



SN10-12 SIGFOX Module

User Manual

FCC ID: YAI SN10-12

Model Name	SN10-12
Project code	
Description	SIGFOX module
Version	0.5
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Approved by	Reviewed by	Issued by
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Revision History

Revision	Released Date	Comments/Remark	Author
0.1	2017/03/14	Initial release	Iestyn Chen
0.2	2017/03/17	Update with RX performance spec.	Iestyn Chen
0.3	2017/03/24	Add module layout guide and appendix section	Iestyn Chen
0.4	2017/03/29	Update RX value, reflow profile	Iestyn Chen
0.5	2017/05/26	Modify FCC Interference Statement	Keller Lin

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1. Introduction

The IoT presents a different set of communications challenges to those faced by the conventional internet or cellular networks. Unlike cellphones and computers, IoT devices do not need to transfer large amounts of data. However, requirements for battery life and hardware cost are much more stringent and difficult to meet. For example, a soil moisture sensor might send a single moisture reading – one number – every hour. But to be practical for the farmer the batteries in the sensor need to last for at least one growing season, and ideally several years.

SIGFOX networks provide a simplified way to connect low energy isolated devices to customer' s applications on wide territories, through a high efficiency radio technology with extreme budget links despite low radiations and at very low costs. Customers can then build their applications without any concern of the heavy radio network problematic and management, and, almost, no concern of the radio communication aspects.

The SN10-12 is a transceiver module which complies with SIGFOX network specifications. The SN10-12 is based on NXP OL2385 chip which is a Sub-GHz wireless SoC transceiver. The SN10-12 module provides a wide range of frequency selections for IoT applications network service platform.

1.1. Key Features

- High performance low power RISC micro-controller
- Memory
 - 32kB EROM
 - 7kB RAM
- Ultra Narrow Band Radio
 - Frequency Band:
TX: 902.1375-904.6625MHz

band: (902.1375-904.6625MHz)

Micro Channel 1 (MHz)	Micro Channel 2 (MHz)	Micro Channel 3 (MHz)	Micro Channel 4 (MHz)	Micro Channel 5 (MHz)	Micro Channel 6 (MHz)
902.1375	902.1625	902.1875	902.2125	902.2375	902.2625
902.4375	902.4625	902.4875	902.5125	902.5375	902.5625
902.7375	902.7625	902.7875	902.8125	902.8375	902.8625
903.0375	903.0625	903.0875	903.1125	903.1375	903.1625
903.3375	903.3625	903.3875	903.4125	903.4375	903.4625
903.6375	903.6625	903.6875	903.7125	903.7375	903.7625
903.9375	903.9625	903.9875	904.0125	904.0375	904.0625
904.2375	904.2625	904.2875	904.3125	904.3375	904.3625
904.5375	904.5625	904.5875	904.6125	904.6375	904.6625

RX: 905.2 MHz

- Output Power : 23.62 dBm

- Excellent Receiving Sensitivity: -125dBm @600bps 2GFSK
- Excellent Image Rejection: 60 dB
- Excellent Blocking Performance: 58 dB

2.ELECTRICAL CHARACETRISTICS

2.1 Recommended Operating Range

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Operating temperature range		-40	25	85	°C
Operating supply voltage		3.3		3.6	V

2.2 Power Consumption

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
TX supply current at maximum output power	@22dBm, 3.3V	240	260		mA
RX		16.5	17.5		mA

2.3 Characterization information

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Voltage at digital I/O pins		-0.3		VDD + 0.3	V

