10 TECHNICAL DESCRIPTION OF EQUIPMENT

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

ANTENNA UNIT

Modulator Trigger PCB 03P9237

CR1:	Voltage Shifter
CR2:	Transient Suppression
CR3:	Transient Suppression
CR4:	Voltage Shifter
CR6:	Rectifier
CR7:	Rectifier
CR8:	Voltage Shifter
L1:	Noise Rejection
Q1:	Transistor Amplifier
Q2:	Pulse Amplifier
Q3:	Pulse Amplifier
Q4:	Pulse Amplifier
Q5:	Pulse Amplifier
Q6:	Pulse Amplifier
Q7:	Pulse Amplifier
Q8:	Pulse Amplifier
Q9:	Pulse Amplifier
Q10:	Magnetron Current Detector
U1:	Pulse Forming Network

Chassis Mounted Parts

HY801:	3 Ports Circulator
U801:	MIC Frequency Converter with Limiter
V801:	Magnetron
CR810:	Limiter

I.F. Amplifire PCB IF-9099

CR601:	Switching
CR602:	Switching
CR603:	Switching
CR604:	Switching
CR605:	Switching
CR606:	Switching
CR607:	Switching
CR608:	Over Voltage Protection
CR609:	Switching
CR616:	Reverse Voltage Protection
CR622:	Thermal sensor
CR625:	Over Voltage Protection
CR626:	Switching
CR629:	Over Voltage Protection
CR630:	Over Voltage Protection
CR633:	Over Voltage Protection
Q601:	I.F. Amplifier in Cascade Connection
Q602:	I.F. Amplifier in Cascade Connection

Q603:	Switching
Q609:	I.F. Amplifier in Cascade Connection
Q610:	I.F. Amplifier in Cascade Connection
Q614:	I.F. Amplifier in Cascade Connection
Q615:	I.F. Amplifier in Cascade Connection
Q616:	Detector
Q617:	Detector
Q618:	DC Amplifier
Q619:	DC Amplifier
Q620:	DC Amplifier
Q625:	Video Amplifier
Q626:	Video Amplifier
Q627:	Video Amplifier
Q628:	Video Amplifier
Q630:	Emitter-follower Amplifier
Q635:	Switching
Q636:	Switching
U601:	I.F. Amplifier
U602:	I.F. Amplifier
U603:	I.F. Amplifier
U604:	DC Amplifier
U605:	DC Regulator
U606:	DC Regulator
U607:	DC Regulator
U608:	DC Regulator
U609:	DC Regulator
U610:	Inverter

Motor Soft Starter PCB 03P9250

CR1:	Reverse Voltage Protection
CR2:	C3 discharger
CR3:	Level Shifter
CR4:	Soft starter switch
CR5:	Reverse Voltage Protection
Q1:	Buffer for bearing pulse
Q2:	Buffer for bearing pulse
Q3:	Trigger switch for CR4

Power Supply PCB 03P9236

CR51:	Rectifier
CR52:	Rectifier
CR53:	Rectifier
CR54:	Rectifier
L51:	Noise Rejection
Q51:	45 kHz PWM Output MOS FET
Q52:	IF Bandwidth Select
Q56:	Power Supply Protection Thyristor
Q57:	Power Supply Protection Thyristor
U51:	45 kHz PWM Inverter
U52:	Over Current Detector
U53:	Voltage Detector
U54:	Voltage Detector

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 03P9237 (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 U1 and associated components. It generates pulses that fire modulator FET Q6, Q7,Q8 and Q9. Normally, the circuit is stable with U1 on. The pulse to fire the modulator FET is produced when U1 turns off upon reciving the TX trigger pulse from the display unit. When U1 turns off at the positive-going edge of the TX trigger pulse, it produces a narrow pulse. This narrow pulse is boosted by pulse transformer T801 by the ratio 1:25. The resultant pulse, its level being 5.7kV, is provided to limit the magnetron current.

C801 decouples the pulse energy that is liable to occur across the magnetron heater when T801's secondary windings are unbalanced or the load is asymmetric.

Power Supply PCB 03P9236

The PCB 03P9236 cotaints power supply circuits including TX-HV circuit and magnetron heater power supply. The TX-HV circuit provides a high tension of about 320V to the pulse forming network through CR51 and CR52. A DC voltage of 7.5V is supplied to the magnetron heater through CR54.

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.

During transmission cycles the receiver circuits are isolated from high-level RF energy by diode limiter CR810 and second stage limiter built in MIC 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 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 IF9099

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 six major circuits; Linear Amplifier (Q601/Q602), Logarithmic Amplifier(U601/U602, Q625/Q626), Video Amplifier (Q627/Q628), Bandpass Selector (U604, CR601 to CR607), Tuning Indicator Circuit (Q609/Q610, Q614 to Q620, U603) and Main Bang Suppression Circuit (U610, Q630, Q635/Q636、CR626/CR633).

The signal applied to the base of Q601 is amplified in cascade by Q601 and Q602, and sent to the bandpass selector.

The IF amplifier operates in narrow or wide bandwidth mode depending on the settings of the RANGE switch and TX touchpad. For short ranges, a wide bandwidth (25 MHz) is selected, since the levels at pin #3 of U604 and pin #6 of U604 go high, thus CR602 to CR605 and CR607 are conductive and CR601/CR606 are cut off, causing the signal to pass through CR603/CR604. On the contrary, CR602 to CR605 and CR607 are cut off and CR601/CR606 are conductive, which causes the signal to pass through T603, selecting a narrow bandwidth (5 MHz) on medium and long ranges.

The signal through the bandpass selector is coupled to the logarithmic amplifier and amplified by U601/U602 and Q625/Q626. Thus, the output signals of Q625/Q626 are fed to Q627/Q628 to be amplified further, and then sent to the display unit.

The IF signal of 60 MHz is amplified by Q609/Q610, U603, Q614/Q615 and detected by Q616/Q617. Then the detected signal (Tuning Indicator Signal) is sent to the display unit via Q618 to Q620.

On the other hand, Q609/Q610 and U603 are additional amplifier circuits to make the dynamic range of the IF signal wider, causing the discrimination of the target echoes to get better. The IF signal from the MIC is fed to Q609/Q610 as well as through resistor R651 which is employed to attenuate the signal level. Therefore, Q609/Q610 amplifies even a strong signal which may be saturated in Q601/Q602 and U601/U602, and then sent to logarithmic amplifier U603. This signal is added to the saturated signal in U601/U602, causing the saturation level of the IF signal to become high.