

SFX2

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500mW NBFM Multi-channel UHF Transceiver

The SFX2 transceiver module offers a 500mW RF power output in the UK 458MHz band. This makes the SFX2 ideally suited to those low power applications where existing multi-channel narrow band devices like TR2M have insufficient range.



Figure 1: SFX2-458-5 transceiver

Features

- Conforms to EN 300 220-2 and EN 301 489-3
- High performance double superhet, 255 channel PLL Synthesizer with VCTCXO
- Data rates up to 5 kbps for standard module
- Fast TX switching time (5ms typ.)
- Usable range over 5km (@ 500mW)
- Fully screened
- Feature-rich interface (RSSI, automatic noise squelch, analogue and digital baseband)
- User configurable via RS232 interface

Applications

- Handheld terminals
- Heavy vehicle/machine remote controls
- EPOS equipment, barcode scanners
- Data loggers
- Industrial telemetry and telecommand
- In-building environmental monitoring and control
- High-end security and fire alarms
- Vehicle data up/download

Technical Summary

- Operating frequency: 458.5-459.1MHz UK (23 channels)
- Up to 255 channels (8 parallel selected).
- Transmit power: +27dBm nominal (adjustable 100 - 500mW)
- Supply range: 6V – 15V DC (10% transmit duty cycle), 6V - 9V DC (Continuous Transmission)
- Current consumption: 350mA transmit, 35mA receive
- Data bit rate: 5kbps max. (standard module)
- Receiver sensitivity: -118dBm (for 12 dB SINAD)
- Size: 59 x 39 x 15mm

