

Table C-1 Antenna Specifications, 6 dBi (65-0179) (cont.)

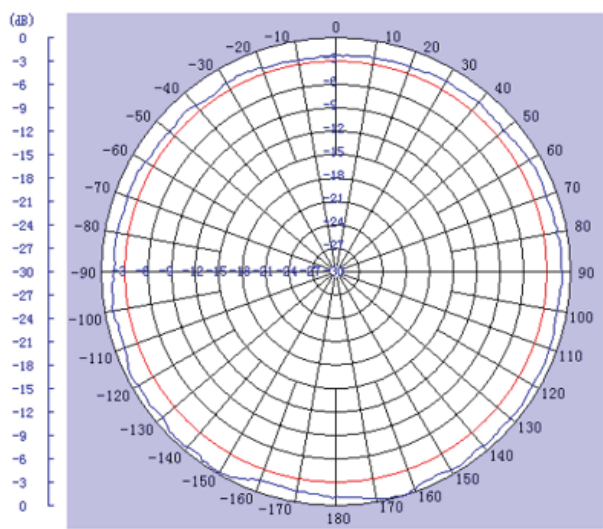
Item	Description	Radiation Patterns
Maximum Power	100 Watts	 Horizontal Radiation Pattern
Connector	N-Style Jack	
Height	10.6"	
Weight	0.5 lbs	
Horizontal Beamwidth	360°	
Rated Wind Velocity	135 mph	
Operating Temperature	-22°F to 158 °F -30 to 70 °C	

Table C-2 Antenna Specifications, 13 dBi (65-0177)

Parameter	Min	Typ	Max
Frequency Range	5150 MHz		5825 MHz
Gain		19 dBi	
Horizontal Beamwidth		16 Deg	
Vertical Beamwidth		16 Deg	
Front to Back	30 dB		
Cross Polarization	25 dB		
VSWR			
• 5150-5350MHz	2.0:1		
• 5470-5825MHz	1.5:1		
Impedance		50 OHM	
Input Power			100W
Operating Temperature	-40 °F -40 °C		158 °F 70 °C
Pole Size	1 in 25 mm		2.5 in 64 mm

C. Radio Specifications

Antenna Specifications

Table C-2 Antenna Specifications, 13 dBi (65-0177) (cont.)

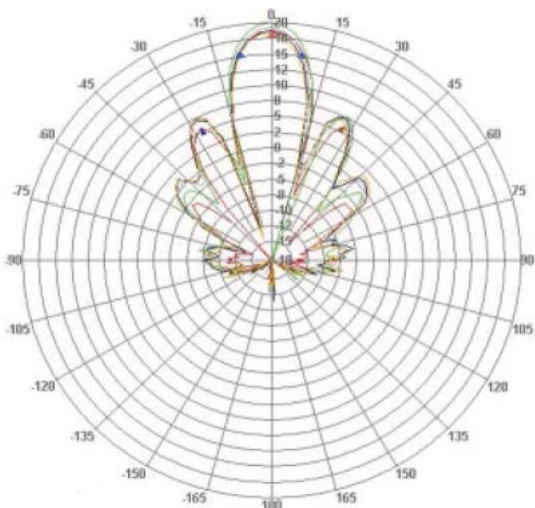
Parameter	Min	Typ	Max
Weight		17.6 oz 0.5 kg	
Dimension (L x W x Thick)	7.5 x 7.5 x 0.8 in 190 x 190 x 20 mm		
Bracket Tilt	45 Deg		
Radiation Pattern			

Table C-3 Antenna Wind Loading, 13 dBi (65-0177)

Parameter	Area	100 mph 161 kph	125 mph 201 kph
Wind Loading	56 sq in 0.04 sq m	14 lbs 6.4 kg	22 lbs 10 kg

C.1.2 Rocket Recorder Antenna

The recorder station backhaul using the Ubiquiti Rocket radio supports a 13 dBi antenna. This antenna is a 2x2 Dual Polarity MIMO Omnidirectional Antenna that provides 360 degree coverage.



Figure C-3 13 dBi Antenna (65-0178)

The supported recorder antenna specifications are as follows:

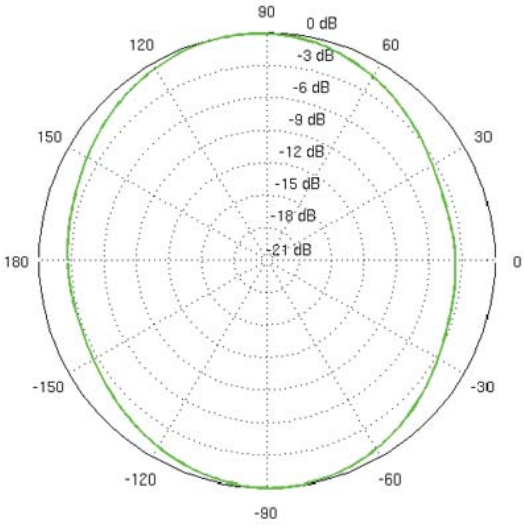
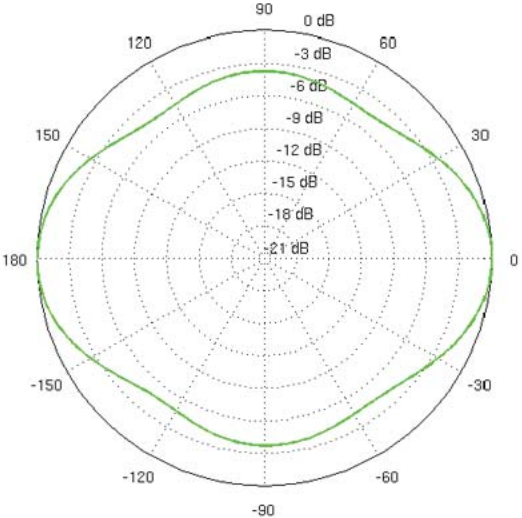
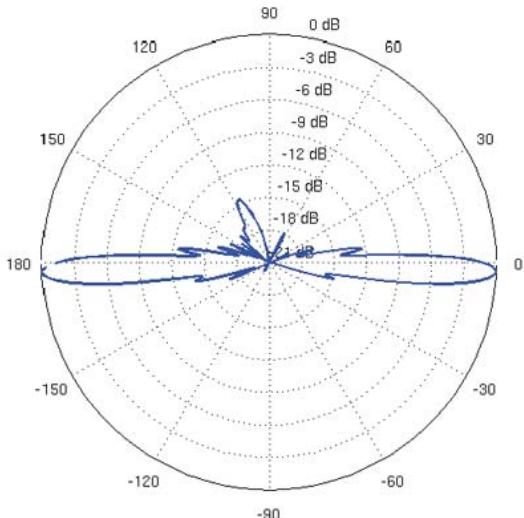
Table C-4 Antenna Specifications, 13 dBi (65-0178)

Item	Description	Radiation Patterns
Frequency Range	5.45 to 5.85 GHz	<i>Horizontal Elevation</i>
Gain	13 dBi	
Elevation Beamwidth	7 deg	
Max VSWR	1.5:1	
Downtilt	2 deg	
Dimensions L x W x H	6.2 x 3.8 x 32.8 in 158 x 98 x 834 mm	
Weight (including pole mount)	1 lb 13 oz 820 g	
Wind Survivability	125 mph 201 kph	

C. Radio Specifications

Antenna Specifications

Table C-4 Antenna Specifications, 13 dBi (65-0178) (cont.)

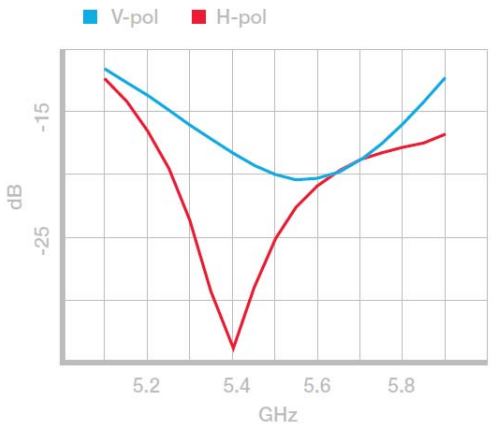
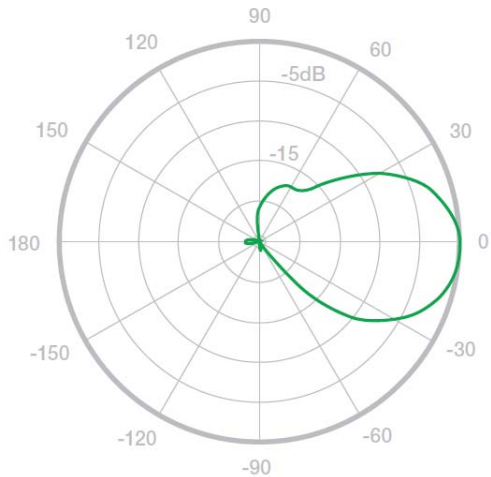
Item	Description	Radiation Patterns
Wind Loading	10 lb @ 100 mph 4.5 kg @ 161 kph	<i>Horizontal Azimuth</i> 
Polarization	Dual Linear	
Cross-pol Isolation	25 Db min	
ETSI Specification	EN 302 326 DN2	
Mounting	Universal pole mount	
<i>Vertical Azimuth</i> 		<i>Vertical Elevation</i> 

C.1.3 NanoStation Recorder/Line Station Antenna

The recorder or line station backhaul using the Ubiquiti NanoStation M5 radios do not use an external antenna; the NanoStation M5 has an integrated 14 dBi dual-polarity antenna.

The NanoStation integrated antenna specifications are as follows:

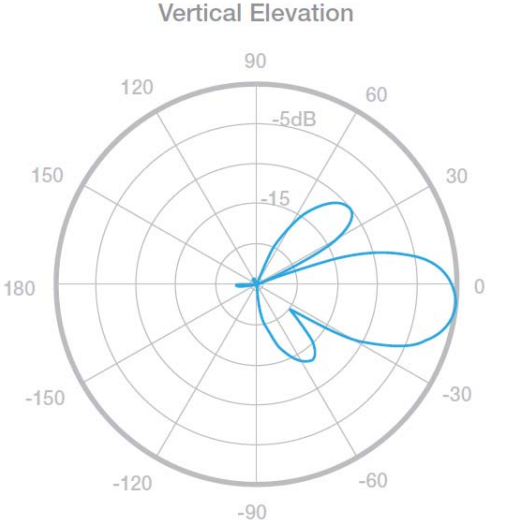
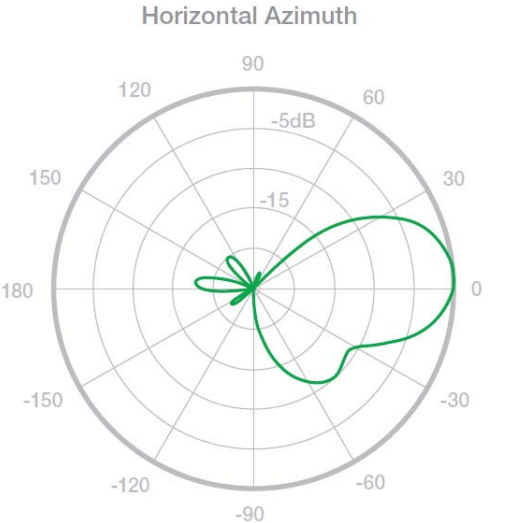
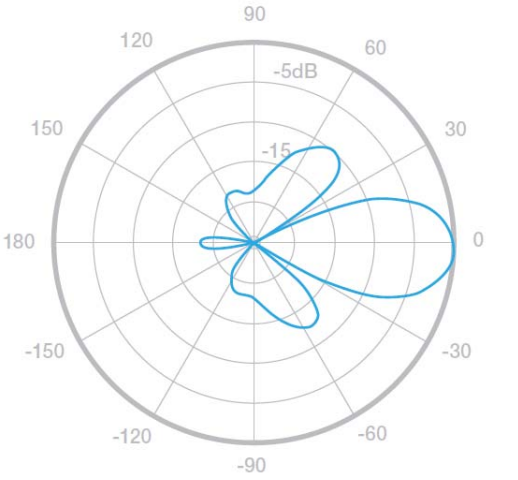
Table C-5 NanoStation Integrated Antenna Specifications

Item	Description	Radiation Patterns
Model	NSM5/+locoM5 integrated	Return Loss  ■ V-pol ■ H-pol dB GHz
Frequency Range	5745 to 5825 MHz (US) 5170 to 5875 MHz (INTL)	
Cross Pol Isolation	20 dB Minimum	
Gain	13 dBi	
Beamwidth	45° (H-pol) 45° (V-pol) 45° (Elevation)	
Max VSWR	1.4:1	
Polarization	Dual Linear	
Maximum Power	5.5 Watts	
Maximum Power	5.5 Watts	
Connector	N-Style Jack	
Height	10.6"	Vertical Azimuth 
Weight	0.5 lbs	
Horizontal Beamwidth	360°	
Rated Wind Velocity	135 mph	
Operating Temperature	-22°F to 158 °F -30 to 70 °C	

C. Radio Specifications

Radio Specifications

Table C-5 NanoStation Integrated Antenna Specifications (cont.)

