VANGUARD 5530™

BROADBAND 4G LTE CELLULAR ROUTER

connecting tomorrow today

User Manual
Vanguard 5530™ Fixed and Mobile Routers
134732-VG5530 Rev. E
Revised July 2016

REVISION HISTORY

REV	DATE	REVISION DETAILS
A	April 2015	Initial release. Part number 134732-VG5530.
B	May 2015	Updated with minor changes to latest firmware release.
C	Feb 2016	Clarified I/O Names, added I/O Electrical Characteristics Table. Updated with changes to latest firmware release.
D	Mar 2016	Updated WLAN > Access Point and added Security > OpenVPN.
E	April 2016	Multi-Carrier & R16 Updates

Copyright Notice

CalAmp reserves the right to modify the equipment, its specification or this manual without prior notice, in the interest of improving performance, reliability, or servicing. At the time of publication all data is correct for the operation of the equipment at the voltage and/or temperature referred to. Performance data indicates typical values related to the particular product. Product updates may result in differences between the information provided in this manual and the product shipped. For access to the most current product documentation and application notes, visit www.calamp.com. No part of this documentation or information supplied may be divulged to any third party without the express written consent of CalAmp. Products offered may contain software which is proprietary to CalAmp. The offer or supply of these products and services does not include or infer any transfer of ownership.

Modem Use

The Vanguard Series modems are designed and intended for use in fixed and mobile applications. “Fixed” assumes the device is physically secured at one location and not easily moved to another location. Please keep the cellular antenna at a safe distance from your head and body while the modem is in use.

Regulatory Statements

Note: 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: i) Reorient or relocate the receiving antenna. II) Increase the separation between the equipment and receiver. III) Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. Iv) Consult the dealer or an experienced radio/TV technician for help.

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

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

Under Industry Canada regulations, this radio transmitter may only operate using an antenna ofa 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.

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.

IC ICES-003 Standard Compliance Notice:

CAN ICES-3 (B)/NMB-3(B)

Important

Maintain a distance of at least 20 cm (8 inches) between the transmitter antenna and any person while in use. This modem is designed for use in applications that observe the 20 cm separation distance.

Interference Issues

Avoid possible radio frequency (RF) interference by following these guidelines:

- The use of cellular telephones or devices in aircraft is illegal. Use in aircraft may endanger operation and disrupt the cellular network. Failure to observe this restriction may result in suspension or denial of cellular services to the offender, legal action, or both.
- Do not operate in the vicinity of gasoline or diesel fuel pumps unless use has been approved or authorized.
- Do not operate in locations where medical equipment that the device could interfere with may be in use.
- Do not operate in fuel depots, chemical plants, or blasting areas unless use has been approved and authorized.
- Use care if operating in the vicinity of protected personal medical devices, i.e., hearing aids and pacemakers.
- Operation in the presence of other electronic equipment may cause interference if equipment is incorrectly protected. Follow recommendations for installation from equipment manufacturers.

Mobile Application Safety

- Do not change parameters or perform other maintenance of the Vanguard 5530 while driving.
- Road safety is crucial. Observe National Regulations for cellular telephones and devices in vehicles.
- Avoid potential interference with vehicle electronics by correctly installing the Vanguard 5530 modem. CalAmp recommends installation by a professional.

UL Listed models only

⚠ When operating at elevated temperature extremes, the surface may exceed +70 Celsius. For user safety, the Vanguard should be installed in a restricted access location.

⚠ WARNING — EXPLOSION HAZARD, do not connect while circuit is live unless area is known to be non-hazardous.

TABLE OF CONTENTS

1 PRODUCT OVERVIEW

The Vanguard 5530™ Router from CalAmp — simple, reliable wireless connectivity without limitations. LTE with fallback to 3G and 2G 3GPP technologies (VG5530-LAT models), LTE with fallback to 3G EVDO and 2G 1xRTT 3GPP2 technologies (VG5530-LVZ models), and (VG5530-LVZ VZAT).

This single, flexible platform addresses a variety of wireless communications needs with serial to IP conversion, over-the-air configuration and system monitoring for optimal connectivity. This ready to deploy broadband router enables wireless data connectivity for up to two LAN and one serial device over public cellular networks at 4G speeds.

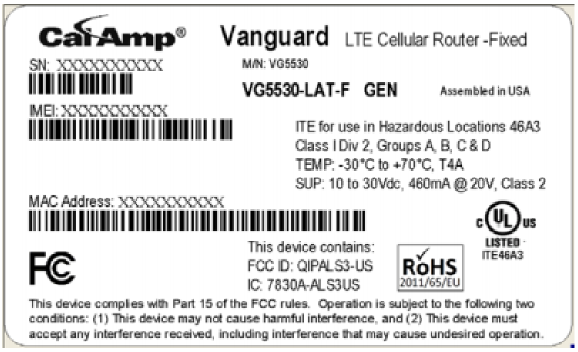
Equipped for a broad range of fixed applications, Vanguard router provides reliable connectivity for Programmable Logic Controllers (PLCs), Remote Terminal Units (RTUs), Ethernet web cameras or any other Ethernet or serial device. For mobile applications, this intelligent broadband router incorporates an optional highly-sensitive 56-channel GPS receiver, GLONASS capable and an intelligent algorithm that offers outstanding receive sensitivity and improved accuracy, integrity and availability of GPS signals. An optional, built-in Wi-Fi access point also allows your tethered devices to remain connected even when you leave the vehicle.

This widely deployed wireless solution delivers countless software capabilities. OEMs may tailor the Vanguard router by loading their application on the Open Developer Platform (ODP) which allows a Linux application to run on a partition of the embedded flash memory.

1.1 MODEL IDENTIFICATION

The model identification label can be found on the bottom of your Vanguard router. This label contains the product part number, the serial number, FCC and IC IDs as well as carrier-specific information that will be required when activating your data account.

Figure 1: AT&T LTE Fixed model identification label



CalAmp® Vanguard LTE Cellular Router -Fixed

SN: XXXXXXXXXXX

M/N: VG5530

VG5530-LAT-F GEN

Assembled in USA

IMEI: XXXXXXXXXXX

ITE for use in Hazardous Locations 46A3
Class I Div 2, Groups A, B, C & D
TEMP: -30°C to +70°C, T4A
SUP: 10 to 30Vdc, 460mA @ 20V, Class 2

MAC Address: XXXXXXXXXXX

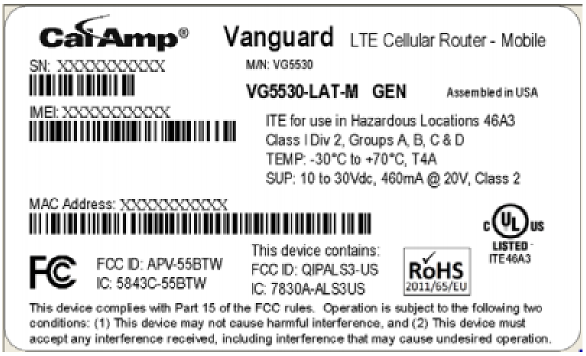
c UL us LISTED ITE46A3

This device contains:
FCC ID: QIPALS3-US
IC: 7830A-ALS3US

RoHS 2011/65/EU

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.

Figure 2: AT&T LTE Mobile model identification label



CalAmp® Vanguard LTE Cellular Router - Mobile

SN: XXXXXXXXXXX

M/N: VG5530

VG5530-LAT-M GEN

Assembled in USA

IMEI: XXXXXXXXXXX

ITE for use in Hazardous Locations 46A3
Class I Div 2, Groups A, B, C & D
TEMP: -30°C to +70°C, T4A
SUP: 10 to 30Vdc, 460mA @ 20V, Class 2

MAC Address: XXXXXXXXXXX

c UL us LISTED ITE46A3

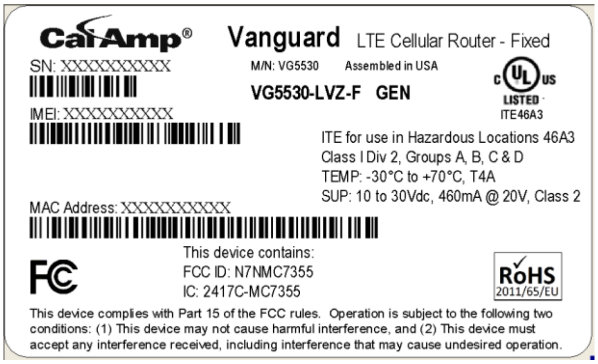
FCC ID: APV-55BTW
IC: 5843C-55BTW

This device contains:
FCC ID: QIPALS3-US
IC: 7830A-ALS3US

RoHS 2011/65/EU

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.

Figure 3: Verizon LTE Fixed model identification label



CalAmp®

Vanguard LTE Cellular Router - Fixed

SN: XXXXXXXXXX

M/N: VG5530 Assembled in USA

VG5530-LVZ-F GEN

c UL us LISTED ITE46A3

IMEI: XXXXXXXXXX

ITE for use in Hazardous Locations 46A3
Class I Div 2, Groups A, B, C & D
TEMP: -30°C to +70°C, T4A
SUP: 10 to 30Vdc, 460mA @ 20V, Class 2

MAC Address: XXXXXXXXXX

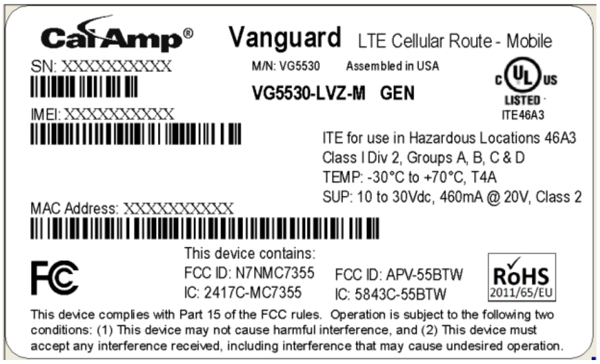
FC

This device contains:
FCC ID: N7NMC7355
IC: 2417C-MC7355

RoHS 2011/65/EU

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.

Figure 4: Verizon LTE Mobile model identification label



CalAmp®

Vanguard LTE Cellular Route - Mobile

SN: XXXXXXXXXX

M/N: VG5530 Assembled in USA

VG5530-LVZ-M GEN

c UL us LISTED ITE46A3

IMEI: XXXXXXXXXX

ITE for use in Hazardous Locations 46A3
Class I Div 2, Groups A, B, C & D
TEMP: -30°C to +70°C, T4A
SUP: 10 to 30Vdc, 460mA @ 20V, Class 2

MAC Address: XXXXXXXXXX

FC

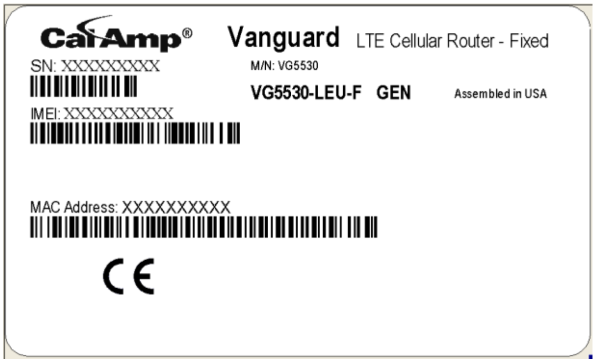
This device contains:
FCC ID: N7NMC7355
IC: 2417C-MC7355

FCC ID: APV-55BTW
IC: 5843C-55BTW

RoHS 2011/65/EU

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.

Figure 5: EU LTE Fixed model identification label



CalAmp® Vanguard LTE Cellular Router - Fixed

SN: XXXXXXXXX

M/N: VG5530

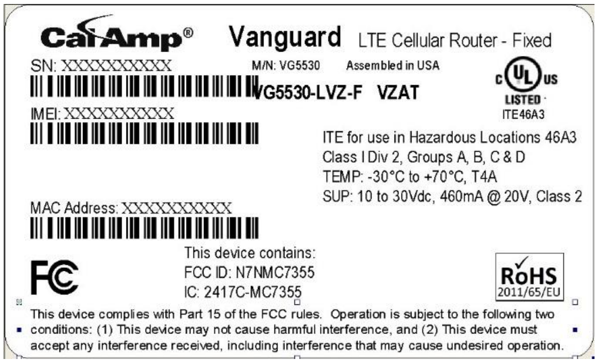
VG5530-LEU-F GEN

Assembled in USA

IMEI: XXXXXXXXXX

MAC Address: XXXXXXXXXX

Figure 6: LTE Fixed model identification label



CalAmp® Vanguard LTE Cellular Router - Fixed

SN: XXXXXXXXXX

M/N: VG5530

Assembled in USA

VG5530-LVZ-F VZAT

LISTED ITE46A3

IMEI: XXXXXXXXXX

ITE for use in Hazardous Locations 46A3
Class I Div 2, Groups A, B, C & D
TEMP: -30°C to +70°C, T4A
SUP: 10 to 30Vdc, 460mA @ 20V, Class 2

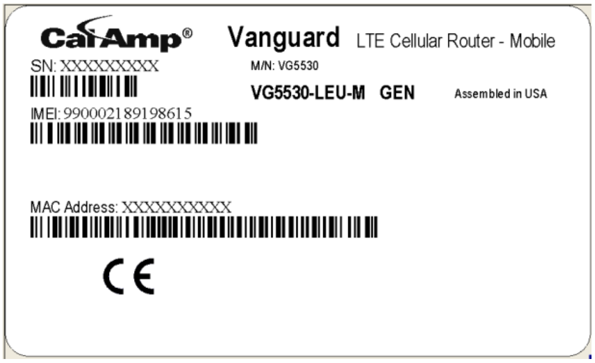
MAC Address: XXXXXXXXXX

This device contains:
FCC ID: N7NMC7355
IC: 2417C-MC7355

RoHS 2011/65/EU

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.

Figure 7: EU LTE Mobile model identification label



CalAmp® Vanguard LTE Cellular Router - Mobile

SN: XXXXXXXXX

M/N: VG5530

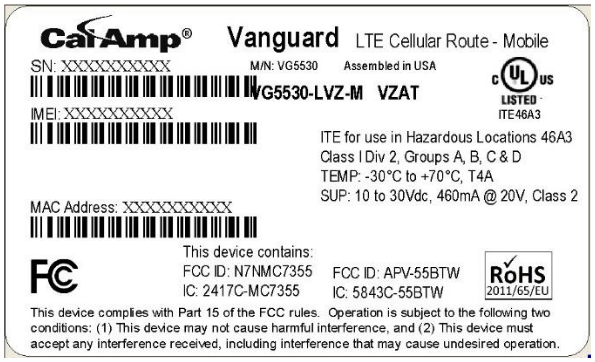
VG5530-LEU-M GEN

Assembled in USA

IMEI: 990002189198615

MAC Address: XXXXXXXXXX

Figure 8: LTE Mobile model identification label



CalAmp® Vanguard LTE Cellular Route - Mobile

SN: XXXXXXXXXX

M/N: VG5530

Assembled in USA

VG5530-LVZ-M VZAT

LISTED ITE46A3

IMEI: XXXXXXXXXX

ITE for use in Hazardous Locations 46A3
Class I Div 2, Groups A, B, C & D
TEMP: -30°C to +70°C, T4A
SUP: 10 to 30Vdc, 460mA @ 20V, Class 2

MAC Address: XXXXXXXXXX

This device contains:
FCC ID: N7NMC7355
IC: 2417C-MC7355

FCC ID: APV-55BTW
IC: 5843C-55BTW

RoHS 2011/65/EU

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.

1.2 FEATURES AND BENEFITS OF THE VANGUARD Broadband 4G LTE Cellular Router

- 4G LTE cellular connectivity with fallback support to 3G and 2G connectivity.
- User selectable carrier (VZAT model)
- Supports dynamic or static IP
- Inbound and outbound Ethernet routing
- DHCP server and Inbound port mapping/translation (Port Forwarding)
- Firewall configuration for increased network security
- Diversity antenna port for increased receive sensitivity
- Local or remote configuration using HTTPS secure web server
- TCP/IP packet assembler and disassembler for serial connected devices
- Inbound IP termination with static IP
- Modem domain names with dynamic DNS
- Embedded Linux on Cortex-A9 processor
- Internet access and web browsing via Ethernet connector
- VPN support
- RADIUS authentication for webpage access
- On board 1.8/3V SIM socket
- Analog and Digital I/O – 4 Analog inputs, 7 Digital inputs and 7 Digital outputs
- GPS and GLONASS AAVL services (Mobile models only)
- 802.11 b/g/n Wireless LAN Access Point and Client modes (Mobile models only)
- Remote Management for router firmware, radio firmware, and configuration
- SNMP support
- ODP – SDK and APIs for application development
- Dedicated ODP Flash memory partition for hosting ODP applications and data

1.2.1 ODP (OPEN Development Platform)

This device includes the Open Development Platform (ODP), which permits customers to develop their own Linux based applications which run on the modem’s ARM Cortex-A9 processor. The customer’s application can utilize the external serial port, the external I/O port, and is able to transfer data over the cellular WAN using the Linux socket libraries. The Vanguard firmware also supports an API that allows the customer’s application to access diagnostic data from the cell module such as connection status and RSSI. More information and support is provided by CalAmp’s Applications Engineering organization.

1.3 GENERAL SPECIFICATIONS

Product specifications are subject to change without notice.

Interface Connectors	RS-232 / RS-485 DE-9S Connector (DCE female) 10/100 Base-T Full Duplex (Dual) 22 Pin I/O Port Mini USB Service port — provided for convenience when upgrading cell module only.
Power Connector	Molex 43045-4000 MicroFit 3.0, 4 pin header with Ignition Sense input
LED Indicators	RSSI, SVC, NET, GPS, AUX
Antenna Interface	Primary Antenna 50-ohm SMA Female Diversity Antenna 50-ohm SMA Female GPS Antenna (Mobile only) 50-ohm, 3.3V SMA Female Wi-Fi Antenna (Mobile only) 50-ohm RP-SMA Female
Size	4.5 (L) x 6.0 (W) x 1.9(H) inches (11.4 x 15.2 x 4.8 cm)
Weight	1.94lb (0.88 kg)
Power Input	9-32 VDC
Maximum TX Power	LTE 23 dBm CDMA 24 dBm
Rx Sensitivity	LTE >-99 dBm CDMA >-110 dBm
Frequencies	**VG5530-LVZ-F-VZAT, VG5530-LVZ-M-VZAT** **LTE / CDMA MODE** **LTE CAT 3** Band 4 (AWS) (1700/2100 MHz) TX: 1710 – 1755 MHz; Rx: 2110 – 2155 MHz Band 13 (700 MHz) TX: 777 – 787 MHz; Rx: 746 –756 MHz **CDMA EVDO Rev A (IS-856-A) / EVDO Rev 0 (IS-856)** BC0 (Cellular 800 MHz) TX: 824 – 849 MHz; Rx: 851 – 869 MHz BC1 (PCS 1900 MHz) TX: 1850 – 1910 MHz; Rx: 1930 – 1990 MHz BC10 (Secondary 800 MHz) TX: 817 –824 MHz; Rx: 861 – 869 MHz **LTE / HSPA MODE** **LTE CAT 3** Band 2 (1900 MHz) TX: 1850-1910 MHz; Rx: 1930-1990 MHz Band 4 (AWS) (1700/2100 MHz) TX: 1710 – 1755 MHz; Rx: 2110 – 2155 MHz Band 5 (850 MHz) TX: 824 – 849 MHz; Rx: 869 –894 MHz Band 17 (700 MHz) TX: 704 – 716 MHz; Rx: 734 –746 MHz Band 25 (1900 MHz G Block) TX: 1850 – 1915 MHz; Rx: 1930 – 1995 MHz **UMTS/HSPA** Band 1 (2100 MHz) TX: 1920 - 1980 MHz; Rx: 2110 – 2170 MHz Band 2 (1900 MHz) TX: 1850-1910 MHz; Rx: 1930-1990 MHz Band 4 (AWS) (1700/2100 MHz) TX: 1710 – 1755 MHz; Rx: 2110 – 2155 MHz Band 5 (850 MHz) TX: 824 – 849 MHz; Rx: 869 –894 MHz Band 8 (900 MHz) TX: 880 - 915 MHz; Rx: 925 – 960 MHz **GSM/GPRS/EDGE** Band 2 (PCS 1900 MHz) TX: 1850-1910 MHz; Rx: 1930-1990 MHz Band 3 (DCS 1800 MHz) TX: 1710 – 1785 MHz; Rx: 1805– 1880 MHz Band 5 (GSM 850 MHz) TX: 824 – 849 MHz; Rx: 869 –894 MHz Band 8 (EGSM 900 MHz) TX: 880 - 915 MHz; Rx: 925 – 960 MHz **VG5530-LEU-F-GEN, VG5530-LEU-M-GEN** **LTE CAT 3**

	Band 3 TX: 1710 – 1785 MHz; Rx: 1805 – 1880 MHz Band 7 TX 2500- 2570 MHz; RX 2620 - 2690 Band 8 TX: 880 - 915 MHz; Rx: 925 – 960 MHz Band 20 TX: 832 - 862 MHz; Rx: 791 – 821 MHz **UMTS/HSPA** Band 1 (2100 MHz) TX: 1920 - 1980 MHz; Rx: 2110 – 2170 MHz Band 3 TX: 1710 – 1785 MHz; Rx: 1805 – 1880 MHz Band 8 TX: 880 - 915 MHz; Rx: 925 – 960 MHz **GSM/GPRS/EDGE** Band 3 (1800 MHz) TX: 1710 – 1785 MHz; Rx: 1805 – 1880 MHz Band 8 (900 MHz) TX: 880 - 915 MHz; Rx: 925 – 960 MHz **VG5530-LVZ-F-GEN, VG5530-LVZ-M-GEN** **LTE CAT 3** Band 4 (AWS) (1700/2100 MHz) TX: 1710 – 1755 MHz; Rx: 2110 – 2155 MHz Band 13 (700 MHz) TX: 777 – 787 MHz; Rx: 746 –756 MHz CDMA EVDO Rev A (IS-856-A) / EVDO Rev 0 (IS-856) BC0 (Cellular 800 MHz) TX: 824 – 849 MHz; Rx: 851 – 869 MHz BC1 (PCS 1900 MHz) TX: 1850 – 1910 MHz; Rx: 1930 – 1990 MHz BC10 (Secondary 800 MHz) TX: 817 –824 MHz; Rx: 861 – 869 MHz **VG5530-LAT-F-GEN, VG5530-LAT-M-GEN** **LTE CAT 3** Band 2 (1900 MHz) TX: 1850-1910 MHz; Rx: 1930-1990 MHz Band 4 (AWS) (1700/2100 MHz) TX: 1710 – 1755 MHz; Rx: 2110 – 2155 MHz Band 5 (850 MHz) TX: 824 – 849 MHz; Rx: 869 –894 MHz Band 17 (700 MHz) TX: 704 – 716 MHz; Rx: 734 –746 MHz **UMTS/HSPA** Band 2 (1900 MHz) TX: 1850-1910 MHz; Rx: 1930-1990 MHz Band 4 (AWS) (1700/2100 MHz) TX: 1710 – 1755 MHz; Rx: 2110 – 2155 MHz Band 5 (850 MHz) TX: 824 – 849 MHz; Rx: 869 –894 MHz **GSM/GPRS/EDGE** Band 2 (1900 MHz) TX: 1850-1910 MHz; Rx: 1930-1990 MHz Band 5 (850 MHz) TX: 824 – 849 MHz; Rx: 869 –894 MHz Band 3 (1800 MHz) TX: 1710 – 1785 MHz; Rx: 1805 – 1880 MHz Band 8 (900 MHz) TX: 880 - 915 MHz; Rx: 925 – 960 MHz
Temperature	Operating: -30°C to +70°C 100% duty cycle. *Note: Cellular TX power may be reduced outside this range;* Storage: -40° to +85°C (-40° to +185°F)
Emissions	FCC Part 15b
Transport Protocols	UDP/TCP
Command Protocol	Web Interface

1.4 MECHANICAL SPECIFICATIONS

The following table and figure show overall dimensions of the Vanguard router for fixed and mobile models. (Both models have the same dimensions and differ only slightly in appearance: the fixed model has only two antenna connectors in the front of the unit, where the mobile model has four.) Dimensioned drawings of units with mounting brackets are provided in Appendix B. The drawings and associated data may be used for layout reference, but it is advised that a physical comparison be made to the modem and bracket before laying out and drilling mounting holes.

Table 1: Vanguard router chassis overall dimensions

Dimension	Inches	Centimeters
Height	1.90	4,83
Width	6.00	15,2
Depth (Overall)	4.50 ± 0.04	11,4 ± 0,1
Depth (Chassis only)	4.28	10,9

Figure 9: Vanguard router chassis overall dimensions. Same mounting holes (not shown) as on bottom side of Chassis.

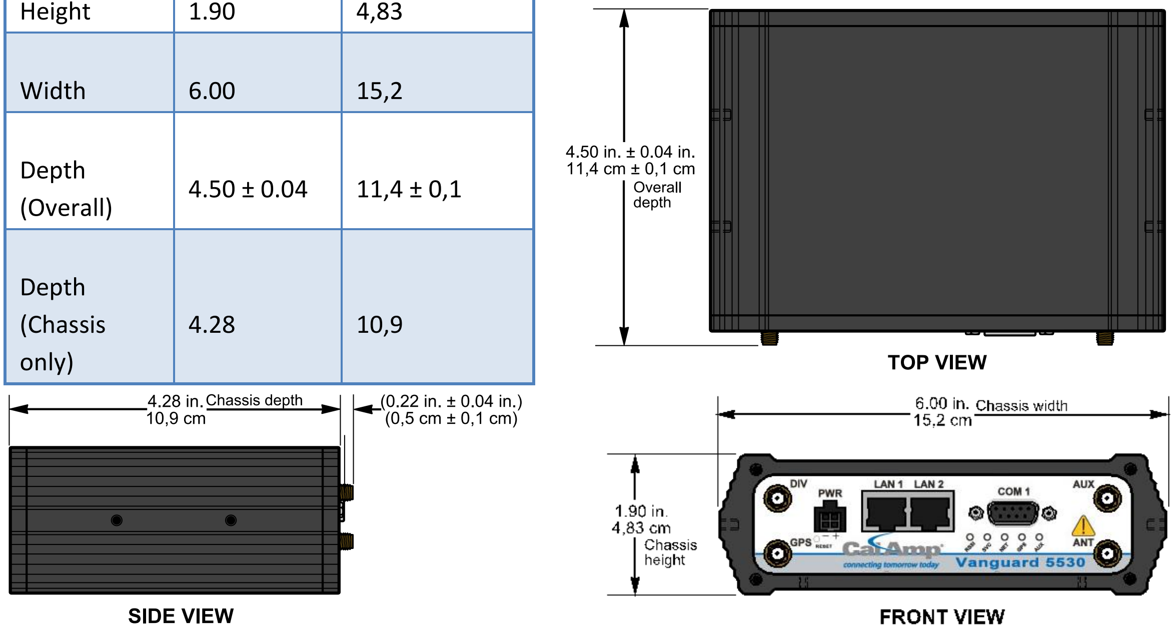
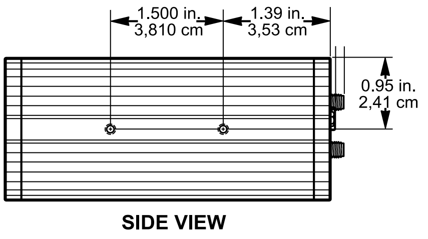
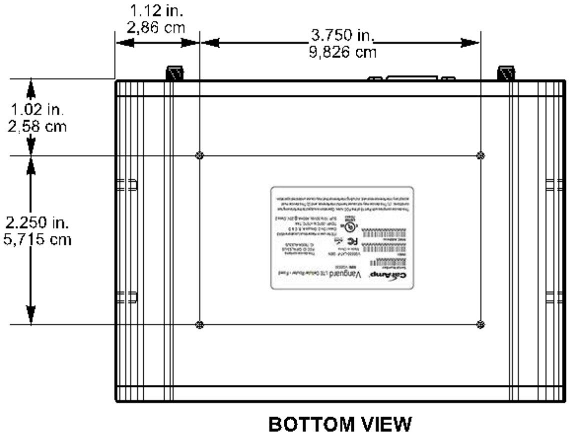


Figure 10: Side tapped mounting hole location detail — typical both sides.



#8-32 UNC – 2B thread × 0.30 in. (0,76 cm) depth
2 holes for mounting both sides (4 holes total).

Figure 11: Base tapped mounting hole location detail — bottom of chassis. Same dimension on top side of Chassis.



#6-32 UNC – 2B thread × 0.12 in. (0,30 cm) depth
4 holes for base mounting (bottom surface only).

1.5 ORDER INFORMATION

The following table shows the available order options and part numbers required for ordering Vanguard routers.

