

ZIGBEE/BLE/THREAD MODULE SERIES M7B-Q95

HARDWARE REFERENCE MANUAL



FCC: 2AWGH-M7B-Q95-B
IC: 26146-M7BQ95B
HVIN: B4
PMN: BLEnd/Z M7B-Q95B

The ubisys wireless connectivity module series M7B-Q95-B integrates Qorvo's QPG6095 low-power wireless system on chip, which comprises an ARM Cortex-M4, 512KB flash ROM, 64 KB SRAM and a multi-channel, multi-protocol radio with quasi-concurrent support for IEEE 802.15.4 (zigbee, rf4ce, Thread) and Bluetooth Low Energy (BLE). Additional flash memory is available on the module to store over-the-air upgrade images or other data.

The modules come with the leading ubisys Compact7B™ zigbee stack and pre-loaded applications, which greatly simplify the design and manufacturing of connected products. For example, ready-to-use applications for typical lighting control applications are available, which can directly steer power stages using PWM signals or analogue control circuits using 0-10V signals. In addition, customized firmware can be ordered, which allows interfacing to existing digital control circuits using proprietary protocols running over UART, SPI or I²C.

These modules are the perfect choice for manufacturers who want to produce standards-compliant products in order to take advantage of direct device-to-device communications within Zigbee mesh networks. This creates opportunities with established eco-systems like Philips hue, IKEA [Trådfri](#), amazon Echo with integrated Zigbee Hub, OSRAM Lightify, and, of course, ubisys Smart Home, as well as other platforms based on Zigbee technology.

You have decided for a high-quality product with first-rate support!

This hardware reference manual provides information for engineers involved in the integration of this module into a product. Separate documentation is available for applications, which come preinstalled on the modules.

If you have any questions or need additional support, please visit the engineering support pages at <http://www.ubisys.de/en/engineering/support.html> for contact details.

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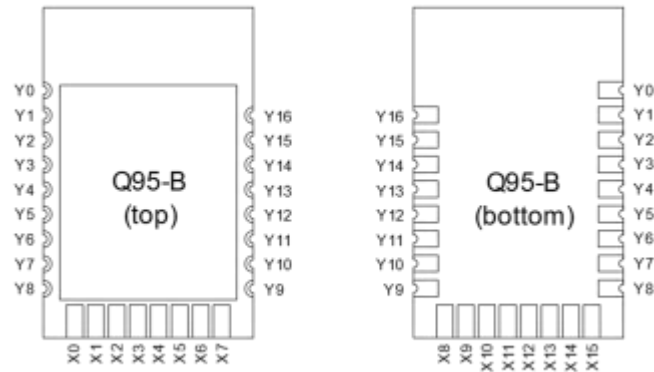
3. FEATURES

- Designed in Germany using high-quality, enduring parts for many years of life expectancy
- MCU: Advanced 32-bit ARM Cortex-M4 running at 32MHz with 64KB SRAM and 512KB flash ROM
- PHY: 10dBm transmit power, -98dBm receiver sensitivity
- Integrated chip antenna
- Low power dissipation
- Multi-channel, multi-mode transceiver
- Pre-loaded firmware, for instance dimmable light with switch input for local control
- Customizations available

3.1. M7B-Q95-B4 (Form Factor B, Pinout Scheme #4)

Status: Active. Recommended for new designs

The following signals are available:



The following signals are available:

