1XK M.2 Module Datasheet (EAR00385 / EAR00443 / EAR00466)

- Wi-Fi 4, 802.11 a/b/g/n
- Bluetooth 5.2 BR/EDR/LE
- SDIO 3.0 interface, SDR50@100MHz
- Chipset: NXP IW416

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Embedded Artists

Embedded Artists AB
Rundelsgatan 14
211 36 Malmö
Sweden

https://www.EmbeddedArtists.com

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Table of Contents

1 Document Information

This document applies to the following products.

Product Name	*Type Number*	*Murata Module*	*Chipset*	*Product Status*
1XK M.2 Module, rev A	EAR00385 / EAR00443 / EAR00466	LBEE5CJ1XK-687	IW416	Production

This table below lists the product differences. All products are not stocked. Consult Embedded Artists for availability and lead time.

Type Number	*Product Name*	*Antenna*	*Packaging*
EAR00385	1XK M.2 Module	On-board antenna	Individual packing for evaluation
EAR00443	1XK M.2 Module	On-board antenna	Tray packing
EAR00466	1XK M.2 Module	External antenna via u.fl.connectors	Tray packing

1.1 Revision History

Revision	*Date*	*Description*
PA1	2021-08-03	First version.
PA2	2021-09-22	General update.
PA3	2021-10-05	Added regulatory information.
PA4	2022-10-19	Corrected antenna gains.
PA5	2023-03-04	Added information about orderable products.

2 Introduction

This document is a datasheet that specifies and describes the *1XK M.2 module* mainly from a hardware point of view.

The main component in the design is Murata's 1XK module (full part number: LBEE5CJ1XK-687), which in turn is based on the NXP IW416 chipset. The 1XK module enable Wi-Fi, Bluetooth and Bluetooth Low Energy (LE) communication.

There are multiple application areas for the 1XK M.2 Module:

- Industrial and building automation
- Asset management
- IoT applications
- Smart home: Voice assist device, smart printer, smart speaker, home automation gateway, and IP camera
- Retail/POS
- Healthcare and medical devices
- Smart city

2.1 Benefits of Using an M.2 Module to get Wi-Fi/BT Connectivity

There are several benefits to use an *M.2 module* to add connectivity to an embedded design:

- Drop-in, certified solution!
- Modular and flexible approach to evaluate different Wi-Fi/BT solutions - with different trade-offs around performance, cost, power consumption, longevity, etc.
- Access to maintained software drivers (Linux and SDK) with responsive support from Murata.
- Supported by Embedded Artists' Developer's Kits for i.MX RT/6/7/8 development, including advanced debugging support on carrier boards
- One component to buy, instead of 40+
- No RF expertise is required
- Developed in close collaboration with Murata and NXP

2.2 More M.2 Related Information

For more information about the M.2 standard and Embedded Artists' adaptation, see: M.2 Primer

For more general information about the M.2 standard, see: https://en.wikipedia.org/wiki/M.2

The official M.2 specification (PCI Express M.2 Specification) is available from: www.pcisig.com

2.3 ESD Precaution and Handling

Please note that the M.2 module come without any case/box and all components are exposed for finger touches – and therefore extra attention must be paid to ESD (electrostatic discharge) precaution, for example use of static-free workstation and grounding strap. Only qualified personnel shall handle the product.

Make it a habit always to first touch the mounting hole (which is grounded) for a few seconds with both hands before touching any other parts of the

boards. That way, you will have the same potential as the board and therefore minimize the risk for ESD.

In general touch as little as possible on the boards in order to minimize the risk of ESD damage. The only reasons to touch the board are when mounting/unmounting it on a carrier board.

Note that Embedded Artists does not replace modules that have been damaged by ESD.

2.4 Product Compliance

Visit Embedded Artists' website at http://www.embeddedartists.com/product_compliance for up to date information about product compliances such as CE, RoHS2/3, Conflict Minerals, REACH, etc.

3 Specification

This chapter lists some of the more important characteristics of the M.2 module, but it is not a full specification of performance and timing. The main component in the design is Murata's 1XK module (full part number: LBEE5CJ1XK), which in turn is based around NXP's IW416 chipset.

For a full specification, see Murata's 1XK Module (LBEE5CJ1XK) product page: https://www.murata.com/products/connectivitymodule/wi-fi-bluetooth/overview/lineup/type1xk and the LBEE5CJ1XK datasheet.

Module / Chipset	
Murata module	LBEE5CJ1XK-687
Chipset	NXP IW416

Wi-Fi	
Standards	802.11a/b/g/n, Wi-Fi 4
Network	uAP and STA dual mode
Frequency	2.4GHz and 5 GHz band
Data rates	11, 54, 72.2, 150 Mbps
Host interface	SDIO 3.0, SDR12@24MHz, SDR25@50MHz, SDR50@100MHz, DDR50@50MHz

Bluetooth	
Standards	5.2 BR/EDR/LE, 3Mbps PHY
Power Class	Class 1
Host interface	4-wire UART@4MBaud
Audio interface	PCM for audio

Powering			
Supply voltage to M.2 module **Note: Do not exceed minimum or maximum voltage. Module will be permanently damaged above this limit!**	**Min** 0.0V minimum 3.0V operating and RF specification	**Typ** 3.3V	**Max** 3.5V **Note** that LBEE5CJ1XK module specification has higher maximum voltage (5.5V), but other components on the M.2 module limit the maximum voltage.
Peak current	TBD max		The power supply must be designed for this peak current, which typically happen during the startup calibration process.
Receive mode current (WLAN)	TBD mA typical max		Note that current consumption varies widely between different operational modes.

Transmit mode current (WLAN)	TBD mA typical max	Note that current consumption varies widely between different operational modes.

Environmental Specification	
Operational Temperature	-40 to +85 degrees Celsius
Storage Temperature	-40 to +85 degrees Celsius
Relative Humidity (RH), operating and storage	10 - 90% non-condensing

3.1 Power Up Sequence

The supply voltage shall not rise (10 - 90%) faster than 40 microseconds and not slower than 100 milliseconds.

There is no specific timing requirement on the M.2 signal W_DISABLE1# (chipset signal PMIC_EN) during power-up, but it is recommended to keep the signal low until the module shall be initialized.

Before initializing the module, and after the supply voltage has reached specification level, pull the M.2 signal W_DISABLE1# low for at least 10 milliseconds and then high.

3.2 External Sleep Clock

The sleep clock signals can be applied to a powered and unpowered M.2 module.

Clock Specification	
Frequency	32.768 kHz
Frequency accuracy	±250 ppm including initial tolerance, aging, temperature, etc.
Duty cycle	20 - 80%
Phase Noise	-125 dBc/Hz, typical at 100 kHz
Cycle jitter	1.5 ns (RMS), typical
Voltage level	3.3V logic, according to M.2 standard

3.3 Mechanical Dimensions

The M.2 module is of type: 2230-S3-E according to the M.2 nomenclature. This means width 22 mm, length 30mm (without trace antenna), top side component height 1.5 mm and key-E connector. The table below lists the different dimensions and weight.

M.2 Module Dimension	Value (±0.15 mm)	Unit
Width	22	mm
Height, with pcb trace antenna Height, without pcb trace antenna	44 30	mm mm
PCB thickness	0.8	mm
Maximum component height on top side	1.5	mm
Maximum component height on bottom side	0	mm
Ground hole diameter	3.5	mm
Plating around ground hole, diameter	5.5	mm
Module weight	1.5 ±0.5 gram	gram

Embedded Artists has added a non-standard feature to the 2230 M.2 modules designed together with Murata, NXP and Infineon (former Cypress). The pictures below illustrate the how the standard module size has been extended by 14 mm in the length direction in order to include a pcb trace antenna.

