1 SPECIFICATIONS

General Specifications
JMA-3910-4/JMA-3910-6/JMA-3925-6/JMA-3925-9

1)	Type of emission:	PON
2)	Display type:	Raster scan, PPI method, vertically long display
3)	Display panel:	Bright 15-inch color CRT (radar video effective diameter of 180mm min.)
4)	Range scales:	0.125, 0.25, 0.5, 0.75, 1.5, 3, 6, 12, 24, 32, 48, 96 and 120nm Maximum range: 10kW = 96nm 25kw = 120nm
5)	Range resolution:	25m max.
6)	Minimum detective range:	28m max.
7)	Range scale accuracy:	1% of the maximum operating range or 30m, whichever larger.
8)	Bearing accuracy:	±1 degree max.
9)	Bearing resolution:	1.9 degrees (4ft) 1.5 degrees (6ft) 1.1 degrees (9ft)
10)	Bearing display:	Relative bearing, true bearing, course-up and stabilized course-up
11)	Ambient conditions:	Temperature Scanner: -25°C to +55°C (Storage: -25°C to +70°C Equipment other than scanner: -15°C to +55°C Relative humidity All equipment: +40°C, 93% Vibration All equipment 2 to 13.2Hz with excursion of ±1mm 13.2 to 100Hz with constant maximum acceleration of 7 m/s^2
12)	Power supply input:	DC24V
13)	Power consumption:	10kW = Approx. 230W 25kW = Approx. 250W
14)	Power supply input fluctuation:	DC21.6 to 26.4V
15)	Pre-heating time:	10kW = Approx. 90 sec 25kW = Approx. 3 min
16)	From standby to operation:	15 sec. max.

Scanner NKE-1055-4/6

1) Outside dimensions: Approx. height 400 × approx. swing circle 1340 (mm) (4ft)
   Approx. height 440 × approx. swing circle 1910 (mm) (6ft)
2) Weight: Approx. 29kg (4ft)
   Approx. 31kg (6ft)
3) Plane of polarization: Horizontal polarization
4) Beam width: Horizontal beam width = 1.9 degrees (4ft)
   Horizontal beam width = 1.2 degrees (6ft)
   Vertical beam width = 25 degrees (4ft)
   Vertical beam width = 25 degrees (6ft)
   Side lobe level
   Within ±10 degrees = –23dB max. (4ft)
   –26dB max. (6ft)
   Outside ±10 degrees = –26dB max. (4ft)
   –30dB max. (6ft)
5) Antenna rotation: Approx. 24rpm
6) Transmission output: 10kW
7) Transmission frequency: 9410±30MHz
8) Transmission tube: Magnetron MSF1425B
9) Transmission pulse width/repetition frequency

	Short	Standard	Long
0.125nm		0.08μs/2080Hz	
0.25nm		0.08μs/2080Hz	
0.5nm		0.08μs/2080Hz	
0.75nm		0.08μs/2080Hz	0.2μs/2080Hz
1.5nm	0.08μs/2080Hz	0.2μs/2080Hz	0.4μs/1560Hz
3nm	0.2μs/2080Hz	0.4μs/1560Hz	0.08μs/780Hz
6nm	0.4μs/1560Hz	0.8μs/780Hz	1.2μs/520Hz
12nm	0.4μs/1560Hz	0.8μs/780Hz	1.2μs/520Hz
16nm	0.8μs/780Hz	1.2μs/520Hz	
24nm		1.2μs/520Hz	
32nm		1.2μs/520Hz	
48nm		1.2μs/520Hz	
96nm		1.2μs/520Hz	

10) Transmission switch: Circulator + Diode limiter
11) Mixer: MIC front end
12) Intermediate frequency amplifier: Intermediate frequency = 60MHz
    Band width = 20MHz (0.08μs)
    6MHz (0.2 and 0.4μs)
    3MHz (0.8 and 1.2μs)
    Gain = 90dB min.
    Receiver characteristic = Logarithmic receiver
13) Overall noise figure: 7.5dB (average)

Scanner NKE-1056-6/9

1) Outside dimensions: Approx. height 400 × approx. swing circle 1910 (mm) (6ft)
Approx. height 440 × approx. swing circle 2830 (mm) (9ft)

2) Weight: Approx. 38kg (6ft)
Approx. 43kg (9ft)

3) Plane of polarization: Horizontal polarization

4) Beam width: Horizontal beam width = 1.2 degrees (6ft)
Horizontal beam width = 0.8 degrees (9ft)
Vertical beam width = 25 degrees (6ft)
Vertical beam width = 25 degrees (9ft)
Side lobe level
Within ±10 degrees = −26dB max. (6 to 9ft)
Outside ±10 degrees = −30dB max. (6 to 9ft)

5) Antenna rotation: Approx. 20rpm

6) Transmission output: 25kW

7) Transmission frequency: 9410±30MHz

8) Transmission tube: Magnetron MSF1437(A)

9) Transmission pulse width/repetition frequency

	Short	Standard	Long
0.125nm		0.08μs/2080Hz	
0.25nm		0.08μs/2080Hz	
0.5nm		0.08μs/2080Hz	
0.75nm		0.08μs/2080Hz	0.2μs/2080Hz
1.5nm	0.08μs/2080Hz	0.2μs/2080Hz	0.4μs/1560Hz
3nm	0.2μs/2080Hz	0.4μs/1560Hz	0.08μs/780Hz
6nm	0.4μs/1560Hz	0.8μs/780Hz	1.2μs/520Hz
12nm	0.4μs/1560Hz	0.8μs/780Hz	1.2μs/520Hz
16nm	0.8μs/780Hz	1.2μs/520Hz	
24nm		1.2μs/520Hz	
32nm		1.2μs/520Hz	
48nm		1.2μs/520Hz	
120nm		1.2μs/520Hz	

10) Transmission switch: Circulator + Diode limiter

11) Mixer: MIC front end

12) Intermediate frequency amplifier: Intermediate frequency = 60MHz
Band width = 20MHz (0.08μs)
6MHz (0.2 and 0.4μs)
3MHz (0.8 and 1.2μs)
Gain = 90dB min.
Receiver characteristic = Logarithmic receiver

13) Overall noise figure: 7.5dB (average)

Display Unit NCD-3780

1) Structure: Desktop type
2) Outside dimensions: Approx. W370 × H451 × D555 (mm)
3) Weight: Approx. 34 kg max.
4) Display: Vertical 15-inch color CRT
5) # of pixels: 1024 × 768
6) Display area: Approx. 280 × 210 (mm)
7) Color, gradation and brilliance

   Radar video
   - Gradation: 16(8 in radar trail display mode)
   - Video color: 1
   - Brilliance control: 4 steps

   Radar track
   - Gradation: 1
   - Video color: 1
   - Brilliance control: 4 steps (simultaneous control with radar video)

   Fixed marker/VRM/EBL
   - Video color: Cyan
   - Brilliance level: 4 steps

   The following brilliance levels are simultaneously changed.

   Letter/dial plane
   - Video color: White
   - Brilliance level: 4 steps

   SHM/cursor
   - Video color: White
   - Brilliance level: 4 steps

8) Range/scale spacing

Range	Scale spacing	# of scales	
0.125nm	0.0625nm	2	
0.25nm	0.125nm	2	
0.5nm	0.25nm	2	
0.75nm	0.25nm	3	
1.5nm	0.25nm	6	
3nm	0.5nm	6	
6nm	1nm	6	
12nm	2nm	6	
16nm	4nm	4	
24nm	4nm	6	
32nm	8nm	4	
48nm	8nm	6	
96nm	16nm	6	(10kW only)
120nm	20nm	6	(25kW only)

9)	Screen display mode:	Radar mode North-up (TM/RM), course-up (TM/RM), head-up (RM) and stabilized course-up (RM) Composite mode North-up (TM) and course-up (TM) Plotter mode (when optional NDB-32 is installed) North-up (TM) and course-up (TM)
10)	Variable range scale:	2VRM (digital display) Range display unit: nm and km 0.000 to 295.0nm (0.000 to 547.0km)
11)	Electronic cursor:	2EBL (digital display) Second EBL can be floated (first one is fixed). Second EBL can be switched to parallel index lines. 000.0 to 359.9 degrees (in 0.1 degree unit) Can be switched between bearing display unit, relative bearing and true bearing.
12)	Cursor:	Displays the range, bearing and L/L (when GPS and GYRO are connected.) Moved using the trackball.
13)	Tuning method:	Manual and auto (tuning indication bar attached)
14)	Sea clutter restraint:	Manual and auto
15)	Rain clutter restraint:	Manual and auto
16)	Radar interference rejection:	Built-in
17)	Bearing scale:	1-degree scale, 360 degrees
18)	Bow display:	Electronic (stern marker can also be displayed)
19)	Guard zone alarm:	Can be switched between "OFF", "IN" and "OUT". Buzzer sound available. Range storing function equipped (1 sector ring)
20)	Off center:	Up to 66% of radius of any scale except 96 and 120nm
21)	TM display:	Built-in (excluding 96 and 120nm)
22)	TM reset position:	66% of radius Manually resettable
23)	Double zoom:	Within 66% of radius from the zoom center (excluding 0.125nm) * Available only when RM is selected in the radar mode.
24)	Radar trail:	TM radar trail in TM RM radar trail in RM Radar trail interval: Short, middle, long, continuous Radar trail can automatically be cleared by switching range or resetting TM.
25)	Pulse width switch:	Long/short (0.75, 1.5, 3, 6, 12 and 16nm)
26)	Target enhancement:	Built-in
27)	Degaussing:	Automatic degaussing (approximately every second)

28) Operating positions

(1) By knob

(1) Tuning knob:	TUNE
(2) Snow/rain clutter restraining knob:	RAIN CLUTTER
(3) Sea clutter restraining knob:	SEA CLUTTER
(4) Gain adjusting knob:	GAIN
(5) Brilliance:	BRILL
(6) VRM:	VRM
(7) EBL:	EBL
(8) Power supply:	ON/OFF POWER

(2) By switches

(1) Main menu key:	MAIN MENU
(2) Sub menu key:	SUB MENU
(3) Enter key:	ENT
(4) Range expanding key:	RANGE △
(5) Range reducing key:	RANGE ▽
(6) Panel light key:	PANEL DIM
(7) Day/night mode selecting key:	DAY/NIGHT
(8) Range scale brilliance key:	RANGE RINGS
(9) Bearing mode key:	BEARING
(10) Pulse width selecting key:	PULSE WIDTH
(11) TM reset key:	TM RESET
(12) TM/RM key:	TM/RM
(13) Center moving key:	OFF CENT
(14) Ship's head marker brilliance key:	SHM
(15) Alarm reset key:	ACK
(16) VRM control key:	VRM
(17) VRM control key	OFF
(18) EBL control key:	EBL
(19) EBL control key:	OFF
(20) Function selecting key:	FUNC
(21) Guard alarm key:	ALARM
(22) Transmission/standby key:	TX/ST-BY
(23) Ten key 0:	0
(24) Ten key 1:	1
(25) Ten key 2:	2
(26) Ten key 3:	3
(27) Ten key 4:	4
(28) Ten key 5:	5
(29) Ten key 6:	6
(30) Ten key 7:	7
(31) Ten key 8:	8
(32) Ten key 9:	9
(33) Clear key:	CLR
(34) Reverse key:	↻
(35) Numerical value display key:	DATA READ
(36) Acquisition key:	ACQ

(3) Special keys

[For merchant ship]

(1) Floating EBL key: FEBL
(2) Vector + key: VECT+
(3) Vector - key: VECT–
(4) Vector key: VECT

[For fishing ship]

(1) Enlarging/reducing key: 
(2) Destination key: DEST
(3) Maker key: 
(4) Other ship track key: TRACK

[Switches available when optional equipment is installed]

(1) Starting point key: o—▷
(2) End point key: —▷o
(3) Target canceling key: CANCEL TARGET
(4) Mark key: MARK
(5) Track key: OWN TRACK

Inputable Signal

(1) Electronic compass
NMEA0183 (HDG, HDT and VHW) (incompatible with 2-axis log)

(2) Navigation system
Equipment capable of outputting NMEA0182/NMEA0183 (GLL, GTD, VTG, RMA, RMB and RMC) or JRC-format signals.

(3) Gyro
SYNC/PULSE: 360X, 180X, 90X and 36X

(4) Log
SYNCHRO: 360X, 180X, 90X and 36X

(5) 2-axis log
NMEA0183 (VBW) (incompatible with electronic compass)

(6) External event mark
Switch input

(7) Radar buoy

Outputable Signal

(1) External alarm
(2) Sub display unit signal (radar adaptor and operation analyzer)
(3) Remote monitor (using vertical multi-scan monitor) (connector option)

Standard Equipment Configuration

Scanner:	1 unit
Display unit:	1 unit
Installation cable:	Typ. 15m (scanner connector)
Installing tools:	1 set
Standard spare parts:	1 set
Sun shield:	1 unit
Installation manual:	1 (Japanese or English)

Installing Clearance Between Equipment

	Max.	Typ.
Between scanner and display unit	30m	15m

Others (Optional)

ARPA function (built-in):	NCA-840
Plotter function (built-in):	NDB-32
Rectifier:	
Handle	
Installation cable (20m):	CFQ-8681-20
Installation cable (30m):	CFQ-8681-30

2 Installation

INSTALLATION MANUAL INDEX

INSTALLATION MANUAL DRAWING

SECTION 1 GENERAL

Correct installation of the radar equipment is an important condition for full and stable utilization of machine performance, and smooth maintenance and repairs. To Install the equipment, proceed as instructed. Mount the scanner unit as high as possible, taking into consideration the weight of the unit. Place the display unit in the steering room, selecting a location where observations are easy. Connection between the scanner unit and the display unit of the radar, requires, normally, 15 m 28-core composite cable with internal shielding. If using longer cables, contact Japan Radio Co., Ltd. first. Cable lengths of up to 30 m are permissible, but if longer cables are required this may affect the performance of the radar. Full consideration is necessary when planning installation.

SECTION 2 INSTALLATION OF SCANNER UNIT

2. 1 SELECTING THE INSTALLATION LOCATION

Take the following into consideration when selecting the installation location:

(1) Consider the weight of the scanner unit and decide what height it can be raised for installation in the ship.

(2) Height at which the scanner unit is installed has to do with the maximum detectable range, the higher its position the better. On the other hand, however, if raised too high, at a point beyond the beam width (-3 dB position) along the vertical direction radio wave energy will be affected noticeably, making it difficult to spot targets lying very near. When installing the unit, consider its weight, longest permissible cable length, and the requirements during future maintenance. Refer to section 5.1 of instruction manual for the relation between the height of the scanner unit and maximum detectable range.

(3) If the width of the radiated beam is 2θ (most energy is concentrated within this width), then the energy reduces considerably in directions outside the 2θ range. Thus, if the scanner unit is raised too high it will be difficult to spot targets lying very close-by. If, on the other hand, the scanner unit is installed low, it will be obvious to miss distance t5argets, and the ship's mast, derrick, funnel, etc. will intercept the radiated beams, making most of your targets unobservable. In general, the lowest position of the scanner unit should be as shown by the line AB in Fig. 2,1 Angle 2θ is 25° for the radar of JMA-3910/3925. Normally, when deciding the height of the scanner, it is necessary to makew sure that the ship's mast does not obstruct the beams.

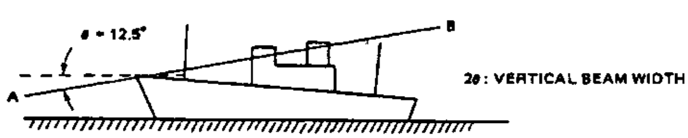


FIG.1.1 LOWEST POSITION OF SCANNER UNIT

(4) When selecting the position of the scanner along the length of the ship, make sure that the shading caused by the ship's mast on the radio waves does not coincide with the ship's center line. If the ship has no large obstruction towards front, normally the scanner is placed on top of the steering room along the ship's center line.

(5) Avoid placing DF (direction finder) or VHF (communications) antenna near the scanner as these will interfere with the radiated waves

(6) Soiling of the radiating surface of the scanner by the smoke from funnel affects radar performance Clean the radiating surface from time to time. To facilitate maintenance, place the scanner in the right position and use mast and tower of the right structure.

(7) Note that, if placed near ship's flag or rope may cause by wind to wrap or coil around the radiator and damage it.

(8) Do not select the derrick post as the location for scanner installation. The derrick post is subject to large vibrations.

(9) Note the swing circle (d) of the scanner and allow a distance of at least d/2+200 mm between scanner swing center and other installations (say, mast or radio antenna). Scanner swing circle in the radar is 1340 mm for NKE-1055-4 (4 feet), 1910 mm for NKE-1055-6 or NKE-1056-6 (6 feet), 2836 mm for NKE-1056-9 (9 feet).

2.2 INSTALLATION

(1) Stand

Install the stand as instructed in drawing Fig. 101, 102, 103, 104 (appendix). Direct the cable gland towards ship's stern, making sure that scanner installation base is parallel to surface of the sea. If the stand is installed directly on the top of steering room and find that the scanner is not sufficiently high, use a pedestal or radar mast. Normally, if height of the scanner is not more than 2 m above the roof of the steering room, place the scanner on a pedestal fixed with angle joints. If, on the other hand, the scanner is positioned above a height of 2 m, use a cylindrical radar mast, and place the scanner on top of it. Whether a pedestal or a radar mast is used it is necessary to provide proper foothold to facilitate the Installation, maintenance, adjustments, and repairs. (See Fig. 2.2.)

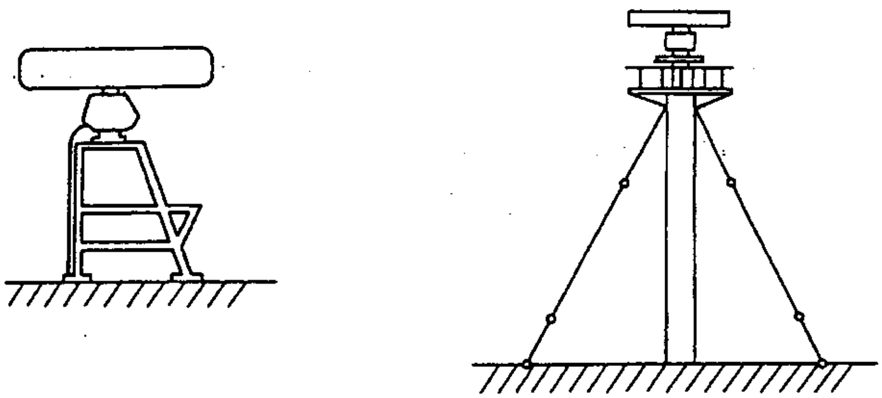


FIG. 2.2 SCANNER STAND

(2) Suspending the Scanner

The scanner is supplied assembled, with felt wound around the area where the suspension rope will contact it Engage the sling with the scanner as shown in Fig 2.3. If felt is not provided where the rope contacts the scanner, or if the scanner is supported near the two extremities of the radiator, you may damage the unit.

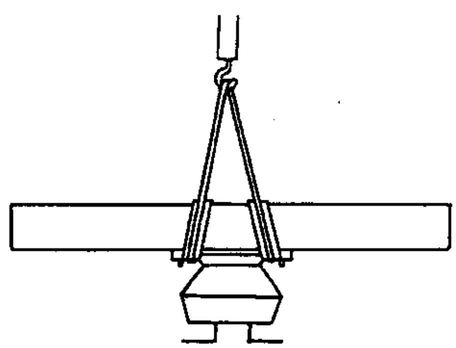


FIG. 2.3 SCANNER SUSPENTION

(3) Paint

Apply necessary paint on the fixing legs, bolts, nuts, etc. to prevent corrosion.

(4) Place the scanner at least 1.5-2 m away from the nautical instruments such as the compass or the chronometer to protect these from the effect of the magnetron inside the scanner.

SECTION 3 INSTALLATION OF DISPLAY UNIT

3.1 SELECTION OF INSTALLATION LOCATION

The installation location of display unit should be determined by considering following matters:

(1) A Location where the observation can be easily made.

(2) In order to eliminate the effect to magnetic compass as much as possible, a location having at least 1 m distance from the compass should be selected.

(3) Consideration should be made to avoid splashes of water through windows or doors directly on the equipment

(4) Location suitable for maintenance and services. When other equipment or wall are located in the back-side, top-side or on left-right side, the display unit will have to be pulled out for maintenance/service. In this case, to facilitate the maintenance/service, an adequate length of installation cable should be left inside for easy pull-out of display unit.

3.2 INSTALLATION METHOD

For installation method, refer to drawing Fig. 105. When making an observation on the CRT screen, it is desired that the display unit be placed in the direction to facilitate the bearing measurement of targets (operator's position looking toward the ship heading direction). Also, it is necessary to select a location where vibration is minimum. Total 4 connection cables(power supply, scanner, gyro and log) are provided. Also, it is necessary to consider the open space required for the bend of cable in the back-side of display unit.

SECTION 4 CABLE WORK

4.1 CABLE CUTTING

Surplus cable length should not be provided at the unit is entry points. If, however, it is difficult to connect to the terminal board (such as where space is limited), disconnect the other unit and draw it forward. Or else, place the unit on the floor, and fix it back to the correct position after the repair. Either of these will require sufficient additional length of cable, and must have the space to accommodate it. To repair a cable, consider where the job can be carried out without difficulty. Provide sufficient cable to allow the unit to be moved to a convenient location for repair.

4.2 CABLE CORE TERMINAL TREATMENT

The radar use proper terminal blocks on the terminal boards. Therefore, it is necessary to treatment of cable core terminals. Each individual wire may be cut to proper length to reach the terminal it will be connected to, and have 5 or 6 mm of insulation removed for insertion into the terminal block (see Fig. 4.1).

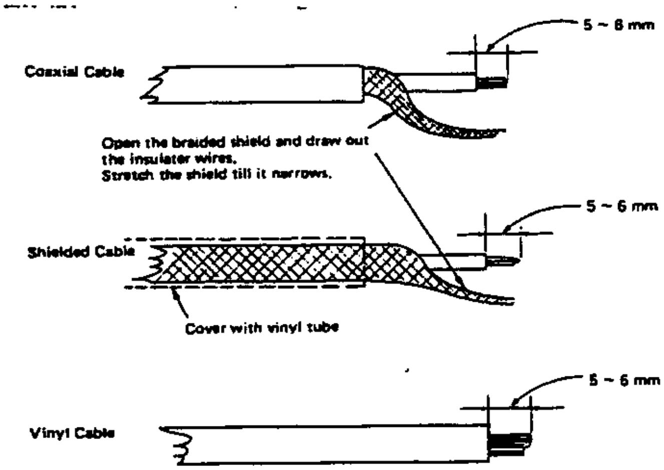


FIG. 4.1 CABLE CORE TREATMENT

SECTION 4 CABLE CONNECTION OF SCANNER, DISPLAY AND RECTIFIER

4.3.1 CABLE CONNECTION OF SCANNER(NKE-1055) of JMA-3910 (REFER FIG. 111 INTERCONNECTION DIAGRAM)

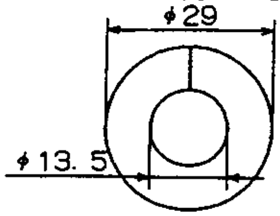
1) Four fixation bolts of the pedestal are loosened, and open. (Refer to FIG 4.3)

2) The cable ground is removed, and the ground and the gasket are inserted in the cable with the connector . (Refer to FIG 4.2)

3) The cable with the connector is inserted from the cable ground, and fix firmly with the screw of the attachment and the suppression metal fittings so that the shield of the cable may come in contact with the body. (Refer to FIG. 4.3)

4) Connector P1(4P), connector P2(6P), connector P3(10P), and connector P10(2P) are inserted in each connector J1, J2, J3, and J10.

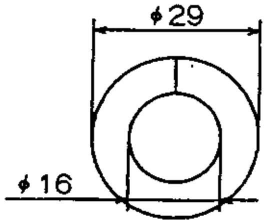
φ13ケーブルの場合
IN CASE OF CABLE(φ13)



φ13ケーブルを組み立てる時は、グランドに組み込まれているガスケットを使用する。

THE GASKET MOUNTING ON THE GRAND FOR USE WHEN ASSEMBLING THE CABLE(φ13)

φ16ケーブルの場合
IN CASE OF CABLE(φ16)

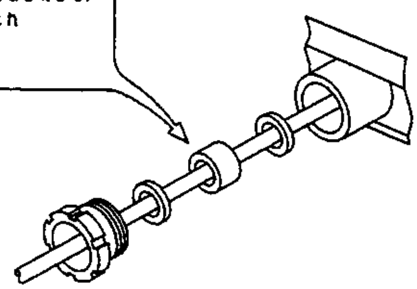


φ16ケーブルを組み立てる時は、添付品のガスケットを使用する。

THE ATTACHED GASKET FOR USE WHEN ASSEMBLING THE CABLE(φ16)

1. ガスケットにケーブルを通した後でビニールテープを2回巻きつける。

After cable passes through gasket. wind two turns around it with vinyl tape.



2. グランド金具締付後、ケーブルとグランド金具とのすきまをパテ埋めする。

After tightening gland clamp. cavities between cable and clamp should be filled with sealing compound.

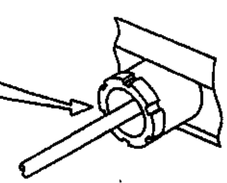


FIG. 4.2 ASSEMBLING PROCEDURE FOR CABLE

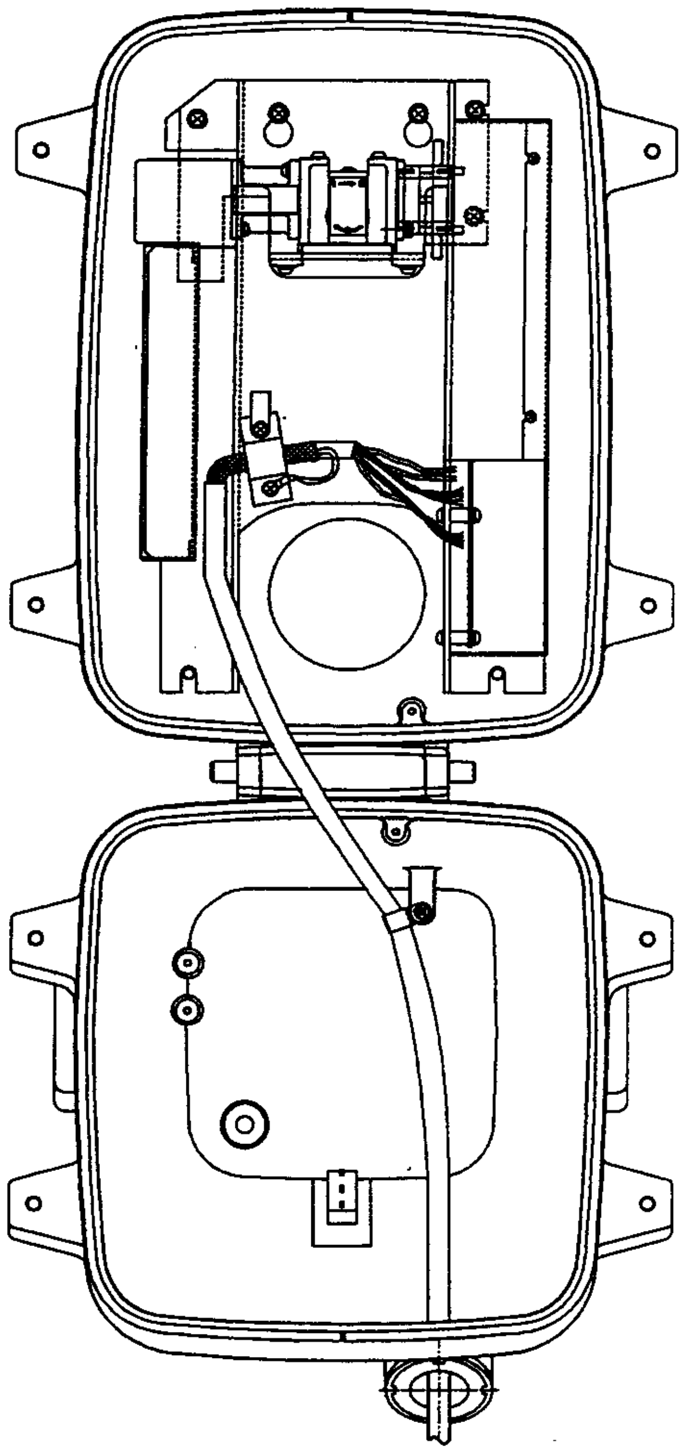


FIG. 4.3 ASSEMBLING PROCEDURE FOR CABLE

4.3.2 CABLE CONNECTION OF SCANNER(NKE-1056) OF JMA-3925 (Refer to FIG.112 INTERCONNECTION DIAGRAM)

1) Four bolts OF the cover are loosened, and the cover is removed.

2) The cable ground is removed, and the cable ground and the gasket are inserted in the cable with the connector . (Refer to FIG 4.4)

3) The cable with the connector is inserted from the cable ground side, and fix firmly so that the cable ground installation board and the shield of the cable may come in contact with the body. (Refer to FIG. 4.5)

4) Connector P1(4P), connector P2(6P), connector P3(10P), and connector P10(2P) are inserted in connector J1, J2, J3, and J10 of terminal board PCB respectively.

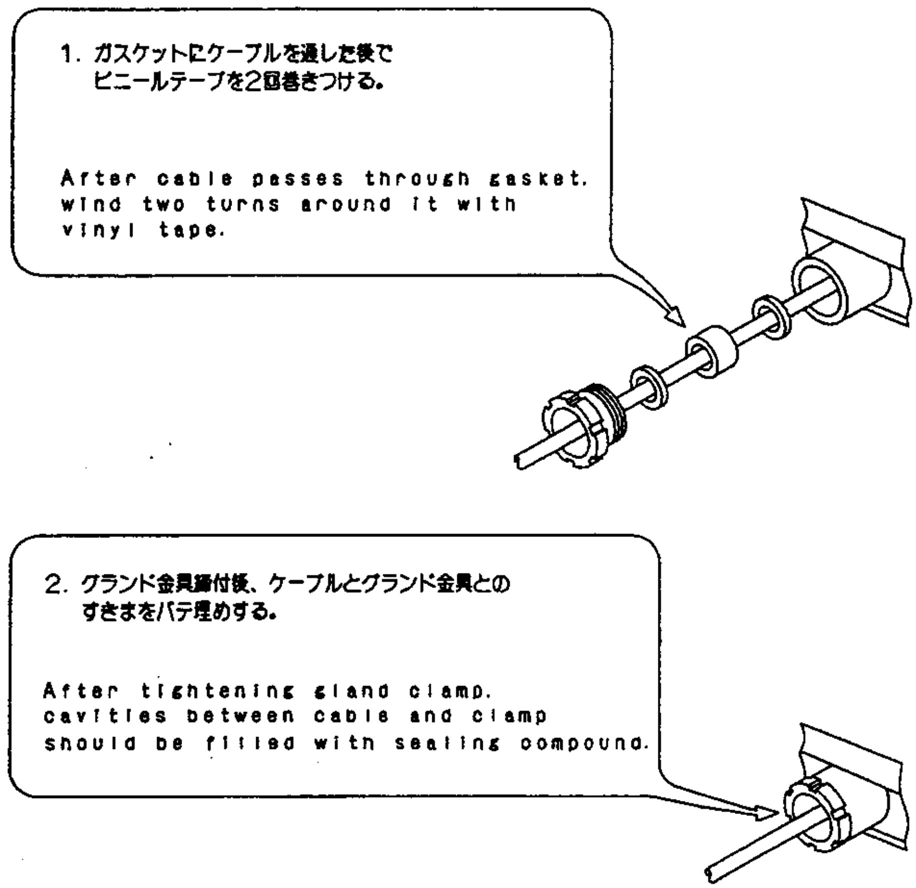


FIG. 4.4 ASSEMBLING PROCEDURE FOR CABLE

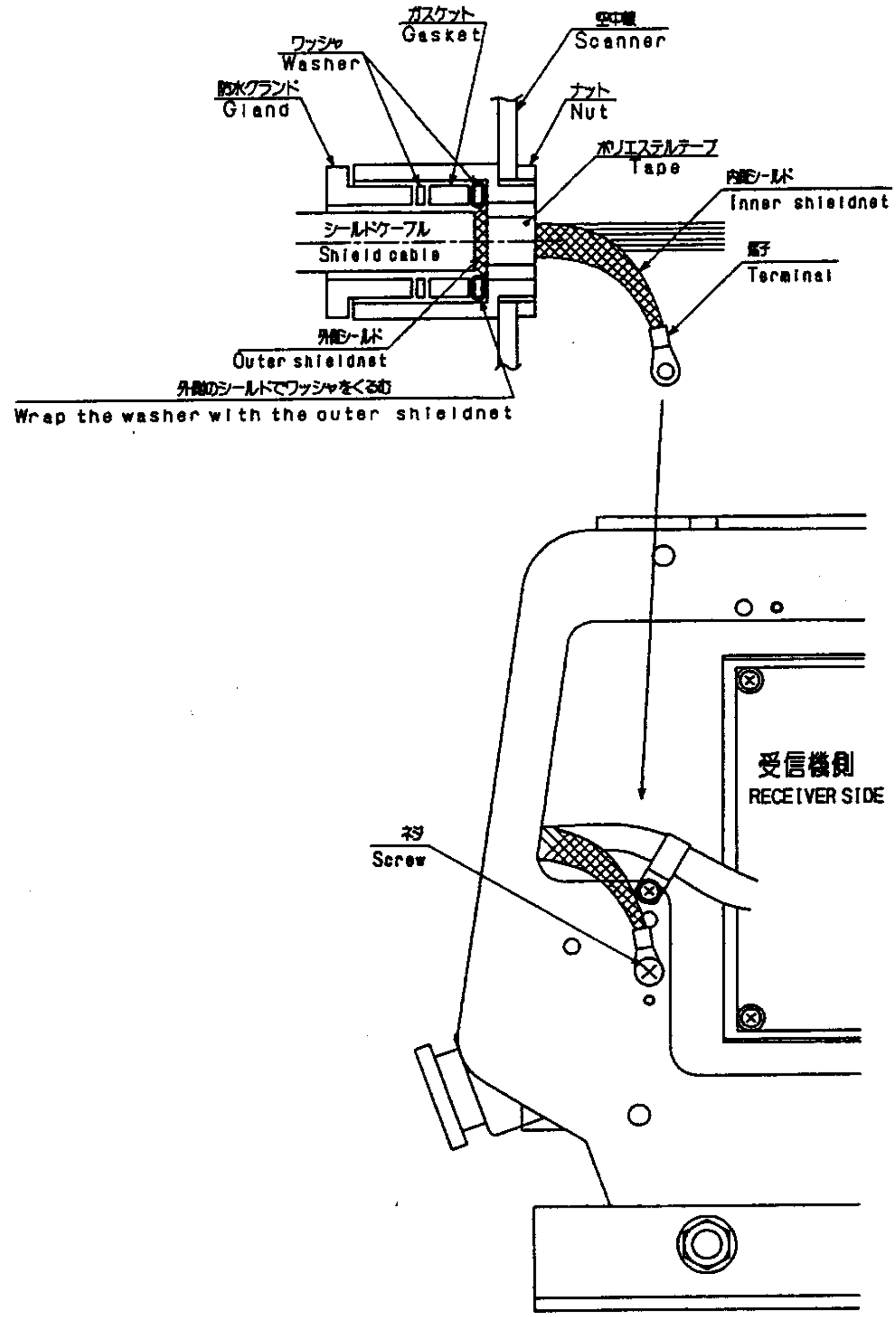


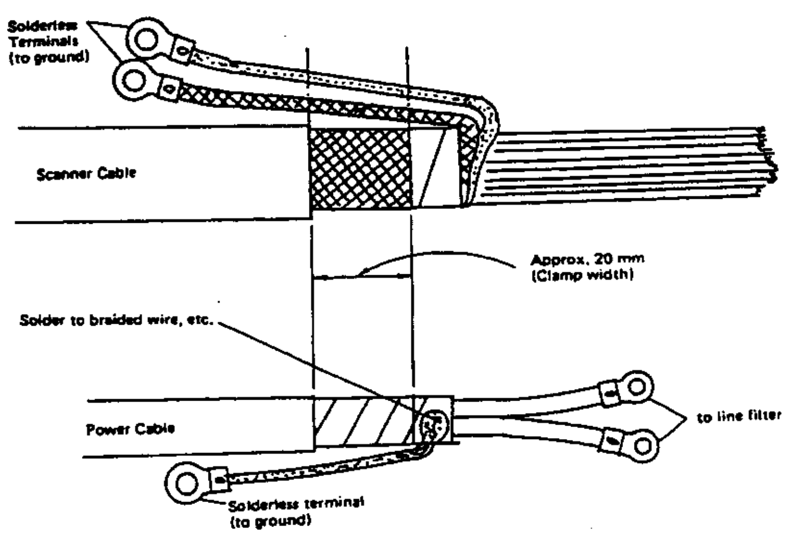
FIG. 4.5 ASSEMBLING PROCEDURE FOR CABLE

4.3.3 CABLE CONNECTION OF DISPLAY (NCD-3780) (REFER FIG. 111, 112 INTERCONNECTION DIAGRAM)

1) The display cover is detached . (FIG. 4.7)

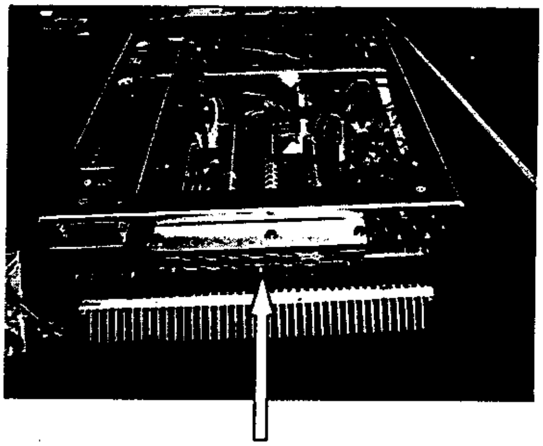
2) Please detach the cable ground in the upper part of the rear, and connect the cable from the cable from scanner unit, the power supply cable, the GYRO cable, and the LOG cable. Please connect the cable from other optional equipment. (Refer to FIG. 4.8)

3) Please do the terminal processing of a double chapter of shield line and the power supply cable of the cable for equipment as shown in FIG. 4.6.



