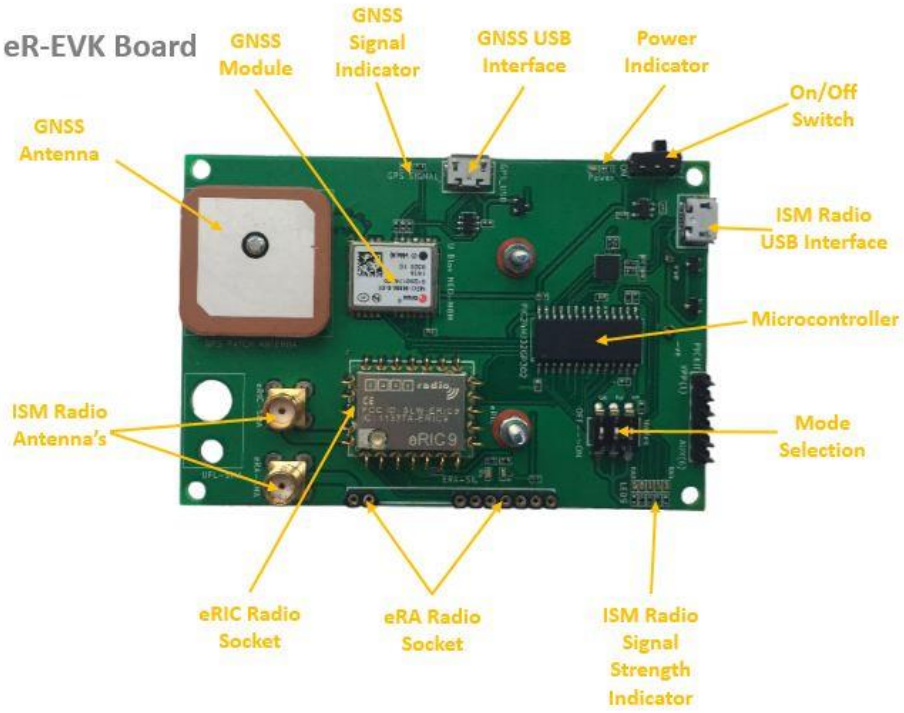
eRA, eRIC, eRA-LoRa, eRIC-LoRa & eRIC-Sigfox Evaluation Board with GNSS

This board can be used for the evaluation and range testing of the following LPRS RF Modules: eRA400, eRA900, eRIC4, eRIC9, eRA-LoRa, eRIC-LoRa and eRIC-Sigfox.

The board is provided with a u-blox® GNSS (Global Navigation Satellite System) receiver and patch antenna that allows the board to accurately report its geographical position during range tests.



Feature	Description
eRIC Radio Socket	Snap in spring clip socket for all eRIC modules. N.B. Position of Pin 1
eRA Radio Socket	Turned pin Single in Line (SIL) sockets for all eRA style modules
RSSI LED Display	Bargraph mode 5 x LED display – Received Signal Strength Indication (RSSI)
Mode Selection	3 way DIL switch sets Mode of operation on power up (See table)
Microcontroller	Microchip PIC24HJ32GP302 microcontroller
ISM Radio USB Interface	Micro USB connector for Serial Data In/Out for RF modules
On/Off Switch	Board power On/Off slide switch
Power Indicator	Red LED indicates that board is powered
GNSS USB Interface	Micro USB connector for serial data output from GNSS module
GNSS Signal Indicator	Indicates valid received signal with 1 pulse per second LED output
GNSS Receiver Module	u-blox NEO M8M Global Navigation Satellite System (GNNS) module
GNSS Antenna	Patch Antenna for GNSS Module
ISM Radio Antenna	50R SMA Female RF connector for antenna or test equipment connection to eRIC modules
ISM Radio Antenna	50R SMA Female RF connector for antenna or test equipment connection to eRA modules
Tx LED (Red)	Indicates transmit data activity
Rx LED (Green)	Indicates receive data activity
PICKIT Programmer	Connector for Microchip PICKIT PIC programmer for microcontroller
Battery Box	3 x AA Pencell battery box. Provides 4.5V power supply for board via On/Off slide switch
Gnd Pin	0V Gnd reference for 'scope or other test equipment

The board can be powered either by the host, via the USB connection or by the built in three cell (4.5V) switched battery supply mounted on the reverse side of the board.

The u-blox GNSS receiver module serial data can be directly accessed using the second micro USB connector provided. Messages from the receiver can be viewed in any serial terminal software program. Alternatively the u-blox U-Centre evaluation software can be used to exercise and fully explore the device.

