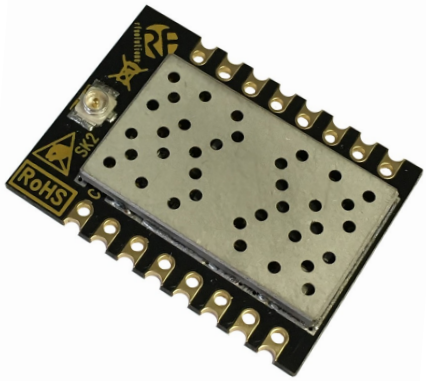
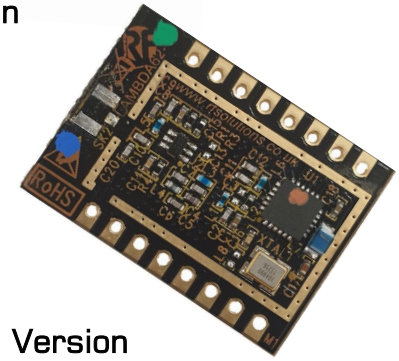
+22dBm LoRa 868/915MHz Transceiver

Features

- 20KM+ Range
- Integrated LoRa™ Modem **Semtech SX1262**
- Highly Efficient Integral Impedance Matching Network
- Provides Full Functionality of the RFIC:
- High Rx sensitivity: down to -148 dBm
- Tx +22 dBm @118mA constant RF output
- +14 dBm high efficiency PA
- 170 dB maximum link budget
- Built in RF switch
- Bullet-proof front end: IIP3 = -12.5 dBm
- 89 dB blocking immunity
- Small Form Factor: 23mm x 20mm
- Programmable bit rate up to 300 kbps
- Low RX current of 4.6 mA, (Lora Operating Mode)
- LoRa,FSK,GFSK,MSK,GMSK,OOK modulation
- Built-in bit synchronizer for clock recovery
- Preamble detection
- 127 dB Dynamic Range RSSI
- Automatic RF Sense and CAD with ultra-fast AFC
- Packet engine up to 256 bytes with CRC
- Built-in temperature sensor and low battery indicator
- 868MHz CE Compliant
- 915MHz "Modular" FCC Certification Pending



C Version



Open Version

Applications

- RF Alarms
- Sensor networks
- Long Range Telemetry
- Meter Reading
- Environmental Sensors
- Building Control & Automation
- Agricultural Applications

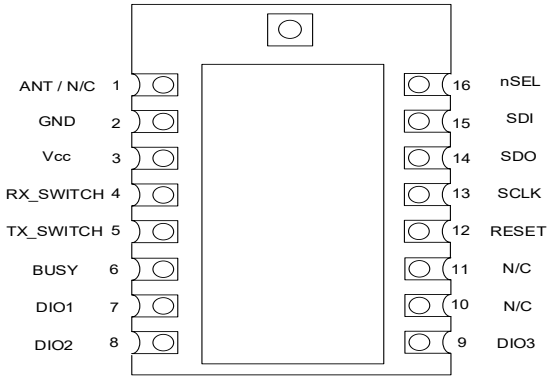
Description

The LAMBDA62 RF module is a class leading, cost effective radio module featuring the Semtech SX1262 LoRa™ long range providing ultra-long range, spread spectrum communication and high interference immunity within minimal current consumption.

This module including crystal, RF Changeover switch, impedance matching network and track layout provide a simple digital interface and direct antenna connection. This enables a plug in RF solution with maximum efficiency. Programming of the module is via SPI interface.

The LAMBDA62 Module is CE compliant. Providing that certain procedures are followed. (please refer to application schematic later in this datasheet).

