

Application Guide

TWIG V Module 12907

Nelson Irrigation Corporation

Revision: A

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1. Introduction

1.1. Purpose and Scope

The purpose of this document is to provide details regarding the use of the TWIG V 12907 module. It covers all certified off module antenna options, which consist of an on-board PCB antenna, Yagi, and omni antennas. It will inform the designer as to the details required to retain the modular certification for the TWIG V 12907 module.

1.2. Applicable Documents

- U.FL to RPSMA Cable Jack Bulkhead, Pigtail 20 cm (L-Com #CA-UFLRSBQC20 datasheet)
- Round Cable EMI Suppression Core (Fair-Rite Products #0431173951 datasheet)
- RPSMA Plug to N-Male, Pigtail 10 ft CA-195 coax (L-Com #CA-RSPNMA010 datasheet)
- Yagi Antenna (L-Com # HG912YE-NF datasheet)
- Yagi Antenna (L-Com # HG909Y-NF datasheet)
- Omni Antenna (L-Com ##HG909Y-NF datasheet)
- Omni Antenna (L-Com #HG906UP-NF datasheet)
- BLE Module (STM #SPBTLE-RF datasheet)

2. Module and Accessories

Part Number	Description
Nelson Irrigation Corporation #12907	Module with factory firmware. At the factory, the module is assigned a permanent and unique ID after it is integrated into its enclosure. This unique ID also specifies its type as a hub, extender or valve driver. The factory firmware utilizes the unique ID to determine how the module functions within the radio network. At the factory, the module is assigned a permanent antenna assignment (either internal or external).
L-Com #CA-UFLRSBQC20	U.FL to RPSMA Jack Bulkhead, Pigtail 20 cm
L-Com #CA-RSPNMA010	RPSMA Plug to N-Male, Pigtail 10 ft CA-195 coax
Fair-Rite #0431173951	Round Cable EMI Suppression Core, 60 ohms @ 10 MHz (solid equivalent: Fair-Rite #2631023002)
L-Com #HG912YE-NF	Yagi Antenna, 12 dBi. Must be installed in a VERTICAL orientation
L-Com #HG909Y-NF	Yagi Antenna, 9 dBi. Must be installed in a VERTICAL orientation
L-Com #HG908UP-NF	Omni Antenna, 8 dBi. Must be installed in a VERTICAL orientation
L-Com #HG906UP-NF	Omin Antenna, 6 dBi. Must be installed in a VERTICAL orientation

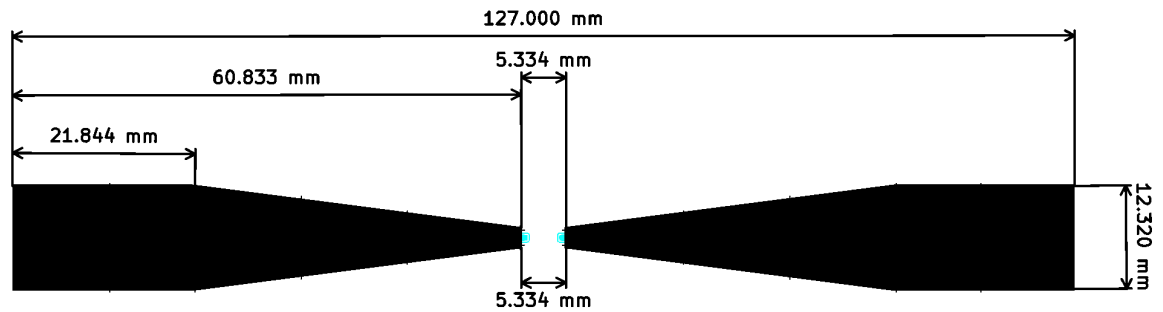
3. Specifications

Network Frequency Range	902 – 928 MHz
Channels	50 (Channel 1 = 902.5 MHz Channel 50 = 927.0 MHz)
Output Power	24 dBm
Modulation Type	LoRa® i.e. a proprietary spread spectrum modulation scheme that is derivative of Chirp Spread Spectrum modulation
External Antenna Connector	U.FI. 50 ohms
Internal Antenna Type	Dipole, installed in a vertical orientation
Nominal Bandwidth	500 KHz
Spreading Factor	8
DC Voltage Input Range	1.8 to 5.5 volts
Bluetooth Interface	BLE 4.1
Debug/Programming Port Interface	Debug: Async Serial 230,400 baud, 8/n/1 ... 3.3V tolerant Programming: Atmel-ICE
Console Port Interface	Async Serial 115,200 baud, 8/n/1 ... 3.3V tolerant
Valve Connector Interface	+14.5V differential, 120 msec pulse, duty cycle < 0.1%

4. Approved Antenna Specifications

4.1. PCB Antenna specifications

The internal antenna configuration for the module utilizes a PCB dipole that must be placed in a vertical orientation. This dipole has the dimensions shown below:



4.2. External Antenna Connector

The external antenna configuration utilizes an on-board a U.FL connector. The outside enclosure must have an RPSMA bulkhead connector. This requirement is accomplished by using a U.FL to RPSMA bulkhead patch cable with a ferrite core (Fair-Rite Products ferrite #0431173951 (solid equivalent: Fair-Riet #2631023002)) inserted over the U.FL connector and secured to the module using a suitable adhesive.