The on board Microchip™ PIC24HJ32GP302 is pre-programmed with a bootloader and application software which can be selected to perform different functions using the Mode Select switch. (See table)

An FTDI USB device provides the serial interface between the board and the host PC USB port.

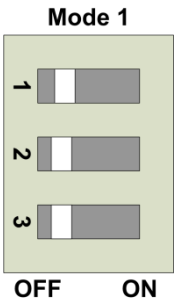
A Microchip™ PICkit compatible Single In Line (SIL) connector is provided to allow re-programming of the on board PIC microcontroller. Application software or firmware can be updated via the board micro USB connector using the pre-loaded bootloader firmware within the microcontroller.

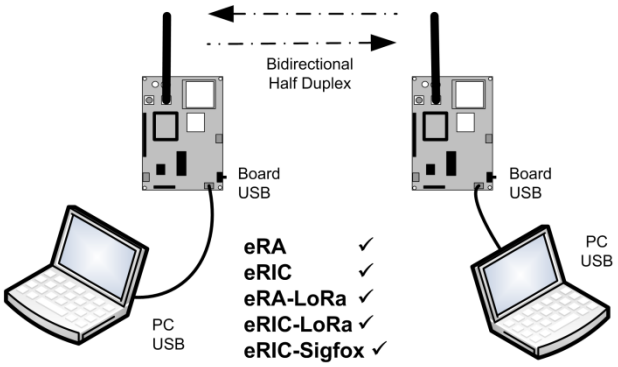
easyRadio Companion software can be used to update the microcontroller firmware. (TBA)

The Mode Select switch allows up to 8 different operating modes to be selected but only 6 modes are implemented in the current firmware version.

The following table describes the different operating modes available:

Mode 1 easyRadio UART





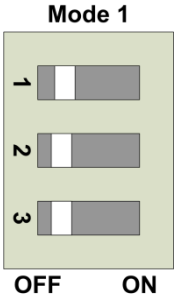
Set the Mode Switch to Mode1 (as shown).

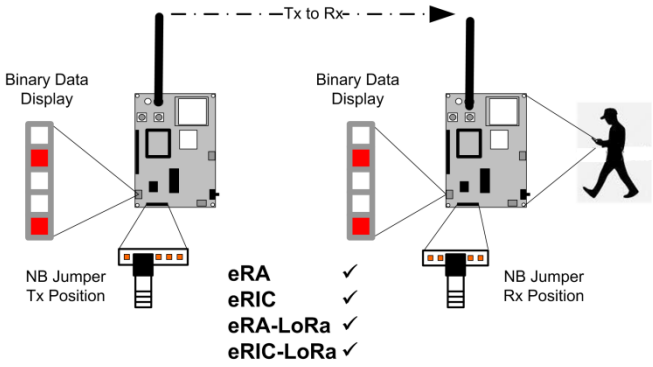
This mode allows serial data on a host PC to be sent and received over-air to and from the selected (matching) RF modules that are plugged into the boards.

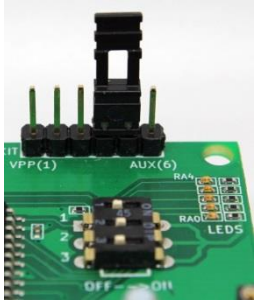
In this mode, the FTDI USB device, the PIC and the eRIC/eRA module are interconnected by software. The board should be connected to a PC (or laptop) by plugging the micro USB cable between the PC and the board micro USB connector. Terminal software or easyRadio Companion software can be used to communicate with the eRIC/eRA modules. Data or easyRadio Commands can be sent or received by the PC in this mode.

Firmware update or user applications can also be uploaded to eRIC and eRA modules using easyRadio Companion software.

Mode 1 Automatic Transmit Mode





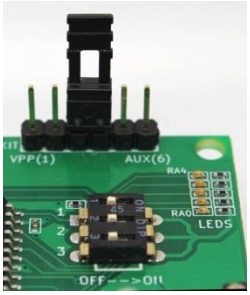


Set the Mode Switch to Mode1 (as above) and place a jumper between Pin4 and Pin5 of the PICkit programming connector (as shown in the picture) before power up or reset.

This sets the RF module into Automatic Transmit Mode and the board will send incrementing binary data over-air and display the transmitted data on the LED display (RA0-RA4).

The jumper should be removed after tests have been completed.

Mode 1 Automatic Receive Mode



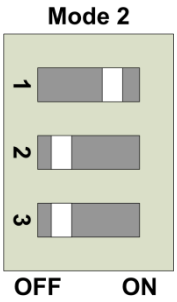
Set the Mode Switch to Mode1 (as above) and place a jumper between Pin3 and Pin4 of the PICkit programming connector (as shown in the picture) before power up or reset.

