



USER MANUAL

Nautilus Radio Module NRM-900-1

FCC ID: I6I-NRM-900-1
Industry Canada ID: 1497A8989A

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Revisions

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Glossary of Abbreviations and Acronyms

RRC: Radio Remote Control

FCC: Federal Communications Commission

SPI: Serial Peripheral Interface

MOSI: Master Output Slave Input

MISO: Master Input Slave Output

UHF: Ultra High Frequency

BER: Bit Error Rate

NOTE: THE MANUFACTURER IS NOT RESPONSIBLE FOR ANY RADIO OR TV INTERFERENCE CAUSED BY UNAUTHORIZED MODIFICATIONS TO THIS EQUIPMENT. SUCH MODIFICATIONS COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

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Scope and Objectives

This document applies to the Nautilus Radio Module NRM-900-1.

This manual is intended to be used by Nautilus engineers for designing the module into the host system. It shall also be used by the end user of the system for familiarization with the module's operation and observing necessary precautions.

1 FCC Part 15 Statement

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.

2 Device Description

2.1 Purpose and target systems

The NRM-900-1 is a UHF data transceiver module which is only approved for installation in devices under the control of the Grantee."

The module provides bi-directional half-duplex data link between two different parts of the system. The module is designed into the target system at Nautilus. Its operational parameters are fully controlled by the system firmware running on the host system.

It is expressly prohibited to use the module in any system not designed and approved by Nautilus. It is also prohibited to alter the system's firmware controlling the module in any way.

2.2 Module specifications

2.2.1 Power requirements

The module shall be powered from a regulated DC power source compliant with the requirements listed in the following table. All target systems shall provide power source for the module that meets these specifications.

Parameter	Min	Max
Input voltage	3.22V DC	3.37V DC
Input voltage ripple		10mVrms
Current consumption		40mA DC

2.2.2 Control signals

The module is fully programmed and controlled by the host system by means of the 4-wire SPI bus plus two status signals. The logic levels of these signals are defined as follows:

- logic 0: from 0V to 0.3V;
- logic 1: from 0.9 to 1.1V_{cc}, where V_{cc} is the power supply voltage.

Due to digital nature of operation, the module is not capable of producing over-modulation or excessive output power if these limits are violated, but it may be damaged and/or become inoperative.

Maximum clock frequency of the SPI bus is 6.0MHz.

Input impedance of the digital inputs is >1MOhm. Output impedance of the digital outputs is <100Ohm. Inputs are not allowed to float and must be properly driven by the host system at all times.

2.2.3 RF Specifications

When installed into a Nautilus host system and properly programmed, the module shall provide the following RF parameters.

Parameter	Min	Nom	Max
Frequency range, MHz	902.6		927.4
Channel spacing, kHz		400	
Output power, dBm	9.0	10.0	12.0
Modulation bandwidth, kHz	500		
Data rate, kbps	250		
RX sensitivity for 1% BER		-95	

2.2.4 External connections

The module has two 6-pin single-row connectors for power and control signals and one reverse-polarity SMA connector for the antenna. The module must be used only with the approved type of antenna. Antenna gain must not exceed 3dBi, otherwise operation may invalidate module's approval.

Pin functions are given in the following table:

Pin #	Pin function
J1.1	GND
J1.2	SPI MOSI – Data input to the module
J1.3	SPI SCK – Serial clock input to the module
J1.4	SPI MOSI – Data output from the module
J1.5	GDO2 – Status output from the module
J1.6	GND
J2.1	+3VDC power input to the module
J2.2	GND
J2.3	GND
J2.4	SPI CS – Module select input
J2.5	GDO0 – Status output from the module
J2.6	GND

2.2.5 Operating conditions

The module must be installed in the host system providing protection against adverse environmental factors, e.g. water and dust ingress.

The host system's mechanical design shall ensure that no connection except described in p.2.2.4 can be made to the module, either accidentally or intentionally.

The host system shall also ensure that no wire or cable can touch any exposed part of the module.

The module shall be operated under following environmental conditions:

Parameter	Min	Max
Temperature, deg. Celsius	-10	60
Humidity, %	10	90, non-condensing

2.2.6 Labelling and FCC Identifier

The module shall have the FCC ID label printed on the bottom side of the PCB. This label shall contain the following information:

- FCC ID: I6I-NRM-900-1
- Manufacturer: NAUTILUS

The module shall be assigned the following FCC ID: I6I-NRM-900-1 Module Programming

All operating parameters of the module are programmed into it during system start-up by the firmware running on the host microcontroller.

The module employs the CC1101 integrated transceiver chip by Texas Instruments. For the detailed description of this chip, necessary to develop the control firmware, the system designer is referred to the CC1101 datasheet published by TI as document number SWRS061E.

The firmware design shall ensure that the end user cannot change the module's operating parameters and functions beyond those designed at Nautilus and tested for compliance with all applicable FCC rules.

2.2.7 Notice for RF Exposure

The module shall have apart 20cm from user for RF safety.