11 TECHNICAL DESCRIPTION OF EQUIPMENT (FCC Rules § 2.983)

11.1 Function of Each Semiconductor or Active Device (FCC Rule § 2.983 (d)(6))

ANTENNA UNIT
TRANSCEIVER MODULE (RTR-059)

Modulator 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

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U5:	Inverter
U6 to U9:	DC Regulator

Motor Soft Starter PCB 03P9249

CR1:	Reverse Voltage Protection
CR2:	C703 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

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.

IF 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 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).

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11.2 Description of the circuits employed for suppression of spurious radiation, for limiting or shaping the control pulse, and for limiting or controlling power

(FCC Rule § 2.983 (d) (11))

ANTENNA UNIT
TRANSCEIVER MODULE (RTR-059)

Modulator PCB 03P9235

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

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

U805:	Pulse Forming Network
U806:	45 kHz PWM Inverter

Chassis Mounted Parts

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

IF Amplifire PCB IF-9214

CR1 to 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 to 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 to U4:	I.F. Amplifier