



INSTALLATION AND OPERATORS GUIDE

WaveRider Product Support

NCL135

An Intelligent Wireless Bridge

(PRELIMINARY)

INSTALLATION AND OPERATORS GUIDE

Version 0.3

WaveRider Product Support

>> *digital picture to follow from Colin* <<

NCL135

An Intelligent Wireless Bridge



WAVERIDER COMMUNICATIONS INC.

www.waverider.com

INSTALLATION AND OPERATORS GUIDE

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The information contained in this manual is subject to change without notice.

WaveRider Communications Inc. recommends that trained and insured technicians perform all tower, antenna and NCL135 installations as specified in FCC 15.247 and 15.203.

GENERAL WARNINGS

Operator and maintenance personnel should be familiar with the safety requirements before attempting installation or operation of the equipment covered by this manual. Failure to follow the requirements and observe safety precautions could result in death or injury to personnel or damage to the equipment.

Observe all safety regulations.

Observe grounding precautions. Verify that the unit under test or being installed and all measurement equipment are properly grounded.

It is the responsibility of the installer and the user to ensure that the public is not exposed to excessive RF levels.

INFORMATION TO USER

Changes or modifications not expressly approved by WaveRider communications Inc. for compliance will void the users authority to operate the equipment.

EQUIPMENT PRECAUTIONS

Never operate the NCL135 without connecting a 50-ohm termination to the antenna port. This termination can be a 50-ohm antenna or a 50-ohm resistive load capable of absorbing the full RF output of the RF Unit PA.

Failure to properly terminate the RF output may cause permanent damage to the NCL135.

WARRANTY

WaveRider Communications Inc. warrants that each NCL135 shall be free from defects in materials and workmanship for a period of twelve (12) months from the date of shipment from the factory.

Section 6 of this manual contains instructions for the return of equipment due to failure or damage from shipping.

REGULATORY NOTICES

The 2.4 GHz NCL135 complies with FCC Part 15 Regulations and IC RSS-210

FCC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

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

The transmission power of this device complies with part 15.247 of the FCC Rules.

Industry Canada

Operation is subject to the following two conditions:

- 1) This device may not cause interference, and
- 2) This device must accept any interference including interference that may cause undesired operation of the device.

L'utilisation de ce dispositif est autorisée seulement aux conditions suivantes:

- 1) Il ne doit pas produire de brouillage, et
- 2) L'utilisateur du dispositif doit être prêt à accepter tout brouillage radioélectrique reçu même si ce brouillage est susceptible de compromettre le fonctionnement du dispositif.

FCC ID:_____ **AND IC ID:**_____

Operators must be familiar with the requirements of the FCC Part 15 Regulations and IC RSS-210 prior to operating any link using this equipment. For installations outside the US or Canada, contact local authorities for applicable regulations.

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1 GENERAL INFORMATION

1-1 How to use this Manual

Before installing and operating the NCL135, WaveRider Communications Inc. recommends that the user read this manual in its entirety.

The user should be familiar with the contents before starting installation and alignment activities. The user should always have the required tools, test equipment and any other required, miscellaneous installation material.

1-2 Manual Organization

The NCL135 Installation and Operators Guide is divided into six sections. These sections describe all aspects of the installation and operation of the NCL135 and return of equipment still under warranty.

Section 1: General Information - Contains discussion on the use of this manual, summary of the manual organization and system description, FCC and IC rules summary.

Section 2: Product Description - Discusses frequency planning, specifications, theory of operation, NCL135 description, cabling and antenna descriptions.

Section 3: Installation - Contains pertinent information on equipment unpacking, tools required, inventory, path profile clearance, site planning and selection, cabling, NCL135 antenna and cable installation.

Section 4: Configuration And Operation - Defines the modem front panel, LED status display, NCL135 and modem configuration, antenna alignment, user interface connections and summary fault.

Section 5: Fault Location - Outlines the various fault conditions as indicated on the NCL135 front panel, LED fault indication and interference resolution.

Section 6: Equipment Return - Identifies help desk availability, the WaveRider Communications Inc. website and how to return equipment under warranty.

