

PROFLEX02 TRANSCEIVER MODULE MODULE USER'S GUIDE



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Table of Contents

1	Introduction	3
1.1	<i>Purpose & Scope.....</i>	3
1.2	<i>Audience.....</i>	3
1.3	<i>Applicable Documents.....</i>	3
1.4	<i>Revision History.....</i>	3
2	Supporting Ping Pong Range Test on Host Board	Error! Bookmark not defined.
3	Module Application Circuits.....	4
3.1	<i>CAD Symbols</i>	4
3.2	<i>Recommended Application Connections</i>	4
3.3	<i>Setting Compliance Limits When Using Host Software</i>	5
4	Wakeup/Reset Alerts	Error! Bookmark not defined.
4.1	<i>Wakeup Alert</i>	Error! Bookmark not defined.
4.2	<i>Reset Alert.....</i>	Error! Bookmark not defined.
5	Antenna Options and PCB Footprint.....	6
5.1	<i>Footprint Overview</i>	6
5.2	<i>U.FL Connector</i>	7
5.3	<i>Carrier Board Alignment Holes.....</i>	10
5.4	<i>Compatibility</i>	13
6	Agency Statements.....	14
6.1	<i>Federal Communication Commission Interference Statement.....</i>	14
6.2	<i>Industry Canada Statements</i>	15
6.3	<i>OEM Responsibilities to comply with FCC and Industry Canada Regulations</i>	15
6.4	<i>End Product Labeling</i>	16
7	Contacting LS Research.....	17

1 Introduction

1.1 Purpose & Scope

The purpose of this document is to provide details regarding the use of the ProFLEX02 transceiver module with the host. This document describes the electrical and wiring considerations when interfacing the ProFLEX02 module with a host board.

1.2 Audience

This document is intended to be read by engineers and technical management. A general knowledge of common engineering practices is assumed.

1.3 Applicable Documents

- *ProFLEX02 Datasheet*
- *ProFLEX02 Host Protocol User's Guide*

1.4 Revision History

Date	Change Description	Revision
12-7-2010	Initial release.	1.0

Table 1 Revision History

2 Module Application Circuits

2.1 CAD Symbols

PADS CAD symbols for schematic and PCB can be downloaded from the LSR website www.lsr.com.

2.2 Recommended Application Connections

Figure 1 shows the minimum circuit connections required for the ProFLEX01 module, when programming/debugging with the MSP-FET430UIF USB debugging interface. The LEDs and USER buttons are needed for Ping Pong Range Test built into the LSR firmware. The LED's are also used during normal operation, and flash to indicate module status (UART activity, RF activity, and heartbeat).

The reset (nRESET) pin (14) is active low. On the ProFLEX01 module it is pulled high with a 47kΩ resistor. To reset the module, pull the pin low to ground for at least 2μS. This is necessary to ensure a proper reset of the module.

In order to wake the module from sleep mode, an additional input signal (WAKEUP) with interrupt capability on the ProFLEX01 module needs to be used. For simplicity it is recommended that this be connected to the Host UART RX signal. This connection is shown in Figure 1 To wake the ProFLEX01 module out of sleep simply send a dummy byte to the module. See Section **Error! Reference source not found.** for further information on wakeup from sleep options.

