Test Report

For

Model: CLASS B AIS TRANSPONDER

Type: FA-50

Report no.: FLI 12-07-056
Date of issue: 10 October 2007

Furuno Labotech International Co., Ltd.
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Testing Laboratory Status

Furuno Labotech International Co., Ltd. (hereafter called FLI) has been holding the following status after having been assessed according to the provisions of ISO/IEC 17025:

(1) Telefication Listed Testing Laboratory:

- listed by Telefication B. V., Edisonstraat 21 A, 6902 PK Zevenaar, The Netherlands
- Laboratory assignment number: L116
- Date of initial certification: 26 July 1999 (*)
- for testing the following product categories/ test standards:
  - EN 60945, Maritime navigation and radiocommunication equipment and systems - General requirements.
  - IEC 61162-1/-2, Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 1: Single talker and multiple listeners / Part 2: Single talker and multiple listeners, high speed transmission.

(2) BSH Recognized Testing Laboratory:

- recognized by Bundesamt für Seeschifffahrt und Hydrographie, Bernhad-Nocht-Str. 78, 20359 Hamburg, Federal Republic of Germany
- Laboratory assignment number: BSH-062-03
- Date of initial certification: 4 April 2003 (*)
- for testing in the fields of:

  “Marine navigational and radiocommunication equipment and systems”
  - EMC and environmental tests according to:

    IEC 60945: 1996, DIN EN 60945: 1997

    IEC 60945: 2002, DIN EN 60945: 2001
  - Radar

    IEC 60936-1: 1999, DIN EN 60936-1: 2000

    IEC 60936-2: 1998, DIN EN 60936-2: 1999

(3) TÜV Appointed EMC Test Laboratory:

- appointed by TÜV Rheinland Japan Ltd., 19-5 Shin Yokohama 3-chome, Kohoku-ku, Yokohama 222-0033 Japan
- Laboratory assignment number: UA 50046428
- Date of initial certification: 21 December 1998 (*)
- for carrying out the tests of:
  - EN 55022, EN 61000-6-1/-2, EN 61000-6-3/-4, EN 61000-3-2/-3, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11.

(*): The current certificates may be found in the FLI web site (http://www.furuno-labotech.co.jp).

1 Principal Information

1.1 Introduction

This report contains the results of measurements and tests carried out by FLI for the purpose of the technical assessment on the radio transceiver operation in the maritime communication services on the Equipment under Test (EUT).

The order for these tests and inspections has been placed by:

Company name: Furuno Electric Co., Ltd.
Address: 9-52 Ashihara-Cho, Nishinomiya-City, 662-8580 Japan

FLI project no.: FLI 04-07-299

1.2 Equipment under test (EUT)

1.2.1 General

(a) Manufacturer: Furuno Electric Co., Ltd.
Ashihara-cho 9-52, Nishinomiya-city, 662-8580 Japan

(b) Model: FA-50

No.	Unit	Type	Serial Number	Remarks
1	CLASS B AIS TRANSPONDER	FA-50	3559-0032	
2	GPS Antenna	GPA-017	381593	either
	GPS Antenna	GPA-017S	021871	selectable
	VHF Antenna	FAB-151D	4-110718-00	
	Combined Antenna	GVA-100	2104	

(c) Classification: Class B CS AIS equipment
(d) Communication capacity: 2250 reports/min per 1 channel
4500 reports/min per 2 channels
(e) Communication system: Carrier Sense Time Division Multiple Access (CSTDMA)
Dual wave simultaneous reception
(f) Frame synchronization: Indirect synchronization from external oscillator
(g) Operating mode: Autonomous, Assigned, Polled/Interrogation response
(h) Channel selection: Automatically
(i) Prevention of abnormal TX: Auto-suspend for detecting TX more than 1 second
(j) ANT Impedance: 50 ohms
(k) Regulations/Standards: IMO MSC. 140(76), IEC 62287-1, ITU-R M.1371-2,
DSC ITU-R M.825-3, IEC 60945 ed. 4 adopted

1.2.2 CLASS B CS TRANSPONDER

1.2.2.1 TRANSMITTER

(a)	Frequency range:	156.025 MHz to 162.025 MHz (DSC: 156.525 MHz)
(b)	Output Power:	1 W/2 W
(c)	Type of emission:	F1D
(d)	Type of modulation:	GMSK
(e)	Channel interval:	25 kHz
(f)	Frequency deviation:	±3ppm or less
(g)	Transmit speed:	9600 bps ± 50 ppm
(h)	Spurious emissions:	9 kHz - 1 GHz, -36 dBm (0.25 µW) or less
		1 GHz - 4 GHz, -30 dBm (1 µW) or less

1.2.2.2 AIS RECEIVER

(a)	Frequency range:	156.025 MHz to 162.025 MHz (DSC: 156.525 MHz)
(b)	Oscillator frequency:	1st LO: f_0 + (51.136 MHz/51.236 MHz)
		2nd LO: 51.1 MHz/51.2 MHz
(c)	Intermediate frequency:	1st IF: 51.136 MHz/51.236 MHz
		2nd IF: 36 kHz
(d)	RX System:	Double-conversion super-heterodyne
(e)	Sensitivity:	-107 dBm (PER ≤ 20%)
(f)	Error at high input level:	-7 dBm
(g)	Co-channel rejection:	10 dB
(h)	Adjacent channel selectivity:	70 dB
(i)	Spurious response:	70 dB (50 MHz to 520 MHz)
(j)	Inter-modulation:	65 dB
(k)	Sensitivity suppression:	86 dB (±5 MHz, ±10 MHz)

1.2.2.3 DSC RECEIVER (TIMESHARING SYSTEM)

(a)	Frequency:	156.525 MHz (CH70)
(b)	Sensitivity:	-107 dBm or less
(c)	Error at high input level:	-7 dBm
(d)	Co-channel rejection:	10 dB
(e)	Adjacent channel selectivity:	70 dB
(f)	Spurious response:	70 dB
(g)	Inter-modulation:	65 dB
(h)	Sensitivity suppression:	84 dB

1.2.3 GPS RECEIVER

(a)	Receiving frequency:	1575.42 MHz
(b)	Tracking code:	C/A code

(c)	Number of channel:	12 channels parallel, 12 satellites
(d)	Position fixing method:	All in view, 8-state Kalman filter
(e)	Position accuracy:	10 m approx., 95% of the time, (HDOP ≤ 4)
		DGPS: 5 m approx., 95% of the time
(f)	Tracking velocity:	900 kts
(g)	Position fixing time:	Warm start: 36 s typical, Cold start: 43 s typical
(h)	Geoids:	WGS84
(i)	Position update interval:	1 s
(j)	DGPS data correcting:	By AIS information

1.2.4 INTERFACES

(a)	COM I/O:		
		Input:	RS-422 (38.4 kbps) / IEC61162-1 (4800 bps) ACK, BBM, DTM, GBS, GGA, GLL, GNS, HDT, OSD, RMC, SSD, VBW, VSD, VTG, AIQ, DSC, DSE
		Output:	RS-422 (38.4 kbps) ABK, ACA, ACS, ALR, VDM, VDO, TXT
(b)	NETWORK:		Ethernet 10BASE-T/100BASE-TX
		Input:	ACK, BBM, DTM, GBS, GGA, GLL, GNS, HDT, OSD, RMC, SSD, VBW, VSD, VTG, AIQ, DSC, DSE, PFEC
		Output:	ABK, ACA, ACS, ALR, VDM, VDO, TXT, PFEC
(c)	Function alarm:		LED indication, series data output

1.2.5 POWER SUPPLY

Transponder unit:	12 - 24 VDC / 2.0 - 1.0 A

1.2.6 ENVIRONMENTAL CONDITIONS

(a)	Ambient Temperature:	
	Antenna unit:	-30°C to +70°C
	Transponder:	-15°C to +55°C
(b)	Relative humidity:	93% at +40°C
(c)	Degree of protection (IEC 60529):	
	Antenna unit:	IPX6
	Transponder:	IP20
(d)	Vibration:	IEC 60945

1.2.7 DIMENSIONS AND MASS

Transponder unit:	255 (W) x 231 (H) x 145 (D) mm, 1.7 kg

1.3 Test schedule

(1) Date of receipt of EUT: 30 July 2007

(2) Date(s) of tests performed: (Testing period: 7 August 2007 to 12 September 2007)
Tests were carried out in accordance with the specifications described in subclause 1.4 at the following locations and on the following dates:

CFR 47 Section	Item	Test site	Date
2.1046	RF power output	FLI Nishinomiya Lab. (*1)	21 August 2007
2.1049	Occupied Bandwidth		12 September 2007
	Spurious Emissions		---
2.1051	- Spurious Emissions at Antenna Terminal		21 August 2007
2.1053	- Field Strength of Spurious Radiation	FLI Nishinomiya Hama Lab. (*3)	28 to 31 August 2007
2.1055	Frequency Stability	FLI Nishinomiya Lab. (*1)	20 August 2007
80.874	Sensitivity Characteristics of VHF Radiotelephone Receiver		7 to 9 August 2007

(*1): 9-52 Ashihara-Cho, Nishinomiya City, Hyogo Prefecture, 662-8580 Japan
(*2): 2-20 Nishinomiya Hama, Nishinomiya City, Hyogo Prefecture, 662-0934 Japan
(*3): Anechoic Chamber used for the test has been registered by FCC.
(**File number: 90607**)

1.4 Test specifications applied

The equipment is intended for use in the following application areas:

For Maritime Safety Communication/Navigation,

The sample was tested to the requirements of the following standard:

- FCC Rules 2.1046 - RF power output,
2.1049 - Occupied Bandwidth,
2.1051 - Spurious Emissions at Antenna Terminal,
2.1053 - Field Strength of Spurious Radiation,
2.1055 - Frequency Stability,
80.874 - Sensitivity Characteristics of VHF Radiotelephone Receiver
(and also based on the Standard IEC 62287-1: 2006)

1.5 Modification made to the EUT

No modifications were made to the EUT during testing.

1.6 Conclusions

The tests on the samples of FURUNO CLASS B AIS TRANSPONDER FA-50 have been completed satisfactorily and showed NO NON-COMPLIANCES with the specifications stated in subclause 1.4 in this report:

The test results of this report relate only to the items tested.

Total page number of this report is 32 including the front page.

Tested by: Teruo Komatsubara / Assistant Chief, Technical Section
Katsumi Imamura / Assistant Chief, Technical Section

Reviewed by: Yoshihiro Ishii / Manager, Technical Section

Approved by:
All tests were performed in Furuno Labotech International Co., Ltd.
All data herein contained is true and correct to our best knowledge.

Date: 10 October 2007
Name: Yoshihiro Ishii
Manager, Technical Section

Signature: 

2 Test Report Overview

CFR 47 Section	Item	Satisfactory	Relevant clause
2.1046	RF power output	Yes	3.1
2.1049	Occupied Bandwidth	Yes	3.2
	Spurious Emissions	---	---
2.1051	- Spurious Emissions at Antenna Terminal	Yes	3.3
2.1053	- Field Strength of Spurious Radiation	Yes	3.4
2.1055	Frequency Stability	Yes	3.5
80.874	Sensitivity Characteristics of VHF Radiotelephone Receiver	Yes	3.6

Note: n. a. - Not applicable, n. p. - Not performed.

3 Test Results

3.1 RF power output (FCC Rule 2.1046)

3.1.1 Setup for measurement

See Clause 4 of this report.

3.1.2 Measuring Equipment List:

See Clause 5 of this report.

3.1.3 Test Results:

(1) Voltages and currents to the final RF module were measured.

(2) RF power output (carrier power) was measured at 2 W setting with a 50 ohm artificial antenna loaded.

Results are shown in Table 3.1A.

Table 3.1A

CH Frequency (MHz)	Power Supply (VDC)	RF power output (W)	Final stage at 2 W	
			Voltage (VDC)	Current (A)
1060 (156.025)	10.2	2.0	11.73	0.45
	12.0	2.0	11.73	0.45
	27.6	2.0	11.73	0.45
2088 (162.025)	10.2	2.0	11.74	0.44
	12.0	2.0	11.74	0.44
	27.6	2.0	11.74	0.44

Environmental conditions observed: On 21 August 2007, 26°C to 26°C, 52% to 52%RH.

3.2 Occupied Bandwidth (FCC Rule 2.1049)

3.2.1 Setup for measurement:

See Clause 4 of this report.

3.2.2 Measuring Equipment List:

See Clause 5 of this report.

3.2.3 Limits:

All emissions should be within the limits specified in the figure 10 of IEC 62287-1, Clause 11.1.3.

(i) At ± 10 kHz removed from the carrier, the modulation sidebands is below -25 dBc.

(ii) At ± 25 kHz removed from the carrier, the modulation sidebands is below -63 dBc (- 30 dBm).

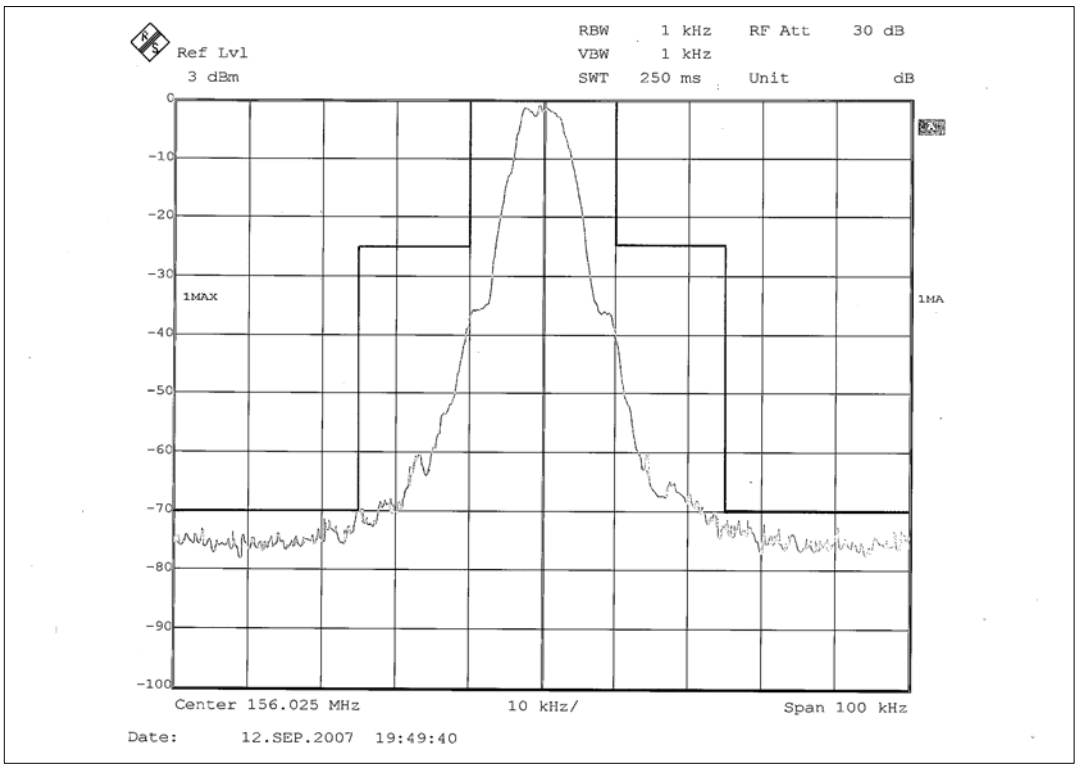
(iii) In the region between + 10 kHz and + 25 kHz removed from the carrier, the modulation sidebands is below the lines specified between these two points.

