GUARDIAN GRAIN MONITORING
INSTALLATION, CONFIGURATION, AND MAINTENANCE MANUAL

This manual applies to:
Guardian Bin Monitoring System

Consisting of:

Handheld Systems (Generation 1)
Remote Systems (Generation 1)

ORIGINAL INSTRUCTIONS

Read this manual before using product. Failure to follow instructions and safety precautions can result in serious injury, death, or property damage. Keep manual for future reference.

Revised: Jan/17

AG GROWTH INTERNATIONAL

This product has been designed and constructed according to general engineering standards[a]. Other local regulations may apply and must be followed by the operator. We strongly recommend that all personnel associated with this equipment be trained in the correct operational and safety procedures required for this product. Periodic reviews of this manual with all employees should be standard practice. For your convenience, we include this sign-off sheet so you can record your periodic reviews.

Date	Employee Signature	Employer Signature

a. Standards include organizations such as the American Society of Agricultural and Biological Engineers, American National Standards Institute, Canadian Standards Association, International Organization for Standardization, EN Standards, and/or others.

Table of Contents

1. Introduction

This manual describes how to assemble the Grain Guard ***Guardian Bin Monitoring System*** (Handheld and Remote Systems - Generation 1).

Before installing and operating this equipment, please read this manual. Familiarize yourself with the process and the necessary precautions for efficient and safe assembly.

Anyone present at the assembly site is required to be familiar with all safety precautions.

Keep this manual available for frequent reference and review it with new personnel. Call your local distributor or dealer if you need assistance or additional information.

2. Safety

2.1. Safety Alert Symbol and Signal Words

This safety alert symbol indicates important safety messages in this manual. When you see this symbol, be alert to the possibility of injury or death, carefully read the message that follows, and inform others.

SIGNAL WORDS: Note the use of the signal words **DANGER**, **WARNING**, **CAUTION**, and **NOTICE** with the safety messages. The appropriate signal word for each message has been selected using the definitions below as a guideline.

Indicates an imminently hazardous situation that, if not avoided, will result in serious injury or death.

Indicates a hazardous situation that, if not avoided, could result in serious injury or death.

Indicates a hazardous situation that, if not avoided, may result in minor or moderate injury.

Indicates a potentially hazardous situation that, if not avoided, may result in property damage.

2.2. General Safety

The safety information found throughout the complete Safety chapter of the manual applies to all safety practices. Additional instructions specific to a certain safety practice (such as Assembly Safety), can be found in the appropriate section.

YOU are responsible for the **SAFE** assembly and installation of the equipment. **YOU** must ensure that you and anyone else who is going to work around the equipment understands all procedures and related **SAFETY** information contained in this manual.

Remember, **YOU** are the key to safety. Good safety practices not only protect you, but also the people around you. Make these practices a working part of your safety program. All accidents can be avoided.

- It is the equipment assembler and installation personnel's responsibility to read and understand **ALL** safety instructions, safety decals, and manuals and follow them when assembling or installing the equipment.
- Only experienced personnel who are familiar with this type of assembly and installation should perform this work. Untrained assemblers/installers expose themselves and bystanders to possible serious injury or death.
- Do not modify the equipment in any way without written permission from the manufacturer. Unauthorized modification may impair the function and/or safety, and could affect the life of the equipment. Any unauthorized modification of the equipment will void the warranty.

2.3. Personal Protective Equipment

Safety Glasses

- Wear safety glasses at all times to protect eyes from debris.

Work Gloves

- Wear work gloves to protect your hands from sharp and rough edges.

Steel-Toe Boots

- Wear steel-toe boots to protect feet from falling debris.

Coveralls

- Wear coveralls to protect skin.

Hard Hat

- Wear a hard hat to help protect your head.

2.4. Safety Equipment Required

First-Aid Kit

- Have a properly-stocked first-aid kit available for use should the need arise, and know how to use it.

2.5. Safety Decals

- Keep safety decals clean and legible at all times.
- Replace safety decals that are missing or have become illegible. See decal location figures that follow.
- Replaced parts must display the same decal(s) as the original part.
- Replacement safety decals are available **free of charge** from your distributor, dealer, or factory.

2.5.1. Decal Installation/Replacement

1. Decal area must be clean and dry, with a temperature above 50°F (10°C).
2. Decide on the exact position before you remove the backing paper.
3. Align the decal over the specified area and carefully press the small portion with the exposed sticky backing in place.
4. Slowly peel back the remaining paper and carefully smooth the remaining portion of the decal in place.
5. Small air pockets can be pierced with a pin and smoothed out using the sign backing paper.

2.5.2. Safety Decal Locations and Details

Replicas of the safety decals that are attached to the equipment and their messages are shown in the figure(s) that follow. Safe operation of the equipment requires that you familiarize yourself with the various safety decals and the areas or particular functions that the decals apply to, as well as the safety precautions that must be taken to avoid serious injury, death, or damage.

Grain Guard reserves the right to update safety decals without notice. Safety decals may not be exactly as shown.

3. Regulatory Compliance

3.1. Handheld System - Handheld Reader

3.1.1. FCC Part 15

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.

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.

Important: *Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.*

Note: This portable transmitter with its antenna complies with FCC/IC RF exposure limits for general population / uncontrolled exposure.

3.1.2. Industry Canada Notifications

Industry Canada

This device complies with Industry Canada's license-exempt RSS standards. 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.

Industrie Canada

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;

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le

brouillage est susceptible d'en compromettre le fonctionnement.

3.1.3. Handheld Reader Bluetooth (BLE) Radio Module Information

The Handheld Reader contains a radio module with the following identifiers assigned by FCC and Industry Canada, respectively: FCC ID: 2AA9B04 and IC: 12208A-04. These two identifiers are stamped on the RF shield of the radio module. The radio module is permanently installed on a printed circuit board inside the Handheld Reader and requires technical personnel to disassemble. It should be noted that unauthorized disassembly of the Handheld Reader voids the warranty. Alternatively, these two identifiers can also be found on a label on the bottom of the Handheld Reader.

Industry Canada

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.

Industrie Canada

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (P.I.R.E.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

EU Directive 1999/5/EC

This radio module conforms to essential requirements of certain R&TTE Directives. Please see the Declaration of Conformity for details. Ag Growth International hereby declares that this Handheld Reader is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. A copy of the original Declaration of Conformity can be found or obtained at {insert mail address or website}.

3.2. Remote Systems - Hub Units

3.2.1. FCC Part 15

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.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

RF Radiation: The Product is an intentional radiator of Radio Frequency (RF) energy. In order to limit RF exposure to personnel in the immediate area, the Product should be located and installed such that a separation of at least 20 cm is maintained between the Product's antennas and personnel in the vicinity of the device.

Important: *Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.*

3.2.2. Industry Canada Notifications

Industry Canada

This device complies with Industry Canada's 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.

Industrie Canada

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;

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

3.2.3. Approved Antennas

FCC Notification

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 required for successful communication. This device (FCC ID: 2AKAAA01SG100) has been designed to operate with the antennas listed in the table below. Antennas not included in this list are strictly prohibited for use with this device.

The required antenna impedance is 50 ohms.

Industry Canada Notification

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.

This radio transmitter (IC: 22125-A01SG100) has been approved by Industry Canada to operate with the antenna types listed in Table 3.1 below, with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in the table, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

This device has been designed to operate with the antenna(s) listed below, and having a maximum gain of +2.0dBi (2.4GHz BLE radio) and +8.0dBi (900MHz LoRa radio). Antennas not included in this list or having a gain greater than +2.0dBi (2.4GHz BLE radio), +8.0dBi (900MHz LoRa radio), +3.5dBi (as per Cellular radio module's approval) and +2.2dBi (as per WiFi radio module's approval) are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

List of Approved Hub Unit Antennas

The table below provides a list of the approved Hub unit antennas.

