

2.4 Test Data

ENGINEERING TEST REPORT ON RA53 KODEN MARINE RADAR

APPLICANT: KODEN ELECTRONICS CO., LTD
EQUIPMENT: MARINE RADAR
TEST SITE: UENOHARA-FACTORY OF KODEN ELECTRONICS CO., LTD
TEST DATE: July in 2001
To: Whom it concern

Good engineering practice were followed while performing test for FCC type acceptance application, and the result are accurate.

Respectfully,

Report Prepared by:

-----*S. Iwasawa*-----

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Engineer of Design Section

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H.Iida
Manager
Design Section

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Data for the acceptance of the Kodan Marine Radar Type RA53

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Foreword

The following information is being submitted in compliance with paragraphs 2.983, 2.985, 2.987, 2.989, 2.991, 2.993 and 2.995 as provided by part 83 of the FCC Rules and Regulations for Type Acceptance of the Kodan Marine Radar, Type RA53.

All testing was performed by the Kodan Electronics Co., Ltd.

Uenohara Factory, 5278, Uenohara, Uenohara-Machi, Kitatsuru-Gun, Yamanashi, 409-0112, Japan.

STANDARD TEST CONDITIONS and ENGINEERING PRACTICES

Except as noted herein, the following conditions and procedure were observed during the testing:

ROOM TEMPERATURE	= 25 +/- 5 Degree-Centigrade
ROOM HUMIDITY	= 20 to 50%

Prior to testing, the E.U.T. was tuned up in accordance with the manufacturer's alignment procedures. All external gain controls were maintained at the position of maximum and/or optimum gain throughout the testing.

MEASUREMENT DATA, unless otherwise noted, are WORST CASE measurements.

Exhibit 1

RF POWER OUTPUT (2.985)

Type of Transmission: P0N
Type of Modulation: Pulse
Frequency Band: 9410 MHz +/- 30 MHz
Frequency Source: Fixed Cavity Resonator
Pulse Rate: 500 Hz to 2000 Hz, Selectable as a function of Range
Pulse Width: 0.08 us to 1.0 us, Selectable as a function of Range

TEST EQUIPMENT

	<u>Equipment</u>	<u>Manufacturer</u>	<u>Model</u>
1.	X-Band Directional Coupler	Hewlett-Packard	X752D
2.	Variable Attenuator	Hewlett-Packard	X382A
3.	Power Meter	ANRITSU	ML83A
4.	Crystal Detector	Hewlett-Packard	423B
5.	Oscilloscope	TEKTRONIX	2445
6.	Frequency meter	Hewlett-Packard	X532B
7.	X-Band Dummy Load	NIHON KOSHUHA	WDL095

TEST PROCEDURE

The Marine Radar is capable of generating the following pulses:

80ns x 2000Hz, 300ns x 1500Hz, 0.6us x 1000Hz, 1.0us x 500Hz

The Power output for each of these combinations was measured by using the following procedure:

- (1) Set up the equipment as shown in Fig.1.
- (2) Record reading of Power Meter.
- (3) Calculate mean power according to attenuation.
- (4) Measure and record pulsewidth and P.R.F. by using oscilloscope and frequency counter.
- (5) Calculate peak power as follows:

$$P0 = Pm / (Fr \times T)$$

P0 : Peak Power, Pm : Mean Power, Fr : P.R.F.*

T : Pulse Width, * P.R.F. : Pulse Repetition Frequency

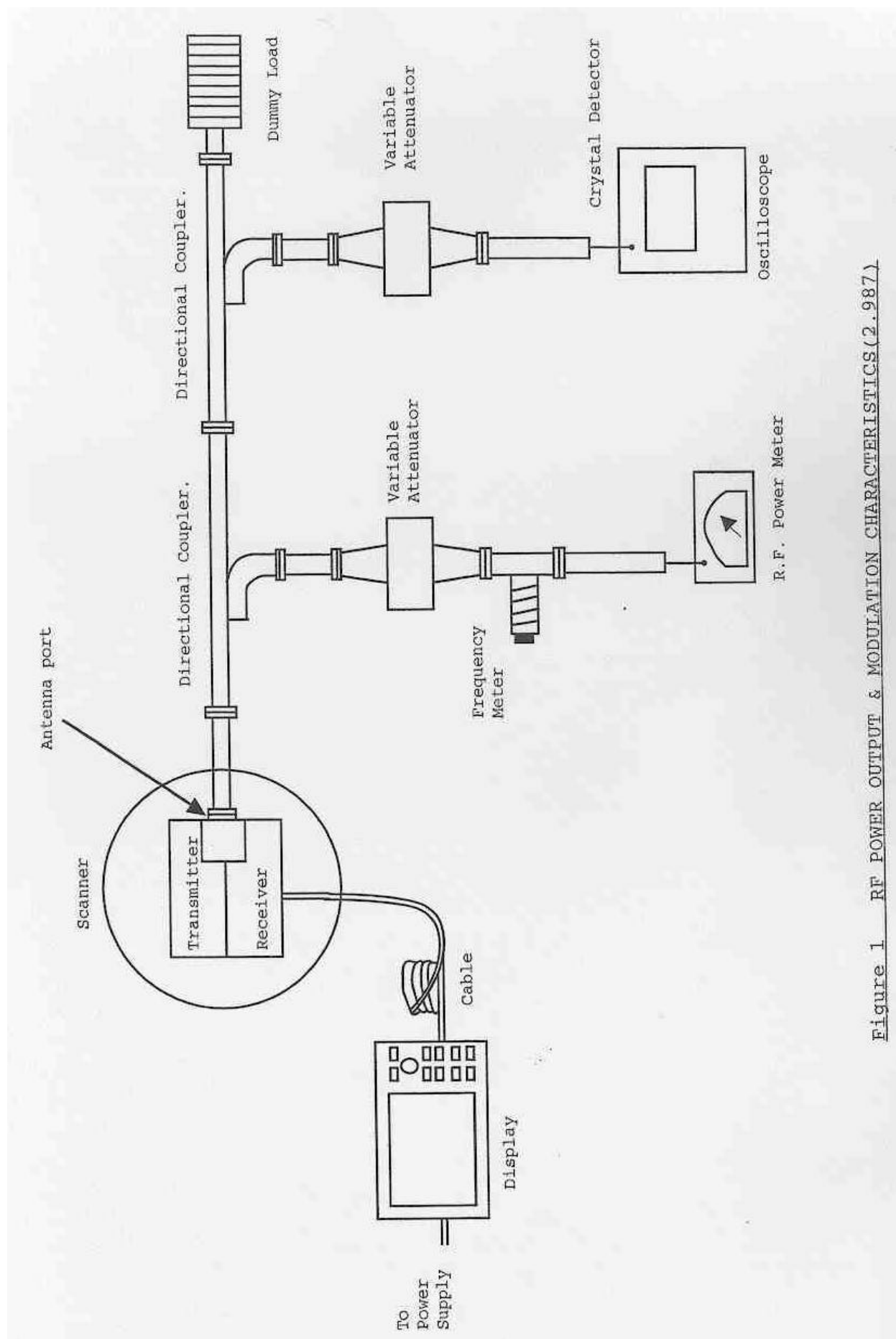


Figure 1 RF POWER OUTPUT & MODULATION CHARACTERISTICS(2.987)

Exhibit 1

TEST RESULT

<u>Transmit Pulse width and P.R.F.</u>	<u>Measured Mean Power</u>	<u>Measured Pulse width</u>	<u>Measured P.R.F.</u>	<u>Calculated Peak power Output</u>
80ns X 2000Hz	0.97W	94ns	2020Hz	5.1kW
300ns X 1500Hz	1.95W	252ns	1488Hz	5.2kW
600ns X 1000Hz	2.67W	508ns	992Hz	5.3kW
1000ns X 500Hz	2.65w	1007ns	496	5.3kW

Exhibit 2

MODULATION CHARACTERISTICS (2.987)

Type of Transmission: P0N
Type of Modulation: Pulse
Frequency Band: 9410 MHz +/- 30MHz
Frequency Source: Fixed Cavity Resonator
Pulse Rate: 500 to 2000 Hz, Selectable as a function of Range
Pulse Width: 0.08 us to 1.0 us, Selectable as a function of Range

TEST EQUIPMENT

	<u>Equipment</u>	<u>Manufacturer</u>	<u>Model</u>
1.	X-Band Directional Coupler	Hewlett-Packard	X752D
2.	Variable Attenuator	Hewlett-Packard	X382A
3.	Power Meter	ANRITSU	ML83A
4.	Crystal Detector	Hewlett-Packard	423B
5.	Oscilloscope	TEKTRONIX	2445
6.	Frequency meter	Hewlett-Packard	X532B
7.	X-Band Dummy Load	NIHON KOSHUHA	WDL095

TEST PROCEDURE

The Marine Radar is capable of generating the following pulses:

0.08 us x 2000 Hz, 0.3 us x 1500 Hz, 0.6 us x 1000 Hz, 1.0 us x 500 Hz

The Modulation characteristics for each of these combinations was measured by using the following procedure:

- (1) Set up the equipment as shown in Fig.1.
- (2) Obtain a convenient display on the oscilloscope and adjust peak to the suitable cursor line.
- (3) Decrease variable attenuator 3 dB, and measure the pulse width at the cursor line.
- (4) Photograph the oscilloscope display.
- (5) Note and record the Frequency Readout of the counter as "Pulse Repetition Frequency".

Exhibit 2

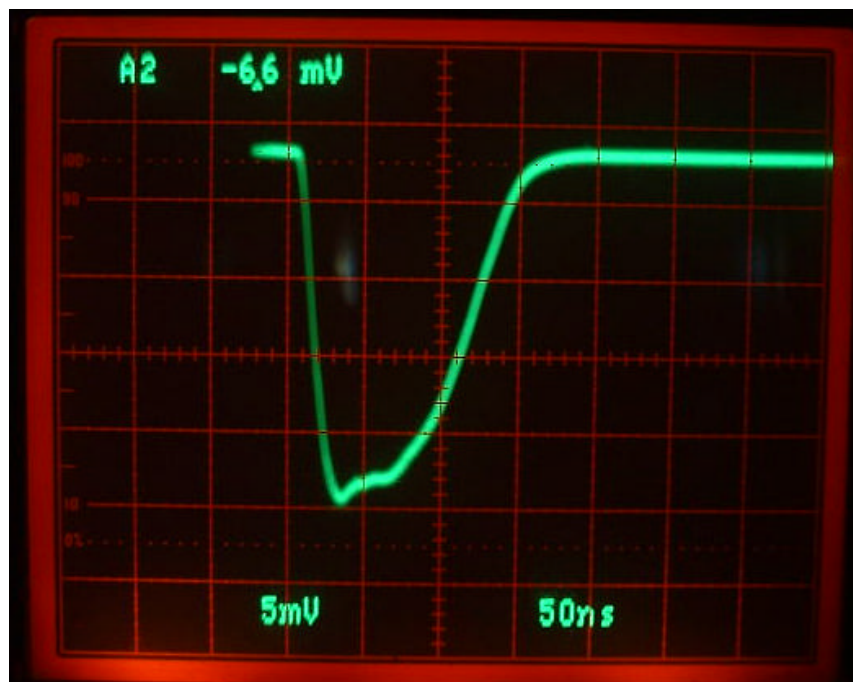
TEST RESULT

Modulation Characteristics (Detected Pulse)

(1) Short Pulse

Pulse width (-3 dB) = 0.094 μ s

Pulse repetition Frequency = 2020 Hz



50 ns/div.

