz):	± 4.9 dB
Electrostatic discharge:	Within the tolerance specified by the standard
Radiated disturbance:	±2.7 dB
Fast transients (bursts):	Within the tolerance specified by the standard
Conducted radio frequency disturbance:	± 1.2 dB
Slow transients (surges):	Within the tolerance specified by the standard

1.6 Description of essential 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
	Exposed Equipment	Portable Equipment		
Radiated emissions	Applicable	Applicable	Yes	Complied
Conducted emissions	Applicable	Not applicable	Yes	Complied

1.6.2 Immunity tests

Phenomenon	Application	Equipment test requirement		Applicable for the EUT	Result
		Exposed Equipment	Portable Equipment		
Radiated Disturbance	Enclosure	Applicable	Applicable	Yes	Complied
Electrostatic discharge	Enclosure	Applicable	Applicable	Yes	Complied
Fast transients (bursts)	Signal and control ports, DC and AC power port	Applicable	Not applicable	Yes	Complied
Conducted radio frequency disturbance	Signal and control ports, DC and AC power port	Applicable	Not applicable	Yes	Complied
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
Slow transients (surges)	AC power input ports	Applicable	Not applicable	No (Note 1)	-

Note 1: The EUT have no AC power port

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 12 o'clock 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.

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 Table 1, 2, 3 and fig.1.

Table1: Equipment

No.	Item	Manufacturer	Model No.	Serial No.
A	MARINE VHF RADIOTELEPHONE	YAESU MUSEN CO., LTD	GX1300	L74C010001

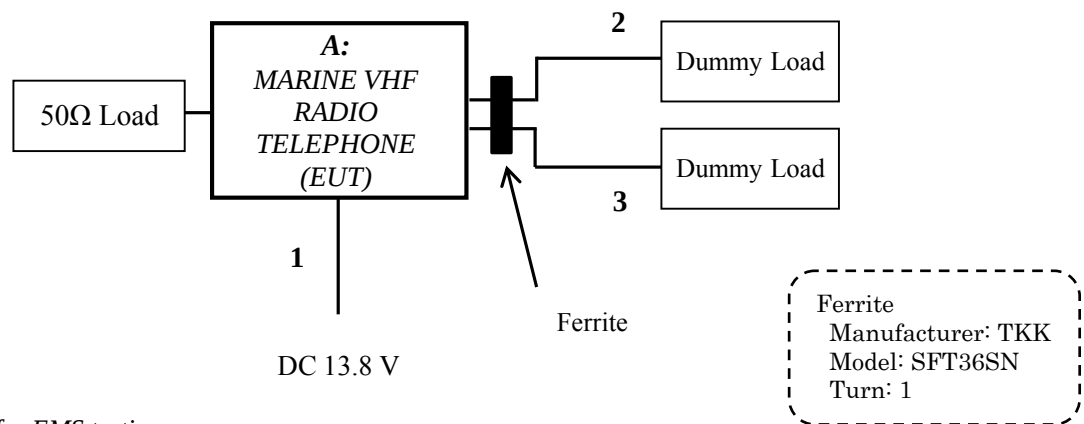
Table2: Support equipment

No.	Item	Manufacturer	Model No.	Serial No.
B	Radio Communication Tester	HP	8920B	US35240529

Table 3: The following cables were used and connected to the EUT

No.	Cable Name	From	To	Length [m]	Shielded	Ferrite
1	DC Cable	DC Power supply	EUT	1.8	No	No
2	Speaker Cable	EUT	Dummy Load	1.8	Yes	Yes
3	NMEA Cable	EUT	Dummy Load	1.8	Yes	Yes
4	Antenna Cable	EUT	RF tester	2.5	Yes	No

Setup diagram for EMI testing



Setup diagram for EMS testing

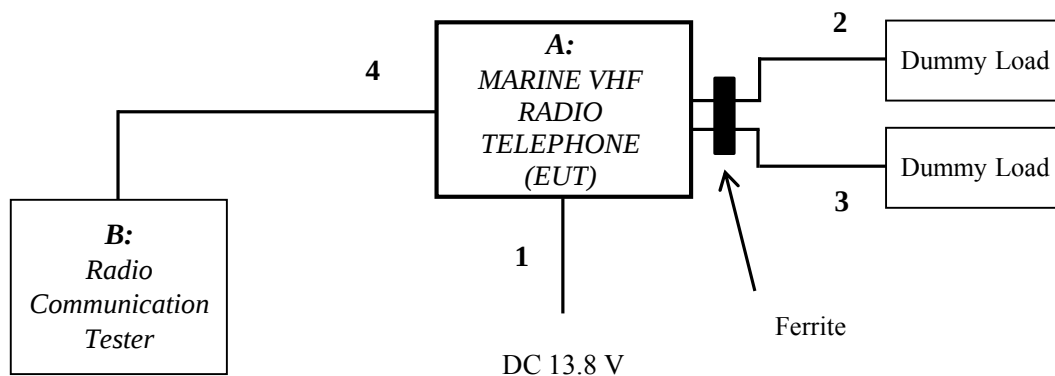


Figure 1: Test Configuration

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), Output power is 25 W (nominal)

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.