Table 3.1 Approved Hub Unit Antennas

Maker	*Model*	*Type*	*Connector*	*Gain (dBi)*	*Note*
LSR	001-0010	Omnidirectional	SMA plug reverse polarity	+2.0	2.4GHz BLE
Nearson	S1551AH-915S	Omnidirectional	SMA plug reverse polarity	+2.0	900MHz LoRa
Laird	OD9-8	Omnidirectional	SMA plug reverse polarity via provided antenna cable	+8.0	900MHz LoRa
Laird	MAF94301	Omnidirectional	SMA plug reverse polarity	+3.0	Cellular radio module
LSR	001-0010	Omnidirectional	SMA plug reverse polarity	+2.0	WiFi radio module

3.2.4. Hub Cellular Radio Module Information

The Hub device contains a radio module with the following identifiers assigned by FCC and Industry Canada, respectively: FCC ID: RI7HE910 and IC: 5131A-HE910. These two identifiers can be found on a permanently affixed label on the RF shield of the radio module. The radio module is permanently installed on a printed circuit board inside the Hub device and requires technical personnel to disassemble. It should be noted that unauthorized disassembly of the Hub unit voids the warranty. Alternatively, these two identifiers can also be found on a label on the enclosure of the Hub device.

In order to satisfy RF exposure compliance requirements of this radio module, install only the antenna(s) described in the section titled “List of Approved Hub Unit Antennas” on page 10. The antenna(s) used for this radio module must be installed to provide a separation distance of at least 20 cm from all personnel in the vicinity of the antenna(s).

Industry Canada

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.

Industrie Canada

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (P.I.R.E.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Co-location Prevention

When this radio module is in operation, the Hub device is configured by software to automatically disable operation of all other radio transmitters, including other radio modules. Therefore, the condition of use granted to this radio module is satisfied.

3.2.5. Hub Wifi Radio Module Information

The Hub device contains a radio module with the following identifiers assigned by FCC and Industry Canada, respectively: FCC ID: XF6-RS9113SB and IC: 8407A-RS9113SB. These two identifiers are stamped on the RF shield of the radio module. The radio module is permanently installed on a printed circuit board inside the Hub device and requires technical personnel to disassemble. It should be noted that unauthorized disassembly of the Hub unit voids the warranty. Alternatively, these two identifiers can also be found on a label on the enclosure of the Hub device.

In order to satisfy RF exposure compliance requirements of this radio module, install only the antenna(s) described in the section titled “List of Approved Hub Unit Antennas” on page 10. The antenna(s) used for this radio module must be installed to provide a separation distance of at least 20 cm from all personnel in the vicinity of the antenna(s).

Industry Canada

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.

Industrie Canada

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (P.I.R.E.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Co-location Prevention

When this radio module is in operation, the Hub device is configured by software to automatically disable operation of all other radio transmitters, including other radio modules. Therefore, the condition of use granted to this radio module is satisfied.

3.3. Remote Systems - Transmitter Units

3.3.1. FCC Part 15

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.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

RF Radiation: The Product is an intentional radiator of Radio Frequency (RF) energy. In order to limit RF exposure to personnel in the immediate area, the Product should be located and installed such that a separation of at least 20 cm is maintained between the Product's antennas and personnel in the vicinity of the device.

Important: *Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.*

3.3.2. Industry Canada Notifications

Industry Canada

This device complies with Industry Canada's 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.

Industrie Canada

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;

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

3.3.3. Approved Antennas

FCC Notification

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 required for successful communication. This device (FCC ID: 2AKAAA02SG100) has been designed to operate with the antennas listed in the table below. Antennas not included in this list are strictly prohibited for use with this device.

The required antenna impedance is 50 ohms.

Industry Canada Notification

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.

This radio transmitter (IC: 22125-A02SG100) has been approved by Industry Canada to operate with the antenna types listed in Table 3.2 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.

This device has been designed to operate with the antenna(s) listed below, and having a maximum gain of +2.0dBi (2.4GHz BLE radio) and +8.0dBi (900MHz LoRa radio). Antennas not included in this list or having a gain greater than +2.0dBi (2.4GHz BLE radio) and +8.0dBi (900MHz LoRa radio) are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

List of Approved Antennas

The table below provides a list of the approved Transmitter unit antennas.

Table 3.2 Approved Antennas (Transmitter Units)

Maker	*Model*	*Type*	*Connector*	*Gain (dBi)*	*Note*
LSR	001-0010	Omnidirectional	SMA plug: reverse polarity	+2.0	2.4GHz BLE
Nearson	S1551AH-915S	Omnidirectional	SMA plug: reverse polarity	+2.0	900MHz LoRa
Laird	OD9-8	Omnidirectional	SMA plug: reverse polarity via provided antenna cable	+8.0	900MHz LoRa

4. Overview

4.1. System Overview

The Guardian Bin Monitoring System provides capabilities for reporting temperature and moisture content of grain stored in grain bins, as detected by sensor cables installed in bins.

Depending on the options selected by the customer at time of purchase, the Guardian Bin Monitoring System is available in the configurations listed below:

- Handheld System (Basic or Advanced)
- Remote System (Wifi or Cellular Hub)

4.2. General Specifications

Table 4.1 provides the general specifications of Guardian system.

Table 4.1 Limitations and Compatibility

Specification	Minimum	Maximum
Number of yards per account	1	8
Number of bins per yard	1	100[a]
Bin height - diameter	12' - 12'	65' - 60'
Number of cables per bin	1	8

a. Based on the allowable number of Transmitter units per Hub.

4.3. Software and Cloud Services

All system configuration and monitoring activities are performed either through a smart-phone/tablet app or through a web-based user interface.

Different systems require (and allow) use of specific software on specific device types. Table below lists the basic differences.

Table 4.2.

System	iOS/Android App	Web UI
Handheld Basic	✓	no
Handheld Advanced[a]	✓	✓
Remote Wifi[b]	✓	✓
Remote Cellular[c]	✓	✓

a. Requires a paid subscription for cloud services and Smartphone-based data upload.
b. Requires a paid subscription for cloud services and Wifi-based data upload from a Wifi Hub unit.
c. Requires a paid Cellular data plan for cloud services and cellular upload from a Cellular Hub unit.

4.3.1. Compatible Devices

No compatible devices shall be used at this time, except for the devices listed and described in this manual.

4.4. Handheld Systems

Sensor readings are taken through a Handheld Reader that plugs into each bin's Handheld Reader Docking Station.

When plugged into a docking station, the Handheld Reader is physically connected to the bin's sensor cable(s), and can communicate sensor readings to a close-by Bluetooth-connected smart phone running the AGI Guardian App.

For each monitored bin, the user moves the Handheld Reader from bin to bin to take and record sensor readings for each bin in turn.

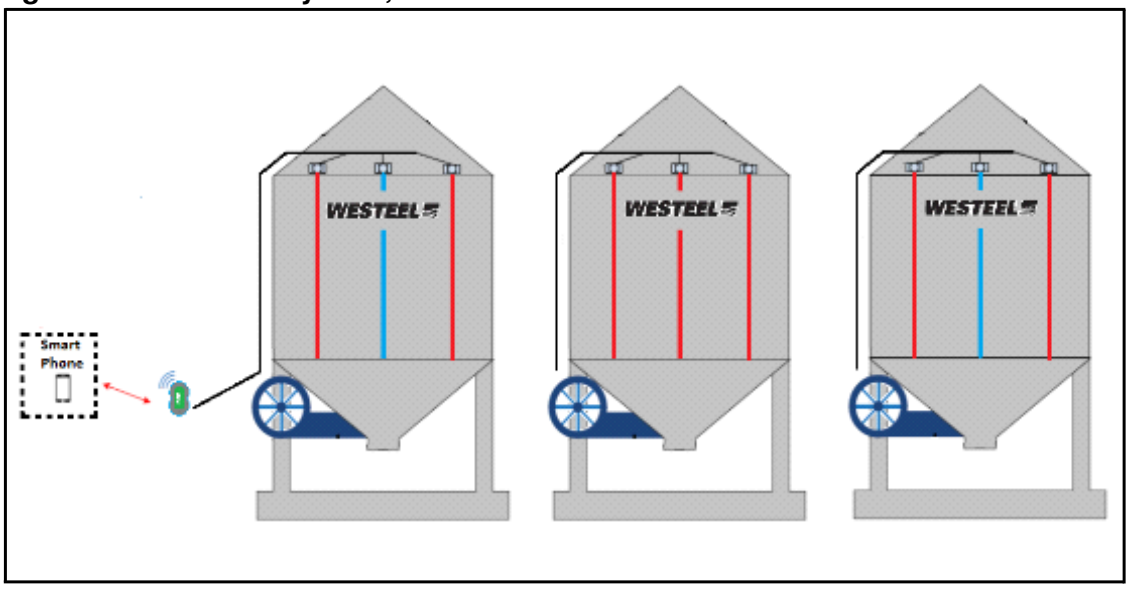
4.4.1. Handheld Basic Systems

Note: *The Handheld Basic system requires the standard Guardian App to be installed on a designated access device (smartphone or tablet).*

Sensor readings and other data (such as diagnostic messages) are taking locally (at the bin) using a Handheld reader and smartphone/tablet. Readings are stored on the smart-phone that is used to communicate with the Handheld Reader.