Exhibit 2

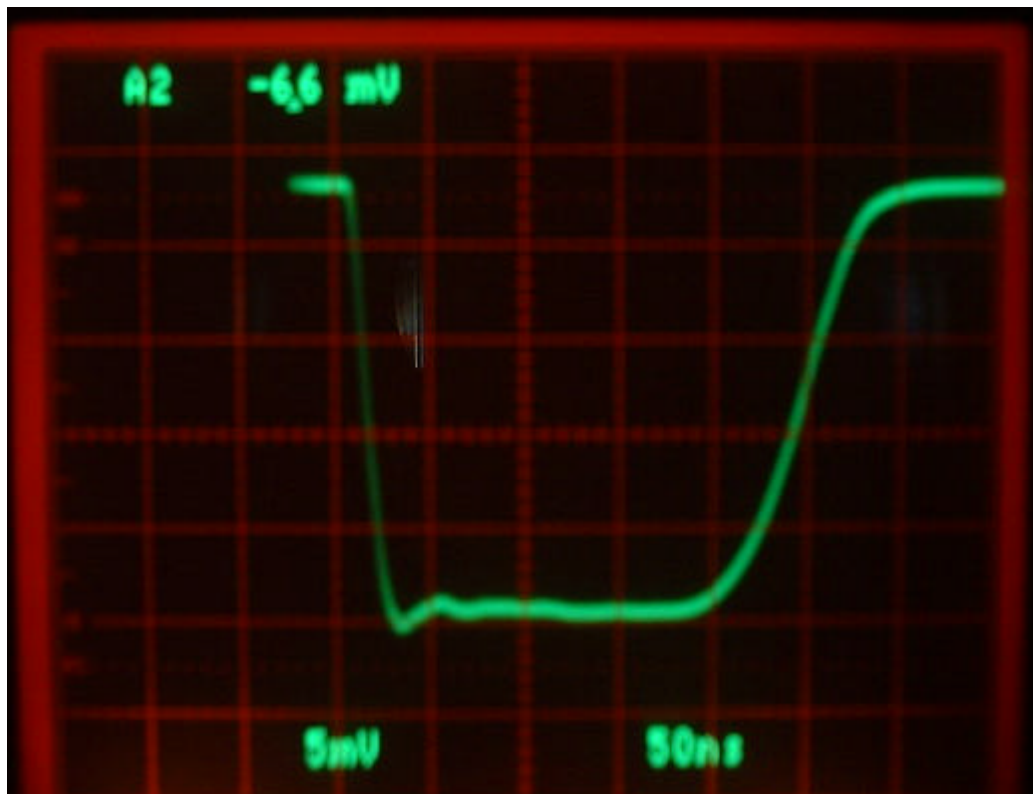
TEST RESULT

Modulation Characteristics
(Detected Pulse)

(2) Middle Pulse-1

Pulse width (-3 dB) = 0.252 μ s

Pulse repetition Frequency = 1488 Hz



50 ns/div.

Exhibit 2

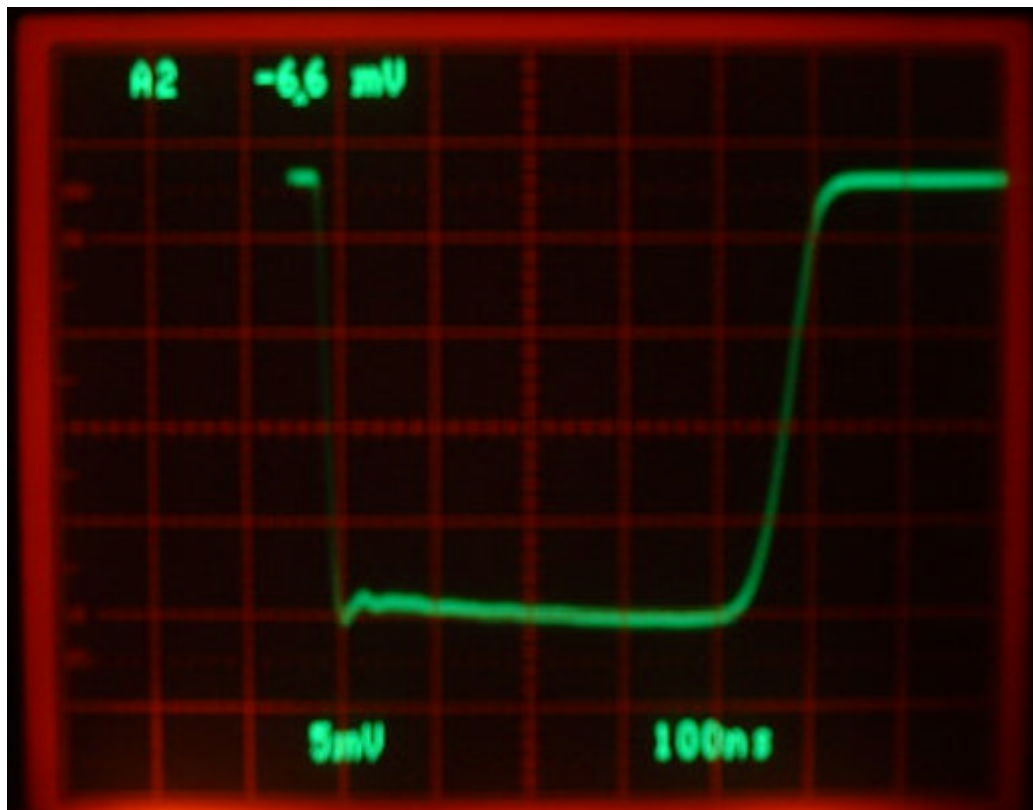
TEST RESULT

Modulation Characteristics
(Detected Pulse)

(3) Middle Pulse-2

Pulse width (-3 dB) = 0.508 μ s

Pulse repetition Frequency = 992 Hz



100 ns/div.

Exhibit 2

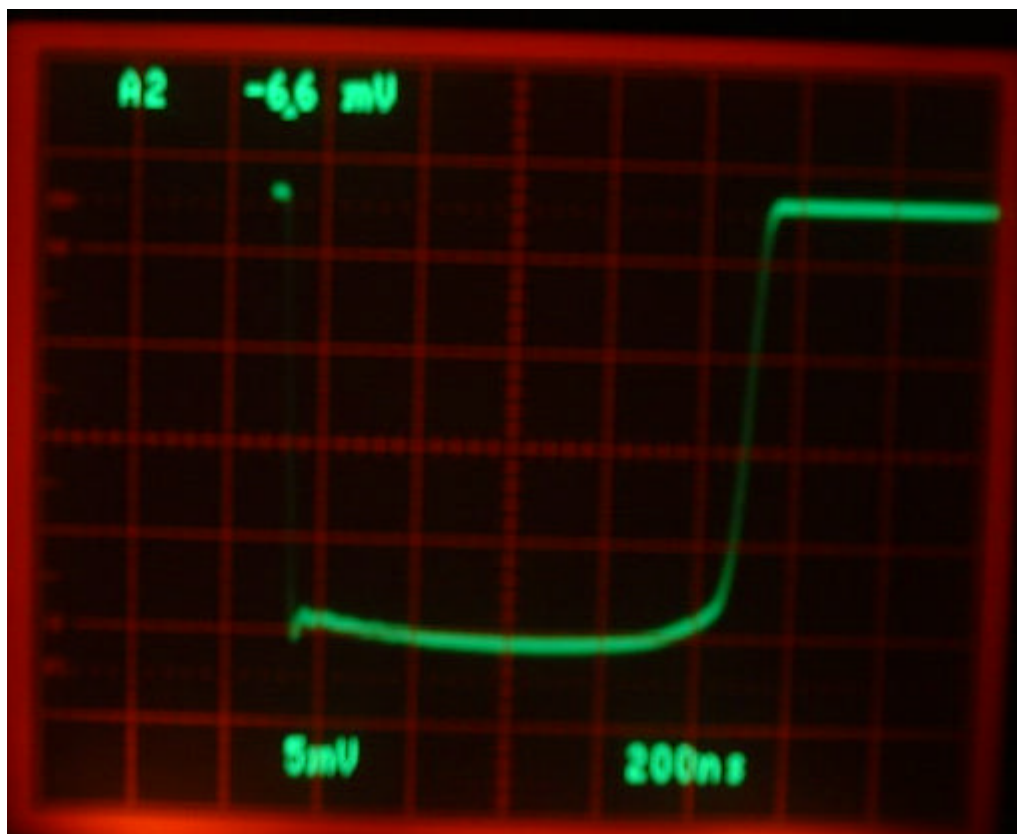
TEST RESULT

Modulation Characteristics
(Detected Pulse)

(4) Long Pulse

Pulse width (-3 dB) = 1.01 μ s

Pulse repetition Frequency = 496 Hz



200 ns/div.

Exhibit 3

OCCUPIED BANDWIDTH (2.989)

Type of Transmission: P0N
Type of Modulation: Pulse
Frequency Band: 9410 MHz +/- 30 MHz
Frequency Source: Fixed Cavity Resonator
Pulse Rate: 500 Hz to 2000 Hz, Selectable as a function of Range
Pulse Width: 0.08 us to 1.0 us, Selectable as a function of Range

TEST EQUIPMENT

	<u>Equipment</u>	<u>Manufacturer</u>	<u>Model</u>
1.	X-Band Directional Coupler	Hewlett-Packard	X752D
2.	Variable Attenuator	Hewlett-Packard	X382A
3.	X-Band Dummy Load	NIHON KOSHUHA	WDL095
4.	Spectrum Analyzer	Hewlett-Packard	8566B

TEST PROCEDURE

The Marine Radar is capable of generating the following pulses:

0.08 us x 2000 Hz, 0.3 us x 1500 Hz, 0.6 us x 1000 Hz, 1.0 us x 500 Hz

The occupied bandwidth for each of these combinations was measured by using the following procedure:

- (1) Connect the equipment as shown in Fig.3.
- (2) Adjust center frequency, span reference level of spectrum analyzer and attenuator if necessary, such that the display nearly fills the screen.
- (3) Measure and record spectrum and bandwidth

The bandwidth is calculated so that the total powers lower than the lowest frequency in the bandwidth and higher than the highest frequency in the bandwidth occupy 0.5% of the transmitted total power respectively.

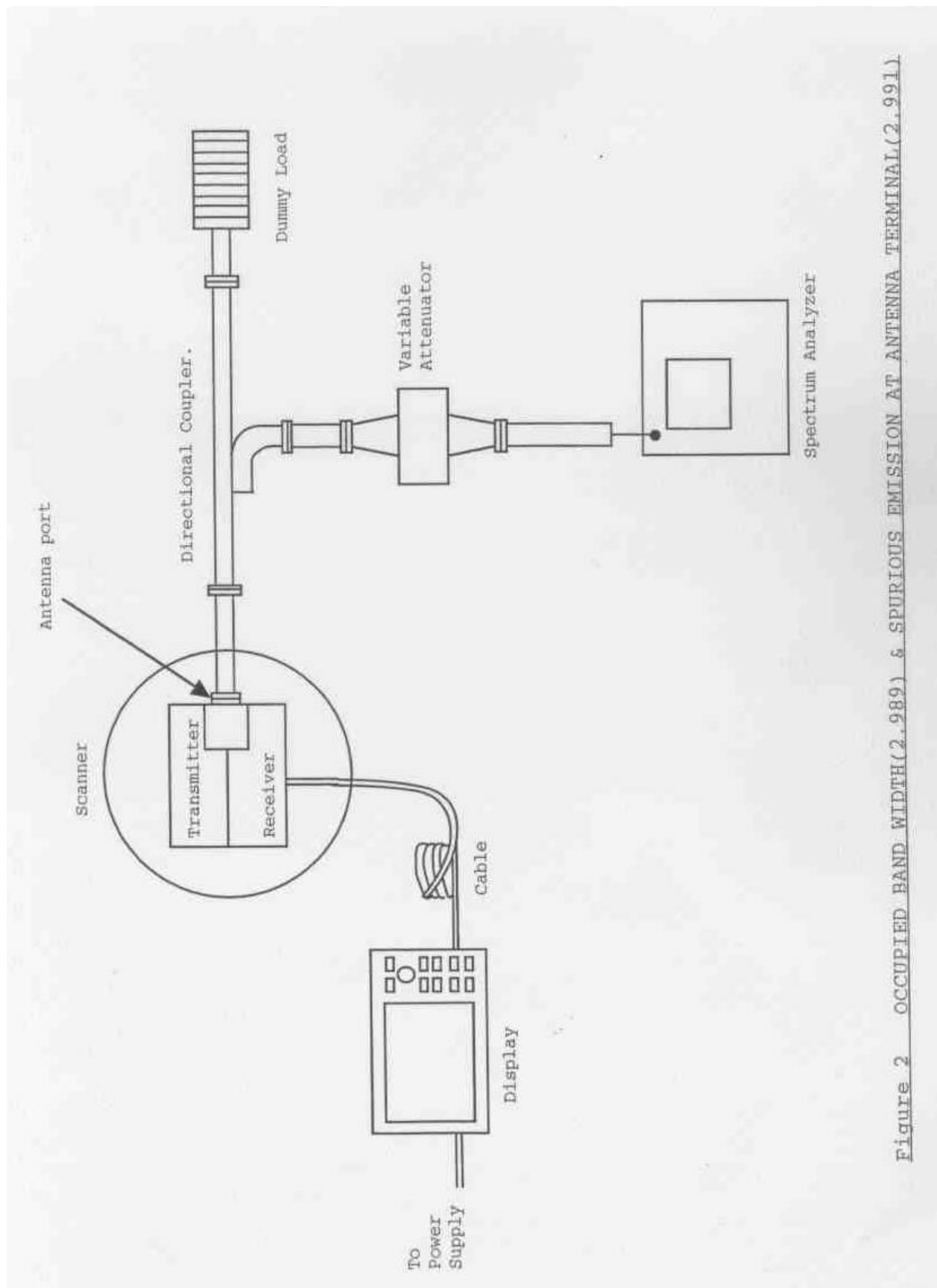
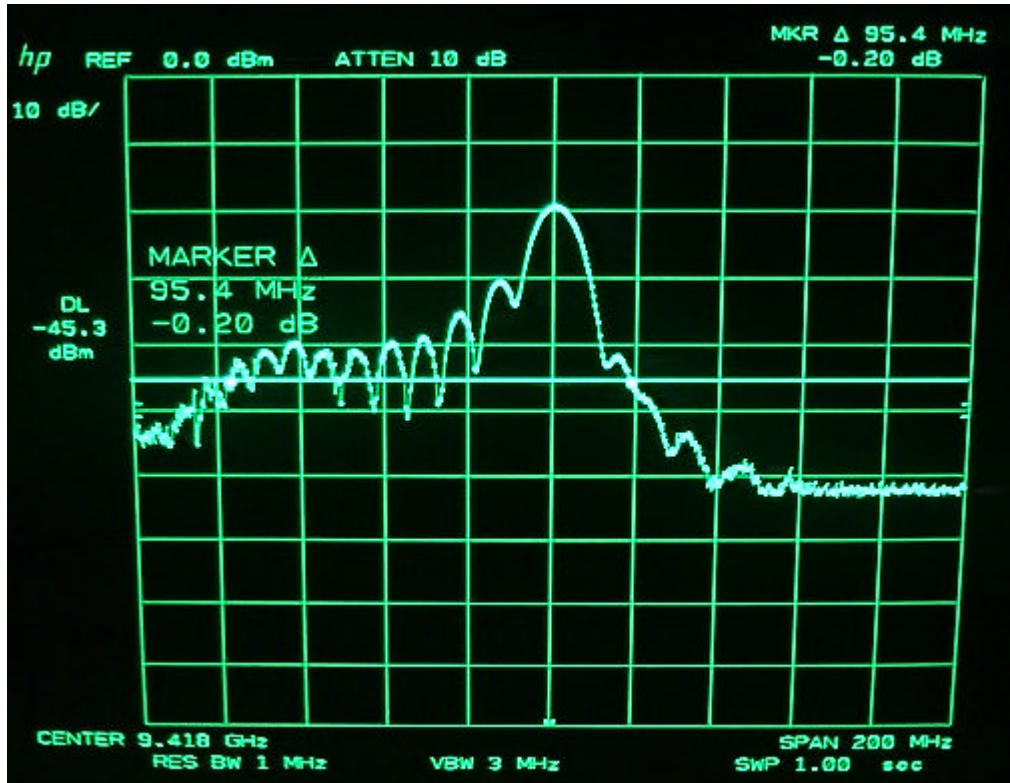


