

TEST REPORT

For

Marine Transceiver/MATRIX AIS/GPS

In conformity with

**FCC CFR 47 Part80 Subpart E
RSS-282 Issue5 (RSS-Gen Issue 3)**

Model : GX2200

**FCC ID : K6630443X3D
IC : 511B-30443X3D**

Test Item : Marine Transceiver/MATRIX AIS/GPS

Report No. : ERY1311P09R1

Issue Date : 09 Nov. 2013

Prepared for

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Prepared by

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History

Report No.	Date	Revisions	Issued By
ERY1311P09R1	09 Nov. 2013	Initial Issue	T.Kato

1 General information

1.1 Product description

Test item	: Marine Transceiver/MATRIX AIS/GPS
Manufacturer	: YAESU MUSEN CO., LTD.
Address	: 43 Utsuroda, Morijuku, Sukagawa-shi, Fukushima-ken 962-0001 Japan
Model	: GX2200
FCC ID	: K6630443X3D
IC	: 511B-30443X3D
Serial number	: L41B000001
Operating frequency	: 156.025 – 163.275 MHz
Output power	: 25 W (High) / 1 W (Low) nominal
Emission designator	: 16K0G3E (Voice), 16K0G2B (DSC)
Software version	: N/A
Hardware version	: N/A
Highest operating frequency	: 9.8304 MHz
Receipt date of EUT	: 06 Nov. 2013
Nominal power source voltages	: 13.8 Vdc

1.2 Test(s) performed/ Summary of test result


Test specification(s)	: FCC CFR 47. Part 80 subpart E : RSS-182 Issue 5 (RSS-Gen Issue 3)
Test method(s)	: TIS-603-D (FCC Part 80) : ANSI C63.4: 2003 (RSS)
Test(s) started	: 09 Nov. 2013
Test(s) completed	: 09 Nov. 2013
Purpose of test(s)	: Certification / Class II permissive change
Summary of test result	: <u>Complied</u>

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. Ohnishi
Manager
EMC testing Department

1.3 Test facility

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at RF Technologies Ltd., located in 472, Nippa-cho, Kohoku-ku, Yokohama, 223-0057, Japan, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948, per October 1, 2010.

The description of the test facilities has been filed under registration number 319924 at the Office of the Federal Communications Commission. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The list of all public test facilities is available on the Internet at <http://www.fcc.gov>.

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

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

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

1.4 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 emission: ± 3.4 dB (10 kHz - 30 MHz)
Radiated emission (9 kHz - 30 MHz): ± 3.3 dB
Radiated emission (30 MHz - 200 MHz): ± 5.0 dB
Radiated emission (200 MHz - 1000 MHz): ± 6.2 dB
Radiated spurious emission (30 MHz - 1000 MHz): ± 1.8 dB
Radiated spurious emission (1 GHz – 18 GHz): ± 2.8 dB

1.5 Summary of test results

Requirement	Section in Standard	Result	Section in this report
Tx Radiated spurious emissions (30 to 1700 MHz) *	FCC 80.211(f)(3)	Complied	2.1
Rx Radiated emissions (30 – 1000 MHz) **	RSS-182 Sec. 7.11 RSS-Gen Sec. 4.10	Complied	2.2

* Maximum frequency of transmitter is 163.275 MHz

** Maximum internal operating frequency is 9.8304 MHz.

1.6 Setup of equipment under test (EUT)

1.6.1 Test configuration of EUT

Equipment(s) under test

No.	Item	Manufacture	Model No.	Serial No.
A	Marine Transceiver /MATRIX AIS/GPS	YAESU MUSEN CO., LTD.	GX2200	L41B000001
B	Microphone	-	-	-

*Microphone is a part of the EUT.

