TECHNICAL INFORMATION

TEST REPORT ON THE PERFORMANCE OF

Universal Automatic Identification System

Trade Name : FURUNO

Model : FA-150

Report no.: FLI 12-04-068

Date of issue: November 30, 2004

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

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Date:	November 30, 2004
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Signature:	

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1 General Information

1.1 GENERAL

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

(b) Model: FA-150

No.	Unit	Type	Serial Number	Remarks
1	Transponder unit	FA-1501	3551-0002	
2	Monitor unit	FA-1502	000002	
3	GPS Antenna	GPA-017S	000422	either selectable
	VHF Antenna	FAB-151D	4-110718-00	
	GPS/VHF Combined Antenna	GVA-100	2104	
	Distributor unit	DB-1	2104	

(c) Classification: Class A AIS equipment

(d) Communication capacity: 2250 reports/min./1 channel
4500 reports/min./2 channels

(e) Communication system: Self-Organized Time Division Multiple Access (TDMA), Simultaneous reception of 2 channels

(f) Frame synchronization: UTC Direct synchronization by built-in GPS receiver or UTC indirect synchronization by using other station

(g) Operating mode: Autonomous, Assigned and Polled

(h) Channel selection: Automatically, by external equipment and manually

(i) Initialization period: Within 2 minutes after switch on

(j) Prevention of unusual TDMA-transmitting:
Automatic transmission stop when detecting 1 second or more continuous transmission

(k) ANT Impedance: 50 ohms

(l) Regulations/Standards: IMO MSC. 74(69) ANNEX 3、A.694(17)、ITU-R M.1371-1、DSC: ITU-R M.825-3, IEC 61993-2, IEC 60945 ed. 4

1.2 TRANSPONDER UNIT

1.2.1 TDMA TX

(a) TX Frequency: 156.025 MHz to 162.025 MHz

(b) Type of Emission: F1D

(c) Type of Modulation: GMSK/GFSK

(d) Channel spacing: 25 kHz/12.5 kHz

(e) TX Output Power (Carrier Power):
1 W/2 W/12.5 W (±1.5 dB), selectable

(f) TX frequency error: within ±3 ppm

(g) Spurious emissions: 150 kHz - 1 GHz, less than -36 dBm (0.25 μW)
1 GHz - 2 GHz, less than -30 dBm (1 μW)

1.2.2 TDMA RX

(a)	RX frequency:	156.025 MHz to 162.025 MHz
(b)	Local Oscillation freq.:	1st LO: f_0 + (51.1375 MHz/51.2375 MHz)
		2nd LO: 51.1015 MHz/51.2015 MHz
(c)	IF:	1st IF: 51.1375 MHz/51.2375 MHz
		2nd IF: 36 kHz
(d)	RX System:	Double super-heterodyne
(e)	Sensitivity:	-107 dBm (PER ≤ 20%) on 25 kHz channel
		-98 dBm (PER ≤ 20%) on 12.5 kHz channel
(f)	Spurious emissions:	less than 2 nW

1.2.3 DSC TX

(a)	TX frequency:	CH 70 fixed, 156.525 MHz
(b)	Type of Emission:	G2B
(c)	Type of Modulation:	2-FSK
(d)	Modulation frequency error:	within ±1%
(e)	Modulation Index:	2 (± 10%)
(f)	TX Output Power (Carrier Power):	
		12.5 W (± 1.5 dB)

1.2.4 DSC RX

(a)	RX frequency:	CH 70 fixed, 156.525 MHz
(b)	Local Oscillation freq.:	1st LO: f_0 - 38.364 MHz
		2nd LO: 38.4 MHz
(c)	IF:	1st IF: 38.364 MHz
		2nd IF: 36 kHz
(d)	RX system:	Double super-heterodyne
(e)	Sensitivity:	-107 dBm (BER ≦ 1%)
(f)	Spurious emissions:	150 kHz - 1 GHz, less than -57 dBm (2 nW)
		1 GHz - 2 GHz, less than -47 dBm (20 nW)

1.3 MONITOR UNIT

(a)	Display:	3.5-inch Monochrome LCD
(b)	Display Size:	60 (H) x 95 (W) mm
(c)	No. of Dots:	120 x 64 dots
(d)	Menu:	MSG/SENSOR STATUS/INTER NAL GPS/USER SETTINGS/
		INITIAL SETTINGS/CHANNEL SETTINGS/DIAGNOSTIC

1.4 GPS RECEIVER

(a)	Receiving Channel:	12 channels parallel, 12-satellite tracking

(b) RX Frequency/RX Code: 1575.42 MHz, C/A code
(c) Position Accuracy: Approx. 10 m, 95% of the time, (HDOP ≦ 4)
DGPS: approx. 5 m, 95% of the time
(d) Tracking Velocity: 900 kts
(e) Position-fixing Time: Warm start: 12 seconds, Cold start: 90 seconds
(f) Position Update Interval: 1 second
(g) DGPS Data Receiving: RTCM SC-104 Ver 2.1 formatted

1.5 INTERFACES

(a) COM1 - COM3: IEC 61162-1(2000-07)/ 61162-2(1998-09)
Input: VSD, SSD, ABM, BBM, ACA, ACK, AIR, DTM, GBS, GGA, GLL, GNS, HDT, LRF, LRI, OSD, RMC, ROT, VBW, VTG
Output: VDM, VDO, ABK, ACA, ALR, TXT, LR1, LR2, LR3, LRF, LRI
IEC 61162-1(2000-07)/ 61162-2(1998-09)
(b) COM4 - 6 (SENSOR input): DTM, GNS, GLL, GGA, RMC, VBW, VTG, OSD, HDT, GBS, ROT*
*: Any talker.
Priority: GN>GP>GL>LC
(c) Alarm Output: Contact Closure

1.6 POWER SUPPLY

(a) Monitor Unit: 12 - 24 VDC, 0.2 - 0.08 A
(b) Transponder Unit: 12 - 24 VDC, 7 - 3.5 A

1.7 ENVIRONMENTAL CONDITIONS

(a) Ambient Temperature:
GPS Antenna: -25°C to +70°C
Other units: -15°C to +55°C
(b) Relative Humidity: 95% at 40°C
(c) Waterproof (IEC 60529):
GPS Antenna: IPX6
Other units: IPX0
(d) Vibration: IEC 60945 edition 4

1.8 DIMENSIONS AND MASS

(a) Monitor Unit: 209 (W) x 125 (H) x 85 (D) mm, 0.55 kg
(b) Transponder unit: 250 (W) x 420 (H) x 103 (D) mm, 7.3 kg

2 Identification of Equipment (FCC Rule 2.925)

The following nameplate is permanently fixed on the corresponding equipment unit.

FCC ID: ADB9ZWFA150

Material of nameplate: Polyester film, 0.1 mm thick

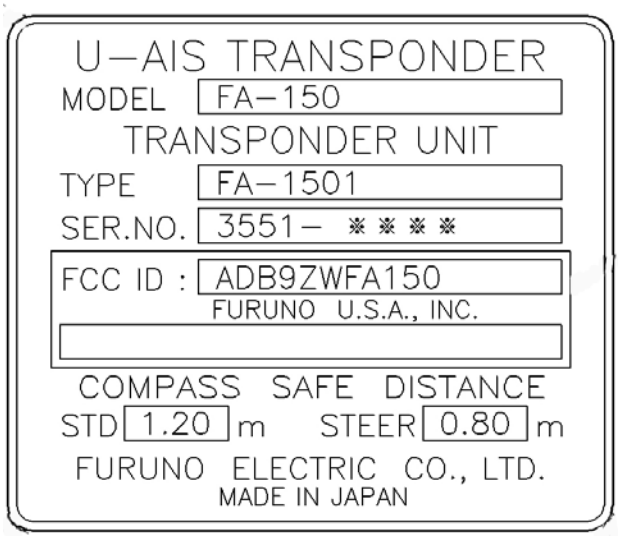
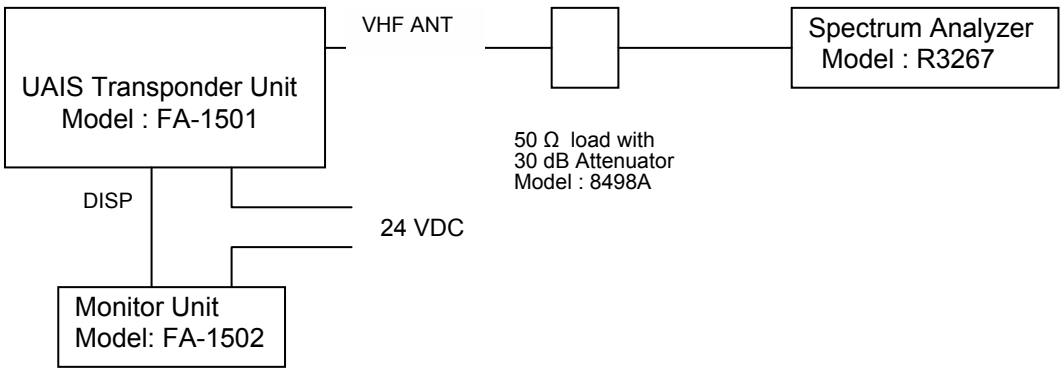


Fig 2.1 FA-150 Nameplate

3 Test data

3.1 RF Power Output (FCC Rule 2.1046)

3.1.1 Setup for measurement



3.1.2 Measuring Equipment List:

See Attachment A [List of Test/Measuring Equipment].

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 the positions of 12.5 W, 2 W and 1 W with a 50 ohm artificial antenna loaded.

Results are shown in Table 3.1A, 3.1B and 3.1C.

Table 3.1A

CH	Power Supply (VDC)	RF Power Output 12.5 (W)	Final stage at 12.5 W	
			Volt. (VDC)	Current (A)
1060	27.6	13.3	13.23	2.53
	24.0	13.3	13.23	2.53
	20.4	13.3	13.23	2.53
1228	27.6	13.1	13.23	2.48
	24.0	13.1	13.23	2.48
	20.4	13.1	13.23	2.48
2260	27.6	12.5	13.22	2.71
	24.0	12.5	13.22	2.70
	20.4	12.5	13.22	2.70
2088	27.6	12.5	13.19	2.91
	24.0	12.5	13.19	2.91
	20.4	12.5	13.19	2.91

Table 3.1B

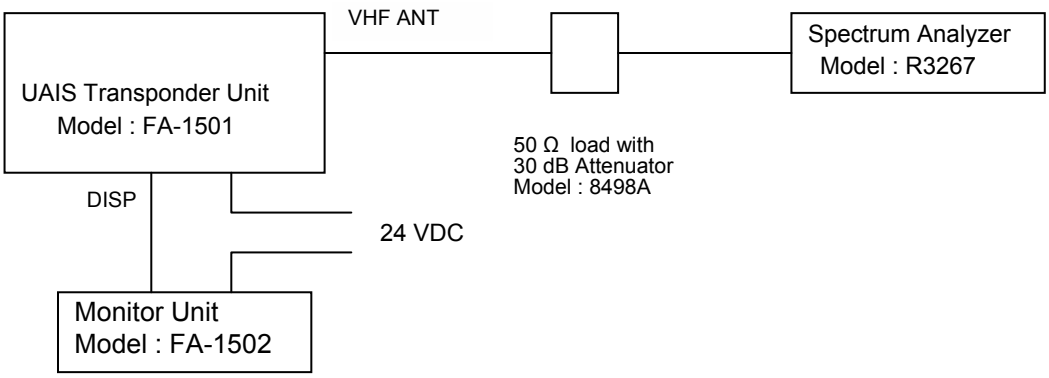
CH	Power Supply (VDC)	RF Power Output 2 (W)	Final stage at 2 W	
			Volt. (VDC)	Current (A)
1060	27.6	2.1	13.40	0.93
	24.0	2.1	13.40	0.93
	20.4	2.1	13.40	0.93
1228	27.6	2.0	13.40	0.90
	24.0	2.0	13.40	0.90
	20.4	2.0	13.40	0.90
2260	27.6	2.0	13.40	0.96
	24.0	2.0	13.40	0.96
	20.4	2.0	13.40	0.96
2088	27.6	2.0	13.39	1.04
	24.0	2.0	13.39	1.04
	20.4	2.0	13.39	1.04

Table 3.1C

CH	Power Supply (VDC)	RF Power Output 1 (W)	Final stage at 1 W	
			Volt. (VDC)	Current (A)
1060	27.6	1.1	13.43	0.68
	24.0	1.1	13.43	0.68
	20.4	1.1	13.43	0.68
1228	27.6	1.1	13.43	0.65
	24.0	1.1	13.43	0.65
	20.4	1.1	13.43	0.65
2260	27.6	1.0	13.43	0.70
	24.0	1.0	13.43	0.70
	20.4	1.0	13.43	0.70
2088	27.6	1.0	13.42	0.76
	24.0	1.0	13.42	0.76
	20.4	1.0	13.42	0.76

3.2 Occupied Bandwidth (FCC Rule 2.1049)

3.2.1 Setup for measurement



3.2.2 Measuring Equipment List:

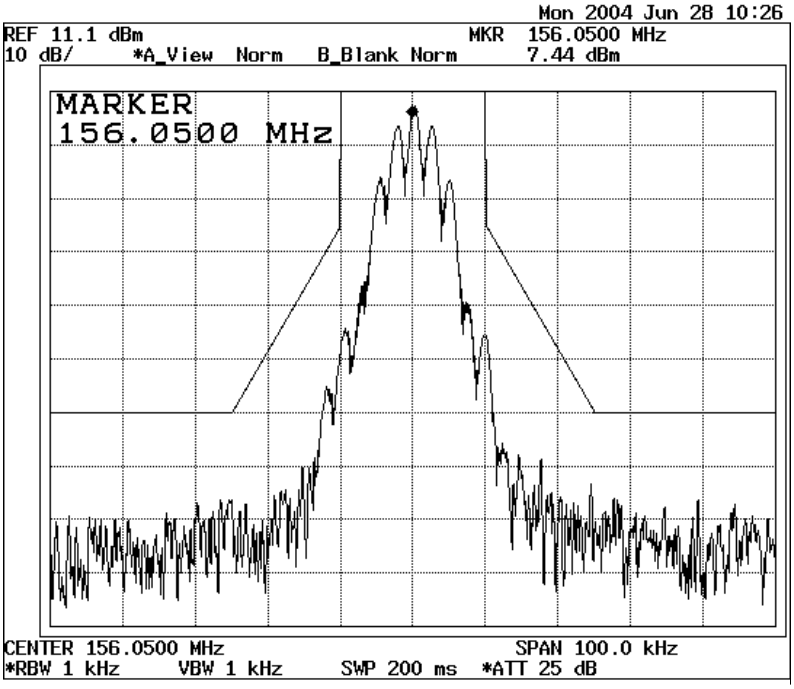
See Attachment A [List of Test/Measuring Equipment].