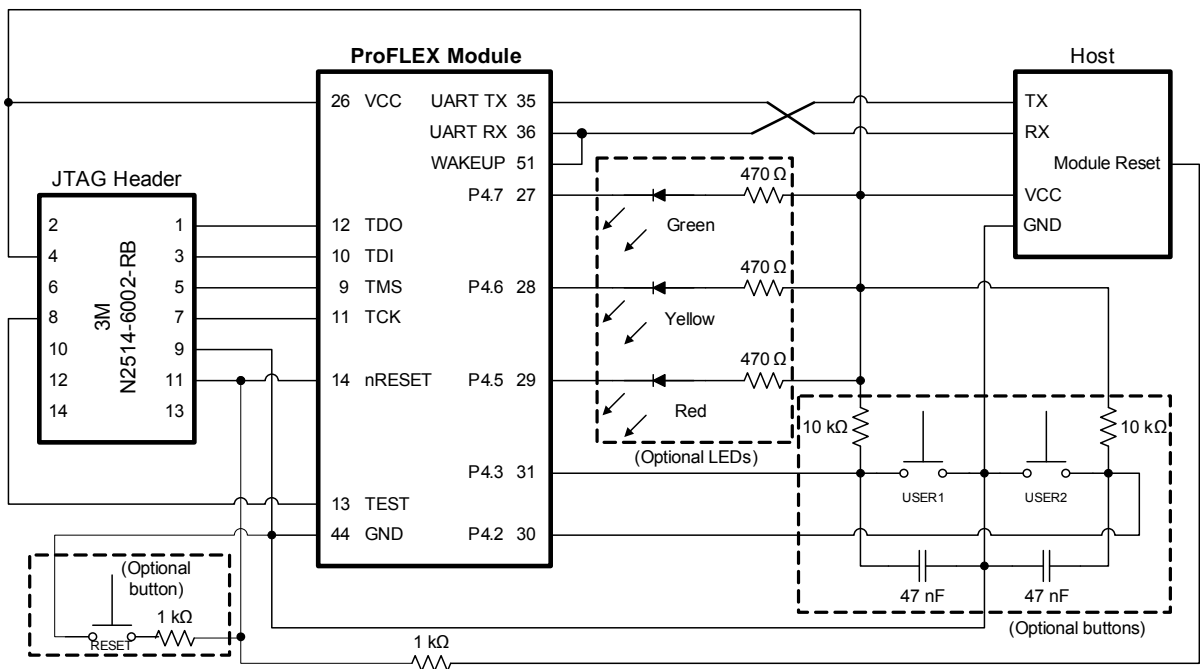


Figure 1 Sample Application Circuit

2.3 Setting Compliance Limits When Using Host Software

To maintain compliance with FCC band edge spectrum limits the output power must be reduced on some channels. Refer to Table 2 below for setting up the proper compliance limits.

RF Channel	Max LSR Host RF Power Value	AT86RF212 TX_PWR Register Value	RF Output Power
11	15	0x0F	24 dBm
12	15	0x0F	24 dBm
13	15	0x0F	24 dBm
14	15	0x0F	24 dBm
15	15	0x0F	24 dBm
16	15	0x0F	24 dBm
17	15	0x0F	24 dBm
18	15	0x0F	24 dBm
19	15	0x0F	24 dBm
20	15	0x0F	24 dBm
21	15	0x0F	24 dBm
22	15	0x0F	24 dBm
23	15	0x0F	24 dBm
24	15	0x0F	24 dBm
25	5	0x05	19 dBm
26	Not used	Not used	Not used

Table 2 Compliance Limits

3 Antenna Options and PCB Footprint

3.1 Footprint Overview

The footprint design on the carrier board will depend on the carrier board requirements, desire for compatibility with other ModFLEX series modules, and the desired antenna.

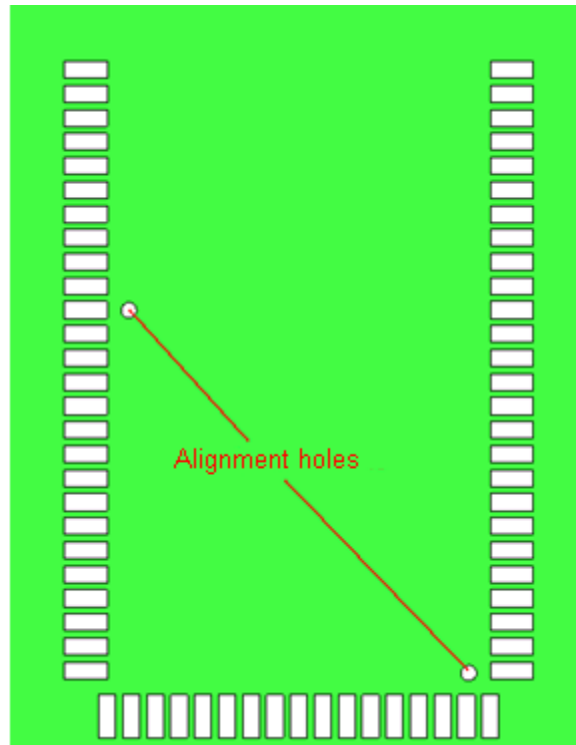


Figure 2 Footprint Overview

3.2 U.FL Connector

3.2.1 Module Footprint

If using the U.FL connector with an external antenna, you do not need to hang the module off the end of the carrier board or have a cut out in the carrier board. However if concerned with compatibility with other LSR ModFLEX modules see section 3.4 for more information.

