

Application Note

How to Certify Your Bluetooth Product



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ABSTRACT

This application note is provided to guide system designers with an overview of the qualification and listing process needed to bring an end product incorporating a TI SimpleLink™ Bluetooth® Low Energy wireless MCU to the market. The content in this document should be considered informative with the actual standards body (for example, Bluetooth SIG, FCC, and so forth) providing the normative requirements.

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1 Introduction

All Bluetooth Low Energy products must go through the Bluetooth SIG qualification and declaration process to demonstrate and declare that they satisfy the requirements of the Bluetooth license agreements and specifications.

This document presents the fundamentals of going through the process of releasing an end product incorporating a TI Bluetooth Low Energy wireless MCU.

In addition to the Bluetooth qualification process, all products must comply with regulatory compliance standards applicable to the regions they operate in, such as FCC and CE/RED. This document briefly covers some of the more common regulatory compliance standards applicable to Bluetooth Low Energy products.

It is important to understand the distinction between a wireless MCU and an end product that incorporates the wireless MCU along with external circuitry such as a PCB, matching network, antenna, and so forth, which together comprise the "end product". Unless otherwise noted, the referenced regulatory and standards body referenced in this guide apply to the end product.

2 Bluetooth Qualification

In order to release a Bluetooth end product to market, the solution needs to be Qualified. Texas Instruments provides Qualified Design Listings (QDL) [2] with corresponding Qualified Design Identification (QDID) for all Bluetooth Low Energy wireless MCUs and associated Bluetooth Low Energy software stacks. This means that no Bluetooth Low Energy software stack testing is required by the customer. Bluetooth SIG rules specify that Qualified Components have a validity period of three (3) years, at which time they may not be available for new End Product Listings (EPLs).

In addition to the BLE-Stack compliance, RF-PHY testing must be performed to ensure the physical performance of the radio and antenna interface meet the minimum Bluetooth RF-PHY performance requirements. This is directly connected to the complete hardware (end product) design. Texas Instruments typically performs End Product Listing (EPL) and RF-PHY qualification on selected development kits that implement a TI reference design and the associated QDIDs are provided when available. TI RF-PHY and EPL QDIDs may be referenced for end product qualification if the RF-PHY design is close enough and follows the design guidelines from the associated TI reference design. A Bluetooth Qualification Consultant [7] (BQC) may assess if further RF-PHY testing is required with your product. End product designers are responsible for complying with the Bluetooth SIG requirements.

RF-PHY testing has to be done by a Bluetooth Qualified Test Facility (BQTF), (such as 7Layers [3], Dekra [4], TUV Rheinland [5] and Wipro [6]). Typically, the test houses also have a BQC, which can be used for further guidance through the qualification process.

The guidelines in this document follow the *Bluetooth Qualification and Declaration Processes* [9] on the Bluetooth SIG website and can be used to complete the Qualification and Declaration Process.

2.1 CC13xx and CC26xx Guidelines

For the CC13xx and CC26xx wireless MCUs, pre-qualified, tested, *Component* QDIDs are used. This means that there are QDIDs available for the complete SW stack, excluding only the RF-PHY part and selected adopted services and profiles. Available Qualified RF-PHY component QDIDs provided by TI can be referenced. BQC will assess if additional testing is required.

The process for Bluetooth Mesh qualification is the same as the one for the other Bluetooth specifications. Texas Instruments provides qualified profiles for Bluetooth Mesh [25]. To identify the QDL and associated QDID to use for your project, see the [Table 2-1](#).

For some devices, TI provides *End Product Listing* QDIDs. These QDIDs allow you to adopt the RF-PHY test results as well as host and controller test results. Your BQC will assess the appropriate level of retest necessary. The product listing creation process using *Component* QDIDs is presented in [Section 2.1.1.1](#). The product listing creation process using a *End Product Listing* QDID is presented in [Section 2.1.1.2](#). *End Product Listing* QDIDs have unlimited validity period.

2.1.1 Product Listing Creation

2.1.1.1 Product Listing Creation Using a Component QDID

Follow these steps to create a product listing using a *Component* QDID:

1. Navigate to the Bluetooth SIG qualification page [9] - Select "Path 2: Qualification Process with Required Testing".
2. Open Launch Studio [13].
3. Give your project a name and enter the appropriate BLE-Stack QDID from the list shown in Section 2.1.2. In addition, if a RF-PHY component QDID corresponding to your design is provided in Section 2.1.2, reference it as well.
4. Tick off the appropriate Test Case Reference List (TCRL) version, typically the latest, and select the product type and configuration (typically: end product, LE Controller, LE Host). Once the TCRL Version, Product Types, Controller Core Configuration and Host Core Configuration are selected additional input fields appear – these are above the TCRL Version selection. These fields correspond to the layers supported by the QDIDs selected. By default, the option "Use my own selection" is active. Choosing the alternate option allows to reuse the ICS Selection made by TI. The ICS Selection should be reviewed and modified based on the design to qualify. End product designers are responsible for complying with the Bluetooth SIG requirements. Once all the selection done, press "Save and Continue (...)".
5. In the layer selection page, Core Specifications can typically be left as is. If you are using any adopted profiles or services you need to tick off the respective fields. Press "Save and Continue (...)".
6. In the ICS Selection page, keep the "Consistency Check" tool open. This tool indicates which capabilities checkboxes are inconsistent with other capabilities checked, or missing mandatory capabilities. Click on the "Refresh consistency report" button to update the messages displayed by the tool. Should there be any other inconsistency issues, see the TI E2E Bluetooth forum [24] for additional information. When done, click "Save and Continue (...)".
7. In the Testing page, you can download the test plan that lists the required tests you need to perform on your product (typically limited to RF PHY testing). When you have downloaded the test plan, click "Save and Continue (...)".
8. Upload the filled out test plan and click "Save and Continue (...)".
9. The next steps are all about your specific product. Fill in the required information in the last remaining pages and you will end up with your very own Declaration ID in the end. Congratulations!

2.1.1.2 Product Listing Creation Using a End Product Listing QDID

Follow these steps to create a product listing using a *End Product Listing* QDID:

1. Navigate to the Bluetooth SIG qualification page [9] - Select "Path 1: Qualification Process with No Required Testing".
2. Open Launch Studio [13].
3. Give your project a name and enter the appropriate End Product Listing QDID from the list shown in Section 2.1.2.

Note: *End Product Listing* QDIDs have unlimited validity period.

4. Click on "Save and Continue to Product Declaration"
5. Select the listing date – this is the date your designs visible on the Bluetooth SIG website.
6. Add the products you want to list by clicking on "Add a Product"
7. Click on "Save and Continue to Declaration ID"
8. Click on "Pay Declaration Fee"
9. Click on "Save and Continue to Review"

2.1.2 CC13xx and CC26xx Qualified Designs

The following table list the QDIDs that are valid for use with TI products. In version 5.30, the formerly called SIMPLELINK-CC13X2-26X2-SDK was renamed to SIMPLELINK-CC13XX-CC26XX-SDK. In version 7.10, the now formerly called SIMPLELINK-CC13XX-26XX-SDK has been renamed again to SIMPLELINK-LOW-POWER-F2-SDK. This SDK is backwards compatible for qualification purposes with previous SDK versions. The complete list of the products supported by each QDID is available on the Bluetooth SIG website. This list can be easily accessed by clicking on the Declaration IDs in the following tables.

The CC2650 Module from TI (CC2650MODA) has an RF-PHY component in addition to regulatory modular radio pre-certification. For more information, see details in [Table 2-5](#). This means that you do not have to repeat RF-PHY testing when using CC2650MODA in accordance with the module's data sheet placement requirements [1]. If you are using another pre-certified module, check with your module vendor to see if you can reuse the module's RF-PHY QDID listing.

Table 2-1. QDIDs for CC13x4 and CC26x4 (including CC1354P10, CC1354R10, CC2674P10, and CC2674R10)

Applicable To	QDID Type	BT Core Spec	Declaration ID, TCRL Version, Qualification Assessment Date	QDID	Includes	Core Spec Features
All BLE-Stack versions	RF-PHY	v5.3	D061813 , TCRL 2021-2, 2022-09-27	194334	RF-PHY for TI LaunchPad™ development kits	LE 1M PHY, LE 2M PHY, LE Coded PHYs
BLE-Stack 5-2.2.x (SDK 7.10 and later)	Component	v5.3	D063565 , TCRL-2022-1, 2023-03-31	196584	Protocol: Link Layer, GAP, GATT, ATT, SMP, L2CAP	LE 2M PHY, LE Coded PHYs, Adv. Extensions, Privacy 1.2.1, CSA#2

Table 2-2. QDIDs for CC13x2, CC13x2x7, CC26x1, CC26x2 and CC26x2x7 (including CC1352P, CC1352P7, CC1352R, CC1352R7, CC2651P3, CC2651R3, CC2651R3SIPA, CC2642R, CC2642R-Q1, CC2652P, CC2652P7, CC2652PSIP, CC2652R, CC2652R7, CC2652RB, CC2652RSIP)

