RADIOMETRIX

TLM2-458-5   PRELIMINARY   Issue A, 08th October 2009

NBFM Multi-channel 500mW UHF Transmitter

The **TLM2 transmitter module offers a 500mW RF output in the UK 458MHz. This unit is ideally suited to applications where existing lower powered transmitters provide insufficient range. The TLM2 transmitter is a multi-channel, narrowband design, suitable for licensed and unlicensed UHF allocations. Together with a matching LMR2 receiver a one-way radio data link can be achieved over a distance of well over 5km (with a suitable antenna).**
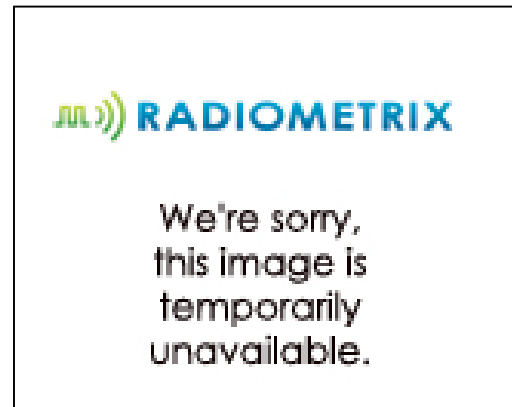

Figure 1: TLM2-458-5

Features

- Conforms to EN 300 220-3 and EN 301 489-3
- PLL Synthesized transmitter with TCXO
- Data rates up to 5 kbps for standard module
- Usable range over 5km
- Fully screened
- User configurable via RS232 interface
- Low power requirements

Applications

- Handheld terminals
- On-site paging system (e.g. Nurse call pagers)
- Heavy vehicle/machine remote controls
- Data loggers
- Industrial telemetry and telecommand
- High-end security and fire alarms
- Vehicle data up/download