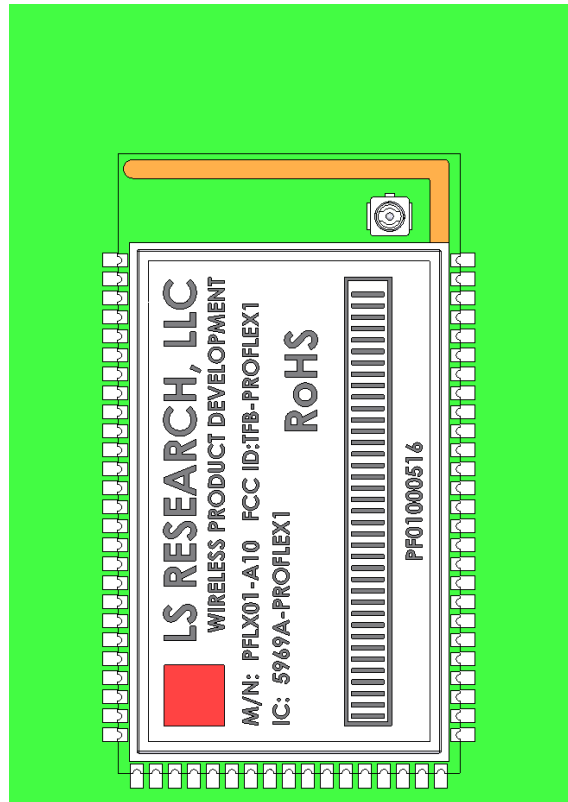


Figure 3 Module footprint without F-Antenna

3.2.2 Removal of U.FL connector

Care should be taken when mating or un-mating the U.FL plug from its receptacle as they are designed (by the manufacturer Hirose) for a maximum of 30 cycles (in practice probably anything more than five cycles is too much). The outer shell of the mating plug can bend or deform easily and not make good electrical contact, thus degrading RF performance - sometimes significantly.

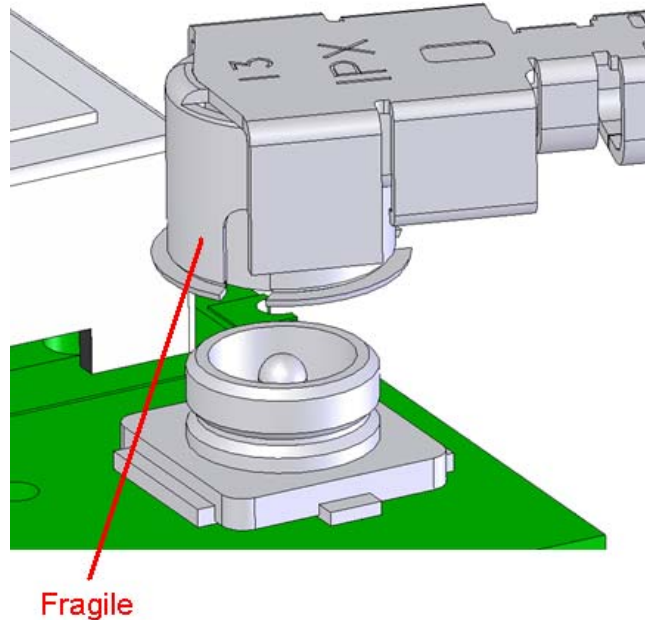


Figure 4 U.FL connector

A special tool exists to safely remove the U.FL cable. LSR recommends the Hirose Electronics tool, part number U.FL-LP(V)-N-2. See picture below for what the tool looks like and how to use it.



Figure 5 U.FL extraction tool

To disconnect connectors, insert the end portion of the extraction tool under the connector flanges and pull off vertically, in the direction of the connector mating axis.

