



An Introduction to *Bluetooth*® Low Energy End Product Listing

nAN-23

Application Note v1.0

Contents

1	Introduction.....	3
1.1	The Bluetooth End Product (EP) definitions	3
1.2	Terminology	4
2	End Product Listing (EPL)	6
3	How to create an EPL	7
3.1	Relisting a design that contains all layers including the profile implementation	7
3.2	Combining an EP-QDL with a Profile Subsystem.....	8
3.3	Adding a proprietary profile.....	9
3.4	Assessment and retesting when relisting.....	9
4	Bluetooth End Product examples.....	11
4.1	Relisting a design containing profiles.....	11
4.2	Relisting a design combined with a profile subset; nRF8001	12
4.3	Relisting a design combined with a profile subset; nRF51822	13
5	Relisting considerations	14

1 Introduction

The purpose of this application note is to show how you can take advantage of existing Nordic Semiconductor qualified designs to design, test, qualify, and list your own products with minimal effort.

To sell a product using the *Bluetooth*® logo, a company must first ensure that its product conforms with the *Bluetooth* Core Specification and that the product is listed on the *Bluetooth* End Product Listing (EPL).

A product listed on the EPL is licensed to use *Bluetooth* wireless technology and is marked in accordance with the SIG product marking guidelines.

For products based on a Nordic Semiconductor *Bluetooth* IC (nRFxxxxx), an EPL listing can be created by referring to a Nordic qualified design. Nordic qualified design listings can be found at: www.bluetooth.org/tpg/listings.cfm.

There is also End Product Listing training material from *Bluetooth* SIG available at: <https://www.bluetooth.org/Events/Training/eplTraining.htm>.

1.1 The Bluetooth End Product (EP) definitions

Two *Bluetooth* End Product options exist:

- An implementation including all layers up to and including GATT. This is not to be confused with an IC containing all these layers; an end product needs to contain all other external components and layout to be considered complete. This type of end product is typically in the form of a generic module. A profile is not a requirement for an end product.

Note: The application or plastics are not affected by *Bluetooth* qualification requirements.

- An implementation including all layers up to and including profile(s). This type of end product is typically in the form of a finished design (for example, proximity key fob or other Original Equipment Manufacturer (OEM) product). For the End Product Manufacturer (EPM), the EP is the complete product including application software and plastics.

1.2 Terminology

Name	Definition	Description
BLE	<i>Bluetooth</i> low energy	BLE is one of the features of <i>Bluetooth</i> core 4.0 wireless technology. It is a protocol optimized for HID/sensor networks where extremely low current consumption is required.
BQE	<i>Bluetooth</i> Qualification Expert	A person associated with a BQTF that is accredited by the <i>Bluetooth</i> SIG to qualify products for customers (for a fee).
BQTF	<i>Bluetooth</i> Qualification Test Facility	A recognized test lab that can perform testing and provide qualification assistance (for a fee).
<i>Bluetooth</i> End Product		End Products can be combined or sold as is without limitations on the license. End Products represent a complete <i>Bluetooth</i> wireless solution. Examples of End products are proximity tags, PUID watches, remote controls, sports/fitness/healthcare sensors, mobile phone accessories, PC security peripherals, and automation sensors.
EPL	End Product Listing	When a product with <i>Bluetooth</i> wireless technology is intended for sale to a consumer, the product must first be listed on the qualified design listing page. Once listed an End Product is called an End Product Listing.
EPM	End Product Manufacturer	A manufacturer that lists a product on the End Product Listing.
EP-QDL	End Product Qualified Design Listing	A qualified <i>Bluetooth</i> design intended for relisting on the End Product Qualified Design Listing. The EP-QDL must contain all information about the design, like the BOM, PCB layout, etc.
GATT	Generic Attribute Profile	GATT is a base profile for all top-level low energy (LE) profiles. It defines how attributes (ATT) can be grouped together into meaningful services.
OEM	Original Equipment Manufacturer	A manufacturer making products that are purchased by another company and sold under that purchasing company's brand name.
PCC	Product Change Checklist	A guidance checklist aimed at identifying test cases that will require re-testing as a result of modifications of the original EP-QDL.
PICS	Protocol or Profile Implementation Compliance Statement	A list of all mandatory and optional <i>Bluetooth</i> features supported by the design.
Profile		Profiles are high level definitions that define how services can be used to enable an application or use case.
Profile Subsystem Product		<p>Subsystems are allowed to be qualified as a product-type to enable their use in combination with other qualified <i>Bluetooth</i> Subsystems. Together, the combination of Subsystems represents a complete <i>Bluetooth</i> solution (moreover, an End-Product).</p> <p>To qualify a Subsystem, it must be proven that it can be used to create a complete <i>Bluetooth</i> solution.</p> <p>Subsystems permit partial <i>Bluetooth</i> implementations to be manufactured and sold to end-users (e.g., OS stacks, or USB dongles) and allow such users the ability to create and combine portions of the <i>Bluetooth</i> Specification together without further qualification. Using the Subsystem, it is possible to take 2 (or more) Subsystems which have never been combined before and use them (provided they were designed to be combined).</p>
PTS	Profile Tuning Suite	A PC-based "black box" test tool developed by the <i>Bluetooth</i> SIG. It is a conformance test system that can be used for conformance testing of Host features and <i>Bluetooth</i> profiles.
QDL	Qualified Design Listing	A qualified listings page that can be referenced by other products, removing the need to do full conformance testing in order to get a qualified EPL.

