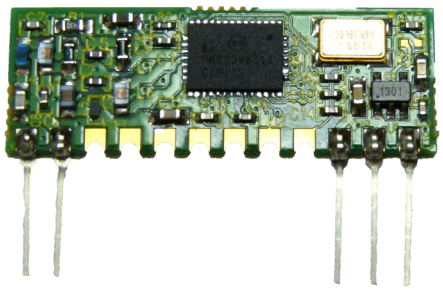
Long Range RF Modules

Features

- FM Narrow Band Crystal Stabilised
- Range up to 1,000 Metres
- 868MHz / 433MHz Versions
- 4 channel versions
  - 434.075MHz
  - 433.920MHz
  - 434.225MHz
  - 434.525MHz
- Miniature SIL Package
- Data Rates Up To 57Kbps
- En 300-220 Compliant
- Transmit Power +13dBm
- Receiver Sensitivity –121dBm
- RSSI Output



Applications

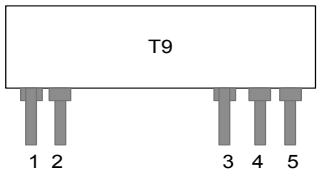
- Telemetry Systems
- Wireless Networking
- Domestic And Commercial Wireless Security Systems
- Panic Attack Facility
- General Purpose Remote Control

General Description

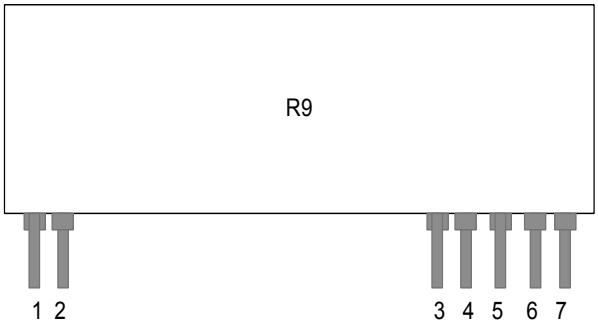
The T9/R9 series are miniature narrow band transmitter and receiver UHF radio modules, which enable the implementation of a simple telemetry link at data rates up to 57K6Kbits/s.
These narrow band UHF radio modules provide a very high RF performance for general purpose applications. The transmitter modules have a power output of up to +13dBm. When combined with a very high receiver sensitivity these modules obtain a very high performance of range and reliability within the 433MHz band.

T9 R9 RF Modules

Transmitter Connection Diagram



Receiver Connection Diagram



Pin Description:

RF GND (pin 1)
RF ground pin, internally connected to pin 4 (0v). This pin should ideally be connected to the nearest ground plane (e.g coax braid, main PCB ground plane etc.).

RF OUT (pin 2)
50 Ohm RF antenna output. To achieve best results, the antenna impedance must match that of the module.

Vcc (pin 3)
+Ve supply pin. The module will generate RF when Vcc is present.

GND (pin 4)
Supply and data ground connection, connected to pin 1.

Data IN (pin 5)
Digital Data input. The drive circuitry should be supplied with the same supply voltage as the TX module.

Pin Description:

RF IN (pin 1)
50 Ohm RF input from antenna, connect using shortest possible route. This input is isolated from the internal circuit using the air gap of the front end SAW RF filter.

RF GND (pin 2)
RF Ground connection, preferably connected to a solid ground plane.

RSSI / Carrier Detect (pin 3)
The Received Signal Strength Indicator provides a DC output voltage proportional to the RF input signal. The amplitude of the RSSI voltage
increases with increasing RF signal strength. A simple transistor interface can yield a carrier detect logic output.

GND (pin 4)
Connect to power supply ground.

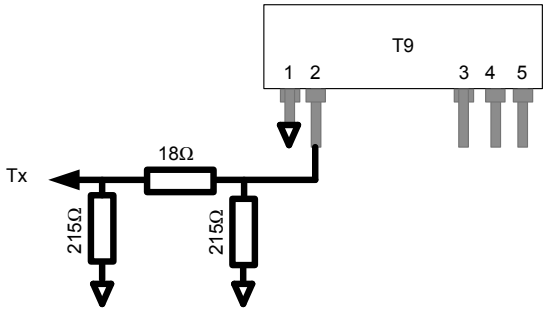
VCC (pin 5)
+Ve supply pin. Operation from a 5V supply able to source 10mA at less than 10mV p-p ripple.

AF (pin 6)
Audio frequency output (max 40microA source)

DATA OUT (pin 7)
CMOS compatible output. This may be used to drive external decoders. To reduce any noise on this output add a 56pF cap from this pin to GND.