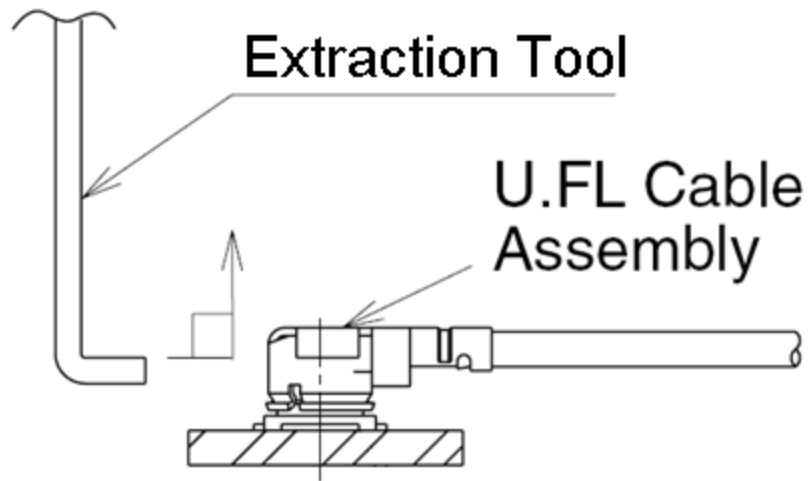


Figure 6 Using extraction tool

3.3 Carrier Board Alignment Holes

The ModFLEX modules have two 0.032" diameter non-plated holes in the PCB that can be used to align the module to the carrier board. When designing the carrier board it is recommended to include two matching alignment holes with copper pads surrounding the holes on the bottom side of the board. The purpose of the copper pads allows for soldering alignment pins when the carrier board is used as an alignment fixture, which is described in the following sections.

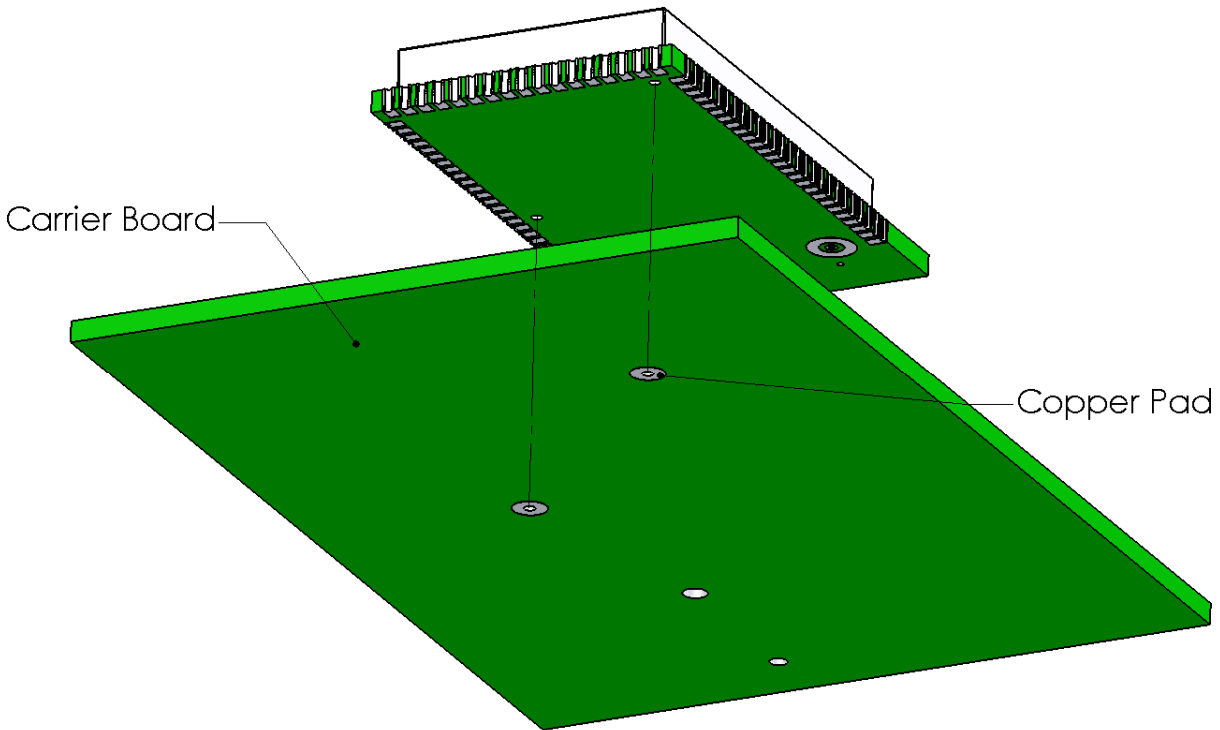


Figure 7 Alignment holes on module and carrier board

3.3.1 Constructing an alignment fixture

Any carrier board can be made into an alignment fixture. When using the carrier board as an alignment fixture the alignment pins can be soldered to the bare carrier board to prevent them from falling out. Then by adding standoffs to the bare carrier board you have created an alignment fixture.

