



SRU232 MODULE

Ver 01.06 Users Guide

[Abstract](#)

Non-Confidential User's Guide 4/7/2015 Copyrighted,
Products described in this Guide have US patents and patents pending.

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Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 1 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

Table of Contents

1) Scope	2
2) Ground Planes	2
3) Frequency Hopping	2
4) Pin Detail.....	3
5) Electric specification.....	5
6) Mechanical Specification	7
7) Recommended module PCB Footprint.....	8
8) PCB Layout Guideline	9
9) Recommended Capacitor bank	10
10) Physical view of module	11
11) Soldering Temperature Profile	12
12) Module FCC and IC, Exposure and Compliance Statement.....	13
13) OEM / Host Labeling / Statement Information	14
14) IC (Industry Canada) Labeling	16
15) Ordering Information.....	17
16) RoHS Declaration	18
17) Datasheet status	19
18) Revision History	20

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 2 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

1) Scope

This product specification describes Delphian System's Bluetooth Low Energy module, series number SRU232. It includes integration information and guidelines to allow a basic understanding of the module functions, application and includes required documentation that is required to allow the integrator to properly label the OEM device.

Caution! Any changes or modifications to this module not approved by Delphian System LLC could void the authority to operate this module.

It contains documentation for proper labeling as required in USA by FCC part 15 and in CANADA by Industry Canada (IC) RSS-Gen Sec.5.2 and includes Industry Canada Information. This includes documents / labeling that must be applied to the end use host device by the OEM as outlined.

Use of this certified transmitter module (section 15.212) could allow the end use host device manufacturer to reduce the testing associated with their product. Additional testing may be required to comply with all other applicable FCC and IC regulations.

2) Ground Planes

Radio requires an RF ground plane on any board made to work with this module. The ground plane should cover the majority of the remaining (as much as permitted by other components) of the Printed Circuit Board (PCB) area. This can be located on any layer of the PCB. Extend the RF ground plane parallel to module pins 31 and 32 the entire length of the board. Connect all ground pins and do not notch the ground plane around the module. Bottom of module is grounded so be cognizant of vias or conductive traces located under the module that are not soldered masked to prevent shorting. Keep metallic components, connectors, copper traces, internal layers, and ground planes away from the antenna area in 3D space.

3) Frequency Hopping

This module uses frequency hopping for data communication with other BLE devices. A pseudo list of no less than 37 available data channels are used and send data packets utilizing these channels. For advertising, it uses 3 fixed channels and hence it advertises fixed packet (47 bytes in length) on all three advertising channels. It uses frequency band between 2.402 GHz ~ 2.480 GHz.

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 3 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

4) Pin Detail

Sr. number	Pin Name	Pin Type	Description
1	GND	Ground	Ground Pin must be connected to solid gnd plane
2	GND	Ground	Ground Pin must be connected to solid gnd plane
3	GND	Ground	General Purpose Digital Input/output
4	P0.22	Digital I/O	General Purpose Digital Input/output
5	P0.23	Digital I/O	General Purpose Digital Input/output
6	P0.24	Digital I/O	General Purpose Digital Input/output
7	P0.25	Digital I/O	General Purpose Digital Input/output
8	P0.28	Digital I/O	General Purpose Digital Input/output
9	P0.29	Digital I/O	General Purpose Digital Input/output
10	P0.00 AREF0	Digital I/O Analog input	General Purpose Digital Input/output ADC/LPCOMP reference input 0
11	GND	Ground	Ground Pin must be connected to solid gnd plane
12	VCC	Power	Power Supply
13	DCC	Power	DC/DC output voltage to external LC filter
14	P0.30	Digital I/O	General Purpose Digital Input/output
15	P0.01 AIN2	Digital I/O Analog input	Digital Input/output and Analog Input ADC/LPCOMP input 2
16	P0.02 AIN3	Digital I/O Analog input	General Purpose Digital Input/output ADC/LPCOMP input 3
17	P0.03 AIN4	Digital I/O Analog input	General Purpose Digital Input/output ADC/LPCOMP input 4
18	P0.04 AIN5	Digital I/O Analog input	General Purpose Digital Input/output ADC/LPCOMP input 5
19	P0.05 AIN6	Digital I/O Analog input	General Purpose Digital Input/output ADC/LPCOMP input 6
20	P0.06 AIN7 AREF1	Digital I/O Analog input Analog input	General Purpose Digital Input/output ADC/LPCOMP input 7 ADC/LPCOMP reference input 1
21	P0.07	Digital I/O	General Purpose Digital Input/output
22	P0.08	Digital I/O	General Purpose Digital Input/output
23	GND	Ground	Ground Pin must be connected to solid gnd plane
24	VCC	Power	Power Supply
25	SWDIO reset	Digital I/O	System reset (active low). Also hardware debug and flash programming I/O
26	SWDCLK	Digital Input	Hardware debug and flash programming I/O
27	P0.11	Digital I/O	General purpose I/O pin.