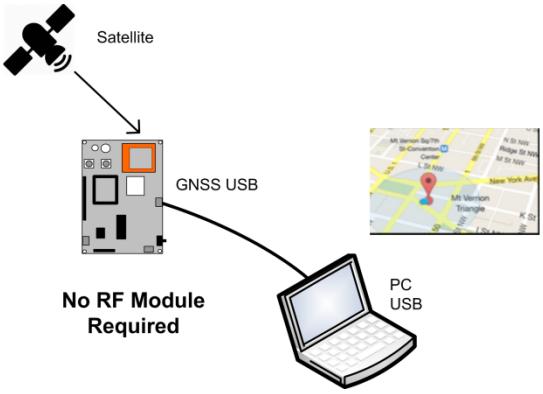
This sets the RF module into Automatic Receive Mode. Upon successful reception of an RF signal from a matching transmitter board set in Mode1_Automatic_Tx mode, the transmitted data will be 'echoed' on the receiving board LED display. Should no signal be received then all the LEDs will be extinguished.

This mode in conjunction with Mode 0 can be used for performing battery powered range tests between a pair of boards.

The jumper should be removed after tests have been completed.

Mode 2 GNSS Test Mode



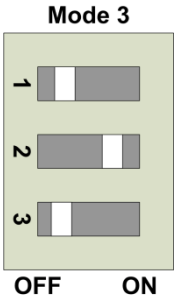


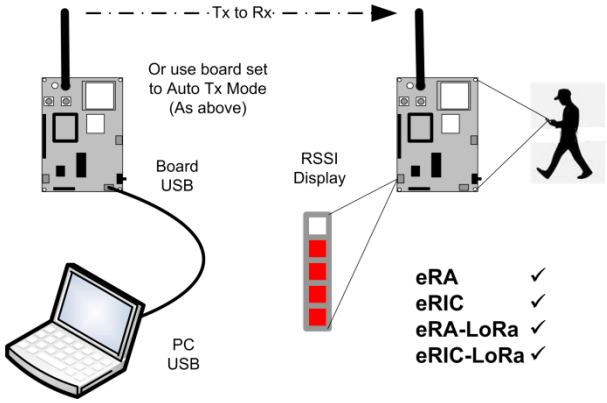
This mode allows the GNSS module serial data to be directly accessed by connecting a cable between the board GNSS micro USB connector (note position) and a PC USB port.

Any terminal software or easyRadio Companion software can be used to communicate with the GNSS module via a PC.

GNRMC NMEA data with time, Active/Invalid, latitude, N/S, longitude, E/W, speed over ground, date is sent by the GNSS module to the PC through the PIC microcontroller. PC UART baud rate for this mode should be set to 19200. The GNSS Evaluation software can be used to locate the current physical position on maps using this mode, which is explained further below.

Mode 3 RSSI Mode

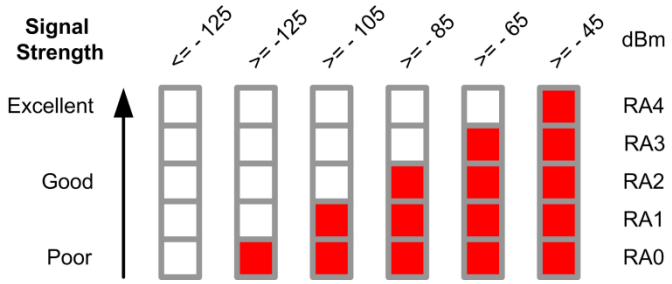




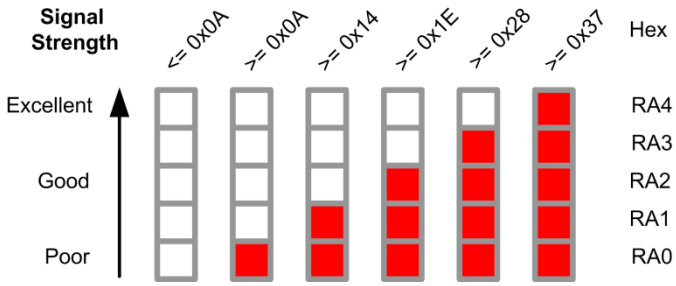
In this mode the RF module 'Received Signal Strength Indication' (RSSI) is displayed as a bar graph on LEDs RA0–RA4 which is most useful during practical range testing and site surveys.