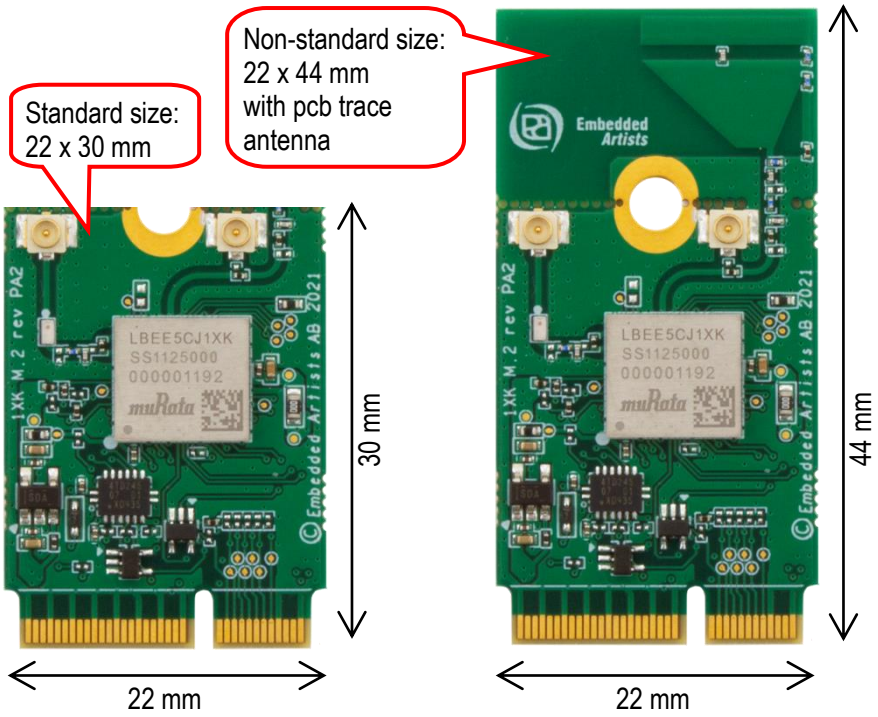


Figure 1 – M.2 Module with, and without, PCB Trace Antenna

The picture below gives dimensions for the grounded center (half) hole and the u.fl. antenna connector.

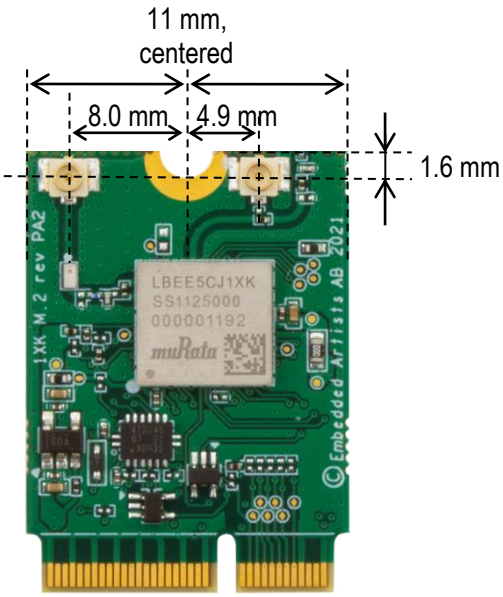


Figure 2 – M.2 Module Without Trace Antenna

3.4 M.2 Pinning

This section presents the pinning used for the M.2 module. It is essentially M.2 Key-E compliant with enhancements to support additional debug signals and 3.3V VDDIO override. The pin assignment for specific control and debug signals has been jointly defined by Embedded Artists, Murata, NXP and Infineon/Cypress.

The picture below illustrates the edge pin numbering. It starts on the right edge and alternates between top and bottom side. The removed pads in the keying notch count (but are obviously non-existing).

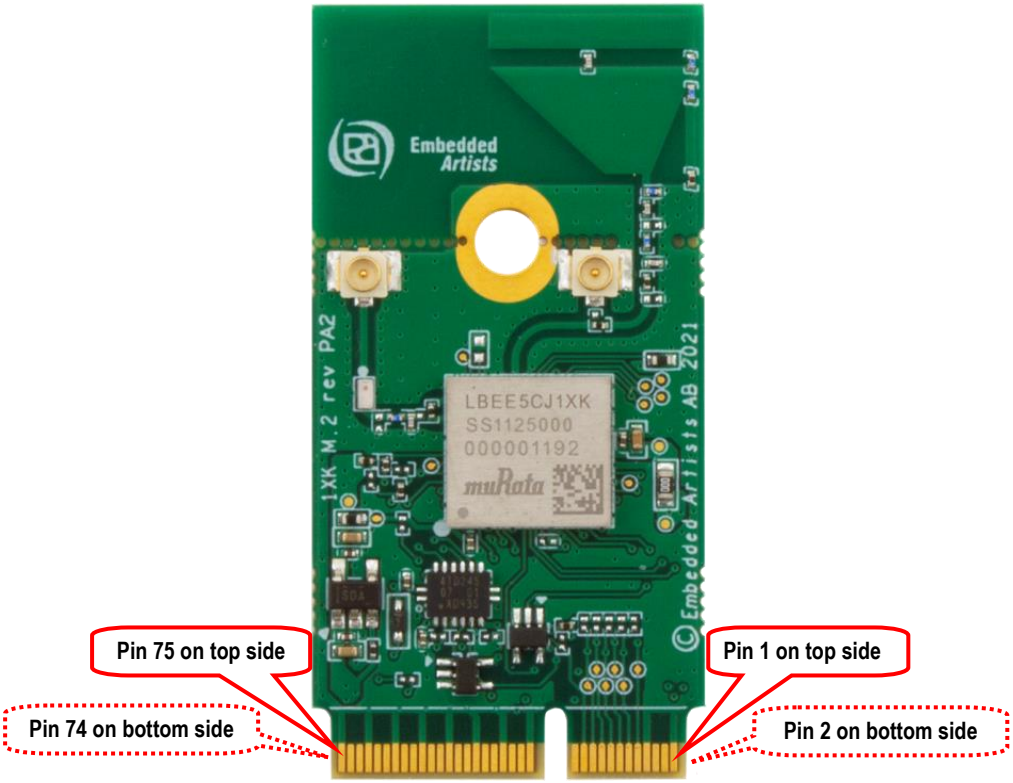


Figure 3 – M.2 Module Pin Numbering

The Wi-Fi interface uses the SDIO interface. The Bluetooth interface uses the UART interface for control and PCM interface for audio. The table below lists the pin usage for the 1XK M.2 modules. The column "When is signal needed" signals four different categories:

- Always: These signals shall always be connected.
- Wi-Fi: These signals shall always be connected then the Wi-Fi interface is used.
- Bluetooth: These signals shall always be connected then the Bluetooth interface is used.
- Optional: These signals are optional to connect.

Pin #	Side of pcb	M.2 Name	Voltage Level and Signal Direction	When is signal needed	Note
1	Top	GND	GND	Always	Connect to ground
2	Bottom	3.3 V		Always	Power supply input. Connect to stable, low-noise 3.3V supply.
3	Top	USB_D+			Not connected.
4	Bottom	3.3 V		Always	Power supply input. Connect to stable, low-noise 3.3V supply.
5	Top	USB_D-			Not connected.