It is recommended that readings are always taken by a single smartphone (or tablet) in order to ensure that all readings are kept together for collective use by the user.

Figure 4.1 Handheld System, Basic



4.4.2. Handheld Advanced Systems

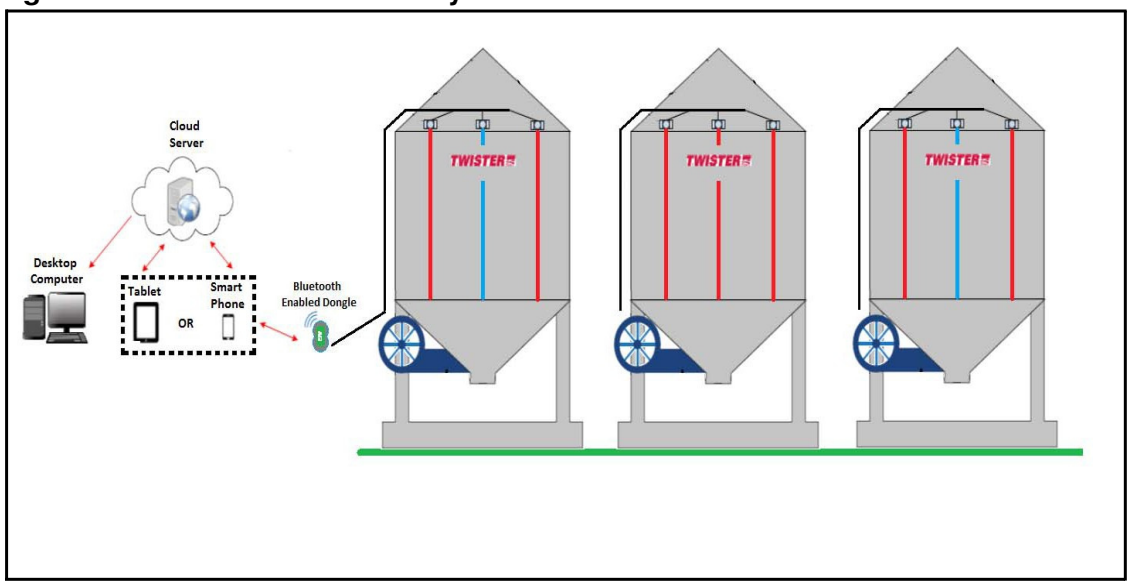
Note: *The Handheld Advanced system requires the standard Guardian App installed on each access device (smartphone or tablet) as well as a Cloud services subscription.*

Sensor readings and other data (such as diagnostic messages) are taking locally (at the bin) using a Handheld Reader and smartphone/tablet. Readings are stored on the smartphone that is used to communicate with the Handheld Reader, but can be uploaded to the Cloud server whenever the smartphone/tablet has network access.

Sensor readings can be taken from multiple devices (smartphones/tablets) and synchronized in a single account on the cloud for access.

Historical sensor readings and diagnostic messages uploaded to the Cloud server can be accessed via any standard or mobile Internet connection, using either a web browser of the Guardian App.

Figure 4.2 Handheld Advanced System



4.5. Remote Systems

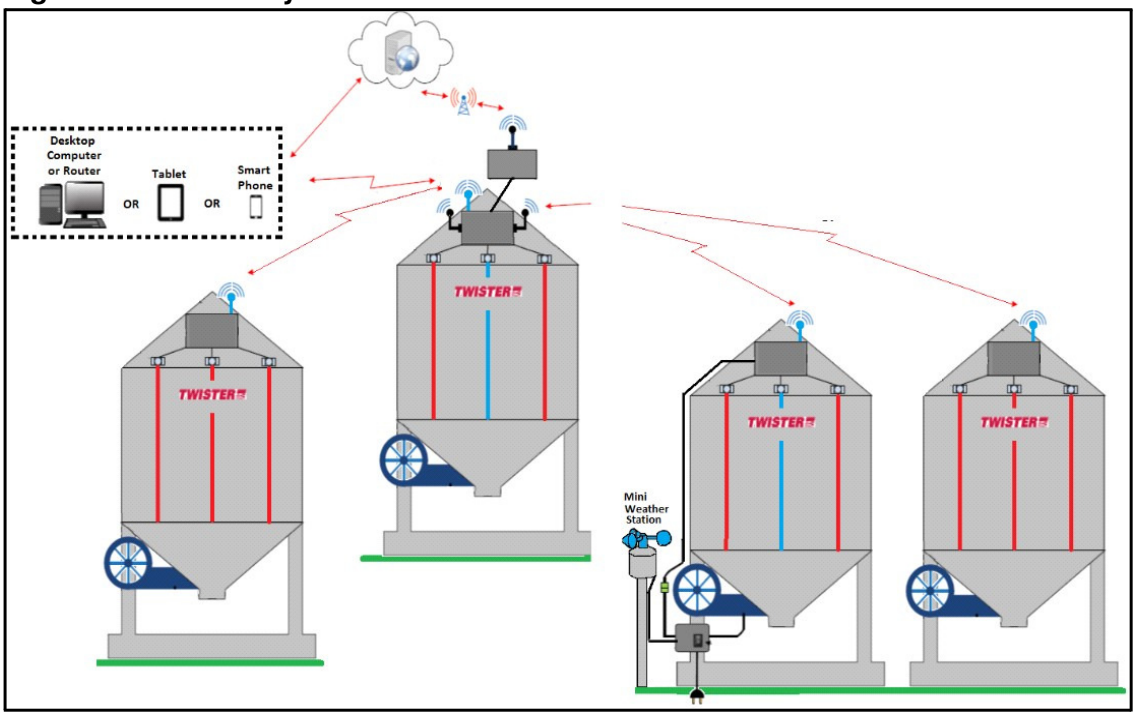
Note: *Remote systems require paid subscription to a WiFi Upload Data Packages or a Cellular Data Packages, depending on the connections type between the Hub unit and the Cloud server.*

A typical Remote system yard is comprised of a Hub unit located on one grain bin that uses wireless communication to monitor nearby grain bins equipped with Transmitter units. In addition to monitoring temperature and moisture cables, the system can optionally be configured to report security events such as the opening or closing of the filler cap lid, inspection hatch, and door.

Sensor readings are taken at user-configured intervals by a Hub or Transmitter unit located on each bin roof, and transmitted to the Cloud server via a Hub unit Wifi or Cellular network connection.

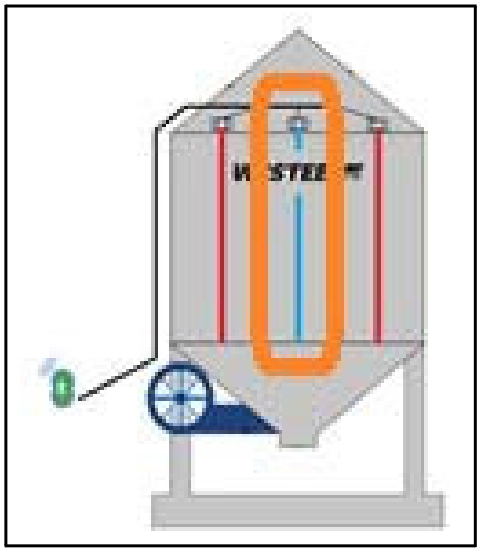
Historical sensor readings and diagnostic messages uploaded to the Cloud server can be accessed via any standard or mobile Internet connection, using either a web browser of the Guardian App.

Figure 4.3 Remote System



5. Components

5.1. Guardian Grain Monitoring Cables



Grain Monitoring cables install on the bin roof, supported by specifically-designed angled-base suspension mounts and cable brackets.

Grain condition is reported from multiple sensors located along the length of each cable.