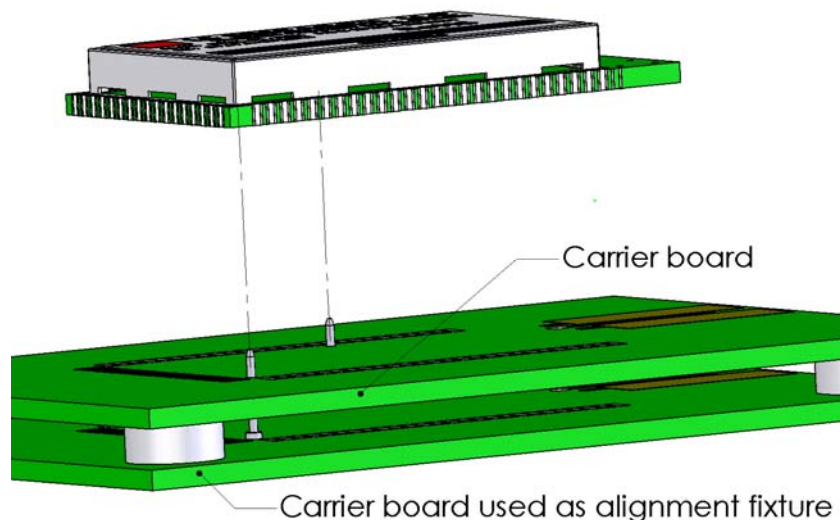


Figure 8 Alignment fixture overview

Step 1: Make an alignment fixture by soldering two Mill-Max 3120-2 series pins or equivalent into the PCB being used for the alignment fixture. For spacing, use 1/8" standoffs between this board and the target carrier board.

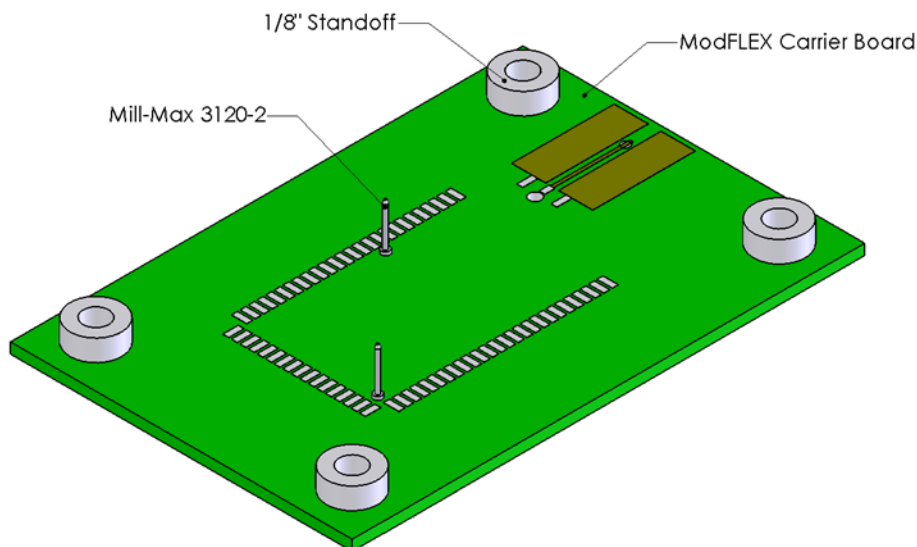


Figure 9 Constructing an alignment fixture

Step 2: Carefully place the target carrier board through the pins on the alignment fixture.

