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Abstract:

This document lists the requirements that must be met in order to use the Wave Wireless 915B Radio in different packages and configurations.

Revision History:

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12-Sep-06	A	LAG	Add details on Tiltek antenna (2.5) Add table (2) listing antenna manufactureres and models Correct table (3) for Log-periodic gain and required cable losses. Add table (4) for indoor antenna required cable losses Correct warning on outdoor antennas (2.1.3)

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1 INTRODUCTION

The Wave Wireless 915B Radio is certified by FCC and Industry Canada (IC) under a Limited Modular Approval (FCC ID: KIN-915B and IC ID: 4309B-915B). This means that the radio can be used in various packages and configurations provided the requirements below are met.

These requirements apply to any Wave Wireless final product using the 915B radio.

Note that this radio under the 915B certifications cannot be sold as a bare board to end-customers or OEMs. Only Wave Wireless manufactured final products can be sold. As such, this document is intended only for Wave Wireless or its contractors to act as an ‘installation guide’ for installing the 915B radio into a final product.

Adhering to these requirements will not necessarily ensure compliance to FCC and IC requirements for the final product. If there are any concerns, testing should be done to ensure compliance. For example, the 915B radio meets the FCC and IC Class B unintentional radiator requirements as a standalone unit. If it is combined with other components or radios, the aggregate may not meet the same limits as the standalone unit.

The term “final product” in this document will refer to the product that is sold that incorporates the 915B radio. Wave Wireless products that use the 915B radio currently includes the CCU3100.

This document will be updated as new configurations are approved for the 915B radio, such as new antenna and power supplies.

The approved configurations are shown in Section 3.

WARNING – Final product (e.g. CCU3100) user documentation (e.g. Installation Guides, Spec. Sheets) must NOT contain any information about how the 915B radio is installed in the final product nor how to access the radio.

1.1 References

LMA PART 15 UNLICENSED MODULAR TRANSMITTER APPROVAL, DA 00-1407, June 26, 2000.

Part 15 FCC CFR 47 Part 15 - RADIO FREQUENCY DEVICES, April 5, 2005.

2 REQUIREMENTS

2.1 Regulatory Notices Requirements

Regulatory Notices

This equipment has been tested and found to comply with the limits for a Class B Intentional Radiator, pursuant to Part 15 of the FCC Regulations. These limits are intended to provide protection against harmful interference when the equipment is operated in a residential environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio

communications. However, there is no guarantee that interference will not occur in a particular installation.

All versions of this device have been tested using unshielded Ethernet CAT-5 cable.

Notice to User

Any changes or modifications to equipment that are not expressly approved by Wave Wireless may void the user's authority to operate the equipment.

2.1.1 FCC

The 915B radio has been designed and manufactured to comply with FCC Part 15 under FCC ID: KIN-915B.

Operators must be familiar with the requirements of the FCC Part 15 Regulations prior to operating any link using this equipment. For installations outside the United States, contact local authorities for applicable regulations.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Interference Environment

Operation is subject to the following conditions:

- This device may not cause harmful interference and,
- This device must accept any interference received, including interference that might cause undesired operation.

Operational Requirements

In accordance with the FCC Part 15 regulations:

1. The maximum average power output of the intentional radiator shall not exceed one (1) watt (30 dBm) for all spread spectrum systems operating in the 902 to 928MHz band.
2. Stations operating in the 902 to 928MHz band may use transmitting antennas of directional gain greater than 6dBi, provided the average output power from the

intentional radiator is reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

3. The operator of a spread spectrum system and the user of the radio device are each responsible for ensuring that the system is operated in the manner outlined in the section on Interference Environment above.

The 915B radio with its certified antennas complies with these requirements when installed correctly as detailed in this manual.

2.1.2 Industry Canada

The 915B radio has Industry Canada (IC) Certification Number 4309B-915B.

Operators must be familiar with IC RSS-210 and RSS-102. The 915B has been designed and manufactured to comply with IC RSS-210 and RSS-102.

This device has been designed to operate with the antennas listed below and having a maximum antenna system gain¹ of 8.7 dBi. Antenna types not included in this list or having a systems gain greater than 8.7 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

2.1.3 Installation Warnings

It is the responsibility of the operator to ensure that the public is not exposed to excessive Radio Frequency (RF) levels. The applicable regulations can be obtained from local authorities.

WARNING

To comply with FCC RF exposure limits, the antenna must be fix-mounted to provide a separation distance of 30cm (12 inches) or more from all persons to satisfy RF exposure requirements. The distance is measured from the nearest point of the modem to the human body. It is recommended that the modem be installed in a location with minimal pathway disruption by nearby personnel.

WARNING

Outdoor antennas must be installed professionally. The installer must understand applicable FCC or Industry Canada rules regarding antennas. Only the approved antenna types with gains up to the specified maximum can be used with the 915B Radio and its final products. Installer must also understand and follow electrical codes that apply to installing outdoor antennas.

¹ Antenna system gain is defined here as the antenna gain in dBi as published by the manufacturer MINUS all losses due to cables, connectors, or devices (e.g. Cavity filters, surge protectors) installed between the 915B Radio Module RF port and the antenna port.

2.2 Final Product Installation Guide Requirements

The regulatory notices in sections 2.1.1, 2.1.2, and 2.1.3 must be included in the installation guide for the final product edited as appropriate (e.g. use final product name rather than 915B Radio). As well, the final product installation guide must provide NO instructions on how to remove the 915B radio from the product. The following notices should be included to make this clear:

This product contains no user-serviceable parts. Opening this product will void any warranty.

2.3 Final Product Labeling Requirements

The final product must have a permanent label that contains the following text:

“Contains FCC ID: KIN-915B” and

“Contains IC: 4309B-915B”.

