



NAO BlueSpot - BLE Advertising ICD

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1 INTRODUCTION

1.1 Purpose

This document describes the NAO® BlueSpot beacon advertising messages and sequences.

1.2 References

1.2.1 Applicable norms and standards

NAO® BlueSpot beacons are compliant with the Bluetooth Core Specification Version 4.0 and can be configured to comply with Apple iBeacon Proximity Beacon specification R1.

1.2.2 Reference documents

More information about NAO® BlueSpot beacon can be found on our website at <http://www.polestar.eu/fr/produits/beacons-nao-bluespots.html>.

1.2.3 Applicable products and versions

This document essentially apply for the NAO® BlueSpot beacon V3 series, and more generally NAO® BlueSpot products that operate on F3.X (F3X) firmware revisions, or later.

1.3 Document organization

After exposing an overview of the interface in Section 2, applicable messages are specified within section 3 of the document. Section 4 finally describe typical message sequences and explicit related temporal parameters.

2 INTERFACE OVERVIEW

NAO® BlueSpot beacons integrate a Bluetooth Low Energy radio (BLE). NAO® BlueSpot BLE radio implements the “Broadcaster” role as well as the “Peripheral role” as defined in the Bluetooth 4.0 specification, Volume 3, Part C section 2.2.2.1.

Depending on its configuration, NAO® BlueSpot beacons can broadcast or unicast frames from which types are:

- Non-connectable undirected advertising PDU (ADV_NONCONN_IND)
- Connectable undirected advertising PDU (ADV_CONN_IND)
- Scannable advertising PDU (ADV_SCAN_IND)
- Extended inquiry response (SCAN_RSP)

NAO® BlueSpot beacons advertise their PDU successively on the 3 advertising channels (37, 38, 39), each frame being transmitted within a duration of about $T_{adv} \pm 50$ ms time window where T_{adv} is the advertising period.

Advertising period can be reconfigured from $100\text{ ms} < T_{adv} < 10\text{ s}$.

Advertising frames are transmitted with a stable RF power on the 3 advertising channels.

Advertising power can be reconfigured from -27 to +3 dBm.

NAO® BlueSpot beacons generally come configured from factory with a $T_{adv} = 1\text{ s}$ advertising period and a transmit power of +3dBm.

3 MESSAGE DEFINITION

3.1 ADV_V3_WL: “welcome” advertising message

Welcome advertising temporarily comes after beacon power up, thus confirming the correct device activation, before toggling in a normal advertising mode until battery replacement.

3.1.1 Advertising properties

Table 1 describes the welcome message properties.

Frame length	16 Bytes
Frame type	connectable undirected advertising PDU (ADV_CONN_IND)
Applicable versions	F3.X only
Variables	ADV_WL_FN

Table 1 : ADV_V3_WL welcome frame properties

3.1.2 Advertising payload definition

Table 2 defines the welcome message payload.

Offset	Bytes	Variable	Name	Type	Value	Notes
0	1	Fixed	Flags[0]	N/A	0x02	See Bluetooth 4.0 Core specification, volume3, Appendix C, 18.1.
1	1	Fixed	Flags[1]	N/A	0x01	See Bluetooth 4.0 Core specification, volume3, Appendix C, 18.1.
2	1	Fixed	Flags[2]	N/A	0x06	See Bluetooth 4.0 Core specification, volume3, Appendix C, 18.1.
3	1	No	Data Length	uint8	0x0C	See Bluetooth 4.0 Core specification
4	1	Fixed	Friendly Name Data Key	N/A	0x09	See Bluetooth 4.0 Core specification
5	10	Yes	ADV_WL_FN	utf-8	0x 4E414F31413242 3343	i.e. “NAO1A2B3C”

Table 2 : ADV_V3_WL welcome frame payload definition

3.1.3 Variables description

ADV_WL_FN represents the complete Local Name (friendly name), represented by a 9-Bytes long UTF-8 string. The local name starts by the “NAO” header followed by a 6-Bytes long Hex-String representing the product identifier that can be found on the product side label (ex: “NAO1A2B3C”).

3.2 ADV_IBC: iBeacon advertising message

3.2.1 Advertising properties

Table 3 reminds the main Apple® iBeacon message properties.

Frame length	30 Bytes
Frame type	(Non-) connectable undirected advertising PDU (ADV_NONCONN_IND , ADV_CONN_IND)
Applicable versions	F2.X, F3.X
Variables	ADV_IBC_UUID, ADV_IBC_MAJOR, ADV_IBC_MINOR, ADV_IBC_THRES

Table 3 : ADV_IBC frame properties

3.2.2 Advertising payload definition

Please refer to the Apple iBeacon Proximity Beacon Specification - Release R1 document available on <https://developer.apple.com/ibeacon/> for further details on the payload definition and variables description.

3.2.3 Variables description

NAO® BlueSpots come configured from factory with default unique identifiers so as there are no extra-configuration requirement.

By default, NAO® BlueSpot proximity UUID's randomly spread over 16 UUID's.
All proximity UUID's share the same root.