3.2.4 Test results:

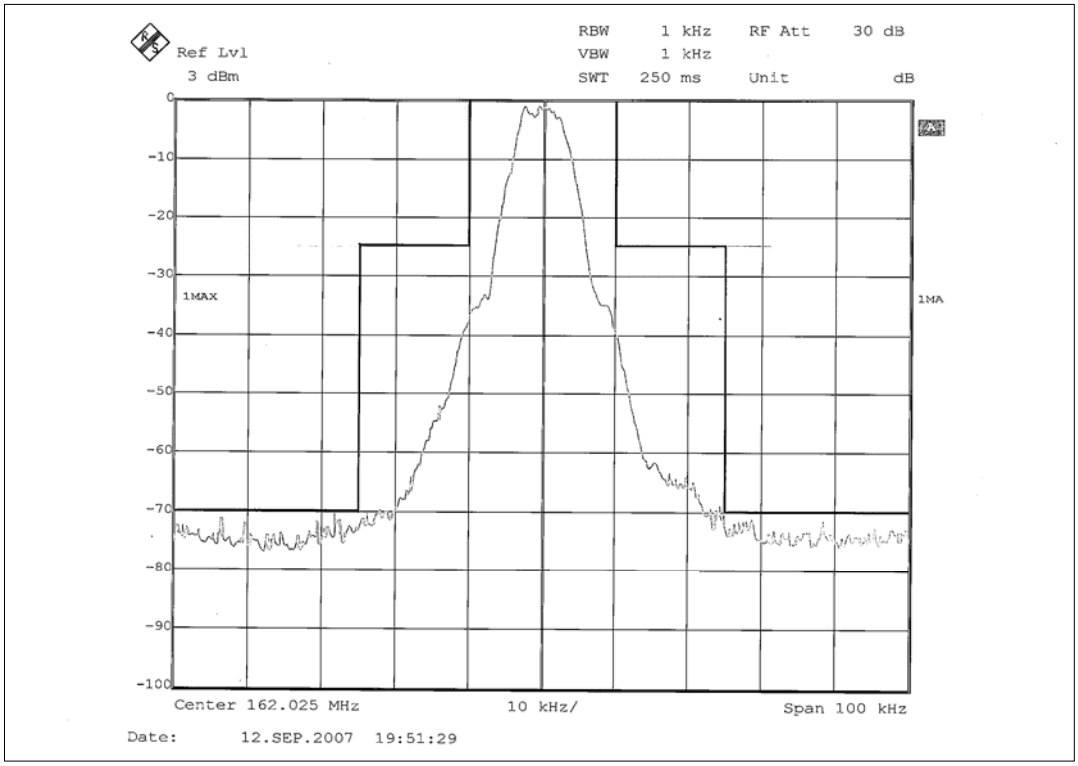
All emissions were found within the specified limits.

Emission spectrum measured: See below plots.

(1) TX frequency: 156.025 MHz RF power output (Carrier Power): at 2 W



(2) TX frequency: 162.025 MHz RF power output (Carrier Power) at 2 W



Environmental conditions observed: On 12 September 2007, 25°C to 25°C, 54% to 54%RH,
Power supply voltage measured: 24.0 VDC to 24.0 VDC.

3.3 Spurious Emissions at Antenna Terminals (FCC Rule 2.1051)

3.3.1 Setup for measurement:

See Clause 4 of this report.

Radio frequency voltage generated within the equipment and appearing as spurious emissions were measured at the output terminal with 50 ohm artificial antenna.

3.3.2 Measuring Equipment List:

See Clause 5 of this report.

3.3.3 Emission Limits:

(1) For TX mode, Emission attenuation should be more than 46 dB from Carrier level of 2 W.

(2) For RX mode,

Frequency range	Limits
9 kHz to 1 GHz	2 nW (-57 dBm)
1 GHz to 4 GHz	20 nW (-47 dBm)

Note: Limits for RX mode were applied according to the Standard IEC 62287-1, Clause 11.3.

3.3.4 Test Results:

Complied.

(1) TX mode:

The spurious emissions at antenna terminal of the unit were found lower than the specified limits.

Frequency range	Emission Attenuation	
	TX CH1060 (156.025 MHz)	TX CH2088 (162.025 MHz)
9 kHz to 500 MHz	Not found 75.1 dB (= Noise Floor)	Not found 72.4 dB (= Noise Floor)
500 MHz to 1000 MHz	Not found 74.2 dB (= Noise Floor)	Not found 74.5 dB (= Noise Floor)
1000 MHz to 1500 MHz	Not found 73.5 dB (= Noise Floor)	Not found 73.3 dB (= Noise Floor)
1500 MHz to 2000 MHz	Not found 71.9 dB (= Noise Floor)	Not found 71.8 dB (= Noise Floor)
2000 MHz to 2500 MHz	Not found 72.0 dB (= Noise Floor)	Not found 72.0 dB (= Noise Floor)
2500 MHz to 3000 MHz	Not found 71.2 dB (= Noise Floor)	Not found 70.9 dB (= Noise Floor)
3000 MHz to 3500 MHz	Not found 71.6 dB (= Noise Floor)	Not found 71.8 dB (= Noise Floor)
3500 MHz to 4000 MHz	Not found 72.3 dB (= Noise Floor)	Not found 72.3 dB (= Noise Floor)
4000 MHz to 4500 MHz	Not found 71.6 dB (= Noise Floor)	Not found 72.3 dB (= Noise Floor)

And also Emission spectrum plots are shown in Graph 3.3a a) to 3.3b i).

(2) RX mode:

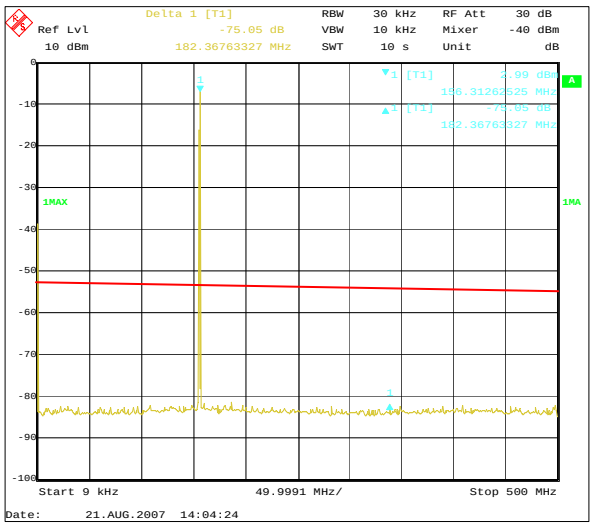
The spurious emissions at antenna terminal of the unit were found lower than the specified limits.

Frequency range	Spurious components found RX1: CH1060 (156.025 MHz) RX2: CH2088 (162.025 MHz)	Limits
9 kHz to 500 MHz	92.2 MHz: -85.3 dBm	≤ -57 dBm (2 nW)
500 MHz to 1000 MHz	614.2 MHz: -88.3 dBm	
1000 MHz to 1500 MHz	1105.2 MHz: -80.5 dBm	≤ -47 dBm (20 nW)
1500 MHz to 2000 MHz	1843.7 MHz: -74.5 dBm	
2000 MHz to 2500 MHz	2132 .3MHz: -72.6 dBm	
2500 MHz to 3000 MHz	2900.8MHz: -84.8 dBm	
3000 MHz to 3500 MHz	3412.8 MHz: -73.4 dBm	
3500 MHz to 4000 MHz	3625.3 MHz: -77.2 dBm	

Environmental conditions observed: On 21 August 2007, 26°C to 26°C, 52% to 52%RH.

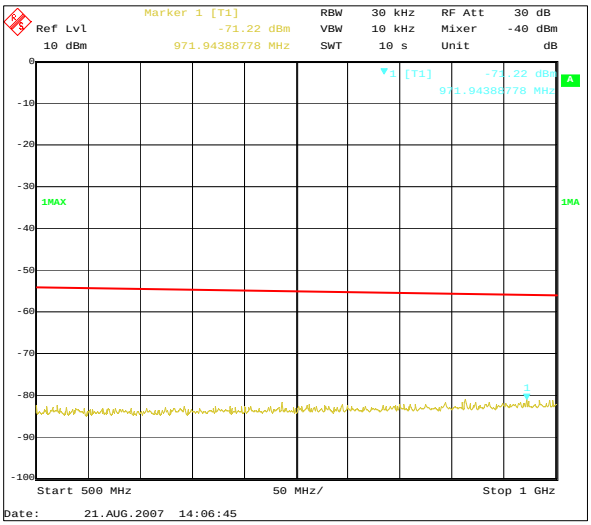
Graph 3.3a – Spurious Emissions at Antenna terminal on Channel 1060 with 2 W TX mode

a)



Limit

b)



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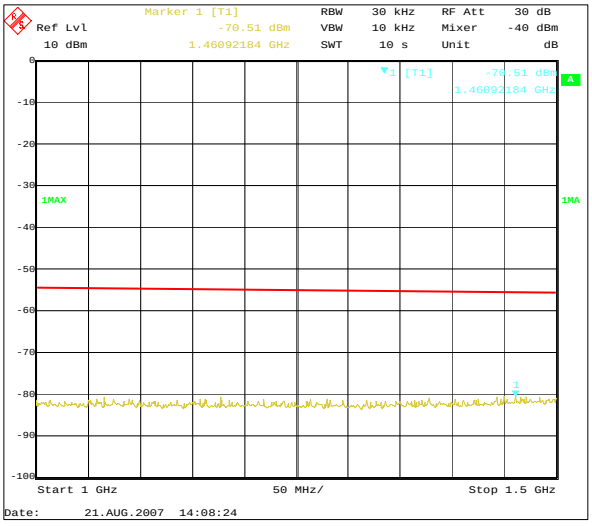
c)