Technical Summary

- Operating frequency: 458.525 - 459.1MHz (standard)
  or 458.8 - 459.3MHz and 461.3MHz (for paging)
- 32 channels
- Transmit power: +27dBm (500mW) nominal
- Supply range: 6V - 9V
- Current consumption: 350mA transmit, <5μA standby
- Data bit rate: 5kbps max. (standard module)
- Size: 74 x 38 x 14 mm
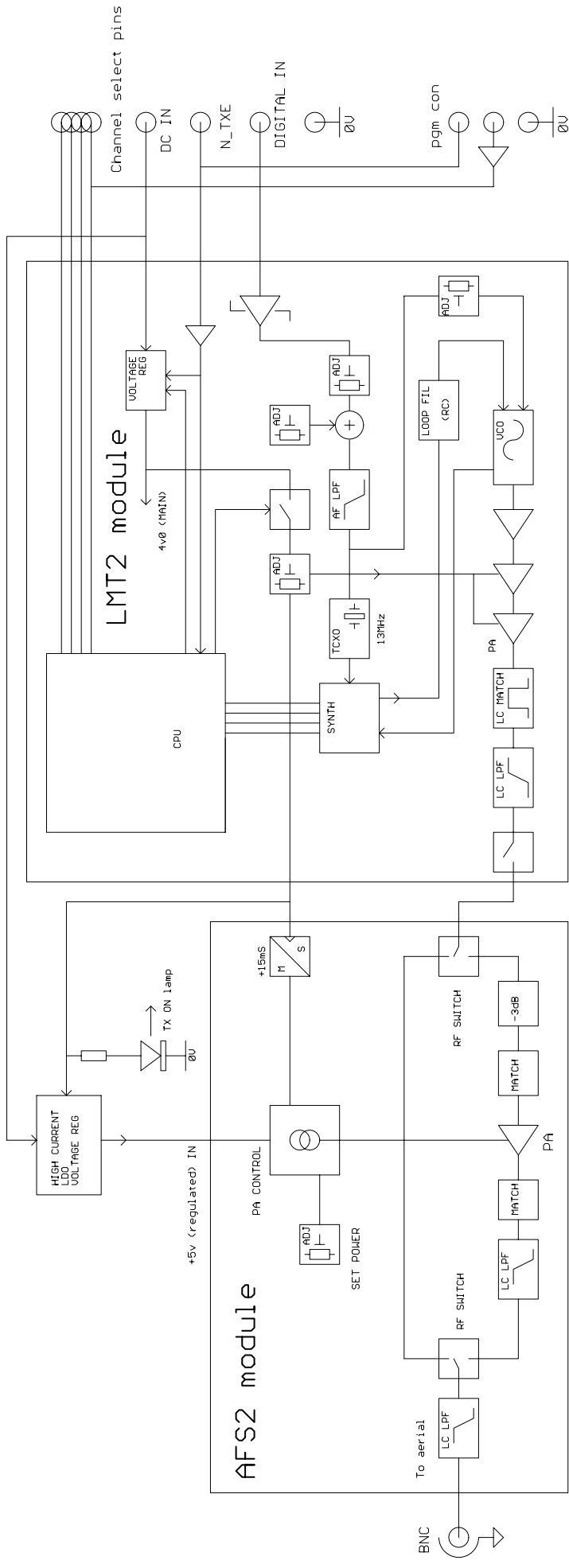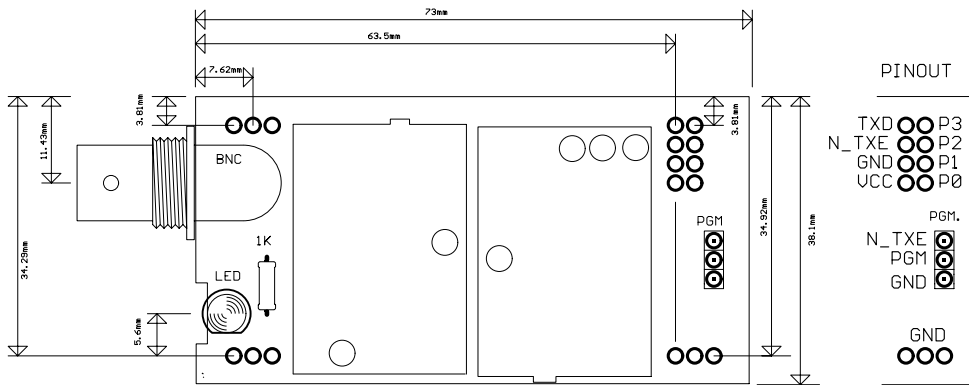
TLM2 500mW narrowband transmitter

Channel select pins
DC IN
N_TXE
DIGITAL IN
0V
pgm con
0V

LMT2 module

CPU

SYNTH

TCXO 13MHz

ADJ

AF LPF

ADJ

ADJ

VOLTAGE REG

4v0 (MAIN)

ADJ

LOOP FIL (RC)

VCO

PA

LC MATCH

LC LPF

AFS2 module

HIGH CURRENT LDO VOLTAGE REG

TX ON lamp
0V

+5v (regulated) IN

PA CONTROL

SET POWER
ADJ

+15mS
M S

RF SWITCH

-3dB

MATCH

PA

MATCH

LC LPF

RF SWITCH

To aerial

LC LPF

BNC

Figure 2: TLM2 block diagram

Figure 3: TLM2 Footprint (Top) view through can

User Interface

Pin description

Pin	Name	Function
1a	Vcc	6-9v DC supply (15v max). 350mA max. current drain
2a	0V	Ground
3a	$\overline{\text{TXE}}$	Transmitter enable. Low = ON, open = off. 100K pullup to raw Vin
4a	TXD	DC coupled input for 3V CMOS logic. R_{in}=47kΩ
1b	P0/PGM	Serial programming / control input (inverted logic level rs232)
2b	P1	'Transmitter in-lock' output (active high)
3b	P2	No connection
4b	P3	Serial output (inverted logic level rs232)