6	Bottom	LED_1#			Not connected.
7	Top	GND	GND	Always	Connect to ground.
8	Bottom	PCM_CLK	1.8V I/O	Bluetooth audio	For Bluetooth audio interface: BT_PCM_CLK Connected to 1XK module, signal GPIO6, pin 8
9	Top	SDIO CLK	1.8V Input to M.2	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_CLK Connected to 1XK module, signal SD_CLK, pin 4
10	Bottom	PCM_SYNC	1.8V I/O	Bluetooth audio	For Bluetooth audio interface: BT_PCM_SYNC Connected to 1XK module, signal GPIO7, pin 9
11	Top	SDIO CMD	1.8V I/O	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_CMD Connected to 1XK module, signal SD_CMD, pin 6 Note: Require an external 10-100K ohm pullup
12	Bottom	PCM_OUT	1.8V output from M.2	Bluetooth audio	For Bluetooth audio interface: BT_PCM_OUT Connected to 1XK module, signal GPIO5, pin 11
13	Top	SDIO DATA0	1.8V I/O	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_D0 Connected to 1XK module, signal SD_DAT0, pin 5 Note: Require an external 10-100K ohm pullup
14	Bottom	PCM_IN	1.8V input to M.2	Bluetooth audio	For Bluetooth audio interface: BT_PCM_IN Connected to 1XK module, signal GPIO4, pin 11
15	Top	SDIO DATA1	1.8V I/O	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_D1 Connected to 1XK module, signal SD_DAT1, pin 56 Note: Require an external 10-100K ohm pullup
16	Bottom	LED_2#			Not connected.
17	Top	SDIO DATA2	1.8V I/O	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_D2 Connected to 1XK module, signal SD_DAT2, pin 3 Note: Require an external 10-100K ohm pullup
18	Bottom	GND		Always	Connect to ground.
19	Top	SDIO DATA3	1.8V I/O	Wi-Fi SDIO	For Wi-Fi SDIO interface: SDIO_D3 Connected to 1XK module, signal SD_DAT3, pin 55 Note: Require an external 10-100K ohm pullup
20	Bottom	UART WAKE#	3.3V OD output from M.2	Bluetooth	For Bluetooth UART interface: BT_HOST_WAKE_L Connected to 1XK module, via open drain buffer, signal GPIO14, pin 17 Require an external 10K pullup resistor to 3.3V.
21	Top	SDIO WAKE#	1.8V OD output from M.2	Wi-Fi SDIO	For Wi-Fi SDIO interface WL_HOST_WAKE_L Connected to 1XK module, via open drain buffer, signal GPIO1, pin 12 Note: Require an external 10K pullup resistor to 1.8V
22	Bottom	UART TXD	1.8V output from M.2	Bluetooth	For Bluetooth UART interface: BT_UART_TXD Connected to 1XK module, signal GPIO10, pin 54
23	Top	SDIO RESET#			Not connected. The Wi-Fi SDIO interface is controlled by pin 56, W_DISABLE1#, which is a 3.3V logic level signal.
24	Key, non existing				
25	Key, non existing				
26	Key, non existing				

27	Key, non existing				
28	Key, non existing				
29	Key, non existing				
30	Key, non existing				
31	Key, non existing				
32	Bottom	UART_RXD	1.8V input to M.2	Bluetooth	For Bluetooth UART interface: BT_UART_RXD Connected to 1XK module, signal GPIO9, pin 7
33	Top	GND		Always	Connect to ground.
34	Bottom	UART_RTS	1.8V output from M.2	Bluetooth	For Bluetooth UART interface: BT_UART_RTS Connected to 1XK module, signal GPIO11, pin 51
35	Top	PERp0			Not connected.
36	Bottom	UART_CTS	1.8V input to M.2	Bluetooth	For Bluetooth UART interface: BT_UART_CTS Connected to 1XK module, signal GPIO8, pin 15
37	Top	PERn0			Not connected.
38	Bottom	VENDOR DEFINED	1.8V I/O	Optional	Connected to 1XK module, signal GPIO3, pin 10 Note: Signal can be JTAG_TDO
39	Top	GND		Always	Connect to ground.
40	Bottom	VENDOR DEFINED	1.8V I/O	Optional	For Wi-Fi SDIO interface WL_DEV_WAKE_L Connected to 1XK module, signal GPIO13, pin 53
41	Top	PETp0			Not connected.
42	Bottom	VENDOR DEFINED	1.8V input to M.2	Bluetooth	For Bluetooth UART interface: BT_DEV_WAKE_L Connected to 1XK module, signal GPIO12, pin 34
43	Top	PETn0			Not connected.
44	Bottom	COEX3	1.8V I/O	Optional	Connected to 1XK module, signal GPIO2, pin 18 Note: Signal can be JTAG_TDI
45	Top	GND		Always	Connect to ground.
46	Bottom	COEX_TXD	1.8V I/O	Optional	Connected to 1XK module, signal GPIO14, pin 17 Note: Signal can be JTAG_TCK
47	Top	REFCLKp0			Not connected.
48	Bottom	COEX_RXD	1.8V I/O	Optional	Connected to 1XK module, signal GPIO15, pin 13 Note: Signal can be JTAG_TMS
49	Top	REFCLKn0			Not connected.
50	Bottom	SUSCLK	3.3V input to M.2	Always	External sleep clock input (32.768kHz) Connected to 1XK module, via buffer, signal SLP_CLK_IN, pin 19
51	Top	GND		Always	Connect to ground.
52	Bottom	PERST0#			Not connected.
53	Top	CLKREQ0#			Not connected.
54	Bottom	W_DISABLE2#	3.3V input to M.2	Always	Not connected.
55	Top	PEWAKE0#			Not connected.
56	Bottom	W_DISABLE1#	3.3V input to M.2	Always	Connected to 1XK module, via buffer, signal PMIC_EN, pin 3 High = module enabled, Low = module disabled
57	Top	GND		Always	Connect to ground.
58	Bottom	I2C_SDA			Not connected.

59	Top	Reserved		Not connected.
60	Bottom	I2C_CLK		Not connected.
61	Top	Reserved		Not connected.
62	Bottom	ALERT#		Not connected.
63	Top	GND	Always	Connect to ground.
64	Bottom	RESERVED	Optional	Optional supply voltage input for control and data signal voltage level. Apply a stable, low-noise, 3.3V / 100mA supply to set 3.3V voltage level on all signals.
65	Top	Reserved		Not connected.
66	Bottom	UIM_SWP		Not connected.
67	Top	Reserved		Not connected.
68	Bottom	UIM_POWER_ SNK		Not connected.
69	Top	GND	Always	Connect to ground.
70	Bottom	UIM_POWER_ SRC/GPIO_1		Not connected.
71	Top	Reserved		Not connected.
72	Bottom	3.3 V	Always	Power supply input. Connect to stable, low-noise 3.3V supply.
73	Top	Reserved		Not connected.
74	Bottom	3.3 V	Always	Power supply input. Connect to stable, low-noise 3.3V supply.
75	Top	GND	Always	Connect to ground.

3.5 VDDIO Override Feature

The M.2 standard specify 1.8V logic level on several of the data and control signals. It is possible to override the voltage level for the 1.8V signals via pin 64. Apply a 3.3V / 100 mA supply to pin 64 in order to get 3.3V voltage level on all data and control signals.

Note: If 3.3V signaling level is used, the SDIO clock frequency is limited to 50 MHz, i.e., SDR25 mode. This can limit the data throughput of the Wi-Fi interface.

