10 TECHNICAL DESCRIPTION OF EQUIPMENT

10.1 Function of Each Semiconductor or Active Device (FCC 2.983 (d)(6))

ANTENNA UNIT

Modulator Trigger PCB 03P9235

CR801:	Rectifier
CR802:	Rectifier
CR803:	Rectifier
CR804:	Transient Suppression
CR805:	Rectifier
CR806:	Detector (Magnetron Current)
CR807:	Pulse width Select
CR809:	Reverse Voltage Protection
L801:	Noise Reject
L802:	Noise Reject
L804:	Noise Reject
Q801:	45 kHz PWM Output MOS FET
Q802:	Pulse Amplifier
Q803:	Pulse Amplifier
Q804:	Pulse width Select
Q805:	Pulse Amplifier
Q806:	Pulse Amplifier
Q807:	IF Bandwidth Select
Q808:	Pulse Amplifier
Q809:	Pulse Amplifier
Q810:	Protective Circuit Monitor
Q811:	Switching
Q812:	Switching
T801:	Transformer
T802:	Pulse Transformer
U802:	Voltage Detector
U803:	Voltage Detector
U804:	Voltage Detector
U805:	Pulse Forming Network
U806:	45 kHz PWM Inverter

Chassis Mounted Parts

HY801:	3 Ports Circulator
U801:	MIC Frequency Converter with Limiter
V801:	Magnetron

I.F. Amplifire PCB IF-9214

CR1～CR6:	Switching
CR8:	Level Shifter
CR10:	DC Restoring
CR11:	Over Voltage Protection
CR12:	Reverse Voltage Protection
CR13:	Reverse Voltage Protection
CR14:	Over Voltage Protection
CR15:	Over Voltage Protection

CR16:	Over Voltage Protection
Q1~Q4:	Video Amplifier
Q5:	Inverter
Q6:	DC Amplifier
Q7:	Switching
Q8:	I.F. Amplifier in Cascade Connection
Q9:	I.F. Amplifier in Cascade Connection
Q10:	Bias Setting
Q11:	Detector
Q12:	Current Buffer
Q13:	Tuning Indication Amplifier
Q14:	Tuning Indication Amplifier
Q15:	Switching
Q16:	MBS Pulse Amplifier
Q17:	Tuning Gate Amplifier
U1~U4:	I.F. Amplifier
U5:	Inverter
U6~U9:	DC Regulator

Motor Soft Starter PCB03P9249

CR1:	Reverse Voltage Protection
CR2:	C703 discharger
CR3:	Level Shifter
CR4:	Soft starter switch
CR5:	Reverse Voltage Protection
Q701:	Buffer for bearing pulse
Q702:	Buffer for bearing pulse
Q703:	Trigger switch for CR704

DISPLAY UNIT

Filter Board FIL-9148

CR1:	Reverse Polarity Protector Diode

Trackball Board TB-9152

U1:	Trackball Pulse Generator
U2:	Trackball Pulse Generator
U3:	Trackball Pulse Generator
U4:	Trackball Pulse Generator

Power Supply Board PTU-9149

CR1:	Current Detector Time delay
CR31:	Rectifier
CR32:	Rectifier
CR33:	Rectifier
CR34:	Rectifier
CR35:	Voltage Detector
CR36:	Voltage Detector
CR37:	Voltage Detector
CR38:	Q33 Driver
CR39:	Fly Wheel Diode
CR40:	Rectifier
CR41:	K2 discharger
CR51:	Q52 Driver
Q1:	45 kHz PWM Invertor Output FET
Q2:	45 kHz PWM Invertor Output FET
Q3:	45 kHz PWM Invertor Output FET
Q4:	45 kHz PWM Invertor Output FET
Q5:	10V Regulator
Q6:	Overcurrent Protector Swiching
Q31:	Voltage Detector
Q32:	Q33 Driver
Q33:	Stepdown Switching Regulator Output FET
Q41:	K2 Driver
Q51:	Q52 Driver
Q52:	Soft start Output FET
U1:	Power Relay Control
U2:	10V Regulator
U3:	45 kHz PWM Invertor Control
U4:	Current Detector
U5:	Voltage Detector
U6:	Stepdown Switching Regulator Control
U7:	Voltage Detector
U8:	Output Interface
U9:	Isolation
U10:	Voltage Detector