Item	Description	Radiation Patterns
	Vertical Elevation	Horizontal Azimuth
		
	Horizontal Elevation	
		

C.2 Radio Specifications

This section provides radio specifications. The following radios are used in the backhaul:

- ◆ **Bullet** – 2.4 GHz High Power 802.11N Outdoor Radio System
See “Bullet Line Station Radios” on page 157

- ♦ **Rocket** – 900 MHz High Power 2x2 MIMO AirMax TDMA BaseStation
See “Rocket Recorder Radios” on page 159
- ♦ **NanoStation M5** – 5.8 GHz, High power, 2x2 MIMO AirMax TDMA PoE station with integrated 14 dBi dual-polarity antenna.
See “NanoStation Recorder/Line Station Radios” on page 160

C.2.1 Bullet Line Station Radios

The specifications for the Ubiquiti Bullet line station radio are as follows:

Table C–6 Bullet Line Station Radio Specifications (56-0019 US, 56-0024 Intl)

Item	Description
System Information	
Processor Specs	Atheros MIPS 24KC, 400 MHz
Memory Information	32 MB SDRAM, 8 MB Flash
Networking Interface	(1) 10/100 Ethernet Port
Regulatory / Compliance Information	
Wireless Approvals	FCC Part 15.247, IC RS210, CE
RoHS Compliance	Yes
Physical / Electrical / Environmental	
Dimensions (length x width)	7.5 x 1.8 in 190 x 46 mm
Weight	6.9 oz 196 g
Enclosure Characteristics	Powder Coated Aluminum
Antenna Connector	N-Type Connector (male)
Power Supply	24V, 0.5A PoE Adapter (included)
Power Method	Passive Power over Ethernet (pairs 4, 5+ ; 7, 8 return)
Max. Power Consumption	6 Watts
Operating Temperature	-40 to 176 °F -40 to 80 °C
Operating Humidity	5 to 95% Condensing
Shock and Vibration	ETSI300-019-1.4
Software Information	
Modes	Station, Access Point, AP Repeater
Services	SNMP, DHCP, NAT
Utilities	Site Survey with Preferred SSID, Antenna Alignment Tool, Discovery Utility

C. Radio Specifications

Radio Specifications

Table C-6 Bullet Line Station Radio Specifications (56-0019 US, 56-0024 Intl) (cont.)

Item	Description
Security	WEP/WPA/WPA2
QoS	802.11e / WMM Support
Statistical Reporting	Ethernet Activity, Uptime, Packet Success/Errors
Operating Frequency	5725 to 5850 (USA) 5170 to 5825 (International)
Output Power	25 dBm
Range Performance	31+ mi 50+ km (Outdoor - Antenna Dependent)

The power specifications for the Ubiquiti Bullet line station radio are as follows:

Table C-7 Bullet Line Station Radio Power Specifications (56-0019 US, 56-0024 Intl)

TX Power Specifications				RX Power Specifications			
11a	Data Rate	Avg. TX	Tolerance	11a	Data Rate	Sensitivity	Tolerance
	1-24 Mbps	25 dBm	+/-2 dB		24 Mbps	-83 dBm	+/-2 dB
	36 Mbps	23 dBm	+/-2 dB		36 Mbps	-80 dBm	+/-2 dB
	48 Mbps	21 dBm	+/-2 dB		48 Mbps	-77 dBm	+/-2 dB
	54 Mbps	20 dBm	+/-2 dB		54 Mbps	-75 dBm	+/-2 dB
11n / airMAX	MCS0	25 dBm	+/-2 dB	11n / airMAX	MCS0	-96 dBm	+/-2 dB
	MCS1	25 dBm	+/-2 dB		MCS1	-95 dBm	+/-2 dB
	MCS2	25 dBm	+/-2 dB		MCS2	-92 dBm	+/-2 dB
	MCS3	25 dBm	+/-2 dB		MCS3	-90 dBm	+/-2 dB
	MCS4	24 dBm	+/-2 dB		MCS4	-86 dBm	+/-2 dB
	MCS5	22 dBm	+/-2 dB		MCS5	-83 dBm	+/-2 dB
	MCS6	20 dBm	+/-2 dB		MCS6	-77 dBm	+/-2 dB
	MCS7	19 dBm	+/-2 dB		MCS7	-74 dBm	+/-2 dB

C.2.2 Rocket Recorder Radios

The specifications for the Ubiquiti Rocket recorder radio are as follows:

Table C-8 Rocket Recorder Radio Specifications (15-0052 US, 15-0054 Intl)

Item	Description
System Information	
Processor Specs	Atheros MIPS 24KC, 400MHz
Memory Information	64MB SDRAM, 8MB Flash
Networking Interface	2 X 10/100 BASE-TX (Cat. 5, RJ-45) Ethernet
Regulatory / Compliance Information	
Wireless Approvals	FCC Part 15.247, IC RS210, CE
RoHS Compliance	YES
Physical / Electrical / Environmental	
Dimensions (length, width, height)	6.7 x 3.1 x 1.2 in 17 x 8 x 3cm
Weight	1.6 lb 0.5kg
Enclosure Characteristics	Outdoor UV Stabilized Plastic
RF Connector	2x RP-SMA and 1x SMA (Waterproof)
Mounting Kit	Pole Mounting Kit included
Power Supply	24V, 1A POE Supply included
Power Method	Passive Power over Ethernet (pairs 4, 5+ ; 7, 8 return)
Max Power Consumption	8 Watts
Operating Temperature	-22 to 167 °F -30 to 75 °C
Operating Humidity	5 to 95% Condensing
Shock and Vibration	ETSI300-019-1.4
Operating Frequency	5745 to 5825 (USA) 5470 to 5825 (International)
Output Power	27 dBm
Range Performance	up to 9.3 miles up to 15 km

C. Radio Specifications

Radio Specifications

The power specifications for the Ubiquiti Rocket radio are as follows:

Table C-9 Rocket Recorder Radio Power Specifications (15-0052 US, 15-0054 Intl)

TX Power Specifications				RX Power Specifications			
11a	Data Rate	Avg. TX	Tolerance	11a	Data Rate	Ave. TX	Tolerance
	6-24 Mbps	27 dBm	+/- 2 dB		6-24 Mbps	-94 dBm min	+/- 2 dB
	36 Mbps	25 dBm	+/- 2 dB		36 Mbps	-80 dBm	+/- 2 dB
	48 Mbps	23 dBm	+/- 2 dB		48 Mbps	-77 dBm	+/- 2 dB
	54 Mbps	22 dBm	+/- 2 dB		54 Mbps	-75 dBm	+/- 2 dB
11n / airMAX	MCS0	27 dBm	+/- 2 dB	11n / airMAX	MCS0	-96 dBm	+/- 2 dB
	MCS1	27 dBm	+/- 2 dB		MCS1	-95 dBm	+/- 2 dB
	MCS2	27 dBm	+/- 2 dB		MCS2	-92 dBm	+/- 2 dB
	MCS3	27 dBm	+/- 2 dB		MCS3	-90 dBm	+/- 2 dB
	MCS4	26 dBm	+/- 2 dB		MCS4	-86 dBm	+/- 2 dB
	MCS5	24 dBm	+/- 2 dB		MCS5	-83 dBm	+/- 2 dB
	MCS6	22 dBm	+/- 2 dB		MCS6	-77 dBm	+/- 2 dB
	MCS7	21 dBm	+/- 2 dB		MCS7	-74 dBm	+/- 2 dB
	MCS8	27 dBm	+/- 2 dB		MCS8	-95 dBm	+/- 2 dB
	MCS9	27 dBm	+/- 2 dB		MCS9	-93 dBm	+/- 2 dB
	MCS10	27 dBm	+/- 2 dB		MCS10	-90 dBm	+/- 2 dB
	MCS11	27 dBm	+/- 2 dB		MCS11	-87 dBm	+/- 2 dB
	MCS12	26 dBm	+/- 2 dB		MCS12	-84 dBm	+/- 2 dB
	MCS13	24 dBm	+/- 2 dB		MCS13	-79 dBm	+/- 2 dB
	MCS14	22 dBm	+/- 2 dB		MCS14	-78 dBm	+/- 2 dB
	MCS15	21 dBm	+/- 2 dB		MCS15	-75 dBm	+/- 2 dB

C.2.3 NanoStation Recorder/Line Station Radios

The specifications for the Ubiquiti NanoStation™ radio are as follows:

Table C-10 NanoStation Radio Specifications (56-0035 US, 56-0032 Intl)

Item	Description
System Information	
Processor Specs	Atheros MIPS 24KC, 400MHz
Memory Information	32MB SDRAM, 8MB Flash
Networking Interface	1 X 10/100 BASE-TX (Cat. 5, RJ-45) Ethernet
Regulatory / Compliance Information	

Table C-10 NanoStation Radio Specifications (56-0035 US, 56-0032 Intl) (cont.)

Item	Description
Wireless Approvals	FCC Part 15.247, IC RS210, CE
RoHS Compliance	YES
Physical / Electrical / Environmental	
Dimensions (length, width, height)	6.42 x 1.22 x 3.15 in 163 x 31 x 80mm
Weight	0.40 lb 0.18kg
Enclosure Characteristics	Outdoor UV Stabilized Plastic
Mounting Kit	Pole Mounting Kit included
Power Supply	24V, 0.5A POE Supply included
Power Method	Passive Power over Ethernet (pairs 4, 5+; 7, 8 return)
Max Power Consumption	5.5 Watts
Operating Temperature	-22 to 167 °F -30 to 75 °C
Operating Humidity	5 to 95% Condensing
Shock and Vibration	ETSI300-019-1.4
Operating Frequency	5745 to 5825 (USA) 5170 to 5875 (International)
Output Power	27 dBm
Range Performance	31+ mile 50+ km

The power specifications for the Ubiquiti NanoStation M5 radio are as follows:

Table C-11 NanoStation Radio Power Specifications (56-0035 US, 56-0032 Intl)

TX Power Specifications				RX Power Specifications			
11a	Data Rate	Avg. TX	Tolerance	11a	Data Rate	Ave. TX	Tolerance
	6-24Mbps	23 dBm	+/-2 dB		6-24Mbps	-83 dBm min	+/-2 dB
	36 Mbps	21 dBm	+/-2 dB		36 Mbps	-80 dBm	+/-2 dB
	48 Mbps	19 dBm	+/-2 dB		48 Mbps	-77 dBm	+/-2 dB
	54 Mbps	18 dBm	+/-2 dB		54 Mbps	-75 dBm	+/-2 dB

C. Radio Specifications

Radio Specifications

Table C-11 NanoStation Radio Power Specifications (56-0035 US, 56-0032 Intl) (cont.)

TX Power Specifications				RX Power Specifications			
11n / airMAX	MCS0	23 dBm	+/- 2 dB	11n / airMAX	MCS0	-96 dBm	+/- 2 dB
	MCS1	23 dBm	+/- 2 dB		MCS1	-95 dBm	+/- 2 dB
	MCS2	23 dBm	+/- 2 dB		MCS2	-92 dBm	+/- 2 dB
	MCS3	23 dBm	+/- 2 dB		MCS3	-90 dBm	+/- 2 dB
	MCS4	22 dBm	+/- 2 dB		MCS4	-86 dBm	+/- 2 dB
	MCS5	20 dBm	+/- 2 dB		MCS5	-83 dBm	+/- 2 dB
	MCS6	18 dBm	+/- 2 dB		MCS6	-77 dBm	+/- 2 dB
	MCS7	17 dBm	+/- 2 dB		MCS7	-74 dBm	+/- 2 dB
	MCS8	23 dBm	+/- 2 dB		MCS8	-95 dBm	+/- 2 dB
	MCS9	23 dBm	+/- 2 dB		MCS9	-93 dBm	+/- 2 dB
	MCS10	23 dBm	+/- 2 dB		MCS10	-90 dBm	+/- 2 dB
	MCS11	23 dBm	+/- 2 dB		MCS11	-87 dBm	+/- 2 dB
	MCS12	22 dBm	+/- 2 dB		MCS12	-84 dBm	+/- 2 dB
	MCS13	20 dBm	+/- 2 dB		MCS13	-79 dBm	+/- 2 dB
	MCS14	18 dBm	+/- 2 dB		MCS14	-78 dBm	+/- 2 dB
	MCS15	17 dBm	+/- 2 dB		MCS15	-75 dBm	+/- 2 dB

LED Indicators

This chapter provides the possible LED status and error indicators for WRUs and LIUs.

