SecuRemote® Smart Module
SRU532 User Manual
(FCC Submission)

Version 01.01.04

Revision History

Version	Date completed	Written by	Reviewed by	Approved by
01.01.01	27 April-2016	Gulrej		
	Initial draft			
01.01.02	28 April-2016	Kinjal	Jatin	Jatin
	Modify as per requirement of FCC submission			
01.01.03	06 May 2016	Jatin		
	Rename document name from User Guide to User Manual. Update end product labelling information as per Sporton's email on dated 6th May 2016			
01.01.04	12 May 2016	Jatin Bhatt		
	Update end product labelling information as per Sporton's email on dated 12th May 2016.			

1. Description

Delphian Systems is pleased to announce the release of a new Long Range Bluetooth Smart module.

The SRU532 is a single mode Bluetooth Smart module with ANT practical mesh network support and up to +12dBm (Chip Antenna) and +17dBm (u.FL Antenna) Tx power. The SRU532 has an integrated 2.4GHz radio subsystem, includes a mature dual protocol software stack supporting BT 4.1, GATT based profiles and ANT with mesh networking attributes. It contains ARM® Cortex® M0 microcontroller with 256KB flash memory and 32KB RAM, removing the requirement for an external microcontroller. Up to 128KB of memory is available for custom application development using the *SecuRemote®* API. An easy to use AT Command Set enables access to the *SecuRemote®* firmware over a UART interface for rapid product development.

Delphian Systems' Bluetooth Smart mobile app developers are available to help you to build your custom applications for IOS and Android.

2. Features

- Industry Leading Wireless Range from integrated chip or external antenna
- Built in nRF51422 single-chip 2.4GHz Bluetooth Smart System on a Chip
- Communicates over Bluetooth 4.1 and ANT simultaneously for mess network based IOT product
- Bluetooth Compliant Transmit Power: +12 dBm @ Chip Antenna and +17 dBm@ Dipole Antenna
- Maximum range: >250 meters Line of Sight
- RF Receive Sensitivity (BLE): -93 dBm
- RF Receive Sensitivity (ANT): -90 dBm

- Miniature Size: 20 mm x 25 mm x 2.3 mm
- Operating Voltage: 1.8V to 3.6V
- Operating temperature: -25 to +65° C
- Fully supports ANT and Bluetooth Smart Soft Devices from Nordic Semiconductor

Figure 1 SRU532 Module

- Current Modular Certifications:
  FCC (USA) 2AEHJSRU532,
  IC: 20053-SRU532 (Canada)
  which may be reused – **no need to certify your own radio**
- Future Certifications: CE (Europe)
- Integrated ARM Cortex M0 32-bit Microcontroller
- Memory: 256KB Flash, 32KB RAM
- 8 Configurable ADC Channels
- 16 and 32 bit timers
- SPI Master/Slave, I2C, UART
- Low Power Comparator
- CPU Independent Programmable Peripheral Interconnect (PPI)
- Quadrature Decoder (QDEC)
- AES HW Encryption
- Real Time Counter(RTC)
- RoHS compliant
- ESD Hardened Antenna port
- ESD Hardened VDD

3. Applications

- Long Range Bluetooth Smart devices
- Internet of Things devices
- High Security Remote Controls
- Home and Building Automation
- Beacon, Smart Tag
- Industrial Controls
- Medical (ex. Heart Rate Monitor, Blood Pressure Sensor, Blood Glucose Meter)
- Automatic Key Control
- Entertainment Devices
- All Bluetooth Smart Applications
- Combines wireless mesh networking capability with Bluetooth Smart promoting the Internet of the Things
- Get to market fast with industry leading long range Bluetooth Smart Technology

4. Ordering Information

Product Code	Description
SRU532-XYZ	SRU532 module with chip & u. FL antenna Connector

Table 1 Ordering Information

Description about "XYZ":

SRU532 - X Y Z

X = First digit represent nRF51422 revision

Y = Second digit represent internal flash variant (A = 128KB, B = 256KB)