Table 2: Vanguard Router Order Information

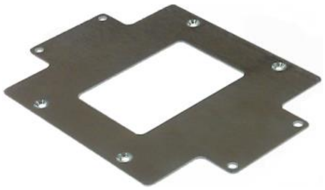
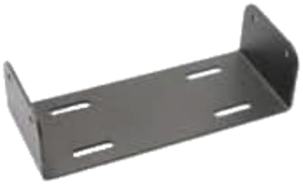
Router	Model Part Number
VG5530-LAT LTE on AT&T (Band 17)	VG5530-LAT-F (Fixed) VG5530-LAT-M (Mobile)
VG5530-LVZ LTE on VZW (Band 13 & 4)	VG5530-LVZ-F (Fixed) VG5530-LVZ-M (Mobile)
VG5530-LEU LTE on Band 20 for Europe	VG5530-LEU-F (Fixed) VG5530-LEU-M (Mobile)

1.5.1 MOUNTING BRACKETS

A mounting bracket is provided with each Vanguard 5530. The type of bracket provided is determined by the typical mounting method for each application.

- For fixed-location applications, a flat-plate bracket provides for low-profile, space-saving mounting.
- For mobile applications, a U-shaped bracket is provided to allow for mounting flexibility.

Table 3: Vanguard Mounting Brackets

Application	Bracket	Part Number / Description
Fixed		817-7010-500 Flat plate (fastens to the top or bottom of the Vanguard chassis)
Mobile		817-2225-900 U-bracket (fastens to the sides of Vanguard chassis for top or bottom mounting)

Four screws are provided with each bracket to fasten the bracket to the body of the Vanguard router.

- **Fixed** — Four #6-32 × ¼ (3/16-inch thread length) clear-zinc plated stainless steel Philips undercut flat head (82° countersink) screws are provided to fasten the flat-plate mounting bracket to the Vanguard chassis.
- **Mobile** — Four #8-32 × ½ (3/8-inch thread length) black plated stainless steel slotted hex flange head cap screws are provided to fasten the U-bracket at the sides of the Vanguard chassis for top or bottom mounting.

1.5.2 ACCESSORIES

Table 4: Vanguard router Accessories

Accessory	Part Number / Description
	4GF546-8113 4" plastic “Rubber Duck” style Antenna
	150-7001-005 110 VAC Input Power
	401-7100-003 GPS SMA Mag-Mount Antenna
	401-7100-004 Wi-Fi Mag-Mount Antenna
	150-7001-002 22' DC Power Cable w/ inline fuse (Mobile models) 150-7500-004 6' DC 3-wire Power Cable (Fixed models)
	L2CAB0002 DE-9 Serial Cable
	L2CAB0006 7' Ethernet Cable

Accessory	Part Number / Description
	250-5800-410 DIN Rail Mount — kit includes DIN mounting plate assembly (with retainer spring and screw), four #6-32 × ¼-inch length cap screws and four #6 lock washers for fastening to bottom of Vanguard chassis.

1.6 EXTERNAL CONNECTORS

This section describes the external connectors for the Vanguard router.

- Figure 12 shows the front panel connections for standard fixed models.
- Figure 13 shows the front panel connections for Mobile models with GPS and Wi-Fi.
- Figure 14 shows the rear panel for all models.

Figure 12: Front panel — Standard Fixed models

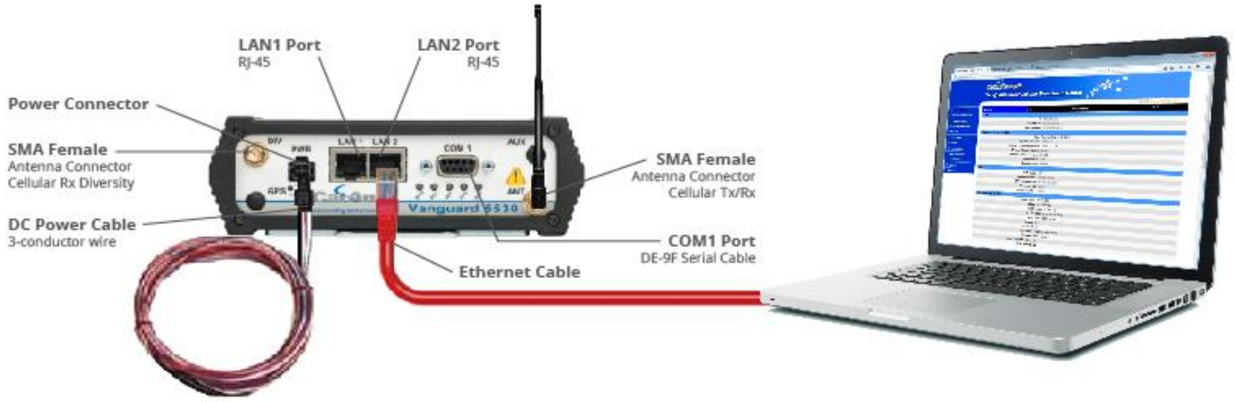


Figure 13: Front panel — Mobile models with GPS and Wi-Fi

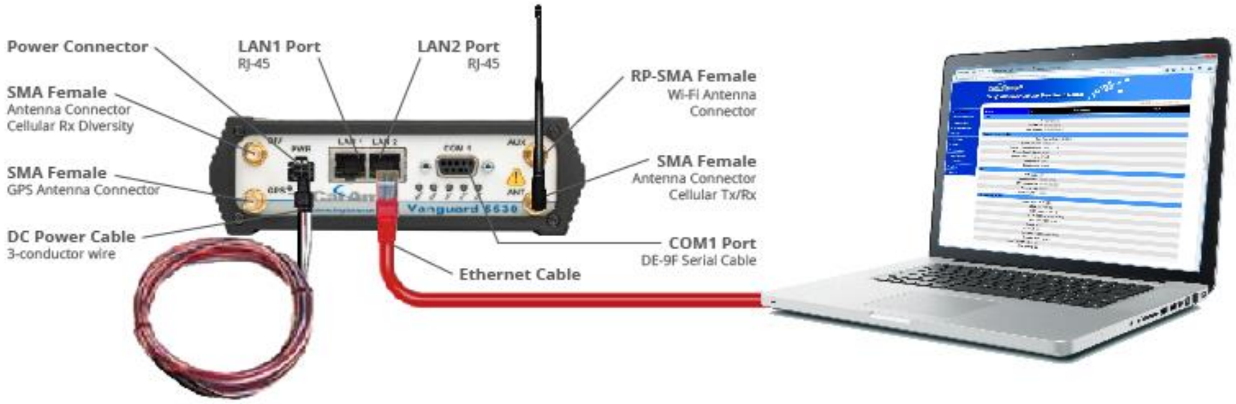


Figure 14: Rear panel connections

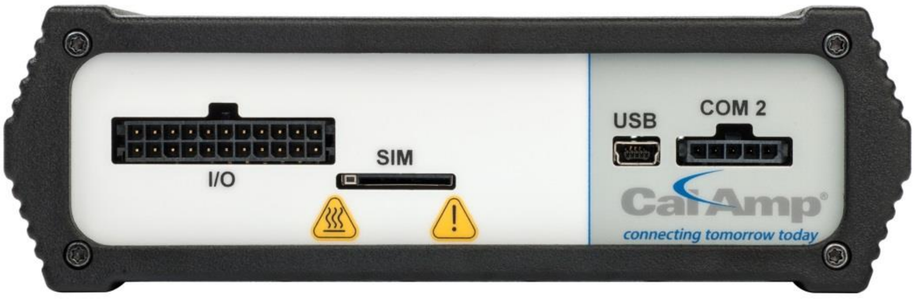


Table 5: External connectors

Panel Indicators	Connection	Description
COM 1	RS-232 / RS-485	Serial to IP conversion use
ANT	SMA	Primary RF Antenna
AUX	RP-SMA	Wi-Fi antenna
GPS	SMA	GPS Antenna
DIV	SMA	Cellular Diversity Antenna
LAN 1, LAN 2	RJ-45	Interface for Ethernet connection to devices
USB	USB Mini	Available for diagnostic use.
RESET		Depress switch to reset router. Press and hold during boot to revert settings to factory defaults.
PWR Jack	Molex 43025-0400 receptacle for four-pin power plug with optional ignition sense	Bottom pins: +9-32VDC power (pin 1) and ground (pin 2) Top pins: optional ignition-sense (3) and not connected (4). See diagram for compatible cable on the following page.
SIM	SIM Card socket	Interface for SIM card (Mini-SIM "2FF" form factor). Your wireless service provider will supply the SIM card with your wireless service contract.
COM 2	Molex 43650-0501 receptacle for 5-pin RS-232 TTL adapter 5-Pin TTL Serial Port	Available for diagnostic use. Serial port – Level conversion cable required.

Table 6: Status LEDs

Function	Off	Green	Flash Green	Red	Flash Red	Amber	Flash Amber
RSSI		Strong		Weak/None		Medium	
SVC		3G/4G	3G/4G/NC		NC	2G	2G/NC
NET	No connectivity		Rx data		Tx data		Rx/Tx
GPS	Disabled	Fix	Search	No fix			
AUX	Disabled	Good		Failed			

- If SVC is solid, then the modem is connected to the cellular network. If it is flashing, the modem is trying to connect to the network.
- AUX refers to Wi-Fi in mobile models.

The behavior of the LEDs is different than the table at boot. The boot sequence is: all red, , all off, all amber, all green, all flash green three times, and then the boot sequence is complete.

1.7 ANTENNA

Primary cellular antenna connections are SMA female connectors and must be used with antenna with SMA male connectors. When using a direct mount or rubber duck antenna, choose the antenna specific to your band requirements. Mounting options and cable lengths are user's choice and application specific.

The diversity antenna connector, labeled DIV, can be used for a Diversity antenna. The diversity port supports all bands. Connect a dual band cellular antenna to this port to implement RX diversity on the unit and increase receive sensitivity on the cellular network.

For mobile models equipped with Wi-Fi, the antenna connector labeled AUX is an RP-SMA female connector for 2.4 GHz Wi-Fi that facilitates 802.11b and 802.11g wireless networks.

1.8 POWER CABLE PINOUT

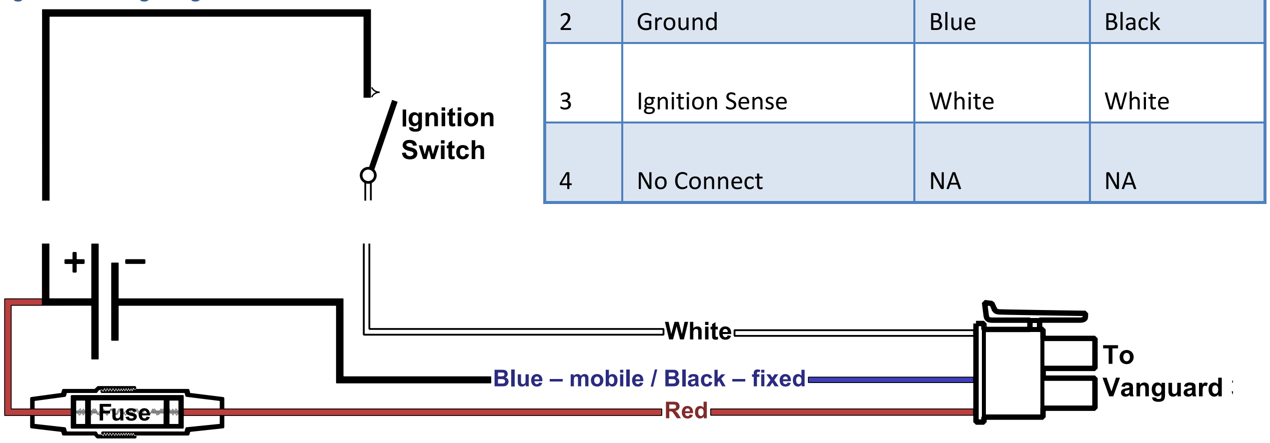
Depending on the version (fixed or mobile) of Vanguard router ordered, different power cables are provided. The mobile version ships with a 22-foot power cable that requires a fuse (included). The fixed version ships with a 6 foot DC three-wire power cable that does not contain a fuse. An AC power adapter is available as an optional accessory. Regardless of the cable length, the pinout is the same and only the color of the ground wire differs (blue in the mobile wire harness, and black in the fixed).

When installed for a fixed application or if the Ignition-sense line is not required in a mobile application, the ignition sense line (white wire) should be shorted to V_{IN} / V_{Batt} (red wire).

Table 7: Power Cable pin-out, signal, and wire colors

Pin	Signal	Color Mobile	Color Fixed
1	V_{IN} / V_{Batt} = 9 – 32V DC	Red	Red
2	Ground	Blue	Black
3	Ignition Sense	White	White
4	No Connect	NA	NA

Figure 15: Wiring for Ignition sense



The fuse provided inside the fuse-holder that is part of the wiring for mobile applications is a 2 Amp fast-acting fuse (EF2AL250VP).

1.9 RS-232 / RS-485 SERIAL PORT

Table 8 provides the serial cable design information to integrate the Vanguard modem into your system. Table 9 gives the default RS-232 / RS-485 communication parameters.

Table 8: Standard RS-232/RS-485 DE-9 Pinout

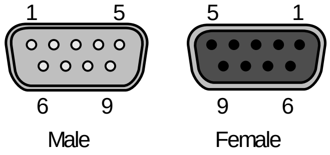
Pin	RS-232 Signal	RS-485 Signal	Direction
1	DCD	--	← (Out)
2	RXD	RXP	←(Out)
3	TXD	TXP	→(In)
4	DTR	--	→(In)
5	GND	--	
6	DSR	--	←(Out)
7	RTS	TXN	→(In)
8	CTS	RXN	← (Out)
9	3.3-12V*	5V	←(Out)

*Power adjustable in GUI; used to power attached adapters

Table 9 Default RS-232 / RS-485 Communication Parameters

Parameter	Value	
Bits Per Second	115,200	
Data Bits	8	
Parity	None	
Stop Bits	1	
Flow Control	None	

Figure 16: DE-9 Connectors



1.10 RESET Button

The RESET button can be used to return the Vanguard to its factory default settings. Power-on the unit then promptly press-and-hold the RESET button. The LEDS will cycle through all red, all off, all amber, all green. During the all green phase, the RSSI LED will turn red to show that the configuration is being reset to defaults. Once the LEDs flash all green 3 times, release the RESET button and proceed as normal.

2 GETTING STARTED

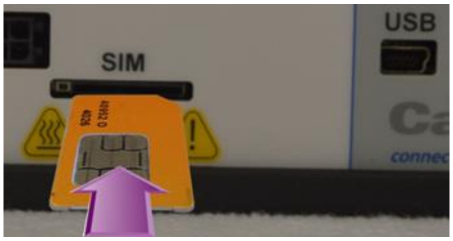
2.1 PACKAGE CONTENTS

- Vanguard Router
- Power Cable
- 22 Pin I/O Cable
- Mounting bracket
- Quick-Start Guide

2.2 DEVICE CONNECTIONS

1. Insert the SIM card into the spring-loaded SIM slot as shown.

Figure 17: Insert SIM card into SIM slot



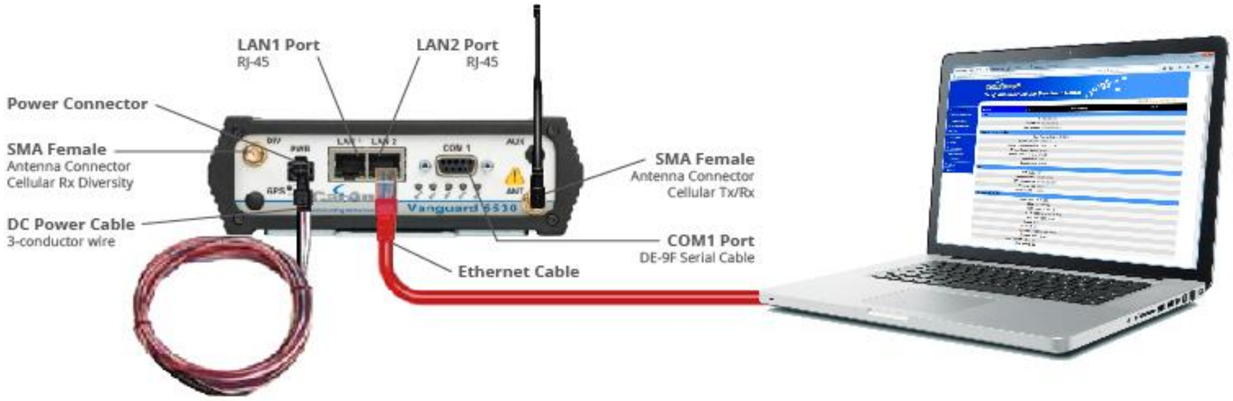
2. Connect a cellular antenna (for Tx/Rx) to the female SMA connector labeled ANT on the front of the Vanguard modem. Optionally, a second cellular antenna may be connected to the female SMA connector labeled DIV on the front panel of the Vanguard modem for Rx diversity.

Note: Use of dual band cellular antennas is preferred.

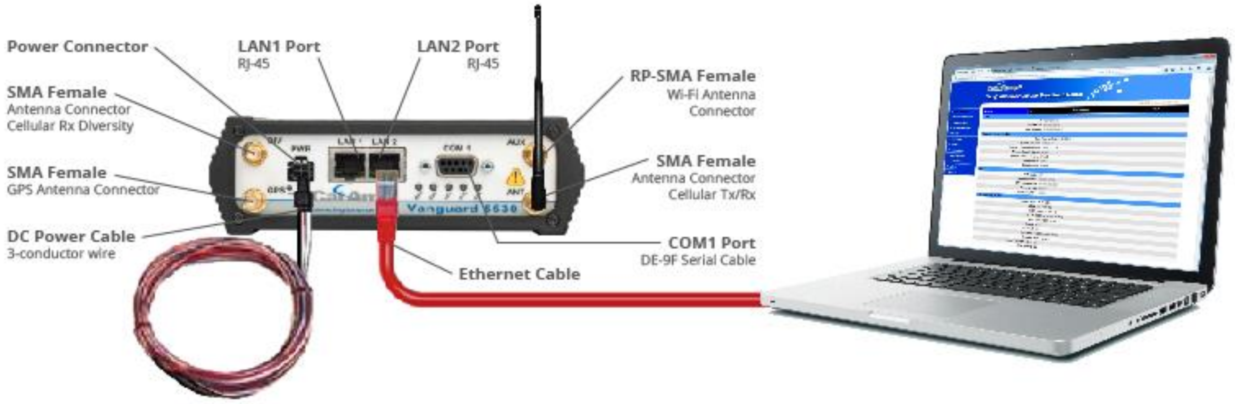
3. For Mobile units, Connect a GPS antenna to the SMA connector labeled GPS and connect a Wi-Fi antenna to the RP-SMA connector labeled AUX.
4. Connect an Ethernet cable into a LAN port and plug the other end into the network port of your PC.
5. Connect the DC power cable (or optional AC power adapter) to an applicable power source and plug the connector into the modem power (PWR) connector. If using the fused power cable to connect to a DC supply (car battery), use the diagram in *Figure 15: Wiring for Ignition sense* and accompanying pin-out information in Table 7 to connect the unit.

Figure 18: Connect antenna to ANT connector, connect Ethernet cable to either LAN port, and connect power cable

Fixed model



Mobile model



2.3 LAN CONFIGURATION

The Vanguard router is configured via a Web-browser interface and contains a DHCP server which will automatically assign an IP address to your computer, however in some cases it may be necessary to change the network settings on your computer to accept the IP address assigned by the Vanguard. Refer to your operating system documentation for detailed network setup instructions.

2.4 CELLULAR CONNECTIONS

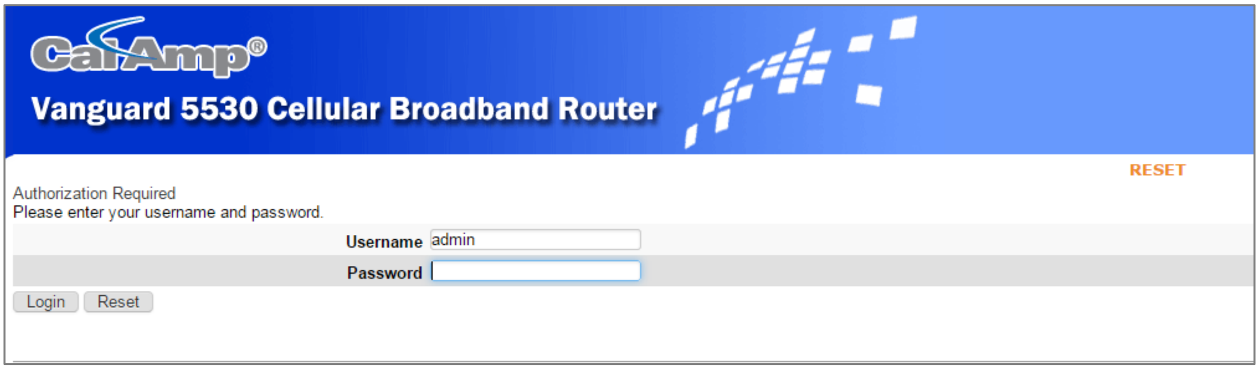
Before you begin, you will need an active Cellular account with the carrier of your choice.

3 VANGUARD WEB INTERFACE

Figure 19: CalAmp Vanguard Cellular Broadband Router Web Interface banner

Start your Web browser and enter **192.168.1.50** in the address bar. A Web Server Authentication window appears.

Figure 20: Web Server Authentication window



Authorization Required
Please enter your username and password.

Username admin
Password

Enter the User Name: **admin** and the Password: **password** and click **OK** to log into the modem's Home Page. Vanguard 5530 Web interface is divided into two sections. On the left is the main navigation pane (shown in the following figures). On the right is the content area for the desired page (shown on the following pages).

IMPORTANT NOTE: CalAmp strongly recommends that the default password be changed before the Vanguard is deployed on a public cellular network.

Figure 21: Main Navigation Pane — Fixed

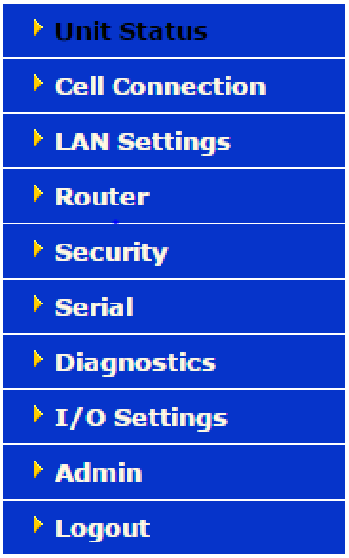
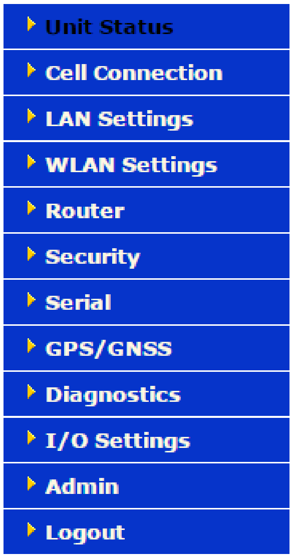


Figure 22: Main Navigation Pane — Mobile (with GPS and Wi-Fi)



Note: If the computer you are using has previously been used to set up another CalAmp router at that same IP address, you may need to delete browser history (specifically, Temporary Internet files) for the pages of the web interface to display correctly.

If you have a Fixed (standard) model, you will not see options in the navigation pane for WLAN Settings or GPS/GNSS, which are only available for the Mobile model.

Save & Apply and Save

On each screen, you have the option to Save & Apply or Save your configuration changes. Save & Apply commits the changes to persistent configuration files. Save only stores the changes in volatile storage, and changes can be reverted back to the original configuration settings by clicking the Unsaved Changes link at the top of the page and the Revert button. You can also modify the configuration values in more than one page and commit all the changes with the Unsaved Changes' Save & Apply button.

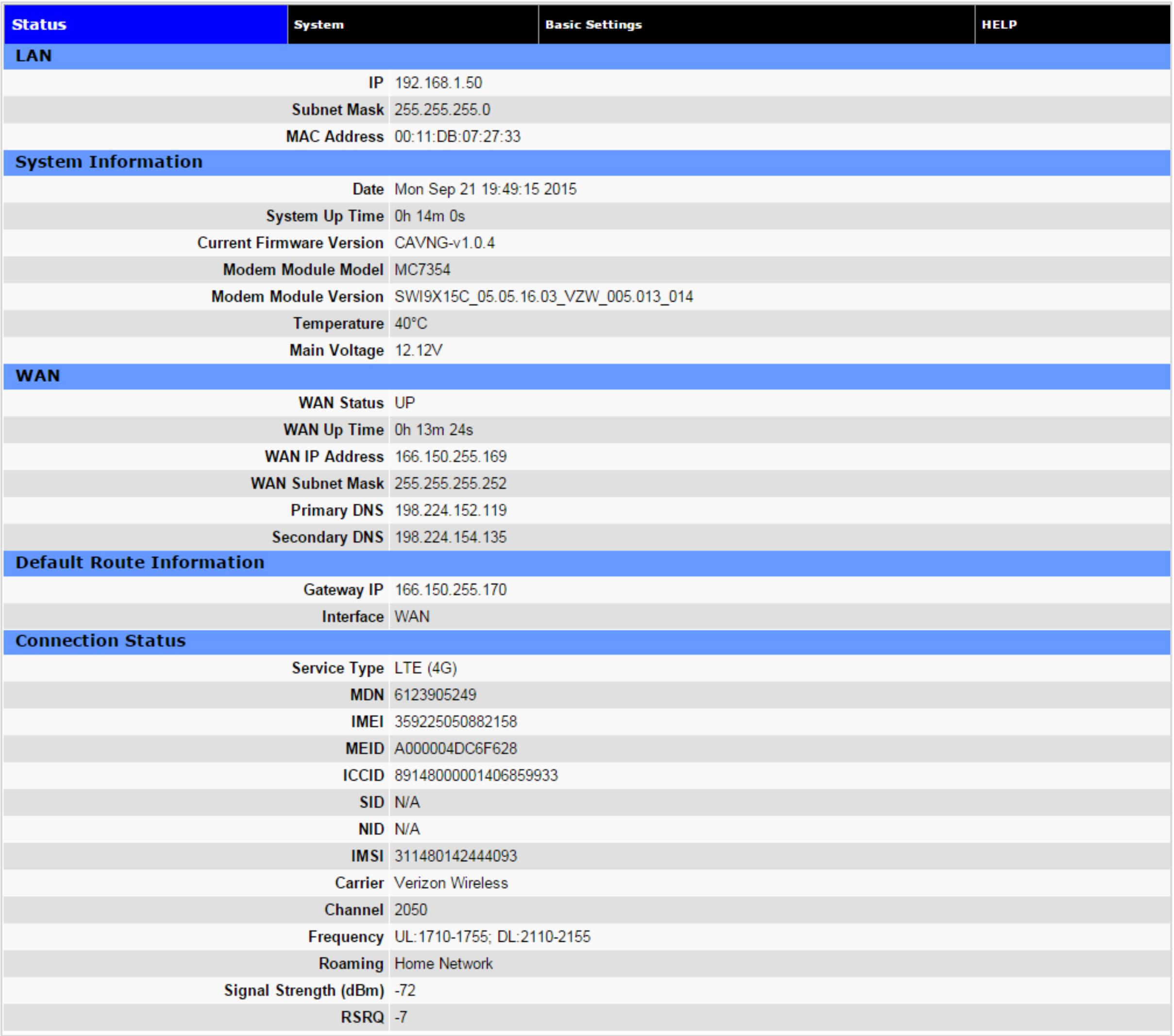
3.1 UNIT STATUS

The Unit Status is the first page displayed when navigating to the Vanguard 5530 Web interface and is the home page. Select **Unit Status** from the left navigation pane to return to this page. From this page you can view Status, System information or access Basic Settings.

3.1.1 STATUS

The Unit Status page displays connection information. This screen refreshes automatically every five seconds. You can disable the automatic refresh by clicking the Auto Refresh button.

Figure 23: Vanguard 5530 Unit Status tab



LAN	
IP	192.168.1.50
Subnet Mask	255.255.255.0
MAC Address	00:11:DB:07:27:33
System Information	
Date	Mon Sep 21 19:49:15 2015
System Up Time	0h 14m 0s
Current Firmware Version	CAVNG-v1.0.4
Modem Module Model	MC7354
Modem Module Version	SWI9X15C_05.05.16.03_VZW_005.013_014
Temperature	40°C
Main Voltage	12.12V
WAN	
WAN Status	UP
WAN Up Time	0h 13m 24s
WAN IP Address	166.150.255.169
WAN Subnet Mask	255.255.255.252
Primary DNS	198.224.152.119
Secondary DNS	198.224.154.135
Default Route Information	
Gateway IP	166.150.255.170
Interface	WAN
Connection Status	
Service Type	LTE (4G)
MDN	6123905249
IMEI	359225050882158
MEID	A000004DC6F628
ICCID	89148000001406859933
SID	N/A
NID	N/A
IMSI	311480142444093
Carrier	Verizon Wireless
Channel	2050
Frequency	UL:1710-1755; DL:2110-2155
Roaming	Home Network
Signal Strength (dBm)	-72
RSRQ	-7

LAN

- **IP**
  LAN IP address of this device (the modem).