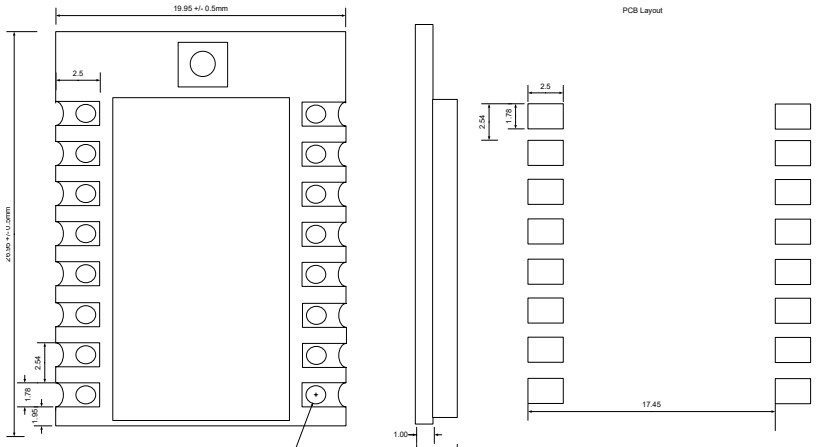
Pin Description



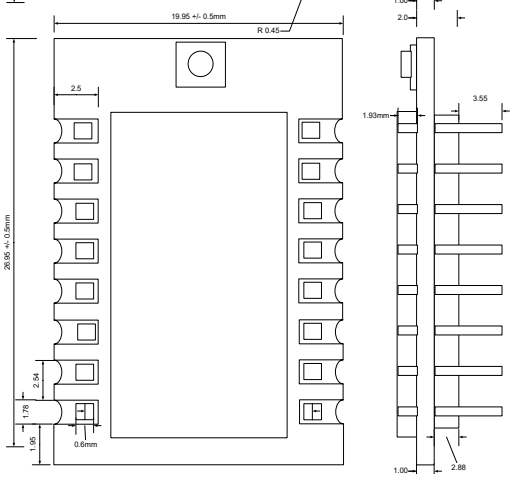
Mechanical Dimensions

Suggested Layout

SMT Version



DIP Version



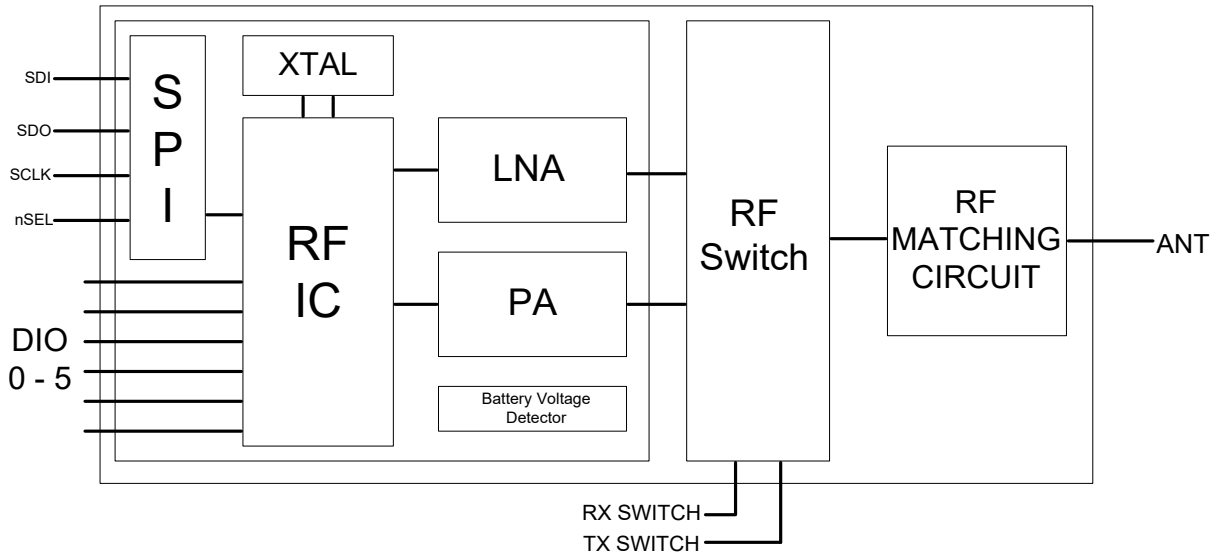
Part Numbers

Part Number	Description	Package
LAMBDA62-8S	FM Transceiver Module, 868MHz	SMT
LAMBDA62-8D	FM Transceiver Module, 868MHz	DIP
LAMBDA62C-9S	FM Transceiver Module, 915MHz	SMT
LAMBDA62C-9D	FM Transceiver Module, 915MHz	DIP

