

Revision

1.0.0



WI.FS24-100ST (WI.FREESTAR) DATASHEET

RADIOTRONIX, INC.

WI.FS24-100ST/ WI.FREESTAR DATASHEET

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1. Introduction

The Wi.FreeStar module is a 2.4 GHz 802.15.4 data transceiver module intended for Very Low Cost Wireless Applications. The module design is based on the MC13192/3 RF transceiver from Freescale which is based on the IEEE 802.15.4 standard and intended for use in Zigbee applications. It provides for enhanced range performance over standard 802.15.4/Zigbee implementations with the integrated 100mW power amplifier. It implements a proprietary communications protocol based on the 802.15.4 standard streamlined to lower cost and power consumption. The Wi.FreeStar module design consists of the MC13192, the MC9S08GT16CFD uP, 100 mW PA, and integrated PCB trace antenna. The module is FCC and CE certified for fast and simple integration into end applications. The Wi.FreeStar Module provides the lowest cost, best in class range in an extremely small form factor.

1.1. Module Overview

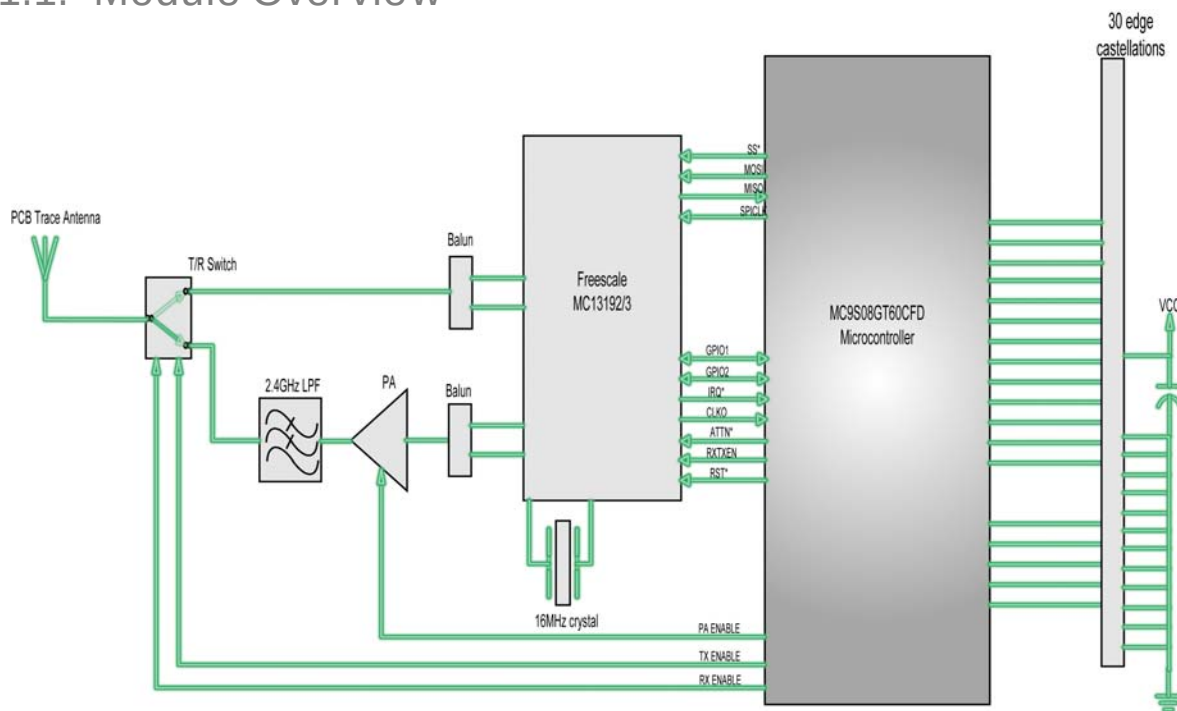


Figure 1: Wi.FreeStar Block Diagram

1.2. Features

- Networking

- o Point-to-Point
- o Point-to-Multipoint
- Range: up to 4000ft.
- Very Small Form Factor (1.4" x 1.0")/ (36.2mm x 24.8mm)
- Inverted-F PCB Trace Antenna
- FCC, IC, and CE Certified
- Direct Sequence Spread Spectrum
- CSMA-CA
- Flash based/ Upgradable
- 10 bits A/D (2 inputs)
- General Purpose Digital I/O (8 pins)
- Windows® Based Configuration and Test Tool