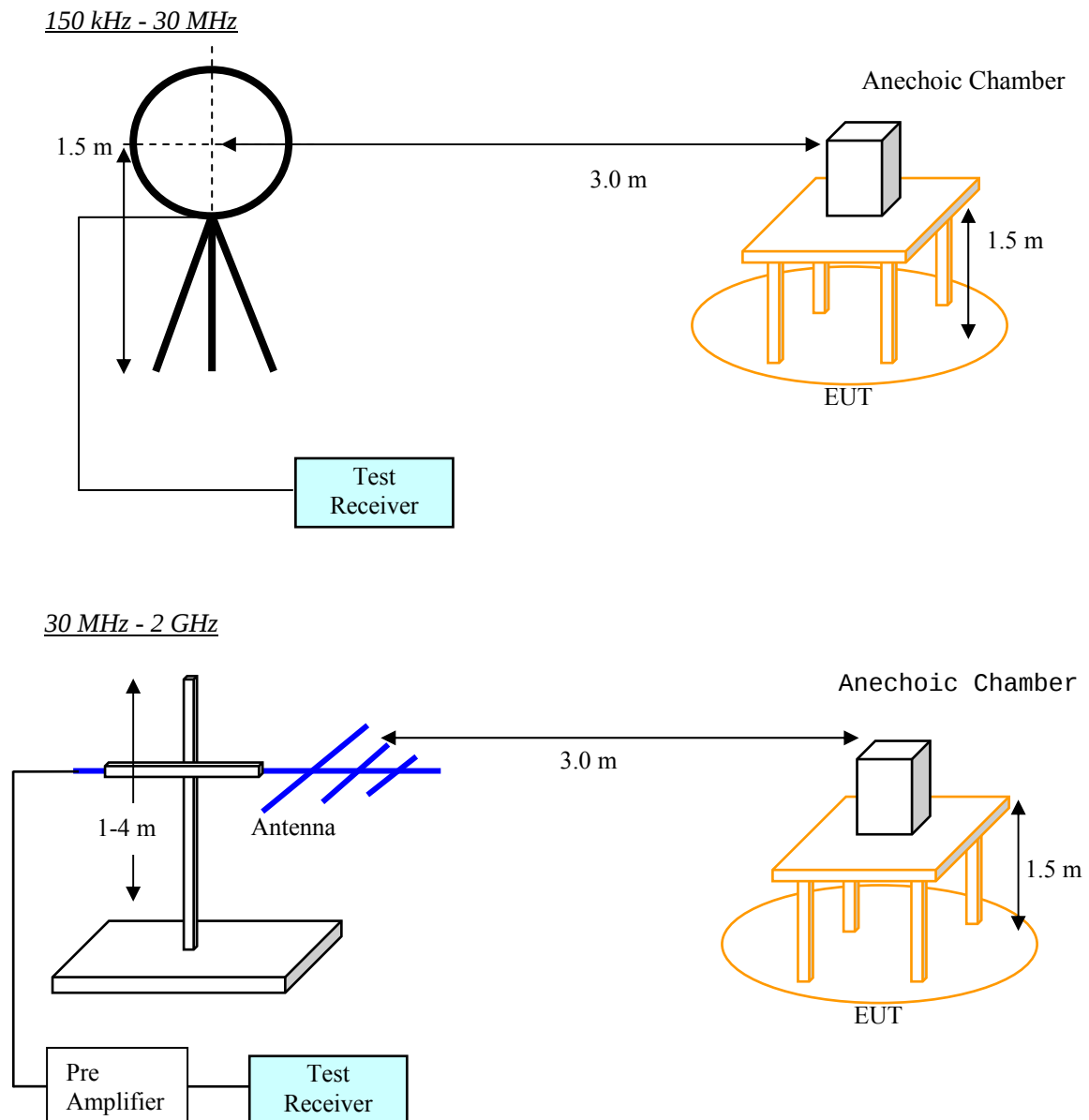
2 Test result and procedure

2.1 EMI requirement

2.1.1 Radiated emissions

[Test setup]

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



[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 as indicated in table 4. A test site in accordance with IEC 60945 and CISPR 16-1-1 shall be used.

The measuring bandwidth shall be in accordance with table 4.

Table 4: 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 1 GHz the quasi-peak detector shall be used, for measurements in the frequency range 1 GHz to 2 GHz a 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 5.

[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 5.

Table 5: EMC emission limits

Frequency range	Limit (QP) [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	3 m

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

AC01(EM)	AC01(EG)	BA10	CL11	CL29	CL30
LP05	PR15	PR12	TR06	DH01	

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

[Test Date]

Tested Date: 03 Oct. 2014
Temperature: 23 degC
Humidity: 56 %
Atmos. Press: 1009 hPa

[Test Result] Tested HW version: 004

Range 1: 150 kHz - 30 MHz

Operating mode: Rx 16ch

No.	Frequency [MHz]	Reading [dBμV]	C.Factor [dB/m]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Ant. [deg]
1	0.30000	34.4	11.5	45.9	52.0	6.1	0
2	0.30000	34.3	11.5	45.8	52.0	6.2	90

Operating mode: Rx 70ch

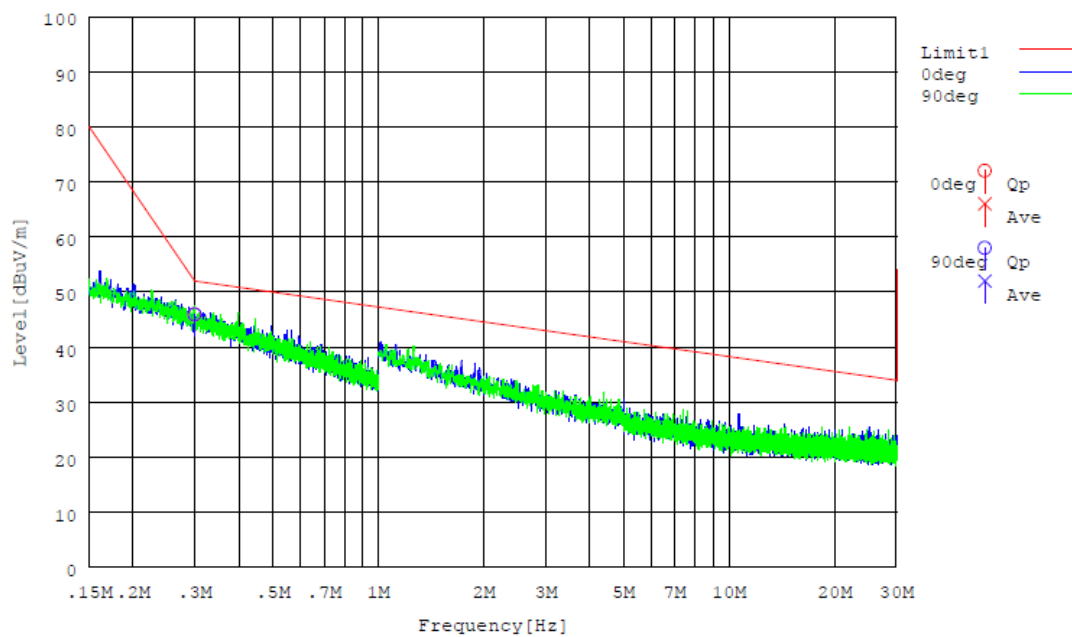
No.	Frequency [MHz]	Reading [dBμV]	C.Factor [dB/m]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Ant. [deg]
1	0.30000	34.3	11.5	45.8	52.0	6.2	0
2	0.30000	34.3	11.5	45.8	52.0	6.2	90

Operating mode: Tx 16ch

No.	Frequency [MHz]	Reading [dBμV]	C.Factor [dB/m]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Ant. [deg]
1	0.30000	34.4	11.5	45.9	52.0	6.1	0
2	0.30000	34.4	11.5	45.9	52.0	6.1	90

[Graph]

Operating mode: Tx 16ch



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	135.100	43.2	11.7	8.0	30.0	32.9	54.0	21.1	Hori.
2	405.300	37.6	16.1	9.7	29.8	33.6	54.0	20.4	Hori.
3	540.400	42.4	18.8	10.4	29.5	42.1	54.0	11.9	Hori.
4	135.100	37.2	11.7	8.0	30.0	26.9	54.0	27.1	Vert.
5	405.300	33.6	16.1	9.7	29.8	29.6	54.0	24.4	Vert.
6	540.400	34.8	18.8	10.4	29.5	34.5	54.0	19.5	Vert.