Figure 2 OCCUPIED BAND WIDTH(2.989) & SPURIOUS EMISSION AT ANTENNA TERMINAL(2.991)

Exhibit 3

TEST RESULT

Transmission Spectrum of 0.08 us X 2000 Hz



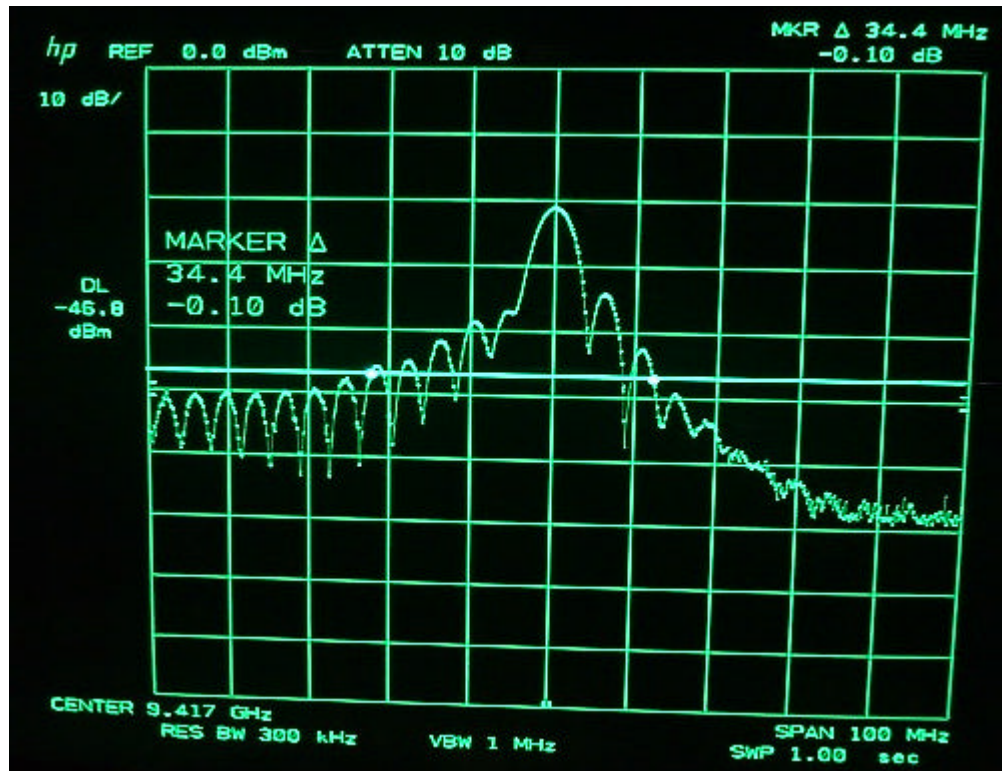
Center frequency	:	9.418GHz
Frequency span	:	200 MHz/div.
Level	:	10 dB/div.
Resolution band width	:	1 MHz/div.
Video band width	:	3 MHz/div.
Sweep time	:	1.0 sec

Occupied band width : 95.4 MHz

Exhibit 3

TEST RESULT

Transmission Spectrum of 0.3 us X 1500 Hz



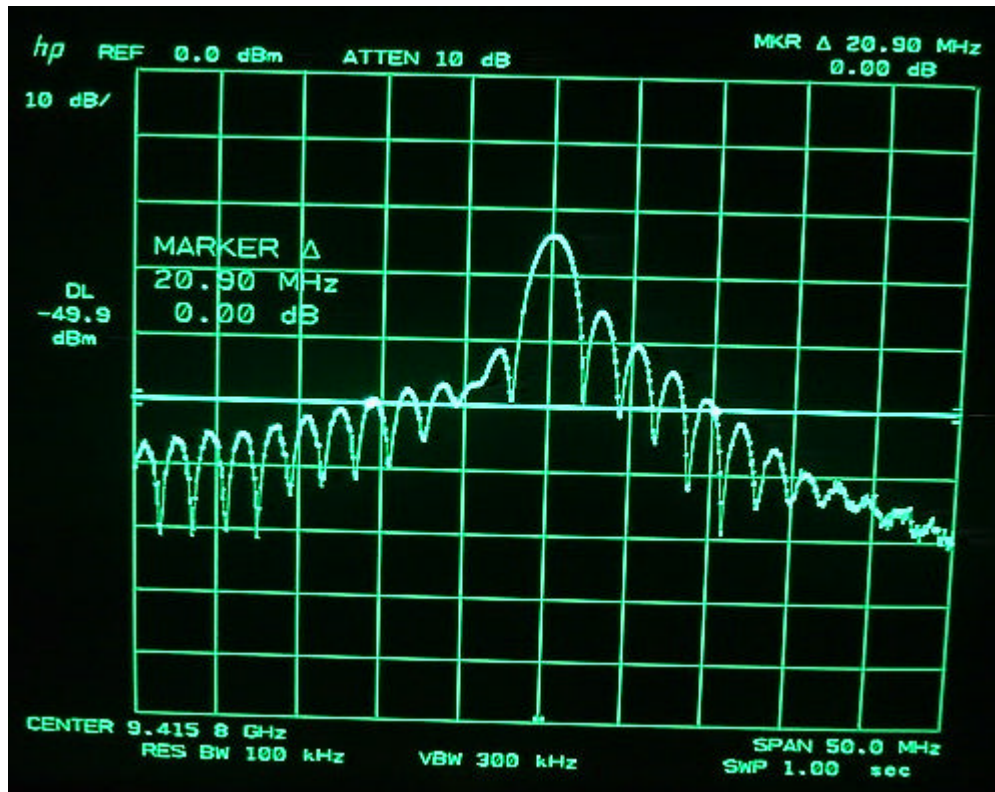
Center frequency	:	9.417GHz
Frequency span	:	100 MHz/div.
Level	:	10 dB/div.
Resolution band width	:	300 kHz/div.
Video band width	:	1 MHz/div.
Sweep time	:	1.0 sec/div.

Occupied band width	:	34.4 MHz
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Exhibit 3

TEST RESULT

Transmission Spectrum of 0.6 us X 1000 Hz



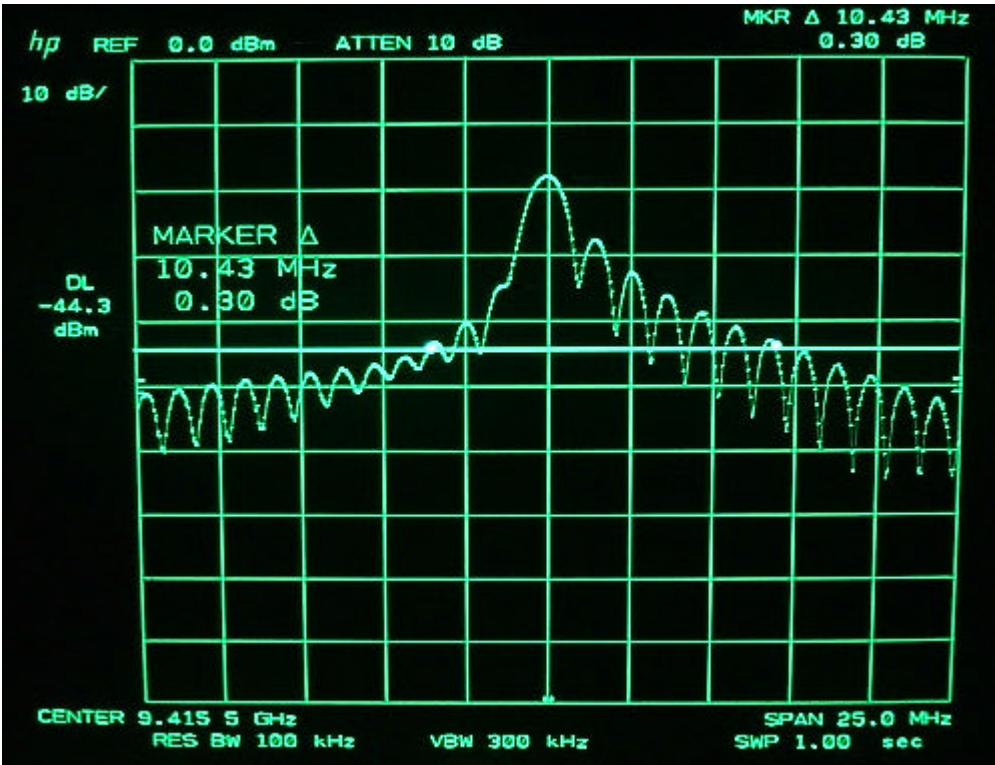
Center frequency	:	9.415GHz
Frequency span	:	50 MHz/div.
Level	:	10 dB/div.
Resolution band width	:	100 kHz/div.
Video band width	:	300 kHz/div.
Sweep time	:	1.0 sec/div.

Occupied band width : 20.9 MHz

Exhibit 3

TEST RESULT

Transmission Spectrum of 1.0 us X 500 Hz



Center frequency	:	9.415GHz
Frequency span	:	25 MHz/div.
Level	:	10 dB/div.
Resolution band width	:	100 kHz/div.
Video band width	:	300 kHz/div.
Sweep time	:	1.0 sec/div.

Occupied band width : 10.4 MHz

Exhibit 3

TEST RESULT

Pulse x rate	Bandwidth
0.08 us X 2000 Hz	95.4 MHz
0.3 us X 1500 Hz	34.4 MHz
0.6 us X 1000 Hz	20.9 MHz
1.0 us X 500 Hz	10.4 MHz

Exhibit 4

SPURIOUS EMISSION AT ANTENNA TERMINAL (2.991)

Type of Transmission: P0N
Type of Modulation: Pulse
Frequency Band: 9410 MHz +/- 30MHz
Frequency Source: Fixed cavity resonator
Pulse Rate: 500 Hz to 2000 Hz, Selectable as a function of Range
Pulse Width: 0.08 us to 1.0 us, Selectable as a function of Range

TEST EQUIPMENT

	<u>Equipment</u>	<u>Manufacturer</u>	<u>Model</u>
1.	Directional Coupler	Hewlett-Packard	X752D
2.	Variable Attenuator	Hewlett-Packard	X382A
3.	Spectrum Analyzer	Hewlett-Packard	8566B

TEST PROCEDURE

The Marine Radar is capable of generating the following pulse:

0.08 us x 2000 Hz, 0.3 us x 1500 Hz, 0.6 us x 1000 Hz, 1.0 us x 500 Hz

The spurious emission at the antenna terminal for each of these combinations were measured by using the following procedure:

- (1) Set up the equipment as shown in Fig.2
- (2) At first, the 0 dB reference level for the main Pulse was established.
- (3) The spectrum was searched over the range 0 to 22 GHz using spectrum analyzer.