Display Main Board SPU-9211

CR1～CR23:	Over Voltage Protection
Q1:	NMEA Driver
Q2:	NMEA Driver
Q3:	TX Trigger Driver
Q4:	Inverter
Q5:	Switch
Q6:	Switch
Q7:	GYRO DATA Driver
Q8:	GYRO DATA Driver
Q9:	External Trigger Inverter
Q10:	Sector Blank Switch
Q11:	TX Trigger Driver
Q12:	Video Amplifier
Q13:	Bearing pulse Inverter
Q14:	Voltage Buffer
Q15:	Inverter
Q16:	Switch
Q17:	Slicer
Q18:	Video Amplifier
Q19～Q26:	CRT Video Driver
Q27:	Voltage Buffer
Q28:	Voltage Buffer
Q29:	Inverter
Q30:	Switch
Q31:	CRT Video Driver
Q32:	CRT Video Driver
Q33:	Switch
Q34:	CRT Contrast Driver
Q35:	CRT Brillance Driver
Q36:	Switch
Q37:	Bearing pulse Driver
Q38:	Bearing pulse Driver
Q39:	Video Amplifier
Q40:	Switch
Q41:	Slave Video Driver
Q42:	Sampling Trigger Driver
Q43:	Sampling Trigger Driver
Q44:	MBS Level Signal Driver
Q45:	Video Amplifier
Q46:	Voltage Buffer
Q47:	Voltage Buffer
Q48:	Video Amplifier
Q49:	Video Amplifier
Q50:	Video Amplifier
Q51:	Video Amplifier
Q52:	Signal Level Converter
U1～U4:	Isolator(Photo cupler)
U5:	Auto Tuning Voltage Adder
U6:	-9V Regulator
U7:	Voltage Buffer
U8:	PLL Oscillator
U9:	Schmitt Imput Buffer

U10~U12: Video Signal Switch
U13: Synchronous Signal Buffer
U14: EE Potentiometer (EE=Electrical Erasable)
U15: STC Voltage Amplifier
U16: Video Amplifier
U17: +9V Regulator
U18: Voltage Buffer
U19: Voltage Buffer (Transistor Array)
U20: A/D Converter
U21: 12 CH. D/A Converter
U22~U27: A/D Converter
U29: CPU SRAM
U30: Echo Video RAM
U31: Echo Video RAM
U32: CPU (Internal 16 Bit, External 8 Bit)
U33: Graphic Display Controller
U34: Crystal Oscillter (Sampling)
U35: Crystal Oscillter (Graphic)
U36: Flash Memory
U37: Frequency Divider
U38: Frequency Divider
U39: NOR Gate
U40: Scan Converter Gate Array
U41: OR Gate
U42: CPU Peripheral Gate Array
U43: Graphic Video RAM
U44: Graphic Video RAM
U45: Graphic Gate Array
U46: Sampling Gate Array
U47: Inverter
U48: Bach-up Interface
U50: Reset IC
U51: RS-232C Transister
U52: AND Gate
Y1: CPU Clock Oscillator

Panel Board PNL-9150

CR1: Pilot lamp
CR2~CR23: Illumination
Q1: LED Driver
Q2: Buzzer Driver
Q3: LED Driver

10.2 Description of the circuits employed for suppression of spurious radiation, for limiting or shaping the control pulse, and for limiting or controlling power (FCC §2.983(d)(11))

Modulator PCB 03P9235 (in Scanner unit)

The primary function of the modulator is to produce narrow high tension pulses to drive the magnetron. To produce such pulses, the modulator board incorporates a modulator trigger circuit, a modulating pulse generator and a booster pulse transformer.

The modulator trigger cicuit is composed of U805 and associated components. It generates pulses that fire modulator FET Q805, Q806. Normally, the circuit is stable with U805 off. The pulse to fire the modulator FET is produced when U805 turns on upon receiving the TX trigger pulse from the display unit. When U805 turns on at the positive-going edge of the TX trigger pulse, it produces a narrow pulse. This narrow pulse is boosted by pulse transformer T802 by the ratio 1:21. The resultant pulse, its level being 4.5 kV, is provided to limit the magnetron current.

C820 decouples the pulse energy that is liable to occur across the magnetron heater when T802's secondary windings are unbalanced or the load is asymmetric.

