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C.F.: 03160710269 - P.IVA/VAT: IT 00876120254 - Numero iscrizione Registro Pile e
Accumulatori: IT19050P00005354 - Numero iscrizione Registro AEE: IT19050000011380
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MODULAR TRANSMITTER APPROVAL

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1 Acronyms, Glossary, Conventions

Table 1-1 introduces the acronyms used inside the document:

Acronym	Meaning
BLE	Bluetooth Low Energy
GFSK	Gaussian Frequency Shift Keying
IC	Integrated Circuit
LDO	Low Drop Out
MCU	Micro-controller Unit
OTAP	Over the Air Programming
UART	Universal Asynchronous Receiver Transmitter
SMT	Surface Mount Technology
TBD	To Be Defined

Table 1-1

Table 1-2 introduces the Glossary of terms used inside the document:

Term	Meaning

Table 1-2

Table 1-3 introduces the conventions list adopted by the document:

Convention	Meaning

Table 1-3

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2 Bibliography and Reference Documents

Table 2-1 shows the list of books, articles and documents cited within the document and the correlation with the code used for their citation:

Citation Data	Code

Table 2-1

3 Document Subject

The document integrates:

- The analysis of modular approval conditions applied to Dixell BLE module
- The test setup
- The firmware

4 Analysis of Modular Approval Conditions Applied to Dixell BLE Module

Relating FCC Part 15.212(a) the modular approval conditions applied to Dixell BLE Module are analyzed:

Requirement	Compliance
The radio elements must have the radio frequency circuitry shielded. Physical components and tuning capacitor(s) may be located external to the shield, but must be on the module assembly	YES All the radio electronics is covered by a shield. Specifically covered by a shield there are: • The radio IC • The oscillator • The LDO that generates the power supply of the module • The antenna matching circuit
The module must have buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal	YES The microcontroller is inside the module and manages the data packets that are charged into the radio IC. The radio IC manage the Bluetooth Low Energy (all the communication layers) protocol to send data.
The module must contain power supply regulation on the module	YES The module contains a LDO that generates all the regulated and stable power supply.
The module must contain a permanently attached antenna, or contain a unique antenna connector, and be marketed and operated only with specific antenna(s), per Sections 15.203, 15.204(b), 15.204(c), 15.212(a), 2.929(b)	YES The module has an integrated antenna. No connector or PAD is available for connecting an external antenna.

Requirement	Compliance
The modular transmitter must be tested in a stand-alone configuration, i.e., the module must not be inside another device during testing for compliance with part 15 requirements. Unless the transmitter module will be battery powered, it must comply with the AC line conducted requirements found in §15.207. AC or DC power lines and data input/output lines connected to the module must not contain ferrites, unless they will be marketed with the module (see §15.27(a)). The length of these lines shall be the length typical of actual use or, if that length is unknown, at least 10 centimeters to insure that there is no coupling between the case of the module and supporting equipment. Any accessories, peripherals, or support equipment connected to the module during testing shall be unmodified and commercially available (see §15.31(i)).	YES For the tests we provided a minimum set up only focused on granting the module interfaces access.
The module must be labelled with its permanently affixed FCC ID label, or use an electronic display (See KDB Publication 784748 about labelling requirements)	YES In the final version the shield will be covered by a label with FCC ID.
The module must comply with all specific rules applicable to the transmitter including all the conditions provided in the integration instructions by the grantee	YES Demonstrated during the FCC tests.
The module must comply with RF exposure requirements	YES Demonstrated with specific calculations.

Table 4-1

5 The Test Setup

The module pictures are reported in Figure 5-1 e in Figure 5-2:

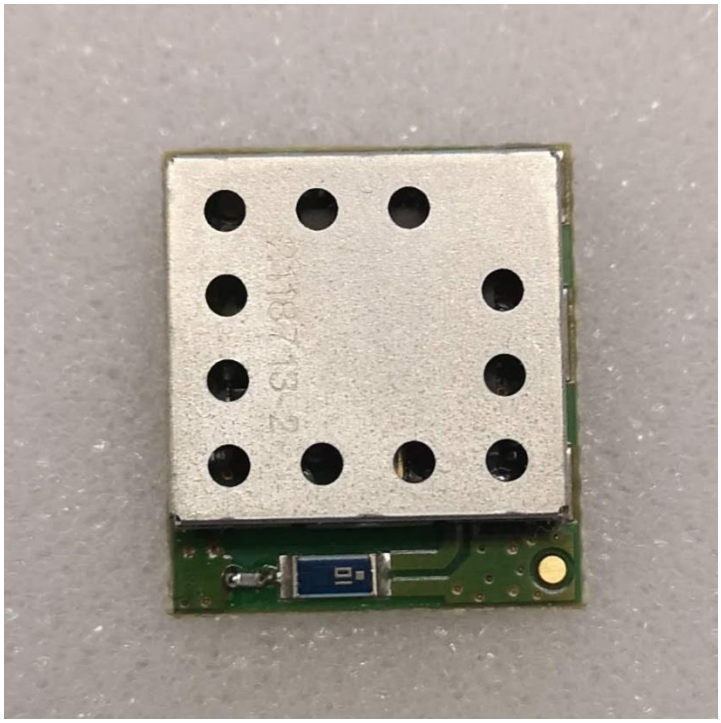

Figure 5-1

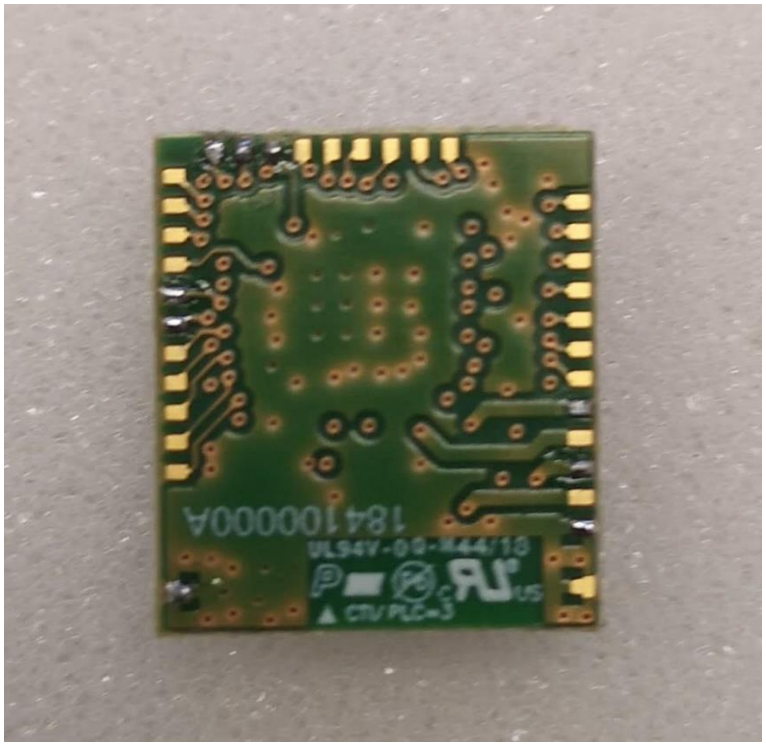

Figure 5-2

As shown in Figure 5-2 the module must be soldered on a host.

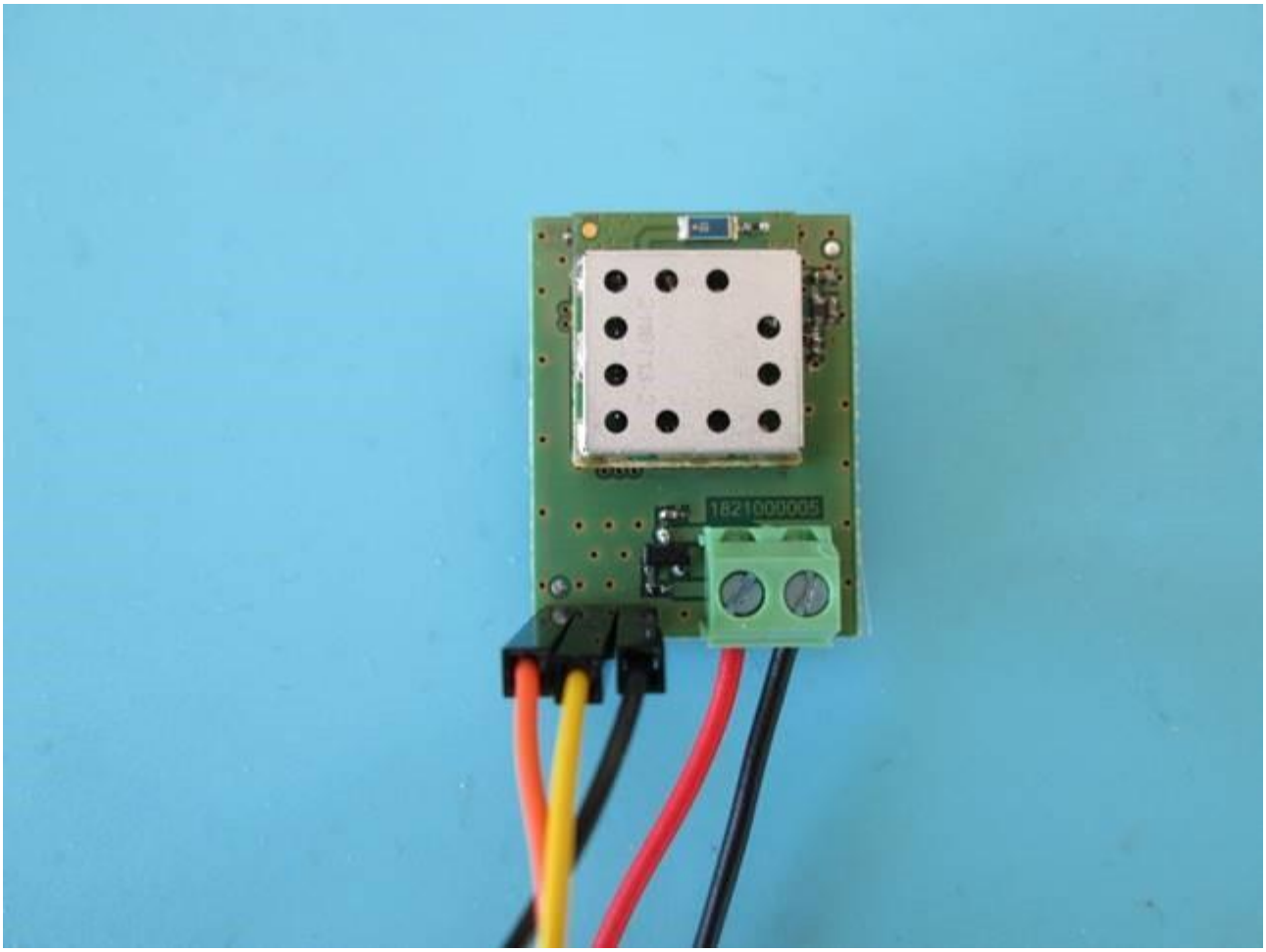

Figure 5-3

In the Figure 5-3 the test set up is shown.

6 The Firmware

The firmware is distinguished into two different parts:

- The BLE communication stack
- The application firmware

The BLE communication stack will remain always unchanged for RF point of view.

The application firmware could change according to the application and the use of general purpose I/O managed by the microcontroller.