3.6 SDIO Interface

The SDIO interface conforms to the SDIO v3.0 specification, including the UHS-I modes, and is backward compatible with SDIO v2.0.

SDIO bus speed modes	Max SDIO clock frequency	Max bus speed	Signaling voltage according to M.2 specification	Supported in 3.3V VDDIO Override Mode
DS (Default speed)	25 MHz	12.5 MByte/s	1.8 V	Yes
HS (High speed)	50 MHz	25 MByte/s	1.8 V	Yes
SDR12	25 MHz	12.5 MByte/s	1.8 V	No
SDR25	50 MHz	25 MByte/s	1.8 V	No
SDR50	100 MHz	50 MByte/s	1.8 V	No
DDR50	50 MHz	50 MByte/s	1.8 V	No

3.7 Test Points

There are some test points that can be of interest to probe for debugging purposes, as illustrated in the picture below.

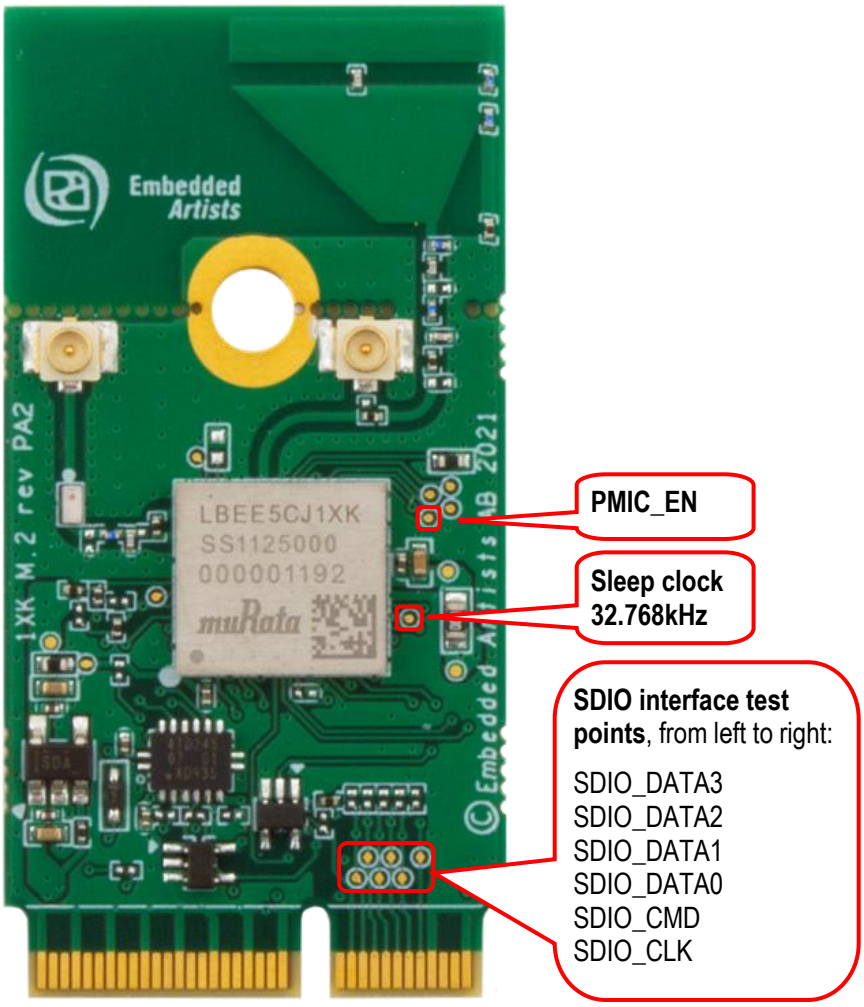


Figure 4 – 1XK M.2 Module Test Points

3.8 Bluetooth Interface Selection

It is possible to configure the Bluetooth interface of the module to be over UART (default) or SDIO. The picture below illustrates the location of the controlling resistor. Note that there is no publicly available driver that supports Bluetooth over SDIO. It is currently only available for specific high-volume customers (and this is out of control of Embedded Artists).

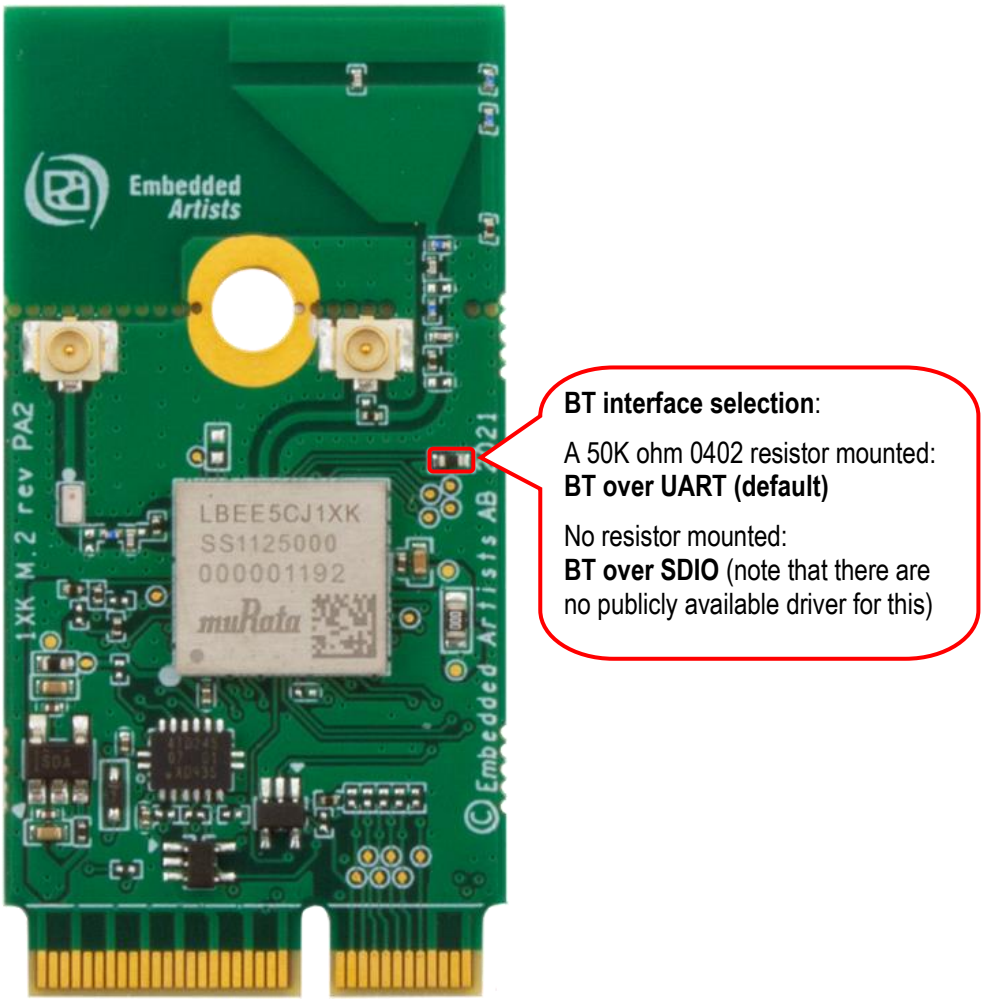


Figure 5 – 1XK M.2 Module Bluetooth Interface Selector

3.9 Current Consumption Measurements

It is possible to measure the currents of the power supplies to the 1XK module, VBAT and VIO. VBAT is the 3.3V the is supplied to the M.2 interface and VIO is an on-board generated 1.8V. VIO is generated from the supplied 3.3V. If the supply voltage (3.3V) to the M.2 module is measured it will be both the VBAT and VIO currents that is measured. By measuring currents at the illustrated points blow it is possible to measure VBAT and VIO independently.

