Laird BL653U Bluetooth 5.1 Nano BLE Data Module User Manual

Contents

Laird BL653U Bluetooth 5.1 Nano BLE Data Module User Manual

CURRENT REGULATORY CERTIFICATIONS

The BL653µ (453-00059 and 453-00060) holds current certifications in the following countries:

Country/Region	**Regulatory ID**
USA (FCC)	SQGBL653U
EU	N/A
Canada (ISED)	3147A-BL653U
UK (UKCA)	N/A
Japan (MIC)	201-200419
Australia	N/A
New Zealand	N/A

CERTIFIED ANTENNAS

The antennas listed below were tested for use with the BL653µ. For CE mark countries, the OEM is free to use any manufacturer's antenna and type of antenna if the gain is less than or equal to the highest gain approved for use. Contact a Laird Connectivity representative for more information regarding adding antennas.*
***Note:** Japan (MIC) lists applicable antennas on its certificates, so if your antenna is not on the approved list, irrespective of whether it is comparative, it must be added to the certificate before it can be used in Japan.

					Peak Gain	
Manufacturer	**Model**	**Laird Connectivity Part Number**	**Type**	**Connector**	**2400-2500 MHz**	**2400-2480 MHz**
Laird Connectivity	NanoBlue	EBL2400A1-10MH4L	PCB Dipole	IPEX MHF 4	2 dBi	–
Laird Connectivity	FlexPIFA	001-0022	PIFA	IPEX MHF 4	–	2 dBi
Mag.Layers	EDA-8709-2G4C1-B27-CY	0600-00057	Dipole	IPEX MHF 4	2 dBi	–
Laird Connectivity	mFlexPIFA	EFA2400A3S-10MH4L	PIFA	IPEX MHF 4	–	2 dBI
Laird Connectivity	Laird Connectivity NFC	0600-00061	NFC	N/A	–	–
Yageo	ANT1608LL14R2400A	NA	Chip	N/A	2 dBi	2 dBi
Laird Connectivity	i-FlexPIFA	EFG2400A3S	Flexible PIFA	MHF1/ MHF4	3.1	

Note: The BL653µ module internal Bluetooth LE chipset IC pins are rated 4 kV (ESD HBM). ESD can find its way through the external header connectors like JTAG connector (if used on the customer's design), if discharge is applied directly. Customer should ensure adequate protection against ESD on their end product design (using the BL653µ module) to meet relevant ESD standard (for CE, this is EN301-489).

FCC REGULATORY

The 453-00059 and the 453-00060 hold full modular approvals. The OEM must follow the regulatory guidelines and warnings listed below to inherit the modular approval.

Part #	**Form Factor**	**Tx Outputs**	**Antenna**
453-00059	Surface Mount	8 dBm	Chip antenna
453-00060	Surface Mount	8 dBm	IPEX MHF4

Antenna Information

The BL653µ has been designed to operate with the antennas listed below with a maximum gain of 3.1 dBi. The required antenna impedance is 50 ohms.

					Peak Gain	
Manufacturer	**Model**	**Laird Connectivity Part Number**	**Type**	**Connector**	**2400-2500 MHz**	**2400-2480 MHz**
Laird Connectivity	NanoBlue	EBL2400A1-10MH4L	PCB Dipole	IPEX MHF 4	2 dBi	–
Laird Connectivity	FlexPIFA	001-0022	PIFA	IPEX MHF 4	–	2 dBi
Mag.Layers	EDA-8709-2G4C1-B27-CY	0600-00057	Dipole	IPEX MHF 4	2 dBi	–
Laird Connectivity	mFlexPIFA	EFA2400A3S-10MH4L	PIFA	IPEX MHF 4	–	2 dBI
Laird Connectivity	Laird Connectivity NFC	0600-00061	NFC	N/A	–	–
Yageo	ANT1608LL14R2400A	NA	Chip	N/A	2 dBi	2 dBi
Laird Connectivity	i-FlexPIFA	EFG2400A3S	Flexible PIFA	MHF1/ MHF4	3.1	

FCC Documentation Requirements

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

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.

This portable transmitter with its antenna complies with FCC/IC RF exposure limits for general population/ uncontrolled exposure.

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

FCC Radiation Exposure Statement:

The product complies with the US 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.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This device is intended only for OEM integrators under the following condition:

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

If the condition above is met, further transmitter testing is not 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

If 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 is responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following:
"Contains FCC ID: SQGBL653U".

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.

