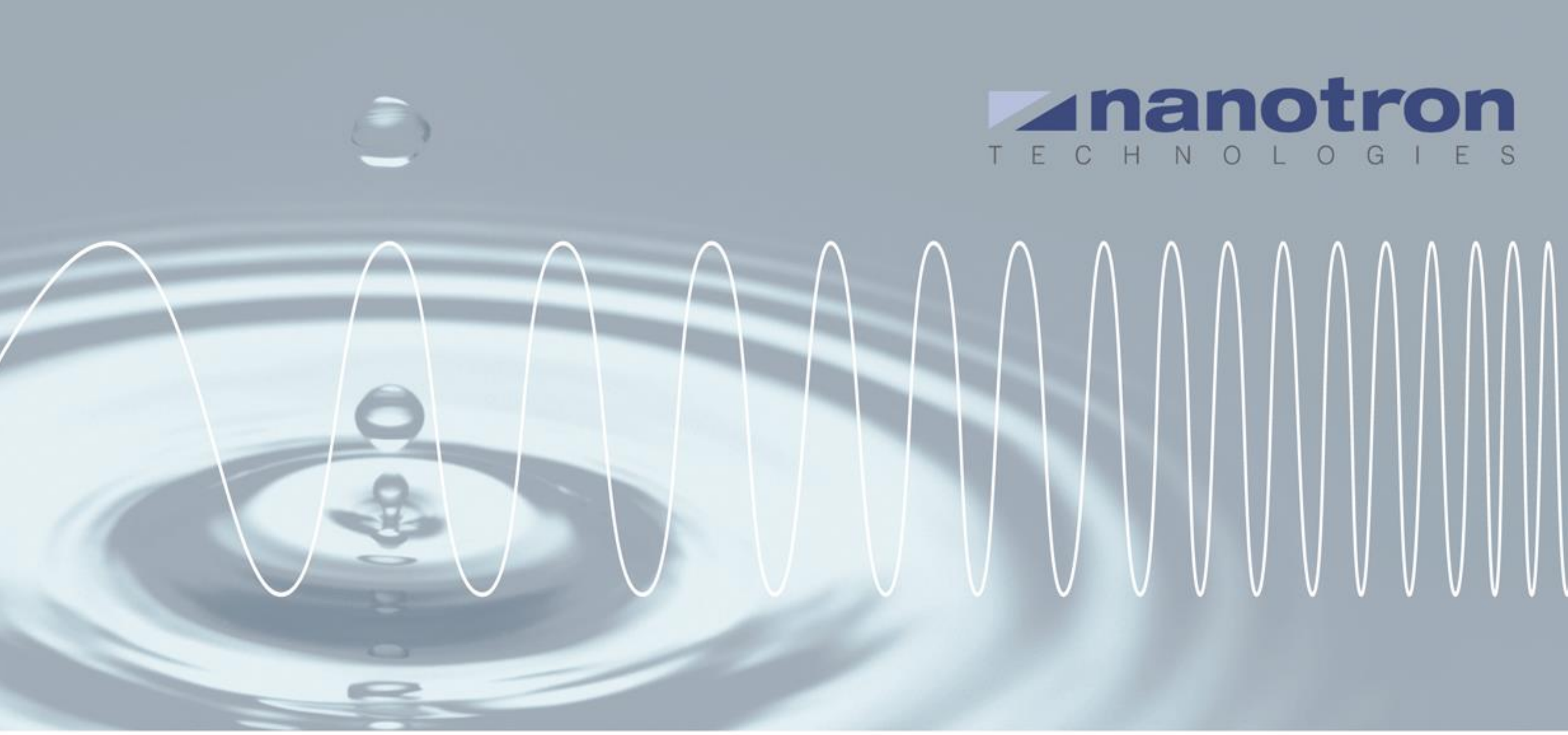

AN0605- Setting the anchor parameters for nanoLES 3

1.0

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1. Introduction

The first step to set up an RTLS is to place the anchors on the field and connect them to the server. But before doing so the user has to decide the areas need to be covered, whether the area should be divided. Once the sections are defined the number of anchors/antennas per section and where they should be placed needs to be planned. Deciding whether the two antennas from a same anchor are on the same position or what kind of antennas are required depending on the specific area are all part of this planning.

As a result the design of the RTLS will lead to the use of cables between anchors and antennas, different antenna types or different antenna positions for the same anchor. This should be taken in to account while defining the used anchors in the nanoLES configuration file. Otherwise it will deteriorate the performance of the location engine.

2. Anchor definition

Each anchor consist of two channels, which the location engine nanoLES 3 treats independently. Each channel can be defined by the parameters: ID, position, delay and attenuation. These parameters, except for the ID, refer to the antennal located at the channel; thus, they can be different for each channel of the same anchor.

By default, and except otherwise specified by the user, the channel parameters are the same for both channels in a same anchor.

In the following subsections each parameter is explained.