Evaluation platforms: NBEK + yy2M Series carrier

SFX2-458-5

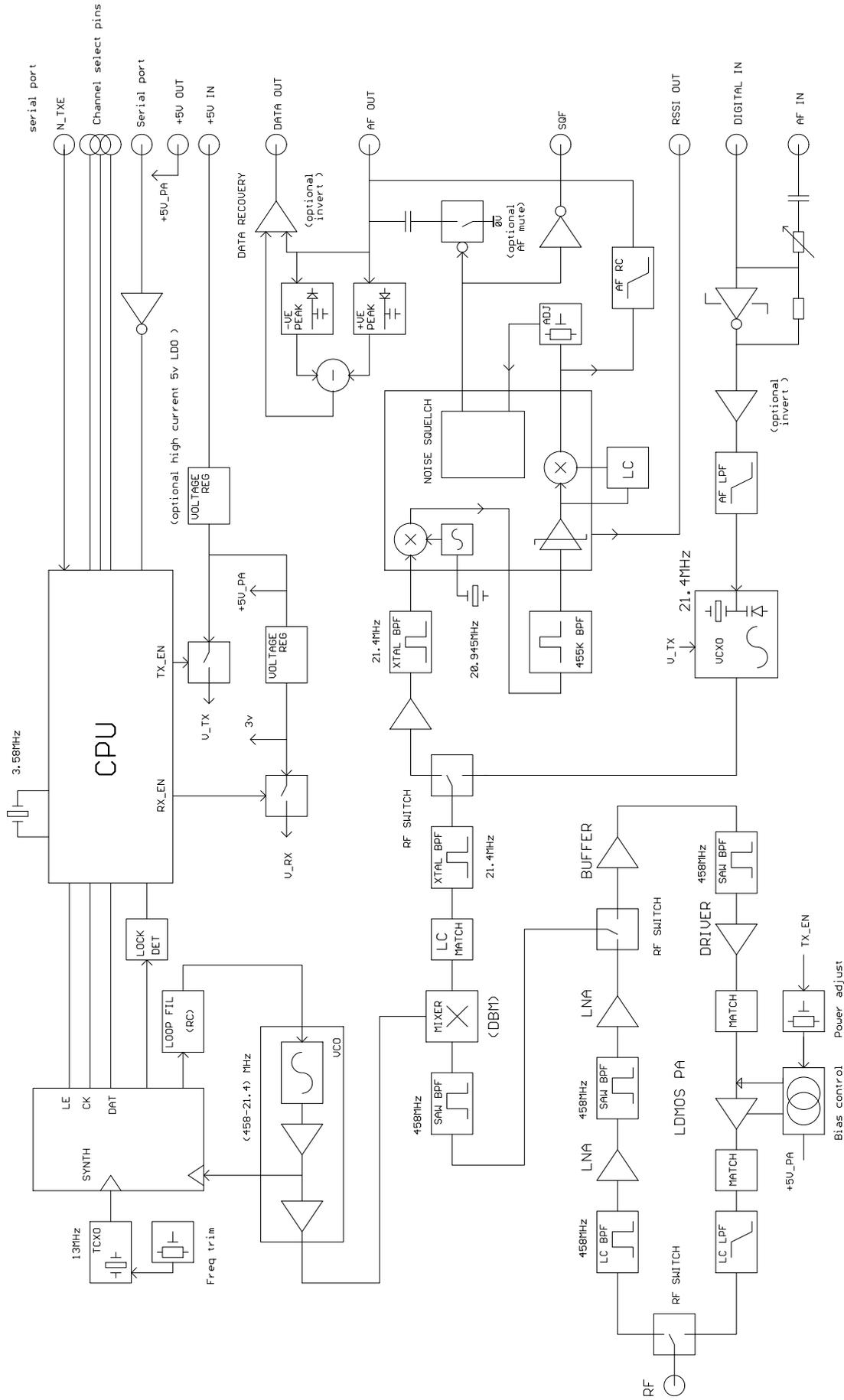


Figure 2: SFX2 block diagram

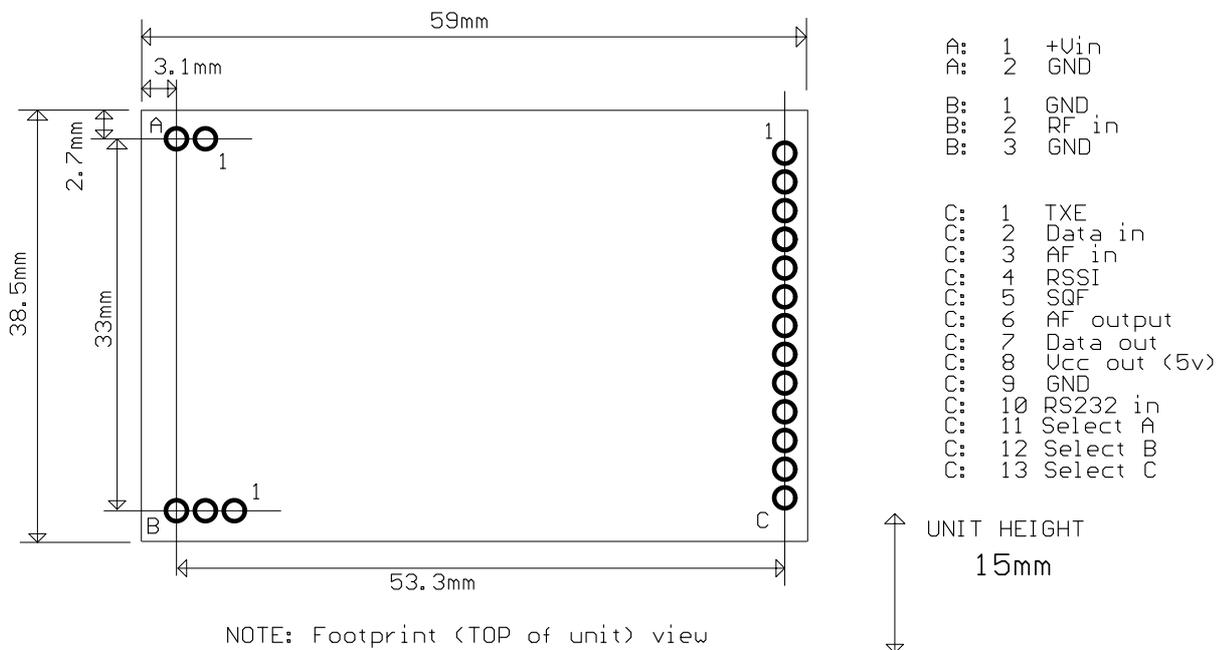


Figure 3: SFX2 Footprint (Top) view

Pin Description - SFX2

| Pins | Name | Function |
|------|---------|-----------------------------------------------------------------------------------------------|
| A1 | Vcc | 6V - 15V |
| A2 | GND | Ground |
| | | |
| B1 | RF GND | RF ground |
| B2 | RF | To the antenna |
| B3 | RF GND | RF ground |
| | | |
| C1 | TXE | Transmitter Enable. Low = ON, Open = RX mode. Internal 10kΩ pull-up to 5V |
| C2 | TXD | DC coupled digital data input for 3-12V CMOS logic. Leave open if unused |
| C3 | AF in | 50mV-2.5V _{pk-pk} AC coupled variable gain input. Factory set to 1V _{pk-pk} |
| C4 | RSSI | DC level between 0.5V and 2.5V. 60dB dynamic range |
| C5 | SQF | Noise operated carrier detect. Open collector. ON/low = no signal |
| C6 | AF out | 200mV _{pk-pk} audio. DC coupled, approx 1V bias. Muted by squelch |
| C7 | RXD | Open collector output of data slicer suitable for Biphase codes |
| C8 | +5V out | Regulated DC supply. 100mA max. drain. Present if unit is powered |
| C9 | 0V | Ground |
| C10 | PGM | Serial programming/configuration input at RS232 level |
| C11 | P1 | Parallel frequency select inputs. Inverted logic, internal 50kΩ pullups to 5V |
| C12 | P2 | |
| C13 | P3 | |

Notes:

1. By changing specific links and components, either the rx and/or the tx path can be made to invert the sense of the baseband waveform, or not. Standard issue SFX2 inverts on both tx and rx paths (so is equivalent to a TR21-458-5)
2. Carrier detect mutes the AF and DATA outputs. It can be disabled by either rotating the level set trimmer fully ACW (disabling both) or by removing the solder link (which disables only the AF mute). The carrier detect is relatively slow (approx 25mS) so is not compatible with the full sub 10mS tx/rx switching speed capability of the unit
3. There is no pullup on the SQF open collector output. RXD has 47K to internal 5v