Z = Packaging (T = Tray packaging, R = Reel Packaging)

e.g. SRU532 – CBR

C= Rev 3 of nRF51422

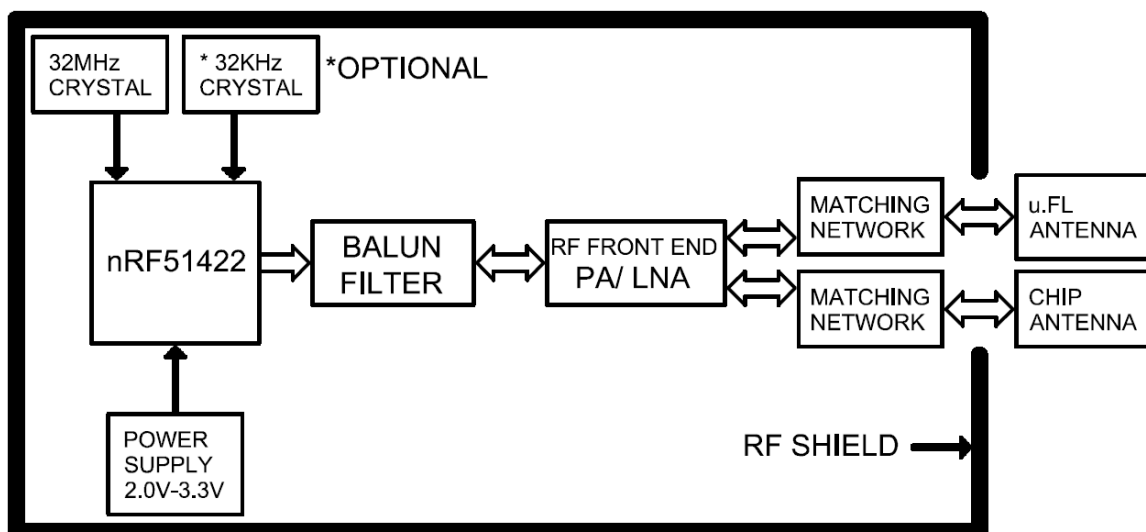B = 256 KB Version of nRF51422

R = Reel packaging

5. Block Diagram

Figure 2 Block Diagram

Contents

6. Module Accessories

	Description
	2.4 GHz Dipole Antenna with Reverse Polarity SMA Connector Gain = +0 dBi
	U. FL to Reverse Polarity SMA Bulkhead Cable

Table 2 Module Accessories

7. Power ON Reset and Brownout Detector

- SRU532 includes a power-on reset (POR), providing correct initialization during device Power ON.
- It also includes   brownout detector (BOD) operating on the regulated 1.8-V digital power supply only. The BOD protects the memory contents during supply voltage variations, which cause the regulated 1.8-V power to drop below the minimum level required by digital logic, flash memory, and SRAM.
- When power is initially applied, the POR and BOD hold the device in the reset state until the supply voltage rises above the power-on-reset and brownout voltages.

8. Package Outline

Figure 3 Schematic Symbol of SRU532

Figure 4 Top view of SRU532

9. Pin Description

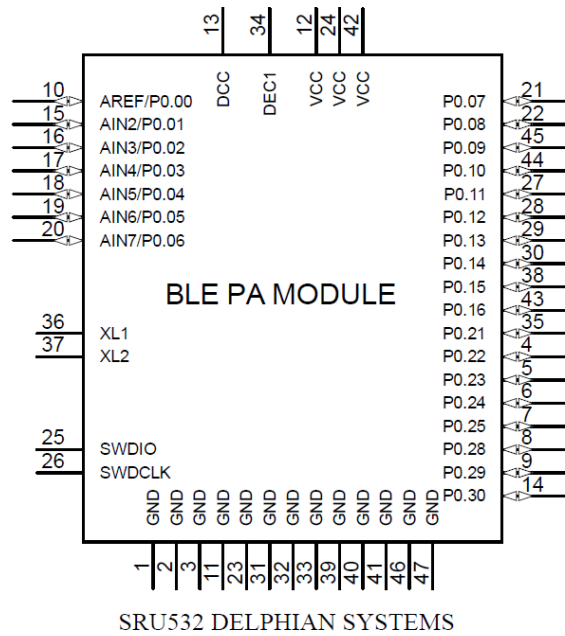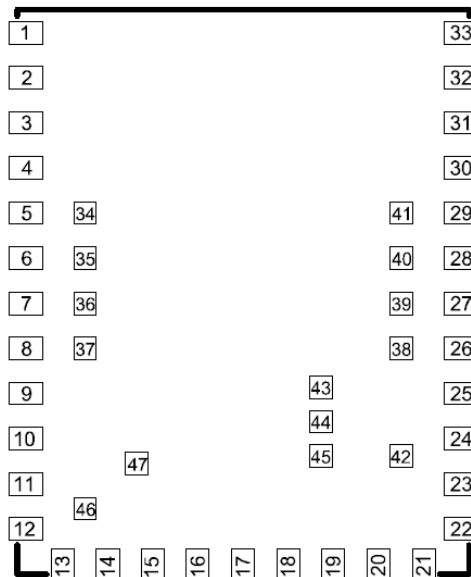| Serial #	Pin Name	Pin Type	Description
1	GND	Ground	Ground Pin must be connected to solid GND plane
2	GND	Ground	Ground Pin must be connected to solid GND plane
3	GND	Ground	General Purpose Digital Input/output
4	P0.22	Digital I/O	General Purpose Digital Input/output
5	P0.23	Digital I/O	General Purpose 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.
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
46	GND	Ground	Ground Pin must be connected to solid GND plane
47	GND	Ground	Ground Pin must be connected to solid GND plane