1.3. Applications

- Direct RD-232/422/485 Wire replacement (requires external RS-232 to 3V CMOS conversion circuitry)
- Asset tracking
- Automated meter reading
- Industrial and/ or Home automation
- RFID
- Wireless sensors
- Remote data logging
- Fleet management

2. Module Specifications

Frequency	2400 to 2483.5 MHz
Output Power	10mW – 100mW (software controlled)
Receiver Sensitivity	-92 dBm @ 1% PER
RF Data Rate	250 kbps
Host Data Rate	19.2 kbps
RF Channels	16 (channel 16 is set at a reduced power level)
EMC Certifications	FCC Part 15.247 Module Certified (Portable)
	EN 300 328 1 Certified/ CE Approved
Voltage Operating Range	2.4 to 3.6 V
Power Consumption	
Transmit Mode (10mW)	125 mA
Transmit Mode (100mW)	150 mA
Receive Mode	<45 mA
Standby Mode	<5 μ A
Host Interface	Serial TTL
Operating Temperature	-40 to +85 °C
Storage Temperature	-55 to +125 °C

3. Application Information

3.1. Pin-out Diagram

WI.FS24-100ST PINOUT DIAGRAM

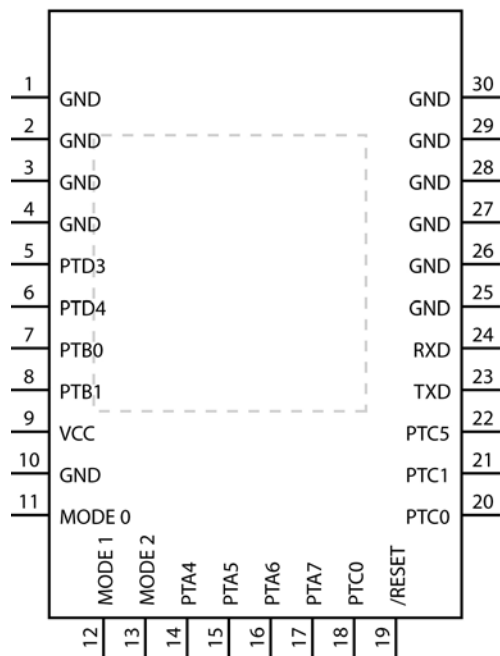


Figure 2: Pin-out Diagram

Note: PIN Numbering begins at top left-hand side with pin number 1 and follows counter-clockwise about the perimeter of the module.

