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TELECOMMUNICATIONS REGULATION CIRCULAR

SUPPRESSION OF INDUCTIVE INTERFERENCE
ANTENNA FACTOR: TO CONVERT MEASURED VOLTS (µV) TO FIELD STRENGTH (µV/m)

MARCH 31, 1977
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TELECOMMUNICATION REGULATORY SERVICE

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SUPPRESSION OF INDUCTIVE INTERFERENCE

ANTENNA FACTOR: TO CONVERT MEASURED VOLTS (μV) TO FIELD STRENGTH (μV/m)

1. The attached curve sheet gives the factor by which the measured microvolts, from various types of resonant antennas, must be multiplied to obtain field strength in microvolts per meter. They are intended for use particularly with Servicemen's type TV field strength meters, and it should be noted that in every case they apply only to a particular impedance transmission line and instrument. If, for example, a 300 ohm input impedance meter is connected to the antenna by a 72 ohm line, the factor will vary with length of lead-in, as well as with frequency, and so be indeterminate.

2. The accuracy is of course only that of the meter, so when a new instrument is received, field staff should take and record measurements on as many local TV, FM and other stations as possible, using some permanent or reproducible antenna set-up, so that the meter can be checked, and corrections made for any subsequent loss of sensitivity.

3. As mentioned above, a 300 ohm instrument should not be connected directly to a 72 ohm line. Instead a balun (72 ohm unbalanced to 300 ohm balanced) should be used. This is a matching transformer to match the 72 ohm input from the antenna system to the 300 ohm balanced input to the television set.

4. The two upper curves are for the car dipoles, when used away from the car. When the dipole is above the car (approximately 66 cm) the measured values will be somewhat smaller. In a limited number of cases tested, the indicated field strength was between 0.67 and 0.75 of the free space field strength, at the same antenna height (2.25 m). It can vary more widely than this, and it is advisable that the individual car be checked, on the frequency most used locally, and that the effect of the orientation of the car be also checked.

5. The Departmental car dipoles can be telescoped in to a 0.5 wavelength only up to about 290 MHz. At higher frequencies, however, they can be used as 1.5 wave dipoles and in this way be made to cover the UHF TV bands also. There is little difference between the antenna factor for a 0.5 wave dipole and for a 1.5 wave dipole (simple dipoles with 300 ohm load), and so the antenna factor for the 0.5 wave dipole, at the frequency actually received, can be used for the major lobes of a 1.5 wave dipole also. The dipole rods are of course set at a length on the dipole measuring rule which corresponds to 0.33 times the received frequency.

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6. The response patterns of a 0.5 wave and a 1.5 wave dipole are as shown on page 3. It will be noted that the major lobes of the 1.5 wave dipole are at about 45 degrees to the axis of the rod, with a lesser response broadside. The above mentioned antenna factor should be used with readings taken on the major lobes. The side nulls of the 1.5 wave dipole are easily obscured by any unbalance, but the null in line with the end of the rod can usually be clearly identified and used for taking bearings.

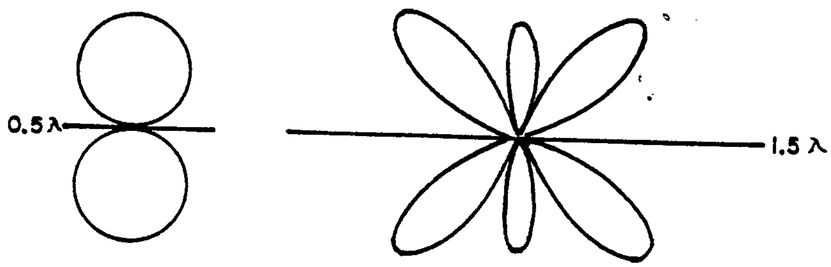
7. In open areas, in the Class B coverage, the field strength 9.1 m above the ground will be approximately 4 times that at a 2.25 m height (see Circular SII-13-47 "Variation of Field Strength with Distance"). In built-up areas, the difference is likely to be much greater, especially near steel frame buildings.

8. The curves for a folded dipole-plus-reflector, and for a 12 element Yagi (300 ohm) are intended for use in checking the field strength at a complainant's antenna, by disconnecting the lead-in from his TV set, and connecting it to a field strength meter. The antenna factor is based on optimum performance of the antenna (4.5 dB and 14 dB respectively), and it can safely be assumed that the field strength is not less than that indicated. The array gain will obtain only on the channel to which the antenna is cut; on any other channel the gain will be less, and the field strength correspondingly greater than the indicated value. The same will be true of a defective or incorrectly oriented antenna.

9. The Yagi curve applies equally to 12 elements in line, or 6 stacked above 6, or to practically any domestic TV antenna of that number of elements, and intended for feeding a 300 ohm line and set. Values can be interpolated between the dipole-plus-reflector curve and the 12 element Yagi curve on a linear proportional basis, for intermediate numbers of elements. That is, the factor for a 7 element Yagi would be half-way between the 2 element (dipole-plus-reflector) and the 12 element.

10. In cases where there is a booster amplifier installed at the masthead or other point such that the measurement cannot be made ahead of it, then the measured microvolts must be correspondingly reduced. 20 dB is about the maximum gain claimed by any manufacturers, on a single pre-adjusted channel, and most claim 12 to 18 dB. The average gain, after being in use for some time, can reasonably be estimated as 14 dB; the meter reading should therefore be divided by 5 before applying the antenna factor.

11. The antenna factor curves are based on the following relations: The open circuit voltage of a resonant 0.5 wave dipole is $\lambda/3.14$ times the field strength; the output voltage is equal to the open circuit voltage times the load resistance, divided by the load resistance plus the radiation resistance; the watts output of a folded dipole to a matched load is equal to the watts output of a simple dipole to a matching load.



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ANTENNA FACTOR

FOR 0.5 WAVE RESONANT ANTENNAS

FIELD STRENGTH uV/m = METER READING (uV) X ANTENNA FACTOR