Table 3 Pin Out Details and Description

9.1. Debug & Programming

The SRU532 support the two pin Serial Wire Debug (SWD) interface and offers flexible and powerful mechanism for non-intrusive debugging of program code. Breakpoints, single stepping, and instruction trace capture of code execution flow are part of this support.

Serial#	Pin Name	Description
25	SWDIO/ RESET	System reset (active low). Also hardware debug and flash programming I/O
26	SWDCLK	Hardware debug and flash programming I/O

Table 4 Pin Out Detail of Programming

Serial#	Pin Name	Description
17	P0.03/ AIN4	UART RX
19	P0.05/ AIN6	UART TX
18	P0.04/ AIN5	RTS
20	P0.06/ AIN7	CTS

Table 5 Pin Out Details of UART

9.2. LED Pin Details

Serial#	Pin Name	Description
6	P0.24	General Purpose Digital Input/output for RED LED
7	P0.25	General Purpose Digital Input/output for YELLOW LED
8	P0.28	General Purpose Digital Input/output for GREEN LED
9	P0.29	General Purpose Digital Input/output for BLUE LED

Table 6 Pin Out Details of LED's

10. Electrical Characteristics

10.1. Absolute Maximum Settings [1]

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

Parameters	Min	Max	Unit
Supply Voltages			
VCC	1.8	3.6	V
GND	0		V
I/O Pin Voltage			
Voltage on any digital pin	-0.3	Vdd+0.3 <= 3.6	V
Input RF level		20	dBm
Environmental			
Storage Temp Range	-40	+125	^{o}C
Operating Temp Range	-25	+75	^{o}C
Moisture Sensitivity Level		2	
ESD Human Body Model		4	kV
Charged Device Model		750	V
Flash Memory			
Endurance	20000[2]		
Retention	10 years @ 40 ^{o}C		
Number of times an address can be written between erase cycles		2	times

Table 7 Absolute maximum settings

- Stress 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.

- Flash endurance is 20,000 erase cycles. The smallest element of flash that can be written is a 32-bit word.

10.2. Recommended Operating Condition

Parameters	Min	Typ.	Max	Unit
VCC @ Normal Mode	1.8	3.0	3.6	V
VCC@ DC to DC Converter mode	2.1	3.0	3.6	V
Operating Temperature	-25	25	+75	ºC

Table 8 Recommended Operating Condition

10.3. GPIO Specifications

Symbol	Parameter (condition)	Note	Min.	Typ.	Max.	Units
VIH	Input high voltage		0.7 VDD		VDD	V
VIL	Input low voltage		VSS		0.3 VDD	V
VOH	Output high voltage (std. drive, 0.5mA)		VDD-0.3		VDD	V
VOH	Output high voltage (high-drive, 0.5mA)		VDD-0.3		VDD	V
VOL	Output low voltage (std. drive, 0.5mA)		VSS		0.3	V
VOL	Output low voltage (high-drive, 0.5mA)		VSS		0.3	V
RPU	Pull-up resistance		11	13	16	KΩ
RPD	Pull-down resistance		11	13	16	KΩ

Table 9 GPIO Specifications

10.4. Current Consumption

Measurement done at TA = 25 ºC, VDD = 3V

Items	Specification
System Off – No RAM retention	0.6uA
System Off – 8KB RAM retention	1.2uA
System Off – 16KB RAM retention	1.8uA
Low MCU Activity	2.6uA
Rx (Peak Current)	13mA
Tx 0 dBm	10.5mA
Tx@ 17 dBm	50mA

Table 10 Current Consumption

11. RF Characteristics

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 (BLE)	-93 dBm
Receiver Sensitivity (ANT)	-90 dBm
Output power (Chip Antenna)	-12 dBm to +10 dBm
Output power (Dipole)	-12 dBm to +17 dBm
Rx/Tx Turnaround	150 uSec