3. RF Characteristics

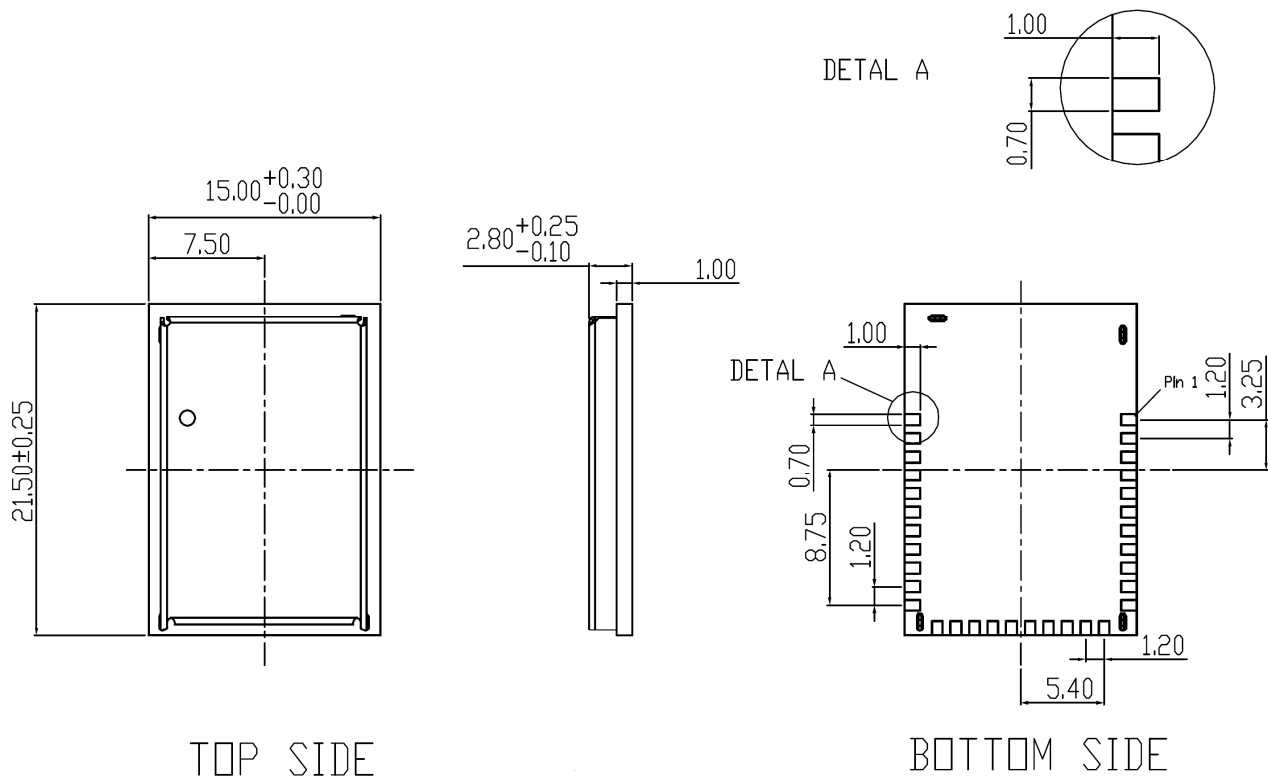
PARAMETER	Model	TX / RX			UNIT	Note
Center Frequency	SN10-12	902.2 / 905.2			MHz	SIGFOX RCZ2
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT	Note
Antenna port impedance		50			Ω	
TX Characteristics						
Following characteristics are valid for conditions as follows (unless otherwise specified) Tamb = -40 °C to 85 °C, VSS = 0 V, VDD = 2.6 V to 3.6 V, crystal = 55.2 MHz						
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT	Note
Maximum output power, CW mode	SN10-12	21	22		dBm	
RX Characteristics						
Following characteristics are valid for conditions as follows (unless otherwise specified) 2GFSK modulation, h = 2.67, BT = 1.0, NRZ, data-rate = 0.6 kChips/s, Channel spacing = 10 kHz, Channel filter bandwidth = 10 kHz, Frame Error Rate (FER) = 20%, payload length = 228 byte, crystal = 55.2 MHz. Tamb = 25 °C, VDD = 2.6 V to 3.6 V, fC = 905 MHz						
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT	Note
Sensitivity	-40 °C to 85 °C	-125			dBm	PER at 10% on 1000 frames sent.
Co-channel rejection	2GFSK jammer	2 5			dB	
Adjacent channel rejection	Channel filter BW = 10 kHz, jammer same modulation as wanted. Channel separation: 10 kHz, 20 kHz, 150 kHz.	50	55		dB	
		55	60		dB	
		60	65		dB	

