Mounting DF antennas

Hints and guidance for mounting the Narda SignalShark Direction-Finding Antennas

Automatic DF antennas such as the Narda ADFA 1 and ADFA 2 models are characterized by high DF speed and accuracy in combination with the measuring receivers of the Narda SignalShark series. The ADFA 2 also covers an extremely wide frequency range. The specifications of such an antenna are always determined in an ideal environment, i.e. free of reflections and other disturbing influences.

In reality, however, the place of use is subject to more or less unfavorable ambient conditions. These environmental conditions, which are not ideal but real, can lead to field distortions which are visible in the measurement result. If an already distorted field reaches the measuring antenna, the antenna will measure exactly the distorted field. Special attention must therefore be paid to avoiding field distortions.

In mobile direction finding, e.g. on the roof of a vehicle, many interfering factors can be avoided.

Lightning protection is often not necessary and when localizing with a heat map, the statistical process can eliminate many reflections due to the permanent change of position.

A stationary mast installation poses a special challenge. Mast, buildings or parts of buildings, other antennas, lightning rods etc. have a non-negligible influence on the field and thus on the measurement result. On the other hand, the effects are of a systematic nature and can be compensated in wide areas by adjusting the installation.

No installation site corresponds to the other; therefore, a general installation note can only have a recommendatory character and give hints. The actual execution of the installation at the place of use therefore requires precise planning and execution in order to obtain optimum DF results.

Narda SignalShark family in the variants (from left to right):
Measuring Receiver Handheld, Measuring Receiver Outdoor Unit, Automatic DF Antenna ADFA, Measuring Receiver Remote

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In general, the best method is to avoid field interference. Then nothing has to be compensated afterwards. However, unfortunately, the environment of the measuring antenna is often already predetermined. Nevertheless, a lot can be achieved with little effort.

1. The mast

A non-conductive mast made of e.g. plastic is ideal. Often, however, metal masts are already specified or absolutely necessary. For frequencies above a few 100 MHz, the interference is relatively low. However, if the ADFA 2, which is specified from 10 MHz, is installed on a metallic mast, the following must be observed:

At frequencies below 200 MHz, the ADFA 2 uses the Watson-Watt principle for DF. The advantages are high DF sensitivity combined with small size. And small size in return means a low wind load.

One prerequisite for accurate direction finding using the Watson-Watt principle is far-field conditions, i.e. orthogonality between the electric and magnetic fields. A metallic mast has strong field overshoots at its ends when the self-resonance is reached. These distort the field at the DF antenna location. To reduce such interference, Narda offers a non-metallic antenna adapter. This is mounted between the end of the metal mast and the ADFA and allows this effect to be minimized.

2. The RF and control cable

Another component that can have a significant influence on the DF result is the RF cable. Its influence can be greatly reduced by the use of ferrites. The Narda RF and control cables are therefore beaded with ferrites as standard. If one wants to operate the ADFA 2 up to its lower frequency limit, additional ferrites (e.g. snap ferrites) should be added on the cable in the area of the non-metallic mast section. Antenna factor and cable attenuation are automatically taken into account or corrected when using Narda antennas and Narda RF cables.

3. Lightning protection

In case of exposed installation, e.g. on a building roof, lightning protection is indispensable. However, a lightning rod represents a monopole in terms of RF and reflects the incident signal. Since the measuring accuracy has to be subordinated to the safety against a lightning strike, the lightning rod must be as "invisible" as possible from the RF point of view. In cooperation with Dehn SE + Co KG, Narda has succeeded in developing a lightning rod that is almost transparent from an RF point of view due to the use of ferrites. Thus, it influences the DF results only insignificantly. Nevertheless, it fulfills its actual purpose, i.e. lightning protection.

Corrective measures

The above mentioned hints help to create better conditions for a perfect bearing. However, if the metallic mast resonates due to its length or if the reflective operating space for the elevator cannot be removed, then the only option left is subsequent correction.