Applicable To	QDID Type	BT Core Spec	Declaration ID, TCRL Version, Qualification Assessment Date	QDID	Includes	Core Spec Features
All BLE-Stack versions	RF-PHY	v5.3	D061813 , TCRL 2021-2, 2022-09-27	194334	RF-PHY for TI LaunchPad™ development kits	LE 1M PHY, LE 2M PHY, LE Coded PHYs
All BLE-Stack versions	RF-PHY	v5.2	D054799 , TCRL 2020-1, 2021-04-13	166660	RF-PHY for AoA/CTE transmission and reception (CC13x2, CC26x2).	LE 1M PHY, AoA/CTE (connection and connectionless-CTE)
BLE-Stack 5-2.2.x (SDK 4.40 and later)	Profile Subsystem	N/A	D052535 , TCRL-2019-2, 2021-01-25	162204	Bluetooth mesh profile specification v1.0.1	<i>This design is for Mesh profiles only. When referencing this QDID, you should reference the appropriate QDID for your BLE-Stack version.</i>
BLE-Stack 5-2.2.x (SDK 4.40 and later)	Component	v5.2	D052819 , TCRL-2020-1, 2021-01-11	156080	Protocol: Link Layer, GAP, GATT, ATT, SMP, L2CAP	LE Coded PHYs, Adv. Extensions, Periodic Adv., LE 2M PHY, CSA#2, AoA/CTE (connection and connectionless-CTE)
BLE-Stack 5-2.2.x (SDK 4.40 and later)	End Product Listing	v5.2	D065853 , TCRL-2023-1, 2023-10-20	225762	Protocol: Link Layer, GAP, GATT, ATT, SMP, L2CAP, RF PHY	LE Coded PHYs, Adv. Extensions, Periodic Adv., LE 2M PHY, CSA#2, AoA/CTE (connection and connectionless-CTE)

Table 2-3. QDIDs for CC2640R2 (including C2640R2F, CC2640R2F-Q1, CC2640R2L, FRE014)

Applicable To	QDID Type	BT Core Spec	Declaration ID, TCRL Version, Qualification Assessment Date	QDID	Includes	Core Spec Features
All BLE-Stack versions	RF-PHY	v5.1	D057186 , TCRL 2021-1, 2021-10-08	176642	RF-PHY component listing	Coded PHYs, LE 1M PHY, LE 2M PHY
Central + Peripheral roles - BLE5-Stack 1.1.x (SDK 5.10 and later)	End Product Listing	v5.0	D057187 , TCRL 2021-1, 2021-10-08	176679	Attribute Protocol, Device Information Service, GAP, GATT, Interoperability Test Specification, L2CAP, LL, RF PHY, SMP	Coded PHYs, Adv. Extensions, LE 2M PHY
Peripheral role only - BLE5-Stack 1.1.x (SDK 5.10 and later)	End Product Listing	v5.0	D057188 , TCRL 2021-1, 2021-10-08	176850	Attribute Protocol, Device Information Service, GAP, GATT, Interoperability Test Specification, L2CAP, LL, RF PHY, SMP	Coded PHYs, Adv. Extensions, LE 2M PHY
Central, Peripheral, Multirole - BLE-Stack 3.3.x (SDK 5.10 and later)	End Product Listing	v5.1	D058218 , TCRL 2021-1, 2021-12-15	180401	Attribute Protocol, Device Information Service, GAP, GATT, Interoperability Test Specification, L2CAP, LL, RF PHY, SMP	v4.2: Privacy 1.2, Secure Connections, DLE

Table 2-4. QDIDs for CC13x0

Applicable To	QDID Type	BT Core Spec	Declaration ID, TCRL Version, Qualification Assessment Date	QDID	Includes	Core Spec Features
All BLE-Stack versions	RF-PHY	v5.1	D057186 , TCRL 2021-1, 2021-10-08	176642	RF-PHY component listing	Coded PHYs, LE 1M PHY, LE 2M PHY
Central + Peripheral roles - All BLE-Stack versions	End Product Listing	v5.0	D057187 , TCRL 2021-1, 2021-10-08	176679	Attribute Protocol, Device Information Service, GAP, GATT, Interoperability Test Specification, L2CAP, LL, RF PHY, SMP	Coded PHYs, Adv. Extensions, LE 2M PHY
Peripheral role only - All BLE-Stack versions	End Product Listing	v5.0	D057188 , TCRL 2021-1, 2021-10-08	176850	Attribute Protocol, Device Information Service, GAP, GATT, Interoperability Test Specification, L2CAP, LL, RF PHY, SMP	Coded PHYs, Adv. Extensions, LE 2M PHY
Central, Peripheral - BLE-Stack 2.3.x (SIMPLELINK-CC13X0-SDK 4.10 and later)	End Product Listing	v5.1	D058218 , TCRL 2021-1, 2021-12-15	180401	Attribute Protocol, Device Information Service, GAP, GATT, Interoperability Test Specification, L2CAP, LL, RF PHY, SMP	v4.2: Privacy 1.2, Secure Connections, DLE

Table 2-5. QDIDs for CC26x0 (including CC2650MODA - not applicable to CC2640R2F)