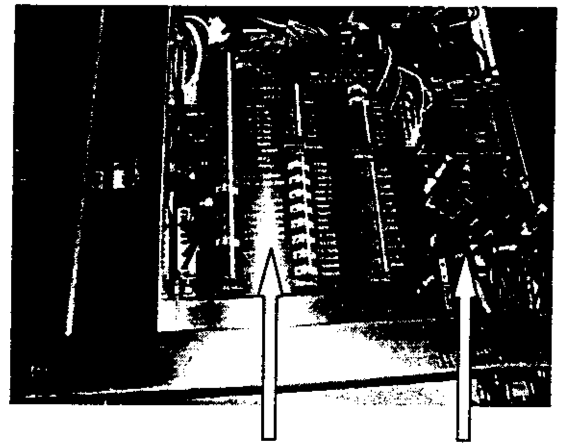
(Example of Power cable is used CVVS-cable, covered copper tape.)

FIG. 4.6 TREATMENT OF THE CABLE TERMINAL



Cable grand

Fig. 4.7 DISPLAY REAR



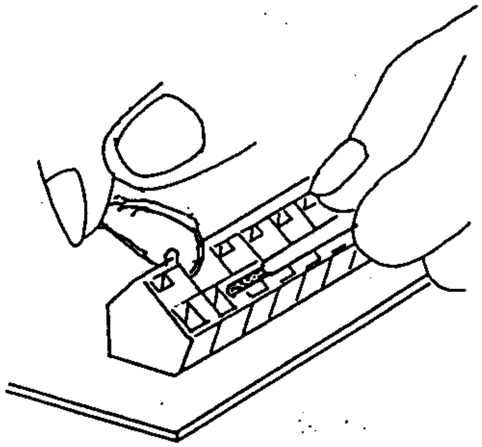
Terminal PCB TB5001

FIG. 4.8 TERMINAL BOARD

4) Please connect each wires of the cable for installation with the terminal board according to the under mentioned points with a tool of the attachment.

A. Insert the tool to the terminal which connects.
B. Peel length and rose of the electric wire are confirmed, and appropriates it to the outlet.
C. Clamping is opened pushing the tool thumbing ahead, and the wire is bumping.
D. The tool is extracted and difference all-in in the following terminal.

5) Please connect wire with terminal board (TB5001) by installing the lag terminal in the terminal of the power supply cable . Please brush off attention enough to the polarity of the power supply. (Refer to FIG. 4.8)



4.3.4 RECTIFIER

When the power supply inboard is an AC, the rectifier is used. Connected change of the insertion terminal of transformer is necessary though the rectifier can be used together by confronting the power supply inboard AC100/110/115 V/200/220/230V.

4. 4 CABLE CONNECTION OF GPS RECEIVER

1. JLR－4310 (GPS RECEIVER) /JLR－4320 (GPS RECEIVER) /JLR－4321 (DGPS RECEIVER)

Because the following cables are supplied with the receiver, insert the connector to receiver. And cut the cable at the end of connector of JMA-3900 radar side.

1. DC15V (POWER SUPPLY)
2. GND (POWER SUPPLY GROUND)
3. Data return (GND)
4. Data output from receiverGPS→JMA－3900)
5. Command input to receiver (JMA－3900→GPS)
6. No connection

JMA－3900 side	Cable side from GPS receiver
TB4301 ＋15V	DC15V pin 1
TB4301 E	GND pin 2
TB4302 GPSRX－	Data return (GND) pin 3
TB4302 GPSRX＋	Data output from receiver pin 4
TB4302 GPSTX－	Command input to receiver pin 5

Attention: The command output to the GPS receiver is GPSTX -. It is not +.

2 NRB－2J (Beacon receiver) ＋JLR－4310 (GPS Receiver) ＋NQA－1481D

Connect as shown in the table because there is the following terminal board in NQA－1481D.

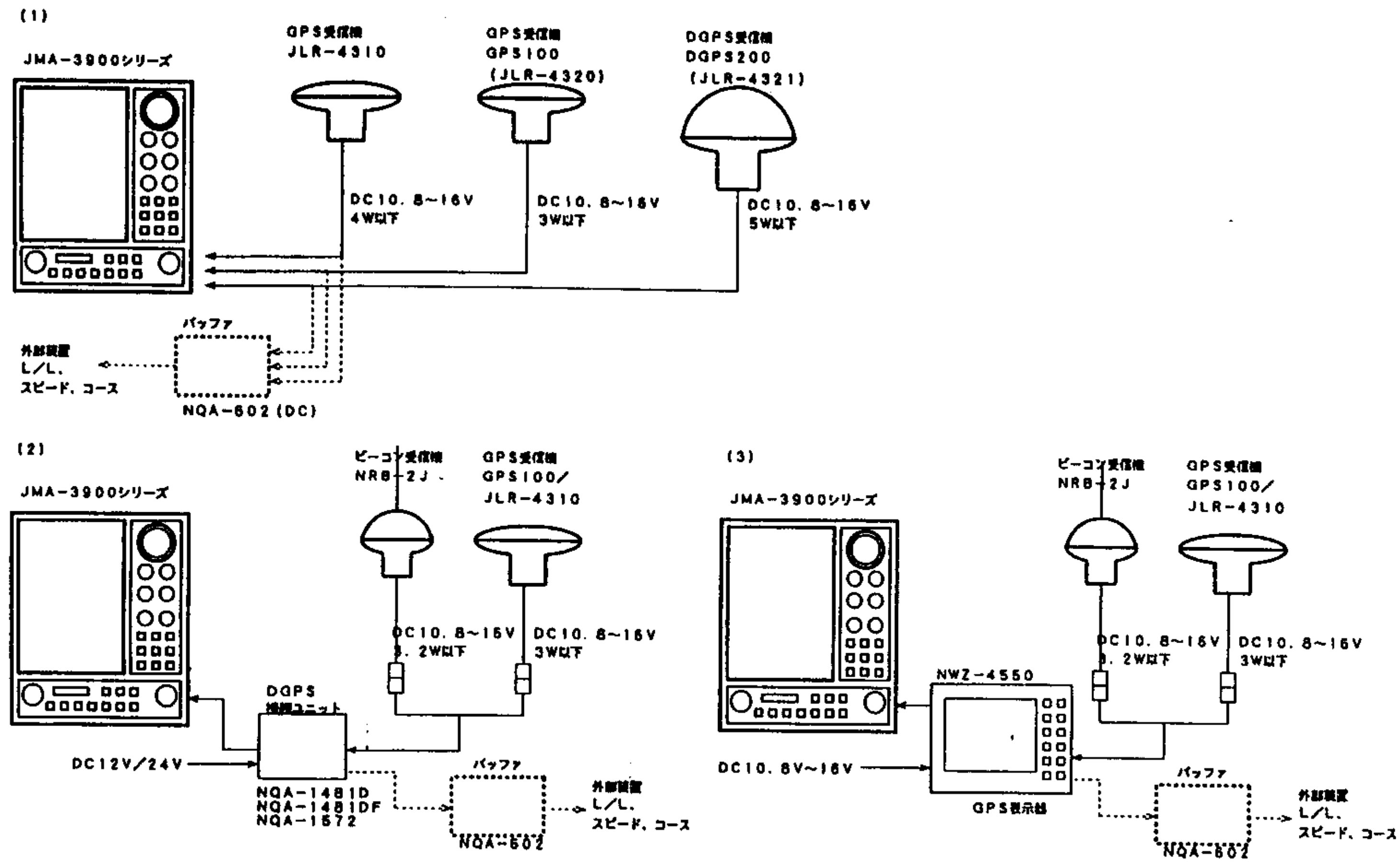
JMA－3900 side	NQA－1481D Terminal board
TB4302 GPSRX＋	TB1 DATAOUT＋ (data output +)
TB4302 GPSRX－	TB1 DATAOUT－ (data output -)

3. NRB－2J (beacon receiver) ＋JLR－4310 (GPS receiver) ＋NWZ－4550

Because the following cables are supplied with the display, connect the wire to JMA-3900 radar.

RED CABLE: DC12V (POWER SUPPLY)
BLACK CABLE: GND (POWER SUPPLY GROUND)
GREEN CABLE: Data return (DATACOM)
YELLOW CABLE: Data output from DISPLAY(DATAOUT+)
BROWN CABLE: Command input to DISPLAY (DATAIN+)
WHITE CABLE: Command input to DISPLAY(DATAIN-)

JMA－3900 side	GPS DISPLAY SIDE
TB4302 GPSRX－	DATA RETURN(DATACOM) GREEN CABLE
TB4302 GPSRX＋	DATA OUTPUT(DATAOUT+) YELLOW CABLE



15インチカラーレーダ(JMA−3900シリーズ)GPS受信機との接続

Connection JMA-3900 series radar and GPS Reciever.

1998.3.18

4. 5 CABLE CONNECTION TO OTHER EQUIPMENT

JMA－3910／3925 radar can install the following options.

○ Signal output to sub-display unit
○ Radar buoy
○ Remote display
○ Sub display(in case of sub display of other radar)

4. 5. 1 Signal output to other sub display

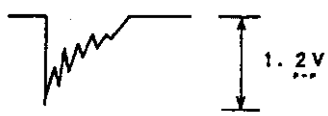
The signal output to other sub display are as follows,

- Video output(50Ω termination)
- Trigger signal(1KΩ termination)
- Rotation signal(Open collector output)

・Video output

Video output is obtained from TB4304－VDO and TB4304－VDOE (return)

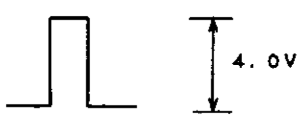
Negative signal



・Trigger signal

Trigger signal is obtained from TB4304－BTIY (TTL output) and TB4304－BTIE (return)

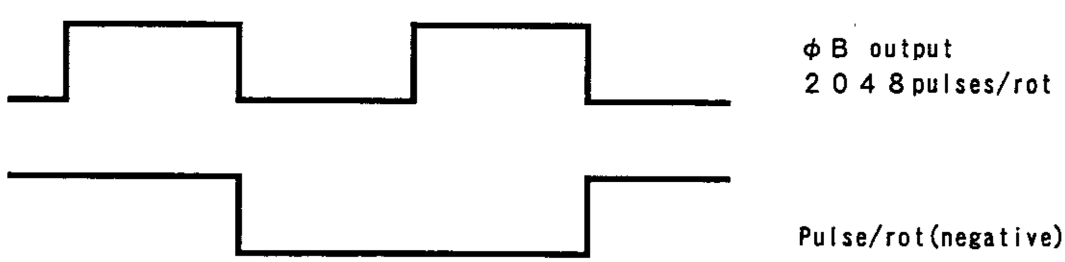
It is about 6μ second from raising edge of trigger to video signal(0 nm).



・Rotation signal

Rotation signal is obtained from TB4304－BPO and TB4304－BPOE (return).
Azimuth reference signal is obtained from TB4304－BZO and TB4304－BZOE (return)

Both signals are used by pull up with about 1KΩ to 5v power supply.



JMA－3900 can supply only 1 phase of rotation signal. If the sub display requires 2 phase rotation signals, it is necessary to set the one input to logical "H" or "L".

4. 5. 2 Radar bouy

The signal outputs are as follows,

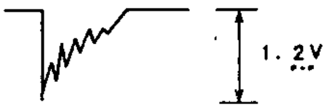
・ Trigger signal
Trigger signal is same as 4. 5. 1

・ Rotation signal(Open collector output)
This signal is same as 4. 5. 1.

Input signal from radar bouy is as follows,

・ Radar bouy video signal(50Ω termination)is connected to TB4304-BVD and BVDE (return)

Video signal is negative



4. 5. 3 Remote display

Output signal to remote display(sub monitor) are as follows,

・ Horizontal sync. signal
・ Vertical sync. signal
・ Video signal(50Ω termination)

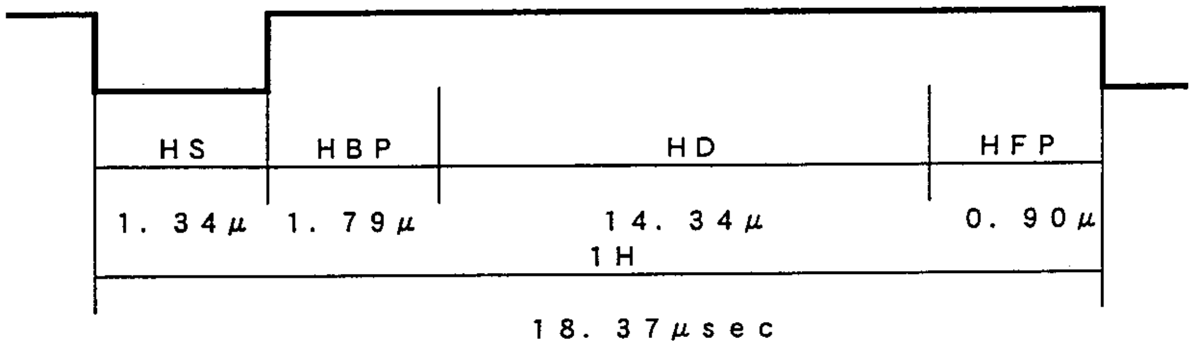
These signals are available to remote display after the D/A converter for the option in PC4401 (CPU circuit) and connecting the CFQ-8914 cable of the option.

The remote display output is almost the same as 1024×768(XVGA) of the personal computer like (see next page).
These outputs are outputted from the CFQ-8914 cables.
The CFQ-8914 cable is prepared as an option, and the interface cable which connects the personal computer monitor with the display unit of radar.
It is the one which connects the one side of this cable with J6 of motherboard PC4101 in the display unit, and converts them into 15 pin high density mounting type connector (15 pin D-SUB connector which is attached to the personal computer monitor etc.).

Therefore, a remote monitor can be connected after this by customer's favorite size by the connecting of the cable for the personal computer monitor and the connection which can be bought in the shop etc.

- Horizontal sync. signal (HS) : Negative

HS signal is outputted according to following timing. Dot clock is 71.4286MHz

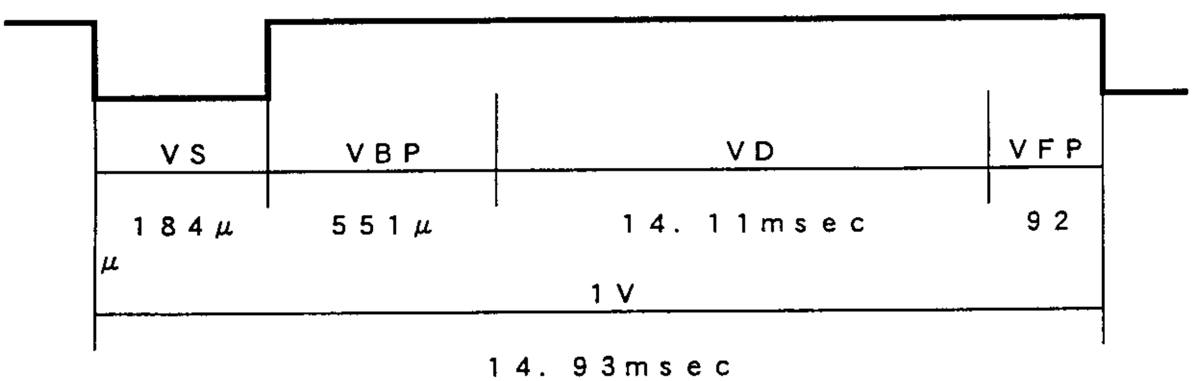


Frequency=54.44KHz
1 Word=2clocks=32dots=475nsec
1dot=14.0nsec(71.4286MHz)
1H=18.37sec= 1312dots
HD=14.34μsec=1024dots
HFP= 0.90μsec= 64dots
HBP= 1.79μsec= 128dots
HS= 1.34μsec== 96dots

★ Output amplitude : 4.3V−0V (1KΩ termination)

- Vertical sync. signal (VS) : Negative

VS signal is outputted according to following timing.



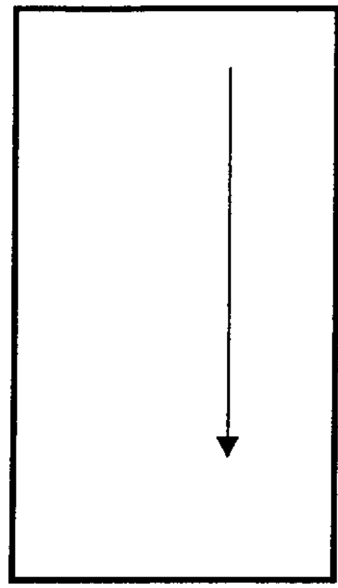
Frequency=68.6Hz
1V=813H=14.93msec
1VD=768H=14.11msec
VFP= 5H= 92μsec
VBP= 30H=551μsec
VS= 10H=184μsec

★ Output amplitude : 4.3V−0V (1KΩ termination)

- Video output : Negative

★ Output impedance: approx. 75Ω
★ Output amplitude: 0.9V−0V (75Ω termination)

CRT Surface



Note)
When you install the remote display, it is necessary to rotate a usual personal computer monitor etc. to clockwise 90 degrees as shown in a left direction. Because the raster direction is like left drawing.

Moreover it is necessary for preventing color distortion by a magnetic shield etc., because the conventional monitor is not installed degauss function.

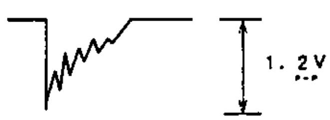
4.5.4 Sub display

Input signal for sub display are as follows,

- Vide input signal (50Ω termination)
- Trigger signal input (10KΩ termination)
- Rotation signal (Composite signal)
- Video input (Negative: 50Ω termination)

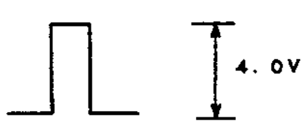
Video signal is connected to TB4301−VD and TB4301−VDE (return).

Negative signal



- Trigger signal input (10KΩ termination: TTL input)

Trigger signal is connected to TB4304−ETIY and TB4304−ETIYE.
It is about 6μ second from raising edge of trigger signal to video signal (0 nm).



· Rotation signal input (pull upped by 1 0 K Ω. So output side is not necessary to pull up) .

Rotation signal is connected to B P and B P E (return : common to rotation reference signal)

Because JMA-3900 series radar do not detect the direction of the rotation, the encoder input is not needed only one BP signal.

· Rotation reference signal input (pull upped by 1 0 K Ω. So output side is not necessary to pull up) .

Rotation reference signal is connected to B Z and B P E (return : common to rotation signal)

SECTION 5 MEASURES AGAINST NOISE IN RADIO COMMUNICATION EQUIPMENT

Each component unit in the radar equipment has various pulse circuits Sometimes electromagnetic waves are radiated from these circuits or cables connecting the component units, and these are called interference noise to the receiving antenna or antenna or the antenna cable of radio communication equipment. The measures necessary to prevent the adverse effect of these noises are described below.

5. 1 Shielding of the Units

The spring, etc. are mounted for the purpose of shielding the necessary parts of each composition units of its radar. These springs, etc should have a complete and through electrical contacts in order to prevent the radiation from the units. Therefore, it Is necessary to pay special on these matters when making the installation. The screws for the cover and door, etc. of the units should be security tighten.

5. 2 Connecting Cable between Units

Use specified cables only to connect the units. Connect the cables as instructed in the paragraph 4.5.

5. 3 Installation Location

Though sufficient shielding is not necessarily perfect in the units, for example, some radiation always takes place from the CRT surface and the power supply fuse holder, and; therefore, it is necessary not to allow access of other receiver antenna cables to these areas Shielding is not perfect in the shielded cables also. These cables must not be laid parallel to the antenna cable.

5. 4 Grounding

Ship's structure and the relative position of the radio equipment and the radar equipment are factors that do not allow a method to be suggested for universal application. To ground the other units to the ship, use the nearest grounding points. For the radio communication equipment also, you must seek the closest grounding point.

SECTION 6 CHECK AFTER INSTALLATION, INITIAL SETTING AND ADJUSTMENTS

6. 1 CHECK AFTER INSTALLATION

After completing the equipment installation work, all work should check whether to be done appropriately according to the instruction. Especially, please check whether it is errorless or the installation of each equipment is certain, the water leak does not occur in the scanner (tighten of the cable ground and the cover) or the earth of the chapter of the shield class of the cable is correctly done to the connection of the cable.

Moreover, please confirm the undermentioned setting before power on because setting the power supply part and CPU PCB is different in 10KW(JMA-3910) and 25KW (JMA 3925).

1) POWER SUPPLY

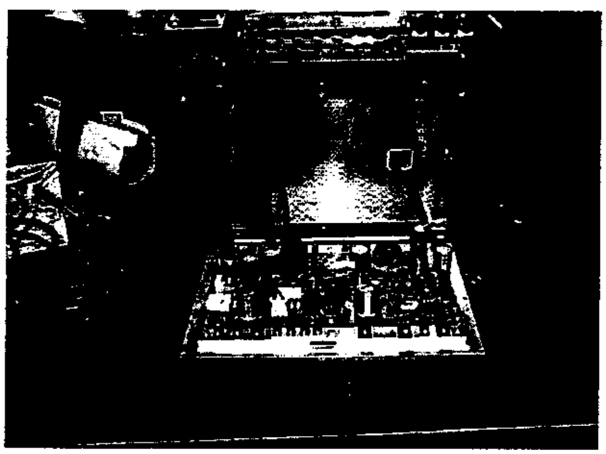


FIG. 6.1 POWER SUPPLY

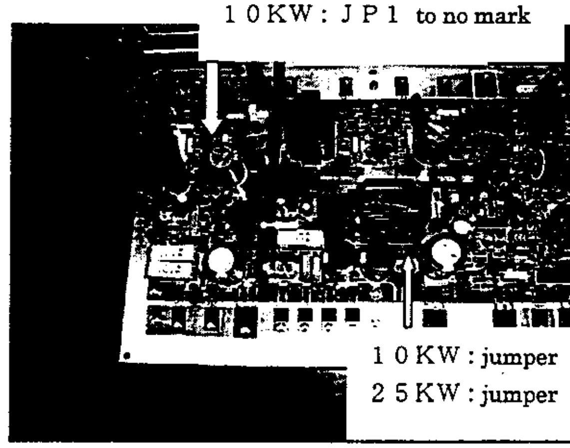
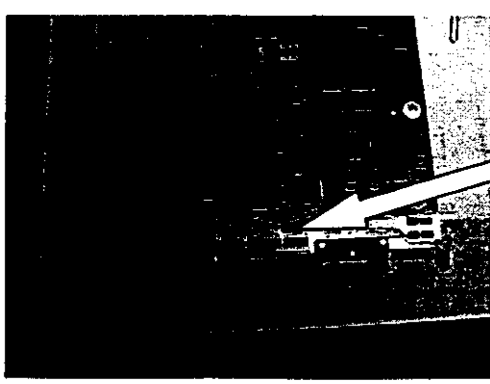


FIG. 6. 2 SETTING OF POWER SUPPLY

2) CPU PCB



10KW : S1-8 to ON
25KW : S1-8 to OFF

FIG.6.3 PC4401 CPU PCB

6. 2 OPERATION CHECK

Please read the method of operating the manual thoroughly before checking the operation of radar after checking. Please radar must be operated according to the instruction manual after confirming the power-supply voltage inboard is in the range of the allowance and check whether to operate normally by operating all the operation parts after it is confirmed not to find abnormality.

Moreover, please refer to the detaching points of the appendix when the exchange or the adjustment of the monitor PCB (Refer to appendix 4) and the unit is necessary . Please confirm there is no miss connected or not tightening the screw and the connector after the replacement.

Please do the following setting and the adjustments after installation, although an enough adjustment is done each radar equipment is to ship from the factory.

6.3 ADJUSTMENT OF NSK UNIT

The NSK unit of this radar equipment can interface to most gyros by setting the DIP switch. (In the step motor type, the primary voltage of DC24V-DC100V and the synchro motor type is AC50-115V)
Please set switch S1, S2, S5 in NSK circuit (PC4201), and jumper JP1 according to the undermentioned procedure according to the kind of the gyro before powe on.
Please confirm the type of the gyro and set according to the following, because the gyro selection switch of the NSK circuit when a usual factory is set is selected so that the synchro type may correspond rotation ratio 360X. Please refer to a set table of applying Figure 113,114 gyro and the speed log selection switch for details.

(1) The switch and the jumper of NSK unit (PC4201) are set before the power supply of radar is turned on.

S1:remainas to turn off.

S2:Because there are a case of the step signal and a case of the synchro signal in the output of the gyro, the gyro of the ship shall be confirmed, and S2 is set.

synchro signal ······ SYNC side.
step signal ······ STEP side.

S5:S5 is set according to gyro. Please refer table of S5.

S5-1: synchro signal ······ OFF
step signal ······ ON

S5-2,3: rotation ratio

	360X	180X	90X	36X
S5-2	OFF	OFF	ON	ON
S5-3	OFF	ON	OFF	ON

S5-4 : Rotation direction

Normal rotation (clockwise) …… [OFF]
Reverse rotation (countercloockwise) …… [ON]

S5-5 : Log type

Pulse signal……… [OFF]
Synchro signal…… [ON]

S5-6 : Not used

5-7,8 : Log ratio

	Pulses/NM			
	800	400	200	100
	Rotations/NM			
	360X	180X	90X	36X
S5-7	OFF	OFF	ON	ON
S5-8	OFF	ON	OFF	ON

S6 : Log test set to [NORM]

JP1 : Gyro type

Synchro signal……Strap to the [SYNC] position
Step signal…… Strap to the [STEP] position

(2) Set S1to [ON]

*After power on, if the radar picture and the course data (own ship's true bearing) are displayed in reverse direction, set the s5-4 switch ON.

Table 6．1 s5 setting table

			1	2	3	4	5	6	7	8
GYRO	SYNC		0							
GYRO	STEP		1							
GYRO	360X			0	0					
GYRO	180X			0	1					
GYRO	90X			1	0					
GYRO	36X			1	1					
GYRO	DIRECTION	NORM				0				
GYRO	DIRECTION	REV				1				
LOG	TYPE	PULSE					0			
LOG	TYPE	SYNCRO					1			
LOG	PULSE ／NM							0		
LOG	PULSE ／NM	800P/360X							0	0
LOG	PULSE ／NM	400P/180X							0	1
LOG	PULSE ／NM	200P/90X							1	0
LOG	PULSE ／NM	100P/30X							1	1

6. 4 TUNING ADJUSTMENT

PROCEDURE

1 Set the range to 24nm or more, and set the tuning controls to its middle position

2 Press the [SUB MENU] switch. Sub menu is opened.

3 Press key [9] twice.

Initial setting menu 2(初期設定メニュー2) is opened.

4 Press [3] key.

Tuning adjust is selected.

5 [ENT] key is pressed, then menu disappear. And Radar picture is displayed.

6 [RANGE ▼]~[RANGE ▲] key is pressed, so that the tuning level indicator bar at the bottom left of the display indicates the maximum.

Then press [ENT] key.

6．5 BEARING ADJUSTMENT

Perform adjustments for matching in bearing between the target measured previously using the compass of own ship, and the picture displayed on the CRT monitor of the radar.

PROCEDURE

1 Press the [BEARING] switch and set the bearing display mode to relative display(head up).

2 Using the compass of the ship, measure the bearing of a suitable target(such as a ship at rest, a breakwater, or a buoy) relative to the bearing of own ship's bow. (For example, take the intended bearing as 25 degrees.)

3 Press the [SUB MENU] key.

Sub menu is opened.

4 Press the [9] key twice.

Initial setting 2 menu is opened.

5 Press [1] key.

Bearing adjustment is selected.

6 When [ENT] key is pressed, then menu disappear. And Radar screen is displayed.

7 When EBL1 is displayed as a result, rotate the EBL control to set EBL1 to the target that was selected at step 2 above, and press [ENT] key.

(For example, at step 2 above, the bearing is to be set 25 degrees.)

9 If complete matching in bearing is not yet achieved, return to step 6 above and repeat the operation procedure.

6. 6 RANGE ADJUSTMENT

Perform adjustments so that the range to the intended target in the display area is correctly displayed.

PROCEDURE

1 Find from PPI display a target to which the range is known.

2 Press [SUB MENU] key.

Sub menu is opened.

3 Press [9] key twice.

Initial setting menu 2 is opened.

4 Press [2] key.

Range adjustment is selected.

5 When [ENT] is pressed, menu disappear , and radar screen is displayed.

6 Press [RANGE ▼] or [RANGE ▲] key so that target that was selected coincides the known distance. Then press [ENT] key.

7 If complete matching in range is not yet achieved, return to step 2 above and repeat the operating procedure.

6. 7 SSETTING OF ANTENNA HEIGHT

Set the antenna height of radar.

PROCEDURE

1 Press [SUB MENU] key.

Sub menu is opened.

2 Press [9] key twice.

Initial setting menu 2 is opened.

3 Press [8] key.

Installation/Maintenance menu is opened.

4 Press [1] key.

Antenna height is selected.

5 By pressing [1] key, select below 5m、5～10m、10～20m、 or over 20m,.

6 Press [ENT] key.

7 Press [SUB MENU] key.

6. 8 OTHER SETTING

(1) SETTING OF OWN COURSE EQUIPMENT

PROCEDURE

1 Press [SUB MENU] key.

Sub menu is opened.

2 Press [9] key.

Initial setting menu 1 is opened.

3 Press [1] key.

Own course equipment is selected.

4 Press [1] key, and select GYRO or ELECTRONIC COMPASS.

5 Press [ENT] key.

6 Press [SUB MENU] key.

(2) SETTING OF SPEED EQUIPMENT

Set a ship speed equipment.

PROCEDURE

1 Press [SUB MENU] key.

Sub menu is opened.

2 Press [9] key.

Initial setting menu 1 is opened.

3 Press [2] key.

Speed equipment is selected.

4 Press [2] key, and select MANUAL, LOG, GPS or 2 AXIS.

5 Press [ENT] key.

6 Press [SUB MENU] key.

(3) SETTING OF DISPLAY AREA

Set the size of radar picture display area.

PROCEDURE

1 Press [SUB MENU] key,

Sub menu is opened.

2 Press [3] key.

RADAR MENU 3 is opened.

3 Press [1] key.

Screen area mode is selected.

4 Press [1] key, and select STANDARD or WIDE.

5 Press [ENT] key.

6 Press [SUB MENU] key.

(4) TRUE BEARING ADJUSTMENT

Adjust the true bearing indication so that master gyro coincides to radar.

PROCEDURE

1. Press [SUB MENU] key. Sub menu is opened.
2. Press [2] key.

   Radar menu 2 is opened.

3. Press [1] key.

   True bearing setting is selected.

4. Press [ENT] or [1] key.

   Number input mode is selected.

5. Press [0] ~ [9] key to adjust compass, then press [ENT] key. (max. 359.9°)
6. Press [SUB MENU] key.

(5) SHIP SPEED SETTING

Set the ship speed by manual.

PROCEDURE

1 Press [SUB MENU] key.

Sub menu is opened.

2 Press [9] key.

Initial setting menu 1 is opened.

3 Press [3] key.

Manual speed setting is selected.

4 Press [ENT] or [3] key.

Number input mode is selected.

5 Press [0] ~ [9] key, and adjust speed , then press [ENT] key. (max. 99.9)

6 Press [SUB MENU] key.

(6) DRIFT SETTING

Set the drift by manual.

PROCEDURE

1 Press [SUB MENU] key.

Sub menu is opened.

2 Press [9] key.

Initial setting menu is opened.

3 Press [6] key.

Drift setting is selected.

4 Press [ENT] or [6] key.

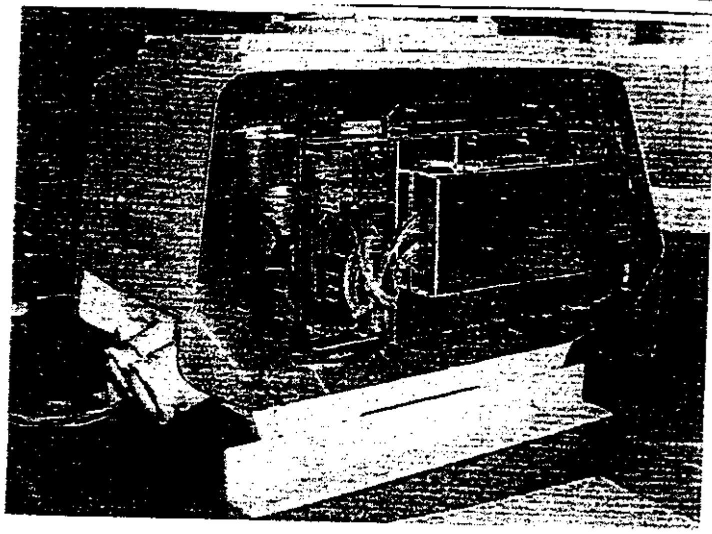
Number input mode is selected.

5 Press [0] ~ [9] key, set drift direction, then press [ENT] key.

6 Press [0] ~ [9] key, set drift speed, then press [ENT] key. (max. 9.9)

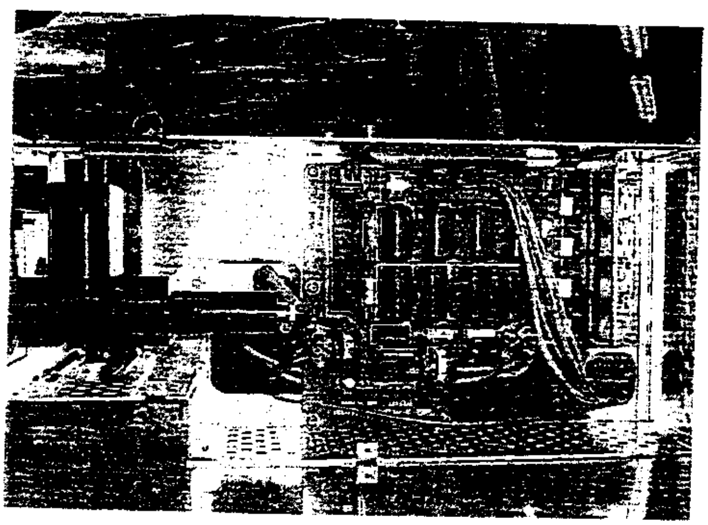
7 Press [SUB MENU] key.

APPENDIX 1. REPLACEMENT PROCEDURE OF MODULATOR AND RECIEVER



REMOVAL OF RECEIVER

1. REMOVE THE PEDESTAL COVER.
2. REMOVE TWO CONNECTORS OF TERMINAL PCB.
3. LOOSE THE SCREWS(EACH TWO) OF FIXING THE RECIEVER AND FIXING MIC.
4. REMOVE THE RECIEVER.