Pin Description

<table>
<tr><th>PIN</th><th>Definition</th><th>Direction</th><th>Function</th></tr>
<tr><td>1</td><td>Antenna</td><td>In/Out</td><td>Versions without Screen can: Antenna connection
“C” Versions without screen can: No Connect</td></tr>
<tr><td>2</td><td>GND</td><td>-</td><td>Ground connection</td></tr>
<tr><td>3</td><td>Vcc</td><td>In</td><td>Power connection</td></tr>
<tr><td>4</td><td>RX_SWITCH</td><td>In</td><td>Enable RX RF Path Active High
<table><tr><td></td><td>TX PIN5</td><td>RX PIN4</td></tr><tr><td>RX Mode</td><td>0</td><td>1</td></tr></table></td></tr>
<tr><td>5</td><td>TX_SWITCH</td><td>In</td><td>Enable TX RF Path Active High
<table><tr><td></td><td>TX PIN5</td><td>RX PIN4</td></tr><tr><td>TX Mode</td><td>1</td><td>0</td></tr></table></td></tr>
<tr><td>6</td><td>Busy</td><td>Out</td><td>Indicates LAMBDA Module/EX1262 is Busy</td></tr>
<tr><td>7</td><td>DIO1</td><td>In/Out</td><td>Digital I/O software configured</td></tr>
<tr><td>8</td><td>DIO2</td><td>In/Out</td><td>Digital I/O software configured</td></tr>
<tr><td>9</td><td>DIO3</td><td>In/Out</td><td>Digital I/O Software configured</td></tr>
<tr><td>10</td><td>N/C</td><td></td><td>No Connect</td></tr>
<tr><td>11</td><td>N/C</td><td></td><td>No Connect</td></tr>
<tr><td>12</td><td>RESET</td><td>In</td><td>Reset Trigger Input</td></tr>
<tr><td>13</td><td>Serial Clock</td><td>In</td><td>SPI Serial Clock Input</td></tr>
<tr><td>14</td><td>Serial Data Out</td><td>Out</td><td>SPI Serial Data Output</td></tr>
<tr><td>15</td><td>Serial Data In</td><td>In</td><td>SPI Serial Data Input</td></tr>
<tr><td>16</td><td>nSEL</td><td>In</td><td>Device Select Active Low</td></tr>
</table>

Block Diagram



Application Resources

The LAMBDA62 is a ready to use application of the Semtech SX1262.
Access to the programming and configuration of Semtech 1262 Transceiver are via the modules interface SPI line.
The LAMBDA62 has been developed with Semtech to provide a low cost platform application of the 1262
transceiver. This offers optimal design realisation and easy integration within the end application.
The most important aspect of any RF Module is to maximise the performance of the transceiver at the external module pads.
In particular the impedance matching network which is the most sensitive section of the RF module design.
In order to maximise signal propagation to the external pad of the module, a specific layout is required which is not (usually) the smallest physical size (beware of small RF modules!).
Many RF Module manufacturers simply reproduce the IC manufacturers data characteristics where in practice the Module RF performance is considerably lower.
We have measured the conducted power transmitted from the LAMBDA62 ufl connector at +22.4dBm, which demonstrates the efficiency of the LAMBDa62 module.

To ensure that the latest details in programming this device are offered, we have not included the 1262s programming information in this document.

You can find the datasheet at the link below:

SX1262 Datasheet

Programming, configuration and further resource data including;

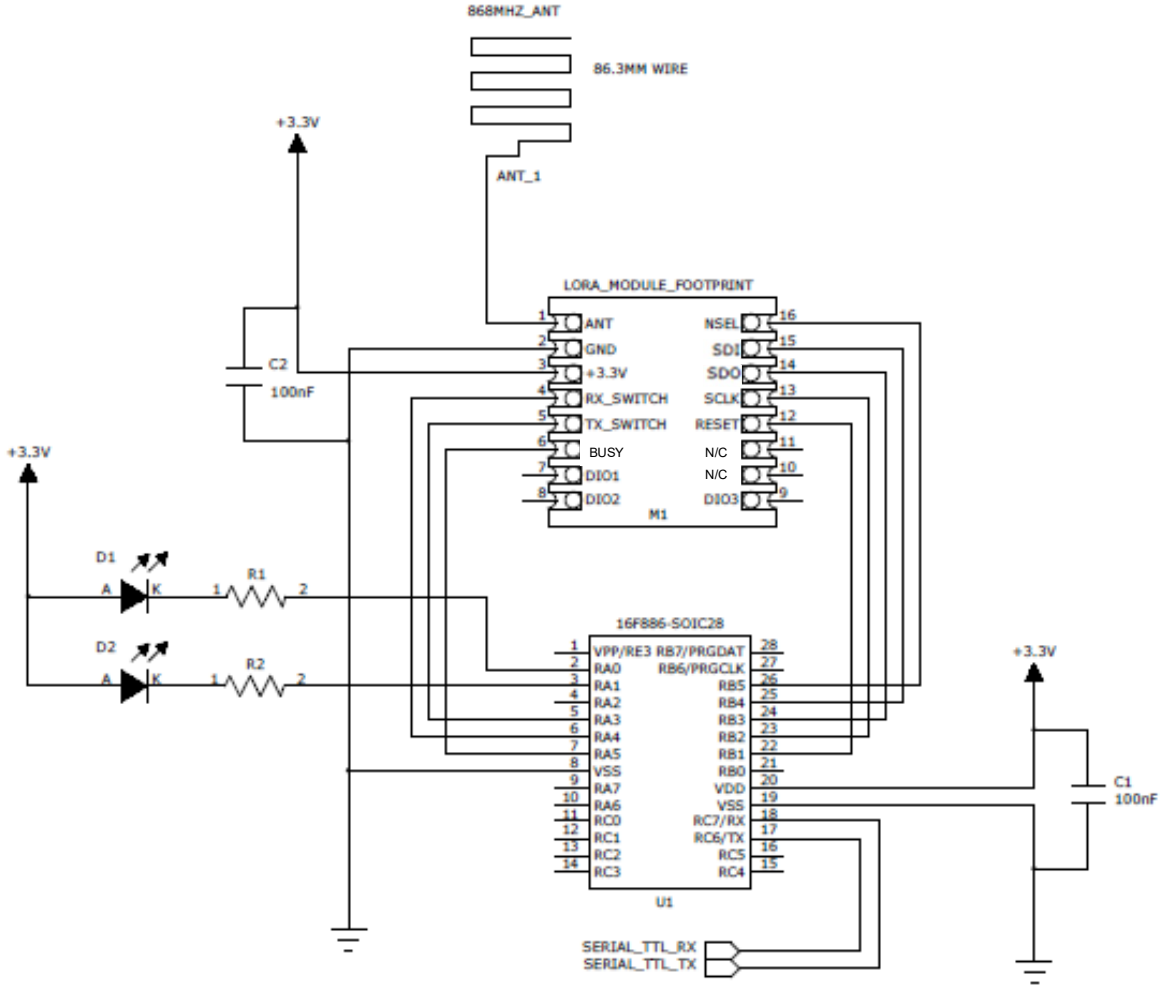
LoRa Calculator: fast evaluation of link budget, time on air and energy consumption.