Operating mode: Rx 70ch

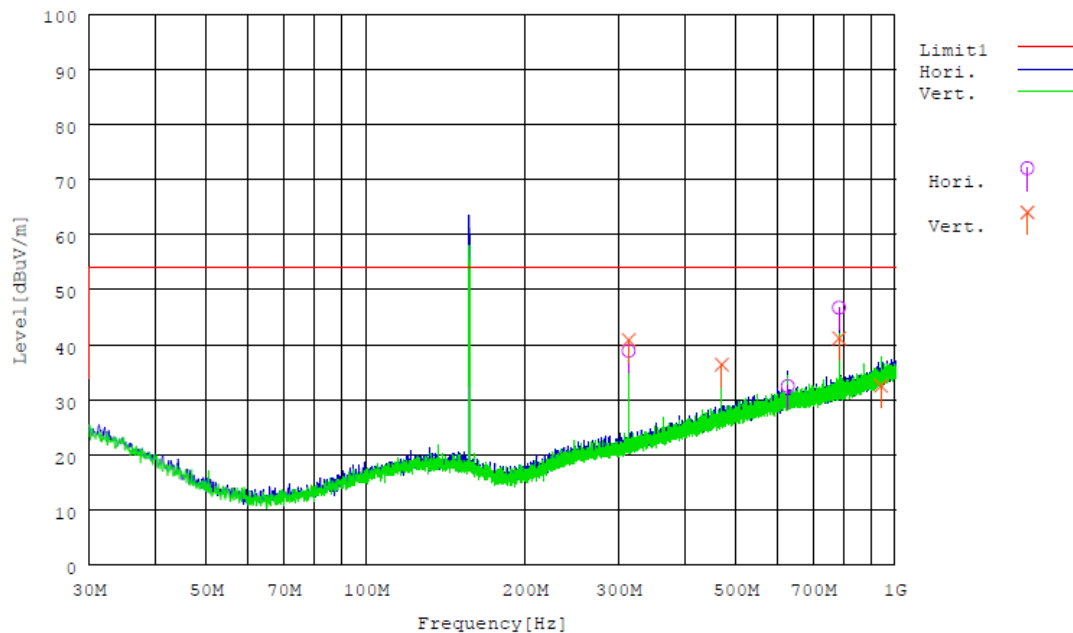
No.	Freq. [MHz]	Reading [dBμV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Ant.
1	134.825	43.4	11.7	8.0	30.0	33.1	54.0	20.9	Hori.
2	404.475	37.1	16.1	9.7	29.8	33.1	54.0	20.9	Hori.
3	539.300	42.7	18.7	10.4	29.5	42.3	54.0	11.7	Hori.
4	134.825	37.4	11.7	8.0	30.0	27.1	54.0	26.9	Vert.
5	404.475	33.1	16.1	9.7	29.8	29.1	54.0	24.9	Vert.
6	539.300	34.8	18.7	10.4	29.5	34.4	54.0	19.6	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	313.600	45.8	13.8	9.2	29.9	38.9	54.0	15.1	Hori.
2	627.200	31.4	19.9	10.8	29.6	32.5	54.0	21.5	Hori.
3	784.000	43.6	21.9	11.5	30.3	46.7	54.0	7.3	Hori.
4	313.600	47.8	13.8	9.2	29.9	40.9	54.0	13.1	Vert.
5	470.400	38.4	17.6	10.1	29.7	36.4	54.0	17.6	Vert.
6	784.000	38.1	21.9	11.5	30.3	41.2	54.0	12.8	Vert.
7	940.800	27.2	23.6	12.1	30.3	32.6	54.0	21.4	Vert.

[Graph]

Operating mode: Tx 16ch



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

Range 3: 1000 MHz - 2000 MHz

Operating mode: Rx 16ch

No	Frequency [MHz]	Reading [dBμV]	C.Fac [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Ant.
1	1351.000	46.7	-9.8	36.9	54.0	17.1	Hori.
2	1486.100	46.3	-9.2	37.1	54.0	16.9	Hori.
3	1765.750	45.9	-7.6	38.3	54.0	15.7	Hori.
4	1351.000	47.4	-9.8	37.6	54.0	16.4	Vert.
5	1486.100	46.4	-9.2	37.2	54.0	16.8	Vert.
6	1765.750	46.5	-7.6	38.9	54.0	15.1	Vert.

Operating mode: Rx 70ch

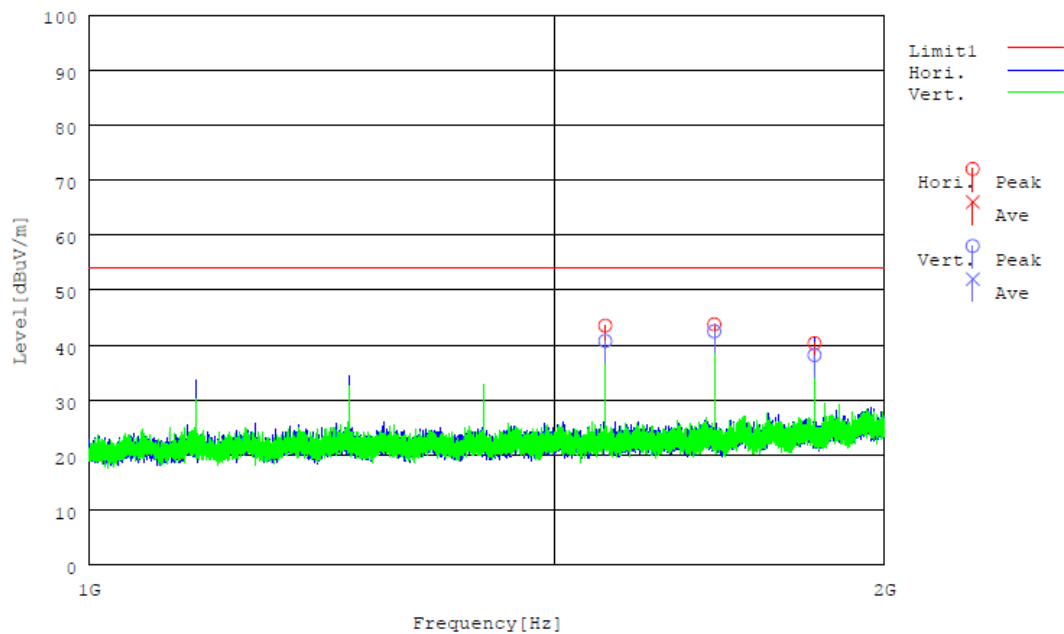
No	Frequency [MHz]	Reading [dBμV]	C.Fac [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Ant.
1	1348.250	46.6	-9.8	36.8	54.0	17.2	Hori.
2	1483.075	46.0	-9.2	36.8	54.0	17.2	Hori.
3	1765.750	45.7	-7.6	38.1	54.0	15.9	Hori.
4	1348.250	46.8	-9.8	37.0	54.0	17.0	Vert.
5	1483.075	45.9	-9.2	36.7	54.0	17.3	Vert.
6	1765.750	46.5	-7.6	38.9	54.0	15.1	Vert.

Operating mode: Tx 16ch

No	Frequency [MHz]	Reading [dBμV]	C.Fac [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Ant.
1	1568.000	52.3	-8.8	43.5	54.0	10.5	Hori.
2	1724.800	51.8	-8.0	43.8	54.0	10.2	Hori.
3	1881.600	47.1	-6.8	40.3	54.0	13.7	Hori.
4	1568.000	49.5	-8.8	40.7	54.0	13.3	Vert.
5	1724.800	50.5	-8.0	42.5	54.0	11.5	Vert.
6	1881.600	45.0	-6.8	38.2	54.0	15.8	Vert.

[Graph]

Operating mode: Tx 16ch



Range 4: 156 MHz - 165 MHz

Operating mode: Rx 16ch

There is no spurious emission above the noise floor.

Operating mode: Rx 70ch

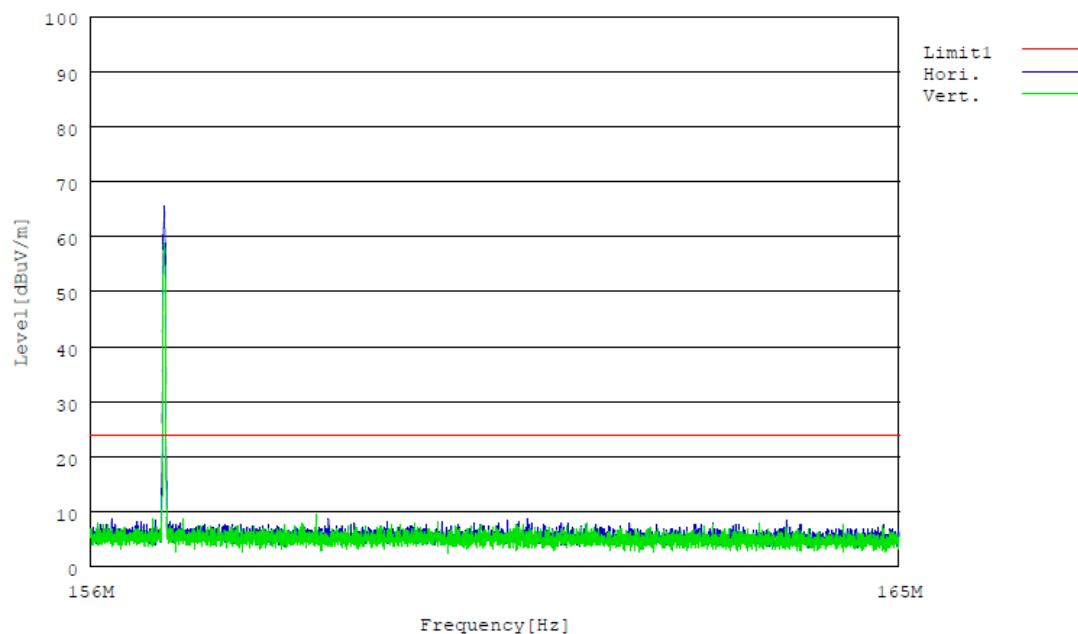
There is no spurious emission above the noise floor.