NOTE

The FCC limit is calculated as follows:

Spurious limit (L)=43 + 10 Log P, in dB below the transmitter output power, where P is the mean power output in watts (See Exhibit 1).

Exhibit 4

TEST RESULT

9410 MHz	0 dB
2nd	-65 dB

All other spurious and harmonics up to 22 GHz were found to be than -70dB below maximum mean power, and/or 17.8 dB below limit.

Limit: $-(43 + 10 \log 2.65) = -47.2 \text{ dB}$

mean power: 2.65 watts at 1.0 us X 500 Hz.

Exhibit 5

SPURIOUS EMISSIONS FIELD STRENGTH (2.993)

Type of Transmission: P0N
Type of Modulation: Pulse
Frequency Band: 9410 MHz +/- 30 MHz
Frequency Source: Fixed cavity resonator
Pulse Rate: 500 Hz to 2000 Hz, Selectable as a function of Range
Pulse Width: 0.08 us to 1.0 us, Selectable as a function of Range

TEST EQUIPMENT

	<u>Equipment</u>	<u>Manufacturer</u>	<u>Model</u>
1.	EMI Measuring system	Anritsu	ME2601A
2.	Antenna(10 kHz to 30 MHz)	AIL TECH	95010-1
3.	Antenna(30 MHz to 200 MHz)	EMCO	3104(Biconical)
4.	Antenna(200 MHz to 1 GHz)	EMCO	3164(Log-Periodic)
5.	Antenna(1 GHz to 23 GHz)	EMCO	3115(Double Ridged Guide)
6.	Spectrum analyzer	Anritsu	MS710C
7.	Mains Network	Anritsu	MN424B
8.	Pre Amplifier	8447D	Hewlett-Packard

CALIBRATION

All test equipment is calibrated and maintained by Koden Quality Assurance Dept.

TEST PROCEDURE

The Marine Radar is capable of generating the following pulses:

80ns x 2000Hz, 300ns x 1500Hz, 0.6us x 1000Hz, 1.0us x 500Hz

The spurious emissions field strength for each of these combination was measured using following procedure.

- (1) Set up the equipment as shown in Fig.3.
- (2) Using the automatic EMI Measuring System, measure and record the spurious radiated emissions from 150 kHz to 1 GHz. The computer in the Measuring system program automatically adds antenna factors and cable losses to the raw voltage measurements to obtain field strength units.
- (3) Set up the equipment as shown in Fig.4.
- (4) Measure and record spurious radiated emissions from 1 GHz to 18GHz (antenna

- limit). Observe and note any emissions from 1GHz to 18 GHz.
- (5) Calculate the field strength of spurious emissions from 1 GHz to 18 GHz by add in antenna factor (including cable loss) to the observed reading. The 3115(Double Ridged Guide) antenna gain and cable loss is calculated by the Table-5.1 below.
- (6) Set up the equipment as shown in Fig.5.
- (7) Using the spectrum analyzer, measure and record terminal interference voltage from 10 kHz to 30 MHz.

Table-5.1 3115(Double Ridged Guide) Antenna Gain and Cable Loss

Frequency(GHz)	3115 Antenna Gain(dBi)	Cable Loss(dB/m)	Wave Length(m)
1 - 2	8.2	0.4	0.20
2 - 3	8.9	0.5	0.12
3 - 4	9.0	0.7	0.09
4 - 5	10.2	0.8	0.07
5 - 6	8.8	0.9	0.05
6 - 7	10.9	1.0	0.04
7 - 8	10.1	1.1	0.04
8 - 9	10.7	1.2	0.03
9 - 10	11.3	1.2	0.03
10 - 11	11.1	1.3	0.03
11 - 12	11.9	1.4	0.02
12 - 13	13.5	1.5	0.02
13 - 14	12.0	1.6	0.02
14 - 15	12.6	1.6	0.02
15 - 16	15.8	1.7	0.02
16 - 17	15.8	1.8	0.02
17 - 18	11.0	1.8	0.02

Note

Spurious emission limit is calculated as follows:

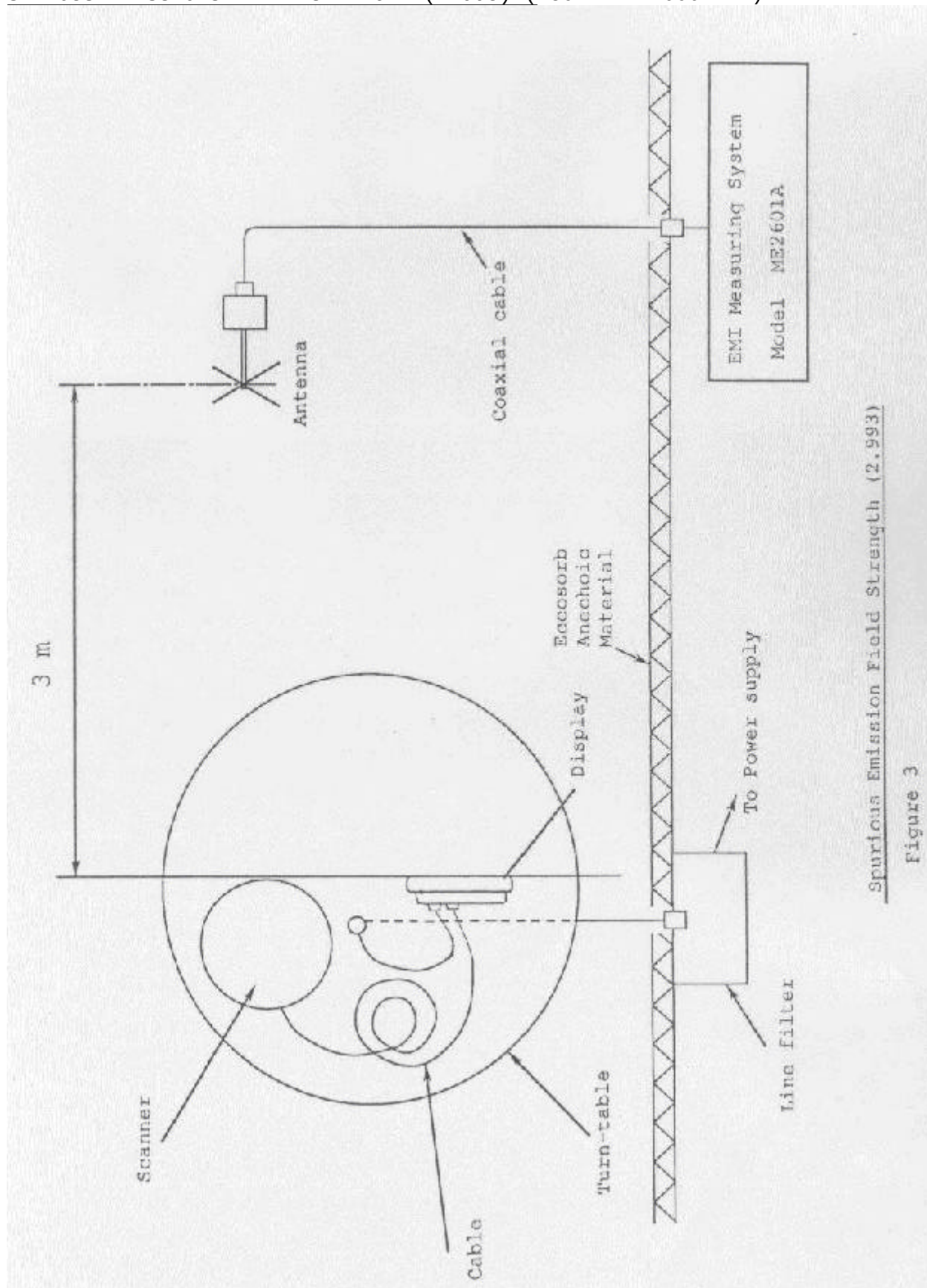
Limit (L) = $43 + 10 \log P$, in dB below the fundamental field strength, where P is the mean power output in watts (See Exhibit 1).

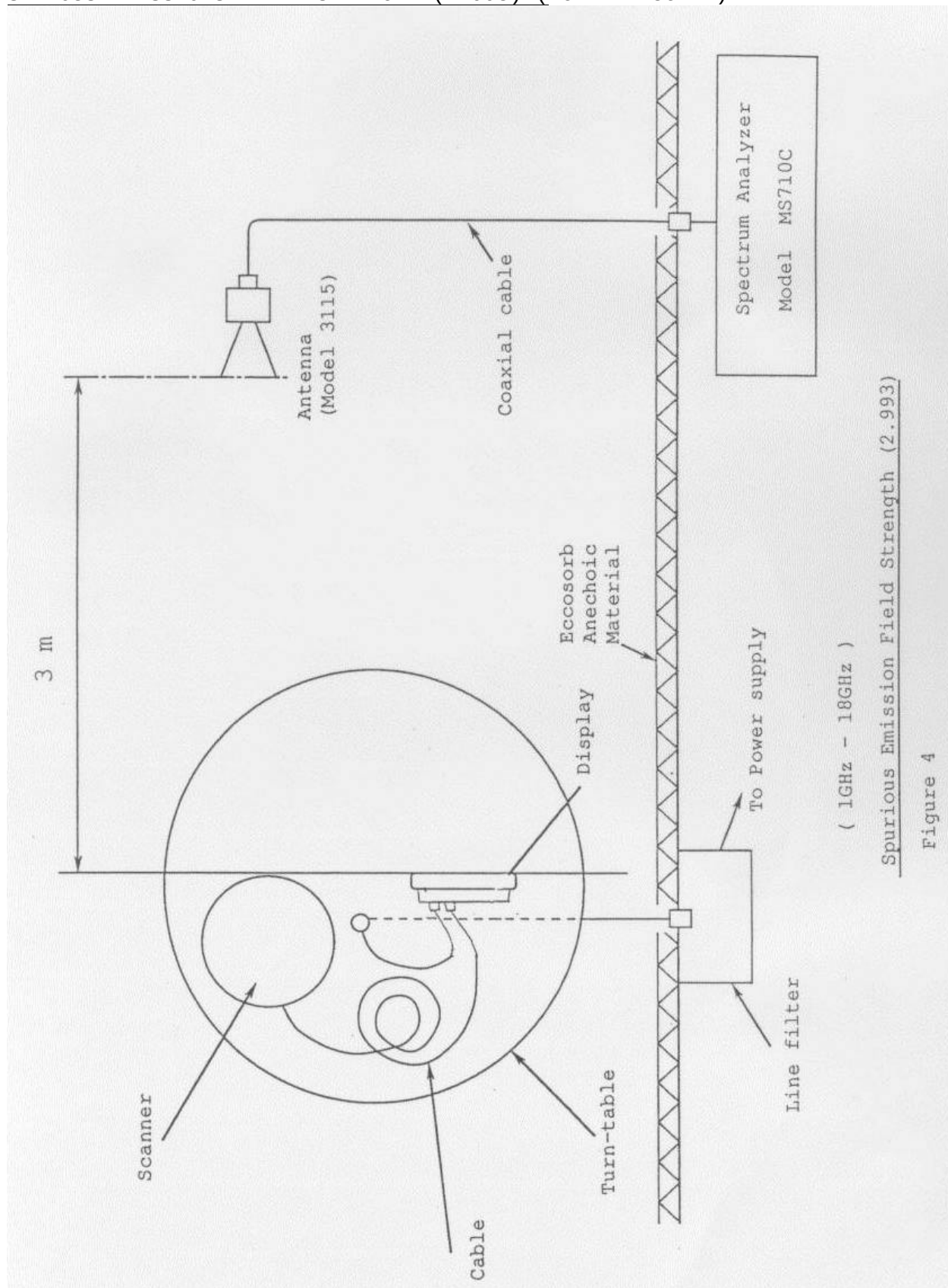
Limit: $-(43 + 10 \log 2.65) = -47.2 \text{ dB}$

mean power: 2.65 watts at 1.0 us X 500 Hz

Test result(All data)