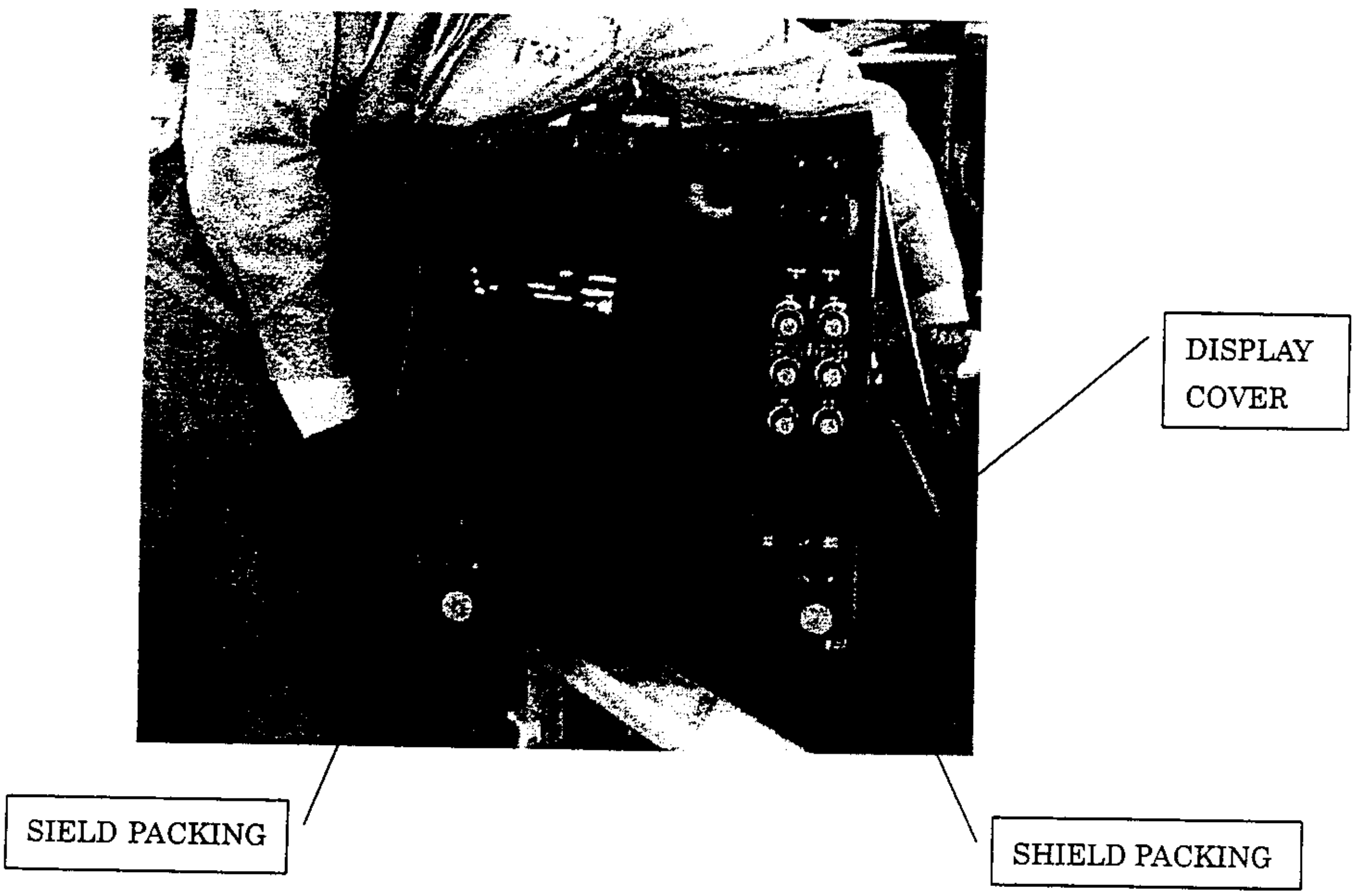
REMOVAL OF MODULATOR

1. REMOVE THE PEDESUTAL COVER.
2. REMOVE THE SCREWS OF FIXING COVER.
3. REMOVE THREE SCREWS.
4. REMOVE MAGNETRON SOCKET.
5. REMOVE THE SCREWS FIXING MAGNETRON.AND REMOVE MAGNETRON.
6. REMOVE THREE SCREWS FOR FIXING SHASIS, AND REMOVE MODULATOR.

APPENDIX 2. REMOVAL OF DISPLAY COVER

Because a right and left edge side is curved, the display cover should be opened and removed by both hands as shown in the figure below.

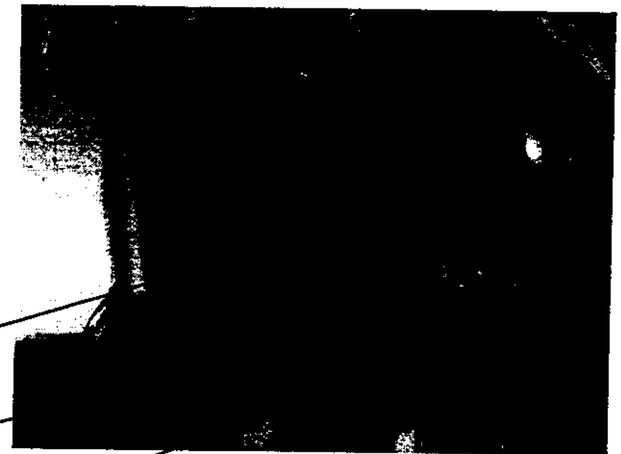
※ Be careful not to hang on the edge of the cover at the time of removal.



APPENDIX 3. REMOVAL PROCEDURE OF SUB PANEL PCB

1. REMOVE THE PUSH BUTTON OF POWER SWITCH.

When the edge of the push button is removed, push its edge by tweezers etc. in the direction of the arrow.

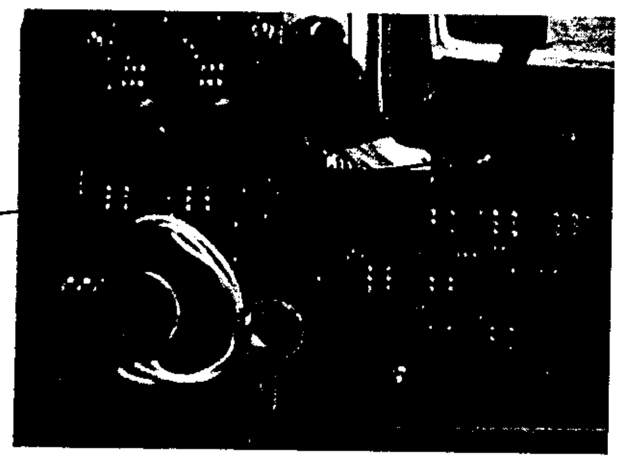


POWER SWITCH

PUSH BUTTON

TWEEZER

2. REMOVE 14 SCREWS OF FIXING THE PCB.



14 SCREWS

3. Lift while inclining PCB with the axis of the power switch pushed, and PCB is removed.

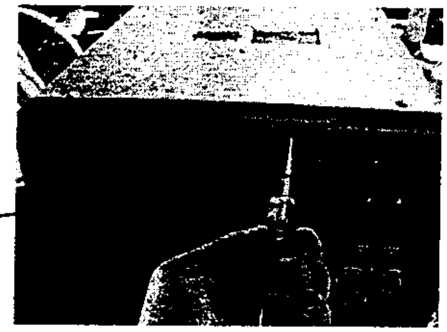
PUSHING THE AXIS

LIFT WHILE INCLINING

APPENDIX 4. ADJUSTMENT AND REPLACEMENT PROCEDURE OF MONITOR PCB

1. REMOVE 9 SCREWS AND REMOVE DISPLAY COVER.
2. REMOVE THE UPPER BEZEL, AND OPEN BOTTOM COVER AND REMOVE 4 SCREWS.

REMOVE 4 SCREWS



3. REMOVE THE CONNECTOT OF FRONT OPERATION PANEL, AND REMOVE IT.

REMOVE THE CONNECTOR

4. REMOVE 2 CONNECTORS OF THE RACK, AND REMOVE 2 SCREWS, THEN REMOVE SHIELD PLAT OF PCB.

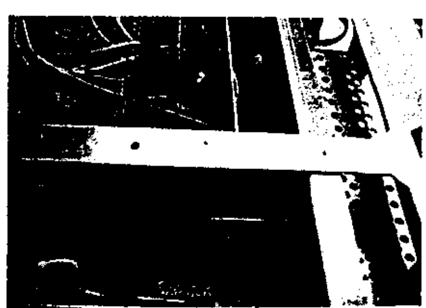
REMOVE 2 SCREWS

REMOVE 2 CONNECTORS

5. REMOVE ALL PCB'S IN THE RACK

REMOVE 3 PCB'S

6. REMOVE 10 SCREWS FIXING PCB RACK AND SHIELD PLATE. REMOVE SCREW OF UPPER SHASIS.
PCB RACK MOVES TO THE POSITION WHERE THE CABLE DOES NOT HANG.



REMOVE 10 SCREWS

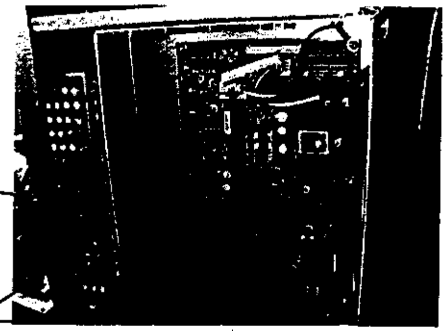
REMOVE SCREW OF UPPER SHASISS

REMOVE SHIELD PLATE AND PCB RACK

7. REMOVE CONNECTOR OF NSK PCB AT THE LEFT OF LEFT SHASSIS. AFTER 6 SCREWS FIXING PCB ARE REMOVED, REMOVE NSK PCB.

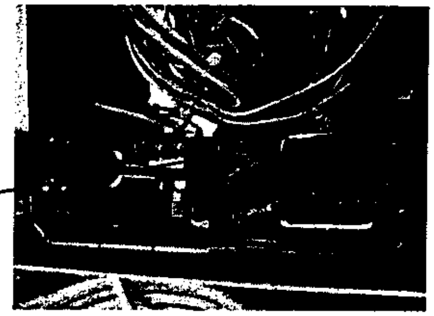
REMOVE 6 SCREWS

REMOVE 2 CONNECTORS



8. IN ORDER TO REMOVE N S K FIXING PLATE, REMOVE LOWER SCREWS(2), INSIDE SCREWS(2) AND TERMINAL SCREWS(2).

REMOVE 2 SCREWS ON TERMINAL PCB

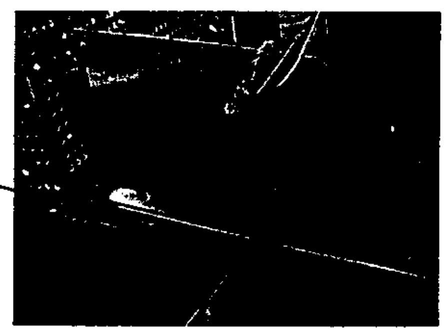


REMOVE 2 SCREWS

REMOVE 2 SCREWS

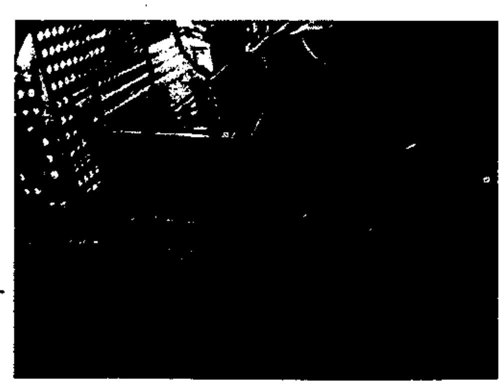
9. WHEN THE NSK FIXING PLATE IS REMOVED, MONITOR PCB IS SEEN.
REMOVE 8 SCREWS FIXING THE HEAT SINK, AND REMOVE HEAT SINK.

REMOVE 8 SCREWS



10. EACH PCB NECESSARY TO ADJUST MONITOR PCB ARE CONNECTED, THEN ADJUST AFTER POWER SUPPLIED.

ADJUST IN THIS CONDITION

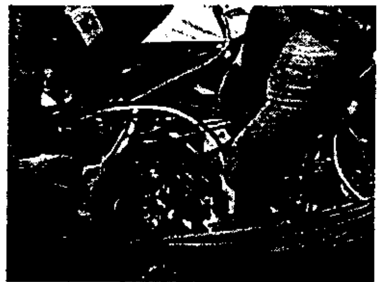


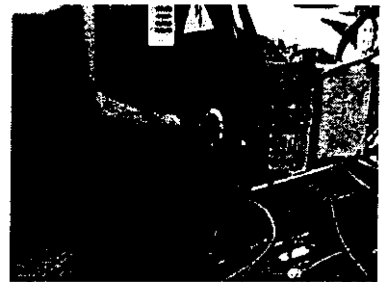
APPENDIX 5. REPLACEMENT PROCEDURE OF MONITOR CRT

1. REMOVAL PROCEDURE IS SAME AS APPENDIX 4. ITEM 1 TO 10. 1

2. REMOVE CONNECTOR 1.

3. REMOVE CONNECTOR 2.





4. REMOVE CONNECTOR3.

CONNECTOR 1

CONECTOR 2

CONNECTOR 3

5. REMOVE CONNECTOR 4.。

CONNECTOR 4 EXIST BEHIND HERE.

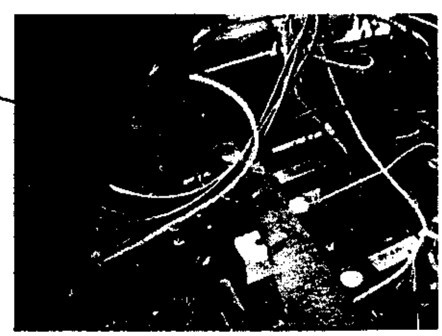
6. REMOVE PCB AND CONNECTOR 5.

P C B

CONNECTOR 5

7. REMOVE CABLE STRAP.

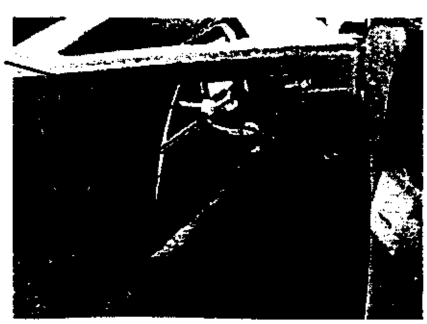
CABLE STRAP



8. REMOVE CABLE STRAP(8 PCS) FIXING DEGAUS COIL.。

9. REMOVE 4 SCREWS FIXING CRT, AND REMOVE CRT.

CABLE STRAP



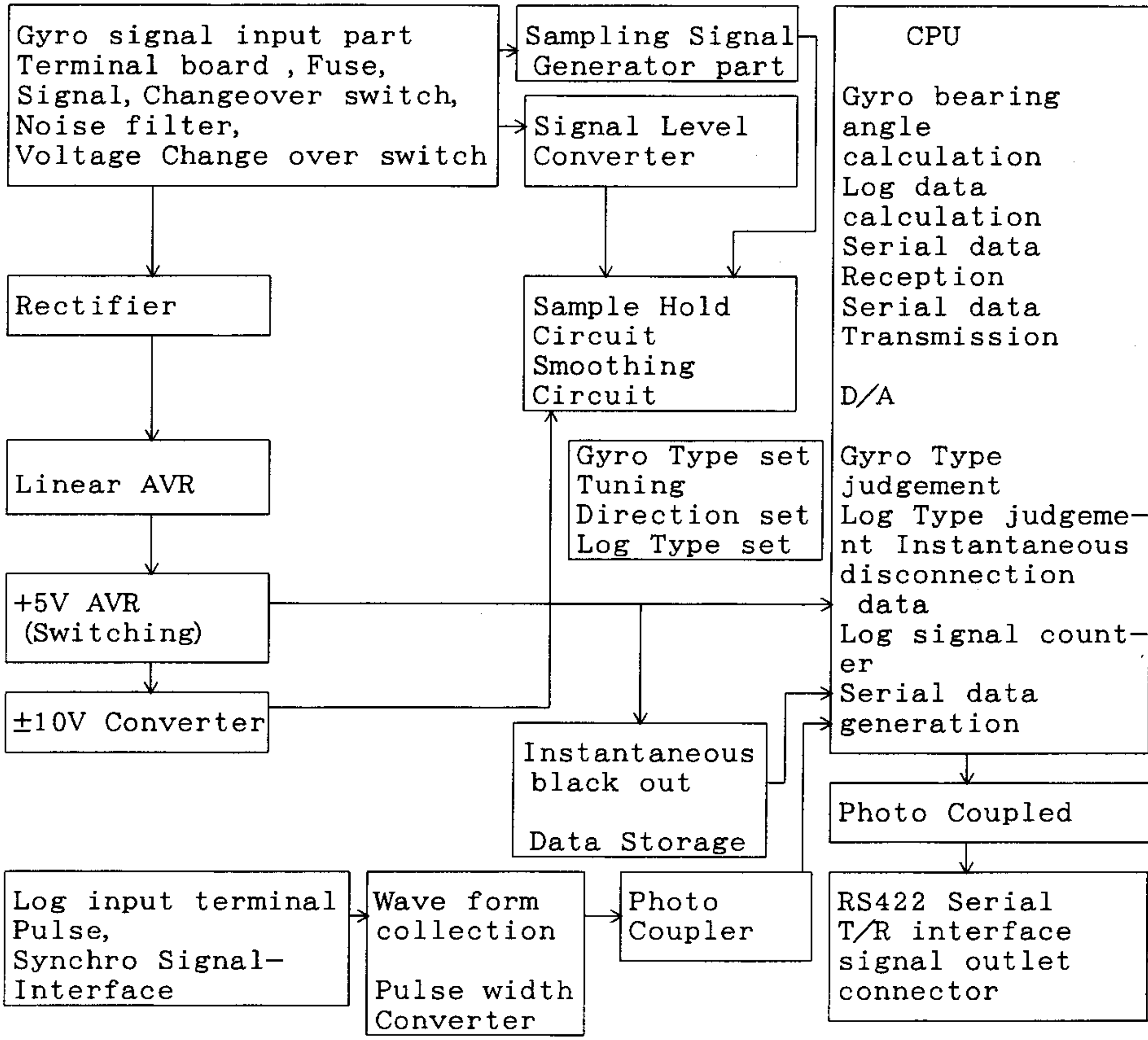
REMOVE 4 SCREWS

3 Principle of Function(Display unit)

3.3 Display Unit

3. 1 NSK Circuit

NSK is divided into following blocks.



·Gyro input power source voltage and Current

Working voltage Range

Synchro type AC50V~AC115V 50/60/400Hz

Step type DC35V~DC70V (Allowable upto DC 100V)
+COMMON Type
−COMMON Type

·Necessary Power Source Current for operation

Synchro type	AC100V Type	55mA	(TYP)
	AC 50V Type	90mA	(TYP)
Step type	DC 35V Type	100mA	(TYP)

·Compatible Angular Velocities

Synchro type	360×	2rpm	(MAX)
	90×	4rpm	
	36×	4rpm	
Step type	180×	2rpm	(MAX)
	90×	4rpm	

·Data Renewal times
50Hz·········Renew the Data every 20mS.

☆Log signals

·Input

Pulse Type

Input Impedance 820Ω

Contact signal, or Voltage Signal of Within a range of 0V~50V

Detection is made that less than 2V is Low and more than 2V is High.

Synchro Type

Input Impedance 20KΩ

Connect either 2 signal cables out of 3 phase signal cables of secondary side of synchro transformer.
Primary side of which is for AC50V~AC115V, 50/60Hz.

·Ship Speed and number of Pulse

Pulse Frequency F to be calculated as $F=V\times P\times \frac{1}{3600}$ Hz

In above formula, P stands for number of pulse (Pulse/NM)
V stands for ship speed (KT/H)

·Pulse type and Synchro type

Pulse type send out contact signal or voltage signal in respond to ship's speed. For contact signal type, receives contact signal itself. For voltage signal, 2V will be the threshold voltage and compatible pulse number will be 800, 400, 200 and 100.

Synchro type send out turning signal modulated by AC 60Hz in synchro motor in respond to ship's speed.
Pick up the variation of one phase and eliminate the 60Hz carrier factor. Variation of revolution is converted in number of pulses so as to obtain speed.

Compatible turning Ratio will be 360X, 180X 90X and 30X.

·Speed Limit

Pulse type	From 0.1 to 110KT
Synchro type	360×from 0.1 to 13KT
	180×from 0.1 to 26KT
	90×from 0.1 to 54KT
	30×from 0.1 to 10KT

·Over Flow

When the input signal does not come for more than 73 seconds, judgement is made that Log counter over flown and stopped (OKT) or signal is disconnected so as to display 00.00

· Power Consumption

At AC100V 55mA 5.5W
At AC 50V 90mA 2.7W

· Connection of Signal Cables

Gyro signal to be connected on TB 10 [GYRO INPUT].
only one type of signal symchro or step can be connected.

Synchro Signal

TB10

TB10		
1/R1	Primary side of signal	R1
2/S1	Secondary side of synchro signal	S1
3/S2	Secondary side of synchro signal	S2
S3	Secondary side of synchro signal	S3
5/R2	Primary side of synchro signal	R2

Step Signal

TB10	
1/R1	Phase A of step signal
2/S1	Phase B of step signal
3/S2	Phase C of step signal
S3	No connection
5/R2	Common Signal line

Log signal to be connected on TB 20 [LOG INPUT].
only one type of pulse contact or synchro can be connected.

TB20	
P+	Pulse type [+] signal line
P−	Pulse type [−] signal line
S+	Either 2 lines out 3 secondary S1, S2, and S3 lines to be connected.
S−	

Check items: Fuse F1, F2, F3, F4 (0.5A) are inserted and firmly locked in.

· Output

Output signal
Output terminal J4201
Output signal exchanges Data with Radar Display unit.
Type of output RS422 Baud Rate 9600 Baud

Data length	8 bits
Start bit	1 bit
Stop bit	2 bits
Parity	Even No. parity

Connector	Signals
J4201 −1	+5V (0.15A)
J4201 −2	Earth
J4201 −3	RS422 Input +side
J4201 −4	RS422 Input −side
J4201 −5	RS422 Output +side
J4201 −6	RS422 Output −side

Function of other switches

S3 Used for CPU (1C 17) resetting.
Even reset applied, memorized Data will not be cleared.
Bearing angle immediately before the stoppage or reset being memorized, same data will start at the next operation.

S4 Zero return switch.
At the time of this switch being activated, memorized data turns to Zero degree.

S6 Log speed test signal generate switch.
In TEST position, 18. 04 Kt speed signal is generated.
Normally switched on NORM position.

Note :When you with to set bearing angle to 0°, S4 Zero return switch can be used as same effect as actual speed is Zero However, NSK considers that above setting is not external incomming signal thus keep on asking initial input setting value.

Log Signal

Log Signal Process Circuit being operated by the power of Gyro signal, Gyro signal should always be supplied into the circuit.

At the absence of Gyro signal, output Data will turn to 00. 00 KT in result of over flow after 72 seconds.

In any circumstance, turn the S6 to TEST position will Generate 18. 04 KT signal therefore S6 should always be in NORM position.

Confirm that S5-5, S5-7, S5-8 are correctly set up.

The LED (CD22) PULSE indicates that the voltage supplied on TB20 (P+, P-) is "Open" or "More than +2V" against P+ terminal.

The LED (CD24) LOGSIG indicates that the selected pulse or synchro signal is active in the counter circuit.

*Others:

The LED (CD26) TxD indicates that RS422 signal is transmitted from CMJ-304B.

The LED (CD25) RxD indicates that RS422 signal is send from Radar Display unit to CMJ-304A.

3. 2 Power Supply Part

Power supply circuit consist of , Pre-power part, AVR part 1, AVR part 2.

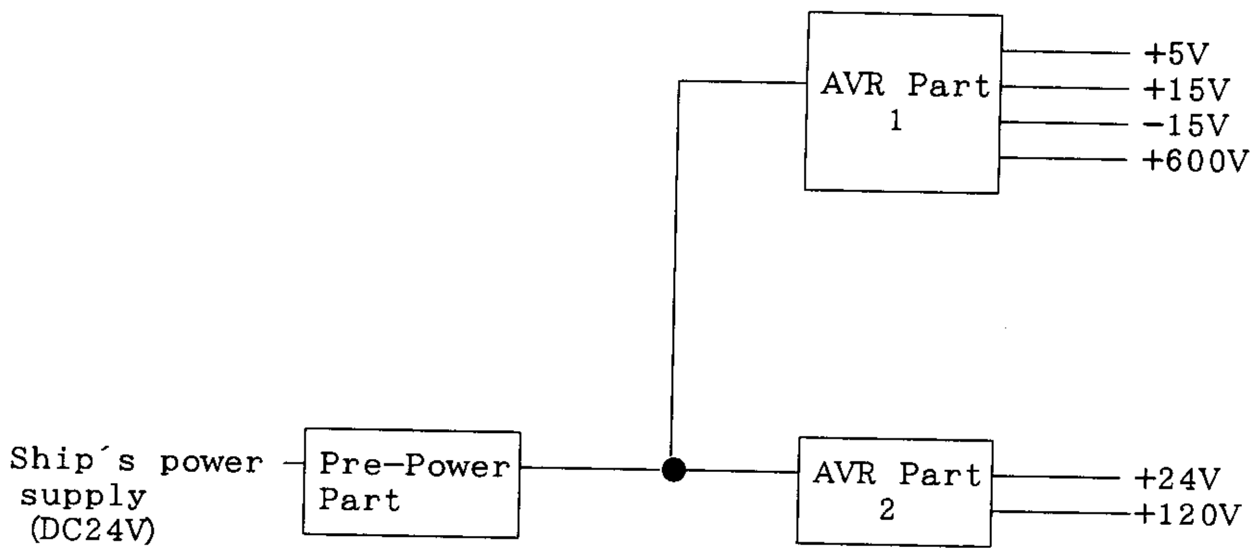


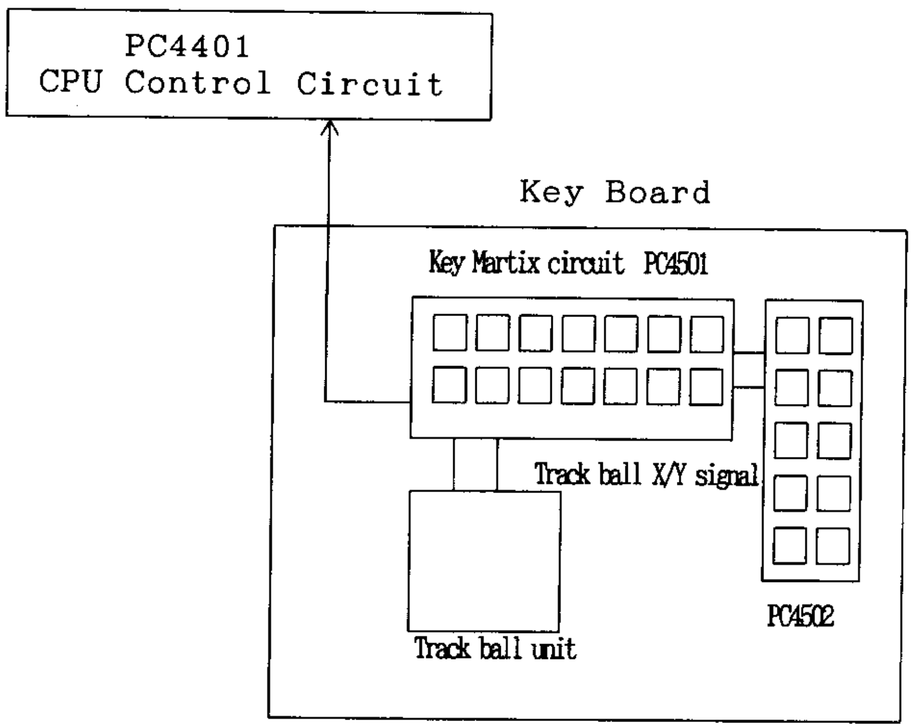
FIG 1

Ship´s power source (DC 24V) connected to Pre-Power Part.
Pre-power part have a converter AVR operated by 60KHz switching frequency and generate +15V Pre-power
power supply for the control circuit of Pre-power part, AVR-1 and AVR 2.

Pre-power source 15V will be sent to AVR part1 and AVR part2
AVR part 1 generate +5V, ±15V and +600V.
also AVR part 2 generate +120V and 24V.

3.3 Key Board Part (PC 4501, PC4502)

Key Board Consist of following circuits.
Panel Circuit 1 (PC4501)
Panel Circuit 1 (PC4502)
Trackball Unit



*Track Ball Unit)
Track ball unit send out X-Y signal to Key Board CPU Control Circuit in accordance with rolling angle of the track ball and detect the position of cursor acquisition.

*Panel Circuit 1 (PC4501)
Panel circuit 1 controlls panel switches, This circuit consist of main switches & main volumes.
Switch control is made by using the data obtained in Matrix Circuit.

*Panel Circuit 2 (PC 4504)
Panel circuit 2 controlls panel switches same as panel circuit 1.
As same as panel circuit 1, control is made by using the data obtained in Matrix circuit.

3. 4 CPU Control Circuit (PC4401)

CPU control circuit consist of following blocks.

1. CPU Control Part
2. Serial Communication Interface Circuit
3. AGDC/Graphic/PPI Frame Memory Circuit
4. The Iteration/Trail Circuit
5. Frame Video Process Circuit
6. D/A Converter/Synchro-Signal Interface Circuit

1. CPU Control Part

CPU (IC2) is a 32bit Microprocessor and processed by clock X1 (4. 9152MHz).

CPU controlls all PCB and units of transceivers etc.

CPU has external memory of 2048K byte static memory (IC24~27) and programmed 2048K byte FlashROM (IC28~31).

Static Memory has a back up function by means of super capacitor and memorable time is for several days.

Flash ROM for programming stores control data for total Radar system and contents of which are also stored semi permanently. CPU controlls other PCB by means of CPU´s address for external use, Data bus and control signals.

CPU controlls other units (NSK/NAVAID/Panel Circuit etc.) through serial communication interface.

2. Serial Communication Interface Circuit

There are 3 channels of serial communication lines.

One channel built in CPU and rest of 2 channels are in LSI IC-109 and IC-138 2 channels each. Usage of each IC are as follows.

CPU Build-in Serial Communication

Channel	Purpose	Baud Rate	Standard
IC4 Input	NSK Input (Receive)	9600	RS-422
IC4 Output	NSK Output (Transmit)	9600	

Exte rnal Serial Communication

Channel	Purpose	Baud Rate	Standard
IC109 Input	GPS (Receiver)	1200/4800	RS-422
IC109 Output	GPS (Transmit)	1200/4800	
IC138 Input	2Axis/Magnetic (Receive)	4800	RS-422
IC138 Output	RS232C (Transmit)	4800	RS-232C

Graphic control circuit is controlled by μPD72123 (AGDC) and Gate array. Graphic plane consist of 1 word 16 bits.
Graphic address line provides A0~A20 21 bits and een is sectioned in G0~G11.
G0~G11 composed of 1024×1024 areas. Clipping of each frames are controlled by software algorithm. Thereby, no special hardware clipping is made.

Memory refreshing is done by GDC during blanking time. AGDC controls screen´s reading/writing and display address. Also controlling Display control signal, Image drawing address, Image drawing control signal, Refresh address and Refreshing.

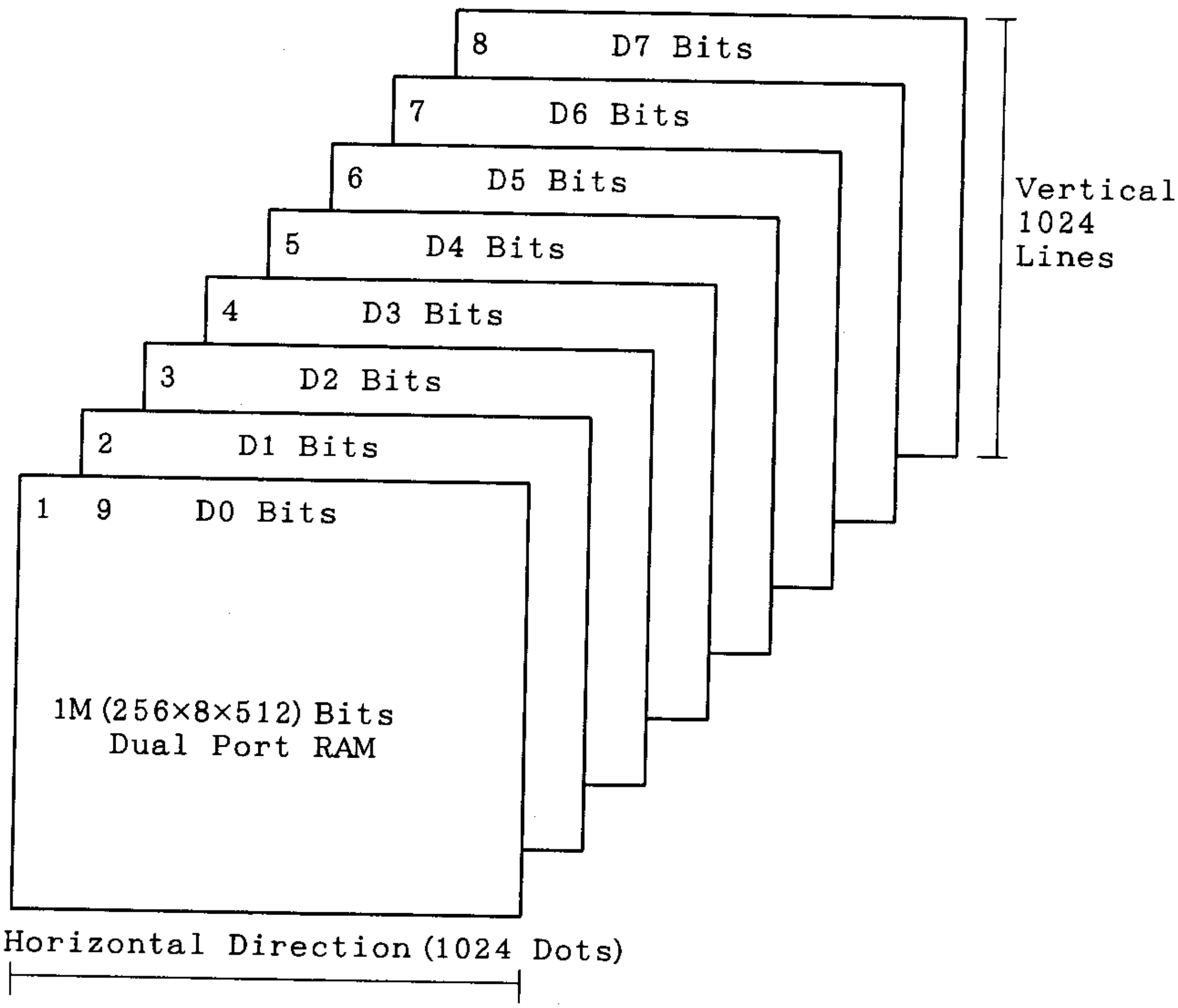
As mentioned above, graphic memory consist of 16 frames (G0~G11, G1', G5', G7', G9') of 1024×1024 dots.

By using 1M-bits 8port-dual-port-RAM, and 8 port Dram for Page-mode-read-write-cycle, making 1 word 16 bits length.
(See block diagram)

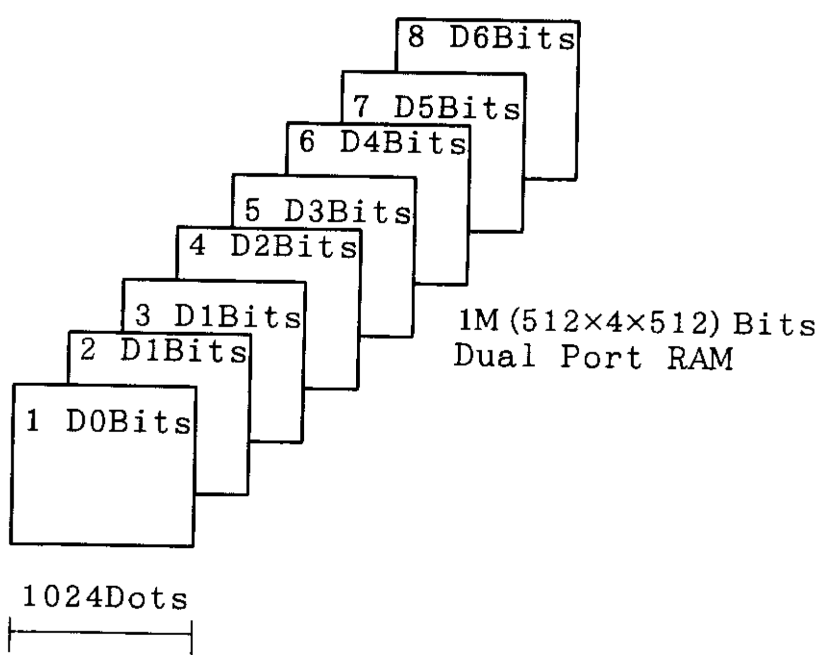
This system employs 1M-bits 8port-dual-port-RAM (DRAM).
DRAM consist of 8 frames of 256 dots×512 dots plane. Picture frame is composed so as the DRAM 1 plane correspondto 1 dot on the raster. Thereby, the data wrote down by row- column-address are one horizontal scan´s 8 dots. However in AGDC, writing should be made 1 word per 16 bits unit.
Therefore, by using image control Gate Array (Mentioned lnter), drive the DRAM in Page-mode, made it possible to write down 16 dots at once. Read-out can be made 8 dots data in 1 access, that you access to the serial port of memory once every 8 dots clock.