- **Subnet Mask**
  LAN subnet mask for the modem.

- **MAC Address**
  Media Access Control Address. Every Ethernet device (i.e. LAN cards) has a unique hardware serial number or MAC address to identify each Network Device from all others.

System Information

- **Date**
  Current date and time (UTC) received from the GPS receiver (Mobile models) or from a time server (see Basic Settings » Network Time).

- **System Up time**
  Uptime in hours, minutes, and seconds.

- **Current Firmware Version**
  Firmware version currently loaded. Please visit www.calamp.com for the latest updates.

- **Modem Module Model**
  Model of the cellular modem installed.

- **Modem Module Version**
  Displays the firmware version of the modem. This may vary depending on the vendor of the radio inside the modem.

- **Temperature**
  Current internal temperature of the Vanguard 5530.

- **Main Voltage**
  System input voltage sensed by the modem.

WAN

- **WAN Status**
  Status of the cellular connection, usually UP when connected properly.

- **WAN IP Address**
  IP address of the Vanguard, as assigned by the cellular carrier, when WAN is UP.

- **WAN Subnet Mask**
  Subnet Mask of the Vanguard, as assigned by the cellular carrier, when WAN is UP.

- **Primary DNS**
  The Primary DNS server, as assigned by the cellular carrier, when WAN is UP.

- **Secondary DNS**
  The Secondary DNS server, as assigned by the cellular carrier, when WAN is UP.

Default Route Information

- **Gateway IP**
  The IP address of the gateway on the cellular network, if provided by the carrier, or the gateway on the Wi-Fi network, if Wi-Fi Client mode is enabled and a Wi-Fi connection is active.

- **Interface**
  The interface (WAN or WI-FI) used to reach the Gateway IP.

Connection Status

The information displayed in this section will vary depending on the Service Type. The possible options are described below.

- **Service Type**
  Determines the type of network your device has connected to: GPRS, EDGE, HSDPA, HSUPA, HSPA or LTE. "Searching..." will display if the SIM is invalid, missing, or if you need to enter the PIN.

- **MDN**
  (Mobile Directory Number) The actual phone number of the device as supplied by the carrier. When the unit is successfully provisioned, the phone number for the user account will be displayed. The MDN may display “NOT AVAILABLE” if the PIN status is disabled or the MDN is unknown.

- **IMEI**
  The International Mobile Equipment Identity is a unique 15-digit number that serves as the serial number of the cellular module in the modem.

- **ICCID**
  The Integrated Circuit Card Identifier is the primary account number stored in the SIM.

- **IMSI**
  The International Mobile Subscriber Identity is a unique number which designates the subscriber. This number is used for provisioning in network elements. The IMSI may display “NOT AVAILABLE” if a SIM card is not detected.

- **Carrier**
  Cellular provider name or code. “No SIM or PIN Required" is displayed if the SIM is invalid missing, or if the correct PIN has not yet been entered.

- **Channel**
  Cell Site channel number at which the modem is connected and is useful for the carrier in the event of troubleshooting.

- **Roaming**
  Displays Roaming or Not Roaming.

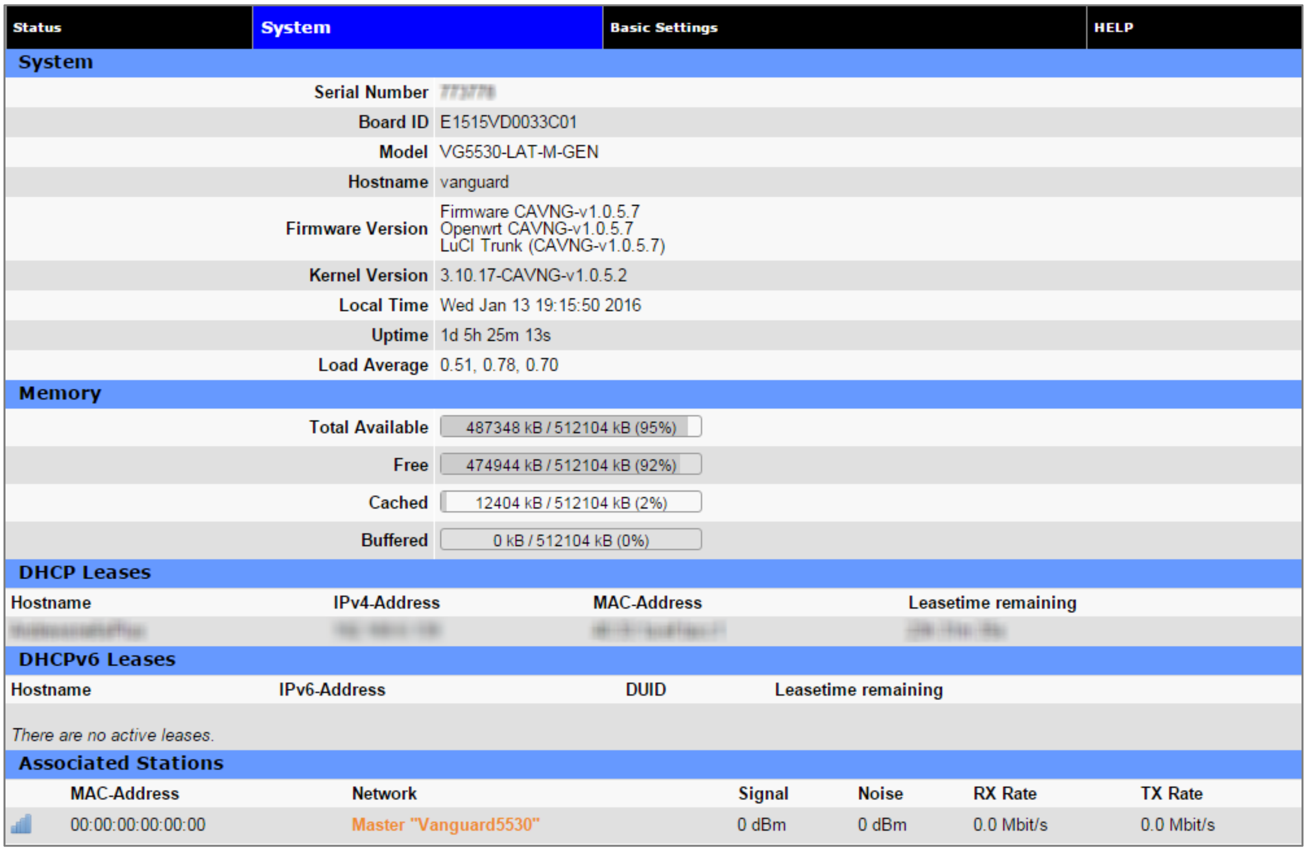
- **Signal Strength**
  Measured in dBm, this is the Received Signal Strength Indication (RSSI).

- **EC/IO**
  (Displayed depending on model and Service Type) Measured in dB, EC/IO is a measure of interference. Values closer to 0 indicate weaker interference.

- **RSRQ**
  (Displayed depending on model and Service Type) Measured in dB, RSRQ is a measure of both interference and signal with adjacent towers. Values closer to 0 indicate better signal quality.

3.1.2 SYSTEM

Figure 24: Unit Status — System



System

Serial Number	[redacted]
Board ID	E1515VD0033C01
Model	VG5530-LAT-M-GEN
Hostname	vanguard
Firmware Version	Firmware CAVNG-v1.0.5.7 Openwrt CAVNG-v1.0.5.7 LuCI Trunk (CAVNG-v1.0.5.7)
Kernel Version	3.10.17-CAVNG-v1.0.5.2
Local Time	Wed Jan 13 19:15:50 2016
Uptime	1d 5h 25m 13s
Load Average	0.51, 0.78, 0.70

Memory

Total Available	487348 kB / 512104 kB (95%)
Free	474944 kB / 512104 kB (92%)
Cached	12404 kB / 512104 kB (2%)
Buffered	0 kB / 512104 kB (0%)

DHCP Leases

Hostname	IPv4-Address	MAC-Address	Leasetime remaining
[redacted]	[redacted]	[redacted]	[redacted]

DHCPv6 Leases

Hostname	IPv6-Address	DUID	Leasetime remaining

There are no active leases.

Associated Stations

	MAC-Address	Network	Signal	Noise	RX Rate	TX Rate
	00:00:00:00:00:00	Master "Vanguard5530"	0 dBm	0 dBm	0.0 Mbit/s	0.0 Mbit/s

System

- **Serial Number**
  The router serial number is a unique ID assigned when the product was built.

- **Board ID**
  Unit motherboard identifier.

- **Model Number**
  Unit model number defining its capabilities and features.

- **Hostname**
  The name of the router provided by the operating system.

- **Firmware Version**
  The version of the top-level component firmware packages in the router OS.

- **Kernel Version**
  The version of the Linux kernel in the router OS.

- **Local Time**
  The current system time observed by the router. Source may be from the configured NTP server or the GPS receiver, if installed.

- **Uptime**
  The time since the router was last rebooted.

- **Load Average**
  The average number of processes in a runnable or non-interruptible state for the past 1, 5, and 15 minutes.

Memory

The current memory usage, broken out into Total Available, Free, Cached and Buffered categories.

DHCPv6 Leases

The list of IPv4 and IPv6 leases given out to clients on the wired or wireless LAN interfaces by the DHCP server.

Associated Stations

Currently bounded Access Point information.

- **MAC-Address**
  MAC-addresses of clients which are connected.

- **Network**
  SSIDs of clients which are connected.

- **Signal**
  Signal strength of AP.

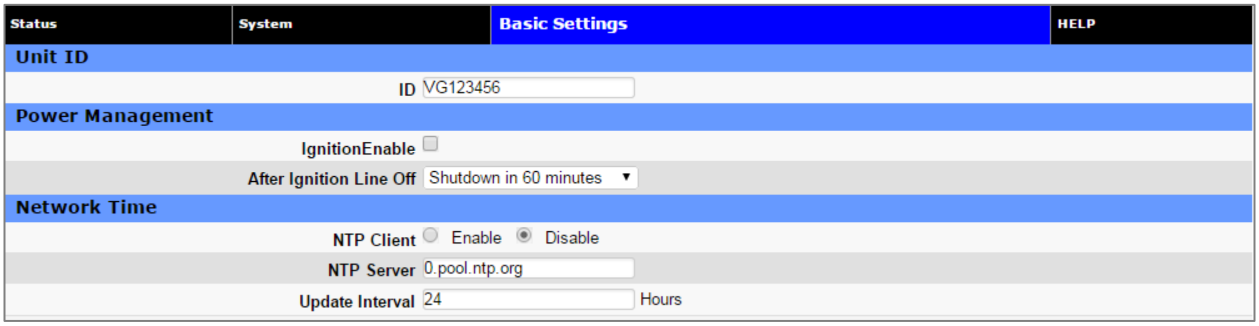
- **Noise**
  The noise level indicates the amount of background noise in the environment.

- **RX Rate**
  Rx Rate is the rate at which packets are received from router.

- **TX Rate**
  Tx Rate is the rate at which packets are sent from router.

3.1.3 BASIC SETTINGS

Figure 25: Unit Status — Basic Settings



Unit ID

ID VG123456

Power Management

IgnitionEnable □

After Ignition Line Off Shutdown in 60 minutes ▾

Network Time

NTP Client ○ Enable ● Disable

NTP Server 0.pool.ntp.org

Update Interval 24 Hours

Unit ID

- **ID**
  The identification string serves to distinguish this unit. It is also the TAIP identification for GPS reporting and serves as the syslocation for the SNMP facility. Unit ID can be up to 32 characters long and can consist of letters, digits and the underscore '_' character.

Power Management

Depending on power cabling, the Vanguard 5530 may stay ON regardless of whether the vehicle ignition is on. The unit can be configured to automatically shut down 1, 5, 30, 60, 120 or 240 minutes after ignition has been turned off. Leaving the unit live allows the driver to use the modem without idling the vehicle and defining a shut-off time limit prevents the modem from draining the battery when the vehicle is unoccupied.

- **Ignition Enable**
  Disabled by default.

- **After Ignition Line Off**
  Select a time limit: 1, 5, 30, 60, 120, or 240 minutes.

Network Time

The Vanguard 5530 is capable of maintaining the current time (UTC) by synchronizing itself with a Network Time Protocol (NTP) Server. You may specify a server domain name or IP address and how frequently the router should synchronize with the server. The router must have DNS access and a route to the internet to synchronize with the supplied default ntp.org server – this is not always true on private cellular networks. The router does not save or track time while powered off, so time will be inaccurate until the router can connect with the server, which it does on startup (in addition to synchronizing according the Update Frequency specified).

- **NTP Client**
  Disabled by default. Select **Enable** to activate the router's NTP client to synchronize with the specified server.

- **NTP Server**
  Enter the domain name or IP address of the desired NTP Server. Most public NTP Servers have a posted usage policy. A review of usage policies and the choice of an appropriate server is recommended.

- **Update Interval**
  Specify the frequency to synchronize the router time with the configured NTP Server. By default, synchronization is set 24 hours.

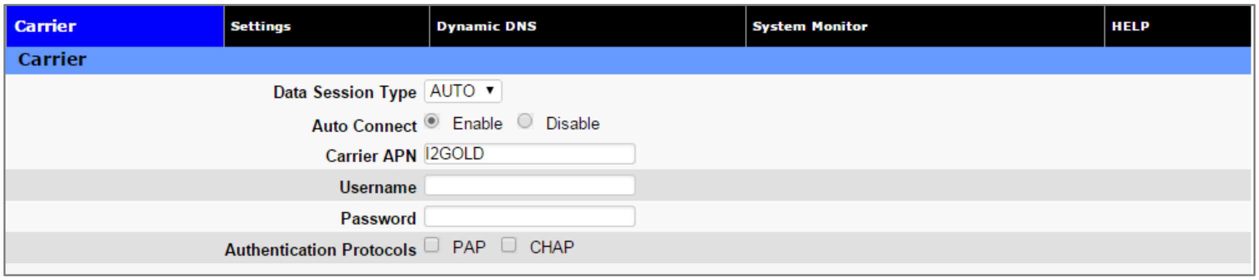
3.2 CELL CONNECTION

Select Cell Connection from the left navigation pane to access the Carrier, Settings, Dynamic DNS and System Monitor tabs.

3.2.1 CARRIER

The Carrier tab enables you to configure the carrier (cellular provider) and credentials to be used for data calls.

Figure 26: For Singlecarrier Cell Connection — Carrier



Carrier

Data Session Type AUTO ▾

Auto Connect ● Enable ○ Disable

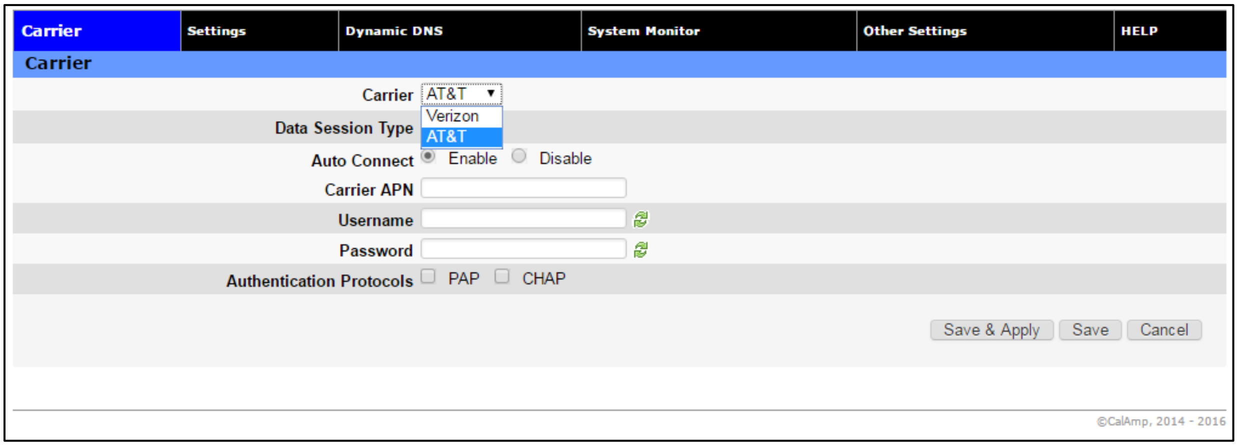
Carrier APN I2GOLD

Username

Password

Authentication Protocols □ PAP □ CHAP

Figure 27: For Multicarrier Cell Connection - Carrier



Carrier

Carrier AT&T ▾
Verizon
AT&T

Data Session Type

Auto Connect ● Enable ○ Disable

Carrier APN

Username

Password

Authentication Protocols □ PAP □ CHAP

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NOTE: For multicarrier: Carrier change will require a SIM card change, will reboot the device and will take approx three (3) minutes to apply.

Carrier

- **Carrier** (Multicarrier 5530 only)
  Select Verizon or AT&T. NOTE: On a carrier change, the Vanguard will reboot and take approximately 3 minutes to update the cell module.

- **Data Session Type**
  Select Auto, 4G, 3G or 2G.

- **Auto Connect**
  Select **Enable** (the default and recommended setting), and the modem will automatically dial the connection at startup, and to attempt reconnection if the connection is lost. Select **Disable** to prevent the modem from automatically connecting at startup. When disabled, a button will be displayed that can be used to manually connect or disconnect the wireless WAN service.

If Auto Connect is enabled and the modem fails to connect, the unit will attempt to reconnect two times and then make an attempt at one minute, at two minutes, at eight minutes, and then every fifteen minutes until successful.

- **Carrier APN**
  The Access Point Name required by the cellular provider to access the network. This value may determine if the router receives a publicly routable WAN address. Enter the APN provided by the carrier.

- **Username**
  Username required by the cellular provider. Leave blank if not required.

- **Password**
  Password required by the cellular provider. Leave blank if not required.

- **Authentication Protocols**
  Configure the authentication protocol to be used, or none. If no protocol is selected (the default and recommended setting for most applications), the Vanguard 5530 will try to negotiate a protocol with a cell tower, if the cellular carrier allows negotiation. If a protocol is selected, then the router will only accept requests for the specified protocol(s), where **PAP** is Password Authentication Protocol and **CHAP** is Challenge-Handshake Authentication Protocol.
  - **PAP**: The Password Authentication Protocol is a pre-shared key method for authenticating with the cellular provider.
  - **CHAP**: The Challenge-Handshake Authentication Protocol is a two-way authentication scheme between router and provider.

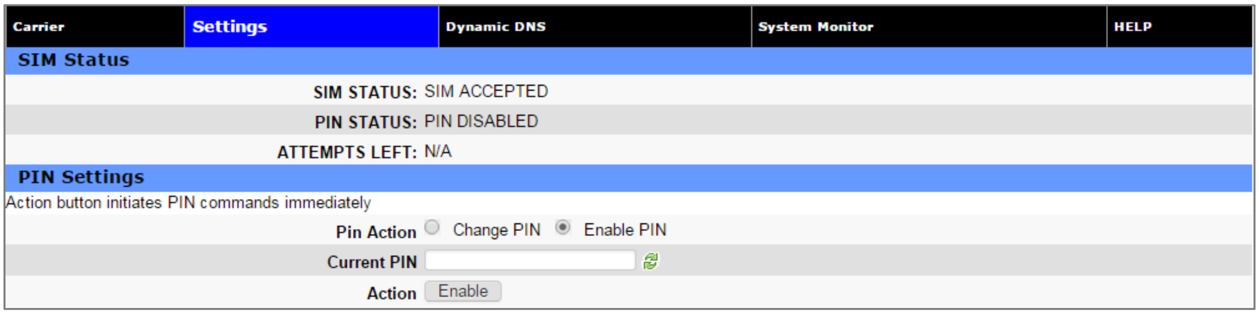
  Note: Normally the cell provider does not require a username or password, in which case leave the User and Password fields blank. SIMs from some carriers for special applications may require user name and password to establish WAN connection with the Cellular network.

3.2.2 SETTINGS

The carrier settings displayed on this page differ depending on which carrier is being used at the time.

One of the key features of LTE is the Subscriber Identity Module (SIM), commonly known as SIM card. The SIM is a detachable smart card containing the user's subscription information. This allows the user to retain his or her information when switching handsets or wireless devices, independent of which handset or wireless device they are using. The SIM has a security feature which, when enabled, requires the user to enter a valid PIN before the modem will connect to the cellular network.

Figure 28: Cell Connection — Settings



SIM Status

SIM STATUS: SIM ACCEPTED

PIN STATUS: PIN DISABLED

ATTEMPTS LEFT: N/A

PIN Settings

Action button initiates PIN commands immediately

Pin Action ○ Change PIN ● Enable PIN

Current PIN

Action Enable

SIM Status

The Current Status section displays the current status of the SIM (whether a SIM card is present, and if so whether it is valid) and PIN (whether a PIN has been entered and PIN security enabled).

- **SIM Status (status text)**
  SIM ACCEPTED displays when a valid SIM card is inserted properly in the modem. NO SIM displays if the SIM card is invalid, missing, or installed incorrectly.

- **PIN Status (status text)**
  PIN DISABLED displays when PIN security is not enabled. PIN ENABLED displays when PIN security is enabled. PIN ACCEPTED displays when PIN security is enabled and a valid PIN is entered.

- **Attempts Left**
  Indicates the number of attempts remaining to correctly enter the PIN before the SIM is locked. Maximum number of attempts is three. If SIM is locked, you must contact your cellular carrier to unlock.

PIN Settings

The Pin Settings section enables you to enter a PIN, change a pin, enable PIN security or disable it. Instructions for the available actions and associated options displayed in this section of the Web page change depending on the SIM status, whether a PIN has been entered, and whether PIN security is enabled or disabled.

The default setting for PIN security is disabled and you will see the status message "Action: PIN is disabled. To change it, it must be enabled first."

Note: Before enabling PIN security, make sure you have the PIN provided by your wireless carrier.

To enter the PIN provided by your wireless carrier (for a new modem)
Change Enable PIN from No to **Yes**, enter your carrier-provided PIN into the **Current PIN** field, and click **Save** to access the PIN security settings.

To change your PIN or change PIN security settings
(enable or disable PIN security, change whether PIN is remembered, or change your PIN)
Change PIN from Yes to **No**, enter your PIN into the **Current PIN** field, and click **Save** to access the PIN security settings.

To Change the PIN Status

Once the PIN has been entered successfully, the status message displays “Action: You may change only one of the following three options at a time,” and three options are presented.

- **Remember PIN (Enter Current PIN) Yes / No**
  - To have your PIN remembered (not need to be entered each time to establish connection), select **Yes**.
  - To not enable this feature (not have your PIN remembered), select **No**.
  - Enter your **PIN** in the Current PIN field and click Save to make your selection take effect.

- **Disable PIN (Enter Current PIN) Yes / No**
  - To disable PIN security, select **Yes**.
  - To enable PIN security, select **No**.
  - Enter your PIN in the Current **PIN** field and click Save to make your selection take effect.

- **Change PIN (Enter Current PIN, New PIN and Confirm PIN) Yes / No**
  - To change your PIN, select **Yes**. Enter your PIN in the **Current PIN** field, enter your new PIN in the **New PIN** field, and enter your new PIN again in the **Confirm New PIN** field. (The PIN you enter in the **New PIN** and **Confirm New PIN** fields must match exactly.)

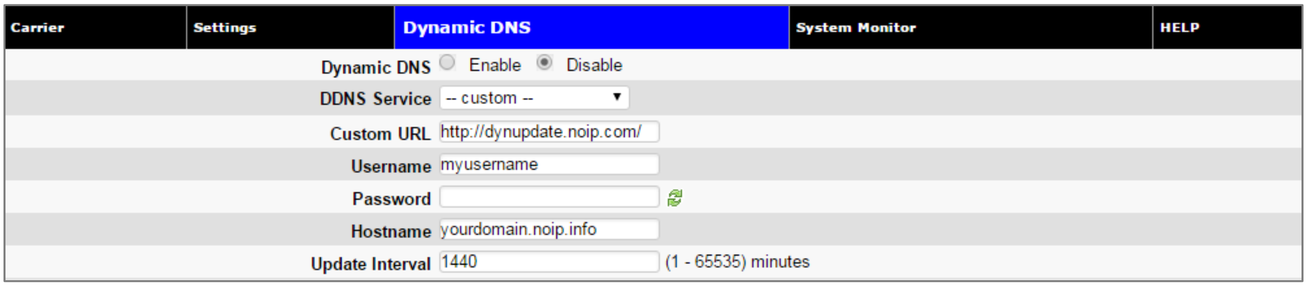
  Note: If you enter too many or too few characters, or characters that are not allowed in a PIN, rules for valid PIN length and character selection are displayed.
  - To not change your PIN, select **No**.
  - Click **Save** to make your selection take effect.

When you have made and saved your change successfully, the PIN Status text changes accordingly, reflecting the change you made.

3.2.3 DYNAMIC DNS

Dynamic DNS is a system which allows the domain name data of a computer with a varying (dynamic) IP addresses held in a name server to be updated in real time in order to make it possible to establish connections to that machine without the need to track the actual IP address themselves at all times. A number of providers offer Dynamic DNS services ("DDNS"), free or for a charge. For example, a free service provided by NO-IP allows users to setup between one and five host names on a domain name provided by NO-IP.

Figure 29: Cell Connection — Dynamic DNS



Dynamic DNS	○ Enable ● Disable
DDNS Service	-- custom -- ▼
Custom URL	http://dynupdate.noip.com/
Username	myusername
Password	
Hostname	yourdomain.noip.info
Update Interval	1440 (1 - 65535) minutes

- **Dynamic DNS**
  Selecting Enable will allow the modem to provide the selected service dynamic IP address information. Selecting Disable will stop any IP information from being sent to the selected service.

- **DDNS Service**
  The internet address to communicate the Dynamic DNS information to. Default is ” – custom –“ which exposes the Custom URL field.

- **Custom URL**
  DDNS Services not in the dropdown list can often still be supported by use of a custom URL specified by the service provider. Keywords in [square brackets] are replaced by their actual values.
  Note: If the default Custom URL, which references NO-IP, fails to update, try the URL:
  http://[USERNAME]:[PASSWORD]@dynupdate.noip.com/nic/update?hostname=[DOMAIN]&myip=[IP]

- **Username**
  The username used when setting up the account. Used to login to the Dynamic DNS service.

- **Password**
  The password associated with the username account.

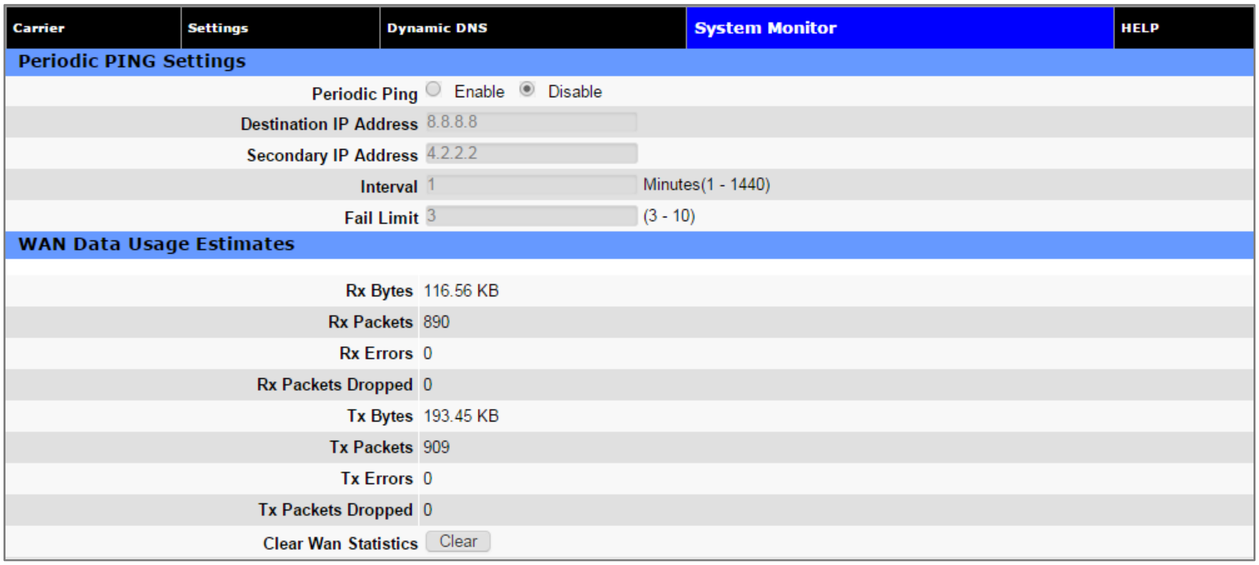
- **Hostname**
  The hostname identified to the Dynamic DNS service. For example, test.myserver.com.

