ELECTROMAGNETIC FIELD MEASUREMENTS OF VERY
SHORT RADIO WAVES NEAR THEIR SOURCE

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(abstract)

Electromagnetic wave theory indicates that the electromagnetic field
associated with the alternating current contains two components. One of
these, the radiation component, varies inversely as the distance from the
source; the other, the induction component, varies inversely with the square
or the cube of the distance. Although the theory has been verified for dis-
tances which involve only the radiation component, measurements made at
short distances have proved somewhat unreliable. Measurements at dis-
tances as short as 8 meters have been made by Ramsey and Drelsback
(Proc. Inst. Rad. Eng., Vol XVI, pp. 1118-1132), using a wavelength of about
16 meters.

In order to extend the verification to shorter distances and wavelengths,
a transmitter and a field intensity meter were designed and constructed for
operation on a wavelength of 2.55 m. The meter was calibrated and field
intensity measurements made using three different transmitting aerials.
Two of these were coil aerials; the third a horizontal doublet antenna.
Computations were made and comparisons established between observed
and computed values of field intensity. The slight discrepancies occurring
were accounted for.

The following conclusion was reached:

That portion of electromagnetic theory which appertains to electro-
magnetic fields produced by antenna and coil aerials is reasonably well
substantiated by experiment. Three serious weaknesses in this branch of
radio theory are, however, evident.

First, in the development of radiation theory the practice has been to
assume an ideal case which fails to approach the situation met in practice.
For example, in the development of the expression representing the field
produced by an antenna, it is assumed that the current is uniform along
the length of an antenna; although current nodes and loops are definitely
present.

Second, much of the development has been done by engineers whose
knowledge and use of mathematics is practical rather than scholarly. This
fact is evidenced by lack of generality and by awkward mathematical
notation.

Third the terminology of radio is marked by looseness and lack of
standardization. In several instances there occur actual inconsistencies
in the significance of expressions as used in radio and as used in other
scientific fields.

Future work should be devoted to remedying the defects mentioned.
Much of radio theory should be redeveloped, and the notation and termin-
ology of radio should be reconciled to that of other fields of physics.
Finally, the actual current distribution in transmitting antennae should
be made the basis for the development of transmission formulas intended
to replace the empirical formulas now used by radio engineers.