Also incorporated in the modulator board are the TX HV circuit and magnetron heater power supply circuit. The TX HV circuit provides a high tension of about 330 V to the pulse forming network through CR802,CR805. A DC voltage of 7.6 V is supplied to the magnetron heater through CR801.

Duplexer and Frequency Converter (in Scanner unit))

The microwave energy produced by the magnetron enters the circulator from port 2. It is fed to port 3 with a negligible loss of energy; port 1 at this time is isolated. In the same manner, the received signal entering into port 3 is transferred to port 1, isolating port 2. This operation of the circulator protects the receiver during transmission and minimizes the loss of the received signal. Thus, the circulator allows a single antenna radiator to be used for transmission and reception of radar signals.

A diode limiter, made up of a pair of PIN diodes, is incorporated in the first stage of the MIC (microwave IC, U801). It is a passive switching device which allows the low-level RF signal to pass through and prohibits relatively strong microwave energy, such as the leak from the magnetron. It also protects the sensitive amplifier from pulses received direct from other radars operating in the proximity.

When a low-level signal is received, the PIN diodes remain in the cutoff state, and the limiter's input impedance matches the characteristic impedance of the receiver allowing the signal to be delivered to the frequency converter of U801. When strong microwave energy is received, the PIN diodes are put in the conductive state (or short-circuited) causing the input energy to be attenuated. The strong input is further reduced to about 150 mW by the varacter diode.

The MIC converts 9 GHz RF signal into an intermediate frequency of 60 MHz. It is achieved by mixing the received signal with the local oscillator signal in the frequency converter of the MIC. The built-in local oscillator oscillates at a frequency 60 MHz higher than the magnetron frequency of 9410 MHz.

I.F. Amplifier IF9214

The IF signal of 60 MHz coming from the MIC is amplified and converted into a video signal, which is delivered to the display unit.

The IF amplifier is composed of five major circuits; Logarithmic Amplifier (U1/U2,U3/U4), Video Amplifier(Q1/Q2/Q3/Q4), Bandwidth Selector (Q5/Q6, CR1 to CR6), Tuning Indicator Circuit(Q8 to Q14) and Main Bang Suppression Circuit (U5, Q15/Q16/Q17, CR11 to CR15)

The IF signal from the MIC("IF"TERMINAL) is applied to the bandwidth selector.

The IF amplifier operates in narrow or wide bandwidth mode depending on the setting of the RANGE switch and TX touchpad. For short ranges, a wide bandwidth (25MHz) is selected, since the levels at the base of Q5 and the collector of Q6 go high, thus CR2,CR4, CR5 and CR6 are conductive and CR1/CR3 are cut off, causing the signal to pass throough CR5/CR6. On the contrary, CR2,CR4,CR5 and CR6 are cut off and CR1/CR3 are conductive, which causes the signal to pass through C5/C6, selecting a narrow bandwidth (2.5MHz) on medium and long ranges.

The signal through the bandwidth selector is coupled to the logarithmic amplifier and amplified and detected by U1/U2/U3. The detected signals are fed to Q1/Q2 to be amplified further, and then sent to the display unit via buffer Q3/Q4.

The other IF signal from the MIC ("IF TUN" TERMINAL) of 60 MHz is amplified by U4, Q8/Q9 and detected by Q10/Q11. Then the detected signal (Tuning Indicator Signal) is sent to the display unit via Q13 to Q14.

On the other hand, U4 is additional amplifier circuits to make the dynamic range of the IF signal wider, causing the discrimination of the target echoes to get better.
The attenuated IF signal from the MIC ("IF TUN" TERMINAL) is fed to U4. Therefore, U4 amplifies even a strong signal which may be saturated in U1/U2/U3 and sent to logarithmic amplifier U4. This signal is added to the saturated signal in U1/U2/U3, causing the saturation level of the IF signal to become high.

The purpose of main bang suppression circuit is to minimize transmission leakage near the center spot on the screen.

When the Magnetron Current pulse generated in Modulator PCB 03P9235 is fed to the inv-inverter U5, it producees a rectangular pulse which is controled by Q6. This pule is fed to "MBS" TERMINAL of the MIC through Q15/CR12 as a main bang suppression waveform, then IF Amplifier incorporated in the MIC turns off during transmission to eliminate direct reception of the strong TX energy (main bang).