Applicable To	QDID Type	BT Core Spec	Declaration ID, TCRL Version, Qualification Assessment Date	QDID	Includes	Core Spec Features
All BLE-Stack versions	RF-PHY	v5.1	D057186 , TCRL 2021-1, 2021-10-08	176642	RF-PHY component listing	Coded PHYs, LE 1M PHY, LE 2M PHY
Central + Peripheral roles - All BLE-Stack versions	End Product Listing	v5.0	D057187 , TCRL 2021-1, 2021-10-08	176679	Attribute Protocol, Device Information Service, GAP, GATT, Interoperability Test Specification, L2CAP, LL, RF PHY, SMP	Coded PHYs, Adv. Extensions, LE 2M PHY
Peripheral role only - All BLE-Stack versions	End Product Listing	v5.0	D057188 , TCRL 2021-1, 2021-10-08	176850	Attribute Protocol, Device Information Service, GAP, GATT, Interoperability Test Specification, L2CAP, LL, RF PHY, SMP	Coded PHYs, Adv. Extensions, LE 2M PHY
Central, Peripheral - BLE-Stack 2.2.x (BLE-STACK-2-X version 2.2.6 and later)	End Product Listing	v5.1	D058218 , TCRL 2021-1, 2021-12-15	180401	Attribute Protocol, Device Information Service, GAP, GATT, Interoperability Test Specification, L2CAP, LL, RF PHY, SMP	v4.2: Privacy 1.2, Secure Connections, DLE

Note

As specified by section 3.1.7.1, *Testing Requirements for Qualification of Combinations of Bluetooth Products* in the Bluetooth Qualification Program Reference Document (PRD): "Combinations involving Bluetooth Component Products shall repeat all Bluetooth profile interoperability tests applicable to the combination." These tests can be performed on the end product using the PTS dongle, which can be obtained on the BT SIG store [\[19\]](#). Only the Adopted Bluetooth profiles need to be tested, and testing can be self-performed. Custom profiles that utilize a 128-bit custom UUID do not require testing during the listing process.

2.1.3 Information regarding errata

Errata are corrections to Bluetooth specifications provided after the specification in question is adopted. If the erratum is adopted after Texas Instruments has produced the QDL and the corresponding QDID, extra documentation will be required to go through the qualification process. The list of the specification errata is available on the Bluetooth website [\[14\]](#).

2.1.3.1 Erratum 10734

[Erratum 10734](#) related to pairing is mandatory for CC26x0/CC13x0 and CC26x2/CC13x2 devices (not for CC254x devices).

For CC26x0/CC13x0, none of the BLE-Stacks has required a code change because of this erratum. For CC26x2/CC13x2, an update has been made in the BLE5-Stack version **2.01.00.00** released within the SIMPLELINK-CC13X2-26X2-SDK version 3.30. If you are using an SDK version anterior to 3.30, you are invited to contact your local sales teams in order to implement the proper modifications.

For CC26x0/CC13x0 and CC26x2/CC13x2 some extra test evidences and/or test report might be required for the qualification process in order to prove the erratum 10734 has been implemented. You can find this extra material on E2E [24]. For CC26x2/CC13x2 devices, the BLE5-Stack 2.2.x.x released within the SIMPLELINK-CC13X2-26X2-SDK version 4.40 and later is qualified with TCRL 2020-1. Therefore, no extra test evidences or test reports for erratum 10734 are required.

2.1.3.2 Erratum 11838

[Erratum 11838](#) related to encryption key size applies to Bluetooth core specification v4.2, 5.0 and 5.1. The erratum is mandatory for CC26x0/CC13x0 and CC26x2/CC13x2 devices. This erratum does not impact CC254x devices - because CC254x devices implement the Bluetooth core specifications v4.0.

For CC26x0/CC13x0,

- An update has been made in the BLE5-Stack version **1.01.09.00** released within the SIMPLELINK-CC2640R2-SDK version 4_10_00_10. If you are using an SDK version prior to 4_10_00_10, you are required to migrate to a newer SDK version.
- An update has been made in the BLE-Stack version **3.03.03.00** released within the SIMPLELINK-CC2640R2-SDK version 4_10_00_10. If you are using an SDK version prior to 4_10_00_10, you are required to migrate to a newer SDK version.

For CC26x2/CC13x2, an update has been made in the BLE5-Stack version **2.01.02.00** released within the SIMPLELINK-CC13X2-26X2-SDK version 4_10_00_78. If you are using an SDK version prior to 4_10_00_78, you are required to migrate to a newer SDK version.

Both for CC26x0/CC13x0 and for CC26x2/CC13x2 some extra test evidences and/or test report might be required for the qualification process in order to prove the erratum 11838 has been implemented. You can find this extra material on E2E [24]. For CC26x2/CC13x2 devices, the BLE5-Stack 2.2.x.x released within the SIMPLELINK-CC13X2-26X2-SDK version 4.40 and later is qualified with TCRL 2020-1. Therefore, no extra test evidences or test reports for erratum 10734 are required.

2.1.4 Applicable TCRL

The Test Case Reference List (TCRL) is a living document introducing new test cases, removing test cases and categorizing test cases. The TCRL is provided by the Bluetooth SIG [26] and is the only reference for Bluetooth qualification.

All TCRLs have an Available Date and an Active Date. The Available Date represents when the TCRL is first published by the Bluetooth SIG. The Active Date represents the date that the TCRL is mandatory for qualification. A previous TCRL release becomes inactive after the newer TCRL release reaches its Active Date.

