TIWI Transceiver Module

User's Guide

Internal Use only

Last Update

30.09.2021

Contents

1 Introduction

1.1 *Purpose & Scope*

The purpose of this document is to provide details regarding the setup and use of the TIWI transceiver module in Leica Geosystems AG and Hexagon AB. This document will also present application guidance such that the module's EMC compliance will not be degraded. This Document is for Internal use only.

1.2 *Audience*

This document is intended to be read by engineers and technical management. A general knowledge of common engineering practices is assumed.

1.3 *Revision History*

Version	Document Changes	Date of Release
1.0	First version	24.04.2015
2.0	Update of AVX 1000146 antenna	23.08.2018
3.0	Update of SWLP.2450.12.4.B.02 antenna	30.09.2021

2 Description

The TIWI is a Bluetooth WLAN Module. The module HW is based on the TiWi-BLE module from LSR. The differences between the TiWi-BLE Module and the module from Leica is only the RF-parameters and the antenna that are used.

2.1 *Features*

- IEEE 802.11b,g,n,d,e,i compliant
- Typical WLAN Transmit Power:
  - 20.0dBm, 11 Mbps,CCK (b)
  - 14.5dBm, 54 Mbps,OFDM (g)
  - 12.5dBm, 65 Mbps,OFDM (n)
- Typical WLAN Sensitivity:
  - -89dBm, 8% PER, 11 Mbps
  - -76dBm, 10% PER, 54 Mbps
  - -73dBm, 10% PER, 65 Mbps
- Bluetooth 2.1+EDR, Power Class 1.5
- Full support for BLE 4.0 and ANT
- Miniature footprint: 18 mm x 13 mm
- Low height profile: 1.9 mm
- U.FL connector for external antenna
- Terminal for PCB/Chip antenna feeds
- Integrated band-pass filter
- Modular certification allows reuse of LSR
- SDIO Host data path interfaces
- Bluetooth Advanced Audio Interfaces
- Low power operation mode
- RoHS compliant Installation

2.2 *Integration of the TIWI Module*

Please look in to the datasheet from Laird (TiWi-BLE Module): https://www.lairdconnect.com/

Document Name: TiWi-BLE Datasheet

3 EMC Compliance Application Guide

3.1 *Introduction*

The TiWi module has been tested as Modular Radio in accordance with the FCC .The device has been tested to relevant FCC parts and the results of the testing may be found in the module's test report.

Since this module and its associated set of approved antenna has been certified as a Modular Radio, this allows to integrate this module into an end-product and only be responsible for the Unintentional Emissions levels produced by the product. The manufacturer of the module is the responsible for the compliance of the Intentional Emissions produced by the module, as long as, the recommendations presented in this application guide.

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.

3.2 *Module Integration Considerations – Antenna Systems*

The module must be used with one of the approved antennas:

Name	Technology	Frequency	Peak Gain	Connector
BTFA-2450	Inverted-F	2.4 – 2.5GHz	2 dBi	U.FL
Ethertronics 1000146	Isolated Magnetic Dipole	2.4 – 2.49GHz	2.7 dBi	U.FL
Taoglas SWLP.2450.12.4.B.02	SMD Patch Antenna	2.4 – 2.5GHz	2.0 dBi	Pad (SMD)

The antennas should place such that they are minimally disturbed by the product's packaging material. The incorporation of the largest practical free-space clearance around the antenna is important for maximizing overall performance. The clearances associated with the SAR compliance must be maintained.

Les antennes doivent placer de telle sorte qu'ils sont très peu perturbées par le matériau d'emballage du produit. L'incorporation de la plus grande clairance pratique espace libre autour de l'antenne est important pour optimiser la performance globale. Les dégagements associés à la conformité SAR doivent être maintenus

3.3 *Module Integration Considerations – Firmware*

The module must use the specific firmware provided by Leica Geosystems AG for the module. Le module doit utiliser le firmware spécifique prévue par Leica Geosystems AG pour le module . This firmware includes:

- Binary image
- ini.ini. configuration file.