Module Pin	Function	Description
Y0	GND	Ground
Y1/X7	GPIO23 ANIO2	Analog input, general purpose digital I/O, peripheral I/O for UART2:TX, SPIM:MISO, SPIS:MOSI, I2CM:SDA, I2CS:SDA, I2SM:SDI, PWM2, TS2, LED0
Y2/X6	GPIO26 ANIO5	Analog input, general purpose digital I/O, peripheral I/O for UART1:TX, SPIM:MOSI, SPIS:MISO, I2CM:SCL, I2CS:SCL, I2SM:SDO, PWM5, LED3, PROG_EN
Y3/X5	GPIO25 ANIO4	Analog input, general purpose digital I/O, peripheral I/O for UART1:RX, UART2:TX, SPIM:SCLK, SPIS:SSN, I2CM:SDA, I2CS:SDA, I2SM:SCK, PWM4, TS2, LED2
Y4/X4	GPIO24 ANIO3	Analog input, general purpose digital I/O, peripheral I/O for UART2:RX, SPIM:SSN, SPIS:SCLK, I2CM:SCL, I2CS:SCL, I2SM:WS, PWM3, TS3, LED1
Y5/X3	VDD	Power supply, 3.3V
Y6/X2	GPIO7	General purpose digital I/O, peripheral I/O for SPIS:SCLK, I2CM: SCL, I2CS:SCL, PWM5, LED1, JTAG:TCK, SWD:CLK
Y7/X1	RESET	Reset line (active-low)
Y8/X0	GND	Ground
Y9/X8	GPIO6	General purpose digital I/O, peripheral I/O for SPIM:MOSI, SPIS:SSN, I2SM:SDO, PWM4, JTAG:TMS, SWD:I/O
Y10/X9	GPIO8	General purpose digital I/O, peripheral I/O for UART1:TX, SPIS:MOSI, I2CM:SDA, I2CS:SDA, PWM4, LED2, JTAG:TDI
Y11/X10	GPIO2	General purpose digital I/O, peripheral I/O for UART2:TX, SPIM:SCLK, SPIS:MOSI, I2CM:SDA, I2CS:SDA, I2SM:SCK, PWM2, TS2, LED2
Y12/X11	GPIO3	General purpose digital I/O, peripheral I/O for UART2:RX, SPIM:MOSI, SPIS:SCLK, I2CM:SCL, I2CS:SCL, I2SM:SDO, PWM3, TS3, LED3
Y13/X12	GPIO9	General purpose digital I/O, peripheral I/O for UART1:RX, SPIS:MISO, PWM5, LED3, JTAG:TDO, SWD:V
Y14/X13	GPIO10	General purpose digital I/O, peripheral I/O for CLKOUT, UART1:TX, SPIS:SSN, PWM0, TS0, LED0
Y15/X14	GPIO11	General purpose digital I/O, peripheral I/O for UART1:RX, UART2:RX, SPIS:SCLK, PWM1, TS1, LED1
Y16/X15	GPIO5	General purpose digital I/O, peripheral I/O for SPIM:MOSI, SPIS:SSN, I2SM:SDO, PWM4

This results in the following mapping of often used peripheral I/Os (LED, PWM, UART1, UART2, SPI master/slave, I²C master/slave) and analogue inputs, together with resulting wake-up and interrupt request capabilities

Module	GPIO	ANIO	Port	IRQ ¹	Wake-up	LED	PWM	UART1	UART2	SPI	I ² C	SPI	I ² C
Pin											Master		Slave
Y1/X7	23	2	C	4	Y	0	2	-	TX	MISO	SDA	MOSI	SDA
Y2/X6	26	5	C	7	Y	3	5	TX	-	MOSI	SCL	MISO	SCL
Y3/X5	25	4	C	6	Y	2	4	RX	TX	SCLK	SDA	SSN	SDA
Y4/X4	24	3	C	5	Y	1	3	-	RX	SSN	SCL	SCLK	SCL
Y6/X2	7	-	A	7	Y	1	5	-	-	-	SCL	SCLK	SCL
Y9/X8	6	-	A	6	Y	-	4	-	-	MOSI	-	SSN	-
Y10/X9	8	-	B	0	Y	2	4	TX	-	-	SDA	MOSI	SDA
Y11/X10	2	-	A	2	Y	2	2	-	TX	SCLK	SDA	MOSI	SDA
Y12/X11	3	-	A	3	Y	3	3	-	RX	MOSI	SCL	SCLK	SCL
Y13/X12	9	-	B	1	Y	3	5	RX	-	-	SCL	MISO	-
Y14/X13	10	-	B	2	Y	0	0	TX	-	-	-	SSN	-
Y15/X14	11	-	B	3	Y	1	1	RX	RX	-	-	SCLK	-
Y16/X15	5	-	A	5	Y	-	4	-	-	MOSI	-	SSN	-

These special purpose debugging and firmware programming signals need to be handled with care. Specifically, the application circuit must be designed in a way that does not start the processor in programming/debugging mode. If in-application debugging is desired, avoid using any of the signals below and route them to a suitable probe connector.

Module	GPIO	SWD	JTAG	Remarks
Pin				
Y2/X6	26	PROG_EN	PROG_EN	Low for about one second, then high enables programming mode for 32 seconds. CAUTION: Make sure that the host board does not inadvertently generate such a condition!
Y6/X2	7	SWDCLK	TCK	
Y7/X1	-	-	-	Active-low system reset
Y9/X8	6	SWDIO	TMS	
Y10/X9	8	-	TDI	
Y13/X12	9	SWDV	TDO	

¹Note: It is possible to select one port per IRQ line. Multiple GPIOs can be configured to raise an interrupt as long as they belong to different IRQ lines.

