FMLR-8X-X-STX

HIGH PERFORMANCE COMBINED 2.4 GHZ LORA®
IOT MODUL

FMLR 2.4 GHz low power wireless module with STM32L0 or STM32L4 MCU, time-of-flight ranging, BLE 5.0 stack

FMLR-8X-X-STX LoRa® IoT modules enable devices and sensors to communicate at high data rates or over long-distance in the world-wide available 2.4 GHz ISM spectrum. The modules also support time-of-flight (ToF) distance measurement for indoor and outdoor localization. Power consumption can be optimized to run on a small-sized battery. The MCU has plenty of resources available to run even the most advanced and demanding wireless stacks and user applications with precise timing, edge sensor computation, consolidation, local storage and more. The FMLR module supports additional modulation schemes such as high-bitrate long-range FLRC. Demos and stacks for LoRa 2.4 GHz, TDMA available on request.

KEY BENEFITS

- Semtech SX1280/1 LoRa 2.4 GHz IoT module
- ToF ranging & localization hardware
- LoRa/FLRC/GFSK with up to 1.3 MBps
- 8.31 dBm TX power
- -132 dBm sensitivity
- Optional ext. flash, TCXO, U.FL connector
- STM32L0/4xx MCU for any stack and app
- Tiny FMLR footprint: 14 x 19.5 mm

APPLICATIONS

- Indoor and outdoor localization
- People and work safety
- Smart agriculture, farming and city

Document Information

ABOUT

File name	FMLR-8X-X-STX datasheet
Document type	Datasheet
Date	2022/01/17
Revision	1.3.107

REVISION HISTORY

Date	Release	Changes
2021/02/25	1.0	Initial revision
2021/05/26	1.1	Changed solder profile
2021/07/08	1.2	Updated product image and BLE functionality
2021/08/09	1.3	Updated FCC info

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Functional Description

The **FMLR-8X-X-STX** LoRa® and LoRaWAN® IoT module provides wireless connectivity to devices, systems, and sensors communicating with high data rates or over a long distance. The 2.4 GHz modules support long-range Time-of-Flight (ToF) distance measurement for indoor and outdoor localization down to an accuracy of 5 meters. Power consumption can be optimized to run from a small-sized battery. The integrated ARM Cortex-M0+ or M4 32-bit microcontroller runs entire RF stacks and has sufficient resources to run user applications.

