Knowles®

TB22

TECHNICAL BULLETIN

MAGNETIC LEAKAGE FOR RECEIVERS

A magnetic field is produced by the passing of current through a coil. The work this field can do is the basis of operation of magnetic receivers. While most of the field is contained in the interior, some can be detected external to the receiver. This external field is called magnetic leakage. The magnetic leakage of a receiver may interact with the telephone pickup coil of a hearing aid and cause feedback problems. In the design and fabrication of Knowles Electronics receivers, every effort is made to keep the external field to a minimum but it is impossible to totally eliminate it. The object of this bulletin is to acquaint the hearing aid designer with magnetic radiation and discuss its effects in relation to our various receivers.

The magnetic field emanating from a receiver is a vector quantity in that it has both intensity and direction. It is important to be aware of both of these factors when designing a hearing aid with a magnetic receiver and a telephone pickup coil. The direction mentioned above is defined as the direction of the axis of a solenoid that will produce a field with the same orientation as the receiver. It is possible to have greater interference from a receiver with a relatively weak field if it is orientated such that the pickup coil detects the maximum field than from a receiver with a stronger field that is orientated in a direction thet is less conductive to interference. For a given receiver there is only a 6dB variation in the strength of the field (at a given distance from the receiver) but because the field is a vector differing orientations can cause more than 20dB variations in pickup. The shape of the field is such that there are two areas of maximum field strength located 180° from each other.

While the strength and direction of a field produced by a current in a coil is the same for identical coils, these quantities vary from one family of receivers to another. For instance, an EF receiver will have about half the amount of magnetic leakage that is produced by a comparably driven BK receiver. The intensity of the field is discussed in terms of the amount of field produced by the drive current in a loop of a given area. In order to more clearly see the relationship between the receiver family, drive current, and magnetic leakage, refer to Table 1 on Page 2.

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TABLE 1

RECEIVER FAMILY	K	θ DIRECTION
BK	.24	125° Figure 1
BP	.11	35° Figure 2
ED	.17	175° Figure 1
EF	.12	162° Figure 1

With this data and information readily available on the Knowles Receiver Performance Specification Sheet 2.1, the amount of external field for any given receiver can be calculated using the formula:

$$A = \sqrt{Z}\ K$$

Where: **A** is the area of the loop in square centimeters.

Z is the 500 Hz impedance of the receiver as specifed on the Knowles Receiver Performance Specification Sheet 2.1.

K is from Table 1.

θ is the angle of direction for the axis of the equivalent magnetic coil.

The values for K were calculated from data taken at low frequencies. The amount of leakage at frequencies near the mechanical resonance will vary rapidly, but should not increase more than 3dB from the low frequency values and will be much less at some points. One can expect a ± 3dB variation in this field from receiver to receiver.

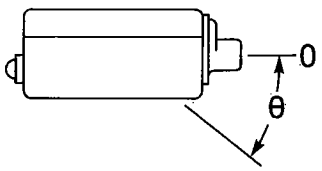

FIGURE 1.

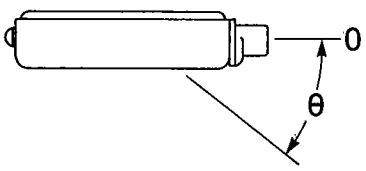

FIGURE 2.