PPI Frame Memory consist of 4 Frames of 1024×1024 dots. By using 1M bits 4 ports dual port RAM and 4 ports DRAM is usedto Read-modify-write-cycle (See block diagram). This system employs 1M bits 4 ports DRAM. DRAM consist of 4 frames of 512dots×512 dots. Each plane´s D0~D3 is taken in harmonic direction and Horizontal one dot each on the screen are assigned as a DRAM. Accordingly, one dot at the upper leftendof the screen is the first DRAM of 4 DRAMs and next one dot is the 2nd DRAM, next one dot is the 3rd DRAM and next dot again is the 4th DRAM. For the following dots, above DRAM isassigned in order.

Graphic Frame Memory Formation (1024×1024 Dots)



PPI Memory Dots Formation



Graphic Screen Formation

Screen	Number Type	Contents
G0	IC74 HM538123BJ-8	Character Display
G1	IC75 HM538123BJ-8	Character Display
G1'	IC76 HM538123BJ-8	SHM, Guard Zone Display
G2	IC77 HM538123BJ-8	EBL1/2, VRM1/2, FIX MARKER Display
G3	IC78 HM538123BJ-8	ARPA symbol
G4	IC79 HM538123BJ-8	ARPA symbol
G5	IC80 HM538123BJ-8	Track Line, Destination Mark
G5	IC81 HM538123BJ-8	Track Line, Destination Mark
G6	IC82 HM538123BJ-8	Track Line, Destination Mark
G7	IC83 HM538123BJ-8	Track Line, Destination Mark
G7'	IC84 HM538123BJ-8	Track Line, Destination Mark
G8	IC85 HM538123BJ-8	Track Line, Destination Mark
G9	IC86 HM538123BJ-8	Track Line, Destination Mark
G9'	IC87 HM538123BJ-8	Coast line
G10	IC88 HM538123BJ-8	Chart
G11	IC89 HM538123BJ-8	Mask

4. Iteration/Trail circuit

The target among the seaclutter has a Iterative characteristics compare to seaclutter. The Iteration circuitis employed for purpose to detect the target among the seaclutters.

The Iterative circuit consist of PPI memory IC90~IC97, scanning iteration data programmed IC101/102 (1K×4bits PROM) and single process LSI IC-100.

The data ROM for scan Iteration and meaning of address are as follows.

A3~A0 are the real time video data come out from timebase circuit. Whereas, A4~A7 are the data read out from the PPI memory.

A8~A9 became as follows by mode change.

Address		Memory	Video	Output	Mode
A_9	A_8	$A_7 \sim A_4$	$A_3 \sim A_0$	$D_3\ D_2\ D_1\ D_0$	
0	0	Optional		$D_N = A_3\ A_2\ A_1\ A_0$	Straight
0	1			$D_n = A_{(3\sim0)} \times \frac{1}{2} + A_{(3\sim0)} \times \frac{1}{2}$	Scan Iteration mode "EAST"
1	0			$D_N = A_{(3\sim0)} \times \frac{1}{4} + A_{(3\sim0)} \times \frac{3}{4}$	Scan Iteration mode "MIDDLE"
1	1			$D_n = A_{(3\sim0)} \times \frac{1}{8} + A_{(3\sim0)} \times \frac{7}{8}$	Scan Iteration mode "SLOW"

- Straight

  Output=Present Scan data

- Iteration 1

  $$\text{Output} = (\text{Present Scan data}) \times \frac{1}{2}\ (\text{A data 1 Scan before}) \times \frac{1}{2}$$

- Iteration 2

  $$\text{Output} = (\text{Present Scan data}) \times \frac{1}{4}\ (\text{A data 1 Scan before}) \times \frac{1}{4}$$

- Iteration 3

  $$\text{Output} = (\text{Present Scan data}) \times \frac{1}{8}\ (\text{A data 1 Scan before}) \times \frac{7}{8}$$

The purpose of the Trail circuit is to display the target stored in PPI Frame Memory and erase it time by time. In thisfunction, other target moving relatively to own ship remains on the screen as a trail. This process also is used the similar IC as the process of Iteration.

The trail presentation can be set in 3 steps until the target in trail disappears.

5. Frame Video Process Circuit

Frame Video process circuit composed of IC–103 gate array.

This Gate array consist of Graphic·PPI–data parallel–seriesconverter–circuit, Graphic–brilliancy–data–forming circuit, Graphic–and–PPI data–crossing–detect–circuit, Display–memory –serial–port–control–signal–generating–circuit as in a form of the ASIC.

By receiving dots clock signal (71.4286MHz), the circuit generatevarious control signals for each circuit, distribute 1/2, 1/4, 1/8 and 1/16 divided clock signals and Display–memory–serial–port–control–signal.

After the Display–memory–serial–port–output data being applied with parallel/series conversion and various process, the Graphic–display–brilliancy–data, Graphic·PPI–data– crossing detection–flg will be sent out.

The IC–103 is dividied in following blocks.

- Graphic data parallel/series conversion block
- PPI data parallel/series conversion block
- Graphic Brilliancy data Forming Block
- Graphic and PPI Data super position Detection Block
- Guard Zone detection block
- Display memory serial port control signal generate block

·Graphic data parallel/series conversion block

Serial port output data of the 2 graphic display memories to be entered by time division then latch the data and parallel series conversion for the 8 data is carried out.

Parallel Series Conversion clock is 71.4286MHz, Load clock is 8.93MHz.

Other than character plane are send out applied with Mask in Mask plain. (If the situation requires to take off the Mask in such case as in the test–mode, correct the data in the Mask plane. If the situation requires to output the plane data independently, carry out the setting by Graphic Mask Data (W02, W01).

·PPI data parallel Series Conversion Block

Receive the output data of NO. 1 PPI, NO. 2 PPI display memoryserial ports and latch the data and after NO. 1 PPI, NO. 2 PPI data are selected or averaged, carry out the 4 data parallel series conversion.

Parallel series conversion clock is 71.4286MHz, Load clock is 17.9MHz.

The NO. 1 PPI and NO. 2 PPI data will be selected by PPI display select data (W02).

·Graphic Brilliancy data Forming Block

On the basis of output data from Graphic data parallel series conversion block, after the priority process, select the required Brilliancy data (3bits). Graphic display Brilliancy data will be set up by CPU (W04~W0D).

Detect the super position of Graphic data and PPI data and output the flag. The graphic plane to detect super position can be set up by cross Memory Select Data (W10, W11) (More than 2 plane can be set up). The level for the PPI data to detect the super position can be set up by Cross data select (W12).

The width of super position detect flag can be set up of its overlapping only by Fore/Aft 1 dot plus, Fore/Aft 2 dotsplus, Fore/Aft 3 dots, plus and by cross-detect-width-data (W14). In changing the setting of cross detect width data, graphic Brilliancy data and PPI data to be shifted. Each cross-shift-data:Graphic (W0F) can be used for above shifting.

·Guard Zone Detect Block

Column direction (X-axis) detect mode and row direction (Y-axis) detect mode are prepared by Zone data and PPI data. Detection is executed by column direction and rom directionin combination. PPI data comparator output level can be set by zone detect setting level:PPI (W15). Column direction detect mode can beset by Zone detect setting mode:column (W16). Row direction direction detect mode can be set by Zone detect setting mode:Row (W17).

·Display Memory Serial Port Control Signal Generate Block

By dividing Dot clock (66MHz) into 1/2 (33MHz), 1/4 (16. 5MHz), 1/8 (8. 25MHz) and 1/16 (4. 125MHz) each clocks and made available. Input and latch the HS and VS then after applied shift, made HSD and VSD available. The volume of shift can be set by synchro-signal-shift-data 1 (W18) and synchro signal-shift-data 2 (W19). The display position of Characterdisplay, Graphic display and PPI display can be shifted in a 8 dots unit respectively. Setting of display position of character display is made by character-display-display-position-Data (W1A), of Graphic display is made by Graphic-display-display-position-Data and of PPI display is made by PPI-display-display-position- Data (W1C). For the purpose of Graphic-display-memory serial-port-control, the serial-port-enable-signal and the clock signal for the serial data access are produced and made available.

6. D/A Converter/Synchronous Signal Interface Circuit

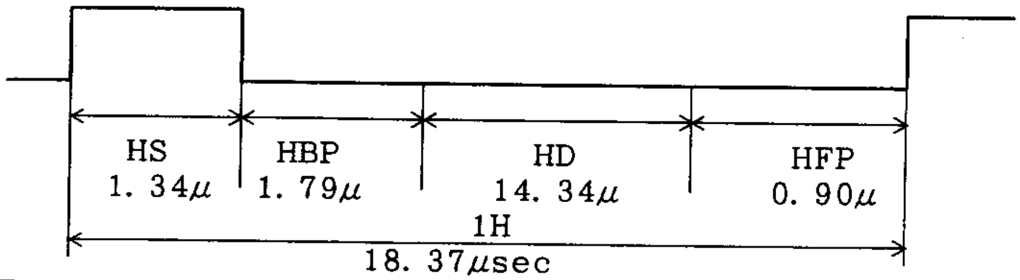
The IC-32 (D/A converter) process the density of brilliancyby receiving control signal from IC-30 and in accordance with the built in color-paletter and send out the video data to the CRT. The video output impedance is 50Ω, maximum clock is 1/2 of 67. 303MHz.

The synchronous-signal-Interface transfer the Horizontal/Vertical synchronous signal came out from AGDC into IC-30 and after normalization, convert them into low impedance through the complementary circuit and feed to the CRT.

Horizontal/Vertical synchronous signal is as follows.

◎ Horizontal Synchronous Signal (HS) :positive polarity

Horizontal synchronous signal will be send out in following timing. Dotclock is 71.4286MHz.

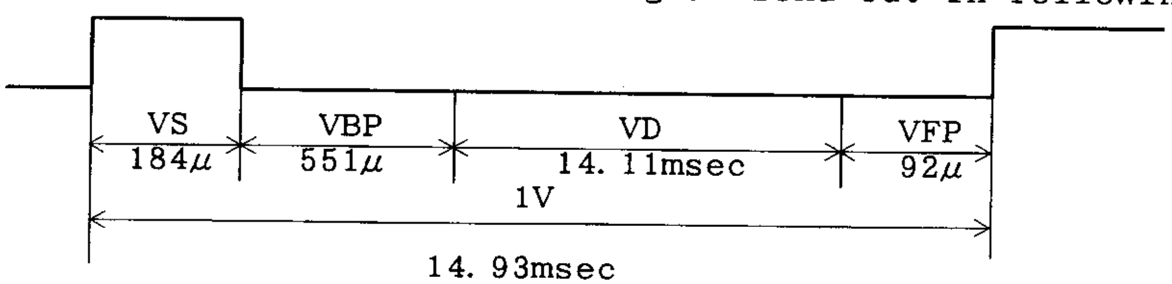


Frequency=54.44KHz
1dot =14.0nsec→71.4286MHz
1H=18.37μsec=1312dots
HD=14.34μsec=dots
HFP= 0.90μsec=dots
HBP= 1.79μsec=dots
HS= 1.34μsec=dots

★ Output impedance:abt. 22Ω
★ Output amplitude:4.3V−0V (NO load), 2.1V−0V (22Ω terminator)

◎ Vertical Synchronous Signal (VS) :Positive polarity

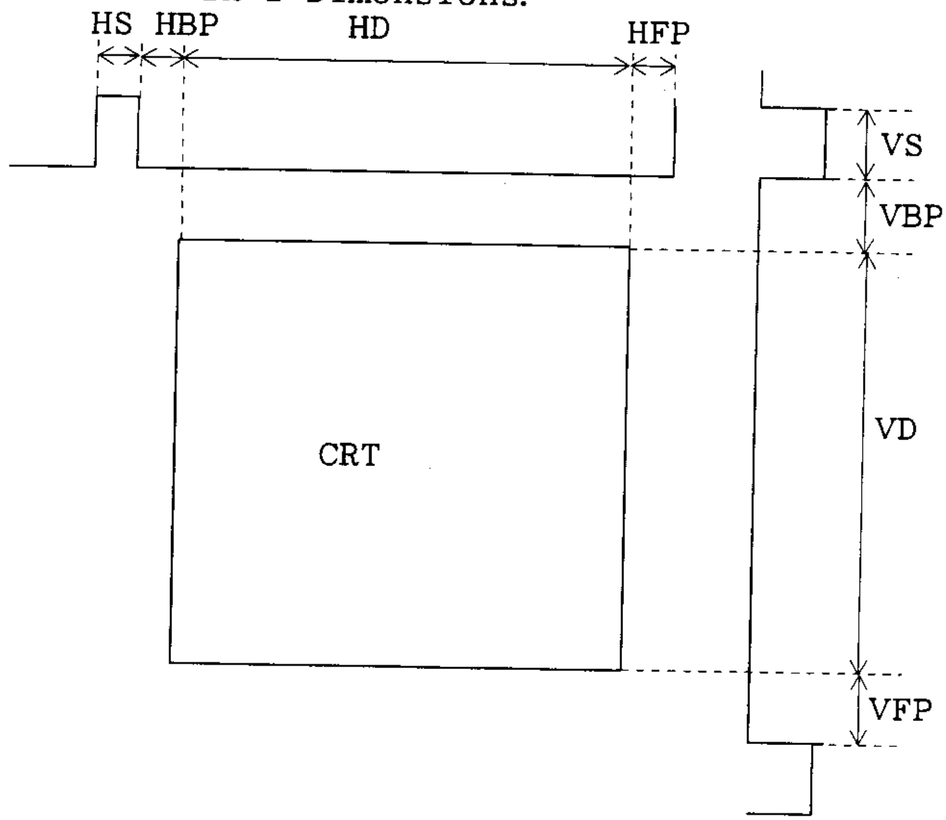
Horizontal synchronous signal send out in following timing.



Frequency=68.6Hz
1V=813H=14.93msec
1VD=768H=14.11msec
VFP= 5H= 92μsec
VBP= 30H=551μsec
VS= 10H=184μsec

★ Output Impedance :abt. 22Ω
★ Output Amplitude :4.3V−0V (No load), 2.1V (22Ω terminator)

Horizontal Synchronous Signal and Vertical Synchronous Signal relation in 2 Dimensions.



3.5 Timebase Circuit

Timebase/Signal Process Circuit consist of following blocks

1. Various System Clock Generator Circuit
2. Video/Trigger Separator Circuit
3. Gain/STC/Rain Rate Control Circuit
4. AUTO STC Control Circuit
5. FTC Circuit
6. A/D Converter
7. Buffer memory for Speed Converter
8. Signal Process Circuit
9. Buffer memory for Scan-Converter
10. Guard Ring Circuit

1. Various System Clock Generator Circuit

The original oscillator circuit of the system clock are XU-2 (54.39MHz;0.125~0.5/16/32NM) and XU-3 (36.26MHz;0.75/120NM) used as a main clock and XU-1 (80MHz;for all ranges) is used for ARPA clock.

Various system clocks for the Trigger/Video signal generated in the transceiver unit are generated in IC-1.

Clock system configuration shown in FIG-2 and sampling clock for mutual relation is shown in FIG-3.

2. Trigger Generator Circuit

System trigger TIY signal are generated in IC-64.

3. GAIN/STC/Rain Rate Control Circuit

STC and Rain-rate-curve are generated in IC-57 and controlled by STC Rain rate knob and fed to the base of TR-3 together with Gain control voltage.

TR2, TR3 are the differential amplifier circuit.

The amplified video output processed with above STC/Rain-Rate/Gain control is available from the TR3.

The address for the IC-57 will be generated by IC-2.

4. AUTO-STC Control Circuit

The AUTO-STC wave form in correspond with the status of video signal, generated in the circuit IC-3, IC34 and applied on the bas e of TR3. TR2 and TR3 is a differential amplifier circuit and at the outlet of TR3, video signal controlledby AUTO STC is availab le.

5. FTC Circuit

In general, frequency factor of Rain and Snow are rather low com pare to the targets, so that by passing through the High pass Filter, factor of rain and snow will be eliminated.

The CD-1 is a sort of variable capacitor, combined with R-14, for ming a High pass Filter. The cut off frequency of this High pass Filter is controlled by CD-1 through FTC knob on the operation panel. By doing so, eliminate the Rain/Snow clutters.

6. A/D Converter

The analogue signal treated with STC/Rain Rate/FTC process of its phase 90 degrees delayed and carry out the quantization.

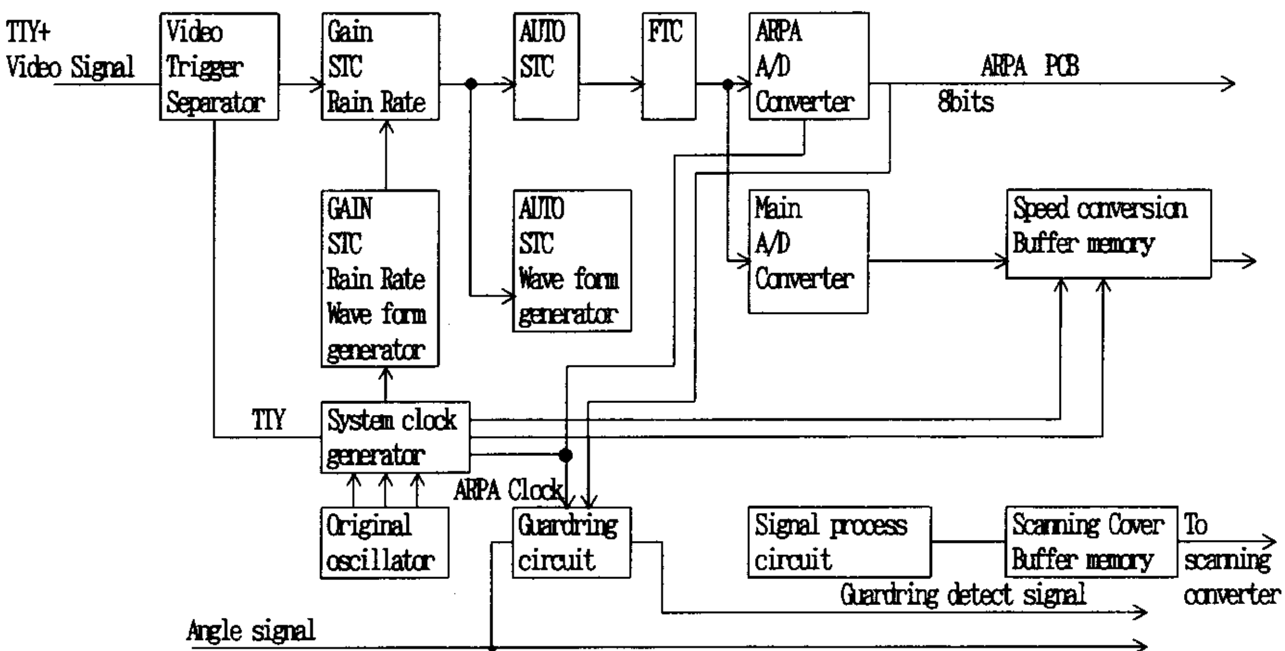
The A/D conversion is done by sampling clock and transfer the data to the buffer memory for the speed conversion.
The IC-8 is a A/D converter for the ARPA, carry out the ARPA clock A/D conversion for all ranges and transfer the data to ARPA PCB.

7. Buffer Memory for Speed Converter
The 8bits video degital signal changed to the high speed sampling in above mentioned A/D converter, write down into the IC-11 in 4 phases process from IC- 5 by the sampling clock.
At the same time, accessed by signal process clock in 4 phases process and transferred to the signal process circuit after latched by IC-16 8 bits latch circuit.

8. Signal Process Circuit
Various signal process to be carried out in IC-2, IC-3 andIC-16~35. Content of signal process is as follows.
A. Interference Rejection
B. Sweep Averaging
C. AUTO-FTC Process
D. Pulsestretch

9. Buffer Memory for Sean Converter
The signal processed digital video signal is converted into 4bits and synchronized with signal process clock then write down into the Buffer memory of IC-36.
On the other hand, read out process is made by scanconverter work clock which started at the edge of antenna bearing pulse rise time regardless to the timeing of write down and the data is transfer to the scan converter.

10. Guard Ring Circuit
When a target acquired in the closed sector (starting and finishing bearing in IC114~119, and starting and finishing distance designated), the circuit output "H" level to motivate CPU detects the echo.



Timebase/signal Process Circuit Block Diagram

3.6 ARPA process circuit

・Summary

Comparison of ARPA Process circuit between JMA-3910/3925 Radar and former JMA-8000M2 Radar.

	JMA-3910/3925	JMA-8000M2
Acquisition Area	32NM	40NM
Acquirable Number	40 Targets	60 Targets
Method of Auto-acquisition	Set up 2 Zones of 0.5NM width in distance direction and Acquire target in that zone.	Able to cover allarea by Auto acquisition except inside Suppression Ring Line
Guard Ring	Set up 2 zones of 0.5nm width in distance direction and whenever the target enter that zone, the alarm sounds.	Able to set up optional Distance Ring zone.
Combined use of Auto-Acquire and Guard Ring	Auto-Acquisition is in priority	Possible
Symbol	IEC872 Base	JRC symbol
Method of target Detection	Calculation Method for center of Gravity in the Gate	Method of Hard Logic Calculation
Signal process Frequency	20MHz	8.91 MHz

A Feature of JMA-3910/3925

1. Improvement in Target Defection
So far, position data has been obtained by means of Hardwarelogic to synthesize or reform the shape of the target.
In this new radar system, accurate position is computed in Software process of the shape of the target picked up in each gate respectively of its center of gravity.

2. Improvement in Signal Process
Compare to conventional method, sampling frequency was raised higher that acquisition area were shortened but the video wave-

In all, improvement were achieved in acquiring echoes in short range and tracking performance.
Also in ARPA territory, having independent signal process circuit as same as timebase circuit, ARPA can be able to process signal independently.

3. Minimizing Failure of IC Circuit Employment
The 3 PCB so far used were assembled in one and more IC components are employed to minimize the possibility of failure.
In graphic process, Radar side GDC being used thereby there would be no problems about the dis-location of the symbols.

II Summery of Major Blocks
1. ARPA process circuit (Target detection circuit)
Target detection circuit is consist of Logic circuit in IC-16 and IC-17~22 Line memories to store the data of each sweep.
The signal came in to the Gate is reformed to a square shape for easy treatment in later process. The target´s leftedge angle right edge angle and length of distance directionare taken up for counting. By the angle of target's right edge, interruption signal is generated in IC-1 TD CPU and read out the data and computing the target's position.
This circuit is used for Initial Auto-acquisition mode and for the detection of Initial Guardring Entering target.

2. ARPA Process Circuit (BANK address generate circuit)
The system is computing center of gravity of the data in the gate. For this purpose, quantized output for every sweep are write down into the memory called BANK.
BANK being a pair for Quantized HIGH and for LOW and write down the quantized data for every 32 sweep and read out from 1C-1 TD CPU alternatively. Namely, one BANK address composed of the distance and the number of sweep (Bearing) write down the data in to its memory.
Another BANK memory is connected with the address from CPU, read out the data from the address in correspond to the distance and the bearing of the gate. The charenge over of above 2 address is done in IC-16. As ARPA process area is 32NM, in order to cover that area, 10 bits are used and rest of 5bits are used for the number of sweep that BANK change over is done every 32 sweeps.

3. BANK Memory Circuit
The BANK memory consist of 1C-23-37 and IC-77.
As mentioned above, BANK is a memory to store quantized output for each sweep. Each BANK is changed over for read out and write down purpose for every 32 sweep.
The IC-23, 24 are the serial-parallel converter circuit to convert quantized output for every 8 bits.
The signal converted in 8 bits latched in buffer of IC-25, 26, 31, and write down in to the memory of IC-33~36 in a timing controlled in IC-16, 37 and 77.

The IC-33 and 34 form a BANK pair and IC-35 and 36 forms another BANK pair. The IC-33 and 35 take the part of Quantized HIGH memory and IC-34 and 37 take the part of Quantized Low memory.

The IC-27~34 is used when the transceiver operate the data from BANK memory to memory per gate, IC-1 TD CPU read the data through these IC for access.

4. Memory per Gate Circuit

The IC-76 and IC-108 are the memory per Gates.

During the BANK read-out period, the stored data in the BANK memory will be accessed by IC-1 TD CPU and wrote down in theassigned memory area in the order of gate number and from the left end to the right so as to facilitate the process after the end of the gate.

The area of 800H is assigned for 1 target. This figure is equivalent to abt. 20° for the gate of 0. 25NM distance direction and abt. 10° for the gate of 0. 5NM.

The center of gravity calculation on for each target from the memory per gate will be done while there were no transmission of data from BANK memory.

5. Target Detect (TD) CPU Circuit and Peripheral Circuit The IC-1 is called TD CPU and is used for the CPU for target detection.

The CPU is NEC V40HL (16MHz version) and internal bus 16 bits, external bus 8 bits of 8086 class CPU. The CPU is due for following jobs.

- Reception of Gyro data from NSK and setting against IC-16
- Communication with ARPA CPU.
- Interruption to the target detect circuit for data access.
- Order changeover to the BANK and operation of data from BANK memory to the memory per gate.
- Center of gravity calculation of the target from the memory-per gate.
- Calculation of predicted position from the target's position and setting of the gate.

The IC-2 is a V-40 peripheral gate array and takes care of Address Bus, Data Bus's Input/Output separation, and formation of memory control signal etc.

The IC-3 is a ROM for TD CPU and of 2M bits type.

The IC-5 is used for TD CPU memory and is 1M bits SRAM.

IC-7 is the dual port RAM to communicate with IC-81 ARPA CPU. The IC can be accessed either from TD CPU or from ARPA CPU and one write down is made every one scan. That , in the occurrence of one write down in one address cause another CPU an interruption and enabling to read out thus maintain communication.

IC-42 and IC-98 are the 1/0 port for TD CPU and used for the control of the target detect circuit

When the TD CPU is running normally and the trigger signal is transmitted, CD-6 flickers. (Flickering speed changes in respond to the repetition frequency.)

6. ARPA CPU Circuit and Peripheral Circuit

IC-81 is ARPA CPU and is used for target detection. NEC V40HL (16 MHz version) is used for CPU as same as TD CPU.

The purpose of the CPU is as follows.

- ·Communication with Radar CPU
- ·Communication with TD CPU
- ·Generate key control commands for ARPA
- ·Calculation for target symbolization and GDC graphic coordinate axis
- ·Calculation of CPA/TCPA and Vector
- ·Calculation for trial maneuver
- ·Communication with peripheral equipments

IC-82 take the part of separation of the address bus and data bus by means of V40 gate array, producing control signals for I/O and memories.

IC-83 is 2M bits ROM for ARPA CPU. IC-85 and IC-92 are 1M bit SRAM. IC-85 is used for external memory for ARPA CPU andIC-92 is used for NAV-data register memory in case of TOTAL NAV usage.

IC-93 and IC-97 used for power supply sensor and back up battery changeover circuit to maintain the power supply to IC-92 memory data in case of main power source black out.

The capacity of Battery can be checked by the code displayed in MAINTE menu.

IC-86 is the dual port RAM used for the communication with the Radar CPU. When the communication does not go well, The error message ARPA ERR displayed upper right part of the screen.

This is the indication that ARPA CPU is considered to be abnormal.

4 Principle of Function(Scanner unit)

4 Principle of Function(Scanner unit)

4.1 GENERAL

The theory of operation for the Radar Set JMA−3910 and JMA−3925 is presented here with descriptions following the functional block diagram circuits.

The schematic diagrams for each electronic subassembly together with the component parts layout for each assembly and parts list are contained within SECTION 6 of this manual.

4.2 ANTENNA UNIT

The antenna unit consists of the RF radiator housed in a separate array assembly and coupled to a rotary joint assembly on the pedestal housing. The radiator rotating mechanism, antenna motor/encoder assembly, bearing reset circuitry, transmitter and receiver modules are all mounted within the pedestal housing. The Functional Block Diagram for the Antenna unit is shown in Fig. 4−2.

4.2.1 RADIATOR

The purpose of the RF radiator is to shape the main transmitted beam of the radar during the transmission phase of the radar's operating cycle and to receive any incoming echo pulses during the receive portion of the cycle.

The radiator is a horizontally polarized, non−resonant, end fed slotted waveguide array. The radiator either 9 foot or 6 foot in length is coupled to the transmitter and the receiver through a short waveguide section a rotary joint and a circulator assembly.

Electrically, the array produces a horizontal beamwidth either of 0.8 for the 9' array or 1.2° for the 6' array at the half power points with a vertical beamwidth of 30° respectively. The direction of the beam (maximum radiated power) is essentially perpendicular to the face of the radiator. Within +/−10° of this main beam, the side lobes are reduced by greater than −23 dB. Outside of this area, the sidelobes are reduced by more than −26 dB.

The array is typically rotated at 24 rpm by the antenna motor−encoder assembly though the gear reduction assembly.

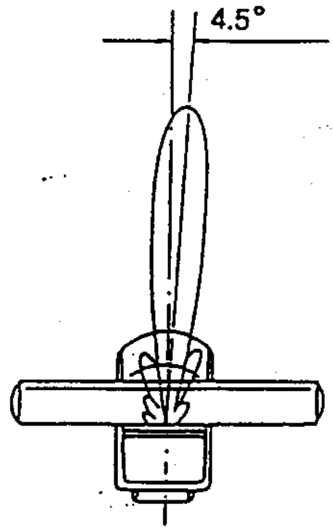


Fig. 4-1 RADIATOR

4.2.2 RADIATOR ROTATING MECHANISM

The antenna drive mechanism consists of a 10 VDC motor and a gear reducer assembly. The DC operating power for the motor is supplied from the ship's DC power via the interunit cable through the antenna motor power supply control circuit. When the Radar is turned to the X-MIT condition, the motor drives the gear reducer assembly through a 5.6:1 ratio to provide the antenna rotation of approximately 24 rpm.

This electrical/mechanical assembly is designed to maintain the antennas rotation in wind speeds up to 100 knots.

4.2.3 MOTOR-ENCODER

The antenna motor also includes a pulse encoder as part of its assembly. The encoder section produces the bearing pulses for display sweep generation, transmitter triggering, and rotation synchronization. A bearing sync pulse is generated every 0.176 degrees of rotation or 2048 pulses per each rotation at 5V amplitude. These pulses (BP) are sent down to the Bearing Pulse circuitry in the display unit via TB102 - BP.

4.2.4 BEARING RESET CIRCUIT

The Bearing Reference Generator circuit, also known as the ship's heading marker circuit, produces a 5V signal each time a directly on the main gearing breaks the magnetic path of S102. This output pulse is used to synchronize the bearing of the display sweep line with the scanner rotation.

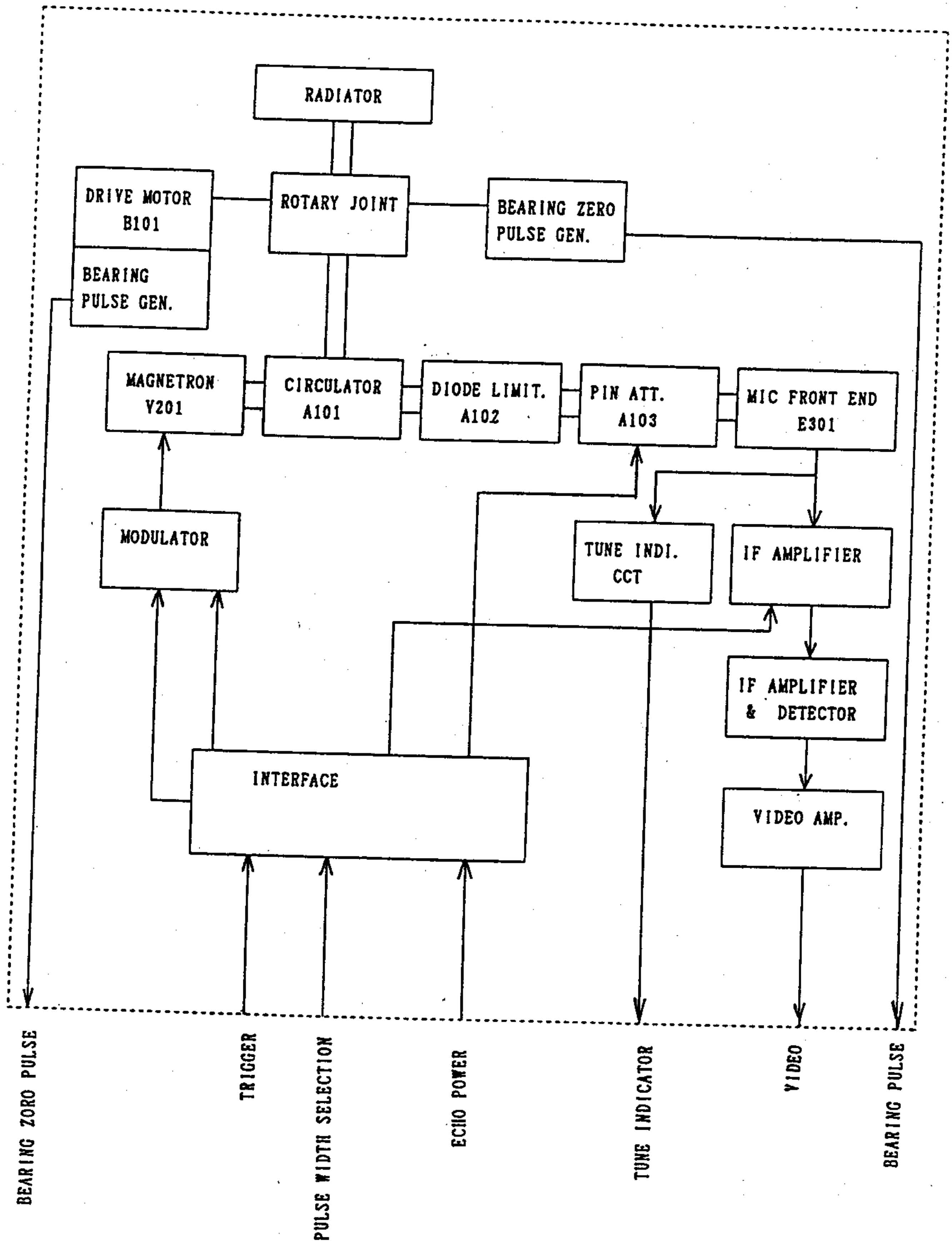


Fig. 4-2 FUNCTIONAL BLOCK DIAGRAM OF OPEN ARRAY ANTENNA UNIT

4.3 TRANSMITTER UNIT

The transmitter consists of the solid state modulator circuits, the 6kW or 10kW magnetron, and the Power Supply.

A solid state type pulse design is used by the modulator and primarily consists of a pulse generator circuit, power MOSFET switch, and pulse transformer.

When setting the X−MIT/OFF key on the indicator control panel at the display unit to "ON", the transmitter trigger pulse is sent via the interunit cable from the transmit trigger generator circuit in the display unit to the modulator.

Generally the pulse width of the pulse generator circuit is controlled by the range key selections on the indicator front panel. Four different pulse lengths: 0.08 μ sec, 0.4 μ sec, 0.8 μ sec and 1.2 μ sec (in accordance with the range scale or menu selections) are provided. The Pulse Repetition Frequency (PRF) changes automatically to match the selected operating pulse length (See Table 4−1).

Upon receiving the positive trigger pulse at its gate, TR6 and TR7 conduct and the charged voltage across capacitors C13 and C14, is immediately discharged through TR6, TR7 and the primary winding of the pulse transformer T1. Consequently, the pulse in the primary winding of the pulse transformer T1, is stepped up by more than 10 times by the T1 secondary winding to drive the cathode of the magnetron. The peak pulse voltage on the primary of T1 is −360V, and on the secondary, −5.5kV at 10kW output.

TABLE 4−1 RANGE, PULSE LENGTH, AND PRF RELATIONSHIPS

Range	Pulse Length	PRF
0.125, 0.25, 0.5, 0.75, 1.5NM	0.08 μ s	2000Hz
3, 6NM	0.4 μ s	1500Hz
12, 24NM	0.8 μ s	750Hz
48, 72NM	1.2 μ s	500Hz

4.4 RECEIVER UNIT

The receiver unit consists of the passive Diode Limiter, the PIN Attenuator, the MIC Front End, and the Receiver IF PCB (CAE−344−2).

The PIN Attenuator includes a PIN diode which limits the RF microwave power in accordance with control current. The current is driven by the modulator circuit PCB (CME−261).

The MIC Front End (E301) device consists of low−noise RF amplifier, a double balanced mixer, and the local oscillator. The received radar echo signals at 9410 MHz are first amplified in the low−noise RF amplifier. The signals are then sent into the double balanced mixer of the MIC. The MIC Local Oscillator is tuned by the adjustment of the operator's Tune control on the display unit front panel to be 60MHz higher than the magnetron's operating frequency for maximum target detection. The output is fed into the double balanced mixer. The balanced mixer output of 60 MHz echo signals is then coupled into the 60MHz IF amplifier.

Receiver PCB (PC301:CAE−344−2)

The Receiver PCB contains the 60MHz IF amplifier, bandwidth control.circuits, video detector, tune circuitry and the video output circuitry.

IF Amplifier Circuit

The IF amplifier consists of low noise amplifier TR1, and bandwidth selector circuits CD1 through CD6.

