Marconi $5\frac{1}{2}$, 10 and 23 cm-band Transmitter Receivers
1 MW S Band (S 2010) 2 MW L Band (S 2011)
$2\frac{1}{2}$ MW S Band (S 2012) 1 MW C Band (S 2013)

S2001

This new range of four Marconi radar transmitter-receivers is employed with any one of twelve different types of aerial heads and a complete selection of signal processing equipment built in modular form. In addition, the Marconi Myriad Computers can be integrated with this basic equipment together with data displays, to provide advanced data handling facilities to any system. The SECAR secondary radar system can be incorporated, aerial fitting on to any of the surveillance radar heads.

The S 600 transmitters are compact reliable equipments extremely efficient and silent in operation. In their design, careful consideration has been given to performance, servicing accessibility and appearance. With the exception of a magnetron, a klyston and a thyratron the transmitters employ solid-state devices throughout, a feature which contributes toward high MTBF figures. Installation, operation, and maintenance functions are simplified, and integral test facilities contribute to keeping the equipment in a fully operational state. A specialized dual tube oscilloscope performance monitor is available as an optional extra.

FEATURES

High reliability through simplicity and maximum use of solid-state techniques. Applicable to both Civil and Military Systems.

Clutter suppression, frequency diversity and ECCM, utilizing advanced techniques. All radar bands from 1,200 MHz to 6,000 MHz.

Advanced automatic monitoring system.

Sumultaneous linear and logarithmic video outputs.

Full built-in test facilities.

Silent in operation.

Construction

The transmitters are housed in small contemporarily styled lightweight cabinets with easily detachable covers. The surface finish is in a pleasing two tone plastic which provides a higher resistance to abrasion than normal enamel paint spray. The basic rectangular framework of the transmitter is formed by welded rigid aluminium $\frac{1}{4}$ in. square tubular sections. Within this framework there are five basic compartments, the plinth, modulator, r.f, top, and electronics section. To ease maintenance and servicing

operations, certain modular units within the transmitter are constructed on withdrawable runner trays. Adequate magnetron cooling is provided by means of a vapour phase cooling system or a fluid to air heat exchanger depending on the transmitter and the magnetron employed. General cabinet cooling is effected by means of tangential air circulation fans.

Circuit

Triggering: A transmitter triggering pulse is generated by a triggering unit and is initiated either by an external triggering source or by an internal free running oscillator, the external source must be a positive going pulse.

Modulation: The triggering pulse is used to fire a thyratron which drives a high level modulator circuit. The modulator employs a d.c charging circuit to charge a pulse forming network. The charge which is precisely set by a d.c thyristor regulator is stored by this network until the thyratron is triggered when the pulse is fed to the primary winding of a pulse transformer. The duration of the pulse from the pulse forming network is 1·5 to 5 micro-seconds and 8 kilovolts in amplitude. The pulse transformer steps up the voltage to approximately 36 kV which is fed to the cathode of the magnetron. The pulse forming network is protected from the accumulation of a negative charge due to overswing or magnetron arcing by an overswing circuit of special design.

E.H.T Circuit: The 36 kV e.h.t voltage required by the modulator is derived from the 380, 400, or 415 volts three phase supply, the circuits are adequately protected and regulated against voltage surges. Rectification is effected by silicon avalanche diode stacks and smoothing by a choke and associated capacitor.

Transmission: The application of the high power modulation pulse to the magnetron cathode causes the magnetron to oscillate, providing the r.f output power. The magnetron employed for any specific frequency band is of special design. The r.f passes through a monitoring section where spectrum analyser, automatic frequency correction, and power level samples are extracted. An auxiliary unit comprising an air drier and compressor provides a clean dry air flow through the waveguide run to blow the magnetron window and eliminate condensation in the waveguide.

Receiving Circuits

Received echoes from the aerial pass through a transmit-receive duplexer and T.R cell system into the receiver waveguide arm, through a 'waveguide to coaxial' transition circuit and a noise tube source into a five port circulator, and are then amplified by a parametric amplifier. The signal is passed to the receiver head amplifier and a narrow band amplifier to two i.f amplifier strips, one linear, and one logarithmic. The outputs from the i.f amplifier chains are detected and passed to associated limiting and video amplifiers which provide linear and logarithmic video signal outputs respectively, for feeding to the display system of the radar.