4. SN10-12 PIN Map and Signal Description

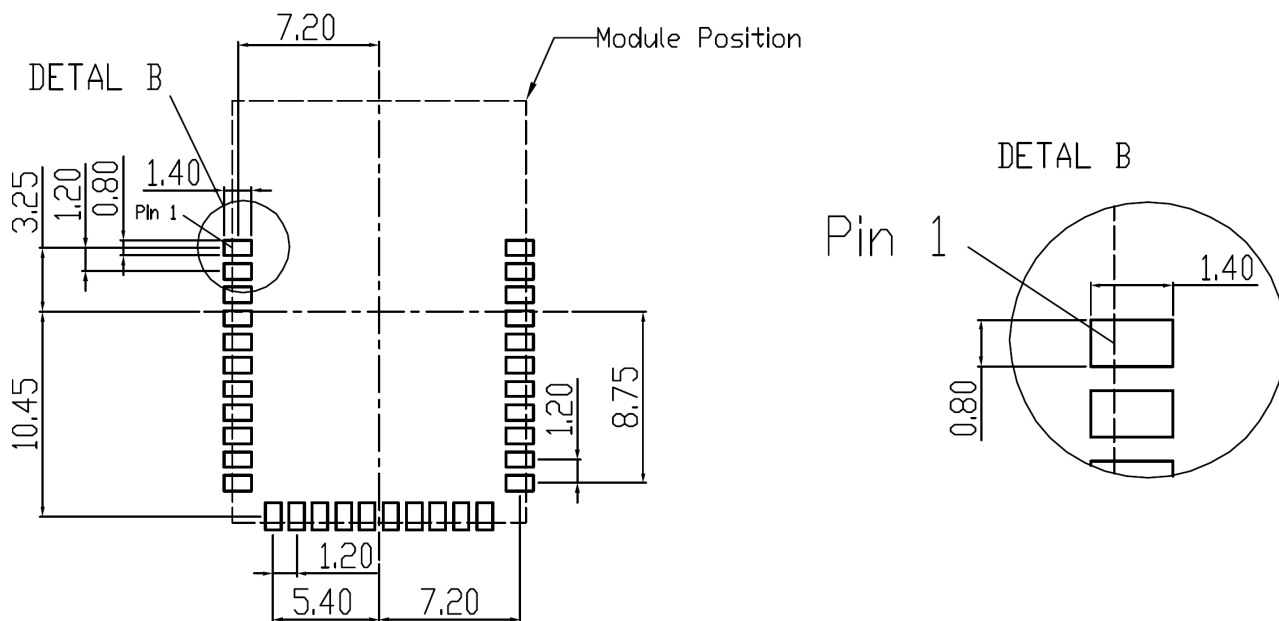
Pin #	Pin Name	Type	Description
1	GND	GND	Ground
2	VDD	Power	Power Supply input
3	GND	GND	Ground
4	GND	GND	Ground
5	GND	GND	Ground
6	GND	GND	Ground
7	GND	GND	Ground
8	GND	GND	Ground
9	P16	Digital I/O	GPIO, SPI_SD1
10	P15	Digital I/O	GPIO, SPI_CS
11	GND	GND	Ground
12	GND	GND	Ground
13	P14	Digital I/O	GPIO, SPI_SCLK
14	P13	Digital I/O	GPIO, SPI_SDO, UART_TX
15	P12	Digital I/O	GPIO, UART_RX
16	P11	Digital I/O	Debug port, INT, Optional
17	P10	Digital I/O	GPIO, UART TX/RX CLOCK
18	RST_N	Digital I/O	GPIO, RESET
19	MDI_MSDA	Digital I/O	Debug port, MSDA
20	MDI_MSCL	Digital I/O	Debug, MSCL
21	GND	GND	Ground
22	P17	Digital I/O	GPIO, SPI_AK
23	P20	Digital I/O	Debug port, RSSI LOG
24	P21	Digital I/O	N.C.
25	P22	Digital I/O	N.C.
26	P23	Digital I/O	GPIO
27	GND	GND	Ground
28	IF_IFN	Digital I/O	GPIO, IFN
29	IF_IFP	Digital I/O	GPIO, IFP
30	GND	GND	Ground
31	ANT	RF	RF Antenna Interface Impedance=50 Ω
32	GND	GND	Ground