The bandwidth selectors are controlled by voltages supplied from IC4 located on the CME−261 PCB. The voltage enables components to be activated in the amplifier circuit so the receiver has a 20MHz, 6MHz or a 3MHz bandwidth characteristic. The selection of bandwidth depends on the pulse length selector signal (PW) from the Display Unit which will be determined by the range in use.

When no pulse length signal is present at CME−261 PCB , IC2 will be " OFF " and the gates A, B, and C of IC3 will be " H " . In this condition, the pulse length in operation is 0.08 μ s and the bandwidth of the receiver is widened to 20MHz. When the pulse length signal is other 0.08 μ s, gates of IC2 will be turned " On " . When the input A of IC3 is " H " , the bandwidth will become 6MHz. When the input B and C of IC3 are " H " , the bandwidth will become narrow at 3MHz.

Video Detector Circuit

IC1 through IC9 at CAE−344−2 operate as logarithmic amplifiers and video detector to remove the 60MHz IF component from the incoming signals. The negative going signals appear across R36 where the IF component is removed by filter L13, C41 and C42. The detected signals, now at video frequency rates, are sent to the video output circuit.

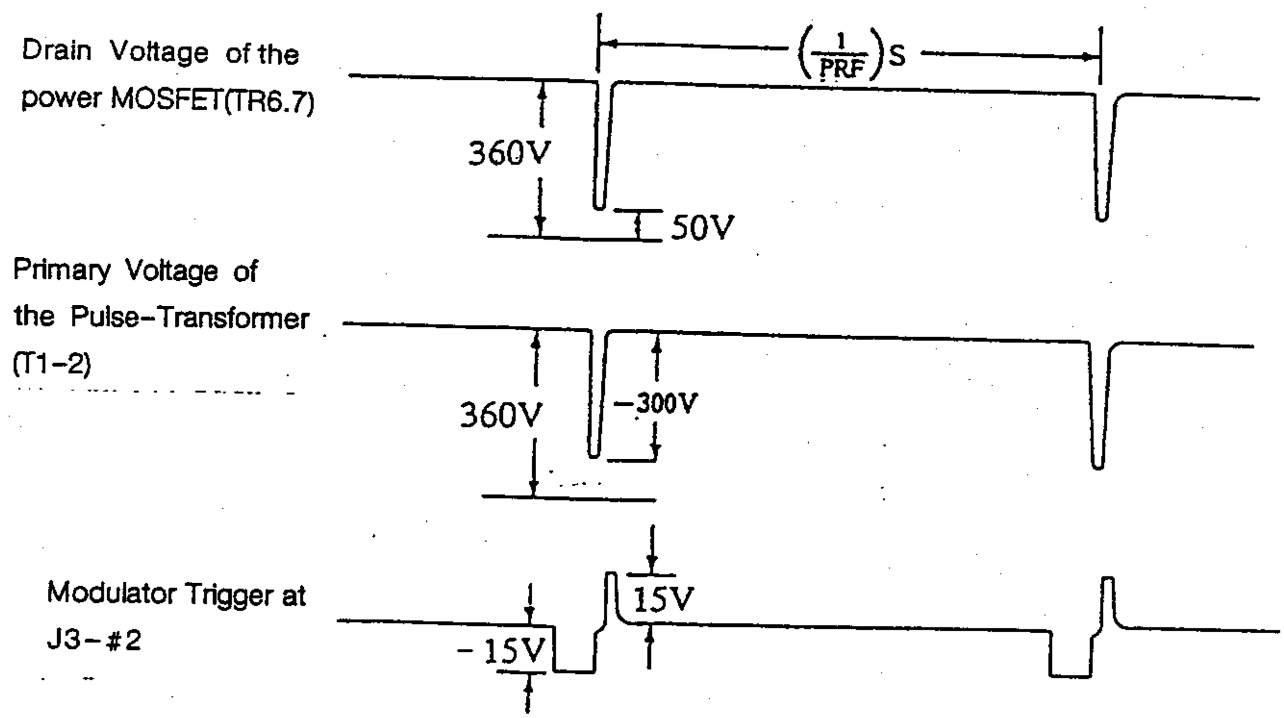


Fig. 4-3 TIME TABLE OF THE TRANSMITTER

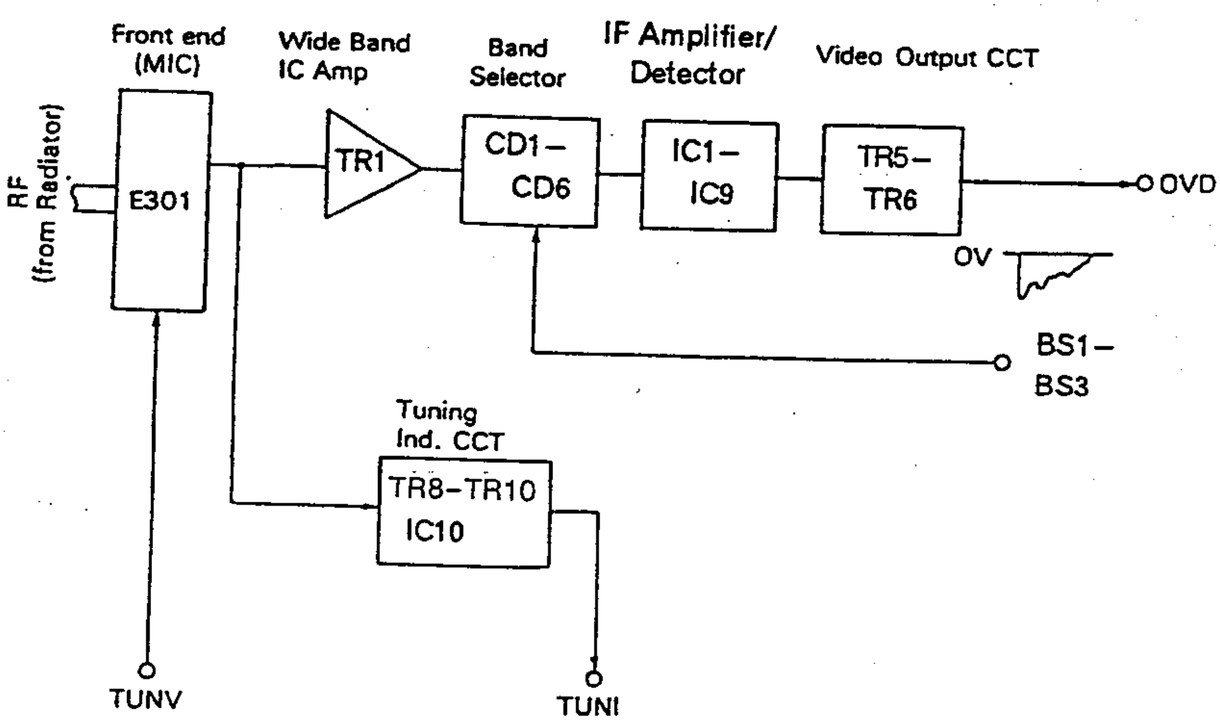


Fig. 4-4 RECEIVER UNIT BLOCK DIAGRAM

Video Output Circuit

The video output circuit at CAE−344−2 consists of emitter follower TR5 and TR6. The emitter follower operates strictly as an impedance transformer to drive the 50 ohms coaxial cable which carries the video signal to the display unit. The video signal is shown in Fig. 4−4.

Tuning Indication Circuit

The tuning indicator circuit at CAE−344−2 consists of amplifier TR8 and TR9, detector TR10, and emitter follower TR10. TR10 discharges C77 to the detected signal voltage. This voltage is sent to the display unit as a tuning indication voltage via buffer amplifier IC10. The range of the tuning indication voltage varies normally between +4V (detuned) and −0.7V (peaked tuning in long pulse).

(CME-261)

ATT Driver Circuit

The PIN Attenuator driver IC6, TR12 is controlled with DC bias (EPWR) and Main Bang Suppression (MBS) trigger, via TR12.

This circuit will drive the PIN Diode to control the microwave power fed to the MIC in the receiver unit (to desired level). These levels are controlled to 1/1, 1/2, 1/4, 1/10 of the peak output power, and MBS will always be applied.

Motor Control Circuit

This circuit will drive the scanner motor for constant rotation of the antenna array. After the TX switch on the display unit is set to " X-MIT " , the ships main, is fed to this circuit. and TR14 ~ 17 will go to ON. The motor will start to rotate.

SECTION 5

TEST: Spurious Emissions Field Strength

EQUIPMENT: JMA-3910 S/N LS 5 4 9 6 6

FCC SPECIFICATION: Sections 2.993 and 80.211.

MINIMUM STANDARD: Mean power of emissions originating in equipment lowest generated frequency to at least 40 GHz shall be attenuated below the mean power of the transmitter by at least 43 plus 10 log (mean power in watts) decibels. Since transmitter mean power is 9.14 watts maximum (long pulse) or 39.61 dBm:

$$\text{Emissions} \leqq 39.61\text{dBm} - [43 + 10\log(9.14)]\ \text{dBm}$$
$$\leqq -13.0\ \text{dBm}$$

TEST RESULTS: No spurious emissions observed above minimum standard.

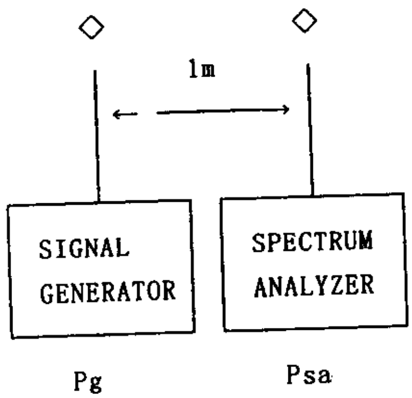
TEST CONDITIONS: Tamb = 20℃ to 25℃ RHamb = 40% ~ 60%
Euut input = 24 VDC
Stabiliazation: UUT energized for 10 minutes minimum.

TEST EQUIPMENT: JRC Original - Shielded Room
Other equipment - see test set-ups.

DATE: 9 - 10 OCT. 1998

TEST ENGINEER: K. YUASA.

CALIBRATION OF TESTS 1～5 (0～1 GHz)



A signal source of known amplitude was used as a calibrating signal with identical antennas on the generator and the spectrum analyzer.
From previous testing in the shielded room, the antenna factors are considered much greater than path loss.
Hence half of the difference in signals Pg and Psa is due to each antenna.

The calibrating signal on the analyzer is therefore:

$$Pcal = Psa - (Psa - Pg) / 2 = (Psa + Pg) / 2 \text{ dBm.}$$

The log ref level on the analyzer is adjusted so as to read other signals directly:

$$LRL\ (adjusted) = LRL\ (set) + Pcal - Psa \text{ dBm.}$$

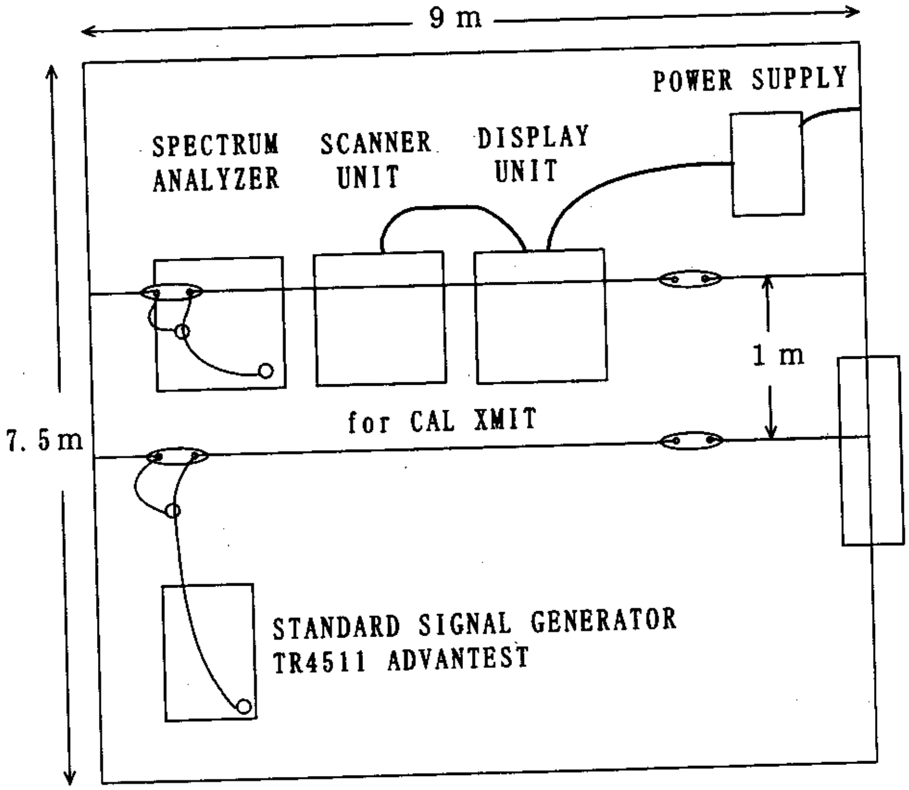
The calibrating signal used was selected on the basis of best average amplitude over the frequency range of interest.

TEST	CAL sig	Psa	Pg	Pcal	LRL(set)	LRL(adj)
1	250 KHz	-89.3	0	-44.7	-10	34.6
2	2.5 MHz	-86.7	0	-43.4	-10	33.3
3	25 MHz	-50.7	0	-25.4	-10	15.3
4	250 MHz	-14.7	0	-7.4	-10	-2.6
5	500 MHz	-12.0	0	-6.0	-10	-4.0

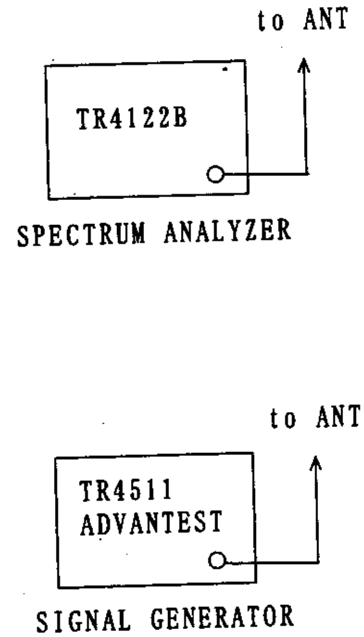
RFI TEST

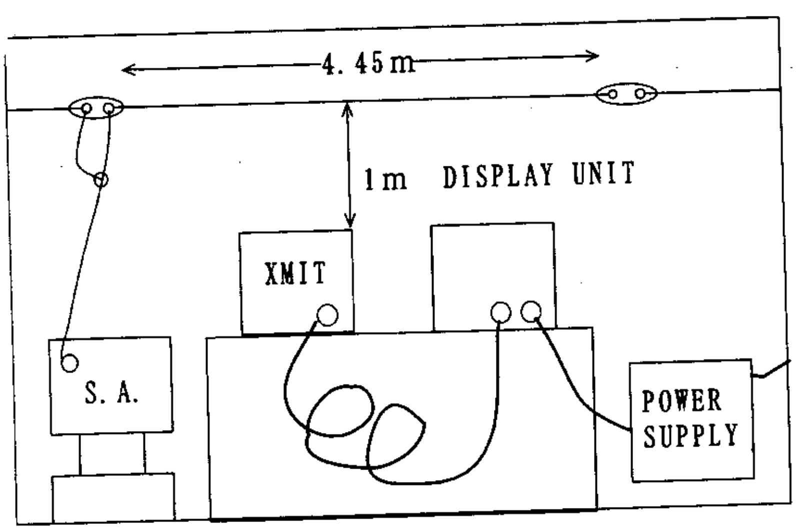
TEST SET-UP #1(0~50MHz)

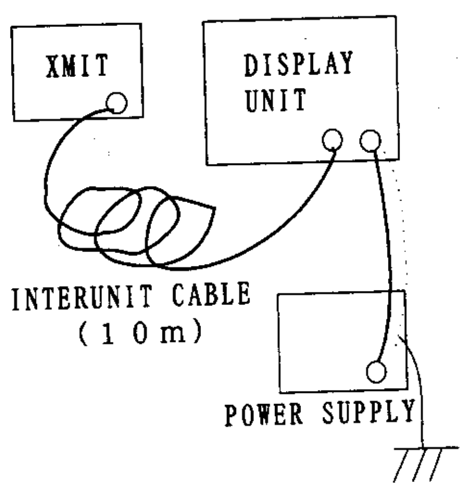
TEST #1 0~500 KHz
TEST #2 0~ 5 MHz
TEST #3 0~ 50 MHz



TEST EQUIPMENT







JRC ORIGINAL
RF ANECHOIC CHAMBER:SIDE VIEW

CABLE

TEST SET UP #2 (50MHz−40GHz)

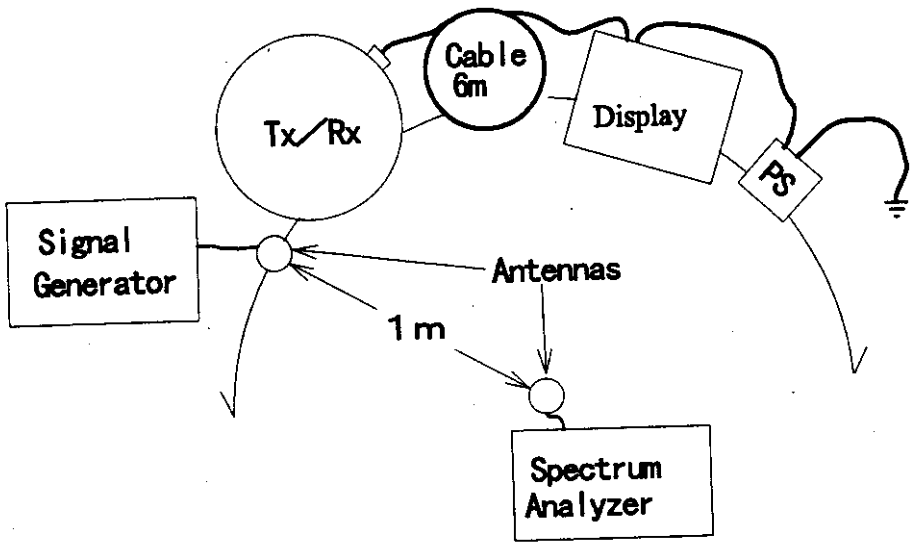
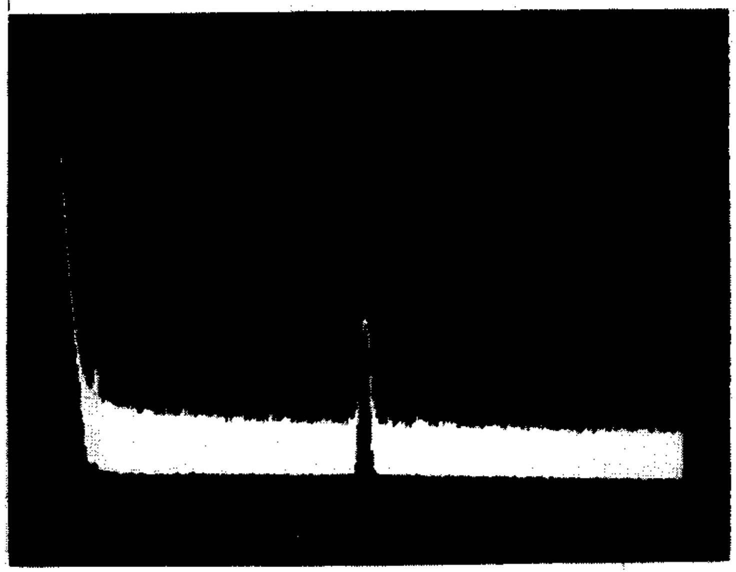


TABLE OF TEST EQUIPMENT USED

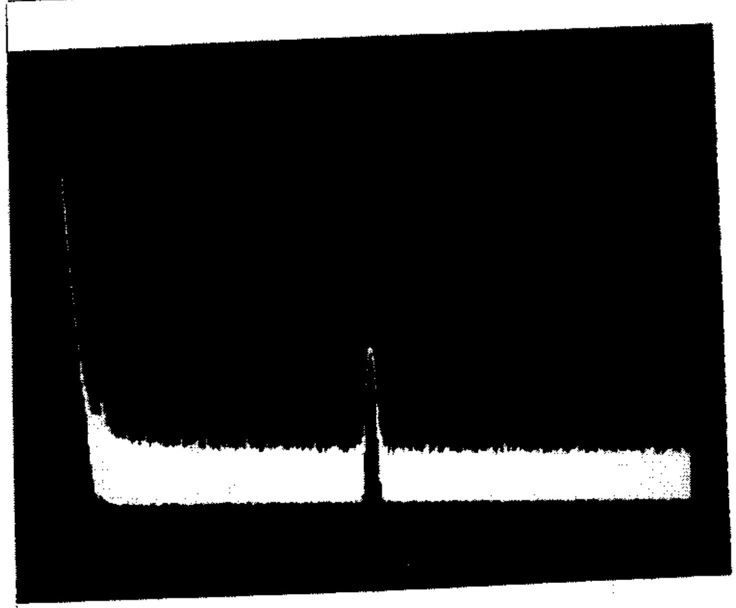
Frequency	Test Antenna	Spectrum Analyzer	Signal Generator	Misc.
0−1000MHz	1/2 Coaxial (Untuned)	TAKEDA RIKEN TR4133B	ADVANTEST TR4511	−
1−18GHz	AILTECH 94612-1 Log Peliodic	〃	NA	−
18−26GHz	AILTECH 94626-1 HP-11519A	〃	NA	−
26−40GHz	AILTECH 94627-1 HP-11519A	〃	NA	−

TEST #1

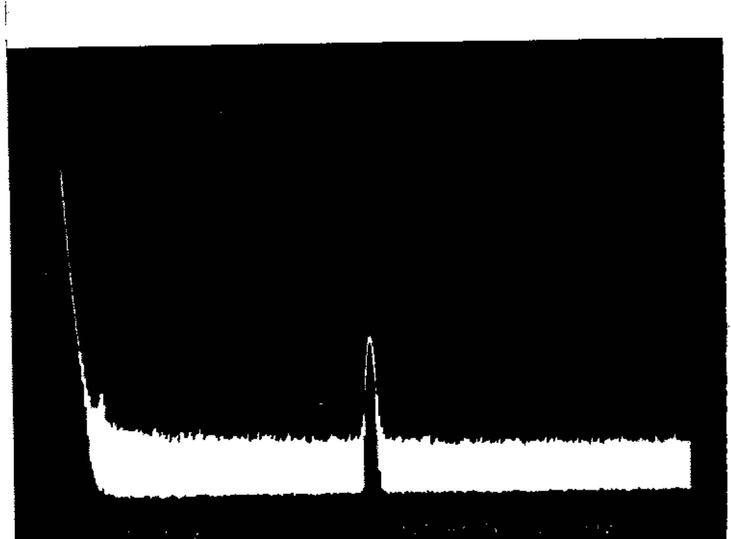
Frequency Band: 0～500 KHz　　Log Ref. Level: 34.6 dBm



Amdient



Stand-By

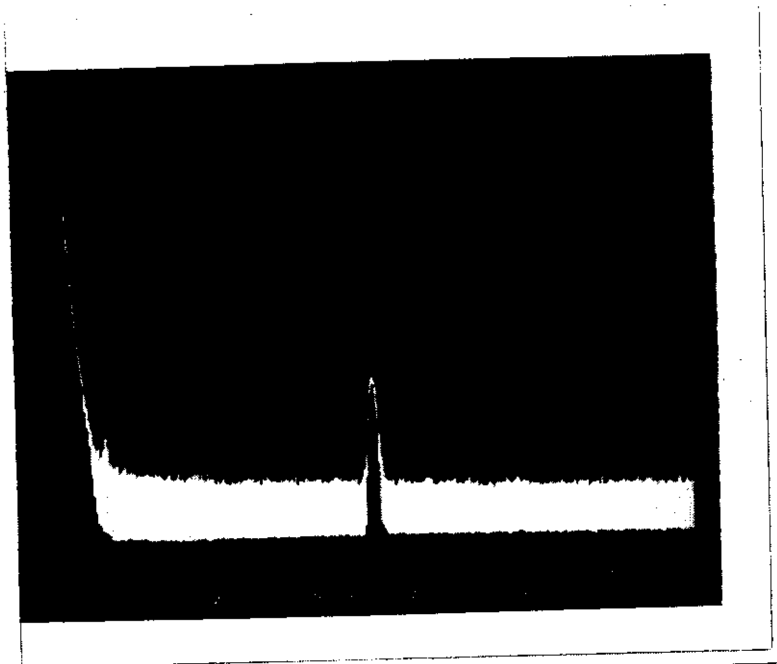


Short Pulse

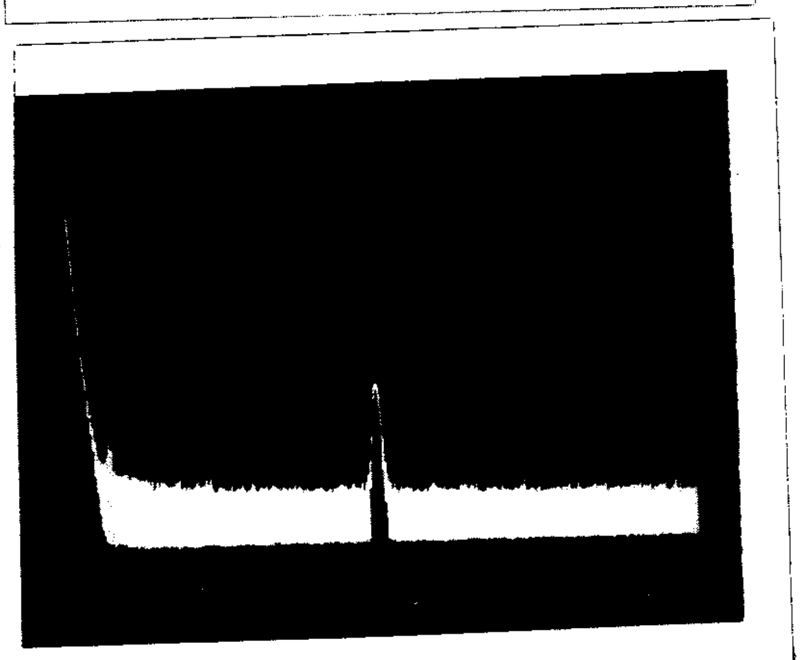
TEST #1

Frequency Band: 0～500 KHz

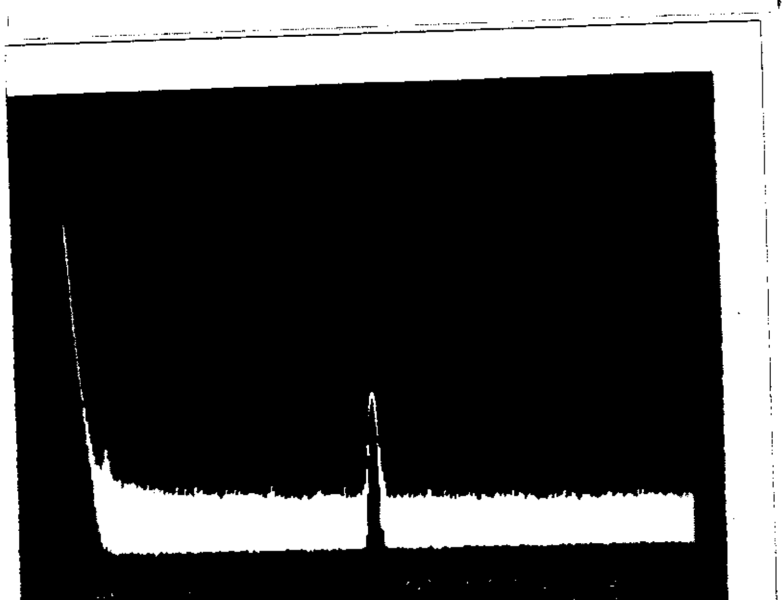
Log Ref. Level: 34.6 dBm



Medium
Short Pulse



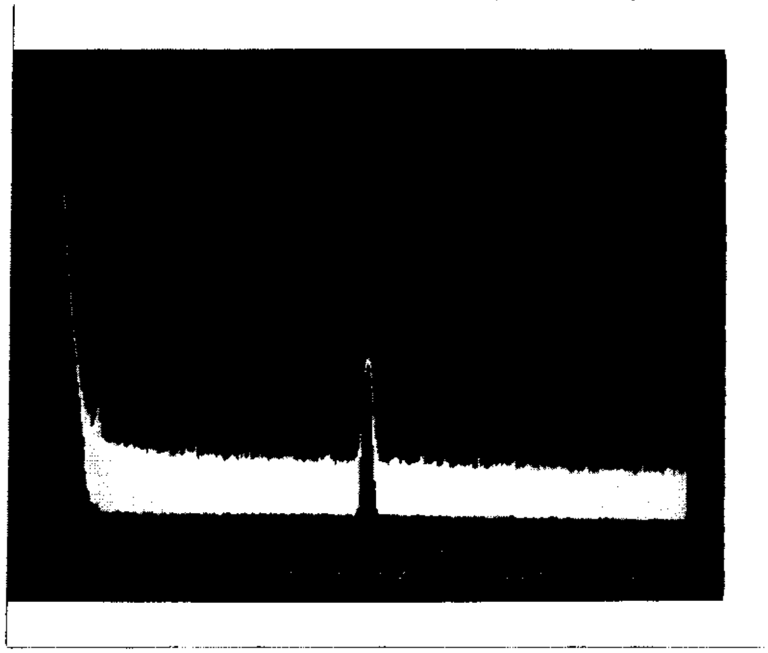
Medium Pulse



Medium
Long Pulse

TEST #1

Frequency Band: 0～500 KHz　　Log Ref. Level: 34.6 dBm

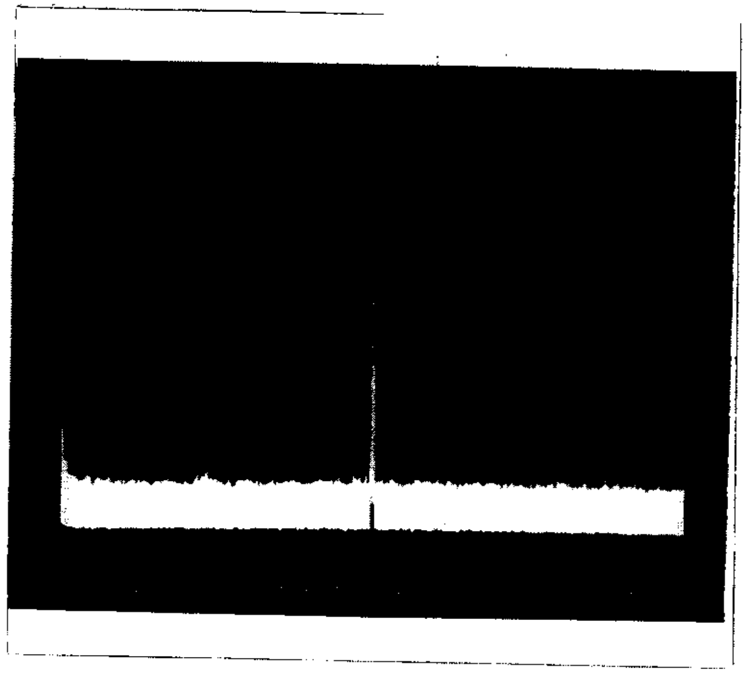


Long Pulse

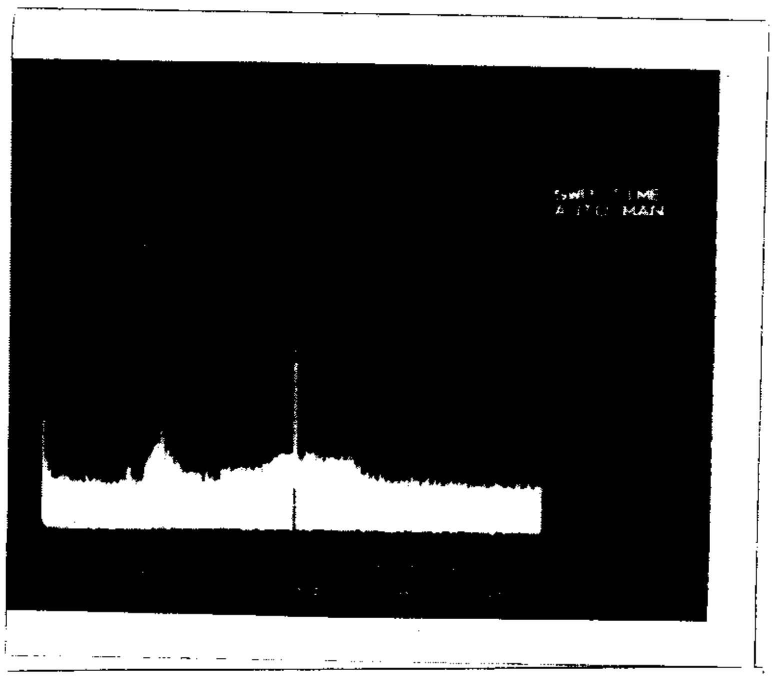
TEST #2

Frequency Band: 0～5 MHz

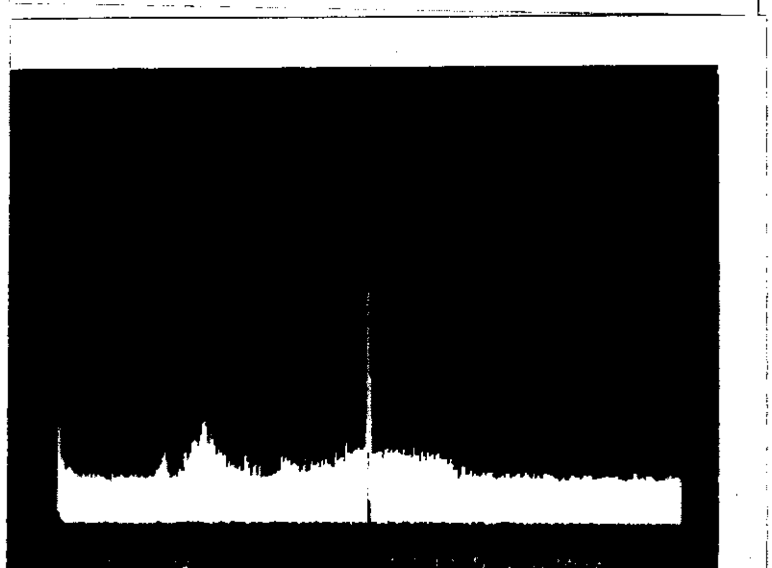
Log Ref. Level: 33.3 dBm



Ambient



Stand-By

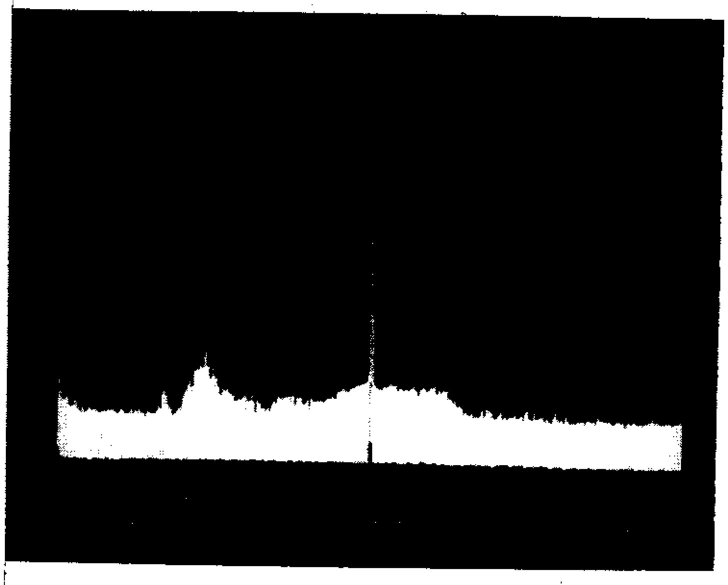


Short Pulse

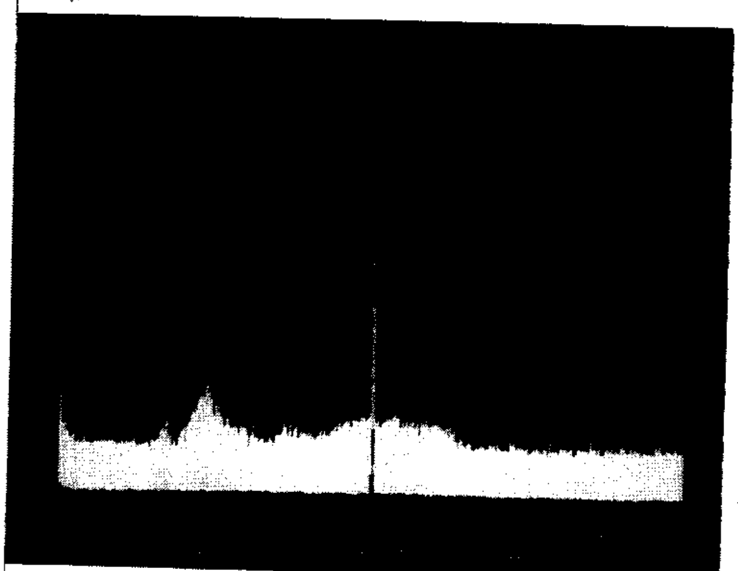
TEST #2

Frequency Band: 0～5 MHz

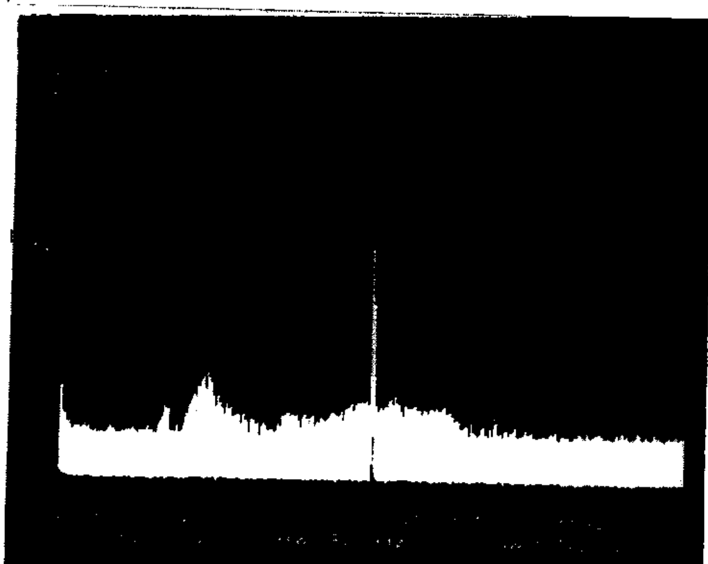
Log Ref. Level: 33.3 dBm



Medium
Short Pulse



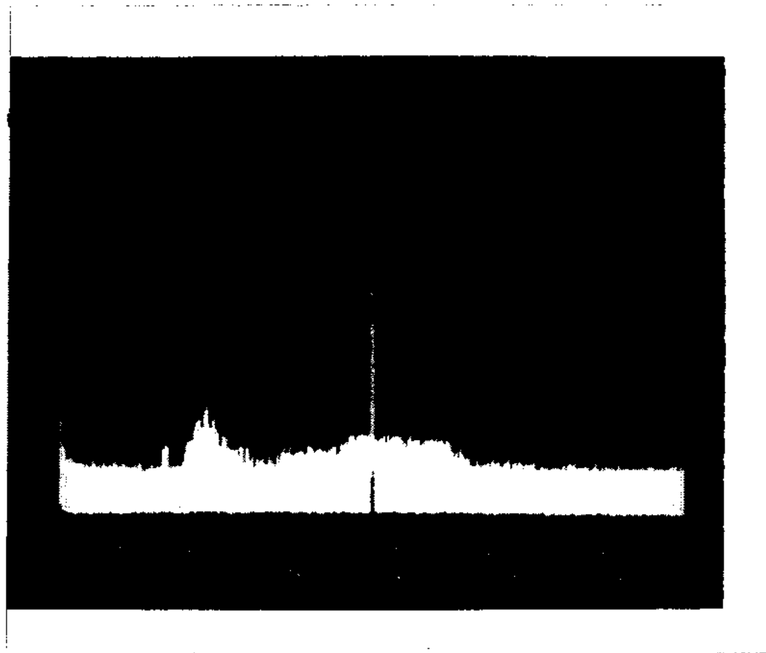
Medium Pulse



Medium
Long Pulse

TEST #2

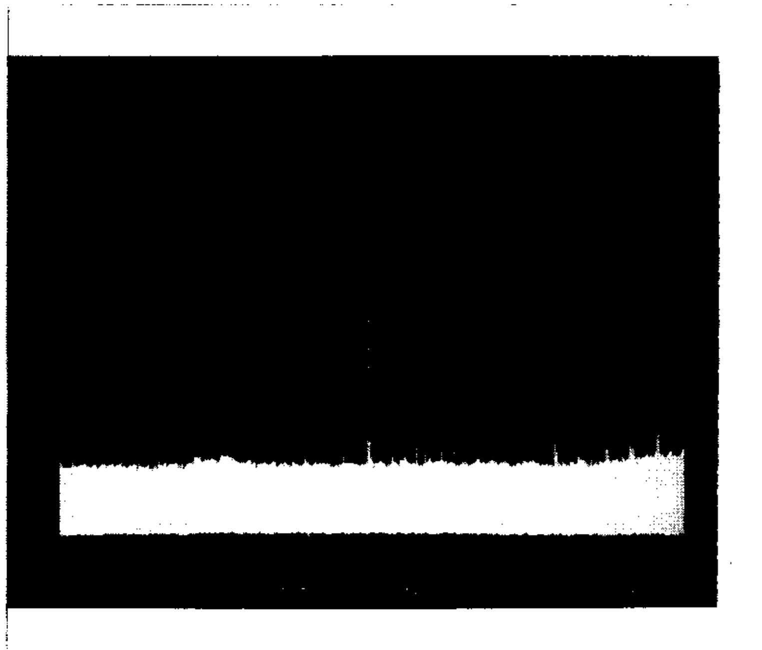
Frequency Band: 0～5 MHz Log Ref. Level: 33.3 dBm



