BLE Location and Navigation

1.0

Features

- BLE Location and Navigation Service (LNS) in GATT Server role
- Low Power mode
- Workflow status reporting through UART
- LED status indication

General Description

This example project demonstrates the Location and Navigation Pod application workflow. The application uses a BLE Location and Navigation Profile to report location and navigation information to the client. Also the Location and Navigation Pod application uses the Battery Service to notify the battery level and the Device Information Service to assert the Device Name, etc.

Development Kit Configuration

Default CY8CKIT-042 BLE Pioneer Kit configuration.

Project Configuration

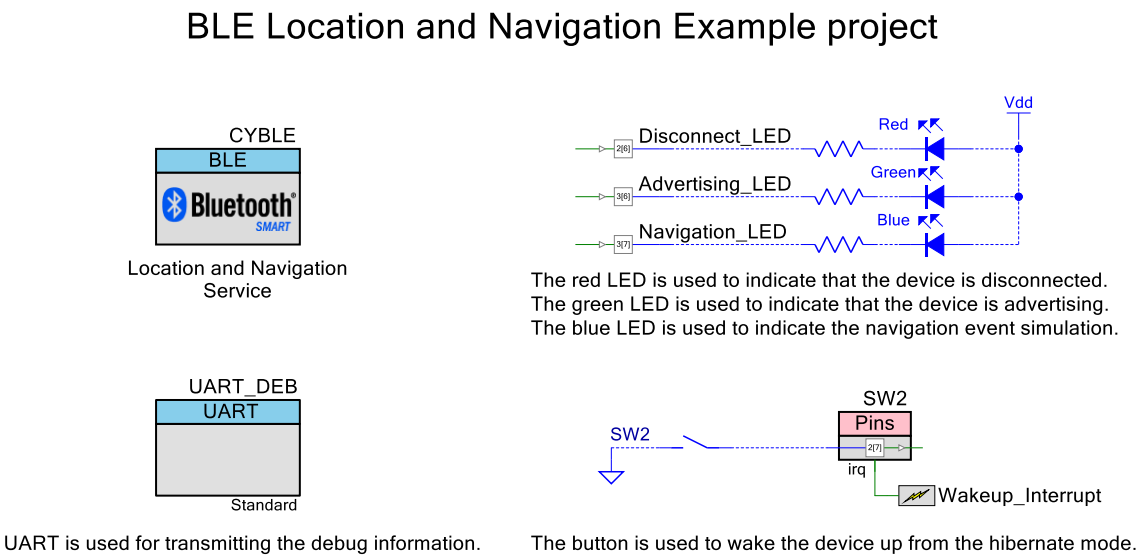


Figure 1. Top design schematic

The BLE component is configured as Location and Navigation Server in the GAP Peripheral role.

Also Battery and Device Information Services are included.