Packet Error Rate Firmware User Guide.

LoRa Modem Designer's Guide.

is available from Semtech at the below links
Semtec Website

Application schematic Interfacing a PIC™ Micro Controller



The above schematic shows an easy interface to a PIC Microcontroller

This is the same application circuit that we used for range testing (please see our range test information later in the document).

We also have application source code available for download on our website. This configures the RF LoRa Module for maximum range.

Walk Test application
Also available is the source code used to carry out a simple range test.
In order to use this two application boards are required, one acts as a beacon transmitter, the other as the beacon receiver. The TX board will illuminate the GREEN LED when transmitting and the Receiver will illuminate the RED LED when RECEIVING
The Transmitter board transmits an RF beacon every second (Green LED flashes to indicate transmission).
This enables a one man range test, by placing either board in a fixed location and monitoring the beacon signals.

Electrical Specifications

Absolute Maximums

Symbol	Parameter	Minimum	Maximum	Unit
V_{dd}	Positive power supply	-0.3	+3.9	V
V_{in}	Voltage on Digital Inputs	-0.3	Vdd+0.3	V
V_{in}	Voltage on Analogue Inputs	-0.3	Vdd+0.3	V
RX	Max Rx input power		+10	dBm
T_{op}	Operating temperature	-40	+85	°C
T_{st}	Storage temperature	-55	115	°C

Recommended Operating Conditions

Symbol	Parameter	Minimum	Maximum	Unit
V_{dd}	Positive power supply	1.8	3.7	V
T_{op}	Working temperature	-40	85	°C

DC Characteristics

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Supply Voltage Range	V_{DD}		1.8	3.3	3.7	V
Power Saving Modes	$I_{Shutdown}$	All blocks of IC OFF.	—	160	—	nA
	$I_{Standby}$	Register values maintained.	—	600	—	nA
	I_{Ready}	Crystal Oscillator and Main Digital Regulator ON, all other blocks OFF.	—	0.6	—	mA
RX Mode Current Using onboad DC-DC		FSK Mode 4.8Kbps	—	4.2	—	mA
		LORA Mode 125KHz	—	4.6	—	mA
		Rx Boosted FSK Mode 4.8Kbps	—	4.8	—	mA
		Rx Boosted LORA Mode 125KHz	—	5.3	—	mA
TX Mode Current	I_{TX}	RFOP = +22dBm @ 868/915MHz RFOP = +20dBm RFOP = +17dBm RFOP = + 14dBm	—	118 102 95 90		mA