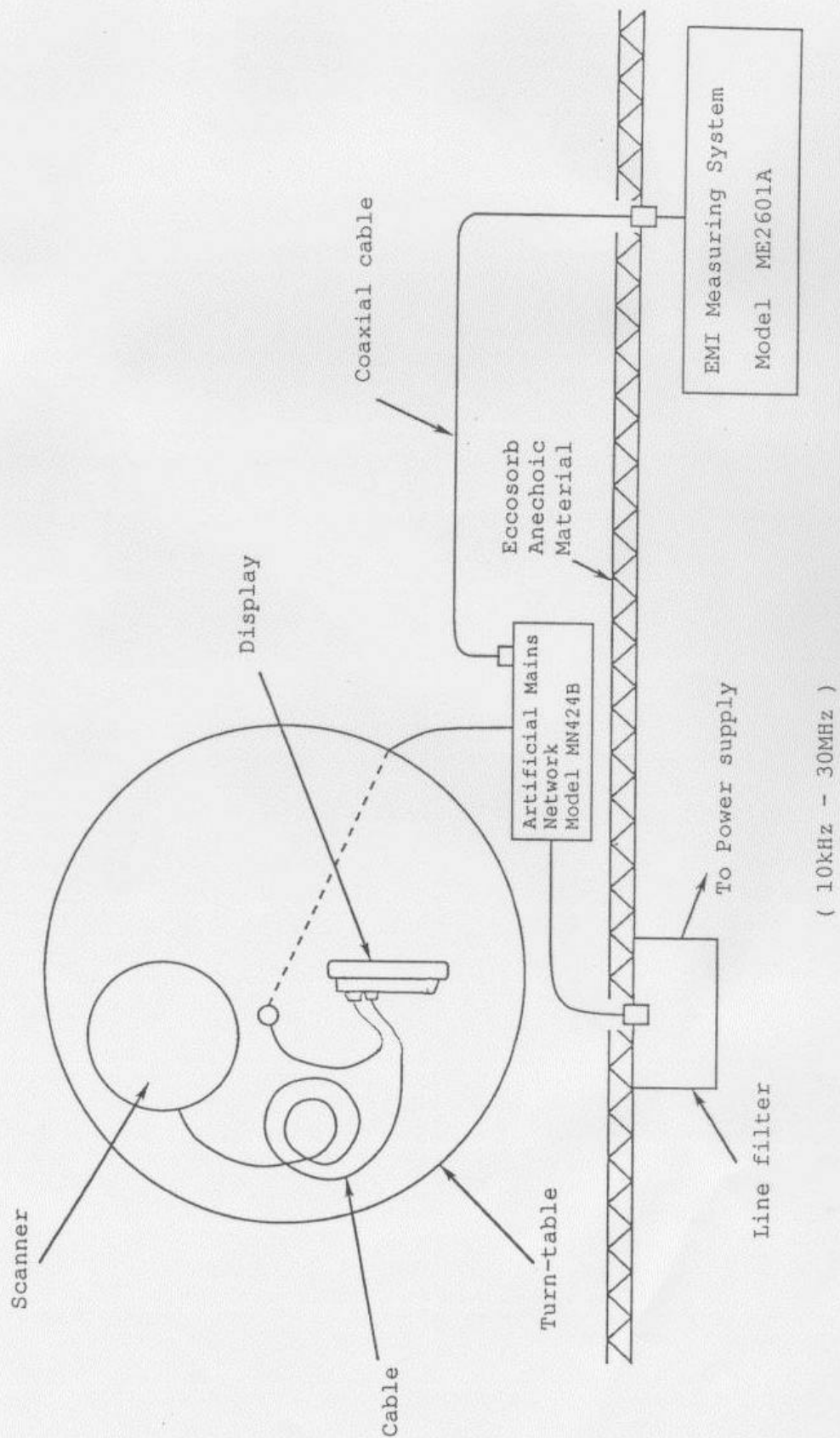
	Frequency	Measurement Level	Ratio to Main Transmission	Refer to
Spurious Emission Field Strength	9.410GHz	120dBu/m	0dB	Figure 4
	150kHz to 30MHz	Max. 56.5dBu/m	-63.5dB	Figure 3
	30MHz to 1GHz	Max. 50.1dBu/m	-69.9dB	Figure 3
	1GHz to 18GHz	Max. 60dBu/m	-60dB	Figure 4
Terminal Interference Voltage	10kHz to 30MHz	58.7dBuV	(-61.3dB)	Figure 5





SPRIOUS EMISSIONS FIELD STRENGTH (2.993)

TERMINAL INTERFERENCE VOLTAGE (10kHz - 30MHz)



Spurious Emission Terminal Interference Voltage

Figure 5

(Radiated Interference Field Strength Data 150kHz - 30 MHz)

4. TEST RESULTS

4.1 ELECTRIC FIELD STRENGTH

4.1.1 TEST RESULTS OF MAGNETIC FIELD STRENGTH

4.1.1.1 STANDBY

Product : Marine Radar
 Model : RA53
 Serial No. : E4360002
 Rating : 24VDC
 Mode : Standby
 Date : 21 May. 2001
 Condition : 23°C 57%

QUASI-PEAK LEVEL

FREQ MHz	FSM dBuV	CL dB	AF dB	EFS dBuV/m	MRGN dB	Limit dBuV/m	Note
0.1500	44.2	0.0	10.0	54.2	25.8	80.0	Q,
0.2000	45.9	0.0	10.0	55.9	12.5	68.4	Q,
0.2500	39.6	0.0	10.0	49.6	9.8	59.4	Q,
0.3000	37.9	0.0	10.0	47.9	4.1	52.0	Q,
0.4000	35.0	0.0	10.0	45.0	5.9	50.9	Q,
0.5000	33.1	0.0	10.0	43.1	6.9	50.0	Q,
0.7500	28.3	0.0	10.0	38.3	10.1	48.4	Q,
1.0000	26.9	0.0	10.0	36.9	10.4	47.3	Q,
2.0000	18.5	0.1	10.0	28.6	16.0	44.6	Q,
3.0000	14.8	0.1	10.0	24.9	18.1	43.0	Q,
4.0000	11.8	0.1	10.0	21.9	20.0	41.9	Q,
5.0000	9.7	0.1	10.0	19.8	21.2	41.0	Q,
7.5000	5.9	0.1	10.0	16.0	23.4	39.4	Q,
10.0000	3.5	0.1	10.0	13.6	24.7	38.3	Q,
15.0000	2.1	0.1	9.5	11.7	25.0	36.7	Q,
18.0002	14.6	0.1	9.2	23.9	12.1	36.0	Q,
20.0000	2.1	0.1	9.0	11.2	24.4	35.6	Q,
25.0000	1.3	0.1	7.9	9.3	25.4	34.7	Q,
25.2010	18.3	0.1	7.9	26.3	8.4	34.7	Q,
30.0000	6.6	0.1	6.8	13.5	20.5	34.0	Q,

FSM : Field Strength Meter Reading
 CL : Cable Loss
 AF : Antenna Factor
 EFS : Electric Field Strength (EFS=FSM+CL+AF)
 MRGN : Margin (MRGN=Limit-EFS)
 Q : CISPR Quasi-Peak
 L : Loop Antenna
 M6 : Maximum Six Data

4.1.1.2 S-PULSE

Product : Marine Radar
 Model : RA53
 Serial No. : E4360002
 Rating : 24VDC
 Mode : TX ON , S-Pulse
 Date : 21 May, 2001
 Condition : 23°C 57%

QUASI-PEAK LEVEL

FREQ MHz	FSM dBuV	CL dB	AF dB	EFS dBuV/m	MRGN dB	Limit dBuV/m	Note
0.1500	44.6	0.0	10.0	54.6	25.4	80.0	Q,
0.2000	46.4	0.0	10.0	56.4	12.0	68.4	Q,
0.2500	39.6	0.0	10.0	49.6	9.8	59.4	Q,
0.3000	37.5	0.0	10.0	47.5	4.5	52.0	Q,
0.4000	35.0	0.0	10.0	45.0	5.9	50.9	Q,
0.5000	33.0	0.0	10.0	43.0	7.0	50.0	Q,
0.7500	28.3	0.0	10.0	38.3	10.1	48.4	Q,
1.0000	26.5	0.0	10.0	36.5	10.8	47.3	Q,
2.0000	18.5	0.1	10.0	28.6	16.0	44.6	Q,
3.0000	14.8	0.1	10.0	24.9	18.1	43.0	Q,
4.0000	12.3	0.1	10.0	22.4	19.5	41.9	Q,
5.0000	10.3	0.1	10.0	20.4	20.6	41.0	Q,
7.5000	6.9	0.1	10.0	17.0	22.4	39.4	Q,
10.0000	4.8	0.1	10.0	14.9	23.4	38.3	Q,
15.0000	1.9	0.1	9.5	11.5	25.2	36.7	Q,
18.0002	14.6	0.1	9.2	23.9	12.1	36.0	Q,
20.0000	2.2	0.1	9.0	11.3	24.3	35.6	Q,
25.0000	1.9	0.1	7.9	9.9	24.8	34.7	Q,
25.2010	18.4	0.1	7.9	26.4	8.3	34.7	Q,
30.0000	6.7	0.1	6.8	13.6	20.4	34.0	Q,

FSM : Field Strength Meter Reading
 CL : Cable Loss
 AF : Antenna Factor
 EFS : Electric Field Strength (EFS=FSM+CL+AF)
 MRGN : Margin (MRGN=Limit-EFS)
 Q : CISPR Quasi-Peak
 L : Loop Antenna
 M6 : Maximum Six Data

4.1.1.3 L-Pulse

Product : Marine Radar
 Model : RA53
 Serial No. : E4360002
 Rating : 24VDC
 Mode : TX ON , L-Pulse
 Date : 21 May. 2001
 Condition : 23°C 57%

QUASI-PEAK LEVEL

FREQ MHz	FSM dBuV	CL dB	AF dB	EFS dBuV/m	MRGN dB	Limit dBuV/m	Note
0.1500	46.4	0.0	10.0	56.4	23.6	80.0	Q,
0.2000	46.5	0.0	10.0	56.5	11.9	68.4	Q,
0.2500	39.9	0.0	10.0	49.9	9.5	59.4	Q,
0.3000	37.5	0.0	10.0	47.5	4.5	52.0	Q,
0.4000	35.0	0.0	10.0	45.0	5.9	50.9	Q,
0.5000	33.0	0.0	10.0	43.0	7.0	50.0	Q,
0.7500	28.3	0.0	10.0	38.3	10.1	48.4	Q,
1.0000	26.1	0.0	10.0	36.1	11.2	47.3	Q,
2.0000	18.5	0.1	10.0	28.6	16.0	44.6	Q,
3.0000	14.6	0.1	10.0	24.7	18.3	43.0	Q,
4.0000	11.7	0.1	10.0	21.8	20.1	41.9	Q,
5.0000	9.6	0.1	10.0	19.7	21.3	41.0	Q,
7.5000	5.9	0.1	10.0	16.0	23.4	39.4	Q,
10.0000	5.0	0.1	10.0	15.1	23.2	38.3	Q,
15.0000	1.8	0.1	9.5	11.4	25.3	36.7	Q,
18.0002	14.6	0.1	9.2	23.9	12.1	36.0	Q,
20.0000	2.1	0.1	9.0	11.2	24.4	35.6	Q,
25.0000	1.7	0.1	7.9	9.7	25.0	34.7	Q,
25.2010	18.9	0.1	7.9	26.9	7.8	34.7	Q,
30.0000	7.2	0.1	6.8	14.1	19.9	34.0	Q,

FSM : Field Strength Meter Reading
 CL : Cable Loss
 AF : Antenna Factor
 EFS : Electric Field Strength (EFS=FSM+CL+AF)
 MRGN : Margin (MRGN=Limit-EFS)
 Q : CISPR Quasi-Peak
 L : Loop Antenna
 M6 : Maximum Six Data

(Radiated Interference Field Strength 30 MHz - 1000MHz)

4.1.2 TEST RESULTS OF ELECTRIC FIELD STRENGTH

4.1.2.1 STANDBY

Product : Marine Radar
 Model : RA53
 Serial No. : E4380002
 Rating : 24VDC
 Mode : Standby
 Date : 13 May. 2001
 Condition : 25°C 46%

(VERTICAL POLARIZATION)

FREQ MHz	MFSM dBuV	PAG dB	SAL dB	CL dB	AF dB	MEFS dBuV/m	MRGN dB	Limit dBuV/m	DIR deg	ANT.H m	Note
157.471	23.8	25.0	2.9	0.8	10.6	13.0	10.5	23.5	20	1.0	Q,
159.613	19.9	25.0	2.6	0.8	10.4	8.8	14.7	23.5	194	2.0	Q,
161.754	19.6	25.0	2.4	0.8	10.3	8.1	15.4	23.5	322	1.0	Q,
201.597	53.0	25.0	-0.2	0.9	9.3	38.0	16.0	54.0	335	1.0	Q,
252.002	42.9	25.0	0.8	1.1	12.6	32.4	21.6	54.0	280	1.0	Q,
302.402	39.8	25.0	0.3	1.2	13.7	30.0	24.0	54.0	163	1.0	Q,
378.002	48.9	25.0	-0.5	1.5	15.6	40.6	13.4	54.0	190	1.8	Q,
403.202	45.0	25.0	-0.1	1.6	16.3	37.7	16.3	54.0	192	1.9	Q,
478.800	41.5	25.0	-0.1	1.7	17.5	35.5	18.5	54.0	249	1.5	Q,
529.205	47.3	25.0	0.2	1.8	18.9	43.1	10.9	54.0	317	1.3	Q,
579.607	45.4	25.0	-0.1	1.9	19.8	41.9	12.1	54.0	11	1.9	Q,
630.004	45.2	25.0	-0.3	2.0	20.1	42.0	12.0	54.0	22	2.0	Q,

