

## 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

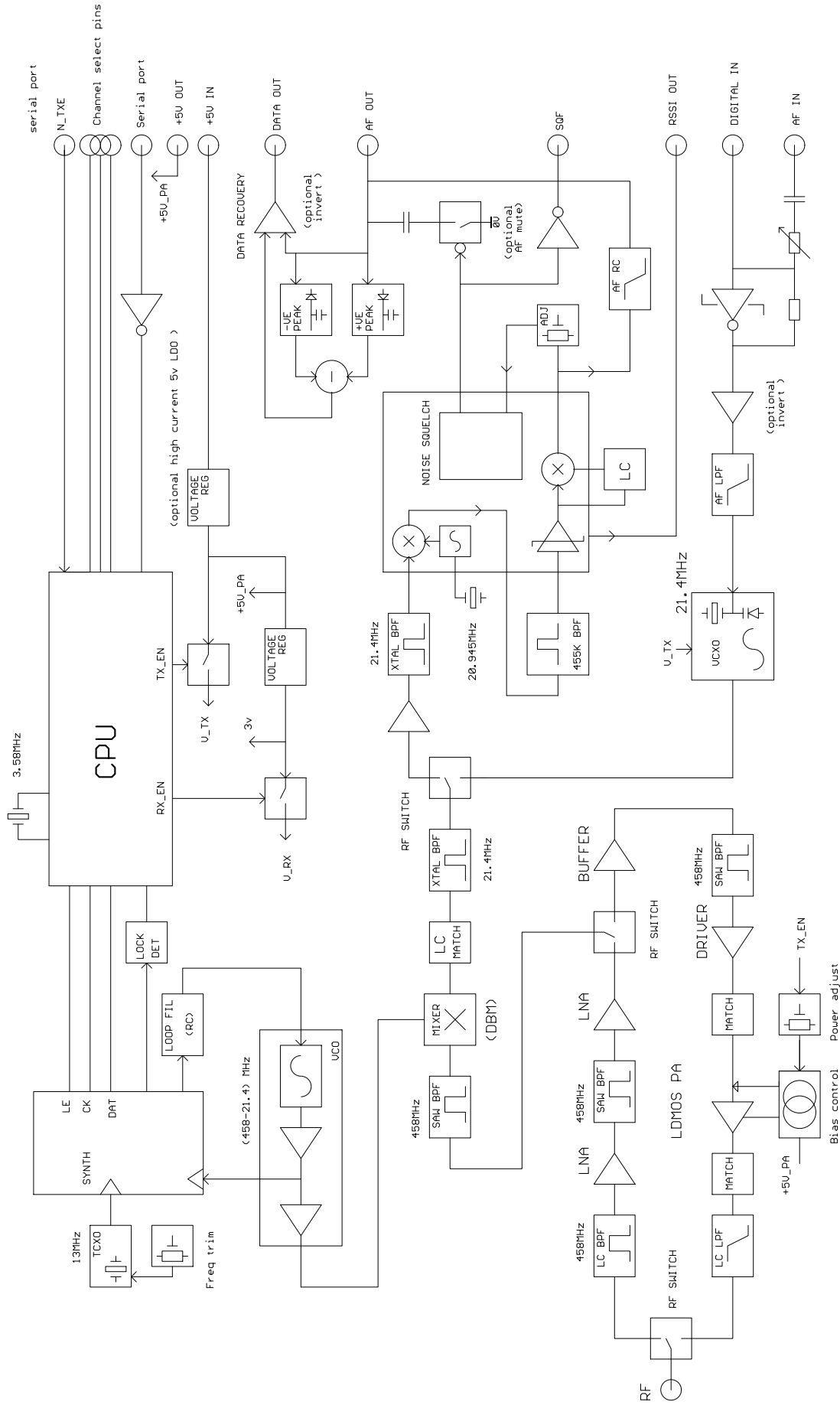
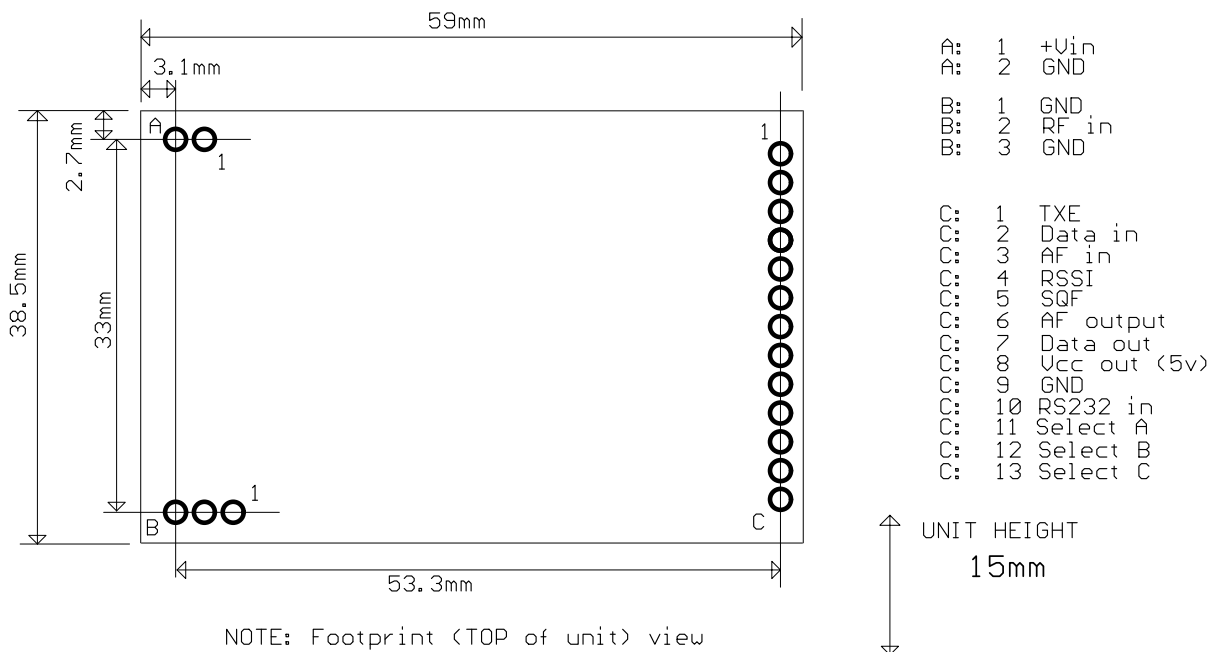


Figure 2: SFX2 block diagram



- A: 1 +Vin
- A: 2 GND
  
- B: 1 GND
- B: 2 RF in
- B: 3 GND
  
- C: 1 TXE
- C: 2 Data in
- C: 3 AF in
- C: 4 RSSI
- C: 5 SQF
- C: 6 AF output
- C: 7 Data out
- C: 8 Vcc out (5v)
- C: 9 GND
- C: 10 RS232 in
- C: 11 Select A
- C: 12 Select B
- C: 13 Select C

UNIT HEIGHT  
15mm

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 <sub>pk-pk</sub> AC coupled variable gain input. Factory set to 1V <sub>pk-pk</sub>
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 <sub>pk-pk</sub> 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:

- 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)
- 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
- There is no pullup on the SQF open collector output. RXD has 47K to internal 5v
- Unlike the parent TR2M, the SFX2 does not incorporate an i1200 modem
- 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

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