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 4 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

28	P0.12	Digital I/O	General Purpose Digital Input/ Output
29	P0.13	Digital I/O	General Purpose Digital Input/ Output
30	P0.14	Digital I/O	General Purpose Digital Input/ Output
31	GND	Ground	Ground Pin must be connected to solid gnd plane
32	GND	Ground	Ground Pin must be connected to solid gnd plane
33	GND	Ground	Ground Pin must be connected to solid gnd plane
34	1-Dec	Power	Power supply decoupling
35	P0.21	Digital I/O	General Purpose Digital Input/ Output
36	XL1	Analog Input	Connection for 32.768 kHz crystal or external 32.768 kHz clock reference
37	XL2	Analog Output	Connection for 32.768 kHz crystal
38	P0.15	Digital I/O	General Purpose Digital Input/ Output
39	GND	Ground	Ground Pin must be connected to solid gnd plane
40	GND	Ground	Ground Pin must be connected to solid gnd plane
41	GND	Ground	Ground Pin must be connected to solid gnd plane
42	VCC	Power	Power Supply
43	P0.16	Digital I/O	General Purpose Digital Input/ Output
44	P0.10	Digital I/O	General Purpose Digital Input/ Output
45	P0.09	Digital I/O	General Purpose Digital Input/ Output

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 5 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

5) Electric specification

Absolute Maximum Ratings⁽¹⁾:

Over operating free-air temperature range (unless otherwise noted)

		Min	Max	Unit
Supply Voltage	All supply pin(s) must have same voltage	-0.3	3.6	V
Voltage on any digital pin		-0.3	Vdd+0.3 <= 3.6	V
Input RF level			10	dBm
Storage Temp Range		-40	+125	°C
Operating Temp Range		-25	+75	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

CAUTION: ESD sensitive device. Precautions should be used when handling the device in order to prevent permanent damage.

Operating Condition Summary Specification:

Items	Specification
Supply Voltage (Vdd)	2.0-3.6V
Vdd ripple	100mV max
Max. Voltage on any pin	Vdd + 0.3V (Not 5V Tolerant)
Ambient Temperature range	-25°C to 85°C

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 6 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

Current Consumption Summary Specification:

Measurement done at TA = 25 °C, VDD = 3V

Items	Specification
System Off – No RAM retention	0.6 uA
System Off – 8KB RAM retention	1.2 uA
System Off – 16KB RAM retention	1.8 uA
Low MCU Activity	2.6 uA
Rx (Peak Current)	13 mA
Tx 0 dBm	10.5 mA

RF Specification Summary:

Items	Specification
Frequency	2402-2480 MHz in 2MHz steps
Data rate and Modulation	1 Mbps, GFSK
Number of Channel	40: 37 data /3 advertising
Receiver Sensitivity	-101 dBm
Output power	-12 dBm to 10 dBm
Rx/Tx Turnaround	150 uSec

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 7 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