Guardian temperature cable features:

- retractable sensor design, allowing the inner sensor cable to be pulled out of the protective outer sheath to allow for repair or replacement while the bin is full;
- provide **only** temperature readings only.

Guardian moisture cables:

- each sensor is contained in a capsule that provides **both** moisture and temperature.

Connecting Cables to the System

Multiple cables must be interconnected by roof wiring harness that will include one or more combiner/splitters.

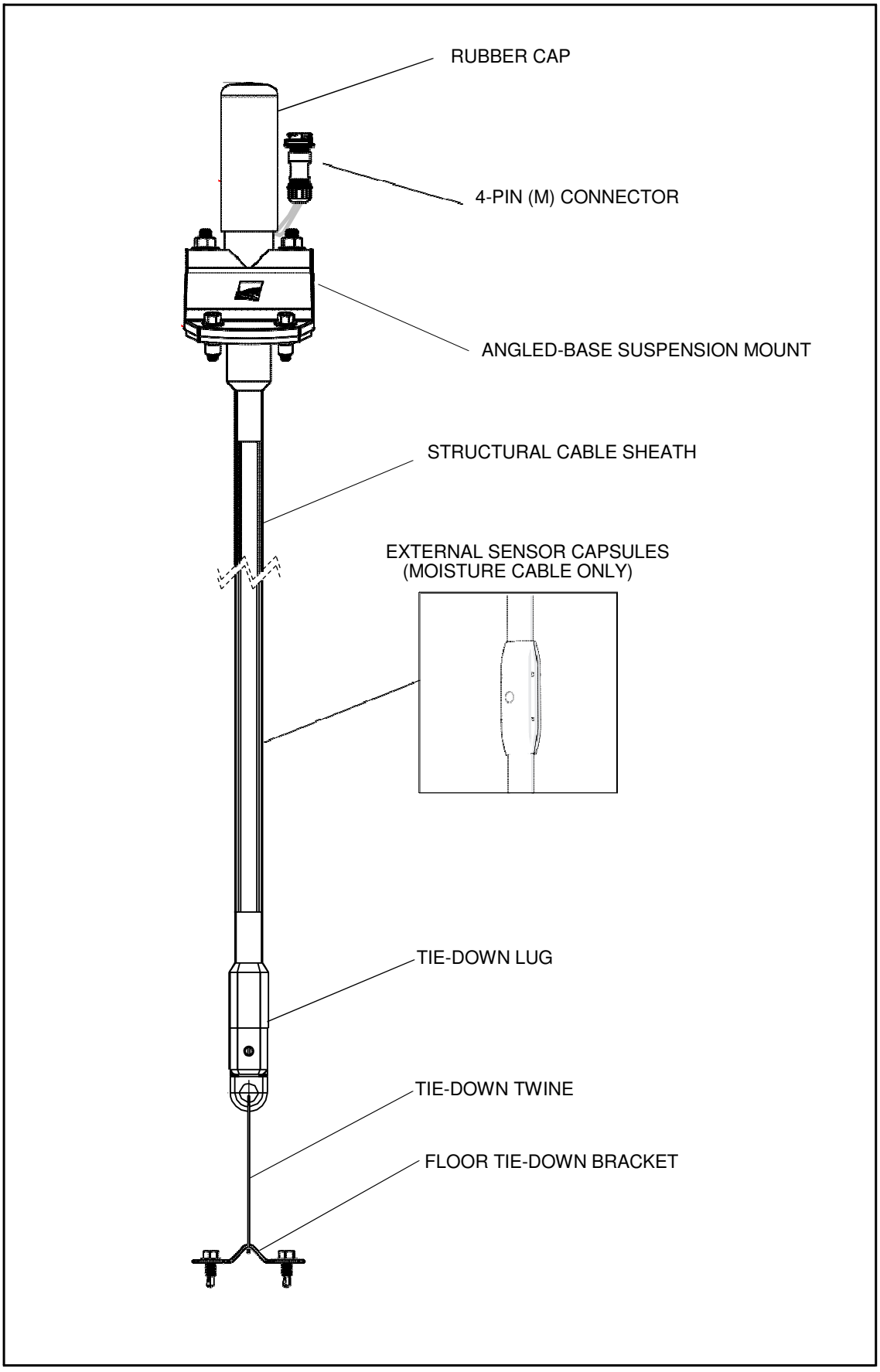
- For remote systems, the roof wiring harness (or a single sensor cable) connects directly into the Hub or Transmitter located on the bin roof.
- For Local Systems, the roof wiring harness connects to the Down-bin cable leading to the Docking Station.

Table 5.1. Temperature Cable Specifications

Specification	Temperature Cables	Moisture Cables
Grain Depth	70-140 ft	70-140 ft
Tensile Strength	8400 lbs	8400 lbs
Estimated Max Load	25 lb/ft	25 lb/ft
Maximum Tie-down Tensile Strength[a]	2100 lbs	2100 lbs
Accuracy (temp)	+/-0.5°C +/-1.0°F	+/-0.5°C +/-1.0°F
Accuracy (moisture)	n/a	+/-0.5%
Sensor spacing	4 ft	4 ft
Connector	SY13 4-pin circular (IP67)	SY13 4-pin circular (IP67)

a. Do not use tie-downs with a tensile strength greater than 25% of the cable tensile strength. AGI provides TIED DOWN TWINE OD 0.050" X 6FT (2012-006-0127) to ensure appropriate tie-down twine use.

Figure 5.1 Typical Grain Monitoring Cable (Temperature or Moisture)



5.1.1. Combiners/splitters

If more than one monitoring cable is used per bin (which is typical), cables must be interconnected to a combiner/splitter that will provide a single cable to be connected to the monitoring device.

Figure 5.2 4:1 Combiner/Splitter (Inline)