3.2.3 Test results

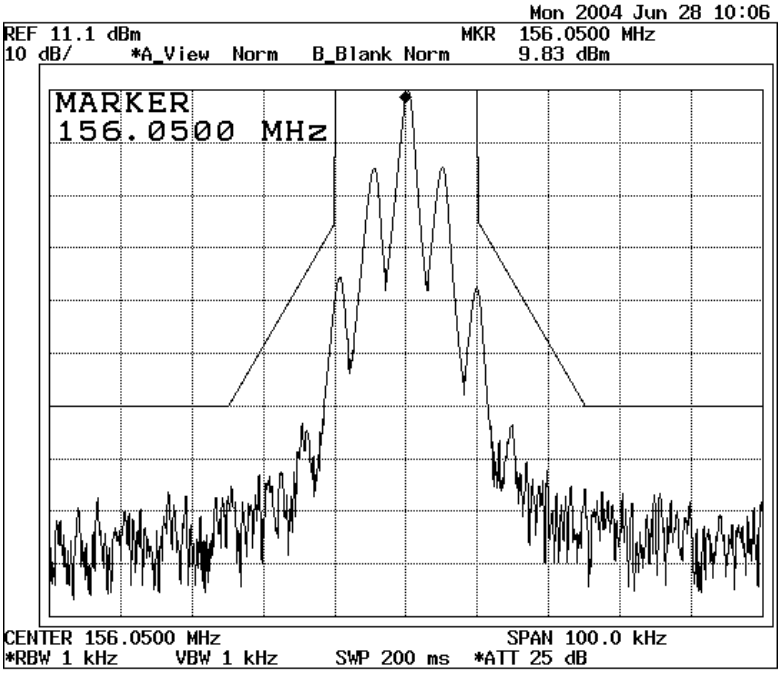
3.2.3.1 Modulation Spectrum for 25 kHz channel mode (Clause 15.1.3, IEC 61993-2)

(1) TX frequency: 156.050 MHz RF Power Output (Carrier Power): 12.5 W

(1.1) Test signal: TDMA Type 1 (Standard Test Signal Number 2):

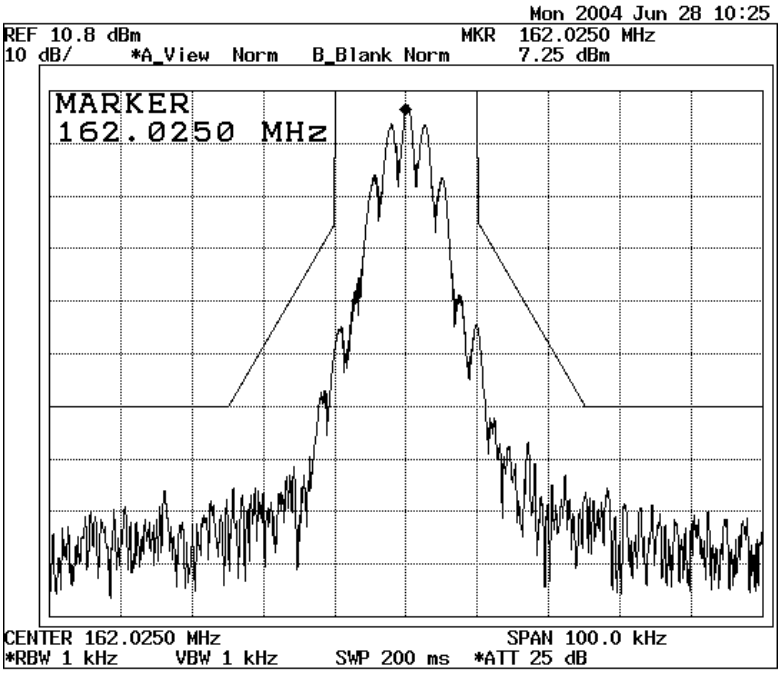


(1.2) Test signal: TDMA Type 2 (Standard Test Signal Number 3):

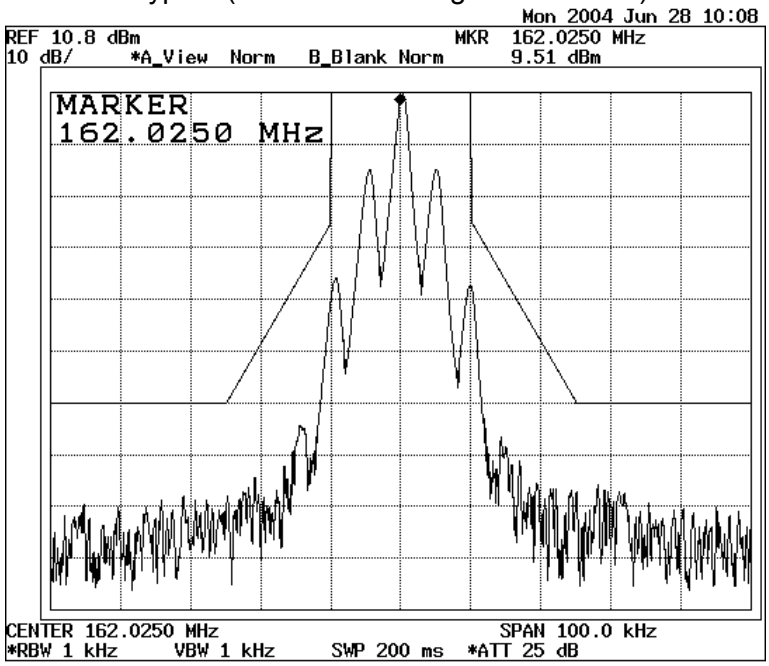


(2) TX frequency: 162.025 MHz RF Power Output (Carrier Power): 12.5 W

(2.1) Test signal: TDMA Type 1 (Standard Test Signal Number 2):

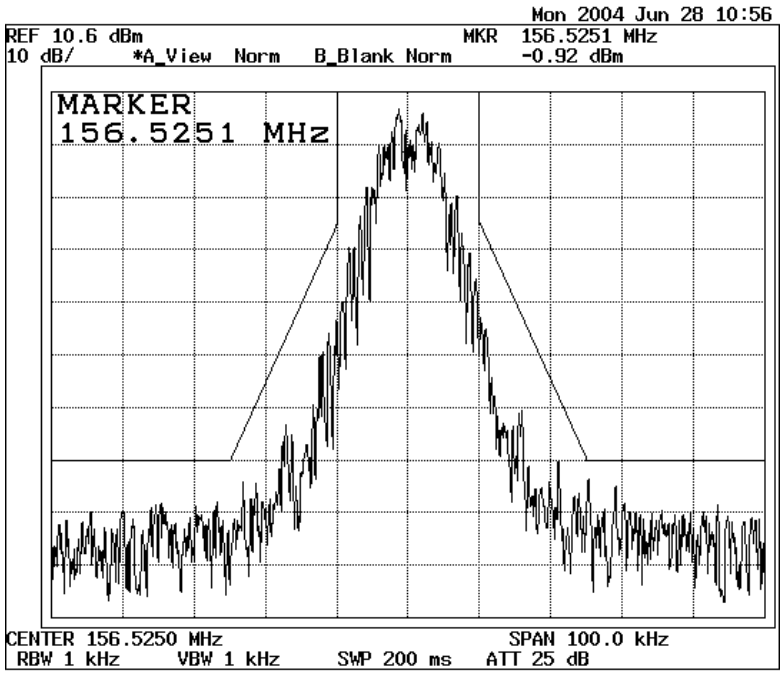


(2.2) Test signal: TDMA Type 2 (Standard Test Signal Number 3):



(3) TX frequency: 156.525 MHz RF Power Output (Carrier Power): 12.5 W

(3.1) Test signal: DSC mode (Standard Test Signal Number 1):

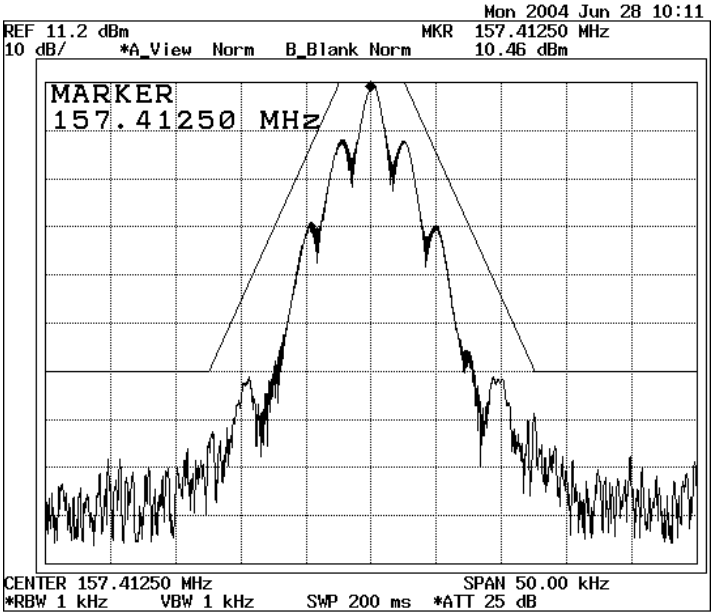


Limit : within the mask specified in figure 4, Clause 15.1.3, IEC 61993-2.
(Emission mask):
- At ± 10 kHz removed from the carrier, the modulation sidebands is below -25 dBc.
- At ± 25 kHz removed from the carrier, the modulation sidebands is below -70 dBc, without any need to be below 0.25 µW.
In the region between + 10 kHz and + 25 kHz removed from the carrier, the modulation sidebands is below a line specified between these two points.

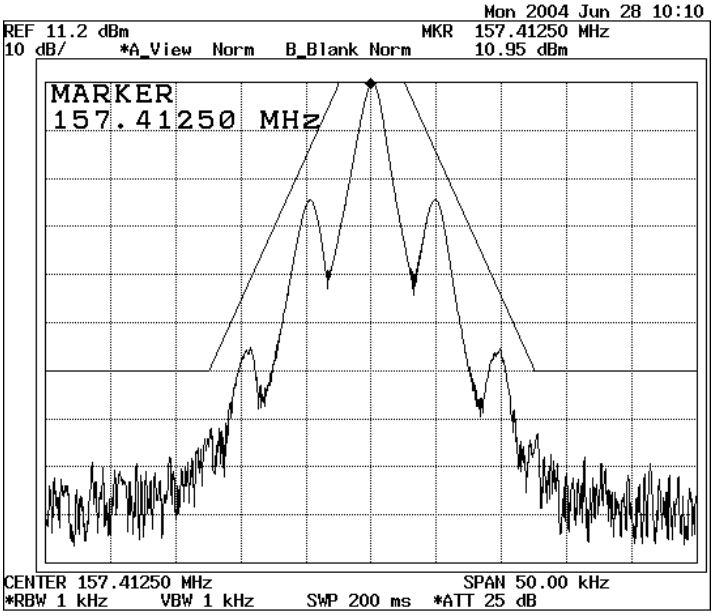
3.2.3.2 Modulation Spectrum for 12.5 kHz channel mode (Clause 15.1.4, IEC 61993-2)

(1) TX frequency: 157.4125 MHz RF Power Output (Carrier Power): 12.5 W

(1.1) Test signal: TDMA Type 1 (Standard Test Signal Number 2):