Reducing Power to 10mW

If the T9 transmitter will be used with an efficient antenna in countries where only 10mW radiated power is allowed, then it is the responsibility of the user to ensure the radiated signal complies. A simple resistive network on the output of the module will attenuate the power down to this level. Resistor values will need to be set according to the power required



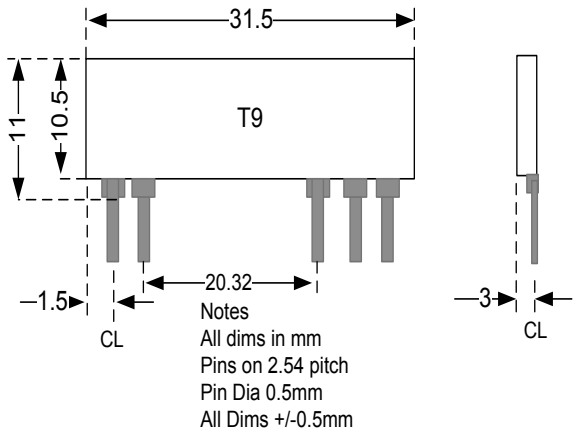
When laying out this network, keep all tracks as short as possible, especially ground paths and use 50 ohm track impedances when connecting to and from this network. This impedance can be realised on 1.6mm FR4 pcb by using a track width of 2.5mm.

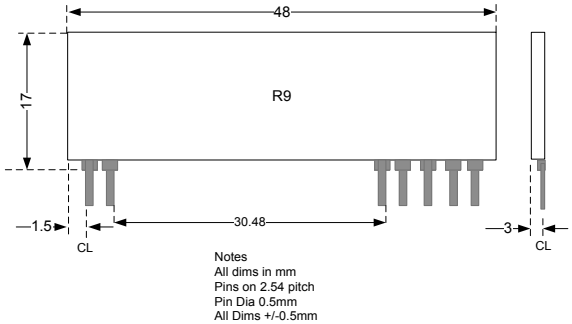
RSSI Values

The R9 receiver RSSI outputs provide a DC output proportional to the level of RF signal received. The table below shows the typical RSSI value depending on the Signal strength.

RF Signal Strength (dBm)	R9 (V)
-130	1.03
-120	1.06
-110	1.16
-100	1.34
-90	1.59
-80	1.78
-70	1.81
-60	1.81
-50	2.17
-40	2.45
-30	2.52
-20	2.52

Mechanical Dimensions





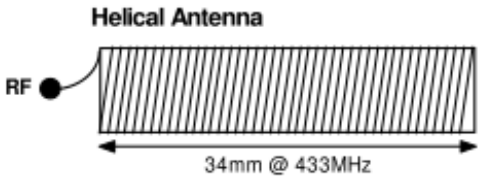
Antenna Design

The design and positioning of the antenna is as crucial as the module performance itself in achieving a good wireless system range. The following will assist the designer in maximising system performance.

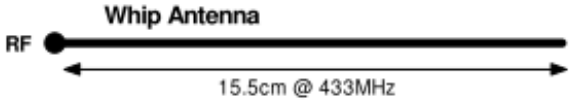
The antenna should be kept as far away from sources of electrical interference as physically possible. If necessary, additional power line decoupling capacitors should be placed close to the module.

The antenna 'hot end' should be kept clear of any objects, especially any metal as this can severely restrict the efficiency of the antenna to receive power. Any earth planes restricting the radiation path to the antenna will also have the same effect.

Best range is achieved with either a straight piece of wire, rod or PCB track @ ¼ wavelength (16.4cm @ 433.92MHz). Further range may be achieved if the ¼ wave antenna is placed perpendicular in the middle of a solid earth plane measuring at least 16cm radius. In this case, the antenna should be connected to the module via some 50 ohm characteristic impedance coax.

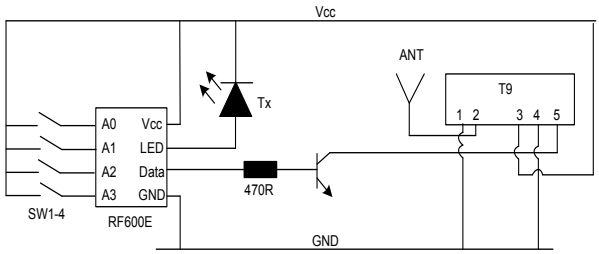


17 turns equally spaced
Ø = 5mm (inside)

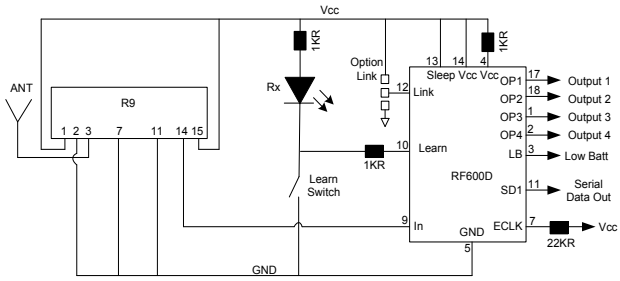


Application Circuits

The application circuits a remote control Schematic, for further Data please see DS600



The transmitter application circuits generates a highly secure Keeloq protocol four switch transmitter encoder with LED indication or Transmission.