Power Consumption in Transmit mode

Symbol	Frequency Band	Conditions	Power Output	Typical	Unit
IDDTX	868/915MHz	+22dBm +20dBm +17dBm +14dBm	+22dBm +20dBm +17dBm +14dBm	118 102 95 90	mA mA mA mA
		Optimal Settings for low current and output power. Please see SX1262 PA optimal settings in Datasheet.	+20dBm +17dBm +14dBm	84 58 45	mA

Receive Mode Specifications

Symbol	Description	Conditions	Typ	Max	Unit
RXS_2FB	Sensitivity 2-FSK RX boosted gain	BR_F=0.6 kb/s FDA=0.8 KHz BW_F=4KHz BR_F=1.2 kb/s FDA=5 KHz BW_F=20KHz BR_F=4.8 kb/s FDA=5 KHz BW_F=20KHz BR_F=38.4 kb/s FDA=40 KHz BW_F=160KHz BR_F=250 kb/s FDA=125 KHz BW_F=500KHz	-125 -123 -118 -109 -104		dBm dBm dBm dBm dBm
RXZ_LB	Sensitivity LoRa RX boosted gain	BW_L=10.4 KHz SF=7 BW_L=10.4 KHz SF=12 BW_L=125 KHz SF=7 BW_L=125 KHz SF=12 BW_L=250 KHz SF=7 BW_L=250 KHz SF=12 BW_L=500 KHz SF=7 BW_L=500 KHz SF=12	-134 -148 -124 -137 -121 -134 -117 -129		dBm dBm dBm dBm dBm dBm dBm dBm
CCR_F	Co-channel Rejection FSK		133		dB
CCR_L	Co-channel Rejection LoRa	SF=7 SF=12	5 19		dB dB
ACR_f	Adjacent channel Rejection FSK	Offset = +/- 50KHz	45		dB
ACR_L	Adjacent channel Rejection LoRa	Offset = +/- 1.5 x BW_L BW_L=125 KHz SF=7 BW_L=125 KHz SF=12	 60 72		dB

General Specifications

Symbol	Description	Conditions	Min	Typ	Max	Unit
FR	Synthesizer Frequency Range	SX1261**	150		960	MHz
FSTEP	Synthesizer Frequency Step			0.95		MHz
PHN	Synthesizer Phase Noise 868/915MHz	1 KHz offset 10 KHz offset 100 KHz offset 1 MHz offset 10 MHz offset		-75 -95 -100 -120 -135		dBc/Hz
TS_FS	Synthesizer wakeup time	From standby to XOSC Mode		40		uS
TS_HOP	Synthesizer hop time	10MHz step		30		uS
TS_OSC	Crystal Oscillator Wakeup time	From Standby_RC		150		uS
OSC_TRM	Crystal Oscillator trimming range for crystal frequency error compensation	Min/max specification	+/-15	+/-30		Ppm
BR_F	Bit Rate FSK	Programmable Min Modulation index is 0.5	0.6		300	Kb/s
FDA	Frequency Deviation FSK	Programmable FDA + BR_F/2=<250KHz	0.6		200	KHz
BR_L	Bit Rate LoRa	Min for SF12 BW_L=7.8KHz Min for SF12 BW_L=500KHz	0.018		62.5	Kb/s
BW_L	Signal BW, LoRa	Programmable	7.8		500	KHz
SF	Spreading Factor for LoRa	Programmable chips/symbol=2^{SF}	5		12	
VTCXO	Regulated voltage range for TCXO voltage supply		1.6	1.7	3.3	V
ILTCXO	Load current for TCXO regulator					mA
TSVTCXO	Startup time for TCXO regulator	From enable to regulated voltage within 25mV from target				uS
IDDTCXO	Current Consumption for TCXO regulator	Quiescent current Relative to load current		1	702	uA %
ATCXO	Amplitude voltage for external TCXO applied to XTA pin	Provided through a 220ohm resistor in series with 10pF Cap	0.4	0.6	1.2	Vpk-pk

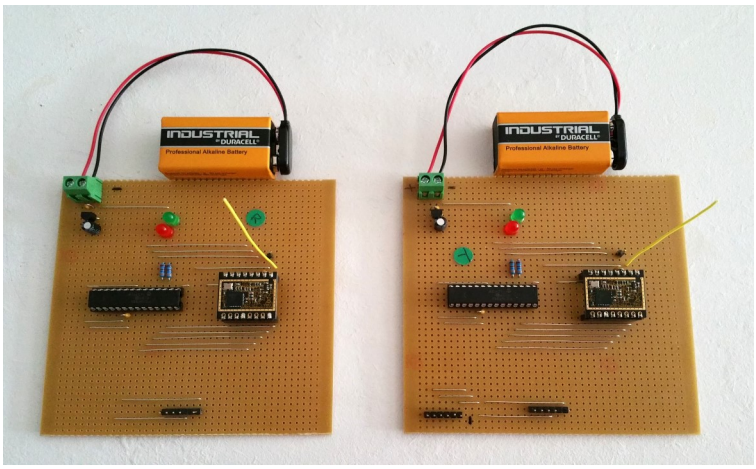
The module contains the Semetch SX1262 which is capable of these operating frequencies however the module contains an impedance matching network which is optimised for operation at 868/915, operating at other frequencies will be impractical.