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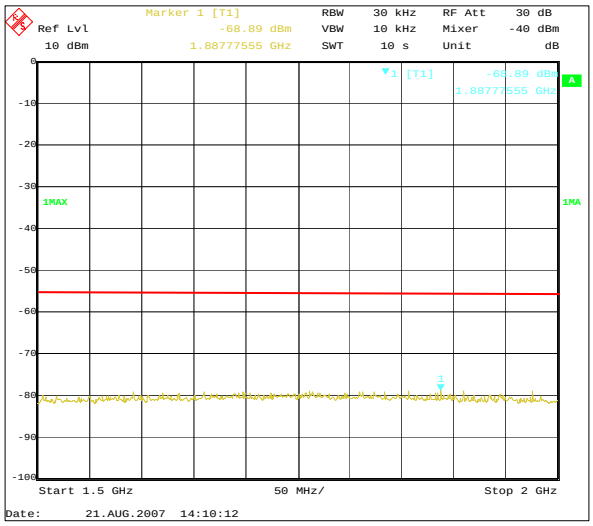
d)



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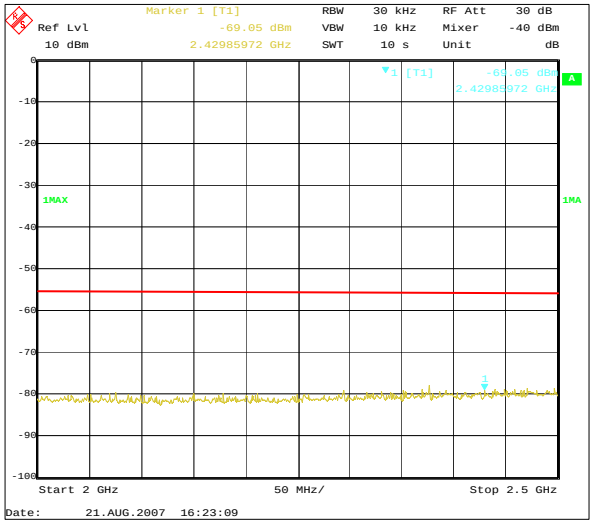

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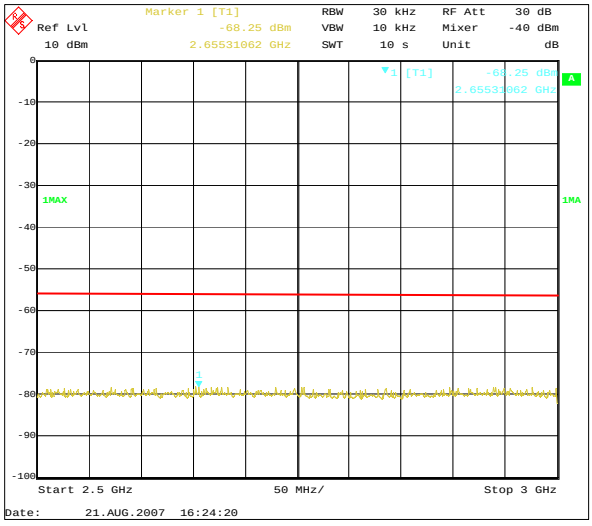

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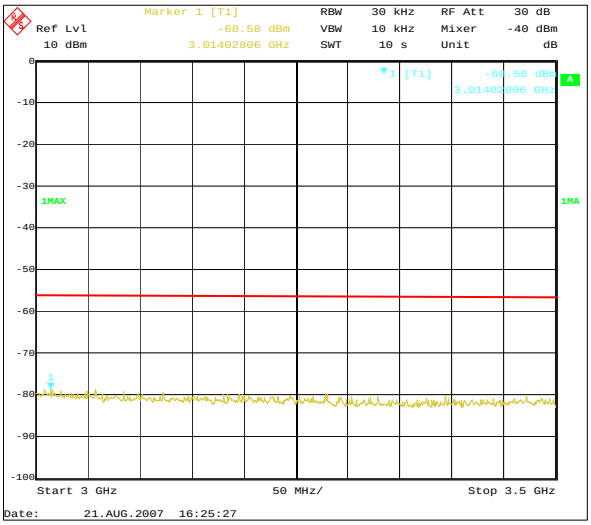
g)



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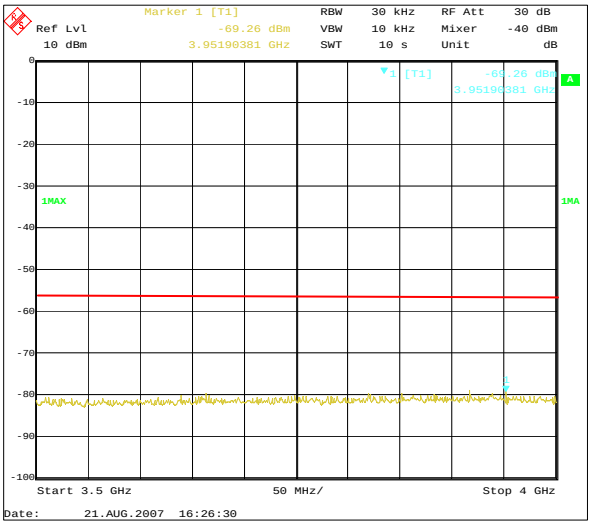
h)



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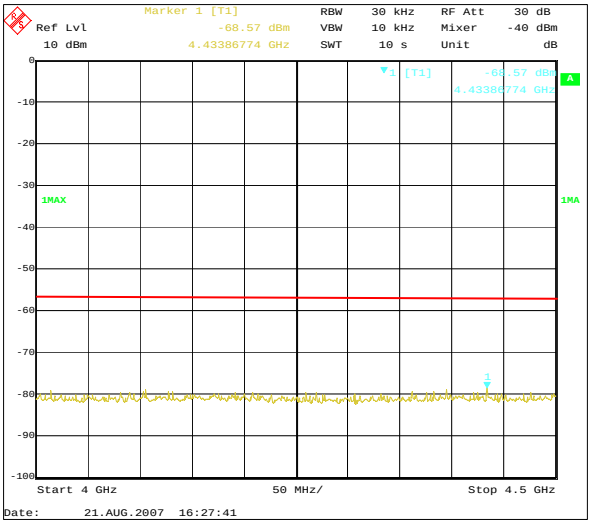
i)



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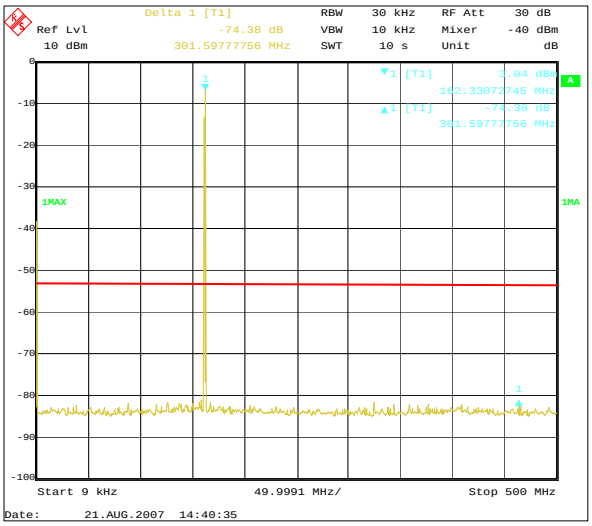
Graph 3.3b – Spurious Emissions at Antenna terminal on Channel 1088 with 2 W TX mode

a)



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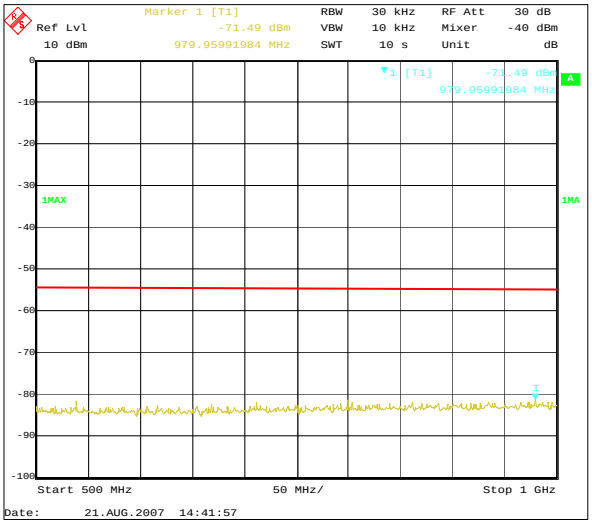
b)