3.4 *Testing Requirements for End-Product*

Once the module is integrated and the product realized, the product must be tested and follow the verification process for Unintentional Conducted and Radiated Emissions in accordance to the FCC guidelines. The module is to be placed in the receive mode for this test.

3.5 *Marking Requirements for End-Product and Compliance Statements.*

3.5.1 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.

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.

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.

3.5.2 Industry Canada Statement

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.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the antennas listed in 3.2 Module Integration Considerations – Antenna Systems, and having a maximum gain of 2 dBi. Antennas not included in this list or having a gain greater than 2dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

L'opération est soumise aux deux conditions suivantes: (1) cet appareil ne peut pas provoquer d'interférences et (2) cet appareil doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement de l'appareil.

Pour réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doivent être choisis de manière que la puissance isotrope rayonnée équivalente (PIRE) ne dépasse pascelle permise pour une communication réussie.

Cet appareil a été conçu pour fonctionner avec l'antenne (s) ci 3.2 Module Integration Considerations – Antenna Systems, et ayant un gain maximum de 2 dBi. Antennes pas inclus dans cette liste ou ayant un gain supérieur à 2dBi sont strictement interdits pour une utilisation avec cet appareil. L'impédance d'antenne requise est de 50 ohms.

3.5.3 Responsibilities to comply with FCC and Industry Canada Regulations

The TiWi Module has been certified for integration into products only by Leica Geosystems AG or Hexagon AB under the following conditions:

1. The antenna(s) must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times.
2. The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter.

As long as the two conditions above are met, further transmitter testing will not be required. However, the integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID and IC Certification Number cannot be used on the final product. In these circumstances, the integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC and Industry Canada authorization.
Le module de TIWI a été certifié pour l'intégration dans des produits uniquement par des intégrateurs Leica Geosystems AG ou Hexagon AB dans les conditions suivantes:

Tant que les deux conditions précitées sont réunies, les tests de transmetteurs supplémentaires ne seront pas tenus. Toutefois, l'intégrateur OEM est toujours responsable de tester leur produit final pour toutes les exigences de conformité supplémentaires requis avec ce module installé (par exemple, les émissions appareil numérique, les exigences de périphériques PC, etc.)

NOTE IMPORTANTE: Dans le cas où ces conditions ne peuvent être satisfaites (pour certaines configurations ou de co-implantation avec un autre émetteur), puis la FCC et Industrie autorisations Canada ne sont plus considérés comme valides et l'ID de la FCC et IC numéro de certification ne peut pas être utilisé sur la produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'un distincte de la FCC et Industrie Canada l'autorisation.

3.5.4 End Product Labeling

The TIWI Module is labeled with its own FCC ID and IC Certification Number. If the FCC ID and IC Certification Number are not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

"Contains Transmitter Module FCC ID: RFD-

BTWCO" "Contains Transmitter Module IC:

3177A-BTWCO" or

"Contains FCC ID: RFD-

BTWCO" "Contains IC:

3177A-BTWCO"

The integrator of the TIWI Module must only use the approved antenna(s) listed above, which have been certified with this module. If another antenna is used please contact the QE of Leica Geosystems AG for further steps.

Le module de TiWi-R2 est étiqueté avec son propre ID de la FCC et IC numéro de certification. L'ID de la FCC et IC numéros de certification ne sont pas visibles lorsque le module est installé à l'intérieur d'un autre appareil, comme par exemple le terminal dans lequel le module est installé doit afficher une étiquette faisant référence au module ci-joint. Le produit final doit être étiqueté dans un endroit visible par le suivant:

"Contient Module émetteur FCC ID: RFD-

BTWCO" "Contient Module émetteur IC:

3177A-BTWCO" ou

"Contient FCC ID: RFD-

BTWCO" "Contient IC:

3177A-BTWCO"

L'intégrateur du module TiWi ne doit utiliser l'antenne approuvée (s) ci-dessus, qui ont été certifiés avec ce module. Si une autre antenne est utilisée se il vous plaît contacter le QE de Leica Geosystems AG pour de nouvelles mesures .