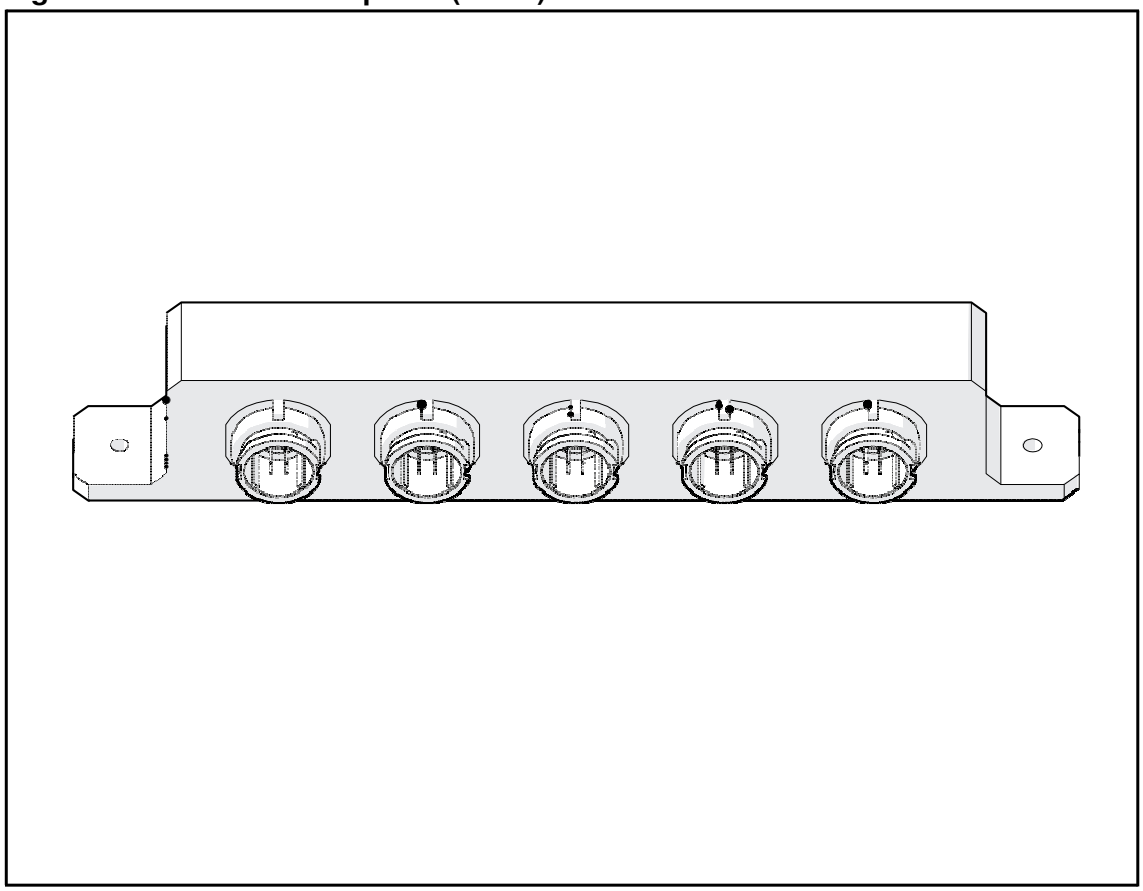
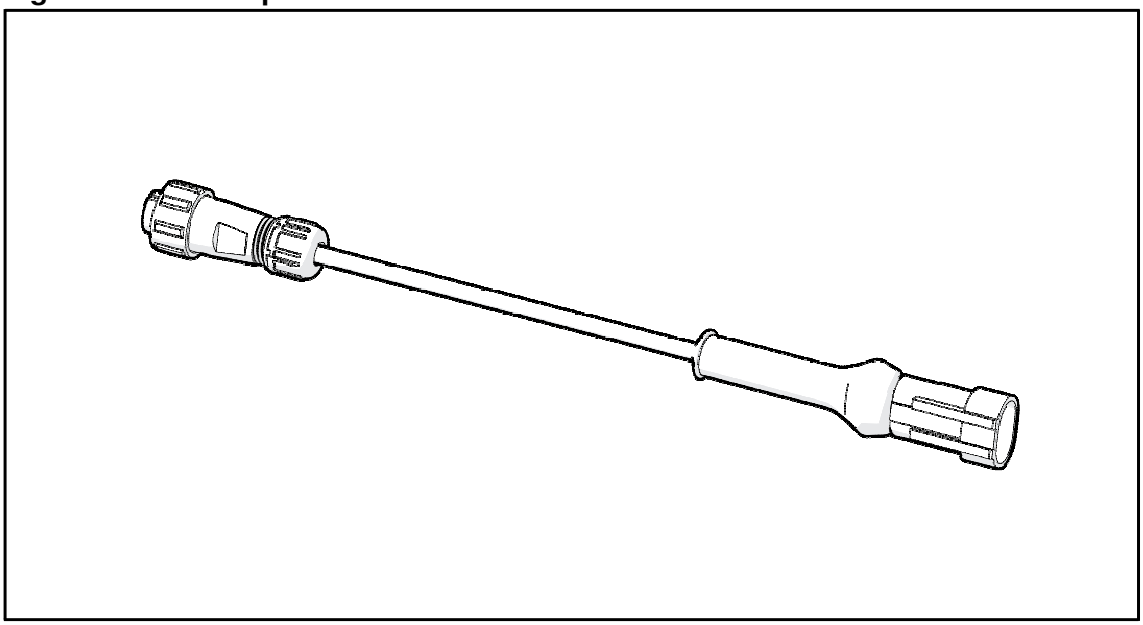


Table 5.2. Combiner/Splitter Part Numbers

Description	Part Number
2:1 Combiner/Splitter	
3:1 Combiner/Splitter	
4:1 Combiner/Splitter	
5:1 Combiner/Splitter	

5.1.2. OPI Adapter Cable

Figure 5.3 OPI Adapter Cable



5.1.3. Sensor and Down-bin Interconnect Cables

Figure 5.4 Standard Guardian Interconnect Cable

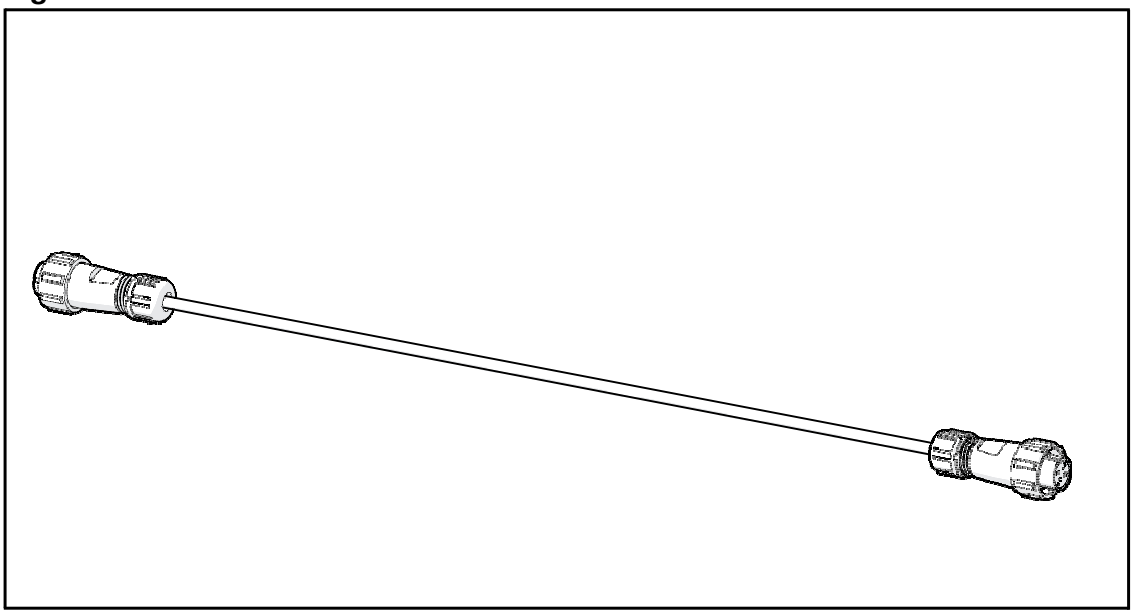


Figure 5.5 Interconnect Cables

PART NUMBER	DESCRITPION	LINK CABLE PART NUMBER	A [FT]
2012-006-0058-1	5' F/F LINK CABLE ASSY	2012-006-0048-1	5
2012-006-0058-2	10' F/F LINK CABLE ASSY	2012-006-0048-2	10
2012-006-0058-3	15' F/F LINK CABLE ASSY	2012-006-0048-3	15
2012-006-0058-4	20' F/F LINK CABLE ASSY	2012-006-0048-4	20
2012-006-0058-5	25' F/F LINK CABLE ASSY	2012-006-0048-5	25
2012-006-0058-6	30' F/F LINK CABLE ASSY	2012-006-0048-6	30
2012-006-0058-7	35' F/F LINK CABLE ASSY	2012-006-0048-7	35
2012-006-0058-8	40' F/F LINK CABLE ASSY	2012-006-0048-8	40
2012-006-0058-9	45' F/F LINK CABLE ASSY	2012-006-0048-9	45
2012-006-0058-10	50' F/F LINK CABLE ASSY	2012-006-0048-10	50
2012-006-0058-11	55' F/F LINK CABLE ASSY	2012-006-0048-11	55
2012-006-0058-12	60' F/F LINK CABLE ASSY	2012-006-0048-12	60
2012-006-0058-13	65' F/F LINK CABLE ASSY	2012-006-0048-13	65
2012-006-0058-14	70' F/F LINK CABLE ASSY	2012-006-0048-14	70
2012-006-0058-15	75' F/F LINK CABLE ASSY	2012-006-0048-15	75
2012-006-0058-16	80' F/F LINK CABLE ASSY	2012-006-0048-16	80