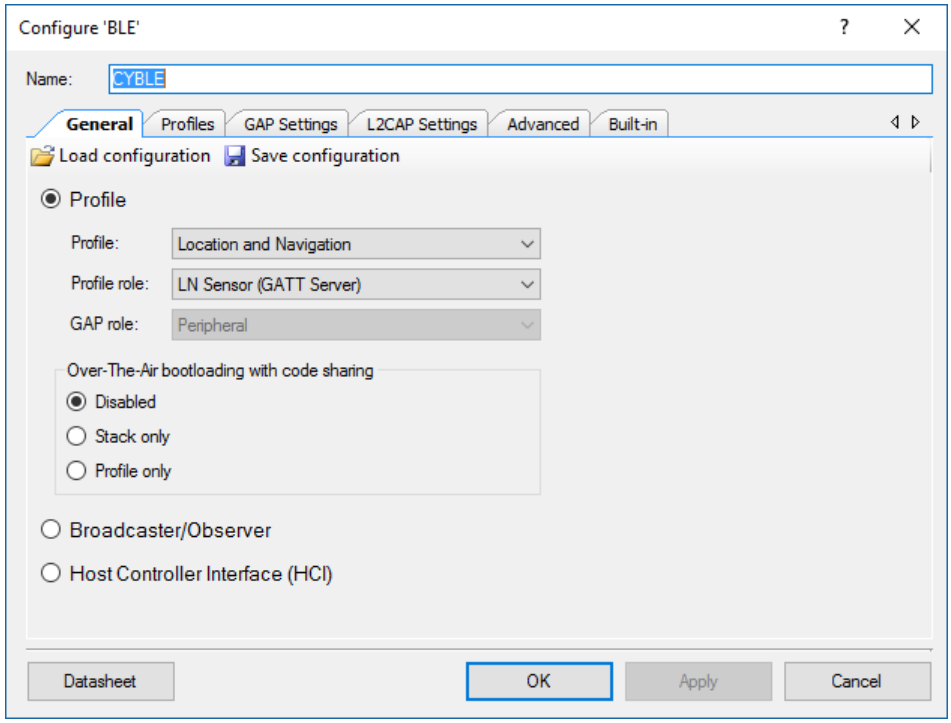


Figure 2. General settings

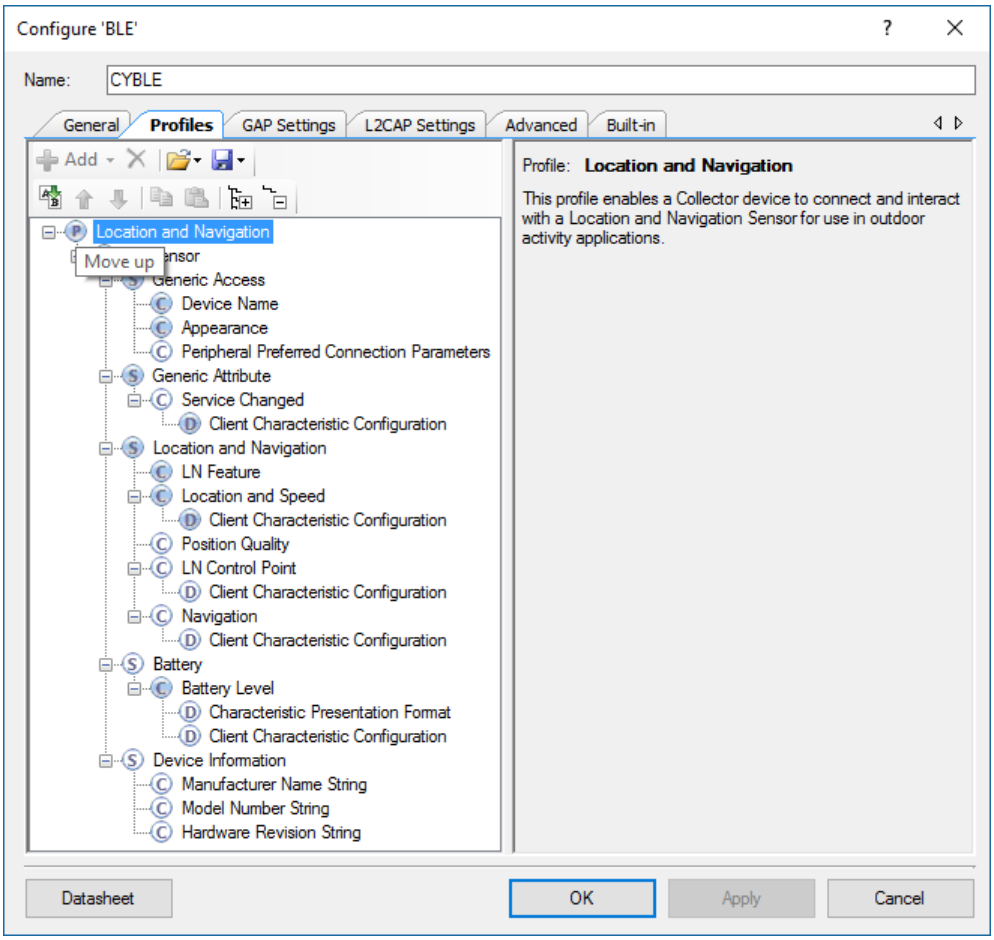


Figure 3. GATT settings

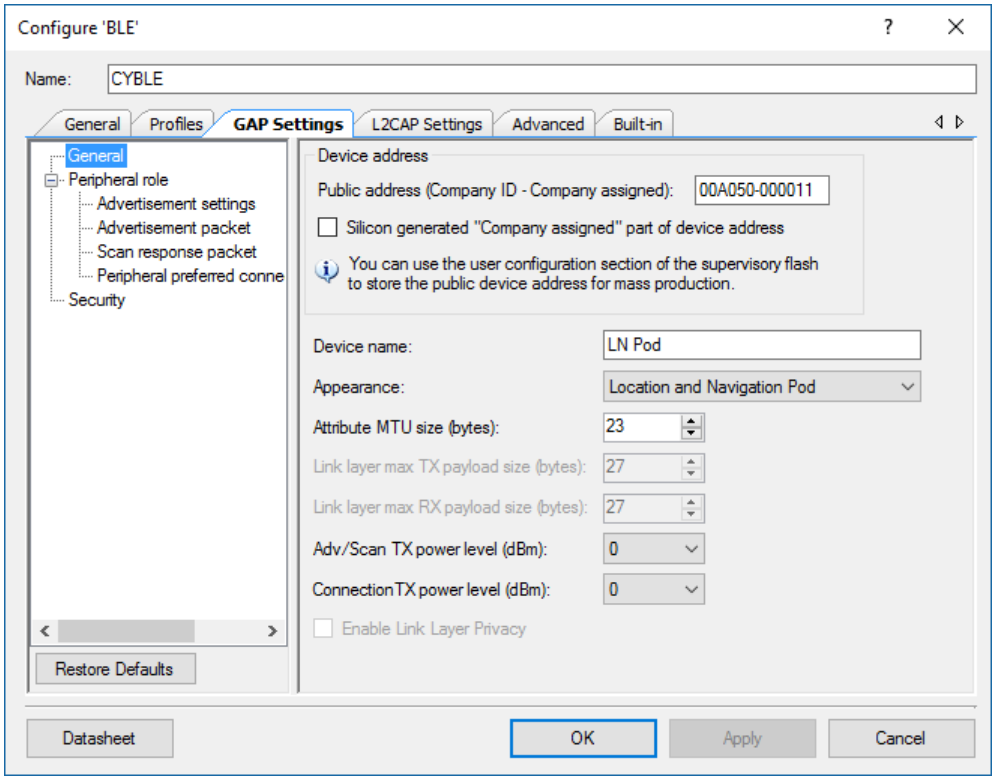