Support Equipment(s)

No.	Item	Manufacture	Model No.	Serial No.	FCC ID
C	Remote Station Microphone	Vertex Standard Co., Ltd.	CMP30	0J150202	-
					-

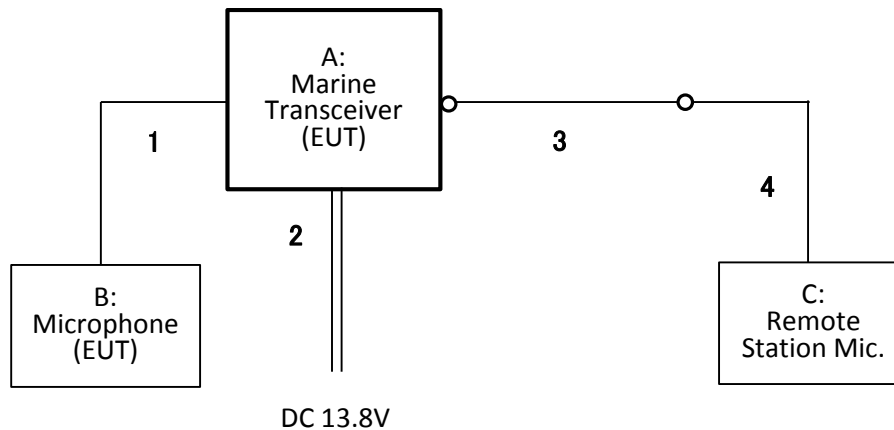
Connected cable(s)

No.	Item	Identification (Manu.etc.)	Cable Shielded	Ferrite Core	Length [m]
1	Mic cable of EUT	YAESU MUSEN CO., LTD.	Yes	No	0.5
2	DC cable	YAESU MUSEN CO., LTD.	No	No	1.3
3	23-Foot Routing cable	YAESU MUSEN CO., LTD.	Yes	Yes	7.0
4	Mic. cable of CMP30	YAESU MUSEN CO., LTD.	Yes	No	0.5

1.6.2 Operating condition:

Tx Mode: The EUT transmit Tx power in 16 ch.
 (Tx power level are two mode. (Hi:25W, Low:1W))
 Rx Mode: The EUT is in receiving mode at 16/70 ch.

1.6.3 Setup diagram of tested system



1.7 Equipment modifications

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

1.8 Deviation from the standard

No deviations from the standards described in clause 1.2.

2 Test procedure and test data

2.1 Radiated spurious emissions (Transmitter test)

Test setup

Test setup was implemented according to the method of ANSI C63.4: 2003 clause 6 “General requirements for EUT equipment arrangements and operation”, clause 8.2 and Annex H.3 “Radiated emission measurements setup”.

Test procedure

Measurement procedures were implemented according to the method of TIA-603-C clauses 2.2.12.2.

- a) Antenna terminal of the EUT is terminated with a nonradiating load.
- b) Adjust the spectrum analyzer as below.
 - 1) RBW = 10 kHz (below 1 GHz), 1 MHz (above 1 GHz)
 - 2) VBW = 300 kHz (below 1 GHz), 3 MHz (above 1 GHz)
 - 3) Sweep speed slow enough to maintain measurement
 - 4) Detector mode : Peak
- c) Place the EUT on the turntable. The EUT set Tx ON in max power level
- d) For each spurious frequency that was found, the test antenna is raised and lowered from 1 to 4 m to obtain a maximum level on the spectrum analyzer. Then the turntable should be rotated 360 deg to determine the maximum reading.
- e) Repeat step d) for each spurious frequency with the test antenna polarized vert/hori.
- f) The EUT was replaced with substitution antenna and signal generator.
- g) Feed the substitution antenna at the transmitter end with signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.
- h) Repeat step g) with both antennas vertically polarized for each spurious frequency.
- i) Calculate power in dBm erp as below.

$$\text{Spurious emission level} = \text{Antenna input level [dBm]} + \text{Substitution antenna gain [dBd]}$$

Applicable rule and limitation

Part 80.211 (f) (3) Radiated emission limits

$$\text{Limit Level} = \text{Po [dBm]} - (43 + 10 \log (\text{Po [W]})) = -13 \text{ [dBm erp]}$$