5.1.4. Cable brackets

Figure 5.6 22” Brackets

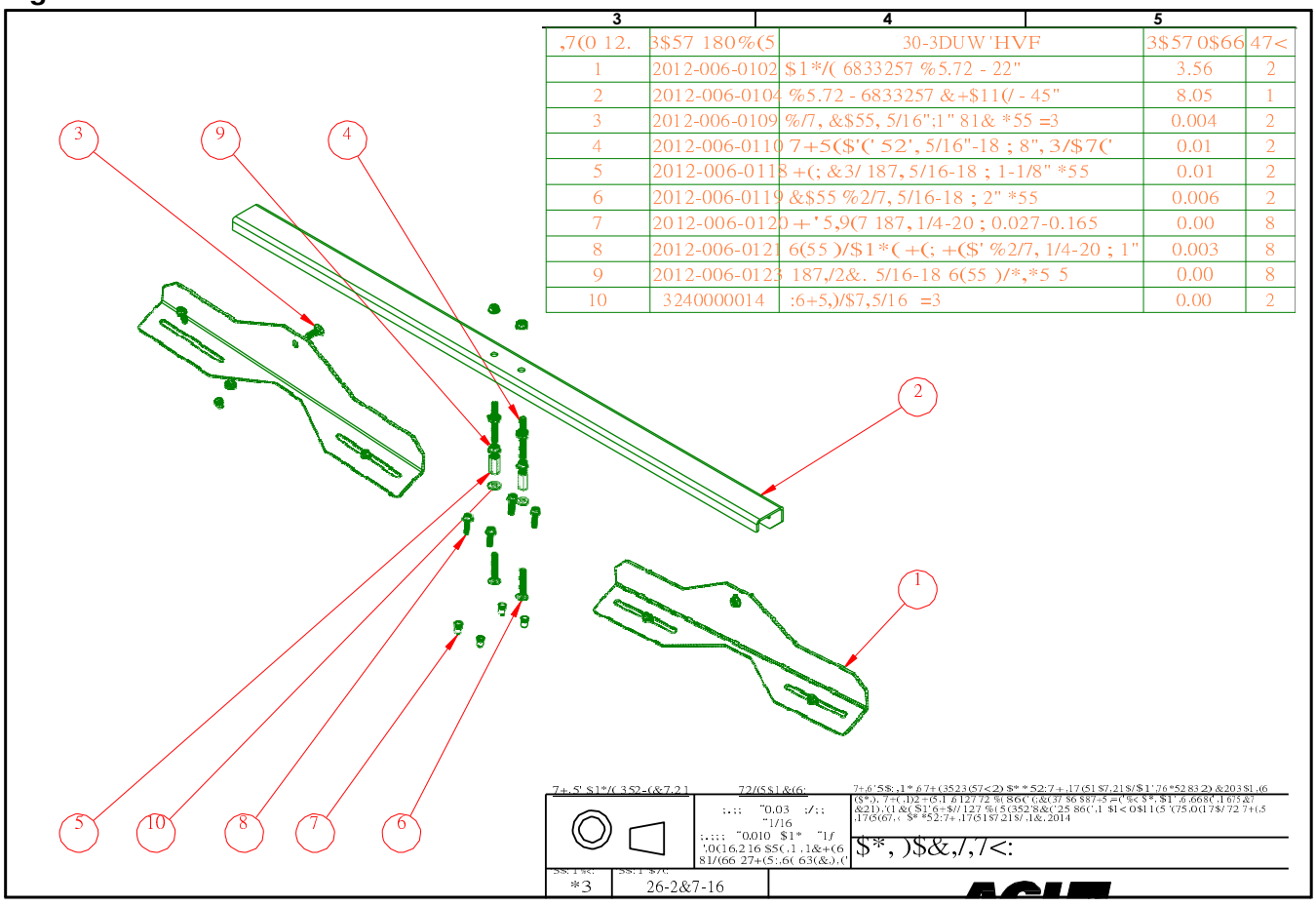
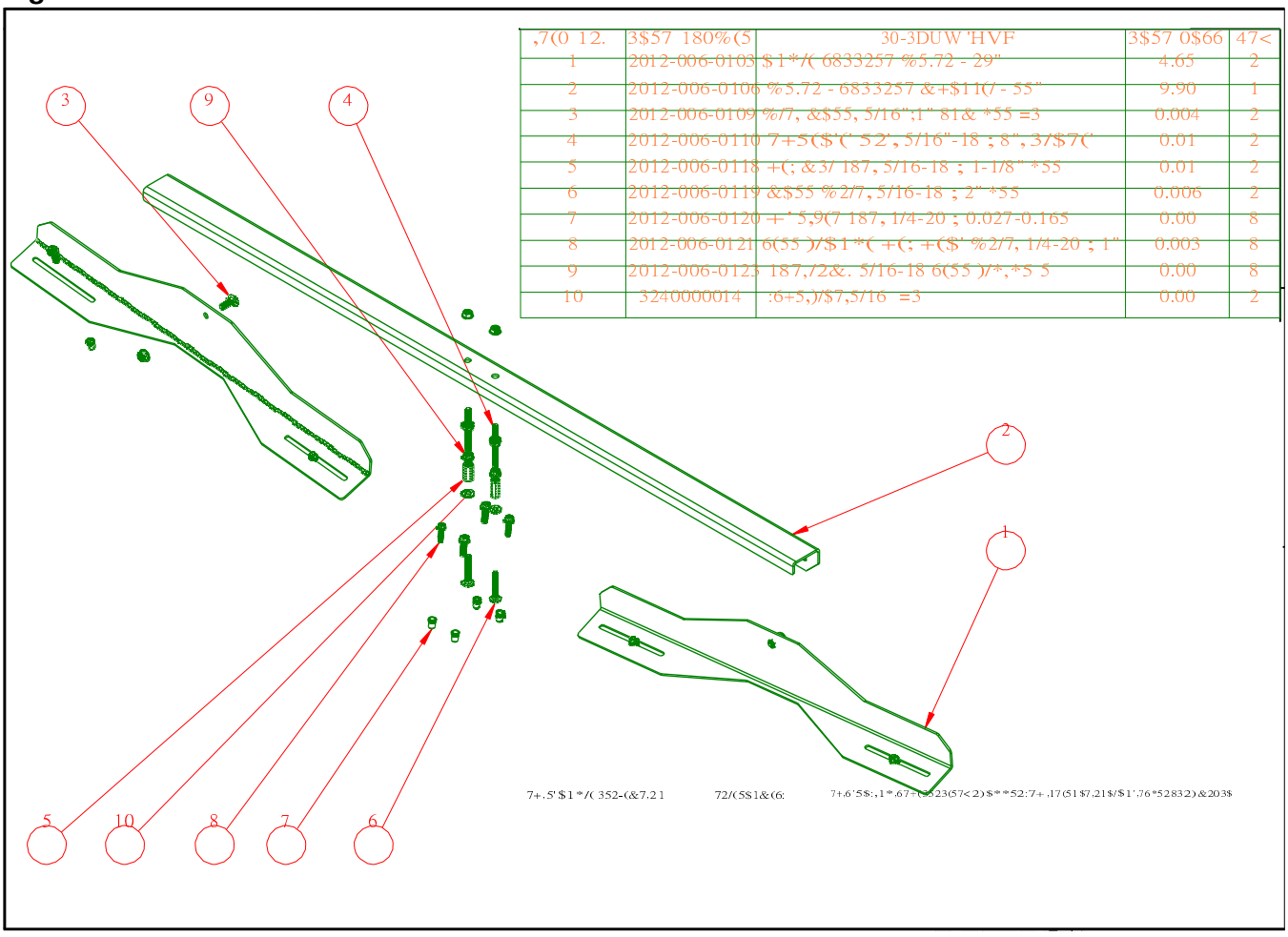


Figure 5.7 29" Brackets



5.2. Hub Unit

The Hub unit is the central communication component in a Remote System configuration.

Each yard in a Remote system must be equipped with one Hub unit that communicates with each Transmitter in the yard to provide current status for each Transmitter-equipped bin.

There are two available Hub Models: Cellular and Wifi.

- Wifi Hub: equipped with Wifi capability
- Cellular Hub: equipped with Cellular and Wifi capability

Figure 5.9 Hub Features

Feature	Description
P1	Solar cell, powering rechargeable internal battery
C1	4-pin circular connector
C2	4-pin circular connector
C3	4-pin circular connector
C4	4-pin circular connector
C5	2-pin 12 - 24 VDC auxiliary power connector
C6	6-pin fan control/DC power input connector
A1	LoRa antenna
A2	Cellular antenna
A3	Wifi antenna
A4	Bluetooth antenna BLE
Visual indicators	none

5.2.1. Hub Specifications

Figure 5.10 Hub Specifications

Specification/Feature	Description
Dimensions	
Weight	
Cable Compatibility	AGI, OPI, IntraGrain
Temperature Range (operating)	-40 deg C to 45 deg C
Temperature Range (storage)	-45 deg C to 60 deg C
Power Requirements	Solar Cell: Auxiliary Power: 12 - 24 VDC
Supported wireless protocols	LoRa, Cellular, Wifi, Bluetooth (BLE)

5.2.2. Hub Care and Maintenance

Regular care and maintenance are not required to be performed.

