



# BL871E2-HI

## Hardware User Guide

1VV0301373 Rev. 3 – 2017-12-15

**TELIT**  
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## PRODUCT APPLICABILITY TABLE

| PRODUCT    |
|------------|
| BL871E2-HI |

*Table 0-1 Product Applicability Table*

## PRODUCT IDS

| Product IDs       |                                    |
|-------------------|------------------------------------|
| Regulatory Agency | ID                                 |
| FCC               | RFR-BL871                          |
| IC                | 23249-BL871                        |
| RED EU TEC        | M17-0326-01-TEC<br>by CETECOM GmbH |

*Table 0-2 Product IDs*

## **FEDERAL COMMUNICATION COMMISSION INTERFERENCE STATEMENT**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**FCC Caution:** Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

### **IMPORTANT NOTE:**

**FCC Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 15 mm between the radiator & your body.

This device is intended only for OEM integrators under the following condition:

- The transmitter module may not be co-located with any other transmitter or antenna,

As long as the condition above is met, further transmitter test will not be required.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

### **IMPORTANT NOTE**

In the event that this condition cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product.

In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

### **End Product Labeling**

The final end product must be labeled in a visible area with the following:

Contains "FCC ID: RMR-BL871".

### **Manual Information to the End User**

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual

## **INDUSTRY CANADA STATEMENT**

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Radiation Exposure Statement:

The product comply with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual.

The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

Déclaration d'exposition aux radiations:

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé. Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

This device is intended only for OEM integrators under the following condition:

- The transmitter module may not be co-located with any other transmitter or antenna.

As long as the condition above is met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes:

- Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 1 condition ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

**IMPORTANT NOTE:**

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

**NOTE IMPORTANTE:**

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

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### End Product Labeling

The final end product must be labeled in a visible area with the following:

Contains "IC: 4957A-BL871".

Etiquetage du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante :

Contient la mention "IC: 4957A-BL871".

### Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module.

Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

## **DECLARATION OF CONFORMITY CE**

The BL871E2-HI fully complies with the essential requirements of the following EU directives:

- RED 2014/53/EU
- RoHS 2011/65/EC

The actual version of EU Declaration of Conformity (EU DoC) can be downloaded from <http://www.telit.com/RED>



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# 1 INTRODUCTION

## 1.1 Purpose

The purpose of this document is to provide information regarding the features, functions, and usage of the BL871E2-HI Bluetooth HCI Module with integrated chip antenna.

## 1.2 Audience

This document is intended for customer personnel who are responsible for design and implementation of a Bluetooth product.

## 1.3 Contact and Support Information

For general contact, technical support services, technical questions, and to report documentation errors contact Telit Technical Support at:

- [TS-SRD@telit.com](mailto:TS-SRD@telit.com)
- [TS-EMEA@telit.com](mailto:TS-EMEA@telit.com)
- [TS-AMERICAS@telit.com](mailto:TS-AMERICAS@telit.com)
- [TS-APAC@telit.com](mailto:TS-APAC@telit.com)

Alternatively, use:

<https://www.telit.com/contact-us/>

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:




<https://www.telit.com/>

Our aim is to make this guide as helpful as possible. Please keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

## 1.4 Text Conventions

Dates are in ISO 8601 format, i.e. YYYY-MM-DD.

| Symbol  | Description   |
|---|---|
|  | Danger – This information <b>MUST</b> be followed or catastrophic equipment failure and/or bodily injury may occur.   |
|  | Caution or Warning – This is an important point about integrating the product into a system. If this information is disregarded, the product or system may malfunction or fail. |
|  | Tip – This is advice or suggestion that may be useful when integrating the product.   |

**Table 1-1 Text Symbols**

## 1.5 Related Documents

### 1.5.1 Product Documentation can be found on the web sites:

<https://www.telit.com/products/wifi-and-bluetooth-modules/bl871e2-hi/>

- BL871E2-HI Evaluation Kit User Guide, 1VV0301468
- BL871E2-HI BlueCode+SR EVK User Guide, 1VV0301478

### 1.5.2 Related Documents Requiring a Non-Disclosure Agreement

- None

## 2 PRODUCT DESCRIPTION

### 2.1 Product Overview

The BL871E2-HI is a complete Bluetooth Host Controller Interface (HCI) module. It supports the following radios:

- Basic Rate (BR)
- Enhanced Data Rate (EDR)
- Low energy (LE)

It is highly optimized for low-cost designs and intended to minimize the customer's design effort and time to market. It also features low power consumption (including low power modes). A chip antenna is included in the module to eliminate RF design tasks.

#### 2.1.1 Product Features

- Complete Bluetooth 4.2 BR/EDR/LE HCI solution with integrated chip antenna
- Best-in-Class Bluetooth (RF) Performance (TX Power, RX Sensitivity, Blocking)
- Very low power consumption, including low power modes of operation
- RED, FCC/IC certification
- Bluetooth BR/EDR
  - Up to 7 active devices
  - Scatternet: Up to 3 piconets simultaneously, 1 as master and 2 as slaves
  - Up to 2 Synchronous Connection Oriented (SCO) links on the same piconet
  - Very fast Automatic Frequency Hopping (AFH) algorithm for Asynchronous Connection-oriented Link (ACL) and eSCO link
  - Internal temperature detection and compensation to ensure minimal variation in RF performance over temperature
  - Includes a 128-bit hardware encryption accelerator as defined by the Bluetooth specifications
  - Support for all Voice Air-Coding – Continuously Variable Slope Delta (CVSD), A-Law,  $\mu$ -Law, Modified Subband Coding (mSBC), and transparent (uncoded)
  - Provides an assisted mode for HFP 1.6 Wideband Speech (WBS) profile or A2DP profile to reduce host processing workload
  - Support of multiple Bluetooth profiles with enhanced QoS
- Bluetooth Low Energy
  - Support for up to 10 connections
  - Multiple tightly coupled sniff instances to minimize power consumption
  - Independent buffering for LE allows large numbers of multiple connections without affecting BR/EDR performance
  - Built-In coexistence and prioritization handling for BR/EDR and LE
    - Capabilities of Link Layer Topology Scatternet
    - Can act concurrently as peripheral and central
    - Time Line Optimization algorithms to achieve maximum channel utilization



### 2.1.2 Applications

This ultra-compact BT HCI module is the companion for:

- any 3G/4G Telit cellular product running Telit BT 4.2 BlueCode SR stack
- customers' MCU running the Telit BT 4.2 BlueCode SR stack
- customer design with its own BT stack driver
- customer design using standard OS (e.g. Android, Windows)

Example applications are:

- Scanner & Printer
- mPOS
- IoT (Healthcare / Industrial Gateway)

### 2.1.3 Core Chipset

The core chipset for the BL871E2-HI is the TI CC2564C which supports Bluetooth Basic Rate (BR), Enhanced Data Rate (EDR), and Low Energy (BLE) 4.2.

This HCI device offers best-in-class RF performance with about twice the range of other Bluetooth LE-only solutions.

Power-management hardware and software algorithms provide significant power savings in all commonly used *Bluetooth* BR/EDR/LE modes of operation.

### 2.1.4 Chip Antenna

The BL871E2-HI includes an Amotech AMAN201510ST01 BT/BLE chip antenna.

### 2.1.5 Evaluation Kit

An evaluation Kit is available to assist customers in their design, evaluation, and test of the Bluetooth product. Please see **Section 3 EVALUATION BOARD (EVB)**.

## 2.2 Block Diagram

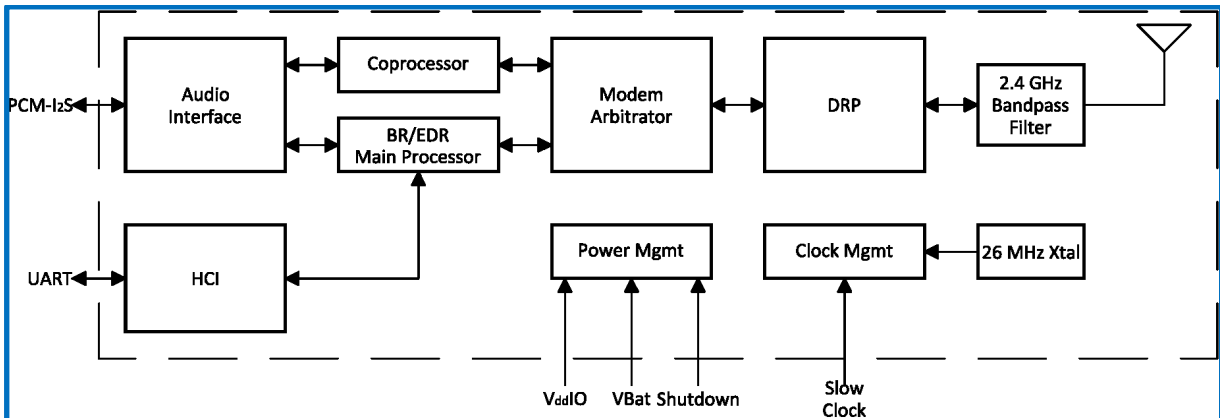


Figure 2-1 Block Diagram

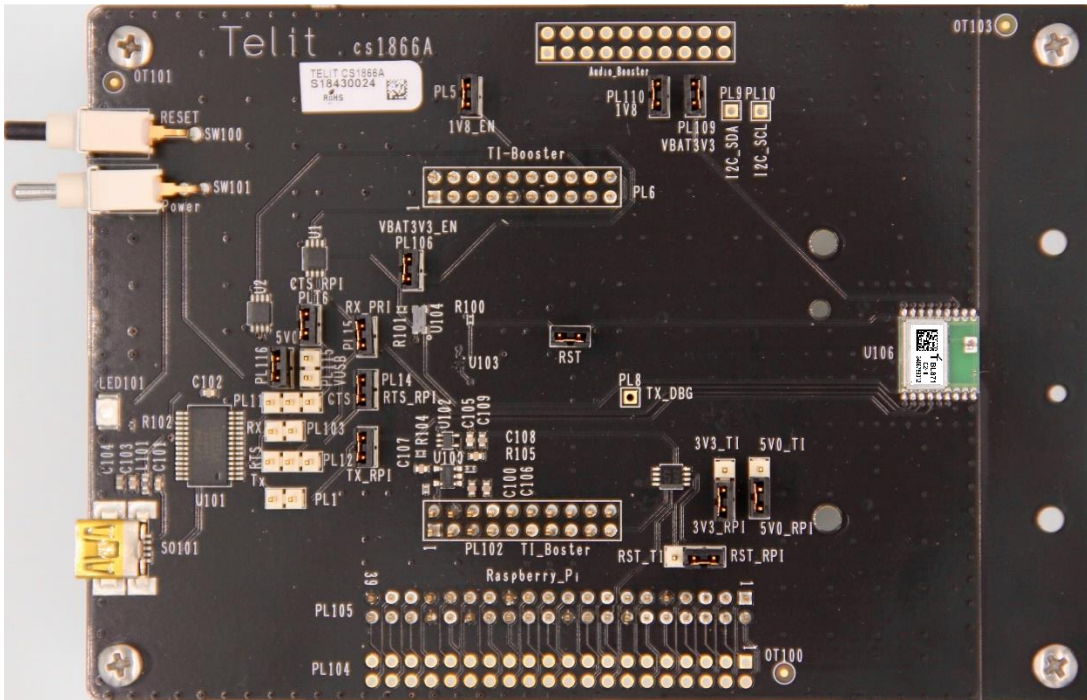
## 2.3 Module Photo



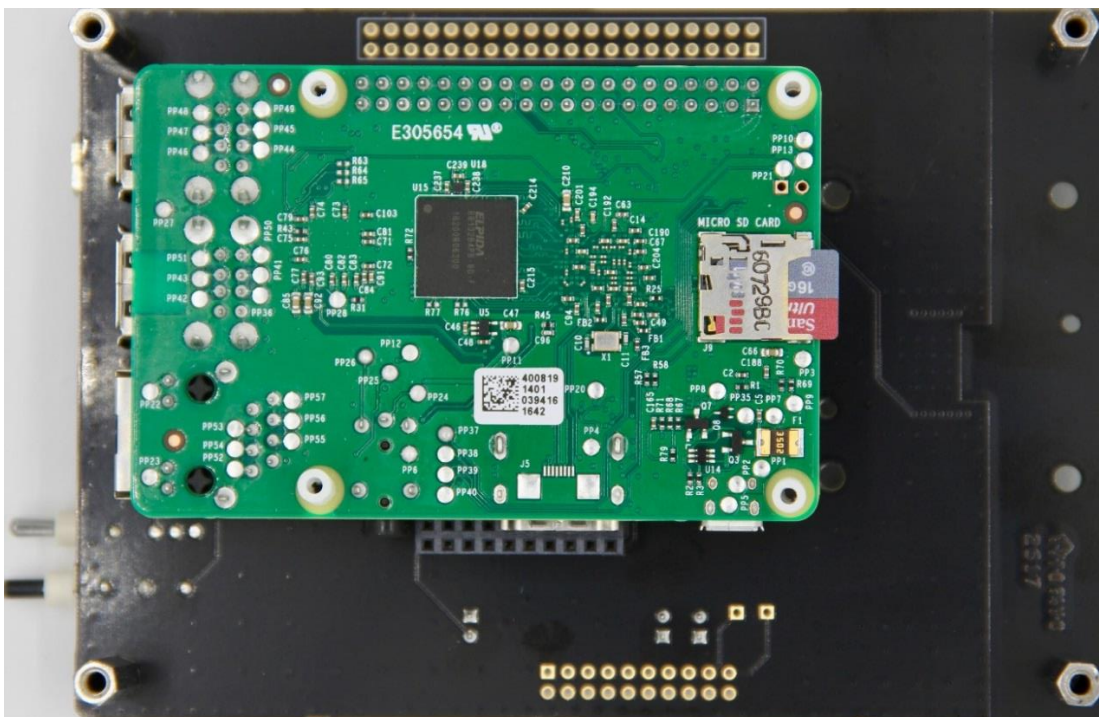
*Figure 2-2 Module Photo*

### 3 EVALUATION BOARD (EVB)

Please refer to the product Evaluation Kit User Guide for detailed information.



**Figure 3-1 Evaluation Board (top)**



**Figure 3-2 Evaluation Board connected to Raspberry Pi (bottom)**

## 4 PRODUCT PERFORMANCE

### 4.1 Power and Sensitivity

- Class 1 TX power up to +8 dBm (conducted measurements)
- Receiver Sensitivity: -95 dBm
- Internal temperature detection and compensation to ensure minimal variation in RF performance over temperature. No external calibration required
- Improved Adaptive Frequency Hopping (AFH) algorithm with minimum adaptation time
- Longer range, about twice that of other Low-Energy-Only solutions

### 4.2 RF Performance

Measurements were made with the antenna bypassed with semi-rigid coaxial cable.

#### 4.2.1 Bluetooth BR and EDR RF Performance

##### 4.2.1.1 Bluetooth Receiver - In-Band Signals

| CHARACTERISTICS                                      | CONDITION                                  | MIN            | TYP   | MAX  | BLUETOOTH SPECIFICATION | UNIT |     |
|--|--|----------------|-------|------|-------------------------|------|-----|
| Operation frequency range                            |  | 2402           |       | 2480 |                         | MHz  |     |
| Channel spacing                                      |  |                | 1     |      |                         | MHz  |     |
| Sensitivity, dirty TX on <sup>(1)</sup>              | GFSK, BER = 0.1%                           |                | -92   |      | -70                     | dBm  |     |
|  | $\pi/4$ -DQPSK, BER = 0.01%                |                | -91.5 |      | -70                     |      |     |
|  | 8DPSK, BER = 0.01%                         |                | -84.5 |      | -70                     |      |     |
| BER error floor at sensitivity + 10 dB, dirty TX off | $\pi/4$ -DQPSK                             | 1E-6           | 1E-7  |      | 1E-5                    |      |     |
|  | 8DPSK                                      | 1E-6           |       |      | 1E-5                    |      |     |
| Maximum usable input power                           | GFSK, BER = 0.1%                           |                | -5    |      | -20                     | dBm  |     |
|  | $\pi/4$ -DQPSK, BER = 0.1%                 |                | -10   |      |                         |      |     |
|  | 8DPSK, BER = 0.1%                          |                | -10   |      |                         |      |     |
| Intermodulation characteristics                      | Level of interferers (for n = 3, 4, and 5) | -36            | -30   |      | -39                     | dBm  |     |
| C/I performance <sup>(2)</sup><br>Image = -1 MHz     | GFSK, cochannel                            |                | 8     | 10   | 11                      | dB   |     |
|  |  | $\pi/4$ -DQPSK |       | 9.5  | 11                      |      | 13  |
|  | EDR, cochannel                             | $\pi/4$ -DQPSK |       | 16.5 | 20                      |      | 21  |
|  |  | 8DPSK          |       |      |                         |      |     |
|  | GFSK, adjacent $\pm 1$ MHz                 |                |       | -10  | -5                      |      | 0   |
|  | EDR, adjacent $\pm 1$ MHz, (image)         | $\pi/4$ -DQPSK |       | -10  | -5                      |      | 0   |
|  |  | 8DPSK          |       | -5   | -1                      |      | 5   |
|  | GFSK, adjacent +2 MHz                      |                |       | -38  | -35                     |      | -30 |
|  | EDR, adjacent +2 MHz                       | $\pi/4$ -DQPSK |       | -38  | -35                     |      | -30 |
|  |  | 8DPSK          |       | -38  | -30                     |      | -25 |
|  | GFSK, adjacent -2 MHz                      |                |       | -28  | -20                     |      | -20 |
|  | EDR, adjacent -2 MHz                       | $\pi/4$ -DQPSK |       | -28  | -20                     |      | -20 |
|  |  | 8DPSK          |       | -22  | -13                     |      | -13 |
|  | GFSK, adjacent $\geq  \pm 3 $ MHz          |                |       | -45  | -43                     |      | -40 |
| EDR, adjacent $\geq  \pm 3 $ MHz                     | $\pi/4$ -DQPSK                             |                | -45   | -43  | -40                     |      |     |
|  | 8DPSK                                      |                | -44   | -36  | -33                     |      |     |
| RF return loss                                       |  |                | -10   |      |                         | dB   |     |
| RX mode LO leakage                                   | Fr <sub>f</sub> = (received RF - 0.6 MHz)  |                | -63   | -58  |                         | dBm  |     |

(1) Sensitivity degradation up to 3 dB may occur for minimum and typical values where the Bluetooth frequency is a harmonic of the fast clock.

(2) Numbers show ratio of desired signal to interfering signal. Smaller numbers indicate better C/I performance.

**Table 4-1 BT Receiver - In-band Signals**

## 4.2.1.2 Bluetooth Transmitter – GFSK

| CHARACTERISTICS                        | MIN | TYP | MAX | BLUETOOTH SPECIFICATION | UNIT |
|--|-----|-----|-----|-------------------------|------|
| Maximum RF output power <sup>(1)</sup> |     | 8   |     |                         | dBm  |
| Power variation over Bluetooth band    | -1  |     | 1   |                         | dB   |
| Gain control range                     |     | 30  |     |                         | dB   |
| Power control step                     |     | 5   |     | 2 to 8                  | dB   |
| Adjacent channel power  M-N  = 2       |     | -45 |     | ≤ -20                   | dBm  |
| Adjacent channel power  M-N  > 2       |     | -50 |     | ≤ -40                   | dBm  |

(1) To modify maximum output power, use an HCI VS command.

**Table 4-2 BT Transmitter – GFSK**

## 4.2.1.3 Bluetooth Transmitter – EDR

| CHARACTERISTICS                                 | MIN            | TYP | MAX | BLUETOOTH SPECIFICATION | UNIT |
|---|----------------|-----|-----|-------------------------|------|
| EDR output power <sup>(1)</sup>                 | $\pi/4$ -DQPSK |     | 6   |                         | dBm  |
|   | 8DPSK          |     | 6   |                         |      |
| EDR relative power                              | -2             |     | 1   | -4 to +1                | dB   |
| Power variation over Bluetooth band             | -1             |     | 1   |                         | dB   |
| Gain control range                              |                | 30  |     |                         | dB   |
| Power control step                              |                | 5   |     | 2 to 8                  | dB   |
| Adjacent channel power  M-N  = 1                |                | -36 |     | ≤ -26                   | dBc  |
| Adjacent channel power  M-N  = 2 <sup>(2)</sup> |                | -30 |     | ≤ -20                   | dBm  |
| Adjacent channel power  M-N  > 2 <sup>(2)</sup> |                | -42 |     | ≤ -40                   | dBm  |

(1) To modify maximum output power, use an HCI VS command.

