

MDS NX915 Integrator's Guide

Part No. 05-6697A01

1.0 INTRODUCTION

The MDS NX915 (Figure 1), is a multi-modem modular system offering both Frequency Hopping Spread Spectrum and DTS transceiver modes that are designed for use in the license-free 902-928 MHz band. The unit is designed for use inside data equipment to provide reliable connectivity in wireless networks.

The NX915 power control circuit ensures that the RF output never exceeds +30 dBm at the antenna connector. The module is designed for **OEM use only**. Host systems, if used with antennas having standard connectors, must be professionally installed. Host systems using integrated antennas or unique antenna connectors must be factory configured by the OEM to operate at the correct output power setting. Refer to the table at the end of this guide to determine applicable antenna types and the RF output power allowed.

1.1 Transceiver Features

The NX915 maximizes performance and flexibility in wireless networks, offering the following key features:

- Up to 81 channels over 902–928 MHz, divided into multiple zones
- User-selectable option to skip sub-bands with interference
- Multiple available network addresses
- Network-wide configuration from the Master station, eliminating most trips to Remote sites
- RSSI and LQI readback indicators
- Poor load VSWR detection alarm indicator
- Store-and-Forward repeater operation
- Same hardware for Master, Remote, or Store-and-Forward configurations
- Supports RS/EIA-232(TTL), Ethernet, and USB user interfaces
- Operates at 4.5 Vdc at the MiniPCIe card edge power connections

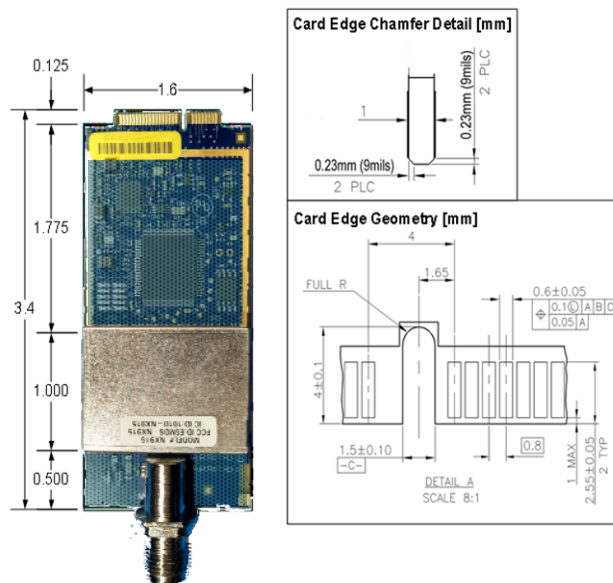


Figure 1. NX915 Transceiver Module
(Mini PCI-Express Card Edge for Data/Power/& I/O and J300 Antenna)

NOTE: Some features may not be available on all units, based on the options purchased, or regulatory constraints in the country of operation.

2.0 INSTALLATION

The transceiver is designed for installation in existing electronic equipment. The I/O and power connections are made through the Mini PCI-Express card edge and it mounts to the host heatsink assembly using two #4 screws inside the RF can area. The required heatsink contact area on the bottom surface of the PCB has the solder mask removed for proper heat transfer.

Only one cable connection is required to the radio for the J300 Antenna connector. Note that the module does have four optionally populated status LEDs (CR100, 101, 200, and 201) that indicate operating mode details. These LEDs provide important information that is useful during startup and optimization of the radio link.

Antennas used with the radio can be either a Yagi directional type (often used at remote sites) or an omni-directional type used for short range applications or at Master stations. Contact your sales representative for information on available antennas.

Follow these steps to install the transceiver module:

1. Power down the Host assembly the module is being installed in to.
2. Mate the MiniPCIe card edge of the module into the socket on the Host assembly.
3. Secure the module to the heatsink surface using two #4 screws through the mounting holes in the corners of the RF can area on the radio's PC board.
3. Install the RF shield over the transceiver section.
4. Select and install an appropriate antenna and feedline for your system coverage requirements.
5. Connect the antenna coaxial lead to J300 on the module. It accepts a Type-TNC male coaxial connector.
 - For antenna gains higher than 6dBi, the system has been approved only with the following types:
 - a. MDS PN: 97-3194A23 (Manuf. PN: Z2402 from PCTEL, Inc.), 7dBd (9.15 dBi), Omnidirectional
 - b. MDS PN: 97-3194A14E (Manuf. PN: Z2342 from PCTEL, Inc.), 10dBd (12.15 dBi) Yagi
6. Host Power Supply Requirement: The input power applied to the unit must be **4.5 Vdc** (-/+0.05 V). See Table 1 for power supply interface connections.

