RADIOMETRIX

SFX2

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 300 220-3 and EN 301 489-3
- High performance double superhet, 255 channel PLL Synthesizer with TCXO
- 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 - 9V (100% duty cycle), 6V – 15V (10% duty cycle)
- 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
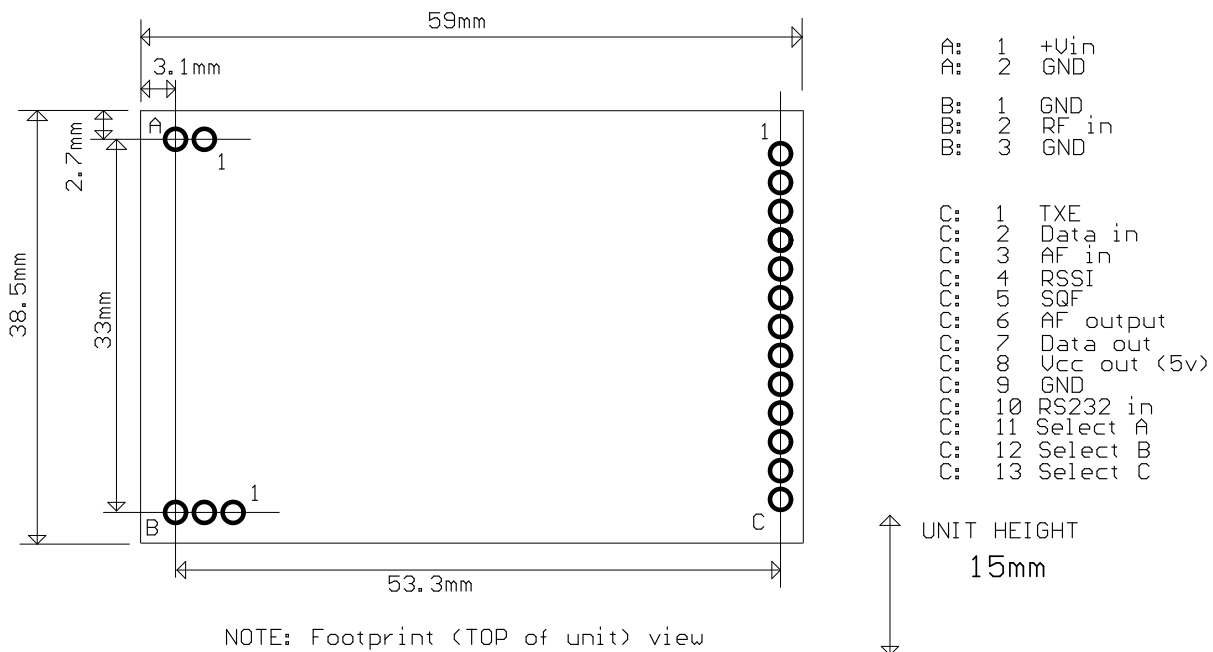
Evaluation platforms: NBEK + xx2M Series carrier

SFX2-458-5

Figure 2: SFX2 block diagram

Figure 3: SFX2 Footprint (Top) view

The footprint diagram shows the following dimensions and pin labels:

- 59mm (top width)
- 3.1mm
- 2.7mm
- 38.5mm (left height)
- 33mm
- 53.3mm (bottom width)
- A (with pins, "1")
- B (with pins, "1")
- C (with pins, "1")

```
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
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UNIT HEIGHT
15mm

NOTE: Footprint (TOP of unit) 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 p-p AC coupled input. Variable gain
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	
C12	P2	Parallel frequency select inputs. Inverted logic, internal 50kΩ pullups to 5V
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 TR2I-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 ±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
Frequency stability	+/- 1.5kHz
Channel spacing	25kHz (12.5kHz by special order)
Number of channels	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
Current	350mA nominal transmit
	35mA receive
Operating temperature	-10 to +55 ^{o}C (Storage -30 to +70 ^{o}C)
Size	59 x 39 x 15 mm
Spurious radiations	Compliant with ETSI EN 300 220-3 and EN 301 489-3
Interface	
user	13pin 0.1" pitch molex
Power	2pin 0.1" pitch molex
RF	3pin 0.1" pitch molex
Recommended PCB hole size	1.2mm (min.)
Intended approval	ETSI Radio standard EN 300 220-3 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	$\pm$ 3kHz
TX modulation bandwidth	DC – 3kHz
Adjacent channel TX power	<-37dBm (<200nW)
Inputs	analogue, data (CMOS/TTL compatible)
Spurious radiations	Compliant with ETSI EN 300 220-3 and EN 301 489-3
Receiver	
Sensitivity	-118dBm for 12 dB SINAD
adjacent channel	65dB
image / spurious	>70dB
blocking	85dB or better
Outputs	RSSI, carrier detect, audio, data
SFX2 timing	
$\overline{\text{TXE}}$ low to TX full power	5ms
$\overline{\text{TXE}}$ high to valid data on RXD	5ms
RSSI attack/delay time	<20ms
Carrier Detect response	approx. 20 – 30ms (25ms typical)

Ordering information

Part No.	Frequency band	Data rate (max)
SFX2-458-5	458.5-459.1MHz UK (23 channels)	5kbps

Radiometrix Ltd

Hartcran House
231 Kenton Lane
Harrow, Middlesex
HA3 8RP
ENGLAND
Tel: +44 (0) 20 8909 9595
Fax: +44 (0) 20 8909 2233
sales@radiometrix.com
www.radiometrix.com

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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/*

Information Requests	*European Radiocommunications Office (ERO)*
Ofcom	*Peblingehus*
Riverside House	*Nansensgade 19*
2a Southwark Bridge Road	*DK 1366 Copenhagen*
London SE1 9HA	*Tel. +45 33896300*
Tel: +44 (0)845 456 3000 or 020 7981 3040	*Fax +45 33896330*
Fax: +44 (0)20 7783 4033	*ero@ero.dk*
information.requests@ofcom.org.uk	*www.ero.dk*