- **Update Interval**
  Sets the interval, in minutes (0 to 65,535), the modem will update the Dynamic DNS server of its carrier assigned IP address. It is recommended to set this interval as long as necessary. Each update is considered a data call by the cellular provider and could deplete low usage data plan minutes.

3.2.4 SYSTEM MONITOR

The System Monitor tab allows access to the configuration of additional self-monitoring for the modem to determine when service provider connections may have been terminated.

Figure 30: Cell Connection — System Monitor



Periodic PING Settings

Periodic Ping	○ Enable ● Disable
Destination IP Address	8.8.8.8
Secondary IP Address	4.2.2.2
Interval	1 Minutes(1 - 1440)
Fail Limit	3 (3 - 10)

WAN Data Usage Estimates

Rx Bytes	116.56 KB
Rx Packets	890
Rx Errors	0
Rx Packets Dropped	0
Tx Bytes	193.45 KB
Tx Packets	909
Tx Errors	0
Tx Packets Dropped	0
Clear Wan Statistics	Clear

Periodic PING Settings

This section allows you to set up a periodic Ping test and specify a failure limit above which the modem will reset.

- **Periodic Ping Enable/Disable**
  Default setting is disabled.

- **Destination IP Address**
  User may enter an accessible IP address or domain name that will respond to a ping command.

- **Secondary IP Address**
  User may enter an accessible IP address or domain name that will respond to a ping command. This address will be used if the entered number of consecutive ping failures using the first address is reached.

- **Interval**
  Time (in minutes) to wait between pings.

- **Fail Limit**
  Number of ping failures to accept before resetting the modem.

WAN Data Usage Statistics

This section tracks the data received from and transmitted to the cellular network. This is a tool that may be used to estimate network usage. These totals are tracked by the router. Your carrier maintains separate statistics from which your billing is determined. One way to use this tool is to track usage over a fairly short period of typical usage. The total then can be extrapolated to estimate longer time periods. This router updates these statistics once approximately every 30 seconds. Press the Clear button to reset the totals to 0.

- **Rx Bytes**
  The total number of bytes received by the modem from the cell network. All statistics will be cleared automatically if this count exceeds 1 billion (1,000,000,000).

- **Rx Packets**
  The total number of TCP and UDP packets received by the modem from the cell network.

- **Rx Errors**
  The number of corrupted TCP and UDP packets received by the modem from the cell network.

- **Rx Packets Dropped**
  The number of TCP and UDP packets received by the modem from the cell network that were not accepted. This may occur due to memory or throughput problems.

- **Tx Bytes**
  The total number of bytes transmitted by the modem to the cell network. All statistics will be cleared automatically if this count exceeds 1 billion (1,000,000,000).

- **Tx Packets**
  The total number of TCP and UDP packets transmitted by the modem to the cell network.

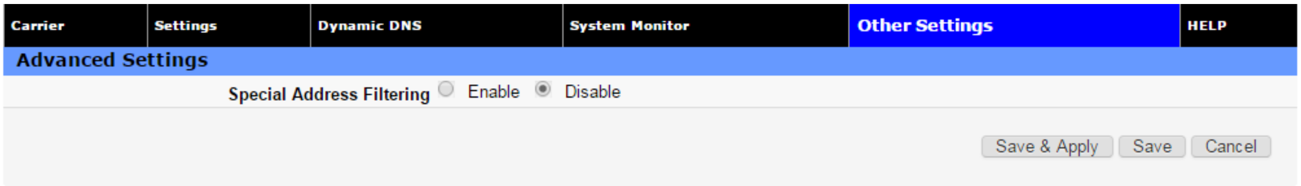
- **Tx Errors**
  The number of corrupted TCP and UDP packets received by the modem that were meant to be transmitted on the cell network.

- **Tx Packets Dropped**
  The number of TCP and UDP packets received by the modem for transmit to the cell network that were not accepted. This may occur due to memory or throughput problems.

Click **Clear WAN Statistics** to reset the totals to 0. These totals are NOT cleared by a modem reboot.

3.2.5 OTHER SETTINGS

Figure 31: Other Settings



Advanced Settings

Special Address Filtering ○ Enable ● Disable

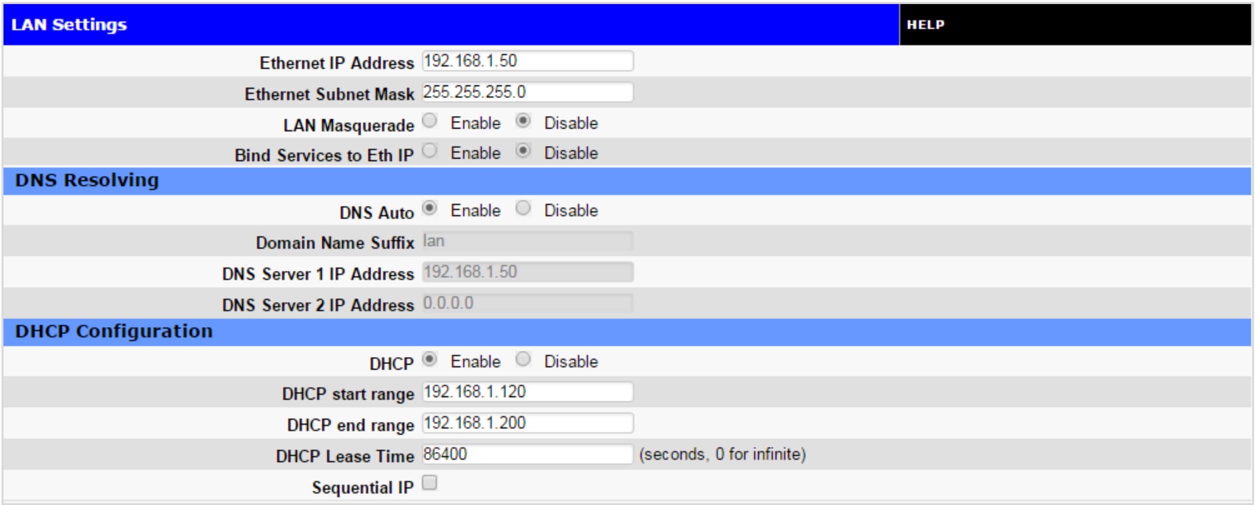
- **Special Address Filtering**
  Some traffic is not tolerated over the public internet. This feature will add filters to prevent such traffic to go out the interface. (the following destination IP addresses will be discarded: 0.0.0.0/8, 192.0.0.0/24, 192.0.2.0/24, 198.51.100.0/24, 203.0.113.0/24, 192.168.0.0/16, 172.16.0.0/12, 10.0.0.0/8, 169.254.0.0/16, 224.0.0.0/4, 240.0.0.0/4).

3.3 LAN SETTINGS

Select **LAN Settings** from the main navigation pane for access to the LAN Settings tab.

3.3.1 LAN SETTINGS

Figure 32: LAN — LAN Settings



LAN Settings	HELP
Ethernet IP Address	192.168.1.50
Ethernet Subnet Mask	255.255.255.0
LAN Masquerade	○ Enable ● Disable
Bind Services to Eth IP	○ Enable ● Disable
DNS Resolving	
DNS Auto	● Enable ○ Disable
Domain Name Suffix	lan
DNS Server 1 IP Address	192.168.1.50
DNS Server 2 IP Address	0.0.0.0
DHCP Configuration	
DHCP	● Enable ○ Disable
DHCP start range	192.168.1.120
DHCP end range	192.168.1.200
DHCP Lease Time	86400 (seconds, 0 for infinite)
Sequential IP	□

LAN Settings

- **Ethernet IP Address**
  This sets the IP address of this device and is the address used to access the configuration pages. If the IP address changes you will have to re-enter the new IP address in your browser to access the configuration pages. The default IP is 192.168.1.50.

- **Ethernet Subnet Mask**
  Sets the subnet mask for the LAN side of the modem to the device.

Important: The LAN subnet must not overlap with the WLAN subnet defined in the Access Point tab of the WLAN page.

- **LAN Masquerade**
  When enabled, the Vanguard masquerades all Ethernet traffic to the LAN, making all WAN traffic appear as if it originated from the Vanguard 5530. This can be useful in applications where less-capable equipment on the local LAN cannot cope with connections from multiple Host IP addresses.

- **Bind Services to Eth IP**
  UDP datagrams or TCP sockets from services inside the Vanguard (Serial, IO, GPS) normally appear to come from the interface (LAN or WAN) closest to the destination. Enable this option to force the source address to be the LAN Ethernet IP address. This can be useful if packets are being sent through a VPN tunnel. Note that outside of a tunnel, NAT may still force the source address to be rewritten to the WAN address.

DNS Resolving

- **DNS Auto**
  Selecting Enable enables the Vanguard to act as DNS Proxy for the DHCP clients. Selecting Disable will provide the DNS Server 1 or 2 addresses to DHCP clients.

- **Domain Name Suffix**
  Suffix to append to short, unqualified computer names for local DNS lookup.

- **DNS Server 1 IP Address**
  The Ethernet IP address of the preferred DNS server. The default address is 192.168.1.50, the same as the LAN Ethernet IP Address for the modem. If the LAN Ethernet ID Address changes, the DNS Server 1 address will automatically change to the same.

- **DNS Server 2 IP Address**
  Ethernet address of the alternate DNS server. The default is set to 0.0.0.0.

DHCP Configuration

- **DHCP**
  Dynamic Host Configuration Protocol; a protocol used by client devices that are connected to the LAN port of this device to automatically obtain an IP address assigned by this device. Selecting Enable will configure this device to assign IP addresses to client devices taken from a pool specified by the values entered in DHCP start range and DHCP end range. Selecting Disable will turn off this DHCP server functionality.

- **DHCP start range**
  DHCP server starting IP address. The default is set as 192.168.1.120.

- **DHCP end range**
  DHCP server ending IP address. The maximum usable number is 253. The default is set to 192.168.1.200.

- **DHCP Lease Time**
  Sets the duration, in seconds, the connected device is allowed to keep the assigned IP address. In many cases it is possible for the device to receive the same IP address after the lease time expires. The default is set to 86400 seconds (1 day).

- **Sequential IP**
  IP addresses are allocated sequentially from the start-end range when checked. Addresses are based on the device's hashed MAC address when unchecked – this will tend to allocate the device the same IP address when connected to different Vanguard routers. Note: This setting affects WLAN DHCP also.

3.4 WLAN SETTINGS

The Mobile model Vanguard Router contains a Wi-Fi wireless LAN (WLAN) interface that can be set up as a Client or Access Point. The AUX LED displays the status of the WLAN interface.

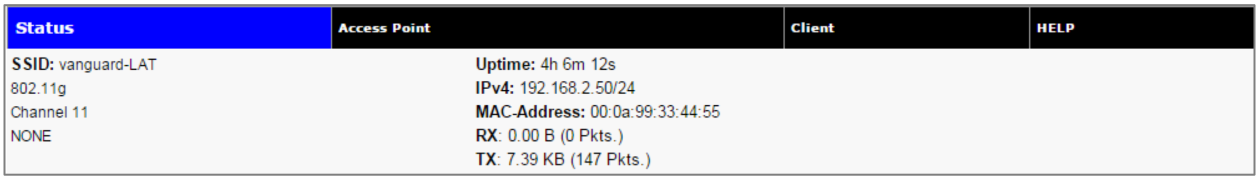
Table 10 AUX LED color / state and status of the WLAN interface

AUX LED Color / State	Meaning
Off	The WLAN interface is not installed.
Red	The WLAN interface is disabled.
Amber	The WLAN interface is configured for Client mode and is searching for an Access Point.

AUX LED Color / State	Meaning
Green	The WLAN interface is configured for Client mode and is connected to an Access Point, or is configured for Access Point mode and is ready to accept connections.
Flashing Green	There is data traffic on the WLAN channel.

3.4.1 STATUS

Figure 33: WLAN — Status



SSID: vanguard-LAT
802.11g
Channel 11
NONE

Uptime: 4h 6m 12s
IPv4: 192.168.2.50/24
MAC-Address: 00:0a:99:33:44:55
RX: 0.00 B (0 Pkts.)
TX: 7.39 KB (147 Pkts.)

- **SSID**
  When Access Point mode is enabled, the name of the wireless local area network that will be broadcast and seen by connecting clients. This column also displays the wireless protocol, the transmitting channel for the Access Point and the Authentication/Encryption type for the Access Point.

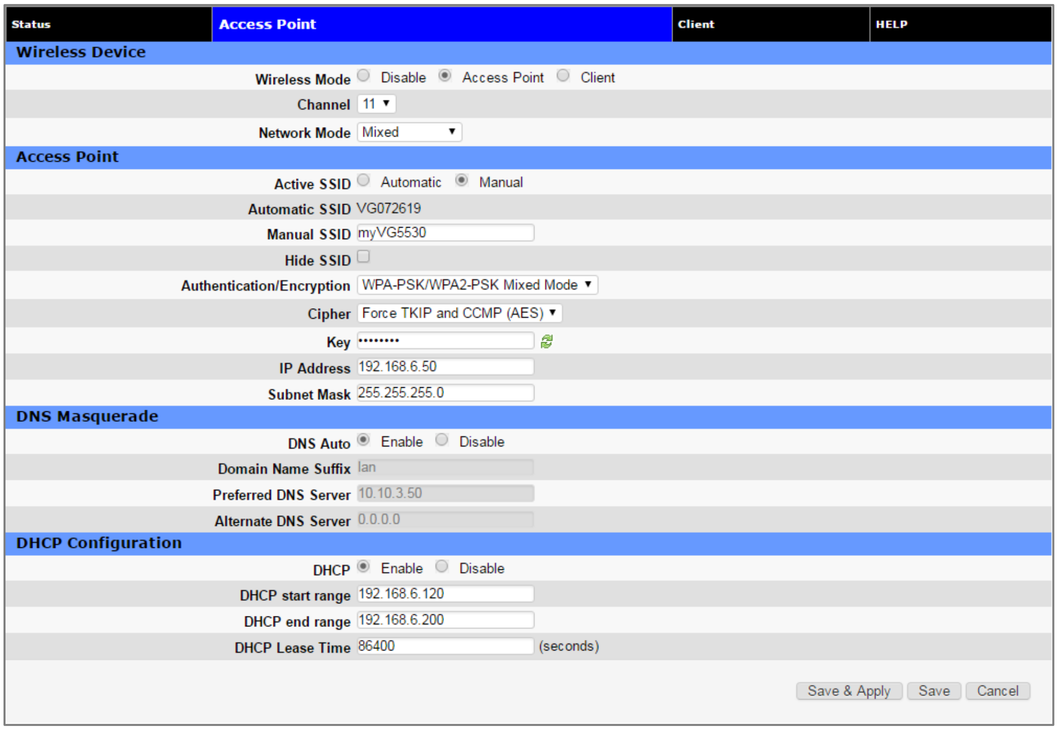
- **Uptime**
  The amount of time the Access Point has been active, or Client has been connected.

- **IPv4**
  The IP Address of the Access Point, or the IP address of the current Client connection.

- **RX / TX**
  The amount of bytes/packets received and transmitted over the WLAN interface.

3.4.2 ACCESS POINT

Figure 34: WLAN — Access Point



Wireless Device

Wireless Mode ○ Disable ● Access Point ○ Client

Channel 11

Network Mode Mixed

Access Point

Active SSID ○ Automatic ● Manual

Automatic SSID VG072619

Manual SSID myVG5530

Hide SSID □

Authentication/Encryption WPA-PSK/WPA2-PSK Mixed Mode

Cipher Force TKIP and CCMP (AES)

Key ••••••••

IP Address 192.168.6.50

Subnet Mask 255.255.255.0

DNS Masquerade

DNS Auto ● Enable ○ Disable

Domain Name Suffix lan

Preferred DNS Server 10.10.3.50

Alternate DNS Server 0.0.0.0

DHCP Configuration

DHCP ● Enable ○ Disable

DHCP start range 192.168.6.120

DHCP end range 192.168.6.200

DHCP Lease Time 86400 (seconds)

Wireless Devices

- **Wireless Mode**
  The following table gives explanations of the Wireless Mode options.

Table 11: Explanation of Wireless Mode options

Mode	Explanation
Disable	The WLAN interface is disabled.
Access Point	The WLAN interface operates in Access Point mode. Parameters can be set on the Access Point tab.
Client	The WLAN interface operates in Client mode. Parameters can be set on the Client tab.

- **Channel**
  The channel to be used in the Access Point mode.

- **Network Mode:**
  Switches network mode between 802.11n and 802.11g. WPA2 + CCMP must be selected for 802.11n throughput.

Access Point

- **Active SSID**
  When Automatic is selected, a unique SSID will be provided. When Manual is selected, the user must configure the SSID.

- **Automatic SSID**
  The automatic SSID is a unique SSID based off of the MAC address and is used when Automatic is selected for the Active SSID.

- **Manual SSID**
  The user must configure the Manual SSID, and it is used when Manual is selected for the Active SSID.

- **Hide SSID**
  When checked, do not broadcast the SSID.

- **Authentication/Encryption**
  Type of authentication or encryption used. Extra fields may display depending on the selected type.

- **IP Address**
  This sets the IP address for the WLAN side of the Vanguard unit.

- **Subnet Mask**

  Sets the subnet mask for the WLAN side of the Vanguard unit.

DNS Masquerade

- **DNS Auto**
  Selecting Enable will automatically set the preferred DNS Server to the WLAN IP address of the Vanguard. Selecting Disable will allow the user to select the preferred and alternate DNS servers.

- **Domain Name Suffix**
  The DNS suffix to be assigned by the DHCP server.

- **Preferred DNS Server**
  IP address of the preferred DNS server.

- **Alternate DNS Server**
  IP address of the alternate DNS server.

DHCP Configuration

- **DHCP**
  Selecting "Enable" will configure this device to assign IP addresses to client devices taken from a pool specified by the values entered in "Start IP Address" and "End IP Address". Selecting "Disable" will turn off the DHCP server functionality for the Ethernet interface.

- **Start IP Address**
  The DHCP server’s IP address pool starting value.

- **End IP Address**
  The DHCP server's IP address pool ending value.

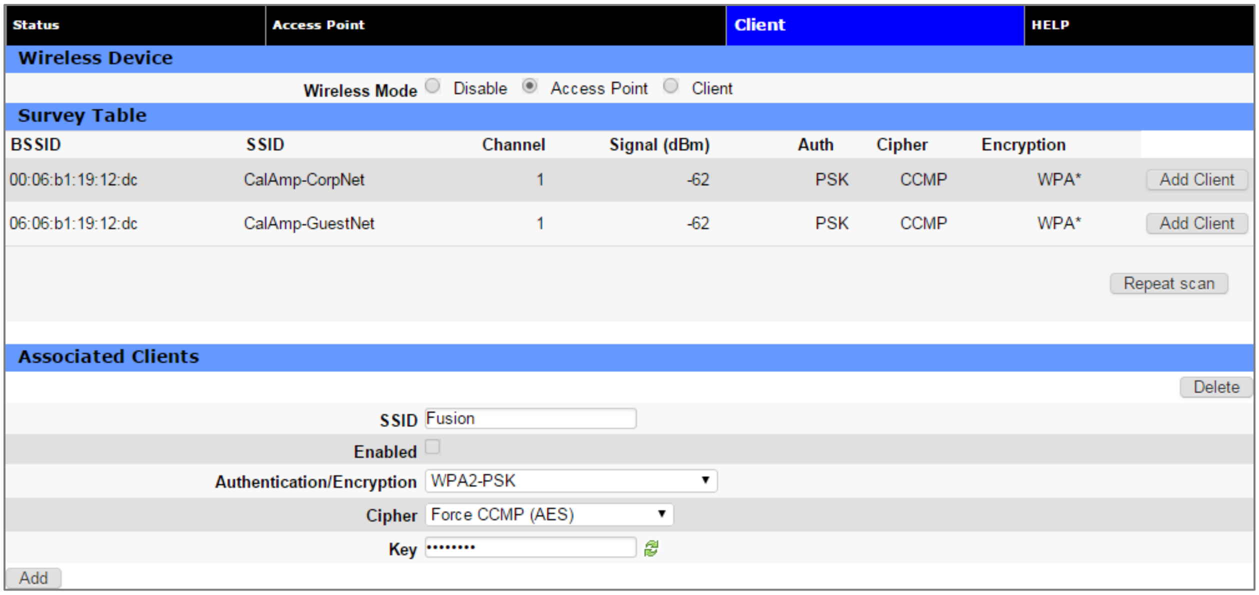
- **Lease Time**
  Sets the duration, in seconds, that the client is allowed to keep the assigned IP address.

3.4.3 CLIENT

The user can configure up to 20 Access Points. The Vanguard Cellular Broadband Router will try to connect to the best Access Point in the list that is reachable. When the Vanguard unit connects to an Access Point, it starts a DHCP client on the interface. The Access Point must provide a DHCP server. The DHCP server must provide an IP address, network mask and gateway to the Vanguard unit. When the Vanguard unit is connected to an Access Point, the default route is set to point to the gateway address obtained from the DHCP server.

Note: The Access Point must broadcast the SSID in order for the Client to be able to connect to it.

Figure 35: WLAN — Client



Wireless Device

Wireless Mode ○ Disable ● Access Point ○ Client

Survey Table

BSSID	SSID	Channel	Signal (dBm)	Auth	Cipher	Encryption	
00:06:b1:19:12:dc	CalAmp-CorpNet	1	-62	PSK	CCMP	WPA*	Add Client
06:06:b1:19:12:dc	CalAmp-GuestNet	1	-62	PSK	CCMP	WPA*	Add Client

Associated Clients

SSID	Fusion
Enabled	□
Authentication/Encryption	WPA2-PSK
Cipher	Force CCMP (AES)
Key	••••••••

Wireless Devices

- **Wireless Mode**
  See Table 11: Explanation of Wireless Mode options.

Survey Table

When the WLAN interface of the Vanguard unit is configured for Client mode, this page scans for and displays the WLAN Access Points that it detects. (This operation can take some time to complete.)

- **BSSID**
  BSSIDs Identify Access Points and Their Clients.

- **SSID**
  Broadcasted SSID of the wireless network.

- **Channel**
  Specifies the wireless channel to use.

- **Signal**
  Signal strength of the network.

- **Auth**
  Type of Authentication used.

- **Cipher**
  Type of Ciphers used for encryption.

- **Encryption**
  Type of Encryption used.

Click **Add Client** to add the Access Point to the Associated Clients table.

Click **Repeat Scan** to force the Vanguard to scan for WLAN Access Points.

Associated Clients

Click Add to manually add a WLAN Access Point.

- **SSID**
  Enter the SSID of the wireless network.

- **Enabled**
  Select Enabled to activate a particular client.

- **Authentication/Encryption**
  Select the wireless encryption method. Extra fields may display depending on the selected type.

- **Cipher**
  Type of Ciphers used for encryption. Select CCMP (Counter Mode CBC-MAC Protocol) or TKIP (Temporal Key Integrity Protocol).

The following table shows the SSID, types of authentication methods available and corresponding encryption methods.

Table 12: Authentication and encryption methods

Authentication	Encryption
Open	none, WEP
Shared	WEP
WPA none	TKIP, AES
WPA–PSK	TKIP, AES
WPA2–PSK	AES

The following table describes WEP keys (ASCII and Hexadecimal; 64-bit and 128-bit) and gives examples.

Table 13 Descriptions of WEP keys and examples

WEP Key	64-bit	128-bit
ASCII (Text)	5 character string (alphanumeric) Example: Hello	13-character string (alphanumeric) Example: LongHello1234
Hex	10 Hexadecimal digits Example: 1A2B3C4D5E	26 Hexadecimal digits Example: 1A2B3C4D5E6F7788990A0B0C0D

The following table describes TKIP keys.

Table 14: TKIP key description and example

TKIP Key	Description	Example
ASCII (Text)	A string of 8 to 63 characters (alphanumeric)	Hello123

The following table describes AES keys.

Table 15: AES key description and example

AES Key	Description	Example
ASCII (Text)	A string of 8 to 63 character (alphanumeric)	Hello123

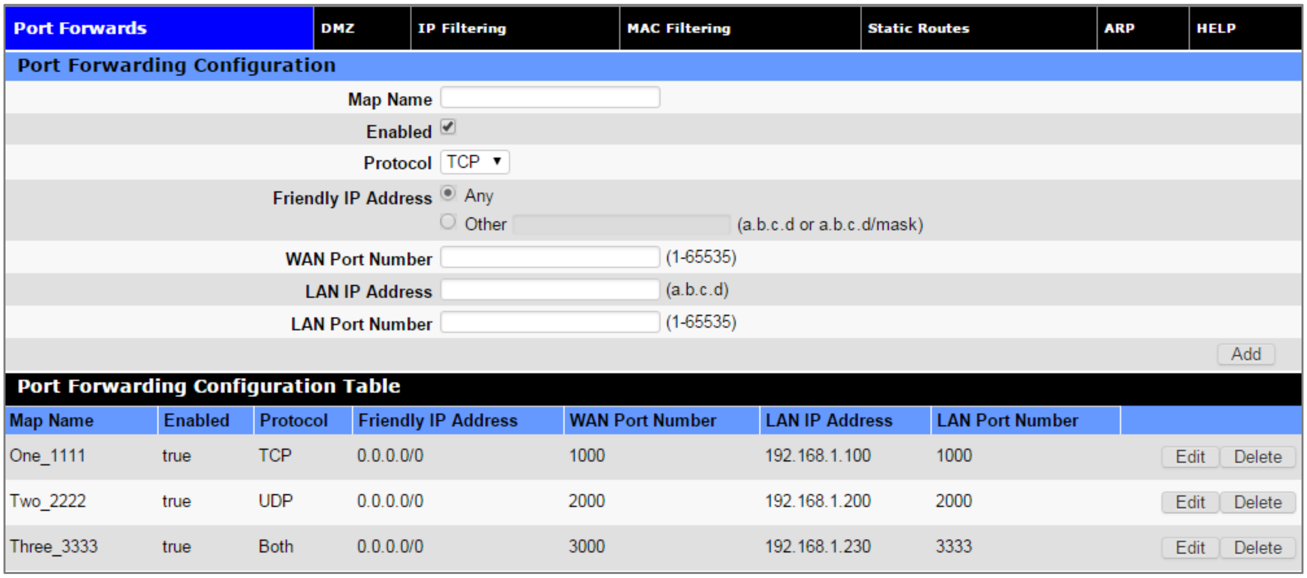
3.5 ROUTER

Select **Router** from the left navigation pane to access the Port Forwards, DMZ, IP Filtering, MAC Filtering , Static Routing and ARP tabs.

3.5.1 PORT FORWARDS

Port Forwarding is a technique for transmitting and receiving network traffic through a router that involves re-writing the destination IP addresses and optionally the TCP/UDP port numbers of IP packets as they pass through. The various routing configurations will be displayed in the IP Forwarding Configuration Table at the bottom of the Port Forwards page.

Figure 36: Router — Port Forwards



Port Forwarding Configuration

Map Name	
Enabled	☑
Protocol	TCP ▾
Friendly IP Address	● Any ○ Other (a.b.c.d or a.b.c.d/mask)
WAN Port Number	(1-65535)
LAN IP Address	(a.b.c.d)
LAN Port Number	(1-65535)

Port Forwarding Configuration Table

Map Name	Enabled	Protocol	Friendly IP Address	WAN Port Number	LAN IP Address	LAN Port Number	
One_1111	true	TCP	0.0.0.0/0	1000	192.168.1.100	1000	Edit Delete
Two_2222	true	UDP	0.0.0.0/0	2000	192.168.1.200	2000	Edit Delete
Three_3333	true	Both	0.0.0.0/0	3000	192.168.1.230	3333	Edit Delete

Port Forward Configuration

- **Map Name**
  Sets an identifying name for the Port Forwarding Configuration Table at the bottom of the page. The Map Name can be up to ten characters in length. Do not use spaces in the character string.

- **Enabled**
  Port forwarding entries can be enabled or disabled individually.

- **Protocol**
  Sets the data protocol as either TCP, UDP or both.

- **Friendly IP Address**
  Specifies an IP address or subnet that is allowed to access the modem. Choose the Any radio-button to allow any address.

- **WAN Port Number**
  Sets the external port number for incoming requests. (Note: Port Forwarding will be ignored if the port number is already in use by another Vanguard service (e.g. serial port, HTTP/HTTPS web pages).)