Note that zero ohm resistors are mounted by default. Select a series resistor with as low resistance as possible to keep the voltage drop to a minimum. Keep the drop below 100mV. VBAT can be slightly above 1 Amp in peak which means that maximum series resistance is 100 milliOhm for the VBAT resistor. For VIO/VDD_SD the current is lower so a 1 ohm resistor can be a suitable value.

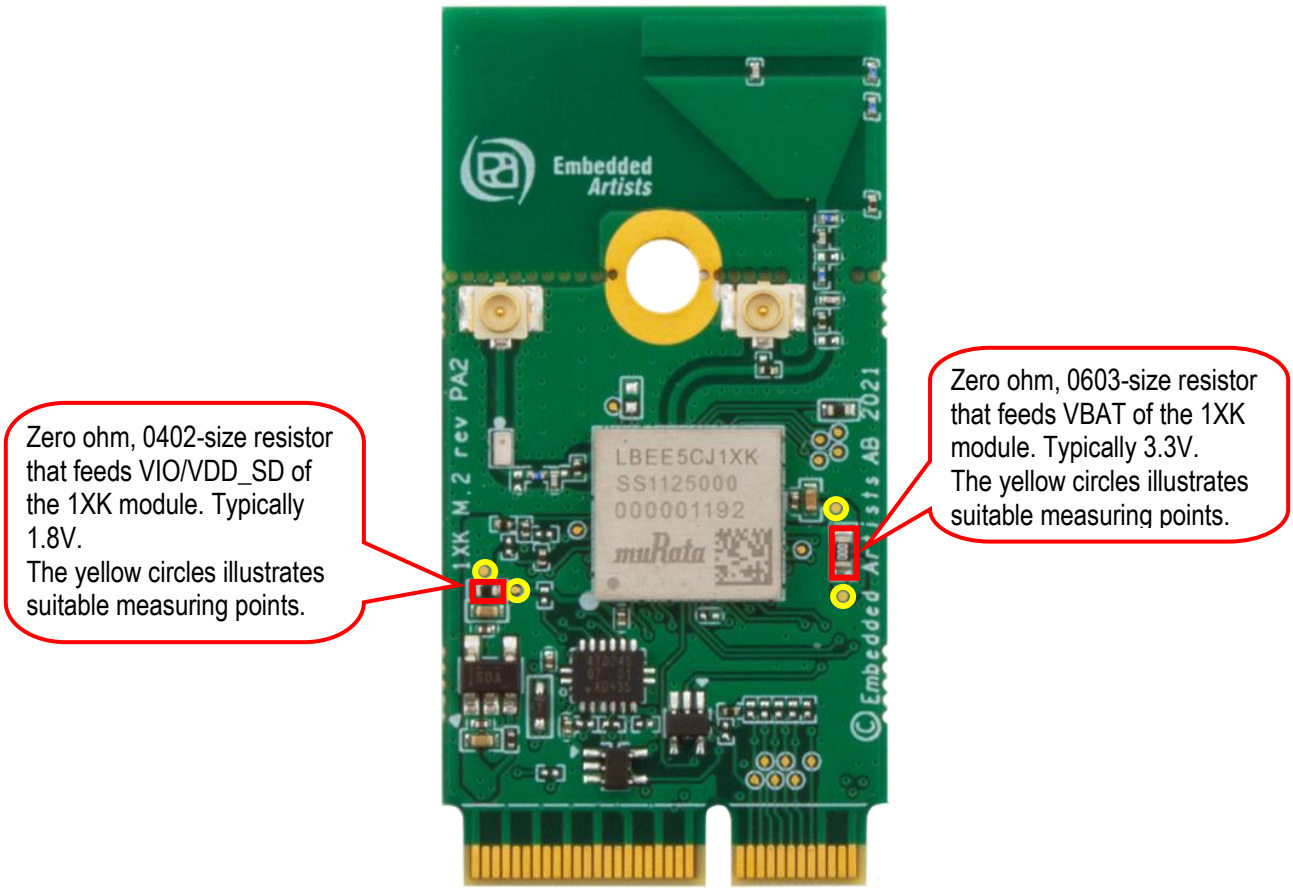


Figure 6 – Current Measurement

4 Antenna

This chapter addresses the antenna side of the module. There is an on-board, reference certified pcb trace antenna. This can be used for testing/evaluation purposes, but also for the final product. Also, for testing and evaluation purposes, it is possible to disconnect the on-board antenna and instead use an u.fl. connector to connect an external antenna.

4.1 Mounting and Clearance

Ideally, arrange the M.2 module so that the antenna is located at a corner of the product. Keep plastic case (i.e., non-metallic) away from the antenna area with at least 5 mm clearance (in all directions). Also keep any metal elements (e.g., connectors, battery, etc.) away from the antenna area with at least 5 mm clearance (in all directions). Keep a clearance area under and above the antenna area of at least 7.5mm , both under and over the PCB.

Human hands or body parts should be kept away (in the normal use case) from the antenna area.

The ground hole in the middle shall be grounded. Use a metal stand-off according to M.2 standard (height suitable for selected M.2 connector) and use metal screw to create a proper ground connection.

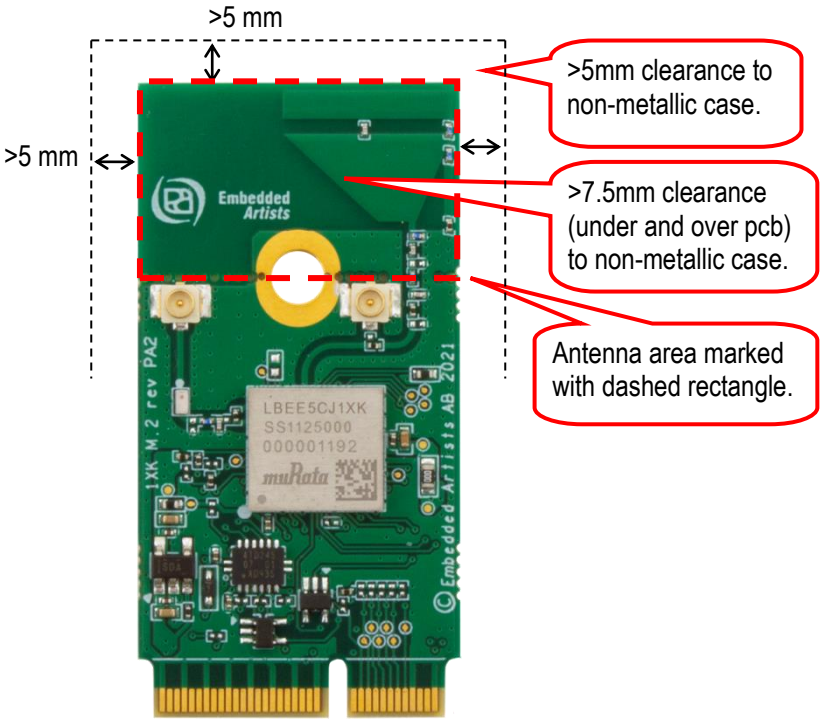


Figure 7 – M.2 Module Clearance Area

4.2 Antenna Connector

The M.2 standard specifies a 1.5 mm outer ring diameter male connector, which is compatible with the Murata MSC and IPEX MHF4 connector specifications. This connector is not used since our M.2 modules also targets industrial users, where the Hirose U.FL. connector standard is more commonly used. U.FL. is compatible with the IPEX MHF1 connector specification.