4. Unlike the parent TR2M, the SFX2 does not incorporate an i1200 modem
5. RS232 input (pin 10) tolerates true +/- levels. No buffering is required.

Channel mapping

The SFX2 has a 255 channel capacity.

The first 32 channels are individually programmable (they have their own N register stores).

The remaining channels (32-255) constitute a sequential table

In serial mode the channel is selected by a GOCHAN xxx command

In parallel mode the lowest 8 channels are selected by the state of P1, P2, P3

SFX2 serial configuration commands

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

| | |
|---------------|--------------------------------------------------------------------------------------|
| SINGLE nnnnn | Set value of N for single channel operation. N value NOT stored in EEPROM |
| GOCHAN xxx | Serial select of channel aaa (ch0 to 255), store to EEPROM |
| GOTEMP xxx | Volatile version of GOCHAN |
| LOAD aa nnnnn | Set value of N for channel aa (channels 0 to 31) |
| LOADTB nnnnn | Set value of N for channel 32 (channels 32 to 255 then in sequence) |
| LOADMX aaa | Set highest permitted (serial selected) channel xxx (others default to ch0) |
| RVALUE rrrr | Set value for R register |
| INCREM i | Set increment value for sequential table (0-7) |
| SETPAR | Channel selected by 3 bit parallel input (ch0 to 7 only) (Disable LOCKSM command) |
| SETSER | Channel selected by most recent 'gochan' operation |
| DUMPEE | Output entire EEPROM contents (128 unformatted bytes) using the P3 pin as an output |
| <cr> | Process entry |
| / | Clear all buffers |

xxx = channel number from 0 to 255

aa = a two digit channel number from 00 to 31

nnnnn = a synthesizer N register value, (up to 65535)

rrrr = the synthesizer R register value, (up to 16383)

i = sequential table step value (0-7)

$$N = \frac{f_{RF} - 21.4MHz}{25kHz} = \frac{458.525MHz - 21.4MHz}{25kHz} = 17485$$

$$R = \frac{f_{TCXO}}{f_{comparison\ frequency}} = \frac{13MHz}{25kHz} = 520 \quad (usually)$$

