Features

- **Designed for use with Atmel's AT48802 Spread-Spectrum Signal Processor**
- **FCC Part 15, Unlicensed Operation**
- **RF Despreading and Narrowband IF for Highest Jamming Margin**
- **1 mW Narrowband Operation, or 1 and 50 mW Spread-Spectrum Operation**

900 MHz Spread-Spectrum RF Module

Preliminary

Description

The AT48810 RF module is intended for time domain duplex spread-spectrum communications under FCC Part 15, 902-928 MHz unlicensed operations. This module features RF despreading and narrowband IF for powerful interference rejection. Spreading is via direct sequence. The unit can also be operated in a narrow-band configuration (FCC limits power to 1 mW in narrow band) by restricting the DC voltage to the power amplifier so that the transmit power is less than 0 dBm per FCC regulations. The unit can also be run in slow half duplex or simplex mode.

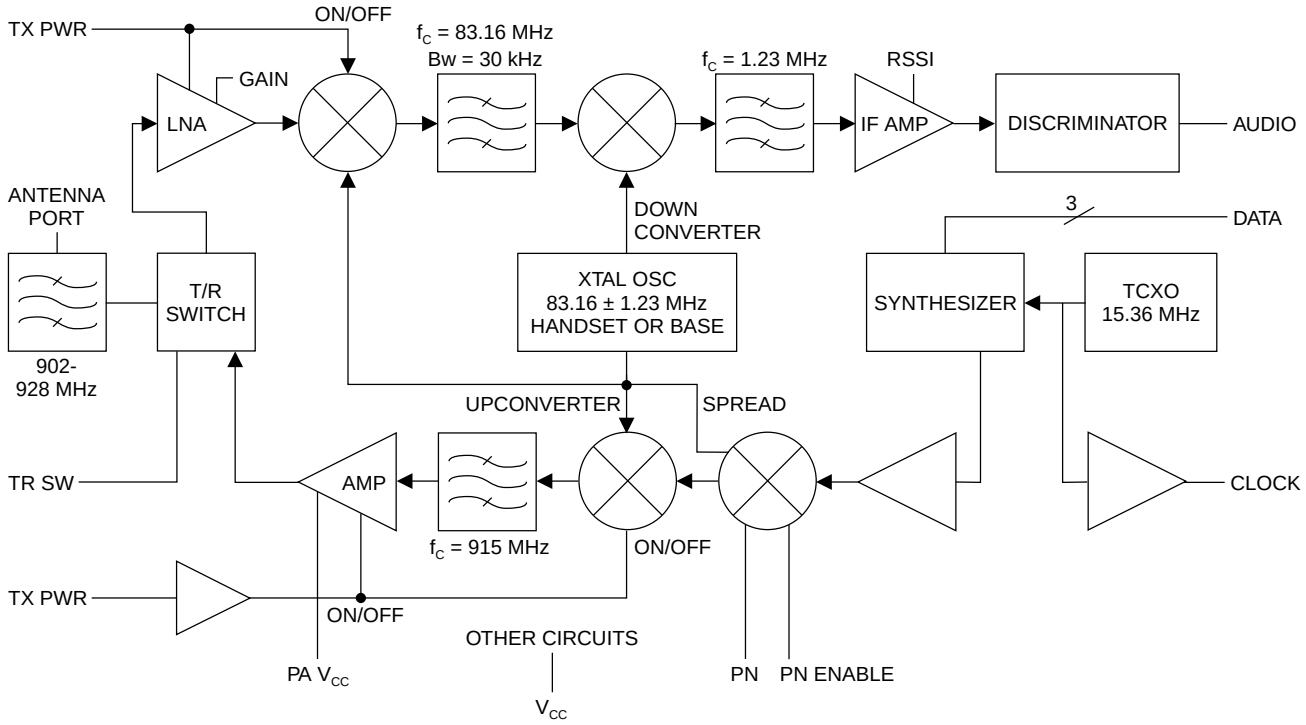
Pin Diagram

15.36 MHz Clock Out	1	2	Audio Out
Ground	3	4	Ground
V_{CC}	5	6	RSSI Out
Synthesizer Data Clock Input	7	8	T/R Switch
Synthesizer Data Input	9	10	LNA Gain Hi/Low
Synthesizer Data Latch Input	11	12	V_{CC}
Modulation Input	13	14	No Connection
No Connection	15	16	Transmit Power On/Off Input
PN Spreading Enable Input	17	18	Power Amp V_{CC} Input
PN Input	19	20	Power Amp V_{CC} Input

Note: 1. Connector on module is Dupont/Berg part number 87814-610. Mating connector is 87409-110.

0625A

Block Diagram



Note: 1. The module cannot legally be certified without an antenna; this is an FCC requirement.