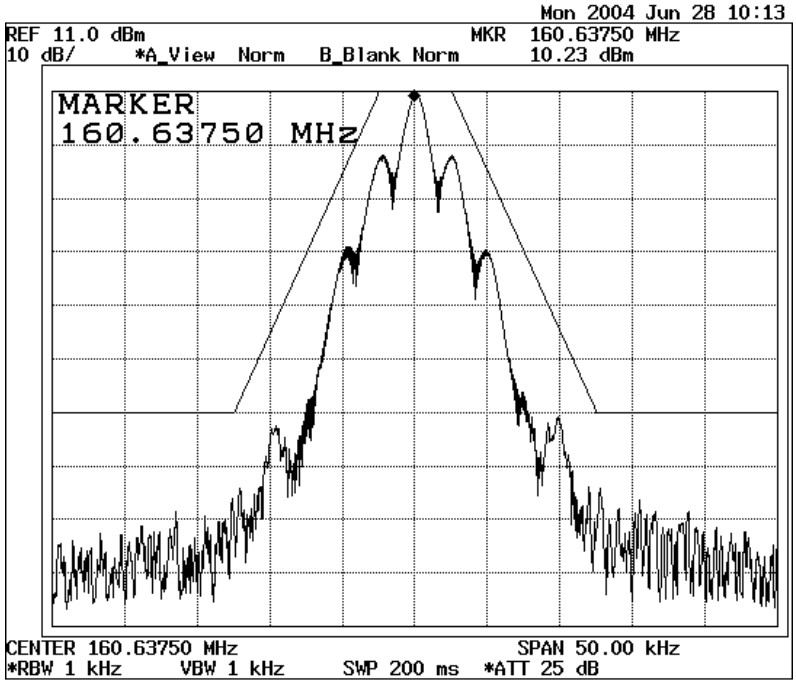


(1.2) Test signal: TDMA Type 2 (Standard Test Signal Number 3):

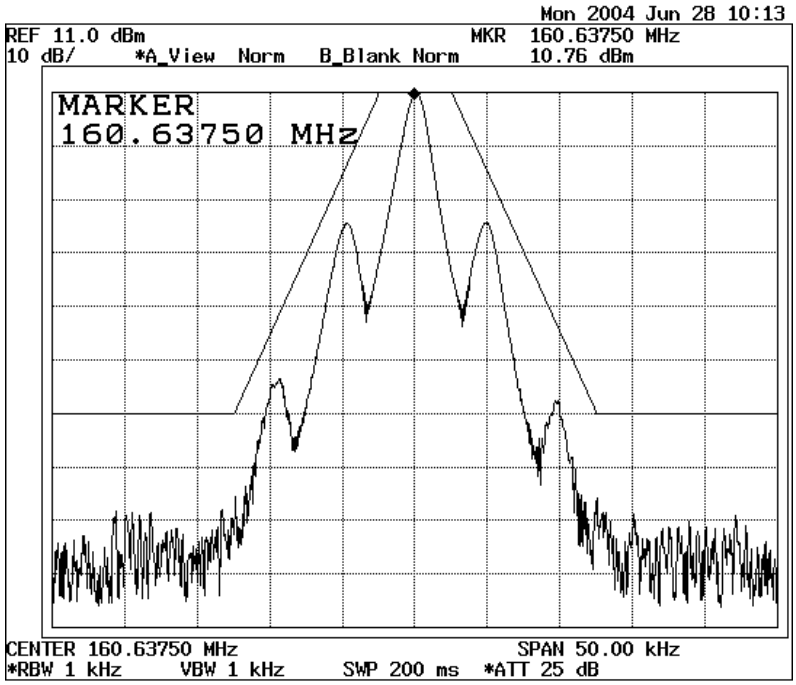


(2) TX frequency: 160.6375 MHz RF Power Output (Carrier Power): 12.5 W

(2.1) Test signal: TDMA Type 1 (Standard Test Signal Number 2):



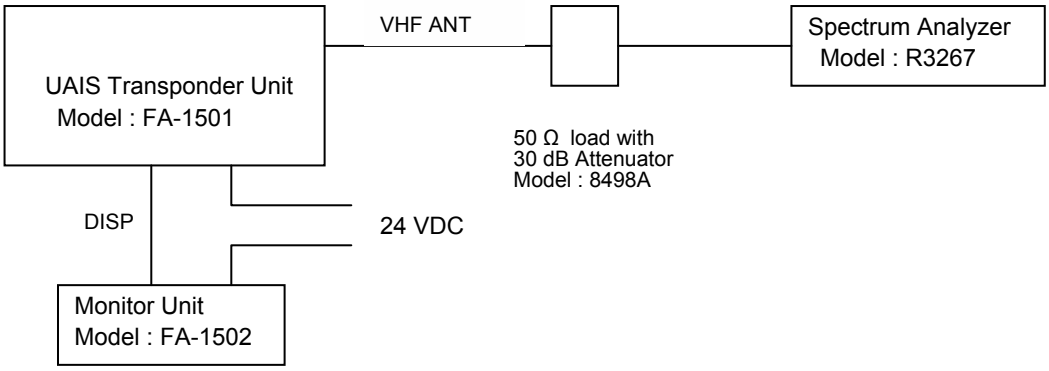
(2.2) Test signal: TDMA Type 2 (Standard Test Signal Number 3):



Limit: within the mask specified in figure 5, Clause 15.1.4, IEC 61993-2.
(Emission mask):
- At ± 12.5 kHz removed from the carrier, the modulation sidebands is below -60 dBc.
In the region between ± 2.5 kHz and ± 12.5 kHz removed from the carrier, the modulation sidebands is below a line starting at 0 dBc / ± 2.5 kHz and ending at -60 dBc / ± 12.5 kHz without any need to be below 0.25 µW.

3.3 Spurious Emissions at Antenna Terminals (FCC Rule 2.1051)

3.3.1 Test Equipment Setup:



Radio frequency voltage generated within the equipment and appearing as a spurious emission was measured at the output terminal when loaded with 50 ohm artificial antenna.

3.3.2 Measuring Equipment List:

See Attachment A [List of Test/Measuring Equipment].

3.3.3 Emission Limits:

< -54 dB below carrier at 12.5 W,
< -46 dB below carrier at 2 W,
< -43 dB below carrier at 1 W

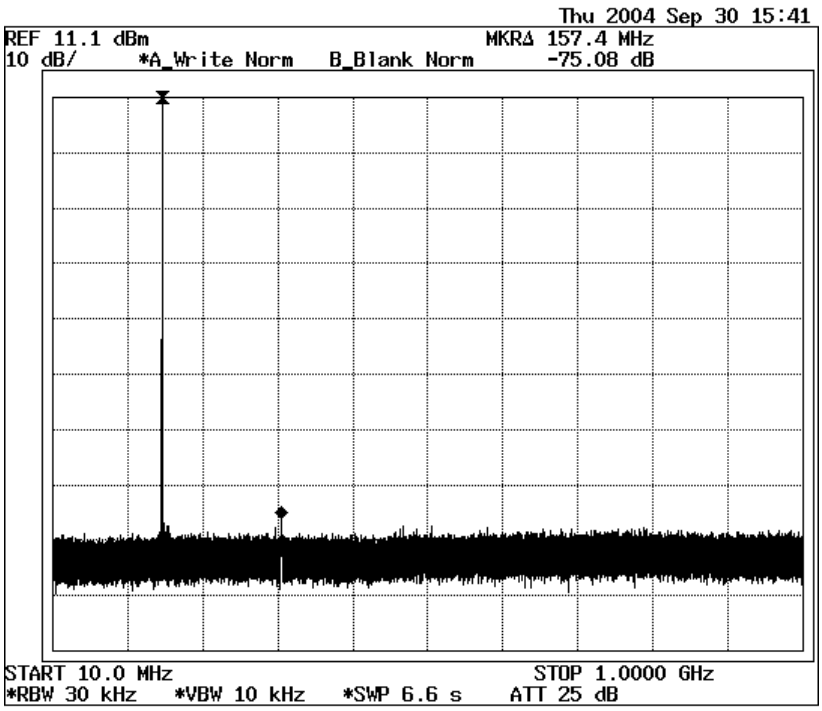
3.3.4 Test Results:

The spurious emissions at antenna terminal of the unit are found lower than the specified limits.
(Note: Spurious emissions at the frequencies for more than 1 GHz were not found.)

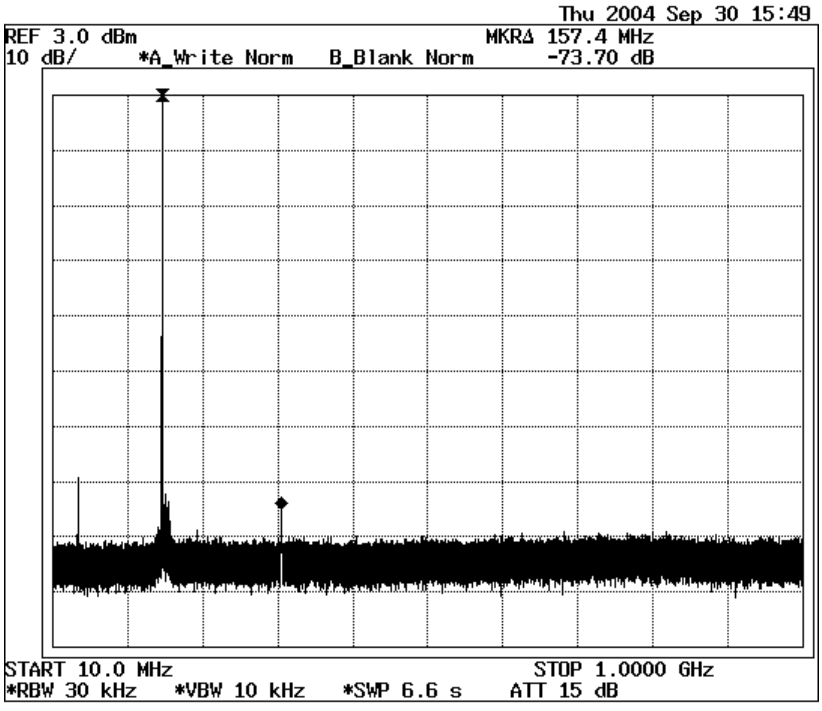
f	CH1060 (156.025 MHz)			CH2088 (162.025 MHz)		
	RF Power Output (Carrier Power)			RF Power Output (Carrier Power)		
	12.5 W	2 W	1 W	12.5 W	2 W	1 W
43.7 MHz	Not found	-69.1 dB	-65.9 dB	Not found	-66.5 dB	-64.8 dB
200.1 MHz	Not found	Not found	-75.3 dB	Not found	Not found	Not found
2f	-75.0 dB	-73.7 dB	-71.1 dB	-75.8 dB	-73.0 dB	-71.8 dB
3f	Not found	Not found	-73.0 dB	-76.2 dB	-75.3 dB	-71.6 dB
4f	Not found	Not found	Not found	-75.4 dB	Not found	Not found
5f	Not found	Not found	Not found	Not found	Not found	Not found

Each harmonic and other spurious emissions measured are also shown in Graph 3.3a to 3.3f.

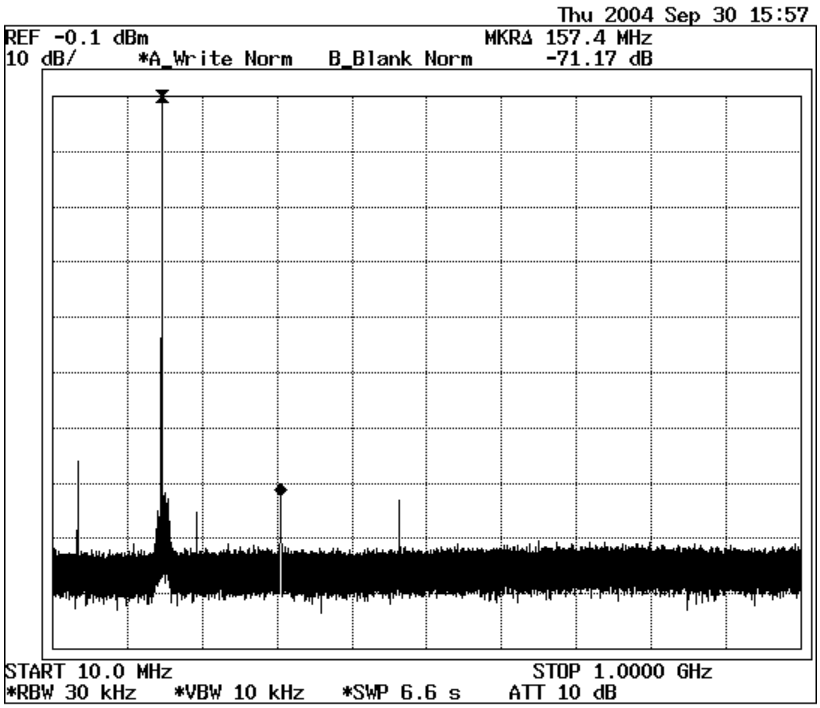
Graph 3.3a – Spurious Emissions at Antenna terminal on Channel 1060 with 12.5 W TX mode



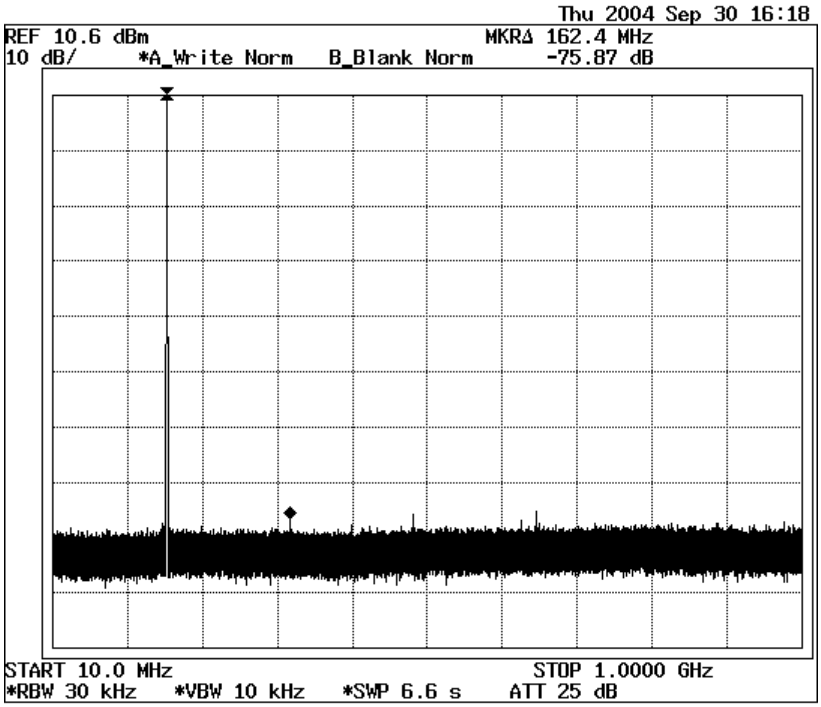
Graph 3.3b – Spurious Emissions at Antenna terminal on Channel 1060 with 2 W TX mode