3.1.1. Light Firmware Pin Assignments

Software uses the following mapping of functions to module pins:

Module Pin	Function	Type	Description
Y0	GND	G	Ground
Y1/X7	GPIO23	D/O	Light Output #3
Y2/X6	GPIO26	A/I	Voltage Monitoring for Over-Voltage Protection
Y3/X5	GPIO25	A/I	Temperature Monitoring for Over-Temperature Protection
Y4/X4	GPIO24	A/I	Current Monitoring for Over-Current Protection
Y5/X3	VDD	P	Power supply, 3.3V
Y6/X2	GPIO7	-	Currently not used
Y7/X1	RESET	D/I	Reset line (active-low)
Y8/X0	GND	G	Ground
Y9/X8	GPIO6	D/I	Man-Machine-Interface (MMI) push-button (for factory reset, etc.)
Y10/X9	GPIO8	D/O	Man-Machine-Interface (MMI) indicator LED (commissioning state, menu, ...)
Y11/X10	GPIO2	D/I	Configurable Control Unit (normally used to control light output locally)
Y12/X11	GPIO3	D/O	Light Output #4
Y13/X12	GPIO9	D/O	Light Output #6
Y14/X13	GPIO10	D/O	Light Output #1
Y15/X14	GPIO11	D/O	Light Output #2
Y16/X15	GPIO5	D/O	Light Output #5

4. TEST AND LATE CUSTOMIZATION INTERFACE

Depending on the pre-loaded firmware version, a test and late-customization interface with accompanying tools is available. This is a two-wire interface, where the module acts as an I²C slave, and a production tool acts as I²C master. This interface allows late changes to the factory block for OEMs, and other application specific customizations and test modes.

Please contact ubisys support for additional details.

5.1. M7B-Q95-B

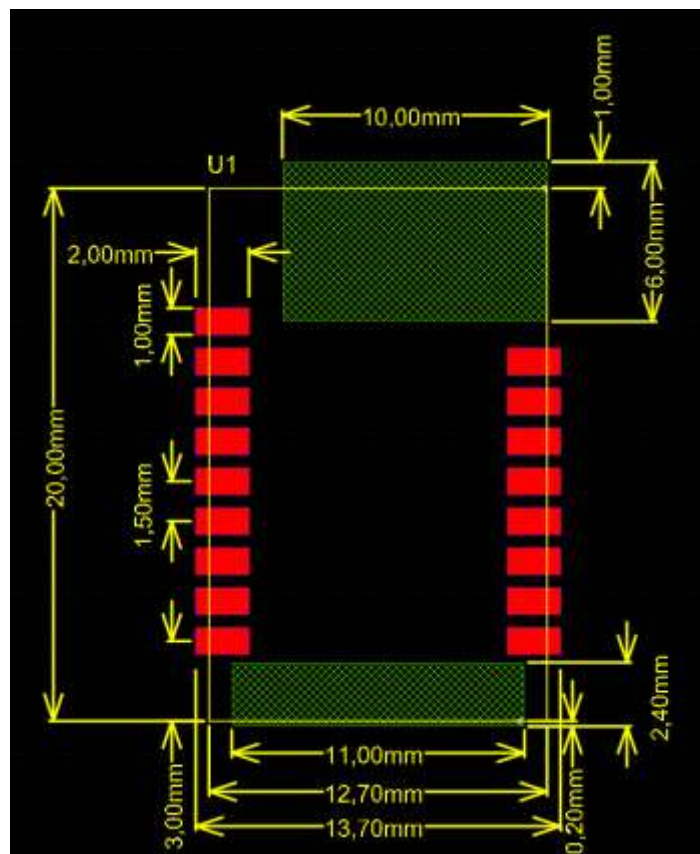
The M7B-Q95-B module was designed for horizontal or vertical mounting. Based on the application one of these can be chosen. On boards where large components could affect the antenna performance the vertical mounting offers a second option.

5.2. Horizontal Mounting

In a horizontal position the module is soldered in by using the soldering pads on the left and right side. All pads are designed to solder the module by hand or reflow.

When mounted in horizontal position there are two mandatory keep-out areas. One area is needed for the antenna, the second area clears the area of the bottom mounting pads for vertical mounting on the short side of the module.