The Receiver application circuits generates a receiver decoder with four relay drive outputs and serial data output. It has easy Learn feature of the Keeloq transmitter and provides a Transmitter lower Battery indication.

Absolute Maximum Ratings: Transmitter (all voltage versions)

	T9 3V Version		T9 5V Version	
	Min.	Max.	Min.	Max.
Operating Temperature	-25°C	+55°C	-10°C	+55°C
Storage Temperature	-40°C	+100°C	-40°C	+100°C
Supply Voltage	-	3.6V	-	24V
Data Input	-	5.5V	-	10V

Electrical Characteristics: Transmitter

	T9 3V Version			T9 5V Version			Units	Pin	Note
	Min.	Typ.	Max	Min.	Typ.	Max.			
DC Levels									
Supply (5V variants)				2.2	5.0	12.0	Volts	3	
Supply (3V variants)	2.2	3.0	3.6				Volts	3	
Current & RF Power									
Supply current		30			30		mA	3	1
RF output power			+13			+13	dBm	2	1
RF & Data (All Variants)									
2nd harmonic		-60			-40		dBm		2
Harmonics @ > 1GHz		-60			-50		dBm		2
Initial frequency accuracy		+/-25			+/-25		Hz		
Frequency accuracy over full temp range			+/-30			±27	KHz		
Modulation bandwidth @ -3dB		50			50		KHz		3
Power up time to full RF		17			17		ms		
Data rate			20			20	kbps		
Data pulse width	50			50			ms		

Notes

1. Measured into a 50ohm impedance.
2. The limit for the European spec EN 300 220 is -36dBm
3. A +/-2.5KHz Deviation on the RF carrier is also available

Absolute Maximum Ratings: Receiver

	R9	
	Min.	**Max.**
Operating Temperature	-10°C	+55°C
Storage Temperature	-40°C	+100°C
Supply Voltage	-	24V
Data Input	-	5.5V

Electrical Characteristics: Transmitter

	R9			Units	Notes
	Min.	**Typ.**	**Max.**		
DC Levels					
Supply voltage	4.5	5	5.5	V	
Supply current		6	7	mA	
Supply ripple	-	-	10	mV_{P-P}	
Data output high		=>4.5		V	
Data output low		<=0.5		V	
RF					
RF sensitivity		-116		dBm	
IF Bandwidth		+/-27		KHz	
Initial frequency accuracy		+/-100		Hz	
Max R.F. input		20		dBm	
E.M.C.					
Spurious responses up to 1GHz		<60		dB	
LO leakage, conducted		<60		dBm	
LO leakage, radiated		<60		dBm	
Image rejection		63		dB	
DYNAMIC TIMING					
Power up to stable data *(With RF signal present)*		18	23	mS	1
Signal to stable data *(With PSU already on)*		2.5	5	mS	1
Power up to valid RSSI (With RF signal Present)		3	5	mS	1
Mark:space ratio		50		%	
Bit rate	100		20000	Bps	3

Notes

1. Timings are to be confirmed.
2. Note 1Hz = 2 bps

T9 R9 RF Modules

Part Numbering—Transmitters

Part No	Operating Frequency	Operating Voltage
T9-434-075	434.075MHz	5-10V
T9-434-075-3V	434.075MHz	3V
T9-433-920	434.920MHz	5-10V
T9-433-920-3V	434.920MHz	3V
T9-434-225	434.225MHz	5-10V
T9-434-225-3V	434.225MHz	3V
T9-434-525	434.225MHz	5-10V
T9-434-525-3V	434.225MHz	3V

Part Numbering—Receivers

Part No	Operating Frequency	Operating Voltage
R9-434-075	434.075MHz	5-10V
R9-433-920	434.920MHz	5-10V
R9-434-225	434.225MHz	5-10V
R9-434-525	434.225MHz	5-10V

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Meets the following EC Directives:

DO NOT
Discard with normal waste, please recycle.

ROHS Directive 2002/95/EC
Specifies certain limits for hazardous substances.

WEEE Directive 2002/96/EC
Waste electrical & electronic equipment. This product must be disposed of through a licensed WEEE collection point. RF Solutions Ltd., fulfills its WEEE obligations by membership of an approved compliance scheme.

Waste Batteries and Accumulators Directive 2006/66/EC
Where batteries are fitted, before recycling the product, the batteries must be removed and disposed of at a licensed collection point.

Environment Agency producer registration number:
WEE/JB0104WV.

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