(2) Assumes 3-dB insertion loss from Bluetooth RF ball to antenna.

**Table 4-3 BT Transmitter – EDR**

4.2.1.4 Bluetooth Modulation – GFSK

| CHARACTERISTICS |                                     | CONDITION                                       |  | MIN | TYP | MAX | BLUETOOTH SPECIFICATION | UNIT      |
|-----------------|-------------------------------------|---|--|-----|-----|-----|-------------------------|-----------|
|                 | -20-dB bandwidth                    | GFSK  |  |     | 925 |     | ≤ 1000                  | kHz       |
| F1 avg          | Modulation characteristics          | Δf1avg  | Mod data = 4 1 s,<br>4 0 s:<br>111100001111... |     | 165 |     | 140 to 175              | kHz       |
| F2 max          |                                     | Δf2max ≥ limit for at least 99.9% of all Δf2max | Mod data = 1010101...                          |     | 130 |     | > 115                   | kHz       |
|                 |                                     | Δf2avg, Δf1avg                                  |  |     |     | 88% | > 80%                   |           |
|                 | Absolute carrier frequency drift    | DH1   |  | -25 |     | 25  | < ±25                   | kHz       |
|                 |                                     | DH3 and DH5                                     |  | -35 |     | 35  | < ±40                   |           |
|                 | Drift rate                          |   |  |     |     | 15  | < 20                    | kHz/50 μs |
|                 | Initial carrier frequency tolerance | f0-TX   |  | -75 |     | +75 | < ±75                   | kHz       |

**Table 4-4 BT Modulation – GFSK**

4.2.1.5 Bluetooth Modulation – EDR

| CHARACTERISTICS                     | CONDITION | MIN | TYP | MAX | BLUETOOTH SPECIFICATION | UNIT |
|-------------------------------------|-----------|-----|-----|-----|-------------------------|------|
| Carrier frequency stability         |           |     |     |     | ≤ 10                    | kHz  |
| Carrier frequency stability         |           |     |     | ±5  | ≤ 10                    | kHz  |
| Initial carrier frequency tolerance |           |     |     | ±75 | ±75                     | kHz  |
| RMS DEVM <sup>(1)</sup>             | π/4-DQPSK |     | 6%  |     | 20%                     |      |
|                                     | 8DPSK     |     | 6%  |     | 13%                     |      |
| 99% DEVM <sup>(1)</sup>             | π/4-DQPSK |     |     | 30% | 30%                     |      |
|                                     | 8DPSK     |     |     | 20% | 20%                     |      |
| Peak DEVM <sup>(1)</sup>            | π/4-DQPSK |     | 14% |     | 35%                     |      |
|                                     | 8DPSK     |     | 16% |     | 25%                     |      |

(1) Maximum performance refers to maximum TX power.

**Table 4-5 BT Modulation – EDR**

## 4.2.2 Bluetooth Low Energy RF Performance

### 4.2.2.1 Bluetooth LE Receiver – In-band Signals

| CHARACTERISTIC                                   | CONDITION                                 | MIN  | TYP | MAX  | BLUETOOTH low energy SPECIFICATION | UNIT     |
|--|---|------|-----|------|------------------------------------|----------|
| Operation frequency range                        |   | 2402 |     | 2480 |                                    | MHz      |
| Channel spacing                                  |   |      | 2   |      |                                    | MHz      |
| Input impedance                                  |   |      | 50  |      |                                    | $\Omega$ |
| Sensitivity, dirty TX on <sup>(1)</sup>          | PER = 30.8%; dirty TX on                  |      | -93 |      | $\leq -70$                         | dBm      |
| Maximum usable input power                       | GMSK, PER = 30.8%                         | -5   |     |      | $\geq -10$                         | dBm      |
| Intermodulation characteristics                  | Level of interferers (for n = 3, 4, 5)    |      | -30 |      | $\geq -50$                         | dBm      |
| C/I performance <sup>(2)</sup><br>Image = -1 MHz | GMSK, cochannel                           |      | 8   |      | $\leq 21$                          | dB       |
|  | GMSK, adjacent $\pm 1$ MHz                |      | -5  |      | $\leq 15$                          |          |
|  | GMSK, adjacent +2 MHz                     |      | -45 |      | $\leq -17$                         |          |
|  | GMSK, adjacent -2 MHz                     |      | -22 |      | $\leq -15$                         |          |
|  | GMSK, adjacent $\geq  \pm 3 $ MHz         |      | -47 |      | $\leq -27$                         |          |
| RX mode LO leakage                               | Fr <sub>f</sub> = (received RF - 0.6 MHz) |      | -63 |      |                                    | dBm      |

- (1) Sensitivity degradation up to 3 dB may occur where the Bluetooth low energy frequency is a harmonic of the fast clock.  
 (2) Numbers show wanted signal-to-interfering signal ratio. Smaller numbers indicate better C/I performance.

**Table 4-6 Bluetooth LE Receiver - In-band Signals**

### 4.2.2.2 Bluetooth LE Transmitter

| CHARACTERISTICS                                | MIN | TYP | MAX | BLUETOOTH low energy SPECIFICATION | UNIT |
|--|-----|-----|-----|------------------------------------|------|
| RF output power                                |     | 8   |     | $\leq 10$                          | dBm  |
| Power variation over Bluetooth low energy band |     |     | 1   |                                    | dB   |
| Adjacent channel power  M-N  = 2               |     | -45 |     | $\leq -20$                         | dBm  |
| Adjacent channel power  M-N  > 2               |     | -50 |     | $\leq -30$                         | dBm  |

**Table 4-7 Bluetooth LE Transmitter**

### 4.2.2.3 Bluetooth LE Modulation

| CHARACTERISTICS                     | CONDITION  | MIN | TYP | MAX                                | BLUETOOTH low energy SPECIFICATION | UNIT      |
|-------------------------------------|--|-----|-----|------------------------------------|------------------------------------|-----------|
| $\Delta f_1$ avg                    | $\Delta f_1$ avg<br>Mod data = 4 1s, 4 0s:<br>1111000011110000...                                      | 240 | 250 | 260                                | 225 to 275                         | kHz       |
| $\Delta f_2$ max                    | Modulation characteristics<br>$\Delta f_2$ max $\geq$ limit for at least 99.9% of all $\Delta f_2$ max | 185 | 210 |                                    | $\geq 185$                         | kHz       |
|                                     |  |     |     | $\Delta f_2$ avg, $\Delta f_1$ avg | $\geq 0.8$                         |           |
| Absolute carrier frequency drift    |  | -25 |     | 25                                 | $\leq \pm 50$                      | kHz       |
| Drift rate                          |  |     |     | 15                                 | $\leq 20$                          | kHz/50 ms |
| Initial carrier frequency tolerance |  | -75 |     | 75                                 | $\leq \pm 100$                     | kHz       |

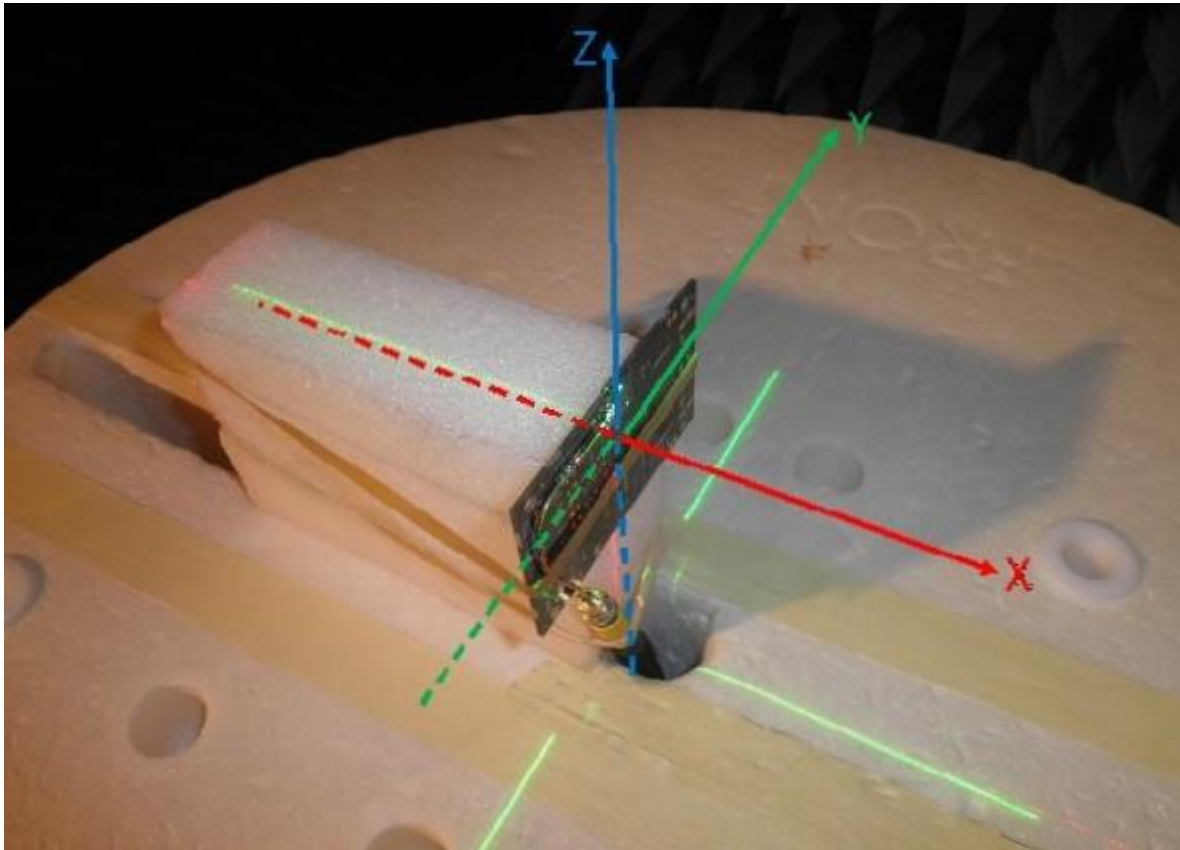
**Table 4-8 Bluetooth LE Modulation**



### 4.3 Antenna Radiation Patterns

The following pages show typical antenna radiation patterns.

The axes are identified below.