- **LAN IP Address**
  Sets the IP Address of the destination host. Inbound requests will be forwarded to this IP address.

- **LAN Port Number**
  Sets port number used when forwarding to the destination IP address.

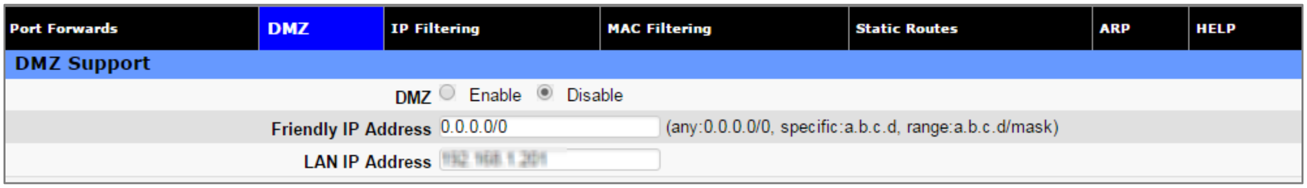
Port Forwarding Configuration Table

This section contains user-added port forwarding entries.

- **Edit**
  Click the Edit button to edit an existing filter.

- **Delete**
  Click the Delete button to delete an existing filter.

3.5.2 DMZ



DMZ Support

DMZ ○ Enable ● Disable

Friendly IP Address 0.0.0.0/0 (any:0.0.0.0/0, specific:a.b.c.d, range:a.b.c.d/mask)

LAN IP Address [redacted]

DMZ Support

DMZ is a host on the internal network that will receive all TCP and/or UDP packets that arrive at the WAN interface, except those ports specified otherwise for Vanguard services (e.g. serial port, HTTP/HTTPS web pages) or Port Forwarding.

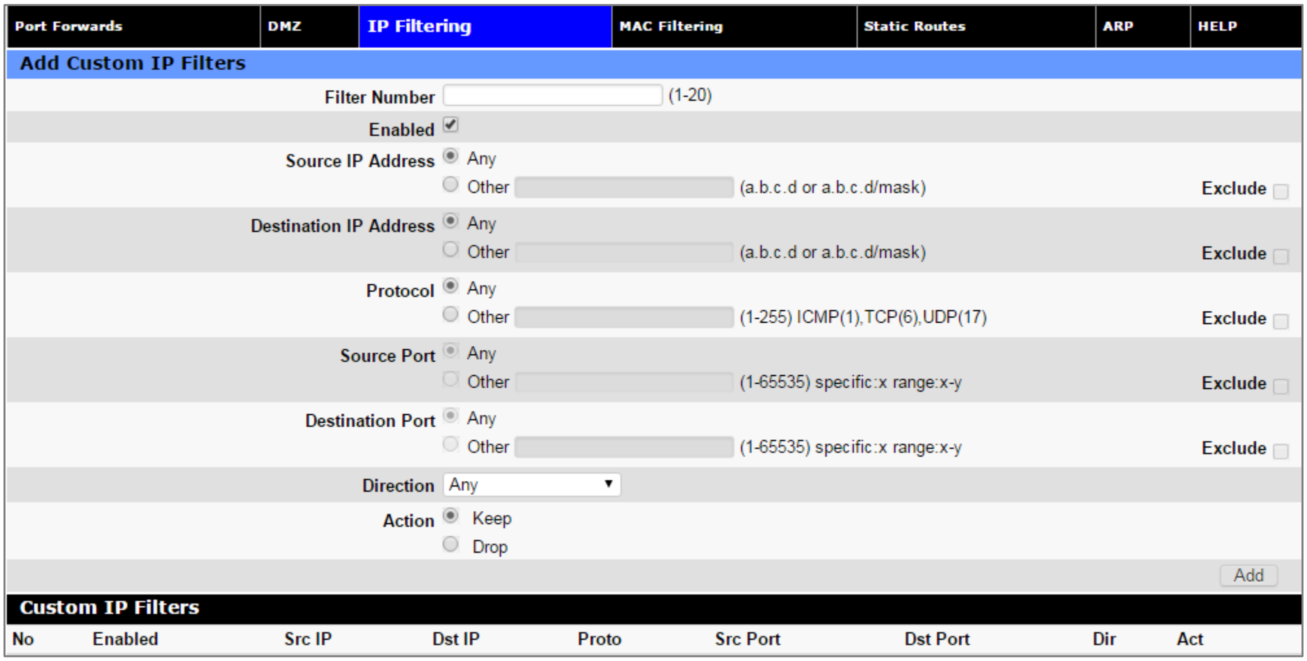
- **DMZ**
  Select **Enable** to allow the modem to forward packets to the address set in the Destination IP Address. Select **Disable** to shut down the DMZ functionality.

- **Friendly IP Address**
  Optionally restricts DMZ forwarding to only those packets received from the specified IP address(es). If set to **0.0.0.0**, packets from all senders are forwarded.

- **LAN IP Address**
  The IP address which has all ports exposed, except ports defined in the Port Forwarding configuration.

3.5.3 IP FILTERING

Figure 37: Router — IP Filtering



Add Custom IP Filters

Filter Number	(1-20)		
Enabled	☑		
Source IP Address	● Any ○ Other	(a.b.c.d or a.b.c.d/mask)	Exclude □
Destination IP Address	● Any ○ Other	(a.b.c.d or a.b.c.d/mask)	Exclude □
Protocol	● Any ○ Other	(1-255) ICMP(1),TCP(6),UDP(17)	Exclude □
Source Port	● Any ○ Other	(1-65535) specific:x range:x-y	Exclude □
Destination Port	● Any ○ Other	(1-65535) specific:x range:x-y	Exclude □
Direction	Any ▾		
Action	● Keep ○ Drop		

Custom IP Filters

No	Enabled	Src IP	Dst IP	Proto	Src Port	Dst Port	Dir	Act

ADD CUSTOM IP Filters

You can define up to 20 IP filters. Each IP filter is identified by a unique number (from 1 to 20). Click Add to add the filter to the Custom IP Filters table. Once all filters have been added, click Save & Apply to save all changes.

An IP packet goes through the filtering logic:

1) An IP packet is received on one of the interfaces and is destined to the Vanguard unit
   OR
2) An IP packet is sent by the Vanguard unit
   OR
3) An IP packet is forwarded by the Vanguard unit.

The filtering logic is the following:

if exists(filter[1]) AND match(packet, filter[1]) then apply(action[1])
else if exists(filter[2]) AND match(packet, filter[2]) then apply(action[2])
else if exists(filter[3]) AND match(packet, filter[3]) then apply(action[3])…

else if exists(filter[20]) AND match(packet, filter[20]) then apply(action[20])
else process packet normally.

Where:

exists(filter[n]) -> The user as defined filter number n.
match(packet, filter[n]) -> The IP packet matches filter number n.
apply(action[n]) -> The action identified in filter number n.

Each criteria has an Any radio-button that matches all values for that criteria.

Each criteria has an Exclude check-box that inverts the sense of the match.

- **Filter Number**
  Each IP filter is identified by a unique number from 1 to 20. Use Add to create new rules; use Edit to update existing rules.

- **Enabled**
  Each IP filter can be independently enabled or disabled.

- **Source IP Address**
  The source IP Address or subnet that will satisfy this criteria.

  If the **Exclude** field is checked, it means that in order for the packet to match with this criteria, it must NOT have this source IP address (or NOT be in the given source IP address range).

- **Destination IP Address**
  The destination IP Address or subnet that will match.

  If the **Exclude** field is checked, it means that for the packet to match this filter, it must NOT have this destination IP address (or NOT be in the given destination IP address range).

- **Protocol**
  The protocol number that will satisfy this criteria.

  If the Exclude field is checked, it means that for the packet to match this filter, it must NOT have this protocol number.

- **Source Port**
  The source port number that will satisfy this criteria. This field is only enabled when the Protocol is TCP(6) or UDP(17).

  If the Exclude field is checked, it means that for the packet to match this filter, it must NOT have this source port number (or NOT be in the given source port number range).

- **Destination Port**
  The destination port number that will satisfy this criteria. This field is only enabled when the Protocol is TCP(6) or UDP(17).

  If the Exclude field is checked, it means that for the packet to match this filter, it must NOT have this destination port number (or NOT be in the given destination port number range).

- **Direction**
  The direction corresponds to the path taken by the IP packet inside the Vanguard unit.

An IP packet can TERMINATE inside the Vanguard unit.

WAN to Vanguard: The IP packet is received from the WAN (cellular) interface and is destined to the Vanguard unit.

LAN to Vanguard:The IP packet is received from the LAN interface and is destined to the Vanguard unit.

WLAN to Vanguard: The IP packet is received from the Wi-Fi interface and is destined to the Vanguard unit.

An IP packet can ORIGINATE from the Vanguard unit.

Vanguard to WAN: The IP packet is sent by the Vanguard unit to the WAN (cellular) interface.

Vanguard to LAN:The IP packet is sent by the Vanguard unit to the LAN interface.

Vanguard to WLAN: The IP packet is sent by the Vanguard unit to the ADD CUSTOM interface.

An IP packet can be FORWARDED by the Vanguard unit.

WAN to LAN: The IP packet is received on the WAN(cellular) interface and forwarded to the LAN interface.

WAN to WLAN: The IP packet is received on the WAN(cellular) interface and forwarded to the ADD CUSTOM interface.

LAN to WAN: The IP packet is received on the LAN interface and forwarded to the WAN (cellular) interface.

LAN to WLAN: The IP packet is received on the LAN interface and forwarded to the ADD CUSTOM interface.

WLAN to LAN: The IP packet is received on the ADD CUSTOM interface and forwarded to the LAN interface.

WLAN to WAN: The IP packet is received on the ADD CUSTOM interface and forwarded to the WAN (cellular) interface.

If the **Exclude** field is checked, it means that for the packet to match this filter, it must NOT be processed in the given direction.

- **Action**
  Keep: If IP filtering is enabled and an IP packet matches all criteria in the IP filter, keep the IP packet (continue normal processing of the IP packet).
  Drop: If IP filtering is enabled and an IP packet matches all criteria in the IP filter, drop the IP packet.

Custom IP Filters

Displays list of configured Custom IP filters.

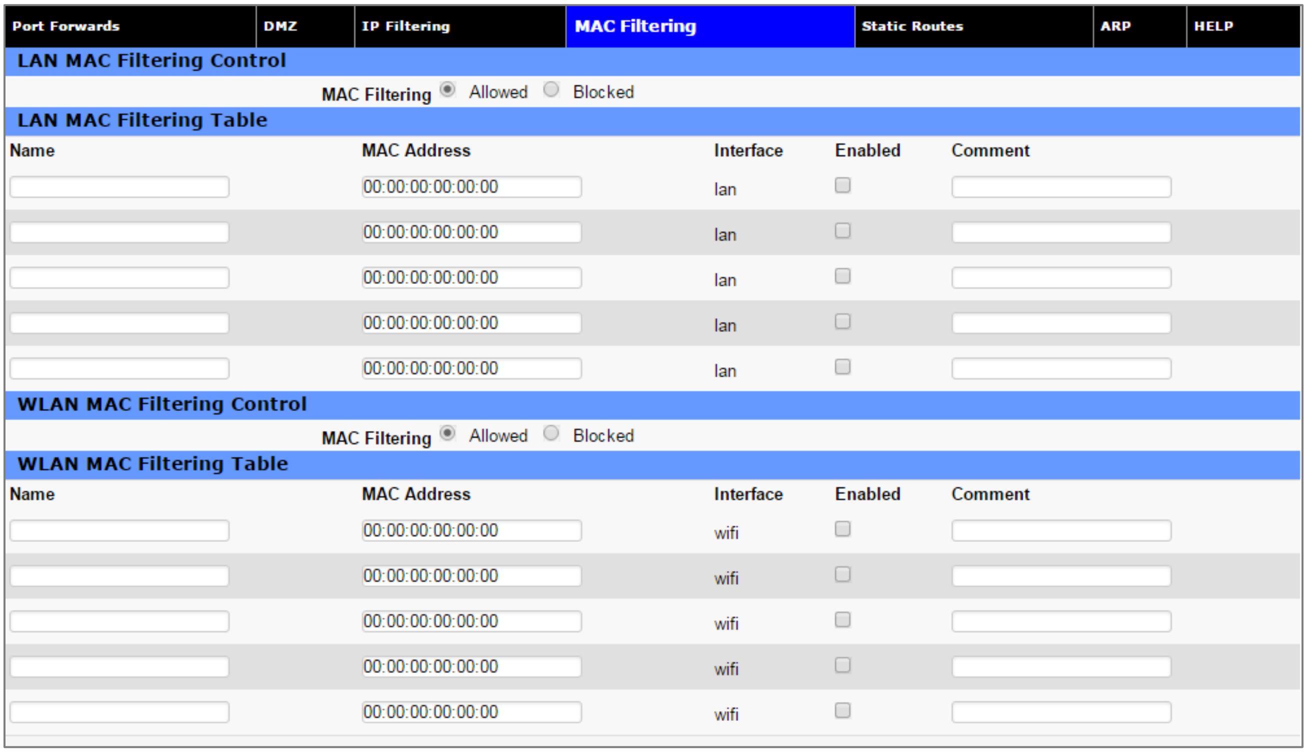
- **Edit**
  Click **Edit** to edit the selected filter.

- **Delete**
  Click **Delete** to delete a filter.

3.5.4 MAC FILTERING

The MAC Filtering tab opens the MAC filtering configuration page. MAC filtering allows up to five device MAC addresses to be entered for the LAN, and WLAN if installed, interfaces. The specific MAC addresses can either be the only addresses allowed to access the device and network (whitelist) or can be blocked from the device and network, allowing all other addresses through (blacklist).

Figure 38: LAN — MAC Filtering



LAN MAC Filtering Control

MAC Filtering ● Allowed ○ Blocked

LAN MAC Filtering Table

Name	MAC Address	Interface	Enabled	Comment
	00:00:00:00:00:00	lan	□	
	00:00:00:00:00:00	lan	□	
	00:00:00:00:00:00	lan	□	
	00:00:00:00:00:00	lan	□	
	00:00:00:00:00:00	lan	□	

WLAN MAC Filtering Control

MAC Filtering ● Allowed ○ Blocked

WLAN MAC Filtering Table

Name	MAC Address	Interface	Enabled	Comment
	00:00:00:00:00:00	wifi	□	
	00:00:00:00:00:00	wifi	□	
	00:00:00:00:00:00	wifi	□	
	00:00:00:00:00:00	wifi	□	
	00:00:00:00:00:00	wifi	□	

LAN and WLAN MAC Filtering

- **MAC Filtering**
  Select **Allowed** or **Blocked** to define the type of filter configured.

- **Name**
  Name of the MAC filter rule.

- **MAC Address**
  Enter the MAC address for a device to be allowed or blocked on the network.

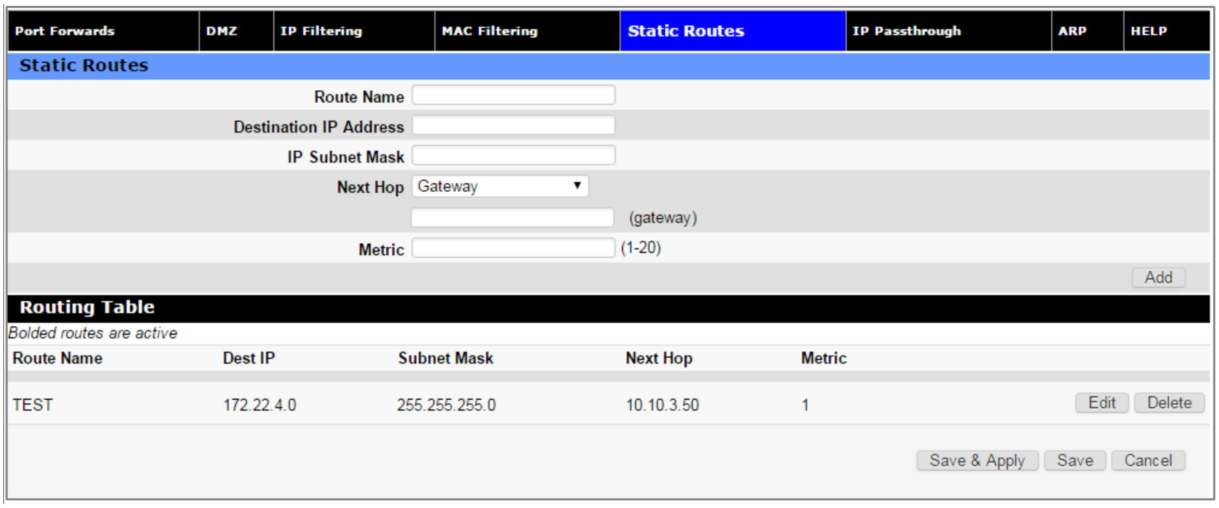
- **Comment**
  Enter an optional comment that describes the device at the allowed MAC address.

- **Enable**
  Check the box to activate the given filter.

3.5.5 STATIC ROUTES

Select the Static Routes tab to open the routing configuration page. Static route tables may be created in this page and appear at the bottom. Static Routing refers to a manual method used to set up routing between networks.

Figure 39: Router — Static Routes



Static Routes

Route Name	
Destination IP Address	
IP Subnet Mask	
Next Hop	Gateway ▾
	(gateway)
Metric	(1-20)

Routing Table

Bolded routes are active

Route Name	Dest IP	Subnet Mask	Next Hop	Metric
TEST	172.22.4.0	255.255.255.0	10.10.3.50	1

Static Routes

- **Route Name**
  Sets an identifying name for the entry in the Static Route table.

- **Destination IP Address**
  Sets the IP address of the destination network.

- **IP Subnet Mask**
  Sets the subnet mask of the destination network.

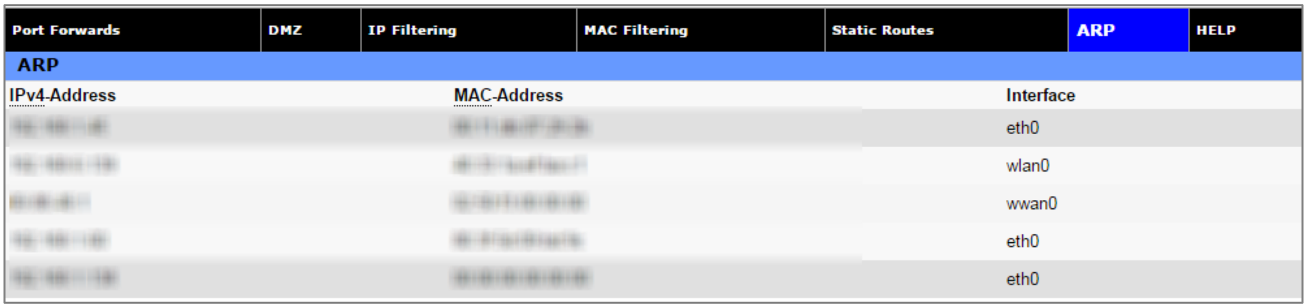
- **Next Hop**
  Identifies how packets should be forwarded to reach the destination network. If the destination network is reachable via LAN, WLAN or PPTP tunnel, a Gateway IP address must be specified. If reachable via cell interface (WAN) or a PPTP client tunnel, the gateway IP address does not need to be specified.

- **Metric**
  Enter a number from 1 to 20. The lower the metric value the higher the route priority.

3.5.6 ARP

Clicking Router > ARP displays the Address Resolution Protocol (ARP) table, which shows IP addresses, the corresponding MAC address on the physical layer, and the interface known to the Vanguard router.

Figure 40: Router — ARP



ARP

IPv4-Address	MAC-Address	Interface
[redacted]	[redacted]	eth0
[redacted]	[redacted]	wlan0
[redacted]	[redacted]	wwan0
[redacted]	[redacted]	eth0
[redacted]	[redacted]	eth0

- **IPv4-Address**
  IP Address of the device on one of the local interfaces (LAN or WLAN) with the specified MAC Address.

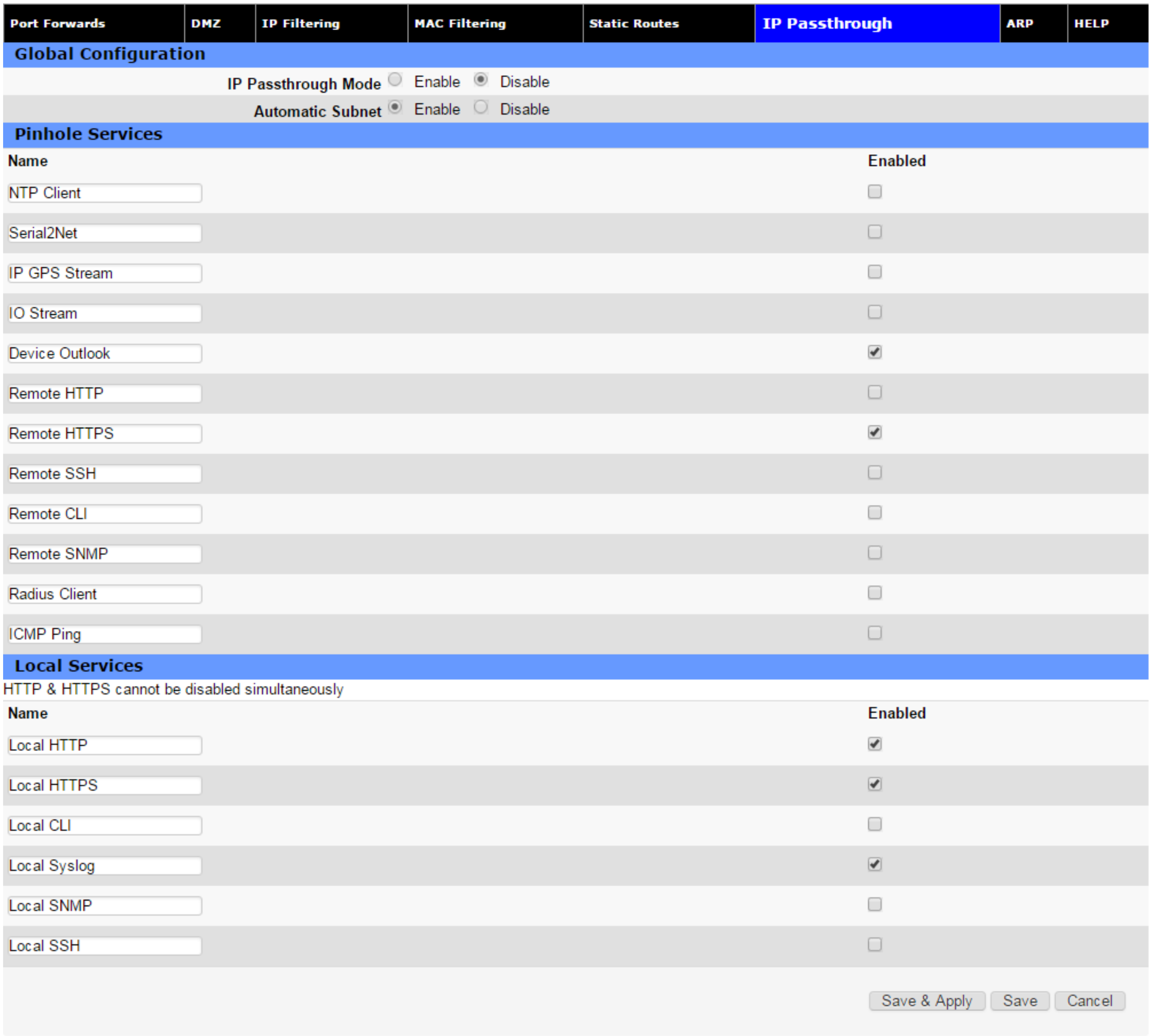
- **MAC Address**
  The MAC Address of the locally connected device.

- **Interface**
  The interface on which the device was located.

3.5.7 IP PASSTHROUGH

IP Passthrough (IPP) will allow user to configure IP Passthrough on Vanguard router.

Figure 41: IP Passthrough



Global Configuration

IP Passthrough Mode ○ Enable ● Disable

Automatic Subnet ● Enable ○ Disable

Pinhole Services

Name	Enabled
NTP Client	□
Serial2Net	□
IP GPS Stream	□
IO Stream	□
Device Outlook	☑
Remote HTTP	□
Remote HTTPS	☑
Remote SSH	□
Remote CLI	□
Remote SNMP	□
Radius Client	□
ICMP Ping	□

Local Services

HTTP & HTTPS cannot be disabled simultaneously

Name	Enabled
Local HTTP	☑
Local HTTPS	☑
Local CLI	□
Local Syslog	☑
Local SNMP	□
Local SSH	□

GLOBAL CONFIGURATION

- **IP Passthrough Mode:**

Select "Enabled" when you want the IP address of WAN to be assigned to single Ethernet device. Most of the routing mode services- Port Forwarding, DMZ, IP-Filter, MAC-Filter, Static Routes; WLAN and Security services- IPSEC, GRE, PPTP, OpenVPN will not be available in this mode.

Select "Disabled" when you want normal working of Vanguard router. All the router feature will be available in this mode.

- **Automatic Subnet:**

Select "Enabled" when you want WAN subnet assigned by ISP to be passed to device connected to Ethernet interface by DHCP.

Select "Disabled" when you want fixed /24 subnet to be passed to the device connected on Ethernet interface by DHCP.

Notes:

Change in router mode from IP Passthrough to non-IP Passthrough or vice versa is Service Affecting and causes the IMMEDIATE Reboot of the device. Configuration change in IP Passthrough mode will not be carried over when the router mode is switched back to non-IP Passthrough mode.

Change in Automatic Subnet value will take effect in the next IP allocation on WAN.

PINHOLE SERVICES

- **Name**:

Name of the Pinhole service.

- **Enabled:**

Check the checkbox if a Pinhole service is to be enabled otherwise the Pinhole service will be disabled.

Enabling a Pinhole service redirects the respective incoming traffic to Vanguard, though it has destination IP as WAN IP which is allocated to Ethernet device.

Also outgoing traffic from Vanguard of respective services would have source IP as WAN IP to enable its routing on WAN, though WAN IP is possessed by Ethernet device.

Note:

Enabling a pinhole service would require its related configuration to be enabled from other configuration screens. e.g. Enabling the Remote HTTPS pinhole service would still require Remote HTTPS to be enabled from Remote Admin screen to make it work end-to-end.

- **NTP Client:**

Enabling this service will allow NTP traffic redirect to configured NTP server on port 123 from Vanguard in IPP mode.

- **Serial2NET:**

Enabling this service will allow Ext-PAD traffic redirect to Vanguard on its configured Ext-PAD TCP/UDP port in IPP mode.

- **IP GPS Stream:**

Enabling this service will allow GPS Manager clients connectivity from/to WAN to/from Vanguard over configured GPS Manager ports in IPP mode.

- **IO Stream:**

Enabling this service will allow IO Manager connectivity from/to WAN to/from Vanguard over configured IO Agent Port in IPP mode.

- **Device Outlook:**

Enabling this service will allow DO connectivity of Vanguard to configured DO server in IPP mode.

- **Remote HTTP:**

Enabling this service will allow remote HTTP client to connect to Vanguard from WAN in IPP mode on configured port.

- **Remote HTTPS:**

Enabling this service will allow remote HTTPS client to connect to Vanguard from WAN in IPP mode on configured port.

- **Remote SSH:**

Enabling this service will allow remote SSH client to connect to Vanguard from WAN in IPP mode on configured port.

- **Remote CLI:**

Enabling this service will allow remote CLI client to connect to Vanguard from WAN in IPP mode on configured port.

- **Remote SNMP:**

Enabling this service will allow remote SNMP client to connect to Vanguard from WAN in IPP mode on configured port.

- **Radius Client:**

Enabling this service will allow Vanguard to perform Radius Authentication for Vanguard login in IPP mode for configured radius server and port.

- **ICMP Ping:**

Enabling this service will allow incoming and outgoing ICMP traffic to redirect from/to Vanguard to/from WAN for all destination/source.

LOCAL SERVICES

- **Name:**

Name of the service accessible on LAN interface.

- **Enabled:**

Check the checkbox if a Local service is to be enabled over LAN. By default except DHCP, ICMP, outgoing HTTP, IO Manager and GPS Manager clients all the traffic is blocked on LAN.

Enabling a local service will allow selected traffic to be ACCEPTed on LAN.

- **Local HTTP:**

Enabling this service will allow LAN HTTP client to connect to Vanguard in IPP mode on configured port.

- **Local HTTPS:**

Enabling this service will allow LAN HTTPS client to connect to Vanguard in IPP mode on configured port.

- **Local CLI:**

Enabling this service will allow LAN CLI client to connect to Vanguard in IPP mode on configured port.

