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CROSSTALK ON 150 m COAXIAL CABLES, 2.5 TO 10 MHz

In the future accelerating system, a power level of 1 kW is to be fed from the central building to the amplifiers in the ring. In the parallel running beam observation cables the interfering signal has to be kept below 1 mV peak, so that the required decoupling is

$$+ 60 \text{ dBm} - (- 50 \text{ dBm}) = 110 \text{ dB}$$

1 kW — 1 mV peak at 50 Ω

The combination "SMLR" as a transmitter and "USVH" as a receiver (both instruments from Rohde & Schwarz) offers a dynamic range of 135 dB between generator output and background noise in the receiver. A heavy metal plate screwed to the generator, carrying the connectors for the cables under test, proved to be essential to keep all spurious "non-cable" couplings far below this 135 dB figure: with two coaxial terminations mounted instead of the cables in Fig. 1, virtually no interference could finally be noticed in the measurement set-up.

Test 1:

Two terminated cables in parallel (Fig. 1)
Cable A : Flexwell 5/8", 50 Ω (outer conductor copper tube)
Cable B : Suhner RG 214 U, 50 Ω (outer conductor braid).

The interference signal was too weak for detection. The decoupling is in excess of 140 dB (this value would have increased the receiver noise indication by 1 dB).

Test 2:

Decoupling inside /outside of the cables (Fig. 2).
A ground-loop voltage was injected between external jackets of the cables and the resulting voltage measured at the inside of the cable under test.

Cable A : Flexwell - interfering voltage attenuated by > 77 dB
Cable B : braid - interfering voltage attenuated by > 44 dB.

It is well known that the determining quantity is the cable jacket current. Since the cable length is many times greater than the wavelength, very complicated directional effects occur, resulting in ripples of the current/voltage ratio of more than 50 dB. By contrast the given voltage/voltage ratio showed a fluctuation of less than 8 dB over the frequency band. Since the two external cable jackets touched each other, the system had the lowest impedance possible or the highest jacket current for a given loop voltage.

The figures stated give therefore the worst case.

Conclusion

The transmission of 1 kW to the amplifiers is not critical as far as the coupling between the cables is concerned.

Ground loops may, however, be a problem: if braid cable is used for the beam observation, the highest permissible potential difference between grounds is ~ 160 mV peak.

In the central building the connection RF-amplifier to common ground will need special attention. If coupling resistance of this line turns out to be too big, it may be necessary to ground the beam observation cables directly at the driver racks.

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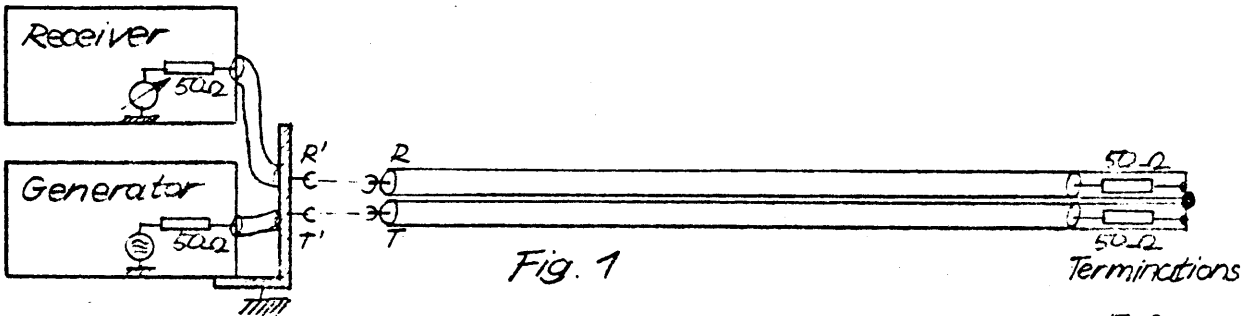

Fig. 1

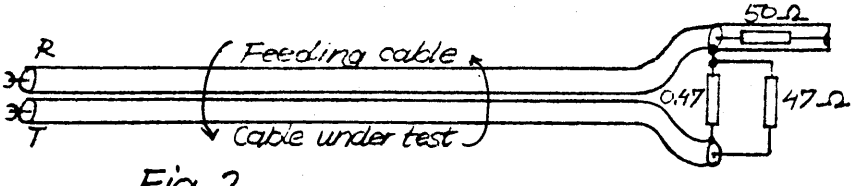

Fig. 2