Table 1. NX915 Power Supply Connections

52-Pin GE MDS NIC Card Edge	
Pin	Description
1, 6, 7, 10, 12, 14, 16, 19, 20, 23, 25, 28, 30, 31, 32, 33, 36, 38, 42, 44, 45, 46, 47, 48, 49, 51	GPIO (Includes Ethernet & Serial) *Consult Factory Documentation for specific details.
2, 24, 39, 41, 52	+4.5V
3, 5, 8, 11, 13, 17, 22	NC
4, 9, 15, 18, 21, 26, 27, 29, 34, 35, 37, 40, 43, 50	GND

7. Set the radio's basic configuration with a PC terminal through the Host system. The three essential settings for all transceivers are (See Section 3 for commands):

- Frequency
- Power
- Modem

8. In a normally operating system, you will see the CR100 POWER LED turn on at start-up.

9. Optimize the installation by checking:

- Antenna aiming and SWR check
- Optimal baud rate setting
- Radio interference checks

3.0 RADIO PROGRAMMING

There are no manual adjustments on the radio. All programming and control is performed through a PC connected to the Host platform that interfaces with the radio's J200 MiniPCle card edge connector.

3.1 User Commands

The following tables provide descriptions of the various user commands for the transceiver.

Table 2. NX915 User Commands

Command	Description	Notes
ABOUT	Displays NIC version build time and date.	
HELP	Displays all available commands.	
RESET	Software reset.	
OWM	Display/set the NIC owner's message.	
SER	Display the NIC serial number.	
ETH	Displays Ethernet interface status.	
ETH REINIT	Restarts Ethernet interface.	
MODEM	Display/set NIC modem selection.	[125,250,500,1000]
RSSI	Displays continuous RSSI in dBm.	
RSSI! [#]	Displays instantaneous or averaged RSSI.	[#] number of seconds to average over, if not included instantaneous value.
KEY	Transmit continuous un-modulated carrier.	
KEYR	Transmit continuous random data modulated carrier.	
DKEY	Stop continuous transmission.	
LNA	Turn FEM LNA ON or OFF.	[ON,OFF]
FREQ	Set operating frequency.	Value is in Hz.
UPTIME	Display the amount of time since last power cycle.	
PWR [#]	Set the TX power (dBm)	

4.0 DC INPUT REQUIREMENTS

4.1 Power Consumption Ratings

The module has the following nominal power consumption ratings when operated at the required input voltage of 4.5 Vdc (-0.05/+0.05 V tolerance) at the power connections:

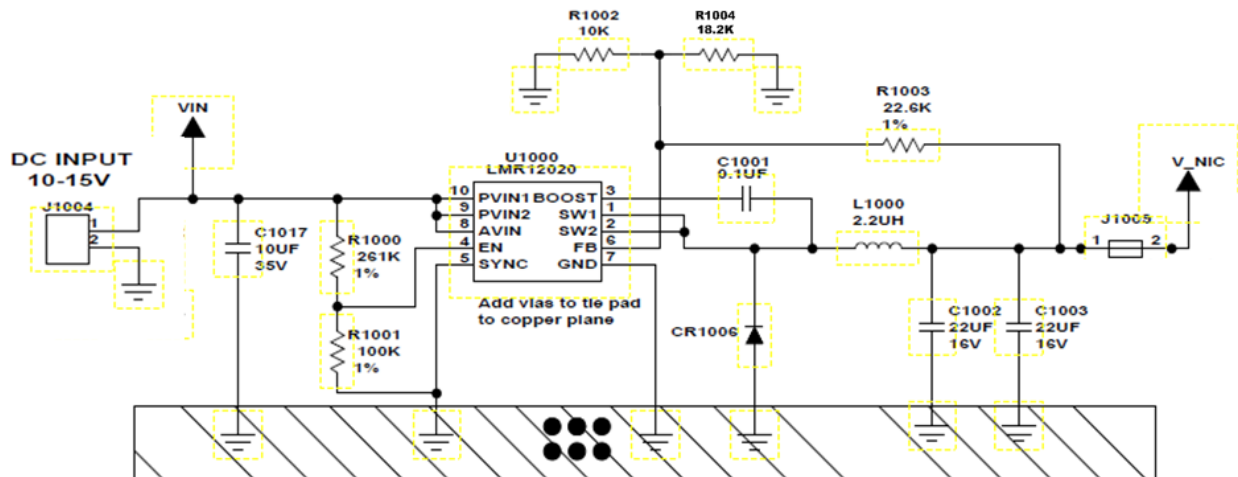
Active Receive Mode: 130mA, Transmit Mode (Worst Case Load): 1.3 Amperes