Operating mode: Tx 16ch

There is no spurious emission above the noise floor.

[Graph]

Operating mode: Tx 16ch



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

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.

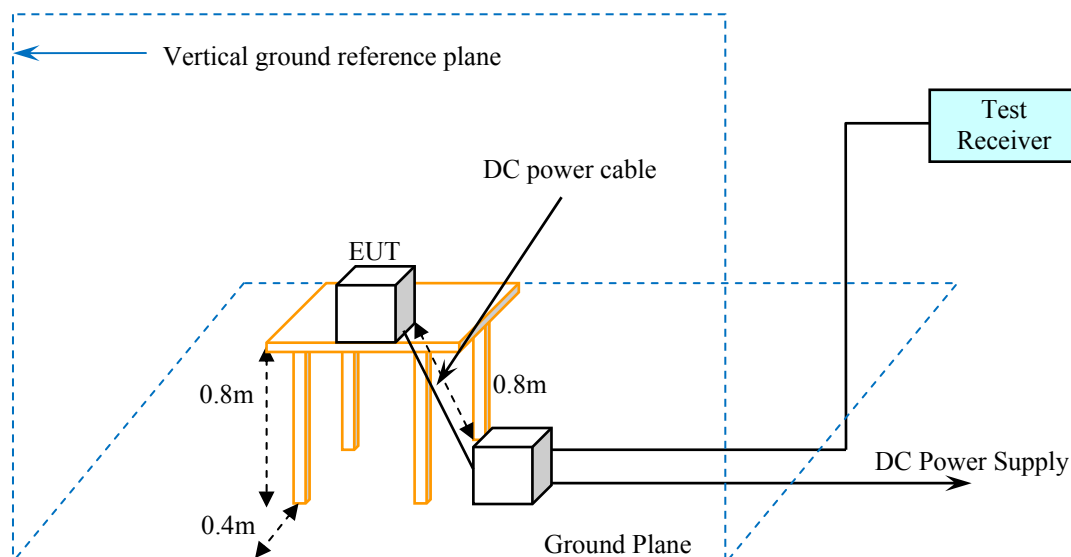
The setting of controls which may affect the level of conducted interference shall be varied in order to ascertain the maximum emission level.

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".



[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)]

TR09	LN02	LN05	CL18		
------	------	------	------	--	--

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

[Test Date]

Tested Date: 10 Sep. 2014
Temperature: 24 degC
Humidity: 54 %
Atmos. Press: 1010 hPa

[Test Data] Tested HW version: 002

Tested line: DC power line

Range 1: 10 kHz - 150 kHz

Operating mode: Rx 16ch

No.	Frequency [MHz]	Reading [dB]	C.Fac [dB]	Result [dBμV]	Limit [dBμV]	Margin [dB]	Phase
1	0.03458	28.4	10.2	38.6	74.9	36.3	Va
2	0.06173	19.5	10.1	29.6	65.1	35.5	Va
3	0.08853	23.7	10.1	33.8	59.0	25.2	Va
4	0.03459	28.8	10.2	39.0	74.9	35.9	Vb
5	0.06167	19.3	10.1	29.4	65.1	35.7	Vb
6	0.08851	23.6	10.1	33.7	59.0	25.3	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:

$$\text{Result} = \text{Reading} + \text{C. F}$$

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

Operating mode: Rx 70ch

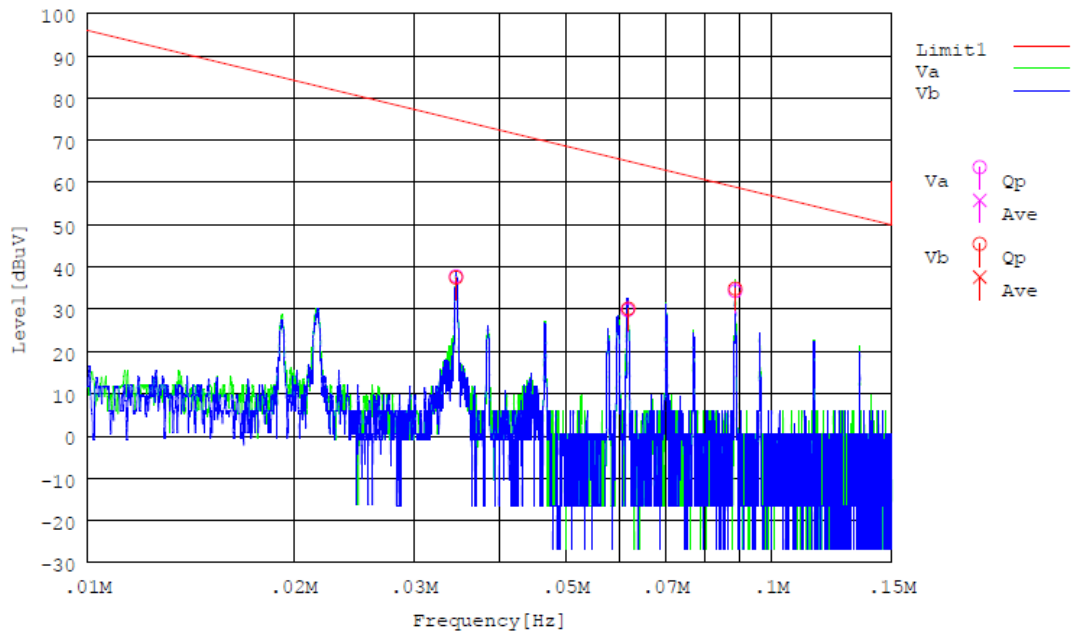
No.	Frequency [MHz]	Reading [dB]	C.Fac [dB]	Result [dBμV]	Limit [dBμV]	Margin [dB]	Phase
1	0.03459	27.2	10.2	37.4	74.9	37.5	Va
2	0.06169	20.2	10.1	30.3	65.1	34.8	Va
3	0.08838	23.5	10.1	33.6	59.0	25.4	Va
4	0.03458	28.7	10.2	38.9	74.9	36.0	Vb
5	0.06173	19.7	10.1	29.8	65.1	35.3	Vb
6	0.08845	23.3	10.1	33.4	59.0	25.6	Vb

Operating mode: Tx 16ch

No.	Frequency [MHz]	Reading [dB]	C.Fac [dB]	Result [dBμV]	Limit [dBμV]	Margin [dB]	Phase
1	0.03458	27.6	10.2	37.8	74.9	37.1	Va
2	0.06163	19.7	10.1	29.8	65.1	35.3	Va
3	0.08857	24.2	10.1	34.3	58.9	24.6	Va
4	0.03457	27.3	10.2	37.5	74.9	37.4	Vb
5	0.06176	20.0	10.1	30.1	65.1	35.0	Vb
6	0.08854	24.8	10.1	34.9	59.0	24.1	Vb