If there is no valid signal/data for more than 5 seconds then all the LEDS are extinguished.
The diagrams below relate the Received Signal Strength to the LED display.

For eRIC modules:

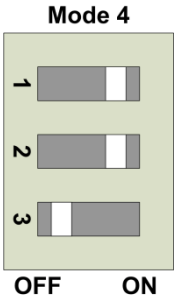


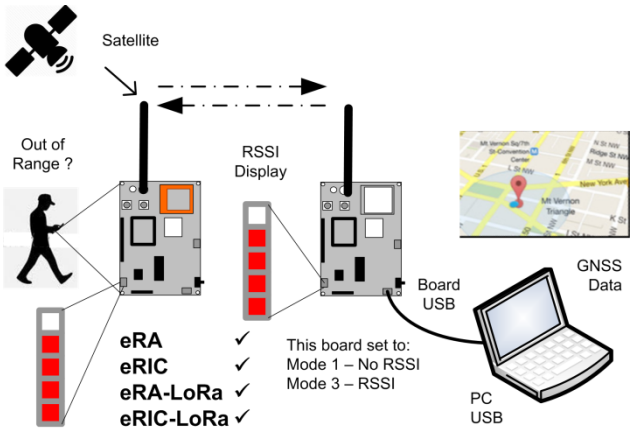
For eRA modules:



Refer to RSSI table in the eRA Datasheet for conversion of the Hex values to dBm which are dependent upon the selected bandwidth.

Mode 4 GNSS Data + RSSI





In this mode, the GNSS module, the PIC microcontroller and the eRIC/eRA modules are interconnected by software. Software in the PIC microcontroller discovers the Baud rate of the chosen eRIC/eRA modules and sets the microcontroller UART to match that of the modules.

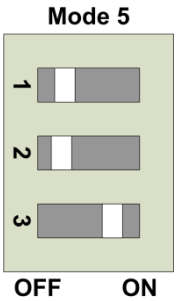
The raw position data received by the GNSS module is parsed (GNRMC) and the serial number of the (eRIC/eRA) module is appended to the packet. It is then transmitted over-air by the module in the following order:

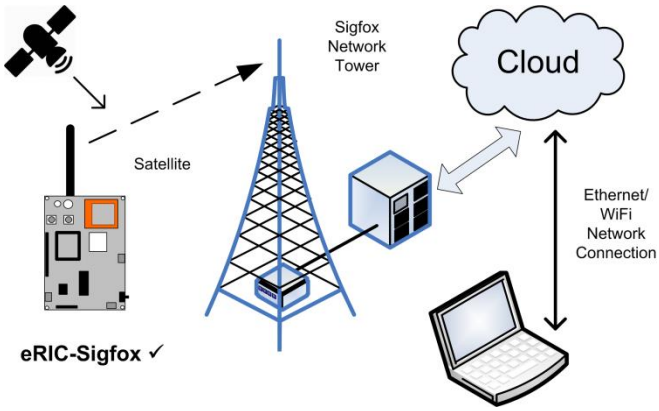
Time, Active/Invalid, Latitude, N/S, Longitude, E/W, Speed over ground in Knots, Date, Module Serial number.

A matching board set to Mode 1 easyRadio UART Mode will receive the over-air data and forward the serial data to the GNSS PC application or easyRadio Companion software.

If the corresponding receiver board is set to Mode 3 the RSSI is displayed on both boards providing indication of both boards signal strength and therefore 'Out of Range' condition.

Mode 5 eRIC SigFox Tracker Mode





In this mode a board fitted with an eRIC-Sigfox module will wake up every 15 minutes, turn on the GNSS module, acquire its position and transmit the data to the local SigFox network.

The data can then be viewed via the Internet on the Sigfox servers.

A total of up to 140 messages (maximum limit) per day can be sent.

The default transmit timer repetition rate is 15 minutes.

Changing Transmit Interval

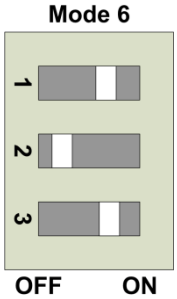
Using the supplied jumpers in conjunction with the PICKit header pins the transmission interval can be set between 1-31 seconds or 1-31 minutes.

Fitting the jumper between pins 3 and 4 sets the interval in seconds whereas fitting the jumper between pins 4 and 5 sets the interval in minutes.

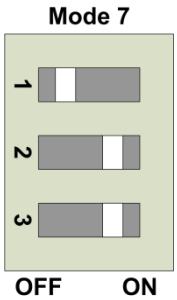
When this jumper is fitted, on power up (or reset) LEDs RA1, RA2, RA3 will initially flash three times to indicate operation in this mode.

