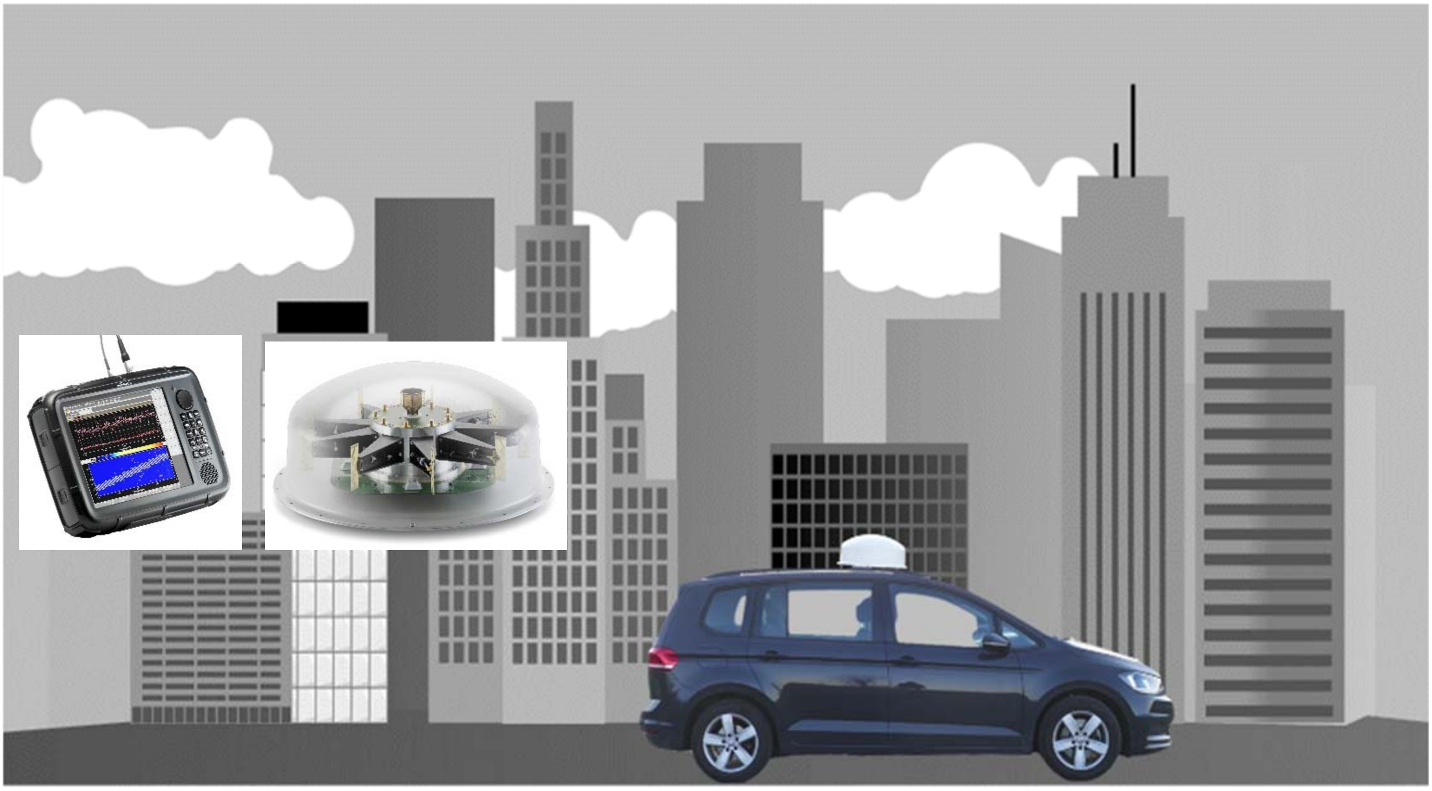
Elevation measurement

How does the SignalShark combined with the automatic direction finding antenna ADFA measure the elevation, and why?