[Graph]

Operating mode: Tx 16ch



Range 2: 150 kHz - 30 MHz

Operating mode: Rx 16ch

No.	Frequency [MHz]	Reading [dB]	C.Fac [dB]	Result [dBμV]	Limit [dBμV]	Margin [dB]	Phase
1	0.18297	20.0	10.3	30.3	57.7	27.4	Va
2	0.18365	20.0	10.3	30.3	57.6	27.3	Vb

Operating mode: Rx 70ch

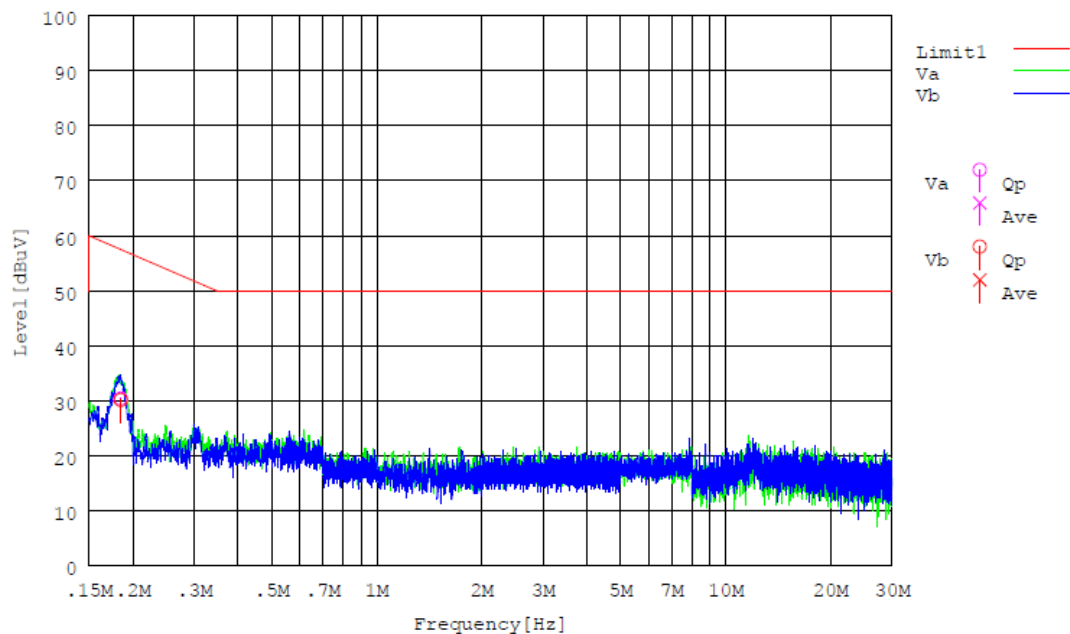
No.	Frequency [MHz]	Reading [dB]	C.Fac [dB]	Result [dBμV]	Limit [dBμV]	Margin [dB]	Phase
1	0.18246	20.1	10.3	30.4	57.7	27.3	Va
2	0.18365	20.0	10.3	30.3	57.6	27.3	Vb

Operating mode: Tx 16ch

No.	Frequency [MHz]	Reading [dB]	C.Fac [dB]	Result [dBμV]	Limit [dBμV]	Margin [dB]	Phase
1	0.18450	20.1	10.3	30.4	57.6	27.2	Va
2	0.18450	19.9	10.3	30.2	57.6	27.4	Vb

[Graph]

Operating mode: Tx 16ch



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	LA08	LA05	SG05	RP21
RP13	CL61	CL19	RC05			

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

[Test Date]

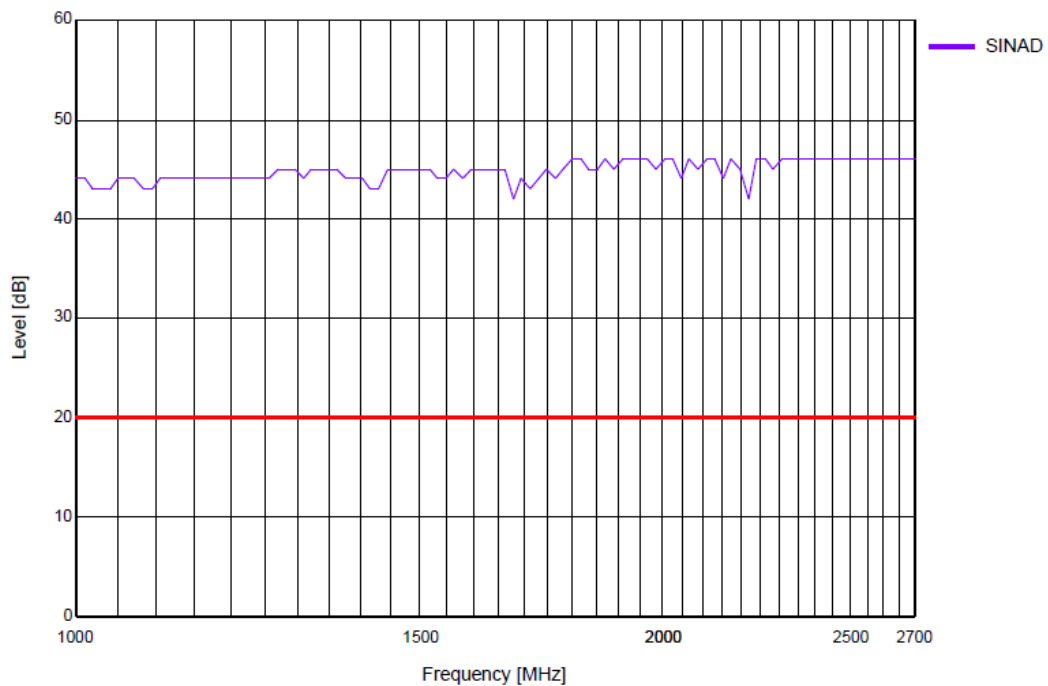
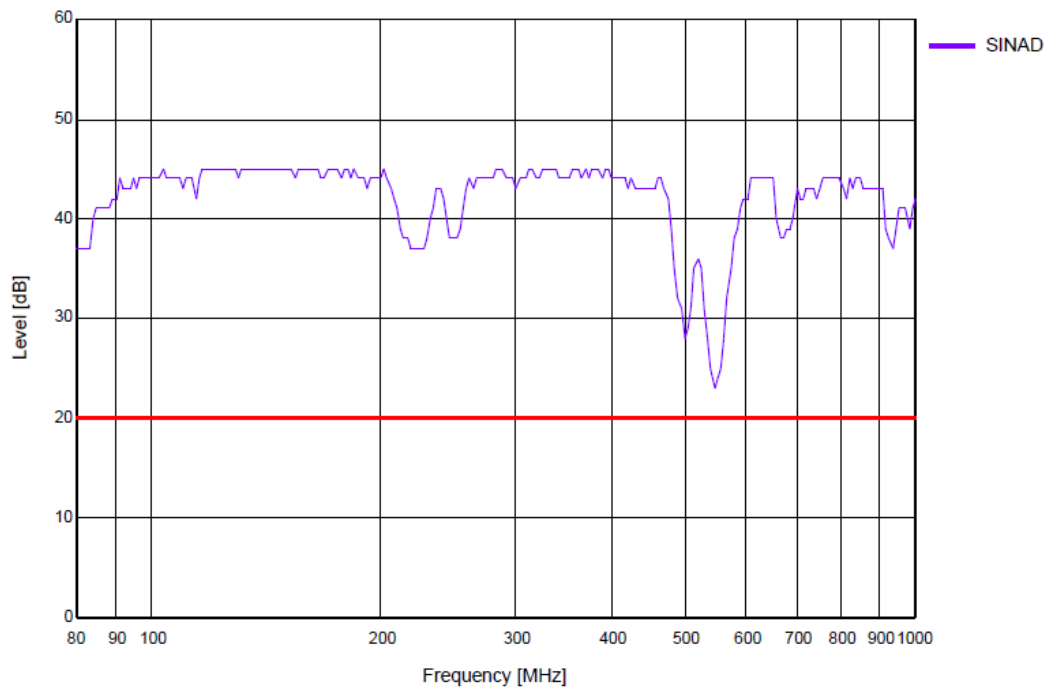
Tested Date: 13 Oct. 2014
Temperature: 23 degC
Humidity: 51 %
Atmos. Press: 1017 hPa

