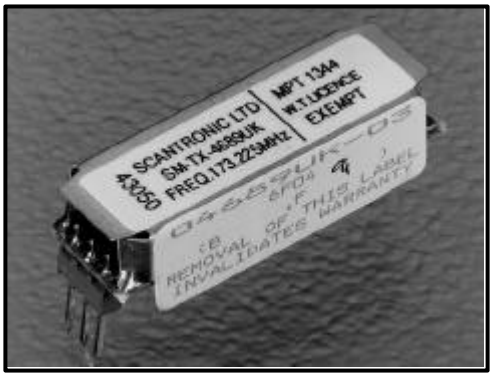
FM 173 MHz Transmitter Module

TXM173-4689-UK03

FEATURES

- **SMALL SIZE, DIRECT PCB MOUNTING**
- **LOW POWER REQUIREMENTS (9mA@ 5 volt)**
- **DIRECT DIGITAL DATA INPUT (CMOS COMPATIBLE)**
- **LICENCE EXEMPT 10 mW OUTPUT POWER,**
- **TYPE APPROVED TO MPT1328 & MPT1344 (UK)**
- **RANGE UP TO 1000m**
- **WIDE OPERATING TEMPERATURE**



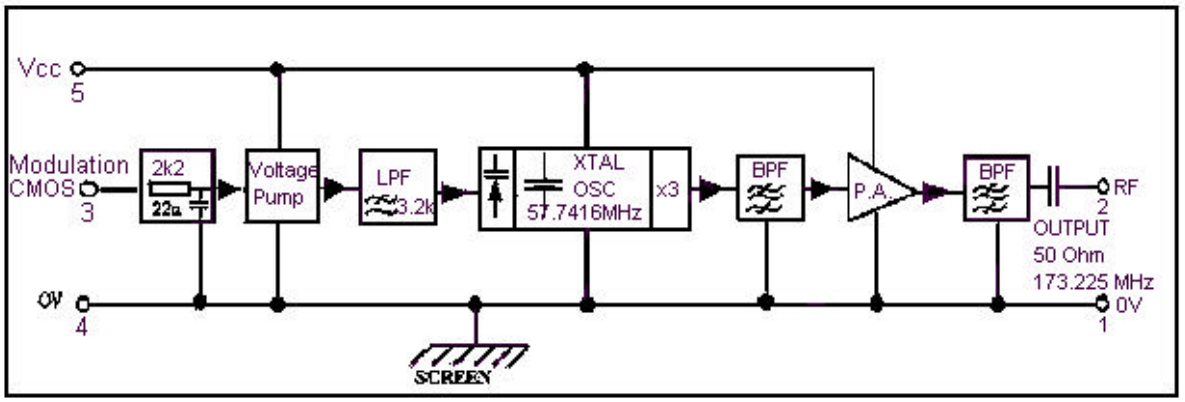
DESCRIPTION

The RF Solutions 4689 transmitter is a modular, PCB-mounting, low power VHF Narrow Band Frequency Modulation (NBFM) telemetry transmitter, designed for use with the 466 receiver module.

The module contains all the RF and modulation circuits required for the transmit end of a short-range, low power, telemetry link.

Fully screened and filtered to reduce spurious emissions these modules can offer an optimum range of up to 1000m when used with suitable antenna.

BLOCK DIAGRAM



FUNCTIONAL DESCRIPTION

MODULATION INPUT, pin 3

This input requires a 0 volt to Vcc logic drive (i.e. a CMOS output), the required bandwidth limiting filter is internal to the module (2nd order, 3.2 kHz low pass). It is recommended that 'HC' logic be used to drive this input for supply voltages of less than 3 Volts and either 'HC' or '4000' series for supplies above 3 volts.

The rise and fall time of the logic drive are uncritical but should be less than 100 µS to avoid any further bandwidth reduction. The module's input circuit looks like 2200Ω resistance in series with 22nF reactance.

SUPPLY INPUT, pin 5

The module is designed for battery powered applications and has a supply range of 2.2 to 3.6 volts. Typically 2 manganese/alkaline cells or a single lithium/manganese or lithium/thionyl-chloride cell. The module will withstand a temporary supply reversal up to 4 volts without damage.

The supply should be clean (less than 50 mV ripple) and able to source up to 5 mA. The module may also be powered from a 3 to 5 volt supply or directly from a CMOS logic output capable of sourcing the required current (eg. any 'HC' series device).

NOTE

In order to comply with the MPT 1328/1344, consideration must be given to the power output/supply voltage graph, the gain of the transmitting antenna and any feeder losses, to ensure that the effective radiated power (ERP) does not exceed 0 dBm (1 mW). ERP levels up to 10 mW may be licensed for use on industrial sites.