Table 11 RF Specification

Note: User cannot configure more then -8dBm internal Tx power for external dipole antenna and -12dBm for chip antenna to meet FCC requirement. If User will configure more than above stated power, then it will violate FCC regulation and Delphian Systems will not liable for it.
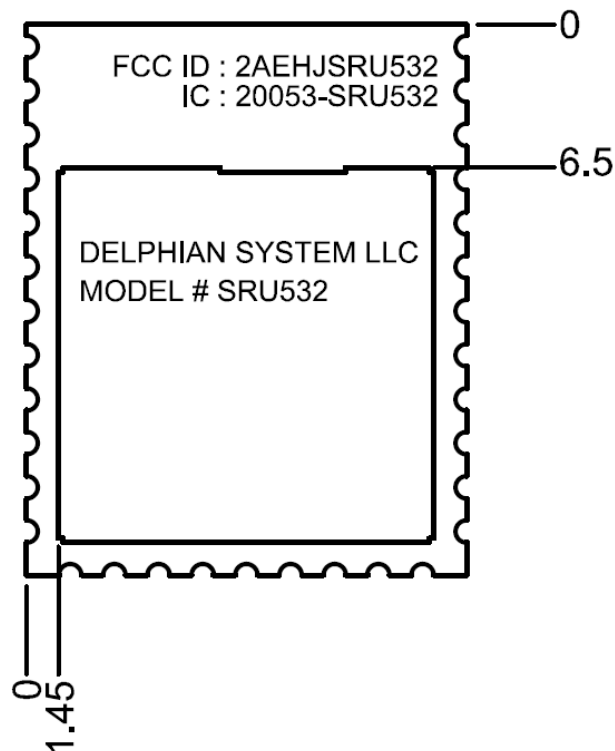
12. Mechanical Dimension

