

## 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

## 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

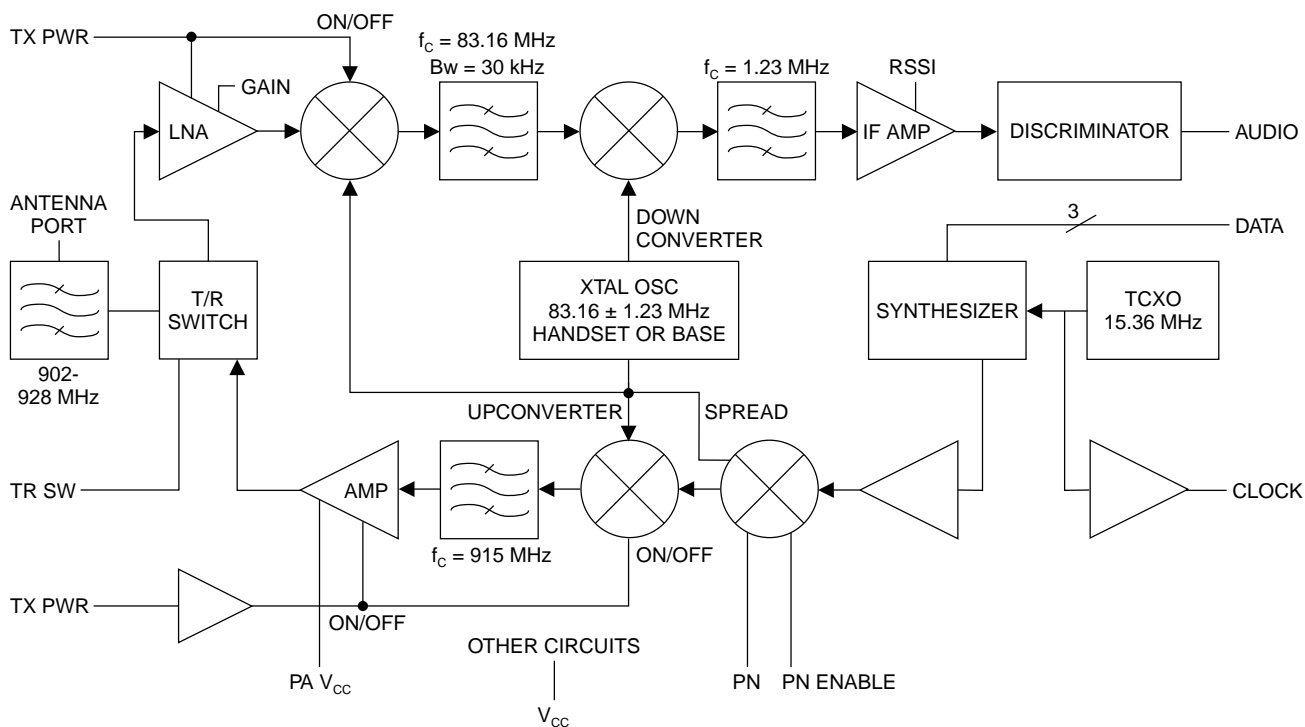
15.36 MHz Clock Out	○ 1	2 ○	Audio Out
Ground	○ 3	4 ○	Ground
V <sub>CC</sub>	○ 5	6 ○	RSSI Out
Synthesizer Data Clock Input	○ 7	8 ○	T/R Switch
Synthesizer Data Input	○ 9	10 ○	LNA Gain Hi/Low
Synthesizer Data Latch Input	○ 11	12 ○	V <sub>CC</sub>
Modulation Input	○ 13	14 ○	No Connection
No Connection	○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

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

## 900 MHz Spread- Spectrum RF Module

## Preliminary

## 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 =  $\pm 3.5$  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 =  $\pm 3.5$  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 <sub>PP</sub> 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

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



## Transmit Power

<b>Power Output</b>	+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 $V_{CC}$ .
<b>On/Off Control</b>	TX PWR input pin 16, CMOS compatible, low = power on	

## Receive

<b>Sensitivity</b>	-105 dBm max. at 12 dB SINAD (C-weighted)
<b>IF Bandwidth</b>	30 kHz at -3 dB nominal
<b>Signal-to-Noise</b>	30 dB min. C-weighted at -80 dBm
<b>Post Detection Net Bandwidth</b>	15 kHz, limited by IF filter
<b>RSSI Output</b>	Log compressed. Slope 0.24 $\mu$ A/dB nominal into a zero ohm load. Rout = 58K nominal. Bandwidth 15 kHz, limited by IF filter. Noise floor - 110 dBm equivalent input.
<b>Attenuators</b>	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.)
<b>Audio Output</b>	Sensitivity 0.4 $\mu$ A/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.
<b>Interface Rejection</b>	<b>Out of Band</b> Antenna filter is -6 dB at $f_o \pm 32.5$ MHz and approx. -30 dB at $f_o \pm 100$ 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. <b>In Band</b> 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

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

<b>Temperature</b>	0° to 55°C
<b>Humidity</b>	10% to 90% non-condensing
<b>Vibration</b>	
<b>Shock</b>	

## Physical

(Dimensional Drawings)

<b>Antenna Port Options</b>	Center, Left, Right
<b>Weight</b>	

## 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