Automatic Frequency Control

Samples obtained from the monitoring section and a local oscillator are combined in an a.f.c mixer. The resultant signal is processed and used to correct the transmitter radiated frequency if it should deviate by more than $\pm$50 kHz.

Power Supplies, Control and Interlocks

The power supplies which employ solid state rectifiers are well regulated and adequately protected. The comprehensive control system of the transmitter is designed so that the switching sequence of the stand-by stage is entirely automatic from the moment the key switch is turned to ON. The equipment will attain the stand-by condition after six minutes, and is indicated by the illumination of a stand-by lamp. The transmitter is switched on by pushing the e.h.t ON button. When the e.h.t OFF button is selected the transmitter reverts to the stand-by state. The system includes two grades of interlock within the transmitter power control system. Those in the first and more important grade are known as 'executive interlocks' monitor vital services and h.t faults and control the main h.t power contactor. For example failure of the magnetron cooling systems or an h.t. short circuit would cause the h.t contactor to open. The second interlock grade, 'non-executive' indicates non-dangerous faults which may cause degraded performance, but allows the transmitter to continue working. All interlocks of both grades are indicated by front panel lamps, opening of an interlock results in the relevant lamp extinguishing. An event causing any interlock of either grade to open causes the System Normal lamp to extinguish, and the 'Interlocks Closed' lamp flashes every second to indicate a fault condition.

Performance Monitor

This performance monitor (an optional extra) is a specialized dual tube oscilloscope which is not affected by the r.f stages of the transmitter. There are three basic electronic functions of the monitor which provide the following facilities:

A general purpose oscilloscope, capable of monitoring all the waveforms in the transmitter.

A sweep generator system having a long persistance CRT which can display wobbulator type responses as well as the transmitter spectrum.

An automatic, noise figure measuring system, which when combined with the appropriate noise tube mount, external to the unit, allows the overall noise figure to be displayed directly on a meter. Additionally this information is available in the form of a GO, NO-GO light which can be sited remotely if required.