4.5 VDC Power Regulation must be met by OEM to satisfy LMA conditions:

OEM Integrator should consult with Product Support for individual circuit implementations. At minimum, OEM Integrators must regulate the DC voltage applied to the NX915 module at +4.5 Vdc (V_NIC), with a tolerance of -0.05/+0.05 Vdc. This can be achieved using a voltage regulator similar to the Texas Instruments LMR12020, which is a precision DC regulator. The external +4.5 VDC input is connected via pins 2, 24, 39, 41, and 52 of the 52 pin MiniPCle card edge connector. The transmitter uses a closed-loop power detection circuit that ensures the peak RF power will never exceed +30dBm.

The input voltage range of the LMR12020 device in this configuration is 10V to 15V. Using switched-mode power-conversion technology, the LMR12020 can step down to voltages as low as 1.13V from a 10V input bus, with typically less than 1 W of power dissipation. The output voltage must be set to a voltage of 4.5V, using an external trim resistor. Operating features of the TI device include cycle-by-cycle current limiting, under-voltage lockout (UVLO), on/off inhibit, output overcurrent protection, and over-temperature protection.

For example purposes, a circuit employing this method of regulation is shown below in schematic form.



5.0 REGULATORY AND RF OUTPUT POWER REQUIREMENTS

5.1 Technical Assistance

Factory technical assistance is available by contacting GE MDS during business hours (8:30 AM to 6:00 PM Eastern Time). Use one of the following means to contact the factory:

Telephone: (585) 241-5510 FAX: (585) 242-8369 E-mail: gemds.techsupport@ge.com Web: www.gemds.com

5.2 Regulatory Information

Federal Communication Commission Sec 15.105 Interference Statement

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 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.

FCC Part 15 and Industry Canada RSS Notices

This device complies with Part 15 of the FCC Rules and Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference that may cause undesired operation of the device.

Warning: Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

a) Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. 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 necessary for successful communication.

b) The radio transmitter described herein (IC ID: 101D-NX915) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil est conforme à la Partie 15 des règlements de la FCC et Industrie Canada exempts de licence standard RSS (s). Son utilisation est soumise à deux conditions: (1) ce dispositif ne peut causer des interférences, (2) cet appareil doit accepter toute interférence pouvant causer un mauvais fonctionnement du dispositif.

a) En vertu des règlements d'Industrie Canada, cet émetteur radio ne peut fonctionner avec une antenne d'un type et un maximum (ou moins) approuvés pour gagner de l'émetteur par Industrie Canada. Pour réduire le risque d'interférence aux autres utilisateurs, le type d'antenne et son gain doivent être choisis de façon que la puissance isotrope rayonnée équivalente (PIRE) ne dépasse pas ce qui est nécessaire pour une communication réussie.

b) L'émetteur radio décrit ci-après (IC ID: 101D-NX915) a été approuvé par Industrie Canada pour fonctionner avec les types d'antennes énumérées ci-dessous avec le gain maximal admissible et nécessaire antenne d'impédance

pour chaque type d'antenne indiqué. Types d'antennes ne figurent pas dans cette liste, ayant un gain supérieur au gain maximum indiqué pour ce type, sont strictement interdites pour une utilisation avec cet appareil.

FCC Limited Modular Approval Notice

This device is offered as an FCC Part 15 Unlicensed *Limited Modular Transmitter (LMA)*. The transmitter module is approved for use only with specific antenna, cable and output power configurations that have been tested and approved for use when installed in devices approved by third-party OEMs, or produced by the Grantee (GE MDS). Modifications to the radio, the antenna system, or power output, that have not been explicitly specified by the manufacturer are not permitted, and may render the radio non-compliant with applicable regulatory authorities.

