NEW

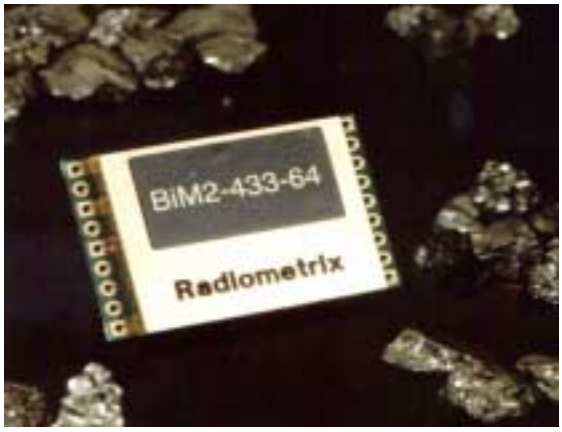
Radiometrix

Issue D, 01 February 2001 **BiM2-433-64**

Advanced data is provided to assist in engineering evaluation.
The data provided is believed to be accurate but may be subject to change.
This is not a specification

433MHz high speed FM radio transceiver module

The BiM2 transceiver is an enhanced replacement for our original BiM module. It offers greater transmit power, higher data rates, greatly improved receiver interference rejection and a lower profile. The module is ideal for enabling bi-directional wireless connectivity in battery powered or handheld applications



BiM2-433-64

Features

Conformity to EN 300-220-1, ETS 300-683
Usable range to 200 metres external, 50 metres in building
Data rates to 64kbit/s
SAW controlled 10mW FM transmitter
Double conversion FM superhet receiver
SAW front end filter and full screening
Plug in replacement for Radiometrix BiM-433-F
3-5Volt supply at < 20mA

The BiM2 is a half duplex radio transceiver module for use in high-speed bi-directional data transfer applications at ranges up to 200metres. The module operates on the European licence exempt frequency of 433.92MHz and conforms to the relevant sections of EN 300-220 and ETS 300-683. The small footprint of 23 x 33mm and low profile of 4mm together with low power requirements of <20mA @ 3 to 5 Volts enable convenient PCB installation. The high raw data rate capability of 64kbit/s and fast state change times will support high data throughput of up to 3 kbyte/s in 'streaming' applications or alternatively allows very short air time utilization (TX on < 10 ms) in multi-node scanning networks.

Applications

- PDA's, organizers and laptops
- Handheld terminals
- EPOS equipment, barcode scanners, belt clip printers
- Data loggers
- Audience response systems
- In Building environmental monitoring and control
- High end security and fire alarms
- Restaurant ordering systems
- Vehicle data up/download

Further information will be available imminently, however, BiM-433-F data sheets contains applications information that is equally applicable to the new BiM2.

Functional overview

The transmit section of the BiM2 comprises of a SAW stabilised and FM modulated 433.92MHz oscillator feeding a 10mW buffer/output stage. Operation is controlled by a TX select line, the output achieving full power within 100us of this line being pulled low. Modulation is applied at the TXD input and may be either a serial digital stream at the same levels as the module's supply rails (digital drive) or a high level analogue waveform with a pk to pk amplitude close to the modules supply level (linear drive). Modulation shaping is performed internally by a 2nd order 44kHz LPF to minimize spectral spreading. The RF output is filtered to meet the requirements of EN 300-220 and fed via a fast antenna changeover switch to the 50Ω antenna pin.

The receive section of the BiM2 is a double conversion FM superhet with IF's of 16MHz and 150kHz. The dual gate MOSFET LNA is followed by a 750kHz bandwidth SAW filter to provide >60 dB's rejection of all out of band signals. The receiver is controlled by an active low select line and will power up in <1ms. A post-detection 2nd order 35kHz LPF establishes the signal bandwidth and ensures the clean operation of the subsequent adaptive data slicer. The slicer has a 2ms averaging time constant and is optimised for balanced data, e.g. bi-phase codes. A fast acting carrier detect output will indicate the presence of any RF signals.