3.2. Pin Description

PIN	TYPE	SIGNAL NAME	DESCRIPTION
ANT2	AO/ AI	ANT2	Integrated PBC F-Antenna
TPRF1	AO/ AI	TPRF1	Coaxial RF Test Point- 50 Ohms
1	GND	GND	Ground
2	GND	GND	Ground
3	GND	GND	Ground
4	GND	GND	Ground
5	DI/ DO	PTD3	General Purpose Digital I/O Firmware Configurable Port D, BIT 3
6	DI/ DO	PTD4	General Purpose Digital I/O Firmware Configurable Port D, BIT 4
7	AI	PTB0	Analog to Digital Converter Input, Port B, Input 0
8	AI	PTB1	Analog to Digital Converter Input, Port B, Input 1
9	PI	VCC	Primary Power Input: $V_{CC} = 2.7 - 3.6$, TBD mA max.
10	GND	GND	Ground
11	DI	MODE0	FCC/ Production Test Mode Input Word, BIT 0
12	DI	MODE1	FCC/ Production Test Mode Input Word, BIT 1
13	DI	MODE2	FCC/ Production Test Mode Input Word, BIT 2
14	DI/ DO	PTA4	General Purpose Digital I/O Firmware Configurable Port A, BIT 4, (KB1P4) Keyboard Interrupt
15	DI/ DO	PTA5	General Purpose Digital I/O Firmware Configurable Port A, BIT 5, (KB1P5) Keyboard Interrupt
16	DI/ DO	PTA6	General Purpose Digital I/O Firmware Configurable Port A, BIT 6, (KB1P6) Keyboard Interrupt
17	DI	PTA7	Digital Input configured to Interrupt on rising edge of signal to wake up module from sleep mode, Port A, BIT 7 (KB1P7) Keyboard Interrupt
18	DI/ DO	PTG0	Port G, BIT 0 (BKGD/ MS) Background/ Mode Select for Programming and Firmware Debug
19	DI	/RESET	Master Reset, Active Low
20	DI/ DO	PTC0	General Purpose Digital I/O Firmware Configurable Port C, BIT 0 (SCI2, TXD2) Serial Communication Interface 2, Transmit Data
21	DI/ DO	PTC1	General Purpose Digital I/O Firmware Configurable Port C, BIT 0 (SCI2, RXD2) Serial Communication Interface 2, Receive Data
22	DI/ DO	PTC5	Reserved
23	DO	TXD	Application Transmit Data Output (SCI1, TXD1) Serial Communication Interface 1, Transmit Data
24	DI	RXD	Application Receive Data Input (SCI1, RXD1) Serial Communication Interface 1, Receive Data
25	GND	GND	Ground
26	GND	GND	Ground
27	GND	GND	Ground
28	GND	GND	Ground
29	GND	GND	Ground
30	GND	GND	Ground

Table 1, Module Pin Descriptions

Legend

DI	Digital Input
DO	Digital Output
AI	Analog Input
AO	Analog Output
PI	Power Input
GND	Ground

Logic Input High: $0.8 (V_{CC}) < V_{IH} < (V_{CC})$ Logic Input Low: $0 < V_{IL} < 0.2 (V_{CC})$ Logic Output High: $(V_{CC} - 0.4) < V_{OH} < V_{CC}$ Logic Output Low: $0 < V_{OL} < 0.4$