[Test Data] Tested HW version: 004

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

[Graph]

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



Note: This test was applied up to 2700 MHz since the result will be used in common with EN 301 843-1 testing.

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

[Test Date]

Tested Date: 14 Oct. 2014
Temperature: 23 degC
Humidity: 52 %
Atmos. Press: 995 hPa

[Test Data] Tested HW version: 004

Operating mode: Rx 16ch

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

VCP: Vertical coupling panel

HCP: Horizontal coupling panel

The discharge points of the EUT show the following photographs.

Operating mode: Rx 70ch

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

Operating mode: Tx 16ch

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

2.2.3 Fast transients (bursts)

[Test condition]

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

[Test equipment]

IM02	BC51					
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[Test result] - **Complied with requirement**

[Test Date]

Tested Date: 10 Sep. 2014
Temperature: 24 degC
Humidity: 54 %
Atmos. Press: 1010 hPa

[Test Data] Tested HW version: 002

Operating Mode	Tested Port	Injection	Test voltage	Criteria	Result
Rx 16ch	DC Cable	CDN	± 1.0 kV	B	Passed
	Speaker Cable	Clamp	± 1.0 kV	B	Passed
	NMEA Cable	Clamp	± 1.0 kV	B	Passed
	Antenna Cable	Clamp	± 1.0 kV	B	Passed
Rx 70ch	DC Cable	CDN	± 1.0 kV	B	Passed
	Speaker Cable	Clamp	± 1.0 kV	B	Passed
	NMEA Cable	Clamp	± 1.0 kV	B	Passed
	Antenna Cable	Clamp	± 1.0 kV	B	Passed
Tx 16ch	DC Cable	CDN	± 1.0 kV	B	Passed
	Speaker Cable	Clamp	± 1.0 kV	B	Passed
	NMEA Cable	Clamp	± 1.0 kV	B	Passed
	Antenna Cable	Clamp	± 1.0 kV	B	Passed

2.2.4 Conducted radio frequency disturbance

[Test condition (sweep)]

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

[Test condition (spot)]

Test level: 10 V rms
Test Frequency: 2, 3, 4, 6.2, 8.2, 12.2, 16.5, 18.8, 22, 25 MHz
Modulation: Amplitude, 400 Hz, 80 %
Dwell time: 3.0 s
Application method: CDN (DC Cable), Direct Injection (Signal cable)
Performance criterion: A

[Test equipment]

CD12	CL15	SG04	RP05	EC02	
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[Test result] - **Complied with requirement**

[Test Date_DC port (HW version: 002)]

Tested Date: 10 Sep. 2014
Temperature: 24 degC
Humidity: 54 %
Atmos. Press: 1010 hPa

[Test Date_other ports (HW version: 003)]

Tested Date: 11 Sep. 2014
Temperature: 24 degC
Humidity: 45 %
Atmos. Press: 1011 hPa

[Test Data (Sweep)]

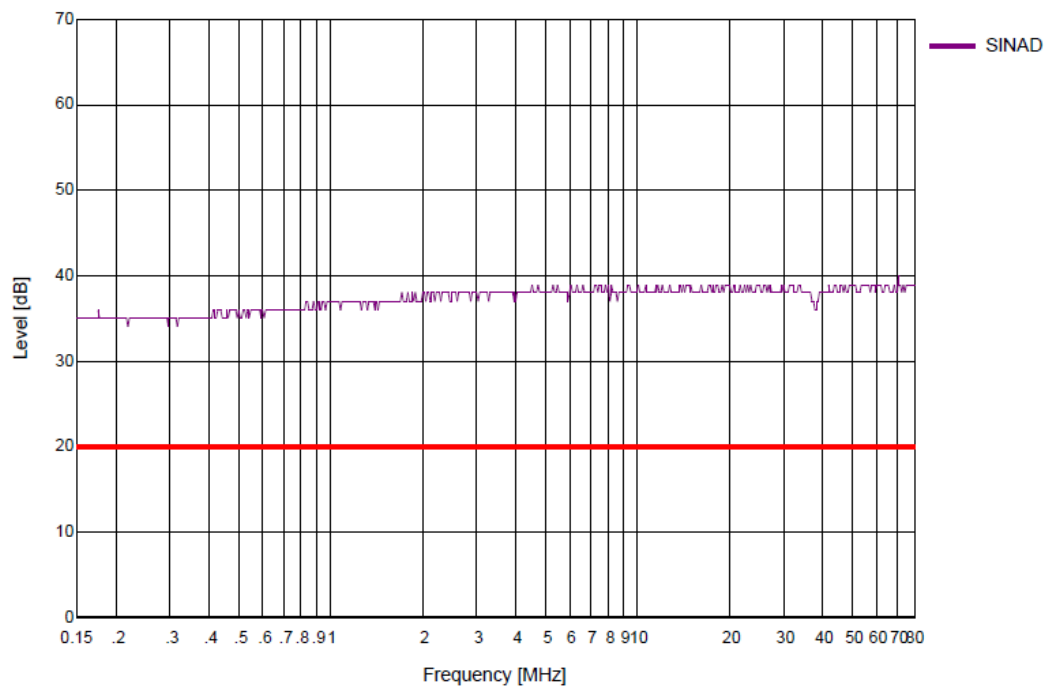
Operating Mode	Tested Port	Injection	Test voltage	Criteria	Result
Rx 16ch	DC Cable	CDN	3 Vrms	A	Passed
	Speaker Cable	Clamp	3 Vrms	A	Passed
	NMEA Cable	Clamp	3 Vrms	A	Passed
	Antenna Cable	Clamp	3 Vrms	A	Passed
Rx 70ch	DC Cable	CDN	3 Vrms	A	Passed
	Speaker Cable	Clamp	3 Vrms	A	Passed
	NMEA Cable	Clamp	3 Vrms	A	Passed
	Antenna Cable	Clamp	3 Vrms	A	Passed
Tx 16ch	DC Cable	CDN	3 Vrms	A	Passed
	Speaker Cable	Clamp	3 Vrms	A	Passed
	NMEA Cable	Clamp	3 Vrms	A	Passed
	Antenna Cable	Clamp	3 Vrms	A	Passed

[Test Data (Spot)]