4.3 Overriding on-board PCB Trace Antenna

The antenna connection from the 1XK module can be redirected to the right U.FL. connector by just moving one zero ohm 0201 series resistor, see illustration below. The on-board trace antenna can be left as-is, or the antenna part can be snapped-off.

Per default, the on-board PCB trace antenna, or the right U.FL. connector, is used for both the Wi-Fi and Bluetooth interface. See next section information on how to have a separate Bluetooth antenna

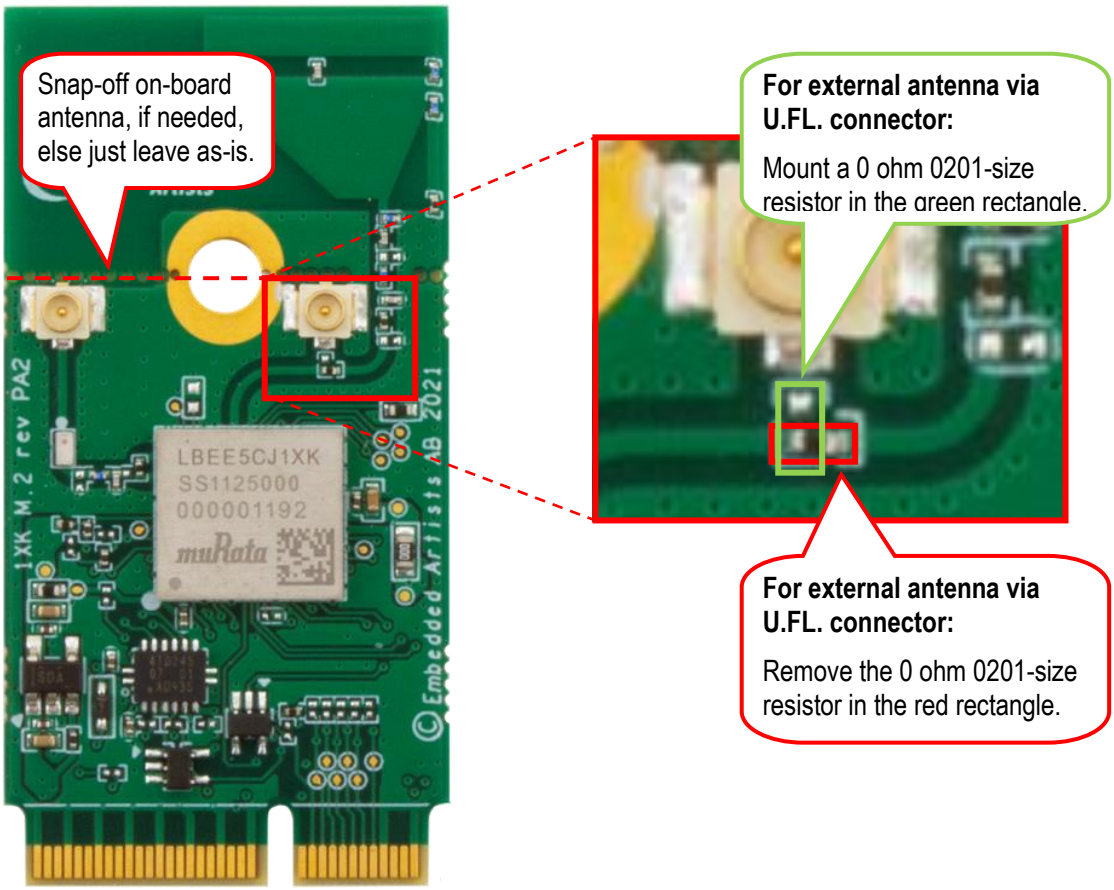


Figure 8 – Rework to Connect U.FL. Connector

4.4 Separate Bluetooth Antenna

Per default, the Bluetooth and Wi-Fi interfaces share the same antenna. It is possible to have a separate antenna for the Bluetooth interface. See the rework instruction below for details. One 0201-size capacitor shall be removed and a 10pF 0201-size capacitor shall be mounted.

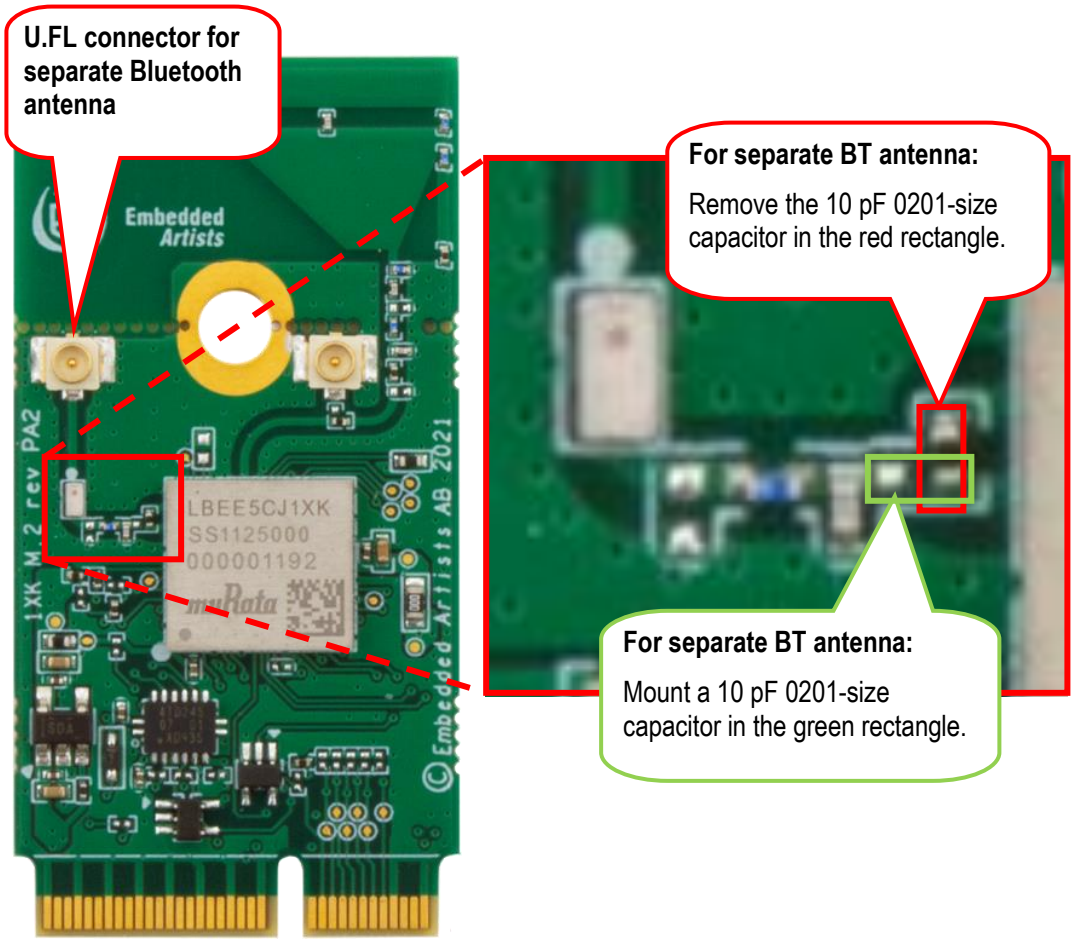


Figure 9 – Rework to for Separate Bluetooth Antenna

4.5 On-board PCB Trace Antenna Performance

The on-board pcb trace antenna type is monopole, certified by Murata.