Figure 4. GAP settings

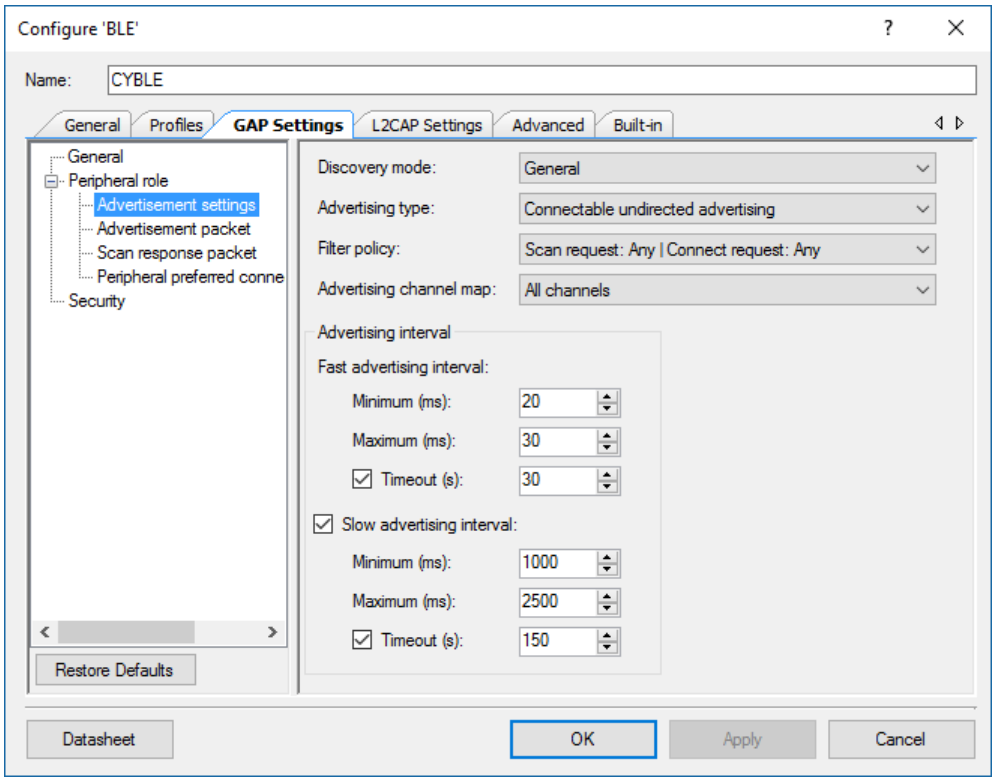


Figure 5. GAP settings -> Advertisement settings

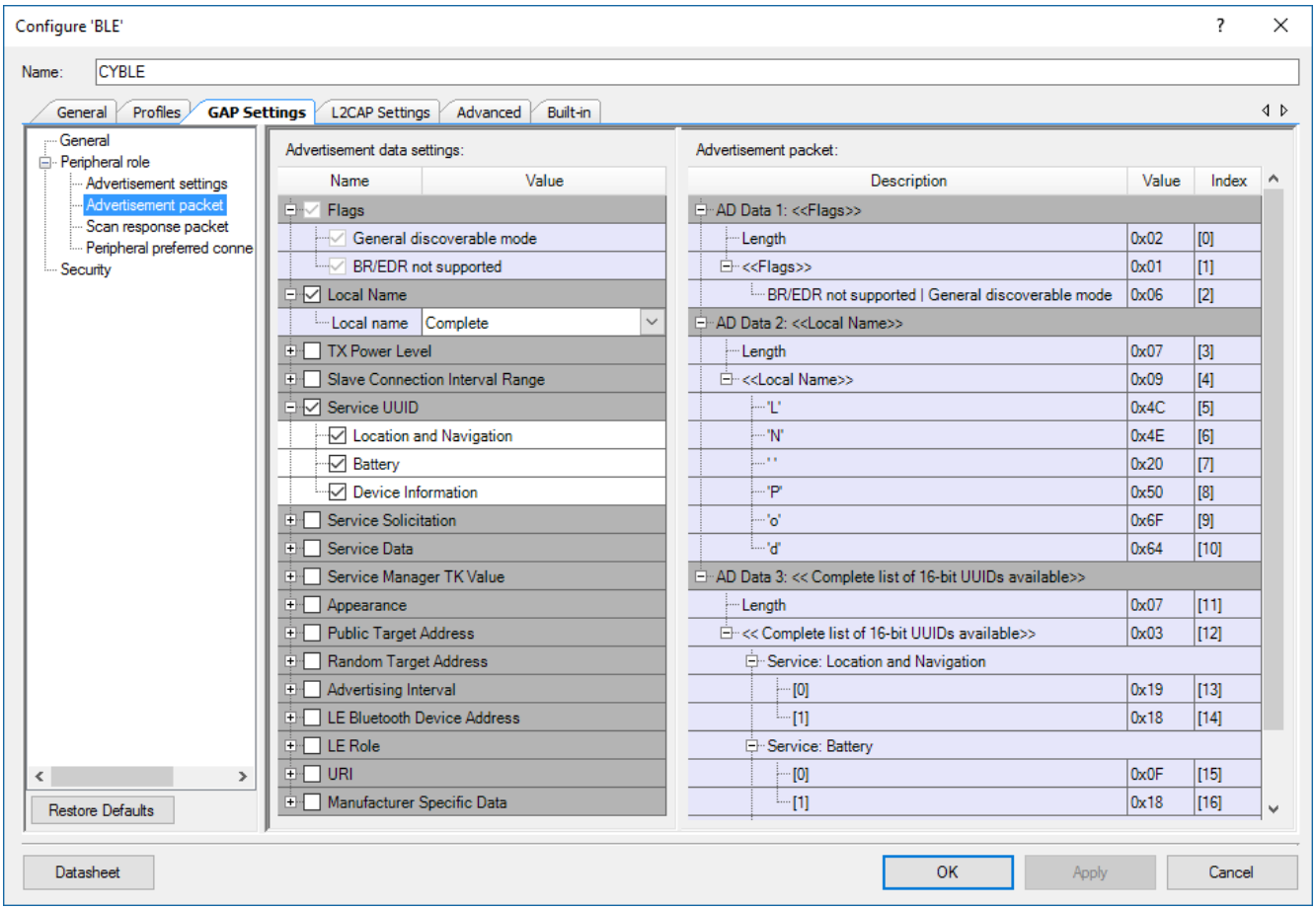


Figure 6. GAP Settings -> Advertisement packet

Project Description

The project demonstrates the core functionality of the BLE component configured as a Location and Navigation Server.