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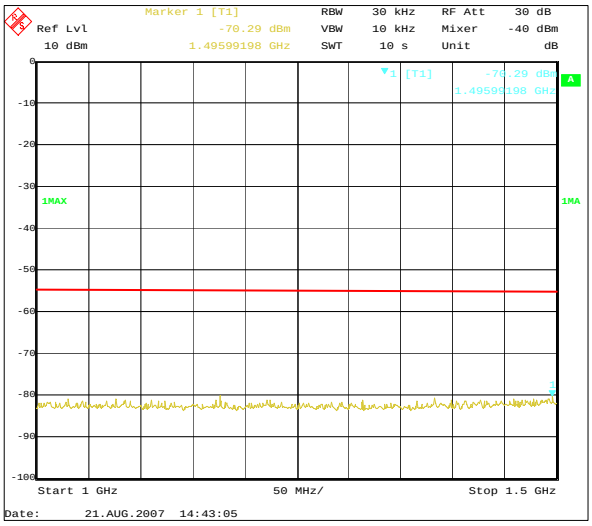
c)



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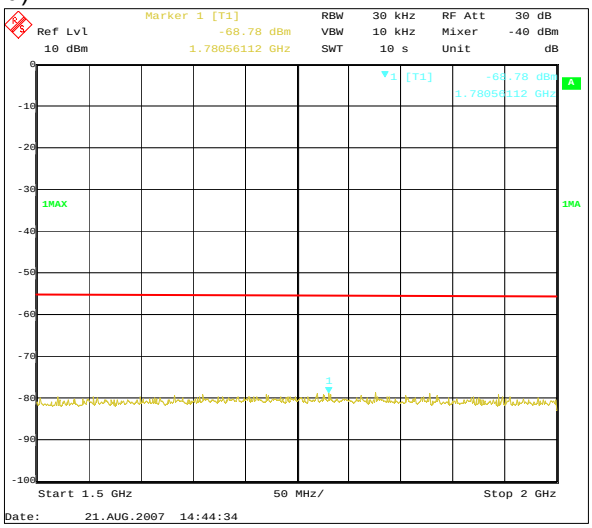

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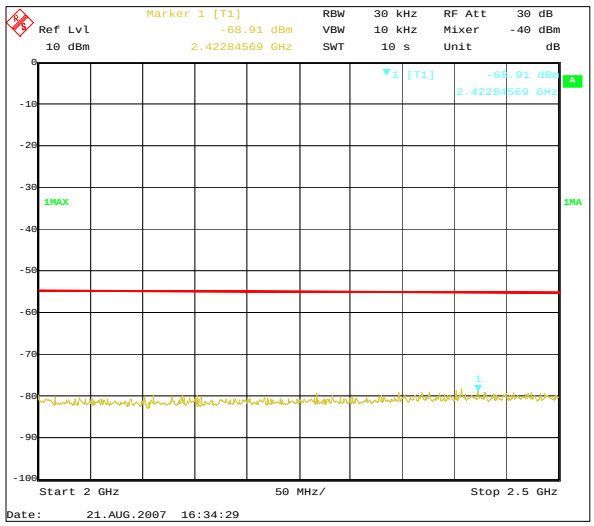

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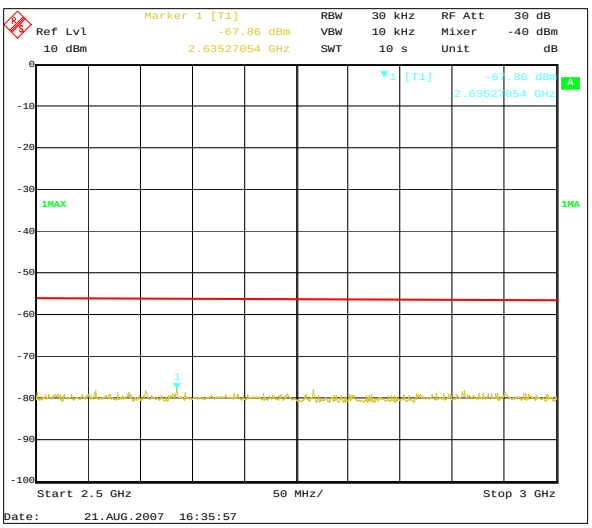

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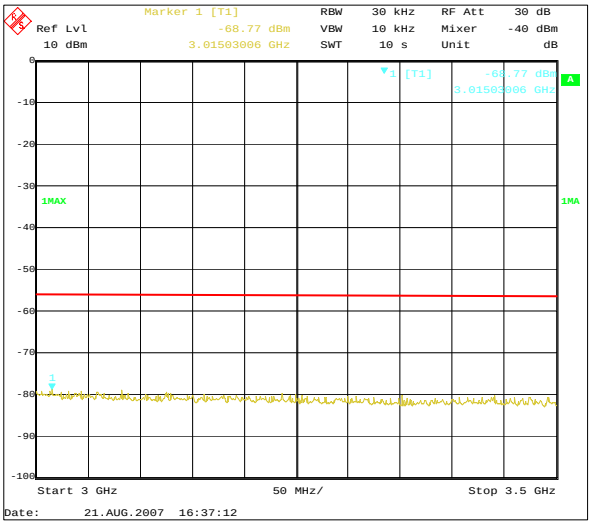

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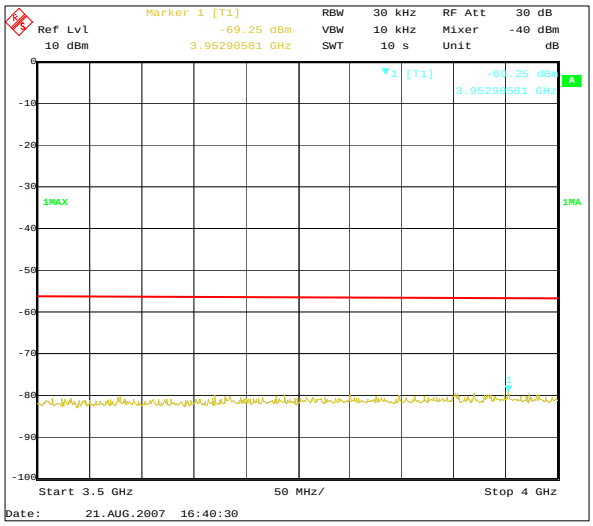

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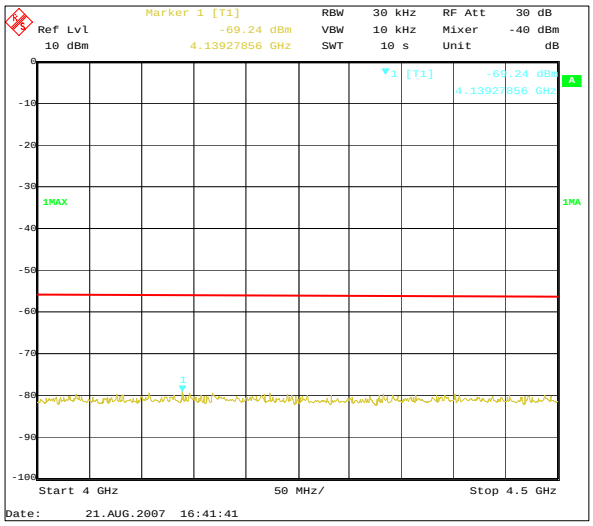


Limit

3.4 Field Strength of Spurious Radiation (FCC Rule 2.1053)

3.4.1 Setup for measurement:

See Clause 4 of this report.

3.4.2 Measuring Equipment List:

See Clause 5 of this report.

3.4.3 Test Site:

Nishinomiya-hama site Anechoic chamber
FCC Registration Number: 90607
FURUNO LABTECH INTERNATIONAL CO., LTD.
Nishinomiya-hama 2-20, Nishinomiya-city, 662-0934 Japan

3.4.4 Distance between the EUT and measuring antenna: 3 m

3.4.5 Method of measurement

(1) With the test setup described in Fig. 3.4A, Field strength of TX fundamental component will be measured.

(2) With the test setup described in Fig. 3.4B, Field strength of each spurious component other than TX fundamental component will be measured.