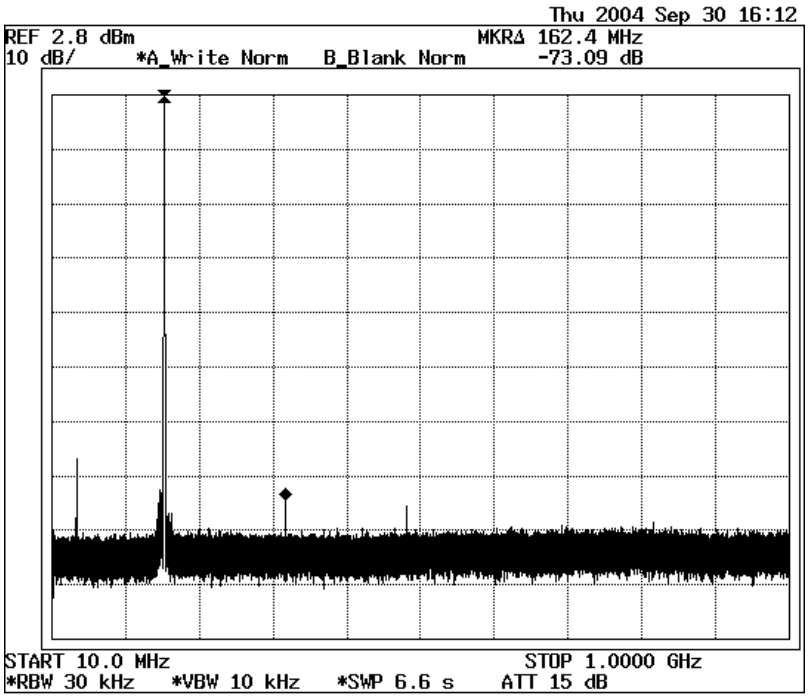
Graph 3.3c – Spurious Emissions at Antenna terminal on Channel 1060 with 1 W TX mode



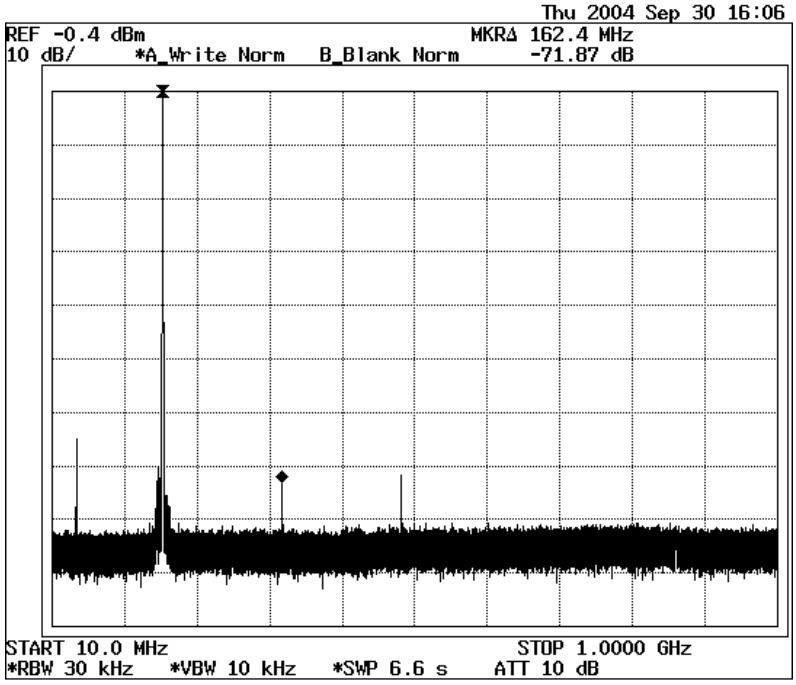
Graph 3.3d – Spurious Emissions at Antenna terminal on Channel 2088 with 12.5 W TX mode



Graph 3.3e – Spurious Emissions at Antenna terminal on Channel 2088 with 2 W TX mode



Graph 3.3f – Spurious Emissions at Antenna terminal on Channel 2088 with 1 W TX mode



3.4 Field Strength of Spurious Radiation (FCC Rule 2.1053)

3.4.1 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

3.4.2 Distance between the EUT and measuring antenna: 3 m

3.4.3 Measuring Equipment List:

See Attachment A [List of Test/Measuring Equipment].

3.4.4 Test settings:

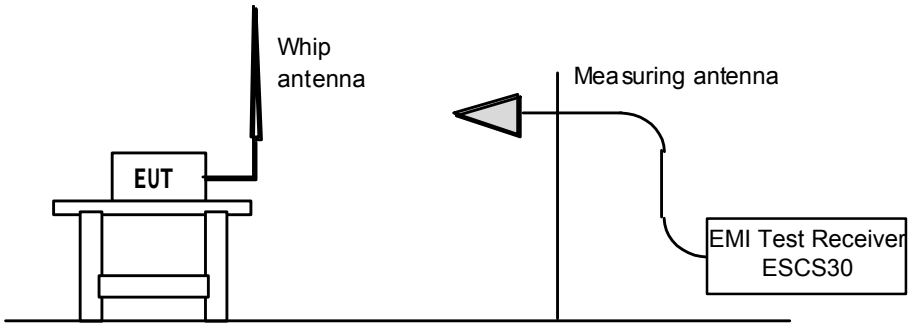


Fig 3.4A Setup for measurement of fundamental component

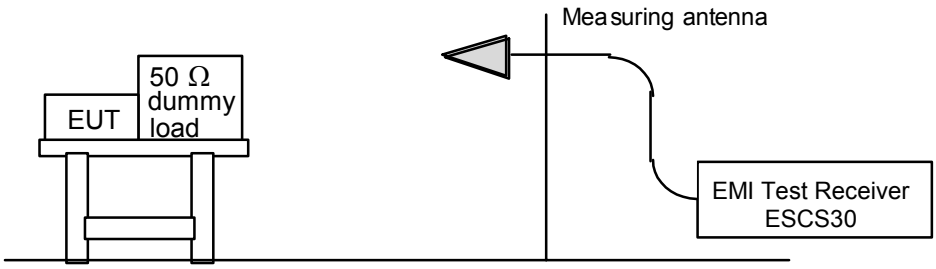


Fig 3.4B Setup for measurement of any spurious other than fundamental component

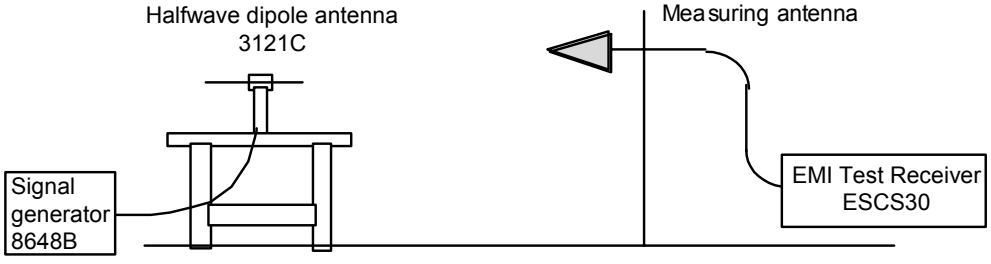


Fig 3.4C Setup for measurement of field strength with substitution antenna

3.4.5 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:

<-54 dB below carrier at 12.5 W,

<-46 dB below carrier at 2 W

3.4.7 Measurement Results:

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

	RF Power Output (Carrier Power): 12.5 W		RF Power Output (Carrier Power): 2 W	
Test channel	Horizontal plane (dBμV/m)	Vertical plane (dBμV/m)	Horizontal plane (dBμV/m)	Vertical plane (dBμV/m)
1060 (156.025 MHz)	121.8	136.8	116.1	129.1
2088 (162.025 MHz)	122.5	137.0	117.7	130.3

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

Test channel	RF Power Output (Carrier Power): 12.5 W		RF Power Output (Carrier Power): 2 W	
1060 (156.025 MHz)	Horizontal plane (dBμV/m)	Vertical plane (dBμV/m)	Horizontal plane (dBμV/m)	Vertical plane (dBμV/m)
2f (312.050 MHz)	28.4	20.8	29.1	22.4
3f (468.075 MHz)	20.5	20.6	20.1	23.4
4f (624.100 MHz)	47.9	47.6	36.3	39.8
5f (780.125 MHz)	36.6	39.3	33.7	37.8
6f (936.150 MHz)	31.9	31.7	Not found	Not found

Test channel	RF Power Output (Carrier Power): 12.5 W		RF Power Output (Carrier Power): 2 W	
2088 (162.025 MHz)	Horizontal plane (dBμV/m)	Vertical plane (dBμV/m)	Horizontal plane (dBμV/m)	Vertical plane (dBμV/m)
2f (324.050 MHz)	20.6	22.0	17.5	19.7
3f (486.075 MHz)	23.7	36.1	21.8	28.5
4f (648.100 MHz)	46.9	41.8	36.6	43.2
5f (810.125 MHz)	34.2	34.7	30.7	28.5
6f (972.150 MHz)	36.8	29.9	28.0	28.7

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

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)

(4) Results of Spurious Attenuation:

Test channel: CH1060 (156.025 MHz) on 12.5 W

	Frequency (MHz)	X1 (dBm)		X2 (dBm)		Attenuation (dB)	
		Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Fundamental	156.025	22.5	41.2			0	0
Spurious	312.050			-70.5	-75.8	93.0	117.0
	468.075			-77.0	-76.8	99.5	118.0
	624.100			-48.1	-45.6	70.6	86.8
	780.125			-61.8	-56.9	84.3	98.1
	936.150			-69.0	-66.3	91.5	107.5

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	20.5	33.5			0	0
Spurious	312.050			-69.8	-74.2	90.3	107.7
	468.075			-77.4	-74.0	97.9	107.5
	624.100			-59.7	-53.4	80.2	86.9
	780.125			-64.7	-58.4	85.2	91.9
	936.150			Not found	Not found	Not found	Not found

Test channel: CH2088 (162.025 MHz) on 12.5 W

	Frequency (MHz)	X1 (dBm)		X2 (dBm)		Attenuation (dB)	
		Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Fundamental	162.025	23.2	41.1			0	0
Spurious	324.050			-79.8	-74.4	103.0	115.5
	486.075			-74.0	-60.3	97.2	101.4
	648.100			-50.4	-52.8	73.6	93.9
	810.125			-64.3	-60.8	87.5	101.9
	972.150			-63.8	-68.8	87.0	109.9

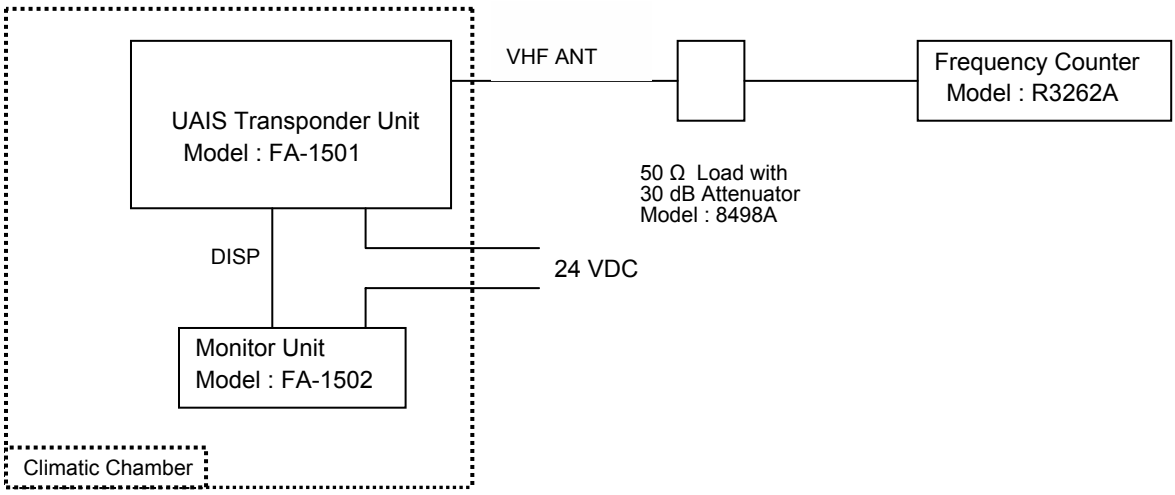
Test channel: CH2088 (162.025 MHz) on 2 W

	Frequency (MHz)	X1 (dBm)		X2 (dBm)		Attenuation (dB)	
		Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Fundamental	162.025	18.4	34.4			0	0
Spurious	324.050			-82.9	-76.7	101.3	111.1
	486.075			-75.9	-67.9	94.3	102.3
	648.100			-60.7	-51.4	79.1	85.8
	810.125			-67.8	-67.0	86.2	101.4
	972.150			-72.6	-70.0	91.0	104.4

Results of Spurious Attenuation are found lower than the specified limits.