Right after startup the device performs BLE component initialization. In this project three callback functions are required for the BLE operation. Callback function AppCallBack() is required to receive generic events from BLE Stack and the service-specific callbacks BasCallBack() and LnsCallBack() are required for Battery and LNS service-specific events accordingly. The CYBLE_EVT_STACK_ON event indicates a successful initialization of BLE Stack. After this event is received, the component starts advertising with the packet structure as configured in the BLE component customizer (see **Figure 6**). The BLE component stops advertising as soon as 180 seconds advertising period expires.

The Location and Navigation Pod device can be connected to any BLE (4.0 or later) compatible device configured as GAP Central role and GATT Client which supports Location and Navigation Profile. The Battery and Device Information services may be optionally used. To connect to the Location and Navigation Pod device, send a connection request to the device while the device is advertising. The green LED is blinking while the device is advertising. The red LED is turned on after disconnection to indicate that no Client is connected to the device. When the Client connects successfully, both red and green LEDs

are turned off. If the Client is connected to the Location and Navigation Pod, the Location and Speed characteristic notifications can be enabled and then the device will simulate some Location changes and notify the Location and Speed characteristic. Blinking of the blue LED indicates a simulated navigation data transfer to the client.

If the Navigation characteristic is supported, to receive its notifications, several conditions should be met. Firstly, the Navigation CCCD should be configured to enable notification. Secondly, Location and Navigation Control Point indication should be enabled. At last, “Start navigation” command should be written into Location and Navigation Control Point characteristic (for details, see the Location and Navigation Profile and Location and Navigation Service specifications adopted by Bluetooth SIG). The WDT is used to timing the simulations and LED blinking.

While connected to the Client and between connection intervals, the device is put into Low Power Mode.

Expected Results

The project sends the Location and Navigation Service characteristic’s notifications/indications and Battery Level notifications to the Central Client device which can show them for user. LEDs are blinking as described in Project Description section.

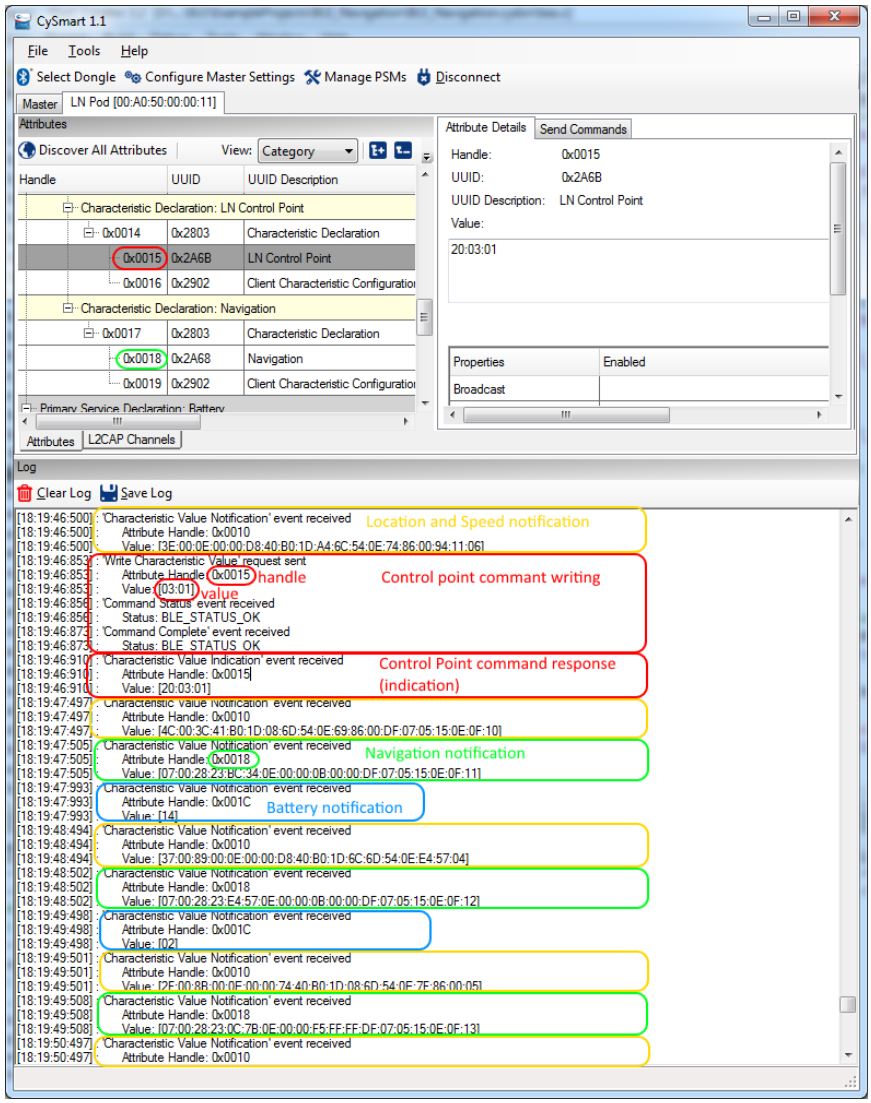
The project is intended to work in pair with any BLE-compatible device (e.g. phone, tablet) with appropriate software (with e.g. Android, iOS with installed application which supports Location and Navigation Profile).