Test results - Complied with requirement

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

AC01	CL11	TR06	PR15	BI05	LA07	CL30
CL31	PR12	DR01				

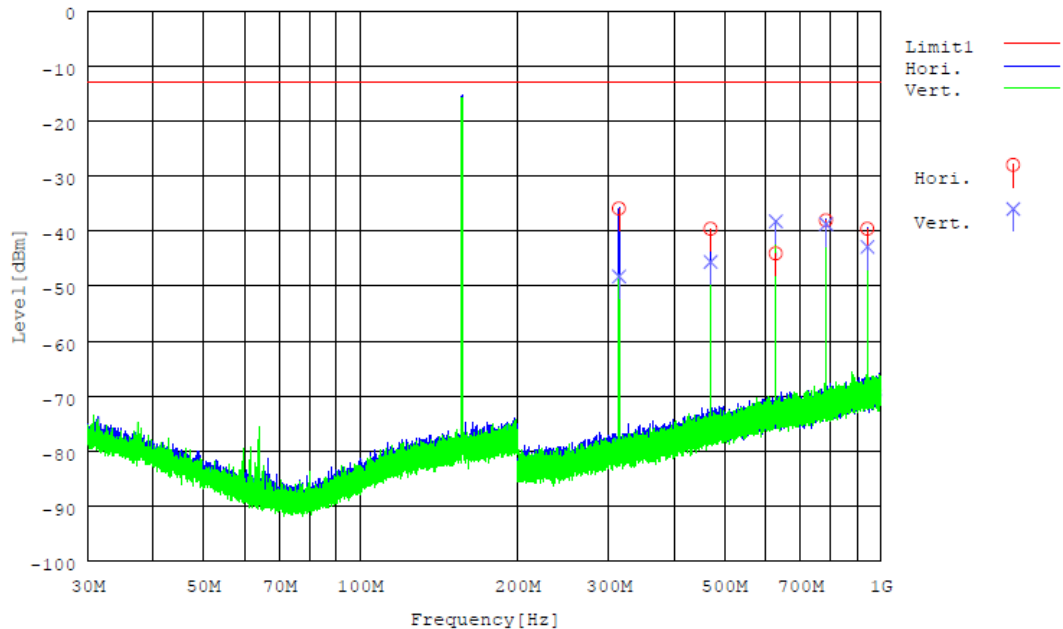
Test Data

Operating mode: Tx mode (16ch / 25W)
 Measurement distance: 3 m

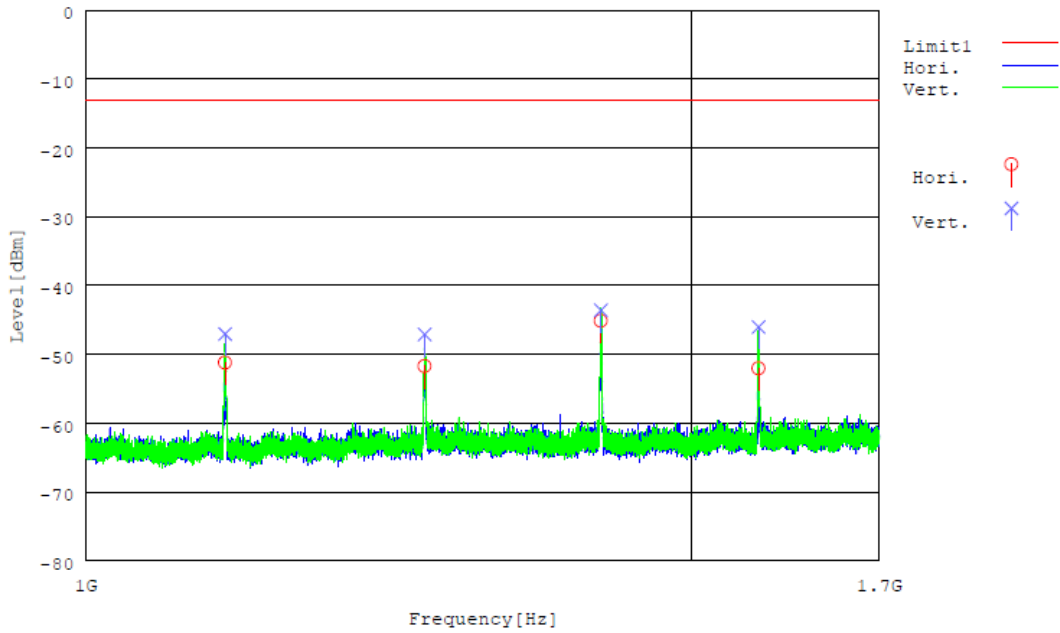
[Spurious emission level]