Figure 5 Mechanical Dimension

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	2.3 mm	+/- 0.20

Table 12 Mechanical Dimensions

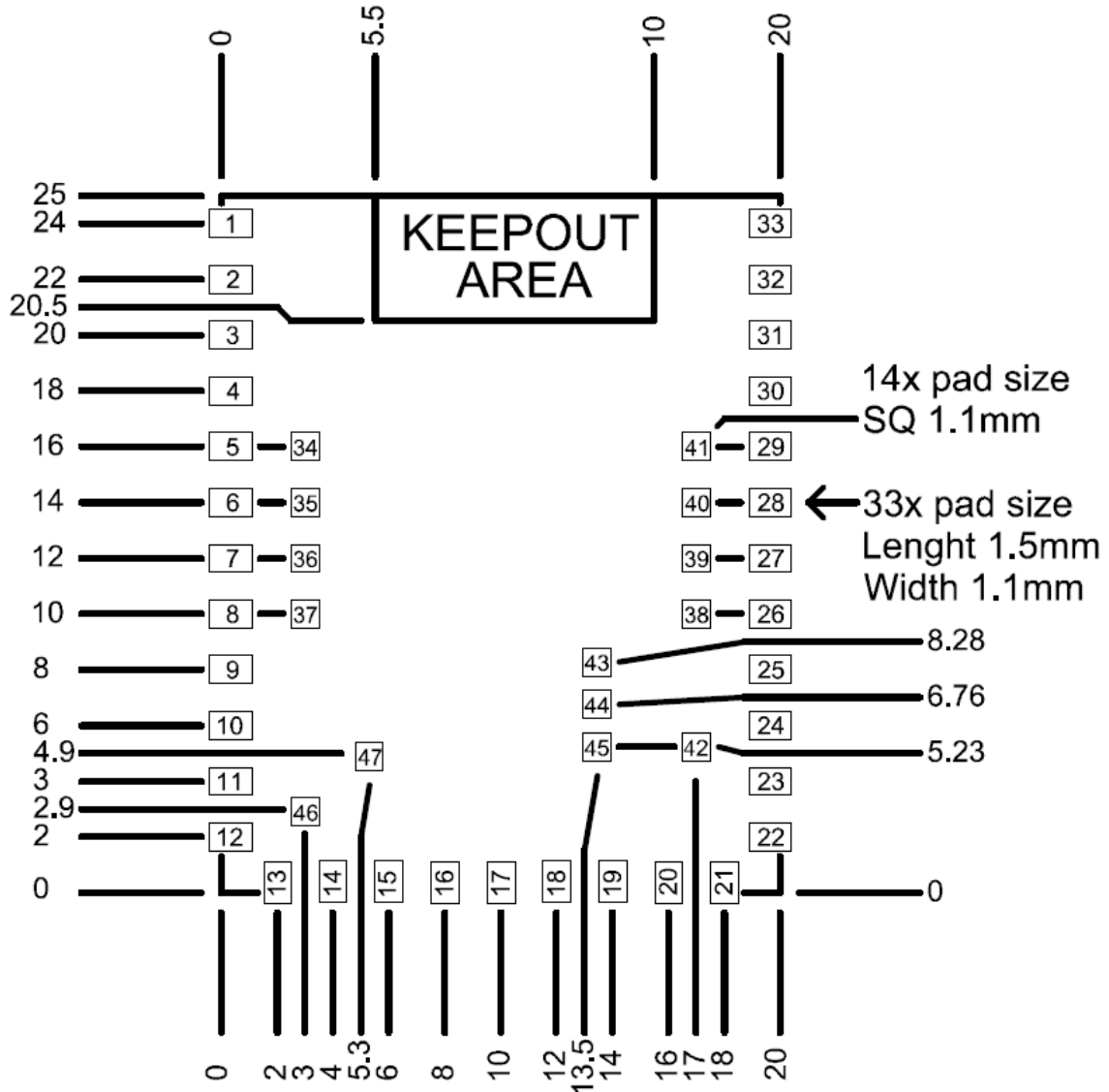## 12.1. Recommended Land Pattern

Figure 7 Module Dimensions

Note: All Dimensions are in mm.

13. FCC IC Label

Label:

> FCC ID: 2AEHJSRU532
> IC# 20053-SRU532
> CAN ICES-3(B)/NMB-3(B)
> 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,
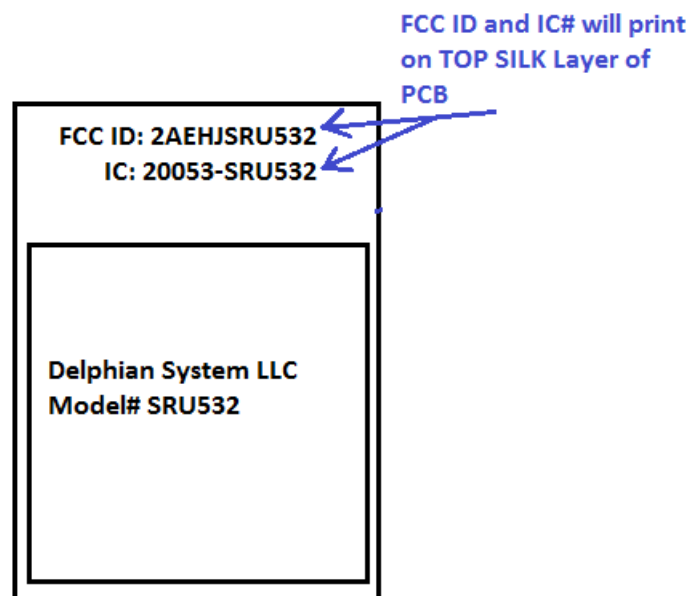>   including interference that may cause undesired operation.

Label Location:

FCC ID and IC# will print on TOP SILK Layer of PCB

FCC ID: 2AEHJSRU532
IC: 20053-SRU532

Delphian System LLC
Model# SRU532

Figure 8 Module Marking

- FCC ID and IC# will print on TOP Silk screen layer of PCB.