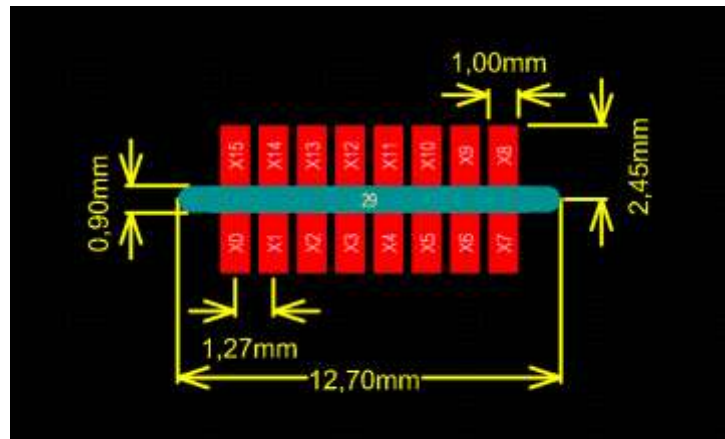
The antenna keep-out applies to all layers of the base board. There shall not be any components, traces, pads or copper areas in any layer within the keep-out area or metal parts, housings or screws close to it.



5.3. Vertical Mounting

The M7B-Q95-B module can be mounted in a vertical position by using the soldering pads on the short side of the module.

It can be soldered between pin rows of a 2-row 1.27mm pin header (2x8) or in slot on the base board with soldering pads at the edges of the slot.



6.1. Absolut Maximum Ratings

Absolut Maximum Ratings	Min	Max	Units
Supply voltage, VCC	-0.3	3.6	V
I/O pin voltage	-0.3	3.6	V
Input RF level, P _{MAX}		+10	dBm
Storage temperature			°C
Operating temperature	-40	+85	°C
Soldering temperature		+260	°C

6.2. Recommended Operating Conditions

Power Maximum Ratings	Min.	Typ.	Max.	Units
Supply voltage, VCC	1.8	3.3	3.6	V
Supply current, I _{CC}		12mA		V
Ambient Temperature, T _A	-40	25	85	°C

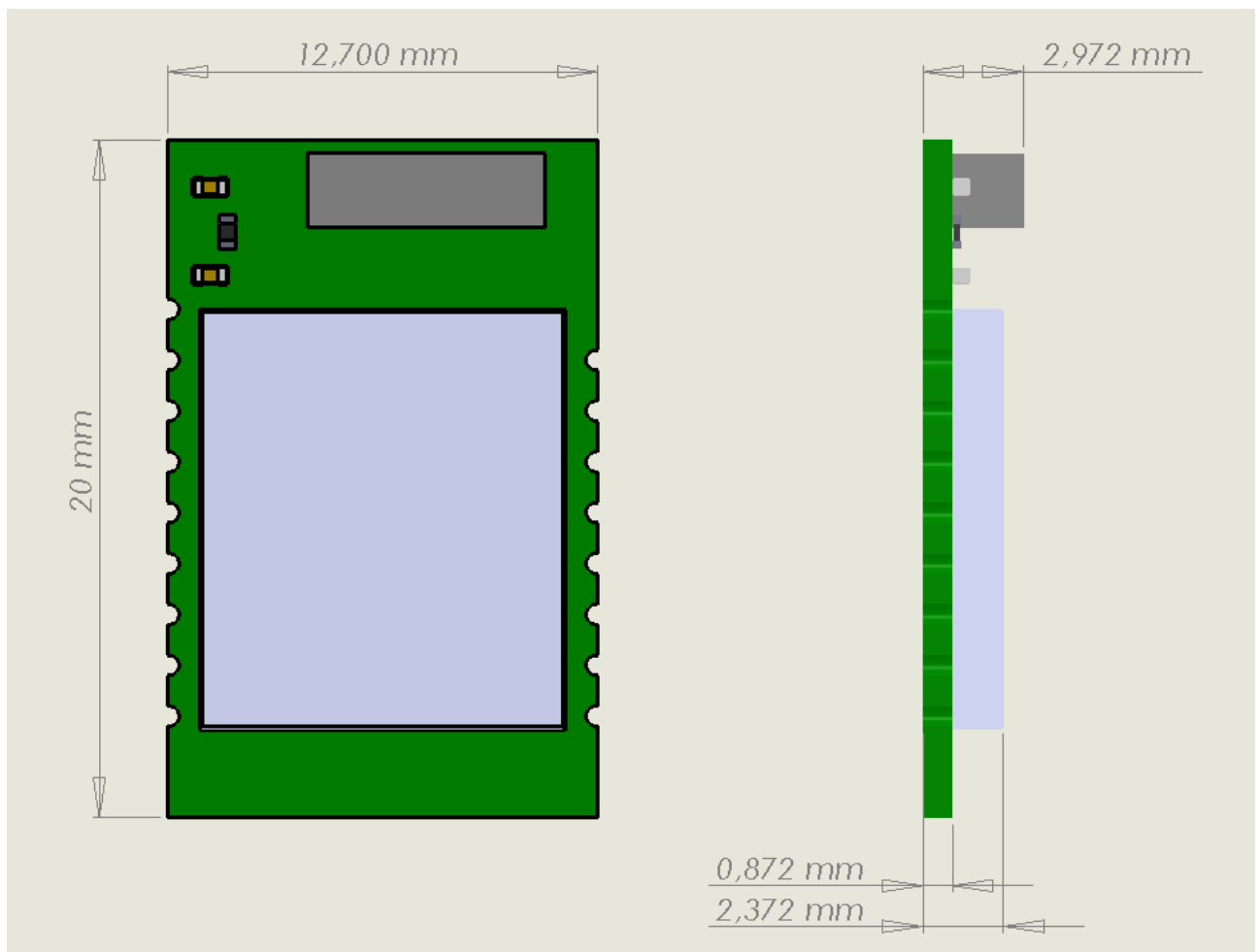
6.3. General Purpose Input Output Specifications