No.	Frequency [MHz]	Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Ant.
1	313.6	-35.9	-13.0	22.9	Hori.
2	470.4	-39.6	-13.0	26.6	Hori.
3	627.2	-44.1	-13.0	31.1	Hori.
4	784.0	-38.1	-13.0	25.1	Hori.
5	940.8	-39.6	-13.0	26.6	Hori.
6	1097.6	-51.2	-13.0	38.2	Hori.
7	1254.4	-51.7	-13.0	38.7	Hori.
8	1411.2	-45.1	-13.0	32.1	Hori.
9	1568.0	-52.0	-13.0	39.0	Hori.
10	313.6	-48.2	-13.0	35.2	Vert.
11	470.4	-45.6	-13.0	32.6	Vert.
12	627.2	-38.2	-13.0	25.2	Vert.
13	784.0	-38.7	-13.0	25.7	Vert.
14	940.8	-42.9	-13.0	29.9	Vert.
15	1097.6	-47.0	-13.0	34.0	Vert.
16	1254.4	-47.1	-13.0	34.1	Vert.
17	1411.2	-43.6	-13.0	30.6	Vert.
18	1568.0	-46.0	-13.0	33.0	Vert.

[Chart]



Note: 156.8 MHz is Tx carrier frequency.

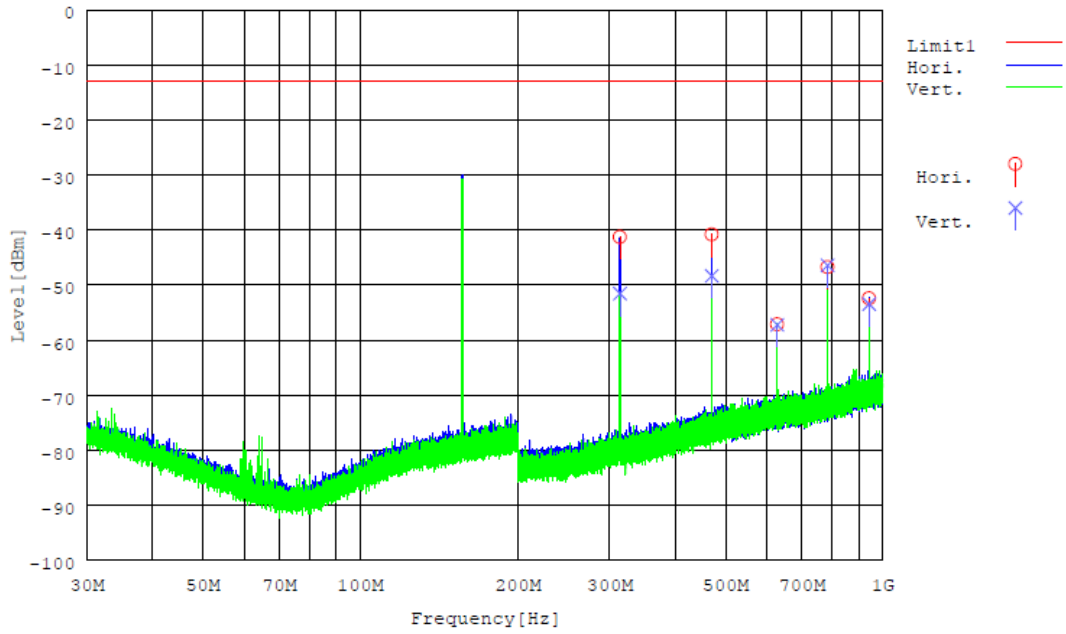


Operating mode: Tx mode (16ch / 1W)