3.5 Frequency Stability (FCC Rule 2.1055)

3.5.1 Setup for Measurement



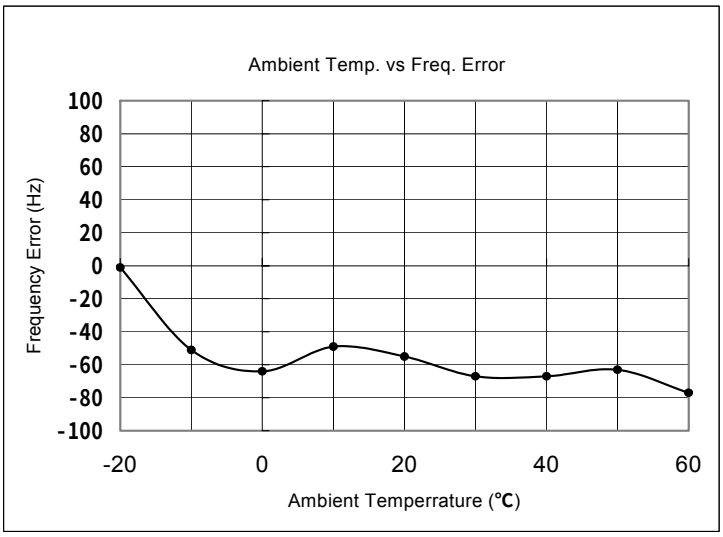
3.5.2 Measuring Equipment List: See Attachment A [List of Test/Measuring Equipment].

3.5.3 Frequency Tolerance Limits:

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

3.5.4 Test Results:

Frequency variation was measured on CH2088 (162.025 MHz) and results are shown as follows. Variation of power supply voltages (20.4 to 24.7 VDC) did not affect the test results with the use of the built-in voltage regulator.



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

3.6.1 TDMA Receivers

(1) Sensitivity - 25 kHz Operation

TEST CONDITIONS		SENSITIVITY LEVEL	
		Fn: 156.025 MHz	Fn: 162.025 MHz
Temperature	Voltage	RF level (dBm)	RF level (dBm)
Tnom (+20 °C)	*Vnom (24.0 V)*	-109 dBm at 10.5% PER	-109 dBm at 5.9% PER
Tmin (-15 °C)	*Vmin (21.6 V)*	- 109 dBm at 19.0% PER	- 110 dBm at 10.9% PER
	Vmax (31.2 V)	- 110 dBm at 9.1% PER	- 111 dBm at 16.1% PER
Tmax (+55 °C)	*Vmin (21.6 V)*	- 109 dBm at 12.3% PER	- 109 dBm at 5.9% PER
	Vmax (31.2 V)	- 109 dBm at 10.0% PER	- 109 dBm at 7.9% PER
Limits		≤ - 107 dBm with a PER of 20% under normal test conditions, < - 101 dBm with a PER of 20% under extreme test conditions,	

(2) Sensitivity - 12.5 kHz Operation

TEST CONDITIONS		SENSITIVITY LEVEL	
		Fn: 157.4125 MHz	Fn: 160.6375 MHz
Temperature	Voltage	RF level (dBm)	RF level (dBm)
Tnom (+20 °C)	*Vnom (24.0 V)*	-101 dBm at 16.5% PER	-101 dBm at 12.6% PER
Tmin (-15 °C)	*Vmin (21.6 V)*	- 101 dBm at 19.3% PER	- 100 dBm at 16.3% PER
	Vmax (31.2 V)	- 101 dBm at 18.3% PER	- 100 dBm at 18.5% PER
Tmax (+55 °C)	*Vmin (21.6 V)*	- 100 dBm at 13.0% PER	- 100 dBm at 9.3% PER
	Vmax (31.2 V)	- 100 dBm at 13.0% PER	- 100 dBm at 8.9% PER
Limits		≤ - 98 dBm with a PER of 20% under normal test conditions, < - 92 dBm with a PER of 20% under extreme test conditions,	

3.6.2 DSC Receiver

(1) Maximum sensitivity

TEST CONDITIONS		SENSITIVITY LEVEL (dBm) Fn: 156.525 MHz (CH 70)		
Temperature	Voltage	Fn	Fn - 1.5 kHz	Fn + 1.5 kHz
Tnom (+20 °C)	*Vnom (24.0 V)*	-112 dBm at <0.5% BER	-111 dBm at <0.5% BER	-111 dBm at <0.5% BER
Tmin (-15 °C)	*Vmin (21.6 V)*	-114 dBm at <0.5% BER	-113 dBm at <0.5% BER	-113 dBm at <0.5% BER
	Vmax (31.2 V)	-114 dBm at <0.5% BER	-113 dBm at <0.5% BER	-113 dBm at <0.5% BER
Tmax (+55 °C)	*Vmin (21.6 V)*	-110 dBm at <0.5% BER	-109 dBm at <0.5% BER	-109 dBm at <0.5% BER
	Vmax (31.2 V)	-110 dBm at <0.5% BER	-109 dBm at <0.5% BER	-109 dBm at <0.5% BER
Limits		≤ - 107 dBm with a BER of 20% under normal test conditions, < - 101 dBm with a BER of 20% under extreme test conditions,		

4 Photographs to Reveal Equipment Construction and Layout (FCC Rule 2.1033)

(See separate covers. (Furuno Labotech document no. FLI01-04-021 dated July 9, 2004.))

5 Description of Circuitry and Devices (FCC Rules 2.1033)

5.1 Function of Each Semiconductor or Active Device

TX Board: 24P0032

Symbol	Component	Type	Function
CR 0001	DIODE(PIN)	1SV268-TD	RF switch
CR 0002	DIODE(BANDSW)	1SS268-TE85L	Protection for RF voltage
CR 0003	DIODE(Z)	02CZ2.7Z-TE85L	Regulator
CR 0004	DIODE(PIN)	1SV268-TD	RF switch
CR 0005	DIODE(Z)	02CZ4.7Z-TE85L	Protection for voltage
CR 0006	DIODE(LED)	PG1101W-TR	LED
CR 0007	DIODE(SB)	MA2J728	Detection for RF voltage
CR 0008	DIODE(SB)	MA2J728	For DC bias
CR 0009	DIODE(SB)	MA2J728	Detection for revers voltage
CR 0010	DIODE(SB)	MA2J728	Detection for RF voltage
CR 0011	DIODE(VC)	1SV229-TPH2	Varactor for VCO
CR 0012	DIODE(VC)	1SV229-TPH2	Varactor for VCO
FL 0001	FILTER(XTAL)	MF45SBD 45.0MHZ	Crystal
Q 0001	MOS FET(RF)	2SK3074-TE12L	RF amp
Q 0002	TR(POWER)	2SA1213-Y-TE12L	DC switch
Q 0003	TR(DIGI)	DTC114EKAT146	DC switch
Q 0004	TR(DIGI)	DTC114EKAT146	DC switch
Q 0005	TR(DIGI)	DTA114EKAT146	DC switch
Q 0006	TR(AF)	2SC2712-Y-TE85L	DC switch
Q 0007	TR(RF)	2SC3356(M)-T1B	RF amp
Q 0008	TR(RF)	2SC3356(M)-T1B	Buffer amp
Q 0009	TR(RF)	2SC3356(M)-T1B	VCO
Q 0010	FET(RF)	PMBFJ310	DC amp
Q 0011	TR(RF)	2SA1037AKT146R	DC switch
Q 0012	TR(RF)	2SC3123	Buffer amp
Q 0013	TR(RF)	2SC3123	Buffer amp
Q 0014	TR(RF)	2SC3123	Buffer amp
Q 0015	TR(RF)	2SC3123	Buffer amp
Q 0016	TR(DIGI)	DTA114EKAT146	DC switch
Q 0017	TR(DIGI)	DTC114EKAT146	DC switch
Q 0021	TR(RF)	2SA1037AKT146R	DC switch

Symbol		Component	Type	Function
Q	0022	TR(RF)	2SA1037AKT146R	DC switch
Q	0023	TR(DIGI)	DTC114EKAT146	DC switch
U	0001	IC(P AMP)	RA35H1516M-01	RF power amp
U	0002	CM COUPLER	DCS3D20-0157	
U	0003	IC(OPAMP)	NJM2904M-T1	DC amp
U	0004	IC(OPAMP)	NJM2904M-T1	DC amp
U	0005	IC(RF AMP)	UPC2745TB-E3	RF amp
U	0006	IC(RF AMP)	UPC2745TB-E3	RF amp
U	0007	IC(REG)	TA7809F-TE16L	Regulator
U	0008	IC(REG)	TA48L033F-TE12L	Regulator
U	0009	IC(MIX)	NJM2594M-TE1	Mixer
U	0010	IC(PLL)	LMX2353TMX	PLL
U	0011	MOS LOG(7SH)	TC7SHU04F-TE85L	Buffer amp
Y	0001	XTAL OSCILLATOR	TTS14NSB-A5 19.2MHZ	Reference OSC

DSC Board: 24P0034

Symbol		Component	Type	Function
CR	1	DIODE(SW)	1SS272-TE85L	Detection for reverse voltage
CR	2	DIODE(PIN)	MA555-TX	AGC
CR	3	DIODE(SB)	MA716-TX	Detection for RF voltage
CR	4	DIODE(PIN)	MA555-TX	AGC
FL	1	XTAL FILTER	MF38.3SB 38.364MHZ	
FL	2	XTAL FILTER	MF38.3SB 38.364MHZ	
Q	1	TR(AF)	2SC2712-Y-TE85L	AGC amp
Q	3	TR(RF)	2SC5336-T1	RF amp
Q	5	TR(RF)	2SC4703-T1	RF amp
Q	6	TR(RF)	2SC3123	Buffer amp
Q	7	TR(AF)	2SC2712-Y-TE85L	IF amp
Q	8	TR(RF)	2SC3356(M)-T1B	Buffer amp
Q	9	TR(RF)	2SC3123	Buffer amp
Q	10	TR(RF)	2SC3123	IF amp
Q	11	TR(RF)	2SC3123	IF amp
Q	14	MOS FET(RF)	2SK882-GR-TE85L	IF amp
U	1	IC(REG)	AN7712SP-E1	Regulator
U	2	IC(REG)	TA48L033F-TE12L	Regulator
U	4	IC(OPAMP)	M5218AFP-600C	IF amp

Symbol		Component	Type	Function
U	5	IC(OPAMP)	NJM2904M-T1	DC amp
U	6	IC(MIX)	NJM2594M-TE1	Mixer
U	7	MOS LOG(7SH)	TC7SHU04F-TE85L	Buffer amp
U	8	IC(MIX)	CMY210GEGE6327-PBF	Mixer
Y	1	XTAL OSCILLATOR	TTS14NSB-A5	29.54025 MHz 1st local OSC

DSC RX1 & RX2 Boards: 24P0033A & 24P0033B

Symbol		Component	Type	Function
CR	2	DIODE(VC)	1SV229-TPH2	Varactor for VCO
CR	3	DIODE(VC)	1SV229-TPH2	Varactor for VCO
CR	4	DIODE(SB)	MA716-TX	Detection for RF voltage
CR	5	DIODE(PIN)	MA555-TX	AGC
CR	6	DIODE(SW)	1SS272-TE85L	Detection for reverse voltage
FL	1	XTAL FILTER	MF51.1NB	51.1375MHZ
FL	1	XTAL FILTER	MF51.2NB	51.2375MHZ
FL	2	XTAL FILTER	MF51.1SB	51.1375MHZ
FL	2	XTAL FILTER	MF51.2SB	51.2375MHZ
Q	2	TR(RF)	2SC3356(M)-T1B	Buffer amp
Q	3	TR(RF)	2SC3356(M)-T1B	VCO
Q	4	TR(AF)	2SC2712-Y-TE85L	DC switch
Q	5	FET(RF)	PMBFJ310	DC amp
Q	6	TR(RF)	2SC3123	IF amp
Q	7	TR(RF)	2SA1037AKT146R	DC switch
Q	8	TR(RF)	2SC3123	IF amp
Q	9	TR(RF)	2SC3123	Buffer amp
Q	10	TR(AF)	2SC2712-Y-TE85L	IF amp
Q	11	TR(AF)	2SC2712-Y-TE85L	AGC amp
Q	12	TR(RF)	2SC2412KT146R	DC switch
Q	13	TR(RF)	2SA1037AKT146R	DC switch
U	1	IC(MIX)	AD831AP	Mixer
U	2	IC(RF AMP)	UPC2745TB-E3	RF amp
U	3	IC(RF AMP)	UPC2745TB-E3	RF amp
U	4	IC(PLL)	LMX2353TMX	PLL
U	5	MOS LOG(7SH)	TC7SHU04F-TE85L	Buffer amp
U	6	MOS LOG(7SH)	TC7SHU04F-TE85L	Buffer amp

Symbol		Component	Type	Function
U	8	IC(OPAMP)	M5218AFP-600C	IF amp
U	9	IC(REG)	TA48L033F-TE12L	Regulator
U	10	IC(OPAMP)	NJM2904M-T1	DC amp
U	11	IC(MIX)	NJM2594M-TE1	Mixer
U	12	IC(REG)	TA7809F-TE16L	Regulator
Y	1	XTAL OSCILLATOR	TTS14NSB-A5	25.55075MHz 2nd local OSC
Y	1	XTAL OSCILLATOR	TTS14NSB-A5	25.60075MHz 2nd local OSC