- **Local Syslog:**

Enabling this service will allow Vanguard to send syslog on configured server and configured port on LAN.

- **Local SSH:**

Enabling this service will allow LAN SSH client to connect to Vanguard in IPP mode on configured port.

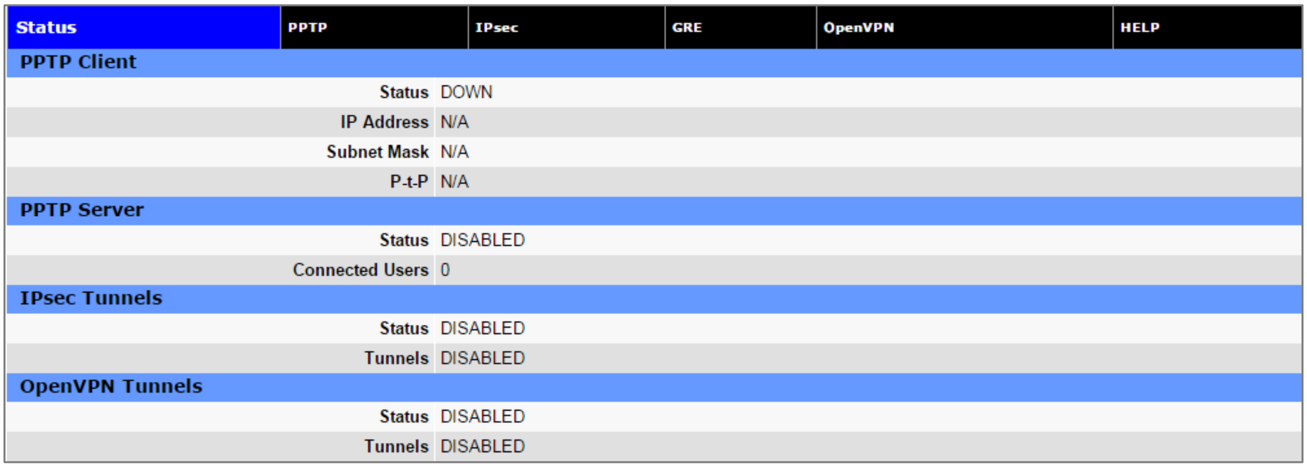
- **Local SNMP:**

Enabling this service will allow LAN SNMP client to connect to Vanguard in IPP mode on configured port.

3.6 SECURITY

3.6.1 STATUS

Figure 42: Security — Status



PPTP Client	
Status	DOWN
IP Address	N/A
Subnet Mask	N/A
P-t-P	N/A
PPTP Server	
Status	DISABLED
Connected Users	0
IPsec Tunnels	
Status	DISABLED
Tunnels	DISABLED
OpenVPN Tunnels	
Status	DISABLED
Tunnels	DISABLED

PPTP Client

- **Status**
  Indicates the status of the PPTP Client interface, usually UP when connected properly. PPTP is the Point-to-Point Tunneling Protocol used to implement a Virtual Private Network (VPN).

- **IP Address**
  The current IP address assigned to the modem by the VPN server.

- **Subnet Mask**
  Usually set to 255.255.255.255, but may be different depending on VPN.

- **P-t-P**
  The PPTP P-t-P is the LAN address of your VPN server.

PPTP Server

- **Status**
  The PPTP Server is either Enabled or Disabled based on user's selection on Security page.

- **Connected Users**
  Number of users currently connected to the PPTP Server.

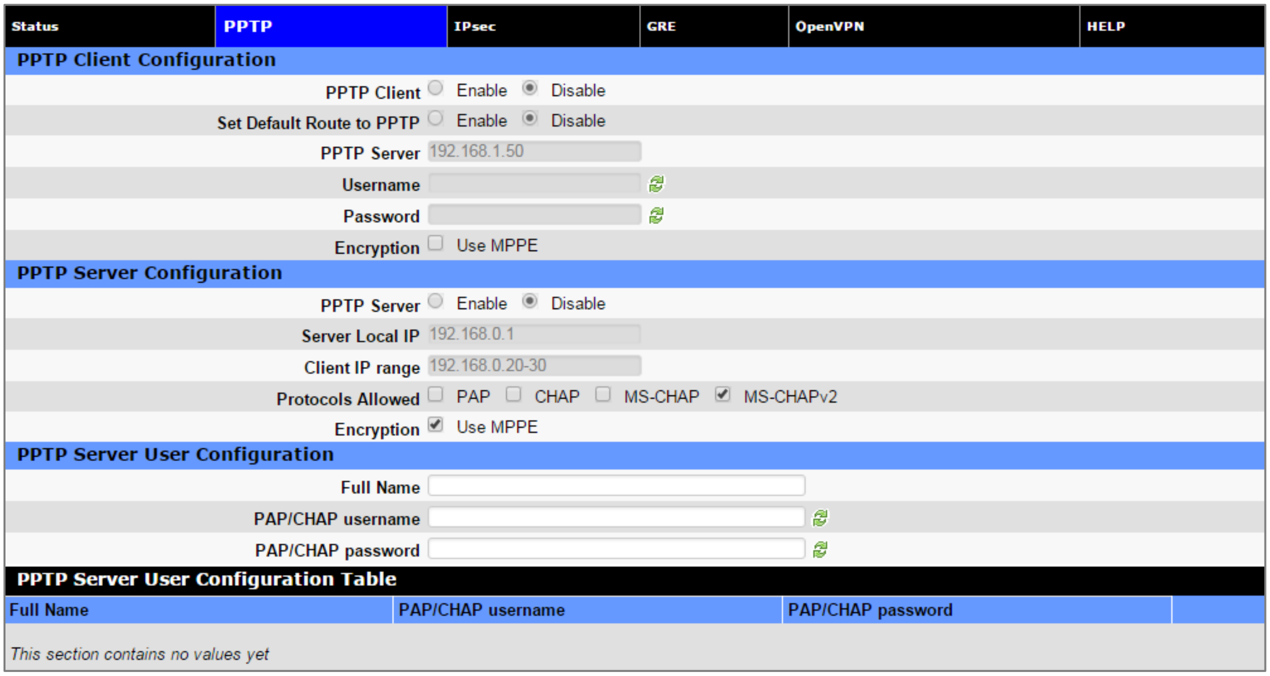
IPsec Tunnels

- **Status**
  The number of established IPsec tunnels based on the number of tunnels Enabled on the Security | IPsec page.

3.6.2 PPTP

The Point-to-Point Tunneling Protocol (PPTP) is a method for implementing virtual private networks (VPN).

Figure 43: Security — PPTP



PPTP Client Configuration

PPTP Client	○ Enable ● Disable
Set Default Route to PPTP	○ Enable ● Disable
PPTP Server	192.168.1.50
Username	
Password	
Encryption	□ Use MPPE

PPTP Server Configuration

PPTP Server	○ Enable ● Disable
Server Local IP	192.168.0.1
Client IP range	192.168.0.20-30
Protocols Allowed	□ PAP □ CHAP □ MS-CHAP ☑ MS-CHAPv2
Encryption	☑ Use MPPE

PPTP Server User Configuration

Full Name	
PAP/CHAP username	
PAP/CHAP password	

PPTP Server User Configuration Table

Full Name	PAP/CHAP username	PAP/CHAP password
This section contains no values yet		

PPTP Client Configuration

- **PPTP Client**
  Selecting **Enable** will allow the PPTP functionality. Selecting **Disable** will shut off PPTP functionality.

- **Set Default Route to PPTP**
  Selecting **Enable** will route all IP traffic through the PPTP network. Selecting **Disable** will route only PPTP traffic through the PPTP network.

- **PPTP Server**
  The IP address of the virtual private network server on which to connect.

- **Username**
  The username required by the VPN server.

- **Password**
  The password, associated with the username, required by the VPN server.

- **Encryption**
  Selecting **Use MPPE** will enable Microsoft Point-to-Point Encryption for communication between the server and clients. This option requires the MS-CHAP or MS-CHAPv2 protocol.

PTPP Server Configuration

- **PPTP Server**
  Selecting **Enable** starts the VPN server, and selecting Disable stops it.

- **Server Local IP**
  The IP address that clients will use to communicate with the server after they connect.

- **Client IP Range**
  The pool of IP addresses assigned to clients.

- **Protocols Allowed**
  Selecting a protocol will instruct the VPN server to accept clients who use that protocol. The server will reject clients using any of the un-selected protocols.

- **Encryption**
  Selecting **Use MPPE** will enable Microsoft Point-to-Point Encryption for communication between the server and clients. This option requires the MS-CHAP or MS-CHAPv2 protocol.

PPTP Server User Configuration

- **Full Name**
  This name can be used as a more descriptive name for a client. It is not used by the server. No spaces are allowed in the name.

- **PAP/CHAP Username**
  The name used by a client to log in to the server.

- **PAP/CHAP Password**
  The password, with associated username, used by a client to log in to the server.

PPTP Server User Configuration Table

Displays list of user- configured PPTP servers user credentials.

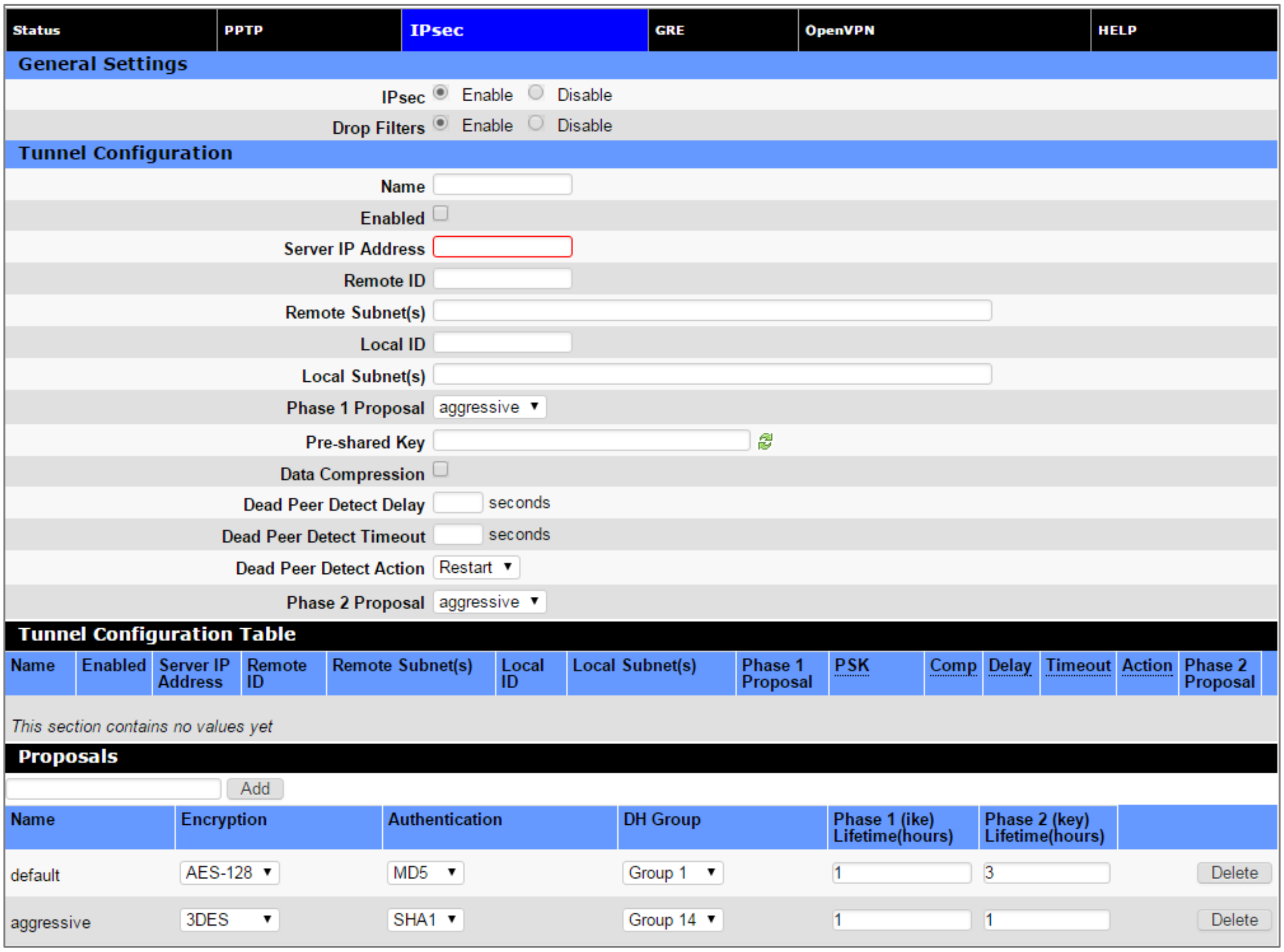
- **Edit**
  Click **Edit** to edit the selected filter.

- **Delete**
  Click **Delete** to delete a filter.

3.6.3 IPSEC

IPsec serves to configure secured communication tunnels. The various tunnel configurations will be displayed in the Tunnel Configuration Table. All tunnels are created using the ESP (Encapsulating Security Payload) protocol.

Figure 44: Security — IPsec



General Settings

IPsec ● Enable ○ Disable

Drop Filters ● Enable ○ Disable

Tunnel Configuration

Name	
Enabled	□
Server IP Address	
Remote ID	
Remote Subnet(s)	
Local ID	
Local Subnet(s)	
Phase 1 Proposal	aggressive ▾
Pre-shared Key	
Data Compression	□
Dead Peer Detect Delay	seconds
Dead Peer Detect Timeout	seconds
Dead Peer Detect Action	Restart ▾
Phase 2 Proposal	aggressive ▾

Tunnel Configuration Table

Name	Enabled	Server IP Address	Remote ID	Remote Subnet(s)	Local ID	Local Subnet(s)	Phase 1 Proposal	PSK	Comp	Delay	Timeout	Action	Phase 2 Proposal

This section contains no values yet

Proposals

Add

Name	Encryption	Authentication	DH Group	Phase 1 (ike) Lifetime(hours)	Phase 2 (key) Lifetime(hours)	
default	AES-128 ▾	MD5 ▾	Group 1 ▾	1	3	Delete
aggressive	3DES ▾	SHA1 ▾	Group 14 ▾	1	1	Delete

IPSec Configuration

- **IPsec**
  All IPsec functionality can be Enabled/Disabled with this control.

- **Drop Filters**
  This setting controls how packets for the Remote Subnet(s) are handled when an enabled tunnel is down. When Enabled, packets that would normally go through the tunnel are discarded when the tunnel is down. When Disabled, packets are routed through the appropriate interface. Their source address may be rewritten by NAT but the destination address is unchanged. Most carriers will discard packets with "private IP" (e.g. 192.168.x.x) destination addresses but some carriers may quietly block any further traffic over the cellular connection.

Tunnel Configuration

The Local and Remote Subnets are used to select the IP packets that are encrypted and sent in the tunnel. The Source IP address is compared against the Local Subnet and the Destination IP address is compared against the Remote Subnet(s).

- **Name**
  A name for the IPsec tunnel. Once a tunnel is defined, it can be enabled by checking the Enable box. To edit an existing tunnel (these are displayed in the Tunnel Configuration Table), click the **Edit** button to the right of the table entry and the saved values are displayed for editing.

- **Enabled**
  Check Enable to enable a tunnel.

- **Server IP Address**
  The public IP address of the remote IPsec server or the firewall in front of the IPsec server.

- **Remote ID**
  The IP address of the remote IPsec server. Usually empty if the IPsec server is not behind a firewall.

- **Remote Subnet**
  Enter the IP address/mask of the network(s) beyond the Server IP Address.
  More than one remote subnet can be specified -- each subnet must be separated by a comma ',' and no spaces are allowed.
  Examples:
  One subnet: 192.168.100.0/24
  Many subnets: 192.168.100.0/24,192.168.101.0/24,192.168.102.33/32

- **Local ID**
  The IPSec server may require that your end of the tunnel identifies itself. Configure this end, if needed.

- **Local Subnet**
  Enter an IP address/mask of the local LAN whose are packets are to be encrypted and sent over the tunnel. (LAN Settings » Bind to Eth IP may need to be enabled to make sure that packets generated by Vanguard services appear to originate from the local LAN address.).

- **Phase 1 Proposal**
  Select an entry from the Proposal table.

- **Pre-shared Key**
  Predetermined key known to both the local unit and the remote side prior to establishing the tunnel.

- **Data Compression**
  Select if data compression is desired.

- **Dead Peer Detect Delay**
  Tunnel keep alive time for R_U_THERE packets during idle periods.

- **Dead Peer Detect Timeout**
  Timeout time during tunnel idle periods where no R_U_THERE_ACK has been received.

- **Dead Peer Detection Action**
  Action to be taken when timeout value is reached.

- **Phase 2 Proposal**
  Select an entry from the Proposal table.

Tunnel Configuration Table

- **Edit**
  Click the **Edit** button to edit the properties of a tunnel.

- **Delete**
  Click the **Delete** button to delete the tunnel.

Proposals

The Phase 1 and Phase 2 Encryption, Authentication, DH Group and Life Time parameters can be changed from this section. The Delete button is displayed only for proposals that are not referenced by any Tunnel configurations.

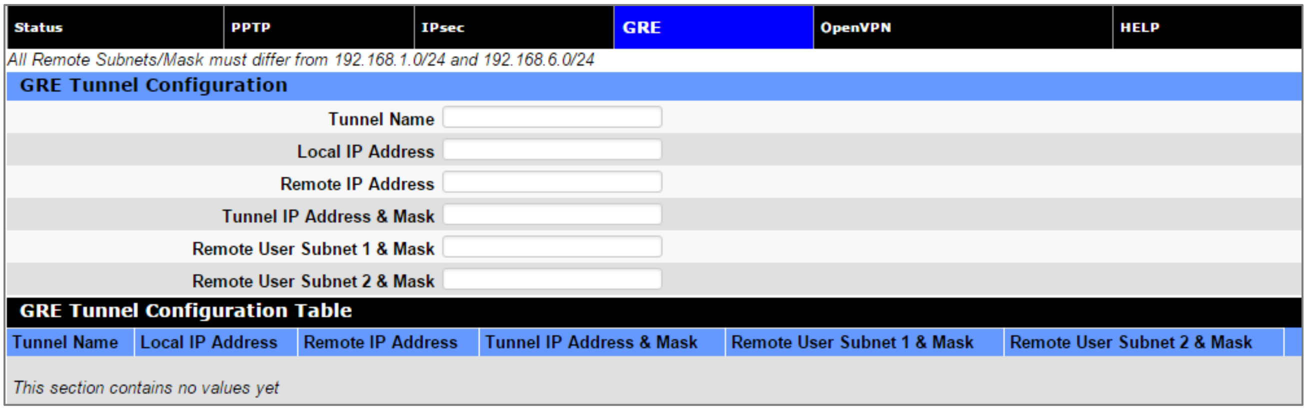
3.6.4 GRE

The GRE page is used to add and delete GRE (Generic Route Encapsulation) tunnels. Current tunnels are listed below. Up to two networks that lie beyond the tunnel may be specified and routes to those networks are automatically created when the tunnel is established. Static local and remote IP addresses are necessary to allow for the tunnel automatic (re)connection.

Note:

- All subnets must differ from one another and must not overlap.
- Remote User Subenet now takes a comma-separated list of subnets.
- If more than two remote user subnets are necessary, additional routes can be setup manually via the Router » Static Routes tab using the Tunnel IP Address as the gateway.

Figure 45: Security — GRE



All Remote Subnets/Mask must differ from 192.168.1.0/24 and 192.168.6.0/24

GRE Tunnel Configuration

Tunnel Name	
Local IP Address	
Remote IP Address	
Tunnel IP Address & Mask	
Remote User Subnet 1 & Mask	
Remote User Subnet 2 & Mask	

GRE Tunnel Configuration Table

Tunnel Name	Local IP Address	Remote IP Address	Tunnel IP Address & Mask	Remote User Subnet 1 & Mask	Remote User Subnet 2 & Mask

This section contains no values yet

GRE Tunnel Configuration

- **Tunnel Name**
  The name associated with the tunnel.

- **Local IP Address**
  The local (normally WAN interface) IP address associated with the tunnel.

- **Remote IP Address**
  The remote IP address associated with the tunnel.

- **Tunnel IP Address & Mask**
  The IP address assigned to the tunnel interface.
  [Example: 192.168.10.100]

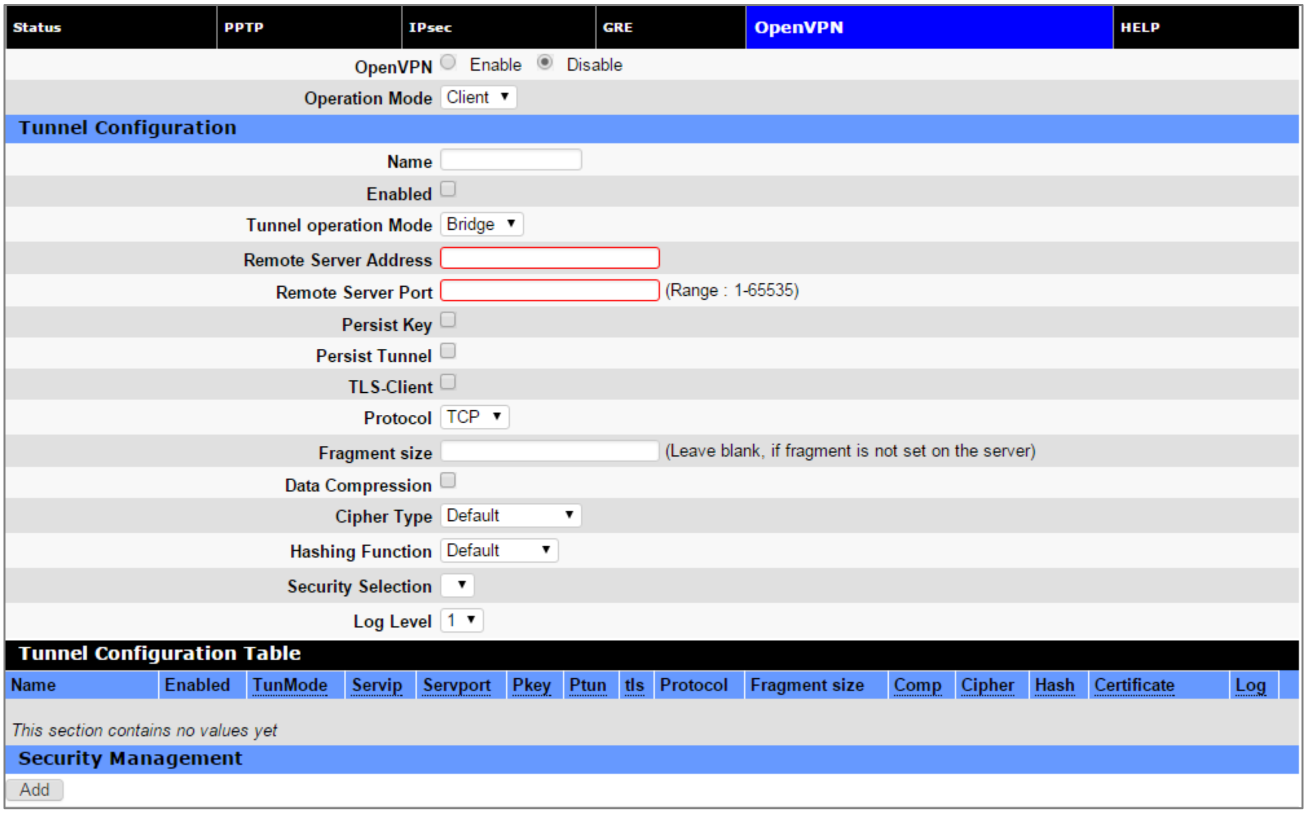
- **Remote User Subnet 1 & Mask**
  The IP network representing that of the remote user subnet, accessible via the tunnel.
  [Example: 192.168.20.0/24]

- **Remote User Subnet 2 & Mask**
  A possible second IP network representing another remote user subnet.
  [Example: 192.168.15.0/24]

3.6.5 OPENVPN

OpenVPN serves to configure secured communication tunnels in bridge and router configurations.

Figure 46: Security — OpenVPN



OpenVPN	○ Enable ● Disable
Operation Mode	Client ▼

Tunnel Configuration

Name	
Enabled	□
Tunnel operation Mode	Bridge ▼
Remote Server Address	
Remote Server Port	(Range : 1-65535)
Persist Key	□
Persist Tunnel	□
TLS-Client	□
Protocol	TCP ▼
Fragment size	(Leave blank, if fragment is not set on the server)
Data Compression	□
Cipher Type	Default ▼
Hashing Function	Default ▼
Security Selection	▼
Log Level	1 ▼

Tunnel Configuration Table

Name	Enabled	TunMode	Servip	Servport	Pkey	Ptun	tls	Protocol	Fragment size	Comp	Cipher	Hash	Certificate	Log

This section contains no values yet

Security Management

Add

- **OpenVPN**
  Enable or disable the OpenVPN module.

- **Operation Mode**
  This parameter tells the device to operate in client mode This feature applies only to tunnels that are enabled.

Tunnel Configuration

- **Name**
  The tunnel name. This must be a unique name (do not use space) to identify the tunnel and must be provided to create a tunnel. It is only used internally.

- **Enabled**
  The tunnel can be enabled or disabled. When it is enabled, the unit will try to establish a connection with the OpenVPN server.

- **Tunnel operation Mode**
  The tunnel operation mode. This option specifies whether the tunnel is be created in bridge or router mode.

- **Remote Server Address**
  The IP address of the remote endpoint of the tunnel.

- **Remote Server Port**
  Port configuration of the remote endpoint of the tunnel.

- **Persist Key**
  This option specifies whether to re-read key files across SIGUSR1 or ping restarts

- **Persist Tunnel**
  This option specifies whether to reopen TUN/TAP device or run up/down scripts across SIGUSR1 or ping restarts. SIGUSR1 is a restart signal similar to SIGHUP, but which offers finer-grained control over reset options.

- **TLS-Client**
  This option when selected enables TLS and assumes client role during TLS handshake

- **Protocol**
  This option specifies whether to use UDP or TCP

- **Fragment size**
  This option is used to specify the packet's fragment threshold. This setting makes sure that no UDP datagrams are sent which are larger than the specified bytes

- **Data Compression**
  This option specify specifies whether to use fast LZO compression.

- **Cipher Type**
  This option is used to specify the ciphering (encryption) to be used for data communication within the tunnel.

- **Hashing Function**
  This option is used to specify the hashing (authentication) to be used for data communication within the tunnel.

- **Security Selection**
  This option specifies certificate selection to be used.

- **Log Level**
  Specifies the log verbosity.

Tunnel Configuration Table

The list of OpenVPN tunnels.

- **Edit**
  Click on Edit to display the tunnel parameters and update the values.

- **Delete**
  Click on Delete to delete the tunnel.

Security Management

- **Name**
  The Certificate combination name. This must be a unique name (do not use space) to identify the certificates and must be provided to create a certificates. It is only used internally.

- **Authentication Based On**
  This option specifies that OpenVPN authentication is based on certificates.

- **Certificate Format**
  This option Specifies whether the certificate format is Pkcs#12 or standard.

  If the selection made is "Pkcs#12", then option to upload Pkcs file and option to enter passphrase come up.

  Pkcs file: It is a single file, which is a combination of ca certificate, client certificate and client key.

  Passphrase: Is used to decrypt the encrypted pkcs#12 file.

  If the selection made is "Standard", then option to upload all the three files namely ca certificate, client certificate and client key come up.

  CA Certificate: It is the Certificate authority (CA) file.

  Client Certificate : Local peer's signed certificate. It must be signed by a certificate authority whose certificate is in --ca file.

  Client key: Local peer's private key.