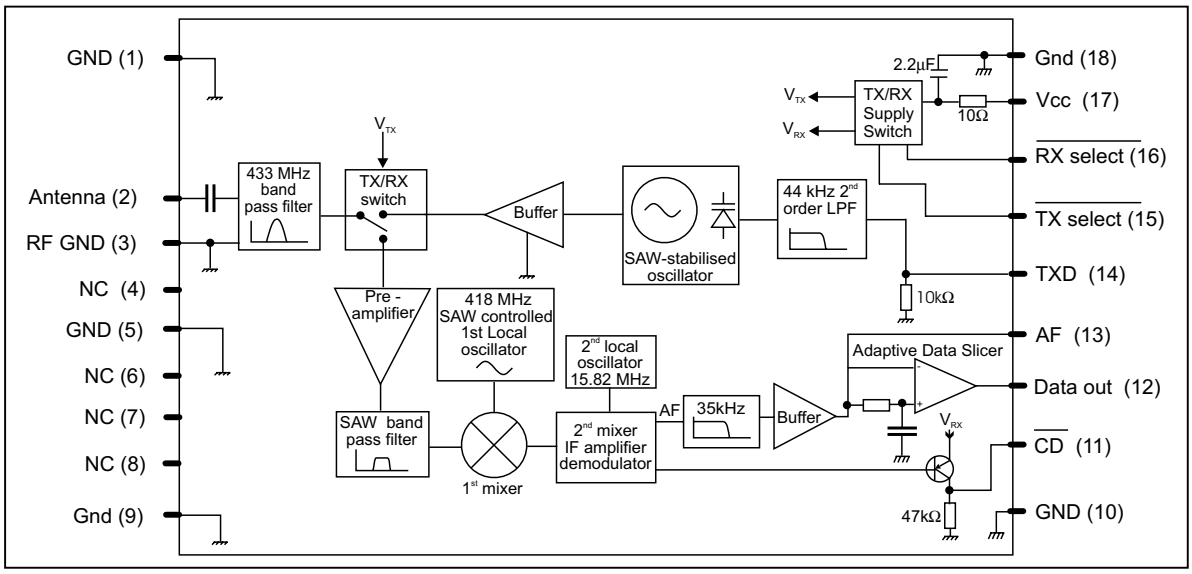


Figure 1: Block diagram

Pin description:

RF GND *pin 1 & 3*
RF ground pin, internally connected to the module screen and pin 5, 9, 10, 18 (0 Volt). This pin should be connected to the RF return path (e.g. coax braid, main PCB ground plane etc.)

Antenna *pin 2*
50Ω RF input from the antenna, it is DC isolated internally. (see antenna for suggested antenna/feeds).

0Volt *pins 5, 9, 10, 18*
Supply ground connection and screen.

CD *pin 11*
Carrier Detect - When the receiver is enabled, a low indicates a signal above the detection threshold is being received. The output is high impedance (50kΩ) and should only be used to drive a CMOS logic input.

RXD *pin 12*
This digital output from the internal data slicer is a squared version of the signal on pin 13 (AF). It may be used to drive external decoders. The data is true data, i.e. as fed to the transmitter. Load impedance should be >1kΩ and <1nF

AF *pin 13*

This is a buffered and filtered analogue output from the FM demodulator. It has a standing DC bias of 1.2 volts and 400mV P-P base band signal. It is useful as a test point or to drive linear decoders. Load impedance should be >2kΩ and <100pF.

TXD *pin 14*

This DC coupled modulation input will accept either serial digital data (0V to Vcc levels) or High level linear signals. Input impedance is 10kΩ.

TX select *pin 15*

Active low transmit select. 10kΩ internal pull up to Vcc.

RX select *pin 16*

Active low receive select. 10kΩ internal pull up to Vcc.

Pin 15 TX	Pin 16 RX	Function
1	1	power down (<1µA)
1	0	receiver enabled
0	1	transmitter enabled
0	0	self test loop back

Note: Loop test allows the receivers to monitor the transmitted signal. The receiver will not receive external signals whilst the TX of the module is enabled.

Vcc *pin 17*

+ve supply pin. +3.0 to +5.5 volts @ <20mA . The supply must be clean < 20mV P-P ripple. A 2.2µF de-coupling capacitor and 10Ω series resistor are used internally to filter the supply.