6) Mechanical Specification

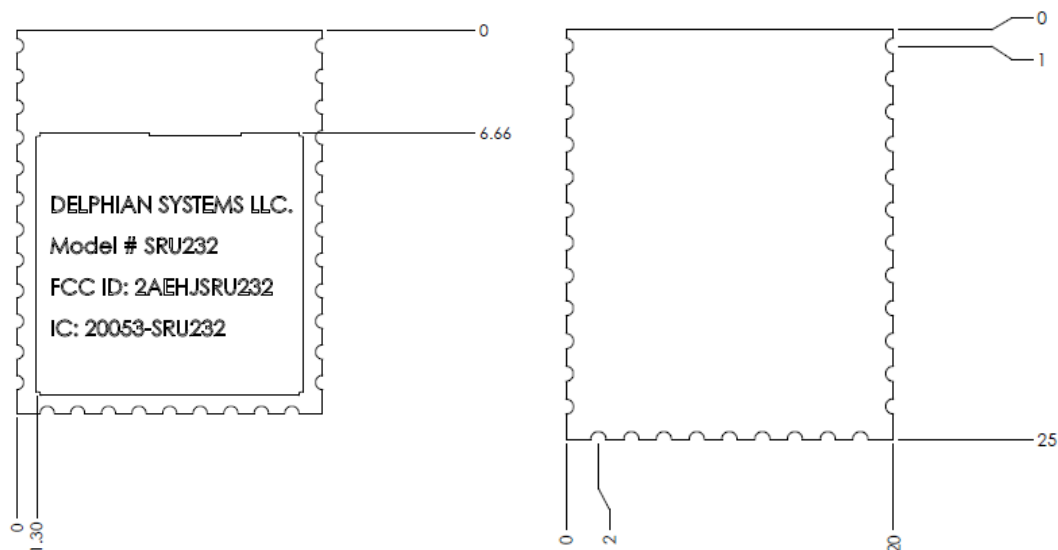


Figure 1: Mechanical specification

Note: All Dimensions are in mm.

No.	Item	Dimension	Tolerance
1.	Length	25.00 mm	+/- 0.20
2.	Width	20.00 mm	+/- 0.20
3.	Height	3.2 mm	+/- 0.20

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 8 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

7) Recommended module PCB Footprint

Note: All Dimensions are in mm.