1-3 FCC/IC Rule Summary

This section provides a summary of the major points contained within Federal Communications Commission (FCC) Part 15 and IC RSS-210 rules governing the operation of this equipment.

Each operator should read and fully understand all FCC and IC rules applicable to spread spectrum transmission.

1-3-1 Interference Environment

The manufacturers and operators of spread spectrum devices are reminded that the operation of spread spectrum devices are subject to the conditions that any received interference, including interference from industrial, scientific and medical (ISM) operations, must be accepted and that harmful interference may not be caused to other radio services. Should the operation of these systems cause harmful interference, the operator of the spread spectrum devices system is required to correct the interference problem, even if such correction requires the cessation of operation of the Part 15 transmitter. The FCC will not exempt spread spectrum devices from this latter requirement because of the application for which the spread spectrum device transmitter is employed. Thus, the FCC strongly recommends that utilities, cellular stations, public safety services, government agencies and others that employ spread spectrum device transmission systems to provided critical communication services, should exercise due caution to determine if there are any nearby radio services that could be affected by their communications.

1-3-2 Limitations on Operations

Three of the conditions pertaining to the operation of spread spectrum devices employing high-gain, directional antennas are:

1. The operation of these systems is limited to fixed, point-to-point applications.
2. Point-to-multipoint systems, omni-directional applications and multiple co-located transmitters transmitting the same information are prohibited.
3. The operator of a spread spectrum system is responsible for ensuring that the system is operated in the above manner.

1-3-3 Potential RF Hazard

It is the responsibility of the installer and the user to ensure that the public is not exposed to excessive RF levels.

1-3-4 Operational Requirements

The maximum peak power output of the intentional radiator shall not exceed the following:

1. One (1) watt for all direct sequence systems operating in the 2.400-2.4835 GHz band.
2. Systems operating in the 2400-2483.5 GHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi, provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.



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3. Fixed, point-to-point operation, as used in paragraphs 2 and 3 above, excludes the use of point-to-multipoint systems, omnidirectional applications and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations.

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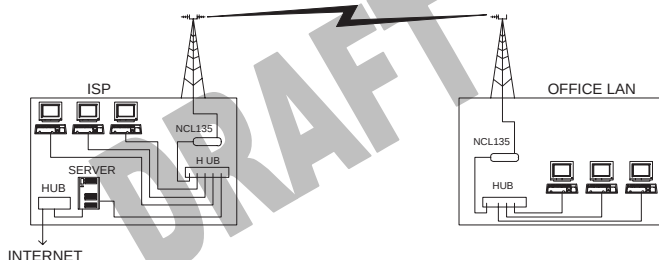
2 PRODUCT DESCRIPTION

2-1 General

The NCL135 provides reliable data communications between two sites with line-of-sight clearance. The NCL135 provides an Ethernet interface allowing the user to connect to almost any other Ethernet device. Data is modulated and transmitted to the far-end NCL135 where it is recovered and passed to the receiving user device. The NCL135 uses Spread Spectrum processing, which reduces the transmitted power density and thus the potential for interference into neighboring communications systems. For this reason, the FCC and IC allow such systems to operate without a site license.

The NCL135 can be placed on a table or desktop.

A typical link diagram using the NCL135 is shown below. A link consists of two units installed at the end-points of a line-of-sight link usually less than 7 km in length.



NCL135 Link Configuration

2-2 Frequency Planning

The NCL135 can coexist with other similar radio links within the vicinity. It uses a variety of processing techniques to provide this compatibility. Diversity with other links can be achieved through the use of different transmit spreading codes, frequencies and antenna pattern separation. In order to provide the maximum immunity to interference, it is recommended that the following guidelines be observed.

2-2-1 Frequency Band

The NCL135 operates at 2400 – 2483.5 GHz.

2-3 Theory of Operation

2-3-1 NCL135

The NCL135 is installed indoors near the user's data equipment. The ambient environment must comply with the specifications contained in Subsection 2.6. Configuration information is supplied by the User Interface Non-volatile memory is provided to store the firmware and the previously entered configuration data. Thus, configuration data is retained during a loss of power. A set of default values are entered during the manufacturing process.

2-4 Antenna and Cabling

2-4-1 General

Use of antennae with gain greater than or equal to 24dBi and cables with less than 2 dB insertion loss are strictly prohibited.