14. RF PCB Layout Guideline

14.1. Recommended RF Layout & Ground Plane

- Digital I/O, Power supply and Clock signals should have shielded by GND plane and stitched via.
- Preferable location of SRU532 is edge/corner of PCB.
- All ground pins must be connected directly to ground solid plane.
- Place ground via as close as possible to ground pins.
- For Optimal Radio performance, the SRU532 module's antenna end should protrude at least 30 mm beyond any metal enclosure.
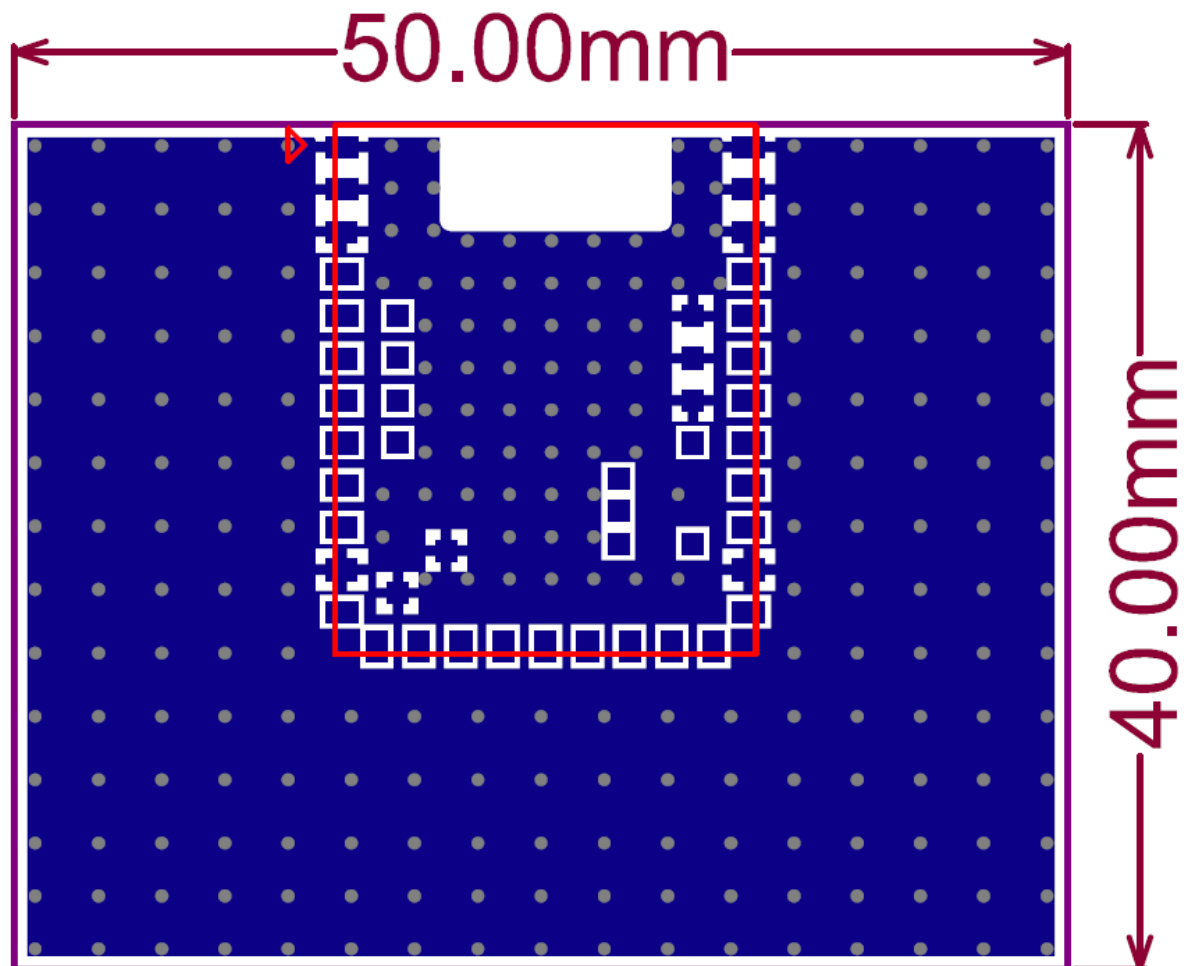

Figure 9 Recommended RF PCB Layout

14.2. Module placed on the recommended PCB Land Pattern

- For optimal performance of the antenna, place the module at the edge of the PCB as shown in the Figure #6.
- Do not place any metal (traces, components, battery etc.) within the clearance area of the antenna. Connect all the GND pins directly to a solid GND plane.
- Place the GND via as close to the GND pins as possible. Use good layout practices to avoid any excessive noise coupling to signal lines or supply voltage lines.
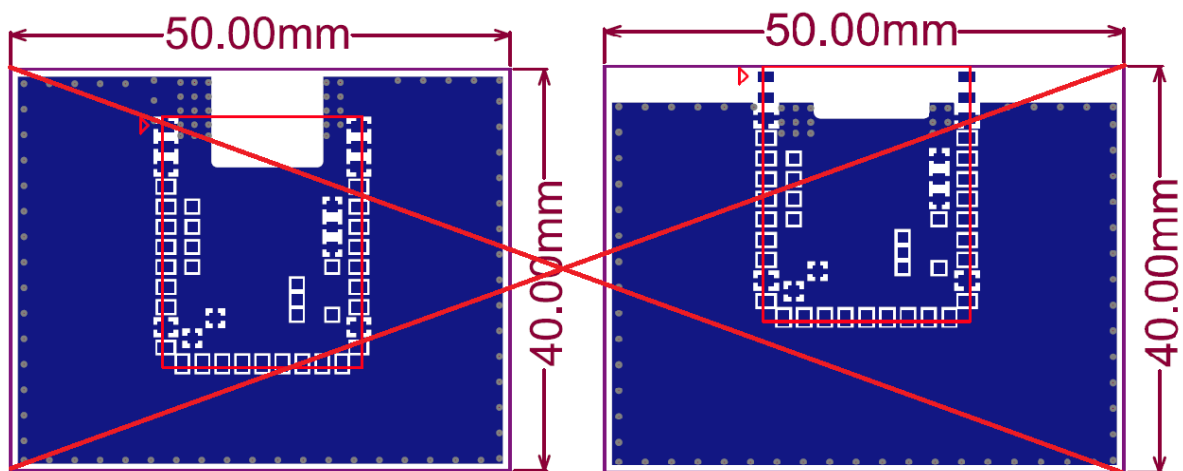- Do not place plastic or any other dielectric material in contact with the antenna