Also, the Location and Navigation pod device can be used together with CySmart app for Windows. It is required to match the security settings between Location and Navigation Pod device and CySmart Client and perform pairing (bonding) before any writing (enabling notifications etc.) into Server’s GATT database. For further instructions on how to use CySmart application, see CySmart User Guide.

The simple example on how to use CySmart Windows application as Location and Navigation Service client is the next:

- Connect the CySmart BLE dongle to a USB port on the PC.
- Launch CySmart app and select connected dongle in the dialog window.
- Reset the development kit to start advertising by pressing SW1 button.
- Click **Start Scan** button to discover available devices.
- Select **LN Pod** in the list of available devices and connect to it.
- Click **Pair**, then **Discover All Attributes**, and **Enable All Notifications** in CySmart app.
- Select the Location and Navigation Control Point characteristic value and write the command “03 01” which means “Navigation Control: Start Navigation” (all these commands and data structures are described in detail in the LNS Specification).

- Observe the Navigation and Location and Speed characteristic notifications with simulated data (target is continuously moving around Cypress Ukraine office):



Optionally, the project can send log messages through UART. The example log is shown below:

```
BLE Location and Navigation Example Project
Stack Version: 2.0.0.81
EVT_STACK_ON
Start Advertisement with addr: 00a050000011
CYBLE_EVT_GAPP_ADVERTISEMENT_START_STOP
state: advertising
EVT_GATT_CONNECT_IND: attId 0, bdHandle 4
EVT_GAP_DEVICE_CONNECTED: 4
EVT_GATTS_XCNHG_MTU_REQ
EVT_GAP_AUTH_REQ
EVT_GAP_ENCRYPT_CHANGE: 1
CYBLE_EVT_GAP_KEYINFO_EXCHNGE_CMPLT
EVT_GAP_AUTH_COMPLETE: security:1, bonding:1, ekeySize:10, authErr 0
EVT_PENDING_FLASH_WRITE
Store bonding data, status: 0x28 flash write not permitted
Store bonding data, status: 0x00 ok
EVT_GATTS_INDICATION_ENABLED
Navigation Notification is Enabled
Store bonding data, status: 0x00 ok
LN Control Point Indication is Enabled
Store bonding data, status: 0x00 ok
Location and Speed Notification is Enabled
Store bonding data, status: 0x00 ok
BAS event: 122, EVT_BASS_NOTIFICATION_ENABLED: 0
Store bonding data, status: 0x00 ok
L&S Ntf: 4c 00 3c 41 b0 1d 08 6d 54 0e 69 86 00 df 07 05 15 0e 0e 30