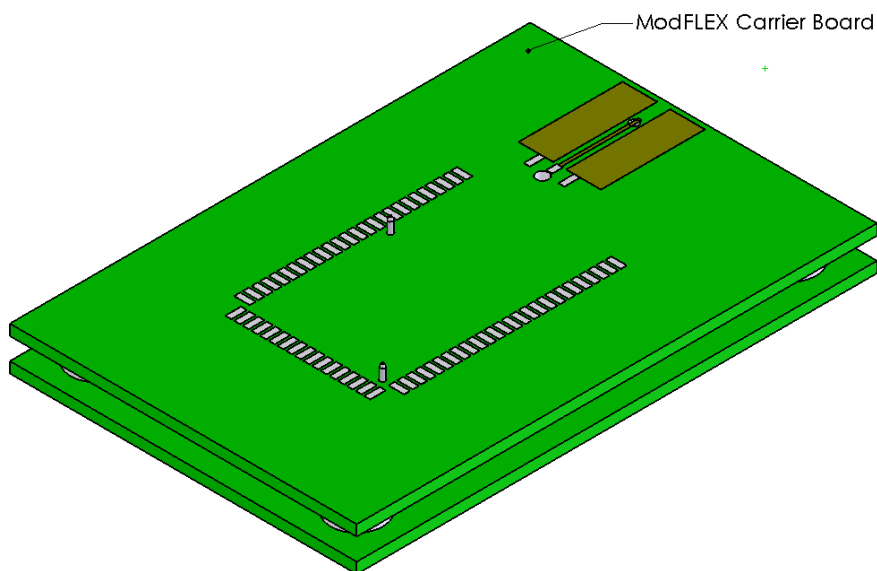


Figure 10 Placing target carrier board

Step 3: Drop the ModFLEX module onto the carrier board through the alignment pins and solder the module to the carrier board.

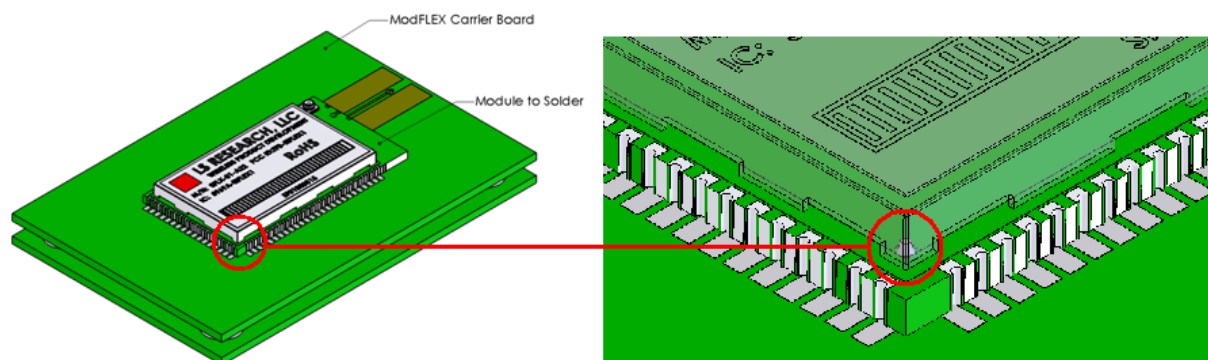


Figure 11 Placing target module

3.4 Compatibility

Not all ModFLEX modules have the same antenna options. To use the modules interchangeably on a carrier board, the designs outlined below must be employed.

Option 1: The carrier board should be designed so the module overhangs the edge of the board 0.23" as pictured below.

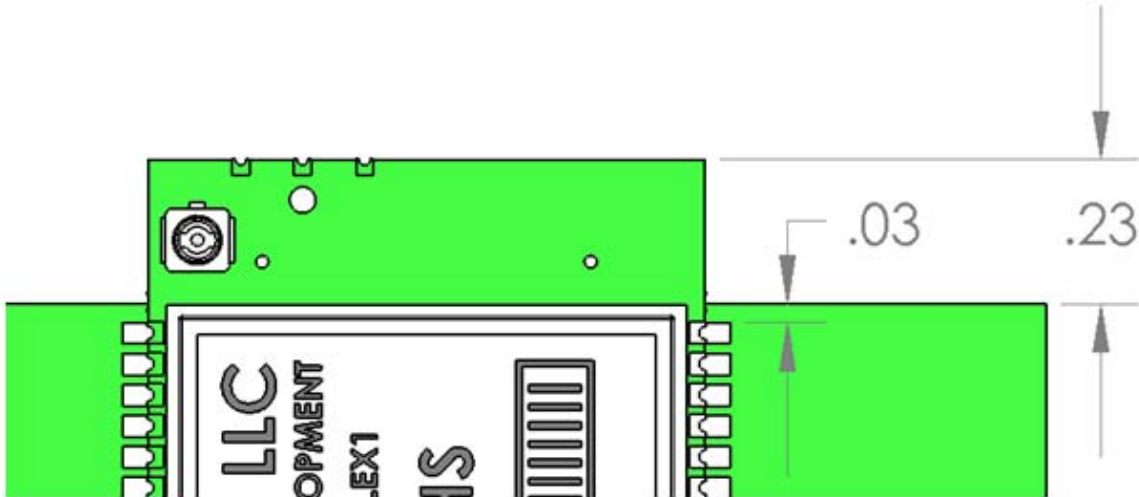


Figure 12

Option 2: Design an opening in the carrier board. A minimum opening is shown below.

