



AN0604 - Sending messages from the RTLS to the tags

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Application Note

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1. Introduction

This document explain how to send custom data from a client to a remote device or tag using nanoLES or a nanoANQ. The remote tag will be either a nanoTAG or a swarm bee. The explained methodology can be used to reconfigure the tags' settings as well as to transmit data messages to swarm devices (not to nanoTAGs).

2. Using nanoLES to send messages

nanoLES provides a tag backchannel interface, which allows to send messages to tags. The user only needs to tell nanoLES the message that he wants to transmit and the ID of the destination tag, and nanoLES takes care of the rest. However, it also supports the option of selecting the anchor that will be used to carry out the operation.

When nanoLES receives the order to send a message through the back channel, it checks which anchor is the best suited to do so (normally anchor that is closest to the tag) and passes the instruction to that one including the message and the destination ID. Once the anchor has received the instruction, it will wait until the destination tag opens its reception window and, at that moment, it will forward the message. Both the transmission by the anchor and the reception by the tag are acknowledged; thus, the client can always know whether the operation was successful or not.

nanoLES backchannel does not implement the broadcast operation. Thus, when the same message needs to be transmitted to multiple tags the client needs to handle one unicast back-channel operation per tag. The duration of each operation can be from some milliseconds up to the blinking interval time, fixed by the user, of the device. As each operation can only start after the previous one has been finalized the whole process could require some time.

To find more information about how to handle the nanoLES back-channel, please refer to [1].

3. Using a specific anchor to send messages

The nanoANQs are capable of sending unicast and broadcast messages. Unicast messages can be sent immediately or delayed. The delay though is not set by the user; the anchor will wait until the destination device opens its reception window to transmit the message. This option is recommended when the destination tag works in low power mode. Broadcast messages can also be sent immediately, but, as they are sent to many devices that may be in different power modes, it is recommended to use the delayed option for them. When this option is selected the anchor keeps the message in memory and retransmits it every time a reception window (of any tag) opens. The anchor keeps doing so until the broadcast is cancelled by the client.

The communication with the nanoANQ is not realized through nanoLES. In this case an Ethernet connection should be open and the UDP protocol must be used. When a UDP packet is sent from the client to the anchor (UPLINK) the anchor answers with a UDP acknowledgement (ACK) message.

3.1. UDP messages format

The format of said messages should be as follows:

UPLINK:

<type> <version> <address> <command_type> < length> <payload>

Where the different fields are:

uint16 type	0x0103 (uplink, from the client to the anchor)
uint16 version	0x0001 for nanoTAG 0x0002 for swarm bee device
uint8 address[6]	tag mac address (destination)
uint8 command_type	0x00 immediate transmission 0x01 delayed transmission
uint8 length	length of payload 0 = cancel pending packets
uint8 payload[128]	

The field length has two functionalities: First it indicates the payload length. Second, when its value is 0x00, it indicates that a pending operation must be cancelled. A pending operation can be, either a delayed unicast transmission that has not yet been executed, or a broadcast operation currently on going.

ACK:

uint16 type	0x0106 (ACK)
uint16 version	0x0001 for nanoTAG 0x0002 for swarm bee device
uint8 address[6]	tag mac address (destination)
uint8 error	0x07 success 0x0C no ack

The field error indicates whether the message was successfully transmitted to the tag or, on the contrary, the message was not acknowledged by the device. The reason for this no-ack could be a message that cannot be interpreted by the tag, it gets lost never reaches the destination,...

3.1.1. Payload protocols

Depending on the targeted device type the message is intended to, a certain protocol must be fulfilled. Otherwise the packet will be dropped, or will lead to unexpected results.

Change of the configuration of the tag (API commands)

In this case both when the tag is a nanoTAG and a swarm bee device the payload should be a backchannel message. This should follow the format as explained in [1]

User message

It is only possible to send user messages to swarm bee devices; a nanoTAG can never be the destination of such a message.

The format of the payload is:

<type> <version> <user_data>

uint8 type	0x08 (DATA_TAG)
uint8 version	0x12 (VERSION)
uint8 user_data [x]	x =126 in unicast messages x =112 in broadcast messages

3.2. Examples

3.2.1. Send a unicast message during next reception window

A user wants to send a data message to a swarm device which is in low power mode with the content "zone 2 entered". The tag ID is 0000656EB681 and the user selects an anchor with IP 192.168.1.1. For that he needs to open an Ethernet connection at port 4646 with that anchor and send the corresponding UDP message.

To build the UDP message we need to follow the previously seen structure:

uint16 type	0x0103 (uplink, from the client to the anchor)
uint16 version	0x0002 for swarm bee device
uint8 address[6]	0x0000656eb681
uint8 command_type	0x01 delayed transmission
uint8 length	0x10 (16 bytes)
uint8 payload[128]	<type> <version> <user_data> type 0x08 (1byte) version 0x12 (1byte) zone 2 entered → 0x7a6f6e65203220656e7465726564 (14 bytes)

The UDP message to the anchor will be:

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0x010300020000656eb681011008127a6f6e65203220656e7465726564

The nanoANQ will wait until it receives a blink from the swarm bee 0x0000656eb681 indicating that the reception window is open. At that moment, it sends the following message to the swarm device: 0x7a6f6e65203220656e7465726564

After the transmission the nanoANQ sends back the transmission status to the client; in this case:

0106 0002 0000656EB681 07 where

type 0x0106 ACK

version 0x0002 communication with a swarm device

address 0x0000656eb681

error 0x07 successful

3.2.2. Broadcasts to a group of swarm devices

A customer wants to send a data notification to all swarm devices seen by a specific anchor with the content "Alarm: leave area".

It is possible that many devices are in different power modes; thus the best option is to select a delayed transmission. The UDP message will be:

uint16 type 0x0103 (uplink, from the client to the anchor)

uint16 version 0x0002 for swarm bee device

uint8 address[6] 0xffffffff for a broadcast transmission

uint8 command_type 0x01 delayed transmission

uint8 length 0x13 (19 bytes)

uint8 payload[128] <type> <version> <user_data>

type 0x08 (1byte)

version 0x12 (1byte)

Alarm: leave area → 0x416c61726d3a206c656176652061726561 (17 bytes)

Everything together:

0x01030002fffffffff01130812416c61726d3a206c656176652061726561

The main difference with respect to the previous example is that the anchor will keep retransmitting the message every time that it detects an open reception window. To stop this behavior the user should send the cancellation command. For that another UDP message is required:

uint16 type 0x0103 (uplink, from the client to the anchor)

uint16 version 0x0002 for swarm bee device

uint8 address[6] 0x000000000000 no actual transmission will occur

uint8 command_type 0x00

uint8 length 0x00 to indicate cancellation of the current task

uint8 payload[128] no payload is required

The message will be 0x010300020000000000000000

4. References

- [1] AN0602 - RTLS tag back channel v.1.1, nanotron Technologies, 2016

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