BAND-II COMBINING UNITS FL5/1, 1A AND FL5/2, 2A

Introduction

The FL5/1, FL5/2 and their A versions constitute a group to combine signals spaced at 2·2-MHz intervals in the range 87·5 to 100 MHz. All four items are basically similar and have two inputs only, so for their usual purpose of combining three Band-II signals they work as pairs connected in tandem. For frequencies between 87·5 and 94·8 MHz the FL5/1 is used to combine two of the signals and the resultant is applied to the FL5/1A, into which the third Band-II signal is introduced. Signals with frequencies between 94·8 and 100 MHz are similarly combined through the FL5/2 and FL5/2A.

These units are identical to corresponding component sections of the Helical Resonator Combining Unit (Band II F.M.) Type 6307, made by Pye T.V.T. Ltd.

General Specifications

Frequency Range	87·5-94·8 MHz (FL5/1, 1A) 94·8-100 MHz (FL5/2, 2A)
Maximum Power Input (signals spaced at 2·2-MHz intervals)	100 watts at each input
Cross-insertion Loss	Not greater than 1 dB between any input and the *Combined Output* point
Input and Output Impedances	50 ohms
Input V.S.W.R.	
Lowest frequency input, f_1	Not greater than 1·15
Centre frequency input, f_2 (FL5/1A and FL5/2A only)	Not greater than 1·22
Highest frequency input, f_3	Not greater than 1·15
Dimensions	19 in. long, 1½ in. deep and 5¼ in. high
Weight	Approximately 23 lb

General Description

The electrical layout of the typical unit is shown in Fig. 1. It is a Maxwell bridge circuit which is in the form of a so-called bridge-ring; an explanation of this configuration is given in Section 8 of Instruction T.11.

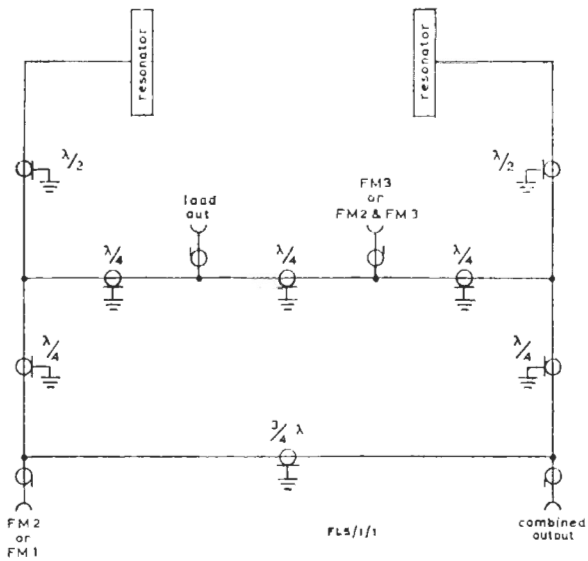

Fig. 1 Electrical Arrangement of the FL5/1, 1A and FL5/2, 2A

As installed at transmitting stations the complete combining unit is one of the two pairs specified previously. Further description referring to the FL5/1 and FL5/1A can be taken to apply also to the FL5/2 and FL5/2A respectively.

The two constituent units are mounted on a bay, with the FL5/1 occupying the upper position. The FL5/1 combines the f_2 and f_3 signal inputs, as defined in the General Specification, and the FL5/1A combines the f_1 and (f_2 + f_3) signals. The connections between the resonators, the balancing load and the input and output sockets are made by particular lengths of coaxial cable which are fitted, where appropriate, with type-C connectors.

The two resonators are identical in construction. Each comprises a helical coil fixed inside a canister. The dimensions are chosen such that the whole behaves like a short-circuited quarter-wave line, with a high impedance at its resonant frequency. A low impedance is presented at a lower frequency by tuning the coil with a short length of coaxial line. This line is matched to the output by means of a length of 50-ohm air-spaced line within the canister and an additional length of coaxial cable outside the canister. The resonator is tuned by moving a flat copper disk near the helix. Turning the disk in the clockwise direction, closer to the helix, raises the resonant frequency.

The balancing load has a fixed value of 50 ohms, provided by a conventional cracked-carbon resistor which is mounted in a ventilated case.

Setting-up Procedure

The only adjustments that can be made are to the tuning of the resonators. The following description assumes the use of a signal generator and a receiver. Other signal sources and measuring instruments can be used but it is important to remember that:

(a) During the setting-up procedure the input to the combining unit must not be greater than 20 watts, otherwise the balancing load resistor may be damaged.

(b) When resonators are being adjusted they present a reactive impedance which may affect the correct operation of the signal source.

Apparatus Required

Signal generator with a 50-ohm output impedance.
Receiver with a 50-ohm input impedance and an output-level indicator.
50-ohm load

FL5/1A or FL5/2A (lower unit)

1. Remove the covers over the resonator tuning screws.
   Short-circuit the inner and outer conductors on the *Combined Output* and *FM 2 & FM 3* coaxial sockets. This can be done conveniently by inserting a 4 B.A. screw into a tapped hole in the centre of the socket cover which is on the rear of the front panel. The screw should be turned until it makes contact with the inner conductor.
   Disconnect the cable between the *Load Out* and *Load In* sockets, and also the cable connecting the *FM 2 & FM 3* socket to the *Combined Output* socket on the upper unit.
2. Connect the signal generator to the *FM 1* socket and the receiver to the *Load Out* socket.
3. Set the signal generator to the f_1 frequency and tune the receiver to this frequency.
4. Tune the left-hand resonator, viewed from the front, until the input to the receiver is a minimum, and note the reading of the output-level indicator.
5. Remove the short-circuits applied in (1).
   Replace the cable connecting the *Load Out* and *Load In* sockets.
   Connect the receiver to the *FM 2 & FM 3* socket.
   Connect the 50-ohm load to the *Combined Output* socket.
6. Tune the right-hand resonator until the input to the receiver is a minimum.

Note: In this position the receiver input should be at least 40 dB less than the output of the signal generator, and less than that measured in **(4)**.

FL5/1 or FL5/2 (upper unit)

7. Short-circuit, as in (1), the *Combined Output* and *FM 3* sockets.
   Disconnect the cable between the *Load Out* and *Load In* sockets.
8. Connect the signal generator to the *FM 2* socket and the receiver to the *Load Out* socket.
9. Set the signal generator to the f_2 frequency and tune the receiver to this frequency.
10. Tune the left-hand resonator until the input to the receiver is a minimum and note the reading of the output-level indicator.
11. Remove the short-circuits applied in (7).
    Replace the cable connecting the *Load Out* and *Load In* sockets. Connect the receiver to the *FM 3* socket.
12. Tune the right-hand resonator until the input to the receiver is a minimum.

Note: In this position the receiver input should be at least 40 dB less than the output of the signal generator and less than that measured in (10).

13. Measure the cross-insertion loss between each pair of input sockets. The loss should be not less than 35 dB.