Metering

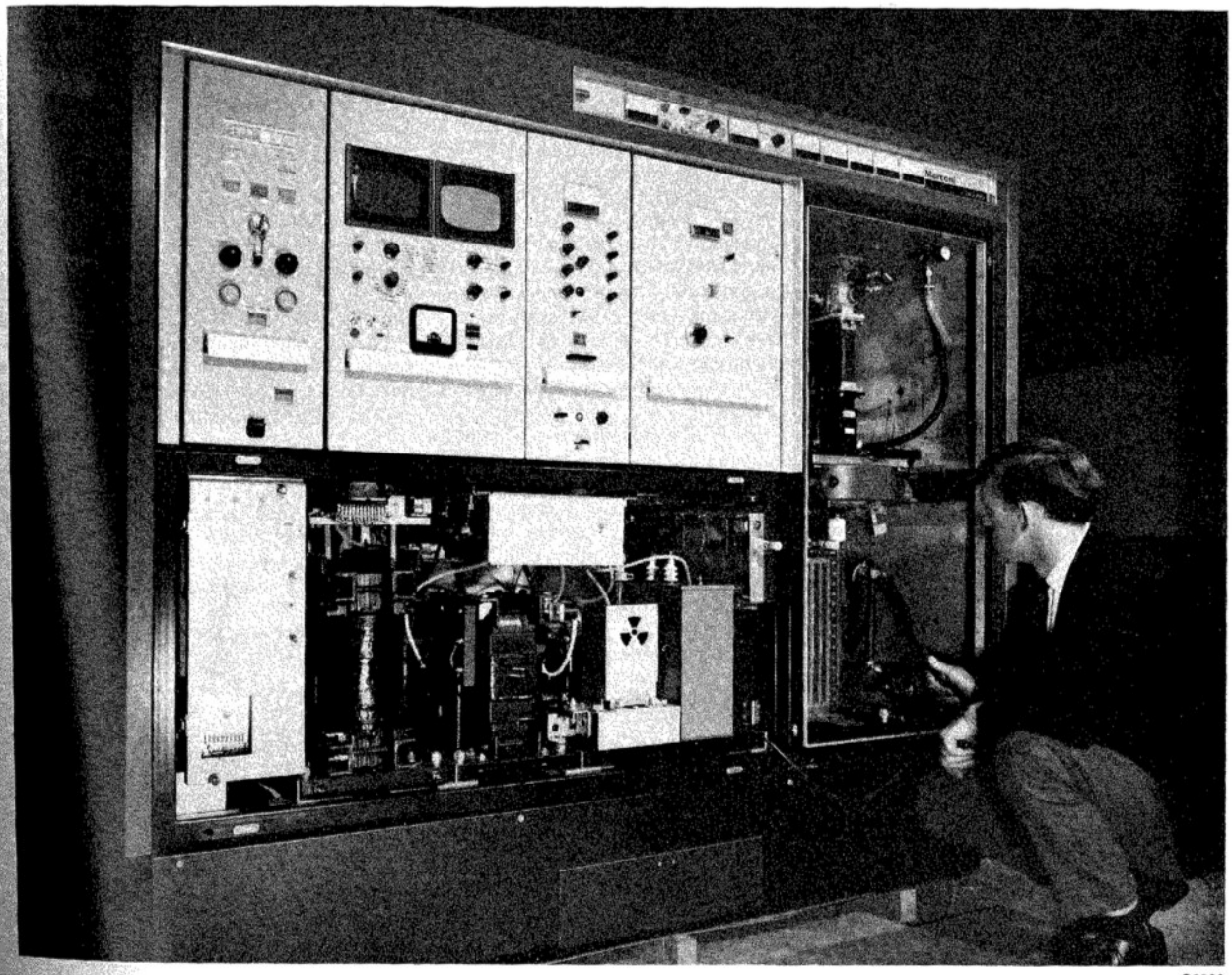
There are seven meters mounted on the front panel of the transmitter top compartment which indicate the following data. R.F power, magnetron current, modulator voltage, and modulator current. The fifth meter has an associated selector switch and indicates the overswing current, alternatively it can be employed in conjunction with the test wander lead to check the voltage and power measurements from any power supply unit. The two remaining meters form part of a leveller unit. One of them measures the output level of the parametric pump. The other which has an associated selector switch measures the klystron current and its associated voltages and in addition all the crystal currents of the receiver and a.f.c circuits.

DATA SUMMARY

1 Megawatt S-Band

Power input: 380 V to 415 V 3 phase 50-60 Hz

Frequency band: 2,700 to 3,100 MHz range covered by 4 magnetrons, each continuously tunable over 100 MHz.



S2000

Transmitter Power output:
Mean 1·5 kW.
Peak 1 MW.
Pulse length: 1 to 5 μsec
P.R.F: 250 to 1,000 p.p.s.
Duty cycle: 0·0015 maximum.
Receiver (R.F): Parametric amplifier noise figure: 3·0 dB (typical).
Pre-set gain: 20 dB.
Bandwidth: 15 MHz (Min).
Receiver (I.F and Video): Linear and logarithmic i.f amplifier are included. P.L.D processing is applied to log video.
1 Megawatt L-Band
Power input: 380 V or 415 V 3 phase 50–60 Hz.
Frequency band: 1,280 to 1,350 MHz—range covered by 2 magnetrons, each continuously tunable over 50 MHz.
Transmitter Power output:
Mean 2·5 kW.
Peak 2 MW.
Pulse length: 1 to 5μsec.
P.R.F: 250 to 1,000 p.p.s.
Duty cycle: 0·00125 maximum.
Receiver (R.F): Parametric amplifier noise figure 2·2 dB (typical).
Pre-set gain: 20 dB.
Bandwidth: 15 MHz (Min).
Receiver (I.F and Video): Linear and logarithmic i.f amplifiers are included. P.L.D processing is applied to log video.
2·5 Megawatt S-Band
Power input: 380 V or 415 V 3 phase 50–60 Hz.
Frequency band: 2,700 to 3,100 MHz covered by spot frequency magnetrons.
Transmitter Power output:
Mean 3·75 kW.
Peak 2·5 MW.
Pulse length: 1·5 μsec.
P.R.F: 250 to 1,000 p.p.s.
Duty cycle: 0·0015 maximum.
Receiver (R.F): Parametric amplifier noise figure 3·0 dB (typical).
Pre-set gain: 20 dB.
Bandwidth: 15 MHz (min).
Receiver (I.F and Video): Linear and logarithmic i.f amplifiers are included. P.L.D processing is applied to log video.
1 Megawatt C-Band
Power input: 380 V to 415 V 3 phase 50–60 Hz.