TDD Rate

7.5 kHz max

Operating Frequencies

Table 1. Version "B" (1, 2, 3, 4, 5, 6, 7, 8)

Channel	N	End B First LO, MHz	TX, MHz	RX, MHz
1	1334	825.7536	910.1424	908.9136
2	1350	829.4400	913.8288	912.6000
3	1356	833.1264	917.5152	916.2864
4	1363	837.4272	921.8160	920.5872

Note:
1. Second LO = 84.3888 MHz
2. Reference Divider = 25
3. Phase Detector = 614.4 kHz
4. First IF = 83.160 MHz
5. Second IF = 1.229 MHz
6. Synthesizer PLL Bandwidth = 80 kHz nominal
7. Frequency Accuracy = ±3.5 ppm (including temperature 0° to 50°C)
8. Switching Time = 2.2 ms nominal, Ch 1 to Ch 4

Table 2. Version "H" (1, 2, 3, 4, 5, 6, 7, 8)

Channel	N	First LO, MHz	TX, MHz	RX, MHz
1	1346	826.9842	908.9136	910.1424
2	1352	830.6688	912.6000	913.8288
3	1358	834.3552	916.2864	917.5152
4	1365	838.6560	920.5872	921.8160

Note:
1. Second LO = 81.9312 MHz
2. Reference Divider = 25
3. Phase Detector = 614.4 kHz
4. First IF = 83.160 MHz
5. Second IF = 1.229 MHz
6. Synthesizer PLL Bandwidth = 80 kHz nominal
7. Frequency Accuracy = ±3.5 ppm (including temperature 0° to 50°C)
8. Switching Time = 2.2 ms nominal, Ch 1 to Ch 4

Transmit Modulation Input

Type	PM, inside the phase lock loop
Bandwidth	200 Hz to 70 kHz, -3 dB
Sensitivity	20 cycles/V nominal
Distortion	-30 dBC max. for 10 cycle peak deviation at 1 kHz rate

Spreading Input

Type	BPSK
Bandwidth	30 MHz
Sensitivity	2.5 V_{PP} for BPSK
PN Enable Input	+5V = spread, high Z = CW
Carrier Suppression	-15 dBc max.
Code Leakage	-30 dB max. (for baseband modulation signal of better quality)
PN Input Load Resistance	1K nominal

Antenna Port

Zo	50 ohms nominal
VSWR	2.5:1 max., 902-928 MHz
T/R Switch	Low = transmit, CMOS compatible. Isolation 35 dB nominal

Transmit Power

Power Output	+17 dBm at V_{CC} = 5.0 VDC, VPA = 4.0 VDC	RF power amp V_{CC} is on a separate pin from the other circuits V_{CC}.
On/Off Control	TX PWR input pin 16, CMOS compatible, low = power on	

Receive

Sensitivity	-105 dBm max. at 12 dB SINAD (C-weighted)
IF Bandwidth	30 kHz at -3 dB nominal
Signal-to-Noise	30 dB min. C-weighted at -80 dBm
Post Detection Net Bandwidth	15 kHz, limited by IF filter
RSSI Output	Log compressed. Slope 0.24 uA/dB nominal into a zero ohm load. Rout = 58K nominal. Bandwidth 15 kHz, limited by IF filter. Noise floor - 110 dBm equivalent input.
Attenuators	T/R switch $\rightarrow$ T gives 35 dB nominal, low = transmit. GAIN control gives 17 dB nominal in LNA low = high gain. (binary controls: on/off only, CMOS compatible.)
Audio Output	Sensitivity 0.4 uA/kHz nominal into a zero ohm load. Rout = 58K nominal. This output must be lowpass filtered (-3 dB at 200 Hz, 6 dB/octave) to give net link frequency response which is flat.
Interface Rejection	**Out of Band** Antenna filter is -6 dB at fo $\pm$32.5 MHz and approx. -30 dB at fo $\pm$100 MHz. A cellular phone with 1 watt power at a distance of 5 feet produces no noticeable SNR degradation in the receiver for the mating transmitter at a distance of 10 feet, running spread spectrum R13 code.
	In Band Processing gain depends on code length. The use of RF despreading assures that the high processing gain can be maximally effective by allowing narrow IF bandwidth thus significantly reducing IF jamming induced desensitization.

Clock Output

15.360 MHz buffered from TCXO, CMOS compatible, one standard load.

Data Port

SPI/3-wire, 3 lines. Synthesizer device is National Semiconductor LMX1501 or equal.

Power Supply

Voltage	+4.5 VDC min., +5.5 VDC max.
Current	Transmit only 185 mA nominal TDD 50/50 130 mA nominal Receive only 85 mA nominal
Turn-On Time for 1 ppm error from final frequency	1. TCXO, from V_{CC} edge = 3 ms max. 2. Synthesizer, V_{CC} stabilized, from data latch edge = 3 ms max. (1)
Power Amp	+4.0 VDC full power, +0.6 VDC for Pout < 0 dBm

Note: 1. It is allowable to program the synthesizer before the TCXO is fully stabilized

Adjustments

There are no user adjustments. The three adjustments are discriminator frequency adjust, TCXO nominal frequency, and transmit upconverter filter tuning.

Environment

Temperature	0° to 55°C
Humidity	10% to 90% non-condensing
Vibration	
Shock	

Physical

(Dimensional Drawings)

Antenna Port Options	Center, Left, Right
Weight	

Ordering Information

Ordering Code	Antenna	Frequency Plan	Second LO
AT48810-RB	Right	B	84.3888 MHz
AT48810-RH	Right	H	81.9312 MHz
AT48810-CB	Center	B	84.3888 MHz
AT48810-CH	Center	H	81.9312 MHz
AT48810-LB	Left	B	84.3888 MHz
AT48810-LH	Left	H	81.9312 MHz