The WRU has three possible states; undeployed, deploying, and deployed.

When tilting the WRU to deploy, re-acquire GPS, or check status, tilt the WRU geophone down until the LEDs light, and then return the WRU to the horizontal position as shown in the following figure:

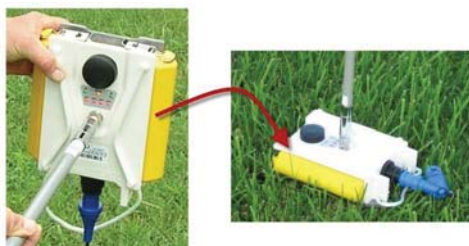


Figure D-1 WRU Down-Tilt Action

When tilting the WRU to undeploy, tilt the WRU geophone up until the LEDs light, and then return the WRU to the horizontal position as shown in the following figure:



Figure D-2 WRU Up-Tilt Action

D.1 WRU Undeployed

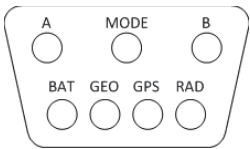
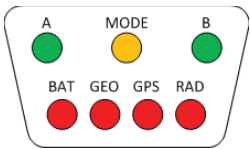
When the WRU is undeployed, all of the LEDs are off. A vertical tilt has the following effect:

- ◆ **Geophone Down** – WRU deployment
- ◆ **Geophone Up** – No effect; nothing happens

D. LED Indicators

WRU Undeployed

Table D-1 WRU LED Indications, Undeployed

LED Indicators	Summary	Description
	Undeployed Dead batteries	If no LEDs are on (lit up) on an undeployed WRU, it can be one of the following scenarios: • Unit undeployed • Batteries dead When you do a tilt test (geophone down) on an undeployed WRU with no LEDs on, the following may occur: • An Undeployed WRU deploys and begins the self tests • A WRU with dead batteries will continue to display no lit LEDs • A WRU is defective if no LEDs turn on after battery replacement. NOTE: Battery state is shown in the RT System 2 user interface tables. For example, the Ground Equipment Table.
	Geo down tilt detected Deploy	Tilt the WRU with the geophone pointing down. After a few seconds, all of the LEDs light up solid. Place the WRU flat on the ground to within five seconds to begin the deployment process: • Battery fuse self-test • Battery test • THD test • Geophone test • GPS fix • Radio test

After removing both batteries from an undeployed WRU, and then replacing BAT A, BAT B, or both, when the first battery is connected, the WRU goes through the power on LED sequence and then remains in the undeployed state.

The following table shows the LED power-on sequence for an undeployed WRU:

Table D-2 WRU LED Indications, Undeployed Power-On Sequence

LED Indicators	Summary	Description
The diagram illustrates the sequence of LED indicators during a hard reset (power on). It shows a series of states for the WRU LED indicators, which are arranged in a clockwise rotation. The sequence starts with the A battery LED (green), followed by the MODE LED (yellow), then the B battery LED (green), and finally the RAD LED (red). The sequence then repeats for the A battery LED, B battery LED, and both batteries present (A and B LEDs green).	Hard reset (power on)	The LEDs light up in clockwise rotation starting with the A battery LED and ending with the A battery LED, B battery LED, or both.

D.2 WRU Deploying

When the WRU begins deploying, the following tests are executed:

D. LED Indicators

WRU Deploying

- ◆ BAT A and BAT B connected
 - Battery fuse test
 - Battery test
 - THD test
 - Geophone Test
 - GPS test
 - Radio Test
- ◆ BAT A or BAT B connected
 - Battery test
 - THD test
 - Geophone Test
 - GPS test
 - Radio Test

The following table shows the possible LED indicators for a WRU that is deploying:

Table D-3 WRU LED Indications, Deploying Sequence

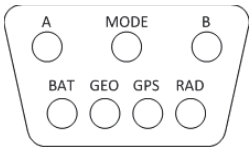
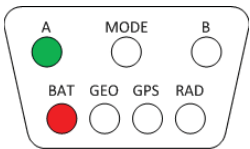
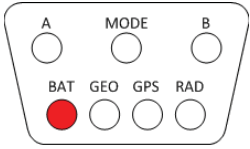
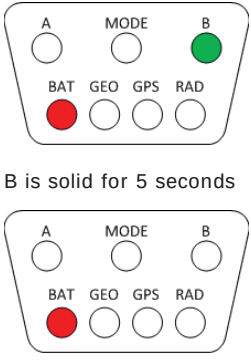
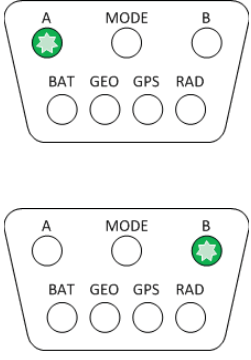
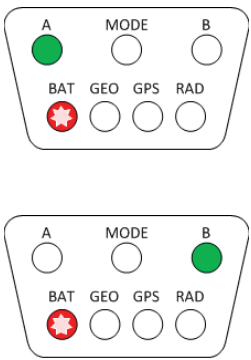
LED Indicators	Summary	Description
	Dead batteries Defective Unit	If no LEDs are on (lit up) during the deploying state, it can be one of the following scenarios: - Batteries dead - Defective Unit When you do a tilt test (geophone down) on a WRU with no LEDs on, the following may occur: - A WRU with dead batteries will continue to display no lit LEDs - A WRU is defective if no LEDs turn on after battery replacement. NOTE: Battery state is shown in the RT System 2 user interface tables. For example, the Ground Equipment Table.
 A is solid for 5 seconds  BAT remains solid	Battery fuse test failure (A)	When both batteries are installed, the battery fuse test is performed. A Solid for 5 seconds BAT Solid A solid BAT LED indicates that the WRU detected a bad fuse during deployment and returned to the undeployed state. When a battery fuse test fails, the WRU will not deploy. Both batteries must be present for the battery fuse test to execute. This allows you to deploy a WRU by removing the battery connected to the bad fuse prior to the deployment tilt action.

Table D-3 WRU LED Indications, Deploying Sequence (cont.)

LED Indicators	Summary	Description
 B is solid for 5 seconds BAT remains solid	Battery fuse test failure (B)	When both batteries are installed, the battery fuse test is performed. B Solid for 5 seconds BAT Solid A solid BAT LED indicates that the WRU detected a bad fuse during deployment and returned to the undeployed state. When a battery fuse test fails, the WRU will not deploy. Both batteries must be present for the battery fuse test to execute. This allows you to deploy a WRU by removing the battery connected to the bad fuse prior to the deployment tilt action.
	Battery test	If both batteries are installed and their capacities are above 9000 mAh, the following occurs: - Battery in use LED (A or B) Flashes - The THD, GEO, GPS, and RAD self-tests are performed NOTE: The general battery test provides a visual indication if the WRU has one or more missing, malfunctioning, or low capacity batteries and provides 45 seconds to correct the problem before proceeding to the remainder of the deployment self-tests.
	Battery failure	If one or both batteries have sub-9000mAh capacities or are not installed, the following occurs: - Solid – A and or B - Flashing – BAT LED flashes for 45 seconds Install one or two batteries with capacities above 9000 mAh during the 45 second window. The following occurs: - Flashing BAT LED turns off - Battery in use LED (A or B) flashes for approximately 2 seconds - The THD, GEO, GPS, and RAD self-tests are performed

D. LED Indicators

WRU Deploying

Table D-3 WRU LED Indications, Deploying Sequence (cont.)

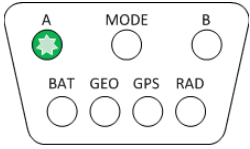
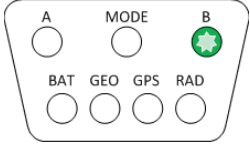
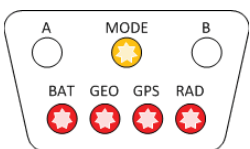
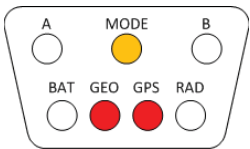
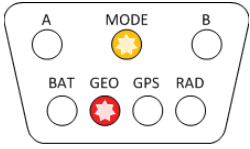
LED Indicators	Summary	Description
 		If no changes are made to the batteries within the 45 second window, The following occurs: - Flashing BAT LED turns off - Battery in use LED (A or B) flashes for approximately 2 seconds - The THD, GEO, GPS, and RAD self-tests are executed
	Self-test starting	If a WRU self-test fails, the WRU will continue to the next test. Flashing: - MODE - BAT - GEO - GPS - RAD NOTE: Error LEDs remain persistent throughout the self-discovery process and are turned off upon completion.
	Continue (lay flat to move to next test)	To skip a test during the self-test process, tilt the WRU geophone down until you see this triangle of LEDs. Tilt the WRU back to horizontal to continue. Solid: - MODE - GEO - GPS NOTE: The GPS test cannot be skipped.
	Geophone test in progress	Flashing: - MODE - GEO NOTE: Performing a vertical geophone down tilt during the geophone test causes the WRU to go into the communications repeater mode. WRU repeaters are used to solve terrain or distance related communication problems between WRUs.

Table D-3 WRU LED Indications, Deploying Sequence (cont.)

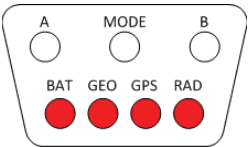
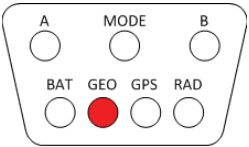
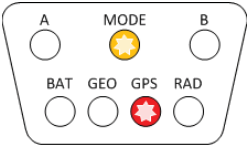
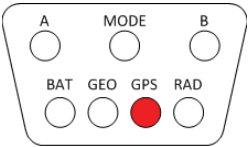
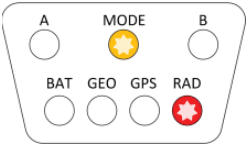
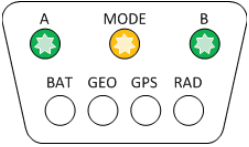
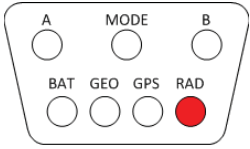
LED Indicators	Summary	Description
	THD test failure	Solid: - BAT - GEO - GPS - RAD NOTE: No LEDs are affected when the THD test starts or when it passes.
	Geophone test failure	GEO Solid NOTE: For a multiple-channel geophone, tests the first channel only.
	Acquiring GPS fix	Flashing: - MODE - GPS NOTE: The WRU will attempt to get a 3-meter GPS lock for up to 15 minutes. During this time, the GPS LED flashes. The WRU will not form until the GPS lock is achieved. If the GPS lock cannot be achieved, form by serial number.
	GPS test failure	GPS Solid GPS fix not found For a multiple-channel geophone, tests the first channel only.
	Neighbor discovery in progress	Flashing: - MODE - RAD
	Neighbor discovered	Flashing: - A - MODE - B

Table D-3 WRU LED Indications, Deploying Sequence (cont.)

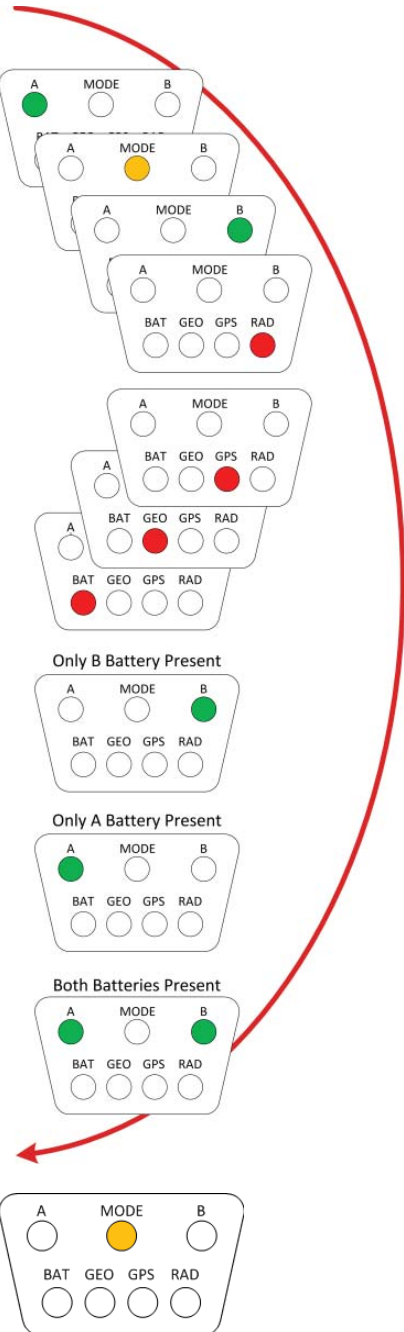
LED Indicators	Summary	Description
	No neighbor detected	RAD Solid If this is the first WRU deployed, this is the expected condition.