3.3. Mechanical Drawings

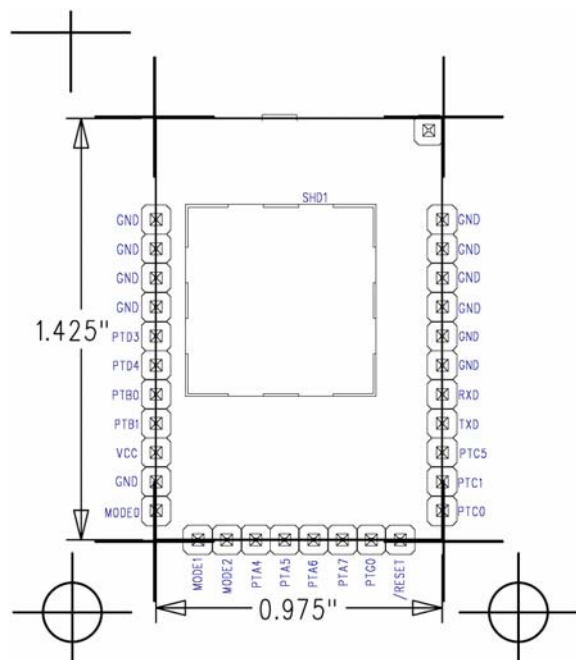


Figure 3: Module Mechanical Drawings

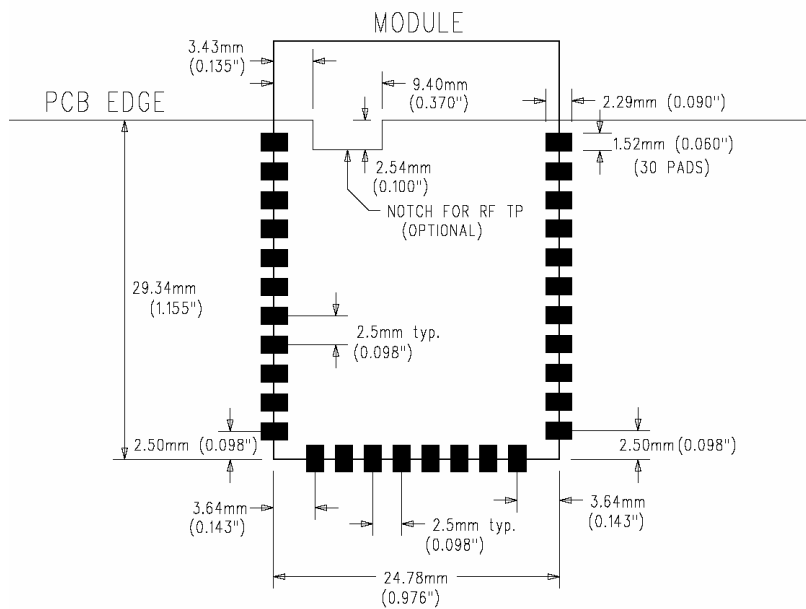


Figure 4: PCB Footprint

3.4. Example Circuit

WI.FS24-100ST: Sample Connection Diagram when using Serial Interface

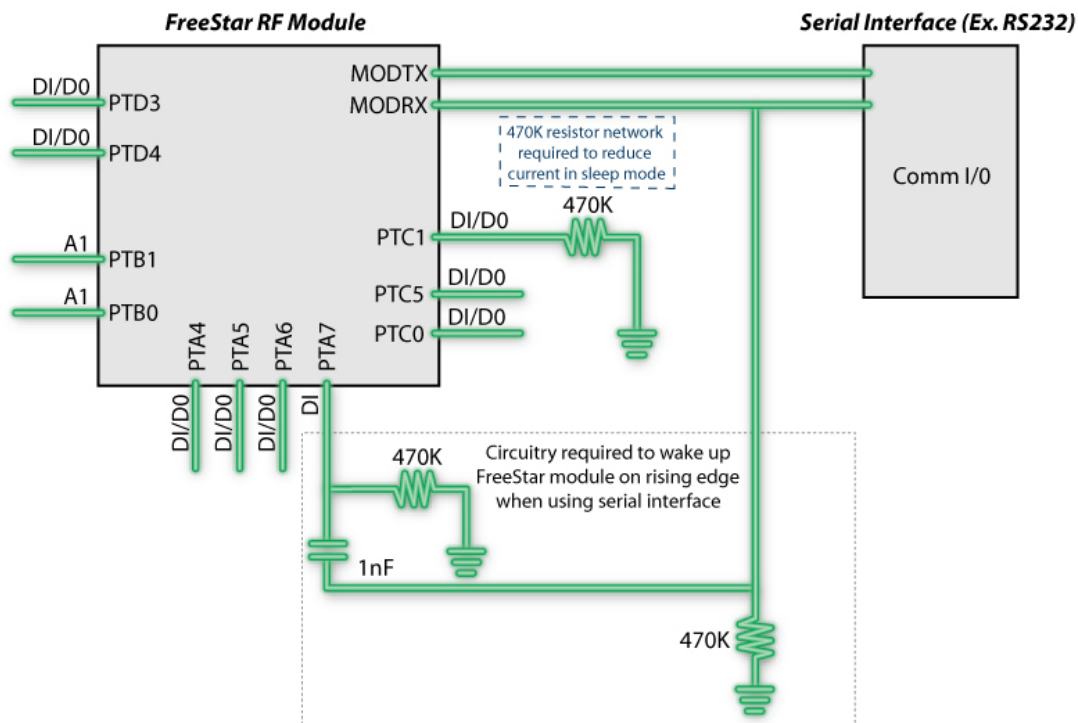


Figure 5: Sample Connection Diagram using Serial Interface

WI.FS24-100ST: Sample Connection Diagram when using Host Processor Interface

