Marconi Rad[illegible]·5cm C-Band Transmitter/Receiver Type S2013

Data Sheet B4

Frequency range : 1) 5300 to 5340MHz
2) 5480 to 5520MHz
using spot frequency magnetrons

Power output : 1MW magnetron

Receiver : parametric amplifier having a noise figure of 4·5dB

The Marconi Transmitter/Receiver Type S2013 is one of four transmitter/receivers individually covering S, L and C bands, housed in similar cabinets and using common techniques and components.

Type S2013 is a self-contained 1 megawatt C- band transmitter/receiver especially designed for use in a height finder system. It is available in two versions covering the frequency bands 5300 to 5340MHz and 5480 to 5520MHz. In each case spot frequencies are chosen by magnetron selection.

Mechanical Features

The transmitter is housed in a small, attractively styled lightweight cabinet 1·68 m (5ft 6in) high by 1·91m (6ft 3in) wide by 648mm (2ft 1½in) deep and weighs 794kg (1750lb).

The cabinet framework consists of welded square tubular steel sections giving a structure of great strength and rigidity combined with lightness. This frame is enclosed by aluminium panels clad with polyvinylchloride, which provides much greater resistance to abrasion than paint finishes. The side and front panels are removable, those on the front giving access to the interior of the radio-frequency and modulator power supply compartments.

The cabinet stands on a strong, integral base frame forming a plinth which houses input power controls, a 24V internal services power supply and the power supply for the magnetron field.

The right-hand compartment contains the pulse transformer, magnetron and items such as the electro-magnet for the magnetron and the directional couplers for transmitted power sample. This compartment is completely enclosed to minimize radiation of spurious energy.

The radio-frequency (r.f.) output is taken into a compartment which spans the top of the transmitter/receiver cabinet. This top compartment houses the duplexer and the couplers for r.f. power measurement, the final output to the aerial being at the top of the cabinet.

The remainder of the cabinet is divided into two further compartments, one containing the high-voltage power supply and modulator, the other containing the low-level electronic units.

The modulator compartment contains the extra-high-tension (e.h.t.) transformer, e.h.t. controller and thyristor regulator, e.h.t. rectifier unit, smoothing components, charging components, thyratron unit and pulse-forming network. These items are mounted on three tray assemblies and can be withdrawn and handled easily for servicing.

The electronics compartment contains four main units. The first unit is a controller for the transmitter, providing a trigger source for the modulator, the noise tube, monitoring equipment and the interlock system with fault indicators. The second unit, if fitted, is the performance monitor Type S2040 which is fully described in Marconi Radar Data Sheet E6. The third unit is the intermediate-frequency and video system of the receiver. These three units are mounted on runners and can be withdrawn easily for servicing. The fourth unit is a composite assembly comprising various receiver items, including the parametric amplifier, the mixer/head amplifier, the local oscillator and the automatic frequency control system. Access to these items is obtained via the hinged front panel. Fastenings hold all withdrawable units and assemblies in the operating position during transit.

Electrical Features

Transmitter

Magnetron

The magnetron is of the long anode block type and is housed in a water-cooled electro-magnet assembly. Cooling of the magnetron and magnet is performed by an external heat exchanger Type S8006.

Modulator

The modulator is a conventional line type employing a pulse-forming network, direct current resonant charging and thyratron switch.

The control of extra-high-tension (e.h.t.) is achieved by a thyristor regulator operating on the input to the e.h.t. transformer. This provides fast, accurate control of e.h.t. with none of the problems associated with variacs or similar devices.

The e.h.t. is produced by silicon rectifier stacks; silicon rectifiers are also used as charging diodes and in the overswing circuit which prevents damage to the modulator should the magnetron arc or miss a pulse.

The modulator switch is an extremely rugged ceramic tetrode hydrogen thyratron. It is separately pulsed on the priming and firing grids to give very low jitter and anode delay-time variations.

Receiver

Transmit-receiver system

Common aerial working is provided for by means of a ferrite duplexer. The receiver is protected from duplexer leakage by a waveguide transmit/receive (T/R) cell in front of the parametric amplifier and by a pulsed attenuator between the parametric amplifier and the mixer.