With the aid of the ADFA automatic antenna, the SignalShark can determine the direction of a transmitter. However, it does not just indicate the direction or azimuth, but also the elevation in frequency ranges where the principle of correlative interferometry is used. That is not something that would normally be expected of an antenna that is used to determine the direction of a signal. This article will explain how direction finding with a single channel antenna works generally, and why measurement of the elevation is important when direction finding a signal.

- How single channel radio direction finding works
- Calibration of azimuth and elevation
- Measurements in urban areas and when approaching the emitter



The elevation is displayed during a measurement with the SignalShark and ADFA. The real benefit of this is that direction finding even in urban areas is stable and precise. But what does that have to do with the elevation? To get a better understanding of that, here's a brief explanation of the measurement principle behind a single channel DF antenna. The display of the elevation is not the main reason for the measurement.

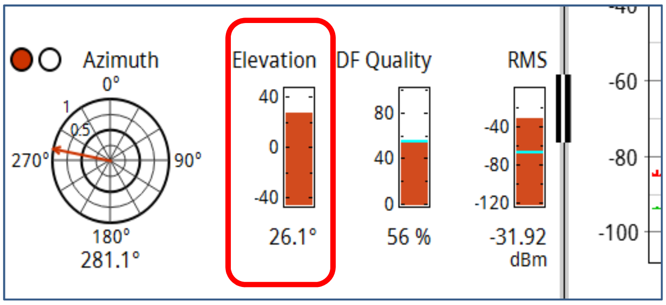


Fig. 1. *Display of elevation during a measurement with the SignalShark and ADFA.*

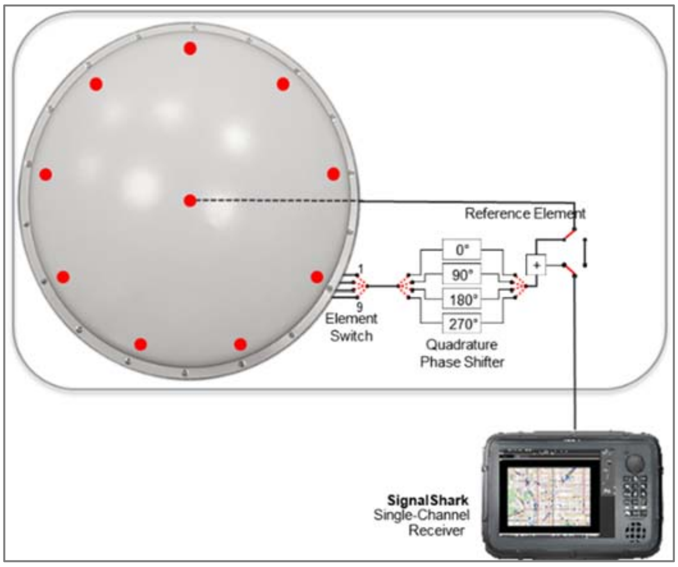


Fig. 2. *Basic configuration of the single channel ADFA direction finding antenna.*

Single channel direction finding measurement is based on the principle of measuring the phase difference of the incoming signal at the dipoles in a circular array in the antenna. This results in a pattern of phase angles between the antenna elements for each angle of incidence. This pattern is compared with a catalog of patterns.