Operating Mode	Tested Port	Injection	Test voltage	Criteria	Result
Rx 16ch	DC Cable	CDN	10 Vrms	A	Passed
	Speaker Cable	Clamp	10 Vrms	A	Passed
	NMEA Cable	Clamp	10 Vrms	A	Passed
	Antenna Cable	Clamp	10 Vrms	A	Passed
Rx 70ch	DC Cable	CDN	10 Vrms	A	Passed
	Speaker Cable	Clamp	10 Vrms	A	Passed
	NMEA Cable	Clamp	10 Vrms	A	Passed
	Antenna Cable	Clamp	10 Vrms	A	Passed
Tx 16ch	DC Cable	CDN	10 Vrms	A	Passed
	Speaker Cable	Clamp	10 Vrms	A	Passed
	NMEA Cable	Clamp	10 Vrms	A	Passed
	Antenna Cable	Clamp	10 Vrms	A	Passed

[Graph]

Operating mode: Rx 16ch
Tested port: Antenna port



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]

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[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

2.2.6 Power supply failure

[Test condition]

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

[Test equipment]

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

[Test Date]

Tested Date: 11 Sep. 2014
Temperature: 24 degC
Humidity: 45 %
Atmos. Press: 1011 hPa

[Test Data]

Tested HW version: 003

Tested Line	Criteria	Result
DC power	C	Passed

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]

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[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	-

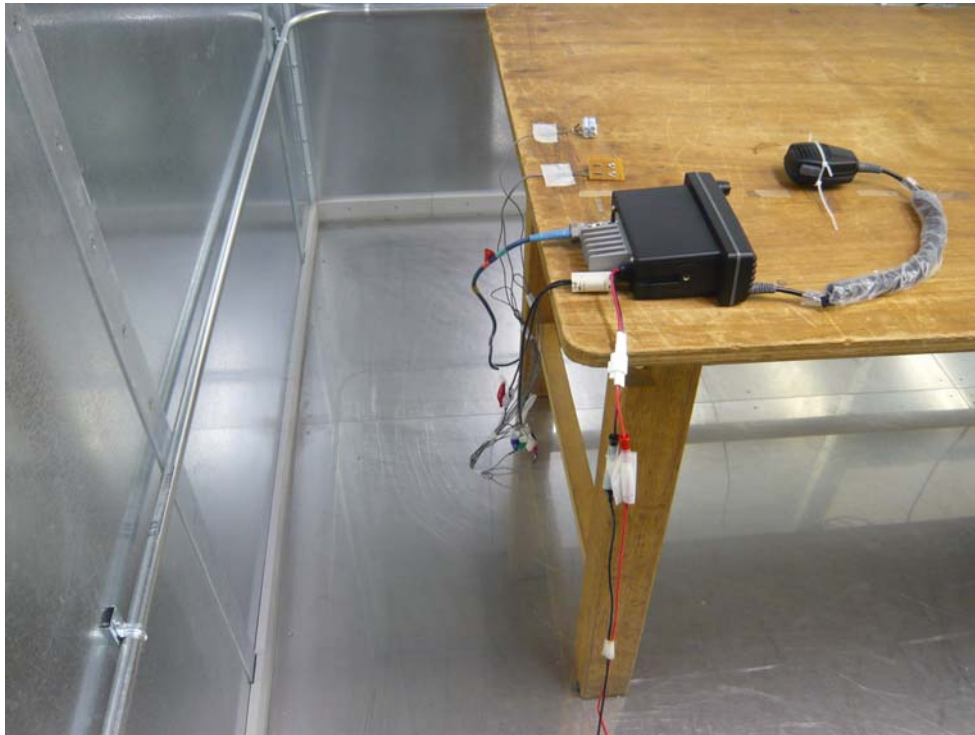
3 Test setup photographs

3.1 EMI Test

3.1.1 Radiated emissions

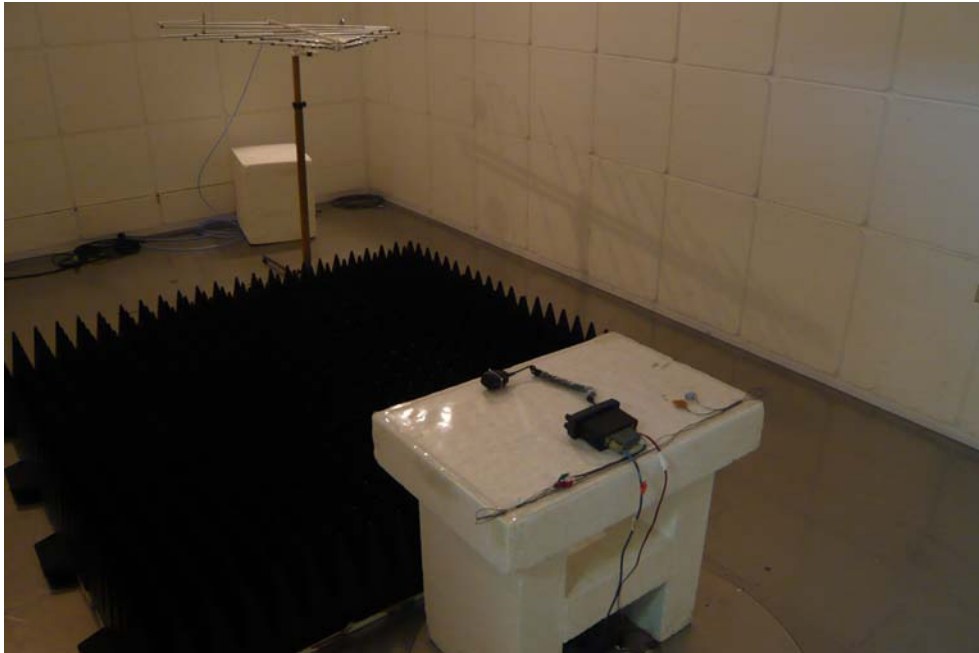


3.1.2 Conducted emissions



3.2 EMS Test

3.2.1 Radiated disturbance



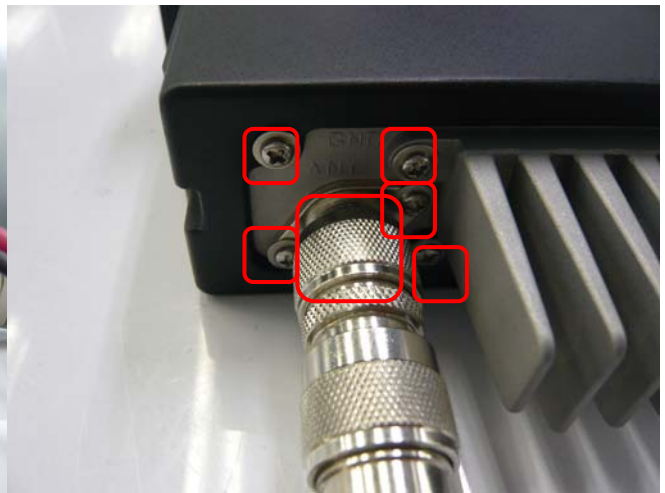
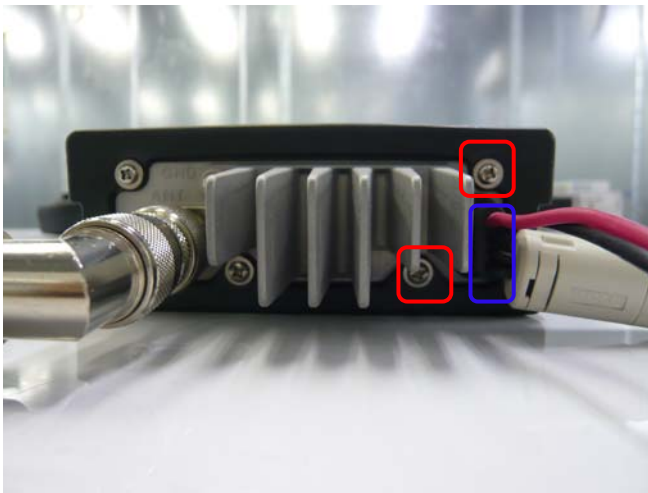
3.2.2 Electrostatic discharge