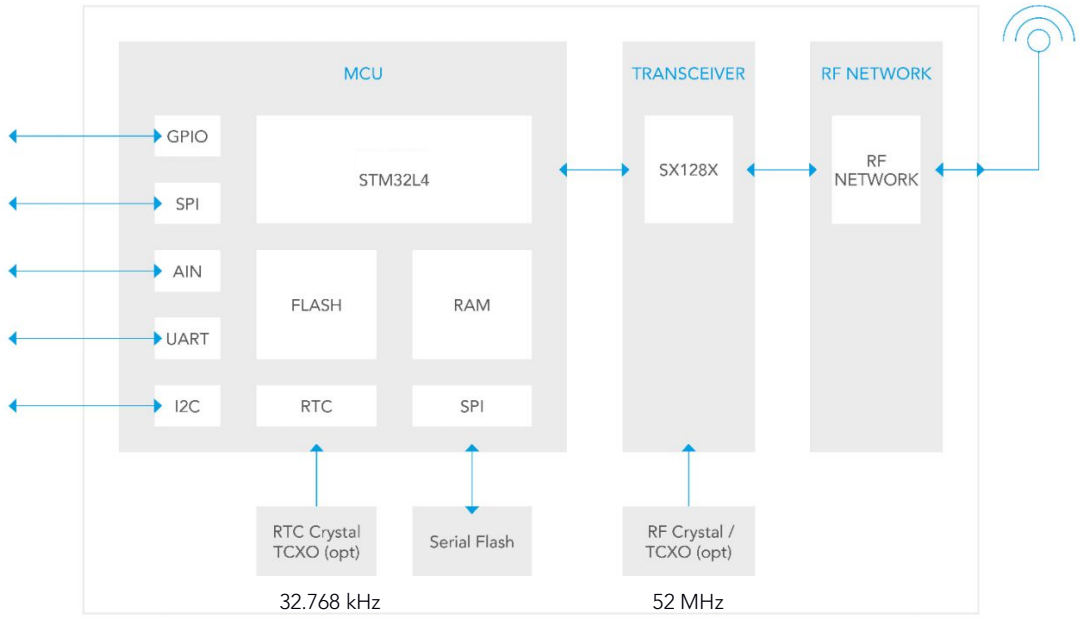


Figure 1: Block diagram FMLR-8X-X-STX

The modules are available with additional onboard flash memory to enable Over-the-Air (OTA) update and data storage. The FMLR family supports additional modulation schemes like the very efficient and robust high-bitrate and long-range FLRC. This enables communication with smartphones, tablets, gadgets, and more. Optional low-power high precision temperature compensated oscillators (TCXO) for both RTC and radio available.

The module's firmware, including the wireless stack, can be updated via SWD, UART-Bootloader or OTA, to support fast prototyping and development.

Technical Specifications

CORE COMPONENTS

LoRa® Transceiver	Semtech SX1280/1
Microcontroller	STM STM32L451REI6
Core	Cortex-M4 with FPU, 80 MHz
Flash Memory	512 kB
RAM	160 kB
Ext. Flash, optional (-4M)	Macronix MX25R4035FZUIL0, 512 kB

MECHANICAL SPECIFICATIONS

Weight	2 g
Dimensions	14 x 19 x 2 mm

OPERATING CONDITIONS

Temperature	-40 – 85 °C
Humidity	0 – 95% RH, non-condensing

ABSOLUTE MAXIMUM RATINGS

Parameter	Min	Max	Unit
Ext. supply voltage on all power pins (V_{DD})	-0.3	3.6	V
Input voltage on any pin	V_{SS} – 0.3	V_{DD}	V
DC current on any pin		15	mA
Storage temperature	-40	+85	°C

WARNING!

Stressing the device beyond the «Absolute Maximum Ratings» may cause permanent damage.

OPERATING CONDITIONS

Parameter	Min	Typ	Max	Unit
Standard operating voltage (V_{DD})	1.9		3.6	V
Digital IO pin input low voltage	V_{SS}		$0.4 \cdot V_{DD}$	V
Digital IO pin input high voltage	$0.4 \cdot V_{DD}$		V_{DD}	V
Digital IO pin output low voltage	0		0.4	V
Digital IO pin input high voltage	$V_{DD} – 0.4$		V_{DD}	V
Current consumption, TX mode (10dBm)		18.3		mA
Current consumption, RX mode	4.8		8.6	mA
Current consumption, sleep mode		1.5		µA
Highest receiver sensitivity			-132	dBm
RF output power	-18		12.5	dBm

CERTIFICATIONS

CE	RED 2014/53/EU
FCC	FCC ID: 2AUQEPC1Y4

ON-BOARD LED

The on-board LED is connected to port PB8. Actively drive port to low (0V) to light up LED. Drive port high or high Z to disable LED.