The table below lists total efficiency:

Measurement condition	Frequency MHz						Total Efficiency in dB		Total Efficiency in %	
	2400	2442	2484	5150	5500	5850	Average 2 GHz band	Average 5 GHz band	Average 2 GHz band	Average 5 GHz band
Certified trace antenna	**-1.0**	**-1.0**	**-0.9**	**-1.3**	**-1.6**	**-1.5**	**-1.0**	**-1.5**	**80.1**	**71.5**

The table below lists peak gain:

Measurement condition	Frequency MHz						Max dBi	
	2400	2442	2484	5150	5500	5850	Max 2 GHz band	Max 5 GHz band
Certified trace antenna	**3.6**	**3.4**	**3.5**	**4.5**	**4.6**	**4.5**	**3.6**	**4.6**

The pictures below illustrate the return loss and efficiency.

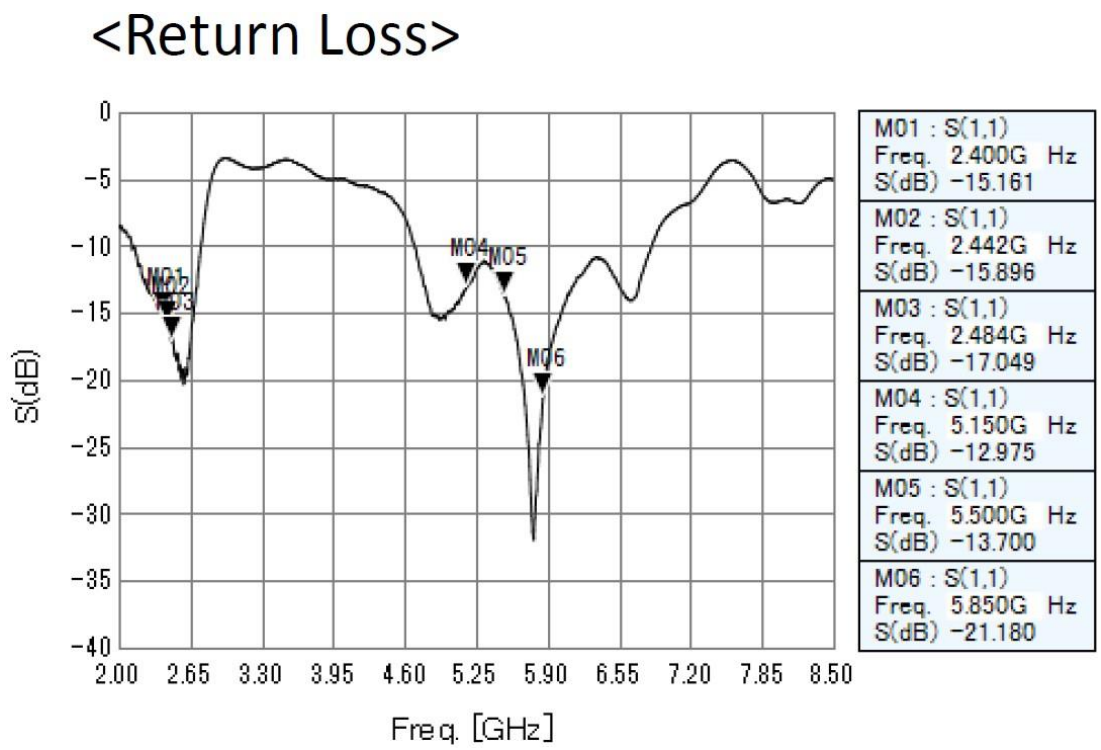


Figure 10 – Return Loss for Certified Trace Antenna

<Efficiency>

[dBi] [dB]

LINEAR POLARIZATION		XY-plane		YZ-plane		ZX-plane		Total Efficiency
		hor.	ver.	hor.	ver.	hor.	ver.	
2400 MHz	MAX.	-1.6	-0.9	2.6	-16.3	-2.2	1.0	
	AVE.	-4.9	-4.6	-2.0	-20.4	-8.3	-0.9	-1.0
2442 MHz	**MAX.**	**-1.6**	**-0.8**	**2.4**	**-15.0**	**-2.0**	**1.1**	
	AVE.	**-5.1**	**-4.6**	**-1.9**	**-19.5**	**-8.3**	**-0.7**	**-1.0**
2484 MHz	MAX.	-1.7	-0.7	2.5	-13.6	-1.7	1.6	
	AVE.	-5.2	-4.5	-1.6	-18.7	-8.2	-0.5	-0.9

[dBi] [dB]

LINEAR POLARIZATION		XY-plane		YZ-plane		ZX-plane		Total Efficiency
		hor.	ver.	hor.	ver.	hor.	ver.	
5150 MHz	MAX.	2.3	0.1	2.2	-11.4	3.5	-0.2	
	AVE.	-4.1	-4.5	-2.0	-19.2	-3.9	-3.9	-1.3
5500 MHz	**MAX.**	**2.3**	**-0.6**	**1.0**	**-12.7**	**3.6**	**-1.8**	
	AVE.	**-4.3**	**-5.0**	**-2.4**	**-20.0**	**-4.3**	**-5.1**	**-1.6**
5850 MHz	MAX.	2.3	-0.7	1.0	-12.9	3.5	-1.6	
	AVE.	-4.1	-5.4	-2.4	-19.8	-4.2	-5.5	-1.5

Figure 11 – Efficiency for Certified Trace Antenna

The directivity measurements are presented below for the 2 GHz and 5GHz bands with the orientation as illustrated below.

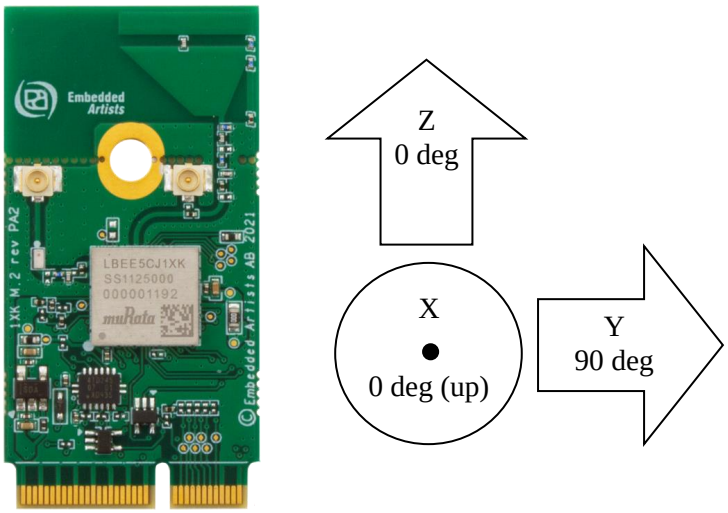
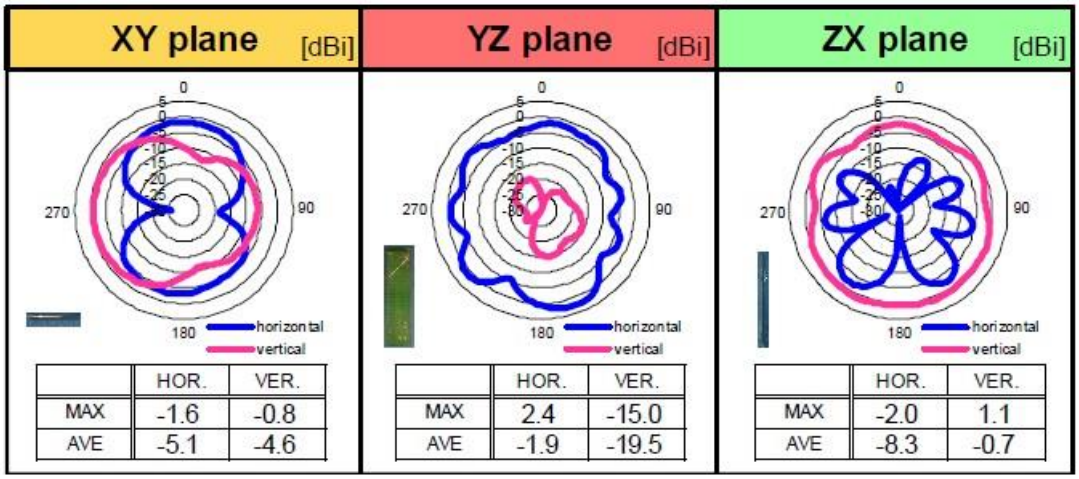