Frequency band:
(a) 5,300 to 5,340 MHz.
(b) 5,380 to 5,420 MHz.
(c) 5,480 to 5,520 MHz.
(d) 5,560 to 5,600 MHz.
covered by 4 magnetrons with spot frequencies.

Transmitter Power output:
Mean 1·5 kW.
Peak 1 MW.

Pulse length: 1 to 5 μsec.

p.r.f: 250 to 1,000 p.p.s.

Duty cycle: 0·0015 maximum.

Receiver (R.F): Parametric amplifier noise figure 4·0 dB (typical).

Pre-set gain: 20 dB.

Bandwidth: 15 MHz (Min).

Receiver (I.F and Video): Linear and logarithmic i.f amplifiers are included. P.L.D processing is applied to log video.

Radar Systems that can be provided from the S 600 series

Transportable Radars

1 megawatt tunable frequency S-band with an 18 ft × 6 ft aerial.

2½ megawatt fixed frequency S-band with an 18 ft × 6 ft aerial.

2 × 1 megawatt (Diversity) tunable frequency with an 18 ft × 6 ft aerial.

2 × 2½ megawatt (Diversity) fixed frequency S-band with an 18 ft × 6 ft aerial.

2 megawatt tunable frequency L-band with an 18 ft × 6 ft aerial.

2 × 2 megawatt (Diversity) tunable frequency L-band with an 18 ft × 6 ft aerial.

1 megawatt tunable frequency S-band with an 18 ft × 6 ft aerial in conjunction with a 1 megawatt fixed frequency C-band and 14 ft × 4 ft h.f aerial.

2 × 1 megawatt (Diversity) tunable frequency S-band with 18 ft × 6 ft aerial combined with 1 megawatt fixed frequency C-band and 14 ft × 4 ft h.f aerial

2 × 2 megawatt (Diversity) fixed frequency C-band with a 14 ft × 4 ft h.f aerial

2 × 1 megawatt (Diversity) fixed frequency C-band with a 14 ft × 4 ft h.f aerial

1 megawatt tunable frequency S-band with a 2 megawatt tunable frequency L-band back-to-back configuration 18 ft × 6 ft aerial.

2 megawatt fixed frequency S-band with a 2 megawatt tunable frequency L-band back-to-back configuration 18 ft × 6 ft aerial.

Static Radars

1 megawatt tunable frequency S-band with a 45 ft aerial.

2½ megawatt fixed frequency S-band with a 45 ft aerial.

2 megawatt tunable frequency L-band with a 45 ft aerial.

1 megawatt fixed frequency C-band with a 16 ft × 8 ft aerial.

2 × 1 megawatt (Diversity) tunable frequency S-band with a 45 ft aerial.

2 × 2½ megawatt (Diversity) fixed frequency S-band with a 45 ft aerial.

2 × 2 megawatt (Diversity) tunable frequency L-band with a 45 ft aerial.

2 × 1 megawatt (Diversity) fixed frequency C-band with a 16 ft × 8 ft aerial.

1 megawatt S-band tunable frequency and a 2 megawatt L-band fixed frequency back-to-back configuration with a 45 ft aerial.

2½ megawatt S-band fixed frequency and a 2 megawatt L-band tunable frequency back-to-back configuration with a 45 ft aerial.

2 × 1 megawatt S-band (Diversity) tunable frequency and 2 × 2 megawatt L-band (Diversity) tunable frequency back-to-back with a 45 ft aerial.

2 × 2½ megawatt S-band (Diversity) fixed frequency and 2 × 2 megawatt L-band (Diversity) tunable frequency back-to-back configuration with a 45 ft aerial.

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