If power is removed from a WRU in the deploying state, the WRU stays in the deploying state and restarts the deploying process when power is restored.

After removing both batteries from a deploying WRU, and then replacing BAT A, BAT B, or both, when the first battery is connected, the WRU goes through the power on LED sequence. If both batteries are connected, the battery fuse test is executed. If only one battery is connected, the battery fuse test is skipped. The remainder of the self-tests are then executed.

The following table shows the LED power-on sequence for an deploying WRU:

Table D-4 WRU LED Indications, Deploying Power-On Sequence

LED Indicators	Summary	Description
	Hard reset (power on)	The LEDs light up in clockwise rotation starting with the A battery LED and ending with the A battery LED, B battery LED, or both for 2 seconds. The A and B battery LEDs at the end of the rotation indicate that one or both batteries are above the minimum threshold of 9000mAh. Finally, the MODE LED lights up for approximately 5 seconds indicating that the WRU is verifying its firmware integrity.

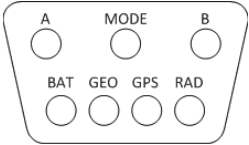
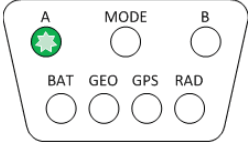
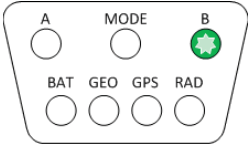
D.3 WRU Deployed

If the WRU is already deployed, a vertical tilt has the following effect:

- ◆ **Geophone Down** – If Sleeping, takes three to four seconds to wake up. If in Standby or Armed displays the battery status, deployment self-test status, and re-acquires the GPS position.
- ◆ **Geophone Up** – All lights light. If placed flat within 5 seconds, the WRU undeploys.

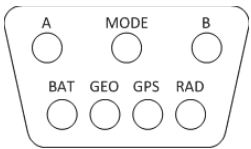
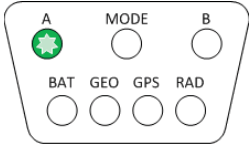
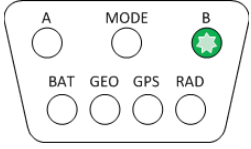
The following table shows how the LEDs light up during normal operation with no vertical tilt for a deployed WRU.

Table D-5 WRU LED Indications, Deployed WRU, No Geophone Tilt

LED Indicators	Summary	Description
	Undeployed Dead Batteries Sleeping	If no LEDs are on (lit up), it can be one of the following scenarios: • WRU undeployed • Batteries dead • WRU Sleeping • WRU Awake, but unformed NOTE: Battery state is shown in the RT System 2 user interface tables. For example, the Ground Equipment Table.
	Battery A in use	A Flashing: • Battery A in use • WRU formed or Armed
	Battery B in use	B Flashing: • Battery B in use • WRU formed or Armed

The following table shows how the LEDs light up during a vertical tilt (geophone down) for a deployed WRU.

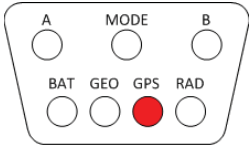
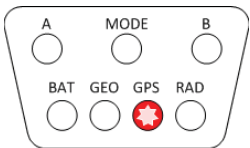
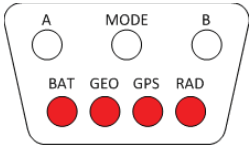
Table D-6 WRU LED Indications, Deployed WRU, Geophone Down Tilt

LED Indicators	Summary	Description
	Undeployed Dead Batteries Sleeping	If no LEDs are on (lit up) before tilting the WRU, it can be one of the following scenarios: • WRU undeployed • Batteries dead • WRU Sleeping • WRU Awake, but unformed When you do a tilt test (geophone down) on a WRU with no LEDs on, the following may occur: • An Undeployed WRU deploys and begins the self tests • A WRU with dead batteries will continue to display no lit LEDs • A Sleeping WRU goes back to the deployed, unformed state and displays the battery status and any self-tests that failed during deployment (BAT, THD, GEO, GPS, or RAD). • A WRU in the Awake unformed state displays the battery status and any self-tests that failed during deployment (BAT, THD, GEO, GPS, or RAD). NOTE: Battery state is shown in the RT System 2 user interface tables. For example, the Ground Equipment Table.
	Battery A in use	A Flashing: • Battery A in use • WRU formed or Armed NOTE: Only when GPS position occurs at the same time the battery status is displayed.
	Battery B in use	B Flashing: • Battery B in use • WRU formed or Armed NOTE: Only when no self-test failures. Re-acquire GPS position occurs at the same time the battery status is displayed.

D. LED Indicators

WRU Deployed

Table D-6 WRU LED Indications, Deployed WRU, Geophone Down Tilt (cont.)

LED Indicators	Summary	Description
	Re-acquire GPS position	GPS Solid for up to 15 minutes The deployed WRU can be in any of the following states: • Unformed • Formed NOTE: The battery status is displayed at the same time the GPS position is re-acquiring.
	GPS position acquired	GPS Flashing The Deployed WRU is in Standby
	Self test failure	The LED associated with the failed self-test is solid. All four LEDs are solid only if all four self-tests failed, or the THD self-test fails. The LEDs are visible only during the deployment process, and when the WRU is tilted (geophone down) to check status after the WRU is deployed. Solid: • BAT • GEO • GPS • RAD

The following table shows how the LEDs light up during a vertical tilt (geophone up) for a deployed WRU.

Table D-7 WRU LED Indications, Deployed WRU, Geophone Up Tilt

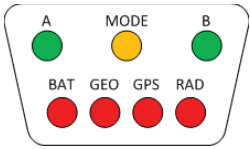
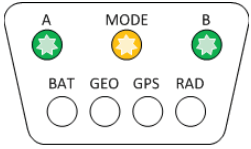
LED Indicators	Summary	Description
	Geo tilt detected Undeploy	Tilt the WRU with the geophone pointing up. After a few seconds, all of the LEDs light up solid. Place the WRU flat on the ground within five seconds to undeploy the WRU.

Table D-7 WRU LED Indications, Deployed WRU, Geophone Up Tilt (cont.)

LED Indicators	Summary	Description
	Undeploy successful	Flashing: • A • MODE • B

After removing both batteries from a deployed WRU, and then replacing BAT A, BAT B, or both, when the first battery is connected, the WRU goes through the power on LED sequence. The WRU transitions to the Awake, unformed state. If the WRU is not formed within 30 minutes, the WRU transitions to the Sleep state.

D.4 LIU Power-On

The LIU LEDs function independently from each other, and there can be a number of combinations of LEDs that are on, off, or flashing. The following list shows the LEDs used to indicate status:

- ◆ **Battery** – A, B, BAT
- ◆ **Power, Mode** – MODE
- ◆ **Discipline** – MODE
- ◆ **Check Link Status** – MODE, 1, 2, 3, and 4
- ◆ **Connection to Central** – LNK
- ◆ **GPS Lock** – GPS
- ◆ **Radio connection, communication with neighbor** – RAD

The following table shows the LED power-on sequence for an LIU:

Table D-8 LIU LED Indications, Power-On Sequence

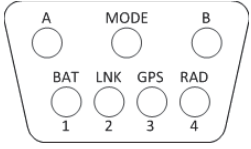
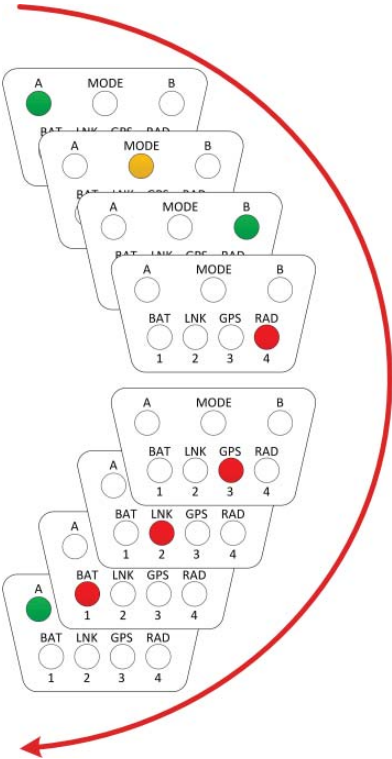
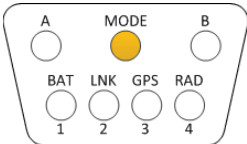
LED Indicators	Summary	Description
	Off	No lights

Table D-8 LIU LED Indications, Power-On Sequence (cont.)

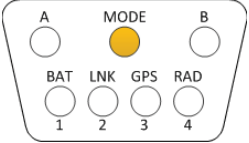
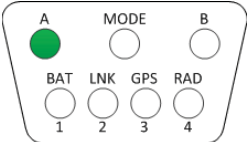
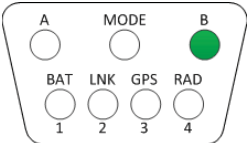
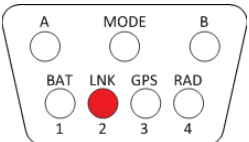
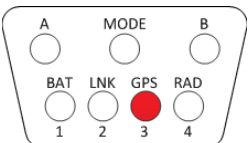
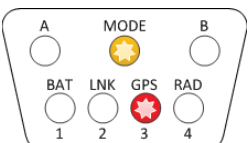
LED Indicators	Summary	Description
	Hard Reset LIU	The LEDs light up in clockwise rotation starting and ending with the A battery LED in the following cases: • When the batteries are attached • Anytime the unit resets itself • In between updating firmware applications
	The unit is verifying the integrity of the firmware.	MODE Solid for approximately 5 seconds

D.5 LIU Normal Operation

The following tables describe the possible Normal Mode LIU Status Indications:

- ◆ “LIU LED Status Indications, Normal Mode” on page 177
- ◆ “LIU LED Error Indications, Normal Mode” on page 179

Table D-9 LIU LED Status Indications, Normal Mode

LED Indicators	Summary	Description
	On, Disciplined to GPS Checking firmware	MODE solid The MODE LED indicates that the integrity of the downloaded firmware is being verified.
	Battery A in use	A solid Indicates Battery A in use powering LIU. Battery Voltage is above depleted threshold.
	Battery B in use	B solid Indicates Battery B in use powering LIU. Battery Voltage is above depleted threshold.
	LIU connected to Central	LNK solid
	GPS lock	GPS solid
	GPS disciplined	Flashing: - GPS flashes in the 1 s rhythm of the PPS - MODE flashes in the 1 s rhythm of the PPS

D. LED Indicators

LIU Normal Operation

Table D-9 LIU LED Status Indications, Normal Mode (cont.)

