Horizontal Task for TRANSRADIO

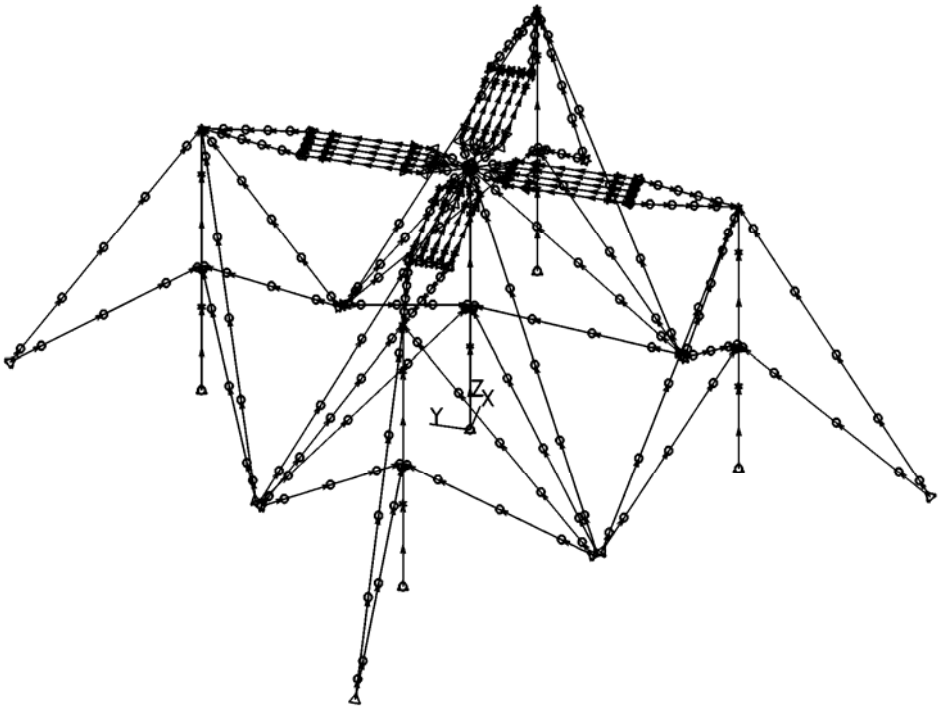
By Bernd Waniewski

Mainflingen, Germany
TRANSRADIO SenderSysteme Berlin AG recently was tasked with building a horizontal cross dipole antenna for medium-wave broadcasting from the Deutsche Telekom Mainflingen Transmitter site, about 35 kilometres southeast of Frankfurt am Main, Germany.
Horizontal antennas have a special property of providing skywave propagation in the evening and overnight.
The aim is to obtain coverage of several hundred kilometres without a large fading zone due to the interference from groundwave and skywave associated with using a vertical antenna.

Horizontal cross dipole antenna for MW broadcasting in Mainflingen (Germany)

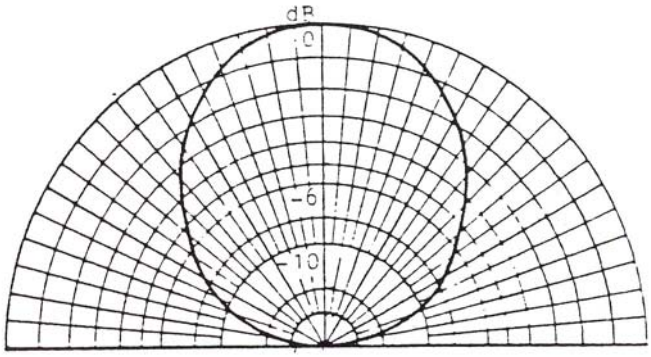
Guided supporting masts

Until now, only a few horizontal medium-wave broadcasting antennas have been erected. These included a directional antenna with two folded dipoles in parallel, also installed at Mainflingen, and test antennas for vertical radiation at Beromünster and Sarnen in Switzerland. None of these is still in operation.
There is also a half-wave folded dipole in Wolvertem, Belgium, still standing but not in use, and a cross dipole antenna in Arganda, Spain, that is still used to cover whole of Spain.
Another cross dipole antenna in Berlin –Britz served East Germany before the unification, but it has since been dismantled.
The cross dipole antenna in Mainflingen consists of five guided supporting masts and the two horizontal dipoles arranged orthogonally atop of the masts.



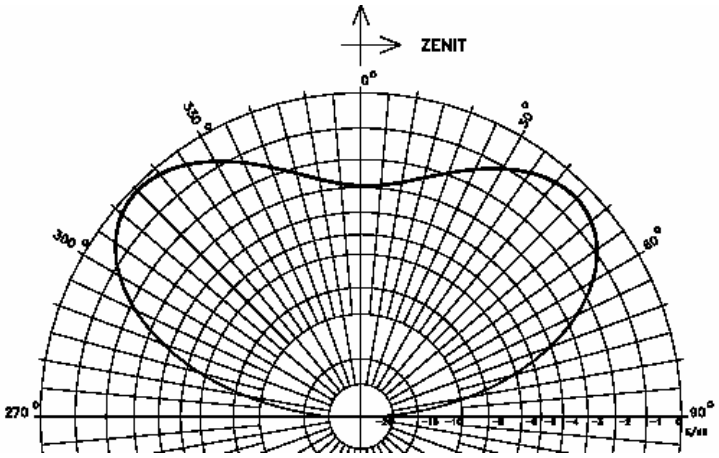
Computer model

The most important criterion for the shape of the vertical pattern is the suspension height of the dipoles. The radiation pattern must have the maximum in the vertical direction when the skywave coverage is for short distance. It is possible to achieve this by means of low suspension height, for example one-tenth of the wavelength (0,1 λ).



Vertical pattern of cross dipole antenna
for suspension height of 0.1 λ

A much larger coverage area was necessary for the cross dipole antenna in Mainflingen. A suspension height of four-tenths of the wavelength (0,4 λ) was chosen in order to obtain a broader vertical pattern.



Vertical pattern of cross dipole antenna
for suspension height of 0.4 λ

Furthermore, the polarization of the vertically radiated waves must correspond to the polarization of the ordinary wave. The wave, being incident to the ionosphere, splits into an ordinary and an extraordinary wave.
The extraordinary wave is attenuated nearly completely, and thus does not contribute to the fieldstrength received at the ground.

Correct sense of rotation

Only the correct sense of rotation of the polarization excites the ordinary wave. Therefore, the two dipoles are fed with the same amplitudes but with a phase shifting of 90 degrees. The dipole located in the x-axis leads to the dipole located in the y-axis.
Each dipole is fed via 75-ohm cable, which is supplemented to a balun by an additional outer cable.
It is possible to ensure the matching of the dipole impedance to the characteristic impedance of the cable by properly choosing the length of the dipole and the length of the balun.
The four outer masts are insulated at the base. The base insulator is bridged by an inductance. When varying the value of this inductance, it is possible to minimize the excitation of the vertical mast, avoiding groundwave propagation into villages near the antenna site.

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Source: Radio World International January 2006