Qualified Components QDIDs have a validity period of three (3) years. A new TCRL release does NOT modify the validity period of a QDID. In other words, a QDID can be referenced even if the TCRL has become inactive. As a result of TCRL changes over time, there may be new test cases introduced for which there is no previously existing test evidence. Assuming the Component is still within the three-year window, members are not responsible for testing new test cases that are introduced and associated with an existing ICS selection or re-executing any test cases impacted by a Test Specification Errata (TSE) introduced in TCRL releases since the original Component's assessment date. Members are always required to ensure their designs are compliant with (and when necessary provide test evidence for new test cases associated with) any Expedited Erratum introduced in TCRL releases since the original Component qualification [27]. Additional test reports and test evidences corresponding to the mandatory errata added between the TCRL used by the QDID and the active TCRL are provided on E2E [24].

2.2 CC23xx Guidelines

For the CC23xx wireless MCUs, pre-qualified, tested, *Component* QDIDs are used. This means that there are QDIDs available for the complete software stack, excluding only the RF-PHY part and selected adopted services and profiles. Available Qualified RF-PHY component QDIDs provided by TI can be referenced. BQC will assess if additional testing is required.

For some devices, TI provides *End Product Listing* QDIDs. These QDIDs allow you to adopt the RF-PHY test results as well as host and controller test results. Your BQC will assess the appropriate level of retest necessary.

2.2.1 Product Listing Creation

The product listing creation process using *Component* QDIDs is presented in [Section 2.1.1.1](#) (reference [Section 2.2.2](#) instead when asked to enter the appropriate BLE-Stack). The product listing creation process using a *End Product Listing* QDID is presented in [Section 2.1.1.2](#). *End Product Listing* QDIDs have unlimited validity period.

2.2.2 CC23xx Qualified Designs

[Table 2-6](#) lists the QDIDs that are valid for use with TI products. The complete list of the products supported by each QDID is available on the Bluetooth SIG website. This list can be easily accessed by clicking on the Declaration IDs in the following tables.

Table 2-6. QDIDs for CC23x0 (including CC2340R5-Q1 and CC2340R5)

Applicable To	QDID Type	BT Core Spec	Declaration ID, TCRL Version, Qualification Assessment Date	QDID	Includes	Core Spec Features
All BLE-Stack versions	RF-PHY	v5.4	D063667 , TCRL-2022-2, 2023-05-02	196592	RF-PHY for TI LaunchPad™ development kits	LE 1M PHY, LE 2M PHY, LE Coded PHYs
BLE-Stack 5-3.2.x (SDK 7.10 and later)	Component	v5.3	D063694 , TCRL-2022-1, 2023-04-04	201833	Protocol: Link Layer, GAP, GATT, ATT, SMP, L2CAP	LE 2M PHY, LE Coded PHYs, Privacy 1.2.1, CSA#2

2.3 CC254x Guidelines

The CC254x family, together with the BLE-Stack, has qualified subsystems that can be referred to when listing your product. The Controller subsystem includes RF PHY testing performed on TI evaluation boards. As this RF PHY testing is not representative for your specific HW, the test facility may request PHY testing on your product in order to ensure it meets the requirements.

Follow these steps to create a product listing:

1. Navigate to the Bluetooth SIG qualification page [\[9\]](#) - Select "Path 2: Qualification Process with **No** Required Testing".
2. Reference the TI Controller and Host QDIDs from [Section 2.3.1](#).
3. The remaining steps are self-explanatory when you are actually doing it. It is basically just a series of one-option buttons to click on.

2.3.1 Qualified Designs CC254x

Table 2-7. QDIDs for CC254x

Design Model Number	Device	BT Core Spec	Declaration ID	QDID	Includes	Core Spec Features
CC254x Host Subsystem - Core 5.0	CC2540/CC2541	v5.0	D043835	127435	GAP, GATT, ATT, SMP, L2CAP, HCI	v4.0
CC254x Controller Subsystem - Core 5.0	CC2540/CC2541	v5.0	D043834	127418	HCI, Link Layer, RF PHY	v4.0

Table 2-7. QDIDs for CC254x (continued)

Design Model Number	Device	BT Core Spec	Declaration ID	QDID	Includes	Core Spec Features
CC254x Bluetooth Low Energy v1.5.x Profile Subsystem	CC2540/CC2541	v5.0	D043836	127436	Alert Notification Profile, Battery Service, Blood Pressure Profile and Service, Cycling Speed and Cadence Profile and Service, Device Information Service, Find Me Profile, Glucose Profile and Service, Health Thermometer Profile and Service, Heart Rate Profile and Service, HID over GATT Profile and Service, Immediate Alert Service, Interoperability Test Specification, Link Loss Service, Phone Alert Status Profile, Proximity Profile, Running Speed and Cadence Profile and Service, Scan Parameters Profile and Service, Time Profile, TX Power Service	
CC254x Bluetooth Low Energy- End Product Listing	CC2540/CC2541	v5.0	D059860	127435 and 127418	GAP, GATT, ATT, SMP, L2CAP, HCI, HCI, Link Layer, RF PHY	v4.0

2.4 RF PHY Test Parameters

Table 2-8 lists the required information for performing RF PHY qualification.