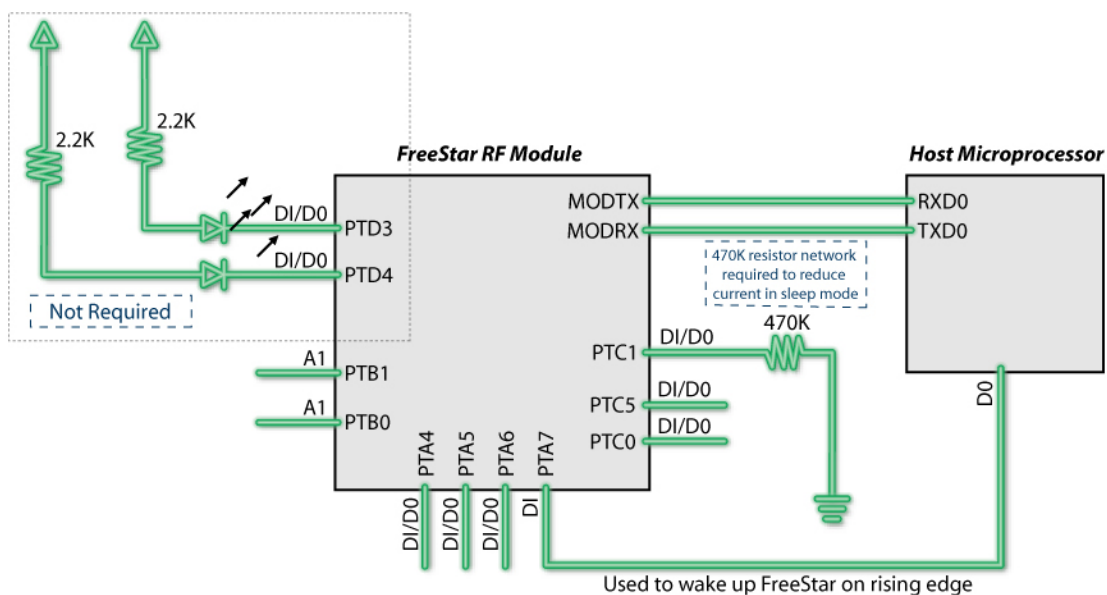


Figure 6: Sample Connection Diagram using Host Processor Interface

4. Radiation Patterns

Wi.FreeStar Rev B (2440 MHz)			
Device of Orientation	Polarization	Gain (dBi)	
		Max	Avg
(V)	Vertical	0.60	-1.72
(V)	Horizontal	-7.27	-12.37
(H)	Vertical	-4.00	-10.91
(H)	Horizontal	0.02	-5.90
(F)	Vertical	-6.60	-13.52
(F)	Horizontal	0.85	-4.67
Total Avg Gain (dBi)		-3.15	