Radio-frequency (r.f.) amplifier

The first stage of the receiver is a low-noise parametric amplifier of the single-port, non-degenerate negative-resistance type.

The J-band pump level is controlled in order to stabilize amplifier gain and frequency. The input circulator is of the three-port type followed by a further three-port giving maximum protection against second-stage and signal source mis-matches.

Intermediate-frequency (i.f.) and video

A balanced mixer is used to convert signals to i.f. and is followed by wide-band, low-noise transistor head amplifier.

The basic receiver has a logarithmic channel followed by a pulse length discriminator and a linear channel.

The video output circuits include adjustable limiters to enable signal-to-noise ratios to be set. The receiver output can thus be fed straight to a display unit.

Automatic-frequency control (a.f.c.)

A normal a.f.c. system is fitted in which a sample of the transmitter pulse is combined with an output from the local oscillator (l.o.) to produce an i.f. pulse which is applied to a Foster-Seeley discriminator. The pulse output is integrated and used to control the frequency of the l.o. to within ±50kHz.

Control System

The only controls necessary for the operation of the transmitter/receiver are a TRANSMITTER ON/OFF key-switch and EXTRA-HIGH-TENSION ON and OFF buttons. After the key-switch is turned to ON, a period of 6 minutes elapses during which the magnetron and thyratron cathodes reach operating temperature. The STANDBY lamp then lights and the ON button may be pressed, making the transmitter/receiver fully operational. When the OFF button is pressed the transmitter/receiver reverts to STANDBY. These controls together with the relevant indicator lamps may be remoted.

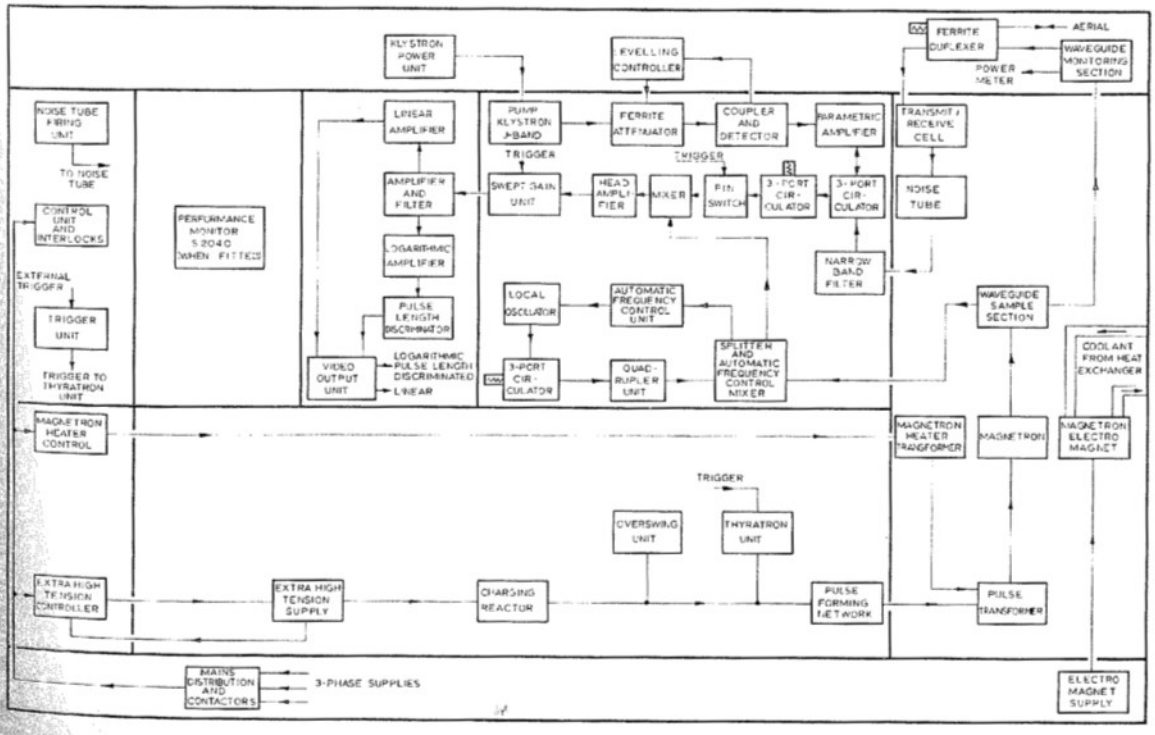
An executive interlock system allows operation only when essential services are present. It provides safe run-down should a failure or dangerous overload occur. A non-executive interlock system indicates faults which cause degraded performance or conditions which could lead to executive interlock action. The state of all interlocks is shown by lamps. A logic system controls the application of power to the units in the transmitter/receiver and stores any interlock failure by holding the appropriate lamp extinguished. A SYSTEM NORMAL lamp provides an overall indication which may be remoted.