An internal one second counter then starts and the count is displayed in (5 bit) binary format on LEDs RA0 – RA4. (RA4 flashes once per second)

When the desired count is reached the jumper should be removed and the transmission interval timer will remain set to this value until the next power up.

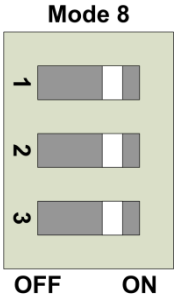


Not Implemented



Not Implemented

Mode 8 Eval Board Firmware Update



In this mode, the FTDI USB device and the PIC are connected by software and this mode is used only for updating the Eval board PIC firmware.

Use of this mode is further explained below.

The table below shows the modes that are applicable to the selected RF module:

Mode	Mode Description	eRA400 eRA900	eRIC4 eRIC9	eRA LoRa	eRIC LoRa	eRIC Sigfox
1	easyRadio UART	✓	✓	✓	✓	
1	Auto Tx to Rx	✓	✓	✓	✓	
2	GNSS	N/A	N/A	N/A	N/A	N/A
3	RSSI	✓	✓	✓	✓	
4	GNSS Data + RSSI	✓	✓	✓	✓	
5	eRIC-SigFox Tracker					✓
6	Not Implemented					
7	Not Implemented					
8	Board Firmware Update					

The table below shows interoperability with other LPRS development products:

Mode	Description	Transmitter			Receiver		
1	easyRadio UART	GNSS	eRIC DK	USB Dongle	GNSS	eRIC DK	USB Dongle
1	Auto Tx to Rx	GNSS	eRIC DK W4		GNSS	eRIC DK SW3	
2	GNSS	GNSS			GNSS		
3	RSSI	GNSS	eRIC DK	USB Dongle	GNSS		
4	GNSS Data + RSSI	GNSS			GNSS	eRIC DK	USB Dongle
5	eRIC-SigFox Tracker	GNSS					
5	LoRa, eRIC, eRA	GNSS			GNSS	eRIC DK	USB Dongle

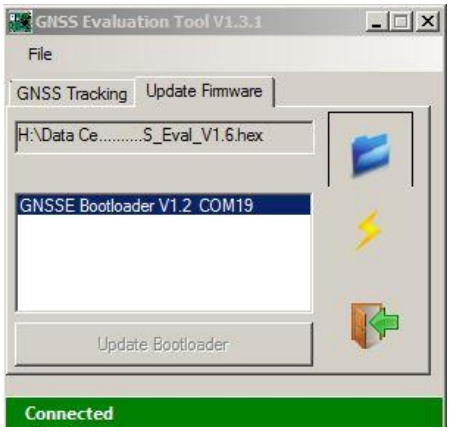
Using the GNNS Evaluation Tool Software:

Download the latest GNNS Evaluation software and the firmware files from the LPRS website:

http://www.lprs.co.uk/development-tools/easyradio-evaluation-software.html

After downloading the files, install the GNNS Evaluation Tool software. At present this is only supported for use on Windows Operating System devices.

The GNNS evaluation software window looks similar to the screen shot below:



Update Firmware

The 'Update Firmware' tab provides a function where in the firmware on the Evaluation board PIC microcontroller can be updated.

To update the firmware, the Eval board must be set in **Mode8** before power up or reset as described earlier. This sets the board in bootloader mode, which is indicated by LED RA0 and LED RA1 flashing three times followed by RA0 LED staying on after power up.

Using the application, click on the blue 'Open file' icon and load the appropriate hex file by browsing to its saved location and opening the file. This action will set RA1 LED On and the grey shaded box will then display the file path and the file version of the loaded file.

The lower white window displays the current bootloader file version (e.g. GNSSE Bootloader V1.2 followed by the auto discovered COM port.

The greyed out 'Flash' icon will then turn yellow and should be clicked to start the firmware update.

Whilst the PC is updating the PIC firmware, RA2 LED will flash continuously to indicate that it is updating. The progress of the update is shown on the PC application as a percentage. After progress is reported at 100% (Success) click the brown 'Close' icon to exit the application.

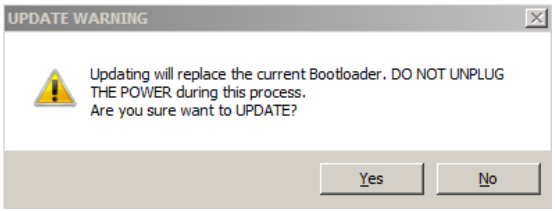
Return the Mode select switches to the all off position (Mode 1) or as required and then power cycle the board.