Table 2, Radiation Patterns

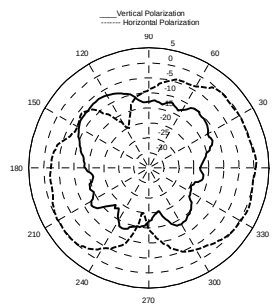
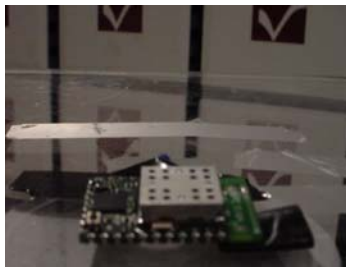
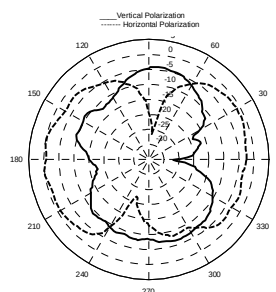
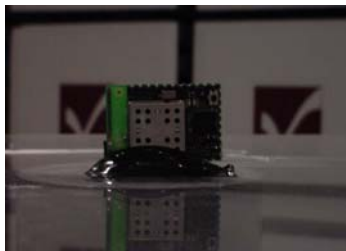
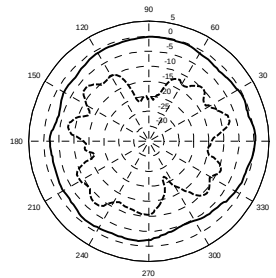
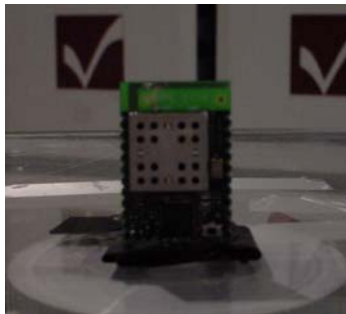


Figure 7: Radiation Patterns (Orientation)

5. Typical Performance/ Curves

Typical TX Power and TX Current vs Supply Voltage over Temperature

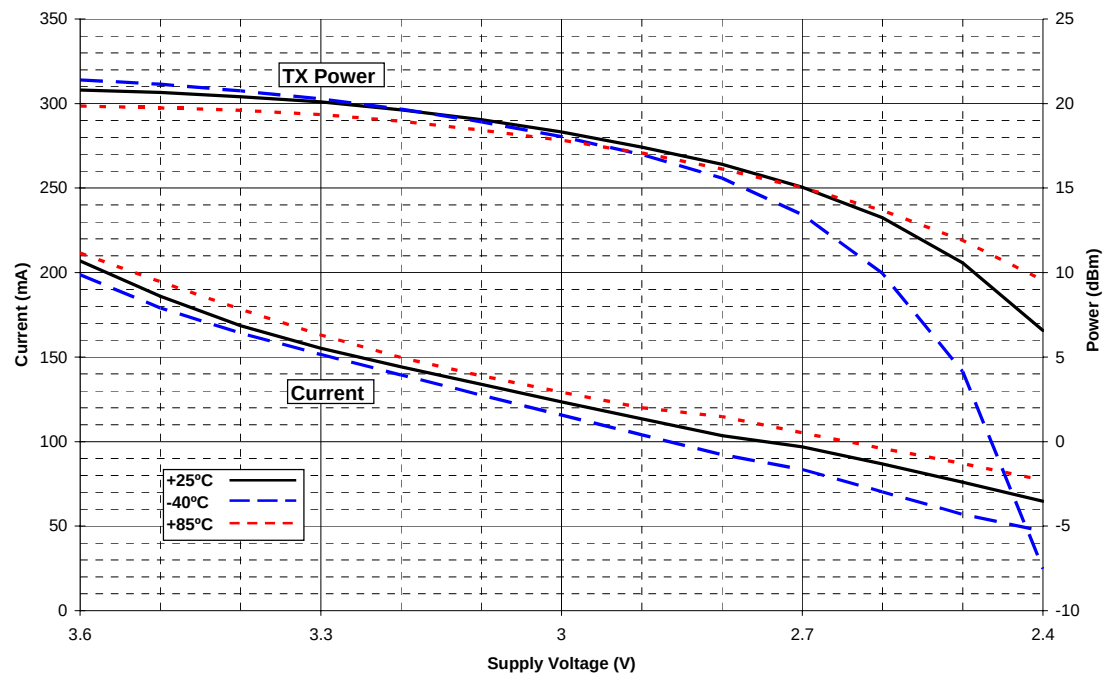


Table 3, Typical Output Power vs. MC13192 power setting (V_{dd} 3.3V, 25°C)