If the label has room, then the statement “This device complies with Part 15 of FCC rules” plus the text from the Interference Environment sub-section of 2.1.1 should be included.

The following picture shows the Wave Wireless standard label that is recommended for all products containing the 915B radio, edited as appropriate.



2.4 Power Supplies

The 915B radio is approved by FCC and IC using specific AC/DC converters. The currently approved converter is the AULT PW147RB4800F01 AC to 48 VDC Power over Ethernet power supply. The use of any other AC power supply requires testing to ensure it complies with FCC and IC rules on Conducted Limits on AC lines (e.g. [Part 15] 15.207).

If the 915B radio is powered by a supply other than the AC lines (e.g. vehicle power) then no testing is required.

2.5 Antennas

Only antennas that have been approved by FCC and IC shall be used with the 915B radio. This means that any antenna of the same family with a gain less than or equal to the approved antenna can be used.

The list of approved antennas is given in Appendix A, which will be updated as new antennas are approved.

The 915B radio is approved for 27.3 dBm output power at the antenna port and FCC and IC rules require the peak radiated power be no more than 36 dBm, so a maximum of 8.7 dB gain is allowed for the antenna system, which includes the antenna gain in dBi and any losses between the 915B radio and the antenna, including cable losses, insertion losses at filters and surge protectors etc.

Therefore if a 12.15 dBi Dipole antenna is used, then the losses must be at least 3.45 dB ($27.3 + 12.15 - 36 = 3.45$ dB). A rule of thumb is that the losses must equal Antenna Gain (dBi) – 8.7.

For antennas of the same type, but with less gain, the cable loss requirements can be reduced. For example, a 9 dBi Dipole antenna would only require 0.3 dB cable loss.

This information shall be clearly noted in any installation manual for the final product.

It is also required that warnings be included in the installation manual regarding separation of people from the antennas.

- Indoor antennas are limited to gains of 7.5 dBi or less, including cable losses. This limits the total EIRP to 34.8 dBm. Indoor antennas must be installed so that people are at least 20 cm from the antenna under normal conditions.
- Outdoor antennas can support the full total gain of 8.7 dBi for the antenna system, for a maximum EIRP of 36 dBm. Outdoor antennas must be installed so that people are normally at least 30 cm from the antenna.

Antennas that support dual polarization, such as the dipole array (Til-tek TA-926VH-8-120 or similar), can only be installed with one of the polarizations active at one time. For the Til-Tek antenna, this means that the 915B radio can only be connected to one of the antenna ports.

2.6 External RF Connectors

The 915B radio can be manufactured by Wave Wireless with a variety of external RF connection options. The following requirements apply:

- Wave Wireless proprietary, unique external connector – This connector is externally accessible and can be used on any final product.
- No RF connector – Final products with an integrated, approved antenna (i.e. no RF connector externally accessible).
- Standard external RF Connectors (e.g. SMA or N type) – Final products that have standard externally accessible RF connectors can only be installed by professionals. The installation guide for these products must make this clear. The guide must provide sufficient instruction to the installer for a successful installation.

3 APPROVED CONFIGURATIONS

3.1 Approved Power Supplies

Table 1 – Approved Power Supplies

#	<u>Power Supply</u>	<u>Voltage</u>	<u>Comments</u>
1	AULT PW147RB4800F01	AC to 48 VDC	Powr Over Ethernet

3.2 Approved Antennas

This table lists the specific antenna manufacturer and model numbers tested for the FCC and IC certifications. Antennas of the same type and equal or less gain are permitted to be used.

Table 2 – Tested Antennas

#	<u>Antenna Type</u>	<u>Manufacturer / Model Number</u>	<u>Gain (dBd)</u>	<u>Gain (dBi)</u>
1	Onmi-Directional Dipole	Antel / BCD-87010N	10	12.15
2	Log-periodic	Swedcom / SC9014	14	16.15
3	Dipole array	Til-tek / TA-926VH-8-120	11.5	13.65

This table shows the cable losses required to use the highest gain antennas of each approved type when mounted outdoors.

Table 3 – Cable Loss Requirements for Outdoor Antennas

#	<u>Antenna Type</u>	<u>Power at Antenna Port (dBm) – peak</u>	<u>+ Antenna Gain (dBi)</u>	<u>- Cable Loss (dB)*</u>	<u>System EIRP (dBm)</u>	<u>Min. Sep. Warning</u>
1	Onmi-Directional Dipole	27.3	12.15	3.45	36.0	30 cm
2	Log-periodic	27.3	16.15	7.45	36.0	30 cm
3	Dipole array	27.3	13.65	4.95	36.0	30 cm

* Cable loss here also includes insertion losses due to devices and connectors.

This table shows the cable losses required to use the highest gain antennas of each approved type when mounted indoors. Note that the System EIRP must be no more than 34.8 dBi for an indoor antenna, so that the radiation at a min. separation of 20 cm is within the required safety limits. For practical installations, an antenna of lesser gain is more likely to be used for indoor installations, so this table is a guideline for the worst cases.

Table 4 – Cable Loss Requirements for Indoor Antennas

#	<u>Antenna Type</u>	<u>Power at Antenna Port (dBm) – peak</u>	<u>+ Antenna Gain (dBi)</u>	<u>- Cable Loss (dB)*</u>	<u>System EIRP (dBm)</u>	<u>Min. Sep. Warning</u>
1	Onmi-Directional Dipole	27.3	12.15	4.65	34.8	20 cm
2	Log-periodic	27.3	16.15	8.65	34.8	20 cm
3	Dipole array	27.3	13.65	6.15	34.8	20 cm

* Cable loss here also includes insertion losses due to devices and connectors.