Bootloader Update

To update the Bootloader the Eval board must be set, as before in **Mode8** before power up or reset.

Using the application, click on the blue 'Open file' icon and load the appropriate bootloader hex file by browsing to its saved location and opening the file.

On detecting the new bootloader file RA0 & RA1 LEDs will light and the previously greyed out text of the 'Upgrade Bootloader' button will become normal. Click this button to begin the firmware update. The following warning will be displayed which must be heeded to prevent permanent damage to the microcontroller.



Click 'Yes' to accept and start the update process.

The progress of the update is again shown on the PC application as a percentage but this time, will run twice as the existing bootloader is internally backed up and finally over-written. During the update RA3 & RA4 LEDs will flash.

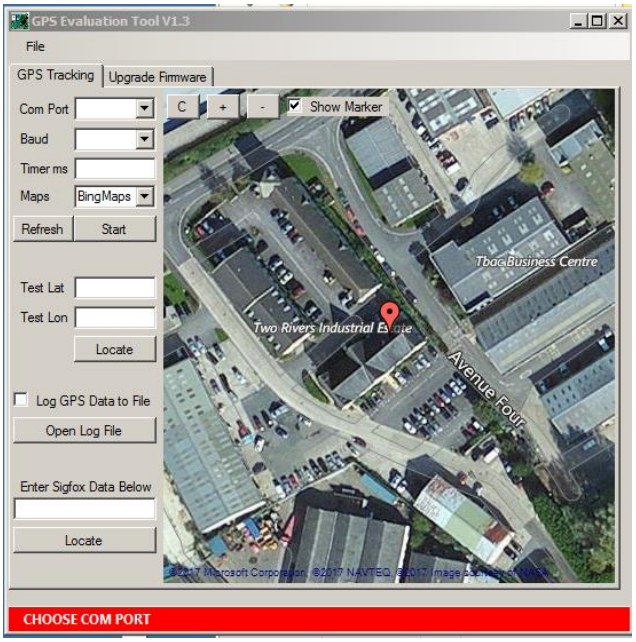
Upon successful completion of the update RA0 LED will light.

Click the brown 'Close' icon to exit the application.

There are three ways that the Evaluation Board and the application software can be configured to locate GNNS co-ordinates on the maps.

1) Manually

After installing and running the 'GPS Evaluation Tool' select the 'GNSS Tracking' tab to display a screen similar to that below:



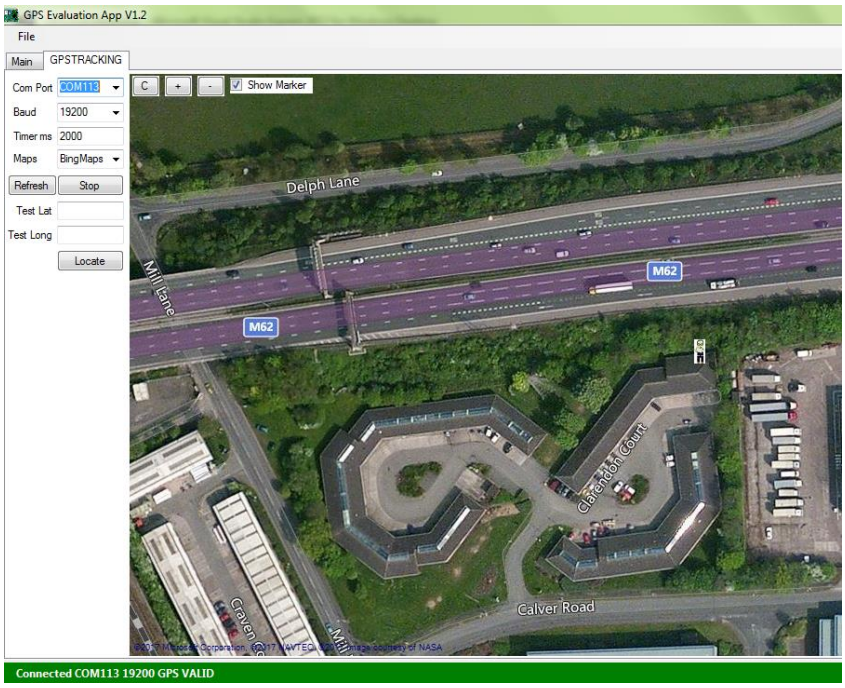
N.B. There is no requirement to connect the Eval Board to the PC in this mode.