Table 2-8. RF PHY Test Parameters

IXIT Reference	Identifier	Sub-Identifier	CC254x Value	CC26xx/ CC13xx Value	Units
RF-PHY:P1:1	Inband Image frequency	Low frequency	+2	-2	MHz
RF-PHY:P1:2	Inband Image frequency	Middle frequency	≤2440: +2, >2440: -2	-2	MHz
RF-PHY:P1:3	Inband Image frequency	High frequency	-2	-2	MHz
RF-PHY:P2:1	Value n for Intermodulation test	Low frequency	5	3	Integer
RF-PHY:P2:2	Value n for Intermodulation test	Middle frequency	5	3	Integer
RF-PHY:P2:3	Value n for Intermodulation test	High frequency	5	3	Integer
RF-PHY:P11:1	Inband Image Frequency (2Ms/s)	Low frequency	NA	-1.7	MHz
RF-PHY:P11:2	Inband Image Frequency (2Ms/s)	Middle frequency	NA	-1.7	MHz
RF-PHY:P11:3	Inband Image Frequency (2Ms/s)	High frequency	NA	-1.7	MHz
RF-PHY:P12:1	Value n for Intermodulation test (2Ms/s)	Low frequency	NA	3	Integer

Table 2-8. RF PHY Test Parameters (continued)

IXIT Reference	Identifier	Sub-Identifier	CC254x Value	CC26xx/ CC13xx Value	Units
RF-PHY:P12:2	Value n for Intermodulation test (2Ms/s)	Middle frequency	NA	3	Integer
RF-PHY:P12:3	Value n for Intermodulation test (2Ms/s)	High frequency	NA	3	Integer

2.5 How to Enable Bluetooth and Regulatory Test Modes

There are multiple ways to enable your product for Bluetooth RF-PHY testing and for regulatory approval testing. This section briefly describes the various options.

2.5.1 Bluetooth RF-PHY Testing

Bluetooth RF-PHY testing is performed by placing and controlling the device under test (DUT) in Direct Test Mode (DTM). Through DTM, an external Bluetooth RF test instrument can issue standardized HCI test commands to the DUT over a 2-wire universal asynchronous receiver/transmitter (UART) interface in order to execute required receiver and transmitter tests. An overview of the DTM interface is provided in the Bluetooth specification, Volume 6, Part F. DTM is only intended for lab test purposes. When DTM is activated, normal Bluetooth Low Energy protocol communication is not permitted.

Note that if your product does not normally provide a UART interface for performing DTM RF-PHY testing, it is usually acceptable to modify your product to expose these pins provided the modification does not interfere with or alter RF/antenna performance.

The TI Bluetooth Low Energy protocol stack supports the DTM interface and required HCI test commands natively as part of the HostTest network processor project that is supplied within the respective SDK. For standalone embedded projects (for example, simple_peripheral) that do not normally expose a UART/HCI interface, a special Production Test Mode (PTM) can be added to the application in order to expose the required DTM interfaces. With PTM, the required IO pins are reserved for the UART HCI interface; however, the DTM interface is only activated by the application in response to a software API function call. For details on how to add PTM to your application, see the documentation in the corresponding SDK.

Since the Bluetooth receiver and transmitter radio performance is a function of the Bluetooth Low Energy protocol stack and radio configuration, it is possible to use the HostTest network processor project for RF-PHY testing of end products that utilize a standalone/embedded project. The use of HostTest for RF-PHY testing purposes is acceptable provided that both your protocol stack and radio configuration are identical to the corresponding standalone/embedded project used by your end product.

2.5.1.1 Regulatory Approval Testing

For regulatory approval testing it is typically required to configure the radio for static receiver and transmitter operation at certain frequencies. To facilitate such testing, the TI Bluetooth Low Energy/Bluetooth Low Energy 5 protocol stack implements the following HCI vendor-specific test commands:

- HCI_EXT_ModemTestTxCmd
- HCI_EXT_ModemTestRxCmd

For a full overview of the applicable HCI extension commands, parameters and associated events, see the *HCI Vendor Specific Guide* included with the Bluetooth Low Energy protocol stack documentation in the SDK.

The above commands can be invoked in a few different ways:

- Through HCI extension commands over a UART interface using the HostTest project as described in the previous “[Bluetooth RF-PHY testing](#)” section. A tool such as BTool or HCITester can be used to enter test commands to the Bluetooth Low Energy-Stack.
- Through Production Test Mode as described in the previous “[Bluetooth RF-PHY testing](#)” section.
- Implementing a stand-alone test sequence or test mode in your embedded application which calls the appropriate HCI extension command APIs directly from the application code. This can be, for example, controlled by a timer or push button interface.

Additionally, the [SmartRF Studio](#) tool can be used to perform some of these tests. SmartRF™ Studio software does not rely upon any firmware on the device and instead directly controls the radio over a test interface (JTAG). However, for some regulatory testing purposes, the actual protocol stack firmware may be required.