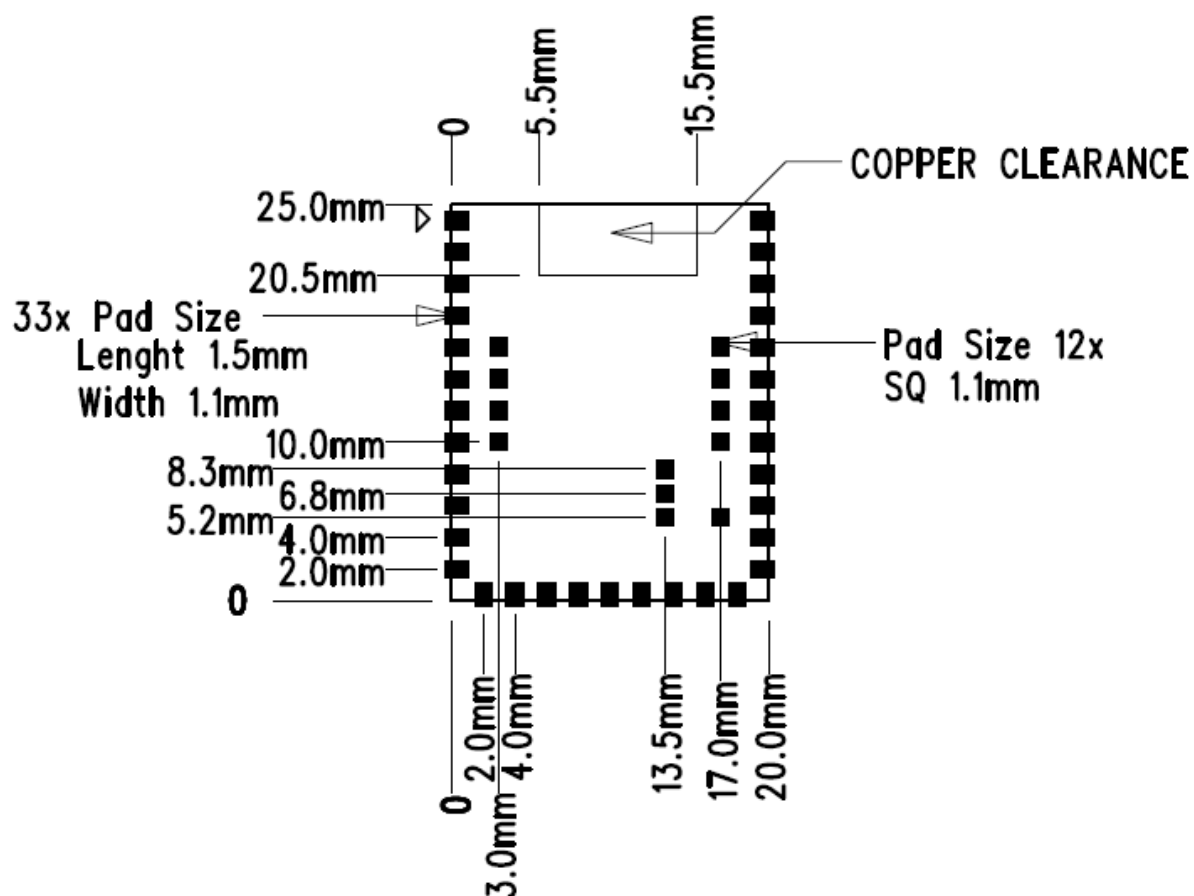


Figure 2: SRU232 module recommended PCB footprint

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 9 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

8) PCB Layout Guideline

- Digital I/O, Power supply and Clock signals should be shielded by GND plane and stitched via.
- Preferable location of SRU232 is edge/corner of PCB.
- All ground pins must be connected directly to ground solid plane.
- Place ground vias as close as possible to ground pins.
- For Optimal Radio performance, the SRU232 module's antenna end should protrude at least 30 mm beyond any metal enclosure.

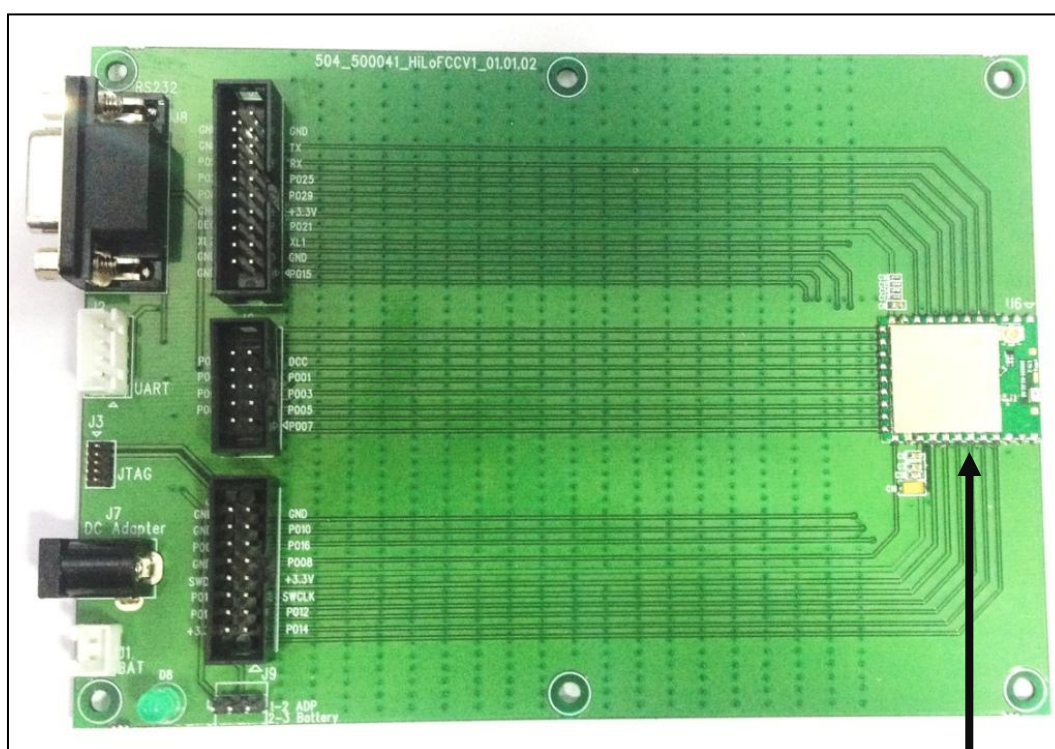


Figure 3: Reference Host board for SRU232

SRU232

Layout above is utilized for FCC and IC testing. Specific restrictions for use of the module is defined in the Guideline bullets above.

