WaveRider®

915A Functional Overview

The 915A is a 900MHz radio module intended to provide connectivity between an end-user's computer and an Internet Service Provider. It is a single PCB wireless solution based on the Intersil PRISM II Direct Sequence Chip Set. The 915A is functionally equivalent to the EUM3005 (previously certified with FCC ID: OOX-EUM3005), the EUM3006 (OOX-EUM3006) and the MMT9000 (OOX-WMAN) in regards to frequency of operation, output power, and modulation scheme.

The 915A is intended for mounting in variety of chassis, including an indoor plastic enclosure and aluminum enclosure for vehicle mounting.

Overall functionality

The 915A consists of two main sections; the digital and the RF section. Block diagrams for both sections can be found in the document "915A Block Diagrams". The digital section contains the following functionality:

1. I/O
2. Ethernet PHY
3. Microprocessor/MAC
4. Memory
5. Power Regulation

The radio module's RF section contains the following functionality:

1. Baseband Processor
2. Modulator/Demodulator (with IF synthesizer)
3. RF Synthesizer
4. Up Converter
5. Power Amplifier
6. Low Noise Amplifier (LNA)
7. Down Converter
8. RF VCO
9. IF VCO
10. Reference Oscillator
11. Antenna (RF) Interface

During transmission, data obtained by the Microprocessor from the I/O ports, is transferred to the MAC. The MAC reformats the data and places it on the Baseband Processor TX data line. This data is modulated using CCK modulation and then spread using a defined PN code such that the data is sent at a rate of 2.75Mbit/s. The data is preceded by a header that uses DPSK modulation. Two signals are generated, the In-Phase (I) and Quadrature (Q) components. The I & Q signals are sent to the Modulator/Demodulator where they are first filtered and then modulated with the IF frequency (70 MHz).

The IF oscillator generates a 140 MHz signal which is divided by two inside the Modulator/Demodulator and used to modulate the I & Q signals. The final IF signal of 70 MHz is then sent to the Up converter. The Up converter will shift this signal to the RF frequency for the channel programmed in the synthesizer, for operation within the 902-928 MHz ISM band. In the final stage, this signal is amplified to produce +27.3 dBm RF power as measured at the output of the antenna port.

In receive mode, the radio signal is amplified by the LNA, and then sent to the Down converter. The Down converter converts this signal from the 902-928 MHz range to the IF frequency, 70 MHz. The Modulator/Demodulator then converts the signal to baseband and splits the signal into its I & Q components, before sending it to the Baseband Processor. Finally, the Baseband Processor despreads and demodulates the data contained in the CCK format, and places it on the RX data line to the MAC. The MAC modifies the data, then transfers it to the Microprocessor which reformats the information and sends it out the I/O ports.

The RF and IF Local Oscillator signals are generated using the synthesizers and voltage controlled oscillators. The RF synthesizer is programmed with the desired RF channel frequency plus the IF frequency. The IF synthesizer in the Modulator/Demodulator is programmed with 140MHz. The baseband processor and the synthesizer are driven from a common 44 MHz oscillator to control the timing of these chips.

Example (for Channel 1 operation):

	RF		**IF**		**LO**
	905 MHz	+	70 MHz	=	975 MHz

Output Power

Each 915A is calibrated at 905, 915 and 925 MHz during manufacturing to output the 27.3 dBm power at the antenna connector.

The maximum time the transmitter is on is 5.1 msec after which it is in receive mode for at least 0.9 msec, so that the max. duty cycle is 5.1/6.0 = 85%. This duty cycle is not under the control of the user, but is inherent in the Dynamic Polled MAC used to control access to the channel.

Antennas

The antennas initially being cerified with the 915A board include:

- WaveRider Indoor Diversity Antenna
- Outdoor YAGI Antenna.

There are two criteria on the max. EIRP for a Part 15 transmitter in the 902-928 MHz range: 1) Maximum of 36 dBm EIRP and 2) Max. of 0.603 mW/cm^2 for radiation exposure. By convention, a min. distance of 20 cm has been used for indoor antennas. Applying this distance to the radiation exposure limits the EIRP to 34.8 dBm. The min. separation distance required for an EIRP of 36 dBm is 22.9 cm.

Outdoor antennas are intended to be mounted in a permanent fixed location, where we require installers to provide at least 30 cm separation between people and the antenna.

The following table shows antenna gains for each type of antenna and the associated antenna system gain including cable losses for typical installations. The cable for the outdoor antenna is LMR200 which has 0.1 dB per foot loss (reference Times Microsystem web site).

#	Antenna Type (e.g. Manufacturer / Model	Power at Antenna Port (dBm) – peak	+ Antenna Gain (dBi)	Min. Cable Length (ft)	- Cable Loss (dB)	System EIRP (dBm)	Min. Sep. Warning
1	WaveRider Indoor Diversity	27.3	4.4	10*	0*	31.7	20 cm
2	YAGI (e.g. Cushcraft PC8910)	27.3	13	43	4.3	36.0	30 cm

***** The WaveRider Indoor Diversity Antenna comes with 10 ft of RF Cable attached, so the antenna gain is from the RF connector and already includes cable loss.

For antennas of the same type, but with less gain, the cable loss requirements can be reduced. For example, an 11 dB YAGI would only require 2.3 dB cable loss.

Power Supply

The 915A is powered from an AC/DC power supply, the Fairway WVG 10F-420A. This power supply has been tested with the 915A as well as having its own FCC Class B acceptance.