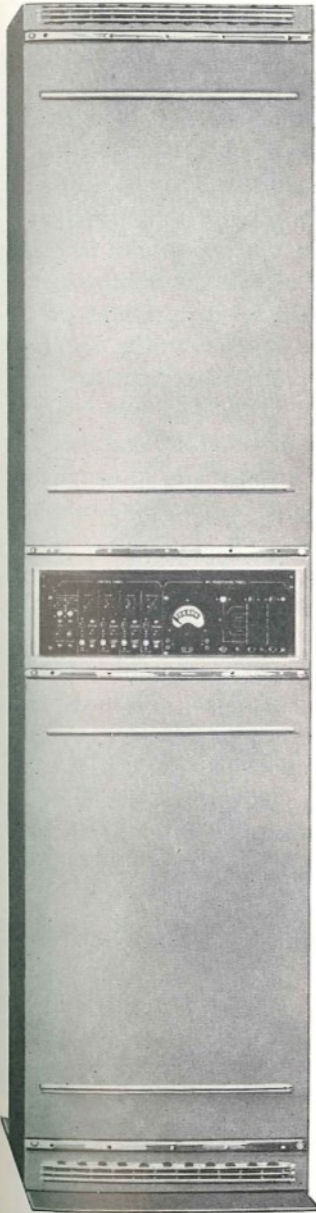




## Simplified Five-Band Privacy Equipment *Type HW 12*

JOINT MARCONI-SIEMENS PRODUCT



6683

THE MARCONI-SIEMENS simplified five-band privacy equipment provides a high degree of protection against unauthorised interception of speech on a radio-telephone circuit, as compared with straightforward inversion apparatus which is intended to deal only with random interception.

Briefly, the equipment performs the following functions:

- (a) Splits the speech frequency band of 250–3000 c/s into five sub-bands each 550 c/s wide.
- (b) Changes the relative positions of individual sub-bands and recombines them in a new order in the 250–3000 c/s speech band.
- (c) Inverts the frequency range of any one or more of the sub-bands.
- (d) Enables an operator to switch in any one of a predetermined set of six different combinations of the five sub-bands.
- (e) The particular six combinations are determined by the cross connections made in a multi-way plug and any six of the 3840, which are theoretically available, may be set up. A rapid change to a different set of combinations is possible merely by changing the multi-way plug.

The resulting speech band, which modulates the radio transmitter, is unintelligible and a reversal of the processes at the distant radio terminal restores the original speech. The sub-bands are re-grouped according to the combination set by prior arrangement with the distant terminal and this precludes any simple method of partial interception.

The processes of band splitting, modulating, inverting and recombining are reversible, thus common channel equipment is used for both transmission and reception. The separation between the two-wire privacy branch and the four-wire 'send' and 'receive' sides of the radio and line circuits is secured by hybrid coil circuits working in conjunction with the suppressor circuits of the radio telephone terminal.

Amplifiers are provided in the privacy path to compensate for the losses in the band-splitting and recombining circuits.

Privacy working can be cut into or out of use, when required, by switching at the radio-telephone terminal.

The equipment is operated from an AC supply at 110–120 V or 200–250 V, 50–60 c/s. The power consumption is 100 W approximately.

The equipment is mounted on both sides of one standard rack 7 ft 6 in. high. The band-pass filters, inverters, combination panel and meter and control panel are mounted at the front while at the rear there are the oscillators, amplifiers, hybrids and low-pass filters.

### CIRCUITS

Input and output amplifiers are provided in both the 'transmit' and 'receive' circuits. The gains of these amplifiers are adjusted to give a suitable operating level and to compensate for losses in the system.

A group of hybrid transformers is employed both on the line and radio sides of the system, where they serve to divide or combine the five sub-circuits. They also couple the 'both-way' operation of the splitting and modulating paths to the four-wire ('transmit' and 'receive') amplifiers and external circuits.

The normal band of speech frequencies, *i.e.* 250–3000 c/s, having passed through the hybrid transformers, is applied to five circuits simultaneously. In four of these circuits the speech signals undergo modulation. Each modulator is supplied with a different carrier frequency so arranged that in conjunction with a band-pass filter each transposes a different portion, 550 c/s wide, of the speech spectrum into the band 2450–3000 c/s. The fifth (unmodulated) circuit passes this portion directly through the fifth band-pass filter. At this point the relative positions of the five sub-bands are interchanged by manual

switching. The sub-bands are then subjected to another stage of modulation similar to the first. When the outputs are finally recombined in hybrid transformers the resultant signal occupies the original band of 250 to 3000 c/s, but is composed of five sections arranged in random order and is therefore unintelligible.

The manual switching of the relative positions of the five sub-bands is effected by means of a multi-way plug and a selection switch. The plug is so connected internally that six combinations are available, the particular combination desired being selected by a switch that may be located on the telephone terminal, or, if required, at a remote point such as the operator's position. The group of six sub-band combinations available at any time can be readily changed by the substitution of another plug differently connected. Plug-changing and switch-selection must, of course, be done in agreement with the distant radio terminal.

The equipment provides for inversion of any of the five sub-bands while these are in the common range of 2450–3000 c/s, *i.e.* between the first and second groups of modulators. The inverters are of similar design to the modulators, and they invert any one sub-band about a carrier frequency of 5450 c/s. An attenuator is connected in place of any inverter not in use.

Connections to the various stages of the equipment are made *via* U-links on test tablets, so that ready access is given to any part of the system for test purposes. All necessary monitoring and checking circuits are included. Testing and metering facilities are provided to enable the required level controls and maintenance checks to be carried out. A service telephone is included to provide direct communication with the distant radio station during adjustment of the equipment.

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