Name	Definition	Description
RF PHY	RF Physical Layer	The RF PHY is the portion of a chip or circuit that contains the physical radio transmitter and receiver (transceiver).
SIG	Special Interest Group	The <i>Bluetooth</i> Special Interest Group (SIG) is a privately held, not-for-profit trade association. The SIG is the body that oversees the development of <i>Bluetooth</i> standards, licensing of <i>Bluetooth</i> technologies, and trademarks to manufacturers.
SoC	System on Chip	A system on chip is an integrated circuit that integrates all components of a computer or other electronic system into a single chip. It may contain digital, analog, mixed signal, and often radio functions.
TPG	Test Plan Generator	Online tool that will generate a test plan based on the roles and features you would like implemented in your design. There are tests for each protocol and profile specification.
UUID	Universally Unique Identifier	A 128-bit number used for identifying specific implementation or descriptors.
µBlue		Nordic Semiconductor's line of <i>Bluetooth</i> low energy solutions.

2 End Product Listing (EPL)

Any product intended for sale to the consumer must first be qualified and listed on the *Bluetooth* qualified listings page as an End Product Listing. This is also a prerequisite for using the *Bluetooth* logo and icons on product and marketing material.

Generating an EPL is free and does not require additional qualification or testing. An EPL always references an EP-QDL or a combination of an EP-QDL and a Profile subsystem.

An EP-QDL is a design that is intended for reuse (relisting). Therefore, an EP-QDL is based on a Bill of Materials (BOM), PCB layout, layers, *Bluetooth* profiles, and PICS. One EP-QDL can be used to create different EPLs. If an EPL design needs *Bluetooth* features not supported in the EP-QDL PICS, a new EP-QDL is required.

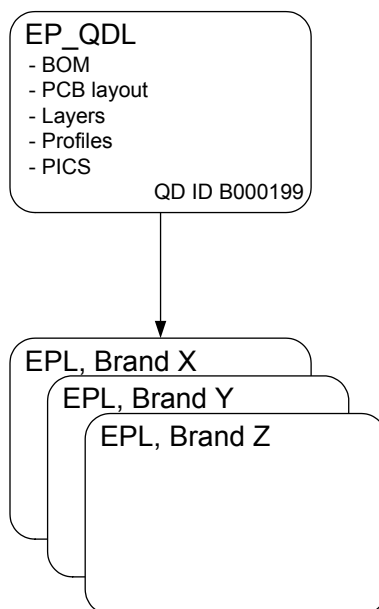


Figure 1 One EP-QDL can be referenced by multiple and independent EPLs.

Generating a new EP-QDL requires a qualification fee and testing.

3 How to create an EPL

An EPL can be established by either:

- Relisting a design that contains all layers including the profile implementation.
- Combining an EP-QDL with a profile subsystem.