Since regulatory testing requirements can vary from jurisdiction to jurisdiction, consult your test lab on specific test requirements based on where your product is sold.

2.6 FAQ

Question: What does the Declaration ID cost?

Answer: Details on declaration and listing fees can be found on the [Bluetooth SIG Qualification & Listing Fees](#) page.

Question: Can I reuse TI's Declaration ID when listing my product with Bluetooth SIG?

Answer: No. Each product must obtain its own Declaration ID. You can reference TI's qualified components or subsystems (QDID's) in your product's listing, as noted in [Section 2](#), to reduce the amount of testing required to qualify your end product.

Question: If I do not put the Bluetooth logo on my product, do I still need to list my product with Bluetooth SIG?

Answer: For more information, see the "[Do I Need to List and/or Qualify My Product?](#)" guide on the Bluetooth SIG website. Additional questions on this topic should be directed to Bluetooth SIG directly via their contact information. Note that TI cannot determine whether a product must be listed or qualified as it is the customer's responsibility to adhere to all regulatory, certification and qualification requirements.

If you determine that you need to list (certify) your product with BT SIG, follow the process that is listed under [Section 2.1](#). You can combine with the TI BLE-Stack QDID (this saves you the bulk of the testing). Test only the adopted services you are using with the PTS tool and do the RF-PHY testing (if you are not using a pre-certified module). The TI software has all the necessary hooks to enable the RF-PHY testing on the device side.

If you determine that you do not need to list your product with BT SIG, then these steps may not be required. However, you may need to perform regulatory testing (for example, FCC) depending on where you sell or ship your product.

Question: My test facility has said that the CC254x QDIDs are expired and, thus, ineligible for use, or I need to test with the latest TCRL.

Answer: The CC254x uses a subsystem certification that does not expire. However, the applicability of the QDID may be dependent on whether the associated Bluetooth specification has been withdrawn by the SIG. The status of the specification can be determined during the listing process. TI recommends using the most recent QDID during the qualification process. The CC254x QDIDs listed in [Table 2-7](#) are still valid and indicated as such when submitted to the SIG Qualification Listing Interface. There is no certification requirement to test with updated TCRLs when using the TI CC254x QDIDs.

Question: What is a Bluetooth Qualification Consultant (BQC)?

Answer:

- Previously known as a BQE or "Bluetooth Qualification Expert (BQE)", an individual recognized by the Bluetooth SIG to provide a Bluetooth member with qualification related services [\[7\]](#).
- Expert in understanding the qualification policy and process
- Optional for members to use them

Question: I have created my own proprietary profiles, do I need to qualify them?

Answer: No, those are not part of the qualification process. However, note that they should follow the GATT protocol (that is, have a primary service, characteristic declarations with proper formatting, and so forth) and use 128-bit custom UUIDs.

Question: Can I reuse the CC2640 or CC254x FCC Certification?

Answer: The CC2640 and CC254x devices are wireless MCUs and thus cannot be individually certified by the FCC (or any regulatory body) since the wireless MCU + external RF design combination must be considered for regulatory listing purposes. However, you may reuse a module certification (MCU + Antenna) provided it is pre-certified with the respective regulatory body and you follow the layout placement guidelines from the data sheet. For example, the CC2650 Module from TI (CC2650MODA [12]) has FCC, ETSI, IC (Canada) and Japan regulatory pre-certification. A listing of modules that incorporate TI Bluetooth Low Energy wireless MCUs can be found on the main Bluetooth Low Energy Wiki page. TI provides the necessary interfaces to allow you to perform the required regulatory testing. For more details, see the following regulatory sections.

Question: Where can I find a list of test facilities to perform regulatory and Bluetooth testing?

Answer: A list of Test Facilities can be found on the Bluetooth SIG website (requires login). Many of these test facilities can also perform regulatory testing.

Question: My test lab is requesting me to fill out a form. Where can I find the required information?

Answer: All of the device-specific information can be found in the wireless MCU data sheet and the RF-PHY Test Parameters table listed above. The remaining items will be obtained by performing actual measurements on your board using Direct Test Mode (DTM) or Modem Test Commands. Details about the internal radio architecture needed for regulatory filing can be obtained by reviewing TI CC254x and CC26xx FCC filings. For more information, see [Section 3](#).

3 FCC Certification

Under Part 15 of the FCC rules, all electronic devices with a clock or oscillator exceeding 9 kHz need to be verified that they are not causing harmful radiated emissions. FCC Part 15 covers unintentional testing and evaluation as well as low power un-licensed transmitters. In addition, all transmitters must be registered and certified by the FCC to ensure they are not causing harmful emissions and interference on regulated frequencies.

Note

Device that incorporate a radio transceiver ("intentional radiators") must comply with FCC Part 15 Sub Part C, commonly referred to as "FCC Part 15C". All Bluetooth Low Energy wireless MCUs incorporate a transceiver and fall under the FCC Part 15C requirements.