 Measurement distance: 3 m

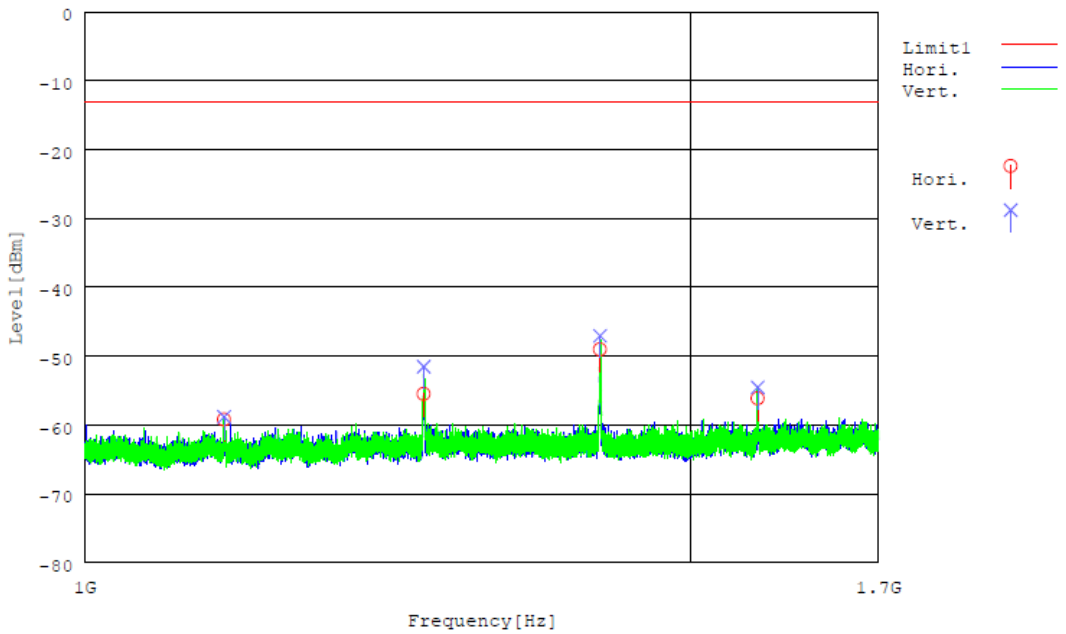
[Spurious emission level]

No.	Frequency [MHz]	Result [dB μ V/m]	Limit [dB μ V/m]	Margin [dB]	Ant.
1	313.6	-41.3	-13.0	28.3	Hori.
2	470.4	-40.8	-13.0	27.8	Hori.
3	627.2	-57.1	-13.0	44.1	Hori.
4	784.0	-46.7	-13.0	33.7	Hori.
5	940.8	-52.4	-13.0	39.4	Hori.
6	1097.6	-59.2	-13.0	46.2	Hori.
7	1254.4	-55.5	-13.0	42.5	Hori.
8	1411.2	-49.0	-13.0	36.0	Hori.
9	1568.0	-56.1	-13.0	43.1	Hori.
10	313.6	-51.5	-13.0	38.5	Vert.
11	470.4	-48.3	-13.0	35.3	Vert.
12	627.2	-57.2	-13.0	44.2	Vert.
13	784.0	-46.4	-13.0	33.4	Vert.
14	940.8	-53.4	-13.0	40.4	Vert.
15	1097.6	-58.8	-13.0	45.8	Vert.
16	1254.4	-51.5	-13.0	38.5	Vert.
17	1411.2	-47.0	-13.0	34.0	Vert.
18	1568.0	-54.5	-13.0	41.5	Vert.

[Chart]



Note: 156.8 MHz is Tx carrier frequency.