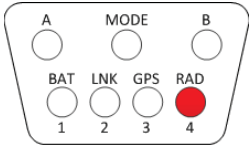
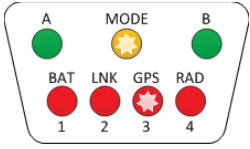
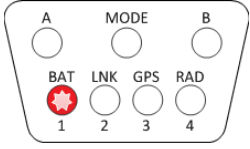
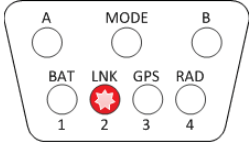
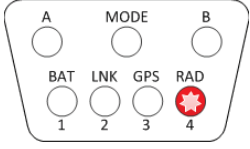
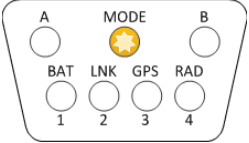
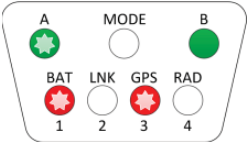
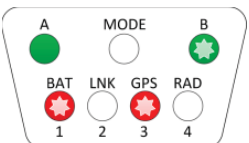
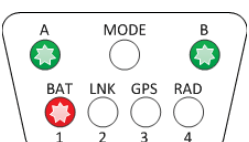
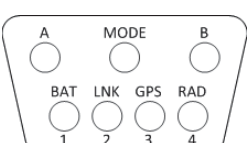
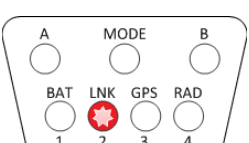
LED Indicators	Summary	Description
	Formed	RAD solid
	Normal	Solid: • A/B • BAT • LNK (connected) • RAD (formed) Flashing: • MODE • GPS • LNK (disconnected)
	Main (ARM) processor is upgrading its own firmware	BAT flashing
	Main (ARM) processor is upgrading the Power Control (XMEGA) processor firmware	LNK flashing
	Main (ARM) processor is upgrading the Radio processor firmware	RAD flashing

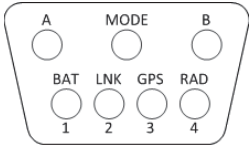
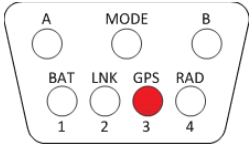
Table D-10 LIU LED Error Indications, Normal Mode

LED Indicators	Summary	Description
	On, no GPS discipline	MODE flashing every 1 second
	Single battery failure Battery B in use Battery A below threshold or disconnected	A: - Off, or 4 long flashes, then off (On 4.5s, off 2s) or - GPS PPS flash B Solid BAT: 4 long flashes, then off (On 4.5s, off 2s)
	Single battery failure Battery A in use Battery B below threshold or disconnected	A Solid B: - Off, or 4 long flashes, then off (On 4.5s, off 2s) or - GPS PPS flash BAT: 4 long flashes, then off (On 4.5s, off 2s)
	Both batteries below threshold –OR– One below threshold and one disconnected	A & B: - Off, or 4 long flashes, then off (On 4.5s, off 2s) or - GPS PPS flashes BAT: 4 long flashes, then off (On 4.5s, off 2s)
	No IP Address acquired	LNK off
	LIU has IP Address, but no communications with Central	LNK flashing

D. LED Indicators

Firmware Upgrade

Table D–10 LIU LED Error Indications, Normal Mode (cont.)

LED Indicators	Summary	Description
	No GPS lock	GPS off No GPS or less than 3 satellites
	GPS lock, not disciplined	GPS on GPS lock, but not disciplined

D.6 Firmware Upgrade

The following table describes the possible WRU and LIU LED indications during firmware upgrade:

Table D–11 WRU and LIU LED Status Indications, Firmware Upgrade

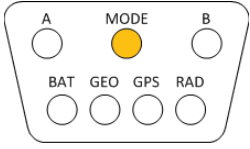
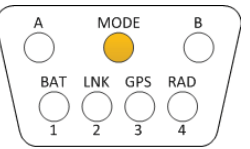
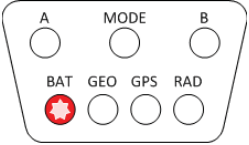
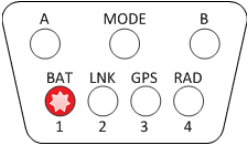
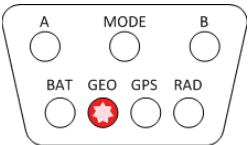
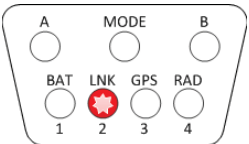
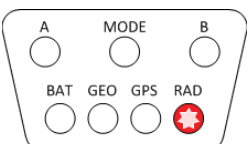
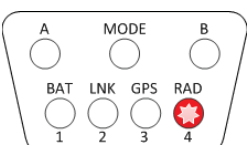
LED Indicators	Summary	Description
 	Firmware upgrade	MODE Solid for approximately 5 seconds During firmware upgrade, the MODE LED indicates that each processor's new firmware is being verified.

Table D-11 WRU and LIU LED Status Indications, Firmware Upgrade (cont.)

LED Indicators	Summary	Description
 	Firmware upgrade	BAT Flashing The main processor is saving the new firmware for all processors to non-volatile memory.
 	The power control processor's firmware is being upgraded	GEO/LNK Flashing for approximately 15 seconds
 	The Radio processor's firmware is being upgraded	RAD Flashing for approximately 1-2 seconds

Weighted Base

This section describes the mast that uses weights to maintain stability.

E.1 Specifications

Tripod Weight = 50 lbs (22.73 kg)

Minimum mast height = 53" (includes 6" for mounting)

Base size = 48" (1.2m) x 48" (1.2m)

Supports up to 12 – 16" x 8" blocks

Pre-galvanized steel frame

Accepts up to 2.5" mast (not included)



Figure E-1 Weighted Mast

E.2 Hardware Supplied

The following hardware is supplied with the tripod mast:

- ♦ 4 - Bolt, Carriage 1/4 - 20 x 3/4"
- ♦ 12 - Bolt, Carriage 1/4 - 20 x 5/8"
- ♦ 4 - Bolt, 1/4 - 20 x 3/4" Hex Head
- ♦ 4 - Bolt, 1/4 - 20 x 1/2" Hex Head
- ♦ 24-Nut, 1/4 - 20
- ♦ 24 - Lock washer, 1/4 Int. tooth

E.3 Assembly Instructions

This section provides instructions and illustrations for assembly of the tripod.

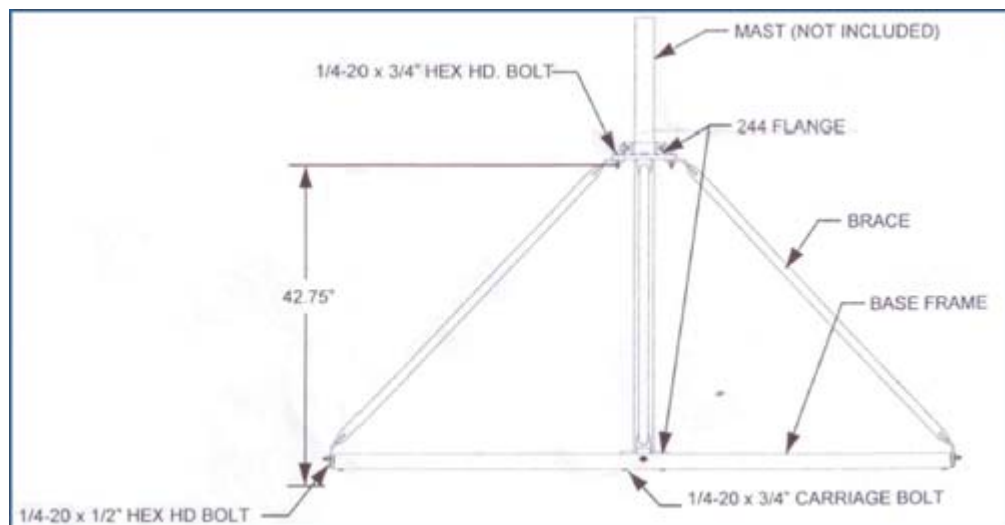


Figure E-2 Tripod Assembly, Front View

To assemble the tripod:

- 1** Assemble one 244 Flange to the Center Support Plate using four 1/4-20 x 3/4" carriage Bolts, Lock washers and Hex Nuts. Make sure to assemble the Bolts with the Heads on the underside of the frame. Hex Nut should be on the top side of the frame.
- 2** Assemble Base Frame and Center Support Plate using twelve 1/4-20 x 5/8" carriage Bolts, Lock washers and Hex Nuts. Make sure to assemble the Bolts with the Heads on the underside of the frame. Hex Nut should be on the top side of the frame.
- 3** Assemble the four (4) Braces to the upper support flange using four 1/4-20x3/4 Hex Head Bolts, Lock washers and Nuts.
- 4** Assemble the other end of the braces to the base frame using the four (4) 1/4-20 x 1/2" Hex Head Bolts, Lock washers, and Nuts.
- 5** Insert Bolts into upper and lower flange.
- 6** Slide the mast (not included) into position and tighten securely and weigh.

Wade Antenna Ltd., Ontario, Canada

Using a Compass

This chapter describes how to use a sighting compass. A sighting compass has the same features as a baseplate compass, but adds a vertical mirror that allows you to view the compass dial and the landmark at the same time.

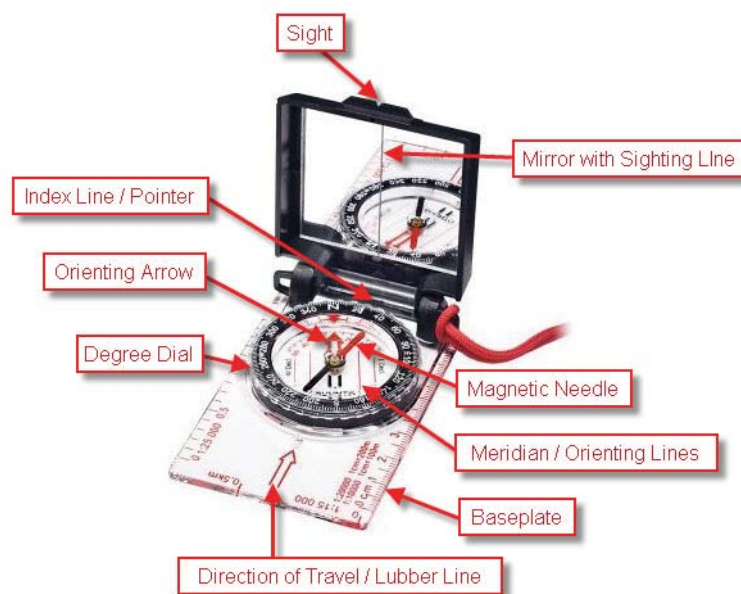


Figure F-1 Sighting Compass (70-0067)

For an in-depth description of using a compass with a map and setting the declination on a compass see the following links:

- ◆ <http://www.compassdude.com/default.shtml>
- ◆ <http://www.compassdude.com/compass-declination.shtml>
- ◆ <http://www.rei.com/learn/expert-advice/navigation-basics.html>
- ◆ <http://www.thecompassstore.com/howtouseyour.html>

A compass needle points to the magnetic north pole which is not the same as true or geographic north. The difference between magnetic and true north is called magnetic declination. The declination value depends on your actual location on the Earth. Over time, as the Earth's magnetic field shifts, the declination values also shift.

Maps are drawn with true north at the top edge. When using a compass to navigate or locate objects, you must adjust the readings to account for the angular difference between true north (★) and magnetic north (MN). The declination value is marked on topographical maps as shown in the following figure:

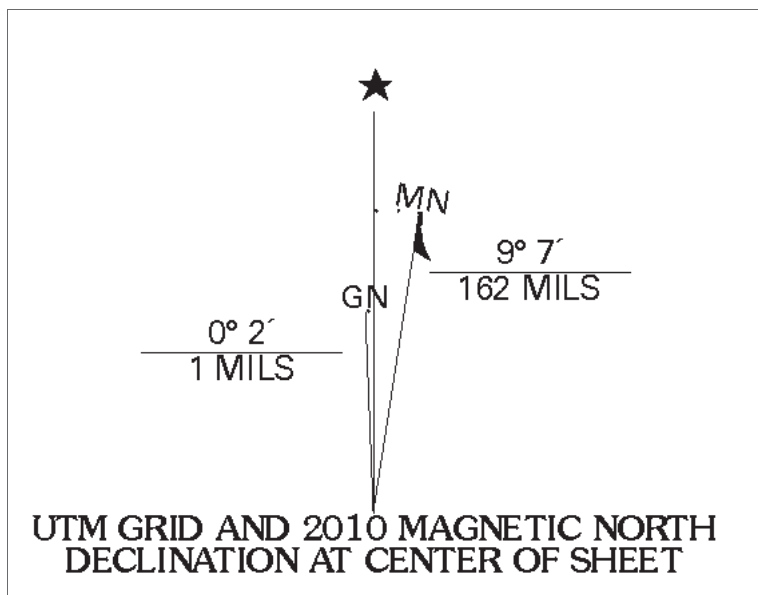


Figure F-2 Declination Indication on Map

However, because of the dynamic nature of the Earth's magnetic field, old maps are inaccurate. To obtain the most recent declination values, enter your map location at the following link:

<http://www.ngdc.noaa.gov/geomag-web/#declination>



NOTE

Placing magnetic objects near a compass can cause an incorrect reading (deviation). Examples include:

- Objects that contain steel and iron such as pocket knives, belt buckles, vehicles, railroad tracks, and ore deposits in the Earth
- Objects that use magnets such as stereo speakers
- Electrical current in cables and overhead lines

To locate an object using a map and a compass:

- 1 Place the long edge of the compass baseplate on the map, connecting the desired start and end points. For example, the start point could be where you are standing [A], and the end point [B] is where you want to locate the backhaul mast. The Direction of Travel arrow should point towards the end point (mast location).
- 2 While holding the compass on the map, turn the Degree Dial until the Meridian / Orienting Lines are parallel with the Meridian lines on the map. This is the same as turning the Degree Dial until the Orienting Arrow points to north on the map.