Module Pinout

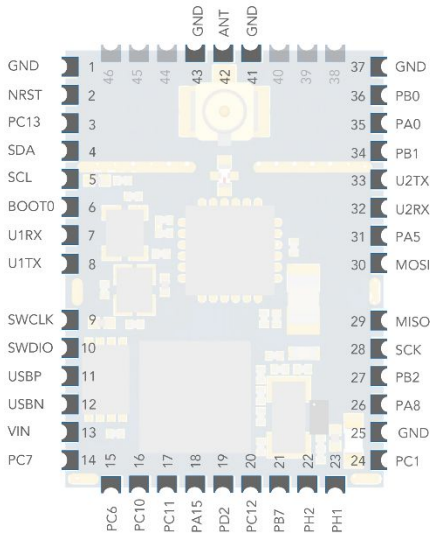


Figure 2: FMLR Pinout

#	Pad name	MCU pad	Description
1	GND		Ground (V_{SS})
2	NRST	NRST	MCU Reset
3	PC13	PC13	GPIO
4	SDA	PB9	I²C1, GPIO
5	SCL	PB6	I²C1, GPIO
6	BOOT0	BOOT0	MCU BOOT0
7	U1RX	PA10	UART1 RX
8	U1TX	PA9	UART1 TX
9	SWCLK	PA14	DBG Clock / GPIO
10	SWDIO	PA13	DBG Data / GPIO
11	USBP	PA12	USB P / GPIO
12	USBN	PA11	USB N / GPIO
13	VIN		Supply Voltage V_{DD}
14	PC7	PC7	GPIO
15	PC6	PC6	GPIO
16	PC10	PC10	GPIO
17	PC11	PC11	GPIO
1	PA15	PA15	GPIO

#	Pad name	MCU pad	Description
21	PB7	PB7	GPIO
22	PH0	PH0	GPIO
23	PH1	PH1	GPIO
24	PC1	PC1	GPIO
25	GND		Ground (V_{SS})
26	PA8	PA8	GPIO
27	PB2	PB2	GPIO
28	SCK[1)]	PB3	SPI SCK
29	MISO[1)]	PB4	SPI MISO
30	MOSI[1)]	PB5	SPI MOSI
31	PA5	PA5	GPIO
32	U2RX	PA3	UART2 RX
33	U2TX	PA2	UART2 TX
34	PB1	PB1	GPIO
35	PA0	PA0	GPIO
36	PB0	PB0	GPIO
37	GND		Ground (V_{SS})
41	GND		Ground (V_{SS})

8						
19	PD2	PD2	GPIO	42	ANT	RF Out (50 Ω)
20	PC12	PC12	GPIO	43	GND	Ground (V_{SS})

[1] If the module variant contains an external flash, these pins are connected internally and should not be used as GPIO pins!