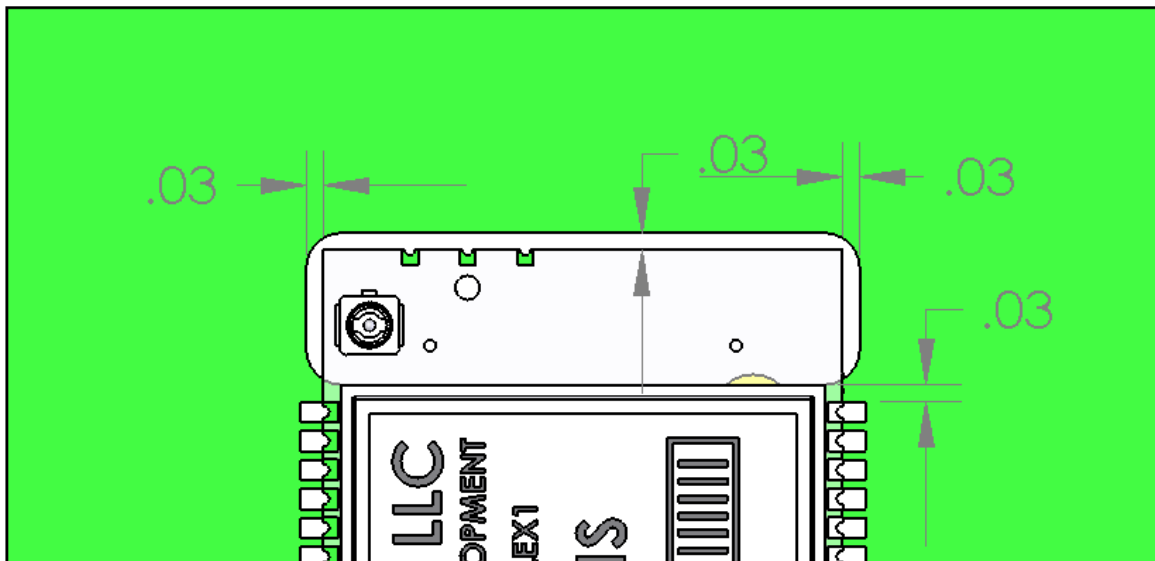


Figure 13

4 Agency Statements

4.1 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 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.

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 CAUTION: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

4.2 Industry Canada Statements

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.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This device has been designed to operate with the antennas listed below, and having a maximum gain of 2.0 dB. Antennas not included in this list or having a gain greater than 2.0 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Nearson S131CL-6-PX-2450S

Embedded PCB trace antenna

4.3 OEM Responsibilities to comply with FCC and Industry Canada Regulations

The ProFLEX01 Module has been certified for integration into products only by OEM integrators under the following conditions:

1. The antenna(s) must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times.
2. The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter.

As long as the two conditions above are met, further transmitter testing 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 (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID and IC Certification Number 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 FCC and Industry Canada authorization.

4.4 End Product Labeling

The ProFLEX01 Module is labeled with its own FCC ID and IC Certification Number. If the FCC ID and IC Certification Number are not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

“Contains Transmitter Module FCC ID: TFB-PROFLEX1”

“Contains Transmitter Module IC: 5969A-PROFLEX1”

or

“Contains FCC ID: TFB-PROFLEX1”

“Contains IC: 5969A-PROFLEX1”

The OEM of the ProFLEX01 Module must only use the approved antenna(s) listed above, which have been certified with this module.

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

The user manual for the end product must include the following information in a prominent location:

*To comply with FCC and Industry Canada RF radiation exposure limits for general population, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times and must not be co-located or operating in conjunction with any other antenna or
Revision History*

5 Contacting LS Research

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