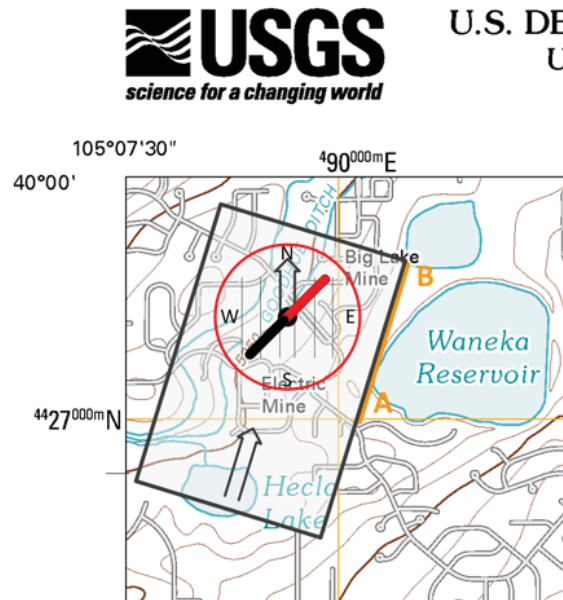


Figure F-3 Compass and Map

3 Adjust for declination.

- If you have an adjustable compass – Move the Orienting Arrow to the right or left by the declination number. When you align the magnetic needle with the Orienting Arrow, the declination is accounted for.
- If you do not have an adjustable compass – Mark the declination on your compass with a piece of tape. Align the magnetic needle with the tape mark.
- Adjust the Orienting Arrow to the left or right. For example:
 - ▶ For a declination of 0, no adjustment is necessary.
 - ▶ For a declination of 9 (9 degrees East), move the Orienting Arrow (or place a tape mark) to the right 9 degrees.
 - ▶ For a declination of -9 (9 degrees West), move the Orienting Arrow (or place a tape mark) to the left 9 degrees.

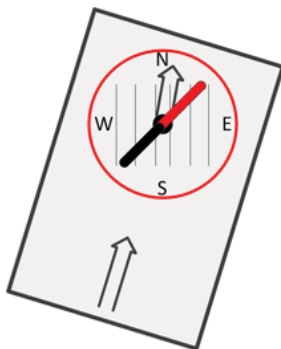


Figure F-4 Compass Adjusted for Declination

- 4 Pick up the compass and adjust the cover so the angle of the cover to the base is between 45 and 70 degrees.
- 5 Hold the base of the compass in the palm of your hand. Keep the compass level. Turn your entire body and the compass until the red end of the Magnetic Needle is aligned with the red end (north end) of Orienting Arrow.

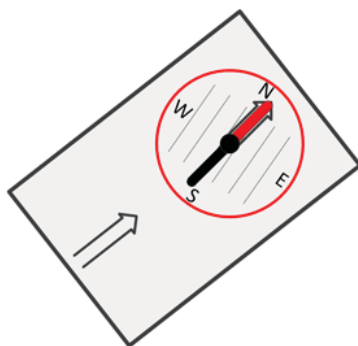


Figure F-5 Compass Adjusted for Declination

- 6 While holding the compass at eye level, keep the compass level and align your destination with the sight notch on the top of the case.
- 7 Ensure that the sighting line in the mirror passes through the center of the compass wheel.

Rope Knot

This chapter shows how to tie a taut-line hitch knot. This loop knot can be adjusted to loosen or tighten a line, yet holds under a load. This knot is commonly used to secure tent lines and loads on vehicles. It is the recommended knot for securing the RT System 2 guy rope mast.

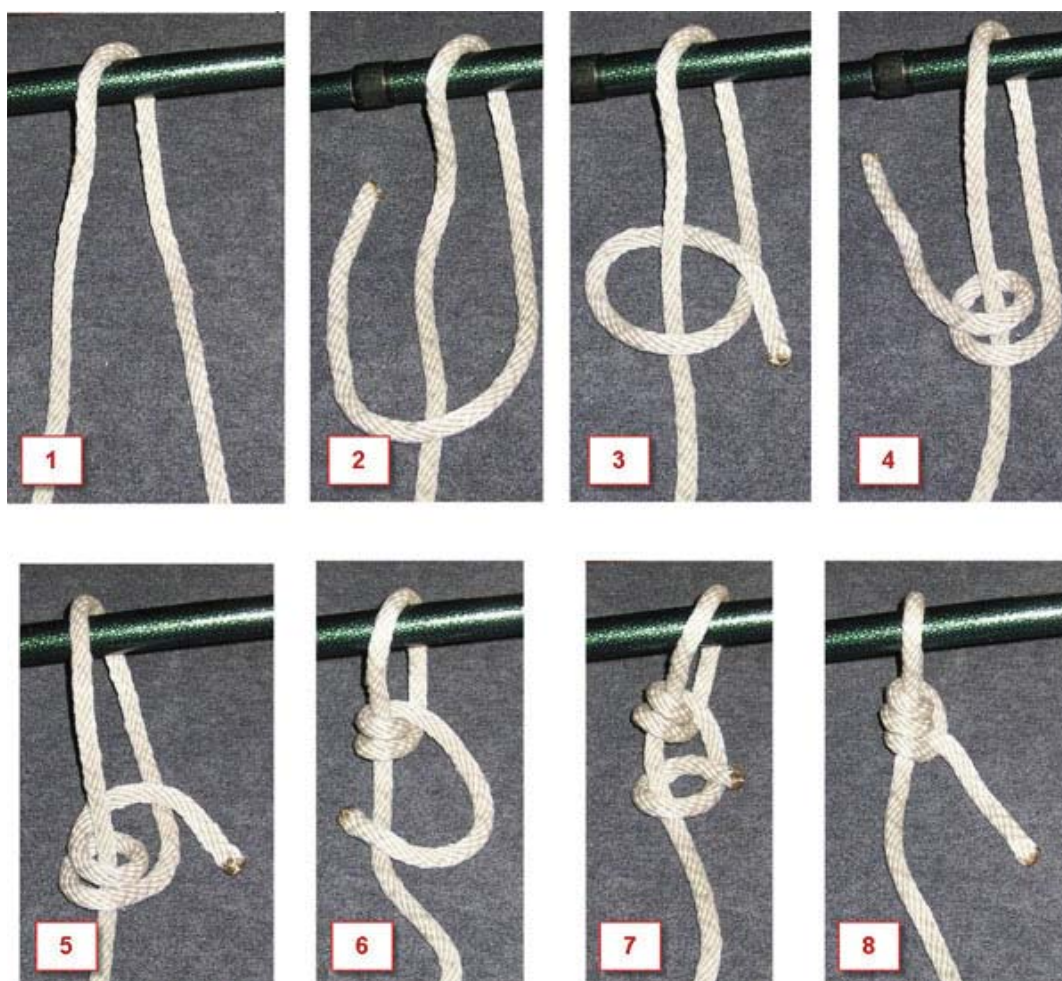


Figure G-1 Tying the Taut-line Hitch Knot

The following link provides a short video example:

http://www.sailingcourse.com/videos/taut_line_hitch.htm

Country Codes

This chapter provides a quick-reference to the ISO 3166 country codes.

Table H-1 ISO 3166 Country Codes

Name	Code
Afghanistan	004
Åland Islands	248
Albania	008
Algeria	012
American Samoa	016
Andorra	020
Angola	024
Anguilla	660
Antarctica	010
Antigua and Barbuda	028
Argentina	032
Armenia	051
Aruba	533
Australia	036
Austria	040
Azerbaijan	031
Bahamas (the)	044
Bahrain	048
Bangladesh	050
Barbados	052
Belarus	112
Belgium	056
Belize	084
Benin	204
Bermuda	060
Bhutan	064

Table H-1 ISO 3166 Country Codes

Name	Code
Bolivia, Plurinational State of	068
Bonaire, Sint Eustatius and Saba	535
Bosnia and Herzegovina	070
Botswana	072
Bouvet Island	074
Brazil	076
British Indian Ocean Territory (the)	086
Brunei Darussalam	096
Bulgaria	100
Burkina Faso	854
Burundi	108
Cambodia	116
Cameroon	120
Canada	124
Cape Verde	132
Cayman Islands (the)	136
Central African Republic (the)	140
Chad	148
Chile	152
China	156
Christmas Island	162
Cocos (Keeling) Islands (the)	166
Colombia	170
Comoros	174
Congo	178

Table H-1 ISO 3166 Country Codes

Name	Code
Congo (the Democratic Republic of the)	180
Cook Islands (the)	184
Costa Rica	188
Côte d'Ivoire	384
Croatia	191
Cuba	192
Curaçao	531
Cyprus	196
Czech Republic (the)	203
Denmark	208
Djibouti	262
Dominica	212
Dominican Republic (the)	214
Ecuador	218
Egypt	818
El Salvador	222
Equatorial Guinea	226
Eritrea	232
Estonia	233
Ethiopia	231
Falkland Islands (the) [Malvinas]	238
Faroe Islands (the)	234
Fiji	242
Finland	246
France	250
French Guiana	254
French Polynesia	258
French Southern Territories (the)	260
Gabon	266
Gambia (The)	270

Table H-1 ISO 3166 Country Codes

Name	Code
Georgia	268
Germany	276
Ghana	288
Gibraltar	292
Greece	300
Greenland	304
Grenada	308
Guadeloupe	312
Guam	316
Guatemala	320
Guernsey	831
Guinea	324
Guinea-Bissau	624
Guyana	328
Haiti	332
Heard Island and McDonald Islands	334
Holy See (the) [Vatican City State]	336
Honduras	340
Hong Kong	344
Hungary	348
Iceland	352
India	356
Indonesia	360
Iran (the Islamic Republic of)	364
Iraq	368
Ireland	372
Isle of Man	833
Israel	376
Italy	380
Jamaica	388

Table H-1 ISO 3166 Country Codes

Name	Code
Japan	392
Jersey	832
Jordan	400
Kazakhstan	398
Kenya	404
Kiribati	296
Korea (the Democratic People's Republic of)	408
Korea (the Republic of)	410
Kuwait	414
Kyrgyzstan	417
Lao People's Democratic Republic (the)	418
Latvia	428
Lebanon	422
Lesotho	426
Liberia	430
Libya	434
Liechtenstein	438
Lithuania	440
Luxembourg	442
Macao	446
Macedonia (the former Yugoslav Republic of)	807
Madagascar	450
Malawi	454
Malaysia	458
Maldives	462
Mali	466
Malta	470
Marshall Islands (the)	584
Martinique	474
Mauritania	478

Table H-1 ISO 3166 Country Codes

Name	Code
Mauritius	480
Mayotte	175
Mexico	484
Micronesia (the Federated States of)	583
Moldova (the Republic of)	498
Monaco	492
Mongolia	496
Montenegro	499
Montserrat	500
Morocco	504
Mozambique	508
Myanmar	104
Namibia	516
Nauru	520
Nepal	524
Netherlands (the)	528
New Caledonia	540
New Zealand	554
Nicaragua	558
Niger (the)	562
Nigeria	566
Niue	570
Norfolk Island	574
Northern Mariana Islands (the)	580
Norway	578
Oman	512
Pakistan	586
Palau	585
Palestine, State of	275
Panama	591

Table H-1 ISO 3166 Country Codes

Name	Code
Papua New Guinea	598
Paraguay	600
Peru	604
Philippines (the)	608
Pitcairn	612
Poland	616
Portugal	620
Puerto Rico	630
Qatar	634
Réunion	638
Romania	642
Russian Federation (the)	643
Rwanda	646
Saint Barthélemy	652
Saint Helena, Ascension and Tristan da Cunha	654
Saint Kitts and Nevis	659
Saint Lucia	662
Saint Martin (French part)	663
Saint Pierre and Miquelon	666
Saint Vincent and the Grenadines	670
Samoa	882
San Marino	674
Sao Tome and Principe	678
Saudi Arabia	682
Senegal	686
Serbia	688
Seychelles	690
Sierra Leone	694
Singapore	702

Table H-1 ISO 3166 Country Codes

Name	Code
Sint Maarten (Dutch part)	534
Slovakia	703
Slovenia	705
Solomon Islands (the)	090
Somalia	706
South Africa	710
South Georgia and the South Sandwich Islands	239
South Sudan	728
Spain	724
Sri Lanka	144
Sudan (the)	729
Suriname	740
Svalbard and Jan Mayen	744
Swaziland	748
Sweden	752
Switzerland	756
Syrian Arab Republic (the)	760
Taiwan (Province of China)	158
Tajikistan	762
Tanzania, United Republic of	834
Thailand	764
Timor-Leste	626
Togo	768
Tokelau	772
Tonga	776
Trinidad and Tobago	780
Tunisia	788
Turkey	792
Turkmenistan	795

Table H-1 ISO 3166 Country Codes

Name	Code
Turks and Caicos Islands (the)	796
Tuvalu	798
Uganda	800
Ukraine	804
United Arab Emirates (the)	784
United Kingdom (the)	826
United States (the)	840
United States Minor Outlying Islands (the)	581
Uruguay	858
Uzbekistan	860
Vanuatu	548
Venezuela, Bolivarian Republic of	862
Viet Nam	704
Virgin Islands (British)	092
Virgin Islands (U.S.)	850
Wallis and Futuna	876
Western Sahara*	732
Yemen	887
Zambia	894
Zimbabwe	716

Ce chapitre fournit des informations sur le suivant :

- ♦ “Batteries” sur la page 194
- ♦ “l’information juridique” sur la page 200

I.1 Batteries

Ce chapitre fournit des informations sur les batteries utilisées dans le système RT System 2 de Wireless Seismic, Inc.