Figure 10 Non Recommended Module Placement

15. Evaluation Boards

Delphian Systems has developed full featured evaluation boards that provide a complete I/O pin out to headers, on-board programming and debug, 32.768 kHz crystal, power & virtual COM port over USB, and 4 user LEDs, for further details go through below links,

https://github.com/DelphianSystems/SecuRemote/tree/master/SecuRemote%20Documents%20for%20Developers/_1_DevKit1/Getting_Started_Guide/SR_DEVSRH532_GSG.RevA.pdf

16. Regulatory Statements

16.1. FCC Statement

This device has been tested and found to comply with 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 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.

Operation is subjected to the following two conditions: (1) This device may no cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Note: Modification to this product will void the user's authority to operate this equipment.

Note: Modification to this product will void the users' authority to operate this equipment.

16.2. FCC Important Notes:

(1) FCC Radiation Exposure Statement
This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
This equipment complies with Part 15 of the FCC Rules. Operation is subject 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.
The devices must be installed and used in strict accordance with the manufacturer's instructions as described in this document.
Caution!
The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modification could void the user authority to operate the equipment.

(2) Co-location Warning:
This device and its antenna(s) must not be co-located or operating in conjunction with any other transmitter antenna.

(3) OEM integration instructions：
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,
(2) The transmitter module may not be co-located with any other transmitter or antenna.
(3) The Chip & SMA antenna with -0.71 & 0 dBi gain was verified in the conformity testing. Radiated transmit power must be equal to or lower than that specified in the FCC/IC Grant of Equipment Authorization for FCC ID: 2AEHJSRU532 and IC: 20053-SRU532.A separate approval is required for all other antenna type, or higher gain antenna.

As long as the above conditions 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 with this module installed (for example, digital device emission, PC peripheral requirements, etc.)
In the event that these conditions cannot be met (for example certain laptop configuration or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these and circumstance, the OEM integrator will be responsible for re-evaluating. The end product (including the transmitter) and obtaining a separate FCC authorization.
Caution!
The OEM is still responsible for verifying compliance with FCC Part 15, subpart B limits for unintentional radiators through an accredited test facility.

(4) End product labeling：
When the module is installed in the host device, the FCC/IC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text:
　　"Contains FCC ID: 2AEHJSRU532"
　　"Contains IC: 20053-SRU532 "
The grantee's FCC ID/IC ID can be used only when all FCC/IC compliance requirements are met.

Any similar wording that expresses the same meaning may be used.
The FCC Statement below should also be included on the label. When not possible, the FCC Statement should be included in the User Manual of the host device.
"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. (2) This device must accept any interference received, including interference that may cause undesired operation."

(5) Information regarding the end user manual：
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 (Section 16.2(4)).

16.3. IC Statement:

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. RF exposure warning: The equipment complies with RF exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Avertissement d'exposition RF: L'équipement est conforme aux limites d'exposition aux RF établies pour un incontrôlés environnement. L'antenne (s) utilisée pour ce transmetteur ne doit pas être co-localisés ou onctionner en conjonction avec toute autre antenne ou transmetteur.