MAIN Board: 24P0035

Symbol		Component	Type	Function
CR	0001	DIODE(LED)	PG1101W-TR	LED
CR	0002	DIODE(LED)	PG1101W-TR	LED
CR	0003	DIODE(LED)	PG1101W-TR	LED
CR	0004	DIODE(LED)	PG1101W-TR	LED
CR	0005	DIODE(SW)	1SS226-TE85L	
CR	0006	DIODE(SW)	1SS226-TE85L	
CR	0007	DIODE(SW)	1SS226-TE85L	
CR	0008	DIODE(SW)	1SS226-TE85L	Switching
CR	0009	DIODE(SW)	1SS226-TE85L	Switching
CR	0010	DIODE(SB)	MA2J728	
CR	0011	DIODE(LED)	PG1101W-TR	LED
CR	0012	DIODE(LED)	PG1101W-TR	LED
CR	0013	DIODE(LED)	PG1101W-TR	LED
CR	0014	DIODE(LED)	PG1101W-TR	LED
U	0001	IC(RF AMP)	UPC2745TB-E3	Buffer amp
U	0002	MOS SDRAM	IC42S16100-7T	SDRAM
U	0003	IC(OPAMP)	NJM5532M-TE1	Buffer amp for DSC
U	0004	IC(OPAMP)	NJM5532M-TE1	Buffer amp for RX1
U	0005	IC(OPAMP)	NJM5532M-TE1	Buffer amp for RX2
U	0006	MOS MPU	HD6417750RF240	Sub CPU
U	0007	MOS	AD9834BRU-REEL7	DDS
U	0008	MOS SDRAM	IC42S16100-7T	SDRAM
U	0011	IC(RESET)	RN5VD28A-TR	Reset
U	0012	MOS LGC(7W)	TC7W14FU-TE12L	Schmitt inverter

Symbol	Component	Type	Function
U 0013	IC(AD/DA)	AK4528VF	AD/DA converter
U 0014	IC(AD/DA)	AK4528VF	AD/DA converter
U 0015	IC(D/A)	MAX5385EUT-T	D/A converter
U 0016	MOS LGC(ALVC)	74ALVC32PW	OR gate
U 0017	MOS LGC(7W)	TC7WU04FU-TE12L	
U 0018	IC(FPGA)	XC2S200E-6PQ208C	
U 0019	IC(A/D)	MAX1117EKA-T	
U 0020	IC(REG)	L78M05T-TL	Regulator
U 0021	MOS LGC(LVC)	SN74LVC1G08DBVR	AND gate
U 0022	IC(REG)	LMS1585AISX-3.3	Regulator
U 0023	MOS MPU	HD6417750RF240	Main CPU
U 0024	MOS SDRAM	EDS1232AATA-75-E	SDRAM
U 0025	FLA(24S01240)	MBM29DL640E90TN	Flash
U 0025	PROGRAM	2450018-01.01	
U 0026	IC(REG)	LT1963AEQ-1.8 #TR	Regulator
U 0027	MOS LGC(LVC)	SN74LVC2G04DBVR	
U 0028	IC(REG)	LT1963AEQ-1.5 #TR	Regulator
U 0029	MOS(LINE D/R)	DS14C232CMX	Line driver and receiver
U 0031	MOS LGC(LVC)	SN74LVC1G08DBVR	AND gate
U 0032	MOS LGC(LVC)	SN74LVC1G08DBVR	AND gate
U 0033	MOS LGC(LVC)	SN74LVC1G08DBVR	AND gate
Y 0001	XTAL OSCILLATOR	TTS14NSB-A5 18.432M	CPU clock OSC

PWR Board: 24P0037

Symbol	Component	Type	Function
CR 1	DIODE(RECTI)	FML-22S	Detection for reverse voltage
CR 2	DIODE(SW)	1SS184-TE85L	Detection for reverse voltage
CR 3	DIODE(SW)	1SS184-TE85L	Detection for reverse voltage
CR 12	DIODE(Z)	02CZ10Y-TE85L	Regulator
CR 51	DIODE(RECTI)	FML-32S	Rectifier
CR 52	DIODE(Z)	02CZ10Y-TE85L	Low voltage detector
CR 53	DIODE(SB)	MA3D750	Rectifier
Q 1	TR(RF)	2SA1037AKT146R	DC switching
Q 2	TR(RF)	2SA1037AKT146R	DC switching
Q 12	TR(RF)	2SA1037AKT146R	DC switch
Q 21	TR(RF)	2SA1037AKT146R	DC switch

Symbol		Component	Type	Function
Q	51	TR(AF)	2SC2712-Y-TE85L	DC switch
Q	52	TR(RF)	2SC2412KT146R	DC switch
Q	53	MOS FET(P.SW)	FS50SMJ-3	DC switching
Q	54	MOS FET(P.SW)	FS50SMJ-3	DC switching
Q	55	TR(AF)	2SD1272-P	voltage monitor
U	11	IC(HYB)	RC-9528-1	
U	21	IC(HYB)	RC-9501	Reg control
U	52	IC(PHOT.C)	TLP181-Y-TPL	output voltage control
U	53	IC(REG)	µPC1093T-E1	output voltage control
U	54	IC(REG)	LM2679T-5.0	Regulator

5.2 Description of the circuitry and devices provided for determining and stabilizing frequency, for suppression of spurious radiation, for limiting modulation, and for limiting power

5.2.1 Block Description

This unit FA-150 consists of the Transponder Unit FA-1501, the Monitor Unit FA-1502 and the VHF/GPS Antennas.

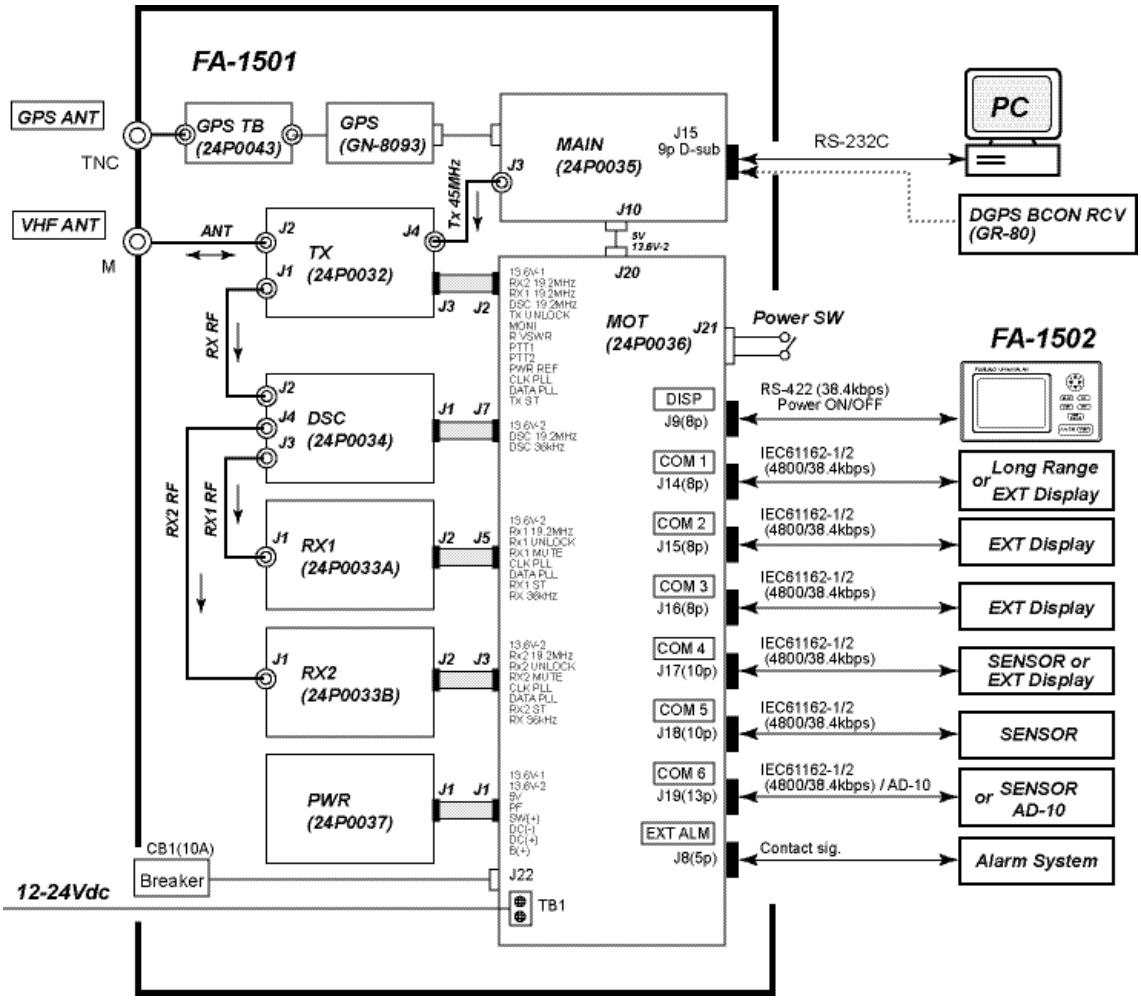
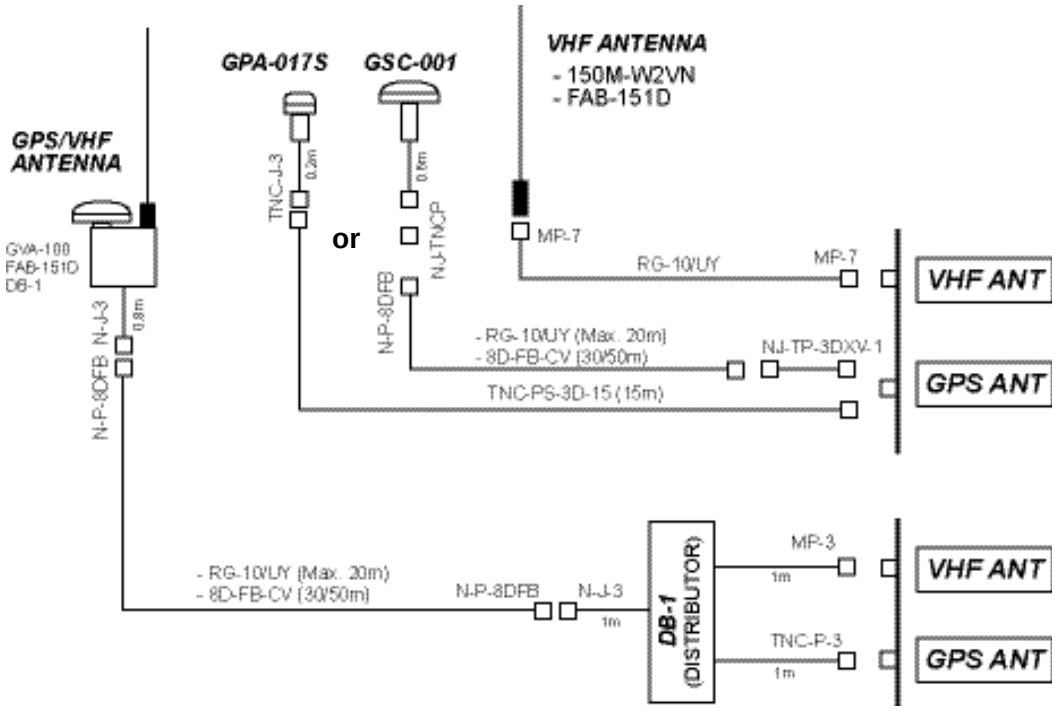


Figure 5.2.1 Block Diagram of FA-1501



VHF separate antenna selection	GPS separate antenna selection	GPS/VHF combined antenna configuration
FAB-151D	GSC-001	GVA-100 + FAB-151D + DB-1
150M-W2VN	GPS-017S	

Figure 5.2.2 VHF/GPS Antenna System of FA-150

5.2.2 Function of major circuits

5.2.2.1 FA-1501

Table 5.2.2.1 Outline of FA-1501

Board name	Outline
MAIN (24P0035)	Consists of MAIN CPU, SUB CPU and its peripheral circuits. Controlling/Processing of AIS (DSC) Communications and I/O interfacing are done by the MAIN CPU. Modulation/Demodulation processing of TDMA/DSC and the analogue-interfacing with the radio parts are done by the SUB CPU.
TX (24P0032)	GMSK-modulated signal of 45 MHz is input from the MAIN Board and converted into the transmitting frequency and power-amplified. RF Power (HPA) Module U1 (RA35H1516M) amplifies the transmitting signal into 12.5 W.
DSC (24P0034)	DSC receiving signal is converted into the 36 kHz IF signal. The receiving frequency is CH70: 156.525 MHz.
RX1 (24P0033A)	AIS receiving signal (TDMA) is converted into the 36 kHz IF signal. Circuit configuration is almost same as those for RX2 Board. Receiving frequencies of CH-A are allocated for RX1 Board.
RX2 (24P0033B)	AIS receiving signal (TDMA) is converted into the 36 kHz IF signal. Circuit configuration is almost same as those for RX1 Board. Receiving frequencies of CH-B are allocated for RX2 Board.
PWR (24P0037)	Consists of switching regulators to convert the input voltages of 12 to 24 VDC to output voltages of 13.6 VDC x 2 and 5 VDC for use in each Board.
MOT (24P0036)	Mother Board for MAIN, RX1, RX2, DSC and PWR Boards. External equipment such as Sensors and Radars are connected to WAGO terminals of the Board.
GPS (GN-8093)	GPS module for receiving the GPS signal of L1: 1575.42 MHz. Number of receiving channels are 12 parallel (12-satellite tracking).
GPS TB (24P0043)	For relaying the GPS receiving signal.