**Figure 4-1XYZ Axis identification**

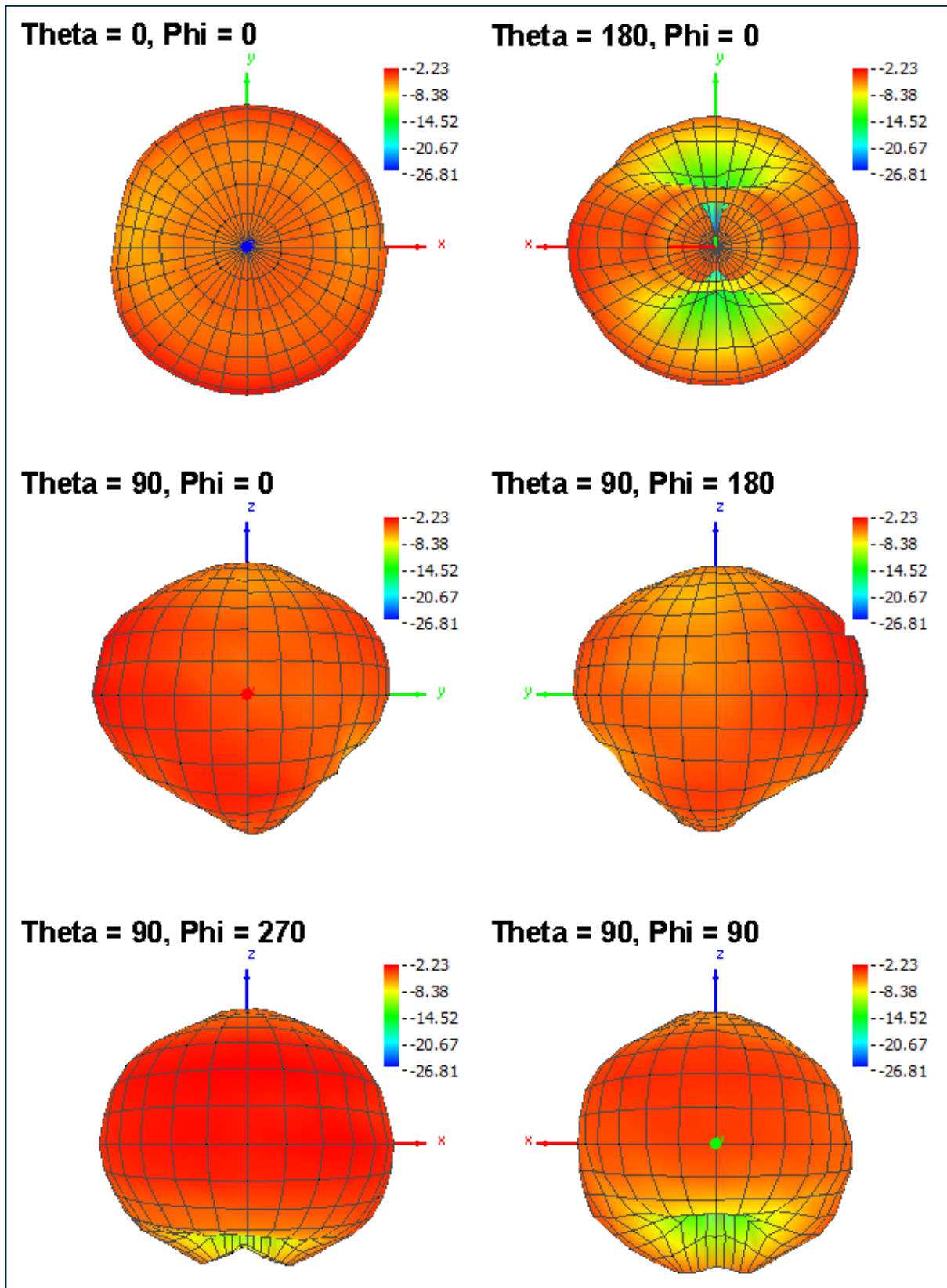


Figure 4-2 Typical Antenna Pattern  $f = 2400$  MHz

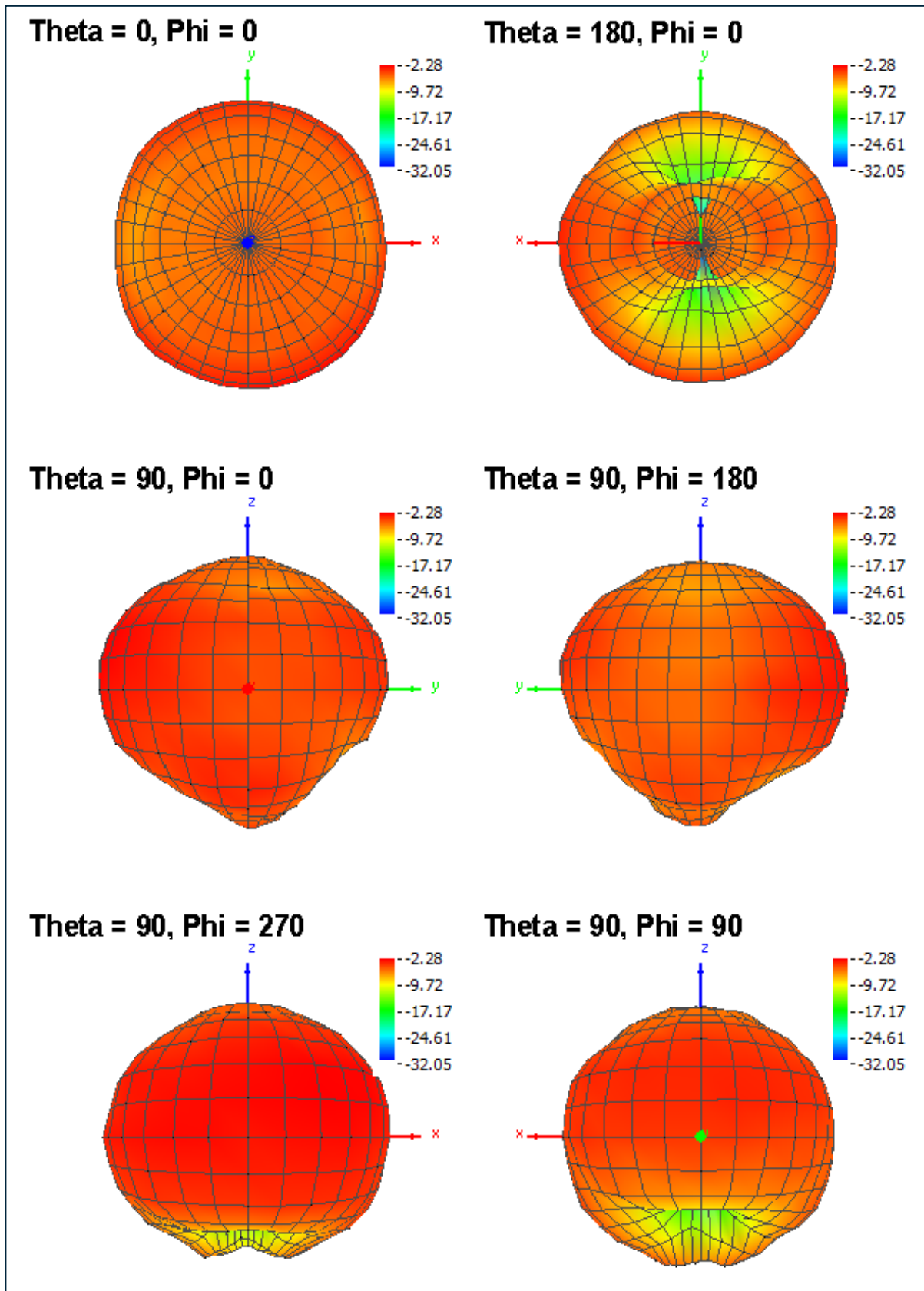


Figure 4-3 Typical Antenna Pattern  $f = 2440$  MHz

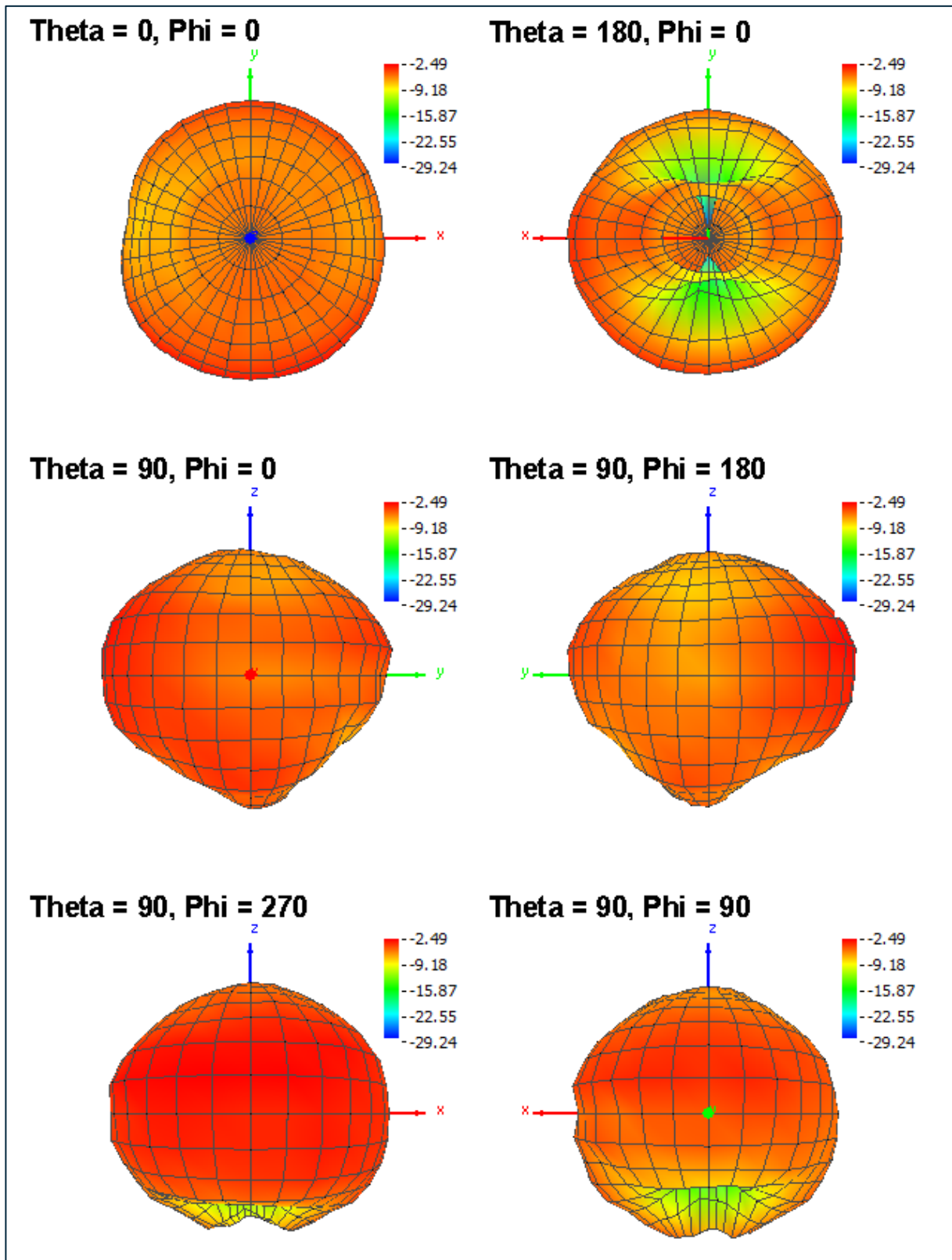


Figure 4-4 Typical Antenna Pattern  $f = 2480$  MHz

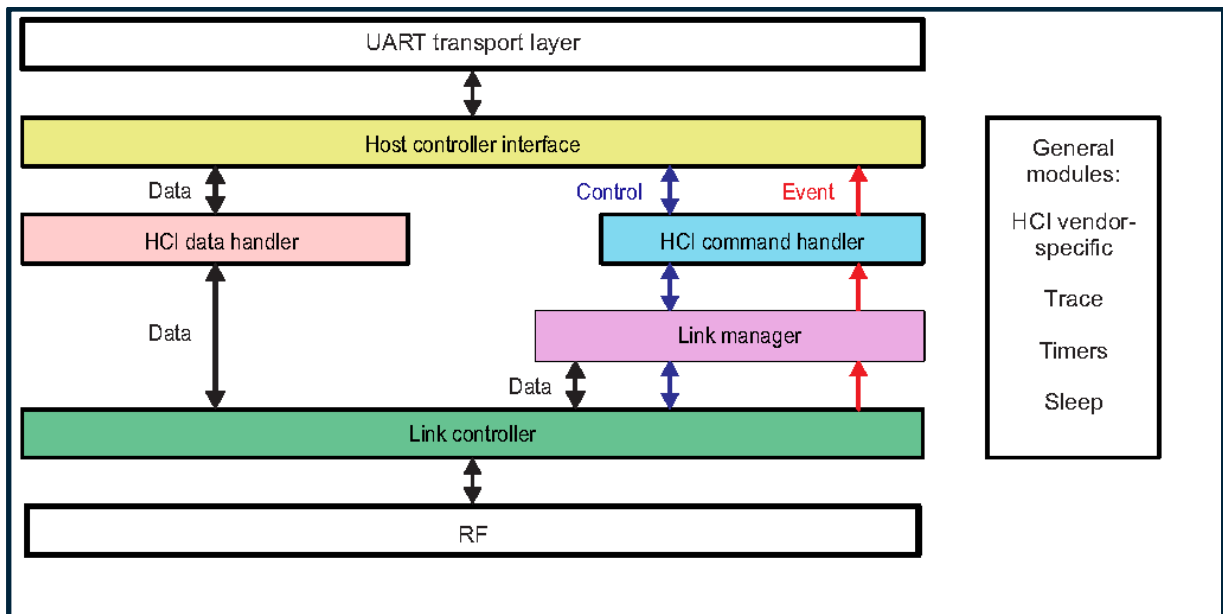
## 5 HCI INTERFACE

The BL871E2-HI module incorporates a UART interface dedicated to the Host Controller Interface (HCI) transport layer.

The HCI transports commands, events, and ACL between the device and the host using HCI data packets.

See Section 6.6 **UART Interface** for UART interface information.

The Bluetooth transport layers are shown in the following diagram:



**Figure 5-1 Bluetooth Transport Layers**

Please refer to the [Adopted Bluetooth Specifications](#) document for detailed information on the HCI data protocol.

## 6 ELECTRICAL INTERFACE

### 6.1 Pinout Diagram

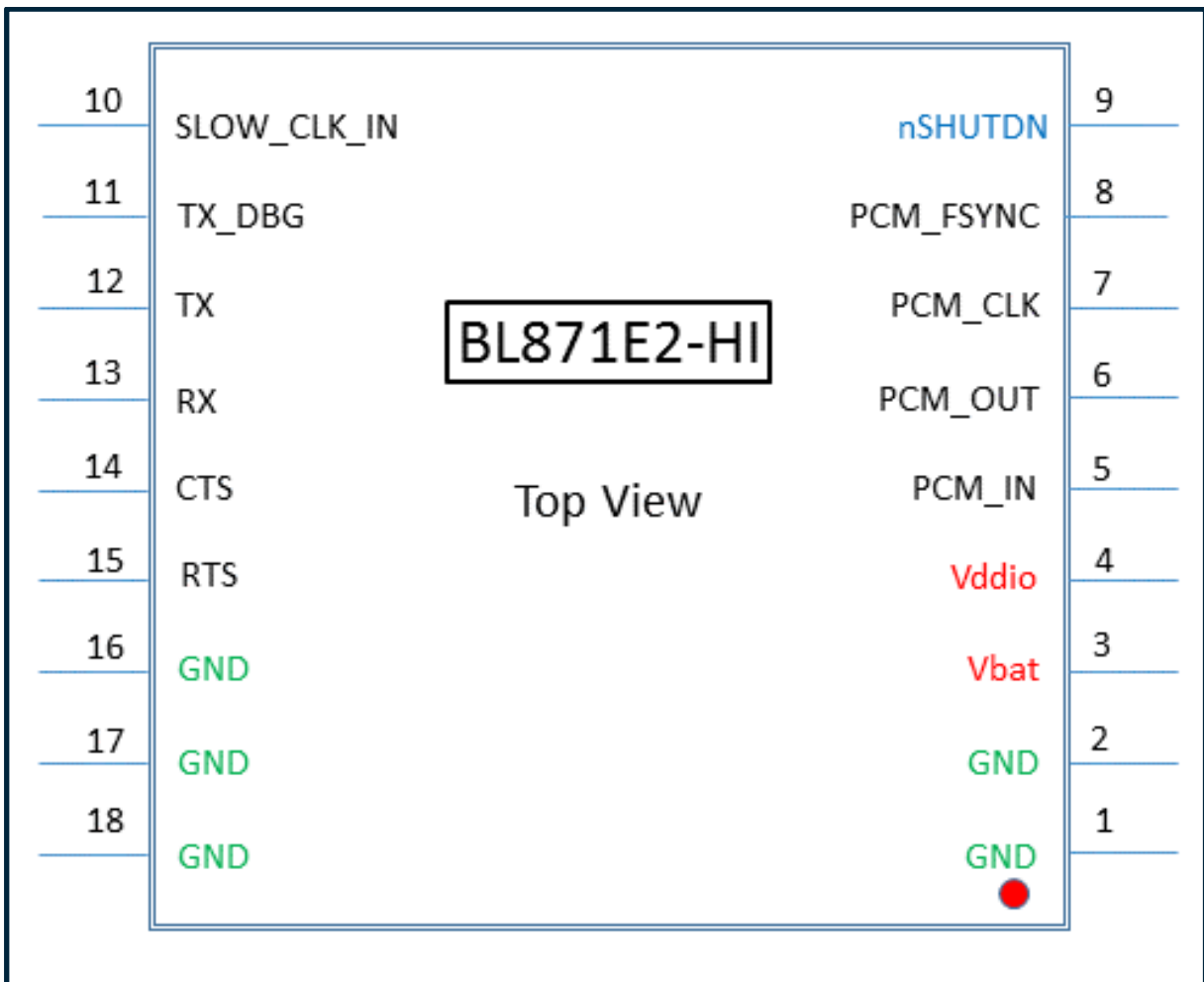


Figure 6-1 Pinout Diagram

## 6.2 Pinout Table

| Pin | Name        | Class  | Description  |
|-----|-------------|--------|--|
| 1   | GND         | Ground | Ground. See Section <b>6.3.2 Ground</b> .                                    |
| 2   | GND         | Ground | Ground. See Section <b>6.3.2 Ground</b> .                                    |
| 3   | VBAT        | Power  | Main Supply. See Section <b>6.3 DC Power</b> .                               |
| 4   | VDDIO       | Power  | I/O Supply. See Section <b>6.3 DC Power</b> .                                |
| 5   | PCM_IN      | In     | PCM. See Section <b>6.7 PCM Interface</b> .                                  |
| 6   | PCM_OUT     | Out    | PCM. See Section <b>6.7 PCM Interface</b> .                                  |
| 7   | PCM_CLK     | I/O    | PCM. See Section <b>6.7 PCM Interface</b> .                                  |
| 8   | PCM_FSYNC   | I/O    | PCM. See Section <b>6.7 PCM Interface</b> .                                  |
| 9   | nSHUTDN     | In     | Module Control.<br>See Section <b>6.5.1 nSHUTDN (input – active low)</b>     |
| 10  | SLOW_CLK_IN | In     | Clock. See Section <b>6.5.2 SLOW_CLOCK_IN (input)</b>                        |
| 11  | TX_DBG      | Out    | Debug Messages. See Section <b>6.5.3 TX_DBG (output)</b>                     |
| 12  | TX          | Out    | UART Data Output. See Section <b>6.6 UART Interface</b> .                    |
| 13  | RX          | In     | UART Data Input. See Section <b>6.6 UART Interface</b> .                     |
| 14  | CTS         | In     | UART Flow Control (H4 mode only).<br>See Section <b>6.6 UART Interface</b> . |
| 15  | RTS         | Out    | UART Flow Control (H4 mode only).<br>See Section <b>6.6 UART Interface</b> . |
| 16  | GND         | Ground | Ground. See Section <b>6.3.2 Ground</b> .                                    |
| 17  | GND         | Ground | Ground. See Section <b>6.3.2 Ground</b> .                                    |
| 18  | GND         | Ground | Ground. See Section <b>6.3.2 Ground</b> .                                    |

**Table 6-1 Pinout Table**



All GROUND pins must be connected to ground.

## 6.3 DC Power

### 6.3.1 Power Features

- Advanced Power Management for extended battery life and ease of design
- On-chip power management, including direct connection to battery
- Low power consumption for Active, Standby, and Scan Bluetooth modes
- Shutdown and Sleep modes to minimize power consumption

### 6.3.2 Ground

All GROUND pins must be connected to ground.

### 6.3.3 There are two power supply pins, VBAT and VDDIO.

#### 6.3.3.1 VBAT

| Pin              | Value      | Units |
|------------------|------------|-------|
| V <sub>BAT</sub> | 2.2 to 4.8 | VDC   |

**Table 6-2 V<sub>BAT</sub> Specifications**

| V <sub>BAT</sub> Ripple freq | Max | Units  |
|------------------------------|-----|--------|
| 0 to 0.1 MHz                 | 60  | mV P-P |
| 0.1 to 0.5 Mhz               | 50  | mV P-P |
| 0.5 to 2.5 MHz               | 30  | mV P-P |
| 2.5 to 3.0 MHz               | 15  | mV P-P |
| > 3.0 MHz                    | 5   | mV P-P |

**Table 6-3 V<sub>BAT</sub> Max Ripple**

#### 6.3.3.2 VDDIO

| Pin               | Value        | Units |
|-------------------|--------------|-------|
| V <sub>DDIO</sub> | 1.62 to 1.92 | VDC   |

**Table 6-4 V<sub>DDIO</sub> Specifications**



### 6.3.4 Power Consumption

Power-management hardware and firmware algorithms provide significant power savings, which is a critical parameter in an MCU-based system.

| Condition                      | Typ | Max | Units   |
|--------------------------------|-----|-----|---------|
| Continuous Transmission (EDR)  |     | 113 | mA      |
| Continuous Transmission (GFSK) |     | 107 | mA      |
| Total I/O (active mode)        |     | 1   | mA      |
| Deep Sleep                     | 40  | 105 | $\mu$ A |
| Shutdown                       | 1   | 7   | $\mu$ A |

**Table 6-5 Power Consumption**

### 6.3.5 Power and Signal Sequencing



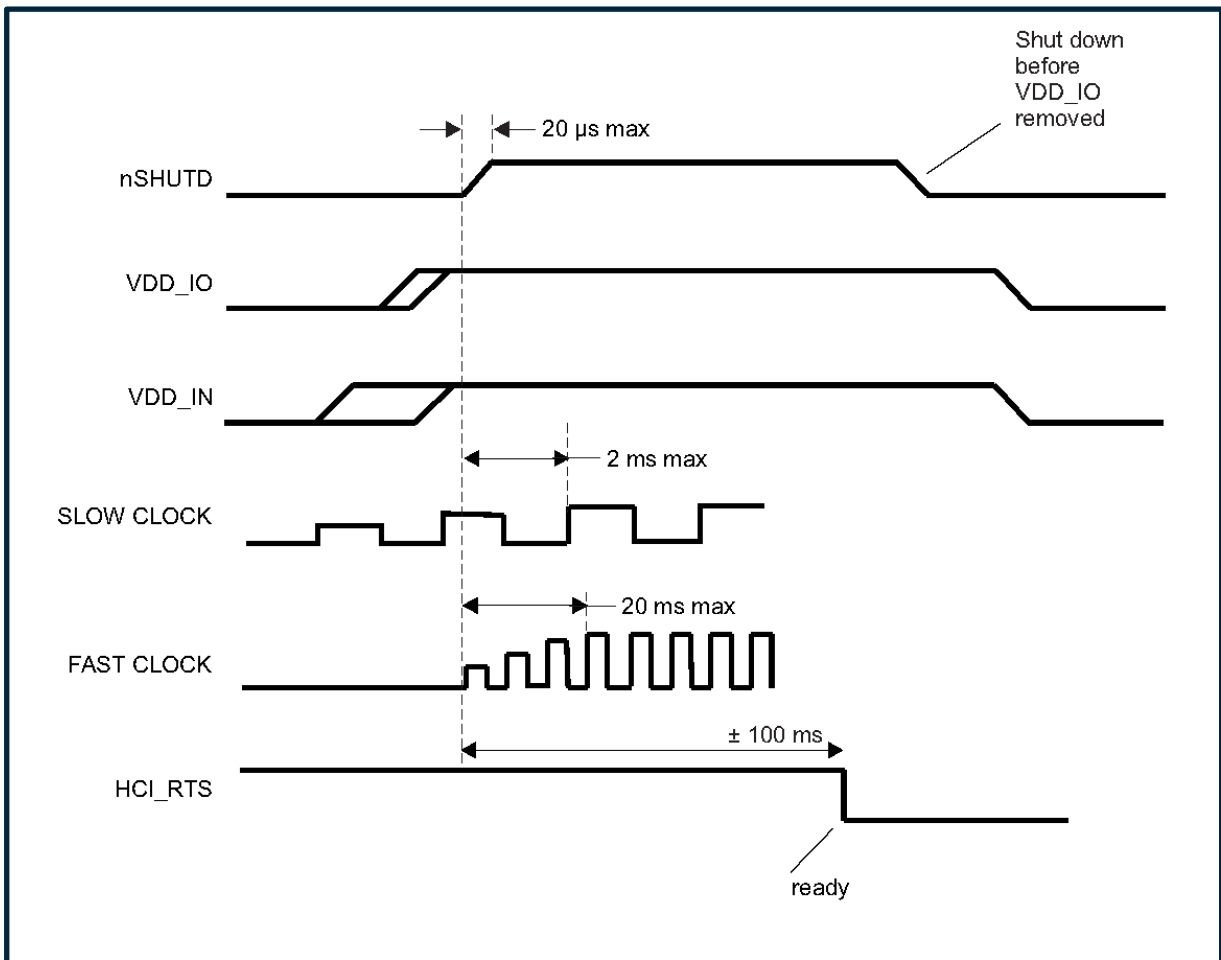
The following power and signal sequencing is required.

#### Initial conditions

$V_{BAT}$  and  $V_{DDIO}$  may be on or off.

I/O signal inputs are not allowed if  $V_{DDIO}$  is off, except for SLOW\_CLK\_IN and PCM pins.

1. nSHUTDN must be low.
2. Turn on  $V_{BAT}$ . It must be within specification before bringing nSHUTDN high.
3. Turn on  $V_{DDIO}$ . It must be within specification before bringing nSHUTDN high.
4. SLOW\_CLOCK\_IN must be within specification before bringing nSHUTDN high.
5. The module will indicate a successful power up sequence by pulling RTS low. This may occur up to 100 ms after nSHUTDN goes high. If RTS does not go low, the module is not properly sequenced up.



**Figure 6-2 Power and Signal Sequencing**

## 6.4 Digital Signal Interface Specifications

| Signal                               | Value                    | Unit |
|--------------------------------------|--------------------------|------|
| V <sub>IH</sub> (min)                | 0.65 x V <sub>DDIO</sub> | V    |
| V <sub>IH</sub> (max)                | V <sub>DDIO</sub>        | V    |
| V <sub>IL</sub> (min)                | 0                        | V    |
| V <sub>IL</sub> (max)                | 0.35 x V <sub>DDIO</sub> | V    |
| Input impedance                      | 1                        | MΩ   |
| Input rise & fall times (10% to 90%) | 200 (max)                | ns   |

**Table 6-6 Input Digital Signal Interface Specifications**

| Signal  | Value                   | Unit |
|---|-------------------------|------|
| V <sub>OH</sub> (min) at 2, 4, 8mA                              | 0.8 x V <sub>DDIO</sub> | V    |
| V <sub>OH</sub> (min) at 0.1mA                                  | V <sub>DDIO</sub> - 0.2 | V    |
| V <sub>OH</sub> (max) at 2, 4, 8mA                              | V <sub>DDIO</sub>       | V    |
| V <sub>OL</sub> (min)   | 0                       | V    |
| V <sub>OL</sub> (max) at 2, 4, 8mA                              | 0.2 x V <sub>DDIO</sub> | V    |
| V <sub>OL</sub> (max) at 0.1mA                                  | 0.2                     | V    |
| Output rise & fall times (10% to 90%)<br>C <sub>L</sub> = 20 pF | 10                      | ns   |

**Table 6-7 Output Digital Signal Interface Specifications**

## 6.5 Digital I/O Pins

### 6.5.1 nSHUTDN (input – active low)

nSHUTDN halts operation of the module and performs an internal reset when pulled low.

nSHUTDN must be low for a minimum of 5 ms.

The rise time for nSHUTDN must not exceed 20  $\mu$ s.

This pin is pulled low internally through 100 K $\Omega$ .

See Section 6.3.5 **Power and Signal Sequencing** for startup sequencing requirements.

### 6.5.2 SLOW\_CLOCK\_IN (input)



The slow clock input as described below must be supplied to operate the module.

The source must be a digital signal in the range of 0 to 1.8 V.