RF OUTPUT, pin 2

The module will deliver 1 mW into a 50Ω load and is unconditionally stable into any load. The RF output pin is capacitively isolated from the internal circuitry and will withstand ±30 Volts DC on this pin.

Good RF layout practice should be followed regarding PCB tracking to this pin and the adjacent ground pin. Specifically:

- keep unscreened wiring/tracking between the RF output and the antenna to a minimum (less than 20mm)
- twist and minimise any lengths of wiring.
- run antenna PCB track 0.1 inch wide under a ground plane (50Ω microstrip for 1 .6mm glass fibre board) and connect ground plane to module's ground.

RF GROUND, pin 1

This pin should be used as a ground point for external RF circuits e.g. coax braids, antenna matching networks etc.

GROUND, pin 4

This pin is a general ground for the supply & modulation inputs, it is internally connected to the RF ground (pin 1, J1) and the screen can.

APPLICATION AND USE

The module is suitable for low bit rate (less than 1000 bps) telemetry links up to 1 Km (see section on antenna).

DATA ENCODING METHODS

The module may be used to send data in many formats eg.;

a) DTMF
b) bi-phase (manchester) (0-500 bps)
c) 2 tone (AFSK) (tones - 20Hz to 1500 Hz, data - DC to 300 baud)
d) delta modulation up to 1KHz sample rate (DC - 100 Hz analogue bandwidth)
e) CCITT \V21 modem tones (300 baud)
f) any serial code which conforms to the data input pulse width restrictions

NOTE:

The module cannot send asyncronous NRZ (eg UART/R5232) data directly, it must be tone encoded first.

The choice of encoding method depends upon the application and nature of the data to be transferred. A good selection of stand alone encoders/decoders are available to suit many of the more common requirements including:-

1) MM53200 (Nat Semi), UM3750 (UMC)
2) MC145026/27/28/29 (Motorola)
3) ED 9/11/15 (Supertex)
5) M13520 (Mitel), XR-14412 (Exar)
6) TP5OWI/88/89 (Nat Semi Plessey, Texas)
7) MEE/8O (MITEL)

NOTE: non-logic outputs must be squared up before driving the TX Module.

When choosing a data format the following points should be considered:-

a) Slow data rates with matching decoder filtering will give greater ranges/data reliability.

b) Keep transmit duration to a minimum in non-polled multi-transmitter systems to minimise 'radio clash' (two transmitters on at once).

c) Systems dependent on the radio link should fail gracefully in the event of loss of signals through radio clash or interference. (e.g. retry/failsafe/report error etc).

d) Checksum/hamming coding/CRC/ redundancy should be employed in all but the simplest of applications.

e) It is recommended that at least 10 mS of preamble to be sent prior to the valid data to allow the RF/data circuits in the transmitter and receiver modules to stabilise e.g. alternate I/Os, high or low tone, ‘junk' data etc.

Notes regarding signal recovery using the matching RXM-466 receiver:-

If the receiver module's internal data squaring circuit (RXD output) is to be used to recover the data, the transmitter's modulation input data should have a 'time averaged' (over any 50mS period) DC level between 0.2 Vcc and 0:55 Vcc to ensure optimum operation of the data slicer. Where this is not the case (i.e. 'mostly high' or 'mostly low' serial data) it is recommended that AF output of the receiver module to be fed to an external data recovery circuit. It is also recommended that the AF output of the receive module to be used for recovery of DTMF, AFSK and V21 modulation.