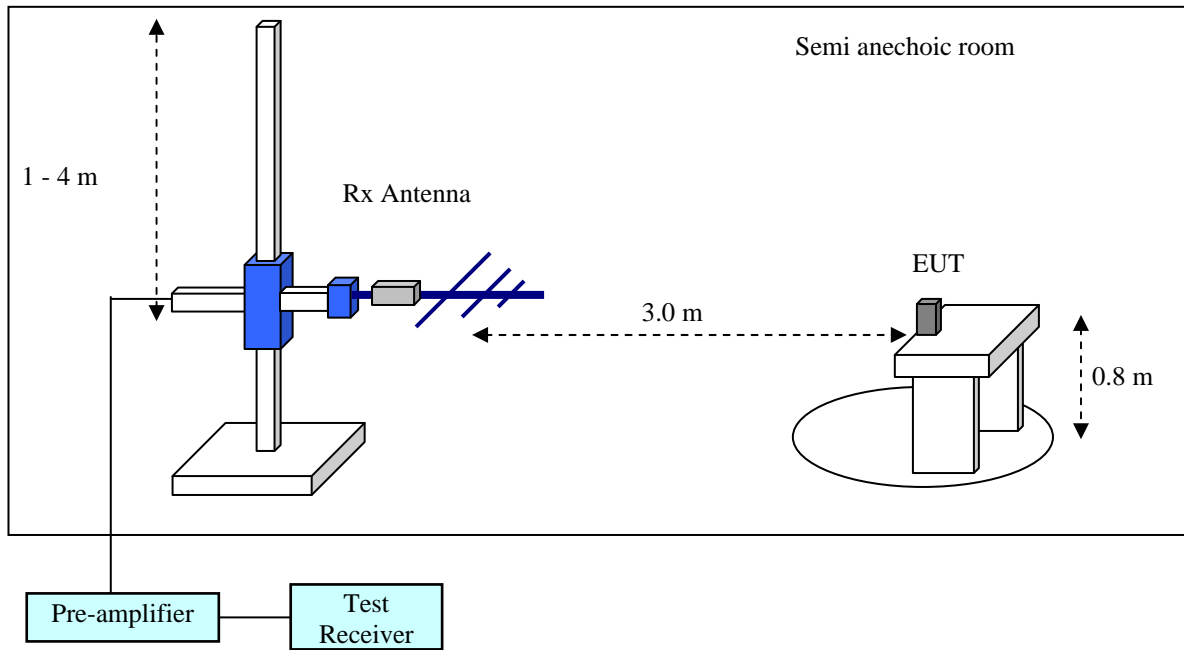
Tested Date: 09 Nov. 2013
 Humidity: 41 %

Temperature: 20 degC
 Atmos. Press: 1029 hPa

2.2 Radiated emissions (Receiver test)

Test setup

Test setup was implemented according to the method of ANSI C63.4: 2003 clause 6 “General requirements for EUT equipment arrangements and operation”, clause 8.2 and Annex H.3 “Radiated emission measurements setup”.



Test procedure

Measurement procedures were implemented according to the method of ANSI C63.4: 2003 clauses 8.2. The EUT is placed on a non-conducted table which is 0.8 m height from a ground plane and the measurement antenna to EUT distance is 3 meters. The turn table is rotated for 360 degrees to determine the maximum emission level.

The antenna height scanned between 1 m and 4 m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

The spectrum analyzer and receiver are set to the followings;

RBW=100 kHz, VBW= 300 kHz

Final measurement is carried out with a receiver RBW of 120 kHz (QP)

Applicable rule and limitation

RSS-Gen clauses 6.1: Radiated emission limits

Frequency [MHz]	Field Strength [$\mu\text{V/m}$]	Measurement Distance [m]	Field Strength [dB $\mu\text{V/m}$]
30 – 88	100	3	40.0
88 – 216	150	3	43.5
216 – 960	200	3	46.0
Above 960	500	3	53.9

In the emission table above, the tighter limit applies at the band edges.

The emission limits shown in the above table are based on measurements employing a quasi-peak detector.

Test results - Complied with requirement

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

AC01	CL11	TR06	PR15	BI05	LA07	
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Test Data

Operating mode: Rx mode 16ch
Measurement distance: 3 m

[Emission level]