Figure 12 –Plane Orientations

<Directivity>

@2442MHz

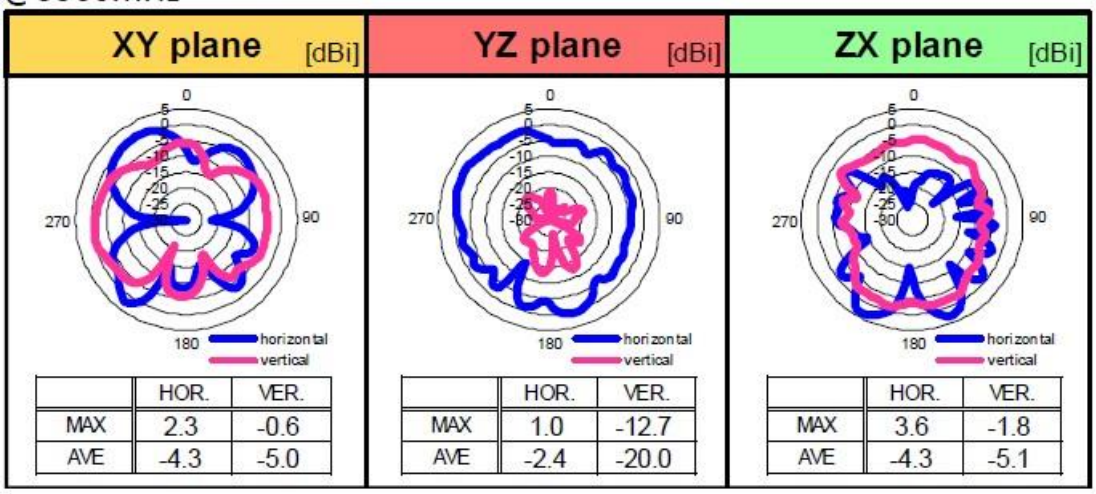


	HOR.	VER.
MAX	-1.6	-0.8
AVE	-5.1	-4.6

	HOR.	VER.
MAX	2.4	-15.0
AVE	-1.9	-19.5

	HOR.	VER.
MAX	-2.0	1.1
AVE	-8.3	-0.7

@5500MHz



	HOR.	VER.
MAX	2.3	-0.6
AVE	-4.3	-5.0

	HOR.	VER.
MAX	1.0	-12.7
AVE	-2.4	-20.0

	HOR.	VER.
MAX	3.6	-1.8
AVE	-4.3	-5.1

Figure 13 – Directivity for Certified Trace Antenna

5 Software and Support

This chapter contains information about software and support.

5.1 Software Driver

The IW416 chipset do not contain any persistent software. A firmware image must be downloaded by the host at start-up. This is the responsibility of the operating system driver.

There are three different cases, depending on which host processor is used:

1. **Embedded Artists' Computer-on-Modules, (u)COM, as host processor**
   Embedded Artists' Linux BSPs and SDKs for the different (u)COM board contains all drivers available and pre-configured. Everything has been tested and works out-of-the-box on the different iMX Developer's Kits.

iMX Developer's Kit	1XK M.2 support
iMX8M Mini uCOM	Yes, from Linux BSP v5.10.35
iMX8M Nano uCOM	Yes, from Linux BSP v5.10.35
iMX8M COM	Yes, from Linux BSP v5.10.35
iMX7 Dual COM	Yes, from Linux BSP v5.10.35
iMX7 Dual uCOM	Yes, from Linux BSP v5.10.35
iMX7ULP uCOM	No
iMX 6 Quad COM	Yes, from Linux BSP v5.10.35
iMX 6 DualLite COM	Yes, from Linux BSP v5.10.35
iMX 6 SoloX COM	Yes, from Linux BSP v5.10.35
iMX 6 UltraLite/ULL COM	Yes, from Linux BSP v5.10.35
iMX RT1176 uCOM	Yes, from SDK 2.10
iMX RT1166 uCOM	TBD
iMX RT1064 uCOM	TBD
iMX RT1062 OEM	TBD

2. **Other i.MX based, for example NXP's EVKs**
   Murata has created documentation how to compile the Linux kernel for the NXP EVKs https://wireless.murata.com/products/rf-modules-1/wi-fi-bluetooth-for-nxp-i-mx.html#Linux

3. **Non-i.MX host processor**
   There is no ready-to-go driver exist. Contact Murata to check driver availability on the hardware platform used.

5.2 Support

Embedded Artists supports customers that use our M.2 module in combination with Embedded Artists' Computer-on-Modules, (u)COM, based on NXP's i.MX RT/6/7/8 families.

For other platforms, support is provided by Murata via their Community Support Forum:
https://community.murata.com/s/topic/0TO5F0000002TLWWA2/connectivity-modules

6 Regulatory

The Murata 1XK module is reference certified. See the LBEE5CJ1XK datasheet from Murata for details.

6.1 European Union Regulatory Compliance

EUROPEAN DECLARATION OF CONFORMITY (Simplified DoC per Article 10.9 of the Radio Equipment Directive 2014/53/EU)

This apparatus, namely 1XK M.2 module (pn EAR00385 / EAR00443 / EAR00466) conforms to the Radio Equipment Directive (RED) 2014/53/EU. The full EU Declaration of Conformity for this apparatus can be found at this location: https://www.embeddedartists.com/products/1xk-m-2-module/, see document *1XK M.2 module Declaration of Conformity*.

The following information is provided per Article 10.8 of the Radio Equipment Directive 2014/53/EU:

(a) Frequency bands in which the equipment operates.

(b) The maximum RF power transmitted.

PN	RF Technology	(a) Frequency Ranges (EU)	(b) Max Transmitted Power
EAR00385 / EAR00443 / EAR00466	Bluetooth BR/EDR/LE	2400 MHz – 2484 MHz	6.3 dBm
EAR00385 / EAR00443 / EAR00466	Wi-Fi IEEE 802.11b/g/n	2400 MHz – 2484 MHz	19.0 dBm
EAR00385 / EAR00443 / EAR00466	Wi-Fi IEEE 802.11a/n	5150 MHz – 5850 MHz	18.0 dBm

The 1XK M.2 module complies with the Directive 2011/65/EU (EU RoHS 2) and its amendment Directive (EU) 2015/863 (EU RoHS 3).

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