A Few Aspects of the Screening of Aerials

By Megohm

The technical and constructional contributor "Megohm" gives weekly in the "Radio Record" a valuable series of articles of current radio interest. He is a highly qualified and experienced constructor and all his articles are based on practical experience. Many readers express high appreciation of his valuable advice.—Ed.

AS an opening to the subject the matter of absorption of wireless waves at the transmitting aerial will be briefly dealt with in order to show the ever-present tendency to loss of signal strength by absorption.

We have all heard of the high-powered broadcast station 5XX at Daventry, England. This station has two massive steel masts to support the aerial. There also existed at Birmingham a low-powered station, 5IT, which was to be closed and replaced by a high-powered station on normal wave-length, known as Daventry Junior, or 5GB. The latter station was duly erected, 5IT closed, and 5GB opened. Now something was discovered that the engineers who planned the scheme had missed. Signal strength at Birmingham from 5GB was found to be much below what was rightly expected according to the power radiated from the aerial, and disappointment was general. The cause of this unexpected weakness was found to be absorption of signal strength by the steel masts of 5XX, which were in the direct path from 5GB's aerial to Birmingham. It is understood that the temporary aerials 100ft. high have been increased to 300ft. and power augmented, with presumably improved results.

Experiments at Rugby have shown that the steel masts there, insulated at the foot on porcelain bases, decrease aerial radiation by about 20 per cent. when the masts are temporarily earthed.

A STEEL mast in close proximity to an aerial acts as an untuned aerial directly connected to earth, and provided that the transmitting wave-length is considerably greater than the natural wave-length of the screening mast, absorption will be considerable. For aerial masts of 100ft. or so in height and broadcast wave-lengths from 300 to 500 metres, this condition is fulfilled.

Receiving Aerials.

EXPERIMENTS made to determine the screening effect of wires adjacent to a vertical receiving aerial show that only when screening wires are parallel to and less than two feet away, and are earthed, that there is any very great screening effect, and that when such screening wire or wires are tuned by a coil and variable condenser between the wire and earth, that the absorbing influence is reduced to a negligible amount. An increase in the number of untuned screening wires increases the absorption.

A German experimenter has shown that the electric field of a local broadcasting station was reduced to 10 per cent. of its normal value at a distance of two or three feet from the base of a iron lamp-post ft. in height, and that a "shadow" of weakened signal strength is evident upon the ground to a distance from the mast approximately equal to its height.

Field experiments in England have shown that when using the loop aerial for directional work, the presence of numerous overhead telegraph wires has a weakening effect upon the reception of a nearby received.

The screening action of trees is fairly well known, and in this as well as other cases the position of the trees is an important factor. If any screening object is near to the receiving aerial and between it and the transmitter, then its full effect will be felt.

The Inverted L Aerial.

THE popular inverted L aerial may be affected by metal work projecting skywards if in any quantity, such as rows of metal ventilators, pipes, metal staircases, etc., if connected to earth. The gas and water pipes in a house are in most cases not sufficiently numerous or in close proximity to the aerial to have much effect, but high steel-frame buildings usually have a very definite absorption effect when in the track of the incoming waves, especially if such buildings are higher than the aerial.

Although care should be taken to select the best available position for the aerial and lead-in, provided that the flat portion is not appreciably screened there need not be any great concern over the proximity of the lead-in to walls or buildings if the greatest available separation is secured.

Experiments made by screening the lead-in with parallel wires show that the screening is only effective whilst the flat portion of the aerial is shorter than the height of the screening wires.

IN describing tests made to ascertain the signal strength at different distances from 2LO (London), "Wireless World" says:—

"It is difficult to allow for all the different kinds of objects which may extract energy from the waves, but a casual view of the countryside will give most people the impression that trees must play a very important part, as there are few districts in the area surveyed which are not fairly thickly wooded. It is significant that there are on the whole many more trees in the counties south of London than in those just north. This must have been noticed by most people familiar with the home counties. It is also made convincing by a comparison of almost any two large-scale ordnance survey maps of the north and south of London. Thus, if the absorption by the trees is of importance, we should expect a greater attenuation of the waves in the south than in the north, and it therefore appears that we are perhaps approaching the common solution to both the above problems.

Testing the Solution.

It was fortunately found possible to provide a practical means of testing the tree hypothesis in a fairly simple manner. The trees over which the waves pass may be considered as upright receiving aerials. Although, of course, they are not tuned to the proper wave-length, they will nevertheless have currents induced in them. If we consider the case of a single tree, we find that this current produces round the tree a local distortion of the electromagnetic field of the waves. Now the magnitude of this distortion is a measure of the amount of energy absorbed by the tree. To measure this effect, a small portable direction-finder was placed at the foot of thetree under examination, and since this instrument determines the direction of the magnetic field at any point, it was an easy matter to map out the field, and thus determine the extent of the distortion.

The actual way in which this experiment was carried out is shown in illustrations. In the first, a close-up view of the base of the tree is shown with the measuring set in the foreground; in the second, a more distant view of the carrying out of the test is shown. By making these experiments with many different trees, a general idea of their absorbing properties could be obtained. Thus it was found that a large tree may absorb as much energy as a quarter-acre of the earth's surface.

Rough estimates were then made of the density of the trees in various parts of the country shown on the contour map. From their numbers an estimate of the energy absorbed in the different directions could be made. It was found that by adding the energy absorbed by the earth to the energy absorbed by the trees in a given direction, the predicted value of signal strength came much closer than before to the values found by experiment; in fact, the agreement now was remarkably close.

It thus appears that we need not look further than to the effect of trees to explain both why the attenuation varies with direction, and why the signal strength is weaker everywhere than theory predicts."