Power Setting	Output Power	Units
>= 30	20	dBm
28	19.6	dBm
26	18.3	dBm
24	18	dBm
22	17.6	dBm
20	17	dBm
18	11.4	dBm
16	10.8	dBm
14	10.1	dBm
12	9.5	dBm
10	1.9	dBm
8	1.4	dBm
6	0.9	dBm
4	0.3	dBm
2	-9.7	dBm

Table 4, Power Settings

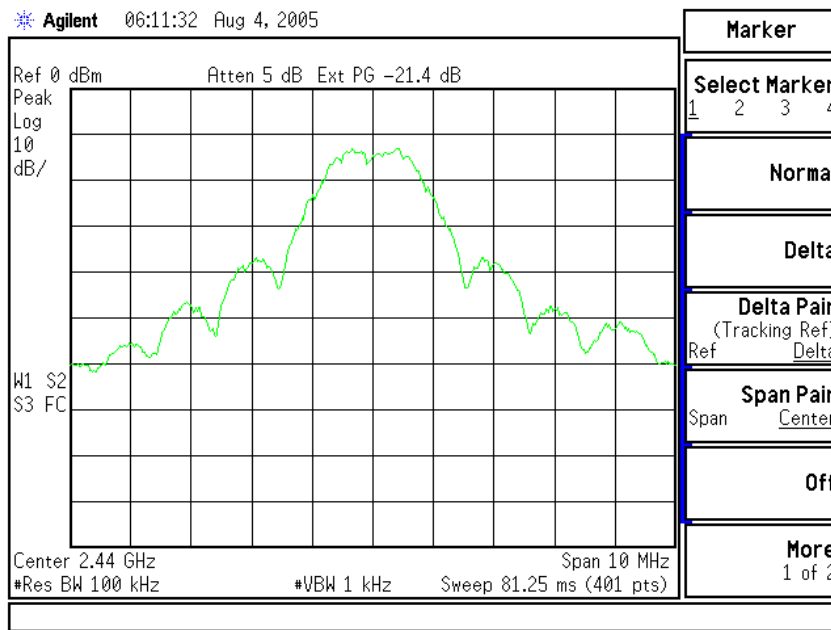


Figure 8: Typical Output Spectrum of Transmitter

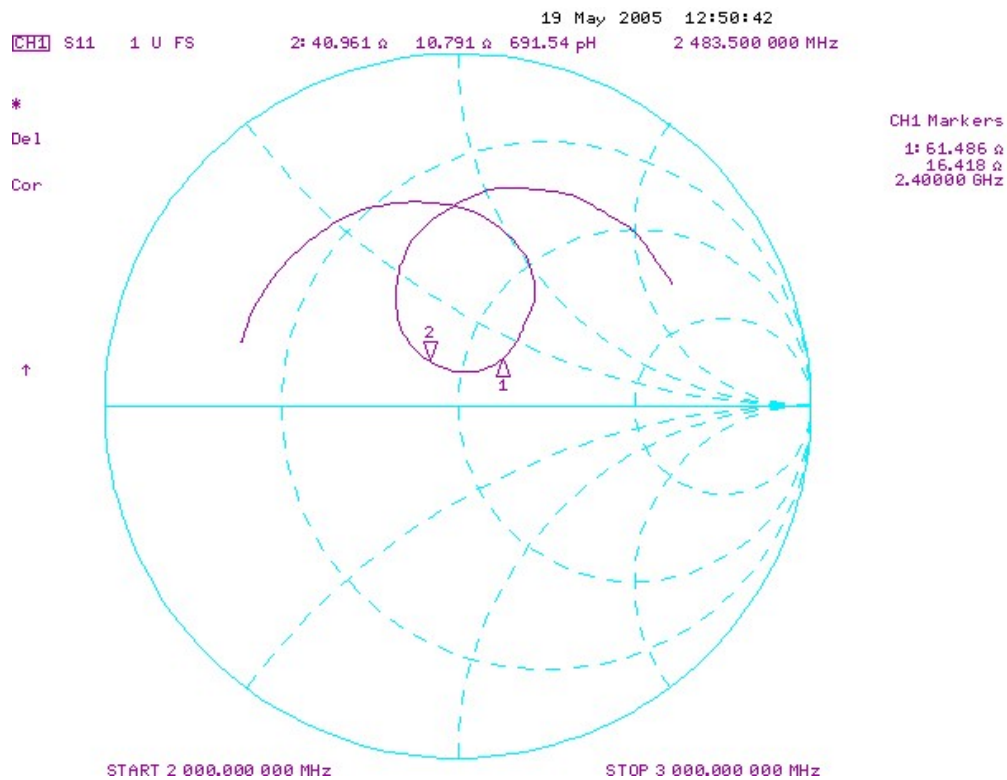


Figure 9: Receive Port Input Impedance at Antenna

6. Electrical Specifications

6.1. Absolute Maximum Ratings

Parameter	Min	Max	Units
Vdd- Power Supply	2.7	3.6	VDC
Input RF Level		10	dBm
Storage Temperature	-55	+125	°C

Table 5, Absolute Maximum Ratings

6.2. Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
Vdd- Power Supply	2.7	3.3	3.6	VDC
Input Frequency	2405		2480	MHz
Ambient Temperature Range	-40	25	+85	°C
Logic Input Low Voltage	0		30% V _{dd}	V
Logic Input High Voltage	70% V _{dd}		V _{dd}	V

6.3. Detailed Electrical Specifications

6.3.1. AC Specifications

Parameter	Min	Typ	Max	Units	Notes
Sensitivity for 1% packet error rate (-40 to +85°C)		-92		dBm	
Sensitivity for 1% packet error rate (25°C)		-92	-87	dBm	
Saturation (maximum input level)		10		dBm	
Nominal Output Power		20		dBm	
Output Power Control Range (+20 to -10 dBm)		30		dB	
Error Vector Magnitude (EVM)			35	%	
Over the Air Data Rate		250		kbps	
On-board antenna gain (peak)		0.8		dBi	
On-board antenna gain (average)		-3.1		dBi	

Table 6, AC Specifications- Rx

6.3.2. DC Specifications

Parameter	Min	Typ	Max	Units	Notes
Power Supply Current					
Transmit Mode (10 dBm)		125		mA	10 dBm
Transmit Mode (20 dBm)		150		mA	20 dBm
Receive Mode		42		mA	
Sleep Mode	1	2	5	μ A	
Output High Voltage	80%		V_{dd}	V	All digital outputs
Output Low Voltage	0		20%	V	All digital outputs