3.7 SERIAL

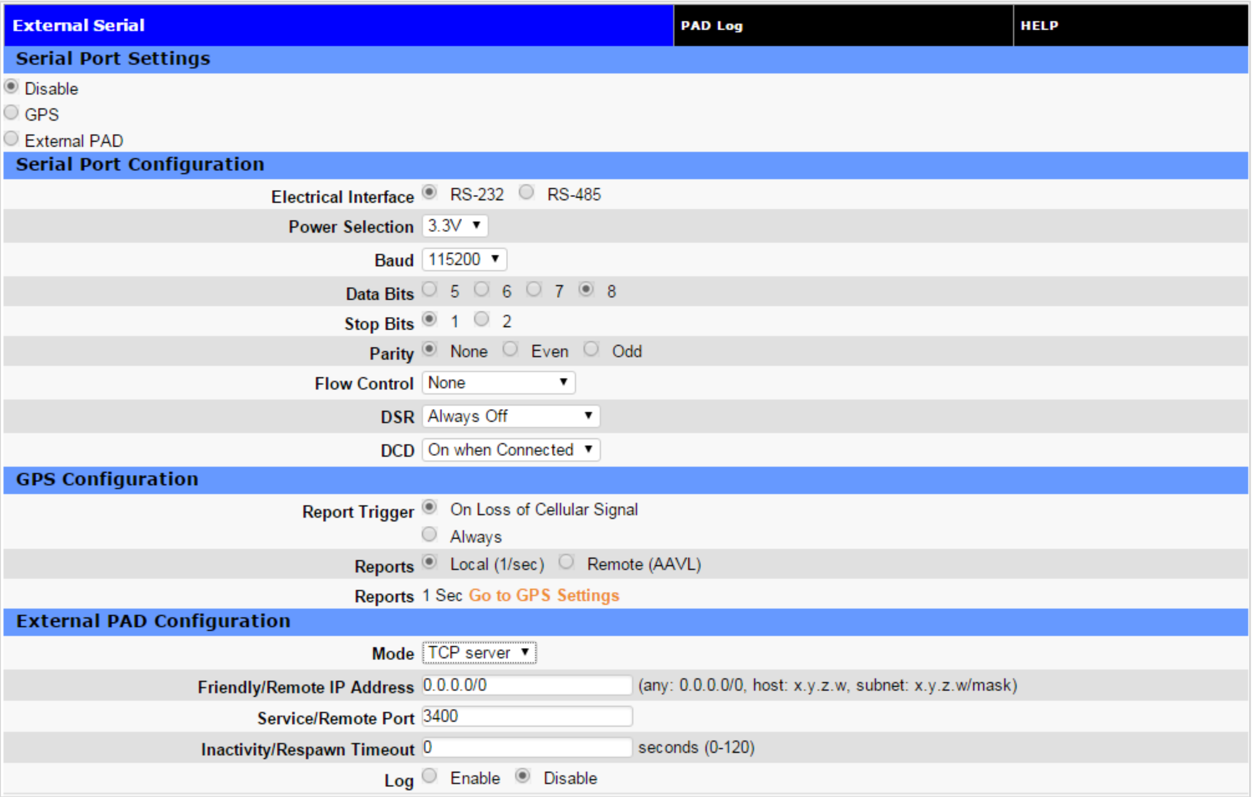
From the main navigation pane, select Serial for access to the external serial port configuration page.

3.7.1 EXTERNAL SERIAL

Use the External Serial tab to define and configure the functioning of the RS-232 / RS-485 Serial Port, which can be set to function as a Packet Assembler and Disassembler (PAD), transferring all serial data to or from a specified UDP/TCP port, or to output GPS position reports.

NOTE: RS-485 Duplex option appears on appropriate hardware.

Figure 47: Serial — External Serial



Serial Port Settings

● Disable
○ GPS
○ External PAD

Serial Port Configuration

Electrical Interface	● RS-232 ○ RS-485
Power Selection	3.3V ▾
Baud	115200 ▾
Data Bits	○ 5 ○ 6 ○ 7 ● 8
Stop Bits	● 1 ○ 2
Parity	● None ○ Even ○ Odd
Flow Control	None ▾
DSR	Always Off ▾
DCD	On when Connected ▾

GPS Configuration

Report Trigger	● On Loss of Cellular Signal ○ Always
Reports	● Local (1/sec) ○ Remote (AAVL)
Reports	1 Sec Go to GPS Settings

External PAD Configuration

Mode	TCP server ▾
Friendly/Remote IP Address	0.0.0.0/0 (any: 0.0.0.0/0, host: x.y.z.w, subnet: x.y.z.w/mask)
Service/Remote Port	3400
Inactivity/Respawn Timeout	0 seconds (0-120)
Log	○ Enable ● Disable

Serial Port Settings

- **Disable**
  The serial port is not assigned GPS or PAD functionality. When Disabled, the port is free for use.

- **GPS**
  The serial port will stream the configured GPS sentences at a selected rate, as setup from the GPS/GNSS page.

- **External Pad**
  The serial port will be bridged to the configured TCP port, providing access to serial devices over the WAN.

Serial Port Configuration

- **Electrical Interface**
  Sets the serial port to use either RS-232 or RS-485. RS-485 is a balanced electrical interface suited for multi-drop applications, such as communication over long cable distances or in noisy environments. When RS-485 is selected, the Flow Control option becomes unavailable.

- **Power Selection**
  Select voltage present on pin 9 of the COM 1 DB-9 serial connector. This voltage can be used to power any serial devices connected to COM 1.

- **Baud**
  Select the serial port baud.

- **Data Bits**
  Select the number of data bits per character: 5, 6, 7, or 8.

- **Stop Bits**
  Select the number of stop bits per character: 1 or 2.

- **Parity**
  Select the type of parity per character: None, Even or Odd.

- **Flow Control**
  Select the type of flow control: None, or Hardware (RTS/CTS).

- **DSR**
  Select how the DSR handshake line should be handled: Always On, On When Connected, On When Available, or Always Off.

- **DCD**
  Select how the DCD handshake line should be handled: Always On, On When Connected, or Always Off.

GPS Configuration

Select GPS to enable GPS reports through the serial port. Note that the report format is set in the GPS > Settings tab. Set the appropriate TCP Server Format in the Local and/or Remote Delivery sections.

- **Report Trigger**
  - **On Loss of Cellular Signal:** Select this if the GPS reports are output only when the cellular signal is lost. Note that there can be a delay of around 30 seconds before the serial reports appear on the serial port after the cellular signal is lost.
  - **Always:** GPS reports are always sent out the serial port.

- **Reports**
  - **Local (1/sec):** Select this to have the Local report sent out the serial port each second.
  - **Remote (AAVL):** Select this to have the Remote report sent out the serial port. The report rate is based on the AAVL settings.

External PAD Configuration

The mode selection configures the service to listen on configured TCP or UDP port or connect to an external host as a TCP client.

- **Mode**
  The TCP server and UDP modes will listen on the configured port for connections from the Friendly IP address. The TCP client will attempt to connect to the configured Remote IP address on the Remote Port.

- **Friendly/Remote IP Address**
  TCP/UDP Server: Sets the IP address of the client that is allowed to connect to the PAD service.
  TCP Client: The remote host address.

- **Inactivity/Respawn Timeout**
  Time after which the current connection with Client will be terminated without warning. This time starts over again each time the Client sends data to the server. The timeout is between 1-120 seconds. Enter 0 for no timeout.

- **Log**
  When enabled, as data passes through the PAD, a copy is stored in an internal log file.

- **Log Type**
  Exposed when Log is enabled, provides the option of logging characters in either ASCII or Hex.

PAD Log

If PAD Log is enabled, the current log can be displayed from this tab.

3.8 GPS/GNSS

The Mobile model Vanguard Cellular Broadband Router contains a standalone, high-accuracy, high-report-rate GPS receiver.

The GPS LED on the front panel provides the status of the receiver.

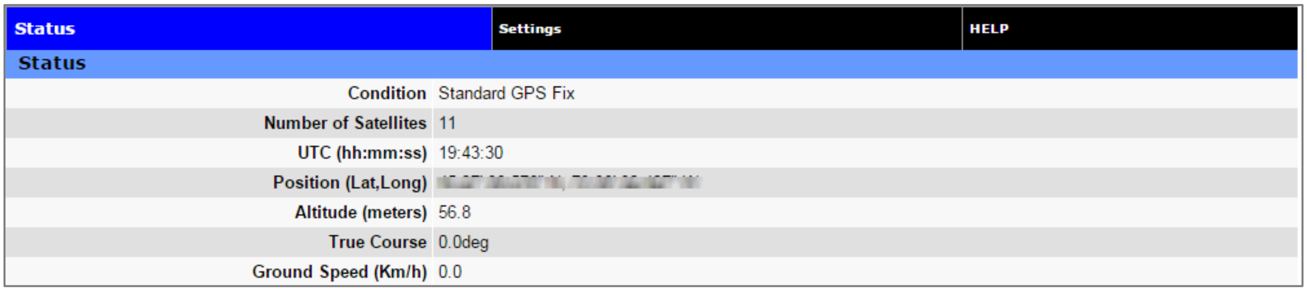
Table 16: GPS LED Color State and GPS Status

GPS LED Color / State	Meaning
Off	GPS is not installed or cell modem GPS is disabled.
Amber	Acquiring GPS position.
Green	Valid positions being reported.
Red	Position lost; reporting from last known position.
Flashing Red	Position lost for more than 2 minutes.

3.8.1 STATUS

This section displays the current status of the GPS receiver.

Figure 48: GPS/GNSS —Status



Status

Condition	Standard GPS Fix
Number of Satellites	11
UTC (hh:mm:ss)	19:43:30
Position (Lat,Long)	[redacted]
Altitude (meters)	56.8
True Course	0.0deg
Ground Speed (Km/h)	0.0

Status

- **Condition**
  Indicates the quality of received GPS reports.

- **Number of Satellites**
  Indicates the number of satellite signals being received and used to calculate position.

- **UTC**
  The current time according to Universal Coordinated Time in hh:mm:ss, using a 24-hour clock format.

- **Position**
  The current position in Latitude (North-South) and Longitude (East-West Positions are reported in degrees, minutes and seconds. For example, a Longitude of 73 degrees, 39 minutes and 45 seconds West appears as: 73 39’ 45” W.

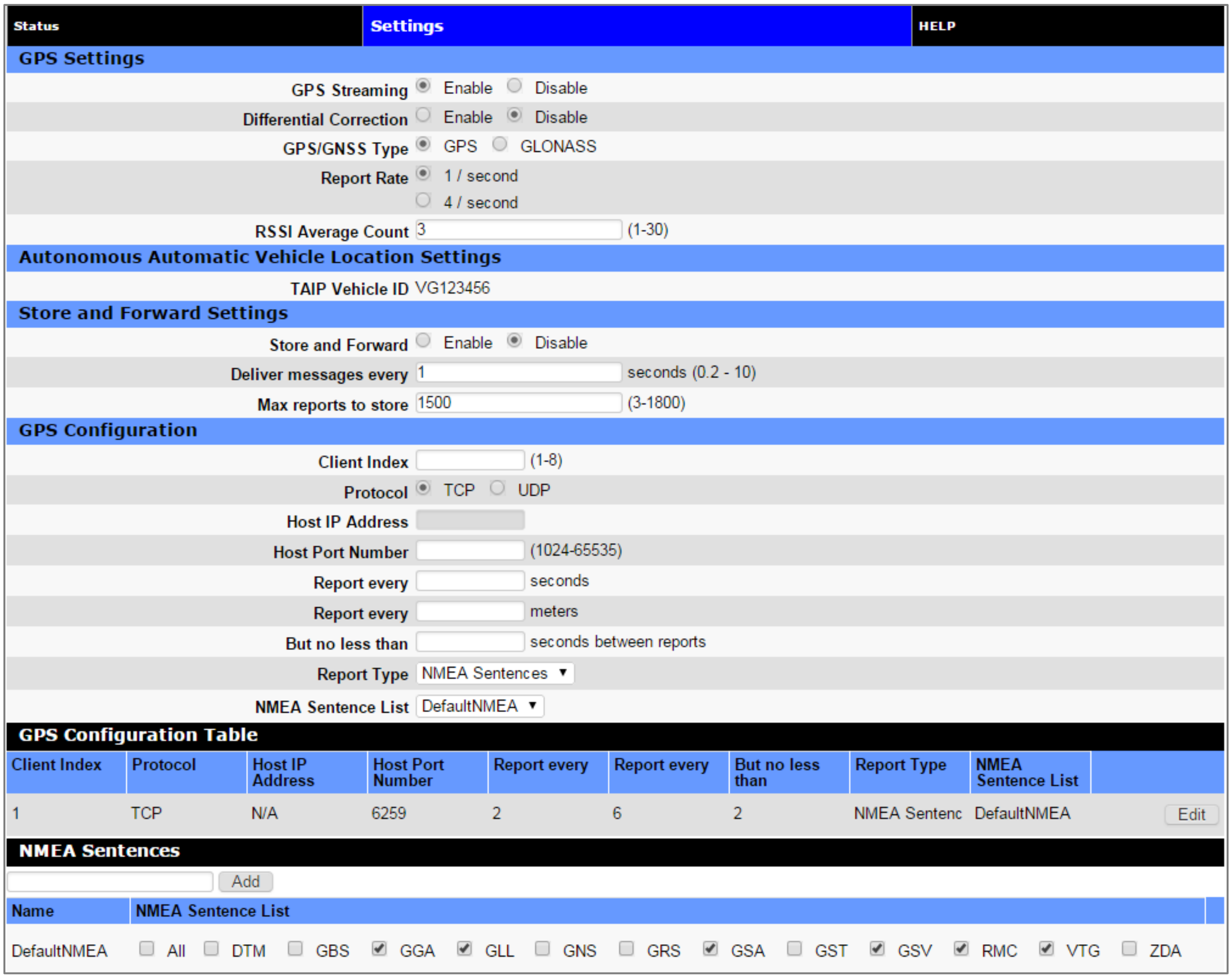
- **Altitude**
  The current height above Mean Sea Level in meters.

- **True Course**
  Shows the current GPS-generated true course in degrees.

- **Ground Speed**
  Shows travel speed (in Km/h).

3.8.2 SETTINGS

Figure 49: GPS — Settings



GPS Settings

GPS Streaming ● Enable ○ Disable

Differential Correction ○ Enable ● Disable

GPS/GNSS Type ● GPS ○ GLONASS

Report Rate ● 1 / second
○ 4 / second

RSSI Average Count 3 (1-30)

Autonomous Automatic Vehicle Location Settings

TAIP Vehicle ID VG123456

Store and Forward Settings

Store and Forward ○ Enable ● Disable

Deliver messages every 1 seconds (0.2 - 10)

Max reports to store 1500 (3-1800)

GPS Configuration

Client Index (1-8)

Protocol ● TCP ○ UDP

Host IP Address

Host Port Number (1024-65535)

Report every seconds

Report every meters

But no less than seconds between reports

Report Type NMEA Sentences ▼

NMEA Sentence List DefaultNMEA ▼

GPS Configuration Table

Client Index	Protocol	Host IP Address	Host Port Number	Report every	Report every	But no less than	Report Type	NMEA Sentence List	
1	TCP	N/A	6259	2	6	2	NMEA Sentenc	DefaultNMEA	Edit

NMEA Sentences

Add

Name	NMEA Sentence List
DefaultNMEA	□ All □ DTM □ GBS ☑ GGA ☑ GLL □ GNS □ GRS ☑ GSA □ GST ☑ GSV ☑ RMC ☑ VTG □ ZDA

GPS Settings

- **GPS Streaming**
  Select **Enable** to start the GPS engine, **Disable** to stop it

- **Differential Correction**
  Differential Correction allows WAAS correction information to be used to improve accuracy of the GPS position reports.

Note: WAAS correction applies to North America only. The WAAS satellites currently in service are 48 (Galaxy 15) and 51 (Anik F1R). The previous WAAS satellites 35 and 47 were taken out of service on 2007/07/30.

- **GPS/GNSS Type**
  Select **GPS** or **GLONASS**.

- **Report Rate**
  For applications that require it, GPS reports are normally received from the internal GPS receiver at a rate of once per second. Local Delivery reports are sent at this rate. Remote Delivery reports are limited by the "But no less than X seconds between reports" setting.

- **RSSI Average Count (1-30)**
  This value is used for averaging the satellite signal strength.

Autonomous Automatic Vehicle Location (AAVL) Settings

The Autonomous Automatic Vehicle Location (AAVL) feature adds the ability for GPS-equipped Vanguard Cellular Broadband Routers to transmit position reports either to a host connected to the local Ethernet port or to a remote host over the cellular network. AAVL allows the system designer to specify the maximum distance or the time interval between remote position reports.

Position reports can be transmitted in a number of possible formats. When the format is disabled or the Address or Port fields are blank, no report is sent.

Table 17: Position report format information

Format	Definition	Example
TAIP, No ID	Trimble ASCII Interface Protocol (TAIP), No ID	>RPV73511+4549542-0736643100035822;*7F<
TAIP, With ID	Trimble ASCII Interface Protocol (TAIP), With ID	>RPV56655+4549542-0736643300000002;ID=ADAM12;*5E<
NMEA, DTM		$GPDTM,W84,,0.0,N,0.0,E,0.0,W84*6F
NMEA, GBS		$GPGBS,182003.00,11.1,5.8,11.2,,,,*47
NMEA, GGA	NMEA GGA (Global Positioning System Fix Data)	$GPGGA,202742.0,4529.7240,N,7339.8585,W,2,9,0.9,28,M,,,,*3E
NMEA, GLL	NMEA GLL (Geographic Latitude & Longitude)	$GPGLL,4529.7241,N,7339.8584,W,202645.0,A,D*7C
NMES, GNS	GNSS Fix Data	$GPGNS,182827.00,4450.35072,N,09335.95929,W,AN,06,1.65,312.6,-30.6,,*43
NMEA, GRS	GNSS Range Residuals	$GPGRS,182827.00,1,-0.5,-0.9,2.6,-9.9,1.4,0.0,,,,,,*68
NMEA, GSA	NMEA VTG (Vector Track and speed over Ground)	$GPGSA,A,3,03,31,23,29,26,,,,,,,,2.86,1.89,2.15*07
NMEA, GST	GNSS Pseudo Range Error Statistics	$GPGST,181911.00,63,,,,12,6.9,12*5C
NMEA, GSV	NMEA VTG (Vector Track and speed over Ground)	$GPGSV,3,1,12,03,43,231,24,06,00,308,,07,03,261,13,09,27,306,20*7F
NMEA, RMC	NMEA RMC (Recommended Minimum data)	$GPRMC,153716.00,A,4529.72428,N,07339.86082,W,0.007,,180108,,,A*69

Format	Definition	Example
NMEA, VTG	NMEA VTG (Vector Track and speed over Ground)	$GPVTG,,T,,M,0.004,N,0.008,K,A*2F
NMEA, ZDA	Time and Date	$GPZDA,181855.00,21,04,2015,00,00*67

GPS "sentences" are collected the from embedded GPS receiver in the Vanguard Cellular Broadband Router. These sentences are converted into the above formats and are provided to both local and remote delivery services. Each report from the TCP ports is terminated with carriage-return/linefeed characters (CRLF). Reports are sent as a datagram with no terminating CRLF.

- **TAIP Vehicle ID**
  The TAIP, With ID format allows a report to contain a user-supplied field to identify the sending mobile. This read-only field, which may contain up to 8 letters or digits or the underscore '_' character, is taken from the Unit ID that can be set from Unit Status » Basic Settings » Unit ID » ID.

Store and Forward Settings

The Vanguard 5530 router can be configured to store reports generated by the Remote Delivery configuration when out of coverage. Those reports will be forwarded to the specified host(s) when the router reestablishes its cellular connection.

- **Store and Forward**
  Enable or disable the Store and Forward feature of the Vanguard 5530.

- **Deliver messages every ( ) seconds**
  This specifies the rate used to deliver the stored messages to the host(s) when the unit is again within coverage. This MUST be configured faster than the reports being generated by the Remote Delivery configuration.

- **Max reports to store**
  This specifies the maximum number of reports to store. When filled, the oldest reports will be overwritten by new reports. (This maximum is divided by the number of different formats that have to be stored and forwarded. For example, if remote hosts only receive the GGA message, then up to 1800 reports can be stored; if remote hosts are to receive GGA and RMC messages, then up to only 900 pairs can be stored.)

GPS Configuration

- **Client Index (1-8)**
  Specify an index number(1-8) of the client, to be used for keeping track of the delivery table entries.

- **Protocol**
  Select TCP to create a TCP server on the specified (local) port or UDP to create a UCP client that sends datagrams to the specified (remote) IP address and port.

- **Host IP Address**
  Specify the IP address for this GPS client, to allow destination for UDP. This field is valid only if protocol is UDP.

- **Host Port Number (1024-65535)**
  Specify the local port for the TCP server or the remote port for the UDP client.

- **Report every ( ) seconds**
  Triggers the sending of a new remote report if the time since the last remote report exceeds the specified number of seconds. A value of 0 disables this filter and triggers only on distance.

- **Report every ( ) meters**
  Triggers the sending of a new remote report if the distance since the last remote report exceeds the specified distance (in meters). A value of 0 disable this filter and triggers only on time.

- **But no less than ( ) seconds between reports**
  To prevent a fast-moving vehicle from reporting too frequently, a lower limit on the time between reports can be specified.

  Note: The Report every filters affect reports to both local (LAN, WLAN) and remote (WWAN) addresses.

- **Report Type**
  Specify the type of reports. Client can select the following report types:

  — **TAIP, no ID**

  Selecting TAIP, no ID as report type client will get TAIP messages.
  Example:>RPV73511+4549542-0736643100035822;*7F<

  — **TAIP, with ID**

  It is similar to above report type, but Along with this client will get Vehicle ID in Reports.
  Example:>RPV56655+4549542-0736643300000002;ID=ADAM12;*5E<

  — **NMEA Sentences**

  Selecting NMEA Sentences as report type, client will get NMEA Sentence in reports.
  Example:$GPGGA,202742.0,4529.7240,N,7339.8585,W,2,9,0.9,28,M,,,,*3E
  $GPGLL,4529.7241,N,7339.8584,W,202645.0,A,D*7C
  $GPRMC,153716.00,A,4529.72428,N,07339.86082,W,0.007,,180108,,,A*69
  $GPVTG,,T,,M,0.004,N,0.008,K,A*2F

- **NMEA Sentence List**
  Select the NMEA Sentence List. Client can create a new NMEA Sentence list.

  GNSS "sentences" are collected the from the internal GNSS receiver in the Vanguard Cellular Broadband Router. These sentences are converted into the above formats and are provided to both local and remote delivery services. Two TCP ports are available for clients to connect to and receive reports at the local or remote reporting rate. Each report from the TCP ports is terminated with carriage-return/linefeed characters (CRLF). Up to two local UDP Hosts and three remote UDP Hosts may be specified. Reports are sent as a datagram with no terminating CRLF.

GPS Configuration Table

This section displays information for all clients present.

- **Edit**
  Click the **Edit** button to modify the existing settings for any client.

NMEA Sentences

This section displays all NMEA Sentence Lists currently present.

- **Add**
  You can add a new NMEA Sentence List by entering a unique name, and then clicking the **Add** button.

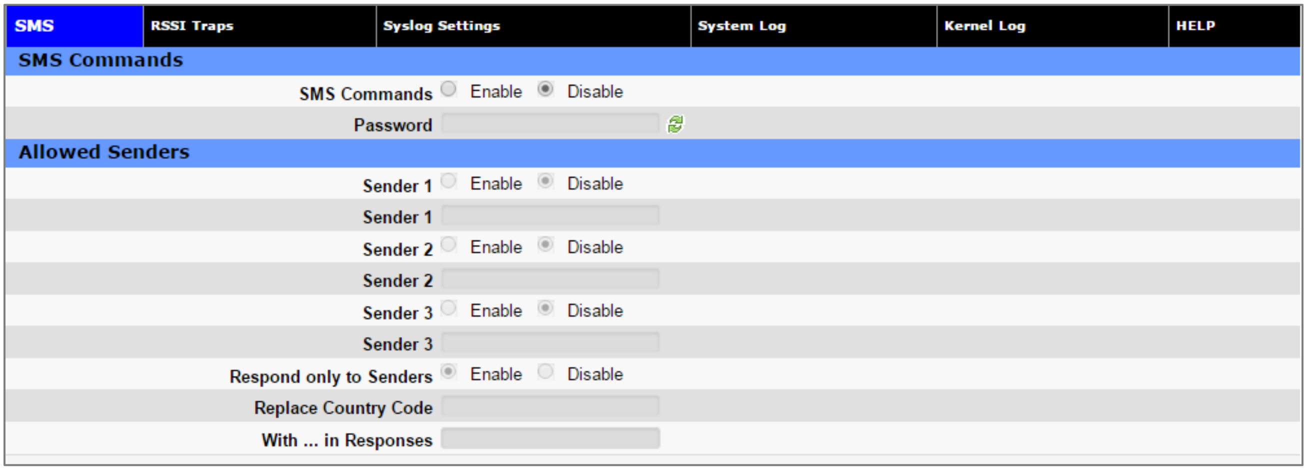
3.9 DIAGNOSTICS

From the main navigation pane, select Diagnostics for access to the SMS, RSSI Traps and Logging configuration pages.

3.9.1 SMS

The SMS CLI (Command-Line Interface) allows a small set of commands to be sent to the Vanguard 5530 using SMS.

Figure 50: Diagnostics —SMS



SMS Commands

SMS Commands	○ Enable ● Disable
Password	

Allowed Senders

Sender 1	○ Enable ● Disable
Sender 1	
Sender 2	○ Enable ● Disable
Sender 2	
Sender 3	○ Enable ● Disable
Sender 3	
Respond only to Senders	● Enable ○ Disable
Replace Country Code	
With ... in Responses	

All commands are prefixed with the slash "/" character. Note that […] denotes an optional field (don't type the square brackets). The supported commands are:

/status pw=[password]

Returns the following fields:
WAN= DOWN or the IP address of the cellular connection
RSSI= the signal strength of the cellular radio channel
ECIO= the interference on the cellular radio channel
PPTP= the state of the PPTP VPN: UP or DOWN
IPSEC= the number of active / enabled / defined tunnels
GPS= the latitude, longitude (in decimal degrees) of the modem
V= the main voltage of the modem
T= the temperature of the modem
D1= , D2= the state of the first two digital inputs: 0 (inactive) or 1 (active)
A1= , A2= the levels of the first two analog inputs, in volts
R1= , R2= the state of the first two digital (historically called "relay") outputs: 0 (ground) or 1 (open)

/iostatus pw=[password]

Returns the following fields:

D1= through D7= the state of the seven digital inputs: 0 (inactive) or 1 (active)
A1= through A4= the levels of the four analog inputs, in volts
R1= through R7= the state of the seven digital (historically called "relay") outputs: 0 (ground) or 1 (open)

/pptpstart pw=[password]

Starts the PPTP VPN.

/pptpstop pw=[password]

Stops the PPTP VPN.

/ipsecstart pw=[password] tun=*label*

Starts the IPsec tunnel that has the specified *label*.

/ipsecstop pw=[password] tun=*label*

Stops the IPsec tunnel that has the specified *label*.

/output pw=[password] rn=v...

Controls the relay outputs, where:

r is "r", "rly", or "relay";

n is "1" through "7";

v is "0" to connect to ground, "1" to open. The command responds with the new state: 'G' (ground) or 'O' (open).

r can be in any case, upper or lower. Both outputs can be set from one command.

/reset pw=[password]

Resets the modem.

SMS Commands

- **SMS Commands**
  – Enable allows the Vanguard 5530 to respond to received SMS commands.
  – Disable causes SMS messages (that start with a slash) to be accepted but quietly discarded.

- **Password**
  If nonblank, all commands require the password in the form pw=password as one of the arguments. The pw prefix can occur in any case ("pw=", "PW=", "Pw=", etc.) but the password must be in the exact case as entered on the web page.

Allowed Senders

- **Sender 1 / Sender 2 / Sender 3**
  Commands can be restricted to be accepted only if they arrive from one of up to three "friendly" SMS Sender addresses, which can enabled or disabled as necessary. Sender addresses are typically numeric digits only

including the country code prefix. Select the button for a Sender (1-3), and then enter the address in the adjacent field. If all three addresses are disabled, then commands will be accepted from **ALL** senders.

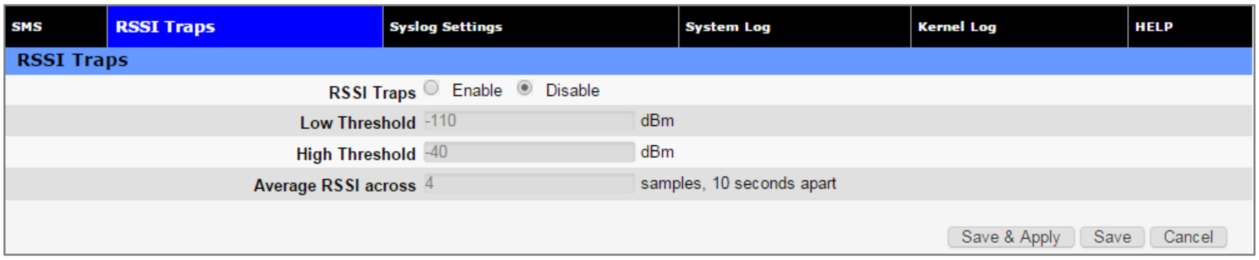
- **Respond only to Senders**
  For security, command responses, including error messages, can be restricted to be returned only to the registered Sender SMS addresses.

- **Replace Country Code**
  This allows you to change the country that the responder uses, which can be useful when monitoring routers across national borders.

- **With … in responses**
  The string you wish to substitute for the country code.