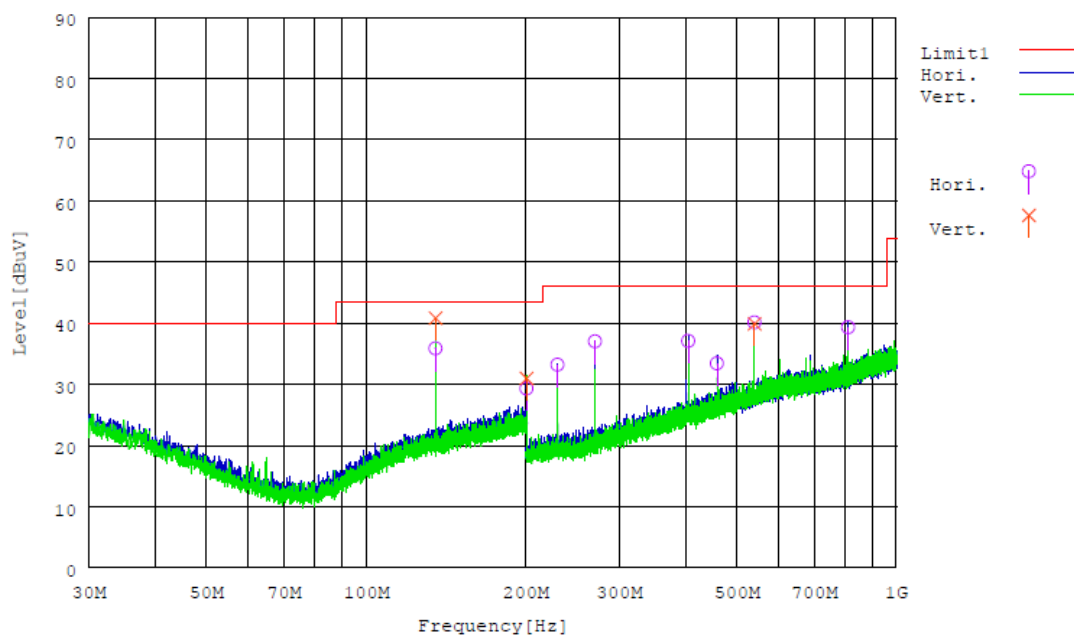
No.	Frequency [MHz]	Reading [dBμV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Ant.
1	135.100	43.3	14.3	8.4	30.1	35.9	43.5	7.6	Hori.
2	200.875	38.7	11.6	9.0	30.0	29.3	43.5	14.2	Hori.
3	229.625	42.0	11.7	9.4	29.9	33.2	46.0	12.8	Hori.
4	270.200	44.6	12.5	9.8	29.9	37.0	46.0	9.0	Hori.
5	405.300	40.0	15.8	11.1	29.8	37.1	46.0	8.9	Hori.
6	459.250	34.7	16.9	11.5	29.7	33.4	46.0	12.6	Hori.
7	540.400	39.4	18.2	12.0	29.5	40.2	46.0	5.9	Hori.
8	810.600	35.7	20.9	13.1	30.4	39.3	46.0	6.7	Hori.
9	135.100	48.2	14.3	8.4	30.1	40.8	43.5	2.7	Vert.
10	200.875	40.4	11.6	9.0	30.0	31.0	43.5	12.5	Vert.
11	540.392	39.2	18.2	12.0	29.5	39.9	46.0	6.1	Vert.

[Calculation sample]

$$\text{Correction Factor [dB/m]} = \text{FACTOR [dB/m]} + \text{LOSS [dB]} - \text{GAIN [dB]}$$

$$\text{RESULT [dBμV/m]} = \text{READING [dBμV]} + \text{Correction Factor [dB/m]}$$

[Chart]



Operating mode: Rx mode 70ch
 Measurement distance: 3 m

[Emission level]