5.2.3. Hub Accessories and Upgrades

Table 5.3. Hub Accessories and Upgrades

Item	Wifi Hub	Cellular Hub	See Section
WiFi anntena upgrade[a]	✓	--	5.6.1.
LoRa radio antenna upgrade[b]	✓	✓	5.6.2.
SIM cards (regional)	--	✓	5.6.3.
Battery Booster Pack	✓	✓	5.6.4.
Cellular Module kit[c]	✓	--	5.6.5.
Cellular antenna upgrade[d]	--	✓	5.6.6.
Fan Control	✓	✓	5.6.7.
Lid/Hatch/Door alarm	✓	✓	5.6.8.

a. Future development. All antenna upgrades will be FCC/IC approved for use with the system.
b. Future development. All antenna upgrades will be FCC/IC approved for use with the system.
c. The Cellular Module kit changes a Wifi Hub into a FCC/IC compliant Cellular Hub.
d. Future development. All antenna upgrades will be FCC/IC approved for use with the system.

5.3. Transmitter Unit

Each bin in a yard in a Remote system (except the one bin with a Hub unit) must be equipped with one Transmitter unit that communicates with the local Hub to provide current status for the bin.

Note: Transmitter Units are fan-control ready, but feature implementation details are not currently available.

Figure 5.12 Transmitter Features

Feature	Description
P1	Solar cell, powering rechargeable internal battery
C1	4-pin circular connector
C2	4-pin circular connector
C3	4-pin circular connector
C4	4-pin circular connector
C5	6-pin fan control/DC power input connector
C6	2-pin 12 - 24 VDC auxiliary power connector
A1	LoRa antenna
A2	Bluetooth (BLE) antenna
Visual indicators	none

5.3.1. Transmitter Unit Specifications

Figure 5.13 Transmitter Unit Specifications

Specification	Description
Dimensions	
Weight	
Cable Compatibility	AGI, OPI, IntraGrain
Temperature Range (operating)	-40 deg C to 45 deg C
Temperature Range (storage)	-45 deg C to 60 deg C
Power Requirements	Solar Cell: Auxiliary Power: 12 - 24 VDC
Supported wireless protocols	LoRa, Cellular, Wifi, Bluetooth (BLE)

5.3.2. Transmitter Unit Care and Maintenance

Regular care and maintenance are not required to be performed.

5.3.3. Transmitter Accessories and Upgrades

Table 5.4. Transmitter Accessories and Upgrades

Item	See Section
LoRa radio antenna upgrade[a]	5.6.2.
Fan Control	5.6.7.
Lid/Hatch/Door alarm	5.6.8.

a. Future development. All antenna upgrades will be FCC/IC approved for use with the system.

5.4. Handheld Reader

The Handheld Reader unit is the central communication component in a Local System configuration.

The Handheld Reader connects to a Docking Station at the base of each monitored bin, and reads the status of monitoring cables through the down-bin cable that runs between the Docking Station and the sensor cable connection point on the bin roof.

When the Handheld Reader is inserted and activated, a smart phone that is actively AGI guardian software can read and record the status of temperature and moisture cables using Bluetooth communication.

Figure 5.15 Handheld Reader Features

Feature	Description
C1	10-pin Docking Station connector
C2	Micro-USB power input, battery recharge
B1	Push button: Single press to Power on, press and hold for 4s to Power off
L1	LED (Blue): Flashing when power is “On” and seeking BLE connection. Continuous when BLE connection is established
L2	LED (Green): Flashing when micro-USB connected and charging. On continuous when micro-USB connected and charge complete

5.4.1. Handheld Reader Specifications

Table 5.5 Handheld Reader Specifications and Features

Specification	Description
Dimensions	
Weight	
Cable Compatibility	AGI, OPI, IntraGrain
Temperature Range (operating)	-40 deg C to 45 deg C
Temperature Range (storage)	-45 deg C to 60 deg C
Power Source	Rechargeable Internal Battery
Micro-USB power input	Max. voltage/current: Min. voltage/current:
Wireless type	Bluetooth (BLE)

5.4.2. Handheld Reader Care and Maintenance

Regular care and maintenance are not required to be performed.

5.5. Docking Station

When the Handheld Reader is inserted in a Docking Station port, a smart phone that is actively AGI guardian software can connect to it via Bluetooth to read and record the status of temperature and moisture cables.

A Docking Station is installed at the base of each monitored bin, and connects to sensor cables through the down-bin cable(s) between the Docking Station and the sensor cable connection point on the bin roof.

There are two models available, depending on the number of sensor cables installed on a bin: one with a single down-bin cable connector, and one with two down-bin cable connectors.

Figure 5.16 Docking Stations

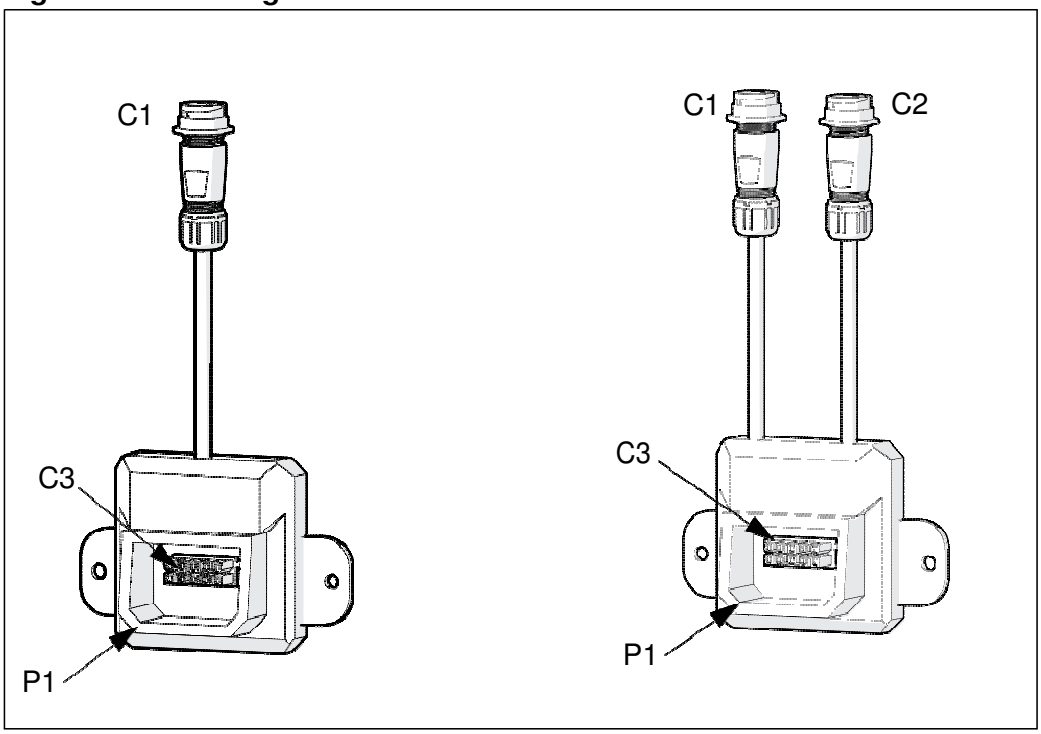


Figure 5.17 Docking Station Features

Feature	Description
C1, C2	4-pin circular connectors
P1	Handheld Reader Port
C3	Handheld Reader Port Connector
CP1	Handheld Reader Port Cover Plug (not shown)
Visual indicators	none

5.5.1. Docking Station Specifications

Table 5.6 Docking Station Specifications

Specification	Description
Dimensions	
Weight	
Temperature Range (operating)	-40 deg C to 45 deg C
Temperature Range (storage)	-45 deg C to 60 deg C
Power Source	not required (provided by Handheld Reader when connected)

5.5.2. Docking Station Care and Maintenance

- When a Docking Station is not in use, the Reader port should be covered by the supplied port cover plug.

5.6. Upgrades and Accessories

5.6.1. WiFi Antenna Upgrade

For the Hub unit, the recommended antenna to be used for the WiFi radio module can be found in ***Table 3.1 Approved Hub Unit Antennas*** of this manual. If another antenna is to be used, it must be of the same type and of the same (or less than the) peak gain of one of the antennas listed in the following table.