5. Module installation Guide

5.1 Mechanical Information

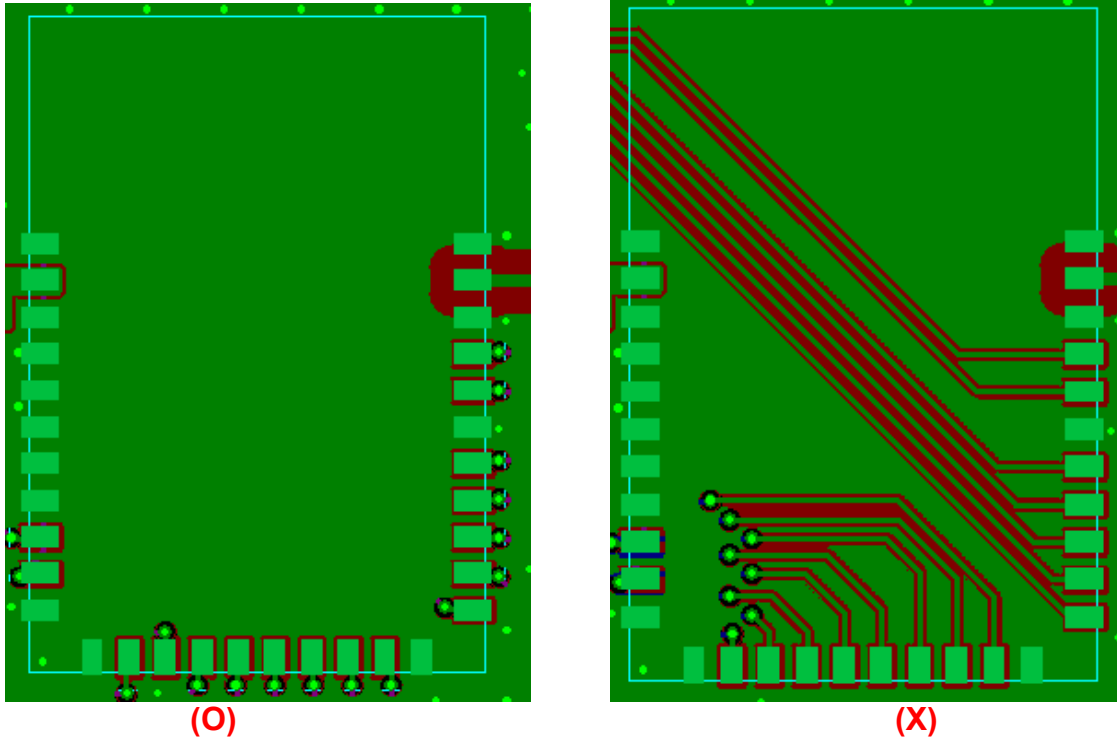


5.2. PCB Layout Footprint



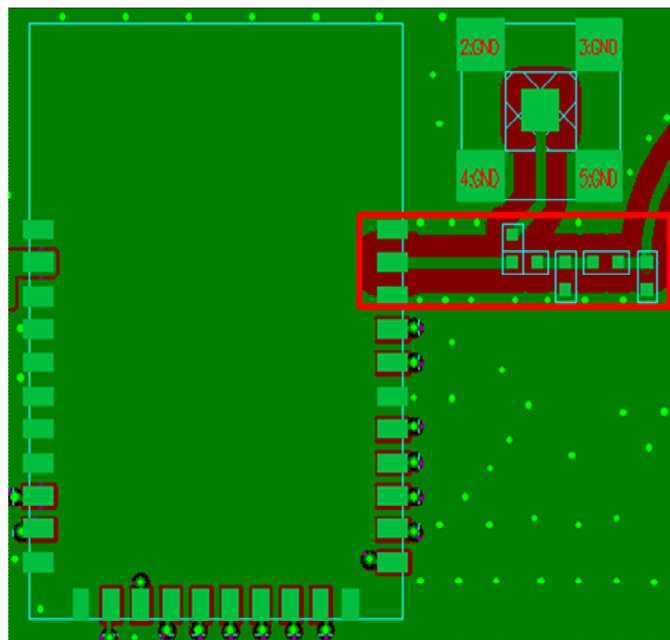
5.3. Module installation Notice

5.3.1 Do not route traces under module to minimize on interference.



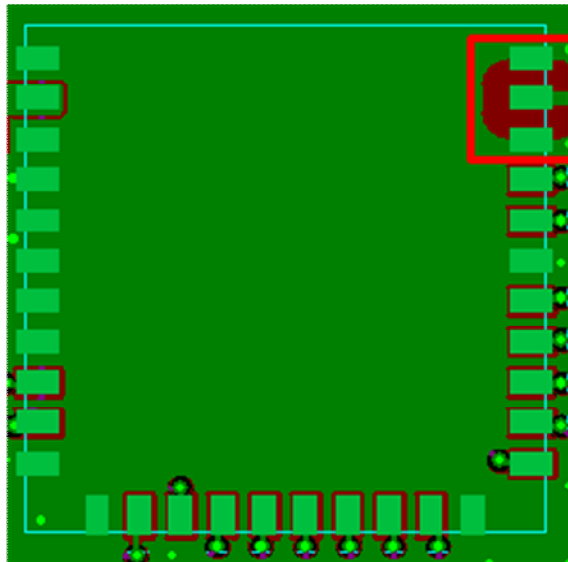