GPIO Specifications	Min.	Typ.	Max.	Units
Input Low Voltage for all GPIOs, V _{IL} VCC = 1.8V			0.6	V
Input Low Voltage for all GPIOs, V _{IL} VCC = 3.3V			1.1	V
Input Low Voltage for analogue inputs			VDD - 0.25	
Input High Voltage for all GPIOs, V _{IH} VCC = 1.8V	0.9			
Input High Voltage for all GPIOs, V _{IH} VCC = 3.3V	1.8			
Input High Voltage for analogue inputs	VDD - 0.25			
Output Low Voltage for all GPIOs, V _{OL} VCC = 1.8V		0.5	0.6	V
Output Low Voltage for all GPIOs, V _{OL} VCC = 3.3V		0.25	0.4	V
Output High Voltage for all GPIOs, V _{OH} VCC=1.8V	1.1	1.3		
Output High Voltage for all GPIOs, V _{OH} VCC=3.3V	2.8	3.1		

6.4. Radio Characteristics

Radio Characteristics	Min.	Typ.	Max.	Units
Operating frequency	2405		2480	MHz
Maximum Output Power			8	dBm

7.1. M7B-Q95-B



8.1. Lead-free reflow soldering

Do not reflow solder with the module on the bottom side of the main PCB. The module might fall off the PCB during that process. Make sure that it is placed on the top side while reflow soldering.

8.2. Hand soldering

Hand soldering is possible. Follow IPC recommendations (reference document IPC-7711) when using a soldering iron.

9. ORDERING INFORMATION

The following tables list the product variants available. Use the specified order code for your orders. Please contact ubisys support if you require any customization.

Order Code	Part Name	Description
1427	M7B-Q95-B4	ZigBee Light Application
x		
x		
x		

10. GENERAL TERMS & CONDITIONS OF BUSINESS

When placing your order you agree to be bound by our General Terms & Conditions of Business, “Allgemeine Geschäftsbedingungen”, which are available for download here:
<http://www.ubisys.de/en/smarthome/terms.html>

11.1. Federal Communications Commission (FCC) Approvals

The ubisys M7B-Q95-B with integrated Antenna has been tested to comply with FCC CFR Part 15 (USA). This device complies with Part 15.247 of FCC Rules.

FCC statement:

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.

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While the applicant for a device into which the M7B-Q95-B is installed is not required to obtain a new authorization for the module, this does not preclude the possibility that some other form of authorization or testing may be required for the end product.

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by ubisys technologies GmbH may void the user's authority to operate the equipment.

When using the M7B-Q95-B with approved antenna, it is required to prevent end-users from replacing them with non-approved ones.

Co-location of this module with other transmitter that operate simultaneously are required to be evaluated using the FCC multi-transmitter procedures.