ISED (CANADA) REGULATORY

Part #	ID
453-00059 453-00060	3147A-BL653U

Antenna Information

This radio transmitter (IC: 3147A-BL653U) was approved by Innovation, Science and Economic Development (ISED) Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

					Peak Gain	
Manufacturer	**Model**	**Laird Connectivity Part Number**	**Type**	**Connector**	**2400-2500 MHz**	**2400-2480 MHz**
Laird Connectivity	NanoBlue	EBL2400A1-10MH4L	PCB Dipole	IPEX MHF 4	2 dBi	–
Laird Connectivity	FlexPIFA	001-0022	PIFA	IPEX MHF 4	–	2 dBi
Mag.Layers	EDA-8709-2G4C1-B27-CY	0600-00057	Dipole	IPEX MHF 4	2 dBi	–
Laird Connectivity	mFlexPIFA	EFA2400A3S-10MH4L	PIFA	IPEX MHF 4	–	2 dBI
Laird Connectivity	Laird Connectivity NFC	0600-00061	NFC	N/A	–	–
Yageo	ANT1608LL14R2400A	NA	Chip	N/A	2 dBi	2 dBi
Laird Connectivity	i-FlexPIFA	EFG2400A3S	Flexible PIFA	MHF1/ MHF4	3.1	

ISED Canada Statement

This device complies with Industry Canada’s license-exempt RSSs. 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

Radiation Exposure Statement:

The product complies 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 minimum separation distance for portable use is limited to 15mm assuming use of antenna with 2dBi of gain. 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.

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.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains IC: 3147A-BL653U”.

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.

ISED ICES-003 Issue 7 Compliance Declaration

This device was originally tested to the requirements of ICES-003 Issue 6, Information Technology Equipment (Including Digital Apparatus) — Limits and Methods of Measurement; and evaluated to the updates published in ICES-003, Issue 7, Information Technology Equipment (Including Digital Apparatus). Based on this evaluation, this product continues to observe compliance to the requirements set forth by The Innovation, Science and Economic Development Canada (ISED), and complies with the updates published in ICES-003, Issue 7, Information Technology Equipment (Including Digital Apparatus).

JAPAN (MIC) REGULATORY

The BL653µ is approved for use in the Japanese market. The part numbers listed below hold WW type certification. Refer to
ARIB-STD-T66 for further guidance on OEM’s responsibilities.

Model	Certificate Number	Antenna
453-00059	201-200419	Chip Antenna
453-00060	201-200419	Trace pin

AUSTRALIA AND NEW ZEALAND REGULATORY

RCM: Pending Compliant to standards EN 300 328 V1.9.1, AS/NZS 4268: 2012-A1:2013, and EN

55022:2010/AC:2011
If this device is used in a product, the OEM has responsibility to verify compliance of the final end product to the Australia/New Zealand (RCM) Standards. All end-products require their own certification (SDoc). You will not be able to leverage the module certification and ship product into the country.

UK (UKCA)

Manufacturer	Laird Connectivity
Products	453-00059, 453-00060
Product Description	Bluetooth v5.x + 802.15.4 + NFC
UK Legislation	Radio Equipment Regulations 2017 Electromagnetic Compatibility Regulations 2016 Electrical Equipment (Safety) Regulations 2016

Reference standards used for conformity:

Legislation	Requirement	Reference standard(s)

Safety

Low voltage equipment safety EN 62368-1: 2014

EN 50663:2017
RF Exposure
EMC Protection requirements – Electromagnetic compatibility

EN 62479: 2010
EN 301 489-1 v2.2.3 (2019-11)
EN 301 489-3 v2.1.1 (2019-03)
EN 301 489-17 v3.2.4 (2020-09)
EN 300 328 v2.2.2 (2019-07) Means of the efficient use of the

Radio Equipment

Means of the efficient use of the radio frequency spectrum (ERM)
radio frequency spectrum (ERM) EN 300 330 v2.1.1 (2017-02) Short Range Devices (SRD)

Declaration:

We, Laird Connectivity, declare under our sole responsibility that the essential test suites have been carried out and that the above product to which this declaration relates is in conformity with all the applicable requirements outlined above, when used for its intended purpose.
The minimum distance between the user and/or any bystander and the radiating structure of the transmitter is 20 cm.

Place of Issue:	Laird Connectivity W66N220 Commerce Court, Cedarburg, WI 53012 USA tel: +1-262-375-4400 fax: +1-262-364-2649
Date of Issue:	September 9, 2021
Name of Authorized Person:	Brian Petted, Technology Leader
Signature of Authorized Person:	

CE REGULATORY

The 453-00059/453-00060 have been tested for compliance with relevant standards for the EU market. The 453-00060 module was tested with a 2 dBi antenna. The OEM can operate the 453-00041 module with any other type of antenna but must ensure that the gain does not exceed 2 dBi to maintain the Laird approval.
The OEM should consult with a qualified test house before entering their device into an EU member country to make sure all regulatory requirements have been met for their complete device.

User's Guide Requirements

The integrator must include specific information in the user's guide for the device into which the BL653µ is integrated. In addition to the required FCC and IC statements outlined above, the following Radio Equipment Directive (RED) statements
must be added in their entirety and without modification into a prominent place in the user's guide for the device into which the BL653µ is integrated:
This device complies with the essential requirements of the 2014/53/EU – Radio Equipment Directive (RED). The following test methods have been applied in order to prove presumption of conformity with the essential requirements of the 2014/53/EU – Radio Equipment Directive (RED):

EN 62368-1:2014/A11:2017

Safety requirements for audio/video, information, and technology equipment

EN 300 328 v2.2.2 (2019-07)

Electromagnetic compatibility and Radio Spectrum Matters (ERM); Wideband Transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using spread spectrum modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive

EN 50665:2017 | EN 50385:2017

RF exposure
EN 301 489-1 v2.2.0 (2017-03)
Electromagnetic compatibility and Radio Spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements

EN 301 489-17 V3.2.0 (2017-03)

Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for 2,4 GHz wideband transmission systems and 5 GHz high performance RLAN equipment

§ EU 2015/863 (RoHS 3)

Declaration of Compliance – EU Directive 2015/863; Reduction of Hazardous Substances (RoHS)
This device is a 2.4 GHz wideband transmission system (transceiver), intended for use in all EU member states and EFTA countries, except in France and Italy where restrictive use applies.
In Italy the end-user should apply for a license at the national spectrum authorities in order to obtain authorization to use the device for setting up outdoor radio links and/or for supplying public access to telecommunications and/or network services.
This device may not be used for setting up outdoor radio links in France and in some areas the RF output power may be limited to 10 mW EIRP in the frequency range of 2454 – 2483.5 MHz. For detailed information the end-user should contact the national spectrum authority in France.

EU Declarations of Conformity

Manufacturer	Laird Connectivity
Products	453-00059, 453-00060
Product Description	Bluetooth v5.x + 802.15.4 + NFC
EU Directives	2014/53/EU – Radio Equipment Directive (RED)

Reference standards used for presumption of conformity:
Low voltage equipment
EN 62368-1: 20143.1a

safety

EN 50663:2017 EN 62479: 201
Means of the efficient use of the radio frequency spectrum (ERM)
EN 300 328 v2.2.2 (2019-07) Wide-band transmission

systems

EN 300 330 v2.1.1 (2017-02) Short Range Devices (SRD

Declaration:

We, Laird Connectivity, declare under our sole responsibility that the essential radio test suites have been carried out and that the above product to which this declaration relates is in conformity with all the applicable essential requirements of Article 3 of the EU Radio Equipment Directive 2014/53/EU, when used for its intended purpose. The minimum distance between the user and/or any bystander and the radiating structure of the transmitter is 20

cm.

Place of Issue:	Laird Connectivity W66N220 Commerce Court, Cedarburg, WI 53012 USA tel: +1-262-375-4400 fax: +1-262-364-2649
Date of Issue:	November 10, 2020
Name of Authorized Person:	Ryan Urness
Signature of Authorized Person:	

Antenna Information

The antennas listed below were tested for use with the BL653µ. For CE mark countries, the OEM is free to use any
manufacturer's antenna and type of antenna if the gain is less than or equal to the highest gain approved for use (2dBi) Contact a Laird Connectivity representative for more information regarding adding antennas.

		Laird Connectivity Part Number			**Peak Gain**	
Manufacturer	**Model**		**Type**	**Connector**		
				2400-2500 MHz		**2400-2480 MHz**
Laird Connectivity	NanoBlue	EBL2400A1-10MH4L	PCB Dipole	IPEX MHF 4	2 dBi	–
Laird Connectivity	FlexPIFA	001-0022	PIFA	IPEX MHF 4	–	2 dBi
Mag.Layers	EDA-8709-2G4C1-B27-CY	0600-00057	Dipole	IPEX MHF 4	2 dBi	–
Laird Connectivity	mFlexPIFA	EFA2400A3S-10MH4L	PIFA	IPEX MHF 4	–	2 dBI
Laird Connectivity	Laird Connectivity NFC	0600-00061	NFC	N/A	–	–
Yageo	ANT1608LL14R2400A	NA	Chip	N/A	2 dBi	2 dBi

Note: The BL653µ module internal Bluetooth LE chipset IC pins are rated 4 kV (ESD HBM). ESD can find its way through the external header connectors like JTAG connector (if used on the customer's design), if discharge is applied directly. Customer should ensure adequate protection against ESD on their end product design (using the BL653µ module) to meet relevant ESD standard (for CE, this is EN301-489).

REGULATORY DOMAIN SUPPORT

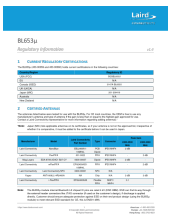
Domain support but not currently certified for – TBD

REVISION HISTORY

Version	Date	Notes	Contributor(s)	Approver
1.0	19 Jan 2021	Initial version	Maggie Teng	Jonathan Kaye
1.1	20 May 2021	Added ISED ICES-003 Issue 7 co mpliance declaration	Sue White	Ryan Urness
1.2	09 Sept 2021	Added UKCA DoC	Sue White	Brian Petted
1.3	11 Feb 2022	Updated UKCA standards	Sue White	Dave Drogowski
1.4	8 Dec 2023	Added EFG2400A3S to supported antennas for FCC / ISED	Dave Drogowski	Brian Petted

Read More About This Manual & Download PDF:

Documents / Resources

	Laird BL653U Bluetooth 5.1 Nano BLE Data Module [pdf] User Manual BL653U Bluetooth 5.1 Nano BLE Data Module, BL653U, Bluetooth 5.1 Nano BLE Data Module, 5.1 Nano BLE Data Module, BLE Data Module, Data Module

References

- Ezurio \| Laird Connectivity is now Ezurio
- User Manual