4. Omni Phase Correction

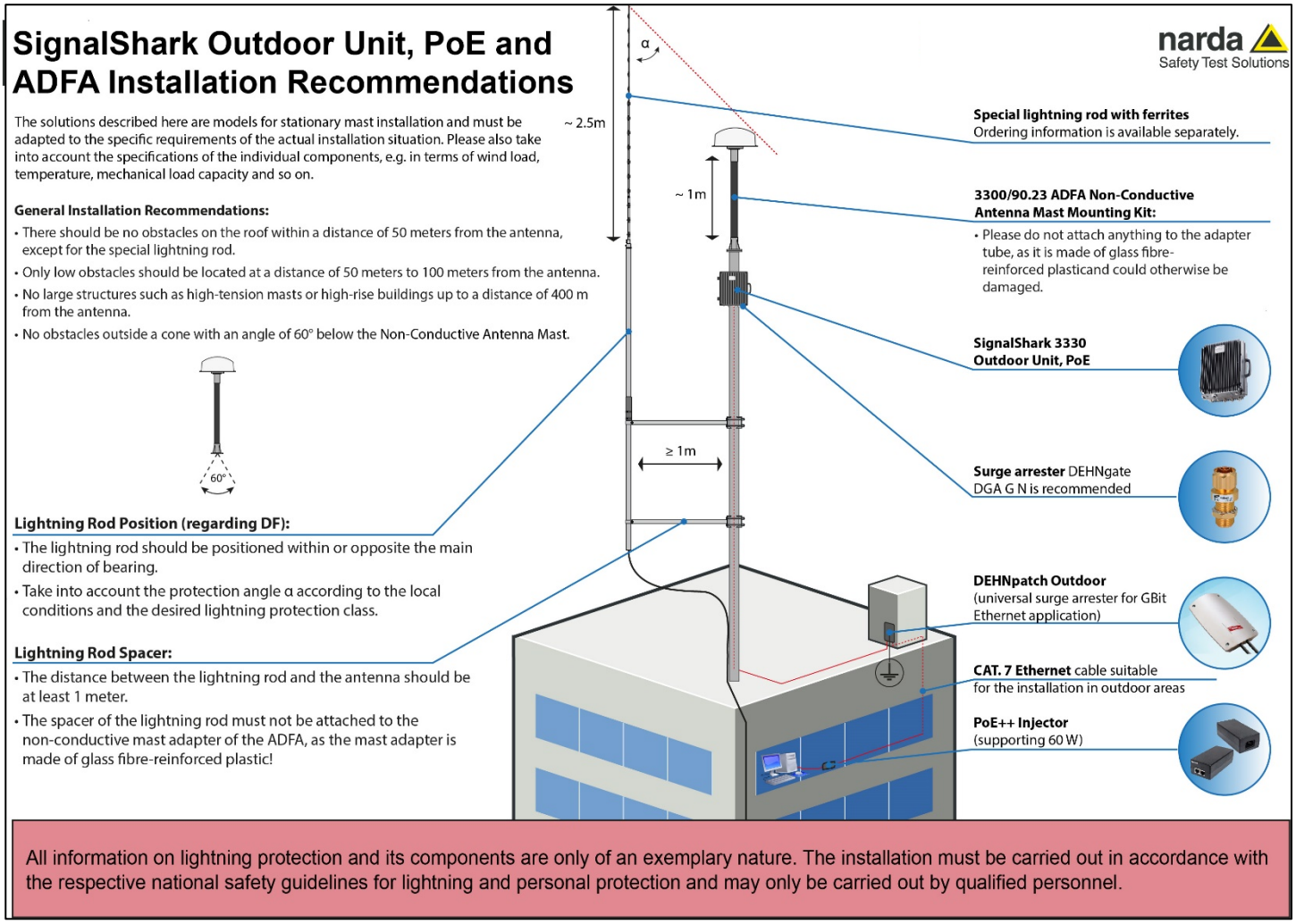
Especially at very low frequencies and large mast lengths ambiguities of the display may occur despite the above mentioned measures. This means that the bearing result is abruptly shifted by 180° below a certain frequency. This jump is systematic, can be measured and then compensated in wide ranges, except at the jump point itself.

5. Azimuth correction

Static effects caused by objects in the near environment, e.g. reflections of other antennas, parts of buildings, lightning rods, etc. are systematic in wide ranges and can then be compensated.

For both omni phase correction and azimuth correction, input options are in preparation at the SignalShark receiver, so that after a determination and input of this data, the displayed bearing results are automatically corrected.

SignalShark Outdoor Unit, PoE and ADFA Installation Recommendations



The solutions described here are models for stationary mast installation and must be adapted to the specific requirements of the actual installation situation. Please also take into account the specifications of the individual components, e.g. in terms of wind load, temperature, mechanical load capacity and so on.

General Installation Recommendations:

- There should be no obstacles on the roof within a distance of 50 meters from the antenna, except for the special lightning rod.
- Only low obstacles should be located at a distance of 50 meters to 100 meters from the antenna.
- No large structures such as high-tension masts or high-rise buildings up to a distance of 400 m from the antenna.
- No obstacles outside a cone with an angle of 60° below the Non-Conductive Antenna Mast.

Lightning Rod Position (regarding DF):

- The lightning rod should be positioned within or opposite the main direction of bearing.
- Take into account the protection angle α according to the local conditions and the desired lightning protection class.

Lightning Rod Spacer:

- The distance between the lightning rod and the antenna should be at least 1 meter.
- The spacer of the lightning rod must not be attached to the non-conductive mast adapter of the ADFA, as the mast adapter is made of glass fibre-reinforced plastic!

All information on lightning protection and its components are only of an exemplary nature. The installation must be carried out in accordance with the respective national safety guidelines for lightning and personal protection and may only be carried out by qualified personnel.

Installation guidance also taking into account the cabling and its lightning protection measures.

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