Table 5.7 List of Approved Antennas for WiFi Radio Module
(from FCC/IC test report of FCC ID: XF6-RS9113SB, IC: 8407A-RS9113SB)

Maker	***Model***	***Type***	***Connector***	***Peak Gain (dBi)***
Redpine	-	Trace	-	+0.99
Molex	PS-47950-001	Flexible Embedded Dipole	U.FL	+3
Fractus	FR05-S1-NO-1-004	Chip	-	+1.8
Linx	ANT-2.4-CW-RCT-RP	Omnidirectional	SMA plug reverse polarity	+2.2

Important: *Any antennas selected for use outside of the above selection criteria will void the user's authority to operate the equipment, and will require additional FCC/IC approval.*

5.6.2. LoRa Antenna Upgrade

For the Hub and Transmitter units, the recommended antennas to be used for the LoRa radio can be found in ***Table 3.1 Approved Hub Unit Antennas*** of this manual. If another antenna is to be used, it must be of the same type and of the same (or less than the) peak gain of one of the antennas listed in ***Table 3.1***.

Important: *Any antennas selected for use outside of the above selection criteria will void the user's authority to operate the equipment, and will require additional FCC/IC approval.*

5.6.3. SIM Cards (regional)

A SIM Card is required to support services on the Cellular radio module. It shall be obtained from the local carrier/service provider.

5.6.4. Battery Booster Pack

Battery Booster Pack is not supported at this time.

5.6.5. Cellular Module Upgrade

The Cellular radio module in the Hub unit is governed by rules set by FCC and IC. Those rules prohibit the end user from installing or removing the Cellular radio module. Any installation or removal of the Cellular radio module must be performed by trained professional personnel from equipment dealers designated by Ag Growth International.

Only Cellular radio modules bearing a label with FCC ID: RI7HE910 and IC: 5131A-HE910 shall be used in the Hub unit.

Important: *Failure to abide by the above criteria will void the user's authority to operate the equipment, and will require additional FCC/IC approval.*

5.6.6. Cellular Antenna Upgrade

For the Hub unit, the recommended antenna to be used for the Cellular radio module can be found in ***Table 3.1 Approved Hub Unit Antennas*** of this manual. If another antenna is to be used, it must be of the same type and of the same (or less than the) peak gain of one of the antennas listed in the following table.

Table 5.8 List of Approved Antennas for Cellular Radio Module

(from FCC/IC test report of FCC ID: RI7HE910, IC: 5131A-HE910)

Maker	*Model*	*Type*	*Connector*	*Peak Gain (dBi)*
Wieson	11320Y11194A1	Omnidirectional	SMA plug	+3.53
Ethertronics	1002292	Flexible Embedded Dipole	U.FL	+3.0

Important: *Any antennas selected for use outside of the above selection criteria will void the user's authority to operate the equipment, and will require additional FCC/IC approval.*

5.6.7. Fan Control

This feature is not currently supported.

5.6.8. Lid/Hatch/Door alarm

Up to 3 Normally-Open switches can be connected in parallel to monitor the opening/closing of door, lid and hatch of a grain bin.

6. Installation

Important: In order to maintain compliance with FCC and Industry Canada RF exposure requirements, all antennas must be kept at a minimum 20 cm from all personnel in the vicinity during system operation. Please observe this requirement when installing or servicing Hub and Transmitter devices.

Installation must not be performed by the end-user. Please consult factory or factory-authorized dealers. The following sub-sections are intended as reference only.

6.1. Installation Safety

6.2. Overview

6.2.1. Installation principles and sequence

6.2.2. Recommended cable layouts per bin diameter

6.2.3. Compatible cables (AGI, OPI, Binsense digital)

6.3. Cable Installation

6.3.1. Scenarios

Instructions will also be needed for installing adaptors for 3rd party cables into a:

- -all 3rd party handheld system
- -all 3rd party remote system
- -mix of AGI and 3rd party handheld or remote system

6.3.2. Procedure: To install a Grain Monitoring Cable and Bracket

6.3.3. Procedure: To install interconnect cables and combiners

6.3.4. Procedure: To uncoil and anchor cables

6.4. Hub (master) Installation

6.4.1. Procedure: To install a Hub unit

6.5. Transmitter Unit Installation

6.5.1. Procedure: To install a Transmitter unit

6.6. Hand-held unit (unit, dock, and down-bin cable) Installation

6.6.1. Procedure: To install a Hand-held reader/ Docking station

6.7. Installing Fan Control Hardware

6.8. Installing Lid/Hatch/Door Alarm Hardware

7. Troubleshooting

No serviceable parts in the Guardian Bin Monitoring System; please consult factory or factory-authorized dealers for troubleshooting.

9. Maintenance, Service, and Upgrade

Important: In order to maintain compliance with FCC and Industry Canada RF exposure requirements, all antennas must be kept at a minimum 20 cm from all personnel in the vicinity during system operation. Please observe this requirement when installing or servicing Hub and Transmitter devices.

Maintenance, Service and Upgrade must not be performed by the end-user. Please consult factory or factory-authorized dealers. The following sub-sections are intended as reference only.

9.1.1. Maintenance, service, and extension

9.1.2. Upgrading a Hub to cell/cloud

9.1.3. Replacing a Handheld unit battery

9.1.4. Replacing a Hub unit battery

9.1.5. Replacing a Transmitter unit battery

9.1.6. WiFi antenna upgrade

For the Hub unit, the recommended antenna to be used for the WiFi radio module can be found in ***Table 3.1 Approved Hub Unit Antennas*** of this manual. If another antenna is to be used, it must be of the same type and of the same (or less than the) peak gain of one of the antennas listed in the following table.

Table 5.9 List of Approved Antennas for WiFi Radio Module

(from FCC/IC test report of FCC ID: XF6-RS9113SB, IC: 8407A-RS9113SB)

Maker	***Model***	***Type***	***Connector***	***Peak Gain (dBi)***
Redpine	-	Trace	-	+0.99
Molex	PS-47950-001	Flexible Embedded Dipole	U.FL	+3
Fractus	FR05-S1-NO-1-004	Chip	-	+1.8

Linx	ANT-2.4-CW-RCT-RP	Omnidirectional	SMA plug reverse polarity	+2.2

Important: *Any antennas selected for use outside of the above selection criteria will void the user's authority to operate the equipment, and will require additional FCC/IC approval.*

9.1.7. LoRa radio antenna upgrade

For the Hub and Transmitter units, the recommended antennas to be used for the LoRa radio can be found in ***Table 3.1 Approved Hub Unit Antennas*** of this manual. If another antenna is to be used, it must be of the same type and of the same (or less than the) peak gain of one of the antennas listed in ***Table 3.1***.

Important: *Any antennas selected for use outside of the above selection criteria will void the user's authority to operate the equipment, and will require additional FCC/IC approval.*

9.1.8. SIM cards (regional)

This feature is not currently supported.

9.1.9. Battery Booster Pack

Not supported at this time.

9.1.10. Cellular Module Upgrade

The Cellular radio module in the Hub unit is governed by rules set by FCC and IC. Those rules prohibit the end user from installing or removing the Cellular radio module. Any installation or removal of the Cellular radio module must be performed by trained professional personnel from equipment dealers designated by Ag Growth International.

Only Cellular radio modules bearing a label with FCC ID: RI7HE910 and IC: 5131A-HE910 shall be used in the Hub unit.

Important: *Failure to abide by the above criteria will void the user's authority to operate the equipment, and will require additional FCC/IC approval.*

9.1.11. Cellular antenna upgrade

For the Hub unit, the recommended antenna to be used for the Cellular radio module can be found in ***Table 3.1 Approved Hub Unit Antennas*** of this manual. If another antenna is to be used, it must be of the same type and of the same (or less than the) peak gain of one of the antennas listed in the following table.

Table 6.0 List of Approved Antennas for Cellular Radio Module

(from FCC/IC test report of FCC ID: RI7HE910, IC: 5131A-HE910)

Maker	***Model***	***Type***	***Connector***	***Peak Gain (dBi)***
Wieson	11320Y11194A1	Omnidirectional	SMA plug	+3.53
Ethertronics	1002292	Flexible Embedded Dipole	U.FL	+3.0

Important: *Any antennas selected for use outside of the above selection criteria will void the user's authority to operate the equipment, and will require additional FCC/IC approval.*

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