BBC

Engineering Information

Information Sheet 1604(4) June 1970

# STEREOPHONIC BROADCASTING

## Technical Details of Pilot-tone System

**Multiplex signal**

The instantaneous deviation of the transmitter carrier frequency is

$$0{\cdot}9\left[\frac{A+B}{2}+\frac{A-B}{2}\sin 2\omega t+0{\cdot}1\sin \omega t\right] \quad \text{x } 75 \quad \text{kHz}$$

where the symbols have the meanings defined below. The expression inside the brackets represents the multiplex signal.

**Left- and right-hand audio frequency signals**

A represents the pre-emphasized left-hand audio-frequency signal.

B represents the pre-emphasized right-hand audio-frequency signal.

The values of A and B are restricted to the range of ±1.

**Compatible signal**

$\frac{A+B}{2}$ represents the compatible signal to which monophonic receivers respond.

Its value cannot fall outside the range of ± 1 because of the restriction on the values of A and B.

**Difference signal**

$\frac{A-B}{2}$ represents the difference signal which provides stereophonic receivers with the necessary information to separate the left-hand and right-hand signals. Its value cannot fall outside the range of ± 1 because of the restriction on the values of A and B.

A pair of sidebands is produced by the suppressed-carrier modulation of a sub-carrier by the difference signal.

**Stereophonic sub-carrier**

The frequency of the stereophonic sub-carrier is $\frac{\omega}{\pi}$ = 38,000 ± 4 Hz. The amplitude of the sub-carrier component is less than 1 per cent of the multiplex signal.

**Pilot-tone**

The frequency of the pilot-tone is $\frac{\omega}{2\pi}$ = 19,000 ± 2 Hz. The function of this component is to enable stereophonic receivers to recover the difference signal from the sidebands of the stereophonic sub-carrier.

**Phase relationship**

The phase relationship between the pilot-tone and the sub-carrier is implicit in the expression for the multiplex signal, and the phase of the pilot-tone is maintained within ± 3° of the nominal value.

**Pre-emphasis**

The left- and right-hand signals are each subject to pre-emphasis with a time constant of 50 μs.

**Maximum deviation**

The compatible and difference signals have been seen to be restricted to the range ± 1 and it can be deduced that the expression

$$\frac{A + B}{2} + \frac{A - B}{2} \sin 2\omega t$$

is also restricted to this range and that the complete multiplex signal is therefore restricted to the range of ± 1·1. Consequently the instantaneous deviation of the transmitter carrier frequency is restricted to ± 0·9 x 1·1 x 75 kHz or, approximately, 75 kHz.