ANTENNA AND SYSTEM RANGE

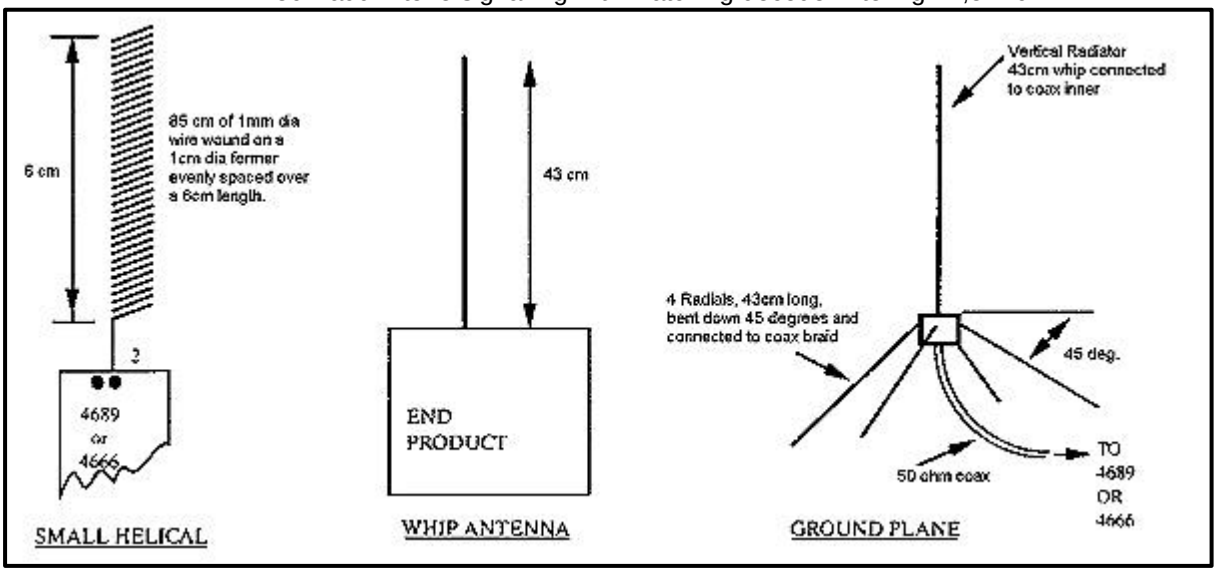
The range of a TXM-4689/RXM-466 RX/TX combination depends upon the antennas employed at each end of the link, the nature of the intervening path and to a lesser extent the method of data encoding/decoding employed.

As a reference -
the TXM-4689/RXM-466 combination with halfwave dipole antenna at each and 500 baud manchester data gives a range of 300 to 600 metres over flat open ground.
The following 'multipliers' should assist with range estimates

PATH factors	open, line of site	1 (ref)
	open, obscured path	0.3-0.9
	built-up area	0.2-0.5
	in building (brick)	0.1-0.3
	in building (reinforced concrete)	0.05-0.3
	tunnels	0.05-2
ANTENNA TYPES (either end)	10 element 'Yagi' (10 dBd)	**l.5-2
	4 element 'Yagi' (6 dBd)	**1.3-1.5
	1/2 Wave dipole	1 (ref)
	1/4 Wave 'wire	0.7-1'
	'helical'	0.7-0.9
	10 cm tuned wire	0.5-0.7
	10 cm untuned wire	0.1-0.3

**=receive end only, use on transmitter exceeds DTI regulations on radiated power.

DATA MODULATION	500 Baud 'manchester'/bi-phase	1 (ref)
	50 Baud 2-tone signalling with matching decoder filtering	1,5-2.0



TECHNICAL DATA

Absolute maximum ratings: Exceeding the values given below may result in damage to the module

Supply voltage Vcc……..- 0.3 to +7.0 Volts DC
Modulation input Vmod……..- 0.3 to +7.0 Volts DC
Operating temperature Tamb……. -10 to + 55 °C
Storage temperature Tstr……. - 40 to +40 °C

PERFORMANCE SPECIFICAIIONS
Vcc=5.0V, tamb = +20°C. unless staled otherwise.

Parameter	Min.	Typ.	Max.	Units	Notes
Operating supply voltage	+4.5	+5.0	+5.5V	V	
Supply current	7	9	11	MA	
Output power	+8	+10	+12	dBm	1
ERP with specified antenna			0	dBm	2
Output frequency		173.225		MHz	
Frequency accuracy	-2.0	0	+2.0	kHz	3
Spurious and harmonic output		-60	-45	dBm	1&2
FM deviation	±1.5	±2.5	±3.5	kHz	4
Modulation bandwidth (tones)	0		1500	Hz	5
Data input pulse width	1			mS	6
Modulation input resistance	2.2			kΩ	
Modulation logic "low" input	-0.5		+0.5	V	7
Modulation logic "high" input	Vcc-0.5		Vcc+0.5	V	7

Notes:
1) Into 5OΩ resistive load.
2) Use of antennas other than the specified type will invalidate the MPT1344 approval.
3) Total, over full supply and temperature range.
4) Standard modulation 500Hz squarewave, Vlow = 0V. Vhigh = Vcc.
5) AFSK modulation, 3dB points.
6) Direct data. 10% telegraphy distortion (high or low).
7) Output frequency is low for logic low input. high for logic high input (true data).

For more information or general enquiries, please call;

R. F. Solutions Ltd,
Unit 21, Cliffe Industrial Estate,
South Street, Lewes,
E Sussex. BN8 6JL.
England.

Tel +44 (0)1273 898 000
Fax +44 (0)1273 480 661.

http://www.rfsolutions.co.uk Email :sales@rfsolutions.co.uk

RF Solutions is a member of the Low Power Radio Association.