16.4. IC Important Notes:

1. 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 manual of the end product.
The user manual which is provided by OEM integrators for end users must include the following information in a prominent location.
2. To comply with IC RF exposure compliance requirements, the antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter, except in accordance with IC multi-transmitter product procedures.
3. The final system 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.
4. The host device shall be properly labelled to identify the module within the host device. The final end product must be labeled in a visible area with the following:

Contains IC: 20053-SRU532
CAN ICES-3(B)/NMB-3(B)

Any similar wording that expresses the same meaning may be used.
The IC Statement below should also be included on the label. When not possible, the IC Statement should be included in the User Manual of the host device.
"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 onctionnement."
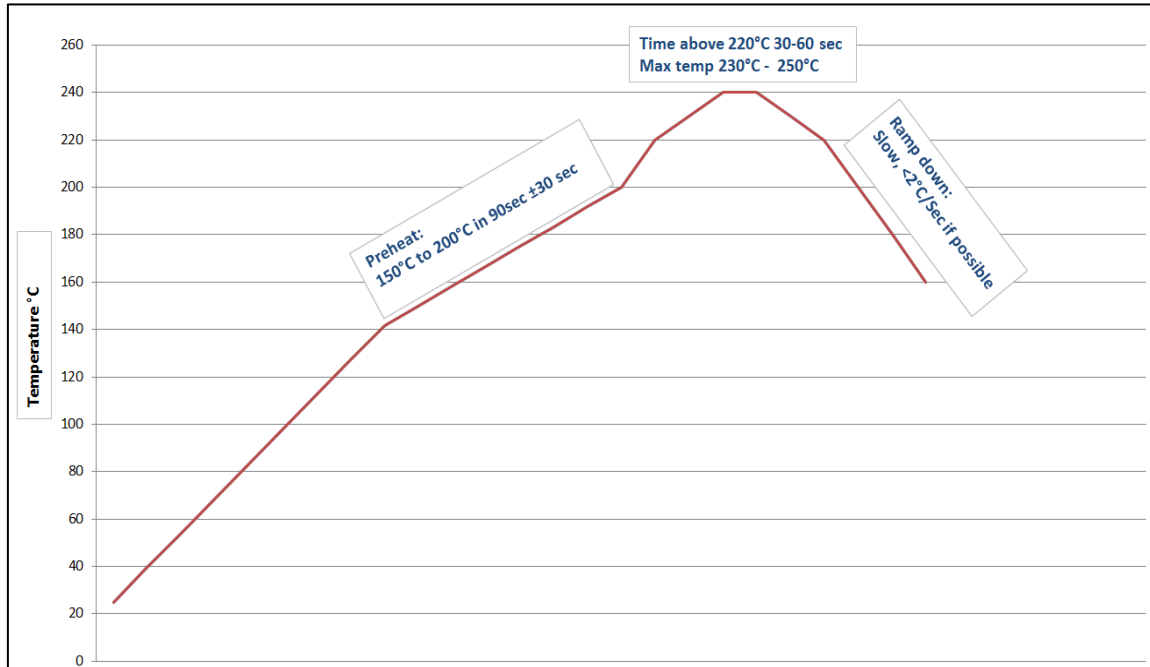
17. Solder Reflow Temperature-Time Profile

Figure 12 Reflow Profile for Lead Free Solder

Note: The quality of solder joints on the surface mount pads where they contact the host board should meet the appropriate IPC Specification. See IPC-A-610-D Acceptability of Electronic Assemblies, section 8.2.1 "Bottom only Terminations."

17.1. Moisture Sensitivity Level

The SRU532 Series is rated for MSL 2, 168-hour floor life after opening

18. Caution (Technical writing need to change)

1) The guidelines of this document should be followed in order to assure proper performance of the module.

2) This product is for use in office, business, and residential applications, but not medical devices.

3) This module may short-circuit. If a short circuit can result in serious damage or injury then failsafe precautions should be used. This could be accomplished by redundant systems and protection circuits.

4) Supply voltage to the module should not be higher than the specified inputs or reversed. Additionally, it should not contain noise, spikes, or AC ripple voltage.

5) Avoid use with other high frequency circuits.

6) Use methods to eliminate static electricity when working with the module as it can damage the components.

7) Contact with wires, the enclosure, or any other objects should be avoided.

8) Refer to the recommended pattern when designing for this module.

9) If hand soldering is used, be sure to use the precautions outlined in this document.

10) This module should be kept away from heat, both during storage and after installation.

11) Do not drop or physically shock the module.

12) Do not damage the interface surfaces of the module.

13) The module should not be mechanically stressed at any time (storage, handling, installation).

14) Do not store or expose this module to:

- Humid or salty air conditions
- High concentrations of corrosive gasses.
- Long durations of direct sunlight.
- Temperatures lower than -40°C or higher than 125°C

19. Contact Detail

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