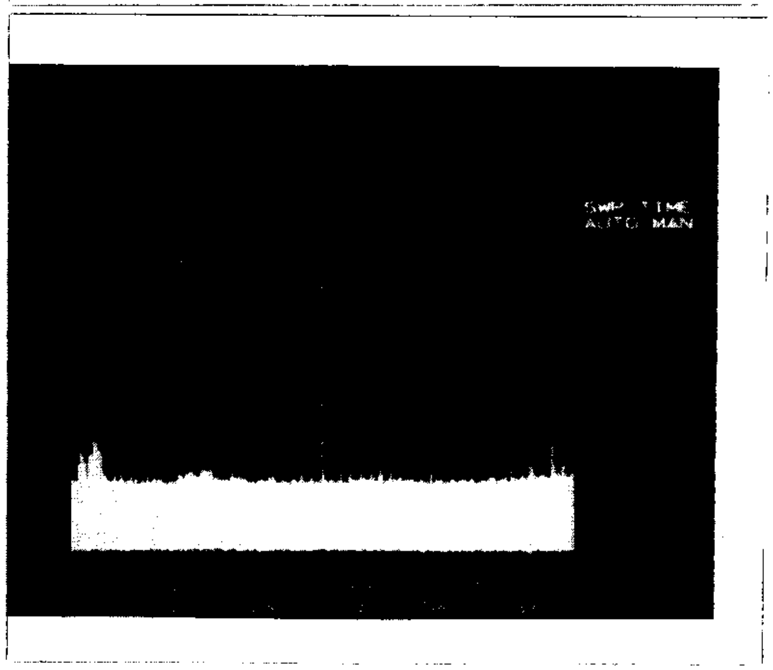
Long Pulse

TEST #3

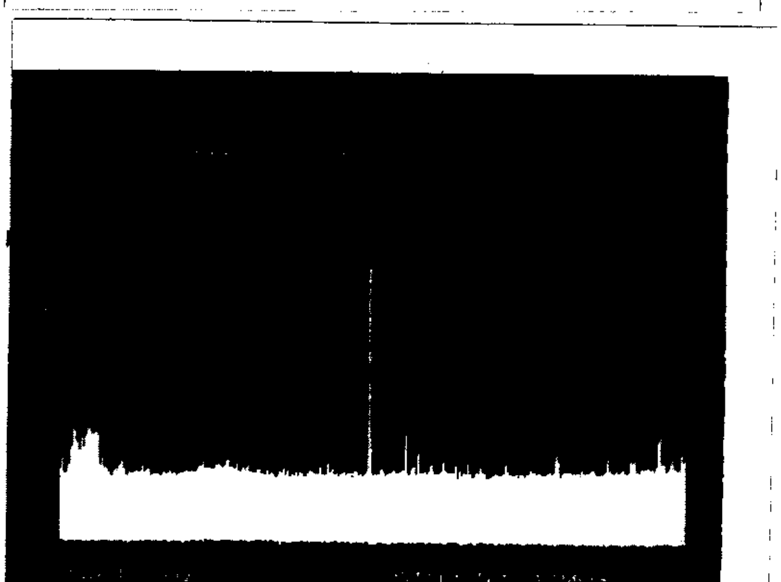
Frequency Band: 0～50 MHz Log Ref. Level: 15.3 dBm



Ambient



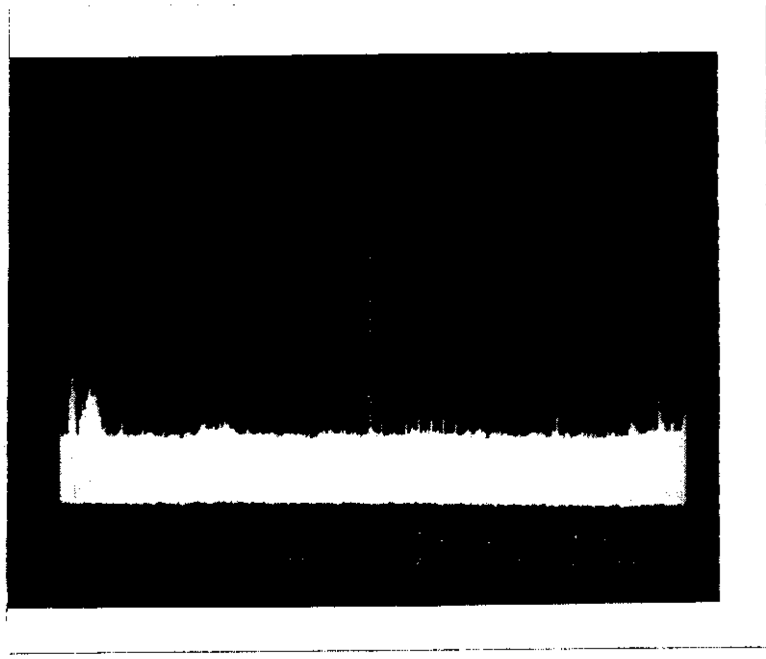
Stand-By



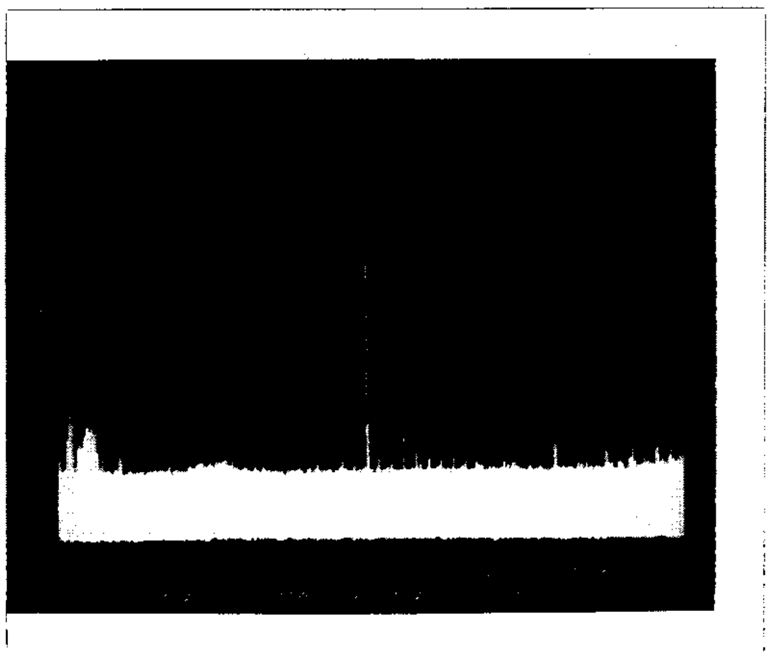
Short Pulse

TEST #3

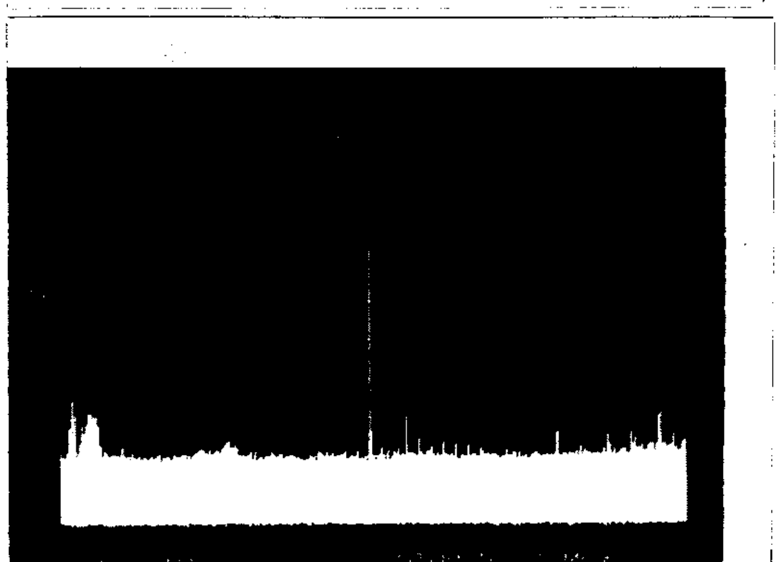
Frequency Band: 0～50 MHz　　Log Ref. Level: 15.3 dBm



Medium
Short Pulse



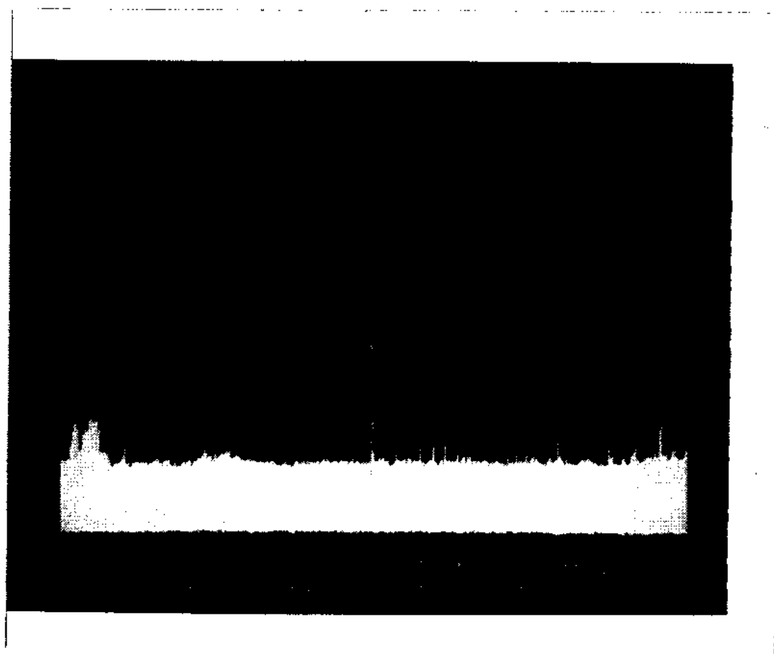
Medium Pulse



Medium
Long Pulse

TEST #3

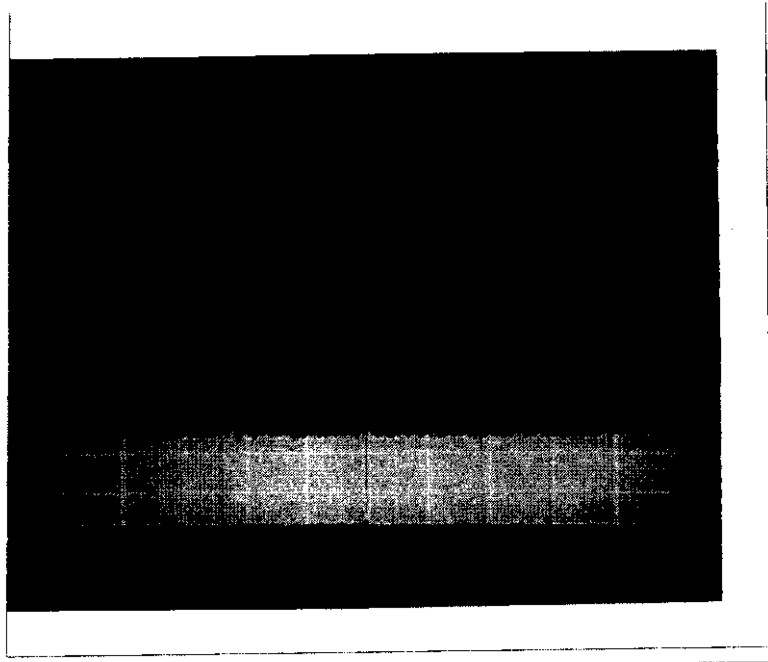
Frequency Band: 0～50 MHz Log Ref. Level: 15.3 dBm



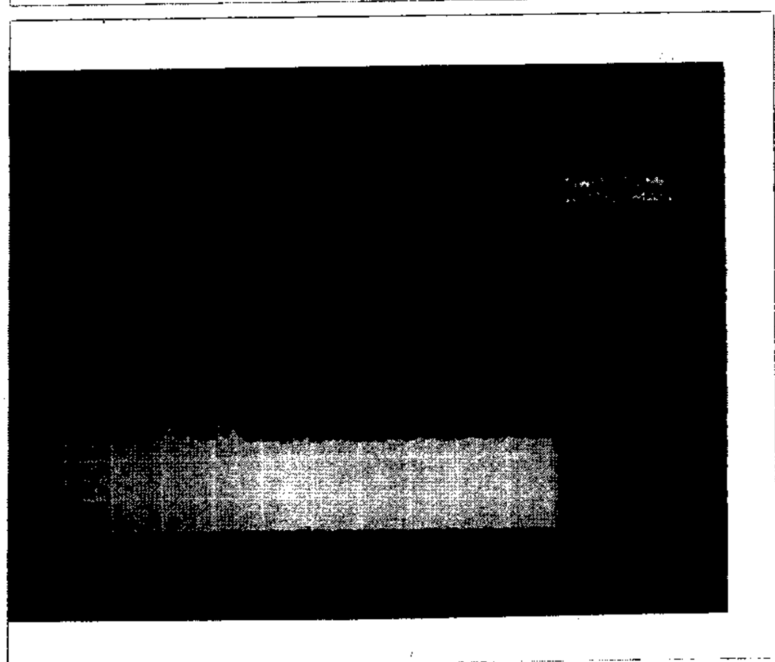
Long Pulse

TEST #4

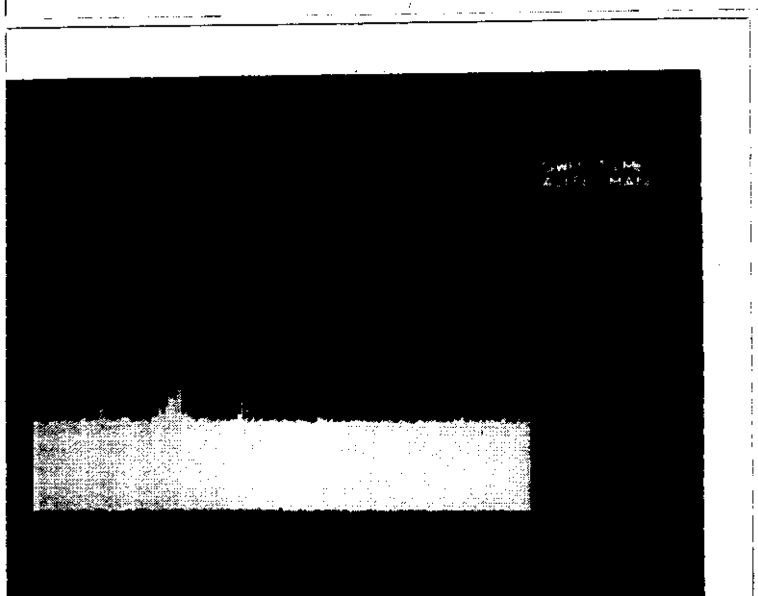
Frequency Band: 0～500 MHz　　　　Log Ref. Level: -2.6 dBm



Ambient



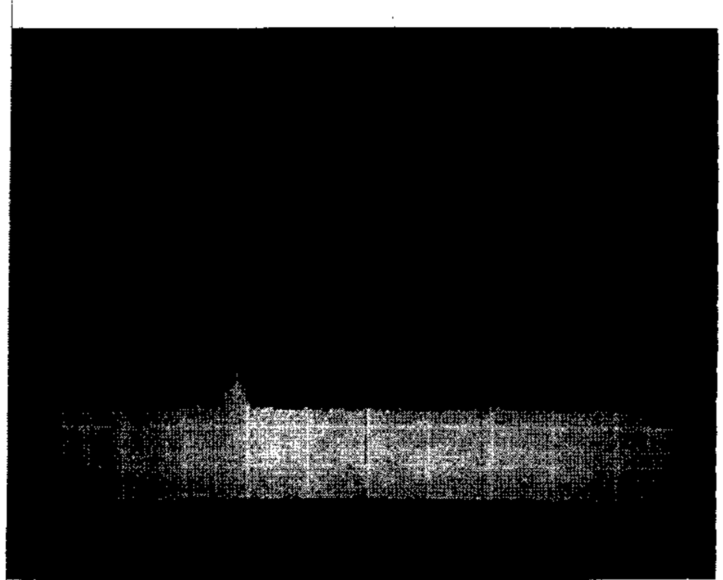
Stand-By



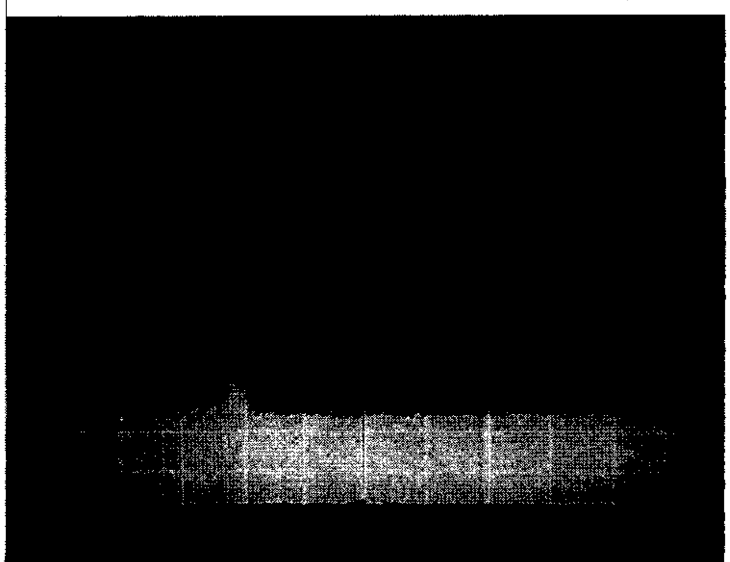
Short Pulse

TEST #4

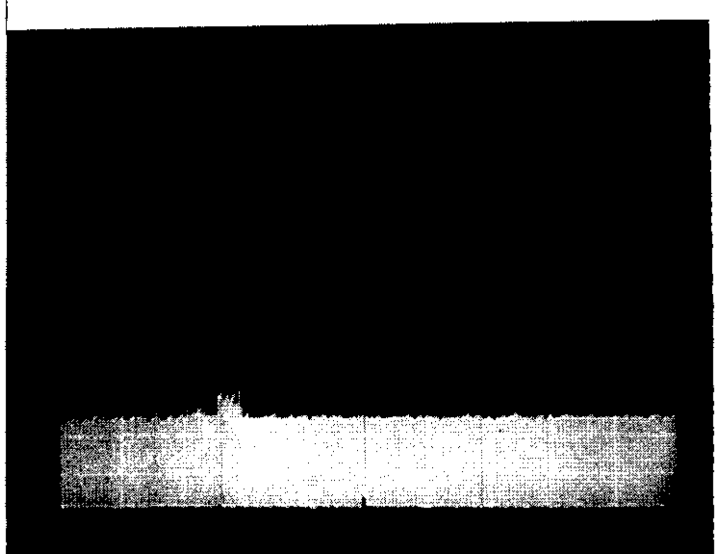
Frequency Band: 0～500 MHz　　　　Log Ref. Level: -2.6 dBm



Medium
Short Pulse



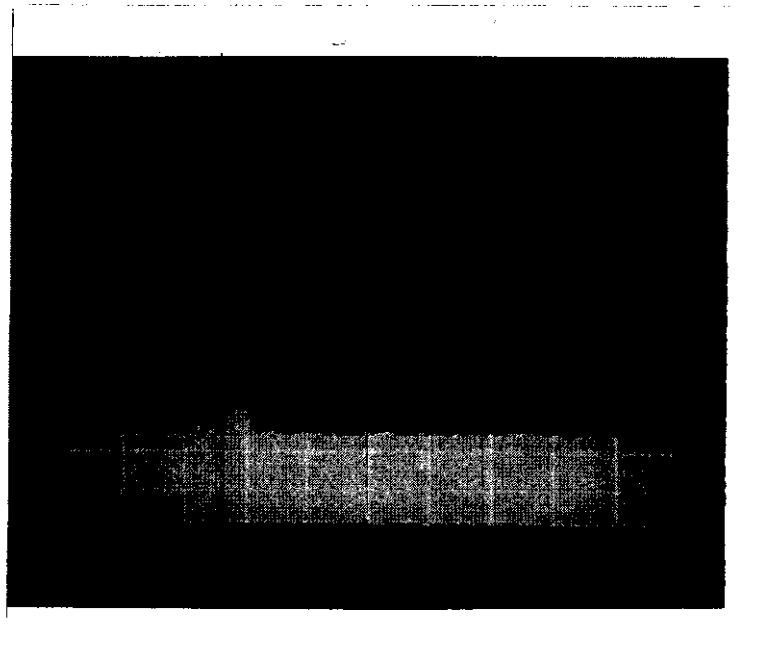
Medium Pulse



Medium
Long Pulse

TEST #4

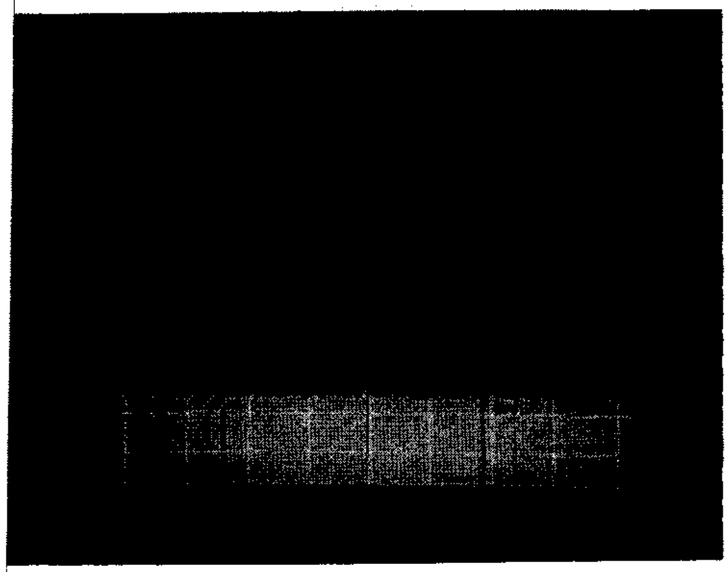
Frequency Band: 0～500 MHz　　　Log Ref. Level: -2.6 dBm



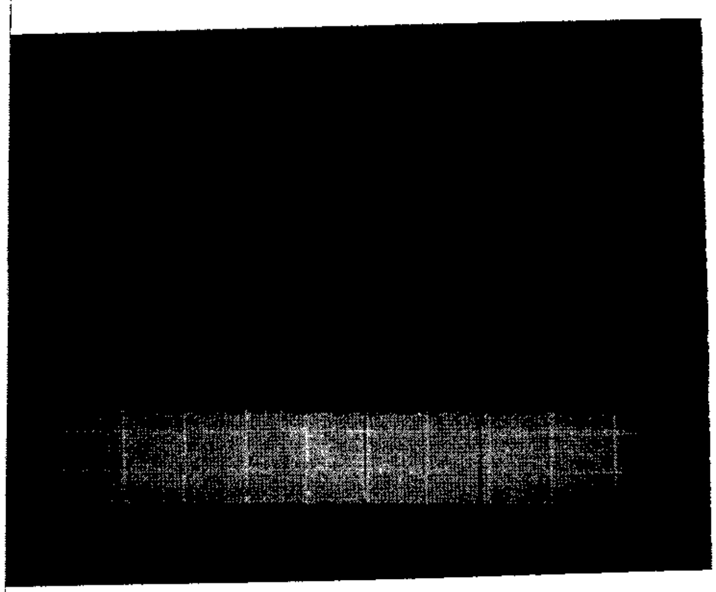
Long Pulse

TEST #5

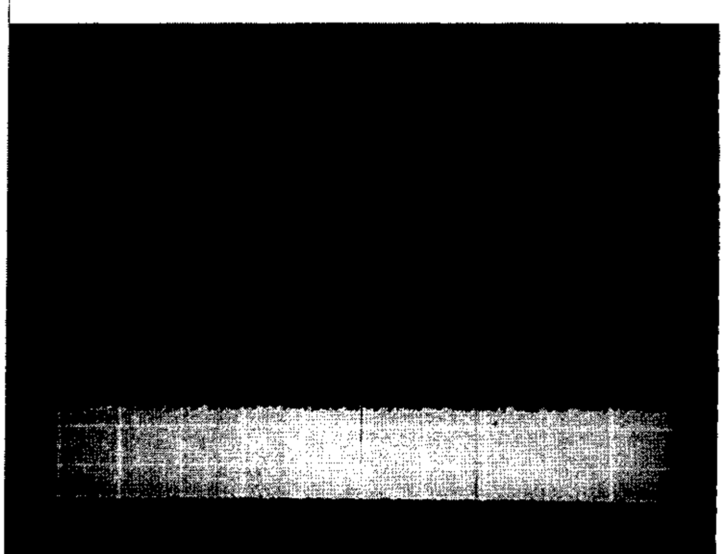
Frequency Band: 0～1 GHz Log Ref. Level: -4.0 dBm



Ambient



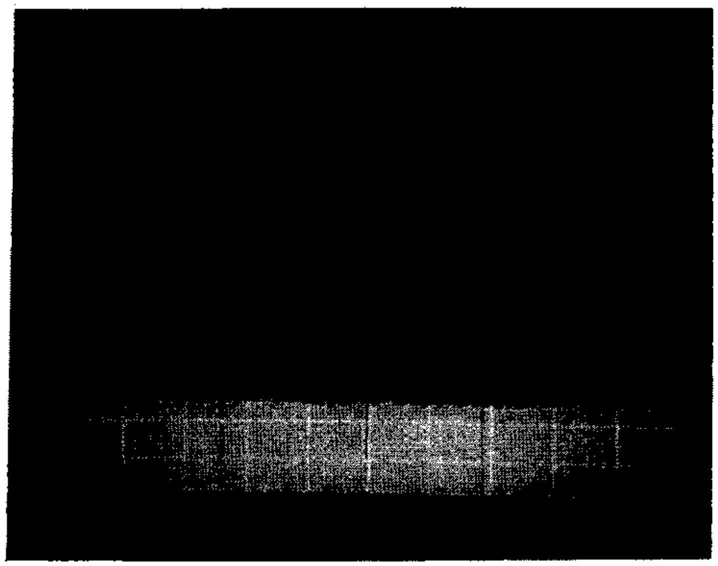
Stand-By



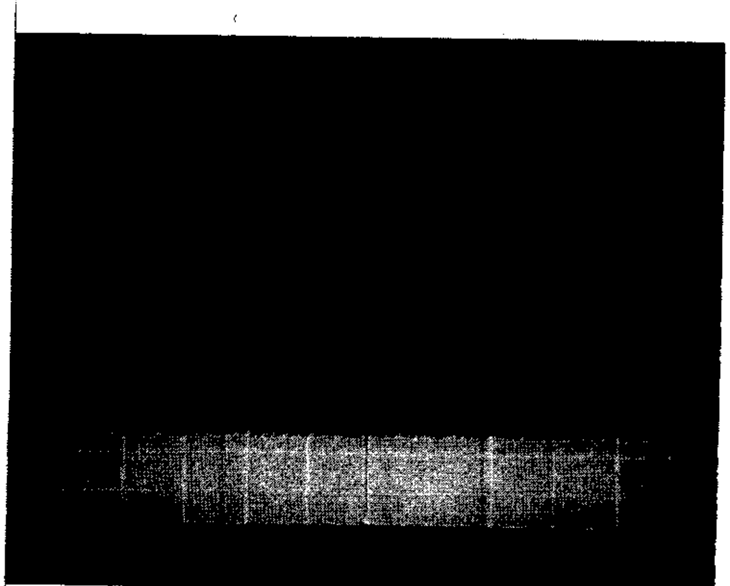
Short Pulse

TEST #5

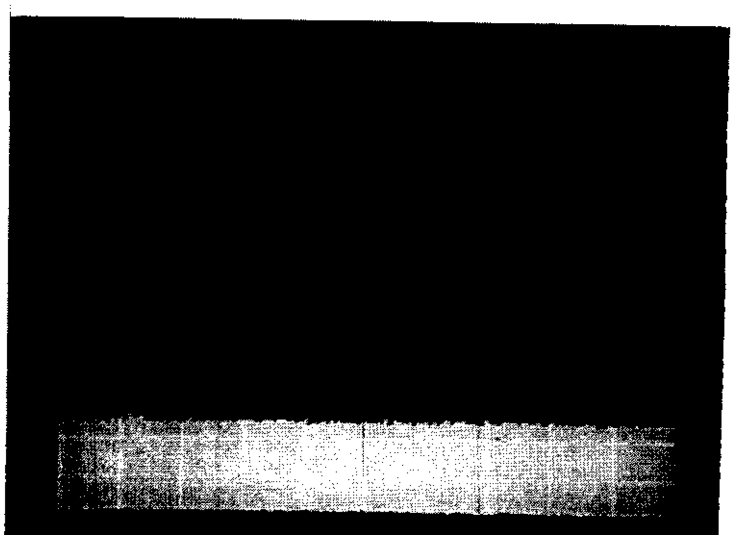
Frequency Band: 0～1 GHz   Log Ref. Level: -4.0 dBm