Section 15.209 of the radio contains general radiated emission limits that apply to all Part 15 transmitters using frequencies at and above 9 kHz. Section 15.247 and 15.249 provide more detailed information about the emission requirements in the unlicensed 2.4 GHz ISM band. Bluetooth Low Energy products are typically certified under 15.247 as Systems Using Digital Modulation. This allows the radio to have higher output power than under 15.249, which is limited to 0 dBm. Bluetooth Low Energy is not considered FHSS under FCC.

There are two ways of getting a FCC certification: directly from the FCC or through a Telecommunications Certification Body (TCB). For almost all devices, you can chose either to use a TCB or FCC for the certification. The exception is when the equipment uses new technology or when the test methods are undefined or unclear, then FCC is the only party that can provide certification.

Devices can reuse a modular radio pre-certification provided that the module manufacturer's layout and placement guidelines are strictly followed, including display of the module's FCC ID. For more information, see the module provider's data sheet.

3.1 FCC ID

The FCC ID is a unique identifier, 4-17 characters, for the equipment and consists of two elements, the Grantee Code and the Equipment Product Code. The Grantee code is a three character alphanumeric string representing the Grantee/Applicant. The Grantee Code always begins with an alphabetic character and does not contain the numbers one or zero. The Grantee Code is assigned by the Commission permanently to a company for authorization of all radio frequency equipment. The Product Code is the non-grantee code portion of the FCC ID that begins after the first three characters. The Product Code may include hyphens and/or dashes (-). The Product code should consist of minimum 1 and maximum 14 characters.

The FCC ID must be permanently marked either directly on the transmitter, or on a tag that is permanently affixed to it. The FCC ID label must be readily visible to the purchaser at the time of purchase. For more information, see the latest FCC regulations at the time of listing.

4 CE Certification

In order to CE Mark and place any radio equipment on the market in EU you need to demonstrate compliance with the Radio Equipment Directive (RED). CE marking is a mandatory conformance mark on products placed on the European market. A CE mark indicates that the manufacturer or its authorized EU representative has declared that the product or equipment complies with all applicable European Directives, and enables the free movements of product within the European market. The CE marking is a declaration by the manufacturer, importer, or the entity first placing the product on the market that the product conforms to the appropriate directives. This is confirmed by the legally binding signature on the Declaration of Conformity.

For Short Range Devices operating in the 2.4 GHz ISM band the relevant Harmonized Standards are:

- EN 300 328 - radio equipment testing of data transmission equipment operating in the 2.4 GHz ISM Band
- EN 301 489 - electromagnetic compatibility
- EN 62479 - compliance to human exposure to electromagnetic fields
- EN 50566 + EN 62209-2 - for handheld and body-mounted devices

Bluetooth Low Energy does not classify as FHSS under ETSI specification and instead classifies as other type of wideband modulation (see section 4.2.1 of the EN 300 328 specification). Relevant test requirements for Bluetooth Low Energy are defined in Section 4.3.2. Note that revision 1.9.1 of the test specification introduced a few new tests such as Medium Utilization factor and Duty Cycle, TX-Sequence and TX-Gap. These tests only applies to equipment with higher output power than 10 dBm. Bluetooth Low Energy devices are limited to 10 dBm output power in the EU due to the Power Spectral Density requirement (4.3.2.3), which limits the radiated PSD to 10 dBm/MHz. As such, all required testing for CE/RED can be performed with continuous (static) RF output such as for FCC testing.

EN 300 328 v. 2.1.1, which was released in November 2016, introduced receiver categories, and a receiver blocking test. More details about this and how to perform this test, can be found in this application report: ETSI EN 300 328 RX Blocking Test for Bluetooth Low Energy [23].

There are several routes to demonstrate compliance with the Radio Equipment Directive; for most cases, meeting with the requirements of the relevant Harmonized Standards provides presumption of conformity required, thus enabling you to sign a Declaration of Conformity with confidence. A certified test house will provide the necessary guidance and help required to place your radio product on the market.

5 Industry Canada (IC) Certification

Industry Canada (IC) is the Canadian authority for certifications and standards making. As the FCC certification, the IC certification can either be done through IC or a TCB. An IC certification requires to have a Canadian representative and a confirmation letter from the representative to be submitted with the application.

There is no need for extra RF testing when applying for certification in Canada if the equipment is already certified by FCC and meets the following conditions:

- The test report must be less than one year old
- The test house must have their Test Site (OATS or Anechoic chamber) approved by IC
- A cross-reference table must be submitted with the test report to show that the equipment meets all of the applicable Canadian requirements.

5.1 IC-ID

As for equipment intended for the US market the radio/EVM needs to be marked with the IC-ID. The IC-ID consists of two parts: Company Number (CN) and a Unique Product Number (UPN) that is chosen by the manufacturer). To obtain a CN number, use the E-filing system. The CN will then be provided by e-mail.

An example would be: IC: 451H-2541SENSOR.

6 References

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27. Component Test Evidence Inheritance

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision J (May 2023) to Revision K (November 2023)	Page
• Updated Section 2.1.2	3

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