Notes:

1. No 'modem version' is available
2. A version with a simplified (16/32 channel, parallel select) user interface identical to the LMT2, is available
3. A remote control 'actuator' software version is available, compatible with the LMR2-CX
4. P0 input has a 50K pullup to internal 4v rail
5. An ancillary connector (PGM) is provided to allow direct connection of an RS232 (non-inverted, true levels) port via a 3 pin 0.1" pitch connector, for limited in-circuit re-programming by PC. This connector does not provide a 'read back' output.
6. Continuous transmission at input voltages above 9v is not recommended, unless forced air (fan) cooling is provided. If duty cycle can be kept low, and the length of transmission minimised, then up to 15v can be used
7. This is a 500mW output product. Good grounding , good quality aerials, properly mounted, and a low impedance power supply are required if full performance is to be reliably obtained. If feasible, we recommend mounting the module, and the board it is on, inside a metal enclosure, with the RF connector exiting through a bulkhead. All signal and power feeds should be filtered and/or decoupled.
   Failure to observe these measures can cause modulation distortion ('recirculation' effects) or instability. Also be aware of the effect that the strong RF fields generated by this device (and it's aerial) can have upon other adjacent circuitry if this is not properly screened, filtered or otherwise protected. Regulators, sensitive analogue circuitry, and microprocessors seem especially interference prone.
8. This design uses a version of the LMT2 100mW transmitter, and the AFS2 500mW power amplifier module

Serial interface commands

The internal firmware for TLM2 has two versions.

> **Version 1** is IDENTICAL to our standard LMT2-458-5 (100mW) in all respects

> **Version 2** is specific to paging applications.

Version 1: programming instruction

2400 baud RS232. 8 bit data, no parity, 1 start bit, 1 or 2 stop bits.

Serial data is sent to the unit on one of the parallel channel select pins (P0). It is very important that the unit does not 'decode' switch bounce in ordinary operation as a command string, or spurious re-writing of the e2prom will result. For this reason the user must send the 16 character string   ENABLESERIALMODE (followed by a carriage return) to activate the serial command mode before sending any of the command strings listed below. Command mode is disabled on power down, or on reception of a # character. To successfully program the unit, it must be enabled ('RXE high (rx) or TXE low (tx)).

GOCHAN aa	Serially select channel aa, where aa is ch0 to ch31
LOAD aa nnnnn	Set value of N register for channel aa, where aa is Channels 0 to 31
SETPAR	Channel selected by 4 bit parallel inputs (ch0 to ch15 only)
SETSER	Channel selected by most recent GOCHAN operation
RVALUE rrrr	Set value for R register
SINGLE nnnnn	Set value of N for single channel operation. N value NOT stored in EEPROM
<cr>	Process entry
/	Clear all buffers
#	Disable command mode

aa = a two digit channel number from 00 to 31
nnnnn = synthesizer N register value (up to 65535)
rrrr = synthesizer R register value (up to 16383)

$$N = \frac{f_{RF}}{f_{Channelspacing}} = \frac{458.525MHz}{25kHz} = 18341$$

$$R = \frac{f_{TCXO}}{f_{channelspacing}} = \frac{13MHz}{25kHz}, \text{ So } R=520$$

Note: *A pause of at least 50ms must be allowed between command strings (EEPROM programming time). SINGLE mode does not store the N value in EEPROM. Therefore the unit is inoperative after a power down until either another valid SINGLE command is received, or mode is changed by a GOCHAN, SETPAR or SETSER command. SINGLE mode is intended for frequency agile applications.*

Version 2: programming instruction

The TLM2 provides 32 individually programmable channels

(As supplied, CH00-CH20 are programmed to 458.8 - 459.3MHz, and channels 21-31 are all set to 461.3MHz)

