AN0520 - How to interpret error codes of notifications

1.0

Document Information

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Trademarks

Contents

1. Introduction

As explained in [2] many factors can influence the wireless communication. Despite of the very high success rate, the interaction of multiple devices and the external factors of the environment could result in some unsuccessful transmission. When this happens the swarm bee LE device informs the user/controller within the regular notification. It is up to the user then to retry and repeat the operation.

There is not a specific notification to indicate problems. All transmission notifications include a field called <ErrorCode> and used to indicate the success, or not, of the operation. Next section list the operations that generate a notification and the notification types.

This document refers to the swarm bee LE products.

2. Error codes in the notifications

To identify the error codes in the notification we first need to know what kind of notifications we can have and when they can be generated. We have defined two types of notifications that contain an error code. They are explained in the following subsections. Deeper information can be found in [1].

2.1. Operations triggering notifications

The data transmission notification indicates that a unicast message has been transmitted. It can be generated by the *swarm* bee after the reception of the commands SDAT and BDAT.

2.1.1. SDAT (send data)

This command can be used for an immediate transmission (option = 0) or for a delayed transmission (option = 1). In the latter case, the transmitting device waits until it receives a blink from the destination indicating that its receiving window is open. At that moment the transmitting device sends the message. The goal of the delayed transmission is to make sure that the message is transmitted when the receiver at the destination is active.

The synchronous response to the SDAT command depends on the selected option:
>   <Option=0>: =<ErrorCode>
>   <Option=1>: =<PayloadID>

If option 1 is selected, an additional asynchronous notification, *SDAT, is generated when the operation is performed, regardless of whether it is successful. This *SDAT notification is always identified by the corresponding <PayloadID>.

2.1.2. BDAT (broadcast data)

Similarly to the SDAT command the BDAT command can be used for an immediate transmission (option = 0) or for a delayed transmission (option = 1). If option 0 is selected an immediate message is broadcasted. Thus, no acknowledgement (ack) is expected and no the message is retransmitted. If option 1 is selected a unicast message is transmitted every time a blink, indicating reception slot open, is received. The destination of the message will be the source of the received blink. As for a normal unicast message, and ack is expected. The transmitting device keeps on transmitting after every blink until the timer reaches the timeout indicated by the user or it received the command BDAT 2.

The synchronous response to the BDAT command is similar to SDAT:
>   <Option=0>: =<ErrorCode>
>   <Option=1>: =<PayloadID>

When option 1 is selected, the BDAT command with option 1 will generate an asynchronous notification *SDAT every time it sends a unicast message. They all will be identified by the corresponding <PayloadID>

2.1.3. RATO (range to)

Similarly to the data transmission commands, RATO can be used for the immediate transmission of a ranging request to a certain device (option = 0) or for to request the transmission of the ranging request after the reception of a blink from the required device.

The synchronous response to the RATO command depends on the option selected:
>   <Option=0>: =<ErrorCode>, <RangingResult>, <RSSI>
>   <Option=1>: =<ErrorCode>

More information about the ranging process both triggered by the RATO command or by the reception of a node ID blink can be found in [3].

2.1.4. Asynchronous ranging operation

The ranging notification can be generated by an API command (RATO) or by the reception of a node ID blink that triggers a ranging operation.
Whether all blinks trigger such a behavior or not is determined by the swarm bee settings. More details can be found in [1]

2.2. Notifications

2.2.1. Synchronous notifications

Response to SDAT / BDAT <Option=0>: =<ErrorCode>

Table 2-1 Error codes after an immediate message transmission

ErrorCode	Definition	Explanation
0	success, data communication valid	
1	no hardware ack received	Only for SDAT Data was sent but the destination device did not send an acknowledgement back, after three retransmissions the swarm device stops the operation.
2	overload, try again later	It can be due to many reason: the channel is busy and CSMA timer expired, the radio is busy transmitting other message…

Response to RATO <option=0>: =<ErrorCode>, <RangingResult>, <RSSI>

Table 2-2 Error codes for an immediate RATO command

ErrorCode	Definition	Explanation
0	success, ranging result valid	
1	ranging to own ID	The swarm device is trying to range with itself, which is not possible.
2	no hardware ack received	A ranging request was sent but the destination device did not send an acknowledgement back, after three retransmissions the swarm device stops the operation.
3	ranging unsuccessful, ranging timer expired	A ranging request was sent and acknowledged. But when the timer expired the expected ranging messages had not been received yet.
5	overload, try again later	The radio is busy at this moment
6	medium blocked; CSMA timer expired	Before transmitting the message the swarm device started the CSMA mechanism but it did not succeed to find the channel free. The CSMA timer expired.

2.2.2. Asynchronous notifications

*SDAT: <ID>,<ErrorCode>,<PayloadID>

Table 2-3 Error codes in the notification SDAT

ErrorCode	Definition	Explanation
0	success, data communication valid	
1	no hardware ack received	Data was sent but the destination device did not send an acknowledgement back, after three retransmissions the swarm device stops the operation.
2	<TIMEOUT>, message could not be delivered	Error specific to SDAT <option=1> The timeout set by the user was reached before the device had the opportunity to send the message.
3	medium blocked; CSMA timer expired	Before transmitting the message the swarm device started the CSMA mechanism but it did not succeed to find the channel free. The CSMA timer expired.
4	unknown	

*RRN: <SrcID>, <DestID>, <ErrorCode>, <Distance>, <NCFG>, <DataNCFG>

Table 2-4 Error codes in the range result notification

ErrorCode	Definition	Explanation
0	success, data communication valid	
1	ranging to own ID	The swarm device is trying to range with itself, which is not possible.
2	no hardware ack received	A ranging request was sent but the destination device did not send an acknowledgement back, after three retransmissions the swarm device stops the operation.
3	ranging unsuccessful, ranging timer expired	A ranging request was sent and acknowledged. But when the timer expired the expected ranging messages had not been received yet.
5	< TIMEOUT>, message could not be delivered	Error specific to RATO <option=1> The timeout set by the user was reached before the device had the opportunity to send a ranging request.
6	medium blocked; CSMA timer expired	Before transmitting the message the swarm device started the CSMA mechanism but it did not succeed to find the channel free. The CSMA timer expired.

3. References

[1] Swarm bee API User Guide v3.0.8, nanotron
[2] AN0519 Transmission mechanism in the swarm bee LE, nanotron
[3] AN0501 swarm bee ranging operation time, nanotron

Document History

Date	Author	Version	Description
14-6-2017	MLA	1.0	Initial version

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