The accuracy of the slow-clock frequency must be 32.768 kHz  $\pm$ 250 ppm for Bluetooth use (as stated in the Bluetooth specification). The external slow clock must be stable within 64 slow-clock cycles (2 ms) following the release of nSHUTDN.

See Section 6.3.5 **Power and Signal Sequencing** for startup sequencing requirements.

| CHARACTERISTICS                                    |  | CONDITION               | MIN                   | TYP | MAX                   | UNIT       |
|--|--|-------------------------|-----------------------|-----|-----------------------|------------|
| Input slow-clock frequency                         |  |                         | 32768                 |     |                       | Hz         |
| Input slow-clock accuracy (Initial + temp + aging) |  | Bluetooth               | $\pm$ 250             |     |                       | ppm        |
| $t_r$ and $t_f$                                    | Input transition time $t_r$ and $t_f$ (10% to 90%) |                         | 200                   |     |                       | ns         |
| Frequency input duty cycle                         |  |                         | 15%                   | 50% | 85%                   |            |
| $V_{IH}$   | Slow-clock input voltage limits                    | Square wave, DC-coupled | $0.65 \times VDD\_IO$ |     | $VDD\_IO$             | V peak     |
| $V_{IL}$   |  |                         | 0                     |     | $0.35 \times VDD\_IO$ | V peak     |
| Input impedance                                    |  |                         | 1                     |     |                       | M $\Omega$ |
| Input capacitance                                  |  |                         | 5                     |     |                       | pF         |

**Table 6-8 Slow Clock Requirements**

### 6.5.3 TX\_DBG (output)

This pin transmits TI internal debugging messages. It is recommended to bring it out to a test point.

## 6.6 UART Interface

A serial data port implements HCI communications into and data out of the BL871-A Module. The UART implements a single full duplex asynchronous serial port.

Refer to **Table 6-6 Input Digital Signal Interface Specifications** for voltage specifications.

### 6.6.1 UART pinout

TX is the HCI serial output.

RX is the HCI serial input.

RTS is the UART flow control output. (H4 interface only)

CTS is the UART flow control input. (H4 interface only)

### 6.6.2 Supported interfaces

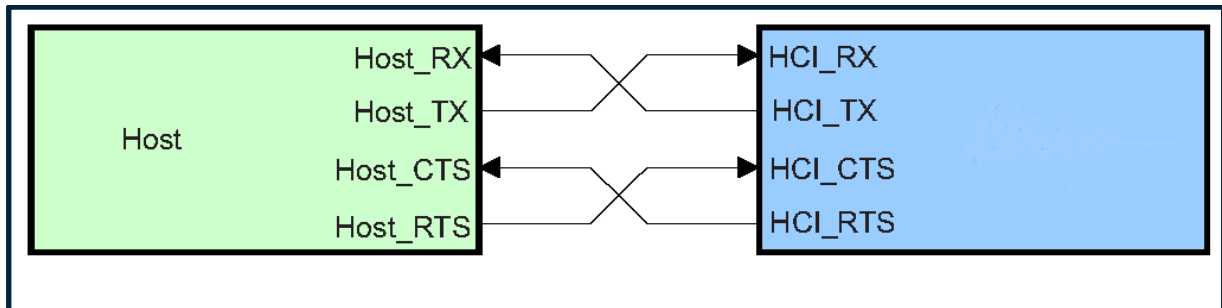
The UART supports H4 (4-wire) and H5 (3-wire) interfaces:

The interface (H4 vs. H5) is automatically detected upon reception of the first command.



If H4 interface is used, then data flow control signals CTS and RTS are required.  
If H5 interface is used, then data flow control is implemented via XON/XOFF.

#### 6.6.2.1 H4 (4-wire) Interface



**Figure 6-3 H4 (4-wire) UART Interface**

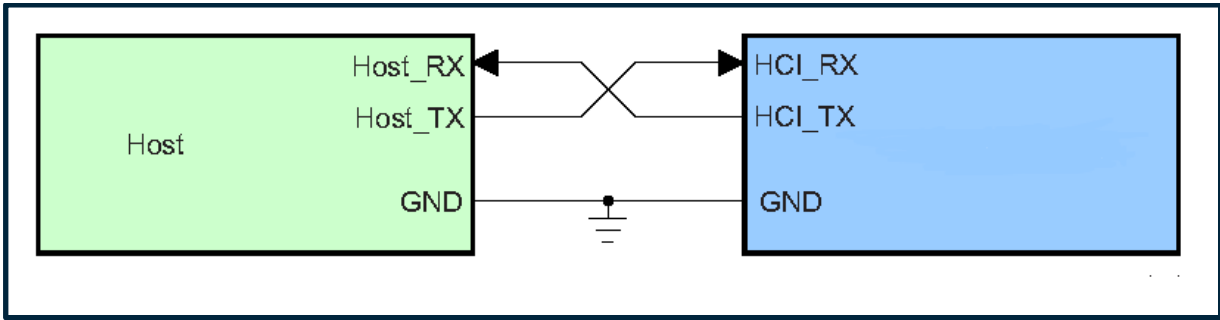
When the UART RX buffer of the module is filled above the flow control threshold, it sets the RTS signal high to stop transmission from the host.

When the CTS signal is set high, the device stops transmission on the interface. If CTS is set high while transmitting a byte, the device finishes transmitting the byte and stops the transmission.

The H4 interface handles the transition between active mode and sleep mode through the enhanced HCI low level (eHCILL) power-management protocol.

For more information on the H4 UART protocol, see *Volume 4 Host Controller Interface, Part A UART Transport Layer of the Bluetooth Core Specifications* ([www.bluetooth.org/en-us/specification/adoptedspecifications](http://www.bluetooth.org/en-us/specification/adoptedspecifications)).

### 6.6.2.2 H5 (3-wire) Interface



**Figure 6-4 H5 (3-wire) UART Interface**

The H5 protocol supports the following features:

- Software flow control (XON/XOFF)
- Power management using the software messages:
  - WAKEUP
  - WOKEN
  - SLEEP
- CRC data integrity check

For more information on the H5 UART protocol, see *Volume 4 Host Controller Interface, Part D Three- Wire UART Transport Layer of the Bluetooth Core Specifications* ([www.bluetooth.org/en-us/specification/adoptedspecifications](http://www.bluetooth.org/en-us/specification/adoptedspecifications)).

### 6.6.3 Supported bit rates and format

Data length is 8 bits and 1 stop bit with no parity. The power on default bit rate is 115.2 kbps. Minimum bit rate is 37,500 bps and maximum bit rate is 4 Mbps.

### 6.6.4 RX

This signal is used to input commands from a host. In the idle condition, this pin is at logic 1.

### 6.6.5 TX

This signal is used to output data to the host. In the idle condition, this pin is at logic 1.

### 6.6.6 CTS

When the CTS signal is set high by the host, the module stops transmission on the UART interface.

If CTS is set high while transmitting a byte, the device finishes transmitting the byte and stops the transmission.

See Figure 6-5 **UART Timing**.

### 6.6.7 RTS

When the UART RX buffer of the module passes the flow control threshold, it sets the RTS signal high to stop transmission from the host.

See Figure 6-5 **UART Timing**.



Upon initial power up, RTS will be logic one and then will go to logic zero to indicate a successful power up sequence.

### 6.6.8 UART Timing

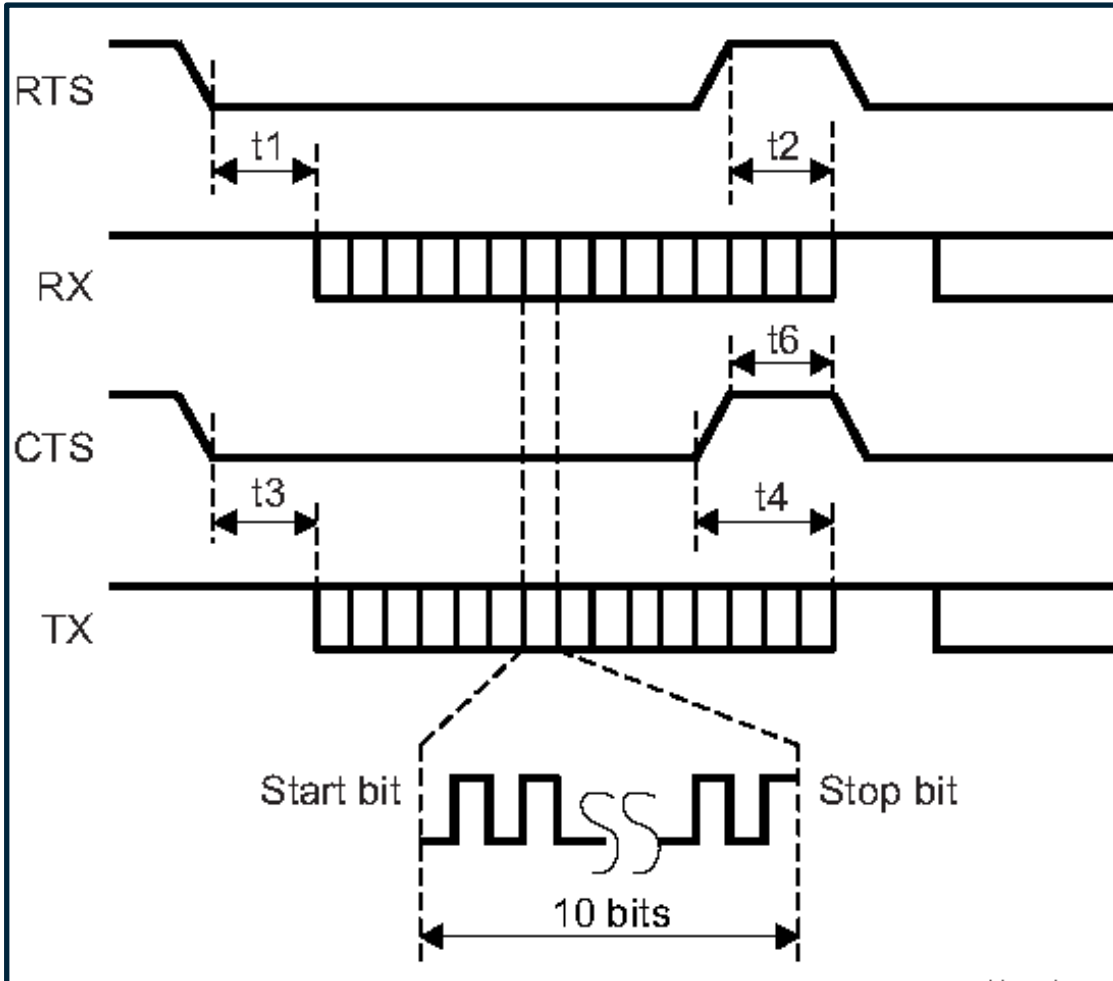


Figure 6-5 UART Timing

| Symbol | Description             | Condition                      | Min | Typ | Max | Units   |
|--------|-------------------------|--------------------------------|-----|-----|-----|---------|
| t1     | RTS low to RX data on   |                                | 0   | 2   |     | $\mu$ s |
| t2     | RTS high to RX data off | Interrupt = $\frac{1}{4}$ FIFO |     |     | 16  | byte    |
| t3     | CTS low to TX data on   |                                | 0   | 2   |     | $\mu$ s |
| t4     | CTS high to TX data off | HW flow control                |     |     | 1   | byte    |
| t5     | CTS high pulse width    |                                | 1   |     |     | bit     |

Table 6-9 UART Timing

### 6.7 PCM Interface

The PCM interface is a fully programmable port to support seamless interfacing with various PCM and I<sup>2</sup>S protocols for codec devices.

The interface includes the following features:

- Two voice channels
- Master and slave modes
  - The module can be either master of the interface (generating Clock and Frame Sync) or the slave (receiving these two signals).
- All voice coding schemes defined by the Bluetooth specification:
  - linear
  - Law
  - $\mu$ -Law
- Long and short frames
- Different data sizes, order, and positions
- High flexibility to support a variety of codecs
- Bus sharing: Data\_Out is in the Hi-Z state when the interface is not transmitting voice data.

#### 6.7.1 PCM I/O Signals

##### 6.7.1.1 PCM\_IN

This signal is used to input PCM data from a host.

##### 6.7.1.2 PCM\_OUT

This signal is used to output PCM data to a host.

##### 6.7.1.3 PCM\_CLK

If the PCM interface is in master mode, the module can generate any clock frequency from 64 KHz to 4.096 MHz.

If the PCM interface is in slave mode, clock frequencies up to 15 MHz are supported.

At clock rates above 12 MHz, the maximum data burst size is 32 bits.

##### 6.7.1.4 PCM\_FSYNC

If the PCM interface is in master mode, the module generates Frame Sync.

If the PCM interface is in slave mode, the module receives Frame Sync.

#### 6.7.2 I<sup>2</sup>S

When the codec interface is configured to support the I<sup>2</sup>S protocol, these settings are recommended:

- Bidirectional, full-duplex interface
- Two time slots per frame: time slot 0 for the left channel audio data; and time slot 1 for the right channel audio data
- The length of each time slot is configurable up to 40 serial clock cycles, and the length of the frame is configurable up to 80 serial clock cycles



### 6.7.3 PCM Data Format

The data format is fully configurable:

- The data length can be from 8 to 320 bits in 1-bit increments when USING 2 channels, or up to 640 bits when using 1 channel.  
The data length can be set independently for each channel.
- The data position within a frame is also configurable within 1 clock (bit) resolution and can be set independently (relative to the edge of the Frame\_Sync signal) for each channel.
- The Data\_In and Data\_Out bit order can be configured independently. For example, Data\_In can start with the most significant bit (MSB); Data\_Out can start with the least significant bit (LSB).  
Each channel is separately configurable.  
The inverse bit order (LSB first) is supported only for sample sizes up to 24 bits.
- Data\_In and Data\_Out are not required to be the same length.
- The Data\_Out line is configured to Hi-Z output between data words.  
Data\_Out can also be set for permanent Hi-Z output, regardless of the data output.  
This configuration allows the device to be a bus slave in a multislave PCM environment. At power up, Data\_Out is configured as Hi-Z output.

### 6.7.4 PCM Frame-Idle Period

The codec interface handles frame-idle periods, during which the clock pauses and becomes 0 at the end of the frame after all data are transferred.

The device supports frame-idle periods both as master and slave of the codec bus.

When the device is the master of the interface, the frame-idle period is configurable.

There are two configurable parameters:

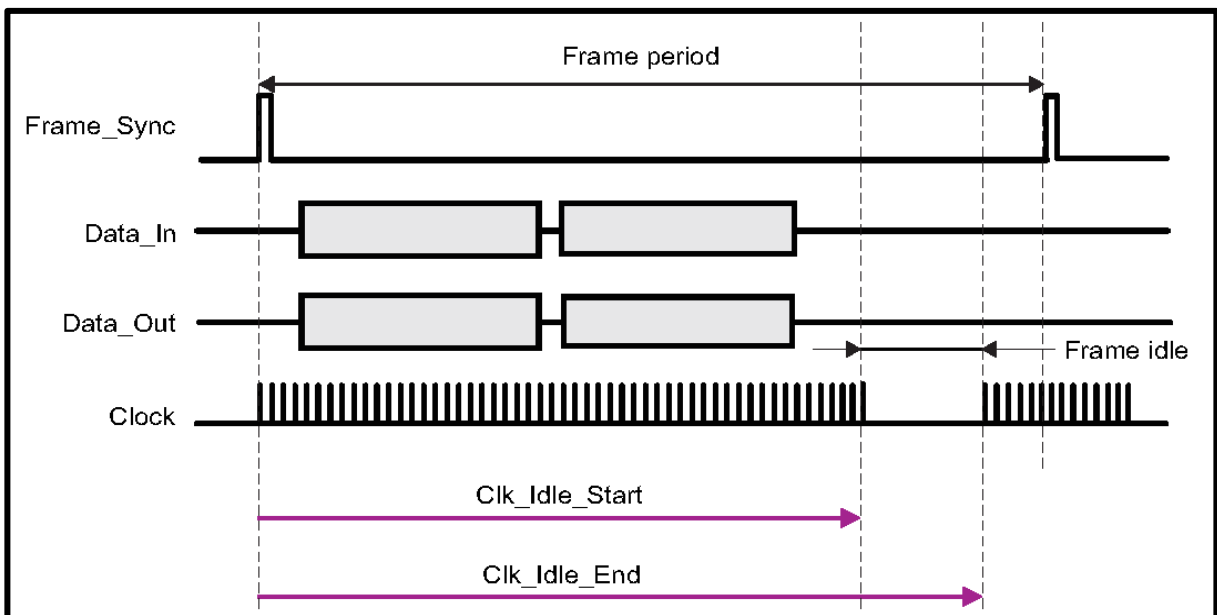
- Clk\_Idle\_Start: indicates the number of clock cycles from the beginning of the frame to the beginning of the frame-idle period. After Clk\_Idle\_Start clock cycles, the clock becomes 0.
- Clk\_Idle\_End: indicates the time from the beginning of the frame to the end of the frame-idle period. The time is given in multiples of clock periods.

The delta between Clk\_Idle\_Start and Clk\_Idle\_End is the clock idle period.

For example, for clock rate = 1 MHz, frame sync period = 10 kHz, Clk\_Idle\_Start = 60, Clk\_Idle\_End = 90.

Between both Frame\_Sync signals there are 70 clock cycles (instead of 100).

The clock idle period starts 60 clock cycles after the beginning of the frame and lasts  $90 - 60 = 30$  clock cycles. Thus, the idle period ends  $100 - 90 = 10$  clock cycles before the end of the frame. The data transmission must end before the beginning of the idle period.



**Figure 6-6 Frame Idle Period**

### 6.7.5 PCM Clock Edge Operation

The codec interface can work on the rising or the falling edge of the clock and can sample the Frame\_Sync signal and the data at inversed polarity.

The operation of a falling-edge-clock type of codec is shown below.

The codec is the master of the bus.

The Frame\_Sync signal is updated (by the codec) on the falling edge of the clock and is therefore sampled (by the device) on the next rising clock.

The data from the codec is sampled (by the device) on the falling edge of the clock.

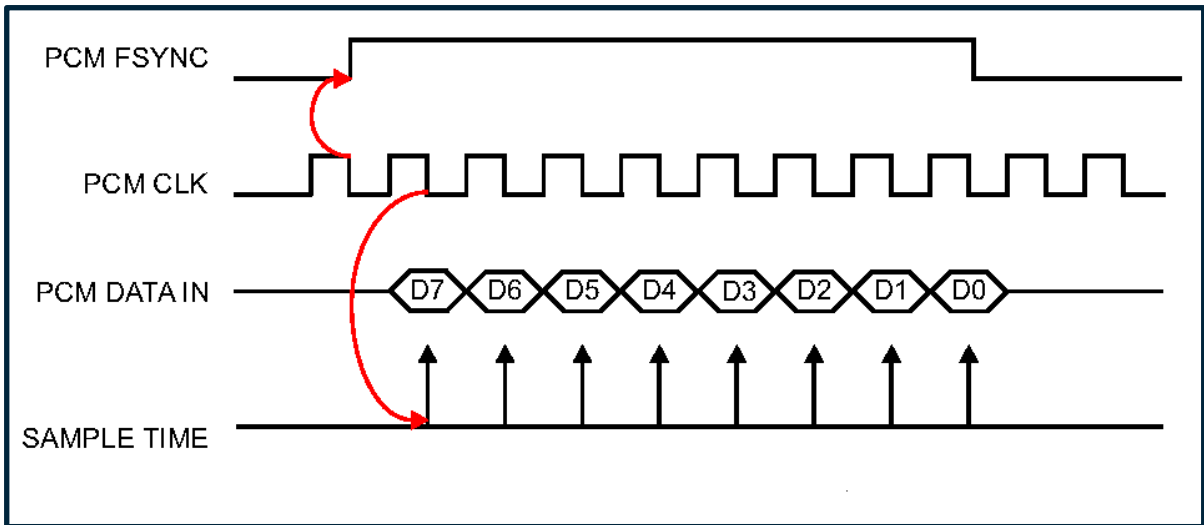


Figure 6-7 Negative Clock Edge Operation

### 6.7.6 PCM Two-Channel Bus Example

The figure below shows a 2-channel bus in which the two channels have different word sizes and arbitrary positions in the bus frame.