Adding a proprietary profile is possible with both alternatives listed above.

3.1 Relisting a design that contains all layers including the profile implementation

This is typically a design that is targeted at a specific application segment and where the applicable profiles have been selected by the Original Design Manufacturer (ODM). The EP-QDL will in this case contain all elements required to establish the EPL. For an example of relisting a design containing profiles, see *section 4.1 “Relisting a design containing profiles” on page 11*.

Follow these steps to relist a design containing all layers:

1. Find the Nordic Semiconductor EP-QDL that your design is based on.
2. Establish an EPL by referencing the EP-QDL.

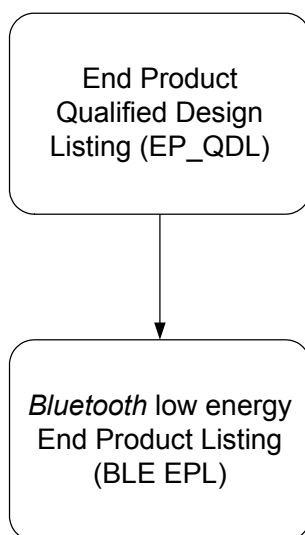


Figure 2 Relisting a System on Chip based EP-QDL

3.2 Combining an EP-QDL with a Profile Subsystem

This is typically a generic design that can be used as a basis for a range of different applications. The EP-QDL will not, in this case, contain references to any profiles (that is, containing all *Bluetooth* low energy layers up to and including GATT). The profiles of choice can be added from a profile subsystem. The profile subsystem associated with the specific EP-QDL contains all supported profiles that can be added to establish the EPL. For examples of relisting a design combined with a profile subset, see sections 4.2 “*Relisting a design combined with a profile subset; nRF8001*” on page 12. and 4.3 “*Relisting a design combined with a profile subset; nRF51822*” on page 13.

Follow these steps to combine an EP-QDL with a profile subsystem:

1. Find the generic EP-QDL that meets your requirements.
2. Select the applicable BLE profile(s) from the associated Profile Subsystem.
3. Combine the EP-QDL with the selected subset of the Profile Subsystem.
4. Establish an EPL referencing the combination of the EP-QDL and the profile subset.

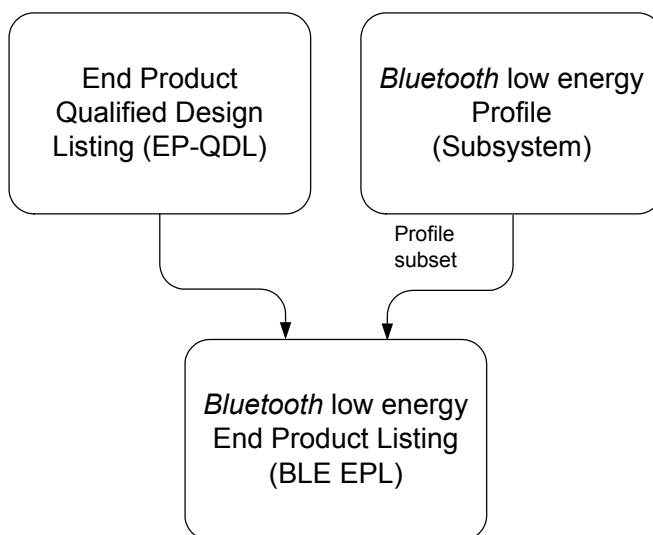


Figure 3 EP-QDL combined with Profile Subsystem

3.3 Adding a proprietary profile

A proprietary profile can be added to an EP-QDL if no suitable adopted *Bluetooth* low energy profiles exist. An EP-QDL can be combined with a proprietary profile or a combination of *Bluetooth* low energy profiles and a proprietary profile. No conformance claim is required (or can be made) with regards to the proprietary profile.

Note: A proprietary APP/profile is not covered by the *Bluetooth* Patent and license agreement.