- On the 'Maps' drop down box choose either 'Bing' or 'Google' maps, as desired. The default is 'Bing' maps.
- If known, the Latitude and Longitude co-ordinates can be entered manually in the 'Test Lat' and the 'Test Long' boxes.
- For example, to locate the LPRS Sales office in Witney UK, enter Latitude: '51.7786' and Longitude: '-1.4816'.
- After entering the data, click the 'Locate' button to display the location of these co-ordinates on the map.

2) Automatically Plot GNNS Position (Mode 2 GNSS Test Mode)

- Connect the micro USB cable between the board USB connector and the PC USB connector.
- Set the board for Mode2 operation before power up or reset.
- Use the 'Com Port' drop down box to select the auto detected Com port.
- Use the 'Baud' drop down box to select '19200' Baud rate.
- After a few moments the red 'CHOOSE COM PORT' bar at the bottom of the window should change to a green 'Connected COM xx 9600'. Where xx is detected Com port.
- If the co-ordinates need to be updated on the map every second set the 'Timer mS' to 1000. The default is 2000.
- Use the 'Maps' drop down box to choose either 'Bing' or 'Google' maps, as desired. The default is 'Bing' maps.
- Click the 'Start' button to begin the location mapping.
- As soon as the GNSS module receives valid data from the satellites (which may initially take several minutes) the red on-board GNSS_LED will flash once per second and a marker will show the reported location on the maps.
- Click the 'Stop' button to stop locating or the 'Refresh' button to clear the current markers.
- Click the 'C' button to centre the map on the first reported location.
- Click the '+' button to zoom in and '-' button to zoom out of the map.
- Tick the 'Show Marker' check box to show an LPRS 'Wireless Mike' marker on the map. Untick this box to hide the 'Wireless Mike' marker and show a red dot marker on the map.
- Click on the marker to display its distance from first located co-ordinate and the maximum distance travelled by all the markers.
- The data can be logged by ticking the 'Log GPS (GNSS) Data to File' box and viewed by clicking the 'Open Log File'.
- Sigfox positions can also be located by entering valid Sigfox data in the entry box.

The picture below shows the location of the LPRS Technical branch in Warrington UK received by the GPS module:



3) Range Testing

Using two Eval boards proceed as follows:

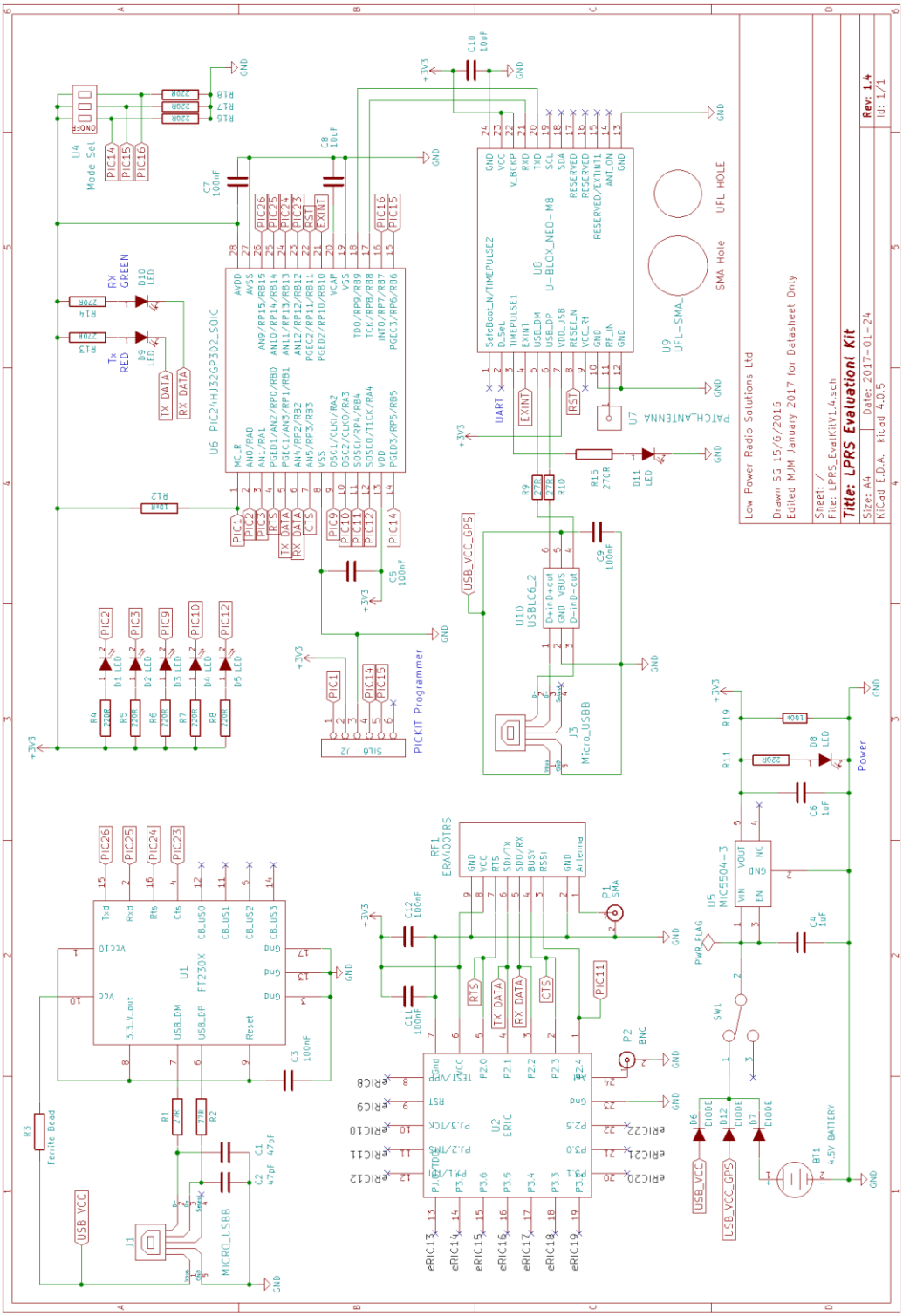
- Plug three fresh 1.5V Alkaline AA batteries into the holder on the back of the Eval board(s).
- Insert an eRIC or an eRA module into the provided socket.
- Set the board for Mode4 operation before power up or reset. On setting this mode, the PIC software checks the eRIC/eRA baud rates and sets its own baud rate to match.
- GNNS data received by the GNNS module is collected and processed by the PIC software. The GNNS GNRMC data is then filtered and sent to the eRIC/eRA module which then sends this packet over-air appending the eRIC/eRA module serial number.