4.3. Yagi Antenna Specifications

Model	HG912YE-NF
Frequency	824 – 960 MHz
Gain	12 dBi
Polarization	VERTICAL
Horizontal Beam Width	43 degrees
Vertical Beam Width	36 degrees
Front to Back Ratio	18 dB
Impedance	50 ohms
Connector	N-Female

Model	HG909YE-NF
Frequency	824 – 960 MHz
Gain	9 dBi
Polarization	VERTICAL
Horizontal Beam Width	53 degrees
Vertical Beam Width	42 degrees
Front to Back Ratio	15 dB
Impedance	50 ohms
Connector	N-Female

4.4. Omni Antenna Specifications

Model	HG908UP-NF
Frequency	902-928 MHz
Gain	8 dBi
Polarization	VERTICAL
Horizontal Beam Width	360 degrees
Vertical Beam Width	35 degrees
Impedance	50 ohms
Connector	N-Female

Model	HG906UP-NF
Frequency	902-928 MHz
Gain	6 dBi
Polarization	VERTICAL
Horizontal Beam Width	360 degrees
Vertical Beam Width	15 degrees
Impedance	50 ohms
Connector	N-Female

5. EMC Compliance

5.1. Summary

The module has been tested and approved as a Modular Radio in accordance with the appropriate FCC and IC standards. The supporting test data may be found in the modular test report.

Since this module and its associated set of approved antennas have been certified as a Modular Radio, this allows the end user to integrate this module into an end-product without the requirement of re-certifying the radio module. The module-integrator is responsible for the unintentional conducted and radiated emissions and must *verify* that the integrated product is compliant with the rules associated with unintentional radiators. The module integrator is also required to maintain an engineering record of the verification testing and declare on the product through proper labeling and marking that the device is compliant with these particular rules.

The installed module's FCC ID and IC numbers need to be clearly marked on the product with the following verbiage "Contains FCC ID: ZH6-TWIGV, S9NSPBTLERF" and "Contains IC: 9686A-TWIGV" and "Contains IC: 8976C-SPBTLERF".

5.2. Module Integration Considerations – External Antenna Systems

The module, when configured for use with the external antenna connector, must use an RPSMA to N-Connector coax cable with a minimum length of 10 feet using CA-195 coax or equivalent.

Antennas for use with the module:

- 1) Yagi type antennas with maximum forward gain of 12 dBi and mounted for vertical polarization.
- 2) Omni type with maximum gain of 8 dBi and mounted for vertical polarization.

The incorporation of the largest practical free-space clearance around the antenna is important for maximizing overall performance. Further, the antenna must be placed such that at least a 8 inch separation distance is maintained from the antenna to all other radio transmitters.

5.3. Module Integration Considerations – Top Assembly

For the internal antenna configuration, it is recommended that all wiring be routed so that it does not approach the PCB antenna structure. For the external antenna configuration, the coax interconnect cable should be routed through a ferrite core as described above.

5.4. Testing Requirements for End-Product

The end-product must be tested and follow the verification process for in accordance to the FCC and IC guidelines. The module needs to be powered and placed in the receive mode for this test.

5.5. Agency Certifications

FCC-ID: ZH6-TWIGV

IC ID: 9686A-TWIGV

5.6. Agency Statements

Federal Communication Commission 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.

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.

FCC CAUTION: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

Industry Canada Statements

This Device complies with 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, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

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.

This device has been designed to operate with the antenna(s) listed below, and having a maximum gain of 1.0/2.0 dBi (Internal Antenna), 8 /12 dBi (Yagi), and 6 / 8 dBi (Omin). Antennas not included in this list or having a gain greater are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

5.7. OEM Labeling Requirements For End-Product

The module is labeled with its own FCC ID and IC Certification Number. The FCC ID and IC certification numbers are not visible when the module is installed inside an enclosure, as such the end device into which the module is installed must display a label referring to the enclosed module. The final end product must be labeled in a visible area with the following:

“Contains Transmitter Module FCC ID: ZH6-TWIGV, S9NSPBTLERF”

“Contains Transmitter Module 9686A-TWIGV” and “Contains Transmitter Module 8976C-SPBTLERF”

or

“Contains FCC ID: ZH6-TWIGV, S9NSPBTLERF”

“Contains IC: 9686A-TWIGV” and “Contains IC: 8976C-SPBTLERF”

The OEM of the module must only use the approved antenna(s) listed above, which have been certified with this module.

Le module est étiqueté avec son propre ID de la FCC et IC numéro de certification. L'ID de la FCC et IC numéros de certification ne sont pas visibles lorsque le module est installé à l'intérieur d'un autre appareil, comme par exemple le terminal dans lequel le module est installé doit afficher une étiquette faisant référence au module ci-joint. Le produit final doit être étiqueté dans un endroit visible par le suivant:

“Contient Module émetteur FCC ID: ZH6-TWIGV, S9NSPBTLERF ”

“Contient Module émetteur IC: 9686A-TWIGV” et “Contient Module émetteur IC: 8976C-SPBTLERF ”

ou

“Contient FCC ID: ZH6-TWIGV, S9NSPBTLERF ”

“Contient IC: 9686A-TWIGV” et “Contient IC 8976C-SPBTLERF ”

Les OEM du module Sterling-LWB5 ne doit utiliser l'antenne approuvée (s) ci-dessus, qui ont été certifiés avec ce module.