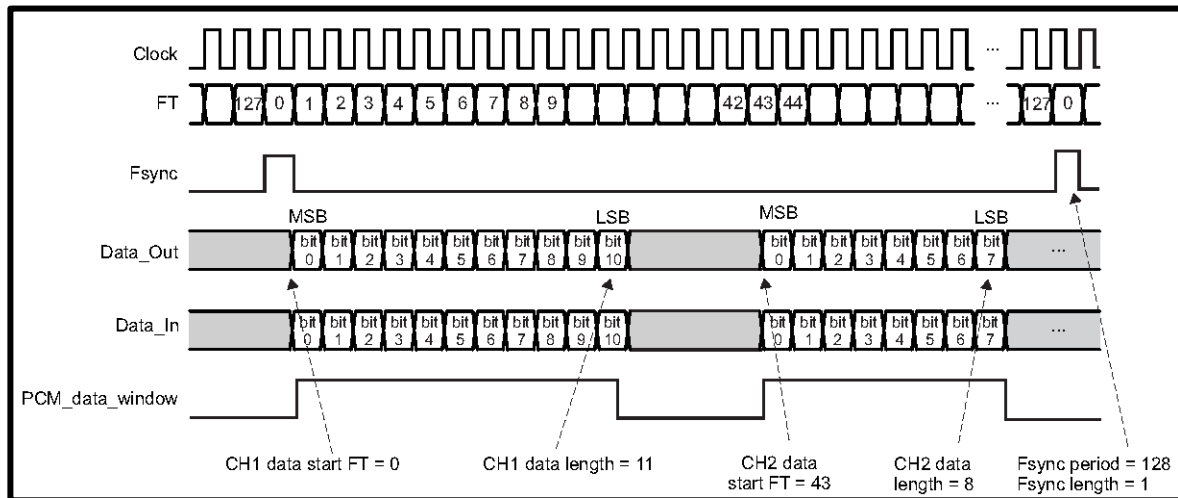


Figure 6-8 Two-channel Bus Timing

6.7.7 PCM Timing

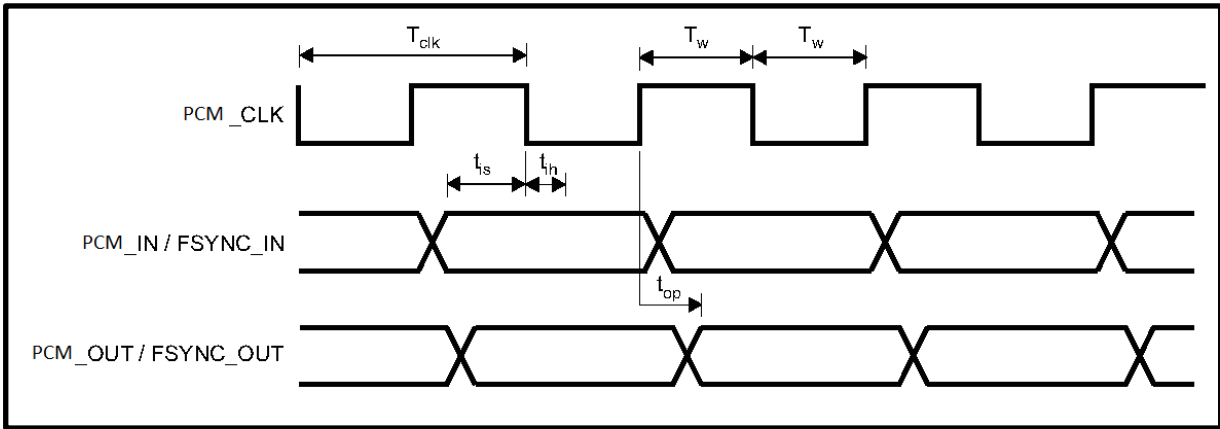


Figure 6-9 PCM Timing

| Symbol    | Description              | Condition  | Min                 | Max             | Unit |
|-----------|--------------------------|------------|---------------------|-----------------|------|
| $t_{clk}$ | Cycle time               |            | 244.14<br>4.096 MHz | 15625<br>64 kHz | ns   |
| $T_w$     | Pulse width (hi or lo)   |            | 50% of $t_{clk}$    |                 | ns   |
| $T_{is}$  | PCM_IN setup time        |            | 25                  |                 | ns   |
| $T_{ih}$  | PCM_IN hold time         |            | 0                   |                 | ns   |
| $T_{op}$  | PCM_OUT propagation time | 40 pF load | 0                   | 10              | ns   |
| $T_{op}$  | FSYNC_OUT propagation tm | 40 pF load | 0                   | 10              | ns   |

Table 6-10 PCM Timing – Master

| Symbol    | Description              | Condition  | Min              | Max | Unit |
|-----------|--------------------------|------------|------------------|-----|------|
| $t_{clk}$ | Cycle time               |            | 66.67<br>15 MHz  |     | ns   |
| $T_w$     | Pulse width (hi or lo)   |            | 40% of $t_{clk}$ |     | ns   |
| $T_{is}$  | PCM_IN setup time        |            | 8                |     | ns   |
| $T_{ih}$  | PCM_IN hold time         |            | 0                |     | ns   |
| $T_{is}$  | PCM_FSYNC setup time     |            | 8                |     | ns   |
| $T_{ih}$  | PCM_FSYNC hold time      |            | 0                |     | ns   |
| $T_{op}$  | PCM_OUT Propagation time | 40 pF load | 0                | 21  | ns   |

Table 6-11 PCM Timing – Slave

### 6.7.8 PCM Assisted Modes

The module contains an embedded coprocessor that can be used for multiple purposes.

It uses a coprocessor to perform the LE functionality or to execute either the assisted HFP 1.6 (WBS) or assisted A2DP functions.

Only one of these functions can be executed at a time because they use the same resources.

The assisted HFP 1.6 (WBS) and assisted A2DP modes of operation comply fully with the HFP 1.6 and A2DP Bluetooth specifications. For more information on these profiles, see the corresponding Bluetooth Profile Specification:

[www.bluetooth.org/en-us/specification/adopted-specifications](http://www.bluetooth.org/en-us/specification/adopted-specifications)

These modes of operation minimize host processing and power by taking advantage of the device coprocessor to perform the voice and audio SBC processing required in HFP 1.6 (WBS) and A2DP profiles. This section also compares the architecture of the assisted modes with the common implementation of the HFP 1.6 and A2DP profiles.

#### 6.7.8.1 Assisted HFP 1.6 (WBS)

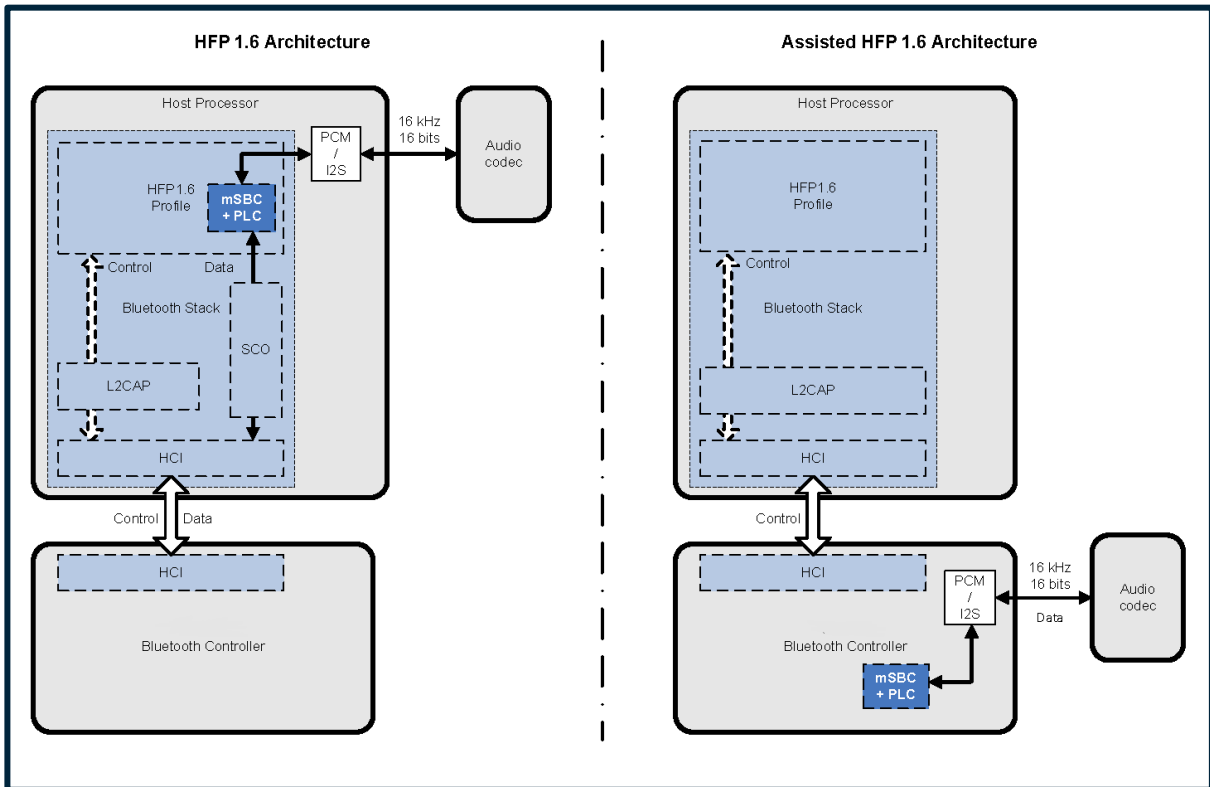
The *HFP 1.6 Profile Specification* adds the requirement for WBS support. The WBS feature allows twice the voice quality versus legacy voice coding schemes at the same air bandwidth (64 kbps). This feature is achieved using a voice sampling rate of 16 kHz, a modified subband coding (mSBC) scheme, and a packet loss concealment (PLC) algorithm. The mSBC scheme is a modified version of the mandatory audio coding scheme used in the A2DP profile with the parameters listed below.

| Parameter         | Value    |
|-------------------|----------|
| Channel Mode      | Mono     |
| Sampling Rate     | 16 kHz   |
| Allocation Method | Loudness |
| Subbands          | 8        |
| Block Length      | 15       |
| Bitpool           | 26       |

**Table 6-12 Assisted HFP - mSBC Parameters**

The assisted HFP 1.6 mode of operation implements this WBS feature on the embedded CC2564C coprocessor. That is, the mSBC voice coding scheme and the PLC algorithm are executed in the coprocessor rather than in the host, thus minimizing host processing workload and power requirements. One WBS connection at a time is supported, and WBS and NBS connections cannot be used simultaneously in this mode of operation.

The architecture comparison between the common implementation of the HFP 1.6 profile and the assisted HFP 1.6 solution is shown below.



**Figure 6-10 Assisted HFP 1.6 - Architecture**

For detailed information on the HFP 1.6 profile, see the *Hands-Free Profile 1.6 Specification* ([www.bluetooth.org/en-us/specification/adopted-specifications](http://www.bluetooth.org/en-us/specification/adopted-specifications)).

## 6.7.8.2 Assisted A2DP

The advanced audio distribution profile (A2DP) enables wireless transmission of high-quality mono or stereo audio between two devices. A2DP defines two roles:

- A2DP source is the transmitter of the audio stream.
- A2DP sink is the receiver of the audio stream.

A typical use case streams music from a tablet, phone, or PC (the A2DP source) to headphones or speakers (the A2DP sink). This section describes the architecture of these roles and compares them with the corresponding assisted-A2DP architecture. To use the air bandwidth efficiently, the audio data must be compressed in a proper format. The A2DP mandates support of the SBC scheme. Other audio coding algorithms can be used; however, both Bluetooth devices must support the same coding scheme. Since SBC is the only coding scheme included in all A2DP Bluetooth devices, it is the only coding scheme supported in the assisted A2DP modes.

Recommended parameters for the SBC scheme in the assisted A2DP modes are shown below.

| SBC ENCODER SETTINGS <sup>(1)</sup> | MID QUALITY |     |              |     | HIGH QUALITY |     |              |     |
|-------------------------------------|-------------|-----|--------------|-----|--------------|-----|--------------|-----|
|                                     | MONO        |     | JOINT STEREO |     | MONO         |     | JOINT STEREO |     |
| Sampling frequency (kHz)            | 44.1        | 48  | 44.1         | 48  | 44.1         | 48  | 44.1         | 48  |
| Bitpool value                       | 19          | 18  | 35           | 33  | 31           | 29  | 53           | 51  |
| Resulting frame length (bytes)      | 46          | 44  | 83           | 79  | 70           | 66  | 119          | 115 |
| Resulting bit rate (Kbps)           | 127         | 132 | 229          | 237 | 193          | 198 | 328          | 345 |

(1) Other settings: Block length = 16; allocation method = loudness; subbands = 8.

**Table 6-13 Recommended SBC Parameters for Assisted A2DP Mode**

Supported Channel Modes:

- Mono
- Dual Channel
- Stereo
- Joint Stereo

Supported Sampling Frequencies (kHz):

- 16
- 44.1
- 48

Supported Block Lengths:

- 4
- 8
- 12
- 16

Supported Subbands:

- 4
- 8

Supported Allocation Methods:

- SNR
- Loudness

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### Supported Bitpool Ranges:

- Assisted A2DP sink: 2 – 54
- Assisted A2DP source: 2 – 57

### Supported L2CAP MTU Sizes (bytes):

- Assisted A2DP sink: 260 – 800
- Assisted A2DP source: 260 – 1021

### Miscellaneous Parameters:

- AVDTP Service: Basic type is supported
- L2CAP Basic mode is supported
- L2CAP Flush: Nonflushable is supported
- A2DP content protection: Protected is not supported



6.7.8.2.1 Assisted A2DP Sink

The role of the A2DP sink is to receive the audio stream in an A2DP Bluetooth connection. In this role, the A2DP layer and its underlying layers are responsible for link management and data decoding.

To handle these tasks, two logic transports are defined:

- Control and signaling logic transport
- Data packet logic transport

The assisted A2DP takes advantage of this modularity to handle the data packet logic transport internally. First, the assisted A2DP implements a light L2CAP layer (L-L2CAP) and light AVDTP layer (L-AVDTP) to defragment the packets. Then the assisted A2DP performs the SBC decoding on-chip to deliver raw audio data through the device PCM-I2S interface.

A comparison between a common A2DP sink architecture and the assisted A2DP sink architecture is shown below.

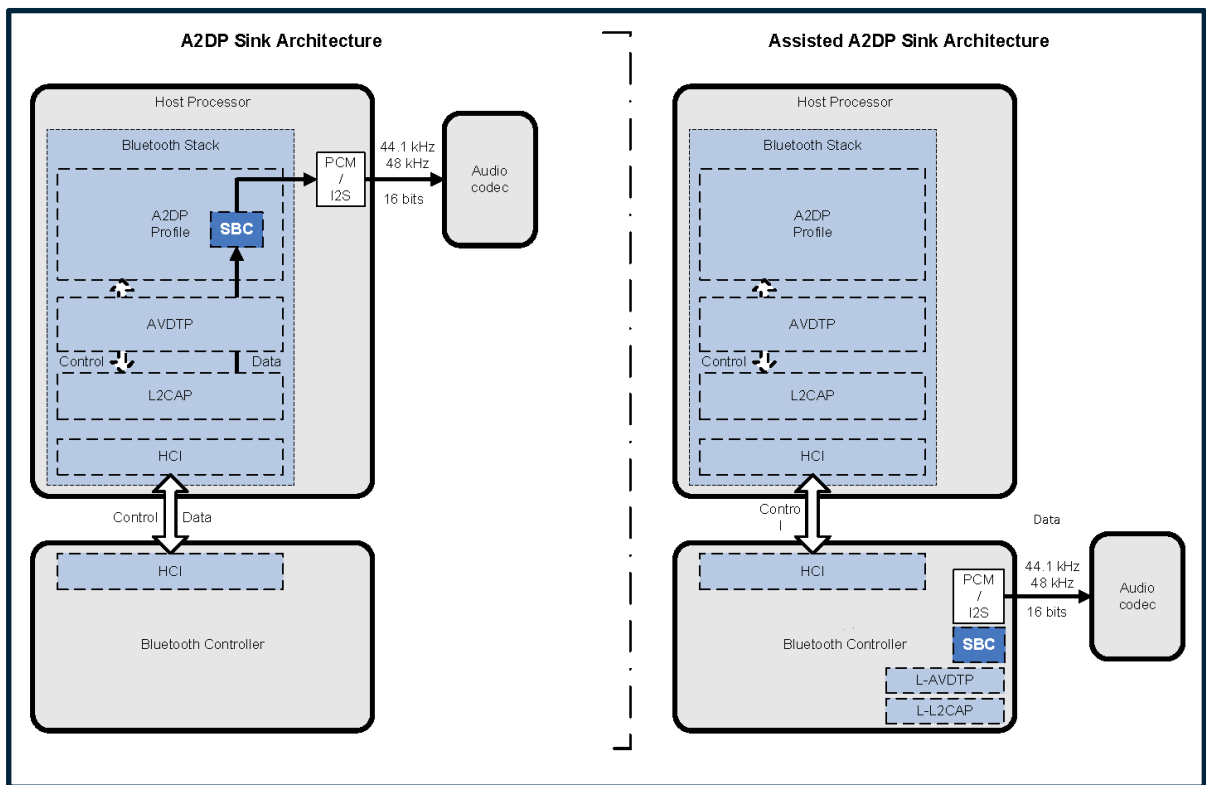


Figure 6-11 Assisted A2DP Sink Architecture

For more information on the A2DP sink role, see the [A2DP Profile Specification](#) at [Adopted Bluetooth Core Specifications](#).

## 6.7.8.2.2 Assisted A2DP Source

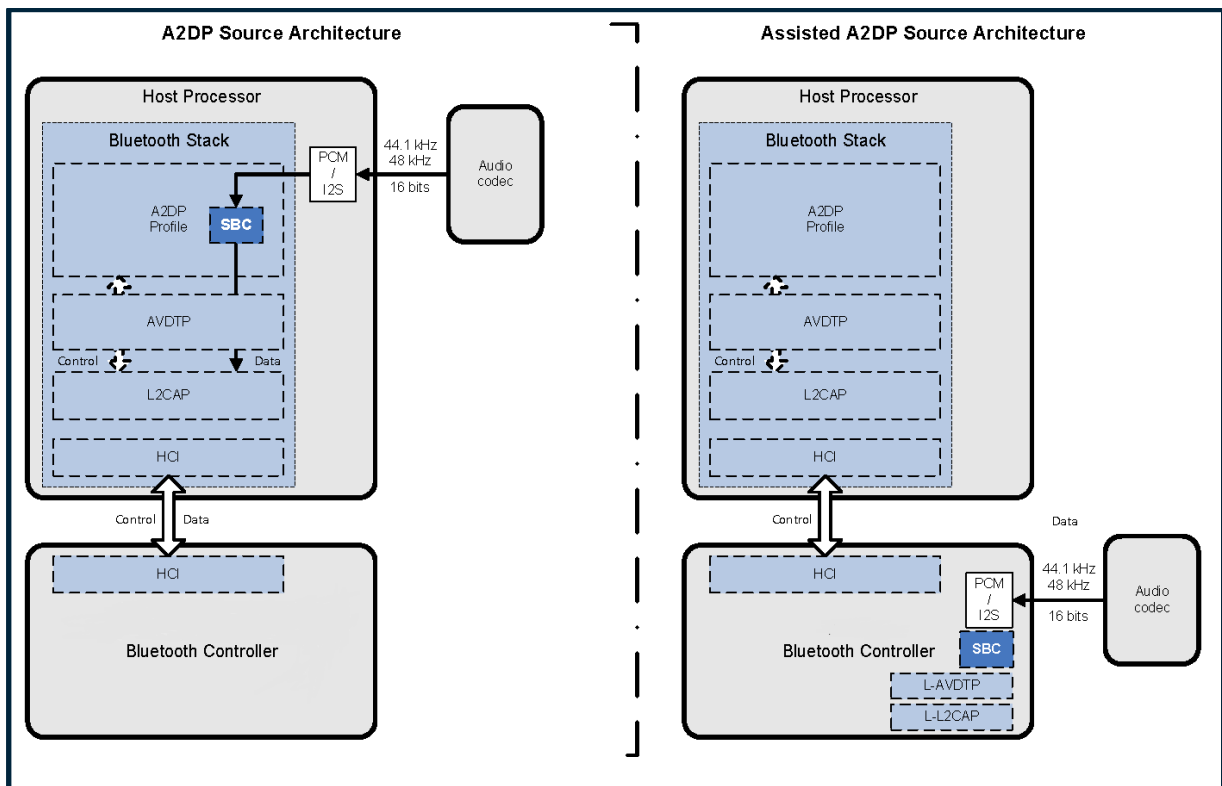
The role of the A2DP source is to transmit the audio stream in an A2DP Bluetooth connection. In this role, the A2DP layer and its underlying layers are responsible for link management and data encoding.