I.1.1 Batteries au lithium-ion

Cette section fournit des informations sur les caractéristiques, l'utilisation et la manipulation des batteries au lithium-ion. Reportez-vous aux sections suivantes pour en savoir plus:

- “Spécifications” on page 194
- “Directives en matière de manipulation et de sécurité” on page 195
- “Transport” on page 196
- “Entreposage” on page 198

I.1.1.1 Spécifications

Le RT System 2 utilise une ou deux batteries au lithium-ion intelligentes et personnalisées, dotées d'un circuit de charge autonome qui protège les batteries contre les surcharges, décharges, courts-circuits ou changements extrêmes de température.

Le tableau suivant indique les spécifications des batteries:

Tableau I-1 Spécifications des batteries au lithium-ion

Élément	Description	Valeur
Tension	Nominale	3,7 V c.c.
	Arrêt	2,8 V c.c.
	Charge complète (90 %)	4,1 V c.c.
	Tension de charge excessive	4,28 V c.c.
	Tension de décharge excessive	2,80 V c.c.
Courant	Courant de charge maximum	2 A
	Consommation, mode actif	4,2 mA maximum
	Consommation, mode veille	66 µA maximum
Charge complète (90 %) mAh	Environ 12 000 mAh à la tension nominale	

Tableau I-1 Spécifications des batteries au lithium-ion (cont.)

Élément	Description	Valeur
Charge complète (90 %) mWh	Environ 44 400 mWh à la tension nominale	
Capacité		48,8 wattheures
Connecteur	5 broches	
DEL	Une DEL qui indique l'état de charge lors de la connexion à la station de charge, de la manière suivante :	• Vert : chargé • Rouge : en train de charger • Orange : phase transitionnelle entre l'état de chargement et l'état chargé, ou dépassement des limites de la température de charge
Étiquette	Une étiquette indiquant le numéro de série sous forme de code à barres	
Température	Fonctionnement	De -40°C à +85°C
	Chargement	De -5°C à +45°C
	Entreposage à température ambiante	• De -20°C à +45°C durant une période maximum d'un mois • De -20°C à +35°C durant 6 mois maximum ; passé ce délai, les blocs-batteries doivent être rechargés à plus de 50 % de leur capacité

I.1.1.2 Directives en matière de manipulation et de sécurité

Respecter les directives suivantes en matière de manipulation et de sécurité :

- ♦ Si un bloc-batterie présente une fuite de liquides, ne pas toucher les liquides. Jeter le bloc-batterie en cas de fuite. En cas de contact oculaire avec du liquide, ne pas se frotter les yeux. Rincer immédiatement les yeux avec de l'eau pendant au moins 15 minutes, en soulevant les paupières supérieures et inférieures jusqu'à ce qu'il n'y ait plus de trace de liquide. Consulter un médecin.
- ♦ Ne pas démonter, écraser ou percer une batterie
- ♦ Ne pas court-circuiter les contacts externes d'une batterie
- ♦ Ne pas jeter une batterie dans le feu ou l'eau
- ♦ Ne pas exposer une batterie à des températures supérieures à 60 °C (140 °F)
- ♦ Maintenir la batterie à l'écart des enfants
- ♦ Éviter d'exposer la batterie à des vibrations ou chocs excessifs
- ♦ Ne pas utiliser une batterie endommagée
- ♦ Les blocs-batteries au lithium-ion DOIVENT être entièrement déchargés avant leur élimination

- ◆ Bien qu'il puisse exister des restrictions locales ou nationales, les batteries au lithium-ion sont considérées comme des « déchets universels non dangereux » par le gouvernement fédéral. Il existe des restrictions qui s'appliquent à ceux qui gèrent de grandes quantités de déchets universels ; celles-ci définissent l'étiquetage, le confinement, etc. Dans la mesure du possible, les batteries doivent être déchargées avant de les jeter. Les conducteurs/contacts de batterie doivent être fixés de manière à éviter un court-circuit accidentel. Chaque bloc-batterie doit être placé dans un sac en plastique.
- ◆ Le recyclage est encouragé lorsqu'il est réalisable. Les batteries contiennent des matériaux recyclables et sont acceptées par plusieurs entreprises de recyclage de batteries. Reportez-vous à l'un des éléments suivants pour obtenir plus d'informations sur le recyclage et l'élimination :
 - <http://www.swe.com>
 - <http://www.rbr.org>
 - <http://www.call2recycle.org>
 - 1-800-8-BATTERY
 - 1-877-2-RECYCLE

I.1.1.3 Transport

Aux États-Unis, les expéditions de grandes quantités de batterie au lithium-ion (plus de 24 piles ou 12 batteries par colis) sont réglementées comme des matières dangereuses (classe 9) par le gouvernement fédéral et sont soumises aux règlements décrits ci-après :

- ◆ Code of Federal Regulations, Title 49 Transportation.
http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?sid=92868a82add6feba6afa796572133179&c=ecfr&tpl=/ecfrbrowse/Title49/49tab_02.tpl
- ◆ International Air Transport Association (IATA)
http://www.iata.org/whatwedo/cargo/dangerous_goods/pages/lithium_batteries.aspx

Les batteries ne peuvent être expédiées par voie terrestre que si toutes les conditions suivantes sont satisfaites :

- ◆ La boîte utilisée satisfait le test de chute de 1,2 m (boîte classée « UN ») de boîte d'emballage
- ◆ Les bornes de bloc-batterie sont protégées pour éviter un court-circuit
- ◆ Le poids brut ne dépasse pas 30 kg (66 livres)
- ◆ L'emballage extérieur porte l'étiquette requise en vigueur. La figure suivante en montre un exemple.



Exemple I-1 Example Battery Shipping Label

Les batteries ne peuvent être expédiées par voie aérienne que si toutes les conditions suivantes sont satisfaites :

- ♦ La boîte utilisée satisfait le test de chute de 1,2 m (boîte classée « UN ») de boîte d'emballage
- ♦ Les bornes de bloc-batterie sont protégées pour éviter un court-circuit
- ♦ Le poids brut de chaque colis ne dépasse pas 10 kg (22 livres)
- ♦ L'emballage extérieur porte l'étiquette requise en vigueur. La figure précédente en montre un exemple ("Example Battery Shipping Label" on page 197).



REMARQUE

Les informations contenues dans le présent document ont pour but de fournir une connaissance générale des règlements s'appliquant aux batteries. Elles ne sont pas exhaustives, et les conditions mentionnées dans ce document peuvent avoir changées. Rien dans le présent chapitre ou dans le Guide de déploiement ne constitue un avis juridique ou est destiné à répondre aux problèmes juridiques, de conformité, ou réglementaires spécifiques qui peuvent survenir dans des circonstances particulières. Le présent chapitre et le Guide de déploiement ne sont pas destinés à remplacer les règlements officiels en vigueur concernant l'emballage et l'expédition de matières dangereuses ou un conseil juridique indépendant sur ces questions. Vous êtes seul responsable du respect de toutes les lois, règlements et autres exigences. Veuillez vous reporter à une copie officielle de la version en vigueur de ces documents pour obtenir les dernières informations.

I.1.1.4 Entreposage

Un entreposage et un entretien adéquats des batteries au lithium-ion est indispensable pour optimiser leur durée de vie utile et éviter une défaillance catastrophique. Respecter les précautions suivantes en matière d'entreposage :

- ◆ Retirer les batteries de l'unité distante sans fil avant l'entreposage
- ◆ Température d'entreposage recommandée des batteries au lithium-ion :
 - De -20°C à +45°C durant une période maximum d'un mois
 - De -20°C à +35°C durant 6 mois maximum ; passé ce délai, les blocs-batteries doivent être rechargés à plus de 50 % de leur capacité
 - L'entreposage à basses températures ralentit la décharge naturelle et la perte de capacité au fil du temps. Entreposer les batteries à 25°C ou moins si possible
- ◆ Niveaux de charge d'entreposage recommandés :
 - Charger (ou décharger) les batteries à un niveau de charge de 30 % à 50 % avant de les entreposer. Des niveaux de charge inférieurs ou supérieurs peuvent réduire la durée de vie des batteries.
 - Ne jamais entreposer des batteries entièrement déchargées, sauf en cas d'élimination.
 - Un chargement périodique est nécessaire pour maintenir une charge de 30 % à 50 % en cas d'entreposage de longue durée
- ◆ Entreposer les batteries dans un endroit bien aéré
- ◆ Ne pas laisser les batteries inutilisées pendant de longues durées, qu'elles soient dans le produit ou placées en entreposage. Si une batterie n'a pas été utilisée pendant 6 mois, vérifier l'état de charge et charger ou éliminer la batterie, le cas échéant.
- ◆ Vérifier régulièrement l'état de charge de la batterie
- ◆ Envisager le remplacement de la batterie par une nouvelle en cas de constat d'une des conditions suivantes :
 - L'autonomie de la batterie descend en dessous d'environ 80 % de son autonomie initiale
 - Le temps de charge de la batterie augmente sensiblement

I.1.2 Chargement des batteries au lithium-ion

Cette section décrit les précautions de chargement et présente le chargeur de batterie.

I.1.2.1 Précautions de chargement

Respecter les précautions de chargement suivantes :

- ◆ Avant de la charger, inspecter la batterie pour détecter les signes éventuels de dommages sur le boîtier ou les connecteurs susceptibles de créer un court-circuit.
- ◆ La batterie peut être chargée dans la plage de température de 0°C à +45°C. En cas de chargement de la batterie en dehors de cette plage, la batterie peut devenir très chaude ou se rompre.
- ◆ Être absolument sûr de l'utilisation d'une source de 5 V lors du chargement de la batterie.
- ◆ Prendre soin de charger les batteries sur une surface ininflammable.
- ◆ Ne pas charger les batteries à proximité d'objets ou de liquides inflammables.
- ◆ Conserver un extincteur à poudre chimique de classe C à proximité.
- ◆ Ne pas continuer de recharger la batterie si elle ne se recharge pas dans le temps de chargement spécifié.
- ◆ NE JAMAIS laisser une batterie au lithium-ion sans surveillance lorsqu'elle est en train de charger.

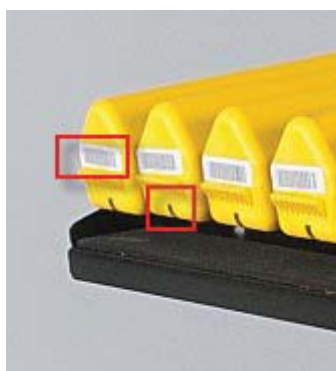
I.1.2.2 Chargeur de batterie

Le chargeur de batterie au lithium-ion est conçu pour fonctionner à partir d'une ligne de service simple 120 V c.a., 10 A.

Le bloc d'alimentation servant à charger le bloc-batterie fournit une tension régulée de 5 V c.c.



Exemple I-2 Chargeur de batterie



**Exemple I-3 Étiquette avec
numéro de série et voyant
DEL**



PRUDENCE

Le risque d'explosion si la batterie est remplacée par un type incorrect. Débarrassez-vous utilisées batteries selon les instructions.