Medium
Short Pulse



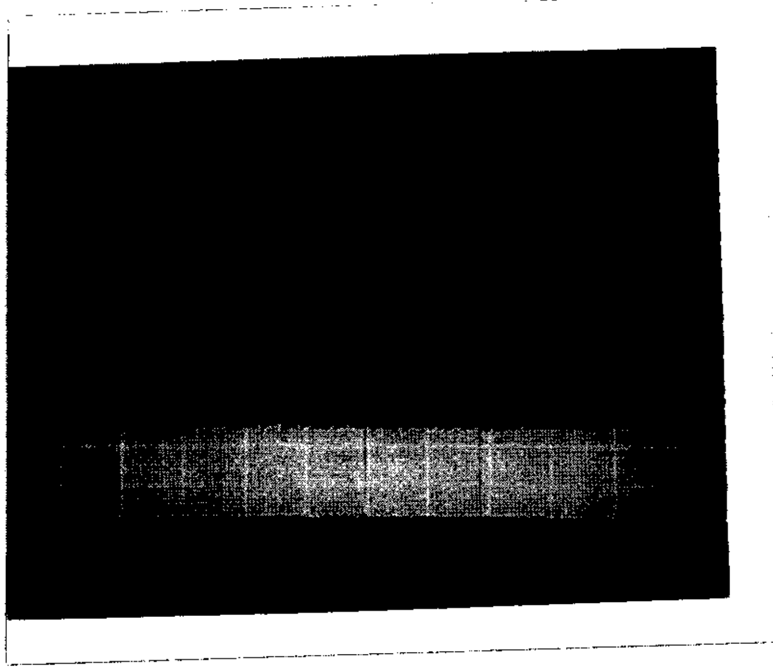
Medium Pulse



Medium
Long Pulse

TEST #5

Frequency Band: 0～1 GHz   Log Ref. Level: -4.0 dBm



Long Pulse

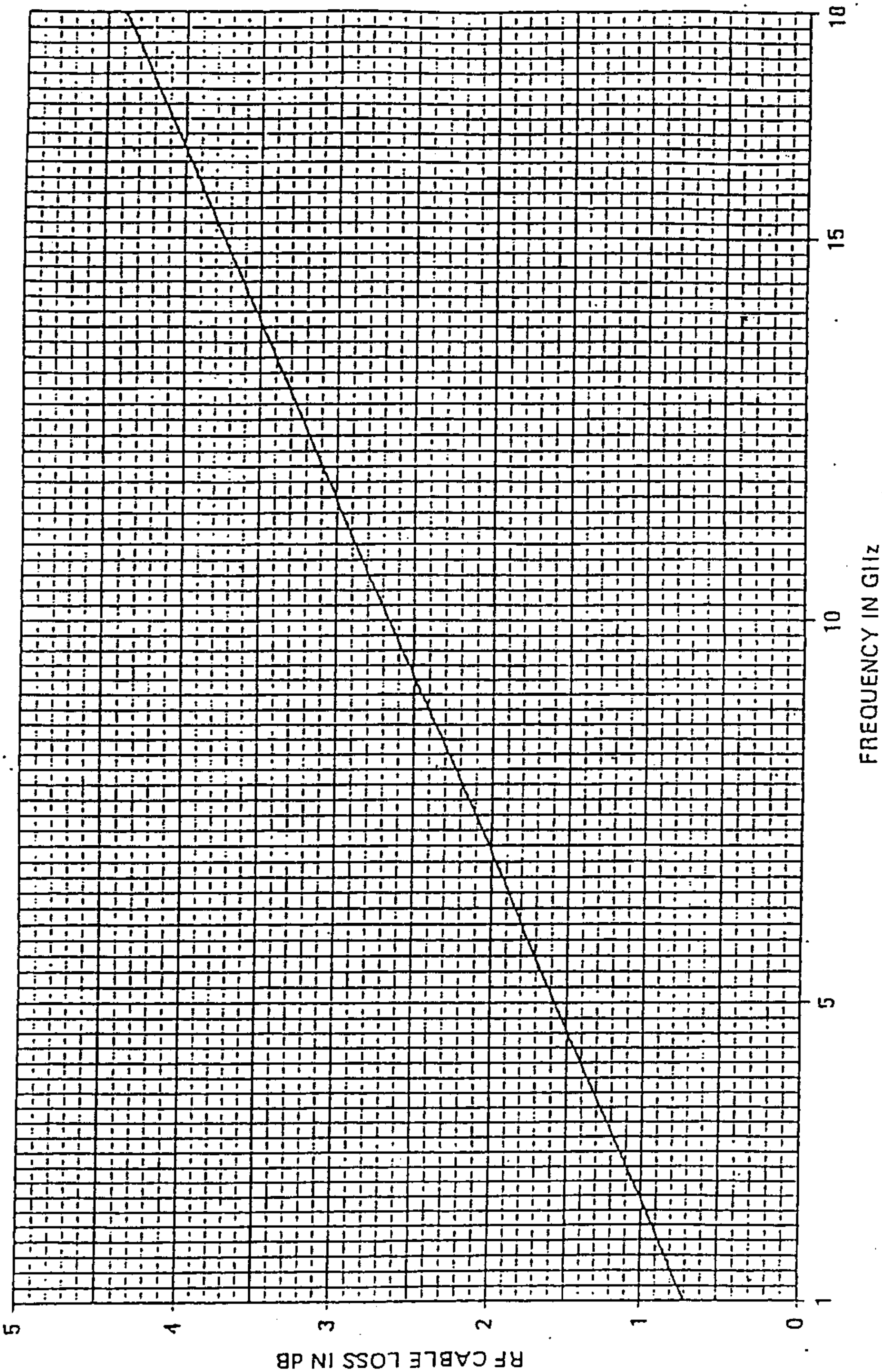


Figure 4-2. Model 94615-1 RF Cable Loss Chart

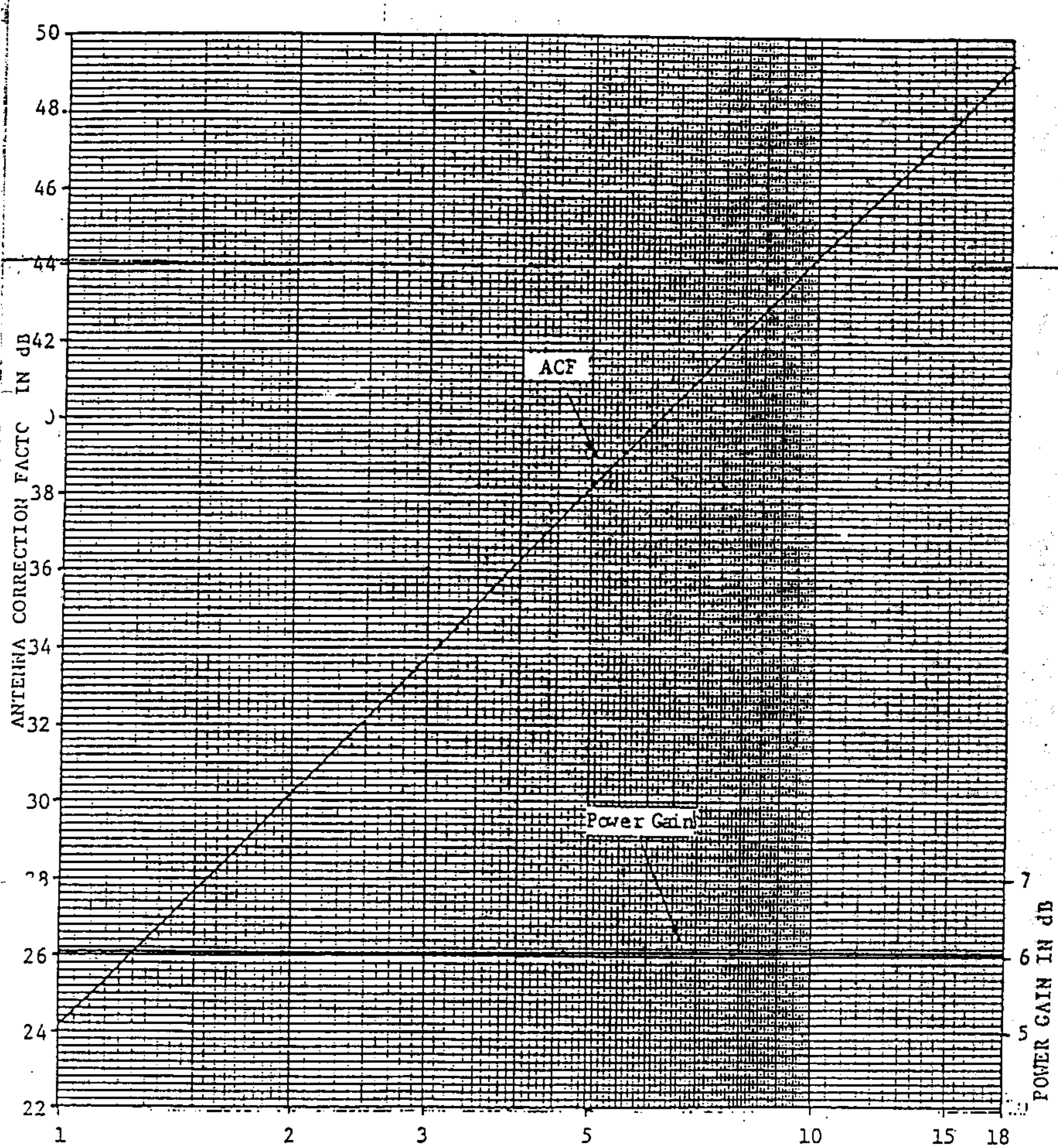


Figure 4-1. Antenna Correction Factor and Power Gain, Model 94612-1 Antenna

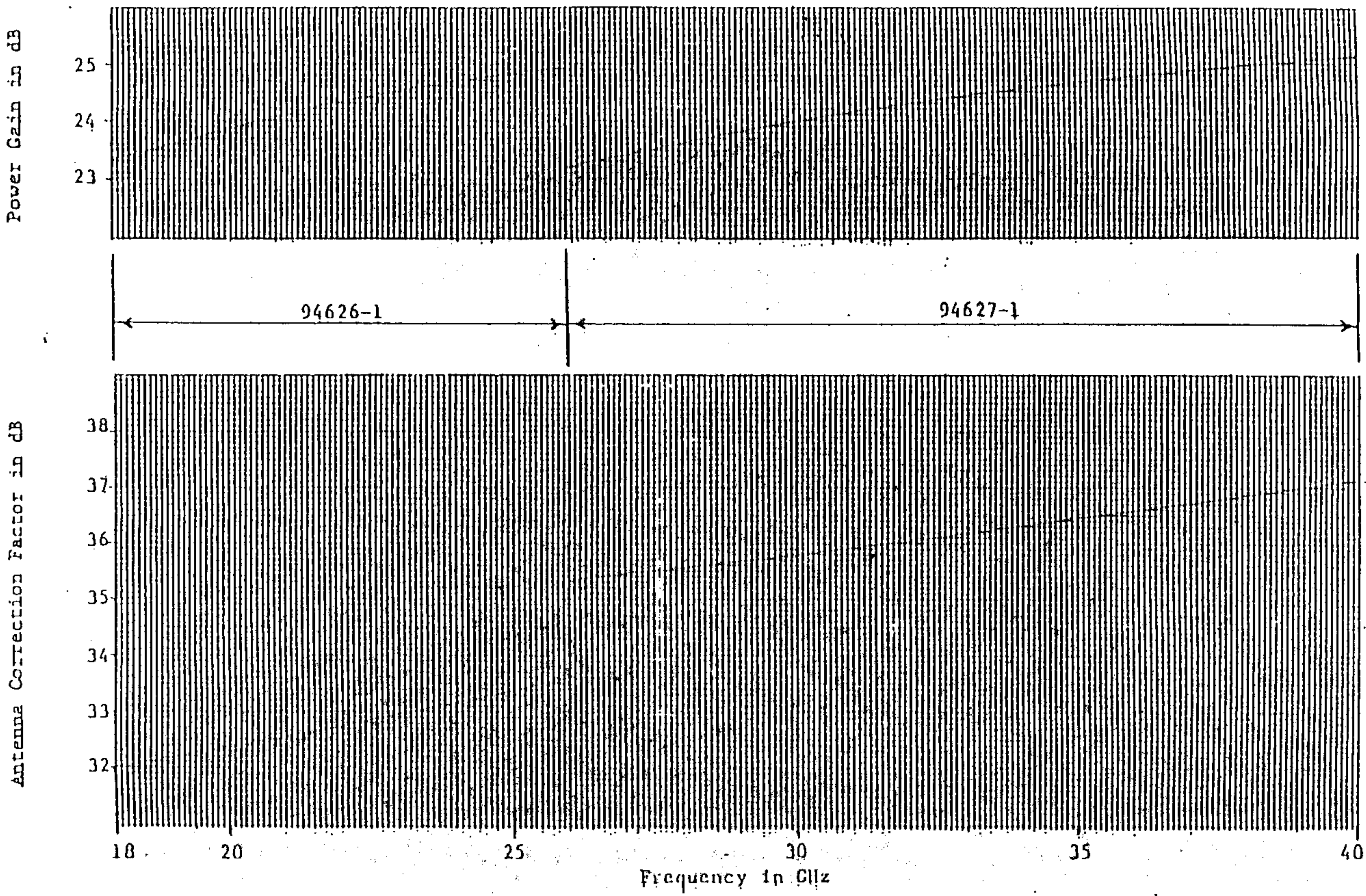
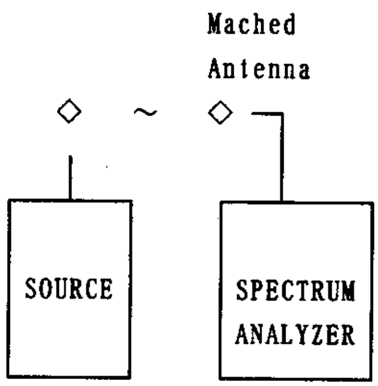


Figure 1-1. Antenna Correction Factor and Power Gain for Horn Antennas

CALIBRATION OF TESTS 6 ～ 13 (1 ～ 60 GHz)

Instead of using a signal souce of known amplitude to calibrate the receiveing system, the path and antenna characteristics were computed.



A half wave dipole was assumed to be the transmitting antenna. (FCC 2.993)

The power density at distance R is: $P = \dfrac{1.64\ Pt}{4\pi R2}$

Where Pt is power transmitted.

The power to the analyzer is: $Psa = PAr = \dfrac{PG\lambda 2}{4\pi}$

Where G is the receiving antenna gain and Ar is the effective area of the receiving antenna

$$\text{Hence } Psa = \frac{1.64\ Pt}{4\pi R2} \times \frac{PG\lambda 2}{4\pi} = \frac{1.6\ G\lambda 2}{16\pi 2} \times Pt \quad \text{at 1 meter}$$

$$\text{and} \quad Pt = \frac{16\pi 2Psa}{1.64\ G\lambda 2} = \frac{96.3\ Psa}{G\lambda 2}$$

$$= Psa\ (dBm) + 19.8\ (dB) - G\ (dB) - 20\ \log\lambda\ (dB)$$

TEST	HORN GAIN (AVG) dB LOA	HI	WAVELENGTH (dB) LO	HI	Pt - Psa LO	HI	LOG REF LEVEL
6	6		-10.5	-24.4	24.3	38.2	0 dBm
7	6		-23.5	-29.0	37.3	42.8	0 dBm
8	6		-29.0	-32.4	42.8	46.5	0 dBm
9	6		-32.0	-34.5	46.2	48.3	0 dBm
10	6		-34.0	-36.0	45.8	49.7	0 dBm
11	23.3	24.9	-35.6	-38.8	32.1	33.7	0 dBm
12	24.7	23.7	-38.4	-39.7	33.5	35.8	0 dBm
13	23.6	25.1	-39.4	-46.0	35.6	37.2	0 dBm

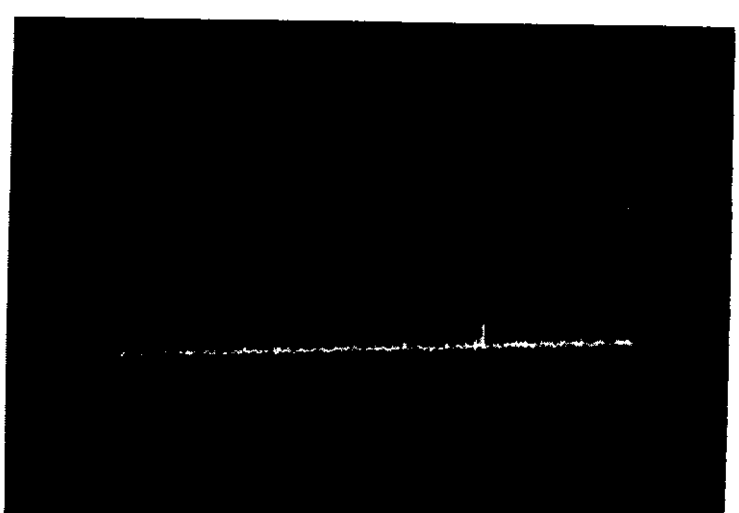
TEST #6

Frequency Band: 1～5GHz   Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

Ambient

Stand-By



Short Pulse

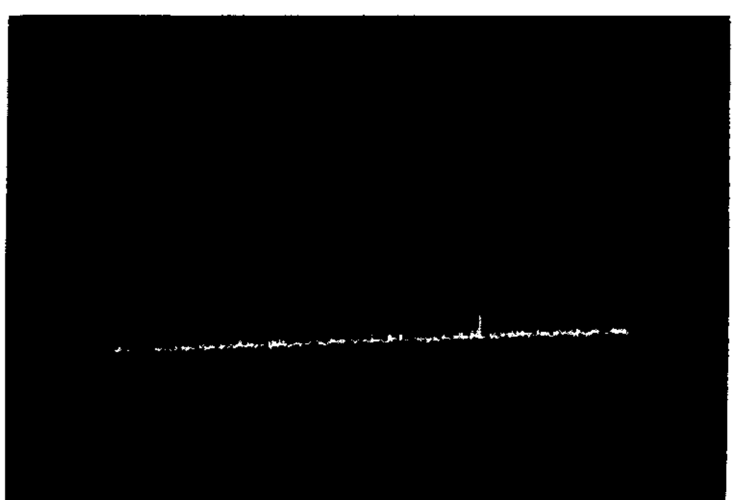
TEST #6

Frequency Band: 1～5 GHz　　　　Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

Short-Medium Pulse

Medium Pulse



Medium-Long Pulse

TEST #6

Frequency Band: 1～5 GHz Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

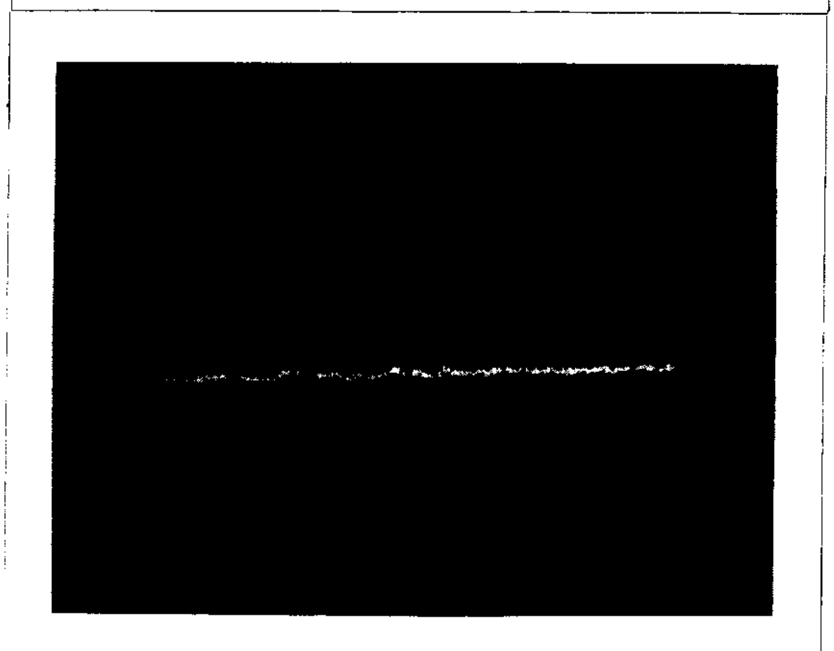
Long Pulse

TEST #7

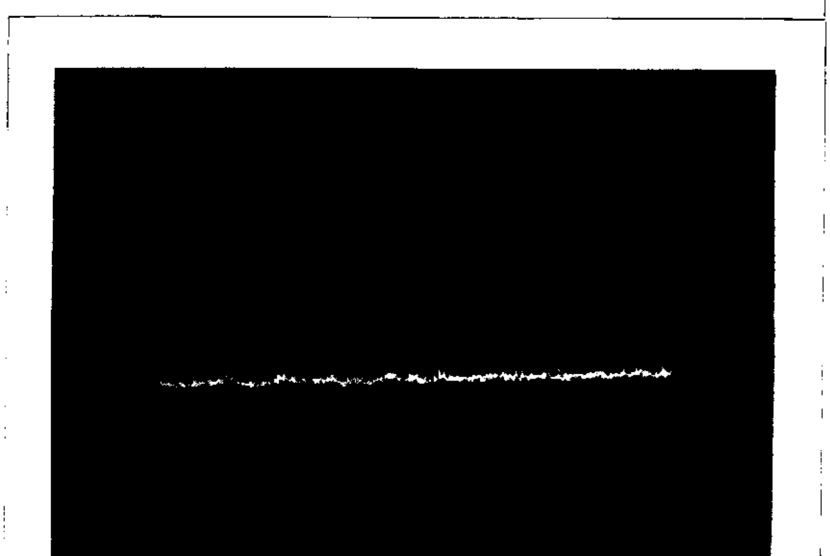
Frequency Band: 4.5～8.5 GHz　　　　　　Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

Ambient



Stand-By

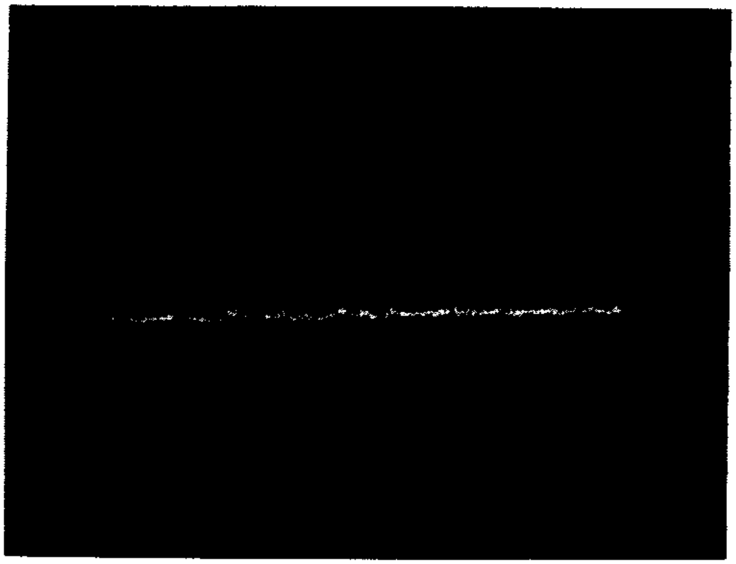


Short Pulse

TEST #7

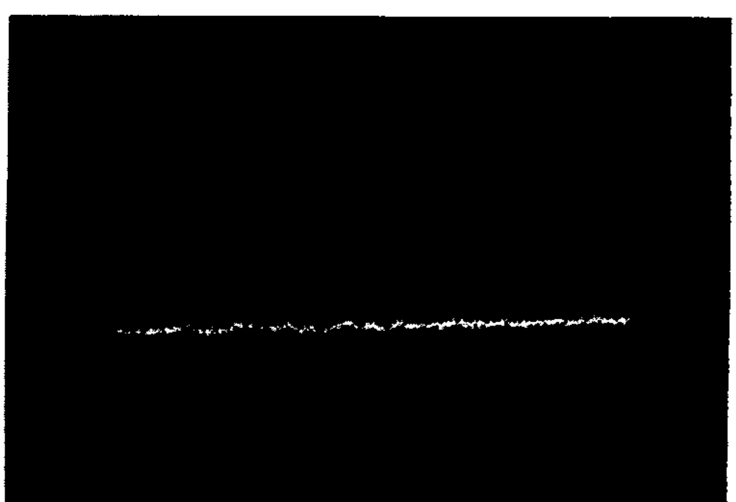
Frequency Band: 4.5～8.5 GHz　　　Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)



Short-
Medium Pulse

Medium Pulse



Medium-
Long Pulse

TEST #7

Frequency Band: 4.5~8.5 GHz　　　Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed:　(See Calibration Procedure for Test 6~13)

Long Pulse

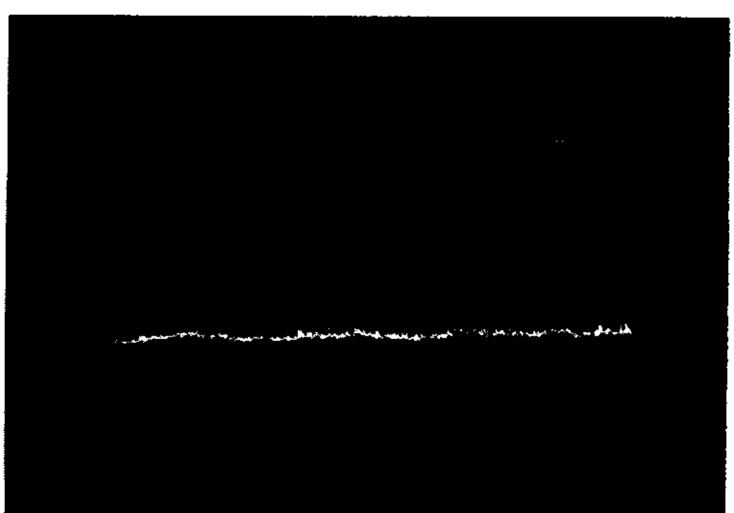
TEST #8

Frequency Band: 8.5～12.5 GHz Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

Ambient

Stand-By



Short Pulse

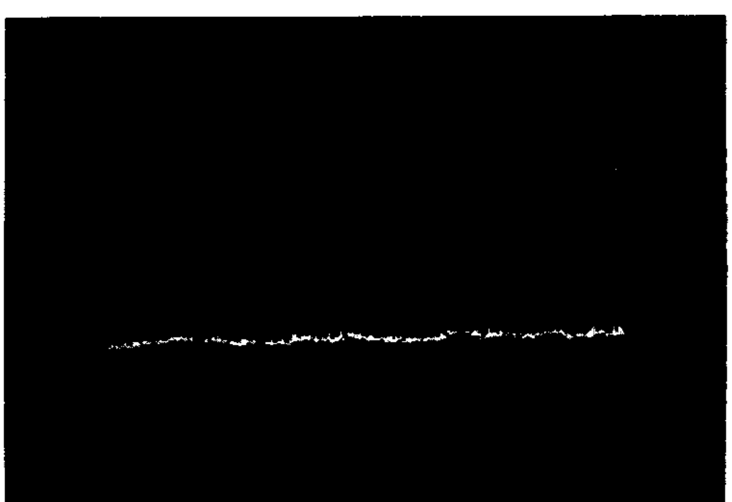
TEST #8

Frequency Band: 8.5～12.5 GHz Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

Short-Medium Pulse

Medium Pulse



Medium-Long Pulse

TEST #8

Frequency Band: 8.5～12.5 GHz Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

Long Pulse

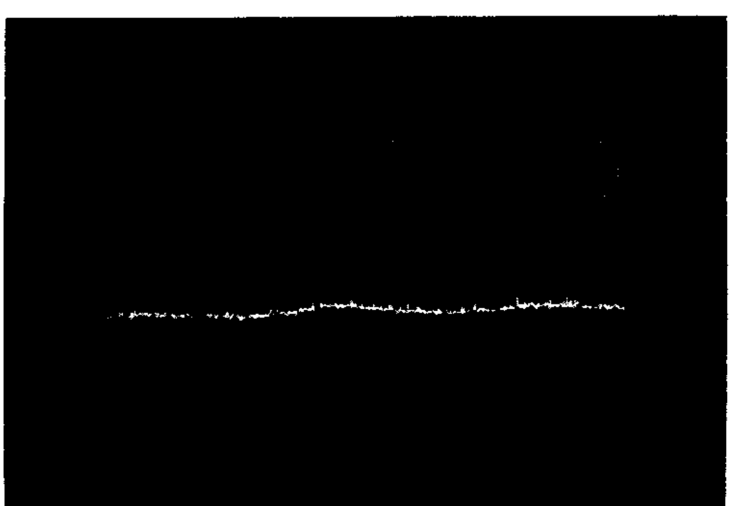
TEST #9

Frequency Band: 12～16 GHz　　　　Log Ref. Level:　0 dBm

Maximum Sprious Signal Observed:　(See Calibration Procedure for Test 6～13)

Ambient

Stand-By



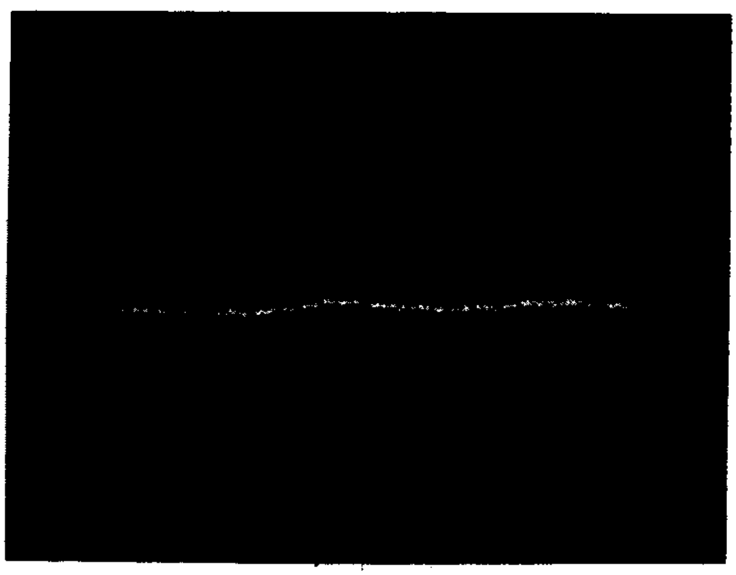
Short Pulse

TEST #9

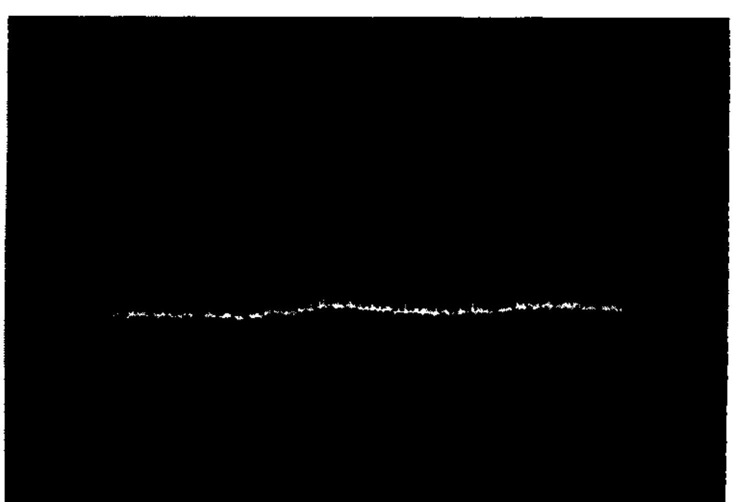
Frequency Band: 12～16 GHz Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

Short-Medium Pulse



Medium Pulse

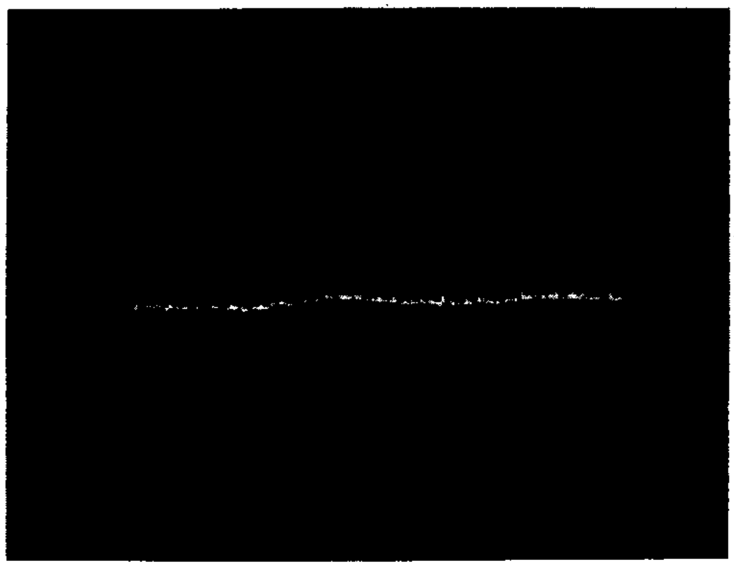


Medium-Long Pulse

TEST #9

Frequency Band: 12～16 GHz   Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)



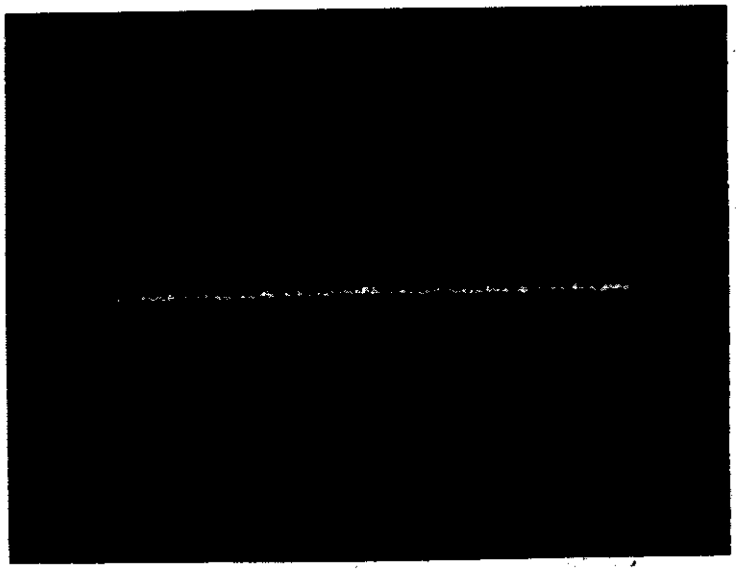
Long Pulse

TEST #10

Frequency Band: 15～19 GHz

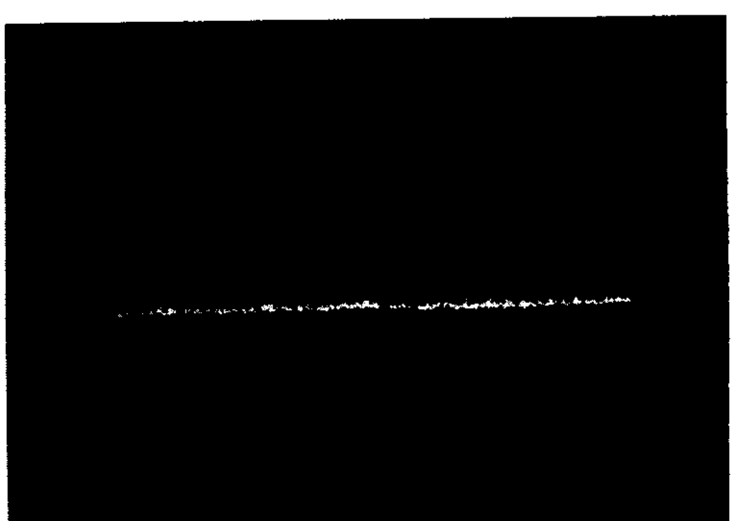
Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)



Ambient

Stand-By



Short Pulse

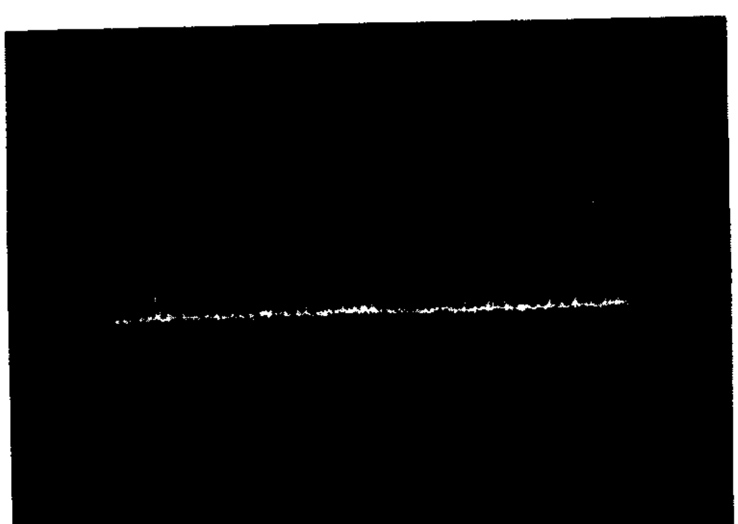
TEST #10

Frequency Band: 15～19 GHz　　Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

Short-Medium Pulse

Medium Pulse



Medium-Long Pulse

TEST #10

Frequency Band: 15～19 GHz

Log Ref. Level: 0 dBm

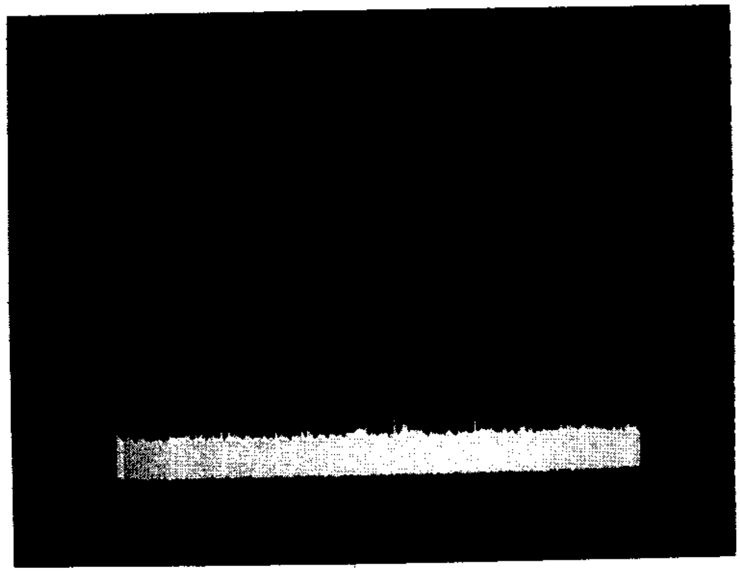
Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