FMLR Family Footprint

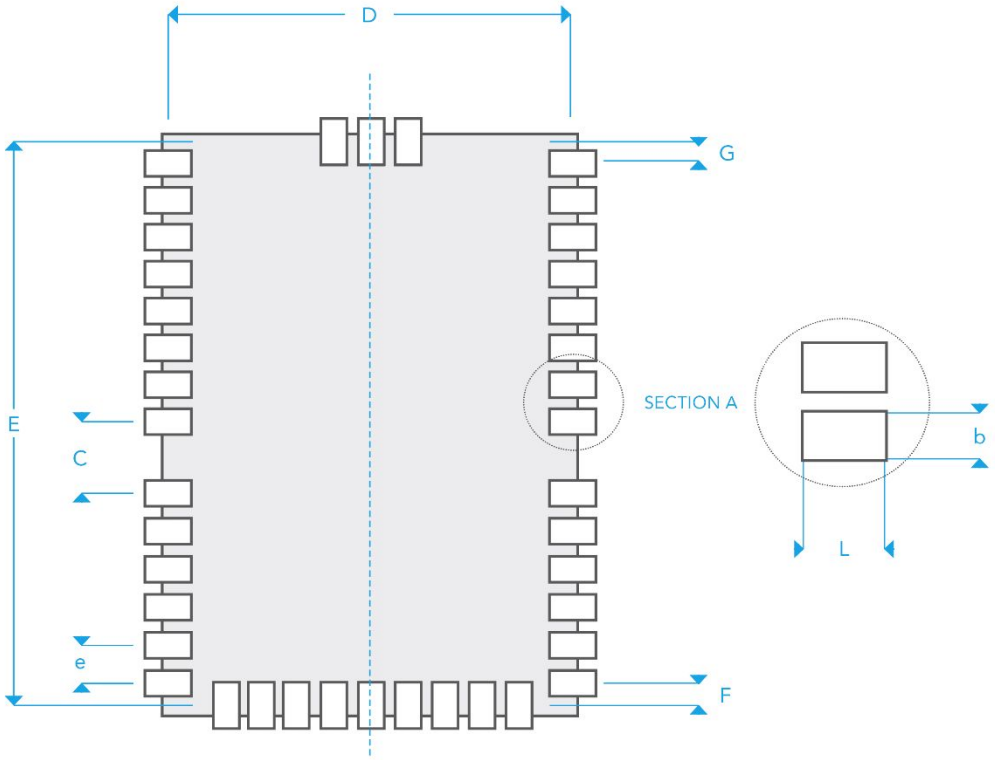


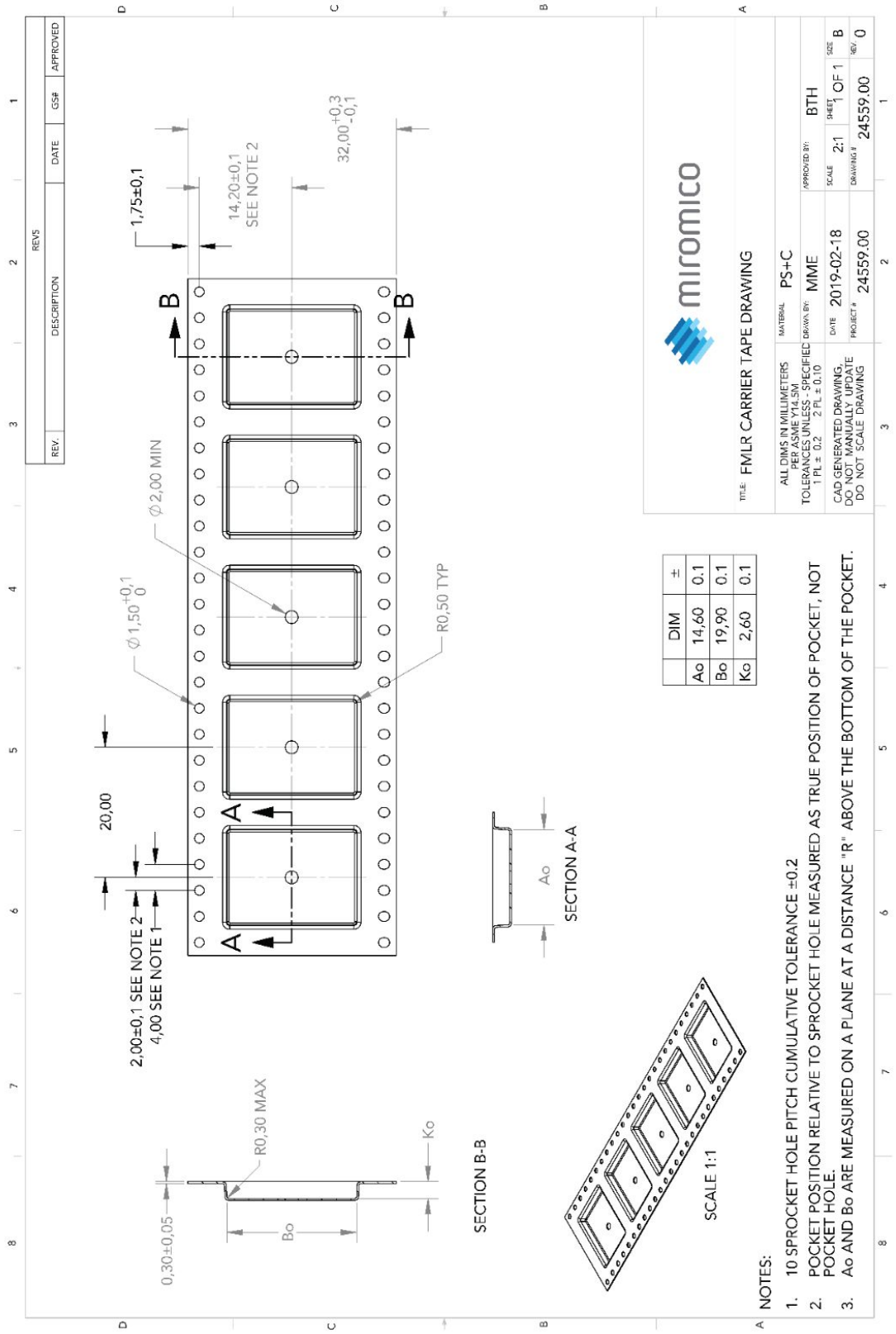
Figure 3: FMLR Footprint

FMLR FOOTPRINT DIMENSIONS

Dimension *(see Figure 3: FMLR Footprint)*	Min	Typ	Max
C		2.5	
D		13.7	
e		1.25	
b	0.85	0.9	0.95
L	1.45	1.5	1.55
F		1	
G		0.5	

All dimensions in mm

Tape Information



All dimensions in mm

Recommended Soldering Conditions

The following graph shows a typical temperature profile for the module soldering process. The exact values to be used in production are highly dependent on other parameters of the soldering process, such as soldering paste, PCB design, soldering process, etc.

Reflow process should be finished within 2 cycle.