To handle these tasks, two logic transports are defined:

- Control and signaling logic transport
- Data packet logic transport

The assisted A2DP takes advantage of this modularity to handle the data packet logic transport in the device. First, the assisted A2DP encodes the raw data from the PCM-I2S interface using an on-chip SBC encoder. Then the assisted A2DP implements an L-L2CAP layer and an L-AVDTP layer to fragment and packetize the encoded audio data.

A comparison between a common A2DP source architecture and the assisted A2DP source architecture is shown below.



**Figure 6-12 Assisted A2DP Source Architecture**

For more information on the A2DP source role, see the A2DP Profile Specification at [Adopted Bluetooth Core Specifications](#).

## 7 REFERENCE DESIGN

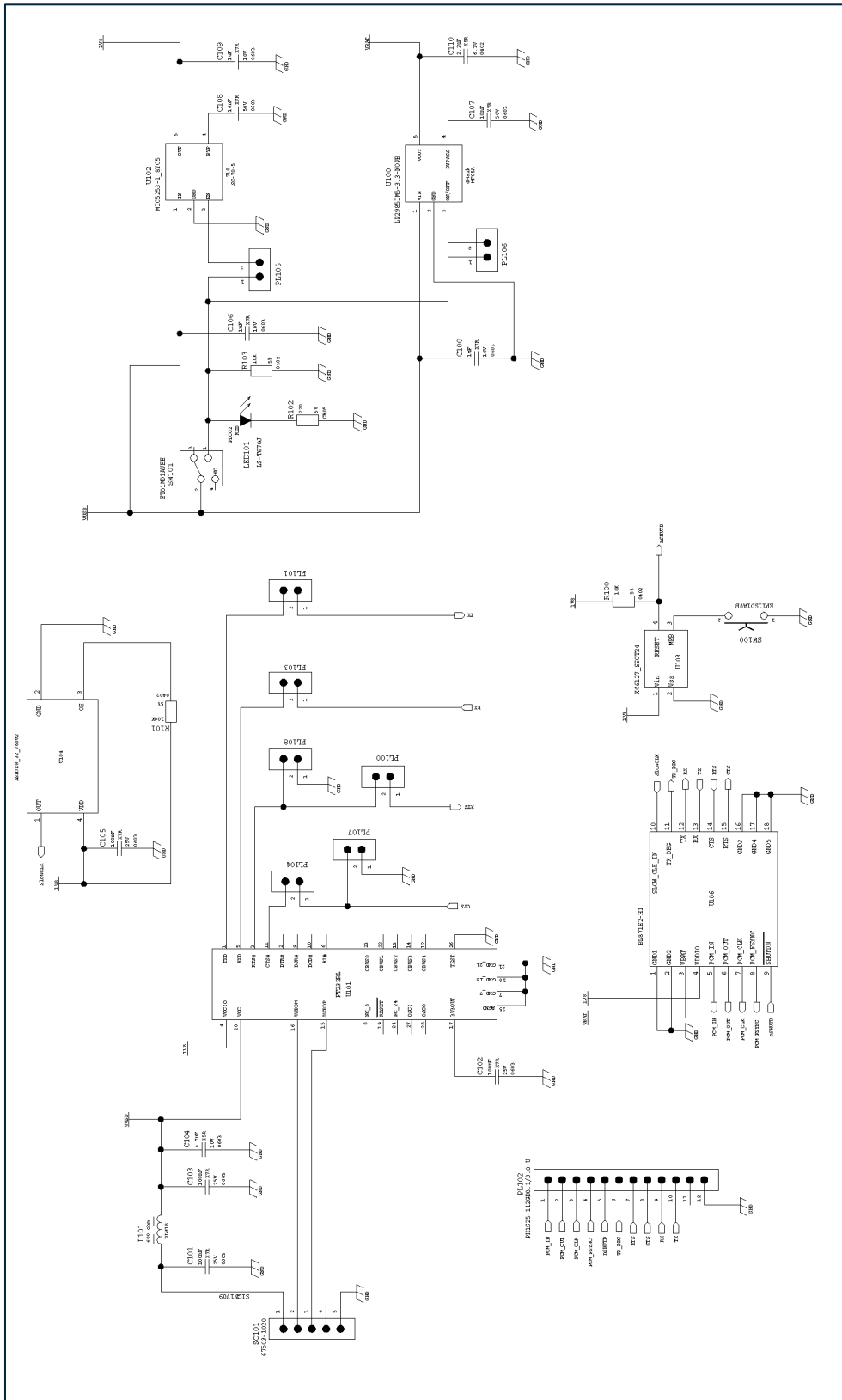


Figure 7-1 Reference Design - schematic diagram

| BL871E2-HI REFERENCE DESIGN BOM                             |                    |                                |                      |        |     |  |  |  |  |
|---|--------------------|--------------------------------|----------------------|--------|-----|--|--|--|--|
| Reference Designator(s)                                     | LABEL              | DESCRIPTION                    | VALUE                | TOL    | QTY |  |  |  |  |
| C100,C106,C109  | CC0603KRX7R6BB105  | Cond Cer SMD                   | 10V                  | 10%    | 3   |  |  |  |  |
| C101,C102,C103,C105   | 1BB01T0258         | Cond Cer SMD                   | 25V                  | 10%    | 4   |  |  |  |  |
| C104  | LMK107B475KA-T     | Cond Cer SMD                   | 10V LM               | 10%    | 1   |  |  |  |  |
| C107,C108   | 1BB01T0284         | Cond Cer SMD                   | 50V                  | 10%    | 2   |  |  |  |  |
| C110  | 1BB01T0533         | Cond Cer SMD                   | 6.3V                 | 10%    | 1   |  |  |  |  |
| J1,J2,J3,J4,J5,J6,J7,J8,J9,J10                              | jumper-2-pin       | 2-pin-jumper                   |                      |        | 10  |  |  |  |  |
| L101  | BLM18BD601SN1      | ML Ferrite Chip EMI Suppressor |                      |        | 1   |  |  |  |  |
| LED101  | LS-T670J           | Light Emitting Diodes          |                      |        | 1   |  |  |  |  |
| OT100,OT101,OT103   | OPT40SM100         | Optical Centering Point        |                      |        | 3   |  |  |  |  |
| PL102   | PH1S25-112GB8.1/3. | 2.54mm Pin Header              | Single Row H=10.8 mm | 1x12ct | 1   |  |  |  |  |
| PL100,PL101,PL103,PL104,PL105,PL106,PL107,PL108,PL109,PL110 | 471-1955-102-400   | 2.54mm Pin Header              | Single Row H=8.6 mm  | 1x2ct  | 10  |  |  |  |  |
| R101  | RC0402JR_07100KL   | RES SMD 0402                   | 5%                   | 1/16W  | 1   |  |  |  |  |
| R102  | CR05-221J          | Chip Resistor CR05             | 5%                   | 1/16W  | 1   |  |  |  |  |
| R100,R104,R105  | RC0402J_10K        | RES SMD 0402                   | 5% 1                 | /16W   | 3   |  |  |  |  |
| SO101   | 67503-1020         | Mini USB port Type B           |                      |        | 1   |  |  |  |  |
| SW100   | EP11SD1AVB         | PTH PSHBUTTON SPST R/A         |                      |        | 1   |  |  |  |  |
| SW101   | ET01MD1AVBE        | Toggle Switch                  |                      |        | 1   |  |  |  |  |
| U100  | LP2985IM5-3.3-NOPB | LOW DROPOUT REG.               | LP2985IM5-3.3        | NOPB   | 1   |  |  |  |  |
| U101  | FT232RL            | IC USB TO SERIAL UART          | FT232R               | SSOP-2 | 1   |  |  |  |  |
| U102  | MIC5253-1_8YC5     | 100mA Low Dropout Voltage Reg  |                      |        | 1   |  |  |  |  |
| U103  | XC6127_SSOT24V2    | RESET IC                       |                      |        | 1   |  |  |  |  |
| U104  | ASH7KW_32_768V2    | RTC crystal oscillator         |                      |        | 1   |  |  |  |  |
| U106  | BL871E2-HI         | Telit BT module                |                      |        | 1   |  |  |  |  |

Figure 7-2 Reference Design - BOM

## 8 MECHANICAL DRAWINGS

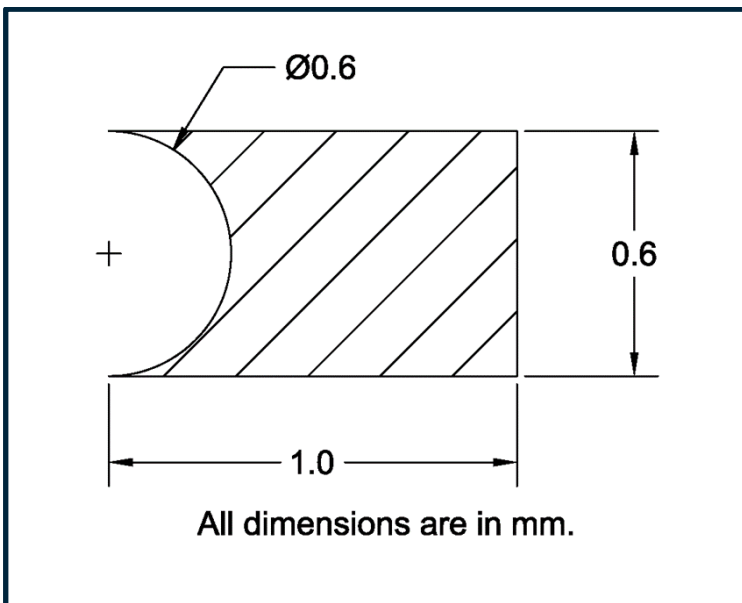
### 8.1 Module Dimensions

The overall dimensions of the BL871E2-HI are 9.7mm x 10.1mm x 2.5 mm.

The metal shield encompasses only the electronics and not the chip antenna. The maximum height will be 2.5 mm  $\pm$  0.15 mm and is determined by the thickness of the PCB and the shield.

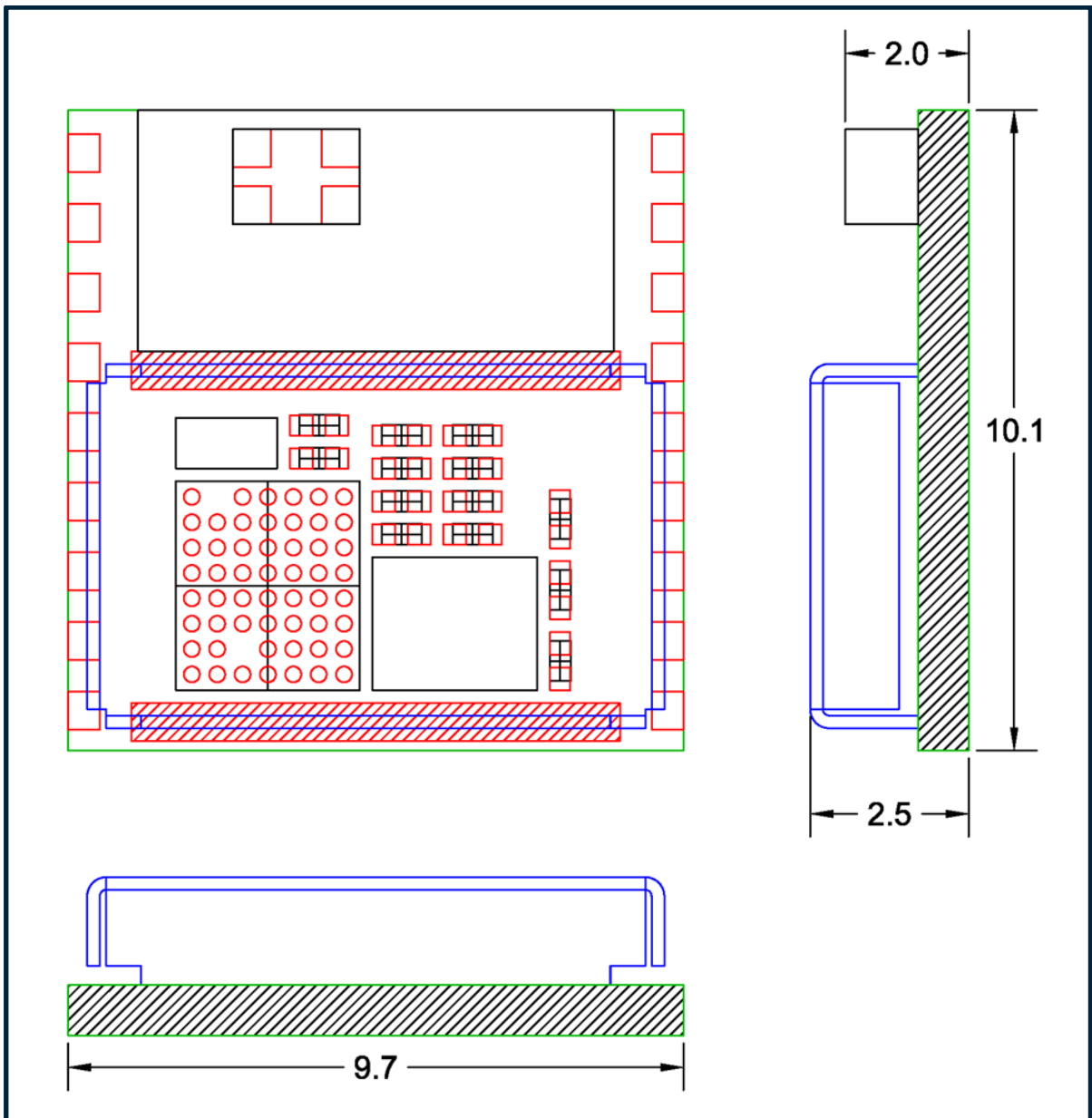
### 8.2 Bottom Side Castellated PAD

The castellated PAD uses a 0.6mm via with a capture pad of 0.6mm by 1.0mm. During the board manufacturing process, the pad and the capture pad are routed off at the half way point.



*Figure 8-1 Pad Design (bottom side)*

### 8.3 Mechanical Outline Drawing

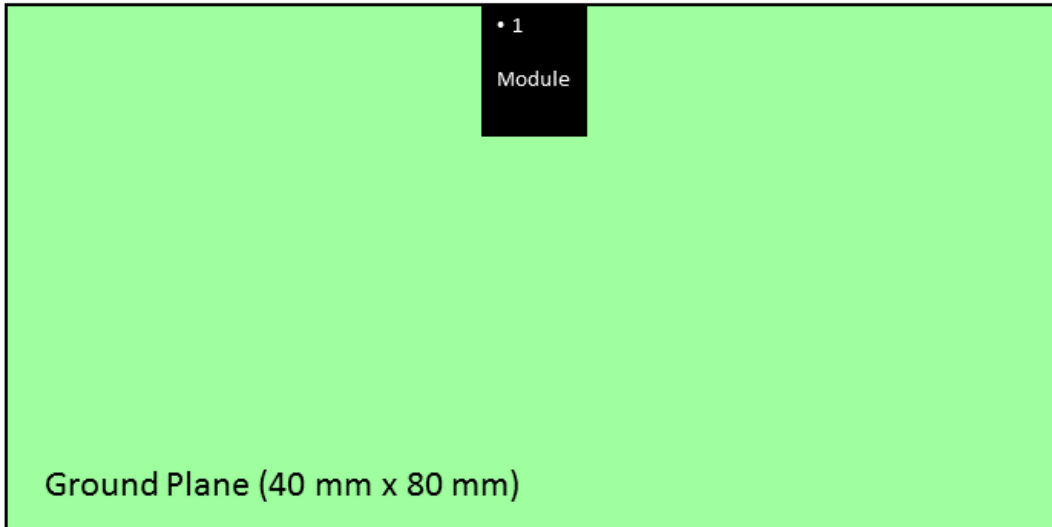


**Figure 8-2 Mechanical Outline Drawing**

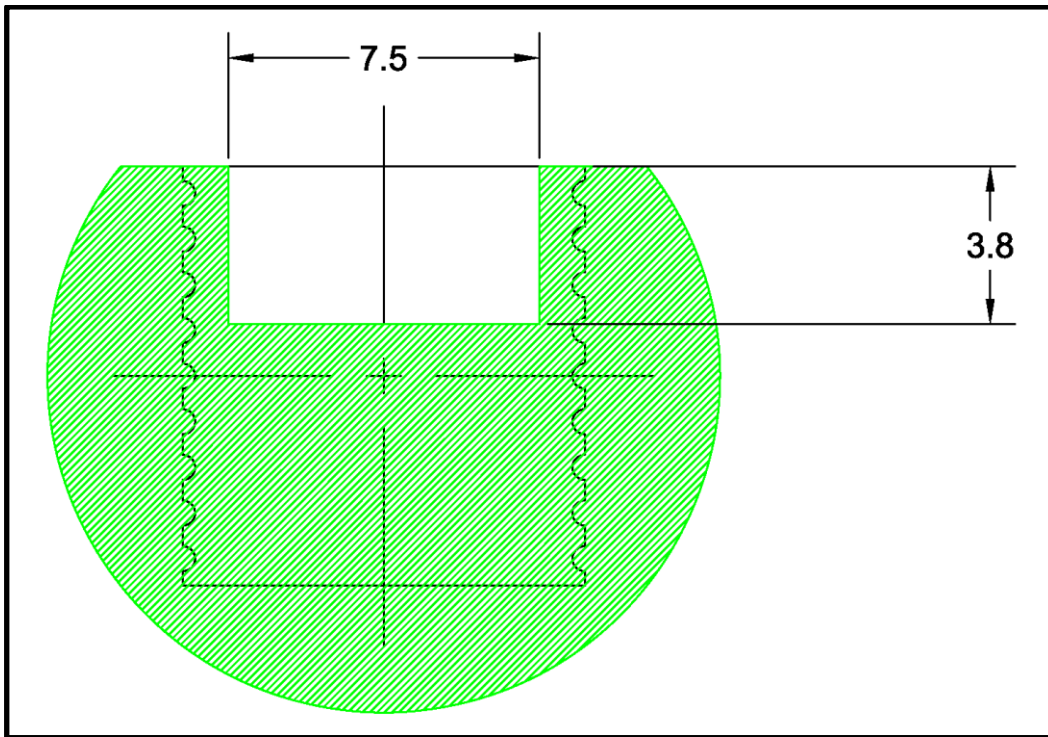
## 9 PCB FOOTPRINT

The BL871E2-HI requires a ground plane of 40mm by 80mm for the chip antenna to work properly.

The BL871E2-HI is centered on the long axis of the ground plane. It is placed flush with its top edge, except for a cutback clearance (determined by the customer's manufacturing process).