Long Pulse

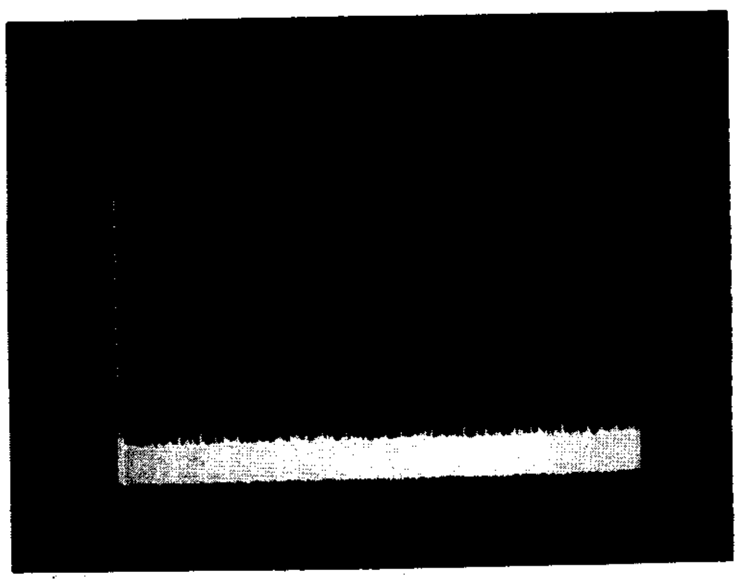
TEST #11

Frequency Band: 12.4～28 GHz　　Log Ref. Level: 0 dBm

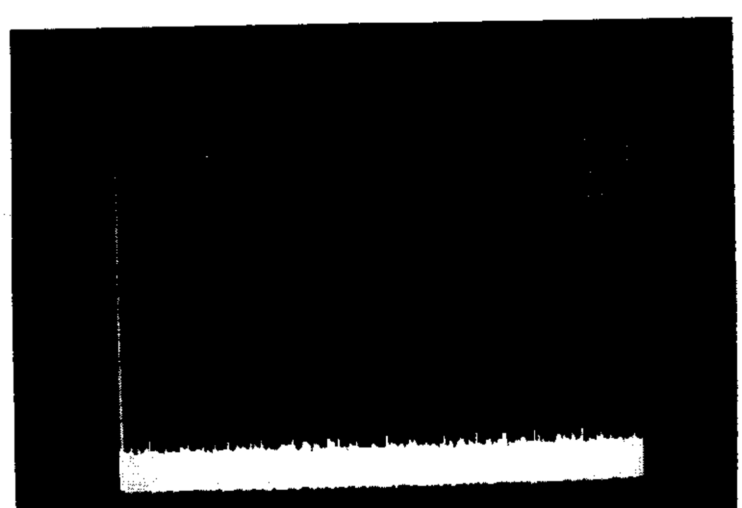
Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)



Ambient



Stand-By



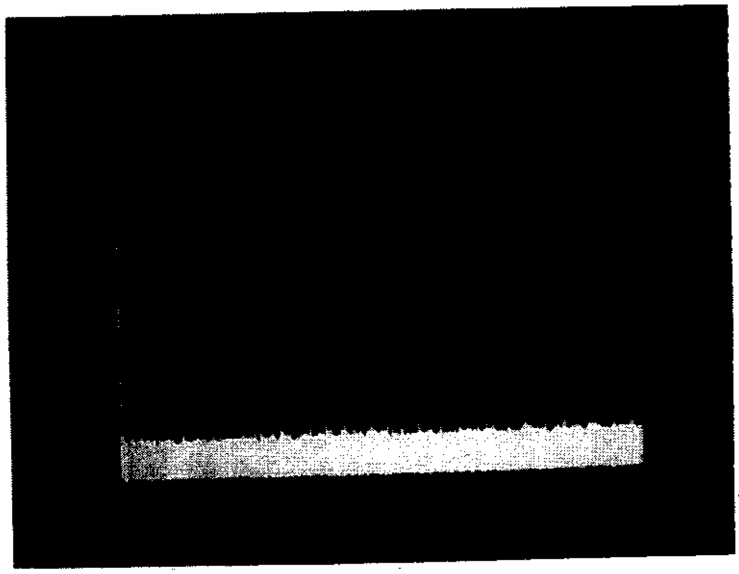
Short Pulse

TEST #11

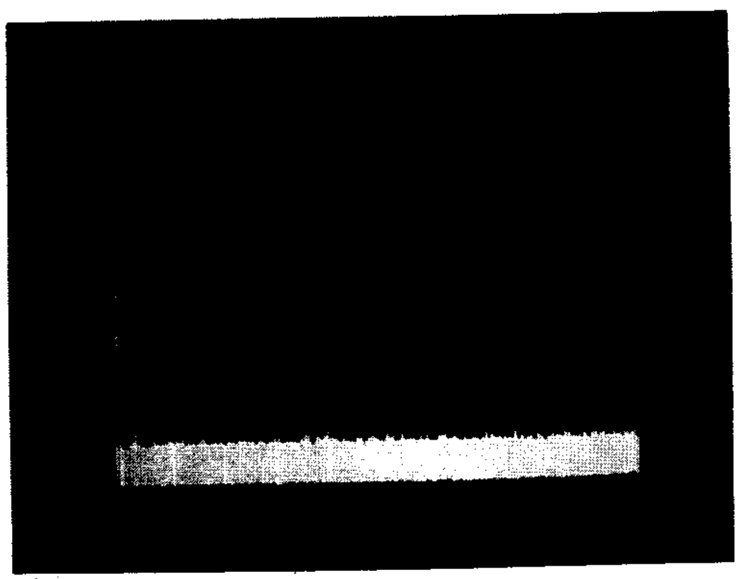
Frequency Band: 12.4～28 GHz

Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)



Short-Medium Pulse



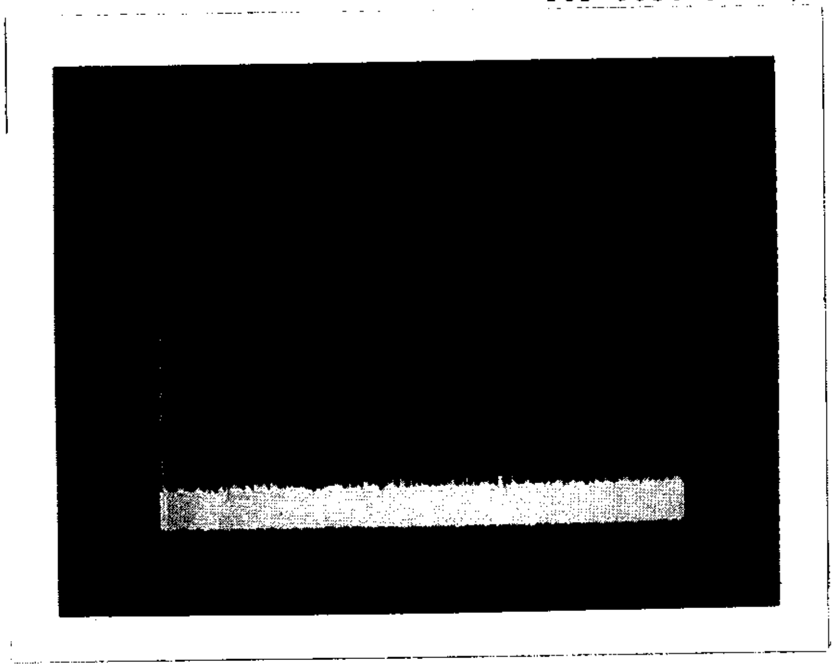
Medium Pulse

Medium-Long Pulse

TEST #11

Frequency Band: 12.4～28 GHz　　　　Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

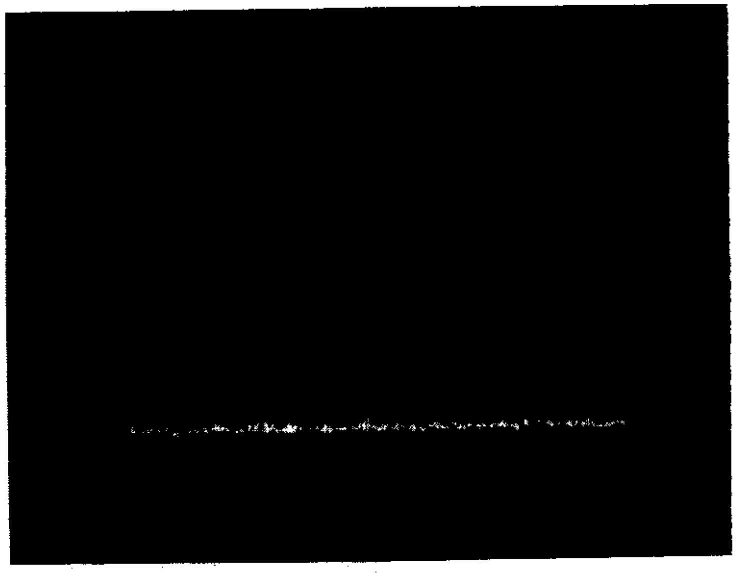


Long Pulse

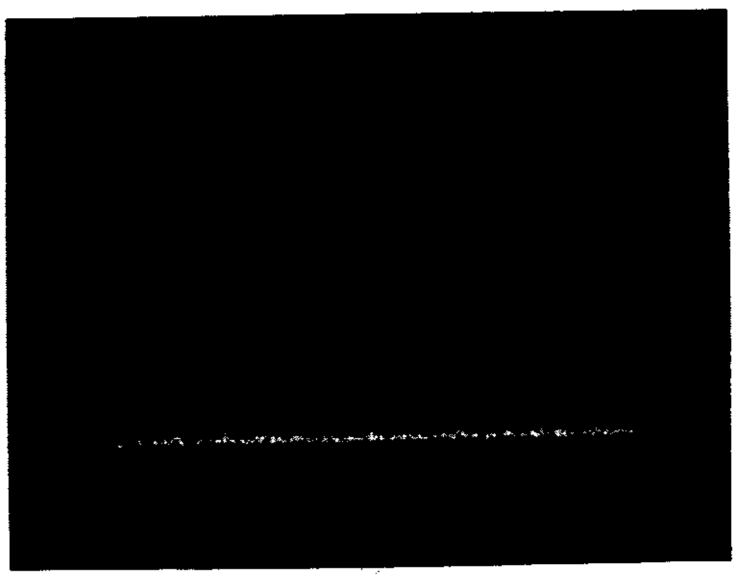
TEST #12

Frequency Band: 25～29 GHz　　　　Log Ref. Level: 0 dBm

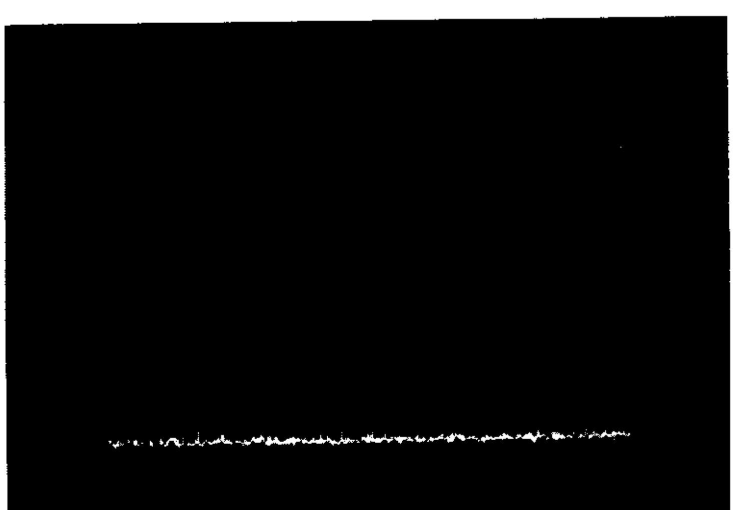
Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)



Ambient



Stand-By



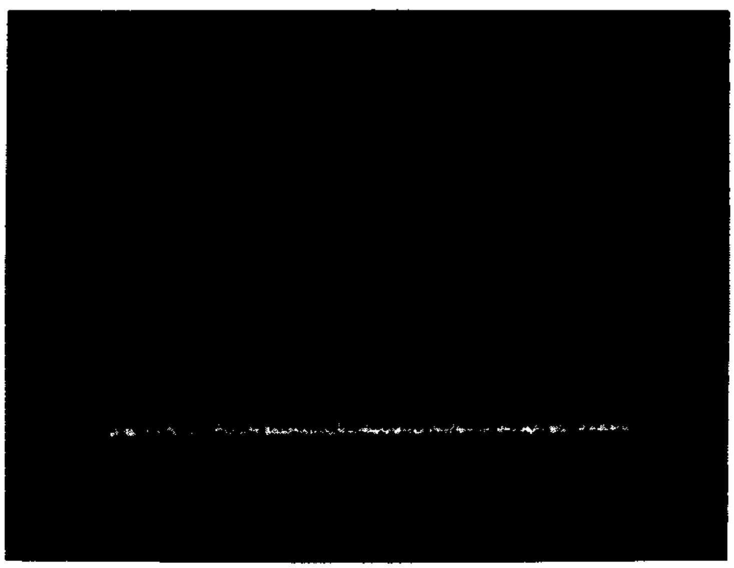
Short Pulse

TEST #12

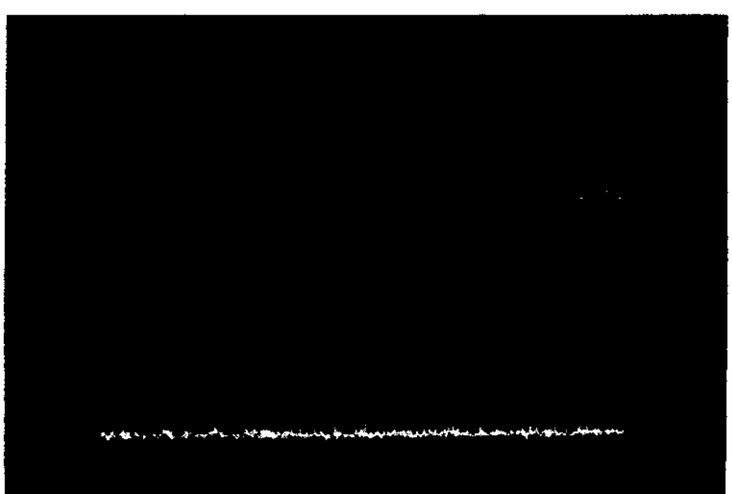
Frequency Band: 25～29 GHz　　　　　Log Ref. Level:　0 dBm

Maximum Sprious Signal Observed:　(See Calibration Procedure for Test 6～13)

Short-Medium Pulse



Medium Pulse



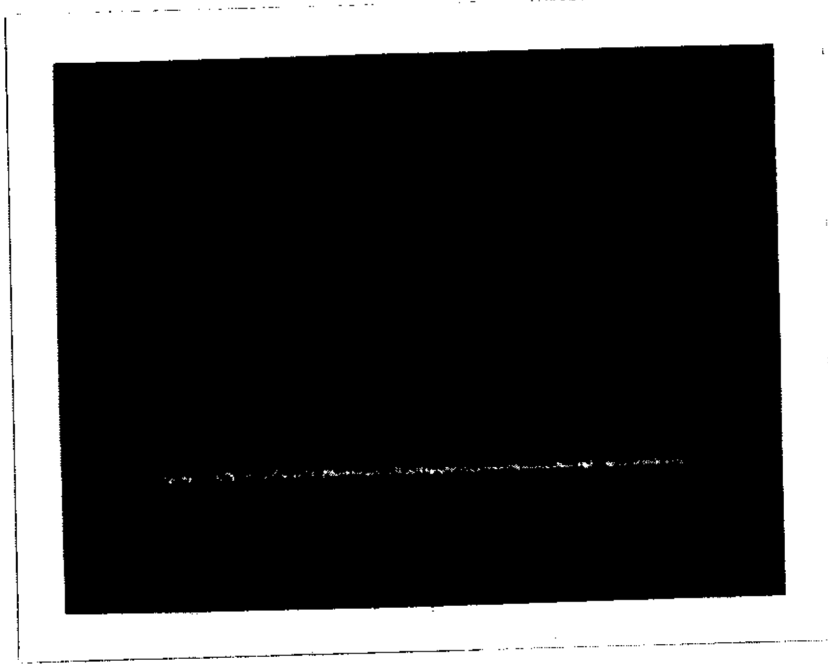
Medium-Long Pulse

TEST #12

Frequency Band: 25～29 GHz

Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)



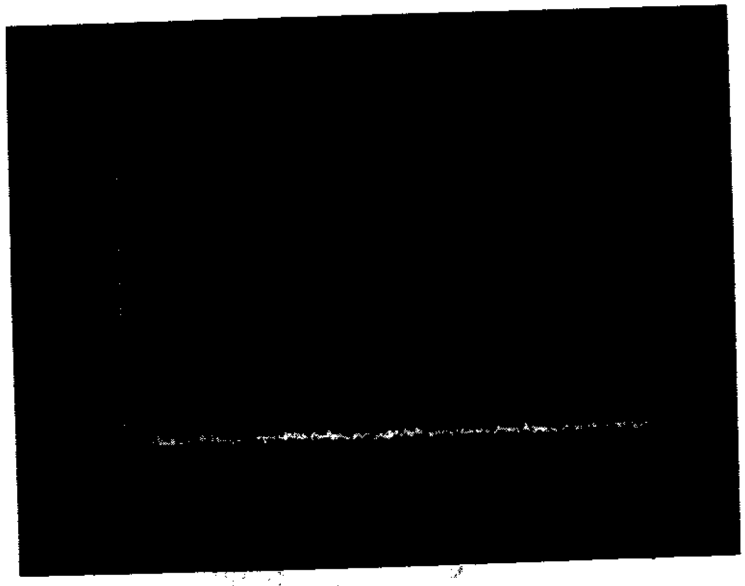
Long Pulse

TEST #13

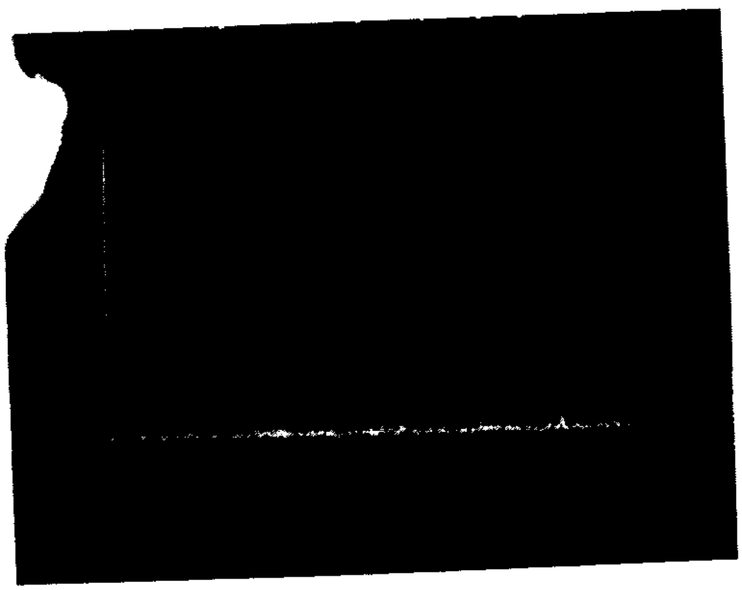
Frequency Band: 28～60 GHz

Log Ref. Level: 0 dBm

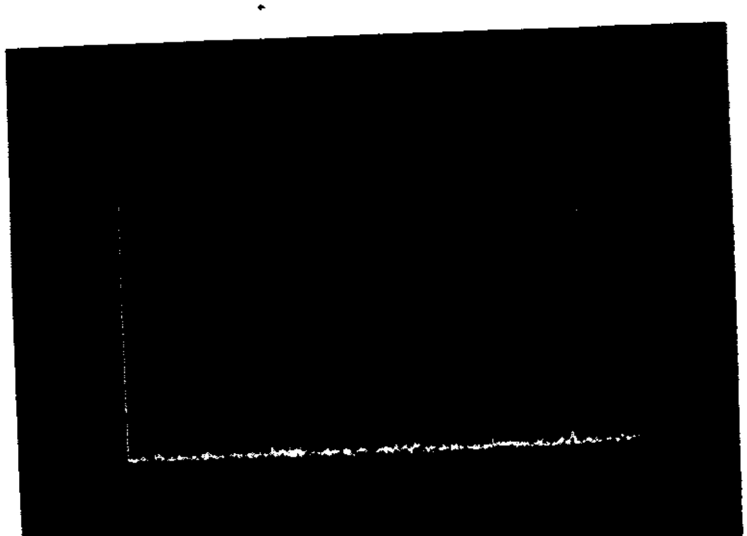
Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)



Ambient



Stand-By

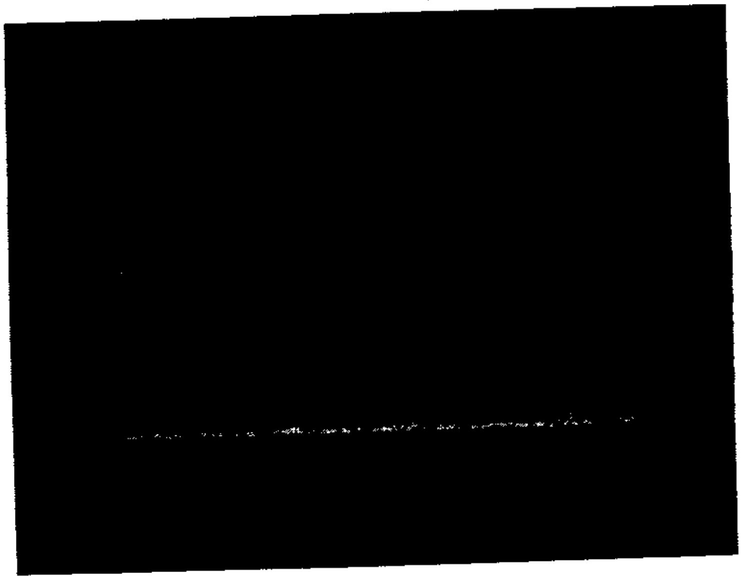


Short Pulse

TEST #13

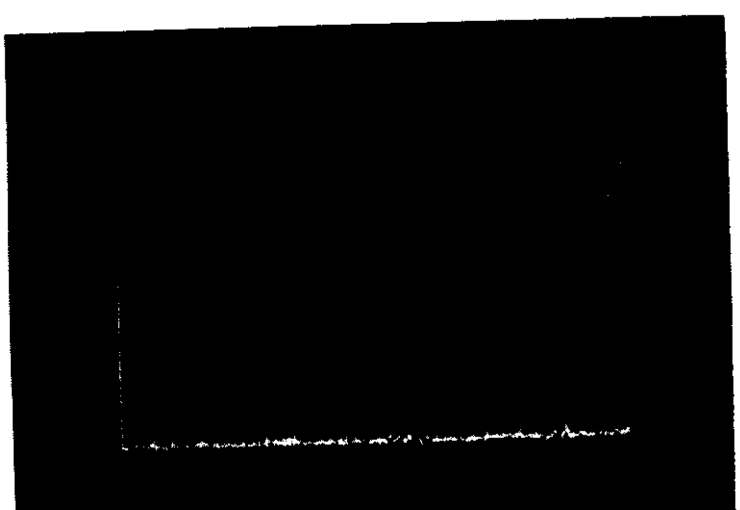
Frequency Band: 28～60 GHz Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)



Short-Medium Pulse

Medium Pulse



Medium-Long Pulse

TEST #13

Frequency Band: 28～60 GHz

Log Ref. Level: 0 dBm

Maximum Sprious Signal Observed: (See Calibration Procedure for Test 6～13)

Long Pulse

·CKEJMA3910

NAME OF TEST: RECEIVER RADIATED EMISSIONS

PARAGRAPHS:

15.109: RADIATION INTERFERENCE LIMITS
15.231(b): FIELD STRENGTH OF EMISSIONS FROM INTENTIONAL RADIATORS
15.33: FREQUENCY RANGE OF RADIATED MEASUREMENTS
80.217: SUPPRESSION OF INTERFERENCE ABOARD SHIPS

GUIDE: SEE MEASUREMENT PROCEDURE BELOW

TEST CONDITIONS: STANDARD TEMPERATURE & HUMIDITY

TEST EQUIPMENT: AS PER ATTACHED PAGE

SEARCH ANTENNAS:

1GHz - 18 GHz: LOGPERIODIC ANTENNA 94612-1
18GHz - 26.5 GHz: HORN ANTENNA 94626-1
26.5GHz - 40 GHz: HORN ANTENNA 94627-1

MEASUREMENT PROCEDURE

1. At first, bench tests were performed to locate the spurious emissions at the antenn a terminals.

2. In the field, tests were conducted over the range shown. The test sample was set u p on a wooden turntable above ground, and at a distance of three meters from the a ntenna connected to the Spectrum Analyzer.

3. In order to obtain the maximum response at each frequency, the turntable was rotate d, and the search antennas were raised and lowered. The E.U.T. was also adjusted for maximum response. Tests conducted in Horizontal & Vertical polarization modes.

4. The field strength was calculated from:

$$E \cdot V/m @ 3\ m = LOG10^{-1}\frac{(dBm + 107 + A.F. + C.L.)}{20}$$

5. MEASUREMENT RESULTS: ATTACHED FOR WORST CASE CONDITIONS.

·CKEJMA3910

MEASUREMENT RESULTS: RECEIVER RADIATED EMISSIONS

SPECTRUM SEARCHED = 0 to 10 x Fc
WORST CASE = V
LIMITS = 15.109(a)
RESTRICTED BAND MEASUREMENTS = 15.205
ALL OTHER EMISSIONS = ≥ 20 dB BELOW LIMIT

TESTS WERE CONDUCTED WITH:

a. All controls and switches operated.
b. Half-wave dipole antenna or manufacturer/applicant supplied antenn a.

SAMPLE CALCULATION:

EMISSION FREQUENCY, MHz =Less then noise level

$$\text{LEVEL} = \text{LOG10-1} \frac{(-64.2 + 107 + 45)}{20}$$

LEVEL, ·V/m @ 3 m = 24547.1
LEVEL, ·V/m @ 1 N.M. = 39.7

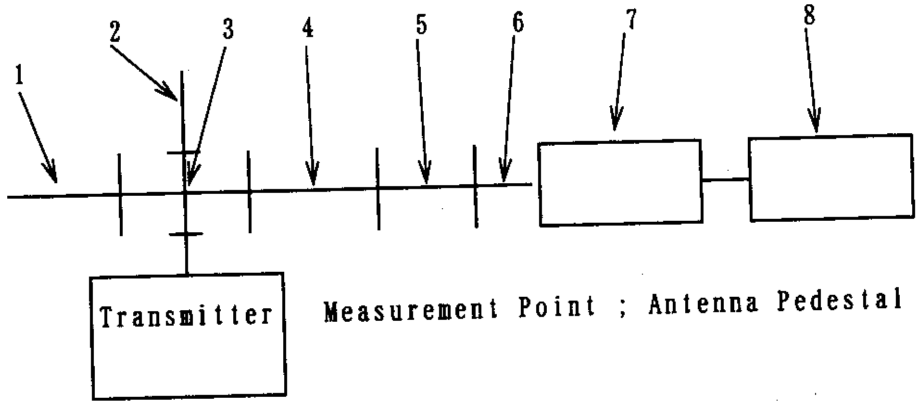
RESULTS

RADIATED RECEIVER SPURIUS EMISSIONS

All other emissions in the range specified by rule 15.33 (b) were that 20dB below the limits of 15.109(a).

TUNED, MHz	EMISSION, MHz	PEAK	RBW, kHz	VBW, kHz	METER, dBμV	A.F,C.L dB	μV/m @3m	μV/m @1N.M.
9400	9384	P	30.0	30.0	35.1	45	24547.1	39.7

(Sec. 2.995)　4.0 Frequency Stability



Measurement Point ; Antenna Pedestal Output

1 Dummy Load	X910B	HP
2 High Power Dummy Load	4D371A	Shimada
3 Directional Coupler	5D351	Shimada
Coupling 20 dB		
Directivity 20 dB		
4 Frequency Meter	X532B	HP
5 Attenuator	X382A	HP
6 Adapter	X281A	HP
7 Power Sensor	8481A	HP
8 Power Meter	435A	HP
Temperature Chamber		Onisi Netugaku

<u>Measurement Procesure</u>

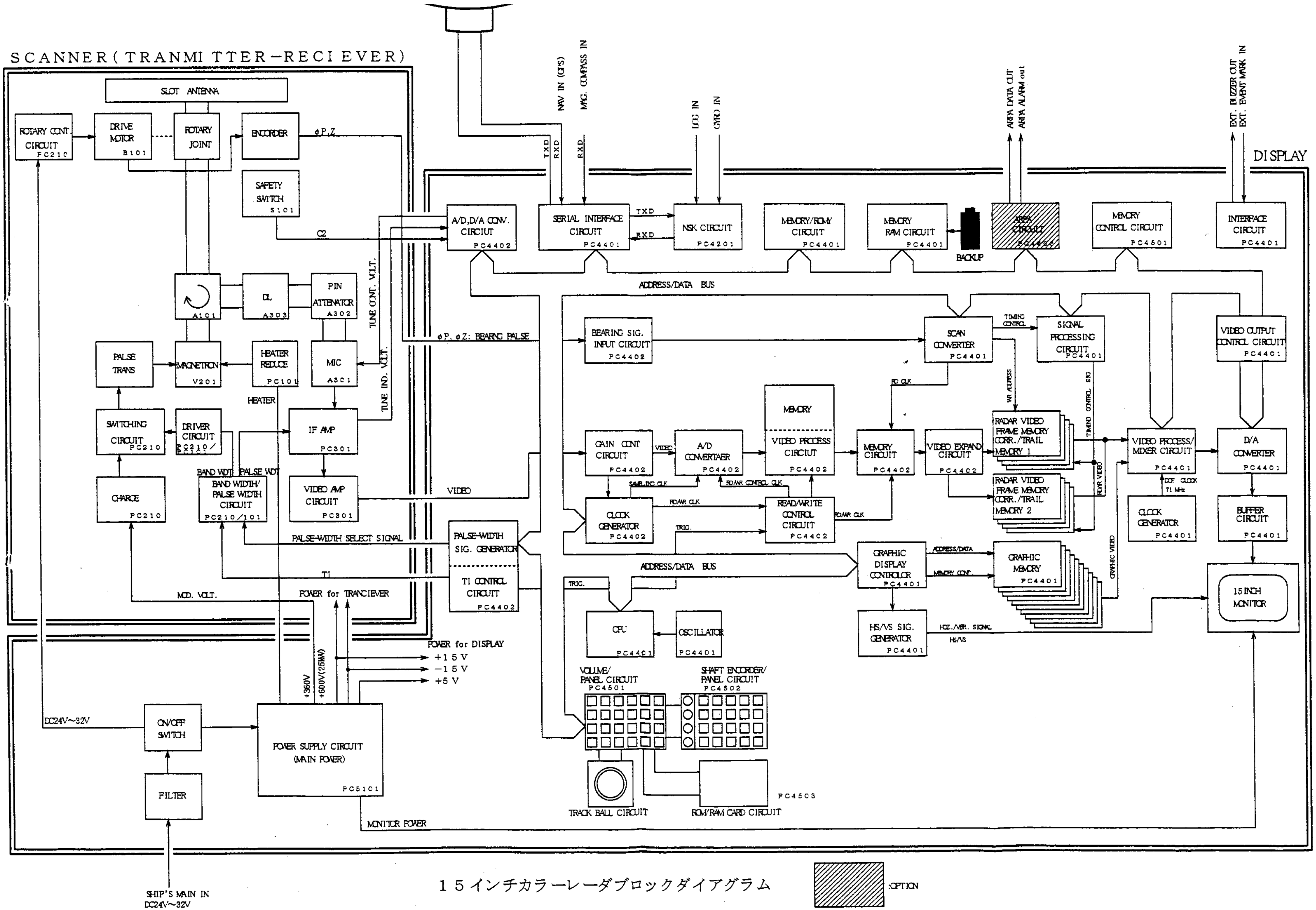
1 The antenna pedestal and display unit were set up in the temperature chamber and the measurement equipment were set outside the temperature chamber.

2 With power removed, the temperature was decreased to 30 and permitted to stabilize for three hours. Power was applied and measured warm up time. After 30 minutes place the radar in X MIT, mesured frequency at 21.6V, 24V, 26.4V

3 With power off, the temperature was raised in 10 steps. The sample was permitted to stabilize at each step for at least three hours. Power was applied and measured warm up time. After 30 minutes place the radar in X MIT, measured frequency at 21.6V, 24V, 26.4V

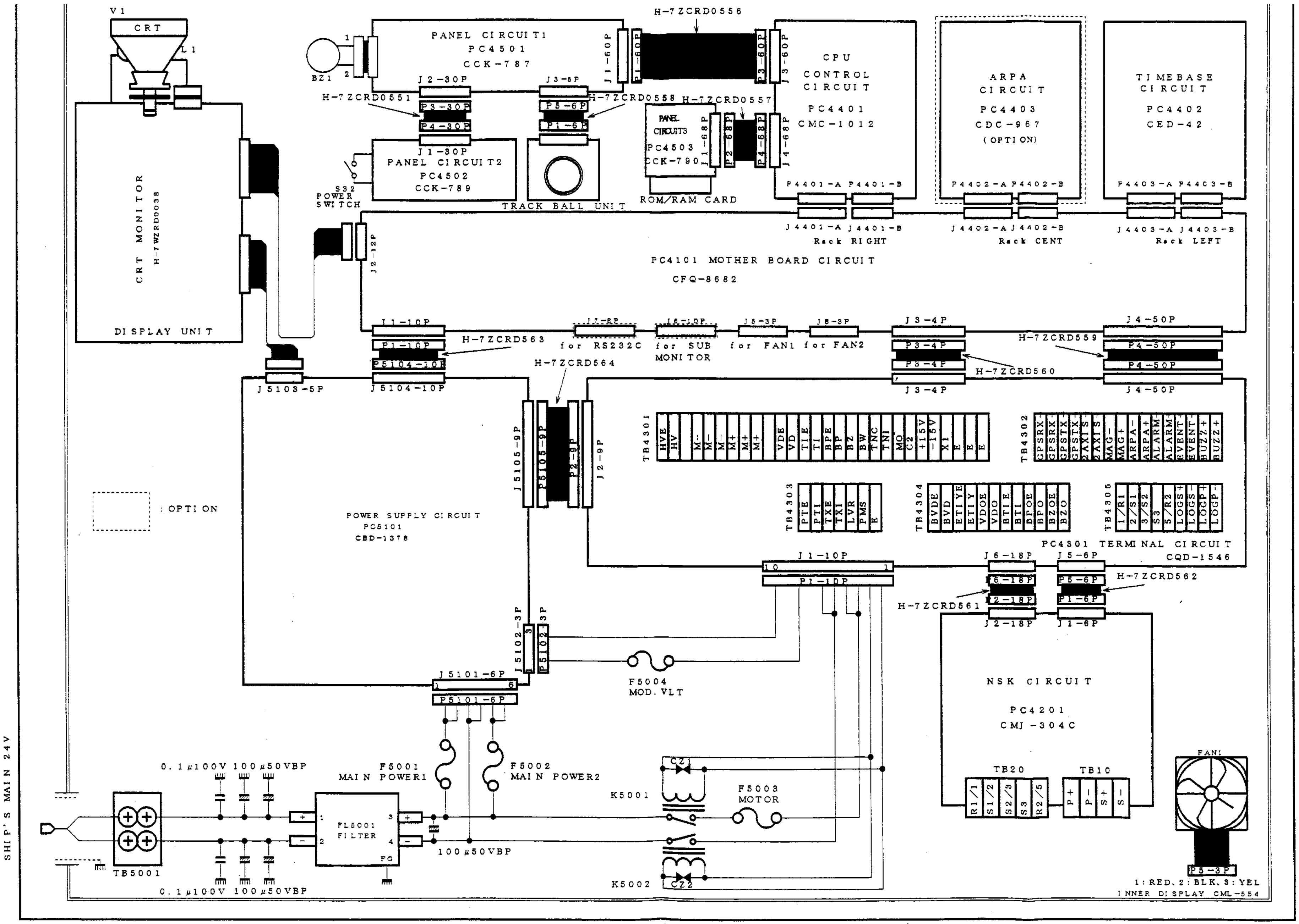
Temperature	Operating Frequeny MHz									Warm Up Time
	Short Pulse			Medium Short Puls			Medium			
	21.6V	24.0V	26.4V	21.6V	24.0V	26.4V	21.6V	24.0V	26.4V	
-30	9419	9419	9419	9419	9419	9417	9416	9416	9417	1'30"
-20	9417	9417	9419	9416	9416	9419	9415	9413	9415	1'30"
-10	9417	9417	9417	9416	9416	9416	9414	9414	9414	1'30"
0	9417	9419	9417	9416	9419	9416	9413	9415	9413	1'30"
+10	9415	9416	9415	9415	9416	9416	9412	9413	9413	1'31"
+20	9412	9412	9412	9412	9412	9412	9411	9411	9412	1'31"
+30	9408	9408	9409	9408	9408	9408	9407	9408	9408	1'31"
+40	9405	9405	9406	9405	9405	9405	9404	9405	9405	1'31"
+50	9402	9403	9403	9402	9403	9403	9402	9402	9402	1'31"
+55	9401	9403	9403	9401	9403	9403	9401	9401	9403	1'31"

Temperature	Operating Frequeny MHz						Warm Up Time
	Medium Long Puls			Long Pulse			
	21.6V	24.0V	26.4V	21.6V	24.0V	26.4V	
-30	9413	9413	9413	9415	9413	9412	1'30"
-20	9412	9412	9413	9412	9412	9412	1'30"
-10	9412	9412	9413	9412	9412	9412	1'30"
0	9412	9413	9413	9411	9412	9412	1'30"
+10	9411	9412	9412	9411	9411	9411	1'31"
+20	9409	9409	9409	9408	9409	9409	1'31"
+30	9407	9408	9408	9407	9407	9408	1'31"
+40	9404	9404	9404	9404	9404	9403	1'31"
+50	9401	9402	9402	9402	9402	9402	1'31"
+55	9400	9401	9401	9400	9401	9401	1'31"



１５インチカラーレーダブロックダイアグラム

:OPTION



NCD3780 INNTERNAL CONNECTION OF DISPLAY UNIT