Follow these steps to add a proprietary profile to an EP-QDL:

1. Perform the steps described in *section 3.1 on page 7* or *section 3.2 on page 8* depending on the characteristics of the applicable EP-QDL.
2. Describe the implemented proprietary profile in the text field of the EPL's End Product Detail (the descriptive text linked to the EPL found on the [Bluetooth.org](https://www.bluetooth.org) qualified listings page).

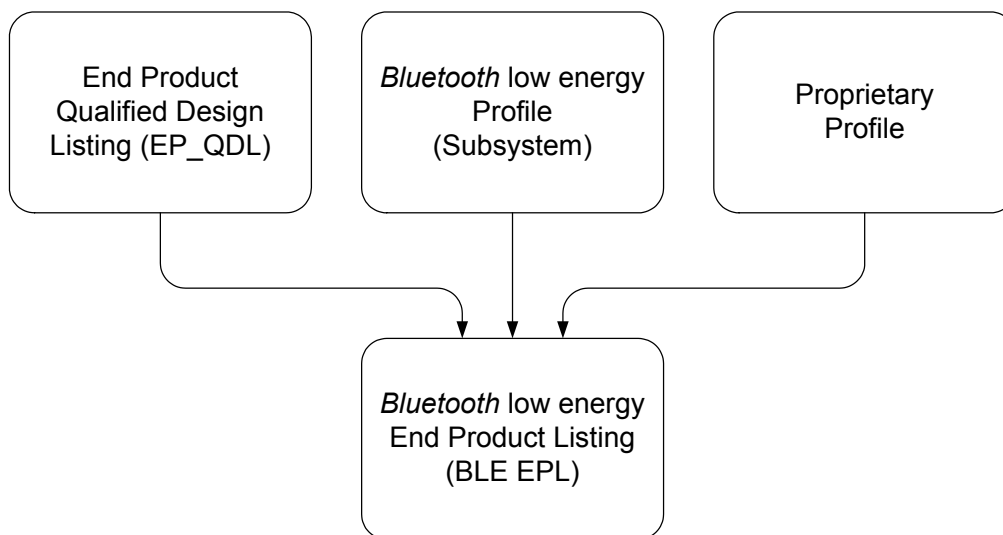


Figure 4 Combining proprietary and Bluetooth profiles in an End Product

3.4 Assessment and retesting when relisting

You can relist the listed EP-QDLs and the associated profile subsystems with the approval of the company owning the design. If you do not make any adjustments to the original EP-QDL design, your EPL can reference this EP-QDL without incurring qualification fees or the need for retesting.

For example, a design that has been qualified by company A can later be relisted by company B. Company A bears the burden of qualification costs while company B can reuse the qualification at no cost.

This is under the assumption that:

- No extra features (PICS features) are added to the design.
- There are no PCB/BOM modifications.

A typical example for this type of scenario is pre-qualified *Bluetooth* modules.

However, you can still relist a design even if you make some adjustments to the PCB/BOM. In this case, any adjustment or modifications to the design will need to be assessed, even if the modification does not alter the EP-QDL PICS. The objective of the assessment is to determine if the adjustment or modification is likely to invalidate any part of the qualification evidence. If this is the case, the corresponding qualification tests will need to be rerun.

If the applicable conformance tests pass, the EPL can reference the EP-QDL. The test evidence and assessment statement is stored by the relisting company for future reference.

It is recommended that a BQE is consulted when an assessment is required. As with teleregulatory tests, Bluetooth RF PHY tests cannot be done by the relisting company and can only be executed at a BQTF. Assessment related to the profile implementation can be done by the relisting company and does not require BQTF or BQE assistance. The product change checklist (PCC) is used as a guideline for the assessment process.

Please note:

- The responsibility for maintaining qualification integrity rests on the relisting company.
- Reassessment is always required if there are any modifications or adjustments done to the original EP-QDL.

4 Bluetooth End Product examples

This chapter contains several scenarios illustrating the different ways a product can be qualified as an End Product.

4.1 Relisting a design containing profiles

The nRF8002 device is a *Bluetooth* low energy system-on-chip device containing all *Bluetooth* low energy layers including the proximity profile. This device is specifically designed for proximity keyfob applications. The *Bluetooth* Qualification Design ID for nRF8002 is B019507.