If the host manufacturer uses the module in a Mobile configuration then the following text is placed in the host product, user guide:

- This device complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, and must be installed with a separation distance of at least 20cm from all persons.
- If the RF exposure conditions are different after module integration into a host product (eg: Portable usage, or co-location with another transmitter/ antenna), the this text must be altered as appropriate

This modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed

11.1.1.FCC Labelling Requirements

When integrating the M7B-Q95-B into a product it must be ensured that the FCC labelling requirements are met. This includes a clearly visible label on the outside of the finished product specifying the ubisys technologies GmbH FCC identifier (FCC ID: 2AWGH-M7B-Q95-B) as well as the FCC notice shown on the previous page. This exterior label can use wording such as “Contains Transmitter Module FCC ID: 2AWGH-M7B-Q95-B” or “Contains FCC ID: 2AWGH-M7B-Q95-B” although any similar wording that expresses the same meaning may be used.

11.2. Industry Canada (IC) Approvals

The ubisys technologies GmbH M7B-Q95-B with integrated antenna has been tested to comply with IC.

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- 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.
- This module complies with FCC and Industry Canada RF radiation exposure limits set forth for general population. To maintain compliance, this module must not be co-located or operating in conjunction with any other antenna or transmitter.

The labelling requirements for Industry Canada are similar to those of the FCC. Again a clearly visible label must be placed on the outside of the finished product stating something like “Contains Transmitter Module, IC: 26146-M7BQ95B”, although any similar wording that expresses the same meaning may be used.

The integrator is responsible for the final product to comply to IC ICES-003 and FCC Part 15, Sub. B – Unintentional Radiators

L'ubisys technologies GmbH M7B-Q95-B avec antenne intégrée a été testé pour être conforme à IC.

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- Le fonctionnement est soumis aux deux conditions suivantes : (1) ce dispositif ne doit pas causer d'interférences, et (2) ce dispositif doit accepter toute interférence, y compris celles qui peuvent provoquer un fonctionnement non souhaité du dispositif.
- Ce module est conforme aux limites d'exposition aux radiations RF fixées par la FCC et Industrie Canada pour la population générale. Pour rester conforme, ce module ne doit pas être installé ou fonctionner en conjonction avec une autre antenne ou un autre émetteur.

Les exigences d'étiquetage d'Industrie Canada sont similaires à celles de la FCC. Là encore, une étiquette clairement visible doit être placée sur l'extérieur du produit fini, indiquant quelque chose comme "Contient le module émetteur, IC : 26146-M7BQ95B", bien que toute formulation similaire exprimant la même signification puisse être utilisée.

L'intégrateur est responsable de la conformité du produit final à la norme ICES-003 et à la norme FCC Part 15, Sub. B - Radiateurs non intentionnels.

11.3. European Certification (ETSI)

The M7B-Q95-B has been certified to the following standards:

- Radio: EN 300 328
- EMC: EN 301 489-1 & EN 301 489-17 Ver. 3.1.1

If the M7B-Q95-B module is incorporated into an OEM product, the OEM product manufacturer must ensure compliance of the final product to the European Harmonised EMC, and low voltage/safety standards. A Declaration of Conformity must be issued for each of these standards and kept on file as described in Annex II of the R&TTE Directive. The final product must not exceed the specified power ratings, antenna specifications and installation requirements as specified in this user manual. If any of these specifications are exceeded in the final product then a submission must be made to a notified body for compliance testing to all the required standards.

The 'CE' marking must be applied to a visible location on any OEM product. For more information please refer to <http://ec.europa.eu/enterprise/faq/ce-mark.htm>. Customers assume full responsibility for learning and meeting the required guidelines for each country in their distribution market

12. DECLARATION OF CONFORMITY

Declarations of Conformity for the M7B-Q95-B module have been issued by ubisys technologies GmbH, which cover radio emissions, electromagnetic compatibility and immunity. These documents are available from our website or on request.

13. REVISION HISTORY

Revision	Date	Remarks
0.1	10/03/2020	Initial Draft Version
0.2	08/12/2020	Physical dimensions added
0.3	10/01/2020	Product approvals defined more precisely

14. CONTACT

UBISYS TECHNOLOGIES GMBH
NEUMANNSTRASSE 10
40235 DÜSSELDORF
GERMANY

T: +49 (211) 54 21 55 - 00

F: +49 (211) 54 21 55 - 99

www.ubisys.de

info@ubisys.de