When this module is placed inside an enclosure, a durable label must be affixed to the outside of the final host device and shall be labeled with “**Contains FCC ID: E5MDS-NX915, Contains IC: 101D-NX915**” indicating the module's FCC ID & IC Numbers.

Note: A host product is required to comply with all applicable FCC & Industry Canada equipment authorizations regulations and/or requirements and equipment functions not associated with the transmitter module portion. For example requirements for any co-location of additional transmitter with the module and/or at the minimum compliance with FCC part 15B & IC ICES-003; Digital device are the sole responsibility of the OEM integrators for the final host device.

RF Exposure Warnings

The antenna(s) to be used with this module must be installed with consideration to the guidelines for RF exposure risk to all nearby personnel, and must not be co-located or operating in conjunction with any other antenna or transmitter.



Professional installation required. The radio equipment described in this guide emits radio frequency energy. Although the power level is low, the concentrated energy from a directional antenna may pose a health hazard. Do not allow people to come closer than **23 cm (9 inches)** to the antenna when the transmitter is operating in indoor or outdoor environments. In mobile applications (vehicle mounted) the above separation distance must be maintained at all times. More information on RF exposure is available online at: www.fcc.gov/oet/info/documents/bulletins

L'énergie concentrée en provenance d'une antenne directionnelle peut présenter un danger pour la santé. Ne pas permettre aux gens de s'approcher à moins de 23 cm à l'avant de l'antenne lorsque l'émetteur est en opération. On doit augmenter la distance proportionnellement si on utilise des antennes ayant un gain plus élevé . Ce guide est destiné à être utilisé par un installateur professionnel. Plus d'informations sur l'exposition aux rayons RF peut être consulté en ligne à l'adresse suivante:

www.fcc.gov/oet/info/documents/bulletins **RF Exposure Notices**

5.3 RF Output Settings

Consult Table 3 for the maximum applicable power settings. The NX915 is a multi-modem system offering both Frequency Hopping Spread Spectrum and DTS transceiver modes in the license-free 902-928 MHz band. It therefore has specific output power limits for each modem dependent on your installation. Since RF cable lengths and cable types may vary from one installation to another it is critical to comply with the following:

The EIRP shall be calculated based on the transmitter antenna gain (G_{dBi}), cable loss (CL_{dB}) and Peak output power at the antenna terminal (P_{dBm}). Calculated EIRP = $P_{dBm} + G_{dBi} - CL_{dB}$

- Never exceed the modem specific EIRP values listed in Table 3 for any given system loss.

Table 3. NX915 Max Power Settings

Max Power Settings for FHSS modes

Antenna Gain (Antenna Gain in dBi ¹)	Modem Selection	Peak Output Power at Antenna Terminal (dBm)	Cable Loss (System Attenuation)	EIRP ² (dBm)
6 (or less) Omni or Yagi	125	29.99	0.86dB	35.13
9.15 Omni Directional Antenna	125	29.99	3.86dB	35.28
12.15 Yagi Antenna	125	29.99	6.86dB	35.28
6 (or less) Omni or Yagi	250	29.99	0.86dB	35.13
9.15 Omni Directional Antenna	250	29.99	3.86dB	35.28
12.15 Yagi Antenna	250	29.99	6.86dB	35.28

Max Power Settings for DTS modes

Antenna Gain (Antenna Gain in dBi ¹)	Modem Selection	Peak Output Power at Antenna Terminal (dBm)	Cable Loss (System Attenuation)	EIRP ² (dBm)
6 (or less) Omni or Yagi	500	27.93	0.86dB	33.07
9.15 Omni Directional Antenna	500	27.93	1.86dB	35.22
12.15 Yagi Antenna	500	27.93	4.86dB	35.22
6 (or less) Omni or Yagi	1000	28.80	0.86dB	33.94
9.15 Omni Directional Antenna	1000	28.80	2.86dB	35.09
12.15 Yagi Antenna	1000	28.80	5.86dB	35.09
6 (or less) Omni or Yagi	1000W	29.62	0.86dB	34.76
9.15 Omni Directional Antenna	1000W	29.62	2.86dB	35.91
12.15 Yagi Antenna	1000W	29.62	5.86dB	35.91

1. Most antenna manufacturers rate antenna gain in dBd. To convert to dBi, add 2.15 dB.
2. Feedline loss varies by cable type and length. Installation specific compensation is required.