Table 7, DC Specifications

7. Custom Applications

For cost-sensitive applications, such as wireless sensors and AMR, Radiotronix can embed the application software directly into the microcontroller built into the module. For more information on this service, please contact Radiotronix.

8. Ordering Information

Product Part Number	Description
Wi.FS24-100ST	ZigBee-Ready Module (2.4 GHz)

8.1. Contact Information

Corporate Headquarters:

905 Messenger Lane

Moore, Oklahoma 73160

405-794-7730

website: www.radiotronix.com

support: support@radiotronix.com

8.1.1. Technical Support

Radiotronix has built a solid technical support infrastructure so that you can get answers to your questions when you need them. Our primary technical support tools are the support forum and knowledge base found on our website. We are continuously updating these tools. To find the latest information about these technical support tools, please visit <http://www.radiotronix.com/support>. Our technical support engineers are available Mon-Fri between 9:00 am and 5:00 pm central standard time. The best way to reach a technical support engineer is to submit a Webcase. Webcase submissions can be made at <http://www.radiotronix.com/support/webcase.asp>. For customers that would prefer to talk directly to a support engineer, we do offer phone support free of charge.

8.1.2. Sales Support

Our sales department can be reached via e-mail at sales@radiotronix.com or by phone at 405-794-7730. Our sales department is available Mon-Fri between 8:30 am and 5:00 pm central standard time. Visit our web site at <http://www.radiotronix.com/corpsales.asp> for information on where to buy our products.

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