The base EP-QDL design is the nRF8002-DK Development kit. The layout of this design can be modified to fit the end application requirements. The EPL is established by referencing the nRF8002 EP-QDL. No qualification fee is required in the process but assessment and RF PHY re-testing is required based on the extent of the PCB/BOM adjustment.

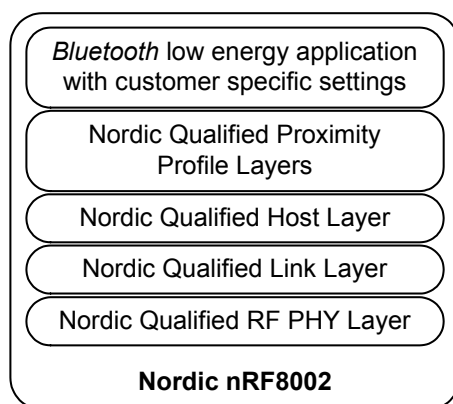


Figure 5 The nRF8002 layers

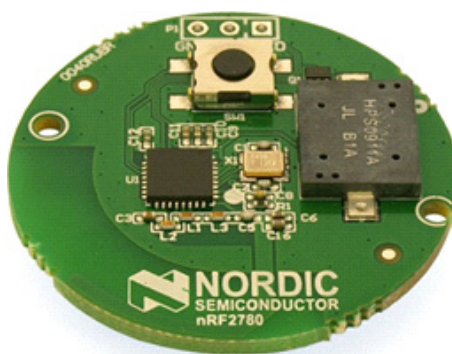


Figure 6 nRF8002-DK Proximity key fob

4.2 Relisting a design combined with a profile subset; nRF8001

nRF8001 is a generic *Bluetooth* low energy connectivity-on-chip device containing all *Bluetooth* low energy layers up to and including GATT. nRF8001 can be combined with multiple profiles which are listed in the associated nRF8001 profile subsystem. This chip can be used to implement a diverse set of *Bluetooth* low energy based applications. The *Bluetooth* Qualification Design ID for nRF8001 is B017595.

The base EP-QDL design is the nRF8001 nRFgo module found in the nRF8001 development kit. The profile superset compatible with the nRF8001 device is represented by the nRF8001 profile subsystem. Start by selecting the profile subset you intend to use in the end application. Then create the EPL by referencing the profile subset combined with the EP-QDL. No qualification fee is required in the process but assessment and RF PHY re-testing is required based on the extent of the PCB/BOM adjustment. Profile retesting is advised but not required if the Nordic profile porting guidelines are followed.

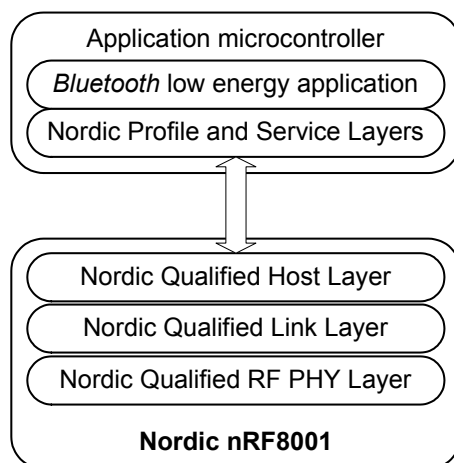


Figure 7 nRF8001 layers and application MCU

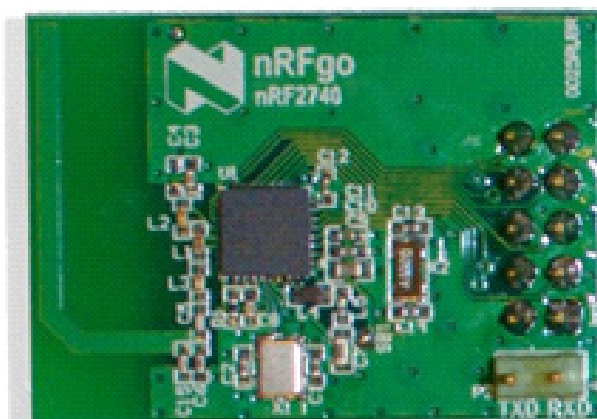


Figure 8 The nRF8001 on nRF2740 module

4.3 Relisting a design combined with a profile subset; nRF51822

nRF51822 is a generic *Bluetooth* low energy System on Chip that contains all *Bluetooth* low energy layers including profiles. For increased flexibility, the protocol stack and profiles are not preprogrammed into the device but are downloaded from the Nordic semiconductor website.