2.1. Anchor ID (a_id)

The anchor ID is built from the lower 24 bits of the 48-bit Ethernet MAC address of the anchor. If we have the MAC address of the anchor it will be something like: 18-0B-52-a_id

The two channels of the anchor are identified as channel 0 (ch0) and channel1 (ch1). To refer to a specific antenna the user should write: *<a_id>:0* (for ch0) or *<a_id>:1* (for ch1). If the channel is not specified in the ID, the parameter or instruction will apply to both.

2.2. Position (x,y,z)

The position, with its x, y and z coordinates, can be the same for both antennas or different. When the channel is not specified, nanoLEs will interpret that the position is the same for both antennas. When one antenna is present in multiple sections, a different position can be assign for each section.

The x, y and z coordinates are expressed in meters and with up to 2 decimal digits, for instance 2.35 m.

2.3. Delay (dly)

The tag position is calculated based on the timestamp that signal (or blink) receives at its arrival to the anchor. The time stamping is done by hardware at the arrival to the receiver circuitry. However, the location engine uses the antenna position for the calculation, thus it needs to know the instant at which the signal arrives to the antenna. The time lapse in between the two instants is the delay.
The nanoANQs are calibrated to compensate for that delay when they are used with the same antenna they are delivered with connected directly to the SMA/u.FL connector. When, for instance, a cable is added in between the antenna and the connector the delay has to be adjusted with the parameter antenna delay (dly)
The delay is expressed in ns and with up to two decimal digits. The value of the parameter dly can be different for each antenna. If not defined by the user its value is 0 ns.

2.3.1. Calculation of dly

The formula to calculate the delay is:

$$dly\ [ns] = \frac{length_{cable}[m]}{velocity_{cable}[m/s]}\ x\ 10^9$$

The parameter $velocity_{cable}$ is the speed of the signal through the cable. To know it the user should check the data sheet of the cable. This velocity is often expressed as a percentage, where the 100% is equal to the speed of light in the air, $3\ x\ 10^8$ m/s.

Figure 2-1 is part of a datasheet where the user can find the velocity in the cable for a certain cable. As it indicates 80%, the velocity in the cable will be 80% of the speed of light, which is equal to $2.4\ x\ 10^8$ m/s

Electrical properties

		MRC 195 ECO (0.94/2.79)
DC resistance (Ω/km)	Inner conductor	25.3
	Outer conductor	19.7
Mutual capacitance	pF/m	84
Velocity ratio	%	80

Figure 2-1 Data sheet indicating the velocity in the cable *(source: Macra, MRC_eco, Version 1.1)*

2.4. Attenuation (att)

Every time an anchor receives a signal (blink) it measures its signal strength (RSSI). When the anchor passes the data to nanoLES, the location engine estimates the position of the tag in every section where the blink was detected. At the end of the process the location engine needs to decide in which section the tag actually is. The decision is taken based on the RSSI values of the detected signal. Moreover, the values at each antenna are offered at the output port. If required, the user can utilize them for some post processing.

The signal strength is measured at the receiver circuitry, thus it is influenced by the antenna or any other component before the receiver circuitry. For the RSSI values to be meaningful, toss or gain influences of such components should be normalized. To do so the parameter Antenna Attenuation (att) should be used.

The Antenna attenuation is given in dB and with up to two decimal digits. Its value can be positive or negative; positive attenuation means losses and negative attenuation gain. If not defined by the user its value is 0 dB.

2.4.1. Calculation of att

When all the anchors in the system are used with the similar antennas, or cables in between the antenna and the anchor, all RSSI values will suffer the same attenuation. In this case the att parameter can be left equal to 0 dB. This is the situation when the anchors are used as they were delivered, with the same antennas and no cables.

When different antenna gains and other components, like cables, are used the attenuation parameter should be adjusted.

The formula to calculate the attenuation is:

$$att\ [dB] = -G_{antenna}[dB] + L_{cable}[dB] + L_{others}[dB]$$

$$L_{cable}[dB] = coef\ x\ cable\_length[m]$$

Where $G_{antenna}$ is the antenna gain and L_{cable} is the attenuation added by the cable, given in the datasheet.

Attenuation (dB/100m)

nominal

Frequency (MHz)	MRC 195 ECO (0.94/2.79)
30	6.5
150	14.6
220	17.7
450	25.5
900	36.5
1800	52.5
2500	62.4
5200	92.9

Figure 2-2 Cable data sheet indicating its attenuation (source: Macra, MRC_eco, Version 1.1)

The parameter L_{cable} is given in the data sheet of the cable, as shown in Figure 2-2 normal as dB of attenuation per 100 meters. The user should select the value for a frequency of 2500 MHz.

3. References

[1] nanoLES 3 User Guide, v 1.5, nanotron 2017
[2] nanotron Toolbox 3, nanotron, 2016

Document History

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28/3/2017	MLA	1.0	Initial version

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Further Information

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