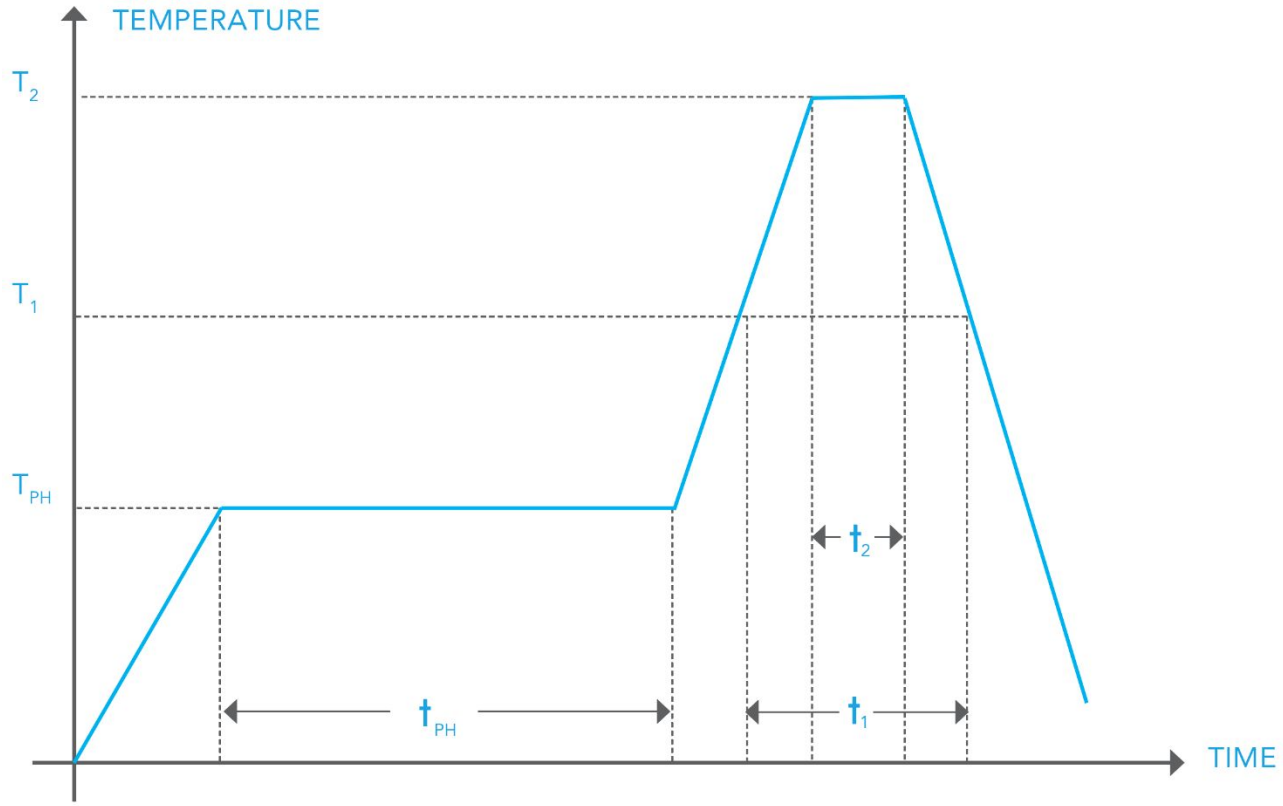


Figure 4: Soldering Profile

SOLDERING CONDITIONS

Step (see Figure 4: Soldering Profile)	Temperature	Time
Preheat (T_{PH}, t_{PH})	150 to 180 °C	120 s
Heating (T_1, t_1)	220 °C	60 s
Reflow (T_2, t_2)	255 °C	5 s

Device Options

PRODUCT ID	MCU OPTIONS							RF OPTIONS		
	Cortex-M0+	Cortex-M4	192KB flash	512KB flash	20KB RAM	160KB RAM	4Mbit Flash	ToF ranging	U.FL connect.	Antenna pad
FMLR-80-U-STL0Z	■		■		■			■	■	
FMLR-80-P-STL0Z	■		■		■			■		■
FMLR-80-U-STL0Z-4M	■		■		■		■	■	■	
FMLR-80-P-STL0Z-4M	■		■		■		■	■		■
FMLR-81-U-STL0Z	■		■		■				■	
FMLR-81-P-STL0Z	■		■		■					■
FMLR-81-U-STL0Z-4M	■		■		■		■		■	
FMLR-81-P-STL0Z-4M	■		■		■		■			■
FMLR-80-U-STL4E		■		■		■		■	■	
FMLR-80-P-STL4E		■		■		■		■		■
FMLR-80-U-STL4E-4M		■		■		■	■	■	■	
FMLR-80-P-STL4E-4M		■		■		■	■	■		■
FMLR-81-U-STL4E		■		■		■			■	
FMLR-81-P-STL4E		■		■		■				■
FMLR-81-U-STL4E-4M		■		■		■	■		■	
FMLR-81-P-STL4E-4M		■		■		■	■			■

Options for other STM32 variants (USB, Cortex-M0+/M4 with FPU, etc.) and external flash sizes are available on request.

Additional Documentation

FCC CAUTION:

Antenna Manufacturer:	Adafruit Industries LLC
Antenna Model:	2308
Antenna type:	External
Antenna gain:	4 dBi

Host product manufacturers that they need to provide a physical or e-label stating, "Contains FCC ID: 2AUQEPC1Y4" with their finished product. Only those antennas with same type and lesser gain filed under this FCC ID can be used with this device. 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. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed. The final host integrator must ensure there is no instruction provided in the user manual or customer documentation indicating how to install or remove the transmitter module except such device has implemented two-ways authentication between module and the host system. The final host manual shall include the following regulatory statement: This equipment has been tested and found to comply with the limits. 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 module has been tested and found to comply with part 15.247 requirements for Modular Approval. This module is intended for OEM integrator. The OEM integrator is responsible for the compliance to all the rules that apply to the product into which this certified RF module is integrated. Additional testing and certification may be necessary when multiple modules are used.

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the 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 operation.

FCC RF RADIATION EXPOSURE STATEMENT:

1. This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

2. This equipment complies with RF radiation exposure limits set forth for an uncontrolled environment.

3.This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.

ADDITIONAL RESSOURCES

Product Information Page	Product Website
Technical Documentation	Technical Documentation Website

Keep in touch

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