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 10 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

9) Recommended Capacitor bank

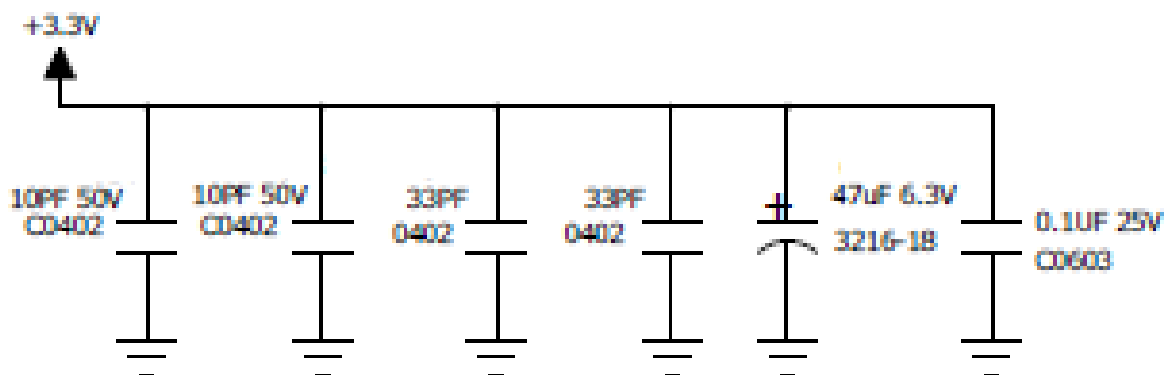


Figure 4: Recommended Capacitor bank

- Ceramic and Tantalum Capacitor bank is recommended on VCC pins.
- Actual value(s) of capacitors are dependent upon: Noise, PCB layout and Surrounding components.
- It is recommended to derive correct value of capacitors after installation of SRU232 in actual device host board.

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 11 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

10) Physical view of module

**Manufacturer, Model #, FCC ID and IC: information as shown:
Information to be laser etched on Nickel shield**

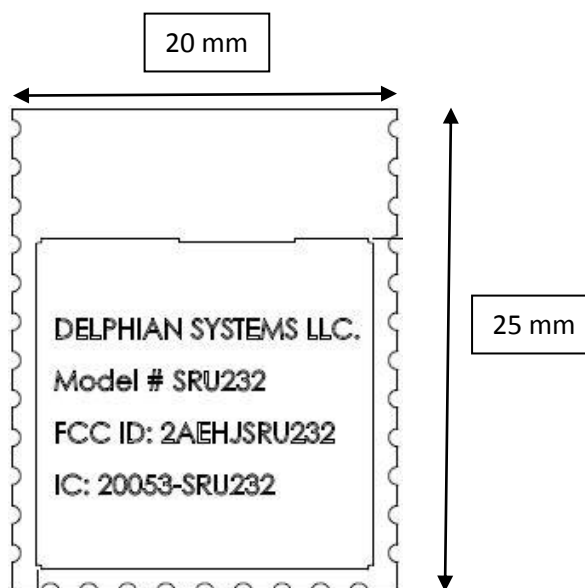


Figure 5: Physical view of model

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 12 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