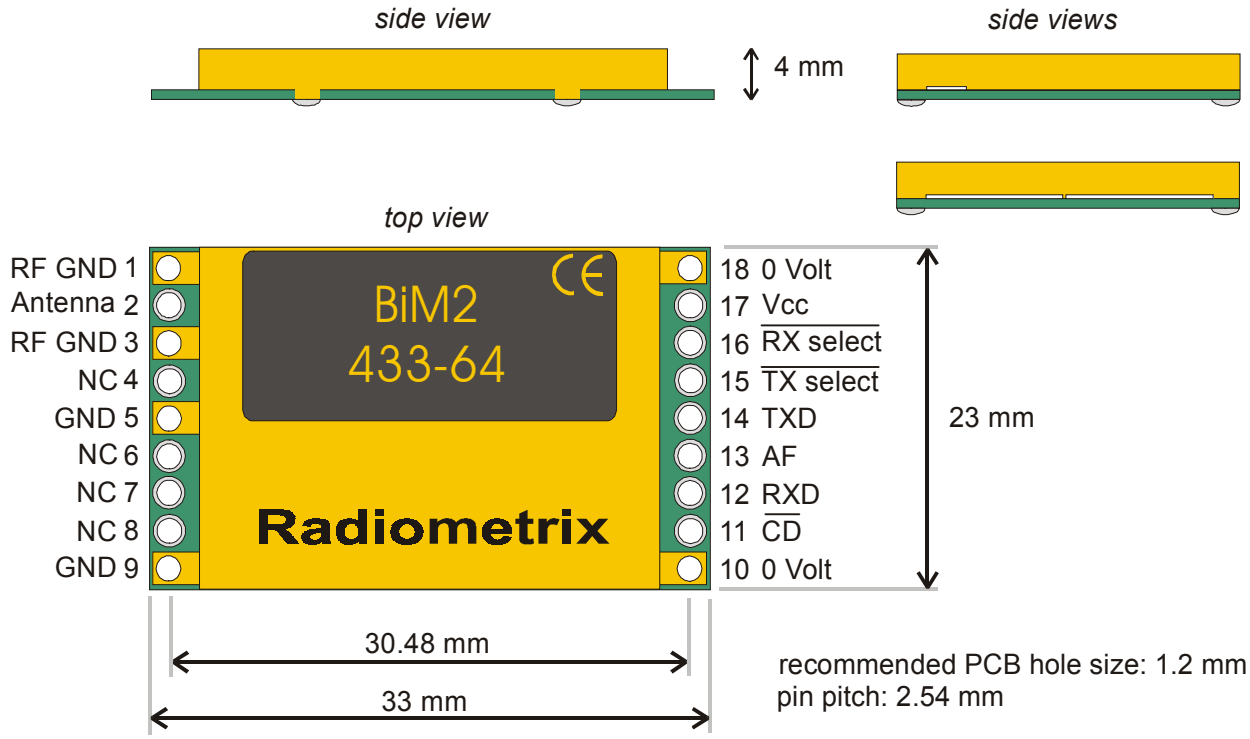


Figure 2: Physical dimension

Survival Maximums:

Operating temperature:	-10°C to + 55°C
Extended operation at Reduced specification	-20°C to + 70°C
Storage temperature :	-40°C to + 100°C
Vcc (pin 17)	-0.1V to +10.0 V
All other pins	-0.1V to +Vcc+0.6V
Antenna (pin 2)	±50 V @ <10MHz , +20dBm @ > 10MHz

Note: Operation of the BiM2 above 5.5 volt with efficient antenna may result in radiated power levels above the licensed power level.

Figures apply to 5V versions unless otherwise noted
Temperature 20° C unless noted

Electrical Performance	pin	min.	typ.	max.	units	notes
DC Levels						
supply voltage, Vcc *(std. version)*	17	4.0	5	5.5	V	
supply voltage, Vcc *(3V version)*	17	3.0	3.3	4.0	V	
TX supply current, Vcc *(std)*	17	10	14	16	mA	5V supply
TX supply current, Vcc *(3.3V)*	17	6	8	10	mA	3.3V supply
RX supply current, Vcc *(std)*	17	12	18	21	mA	5V supply
RX supply current, Vcc *(3.3V)*	17	10	14	17	mA	3.3V supply
supply ripple allowed	17	-	-	20	mV_{pk-pk}	below1MHz
AF output DC level	13	1.0	1.25	1.5	V	
load capacitance on AF / Data	12,13	-	-	100	pF	
CD output load resistance	11	220	-	-	kΩ	
Interface levels						
data output high, 100µA source	12	-	Vcc-0.6	-	V	RXD high
data output low, 100µA sink	12	-	0.4	-	V	RXD low
TX & RX select, high *(deselect)*	15, 16	Vcc-0.5		Vcc	V	
low *(select)*	15, 16	0		0.5	V	
Internal select pull-ups	15,16	-	10	-	kΩ	
TXD, high	14	Vcc-0.5		Vcc	V	
low	14	0		0.5	V	