5.3.2

The trace Impedance of the antenna port (Pin 31) is 50 Ω . In order to minimize the return loss, it is recommended to use short traces.

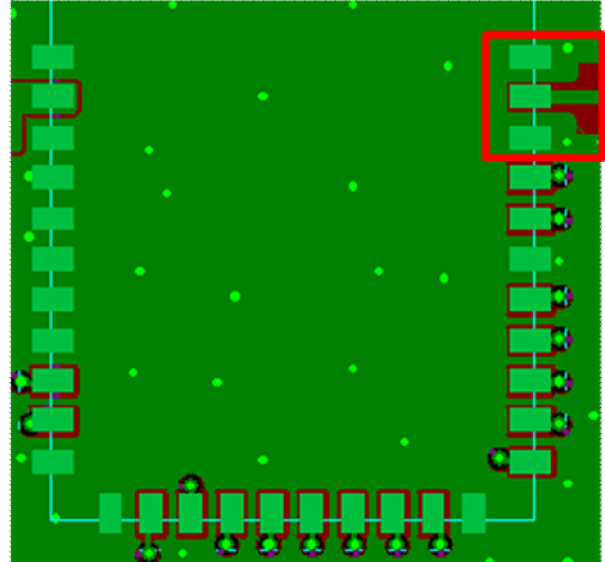


5.3.3

Keep enough clearance between the antenna port (Pin 31) and surrounding GND to minimize the power loss.