(3) With the test setup described in Fig. 3.4C, Field strength generated by the Signal Generator with the substitution antenna for the fundamental and spurious frequencies will be measured. (Substitution method for calculation of the radiated power)

3.4.6 Field Strength Limits:

Emission attenuation should be more than 46 dB from Carrier level of 2 W.

3.4.7 Measurement Results:

1. Field strength of fundamental component (Refer to Fig 3.4A)

Test channel	Field strength (dBμV/m) (RF Power Output (Carrier Power): 2 W)	
	Horizontal plane	Vertical plane
1060 (156.025 MHz)	105.7	107.6
2088 (162.025 MHz)	119.5	121.9

2. Field strength of each spurious components (Refer to Fig 3.4B)

Test channel 1060 (156.025 MHz)	Field strength (dBμV/m) (RF Power Output (Carrier Power): 2 W)	
	Horizontal plane	Vertical plane
2f (312.050 MHz)	Not found (= Floor noise level)	Not found (= Floor noise level)
3f (468.075 MHz)	Not found (= Floor noise level)	Not found (= Floor noise level)
4f (624.100 MHz)	Not found (= Floor noise level)	Not found (= Floor noise level)
5f (780.125 MHz)	Not found (= Floor noise level)	Not found (= Floor noise level)
6f (936.150 MHz)	Not found (= Floor noise level)	Not found (= Floor noise level)

Test channel 2088 (162.025 MHz)	Field strength (dBμV/m) (RF Power Output (Carrier Power): 2 W)	
	Horizontal plane	Vertical plane
2f (324.050 MHz)	Not found (= Floor noise level)	Not found (= Floor noise level)
3f (486.075 MHz)	Not found (= Floor noise level)	Not found (= Floor noise level)
4f (648.100 MHz)	Not found (= Floor noise level)	Not found (= Floor noise level)
5f (810.125 MHz)	Not found (= Floor noise level)	Not found (= Floor noise level)
6f (972.150 MHz)	Not found (= Floor noise level)	Not found (= Floor noise level)

3. Field strength with substitution antenna (Refer to Fig 3.4C)

Signal generator		Radiated power with substitution antenna (dBm)	Field strength (dBμV/m)	
Frequency (MHz)	Output level (dBm)		Horizontal plane	Vertical plane
156.025	-30	-29.57	69.7	66.0
162.025	-30	-29.57	69.7	66.3
312.050	-40	-39.78	59.1	56.8
324.050	-40	-39.69	60.7	56.7
468.075	-40	-40.36	57.1	57.0
486.075	-40	-40.39	57.3	56.0
624.100	-40	-40.81	55.2	52.4
648.100	-40	-40.88	56.4	53.7
780.125	-40	-41.05	57.3	55.1
810.125	-40	-41.12	57.4	54.4
936.150	-40	-41.18	59.7	56.8
972.150	-40	-41.28	59.3	57.4

3.4.8 Test Results:

Test channel: CH1060 (156.025 MHz) on 2 W

	Frequency (MHz)	X1 (dBm)		X2 (dBm)		Attenuation (dB)	
		Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Fundamental	156.025	6.43	20.233				
Spurious	312.050			Not found	Not found	Complied	Complied
	468.075			Not found	Not found	Complied	Complied
	624.100			Not found	Not found	Complied	Complied
	780.125			Not found	Not found	Complied	Complied
	936.150			Not found	Not found	Complied	Complied

Test channel: CH2088 (162.025 MHz) on 2 W

	Frequency (MHz)	X1 (dBm)		X2 (dBm)		Attenuation (dB)	
		Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Fundamental	162.025	12.0	26.03				
Spurious	324.050			Not found	Not found	Complied	Complied
	486.075			Not found	Not found	Complied	Complied
	648.100			Not found	Not found	Complied	Complied
	810.125			Not found	Not found	Complied	Complied
	972.150			Not found	Not found	Complied	Complied

Spurious emissions were found lower than the specified limits.

Calculation of Spurious Attenuation by using Substitution Method:

(1) Calculation of Radiated Power (X1) of the TX fundamental component:

X1 = ((Field Strength of Fundamental Component) – (Field Strength measured with Substitution Ant.)) + (Radiated Power with Substitution Ant.)

(2) Calculation of Radiated Power (X2) of each spurious component:

X2 = ((Field Strength of Spurious Component) – (Field Strength measured with Substitution Ant.)) + (Radiated Power with Substitution Ant.)

(3) Calculation of Spurious Attenuation:

Spurious Attenuation (dB) = (X1) - (X2)

Environmental conditions observed: On 28 August 2007, 25°C to 25°C, 44% to 44%RH,
Power supply voltage measured: 24.0 VDC to 24.0 VDC,
On 29 August 2007, 25°C to 25°C, 44% to 44%RH,
Power supply voltage measured: 24.0 VDC to 24.0 VDC,
On 30 August 2007, 25°C to 25°C, 44% to 44%RH,
Power supply voltage measured: 24.0 VDC to 24.0 VDC,
On 31 August 2007, 25°C to 25°C, 44% to 44%RH,
Power supply voltage measured: 24.0 VDC to 24.0 VDC.

3.5 Frequency Stability (FCC Rule 2.1055)

3.5.1 Setup for Measurement

See Clause 4 of this report.

3.5.2 Measuring Equipment List:

See Clause 5 of this report.

3.5.3 Frequency Tolerance Limits:

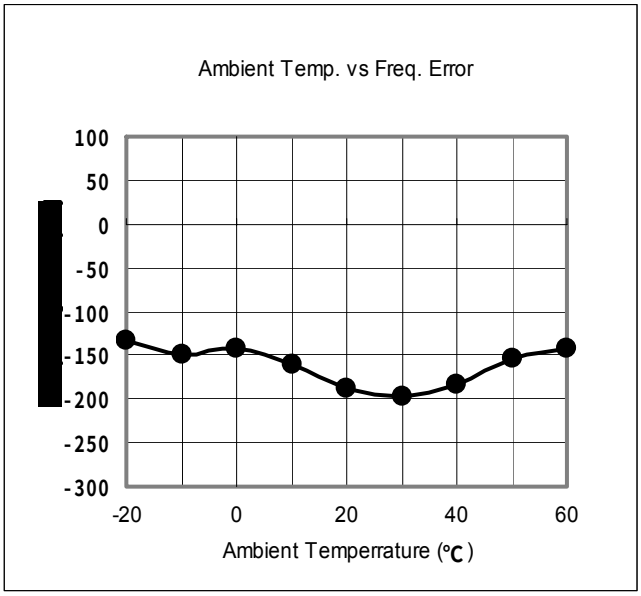
5 ppm (± 810.125 Hz for CH2088 (162.025 MHz))

3.5.4 Test Results:

Complied.

Frequency variation was measured on CH2088 (162.025 MHz) and results are shown as follows. Variation of power supply voltages (10.2 VDC (12 VDC -15%) to 27.6 VDC (24 VDC +15%)) did not affect the test results with the use of the built-in voltage regulator.

Temp. (°C)	Tx Freq. (Hz)	Freq. Error (Hz)	Freq. tolerance (ppm)
-20	162024868	-132	-0.81
-10	162024852	-148	-0.91
0	162024858	-142	-0.88
10	162024840	-160	-0.99
20	162024813	-187	-1.15
30	162024802	-198	-1.22
40	162024816	-184	-1.14
50	162024846	-154	-0.95
60	162024858	-142	-0.88



3.6 Sensitivity Characteristics of VHF Radiotelephone Receiver (FCC Rule 80.874)

3.6.1 Setup for measurement

See Clause 4 of this report.

3.6.2 Test method:

Based on the Standard IEC 62287-1: 2006

3.6.3 Measuring Equipment List:

See Clause 5 of this report.

3.6.4 Limits:

Limits are described in each table.

3.6.5 Test Results:

Sensitivity levels measured were found within the specified limits.