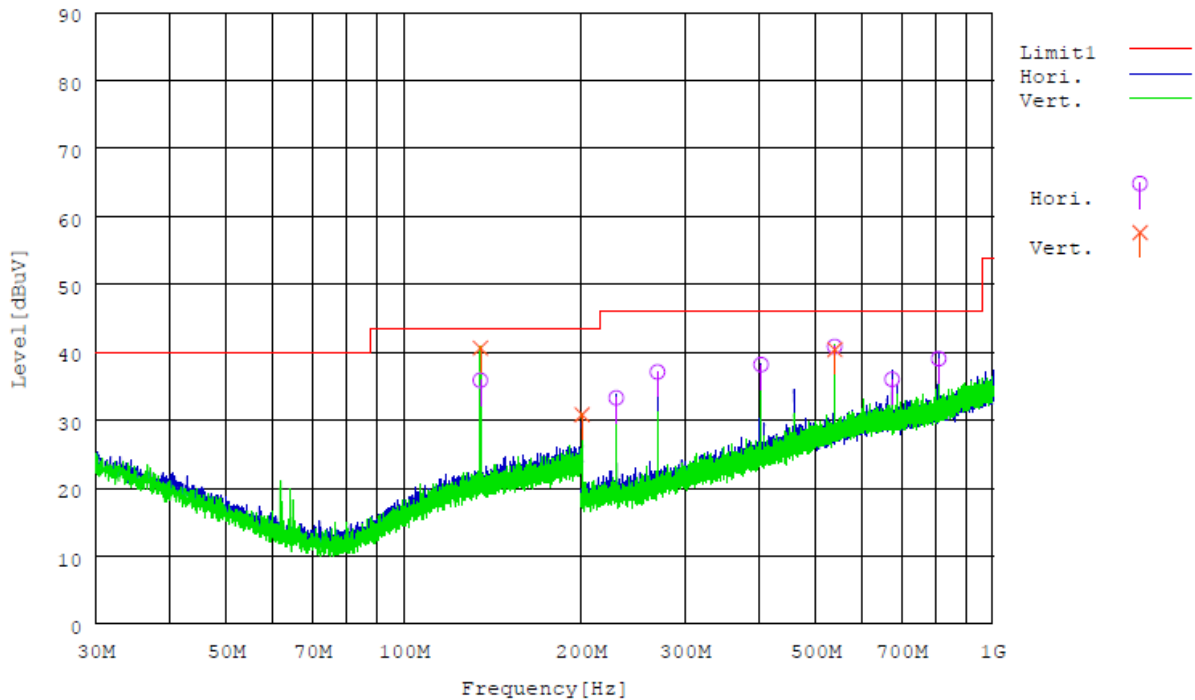
No.	Frequency [MHz]	Reading [dBμV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Ant.
1	134.825	43.4	14.2	8.4	30.1	35.9	43.5	7.6	Hori.
2	229.625	42.1	11.7	9.4	29.9	33.3	46.0	12.7	Hori.
3	269.650	44.7	12.5	9.8	29.9	37.1	46.0	8.9	Hori.
4	404.475	41.1	15.8	11.1	29.8	38.2	46.0	7.8	Hori.
5	539.300	40.1	1.2	12.0	29.5	40.8	46.0	5.2	Hori.
6	674.124	33.7	19.5	12.6	29.8	36.0	46.0	10.0	Hori.
7	808.950	35.4	20.9	13.1	30.4	39.0	46.0	7.0	Hori.
8	134.825	48.1	14.2	8.4	30.1	40.6	43.5	2.9	Vert.
9	200.874	40.2	11.6	9.0	30.0	30.8	43.5	12.7	Vert.
10	539.300	39.7	18.2	12.0	29.5	40.4	46.0	5.6	Vert.

[Calculation sample]

$$\text{Correction Factor [dB/m]} = \text{FACTOR [dB/m]} + \text{LOSS [dB]} - \text{GAIN [dB]}$$

$$\text{RESULT [dBμV/m]} = \text{READING [dBμV]} + \text{Correction Factor [dB/m]}$$

[Chart]



Tested Date: 09 Oct. 2013
 Humidity: 41 %

Temperature: 20 degC
 Atmos. Press: 1029 hPa

3 Test setup photographs

3.1 Radiated emissions



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	-	2013/4/20	2014/4/30
AC01(EG)	Anechoic Chamber (1st test room)	JSE	203397C	-	2012/11/17	2013/11/30
BI05	Biconical Antenna	SCHWARZBECK	VHA9103 & BBA9106	91032894	2012/12/3	2013/12/31
CL11	Antenna Cable for RE	RFT	-	-	2013/10/22	2014/10/31
CL30	RF Cable 5 m	SUHNER	SUCOFLEX104PE	MY3599	2013/8/10	2014/8/31
CL31	RF Cable 1 m	Junkosha	MWX221	1303S118	2013/10/17	2014/10/31
DH01	DRG Horn Antenna	A.H. Systems	SAS-571	785	2012/1/27	2014/1/31
LA07	Logperiodic Antenna	SCHWARZBECK	VUSLP9111B	102	2012/12/3	2013/12/31
PR12	Pre. Amplifier (1-26G)	Agilent Technologies	8449B	3008A02513	2013/1/15	2014/1/31
PR15	Pre. Amplifier	Anritsu	MH648A	6201156141	2013/6/11	2014/6/30
TR06	Test Receiver (F/W : 3.93 SP2)	Rohde & Schwarz	ESU26	100002	2013/9/10	2014/9/30

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.