Range Test Notes

Transmitter and Receiver boards were built using simple Vero board and a PIC microcontroller (16F886). The transmitter sent a beacon signal at 1 second intervals. The receiver acknowledges this signal back to the transmitter.

A simple piece of wire was used as antenna for both transmitter and receiver.

This test was designed to represent a real life application. It is often difficult to design an application with all RF features to an optimum potential i.e. the antenna was not 100% ideal as there was no antenna ground plane, and the motherboard was rudimentary,



Our Range Testing was conducted on Brighton to Shoreham Seafront providing an open Line of Sight Test.

1. The Transmitter was mounted on a plastic wheelie bin 4ft from the ground.
2. The Receiver was carried on the dashboard of a vehicle (5ft above ground) along the seafront. Line of sight was not achieved until the receiver was at least 9km distance
3. As the receiver travelled away from the transmitter Line of sight was lost . A Reliable signal was observed to about 3K range, thereafter the signal became intermittent. When the Transmitter and Receiver regained Line of sight a reliable signal was again observed. This continued for the available distance (about 12KM) at which point the terrain prevented further testing. At the longest available range the signal was 100% reliable.

Test conditions

- T_A = +25 °C
- V_{DD}= +3.3 Vdc
- Dry, Broken Sunshine, Relative Humidity 45%

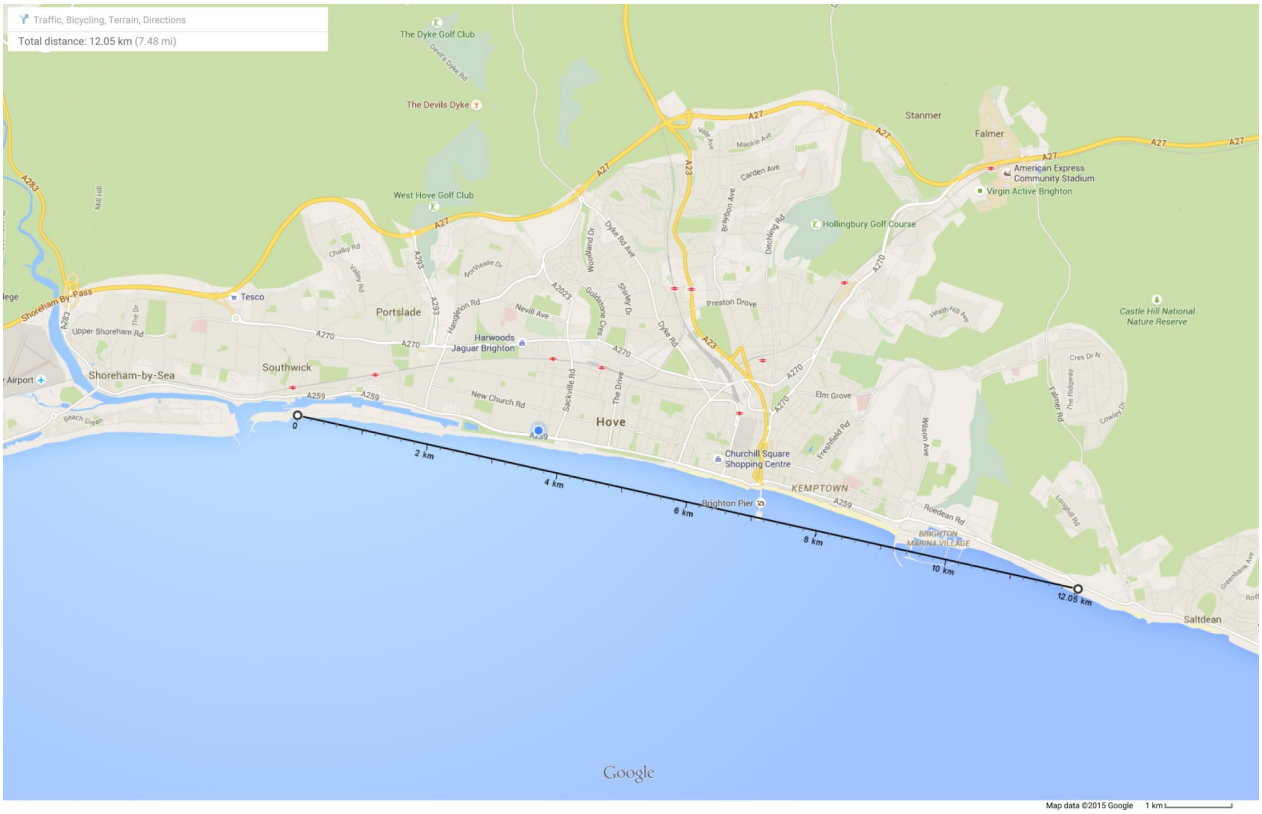
RF input and output levels can typically be achieved at the antenna port after filtering components.