Metering

Considerable built-in metering is provided to assist in fault finding. Seven meters mounted on the front panel provide continuous indication of :

1) High-tension volts
2) High-tension current
3) Magnetron cathode current
4) Overswing current
5) Output power
6) Receiver crystal current
7) Parametric amplifier pump level.

Meter (4) can be switched to a wander lead which can be plugged into various units to enable



Block diagram 1·0MW 5·5cm C-band Radar Transmitter/Receiver Type S2013 showing approximate mechanical configuration.

the voltage and current of the built-in unit power supplies to be measured.

Meter (6) can be switched to measure other voltages and currents associated with the parametric amplifier, pump, a.f.c. system etc.

The receiver unit has a meter to give a continuous indication of TUNING ERROR. The i.f. and video unit incorporates a meter to indicate i.f. levels.

Monitoring

Facilities for monitoring the main performance parameters are built-in.

The transmitter power output level is shown directly on a meter and the receiver noise figure is measured by means of a built-in noise source. By switching this on and noting the increase in noise level in the linear channel, the noise ratio is obtained.

More comprehensive monitoring of waveforms, magnetron spectrum, noise ratio etc. is provided by an additional performance monitor (Type S2040) which fits into a ready-wired position in the transmitter.

Fault finding whether by the performance monitor or by a separate oscilloscope is greatly assisted by the use of withdrawable units and the provision of special monitor points on printed boards for input and output signals.

Data Summary

Power input:
415V±5%, 48–52Hz standard, or 380V ±5%, or 58–62Hz to order, 8kVA, 3-phase, 4-wire.
Frequency band:
1) 5300–5340 MHz.
2) 5480–5520 MHz.

Transmitter
Nominal power output (magnetron):
1MW peak, 1·5kW mean.
Pulse length: 5μs standard
Down to 2μs to order.
Pulse recurrence frequency:
300 p.p.s. standard. Other values from 220 to 750 p.p.s. to order.
Duty cycle (maximum):
0·0015.
Magnetic field:
electromagnetic.
Waveguide:
No.12, pressurized at 2·45 kg/cm^2 (35lb/in^2 gauge).
Trigger input:
+5V, 2μs into 75 Ω.

Receiver
Parametric amplifier:
Noise figure: 4·5dB.
Gain: 20dB (pre-set).
Bandwidth: 14 to 20MHz.

Mixer/Head amplifier:
Noise figure: 11dB.
Gain: 30dB.
Bandwidth: 20MHz.
Intermediate-frequency: 45 MHz.

Linear channel:
Bandwidth: to suit pulse length.
Output: +1V r.m.s. noise (adjustable), +5V signal (maximum) into 75 Ω.

Logarithmic channel:
Bandwidth: to suit pulse length.
Dynamic Range: greater than 60dB.
Output (logarithmic pulse length discriminated expanded): +1V r.m.s. noise (adjustable); +5V signal (maximum) into 75 Ω.

Environment
Temperature:
Operational: 0 to +50°C.
Survival: −40 to +65°C.
Relative humidity:
Operational: 95% at 25°C.
Survival: 95% at 40°C.
Pressure:
Operational: 750 mb.
Survival: 420 mb.

Dimensions
Height:
1·68m (5ft 6in).
Width:
1·91m (6ft 3in).
Depth:
648mm (2ft 1½in).
Weight:
794kg (1750lb).

The information given herein is subject to confirmation at the time of ordering.

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