3.6.5.1 AIS Sensitivity

For RX1

TEST CONDITIONS		SENSITIVITY LEVEL	
		Fn: 156.025 MHz (RX1: CH1060, RX2: CH2088)	Fn: 162.025 MHz (RX1: CH2088, RX2: CH1060)
Temperature	Power Supply Voltage	RF level (dBm)	RF level (dBm)
Tnormal (+23 °C)	*Vmin (9.6 V)*	- 112 dBm at 15.5% PER	- 111 dBm at 12.5% PER
	Vnom (12.0 V)	- 112 dBm at 15.5% PER	- 111 dBm at 14.0 % PER
	Vmax (31.2 V)	- 112 dBm at 14.5% PER	- 111 dBm at 14.0% PER
Tmin (-15 °C)	*Vmin (9.6 V)*	- 113 dBm at 15.0% PER	- 112 dBm at 11.5% PER
	Vnom (12.0 V)	- 113 dBm at 14.0% PER	- 112 dBm at 12.0% PER
	Vmax (31.2 V)	- 113 dBm at 15.0% PER	- 112 dBm at 12.5% PER
Tmax (+55 °C)	*Vmin (9.6 V)*	- 111 dBm at 12.5% PER	- 110 dBm at 7.5% PER
	Vnom (12.0 V)	- 111 dBm at 15.0% PER	- 110 dBm at 10.0% PER
	Vmax (31.2 V)	- 111 dBm at 10.0% PER	- 110 dBm at 11.0% PER
Measurement uncertainty		±1 dB	
Limits		≤ - 107 dBm with a PER of 20% under normal test conditions, ≤ - 104 dBm with a PER of 20% under extreme test conditions,	

Note: Fn - Input signal frequency.

For RX2

TEST CONDITIONS		SENSITIVITY LEVEL	
		Fn: 156.025 MHz (RX1: CH2088, RX2: CH1060)	Fn: 162.025 MHz (RX1: CH1060, RX2: CH2088)
Temperature	Power Supply Voltage	RF level (dBm)	RF level (dBm)
Tnormal (+23 °C)	*Vmin (9.6 V)*	- 113 dBm at 18.0% PER	- 112 dBm at 18.0% PER
	Vnom (12.0 V)	- 113 dBm at 14.5% PER	- 112dBm at 13.5% PER
	Vmax (31.2 V)	- 112 dBm at 18.0% PER	- 112 dBm at 14.0% PER
Tmin (-15 °C)	*Vmin (9.6 V)*	- 113 dBm at 5.5% PER	- 112 dBm at 7.5 % PER
	Vnom (12.0 V)	- 113 dBm at 11.5% PER	- 112 dBm at 5.5% PER
	Vmax (31.2 V)	- 113 dBm at 12.5% PER	- 112 dBm at 9.0% PER
Tmax (+55 °C)	*Vmin (9.6 V)*	- 112 dBm at 12.5% PER	- 111 dBm at 9.0% PER
	Vnom (12.0 V)	- 112 dBm at 8.5% PER	- 111 dBm at 13.5% PER
	Vmax (31.2 V)	- 112 dBm at 15.0% PER	- 111 dBm at 10.5% PER
Measurement uncertainty		±1 dB	
Limits		≤ - 107 dBm with a PER of 20% under normal test conditions, ≤ - 104 dBm with a PER of 20% under extreme test conditions,	

3.6.5.2 DSC Sensitivity

For RX1

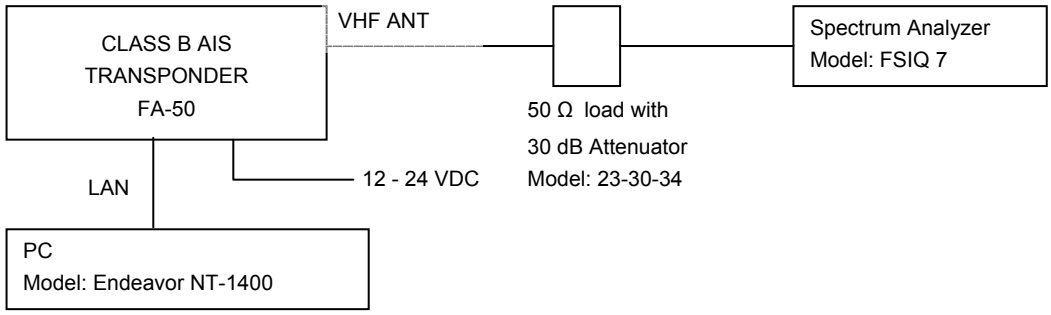
TEST CONDITIONS		SENSITIVITY LEVEL (dBm)		
		Fn: 156.525 MHz, RX1: CH 70, RX2: CH2088		
Temperature	Power Supply Voltage	Fn	Fn - 1.5 kHz	Fn + 1.5 kHz
Tnormal (+23 °C)	*Vmin (9.6 V)*	- 115 dBm at 0.57% BER	- 113 dBm at 0.63% BER	- 114 dBm at 0.38% BER
	Vnom (12.0 V)	- 115 dBm at 0.55% BER	- 113 dBm at 0.68% BER	- 114 dBm at 0.30% BER
	Vmax (31.2 V)	- 115 dBm at 0.42% BER	- 113 dBm at 0.30% BER	- 114 dBm at 0.28% BER
Tmin (-15 °C)	*Vmin (9.6 V)*	- 116 dBm at 0.63% BER	- 115 dBm at 0.33% BER	- 114 dBm at 0.55% BER
	Vnom (12.0 V)	- 115 dBm at 0.42% BER	- 115 dBm at 0.53% BER	- 114 dBm at 0.30% BER
	Vmax (31.2 V)	- 116 dBm at 0.93% BER	- 115 dBm at 0.35% BER	- 114 dBm at 0.57% BER
Tmax (+55 °C)	*Vmin (9.6 V)*	- 114 dBm at 0.40% BER	- 112 dBm at 0.72% BER	- 114 dBm at 0.85% BER
	Vnom (12.0 V)	- 114 dBm at 0.38% BER	- 112 dBm at 0.50% BER	- 114 dBm at 0.30% BER
	Vmax (31.2 V)	- 114 dBm at 0.57% BER	- 112 dBm at 0.72% BER	- 114 dBm at 0.78% BER
Measurement uncertainty		±1 dB		
Limits		≤ - 107 dBm with a BER of 1% under normal test conditions, ≤ - 101 dBm with a BER of 1% under extreme test conditions,		

For RX2

TEST CONDITIONS		SENSITIVITY LEVEL (dBm)		
		Fn: 156.525 MHz, RX2: CH 70, RX1: CH2088		
Temperature	Power Supply Voltage	Fn	Fn - 1.5 kHz	Fn + 1.5 kHz
Tnormal (+23 °C)	*Vmin (9.6 V)*	- 115 dBm at 0.13% BER	- 114 dBm at 0.50% BER	- 115 dBm at 0.75% BER
	Vnom (12.0 V)	- 115 dBm at 0.40% BER	- 114 dBm at 0.57% BER	- 115 dBm at 0.33% BER
	Vmax (31.2 V)	- 115 dBm at 0.56% BER	- 114 dBm at 0.85% BER	- 115 dBm at 0.72% BER
Tmin (-15 °C)	*Vmin (9.6 V)*	- 116 dBm at 0.30% BER	- 115 dBm at 0.42% BER	- 115 dBm at 0.20% BER
	Vnom (12.0 V)	- 117 dBm at 0.60% BER	- 115 dBm at 0.50% BER	- 116 dBm at 0.80% BER
	Vmax (31.2 V)	- 116 dBm at 0.17% BER	- 115 dBm at 0.35% BER	- 115 dBm at 0.72% BER
Tmax (+55 °C)	*Vmin (9.6 V)*	- 115 dBm at 0.68% BER	- 113 dBm at 0.28% BER	- 115 dBm at 0.85% BER
	Vnom (12.0 V)	- 115 dBm at 0.60% BER	- 114 dBm at 0.47% BER	- 114 dBm at 0.28% BER
	Vmax (31.2 V)	- 114 dBm at 0.28% BER	- 114 dBm at 0.70% BER	- 115 dBm at 0.93% BER
Measurement uncertainty		±1 dB		
Limits		≤ - 107 dBm with a BER of 1% under normal test conditions, ≤ - 101 dBm with a BER of 1% under extreme test conditions,		

4 Test Setup for Measurement

(1) Test Setup for Clauses 3.1, 3.2 and 3.3:



(2) Test Setup for Clauses 3.4:

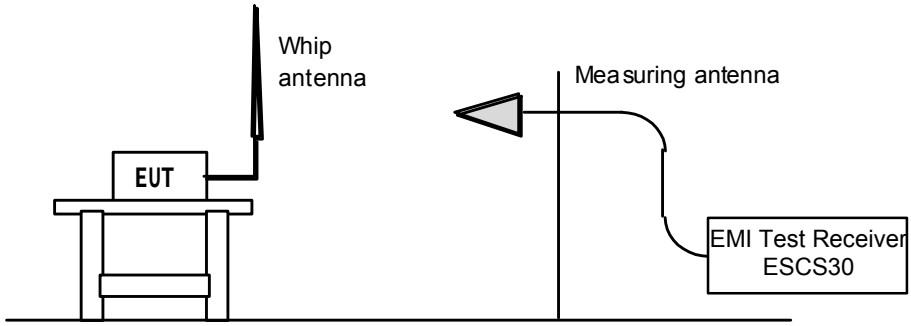


Fig 3.4A Setup for measurement of fundamental component

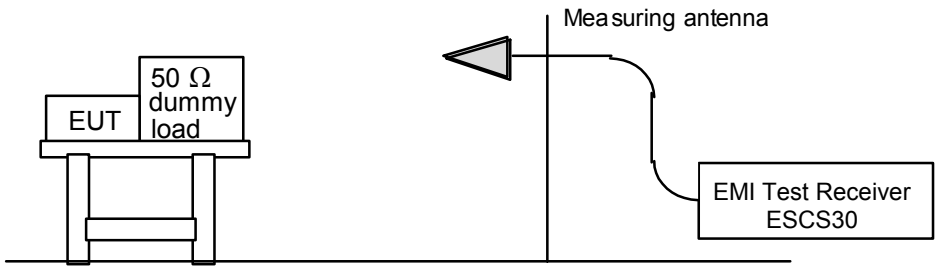


Fig 3.4B Setup for measurement of any spurious other than fundamental component

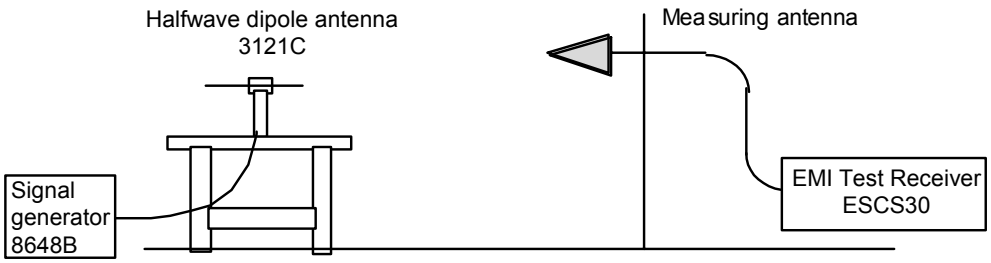
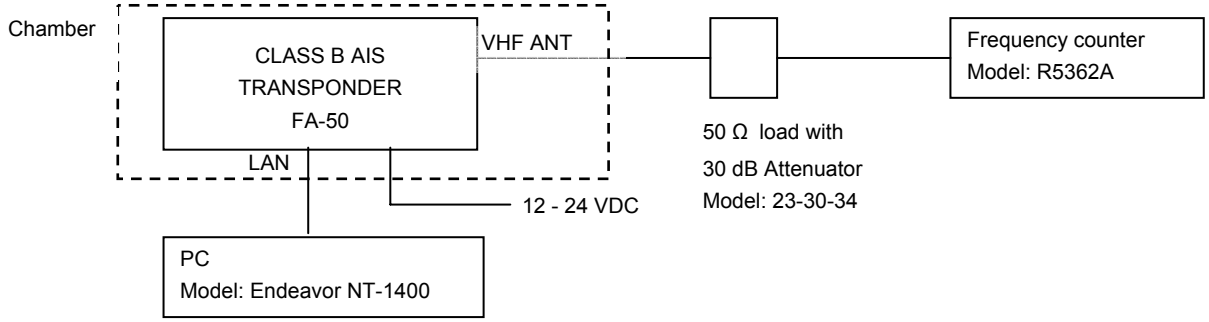
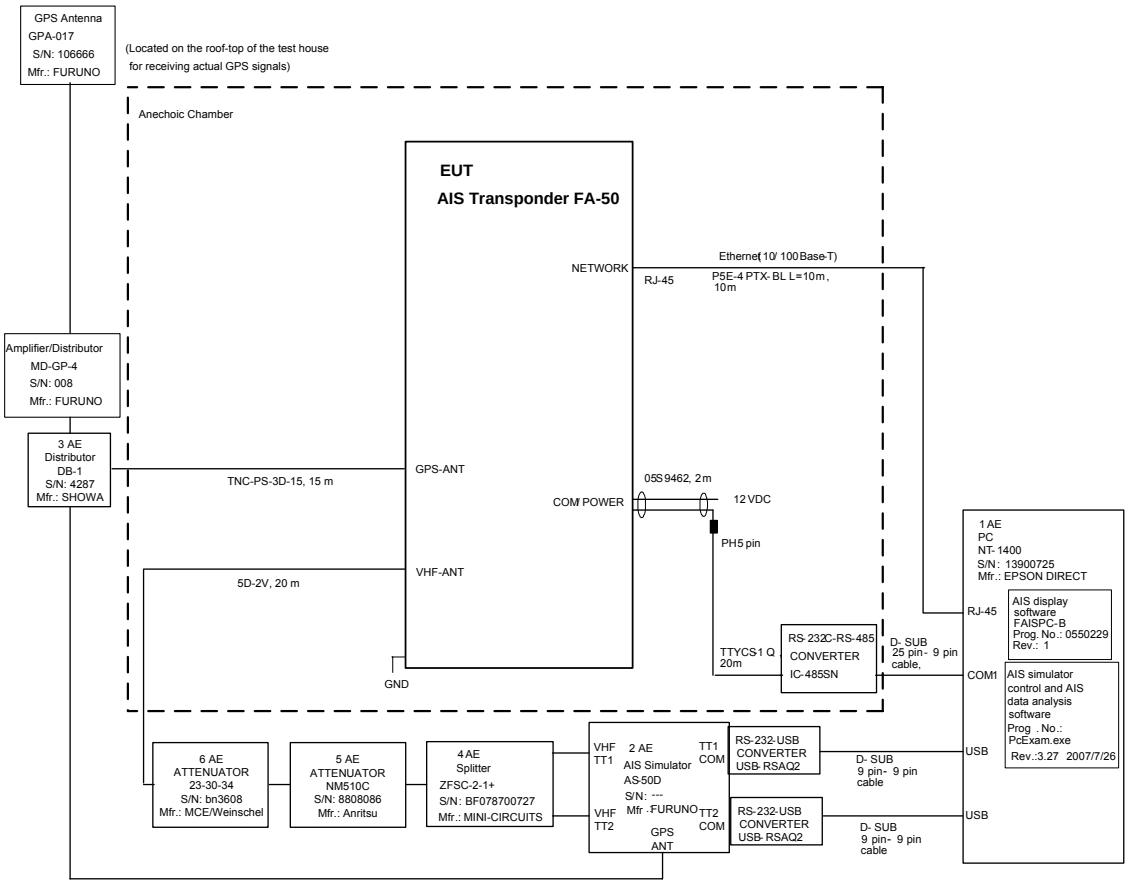


Fig 3.4C Setup for measurement of field strength with substitution antenna

(3) Test Setup for Clause 3.5:



(4) Test Setup for Clause 3.6:



5 Measuring Equipment List

No.	Instrument/Ancillary	Type	Serial No.	Manufacturer	Calibration Due date
1	Signal analyzer	FSIQ7	0109008	R&S	07.2008
2	Frequency counter	R5362A	13720092	ADVANTEST	12.2007
3	Digital multimeter	111	78410077	FLUKE	07.2008
4	Attenuator (30 dB)	23-30-34	BN3608	MCE/Weinschel	- - - - - -
5	Power supply	PAN55-20	AK003307	KIKUSUI	- - - - - -
6	Personal computer	Endeavor NT-1400	139000725	EPSON DIRECT	- - - - - -
7	EMI Test Receiver	ESCS30	826457/021	R&S	08.2008
8	Bi-conical antenna	VBA6106A	1296	Schaffner	08.2008
9	Log periodic antenna	UHALP9107	8411059	Schwarzbeck	08.2008
10	Reference dipole antenna	3121C	1339/1393	Electro-Metrics	08.2009
11	Signal generator	8648B	3847M01057	Agilent	08.2008
12	Climatic chamber (L)	TBE-3HW5GE2F	3013000995	Tabai Espec	09.2007
13	Temperature recorder (L)	437006/R1182	4370TB580	Yokogawa	07.2008

Note: For Measuring Equipments used for Clause 3.6 test, see Clause 4 (4) of this report.

6 Photograph of Test Setup/Arrangement

(1) For Frequency stability,

(2) For Unwanted Emission measurements,