Conclusion

The product performed as expected. Unfortunately we ran out of land to test a LOS beyond 12Km ,so the maximum range is further than tested here.

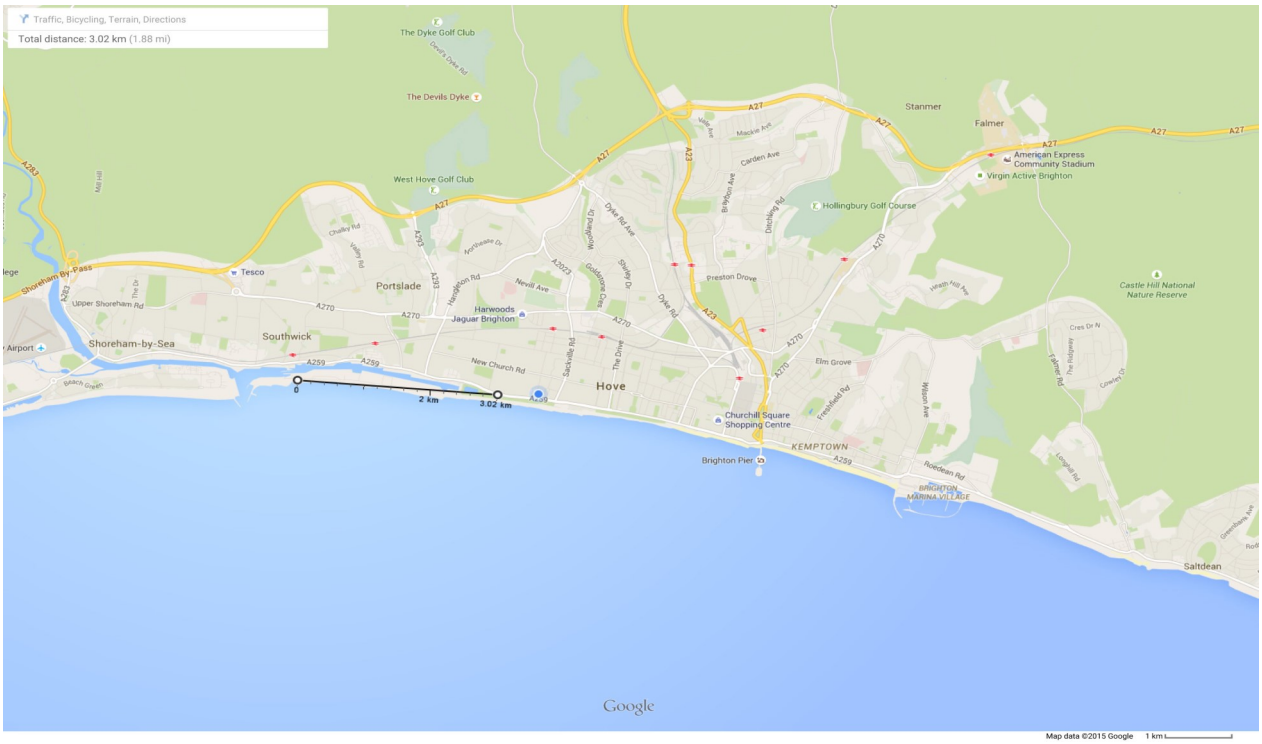
It is also clear that the product performs considerably better when in LOS.

Range Test Results (Line of Sight)



Range Test Results (Non Line of Sight)

This is subjective as the buildings were random!