(HORIZONTAL POLARIZATION)

FREQ MHz	MFSM dBuV	PAG dB	SAL dB	CL dB	AF dB	MEFS dBuV/m	MRGN dB	Limit dBuV/m	DIR deg	ANT.H m	Note
157.471	26.9	25.0	1.8	0.8	10.6	15.1	8.4	23.5	122	2.0	Q,
159.613	25.3	25.0	1.9	0.8	10.4	13.5	10.0	23.5	134	2.0	Q,
161.754	26.8	25.0	2.0	0.8	10.3	14.8	8.7	23.5	165	2.0	Q,
201.597	58.5	25.0	1.8	0.9	9.3	45.5	8.5	54.0	229	1.5	Q,
252.002	51.6	25.0	0.3	1.1	12.6	40.6	13.4	54.0	228	1.0	Q,
302.402	39.4	25.0	-2.1	1.2	13.7	27.1	26.9	54.0	289	2.0	Q,
378.002	54.7	25.0	-0.2	1.5	15.6	46.7	7.3	54.0	352	2.0	Q,
403.202	48.8	25.0	-0.7	1.6	16.2	40.9	13.1	54.0	334	1.9	Q,
478.800	49.9	25.0	0.5	1.7	17.5	44.6	9.4	54.0	356	1.4	Q,
529.205	53.9	25.0	0.5	1.8	18.9	50.1	3.9	54.0	6	1.4	Q,
579.607	40.8	25.0	0.3	1.9	19.8	37.8	16.2	54.0	19	2.0	Q,
630.004	39.8	25.0	-0.5	2.0	20.1	36.4	17.6	54.0	354	1.0	Q,

MFSM : Maximum Field Strength Meter Reading
 PAG : Pre-Amplifier Gain
 SAL : Site Attenuation Loss
 CL : Cable Loss
 AF : Antenna Factor
 MEFS : Maximum Electric Field Strength (MEFS=MFSM-PAG+SAL+CL+AF)
 MRGN : Margin (MRGN=Limit-MEFS)
 DIR : Direction of Turn Table
 ANT.H : Antenna Height
 Q : CISPR Quasi-Peak
 B : Broad Band Dipole Antenna
 D : Dipole Antenna
 M6 : Maximum Six Data

4.1.2.2 S-Pulse

Product : Marine Radar
 Model : RA53
 Serial No. : E4360002
 Rating : 24VDC
 Mode : TX ON, S-Pulse
 Date : 21 May, 2001
 Condition : 23°C 56%

(VERTICAL POLARIZATION)

FREQ MHz	MFSM dBuV	PAG dB	SAL dB	CL dB	AF dB	MEFS dBuV/m	MRGN dB	Limit dBuV/m	DIR deg	ANT.H m	Note
100.798	48.2	25.0	2.1	0.6	10.2	36.1	17.9	54.0	35	1.0	Q.
157.305	28.3	25.0	2.9	0.8	10.6	17.6	5.9	23.5	136	2.0	Q.
157.439	20.6	25.0	2.9	0.8	10.6	9.9	13.6	23.5	168	2.0	Q.
159.518	20.7	25.0	2.6	0.8	10.4	9.6	13.9	23.5	162	2.0	Q.
159.833	20.3	25.0	2.6	0.8	10.4	9.1	14.4	23.5	163	2.0	Q.
201.600	53.9	25.0	-0.2	0.9	9.3	38.9	15.1	54.0	82	1.0	Q.
252.000	43.8	25.0	0.8	1.1	12.6	33.3	20.7	54.0	111	1.0	Q.
302.399	43.4	25.0	0.3	1.2	13.7	33.6	20.4	54.0	301	1.5	Q.
378.000	48.9	25.0	-0.5	1.5	15.6	40.6	13.4	54.0	192	2.0	Q.
403.203	49.9	25.0	-0.1	1.6	16.3	42.6	11.4	54.0	358	1.0	Q.
428.400	43.0	25.0	-0.2	1.6	16.7	36.1	17.9	54.0	354	1.0	Q.
478.805	47.5	25.0	-0.1	1.7	17.5	41.5	12.5	54.0	347	1.0	Q.
529.205	49.1	25.0	0.2	1.8	18.9	44.9	9.1	54.0	12	1.8	Q.
579.605	45.4	25.0	-0.1	1.9	19.8	41.9	12.1	54.0	16	1.8	Q.
630.007	44.4	25.0	-0.3	2.0	20.1	41.2	12.8	54.0	14	2.0	Q.

(HORIZONTAL POLARIZATION)

FREQ MHz	MFSM dBuV	PAG dB	SAL dB	CL dB	AF dB	MEFS dBuV/m	MRGN dB	Limit dBuV/m	DIR deg	ANT.H m	Note
100.798	47.9	25.0	-0.7	0.6	10.2	33.1	20.9	54.0	76	1.9	Q.
157.305	26.0	25.0	1.8	0.8	10.6	14.2	9.3	23.5	110	2.0	Q.
157.439	27.2	25.0	1.8	0.8	10.6	15.4	8.1	23.5	120	2.0	Q.
159.518	26.0	25.0	1.9	0.8	10.4	14.2	9.3	23.5	130	2.0	Q.
159.833	27.0	25.0	2.0	0.8	10.4	15.2	8.3	23.5	354	2.0	Q.
201.600	59.6	25.0	1.8	0.9	9.3	46.6	7.4	54.0	78	1.0	Q.
252.000	52.4	25.0	0.3	1.1	12.6	41.4	12.6	54.0	18	1.0	Q.
302.399	48.5	25.0	-2.1	1.2	13.6	36.1	17.9	54.0	333	1.0	Q.
378.000	55.6	25.0	-0.3	1.5	15.8	47.6	6.4	54.0	340	2.0	Q.
403.203	49.2	25.0	-0.7	1.6	16.2	41.2	12.8	54.0	324	1.0	Q.
428.400	36.7	25.0	-0.2	1.6	16.7	29.8	24.2	54.0	233	1.0	Q.
478.805	49.5	25.0	0.5	1.7	17.5	44.2	9.8	54.0	356	1.5	Q.
529.205	54.0	25.0	0.5	1.8	18.9	50.1	3.9	54.0	8	1.3	Q.
579.605	43.4	25.0	0.4	1.9	19.8	40.4	13.6	54.0	21	1.3	Q.
630.007	39.3	25.0	-0.5	2.0	20.1	35.9	18.1	54.0	5	1.0	Q.

MFSM : Maximum Field Strength Meter Reading
 PAG : Pre-Amplifier Gain
 SAL : Site Attenuation Loss
 CL : Cable Loss
 AF : Antenna Factor
 MEFS : Maximum Electric Field Strength (MEFS=MFSM-PAG+SAL+CL+AF)
 MRGN : Margin (MRGN=Limit-MEFS)
 DIR : Direction of Turn Table
 ANT.H : Antenna Height
 Q : CISPR Quasi-Peak
 B : Broad Band Dipole Antenna
 D : Dipole Antenna
 M6 : Maximum Six Data

4.1.2.3 L-Pulse

Product : Marine Radar
 Model : RA53
 Serial No. : E4360002
 Rating : 24VDC
 Mode : TX ON , L-Pluse
 Date : 21 May. 2001
 Condition : 23°C 57%

(VERTICAL POLARIZATION)

FREQ MHz	MFSM dBuV	PAG dB	SAL dB	CL dB	AF dB	MEFS dBuV/m	MRGN dB	Limit dBuV/m	DIR deg	ANT.H m	Note
75.601	49.1	25.0	2.0	0.5	6.9	33.5	20.5	54.0	8	1.0	Q,
157.305	25.6	25.0	2.9	0.8	10.6	14.9	8.6	23.5	126	2.0	Q,
157.503	19.6	25.0	2.9	0.8	10.6	8.8	14.7	23.5	179	1.9	Q,
157.533	20.9	25.0	2.9	0.8	10.6	10.1	13.4	23.5	172	2.0	Q,
159.833	25.5	25.0	2.6	0.8	10.4	14.3	9.2	23.5	9	1.0	Q,
163.141	21.4	25.0	2.2	0.8	10.1	9.8	13.9	23.5	6	1.0	Q,
201.595	55.5	25.0	-0.2	0.9	9.3	40.5	13.5	54.0	91	1.0	Q,
252.003	47.1	25.0	0.8	1.1	12.6	36.6	17.4	54.0	344	1.8	Q,
378.003	49.5	25.0	-0.5	1.5	15.6	41.2	12.8	54.0	194	1.8	Q,
403.200	44.5	25.0	-0.1	1.6	16.3	37.2	16.8	54.0	197	1.9	Q,
478.802	42.1	25.0	-0.1	1.7	17.5	36.1	17.9	54.0	255	1.4	Q,
529.207	47.8	25.0	0.2	1.8	18.9	43.6	10.4	54.0	325	1.8	Q,

(HORIZONTAL POLARIZATION)

FREQ MHz	MFSM dBuV	PAG dB	SAL dB	CL dB	AF dB	MEFS dBuV/m	MRGN dB	Limit dBuV/m	DIR deg	ANT.H m	Note
75.601	48.0	25.0	-4.3	0.5	6.9	26.1	27.9	54.0	65	2.0	Q,
157.305	24.2	25.0	1.8	0.8	10.6	12.4	11.1	23.5	99	2.0	Q,
157.503	25.2	25.0	1.8	0.8	10.6	13.4	10.1	23.5	131	2.0	Q,
157.533	27.2	25.0	1.8	0.8	10.6	15.4	8.1	23.5	358	1.9	Q,
159.833	26.4	25.0	2.0	0.8	10.4	14.6	8.9	23.5	146	2.0	Q,
163.141	27.6	25.0	2.0	0.8	10.1	15.5	8.0	23.5	18	2.0	Q,
201.595	60.4	25.0	1.8	0.9	9.3	47.4	6.6	54.0	74	1.0	Q,
252.003	52.2	25.0	0.5	1.1	12.5	41.2	12.8	54.0	231	1.0	Q,
378.003	55.8	25.0	-0.3	1.5	15.8	47.8	6.2	54.0	347	2.0	Q,
403.200	48.3	25.0	-0.7	1.6	16.2	40.4	13.6	54.0	326	2.0	Q,
478.802	49.8	25.0	0.5	1.7	17.5	44.5	9.5	54.0	2	1.4	Q,
529.207	54.0	25.0	0.5	1.8	18.9	50.1	3.9	54.0	8	1.3	Q,

MFSM : Maximum Field Strength Meter Reading
 PAG : Pre-Amplifier Gain
 SAL : Site Attenuation Loss
 CL : Cable Loss
 AF : Antenna Factor
 MEFS : Maximum Electric Field Strength (MEFS=MFSM-PAG+SAL+CL+AF)
 MRGN : Margin (MRGN=Limit-MEFS)
 DIR : Direction of Turn Table
 ANT.H : Antenna Height
 Q : CISPR Quasi-Peak
 B : Broad Band Dipole Antenna
 D : Dipole Antenna
 M6 : Maximum Six Data

(Terminal Interference Voltage 10 kHz - 30 MHz)

4.2 CONDUCTED POWER-LINE STRENGTH

4.2.1 STANDBY

Product : Marine Radar
 Model : RA53
 Serial No. : E4360002
 Rating : 24VDC
 Mode : Standby
 Date : 11 May. 2001
 Condition : 22°C 55%

QUASI-PEAK LEVEL (ONE)

FREQ MHz	FSM dBuV	CL dB	LISN dB	CPLS dBuV	MRGN dB	Limit dBuV	Note
0.0390	57.0	0.0	0.6	57.6	17.3	74.9	Q,
0.0808	33.1	0.0	0.2	33.3	28.1	61.4	Q,
0.1225	28.7	0.0	0.1	28.8	24.9	53.7	Q,
0.1652	31.8	0.0	0.1	31.9	27.0	58.9	Q,
2.3752	41.3	0.1	0.1	41.5	8.5	50.0	Q,
2.6280	34.8	0.1	0.1	35.0	15.0	50.0	Q,
2.7383	31.0	0.1	0.1	31.2	18.8	50.0	Q,
20.1896	29.2	0.1	0.7	30.0	20.0	50.0	Q,

QUASI-PEAK LEVEL (OTHER ONE)

FREQ MHz	FSM dBuV	CL dB	LISN dB	CPLS dBuV	MRGN 6.11662 dB	Limit dBuV	Note
0.0390	45.6	0.0	0.6	46.2	28.7	74.9	Q,
0.0808	27.7	0.0	0.2	27.9	33.5	61.4	Q,
0.1225	22.6	0.0	0.1	22.7	31.0	53.7	Q,
0.1652	27.1	0.0	0.1	27.2	31.7	58.9	Q,
2.3752	41.2	0.1	0.1	41.4	8.6	50.0	Q,
2.6280	35.9	0.1	0.1	36.1	13.9	50.0	Q,
2.7383	32.3	0.1	0.1	32.5	17.5	50.0	Q,
20.1896	31.6	0.1	0.5	32.2	17.8	50.0	Q,