Notes:

1. 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.
2. /SETPAR command should be issued at the end of channel programming to put the module back into parallel frequency select mode
3. In 458MHz band, channel 12 (458.825MHz) and channel 15 (458.900MHz) are allocated specifically for fixed alarm and radio keys/vehicle paging applications respectively and should not be used for general purpose applications.
4. User can modify the frequency table of 128 channels to any desired frequency by changing N, R values of synthesizer within $\pm 2.5MHz$ of factory set Channel 0 frequency subject to the Radio Regulatory Band Allocation in the country of intended use.
5. All other frequency, power, analogue input gain and automatic noise squelching adjustment will be treated as custom variants of the module to be set by factory.

Condensed specifications

| | |
|--------------------------------------|-----------------------------------------------------------------------------------------------|
| Frequency | 458.5 - 459.1MHz (in UK allocation) as standard Other UHF frequencies available on request |
| <i>Frequency stability</i> | +/- 1.5kHz |
| <i>Channel spacing</i> | 25kHz (12.5kHz by special order) |
| <i>Number of channels</i> | 255 channels controlled via RS232 interface (8 parallel selected) |
| Supply voltage | 6v - 9v (100% duty cycle) 6v - 15v (10% duty cycle) 5v regulated only version available |
| <i>Current</i> | 350mA nominal transmit 35mA receive |
| Operating temperature | -20°C to +70°C (Storage -30°C to +85°C) |
| Size | 59 x 39 x 15 mm |
| Spurious radiations | Compliant with ETSI EN 300 220-2 and EN 301 489-3 |
| Interface | |
| <i>user</i> | 13pin 0.1" pitch molex |
| <i>Power</i> | 2pin 0.1" pitch molex |
| <i>RF</i> | 3pin 0.1" pitch molex |
| Recommended PCB hole size | 1.2mm (min.) |
| Intended approval | ETSI Radio standard EN 300 220-2 and EMC standard EN 301 489-3 |
| Transmitter | |
| Output power | +27dBm (500mW) ±1dB (factory adjustable 100 - 500mW) |
| TX on switching time | 5 ms nominal (sub 10ms guaranteed) |
| Modulation type | FM, FSK (F1D, F3D) |
| Deviation | ± 3kHz |
| TX modulation bandwidth | DC – 3kHz |
| Adjacent channel TX power | <-37dBm (<200nW) |
| Inputs | analogue, data (CMOS/TTL compatible) |
| Spurious radiations | Compliant with ETSI EN 300 220-2 and EN 301 489-3 |
| Receiver | |
| Sensitivity | -118dBm for 12 dB SINAD |
| <i>adjacent channel</i> | 65dB |
| <i>image / spurious</i> | >70dB |
| <i>blocking</i> | 85dB or better |
| Outputs | RSSI, carrier detect, audio, data |
| SFX2 timing | |
| TXE low to TX full power | 5ms |
| TXE high to valid data on RXD | 5ms |
| RSSI attack/delay time | <20ms |
| Carrier Detect response | approx. 20 – 30ms (25ms typical) |

Ordering information

| Part No. | Variant | Description |
|------------------|-----------------|--------------------------------------------------------------------|
| SFX2-458-5 | 5V regulator | VCC=6V-15V |
| SFX2-458-5-5V | Non Regulator | VCC=5V externally regulated |
| SFX2-458-5-NM | No Mute | No Muting / Squelching of AF output when RF level is below -123dBm |
| SFX2-458-G | GMSK | To be used with external 9600 baud GMSK modem |
| SFX2-458-5-12k5 | 12.5kHz channel | 12.5kHz channel spacing Narrow Band |
| SFX2-458-5-RI | TR2M compatible | Received Data RXD output Inverted like TR2M |
| SFX2-458-5-TI | TR2I compatible | Transmit Data TXD input inverted like TR2I |
| SFX2-458-5-100mW | 100mW RF Power | Transmit Power reduced to +20dBm (100mW) like TR2I/TR2M |

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The Intrastat commodity code for all our modules is: 8542 6000.

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://stakeholders.ofcom.org.uk/spectrum/technical/rtte/>

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