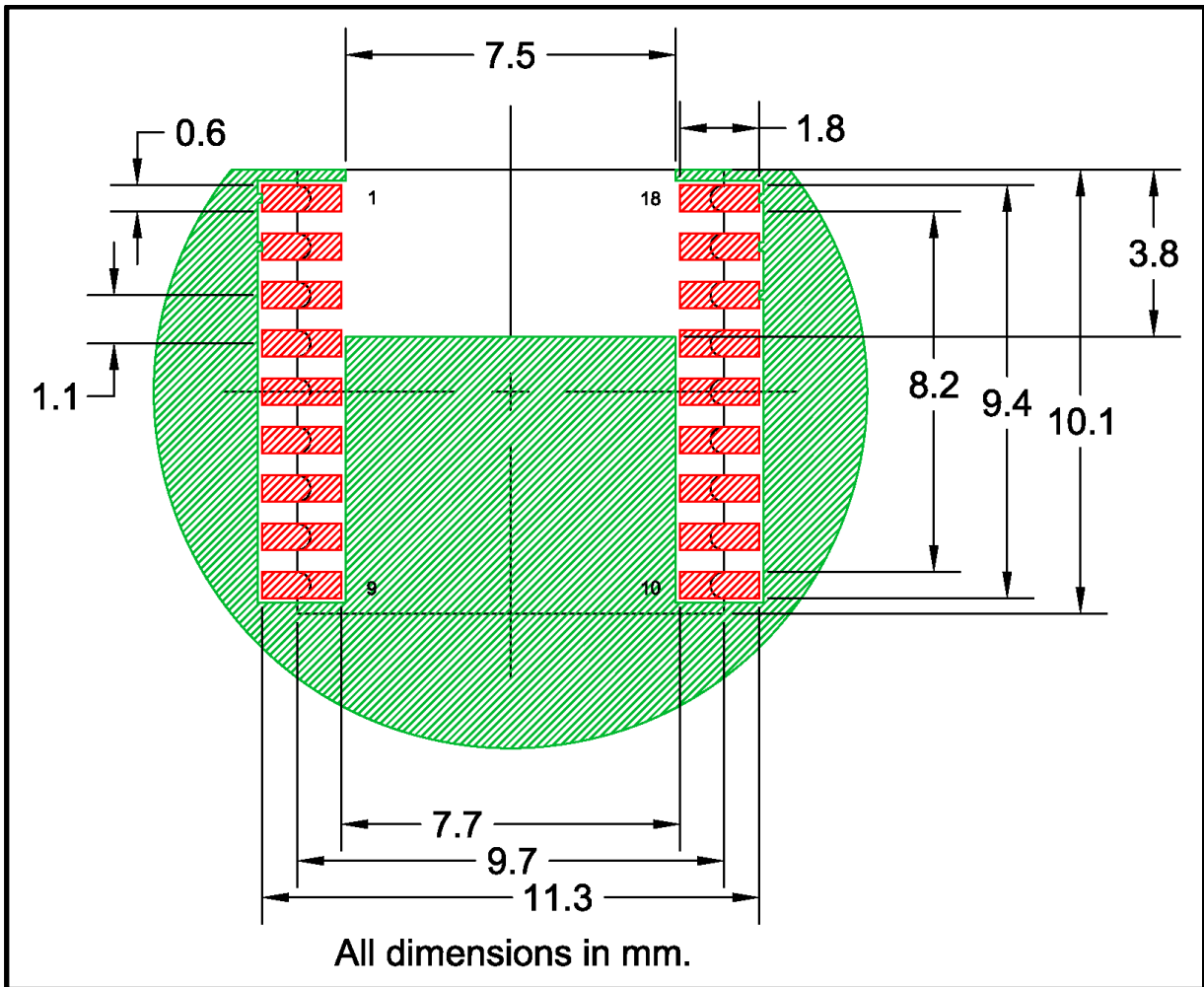


**Figure 9-1 Ground Plane and Module Placement**



**Figure 9-2 PCB Footprint detail - Inner and Bottom Layers**

Note: White area shown is a keepout area (no copper or components).



| Key   |  |   |
|---|--|---|
| White   |  | No copper or components underneath the chip antenna and castellations |
| Red   |  | Module castellations and solder pads                                  |
| Green   |  | Ground plane (partially shown)  |
| Note: This image assumes a clearance of 0.1 mm. |  |   |

**Figure 9-3 PCB Footprint – PCB Top Layer**

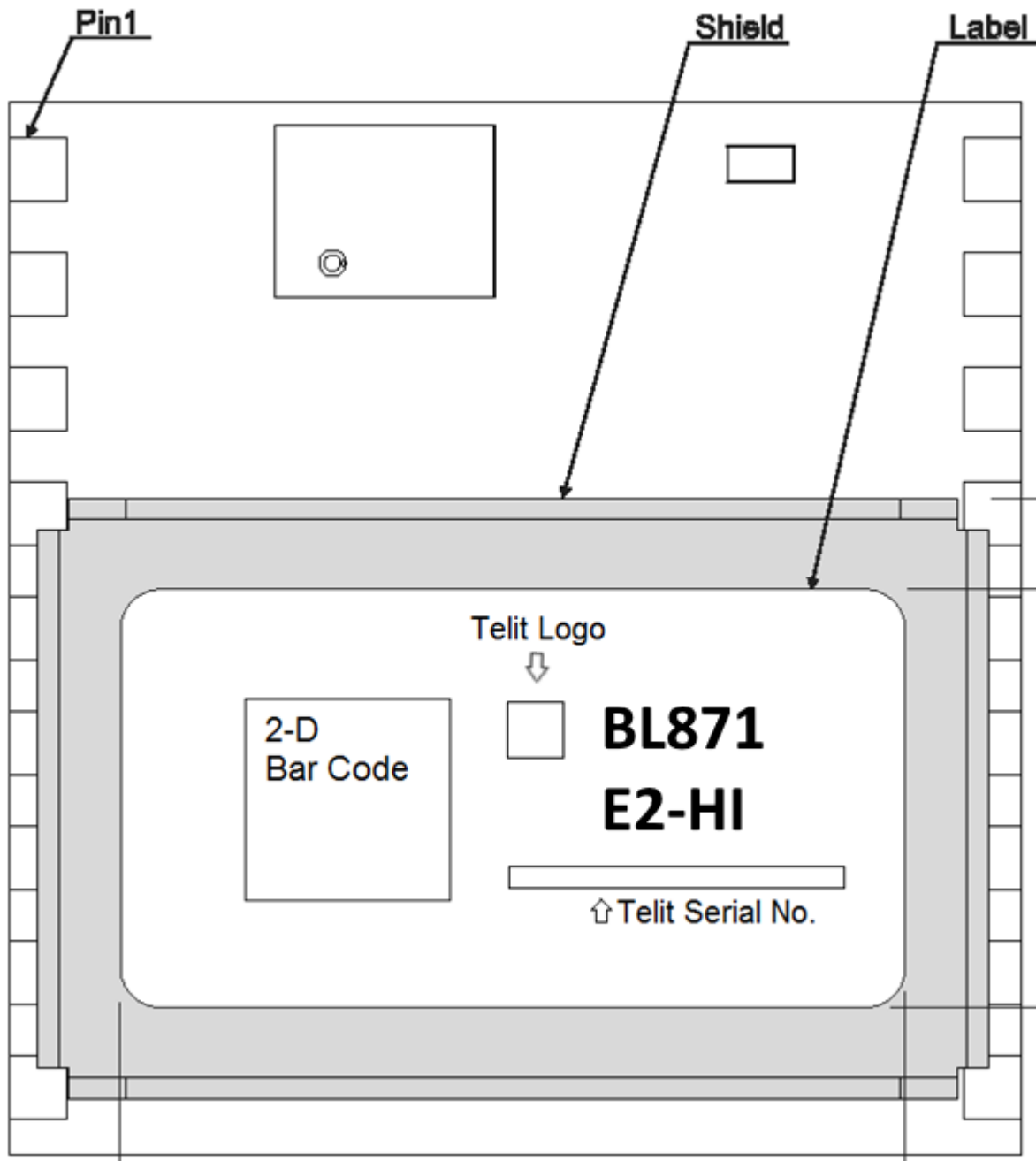


## 10 LABELLING & PACKAGING

### 10.1 Module Weight

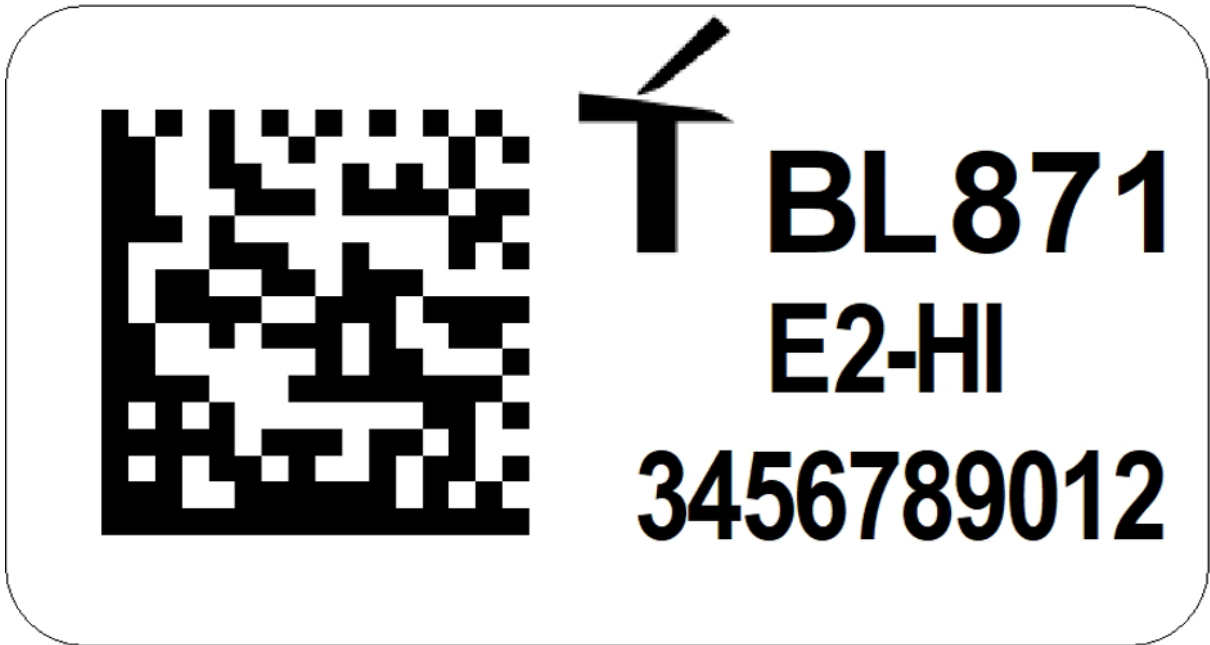
The weight of the module is < 0.4 g.

### 10.2 Product Labelling



**Figure 10-1 Product Label**

### 10.3 Label Format



*Figure 10-2 Label Layout*

## 10.4 Packaging

The BL871E2-HI is provided in Tape and Reel with 250 pcs or 1000 pcs as shown below.

### 10.4.1 Tape & Reel – 250 pcs

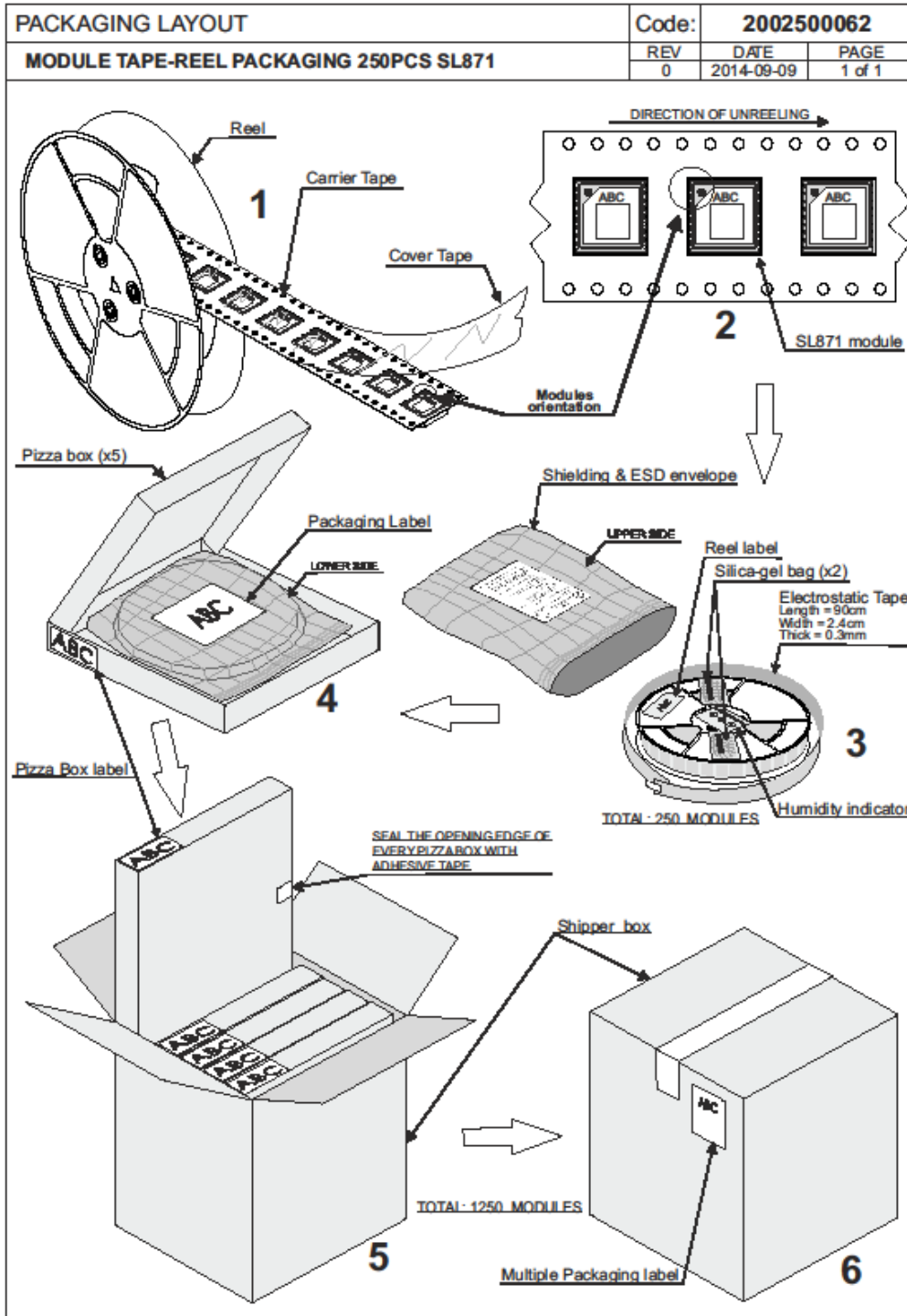


Figure 10-3 Tape & Reel Packaging (250 pcs)

10.4.2 Tape & Reel – 1000 pcs

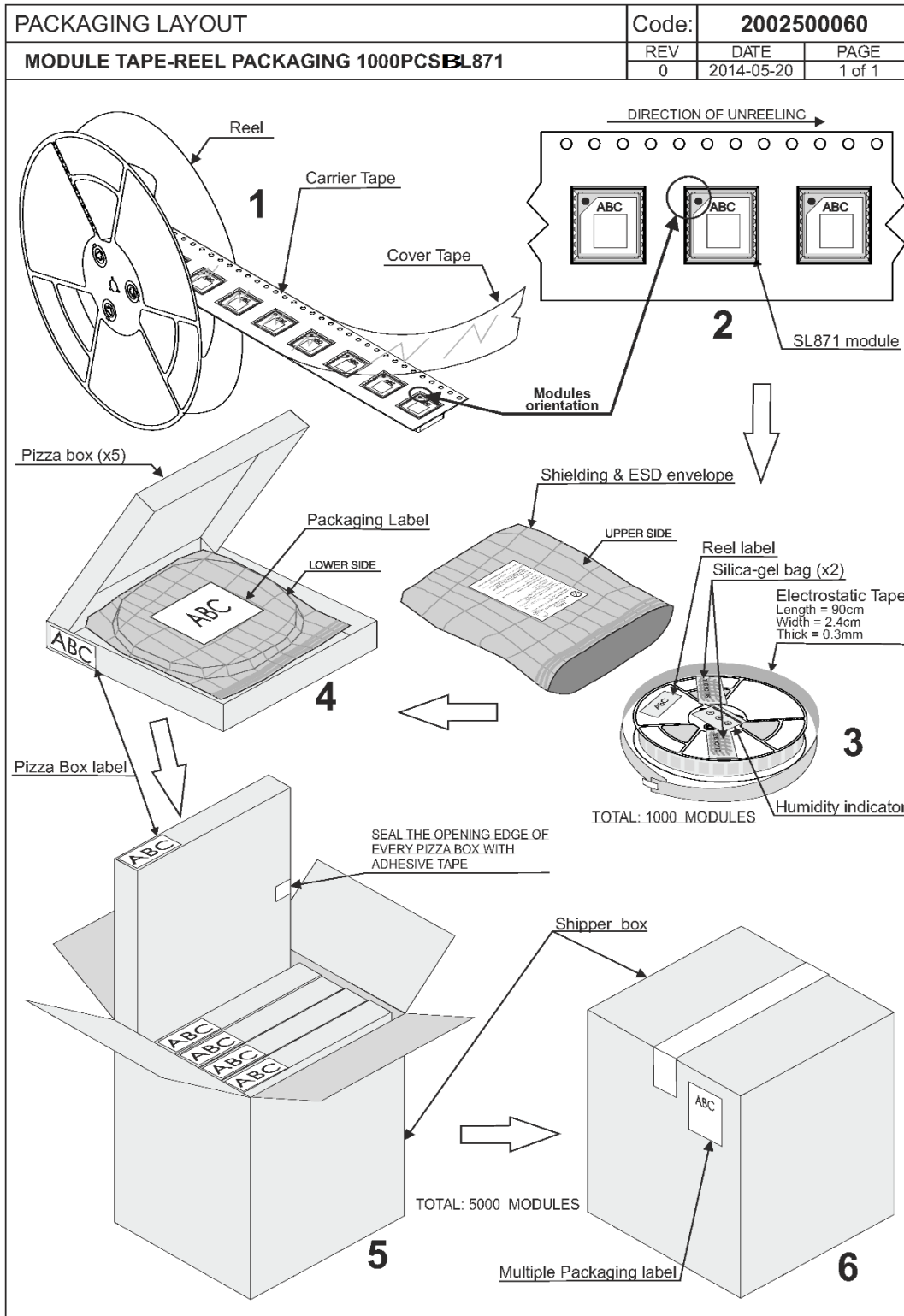


Figure 10-4 Tape & Reel Packaging (1000 pcs)

## 11 HANDLING

### 11.1 Moisture Sensitivity

Precautionary measures are required in handling, storing and using these electronic devices to avoid damage from moisture absorption. If localized heating is required to rework or repair the device, precautionary methods are required to avoid exposure to solder reflow temperatures that can result in performance degradation or damage.

The module has a moisture sensitivity level rating of 3 as defined by IPC/JEDEC J-STD-020. This rating is assigned due to some of the components used within the module.

The modules are supplied in a hermetically sealed bag with desiccant and humidity indicator cards. The parts must be placed and reflowed within 168 hours of first opening the hermetic seal provided the factory conditions are less than 30°C and less than 60% and the humidity indicator card indicates less than 10% relative humidity.


If the package has been opened or the humidity indicator card indicates above 10%, then the parts will need to be baked prior to reflow. The parts may be baked at  $+125^{\circ}\text{C} \pm 5^{\circ}\text{C}$  for 48 hours.



However, the packaging materials (tape and reel or trays) can NOT withstand that temperature. Lower temperature baking is feasible if the humidity level is low and time is available.

Additional information can be found on the MSL tag affixed to the outside of the hermetically sealed bag and IPC/JEDEC J-STD-033.