FSM : Field Strength Meter Reading
 CL : Cable Loss
 LISN : LISN Factor
 CPLS : Conducted Power-Line Strength (CPLS=FSM+CL+LISN)
 MRGN : Margin (MRGN=Limit-CPLS)
 Q : CISPR Quasi-Peak

4.2.2 S-PULSE

Product : Marine Radar
 Model : RA53
 Serial No. : E4360002
 Rating : 24VDC
 Mode : TX ON , S-Pluse
 Date : 11 May, 2001
 Condition : 22°C 55%

QUASI-PEAK LEVEL (ONE)

FREQ MHz	FSM dBuV	CL dB	LISN dB	CPLS dBuV	MRGN dB	Limit dBuV	Note
0.0390	58.1	0.0	0.6	58.7	16.2	74.9	Q,
0.0809	28.8	0.0	0.2	29.0	32.4	61.4	Q,
0.1228	33.2	0.0	0.1	33.3	20.4	53.7	Q,
0.1661	31.8	0.0	0.1	31.9	26.9	58.8	Q,
2.4702	32.5	0.1	0.1	32.7	17.3	50.0	Q,
2.5180	36.2	0.1	0.1	36.4	13.6	50.0	Q,
2.6318	34.3	0.1	0.1	34.5	15.5	50.0	Q,
20.6746	31.1	0.1	0.7	31.9	18.1	50.0	Q,

QUASI-PEAK LEVEL (OTHER ONE)

FREQ MHz	FSM dBuV	CL dB	LISN dB	CPLS dBuV	MRGN 6.11662	Limit dBuV	Note
0.0390	46.5	0.0	0.6	47.1	27.7	74.9	Q,
0.0809	23.3	0.0	0.2	23.5	37.9	61.4	Q,
0.1228	24.6	0.0	0.1	24.7	29.0	53.7	Q,
0.1661	29.0	0.0	0.1	29.1	29.7	58.8	Q,
2.4702	33.6	0.1	0.1	33.8	16.2	50.0	Q,
2.5180	37.0	0.1	0.1	37.2	12.8	50.0	Q,
2.6318	35.5	0.1	0.1	35.7	14.3	50.0	Q,
20.6746	32.4	0.1	0.5	33.0	17.0	50.0	Q,

FSM : Field Strength Meter Reading
 CL : Cable Loss
 LISN : LISN Factor
 CPLS : Conducted Power-Line Strength (CPLS=FSM+CL+LISN)
 MRGN : Margin (MRGN=Limit-CPLS)
 Q : CISPR Quasi-Peak

4.2.3 L-PULSE

Product : Marine Radar
 Model : RA53
 Serial No. : E4360002
 Rating : 24VDC
 Mode : TX ON , L-Pulse
 Date : 11 May. 2001
 Condition : 22°C 55%

QUASI-PEAK LEVEL (ONE)

FREQ MHz	FSM dBuV	CL dB	LISN dB	CPLS dBuV	MRGN dB	Limit dBuV	Note
0.0391	51.8	0.0	0.6	52.4	22.4	74.8	Q,
0.0812	28.2	0.0	0.2	28.4	32.9	61.3	Q,
0.1232	33.2	0.0	0.1	33.3	20.3	53.6	Q,
0.1653	27.0	0.0	0.1	27.1	31.8	58.9	Q,
2.4788	33.0	0.1	0.1	33.2	16.8	50.0	Q,
2.5240	36.8	0.1	0.1	37.0	13.0	50.0	Q,
2.6382	34.0	0.1	0.1	34.2	15.8	50.0	Q,
21.0655	32.7	0.1	0.7	33.5	16.5	50.0	Q,

QUASI-PEAK LEVEL (OTHER ONE)

FREQ MHz	FSM dBuV	CL dB	LISN dB	CPLS dBuV	MRGN 6.11662	Limit dBuV	Note
0.0391	39.3	0.0	0.6	39.9	34.9	74.8	Q,
0.0812	23.0	0.0	0.2	23.2	38.1	61.3	Q,
0.1232	24.4	0.0	0.1	24.5	29.1	53.6	Q,
0.1653	23.5	0.0	0.1	23.6	35.3	58.9	Q,
2.4788	34.2	0.1	0.1	34.4	15.6	50.0	Q,
2.5240	37.7	0.1	0.1	37.9	12.1	50.0	Q,
2.6382	35.1	0.1	0.1	35.3	14.7	50.0	Q,
21.0655	32.0	0.1	0.5	32.6	17.4	50.0	Q,

FSM : Field Strength Meter Reading
 CL : Cable Loss
 LISN : LISN Factor
 CPLS : Conducted Power-Line Strength (CPLS=FSM+CL+LISN)
 MRGN : Margin (MRGN=Limit-CPLS)
 Q : CISPR Quasi-Peak

FIG 1 ***** Test Results of Magnetic Field Strength *****
per EN60945 (Frequency Range from 150kHz to 30MHz)

Product : Marine Radar
Model : RA53
Serial No. : E4360002
Rating : 24VDC
Mode : Standby
Date : 21 May. 2001
Condition : 23°C 57%

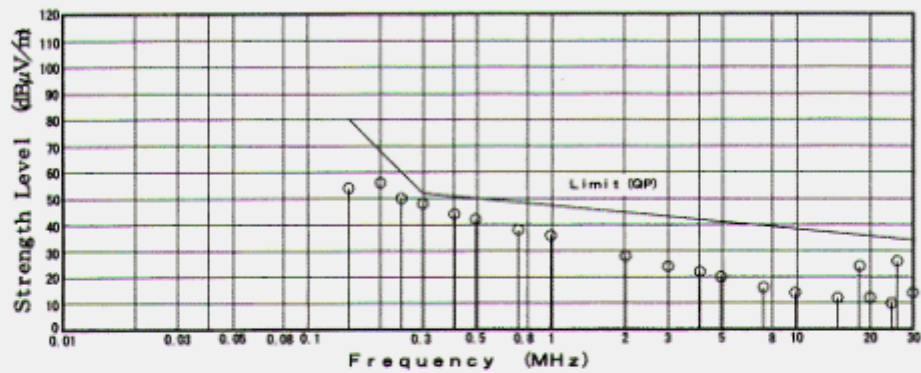


FIG 2 ***** Test Results of Magnetic Field Strength *****
per EN60945 (Frequency Range from 150kHz to 30MHz)

Rating : 24VDC
Mode : TX ON, S-Pulse
Date : 21 May. 2001
Condition : 23°C 57%

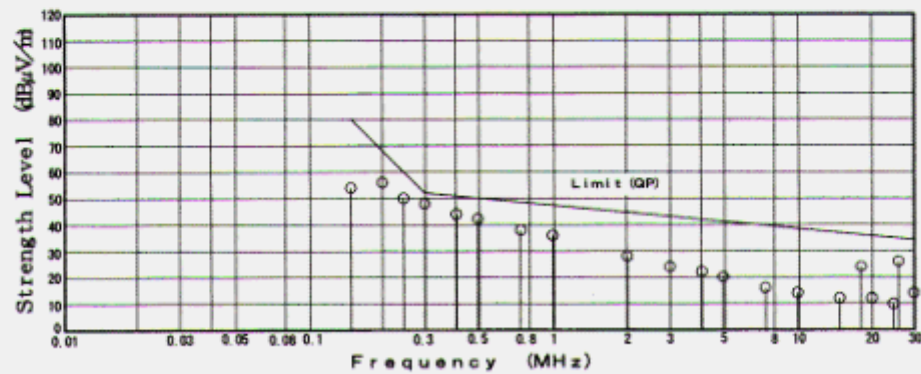


FIG 3 ***** Test Results of Magnetic Field Strength *****
per EN60945 (Frequency Range from 150kHz to 30MHz)

Rating : 24VDC
Mode : TX ON, L-Pulse
Date : 21 May, 2001
Condition : 23°C 57%

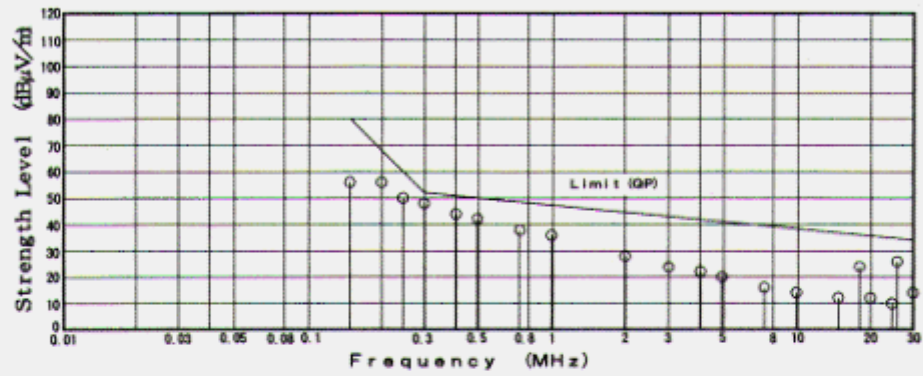


FIG 4 ***** Test Results of Electric Field Strength *****
per EN60945 (Frequency Range from 30MHz to 1000MHz)

Product : Marine Radar
Model : RA53
Serial No. : E4360002
Rating : 24VDC
Mode : Standby
Date : 13 May. 2001
Condition : 25°C 46%
x: Vertical Polarization
o: Horizontal Polarization

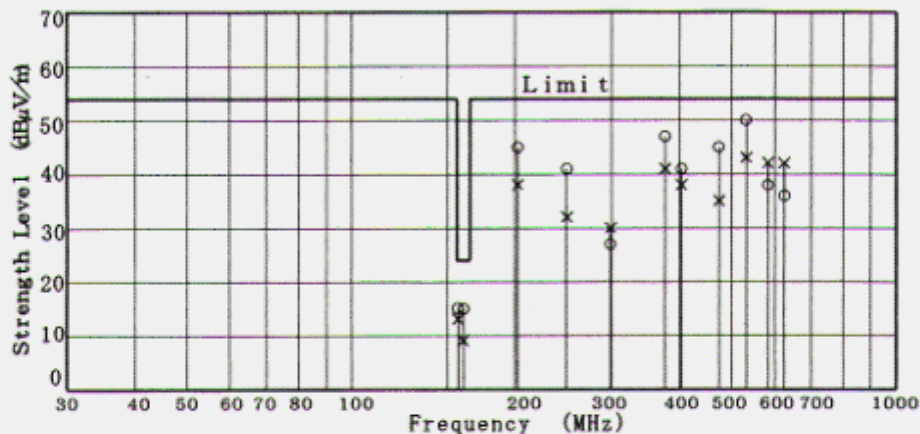


FIG 5 ***** Test Results of Electric Field Strength *****
per EN60945 (Frequency Range from 30MHz to 1000MHz)

Rating : 24VDC
Mode : TX ON, S-Pulse
Date : 21 May. 2000
Condition : 23°C 56%
x: Vertical Polarization
o: Horizontal Polarization

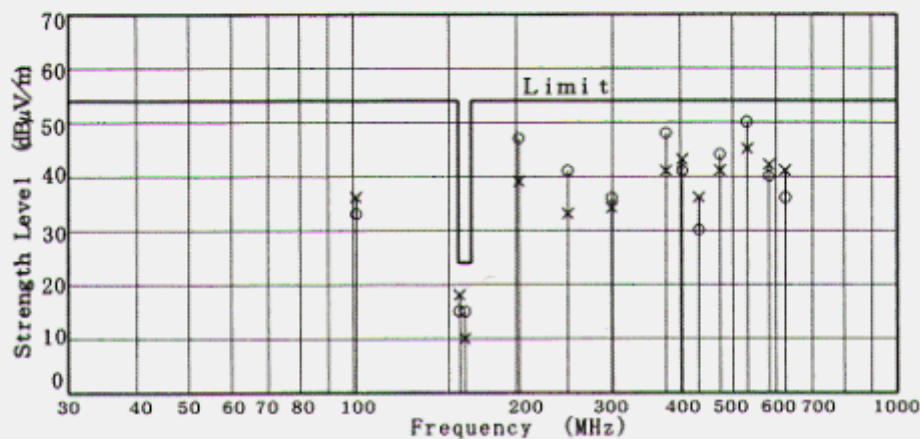


FIG 6 ***** Test Results of Electric Field Strength *****
per EN60945 (Frequency Range from 30MHz to 1000MHz)

Rating : 24VDC
Mode : TX ON, L-Pulse
Date : 21 May. 2001
Condition : 23°C 57%
x: Vertical Polarization
o: Horizontal Polarization