11) Soldering Temperature Profile

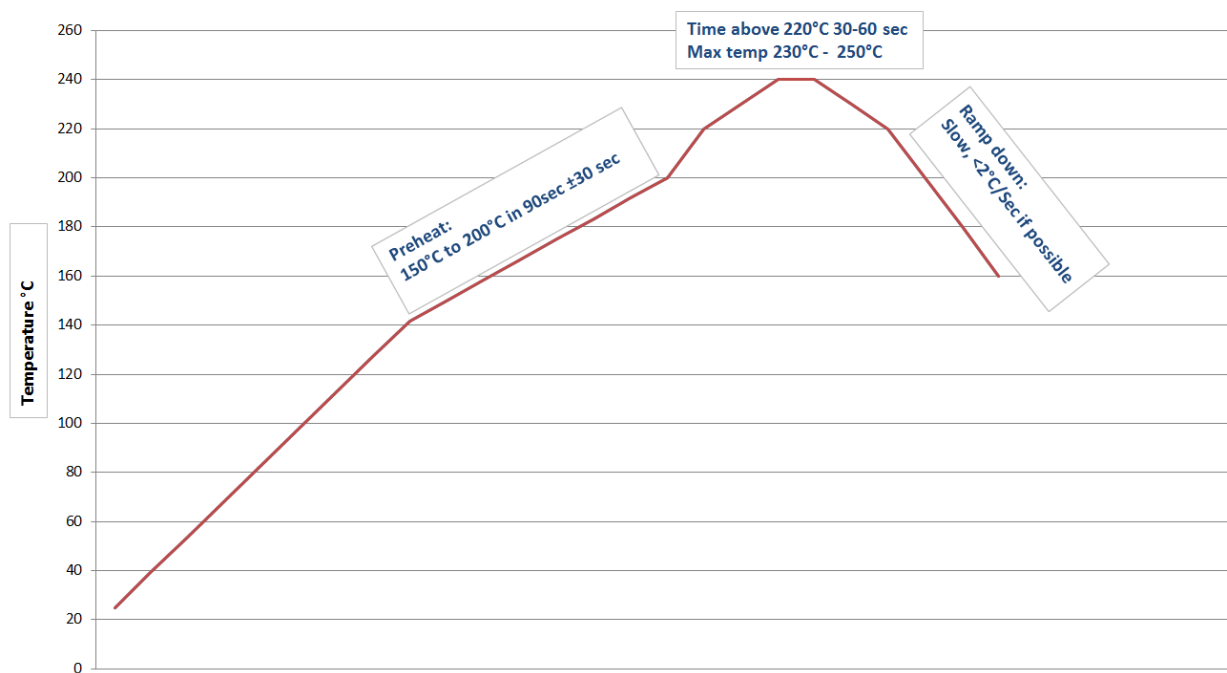


Figure 6: Recommended Soldering Profile

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 13 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

12) Module FCC and IC, Exposure and Compliance Statement

FCC ID: 2AEHJSRU232

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.

+++++

To satisfy RF exposure requirements, this device and its antenna must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

+++++

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 a 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 or more of the

Following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the 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.

In order to maintain compliance with FCC regulations. Operation with non-approved equipment is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to this module without the approval of manufacturer could void the user's authority to operate this equipment.

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 14 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

13) OEM / Host Labeling / Statement Information

In order to comply to the use rules of Model SRD531, The OEM / Host is required to label the product according and provide the following statements:

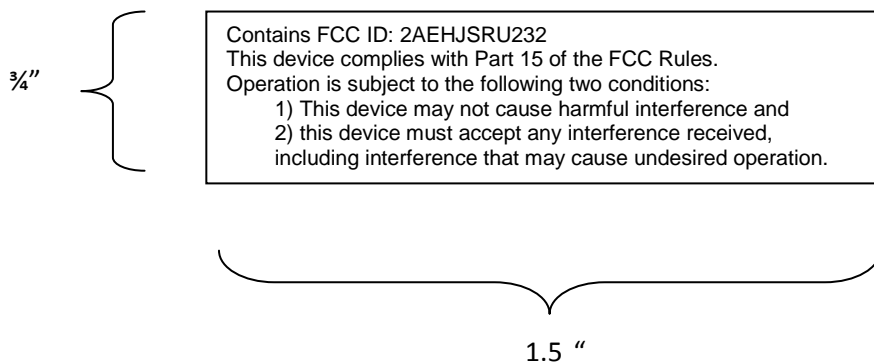
FCC Label #1: 2 part statement label. This label must be applied to the Host /OEM device/ product. (Exception being products that are defined in Alternate statement below)

Material: polyester white base with clear overcoat with permanent printing and acrylic adhesive. Size and printing as shown. Paper labels are not permitted on the product.