LAMBDA62 Types and Device Marking

The LAMBDA62 RF module is available at 868 and 915MHz in the following types

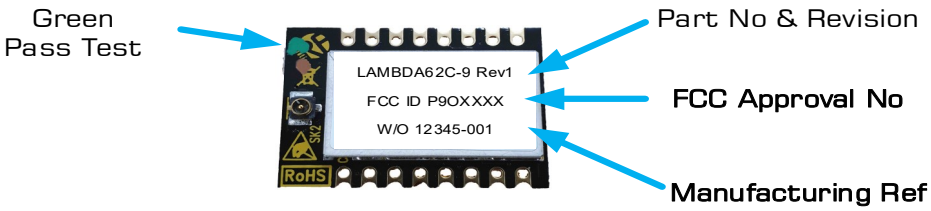
LAMBDA module is CE Compliant and at the time of writing is being submitted for modular FCC part 15 certification

Note:

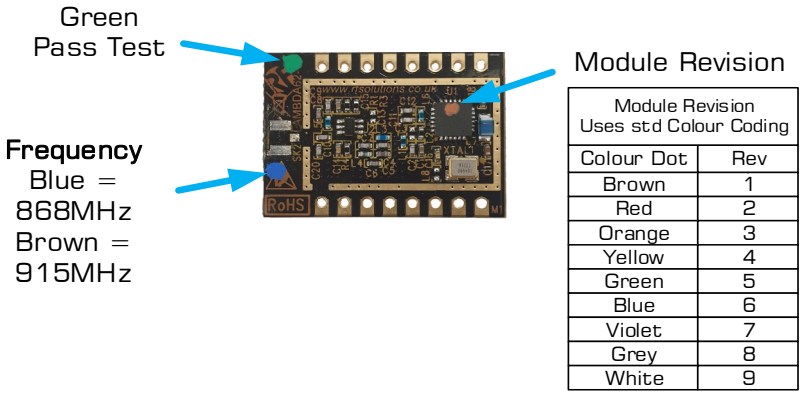
868MHz : Open module with antenna connection via pin 1 of the module. This provides the lowest cost whilst achieving CE Compliance

915MHz: With Screen Can fitted and antenna connection via ufl . This is in order to achieve Fcc Certification.

Module with Screen Can & UFL

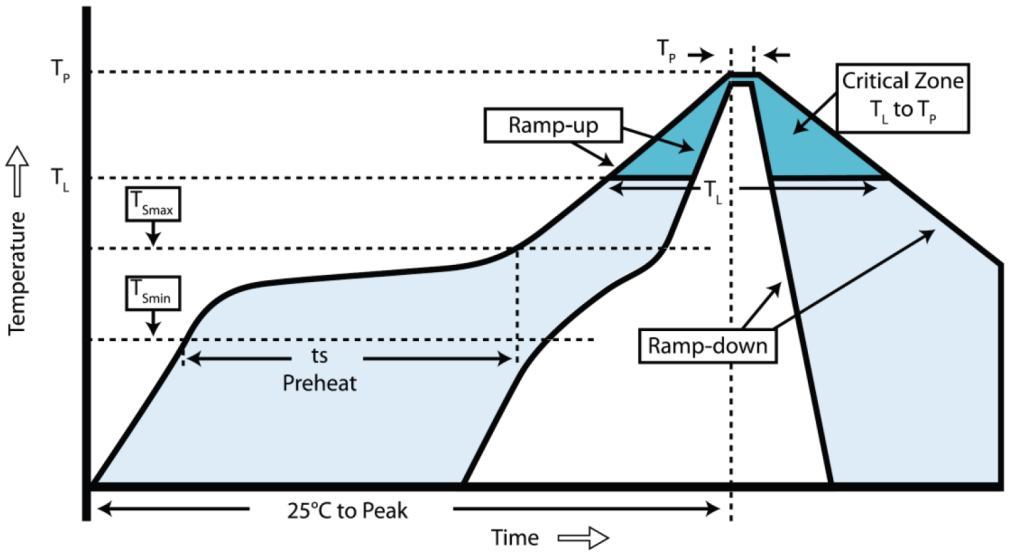


Open Module



Module Revision Uses std Colour Coding	
Colour Dot	Rev
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9

RF LoRa module re-flow guide



Profile feature	Value (lead free)
Ramp up rate	3°C /s
Pre-heat Temperature - Temperature Min (T_{Smin}) - Temperature Max (T_{smax}) - Pre-heat time	 150°C 200°C 60-100s
Peak Temperature (T_P)	240°C
Time at T_P	10-20sec
Ramp down rate	6°C/s
Time from 25°C to peak	8 mins max.

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- Поставка более 17-ти миллионов наименований электронных компонентов;
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- Оперативные сроки поставки под заказ (от 5 рабочих дней);
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- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
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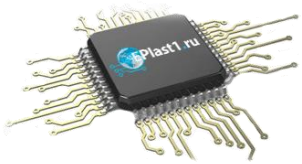
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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