NOTE: JEDEC standards are available free of charge from the JEDEC website <http://www.jedec.org>.

|   |  |          |
|---|--|----------|
|  | <b><u>CAUTION</u></b>                                  | LEVEL    |
|   | This bag contains<br><b>MOISTURE-SENSITIVE DEVICES</b> | <b>3</b> |

If Blank, see adjacent bar code label

1. Calculated shelf life in sealed bag: 12 months at  $< 40\text{ }^{\circ}\text{C}$  and  $< 90\%$  relative humidity (RH)
2. Peak package body temperature: \_\_\_\_\_  $^{\circ}\text{C}$   
If Blank, see adjacent bar code label
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must
  - a) Mounted within: 168 hours of factory  
If Blank, see adjacent bar code label  
conditions  $\leq 30\text{ }^{\circ}\text{C}/60\%$
  - b) stored at  $<10\%$  RH
4. Devices require bake, before mounting, if:
  - a) Humidity Indicator Card is  $> 10\%$  when read at  $23 \pm 5\text{ }^{\circ}\text{C}$
  - b) 3a or 3b not met.
5. If baking is required, devices may be baked for 48 hours at  $125 \pm 5\text{ }^{\circ}\text{C}$

Note: If device containers cannot be subjected to high temperature or shorter bake times are desired,  
reference IPC/JEDEC J-STD-033 for bake procedure

Bag Seal Date: \_\_\_\_\_  
If Blank, see adjacent bar code label

Note: Level and body temperature defined by IPC/JEDEC J-STD-020

**Figure 11-1 Moisture Sensitive Device Label**

### 11.2 ESD Sensitivity

The module contains class 1 devices and is Electro-Static Discharge Sensitive (ESDS).

Telit recommends the two basic principles of protecting ESD devices from damage:

- Handle sensitive components only in an ESD Protected Area (EPA) under protected and controlled conditions;
- Protect sensitive devices outside the EPA using ESD protective packaging.

All personnel handling ESDS devices have the responsibility to be aware of the ESD threat to the reliability of electronic products.

Further information can be obtained from the JEDEC standard **JESD625-A Requirements for Handling Electrostatic Discharge Sensitive (ESDS) Devices**.

### 11.3 Reflow

The modules are compatible with lead free soldering processes as defined in **IPC/JEDEC J-STD-020**. The reflow profile must not exceed the profile given **IPC/JEDEC J-STD-020 Table 5-2, "Classification Reflow Profiles"**.



Although **IPC/JEDEC J-STD-020** allows for three reflows, the assembly process for the module uses one of those profiles, therefore the module is limited to two reflows.

When re-flowing a dual-sided SMT board, it is important to reflow the side containing the module last. This prevents heavier components within the module from becoming dislodged if the solder reaches liquidus temperature while the module is inverted.

**Note:** JEDEC standards are available free from the JEDEC website <http://www.jedec.org>.

### 11.4 Assembly Considerations

Since the module contains piezo-electric components, it should be placed near the end of the assembly process to minimize mechanical shock to it.

During board assembly and singulation process steps, pay careful attention to unwanted vibrations, resonances and mechanical shocks, e.g. those introduced by manufacturing equipment.

### 11.5 Washing Considerations

The module can be washed using standard PCB cleaning procedures after assembly. The shield does not provide a water-tight seal for the internal components of the module, so it is important that the module be thoroughly dried prior to use by blowing excess water and then baking the module to drive out residual moisture. Depending upon the board cleaning equipment, the drying cycle may not be sufficient to thoroughly dry the module, so additional steps may need to be taken. Exact process details will need to be determined by the type of washing equipment as well as other components on the board to which the module is attached. The module itself can withstand standard JEDEC baking procedures.

### 11.6 Safety

Improper handling and use of this module can cause permanent damage to the receiver. There is also the possible risk of personal injury from mechanical trauma or choking hazard.

Please refer to **Section 14 SAFETY RECOMMENDATIONS** for further information regarding safety recommendations.

### 11.7 Disposal

Telit recommends that this product should not be treated as household waste. For more detailed information about recycling this product please contact your local waste management authority or the reseller from whom you purchased the product.



## 12 ENVIRONMENTAL REQUIREMENTS

### 12.1 Operating Environmental Limits

|                            |  |
|----------------------------|--|
| Temperature                | -40°C to +85°C   |
| Temperature Rate of Change | ±1°C / minute maximum  |
| Humidity                   | Up to 95% non-condensing or a wet bulb temperature of +35°C, whichever is less |

***Table 12-1 Operating Environmental Limits***

### 12.2 Storage Environmental Limits

|                               |  |
|-------------------------------|--|
| Temperature                   | -40°C to +85°C   |
| Humidity                      | Up to 95% non-condensing or a wet bulb temperature of +35°C, whichever is less |
| Shock (in shipping container) | 10 drops from 75 cm onto concrete floor  |

***Table 12-2 Storage Environmental Limits***

## 13 COMPLIANCES

The modules comply with the following:

- Directive 2011/65/EU art. 16 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
- Manufactured in an ISO 9001:2008 accredited facility
- Manufactured to TS 16949:2009 requirements
- Directive 2014/53/EU Radio Equipment Directive (RED)

### 13.1 Bluetooth Qualification



**QDL Bluetooth® qualified design listing**

---

The Bluetooth SIG Hereby Recognizes

**Telit Wireless Solutions GmbH**  
Member Company

---

**BlueMod+SRHCI**  
Qualified Design Name

Declaration ID: **D035946**  
Qualified Design ID: **98219**  
Specification Name: **4.2**  
Project Type: **Controller Subsystem**  
Model Number: **BL871E2-HI**  
Listing Date: **17 August 2017**  
Hardware Version Number: **cs1839a**

Assessment Date: **17 August 2017**  
Software Version Number: **Patch 1.0**

---

This certificate acknowledges the *Bluetooth*® Specifications declared by the member are achieved in accordance with the Bluetooth Qualification Process as specified within the Bluetooth Specifications and as required within the current PRD



# 13.2 FCC Compliance

10/6/2017

FCC - OET TCB Form 731 Grant of Equipment Authorization

**TCB**

**GRANT OF EQUIPMENT  
AUTHORIZATION**

**TCB**

Certification  
Issued Under the Authority of the  
Federal Communications Commission  
By:

CETECOM Inc.  
411 Dixon Landing Road  
Milpitas, CA 95035

Date of Grant: 10/06/2017  
Application Dated: 10/06/2017

Telit Wireless Solutions GmbH  
Mendelssohnstrasse 15  
Hamburg, 22761  
Germany

Attention: Jens Jensen

**NOT TRANSFERABLE**

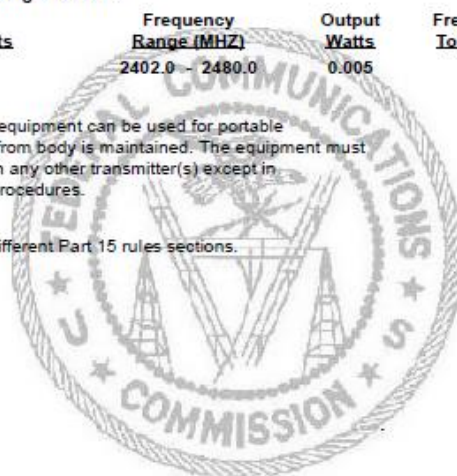
EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: RFR-BL871  
Name of Grantee: Telit Wireless Solutions GmbH  
Equipment Class: Digital Transmission System  
Notes: Bluetooth/ BLE HCI Module  
Modular Type: Single Modular

| <u>Grant Notes</u> | <u>FCC Rule Parts</u> | <u>Frequency Range (MHZ)</u> | <u>Output Watts</u> | <u>Frequency Tolerance</u> | <u>Emission Designator</u> |
|--------------------|-----------------------|------------------------------|---------------------|----------------------------|----------------------------|
| CC                 | 15C                   | 2402.0 - 2480.0              | 0.005               |                            |                            |

Modular Approval- Powers listed are EIRP. This equipment can be used for portable applications when a distance of 15 mm or more from body is maintained. The equipment must not be co-located or operating in conjunction with any other transmitter(s) except in accordance with FCC multi-transmitter product procedures.

CC: This device is certified pursuant to two different Part 15 rules sections.



# BL871E2-HI Hardware User Guide

10/6/2017

FCC - OET TCB Form 731 Grant of Equipment Authorization

## TCB

### GRANT OF EQUIPMENT AUTHORIZATION

## TCB

Certification  
Issued Under the Authority of the  
Federal Communications Commission  
By:

CETECOM Inc.  
411 Dixon Landing Road  
Milpitas, CA 95035

Date of Grant: 10/06/2017  
Application Dated: 10/06/2017

Telit Wireless Solutions GmbH  
Mendelssohnstrasse 15  
Hamburg, 22761  
Germany

Attention: Jens Jensen

#### NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: RFR-BL871  
Name of Grantee: Telit Wireless Solutions GmbH  
Equipment Class: Part 15 Spread Spectrum Transmitter  
Notes: Bluetooth/ BLE HCI Module  
Modular Type: Single Modular

| Grant Notes | ECC Rule Parts | Frequency Range (MHZ) | Output Watts | Frequency Tolerance | Emission Designator |
|-------------|----------------|-----------------------|--------------|---------------------|---------------------|
| CC          | 15C            | 2402.0 - 2408.0       | 0.007        |                     |                     |

Modular Approval- Powers listed are EIRP. This equipment can be used for portable applications when a distance of 15 mm or more from body is maintained. The equipment must not be co-located or operating in conjunction with any other transmitter(s) except in accordance with FCC multi-transmitter product procedures.

CC: This device is certified pursuant to two different Part 15 rules sections.



<https://apps.fcc.gov/oetcf/tcb/reports/Tcb731GrantForm.cfm>

1/1

### 13.3IC Compliance



**CETECOM Inc.**  
 411 Dixon Landing Road, Milpitas, CA 95035 USA  
 ph/fax: +1 408 586 6200/6299 email: [info@cetecomusa.com](mailto:info@cetecomusa.com) <http://www.cetecom.com>

Product Certification Body / organisme de certification  
 Recognized Certification Body for Canada / organisme accepté de certification pour le Canada

**Technical Acceptance Certificate / Certificat d'Acceptabilité Technique**

|  |  |                                |  |
|--|--|--------------------------------|--|
| CETECOM Inc. registration no. / CETECOM Inc numéro de registration   |  | CTC-IC-17027                   |  |
| certificate holder and address / titulaire du certificate et adresse |  | Telit Wireless Solutions, Inc. |  |
| ISED Canada certification no. / no. de certification d'ISED Canada   |  | 23249-BL871                    |  |
| model number / marque et modèle                                      |  | HVIN:BL871E2-HI                |  |
| Product Marketing Name / Nom de marque de product                    |  | PMN: BL871E2-HI                |  |
| product description / description du produit                         |  | Bluetooth                      |  |

| Specification<br>spécification | Issue<br>Number<br>numéro de<br>série | Frequency Range<br>bande de fréquence (MHz) |            | Emissions<br>Designator<br>bande de<br>fréquence | Power<br>Puissance<br>ERP below 1GHz<br>EIRP above 1GHz |        | Field<br>Strength<br>Force de<br>champ | Distance |
|--------------------------------|---------------------------------------|---|------------|--|---|--------|--|----------|
|                                |                                       |   |            |  |   |        |  |          |
| RSS247                         | 1                                     | 2402.0 MHz                                  | 2480.0 MHz | 1M13G1D  | 5.0 mW  | 7.0 mW | --                                     | --       |
| RSS247                         | 1                                     | 2402.0 MHz                                  | 2480.0 MHz | 1M05G1D  | 5.0 mW  | 5.0 mW | --                                     | --       |
|                                |                                       |   |            |  |   |        |  |          |
|                                |                                       |   |            |  |   |        |  |          |
|                                |                                       |   |            |  |   |        |  |          |
|                                |                                       |   |            |  |   |        |  |          |
|                                |                                       |   |            |  |   |        |  |          |

(\*) in addition compliant with / en addition conforme avec RSS-102 / i5 / 03-2015 and RSS-Gen / i4 / 11-2014

|  |  |
|--|--|
| OATS facility (contact information, name, mailing address, e-mail, fax and telephone numbers) /<br>Laboratoire (coordonnées, nom, adresse postale, e-mail et numéros de télécopieur et de téléphone) | CETECOM Inc.<br>411 Dixon Landing Road; 95035 Milpitas<br>CA, USA, phone +1-408-586-6200 |
| OATS facility ID / numéro de compagnie laboratoire   | 3462B-1  |

**This certificate becomes valid when published on the [Radio Equipment List \(REL\)](#)**  
*Ce certificat est valide quand publié dans [Nomenclature du matériel radio \(NMR\)](#)*

Certification of equipment means only that the equipment has met the requirements of the above-noted specification. Licence applications, where applicable to use certified equipment, are acted on accordingly by the Industry Canada issuing office and will depend on the existing radio environment, service and location of operation. This certificate is issued on condition that the holder complies and will continue to comply with the requirements and procedures issued by Industry Canada. The equipment for which this certificate is issued shall not be manufactured, imported, distributed, leased, offered for sale or sold unless the equipment complies with the applicable technical specifications and procedures issued by ISED.

*La certification du matériel signifie seulement que le matériel a satisfait aux exigences de la norme indiquée ci-dessus. Les demandes de licences nécessaires pour l'utilisation du matériel certifié sont traitées en conséquence par le bureau de délivrance d'ISDE et dépendent des conditions radio ambiantes, du service et de l'emplacement d'exploitation. Le présent certificat est délivré à la condition que le titulaire satisfasse et continue de satisfaire aux exigences et aux procédures d'ISDE. Le matériel à l'égard duquel le présent certificat est délivré ne doit pas être fabriqué, importé, distribué, loué, mis en vente ou vendu à moins d'être conforme aux procédures et aux spécifications techniques applicables publiées par ISDE.*

**I hereby attest that the subject equipment was tested and found in compliance with the above-noted specification.**  
*J'atteste, par la présente, que le matériel a fait l'objet d'essai et a été jugé conforme à la spécification ci-dessus.*

|                  |   |   |
|------------------|---|---|
| October 27, 2017 | <br>Digitally signed by Franz Engert<br>DN: cn=Franz Engert, o=US, ou=CETECOM, ou=Compliance, email=franz.engert@cetecom.com<br>Franz Engert / Certification Manager<br>CETECOM Inc. | CAB ID: US0187<br> |
|------------------|---|---|

rel.27.10.2017 10:19:00

## 13.4 RED Certification

Type Examination Certificate



CETECOM GmbH  
EC Identification Number 0880



Bundesnetzagentur

authorized by the German Government to  
act as notified body in accordance with  
Directive 2014/53/EU of 16 April 2014

BNWZ-AB-13/1-58

**Certificate Holder:** Telit Wireless Solutions  
3131 RDU Center Drive, Suite 135  
Morrisville, NC 27560 USA

**Product Manufacturer:** Telit Wireless Solutions  
3131 RDU Center Drive, Suite 135  
Morrisville, NC 27560 USA

**Product Designation:** BL871E2-HI

**Product Description:** Bluetooth Module with technical specification according to page 2

| Essential Requirement(s)           | Applied Specification(s)/Standard(s)  | Result<br>(Notes) |
|------------------------------------|---|-------------------|
| Radio Spectrum<br>RED, Article 3.2 | EN 300 328 V2.1.1   | conform           |
| EMC<br>RED, Article 3.1b           | Draft EN 301 489-1 V2.1.1 (2016-11)<br>Draft EN 301 489-17 V3.1.1 (2016-11) | conform           |
| Safety<br>RED, Article 3.1a        | Not covered by evaluation   |                   |
| Health<br>RED, Article 3.1a        | EN62749:2010, EN 62209-2:2010   | conform           |

As the official journal for Council Directive 2014/53/EU does not contain harmonized standards for all essential requirements at the time of the assessment, this EU Type Examination Certificate is based in part on harmonized standards acc. to Council Directive 1999/5/EC and/or draft standards which haven't been harmonized so far but represent the latest state of standardization.

**Type Examination Certificate:**

Our opinion in accordance with Annex III of Council Directive 2014/53/EU on Radio Equipment Directive and the mutual recognition of their conformity is that the evaluation of the submitted documents related to the apparatus identified above complies with the requirement of that directive stated in the above scope. The scope of this evaluation relates to the submitted documents only.

**Marking:**

The product shall be marked with the CE marking as required in the Council Directive 2014/53/EU.

**Annexes:**


The certificate is only valid in conjunction with the following number of annexes: 1

**Validity:**

The validity of this certificate is limited to 5 years after the date of issue. Conformity is provided unless changes/modifications have been done to the applied standard(s) and/or assessed type of equipment.

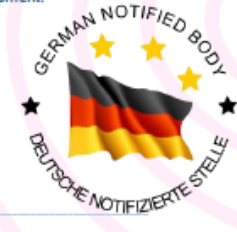
**Certificate Registration No.:** M17-0326-01-TEC

**CETECOM GmbH**

 Digitally signed by Franz Engert  
DN: cn=Franz Engert, c=US, o=CETECOM, ou=Compliance, email=franz.engert@cetecom.com

**Place, issue date**  
Milpitas, 2017-10-13

Authorized signature



CETECOM GmbH - Im Teebruch 116  
45219 Essen - Germany - www.cetecom.com

## 14 SAFETY RECOMMENDATIONS

### PLEASE READ CAREFULLY

Be sure that the use of this product is allowed in the country and in the environment required. The use of this product may be dangerous and must be avoided in the following areas:

- Where it can interfere with other electronic devices in environments such as hospitals, airports, aircraft, etc.
- Where there is risk of explosion such as gasoline stations, oil refineries, etc.

It is the responsibility of the user to enforce the country regulations and specific environmental regulations.

Do not disassemble the product. Evidence of tampering will invalidate the warranty.

- Telit recommends following the instructions in product user guides for correct installation of the product.
- The product must be supplied with a stabilized voltage source and all wiring must conform to security and fire prevention regulations.
- The product must be handled with care, avoiding any contact with the pins because electrostatic discharges may damage the product itself.

The system integrator is responsible for the functioning of the final product; therefore, care must be taken with components external to the module, as well as for any project or installation issue. Should there be any doubt, please refer to the technical documentation and the regulations in force.

Non-antenna modules must be equipped with a proper antenna with specific characteristics.

The European Community provides some Directives for electronic equipment introduced on the market. All the relevant information is available on the European Community website:

<http://ec.europa.eu/enterprise/sectors/rtte/documents/>

The text of the Directive 99/05 regarding telecommunication equipment is available, while the applicable Directives (Low Voltage and EMC) are available at:

<http://ec.europa.eu/enterprise/sectors/electrical/>

The power supply used shall comply the clause 2.5 (Limited power sources) of the standard EN 60950-1 and the module shall be mounted on a PCB which complies with V-0 flammability class.

Since the module must be built-in to a system, it is intended only for installation in a RESTRICTED ACCESS LOCATION. Therefore, the system integrator must provide an enclosure which protects against fire, electrical shock, and mechanical shock in accordance with relevant standards.

## 15 DOCUMENT HISTORY

| Revision | Date       | Changes  |
|----------|------------|--|
| 0        | 2017-09-08 | First Issue  |
| 1        | 2017-10-05 | Added FCC and IC IDs<br>Added FCC and IC regulatory information<br>Minor text revisions            |
| 2        | 2017-12-15 | Changed pictures related to module label<br>Added RED information<br>Changed packaging information |

**Table 15-1 Document History**





# SUPPORT INQUIRIES

Link to [www.telit.com](http://www.telit.com) and contact our technical support team for any questions related to technical issues.

[www.telit.com](http://www.telit.com)



Telit Communications S.p.A.  
Via Stazione di Prosecco, 5/B  
I-34010 Sgonico (Trieste), Italy

Telit Wireless Solutions Inc.  
3131 RDU Center Drive, Suite 135  
Morrisville, NC 27560, USA

Telit Wireless Solutions Ltd.  
10 Habarzel St.  
Tel Aviv 69710, Israel

Telit IoT Platforms LLC  
5300 Broken Sound Blvd, Suite 150  
Boca Raton, FL 33487, USA

Telit Wireless Solutions Co., Ltd.  
8th Fl., Shinyoung Securities Bld.  
6, Gukjegeumyung-ro8-gil, Yeongdeungpo-gu  
Seoul, 150-884, Korea

Telit Wireless Solutions  
Tecnologia e Servicos Ltda  
Avenida Paulista, 1776, Room 10.C  
01310-921 São Paulo, Brazil

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