3.2.3 ESD discharge points

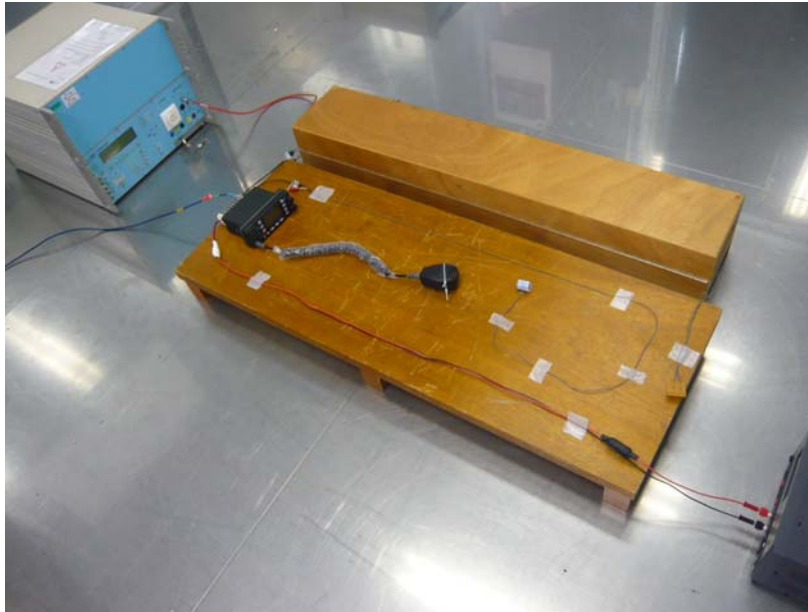
Contact Discharge

Air Discharge

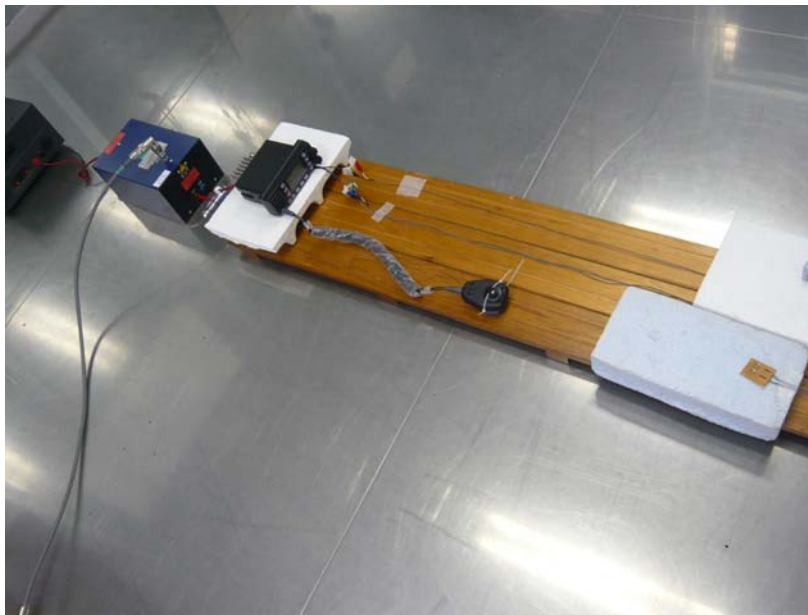




3.2.4 Fast transients (bursts)



3.2.5 Conducted radio frequency disturbance



3.2.6 Power supply short term variation

This item was not tested.

3.2.7 Slow transients (surges)

This item was not tested.

4 List of utilized test equipment/ calibration

RFT ID No.	Kind of Equipment and Precision	Manufacturer	Model No.	Serial Number	Calibration Date	Calibrated until
AC01(EM)	Anechoic Chamber (1st test room)	JSE	203397C	-	2014/4/26	2015/4/30
AC01(EG)	Anechoic Chamber (1st test room)	JSE	203397C	-	2013/11/23	2014/11/30
BA10	Biological Antenna	TESEQ	CBL6111D	32342	2014/6/9	2015/6/30
CL11	Antenna Cable for RE	RFT	-	-	2014/3/31	2015/3/31
CL18	Antenna Cable for CE	RFT	-	-	2014/4/18	2015/4/30
CL29	RF Cable 2 m	SUHNER	SUCOFLEX104PE	94709	2014/1/21	2015/1/31
CL30	RF Cable 5 m	SUHNER	SUCOFLEX104PE	MY3599	2014/8/28	2015/8/31
DH01	DRG Horn Antenna	A.H. Systems	SAS-571	785	2014/1/21	2016/1/31
LA07	Logperiodic Antenna	SCHWARZBECK	VUSLP9111B	102	2013/12/17	2014/12/31
LN02	LISN (3ph 32A)	SCHWARZBECK	NSLK8128	8128-212	2014/1/22	2015/1/31
LN05	LISN	Kyoritsu	KNW-407F	8-1773-2	2014/5/22	2015/5/31
LP05	Loop Antenna	ETS-Lindgren	6502	00143302	2014/2/4	2015/2/28
PR12	Pre. Amplifier (1-26G)	Agilent Technologies	8449B	3008A02513	2014/1/21	2015/1/31
PR15	Pre. Amplifier	Anritsu	MH648A	6201156141	2014/6/10	2015/6/30
TR06	Test Receiver (F/W : 3.93 SP2)	Rohde & Schwarz	ESU26	100002	2014/9/5	2015/9/30
TR09	Test Receiver (F/W : 4.43 SP3)	Rohde & Schwarz	ESU8	100386	2014/2/4	2015/2/28
AC01(I)	Anechoic Chamber (1st test room)	JSE	203397C	-	2014/9/23	2015/9/30
BC51	Burst Clamp	SCHAFFNER	CDN8015	21369	2014/1/20	2015/1/31
CD12	CDN	FCC (TSJ)	TSCDN-M2-16A	100567	2014/4/16	2015/4/30
CL15	Antenna Cable for CS	RFT	—	—	2014/2/28	2015/2/28
CL19	Antenna Cable for RS	SUCOFLEX	—	—	2014/9/23	2015/9/30
CL61	Antenna Cable for RS	SUCOFLEX	—	—	2014/9/23	2015/9/30
EC02	EM Injection Clamp	FCC	TSIC-32	503	2014/7/1	2015/7/31
EM10	EM Probe/Monitor	AR	FL7006	0334662	2013/12/3	2014/12/31
ES04	ESDTester	EMC Partner	ESD3000	374	2014/8/11	2015/8/31
IM02	Surge/Burst Simulator	EMC-PARTNER	TRA2000IN6	997	2014/1/20	2015/1/31
LA08	Logperiodic Antenna (High Power)	SCHWARZBECK	VULP9118-E	924	2014/9/23	2015/9/30
RP05	RF Power Amplifier	ifi	M75	K215-0306	2014/2/28	2015/2/28
RP13	RF Power AMP 0.8-4.2GHz 50W	AR	50S1G4A	0326341	2013/12/13	2014/12/31
RP21	RF Power AMP (1200W)	PRANA	MT1200DC	1303-1311	2014/1/6	2015/1/31
RC05	Radio communication tester	Agilent Technologies	8920B	US35240529	2014/5/13	2015/5/31
SG04	Signal Generator	Rohde & Schwarz	SMG	51400285	2014/3/13	2015/3/31
SG05	Signal Generator	Rohde & Schwarz	SMR20	100905	2014/2/5	2015/2/28

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.