I.2 l'information juridique

I.2.1 Conformité avec les règles et règlements de la FCC

La Federal Communications Commission (FCC) réglemente l'utilisation d'antennes dans l'article suivant : Code of Federal Regulations – Title 47, Part 15 – Radio Frequency Devices, Subpart C – Intentional Radiators, Section 15.203 Antenna Requirement.



REMARQUE

Cet équipement a été testé et jugé conforme aux limites fixées pour un appareil numérique de classe A, conformément à la partie 15 des règles de la FCC. Ces limites sont conçues pour fournir une protection raisonnable contre les interférences nuisibles lorsque l'équipement est utilisé dans un environnement commercial. Cet équipement génère, utilise et peut émettre l'énergie des fréquences radio et, s'il n'est pas installé et utilisé conformément au mode d'emploi, peut causer des interférences nuisibles avec les communications radio. Le fonctionnement de cet équipement dans une zone résidentielle est susceptible de provoquer des interférences nuisibles, auquel cas l'utilisateur devra corriger les interférences à ses propres frais.



REMARQUE

En vertu des réglementations d'Industrie Canada, cet émetteur radio peut être utilisé uniquement à l'aide d'une antenne de type et de gain maximum (ou inférieur) approuvés pour l'émetteur par Industrie Canada. Pour réduire les interférences radio éventuelles avec d'autres utilisateurs, le type et le gain de l'antenne doivent être choisis de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas la valeur nécessaire pour établir une communication réussie.

Lorsqu'il est utilisé comme prévu, le RT System 2 respecte les conditions de l'article 15.203 de la FCC et d'Industrie Canada CNR-Gen 7.1.2 de la manière suivante :

- ◆ Les antennes du RT System 2 doivent être installées et manipulées par des professionnels spécifiquement désignés pour cela.
- ◆ Les changements ou modifications non expressément approuvés par Wireless Seismic, Inc. peuvent annuler l'autorisation de l'utilisateur d'utiliser l'équipement.
- ◆ Le système RT 2 doit être utilisé uniquement avec les antennes fournies (*Tableau I-2*) attachées à l'unité distante sans fil ou WRU (tous les modèles) ou à l'unité d'interface de ligne ou LIU (tous les modèles) avec un connecteur (fileté ou HPQN) mâle de type N.

**REMARQUE**

Cet émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous. Le gain maximum permis et l'impédance d'antenne requise pour chaque antenne sont indiqués. Les types d'antenne non inclus dans cette liste, ayant un gain supérieur au gain maximum indiqué pour le type en question, sont strictement interdits pour ce dispositif.

Tableau I-2 Spécifications des antennes

Modèle	Fréquence (MHz)	Gain Maximal	Bande passante verticale	Poids	Dimensions (longueur x diamètre)
WSI 65-0204/65-0264 (antenna standard)	2400	5,5 dBi (50 ohms)	25°	0.4 lbs 0.2 kg	32 x 0,6 po 810.5 x 15 mm
WSI 65-0091 (extenseur standard)	2400	0 dBi	s.o.	0.6 lbs 0.3 kg	30 x 0,7 po 762 x 18,5 mm

**PRUDENCE**

Afin de se conformer aux normes de la matière d'exposition aux radiofréquences (RF), les unités RT System 2 doivent être installées de manière à garder en permanence une distance minimale de 20 cm entre la ou les antennes et le corps de toute personne en mode de fonctionnement normal.

L'autorisation d'équipement de FCC a été accordée comme suit :

- ♦ Le 5Mbps unité d'interface de ligne a reçu l'autorisation d'équipement.
- ♦ Le 5Mbps unité lointaine sans fil a reçu l'autorisation d'équipement.

I.2.2 Industrie Canada Conformité

L'unité distante sans fil (WRU) fournie avec ce guide a obtenu l'approbation d'Industrie Canada (IC) ainsi que la certification en vertu de l'édition 8 de la norme RSS-210 et de l'édition 4 de la norme RSS-102.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

L'unité d'interface de ligne (LIU) fournie avec ce guide a obtenu l'approbation d'Industrie Canada (IC) ainsi que la certification en vertu de l'édition 8 de la norme RSS-210 et de l'édition 4 de la norme RSS-102.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Cet appareil est conforme avec l'industrie Canada licence exemptes des normes. Son fonctionnement est soumis aux deux conditions suivantes :

- ♦ Ce dispositif ne peut causer des interférences, et
- ♦ Ce dispositif doit accepter toute interférence, y compris les interférences qui peuvent causer un mauvais fonctionnement du dispositif.

I.2.3 Acquiescement de CE

L'unité distante sans fil (WRU) et l'unité d'interface de ligne (LIU) fournies avec ce guide sont conformes aux directives applicables de l'UE pour la marque de Conformité européenne (CE). La marque suivante est apposée sur chaque unité.



Exemple I-4 Marque de CE

Numerics

12 V DC 39
19 dBi directional antenna 149
5.8 GHz band 38
56-0032 INTL 71
56-0035 US 71
6 dBi antenna 149
65-0091 18
90-0026 10
90-0028 10
90-0032 10
90-0039 10

A

access point radio 67
Acquiring GPS fix 169
anchor plate 23
antenna
 attach 18
 bracket 56
 connecting 18
 extender 18
 extenders 11
 specifications 39, 44, 145
antennas 39, 144
 radio 44
anti-tipping 23
armored cable 59
assemble
 the backhaul 50
 the ground equipment 16
auto-power-leveling 39

B

B 169, 175
backhaul 26, 31
 components 31
 masts 49
 power requirements 39
Backpack Kit 31
base 49, 51
 tips 50
batteries
 attach 16
battery
 charge time 12
 charger 142
 charger location 12
 charging 142
 failure 179
 fuse test failure 166
 handling and safety guidelines 139
 latch 16
 remove 136
 shipments 140
 specifications 138
 storage 141
Battery A in use 172, 173
Battery B in use 172, 173
battery failure 179
browser pop-ups 121
Bucket Brigade 26

C

cable
 Armored Ethernet 45
 clamp 55
 Ethernet 45
 LIU to Battery 45
 LIU to NanoStation radio 45
 LIU-to-PC 45
 RF Extender 45
 Shielded Ethernet 45
cables 59, 63
central 31
clamps 63
color-coded 67
compass 184
contact 10
Continue 168
country codes for radios 71
CSS 27
custom number of recorder radios 119

D

data flow 28
declination 184
deploy
 at actual location 14
deviation 185
disassemble the WRU 136
discharge 138
discover and configure the radios 71, 106
Dummy Batteries 11

E

elbow connector 59
Elevation Profile 77, 113
error
 Geophone failure 169
 indicators 163
 No GPS fix 169
 No neighbor detected 170
 Self test failure 174
Error LEDs 168
Ethernet cable
 non-powered 80
 powered 80
extreme temperature charging 138

F

FCC 144
 Section 15.203 144
Fiber Backhaul Kit 32, 45
fiber cables 68
fiber optic cable 38
figure
 Tripod Assembly – Front View 183
final speed test 119
firmware
 upgrade 181
Formed 178
four-line, dual-backhaul line 29
frequency
 International 71
 United States of America 71
fuse test failure 166

G

geographic north 184
geophone 17
Geophone test in progress 168
Global Mapper 77
Google Earth 77, 113
GPS

- acquire position 21
- antenna 59
- disciplined 177
- error 169
- LED flashing 21
- lock 21, 177
- lock, not disciplined 180
- no discipline 179
- no lock 180

green-to-green 59

ground 63
 equipment 11
 wire 59, 63

ground equipment
 assemble 16

guy
 lines 60, 61
 ring 54, 55, 56

H

help 10
hopping 26
hose clamp 52

I

Industrial, Scientific, and Medical radio band 27
Industry Canada RSS-Gen 7.1.2 144
install and troubleshoot the radios 78
ISM 27
ISO 3166-1 71

L

LED
 dead batteries 164, 166, 172, 173
 reset pattern 176
 sleeping 164, 166, 172, 173
 status 163
 undeployed 164, 166, 172, 173

line radio 39, 52
 kit 32

line station 31

LIU 38
 A, flashing 179
 A, solid 177, 178
 all off 175
 B, flashing 179
 B, solid 177, 178
 BAT, flashing 178, 179
 BAT, solid 178
 Disciplined to GPS 177
 GPS, flashing 177, 178, 179
 GPS, off 180
 GPS, solid 177, 180
 hard reset 176
 LEDs 175
 LNK, flashing 178, 179
 LNK, off 179
 LNK, solid 177, 178
 MODE, flashing 177, 178, 179
 MODE, solid 177
 power on LED rotation 176
 RAD, flashing 178
 RAD, solid 178

LIU connected to Central 177

LIU Kit 31
locate an object using a map and a compass 185
loop knot 188

M

magnetic
 north 184
 objects near a compass 185
mast 49, 51, 61, 62, 182
 assemble 54
 collar 60
 kit 31
masts 49
modifications 144

N

Neighbor
 discovered 169
 discovery in progress 169
no
 communications with Central 179
 GPS discipline 179
 GPS lock 180
 IP Address 179
node 26

O

obstructions 50
one recorder, multiple line station radios 117
overcharge 138

P

pendant link 72
pendant radio connection 96
pendant radio link connections 95
PoE 27
 injector 27
 switch 27
Point-to-Multipoint 26
Point-to-Point 26
pole pairs 67
power off WRU 135
Power over Ethernet 27
power-leveling 39
private network 72, 107

R

radio
 Access Point (A) 67
 configuration 70
 configuration files 71, 106
 configure 117
 country codes 71
 create an Elevation Profile 77
 credentials 74
 default IP Address 73
 error message 71
 frequencies 105
 install and troubleshoot 115
 label 67
 link to recording truck 72
 location plan 76
 multiple line station 117
 one recorder 117
 pairs 67
 prepare 70, 104
 recorder 119
 redundant recorder 118
 replacing 90
 set power level 97

S

- shielding 85
- speed test 80
- Station (S) 67
- upload configuration file 75
- upload new firmware 90
- version 70
- versions 105
- recorder** 31
 - radio 43
- Recorder Radio Kit** 33, 34
- recording truck** 31
- recording truck connection**
 - fiber cable 92
 - optimal angle pendant to line 94
 - radio link (pendant) 93
- redundant recorder radio** 118
- relay** 26
- remote** 31
- remove battery** 136
- repeater** 19
- rolling the backhaul** 86
- run the speed test** 82, 120

S

- self test** 168
 - fails 22
 - failure 21
 - in progress 168
- set the PN radio power level** 97
- short circuit** 138
- single-backhaul line** 28
- skip**
 - a self-test 22
 - a test 168
- slope** 50
- specifications**
 - antenna 39, 44, 145
- stakes** 52, 61
- star configuration** 26, 30
- static IP address** 72
- station radio** 67
- status**
 - Acquiring GPS fix 169
 - Battery A in use 172, 173
 - Battery B in use 172, 173
 - Continue 168
 - Geophone test in progress 168
 - Neighbor discovered 169
 - Neighbor discovery in progress 169
 - self test in progress 168
 - Undeployed 164, 172, 173
- String-of-Pearls** 26
- supported**
 - antennas 39, 44, 145
- Surge Protector** 34, 44, 59, 60
 - ground wire 63

T

- THD test failure** 169
- tie a taut-line hitch knot** 188
- tipping, preventing** 23
- tripod assembly** 183
- true north** 184

U

- Ubiquiti Discovery Tool** 71, 106
 - download 73
- undeploy the WRU** 135
- undeployed** 136, 164, 172, 173
- unzip**
 - 7-Zip 91, 129
 - Windows 7 91, 129

- upload new firmware** 128
- upload new radio firmware** 90
- users** 10

W

- white-to-white** 59
- wind** 51
- WRU**
 - A, flashing 169, 172, 173, 175
 - A, solid 166
 - B, flashing 169, 172, 173, 175
 - B, solid 167
 - BAT, flashing 168, 181
 - BAT, solid 166, 167, 174
 - GEO, flashing 168, 181
 - GEO, solid 168, 169, 174
 - GPS, flashing 168, 169
 - GPS, solid 168, 169, 174
 - hard reset 165, 171
 - MODE, flashing 168, 169, 175
 - MODE, solid 168, 180
 - no LEDs 164, 166, 172, 173
 - power off 135
 - power on 19
 - power on LED rotation 165, 171
 - RAD, flashing 168, 169, 181
 - RAD, solid 170, 174
 - tests 21