The packet structure is shown below:

- Time, Active/Invalid, Latitude, N/S, Longitude, E/W, Speed over ground in Knots, Date, Serial Number of the (eRIC/eRA) module.
- This board, being battery powered is portable and can be hand held during walk/range tests.

The other board configured as a receiver should be connected to a PC to map the co-ordinates received by the GNNS Evaluation board (Transmitter). The receiver board can be another evaluation board set in Mode1 or any other eRIC/eRA development board.

Open com port for receiver board and select baud rates and other settings. Then whenever the module on the receiver board receives GNNS data from transmitter evaluation board, it will display the co-ordinates on maps.


Low Power Radio Solutions Ltd
Drawn SG 15/6/2016
Edited MJM January 2017 for Datasheet Only
Title: LPRS Evaluation Kit
Rev: 1.4
Size: A4
Date: 2017-01-24
KiCad E.D.A. kicad 4.0.5
U6 PIC24HJ32GP302_SOIC
U8 U-BLOX_NEO-M8
U9 UFL-SMA_
U7 PATCH_ANTENNA
U10 USBLC6_2
J3 Micro_USBB
PICKIT Programmer
U4 Mode Sel
U1 FT230X
U2 ERIC
RF1 ERA4001RS
U5 MIC5504-3
J1 MICRO_USBB
BT1 4.5V BATTERY
UFL HOLE
SMA Hole
Power

Product Order Codes

Name	Description	Order Code
Eval Board II	eRIC/eRA Evaluation Board (does not include RF Modules)	eR-EVK-01
	(N.B. A pair of boards are required for range testing)	

Document History

Issue	Date	Revision
0.1	January 2017	Draft
1.0	February 2017	Release
1.1	May 2017	Additions, clarifications and amendments
1.2	June 2017	Drawings updated
1.3	June 2017	Interoperability table added

Please contact the Sales office for availability of variants of the standard product.

Changes to this Document This data sheet has been updated to reflect changes throughout the range of LPRS modules. Specific changes are recorded in the documentation history above.

Copyright See: www.lprs.co.uk
Disclaimer See: www.lprs.co.uk
Terms and Conditions of Use See: www.lprs.co.uk

Contact Information Please contact LPRS or your local distributor

Low Power Radio Solutions Ltd.
Two Rivers Industrial Estate
Station Lane, Witney
Oxon, OX28 4BH
England

Tel: +44 (0)1993 709418
Fax: +44 (0)1993 708575
Web: http://www.lprs.co.uk
Email: info@lprs.co.uk
Technical: technical@lprs.co.uk

Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)
Факс: 8 (812) 320-02-42
Электронная почта: org@eplast1.ru
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.