The relisting process is similar to that for the nRF8001 device. Start by selecting the profile subset you intend to use in the end application. Then create the EPL by referencing the profile subset combined with the EP-QDL. No qualification fee is required in the process but assessment and RF PHY re-testing is required based on the extent of the PCB/BOM adjustment.

Note that the nRF51822 chip is sold with an empty flash memory and can be used with several different protocol stacks. The specific protocol stack designation (for example, S110) valid for the qualification is referenced in each EP-QDL listed by Nordic Semiconductor. Qualified protocol stacks can be downloaded as pre-compiled SoftDevices from Nordic Semiconductor and uploaded to an nRF51822 device without modifications.

Since the pre-compiled SoftDevices are a separate binary block that are runtime protected, they cannot be accidentally changed by your application during development or after shipping and therefore, they ensure the validity of the EP-QDL for your application. If you want to add a profile subsystem you can also download qualified profiles and merge these with your application to form the final product.

The base EP-QDL design is the nRF51822 nRFgo module found in the nRF51822 Development Kit. **Figure 9** illustrates the components in the final EPL.

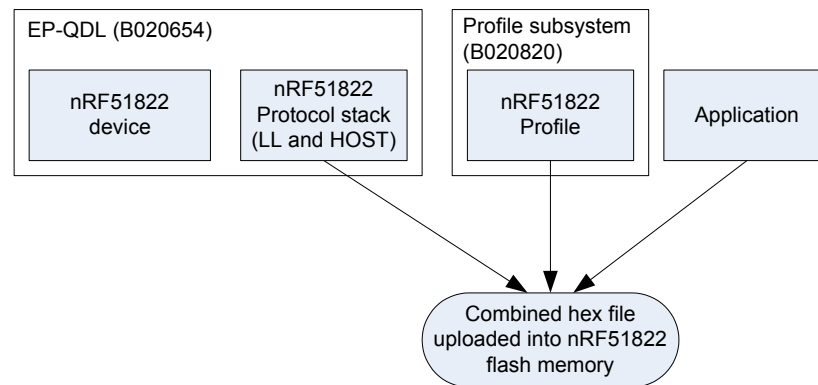


Figure 9 nRF51822 layers and EPL elements

5 Relisting considerations

An EPL is required to sell a product to the end consumer. An EPL can only be obtained by relisting an EP-QDL. This means that any company that plans to sell their *Bluetooth* product to an end product manufacturer would require their own valid EP-QDL for their product (as an EPL cannot be relisted).

Module manufacturers and Original Design Manufacturers (ODMs) will require an EP-QDL for their product in order to enable their customers to relist without incurring costs. An EP-QDL can be generated based on an existing Nordic EP-QDL, but note that this will trigger a qualification fee to the *Bluetooth* SIG in addition to any retesting- or assessment costs. EP-QDLs can only be created with the assistance of a BQE. Please consult Nordic Semiconductor technical support or a BQE if your product is not intended for sale to the end consumer.

If you intend to make designs for integration into third party products or several designs of your own that are identical from a *Bluetooth* perspective, it makes more financial sense to register an EP-QDL based on your own hardware design. With your own EP-QDL you or your customers can re-list without assessment/testing, rather than referring back to Nordic Semiconductor's EP-QDL and being forced to go through the assessment and possible testing for each model.

Also, by registering your own EP-QDL the vendors you have used to create your design will not be visible on the *Bluetooth* website.

Liability disclaimer

Nordic Semiconductor ASA reserves the right to make changes without further notice to the product to improve reliability, function or design. Nordic Semiconductor ASA does not assume any liability arising out of the application or use of any product or circuits described herein.

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Contact details

For your nearest dealer, please see <http://www.nordicsemi.com>.

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Revision History

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