5.2.2.2 FA-1502

Table 5.2.2.2 Outline of FA-1502

Board name	Outline
CPU (24P0062)	AIS information display (MKD) and the system setting-up. Communications interface of RS-422 with FA-1501 is used with the speed of 38.4 kbps.

5.3 FA-1501 Block Description

5.3.1 TX Board (24P0032)

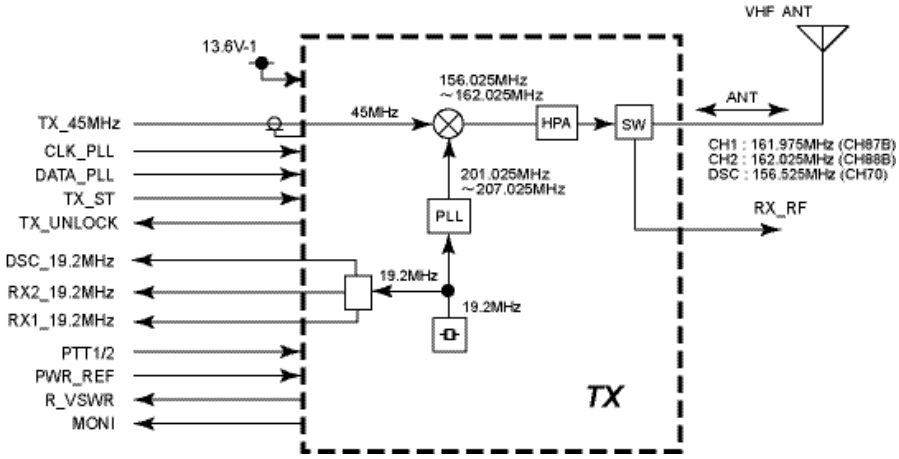


Figure 5.3.1 Outline of TX Board

The TX Board consists of Reference Oscillator, Frequency converter, TX PLL circuits, Power amplifier and TX/RX Antenna switching circuits.
Modulated signal of 45 MHz input from MAIN Board is converted to TX frequency of 150 MHz band, and then amplified into 12.5 W in the HPA module.
Reference oscillation frequency of 19.2 MHz is used as the PLL reference frequency for DSC, RX1 and RX2 Boards in addition to TX Board.

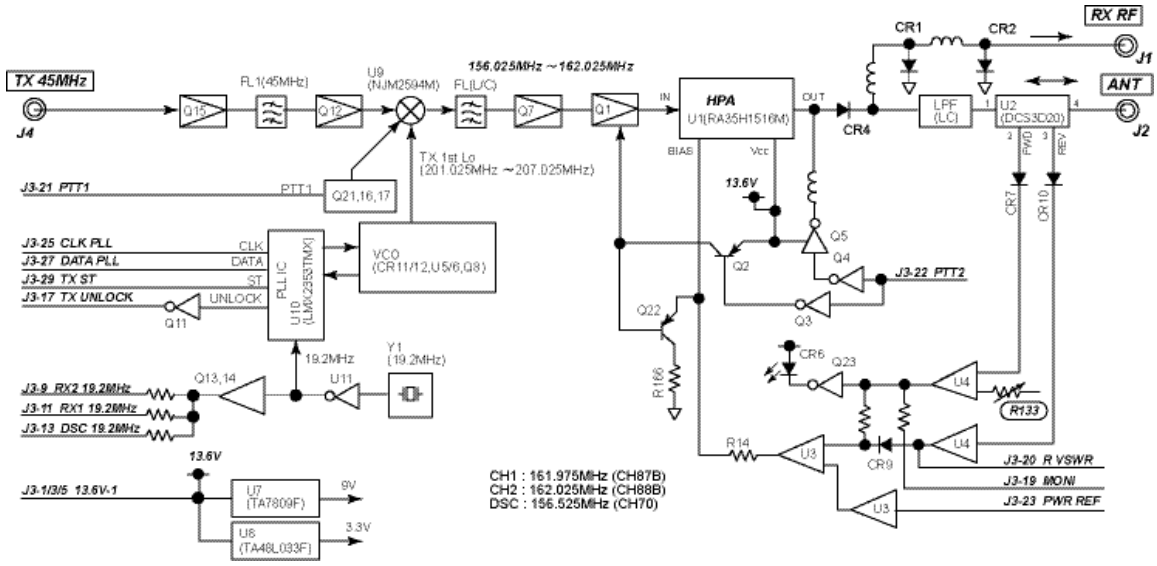


Figure 5.3.2 Block Diagram of TX Board

TX 45 MHz modulated signal coming from the MAIN Board is input to U9 via Q15, FL1 and Q12. FL1 is the BPF (Passband width: ±10 kHz), and reducing the spurious components included in the TX modulated signal.

At U9 TX 45 MHz modulated signal is mixed with the 1st Local oscillation frequency of 201.025 MHz to 207.025 MHz, and then converted to the transmitting frequency of 156.025 MHz to 162.025 MHz. Next stage FL1 is the BPF with the L/C circuits, reducing the spurious components generated by the frequency conversion.

U1 is of HPA module (Gain: 30 dB or more) and holds TX Power output of 12.5 W.

The output of HPA is of the spurious components attenuated by an LPF made of L/C circuits, and is delivered to the VHF ANT terminal via U2: CM Coupler.

Y1 is the 19.2 MHz reference oscillator for the PLL circuits of TX Board, and has an accuracy of ±1 ppm, maintaining the VHF transmitting frequency tolerance within ±500 Hz.

Main Control and Detection signals

R VSWR

Detects the reflected (reverse) wave voltage (REV) from U2.

Activates to transmit the error message “ANT” for announcing the abnormality of the VHF ANT circuits when VSWR reaches 3 or above.

MONI

Detects the forward wave voltage (FWD) from U2.

Activates to transmit the error message “TX” for announcing the TX abnormality when no detecting the voltage during TX operation. The LED CR6 goes on during TX operation.

PWR REF

For setting up the TX Power output to 0, 1, 2 or 12.5 W. The level setting of TX Power output is done by controlling the “BIAS” level of the HPA by using “FWD” signal from U2 and “PWR REF” signal.

TX Power is set to 12.5 W by adjusting the Potentiometer R133 when TX Power selection of 12.5 W is made.

PTT1, PTT2

PTT1 signal controls U9, and PTT2 controls the HPA peripheral circuits. Both are the control signals for switching TX/RX and have the same control timing.

TX UNLOCK

Activates to transmit the error message “TX” for announcing the TX abnormality when the TX PLL circuits operation becomes unlocked.

Distribution of 19.2 MHz Reference Oscillation frequency of Y1

19.2 MHz Reference Oscillation frequency of Y1 in TX Board is distributed to RX1 and RX2 Boards as the reference of the PLL circuits, and to DSC Board as the reference to generate 2nd Local Oscillation.

Frequency adjustment is not necessary for Y1.

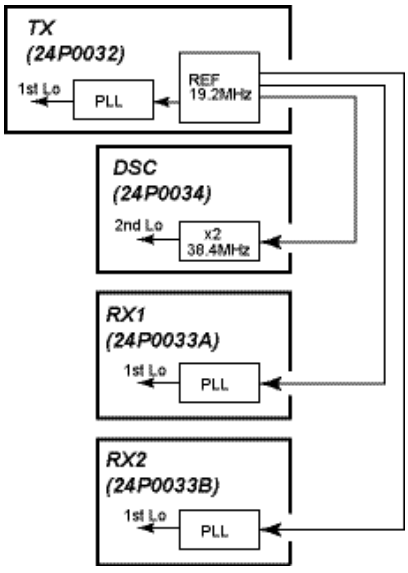


Figure 5.3.3 Distribution of 19.2 MHz reference oscillation frequency

5.3.2 RX-1 Board (24P0033A) and RX-2 Board (24P0033B)

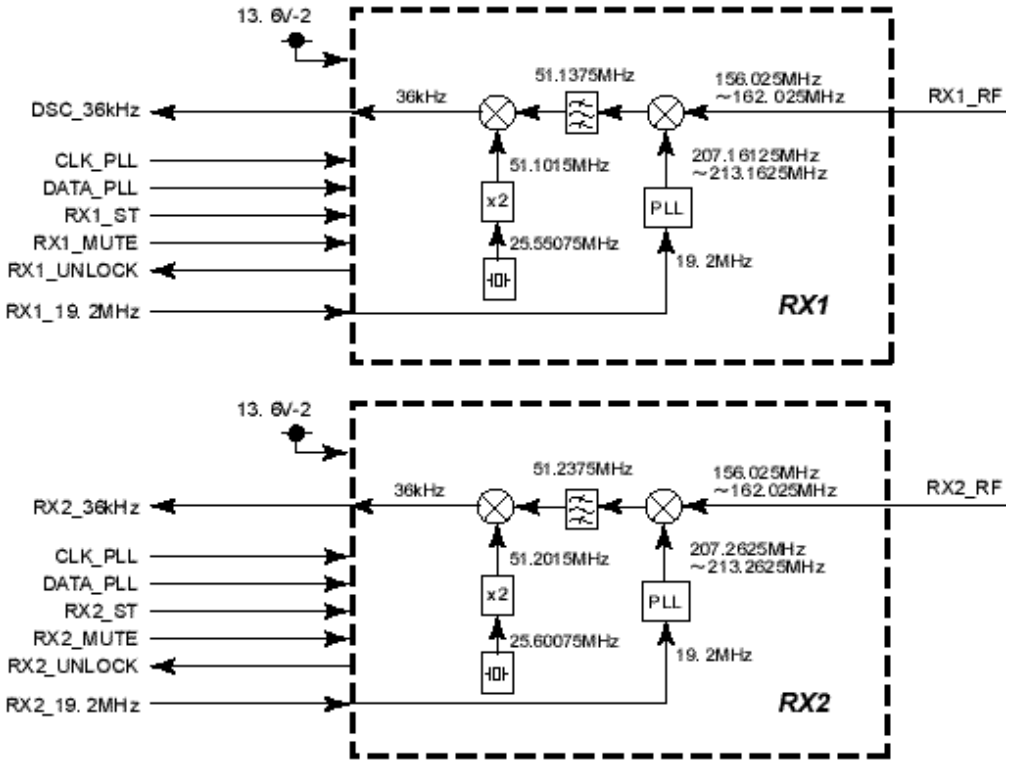


Figure 5.3.4 Outline of RX1 and RX2 Boards

This board converts AIS receiving signal (TDMA) to 36 kHz IF signal. RX1 and RX2 circuits are almost same except for the 1st IF frequency and the 2nd Local oscillation frequency. Receiving frequencies of CH-A are allocated for RX1 Board and CH-B for RX2 Board.

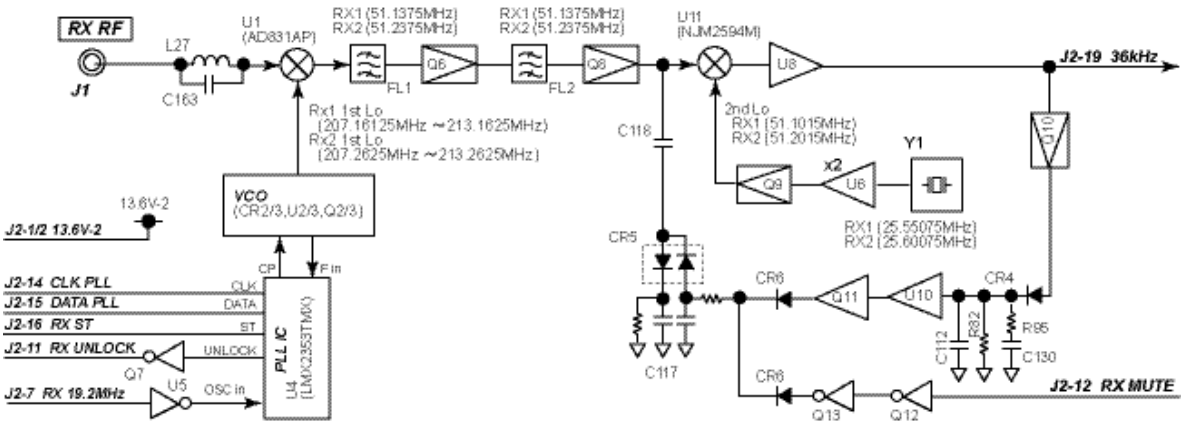


Figure 5.3.5 Block Diagram of RX1 and RX2 Boards

AIS Receiving Signal is fed to U1 via L27 and C163 composing the 200 MHz band-trap filter for eliminating the leakage of the 1st local frequency components toward the “RX RF” terminal.
At U1, 150 MHz band AIS Receiving Signal is mixed with the 1st local frequency of 201 MHz to 213 MHz, and converted to 51 MHz 1st IF signal.
Next stage, FL1 is the BPF (Passband width: ±4.5 kHz), and FL2 is also the BPF (Passband width: ±10 kHz) and reducing the spurious components generated by the frequency conversion.
Y1 is the 25.55075 MHz for RX1 (25.60075 MHz for RX2) reference oscillator, and has an accuracy of ±2.5 ppm.

Y1 output frequency is converted to the 2nd Local oscillation frequency of 51.1015 MHz for RX1 (51.2015 MHz for RX2) by the frequency doubler U6.
At U11 the 51 MHz 1st IF signal is mixed with the 2nd Local frequency and converted to 36 kHz signal fed to MAIN Board. Antenna Input signal of 50 Ω/-107 dBm corresponds to the 36 kHz signal of 600Ω/+60 dBμV.
Q10, CR4, U10 and Q11 compose the AGC circuits. Input signal level fed to U11 is controlled by the CR5 PIN diode operation which is controlled by the AGC output voltage.
AGC operation is activated for the Antenna Input level of -50 dBm or more.