RF Parameters	pin	min.	typ.	max.	units	notes
Antenna pin impedance	2	-	50	-	Ω	TX or RX
RF centre frequency	-	-	433.92	-	MHz	
Transmitter						
RF power output, Vcc std	2	+7	+10	+12	dBm	5V
RF power output, Vcc 3.3V	2	+3	+6	+8	dBm	3.3V
Initial frequency accuracy	-	-50	0	+50	kHz	
Overall frequency accuracy	-	-100	0	+100	kHz	
FM deviation	-	20	30	40	kHz	
Modulation bandwidth	-	DC	-	32	kHz	
Modulation distortion	-	-	-	15	%	

RF Parameters	pin	min.	typ.	max.	units	notes
Receiver						
RF sensitivity, 10dB S/N, 5V	2, 13	-95	-101		dBm	
RF sensitivity, 10dB S/N, 3.3V	2, 13	-91	-96		dBm	
RF sensitivity, 1ppm BER, 5V	2, 12	-87	-93		dBm	
RF sensitivity, 1ppm BER, 3.3V	2, 12	-82	-88		dBm	
CD threshold, Vcc = 5V	2, 11	-98	-104		dBm	
CD threshold, Vcc = 3.3V	2, 11	-92	-98		dBm	
IF bandwidth	-	-	500	-	kHz	
CD bandwidth	2, 11	-	400	-	kHz	
Ultimate (S+N)/N, -70dBm input	13	-	>40	-	dB	
maximum operating RF i/p	2	-	+10	-	dBm	
AF output level	13	-	400	-	mV	peak to peak
Initial frequency accuracy	-	-50	0	+50	kHz	CD centre

EMC Parameters	pin	min.	typ.	max.	units	notes
Rejections: rejection figures are relative to a 15dB (S+N)/N wanted signal						
Co-channel rejection	2	-	-10	-	dB	
Image rejection (f_{RF}-$2f_{IF}$)	2	-	64	-	dB	402.0MHz
Out of band rejection	2	-	>70	-	dB	DC to 2GHz
AM rejection	2	-	>30	-	dB	
Out of band blocking level	2	-	>-15	-	dBm	
Out of band IP_3	2	-	+1	-	dBm	
Radiations						
RX LO leakage, conducted	2	-	-60	-57	dBm	
RX LO leakage, radiated	-	-	-70	-	dBm	
TX 2nd harmonic	2	-	-42	-36	dBm	
TX harmonics >1GHz	2	-	-40	-30	dBm	
TX spectral bandwidth @-40dBc	2	-	-	250	kHz	worst case

Baseband Transfer Performance	pin	min.	typ.	max.	units	notes
TX→ RX						
Linear baseband BW @-3dB	13	0.08	-	34	kHz	TXD to AF
Balance code bit rate	12	-	64	-	kbit/s	
Time between code transitions	14	15.6	-	1000	µs	
Average code mark:space	14	30	50	70	%	in any 2ms
preamble duration	14	3	-	-	ms	01010101 pattern
link delay	14, 12	-	15	-	µs	TXD to RXD
Dynamic Timing						
Power up with signal present						
Power up to valid CD, t_{PU-CD}	11	-	0.7	1	ms	
Power up to stable AF, t_{PU-AF}	13	-	0.5	1	ms	
Power up to stable data, $t_{PU-data}$	12	-	3	4	ms	
Signal applied with supply on						
Signal to valid CD, t_{sig-CD}	11	-	0.25	0.5	ms	
Signal to stable data, $t_{sig-data}$	12	-	3	5	ms	
TX power up to full RF	2	-	100	-	µs	

Antenna requirements

Three types of integral antenna are recommended and approved for use with the module:

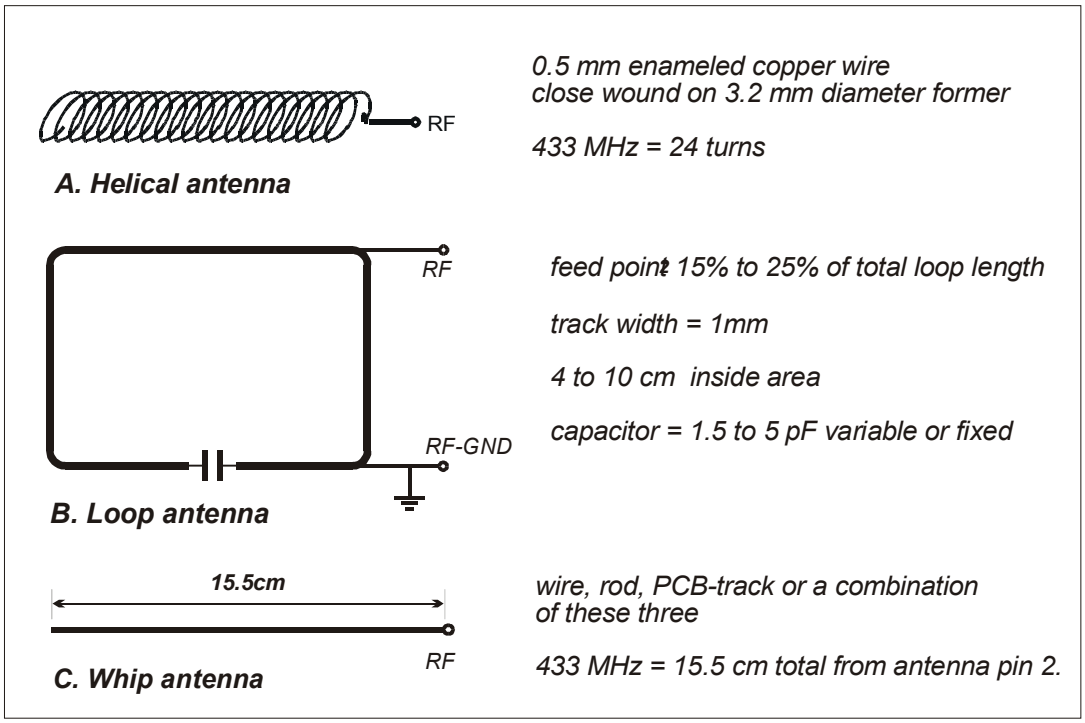
A) ***Helical*** Wire coil, connected directly to pin 2, open circuit at other end. This antenna is very efficient given it's small size (20mm x 4mm dia.). The helical is a high Q antenna, trim the wire length or expand the coil for optimum results. The helical de-tunes badly with proximity to other conductive objects.

B) ***Loop*** A loop of PCB track tuned by a fixed or variable capacitor to ground at the 'hot' end and fed from pin 2 at a point 20% from the ground end. Loops have high immunity to proximity de-tuning.

C) ***Whip*** This is a wire, rod ,PCB track or combination connected directly to pin 2 of the module. Optimum total length is 16cm (1/4 wave @ 433MHz) Keep the open circuit (hot) end well away from metal components to prevent serious de-tuning. Whips are ground plane sensitive and will benefit from internal 1/4 wave earthed radial(s) if the product is small and plastic cased

	A *helical*	B *loop*	C *whip*
Ultimate performance	**	*	***
Easy of design set-up	**	*	***
Size	***	**	*
Immunity proximity effects	**	***	*
Range open ground to similar antenna			200m

The antenna choice and position directly controls the system range. Keep it clear of other metal in the system, particularly the 'hot' end. The best position by far, is sticking out the top of the product. This is often not desirable for practical/ergonomic reasons thus a compromise may need to be reached. If an internal antenna must be used try to keep it away from other metal components, particularly large ones like transformers, batteries and PCB tracks/earth plane. The space around the antenna is as important as the antenna itself



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Radio and EMC regulations

The Intrastat commodity code for all our modules is: 8542 4090.
The purchaser of Radiometrix subassemblies must satisfy all relevant EMC and other regulations applicable to their finished products.

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 Radiocommunications Agency (RA) web site: www.radio.gov.uk/document/libind.htm#emc

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(End of BiM2-433-64 Advanced Engineering Data)