SimulBatteryLevelUpdate: 3
L&S Ntf: 37 00 89 00 0e 00 00 d8 40 b0 1d 6c 6d 54 0e e4 57 04
L&S Ntf: 2f 00 8b 00 0e 00 00 74 40 b0 1d 08 6d 54 0e 7f 86 00 05
SimulBatteryLevelUpdate: 4
L&S Ntf: 3e 00 0e 00 00 d8 40 b0 1d a4 6c 54 0e 74 86 00 94 11 06
SimulBatteryLevelUpdate: 5
L&S Ntf: 4c 00 3c 41 b0 1d 08 6d 54 0e 69 86 00 df 07 05 15 0e 0e 34
L&S Ntf: 37 00 89 00 0e 00 00 d8 40 b0 1d 6c 6d 54 0e e4 57 04
SimulBatteryLevelUpdate: 6
L&S Ntf: 2f 00 8b 00 0e 00 00 74 40 b0 1d 08 6d 54 0e 7f 86 00 05
SimulBatteryLevelUpdate: 7
L&S Ntf: 3e 00 0e 00 00 d8 40 b0 1d a4 6c 54 0e 74 86 00 94 11 06
L&S Ntf: 4c 00 3c 41 b0 1d 08 6d 54 0e 69 86 00 df 07 05 15 0e 0e 38
CP is written: 03 01
Opcode: Navigation Control
Parameter: Start navigation
CP Ind: 20 3 1
LN Control Point Indication is Confirmed
SimulBatteryLevelUpdate: 8
L&S Ntf: 37 00 89 00 0e 00 00 d8 40 b0 1d 6c 6d 54 0e e4 57 04
Navigation Ntf: 07 00 28 23 e4 57 0e 00 00 0b 00 00 df 07 05 15 0e 0e 3a
SimulBatteryLevelUpdate: 9
L&S Ntf: 2f 00 8b 00 0e 00 00 74 40 b0 1d 08 6d 54 0e 7f 86 00 05
Navigation Ntf: 07 00 28 23 0c 7b 0e 00 00 f5 ff ff df 07 05 15 0e 0e 3b
L&S Ntf: 3e 00 0e 00 00 d8 40 b0 1d a4 6c 54 0e 74 86 00 94 11 06
Navigation Ntf: 07 00 28 23 94 11 0e 00 00 f5 ff ff df 07 05 15 0e 0f 00
SimulBatteryLevelUpdate: 10
L&S Ntf: 4c 00 3c 41 b0 1d 08 6d 54 0e 69 86 00 df 07 05 15 0e 0f 00
Navigation Ntf: 07 00 28 23 bc 34 0e 00 00 0b 00 00 df 07 05 15 0e 0f 01
SimulBatteryLevelUpdate: 11
L&S Ntf: 37 00 89 00 0e 00 00 d8 40 b0 1d 6c 6d 54 0e e4 57 04
Navigation Ntf: 07 00 28 23 e4 57 0e 00 00 0b 00 00 df 07 05 15 0e 0f 02
L&S Ntf: 2f 00 8b 00 0e 00 00 74 40 b0 1d 08 6d 54 0e 7f 86 00 05
Navigation Ntf: 07 00 28 23 0c 7b 0e 00 00 f5 ff ff df 07 05 15 0e 0f 03
SimulBatteryLevelUpdate: 12
L&S Ntf: 3e 00 0e 00 00 d8 40 b0 1d a4 6c 54 0e 74 86 00 94 11 06
Navigation Ntf: 07 00 28 23 94 11 0e 00 00 f5 ff ff df 07 05 15 0e 0f 04
SimulBatteryLevelUpdate: 13
L&S Ntf: 4c 00 3c 41 b0 1d 08 6d 54 0e 69 86 00 df 07 05 15 0e 0f 04
Navigation Ntf: 07 00 28 23 bc 34 0e 00 00 0b 00 00 df 07 05 15 0e 0f 05
L&S Ntf: 37 00 89 00 0e 00 00 d8 40 b0 1d 6c 6d 54 0e e4 57 04
Navigation Ntf: 07 00 28 23 e4 57 0e 00 00 0b 00 00 df 07 05 15 0e 0f 06
SimulBatteryLevelUpdate: 14
L&S Ntf: 2f 00 8b 00 0e 00 00 74 40 b0 1d 08 6d 54 0e 7f 86 00 05
Navigation Ntf: 07 00 28 23 0c 7b 0e 00 00 f5 ff ff df 07 05 15 0e 0f 07
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