This label to be placed on product visible to end user on Host / OEM device/product.

Alternate application: Printing permanently in the instructions is allowed whereas the Host / OEM product is smaller than the palm of a hand. Printing font must be 8 pt. or larger.

(FCC TWO PART STATEMENT)



Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 15 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

FCC Labels 2: To the FCC two part statement above, the following statement should be placed in the host device/product user's manual.

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 a 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 or more of the

Following measures:

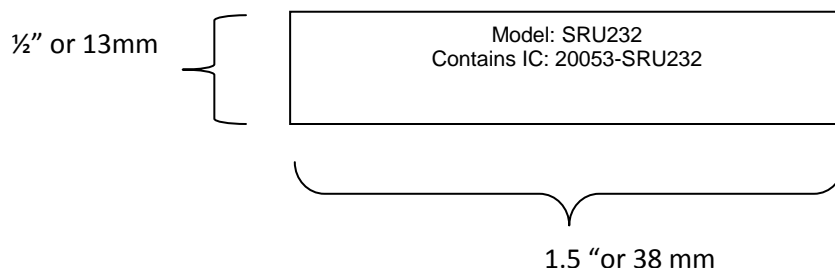
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 16 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

14) IC (Industry Canada) Labeling

Product label: Products built using the SRD521 module must have the following label affixed to it. It must be placed in a location readily readable by the end user. The label material is to be white polyester with black permanent ink and permanent adhesive. Minimum size of label and print are shown below.



Industry Canada Information: The following statement is to be placed in the end product user manual.

This device complies with Industry Canada license-exempt RSS standard(s). 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.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 17 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

15) Ordering Information

PART Number: SRU232.

Contact: Delphian Systems LLC.

Web address: www.delphiansystems.com

Part is not available for online ordering.

Data sheet is available in electronic form or as printed document upon request.

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 18 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

16) RoHS Declaration

Declaration of environmental compatibility for supplied products:

We hereby declare to our best present knowledge based on declaration of our suppliers that this product does not contain the following substances which are banned by Directive 2002/95/EC (RoHS) or if present, a maximum concentration of 0.1% by weight in homogeneous materials for:

- Lead and lead compounds
- Mercury and mercury compounds
- Chromium (VI)
- PBB (polybrominated biphenyl) category
- PBDE (polybrominated biphenyl ether) category

And a maximum concentration of 0.01% by weight in homogeneous materials for:

- Cadmium and cadmium compounds

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 19 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

17) Datasheet status

- This data sheet contains the final specification as of the date shown in the header above.
- Delphian Systems reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
- Supplementary data sheets (white papers) are available upon request.
- Information supplied here is the most recent at the time of publication.
- Consult the most recently issued data sheet before initiating or completing a design.
- Contact Delphian Systems to secure the latest version of this data sheet:
www.delphiansystems.com
- Delphian Systems assumes no responsibility for improper use of this product. Do not attempt to “overclock” or apply voltages other than what is shown in this document.
- All rights reserved. Design of these products shown here have U.S and foreign patents pending.
- The antenna(s) specified in this document was designed and tested to comply to FCC part 15. Any changes are not permitted.

Document Name : SRU232 Module Users Guide	Rev.: 01.06
Product Name: High Range BLE/ANT Module	Page : Page 20 of 21
Mfg: Delphian Systems LLC.	Date : 4/7/2015
Model #: SRU232	FCC ID: 2AEHJSRU232
Canada CN# 20053	IC: 20053-SRU232

18) Revision History

Revision	Date	Author	Modification/Remarks
01.01	04/06/2015	Hiren Jayani	Initial Release of User Guide.
01.02	04/07/2015	Jatin Bhatt	Add Block diagram, PCB layout Guideline. formatting
01.03	04/07/2015	Hiren Jayani	Formatting, add table of contents and add current consumption detail
01.04	04/07/2015	Ashok Hirpara	Replace Belwith with Delphian
01.05	04/07/2015	Gary Myers	Add Balun detail, 32 Mhz, Power details.
01.06	05/12/2015	Gary Myers	Add FCC RF exposure statement