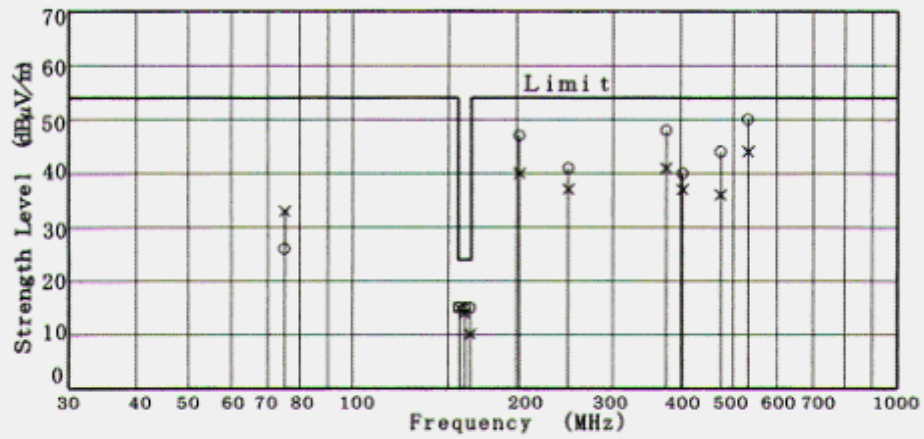


FIG 7 ***** Test Results of Conducted Power-Line Strength *****
per EN60945 (Frequency Range from 10kHz to 30MHz)

Product : Marine Radar
Model : RA53
Serial No. : E4360002
Rating : 24VDC
Mode : Standby
Date : 11 May. 2001
Condition : 22°C 55%
x: Between One Conductor of Power-Line and Ground
o: Between Other Conductor of Power-Line and Ground

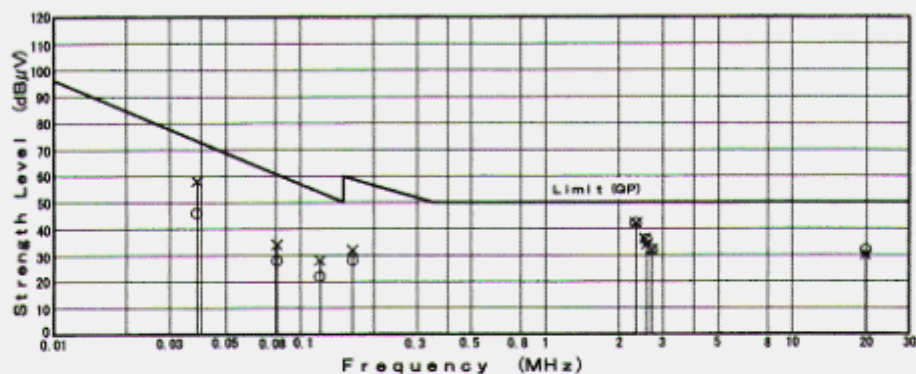


FIG 8 ***** Test Results of Conducted Power-Line Strength *****
per EN60945 (Frequency Range from 10kHz to 30MHz)

Rating : 24VDC
Mode : TX ON, S-Pulse
Date : 11 May. 2001
Condition : 22°C 55%
x: Between One Conductor of Power-Line and Ground
o: Between Other Conductor of Power-Line and Ground

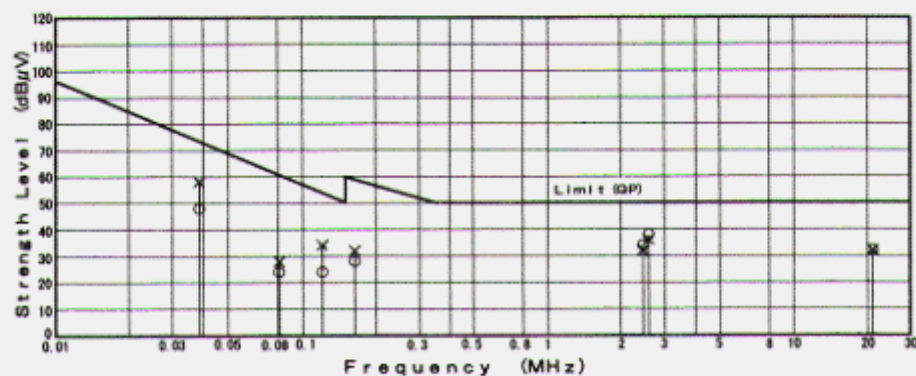


FIG 9 ***** Test Results of Conducted Power-Line Strength *****
per EN60945 (Frequency Range from 10kHz to 30MHz)

Rating : 24VDC
Mode : TX ON, L-Pulse
Date : 11 May. 2001
Condition : 22°C 55%
x: Between One Conductor of Power-Line and Ground
o: Between Other Conductor of Power-Line and Ground

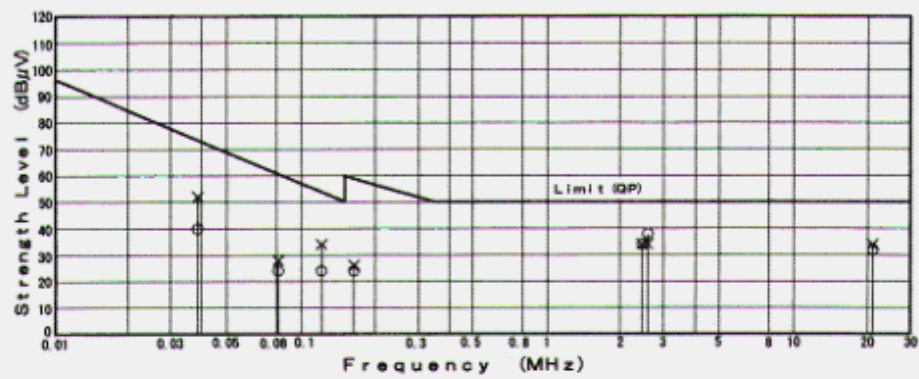


Exhibit 6

FREQUENCY STABILITY (2.995)

Type of Transmission: P0N
Type of Modulation: Pulse
Frequency Band: 9410 MHz +/- 30 MHz
Pulse Rate: 500 Hz to 2000 Hz, Selectable as a function of Range
Pulse Width: 0.08 us to 1.0 us, Selectable as a function of Range

TEST EQUIPMENT

	Equipment	Manufacturer	Model
1.	Temperature Chamber	TABAI ESPEC	TBL-1.5HW4G2AC
2.	Directional Coupler	Hewlett-Packard	X752D
3.	frequency meter	Hewlett-Packard	X532B
4.	X-Band Dummy Load	NIHON KOSHUHA	WDL095
5.	Variable Attenuator	Hewlett-Packard	X382A
6.	Power Meter	ANRITSU	ML83A

TEST PROCEDURE

The Marine Radar is capable of generating the following pulses:

80ns x 2000Hz, 300ns x 1500Hz, 0.6us x 1000Hz, 1.0us x 500Hz

The circuitry of the Radar contains a key-inhibit timer that prevents transmission until the magnetron has warmed-up for 2 minutes. Consequently, all data are taken after the 2 minutes warmed-up.

- (1) Set up the equipment in the temperature chamber as shown in Fig.6. Set the chamber to -20 Degree Centigrade and allow the equipment to stabilize.
- (2) Turn the equipment on and measure the transmitted frequency using the resonate cavity frequency meter. Measure each the pulse types at one minute intervals until unit stability is achieved or 10 minutes have elapsed, whichever is longer.
- (3) Increase the chamber temperature by 10 Degree Centigrade and repeat step 1 and 2.
Continue in 10 Degree Centigrade increments until 50 Degree Centigrade has been achieved.
- (4) Measure the output frequency at room ambient temperature following voltages

applied to the power input.

12V input: Apply 10.2V and 13.8V

24V input: Apply 20.4V and 27.6V

32V input: Apply 27.2V and 36.8V

(5) Calculate test frequency limits from the followings;

The frequency of the principal emission must not be nearer to the edge of the authorized band than $1.5/t$ in MHz, (where t is the shortest pulse used, in micro second).

$t = 80\text{ns(nominal)}$

$1.5/t = 18.8 \text{ MHz}$

Band Limit = 9.300000 to 9.500000 GHz

Emission Limit = 9.3188 to 9.4812 GHz

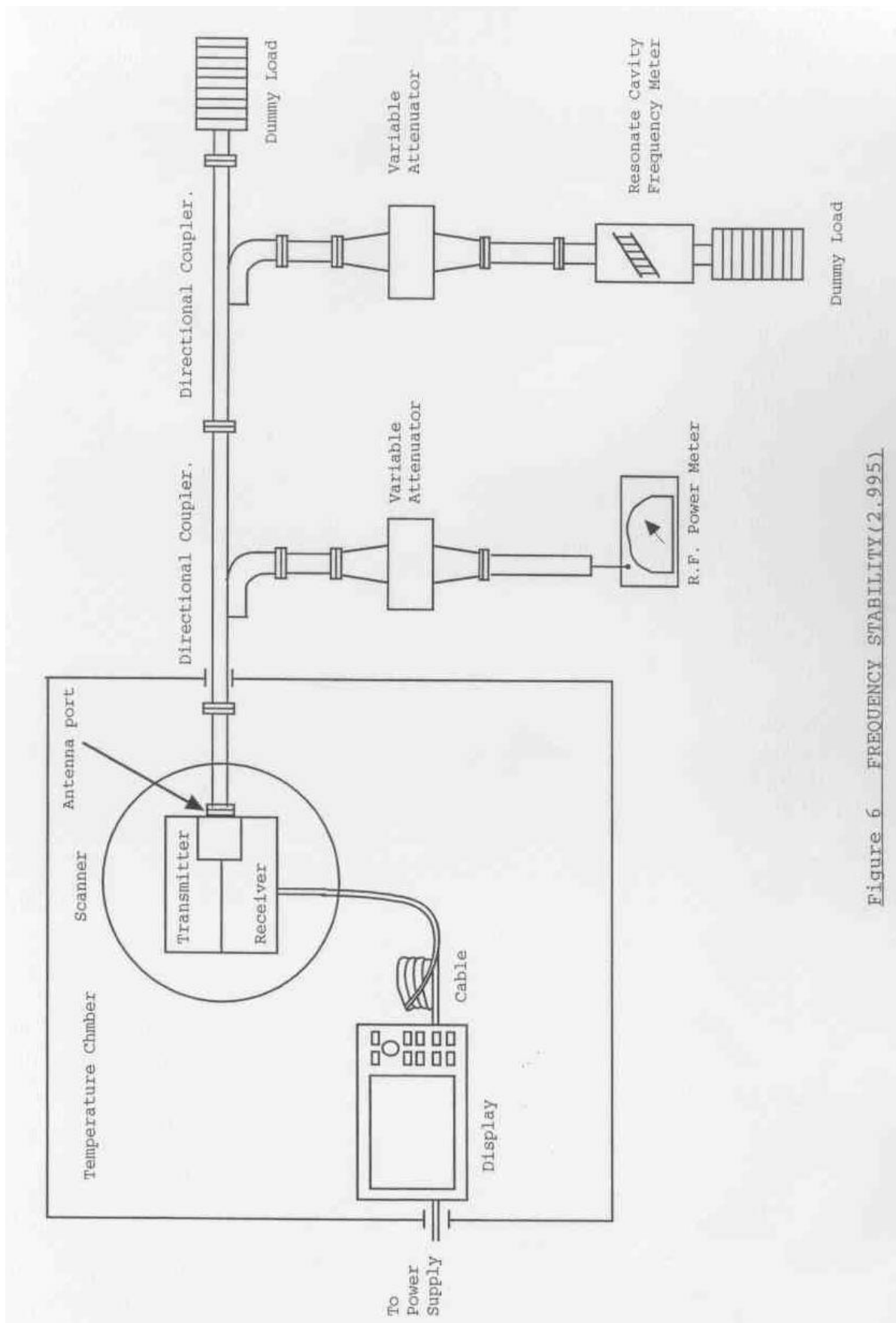


Figure 6 FREQUENCY STABILITY(2.995)

Exhibit 6

TEST DATA

Temperature Stability

Pulse Type		80ns X	300ns X	600ns X	1000ns X
		2000Hz	1500Hz	1000Hz	500Hz
Frequency(GHz)	Initial	Final	Final	Final	Final
Temperature					
(Deg.)					
-20	9.417	9.418	9.416	9.414	9.406
-10	9.415	9.416	9.414	9.412	9.400
0	9.413	9.413	9.411	9.409	9.397
+10	9.410	9.411	9.409	9.407	9.394
+20	9.407	9.408	9.406	9.405	9.390
+30	9.405	9.405	9.403	9.402	9.387
+40	9.402	9.403	9.401	9.400	9.383
+50	9.400	9.400	9.399	9.398	9.380

Voltage Stability

Applied Voltage(Vdc)	Initial Frequency(GHz)	Final Frequency(GHz)
10.2	9.409	9.407
12.0	9.409	9.407
13.8	9.409	9.407
24.0	See note below	
27.2	9.409	9.407
32.0	9.409	9.407
36.8	9.409	9.407

Note: All data taken in the 80 ns X 2000Hz mode.

Note: Qualification at both 12Vdc qualifies 24Vdc input by similarity.

*** Final reading taken 5 minutes following initial reading.