Main Control and Detection signals

RX UNLOCK

Activates to transmit the error message “CH1” and/or “CH2” for announcing the RX abnormality when the RX PLL circuits operation becomes unlocked.

RX MUTE

Not used.

5.3.3 DSC Board (24P0034)

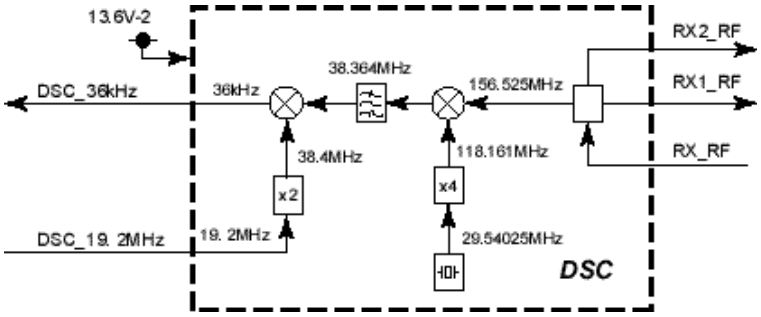


Figure 5.3.6 Outline of DSC Board

CH70 DSC Receiving signal of 156.525 MHz is converted to 36 kHz IF signal.

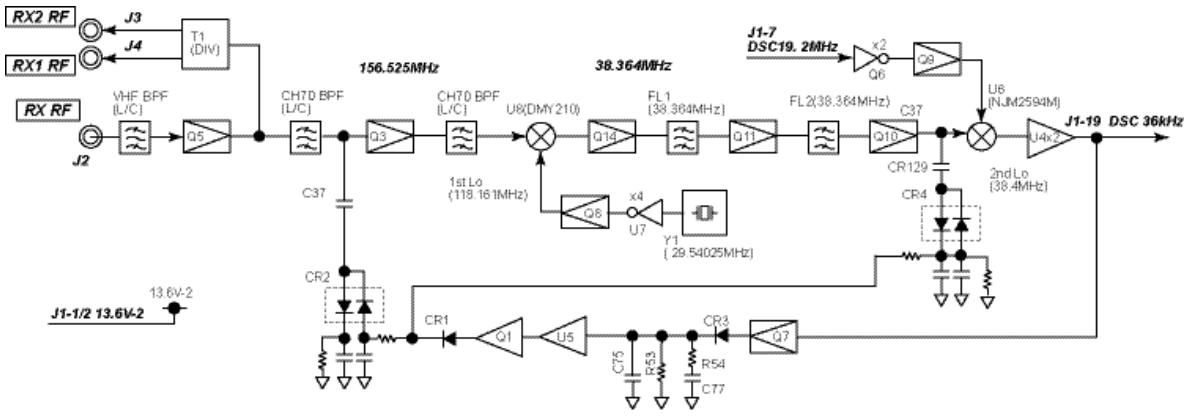


Figure 5.3.7 Block Diagram of DSC Board

CH70 DSC Receiving signal is input to VHF band BPF with the L/C circuits, Q5 and then T1 for distributing the signal to RX1 and RX2 Boards. Q5 is a 6 dB amplifier that compensates the distribution loss of T1.
And also Q5 output signal is fed to U8 via CH70 BPF with L/C circuits and Q8.
Y1 is 29.54025 MHz oscillator having an accuracy of ± 2.5 ppm.
At U7 the oscillated output frequency is multiplied by 4 into the 1st local oscillation frequency of 118.161 MHz.
At U8 CH70 DSC receiving signal is mixed with the 1st local frequency and converted to 38.364 MHz 1st IF signal.
FL1 and FL2 are the BPFs (Passband width: ± 10 kHz) reducing the spurious components generated by the frequency conversion.

DSC 19.2 MHz Signal from TX Board is converted to the 2nd Local oscillation frequency of 38.4 MHz by the frequency doubler Q6.

At U6 the 1st IF signal is mixed with the 2nd Local oscillation frequency and converted to 36 kHz signal fed to MAIN Board. Antenna input signal of 50 Ω/-107 dBm corresponds to the 36 kHz signal of 600 Ω/+60 dBμV.

Q7, CR3, U5 and Q1 compose the AGC circuits having 2 lines controlling for RF and IF circuits. For RF circuits, Input signal level to Q3 is controlled by the CR2 PIN diode operation which is controlled by the AGC output voltage.
For IF circuits, Input signal level to U6 is also controlled by the CR4 PIN diode.
AGC operation is activated for the Antenna Input level of -50 dBm or more.

5.3.4 MAIN Board (26P0035)

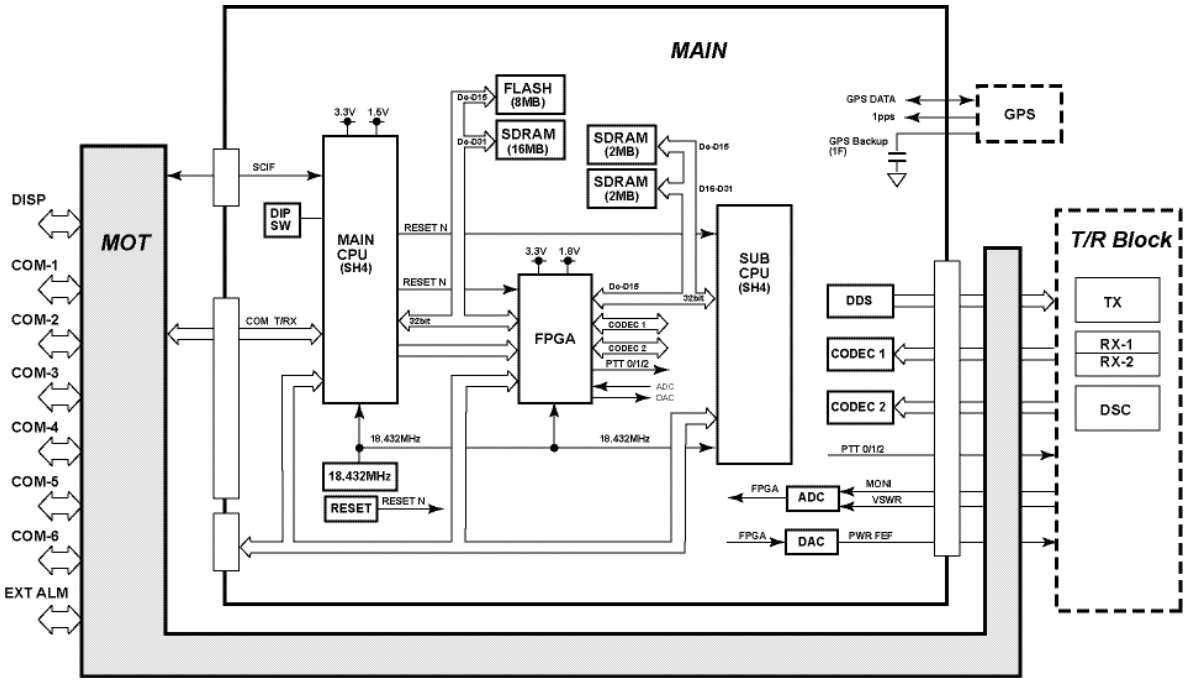


Figure 5.3.8 Block Diagram of MAIN Board

This board contains MAIN CPU, SUB CPU and peripheral circuits. Main functions are as follows:

MAIN CPU

For controlling and processing of AIS (DSC) communications system and I/O interfacing.

SUB CPU

For the TDMA/DSC signal processing and the analog-interfacing with the radio parts.

FPGA

For the asynchronous serial communication with the external equipment, the timing control of the AIS(TDMA) communications, the TDMA slot forming, and interfacing with the CODEC I/O, DDS Output, MAIN CPU and SUB CPU.

DDS

45 MHz GMSK modulated signal of AIS (TDMA) or FM modulated signal (DSC) generated by SUB CPU are fed to TX Board by using DDS.

CODEC 1

36 kHz AIS(TDMA) receiving signals are input from RX1 and RX2 Boards, AD-converted, fed to SUB CPU via FPGA, and demodulated.

CODEC 2

36 kHz DSC receiving signal is input from DSC Board, AD-converted, fed to SUB CPU via FPGA, and demodulated.

5.3.5 MOT Board (24P0036)

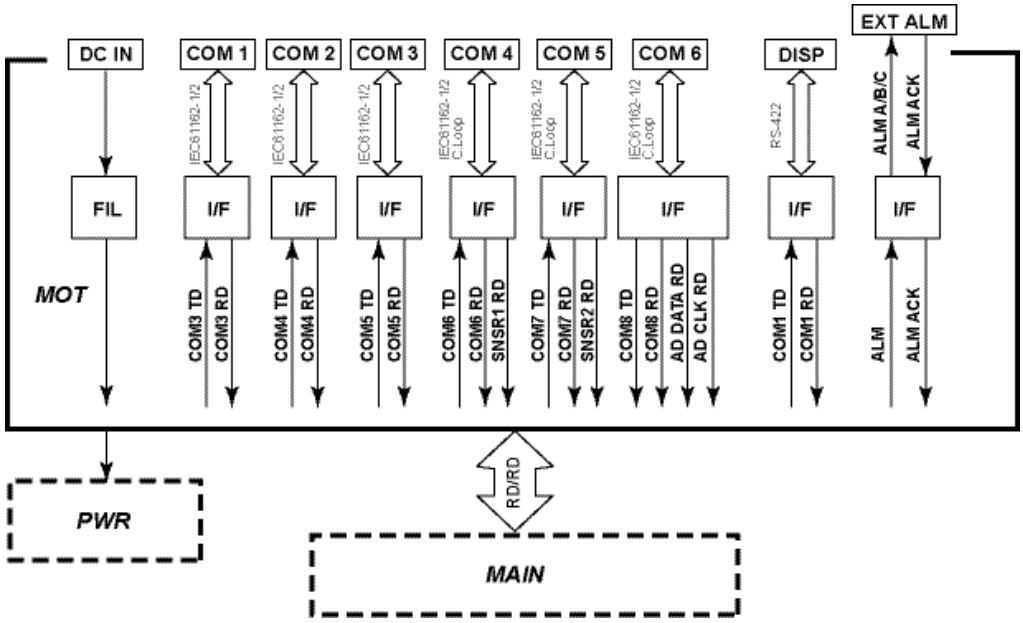


Figure 5.3.9 Block Diagram of MOT Board

The following figure shows the I/F of COM1 Port. The I/F of other ports consists of the same circuits. For example, the I/O circuits of COM1 Port are electrically separated by U2 for complying with the Standard IEC 61162-2 and for communicating with the external equipment.

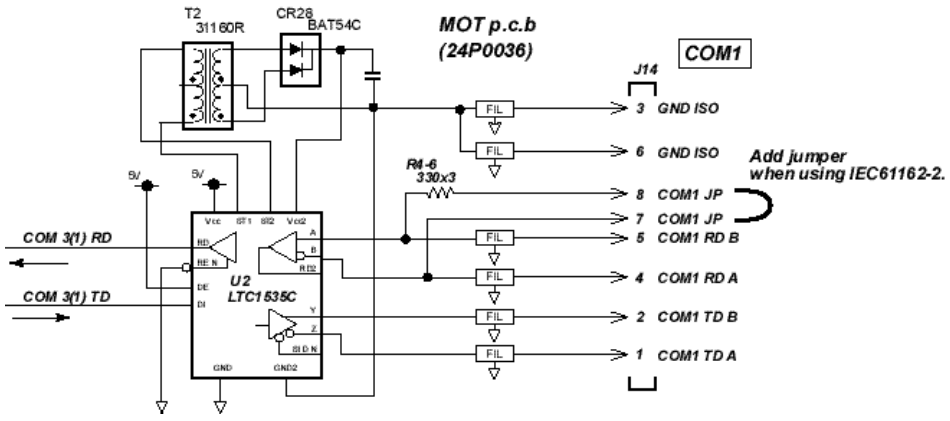


Figure 5.3.10 I/F of COM1 Port

6 Operator's Manual Incl. Circuit Diagrams (FCC Rule 2.1033)

(See separate covers)

Attachment A LIST OF MEASURING/TEST EQUIPMENT

No.	Instrument/Ancillary	Type	Serial No.	Manufacturer	Calibration Due date
1	Spectrum analyzer	R3267	121001335	ADVANTEST	12.2005
2	Frequency counter	R5362A	13720092	ADVANTEST	08.2005
3	Digital multimeter	E2378A	2943J06324	HP	02.2005
4	Attenuator (30 dB)	8498A	1801A02471	HP	09.2005
5	DC Current meter	201137	83AA0210	YOKOGAWA	02.2005
6	Power supply	PAN55-20	AK003307	KIKUSUI	- - - - - -
7	Personal computer	Endeavor NT-1400	139000724	EPSON DIRECT	- - - - - -
8	EMI Test Receiver	ESCS30	826457/021	R&S	08.2005
9	Bi-conical antenna	VBA6106A	1296	Schaffner	08.2006
10	Log periodic antenna	UHALP9107	8411059	Schwarzbeck	08.2006
11	Reference dipole antenna	3121C	1339/1393	Electro-Metrics	08.2007
12	Signal generator	8648B	3847M01057	Agilent	08.2005