GOCHAN aa	Serially select channel aa, where aa is ch0 to ch31
TEMP aa	select channel aa, but revert to last GOCHAN value on next key-up
LOAD aa nnnnn	Set value of N register for channel aa, where aa is Channels 0 to 31
RVALUE rrrr	Set value for R register
<cr>	Process entry
/	Clear all buffers

aa = a two digit channel number from 00 to 31 (and it MUST be two digits, so use "01" instead of "1".etc)
nnnnn = synthesizer N register value (up to 65535)
rrrr = synthesizer R register value (up to 16383)

$$N = \frac{f_{RF}}{f_{Channelspacing}} = \frac{458.800MHz}{25kHz} = 18352$$

$$R = \frac{f_{TCXO}}{f_{channelspacing}} = \frac{13MHz}{25kHz} \text{, So R=520}$$

Notes:

1. A 2400 baud cmos level 'inverted RS232 format' (1 start bit, 8 data, 1or 2 stop bits, no parity) is used.
2. The unit echos all bytes sent back on the P3 output.
   Following any successful operation, the bytes   OK <cr> are also sent back, when the unit is ready.
3. To successfully program the unit it must be in active state (txe low), so provision should be made to force the unit into this state while programming (the third pin on the auxiliary programming connector does this).
4. All commands except the non-volatile TEMP aa initiate an e2prom programming sequence. 50mS must be left before the next command is sent.
5. These units employs a sub-set of the programming commands used by standard LMT module. (As the P0 pin is dedicated to serial communication only, the 'ENABLESERIALMODE' command string is NOT required.)

Condensed specifications

Frequency	As supplied: Version 1: 458.525 - 459.1MHz (25kHz steps) Version 2: 458.8 - 459.3MHz (25KHz steps) and 461.3MHz
Frequency stability	+/- 1.5kHz
Channel spacing	25kHz
Number of channels	32 channels controlled via RS232 interface
Transmit	
Output power	+27dBm (500mW) ±1dB
TX on switching time	50 ms from $\overline{TXE}$ transition
Modulation type	FSK (F3D)
TX modulation bandwidth	DC – 3kHz (3v CMOS compatible DATA input)
Adjacent channel TX power	<-37dBm
TX spurri	<-40dBm (no output in standby)
Spurious radiations	Compliant with ETSI EN 300 220-3 and EN 301 489-3
Inputs	data (CMOS/TTL compatible)
Supply V*oltage*	+6 to 9v (6-15v for intermittent operation)
Current	350mA nominal transmit
	<5μA standby ($\overline{TXE}$ high or floating)
Interface	
User	4+4 pin 0.1" pitch DIL header, plus 3 x 3pin 0.1" pitch SIL 'mounting' headers (PGM)
RF	BNC (bulkhead type)
	A 2mA LED indicator may be fitted by the user. A 1K series resistor (from 5.3v) is provided
Recommended PCB hole size	1.2mm (min.)
Size	74 x 38 x 14mm (not including connectors, which increase the length)
Operating temperature	-20 to +55 ^{o}C (Storage -30 to +70 ^{o}C)
Intended approval	ETSI Radio standard EN 300 220-3 and EMC standard EN 301 489-3

Ordering Information:

Part No.	Frequency band
TLM2-458-5 (version 1)	458.525 - 459.1MHz
TLM2-460-5 (version 2)	458.8 - 459.3MHz and 461.3MHz
Matching Receiver	
LMR2-458-5 (version 1)	458.525 - 459.1MHz
LMR2-460-5 (version 2)	458.8 - 459.3MHz and 461.3MHz

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R&TTE Directive

After 7 April 2001 the manufacturer can only place finished product on the market under the provisions of the R&TTE Directive. Equipment within the scope of the R&TTE Directive may demonstrate compliance to the essential requirements specified in Article 3 of the Directive, as appropriate to the particular equipment.
Further details are available on The Office of Communications (Ofcom) web site:
http://www.ofcom.org.uk/radiocomms/ifi/

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