2-4-2 Antenna

WaveRider Communications Inc. recommends a professional installation of any directional antenna with a gain less than or equal to 24dBi and a suitable coaxial cable providing a minimum of 2 dB of insertion loss. The NCL135 has been certified to operate with a 24dBi parabolic antenna and 10 meters of LRM400 low loss cable.

All antennas used in the United States must be approved by the FCC.

(for further information refer to... of this document)

2-4-3 Cables

Coaxial cables used in this product impact upon many factors, such as path loss, antenna gain, and required received signal strength. When practical, use the lowest loss coaxial cable allowed for chosen antenna gain. The NCL135 has been certified to operate with a 24dBi parabolic antenna and 10 metres of LRM400 low loss cable.

(for further information refer to... of this document)

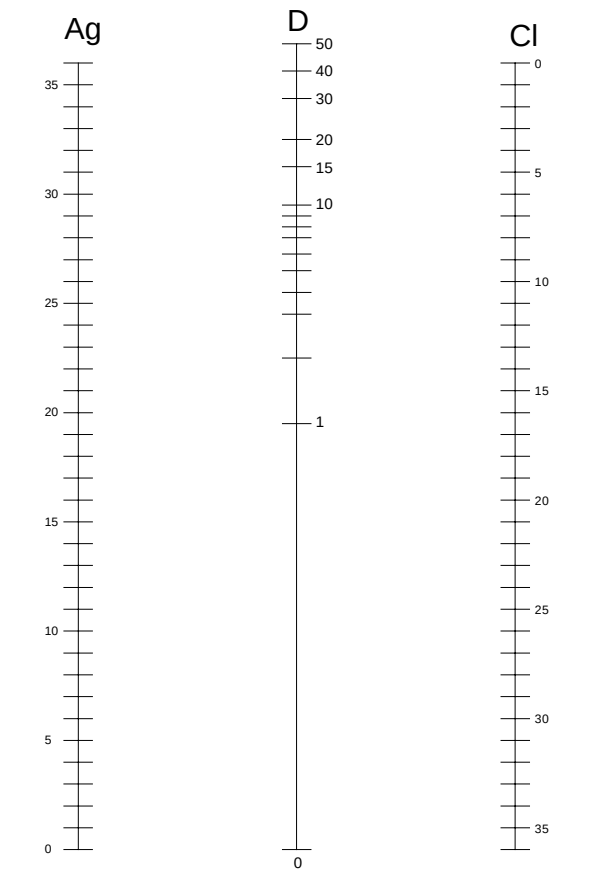


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Maximum Ethernet cable is 100 metres as specified in TIA/Eia 568A Standard

2-4-4 Nomogram

A wide variety of antennas may be used with the NCL135. The graph below provides guidelines for recommended antenna sizes for various link distances.



This nomogram is accurate to ± 500 meters. Based on a Rx sensitivity of -77 dBm and a transmission power of 20 dBm

2-4-4-1 Limitations of Nomogram

This nomogram is not designed to calculate the feasibility of a repeater link. The nomogram does not account for any radio interference what so ever and is only an estimation tool based on line of sight. Note that trees near the line of sight could add as much as 36 dBm per Km to the Cl scale. An urban setting could



add as much as 50 dBm per Km to the CI scale. Heavy rail can add as much as 15 dBm per Km to the CI scale.

2-4-4-2 Purpose of Nomogram

The purpose of this nomogram is to assist the user in determining the feasibility of a radio link based only on distance (Km), antenna gains (dBm), and cable/connector losses (dBm).

2-4-4-3 How to use Nomogram

Calculate the total antenna gain for the entire radio link. This is referred to Ag on the nomogram.

Calculate the total cable and connector loss for the entire radio link. This is referred to CI on the nomogram.

Using a ruler, draw a line from the Ag value to the CI value.

The maximum feasible distance, in Km, of the link is where the line intersects the line labeled D.

Notes:

A detailed path profile analysis should be performed before the antenna size can be verified. The above are general guidelines only.

