Marconi Quadrant Aerials

The Quadrant Aerial is a special form of horizontal dipole of which the horizontal radiation pattern is practically omnidirectional. It has several useful applications: as a transmitting aerial, its particular value is for high-frequency services in tropical and semi-tropical regions over distances between 500 and 2500 km. As a receiving aerial, it can be of great use at the central station of a network. Though the gain in any direction is somewhat less than that of a co-linear dipole broadside on to the direction, the qaudrant aerial radiates almost equally well in all directions, which the dipole does not at these distances. The quadrant aerial consists of a horizontal 'V' dipole with an included angle of 90°, fed in balanced fashion at its apex. The horizontal radiation pattern most nearly approaches a circle when the arm lengths are slightly less than half a wavelength, but the deviation from a circle is less than ±3 dB when the armlengths are between one-third and two-thirds of a wavelength. The vertical plane polar diagram is similar to that of a simple horizontal dipole, and it has the same dependence on height above ground.

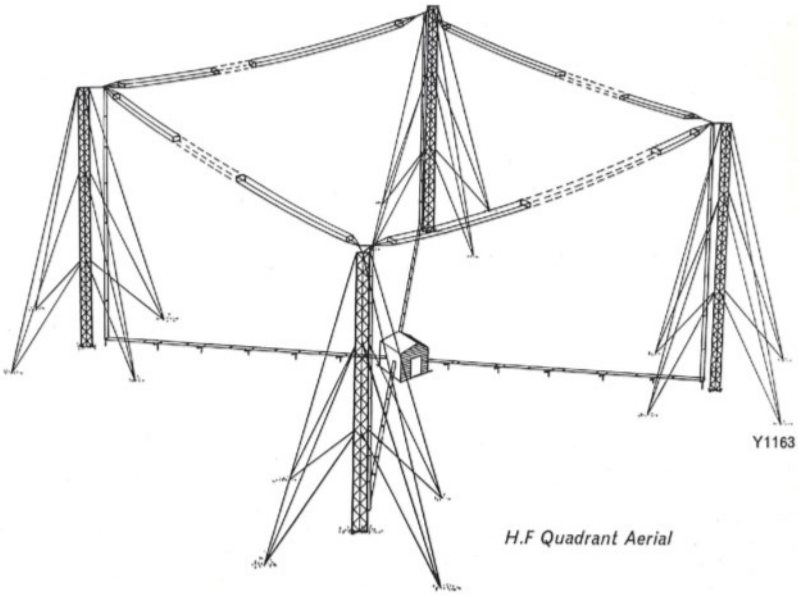
A single h.f quadrant aerial requires three masts to support it, but four aerials covering different bands may be erected on four masts, and it is in this form that a set of quadrant aerials is usually supplied. At power levels above a few hundred watts it is recommended that the aerial should be regarded as a spot frequency radiator and matched to the 600 Ω feed at the working frequency.

For general-purpose reception, the aerial can conveniently be used over a 2:1 frequency range, and a set of four aerials can then be used to cover the complete high-frequency communication spectrum with adequate overlap.

For example:

2·5 to 5 MHz.
4·5 to 9 MHz.
8 to 16 MHz.
14 to 28 MHz.

It is frequently feasible to erect all four aerials at the same height. This is because the low-frequency aerials will generally be used for short-distance reception, for which the arrival angles are high, and the high-frequency aerials are used for long distance reception for which the arrival angles are low. Thus heights between 0·15 and 0·25 of a wavelength are appropriate for the low-frequency aerials, and heights of the order of 1·5 wavelength would be suitable for the highest frequencies.



H.F Quadrant Aerial

It should be appreciated that the signal strength radiated in a particular direction by the quadrant aerial is, in general, slightly less than that radiated by a co-linear dipole arranged broadside on to that direction. On the other hand, the quadrant has the advantage in giving a high average signal strength to a range of stations in various directions. Nevertheless, a plain co-linear half-wavelength dipole is practically omni-directional for short-distance skywave transmission, say distances from 50 to 500 kilometres and accordingly, over this distance, the quadrant aerial is unlikely to show any advantage.

The greatest utility of the quadrant aerial for transmitting purposes is likely to be for ranges from about 500 to 2500 kilometres. Greater distances are not likely to be of interest for omni-directional transmission since the change in transmission conditions is usually such that different frequencies are required in different directions, and it is frequently considered better engineering to use less transmitter power with high-gain directional aerials.

DATA SUMMARY

Frequency range: 2·0–28 Hz. For transmitting, the quadrant is spot matched on site to the working frequency and is preferably designed for desired polar diagrams as to length and height above ground. For receiving, a bandwidth of approx. 1·8:1 inside an s.w.r of 2:1 can be expected, but the actual frequency range falling within this s.w.r limit also depends on the height of the quadrant above ground.

Input impedance: Receiving and transmitting quadrants are designed to match into 600 Ω feeder.

Polarization: Horizontal.

Radiation pattern: Horizontal (approaching circular).

Power handling capacity: Up to 20 kW average.

Maximum wind velocity: 100 m.p.h wind velocity.

Maximum gain: Max. gain 6 dB with respect to an isotropic source.

THE MARCONI COMPANY LIMITED
Radio Communications Division

Marconi House, Chelmsford, Essex
Telephone: Chelmsford 53221. Telex: 99201
Telegrams: Expanse Chelmsford Telex