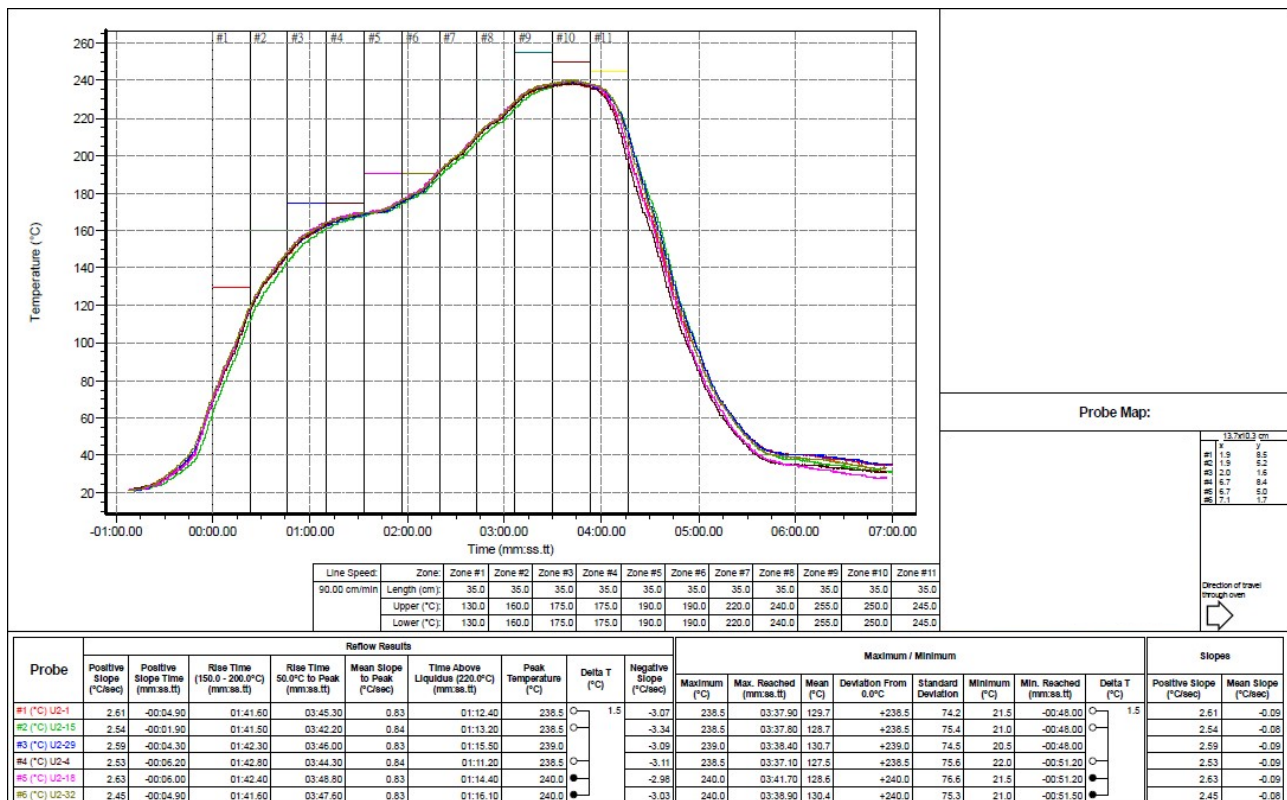


(O)



(X)

5.4 . SMT Solder Reflow Notice:



Note: Allowable reflow soldering times: 2 times base on recommended reflow profile.

5.5 Antenna design declaration:

To compliance FCC KDB 996369 D01 v02 cause II. This module can only be used with a host antenna circuit trace layout design in strict compliance with the InnoComm instructions provided.

The SN10-12 module use trace antenna in fixture board and compliance 47 CFR FCC Part 15 Subpart C (Section 15.247). For proper integration our modules in end products, we shall provided detailed and comprehensive instructions. Integrator, or end-user who use new antenna design will need to apply another FCCID and compliance FCC requirement.,

Antenna design Notice:

Follow notice in section 5.3.2 and 5.3.3., the **trace Impedance of the antenna port (Pin 31) is 50 Ω .**

Appendix

6.1 SW User Guide information.

The SIGFOX software driver supports MCUs. These MCUs are a subset of the MCUs supported by the Kinetis Software Development Kit (KSDK) layer.

This SW driver is built on the Analog Middleware Layer (AML), which creates an API abstraction layer for the desired Software Development Kit (SDK).

The current implementation includes abstractions for KSDK 2.0 and S32 SDK. This allows support to be added for additional layers, such as the KSDK, without having to change the SIGFOX Software Driver itself.

The detail Command and SPI please read the web link as below.

[SigFox Software driver user guide](http://cache.nxp.com/assets/documents/data/en/user-guides/OL2385SWUG.pdf?fsrch=1&sr=9&pageNum=1)

[http://cache.nxp.com/assets/documents/data/en/user-guides/OL2385SWUG.pdf?fsrch=1&sr=9&pageNum=1:](http://cache.nxp.com/assets/documents/data/en/user-guides/OL2385SWUG.pdf?fsrch=1&sr=9&pageNum=1)

Federal Communication Commission Interference 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.

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.

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

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device is intended only for OEM integrators under the following conditions:

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.
- 3) Module approval valid only when the module is installed in the tested host or compatible series of host which have similar RF exposure characteristic with equal or larger antenna separation distance.

As long as **3** conditions above are met, further transmitter test will not be 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: In the event that these conditions can not 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 can not 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 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:YAIN10-12". The grantee's FCC ID can be used only when all FCC compliance requirements are met.

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.