ADV_IBC_UUID_root	504F4C45-5354-4152-0000-00000000000X
ADV_IBC_UUID[]	504F4C45-5354-4152-0000-000000000000,504F4C45-5354-4152-0000-000000000001 504F4C45-5354-4152-0000-000000000002,504F4C45-5354-4152-0000-000000000003 504F4C45-5354-4152-0000-000000000004,504F4C45-5354-4152-0000-000000000005 504F4C45-5354-4152-0000-000000000006,504F4C45-5354-4152-0000-000000000007 504F4C45-5354-4152-0000-000000000008,504F4C45-5354-4152-0000-000000000009 504F4C45-5354-4152-0000-00000000000A,504F4C45-5354-4152-0000-00000000000B 504F4C45-5354-4152-0000-00000000000C,504F4C45-5354-4152-0000-00000000000D 504F4C45-5354-4152-0000-00000000000E,504F4C45-5354-4152-0000-00000000000F

Table 4 : ADV_IBC_UUID variable description

On iOS, Monitoring and ranging NAO® BlueSpot without filtering require registering 16 CLBeaconRegion instances defined by above UUID's.

By default, NAO® BlueSpot come configured with major/minor's that are guaranteed to be unique.

4 MESSAGES SEQUENCES

4.1 SEQ_V3_MAIN

During the first seconds after power-up, NAO® BlueSpot beacon executes a self-test sequence, then should normally starts advertising. In case of a correct activation (i.e. no failing/missing battery detection, nor hardware nor software failure detection), NAO® BlueSpot declares its identity (ADV_V3_WL). During the activation period, NAO® BlueSpot beacons accept connections (ex: for a configuration update or firmware upgrade). They also answer to scan requests (EIR_V3_PSEXT). After the activation period, NAO® BlueSpot toggles in its nominal advertising cycle until battery replacement.

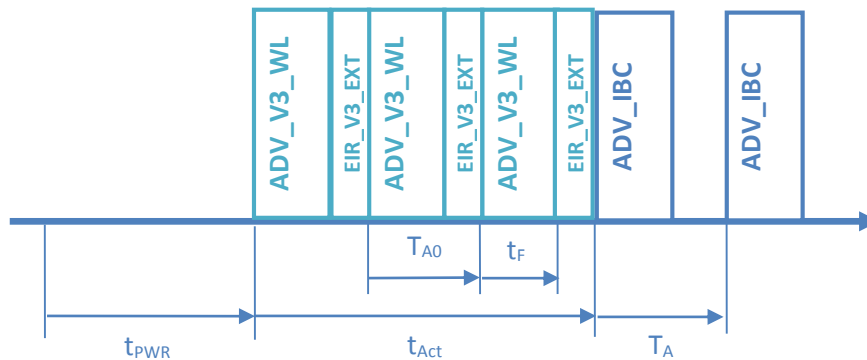


Figure 1 : Boot/Startup sequence description

The nominal advertising cycle consists in periodical emissions of an Apple® iBeacon compliant message (ADV_IBC). During the nominal advertising cycle, the advertising PDU toggles between an undirected non connectable type (**ADV_NONCONN_IND**) and an undirected connectable type (**ADV_CONN_IND**). On the latter, NAO® BlueSpot accepts connections and can also answer to scan requests (EIR_V3_PSEXT).

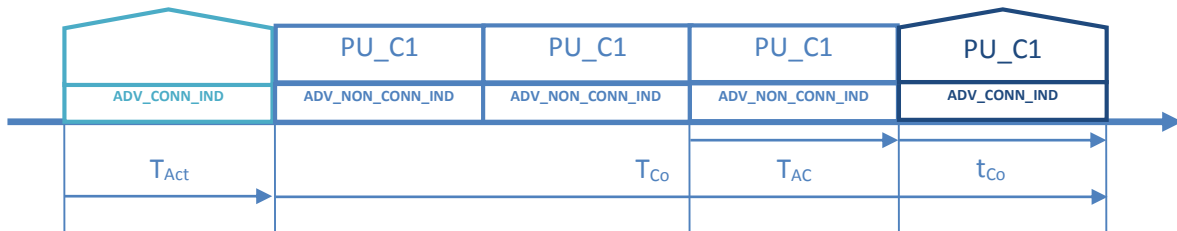


Figure 2 : Connectability sequence description

param	Description	min	max	Typ.	Notes
t_F	Frame duration	2 ms	5 ms	3 ms	Including 3 bursts on 3 channels
t_{PWR}	Power up duration	1 s	15s	3.5s	Depending on batteries insertions
T_{A0}	Boot Adv period	100 ms	10 s	100 ms	
t_{Act}	Activation duration	0 s	5s	1s	
T_A	Advertising period	100 ms	10 s	1 s	
T_{Co}	Connect. period	30 s	30 s	30 s	Fixed
t_{Co}	Connect. duration	1 s	$T_{Co} - 1$	5 s	

Table 8 : Sequence parameters

4.2 SEQ_V3_CUSTOM

In case a custom advertising configuration, Apple® iBeacon compliant message (ADV_IBC) and/or the proprietary scan response content (EIR_V3_PSEXT) are replaced by the user defined content, following the main sequence progress (SEQ_V3_MAIN).

END OF DOCUMENT