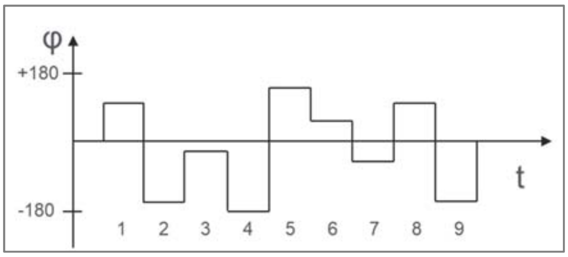


Fig. 3. *Example of a phase angle pattern.*

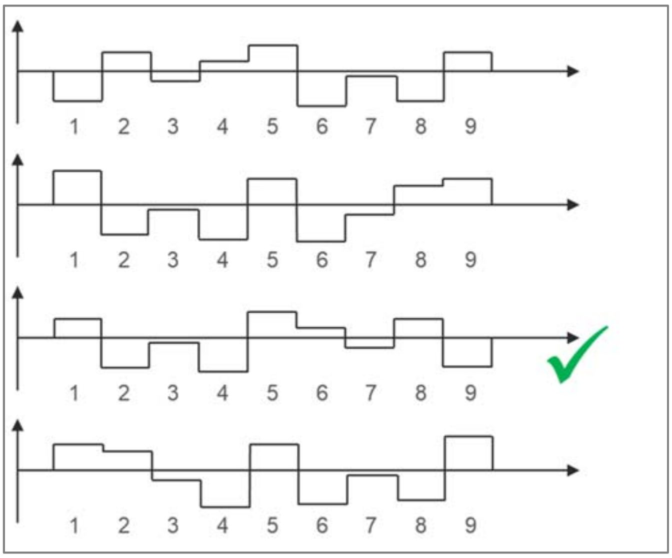


Fig. 4. *Catalog of possible phase angle patterns stored in the SignalShark.*

This catalog is initially determined for each type of antenna in a test field, and is then recorded in the SignalShark. This is not just done in the four directions shown in figure 4. Rather, a large number of meaningful directions and frequency steps are chosen. In fact, the degree to which the actual measurement results correspond to the catalog values is described by the DF quality parameter.

Fig. 5. *The antenna is rotated in the test field at different frequencies to determine the catalog.*

Normally, these catalogs only contain reference values for the horizontal plane, since this is the plane in which the direction basically determined. At a great distance from the transmitter, this is, of course, correct. But in an urban environment, the signals may not impinge on the antenna only in the horizontal plane. As the source is approached, the signals may be coming from above, i.e. with a certain elevation relative to the antenna. This elevation will also have an effect on the phase differences that are determined. If there are no reference values recorded in the catalog for such a situation, the DF quality is degraded and it is even possible that the measurement results will be incorrect.

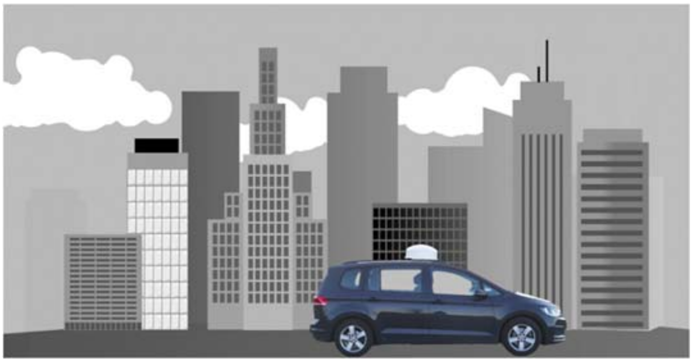


Fig. 6. *The closer that the test vehicle gets to the source and the higher the source is in relation to it, the angle of incidence of the signal on the antenna is no longer horizontal but is at an angle from above, the elevation angle.*

To avoid this, the ADFA1 and 2 automatic antennas from Narda are also calibrated for elevation and these values are likewise included in the catalog.

This ensures that the Narda direction finding antennas will still deliver stable, precise, and reliable data even when approaching the source, where this is of course particularly important. When purchasing an automatic antenna, it is good to make sure that it can also handle elevation. The ADFA1 and 2 from Narda both cover an elevation range from +40° to -20°, so that exact direction finding is possible even in hilly terrain.

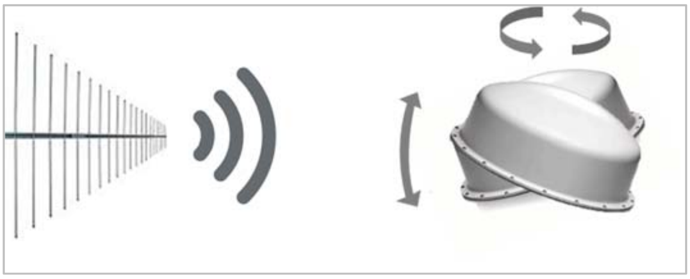


Fig. 7. *Narda antennas are both rotated and tilted during the determination of the phase catalog.*

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