2-5 Specifications

Operating frequency range	2.4 to 2.4385 GHz
Co-located channels	15
Over the air data rate	1.6Mb/s
Network data rate per endpoint	700 Kbps average
Operating temperature	0 to +65
Shock	100g
Vibration	2g's RMS, 20-2000Hz random
Network Interface	10base-T
Radio Type	Frequency Hopping Spread Spectrum
Rf output power	20 dm (fixed)
Rf sensitivity	-85 dbm BFJK -77 QFSK
Indicators	LEDs: fault, power, RF link, Ethernet tx/rx
Connectors	Unique TNC, RJ45, power, DBP console
Size	230mm x 220mm x 27mm
Regulatory approvals	IC, FCC, CE, UL (all pending)
Power	5VDC 750mA max
Power supply	90 -260 VAC 47-63 Hz

3 INSTALLATION

3-1 General

The following sections outline the steps necessary to properly install the NCL135 and align the antenna. Installation should only be performed by trained technicians. Tower installations should only be performed by professional and insured contractors.

3-2 Tools & Equipment To Aid In Installation

It is recommended to have the following tools on hand when attempting to install the NCL135:

- Terminal or computer with terminal emulation program
- A RS232 cable with 9 pin Male connector for the NCL135 end and as required for the computer on the other end.
- Networking cables
- An antenna for each NCL135 in the link
- Supports for the antennas
- Cables from the NCL135 to the Antennas with the appropriate connectors
- Vulcanizing tape to wrap connectors intended for outdoor use
- Cable ties and/or supports
- Hand tools may be required for mounting the antenna and general installation.

Desirable tools:

- Multimeter
- GPS or compass
- Telescope
- Maps
- Antenna alignment test equipment
- Path loss modeling software

3-3 Unpacking The Equipment

The equipment is shipped in specially designed boxes, which protect it against most conditions experienced in normal ground or air shipping and handling. It is recommended that the boxes be left sealed and sheltered until the installation process commences. Any signs of damage ought to be reported to the transportation

company immediately. The boxes and packing material may be saved for use in the event the equipment is returned.

3-4 NCL135 Package Contents

- 1 - NCL135
- 1 -Power Supply and Power Cord
- 1 - NCL135 Installation and Operators Guide
- 1 – Quick Guide

3-5 Path Clearance

The RF path between the two antennas must have an unobstructed line of sight path. Any blockage will cause propagation problems, which will result in a high Error Rate or a complete outage. A careful analysis of the terrain profile between the two sites will provide the designer with required antenna heights for a clear path. The main factors to consider when performing the path clearance calculation are:

- Site Locations
- Path Profile
- Obstacles Along Path

3-6 Cabling

The NCL135 requires three cabling interconnections prior to operation.

These are:

1. Antenna to NCL135
2. NCL135 Ethernet to User Network
3. NCL135 to Power Source

3-7 NCL135 Installation

The NCL135 is designed for placement on a table top either on the feet or on an edge

3-8 Antenna Installation

The antenna is required to meet local regulations. In the United States antennas must be FCC approved. In both Canada and the United States, emissions are subject to regulation and must not exceed permitted limits.

In high performance 2.4 Ghz links the propagation is very near line of sight and may be subject to deep fades from multipath. Adjusting the location by as little as one meter can have profound

effects upon link performance. The antenna ought to be a minimum of 3 meters from radio reflective surface.

If the antenna is mounted indoors, it should be placed at least 12 inches (31 cm) from the glass. The antenna should be near perpendicular to the glass. Transmission through glass with metal content of coatings is reduced substantially.

3-9 Cable Installation

Due to the high attenuation of the transmitted and received signals at 2.4 GHz, the length of cable used between the RF Unit and Antenna should be minimized.

WARNING:

Improperly installed cable and connectors are the most common source of system problems.

A vulcanized tape is recommended for application to the connection after all connectors have been properly tightened.

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4 CONFIGURATION AND OPERATION

<< Currently in development (Ken) <<

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5 FAULT LOCATION

Currently in Development <<Paul>>

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6 EQUIPMENT RETURN

>> Currently in development (Brent) <<

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7 APPENDIXES

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7-1 Appendix A. Support Spreadsheets

>> Currently in development (Paul) <<

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7-2 Appendix B. Problem Report Form

>> Currently in development (Paul)

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