3.9.2 RSSI TRAPS

Figure 51: Diagnostics — RSSI Traps



RSSI Traps

RSSI Traps ○ Enable ● Disable

Low Threshold -110 dBm

High Threshold -40 dBm

Average RSSI across 4 samples, 10 seconds apart

RSSI Traps

Generate SNMP traps and notifications when the cellular signal strength (RSSI) falls outside of specified thresholds

- **RSSI Traps**
  Selecting Enable allows the monitoring of the cellular signal strength.

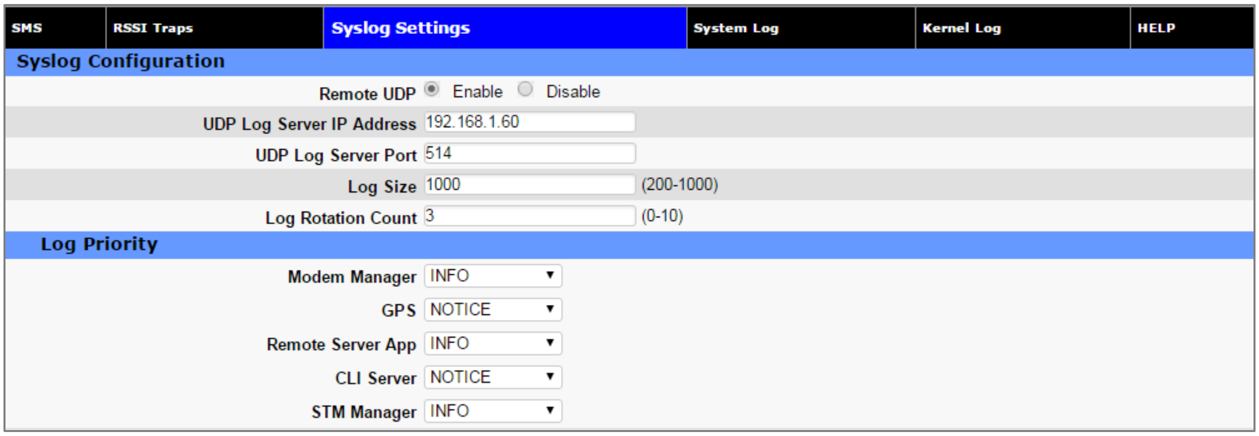
- **Low Threshold**
  Send an SNMP Trap message when the average RSSI falls below this value.

- **High Threshold**
  Send an SNMP Notification message when the average RSSI rises above this value.

- **Average RSSI Across**
  The number of samples, taken 10 seconds apart, used to compute the average RSSI.

3.9.3 SYSLOG SETTINGS

Figure 52: Diagnostics — Syslog Settings



Syslog Configuration

Remote UDP ● Enable ○ Disable
UDP Log Server IP Address 192.168.1.60
UDP Log Server Port 514
Log Size 1000 (200-1000)
Log Rotation Count 3 (0-10)

Log Priority

Modem Manager INFO
GPS NOTICE
Remote Server App INFO
CLI Server NOTICE
STM Manager INFO

Syslog Configuration

- **Remote UDP**
  Choose Enable to send log entries to the specified Log Server as they are posted.

- **UDP Log Server IP Address**
  IP address of the server to which the logs will be routed.

- **UDP Log Server Port**
  Port number of the Log Server.

- **Log Size**
  Maximum size in bytes that the log is allowed to reach before it is archived and a new log is started.

- **Log Rotation Count**
  Number of archived files to keep. Oldest file is abandoned when the rotation count is exceeded.

Log Priority

Define the depth of the information logged by the system logger facility for various Vanguard sub-systems. Options range from DEBUG (most output) to EMERGENCY (least output).

- **Modem Manager**
  Log entries related to the cellular WAN connection.

- **GPS**
  Log entries related to the GPS receiver.

- **Remote Server App**
  Log entries related to reporting to DeviceOutlook and the processing of scheduled updates.

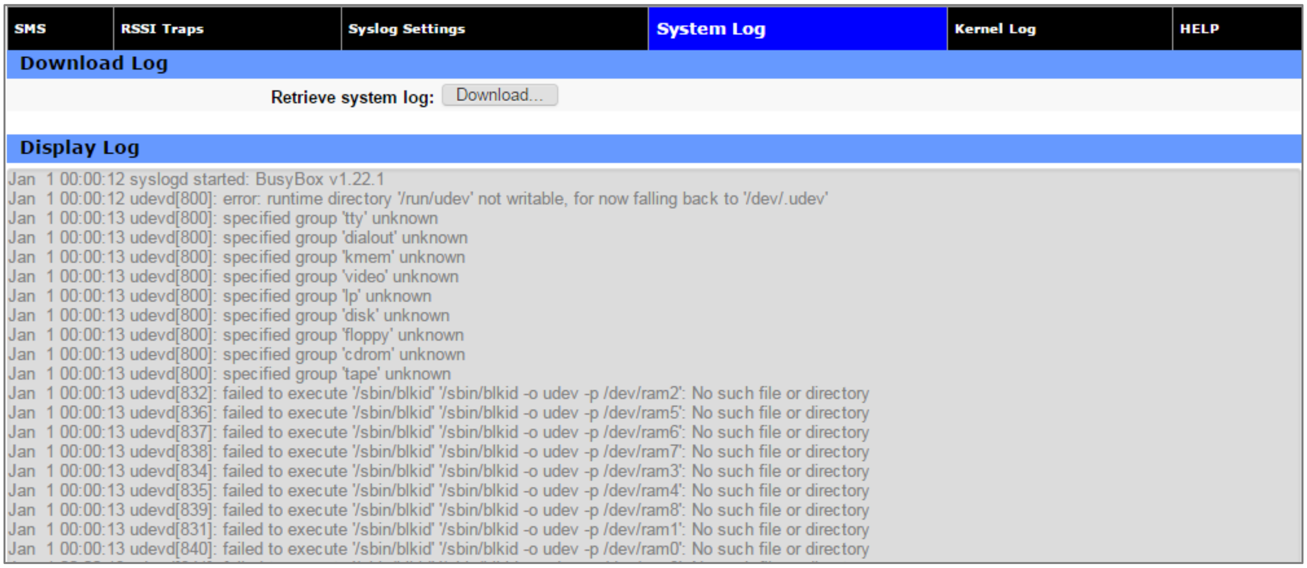
- **CLI Server**
  Log entries related to the ODP Command Line Interface.

- **STM Manager**
  Log entries related to the co-processor that manages I/O ports, shutdown, etc.

3.9.4 SYSTEM LOG

The System Log page provides a way to capture the current status log of the modem. Log information is useful when contacting CalAmp Technical Support to resolve operational problems. The Download… button provides a convenient way to save the log to the local PC.

Figure 53: Diagnostics — System Log

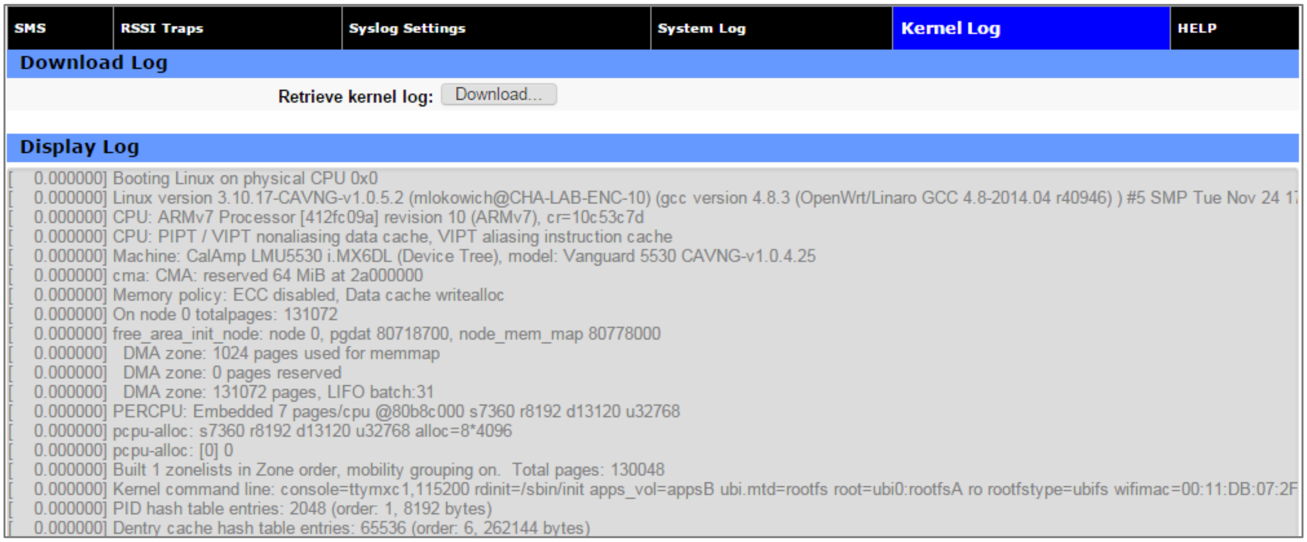


```
Jan  1 00:00:12 syslogd started: BusyBox v1.22.1
Jan  1 00:00:12 udevd[800]: error: runtime directory '/run/udev' not writable, for now falling back to '/dev/.udev'
Jan  1 00:00:13 udevd[800]: specified group 'tty' unknown
Jan  1 00:00:13 udevd[800]: specified group 'dialout' unknown
Jan  1 00:00:13 udevd[800]: specified group 'kmem' unknown
Jan  1 00:00:13 udevd[800]: specified group 'video' unknown
Jan  1 00:00:13 udevd[800]: specified group 'lp' unknown
Jan  1 00:00:13 udevd[800]: specified group 'disk' unknown
Jan  1 00:00:13 udevd[800]: specified group 'floppy' unknown
Jan  1 00:00:13 udevd[800]: specified group 'cdrom' unknown
Jan  1 00:00:13 udevd[800]: specified group 'tape' unknown
Jan  1 00:00:13 udevd[832]: failed to execute '/sbin/blkid' '/sbin/blkid -o udev -p /dev/ram2': No such file or directory
Jan  1 00:00:13 udevd[836]: failed to execute '/sbin/blkid' '/sbin/blkid -o udev -p /dev/ram5': No such file or directory
Jan  1 00:00:13 udevd[837]: failed to execute '/sbin/blkid' '/sbin/blkid -o udev -p /dev/ram6': No such file or directory
Jan  1 00:00:13 udevd[838]: failed to execute '/sbin/blkid' '/sbin/blkid -o udev -p /dev/ram7': No such file or directory
Jan  1 00:00:13 udevd[834]: failed to execute '/sbin/blkid' '/sbin/blkid -o udev -p /dev/ram3': No such file or directory
Jan  1 00:00:13 udevd[835]: failed to execute '/sbin/blkid' '/sbin/blkid -o udev -p /dev/ram4': No such file or directory
Jan  1 00:00:13 udevd[839]: failed to execute '/sbin/blkid' '/sbin/blkid -o udev -p /dev/ram8': No such file or directory
Jan  1 00:00:13 udevd[831]: failed to execute '/sbin/blkid' '/sbin/blkid -o udev -p /dev/ram1': No such file or directory
Jan  1 00:00:13 udevd[840]: failed to execute '/sbin/blkid' '/sbin/blkid -o udev -p /dev/ram0': No such file or directory
```

3.9.5 KERNEL LOG

The Kernel Log page provides a way to capture the kernel log of the modem. The Download… button provides a convenient way to save the log to the local PC.

Figure 54: Diagnostics — Kernel Log



Download Log

Retrieve kernel log:

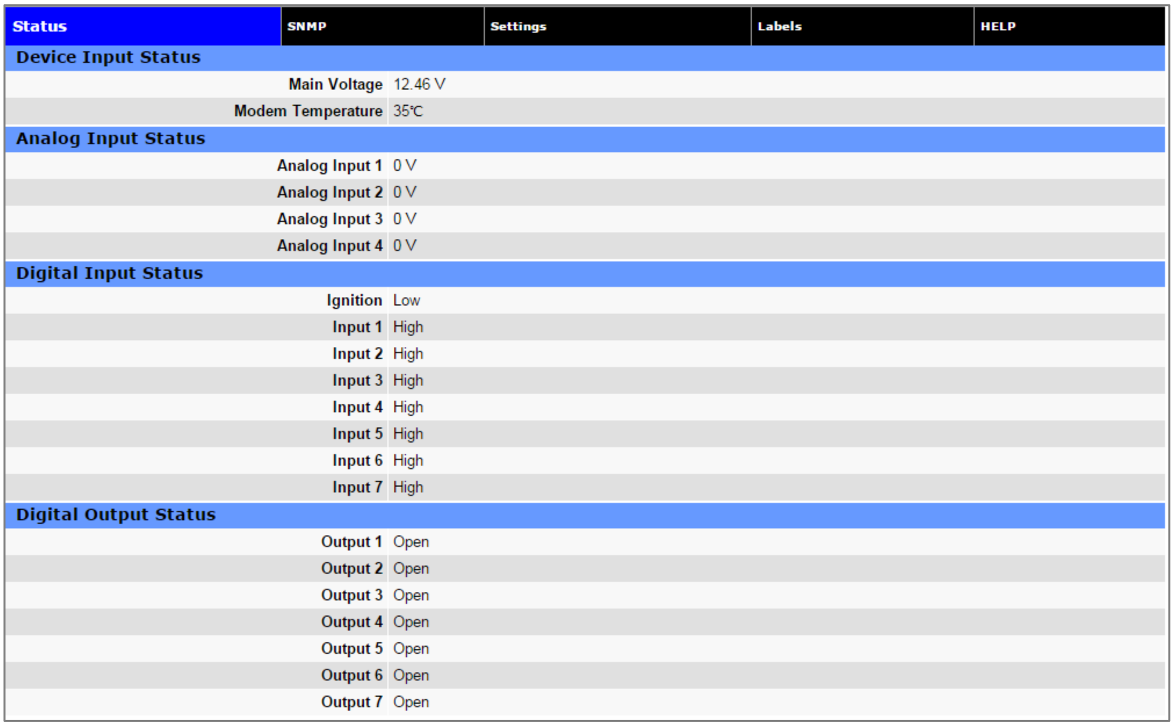
Display Log

```
[    0.000000] Booting Linux on physical CPU 0x0
[    0.000000] Linux version 3.10.17-CAVNG-v1.0.5.2 (mlokowich@CHA-LAB-ENC-10) (gcc version 4.8.3 (OpenWrt/Linaro GCC 4.8-2014.04 r40946) ) #5 SMP Tue Nov 24 1
[    0.000000] CPU: ARMv7 Processor [412fc09a] revision 10 (ARMv7), cr=10c53c7d
[    0.000000] CPU: PIPT / VIPT nonaliasing data cache, VIPT aliasing instruction cache
[    0.000000] Machine: CalAmp LMU5530 i.MX6DL (Device Tree), model: Vanguard 5530 CAVNG-v1.0.4.25
[    0.000000] cma: CMA: reserved 64 MiB at 2a000000
[    0.000000] Memory policy: ECC disabled, Data cache writealloc
[    0.000000] On node 0 totalpages: 131072
[    0.000000] free_area_init_node: node 0, pgdat 80718700, node_mem_map 80778000
[    0.000000]   DMA zone: 1024 pages used for memmap
[    0.000000]   DMA zone: 0 pages reserved
[    0.000000]   DMA zone: 131072 pages, LIFO batch:31
[    0.000000] PERCPU: Embedded 7 pages/cpu @80b8c000 s7360 r8192 d13120 u32768
[    0.000000] pcpu-alloc: s7360 r8192 d13120 u32768 alloc=8*4096
[    0.000000] pcpu-alloc: [0] 0
[    0.000000] Built 1 zonelists in Zone order, mobility grouping on.  Total pages: 130048
[    0.000000] Kernel command line: console=ttymxc1,115200 rdinit=/sbin/init apps_vol=appsB ubi.mtd=rootfs root=ubi0:rootfsA ro rootfstype=ubifs wifimac=00:11:DB:07:2F
[    0.000000] PID hash table entries: 2048 (order: 1, 8192 bytes)
[    0.000000] Dentry cache hash table entries: 65536 (order: 6, 262144 bytes)
```

3.10 I/O SETTINGS

3.10.1 STATUS

Figure 55: I/O Settings — Status



Device Input Status	
Main Voltage	12.46 V
Modem Temperature	35℃
Analog Input Status	
Analog Input 1	0 V
Analog Input 2	0 V
Analog Input 3	0 V
Analog Input 4	0 V
Digital Input Status	
Ignition	Low
Input 1	High
Input 2	High
Input 3	High
Input 4	High
Input 5	High
Input 6	High
Input 7	High
Digital Output Status	
Output 1	Open
Output 2	Open
Output 3	Open
Output 4	Open
Output 5	Open
Output 6	Open
Output 7	Open

Device Input Status

- **Main Voltage**
  Displays current voltage applied to the unit, in Volts.

- **Modem Temperature**
  Displays temperature of the Wireless Modem, in Celsius.

Analog Input Status

- **Analog Input 1-4**
  Displays voltage of the specified analog input, in Volts.

Digital Input Status

- **Ignition and Input 1-7**
  Displays the status of the specified input: Active (high state) or Normal (low state).

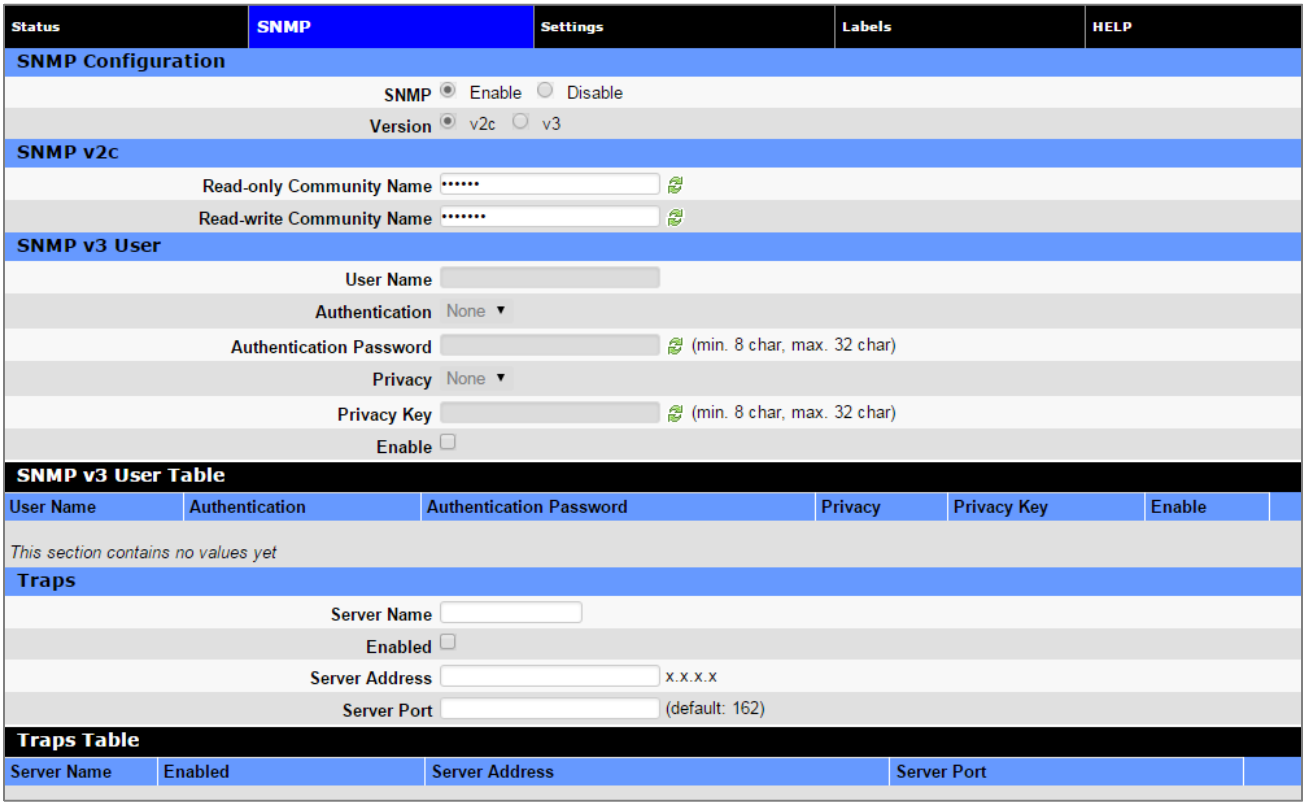
Digital Output Status

- **Output 1-7**
  Displays if the specified output is open or ground.

3.10.2 SNMP

The Simple Network Management Protocol (SNMP) is used in network management systems to monitor network-attached devices for conditions that warrant administrative attention. SNMP version v2c and v3 are supported with the exception of INFORM.

Figure 56: I/O Settings — SNMP



Status | SNMP | Settings | Labels | HELP

SNMP Configuration

SNMP ● Enable ○ Disable

Version ● v2c ○ v3

SNMP v2c

Read-only Community Name ••••••

Read-write Community Name •••••••

SNMP v3 User

User Name

Authentication None ▾

Authentication Password (min. 8 char, max. 32 char)

Privacy None ▾

Privacy Key (min. 8 char, max. 32 char)

Enable □

SNMP v3 User Table

User Name	Authentication	Authentication Password	Privacy	Privacy Key	Enable
This section contains no values yet					

Traps

Server Name

Enabled □

Server Address x.x.x.x

Server Port (default: 162)

Traps Table

Server Name	Enabled	Server Address	Server Port

SNMP Configuration

- **SNMP**
  Selecting **Enable** will allow the SNMP functionality. Selecting **Disable** will shut off SNMP functionality.

- **Version**
  With SNMP Enabled, select the corresponding version that matches the SNMP Manager.

SNMP v2c

- **Read-only Community Name**
  The community string used for accessing the read-only Management Information Bases (MIBs).

- **Read-write Community Name**
  The community string used for accessing all Management Information Bases (MIBs) including writable objects.

SNMP v3

- **User Name**
  The user name for secure access to the Management Information Bases (MIBs) observing v3 standard.

- **Authentication**
  Select the method for encoding the Authentication Password for accessing the Management Information Bases (MIBs) – None, MD5 or SHA.

- **Authentication Password**
  The corresponding user password for accessing the Management Information Bases (MIBs) including writable objects.

- **Privacy**
  Select the method for encoding the Privacy Key – None, DES or AES.

- **Privacy Key**
  The corresponding privacy key.

- **Enable**
  Check this box to enable this User.

Click Save to add this entry to the SNMP v3 User Table.

SNMP v3 User Table

Displays the list of configured Users. After any changes, click Save to make the changes permanent.

- Click Edit to edit the selected user.
- Click Delete to delete the selected user.

Traps

- **Server Name**
  Name of server to which the trap events will be sent.

- **Enabled**
  Selecting Enable will allow the active trap events to be reported to the defined server(s). Selecting Disable will deactivate events reporting. Up to four destinations can be specified.

- **Server Address**
  IP address of server to which the trap events will be sent.

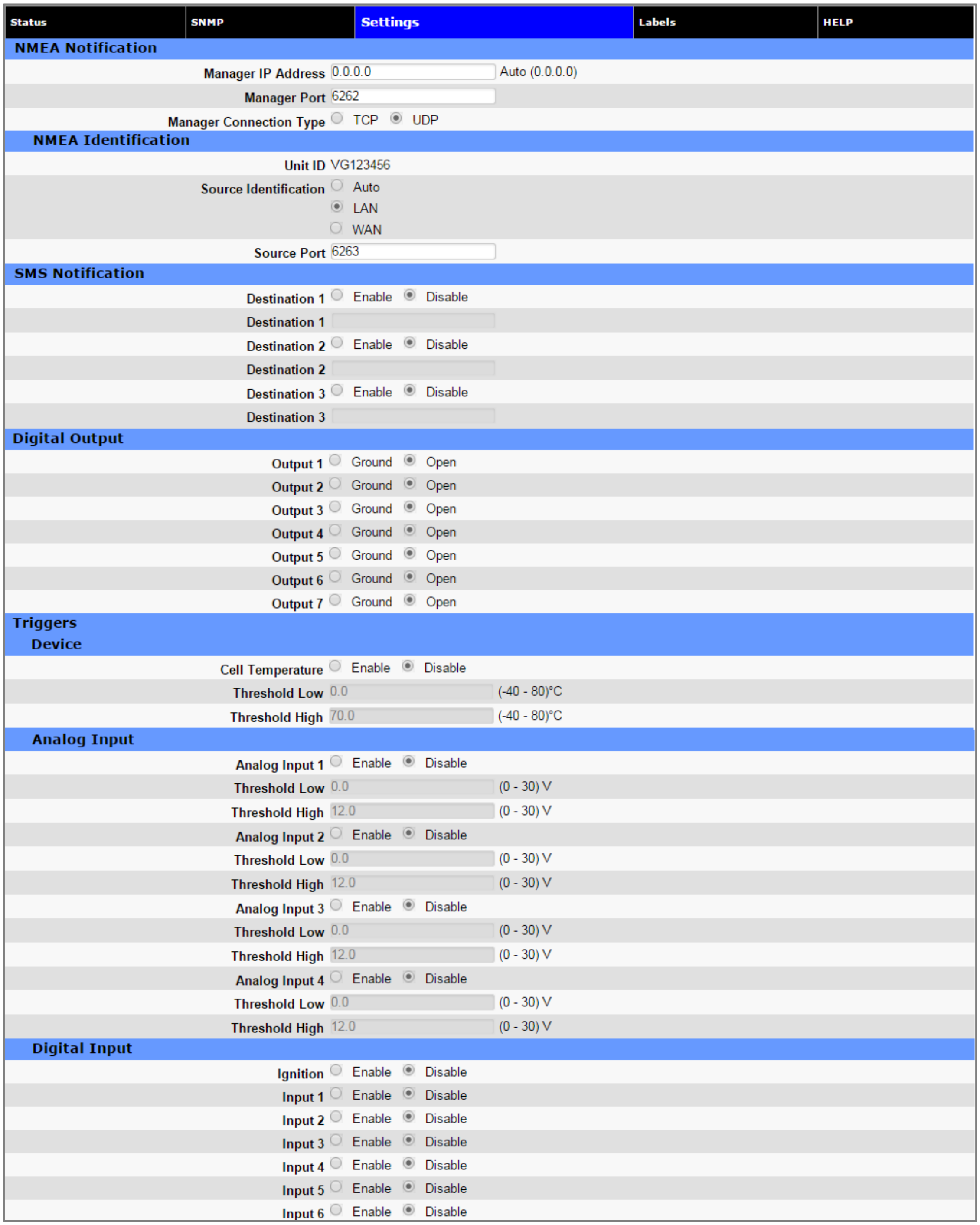
- **Server Port**
  The corresponding server port to which the trap events will be sent (default 162).

3.10.3 SETTINGS

Status Monitoring is provided via NMEA-based protocol. The Vanguard 5530 I/O subsystem operates according to a manager/agent model. The PC-hosted manager sends requests to the Vanguard 5530 I/O agent, which performs the required actions. The Vanguard agent reports alarms to the PC-hosted manager.

More information about the Vanguard 5530 **Error! Reference source not found.** is provided in **Error! Reference source t found.**.

Figure 57: I/O Settings — Settings



Status | SNMP | **Settings** | Labels | HELP

NMEA Notification

Manager IP Address	0.0.0.0	Auto (0.0.0.0)
Manager Port	6262	
Manager Connection Type	○ TCP ● UDP	

NMEA Identification

Unit ID	VG123456
Source Identification	○ Auto ● LAN ○ WAN
Source Port	6263

SMS Notification

Destination 1	○ Enable ● Disable
Destination 1	
Destination 2	○ Enable ● Disable
Destination 2	
Destination 3	○ Enable ● Disable
Destination 3	

Digital Output

Output 1	○ Ground ● Open
Output 2	○ Ground ● Open
Output 3	○ Ground ● Open
Output 4	○ Ground ● Open
Output 5	○ Ground ● Open
Output 6	○ Ground ● Open
Output 7	○ Ground ● Open

Triggers

Device

Cell Temperature	○ Enable ● Disable	
Threshold Low	0.0	(-40 - 80)°C
Threshold High	70.0	(-40 - 80)°C

Analog Input

Analog Input 1	○ Enable ● Disable	
Threshold Low	0.0	(0 - 30) V
Threshold High	12.0	(0 - 30) V
Analog Input 2	○ Enable ● Disable	
Threshold Low	0.0	(0 - 30) V
Threshold High	12.0	(0 - 30) V
Analog Input 3	○ Enable ● Disable	
Threshold Low	0.0	(0 - 30) V
Threshold High	12.0	(0 - 30) V
Analog Input 4	○ Enable ● Disable	
Threshold Low	0.0	(0 - 30) V
Threshold High	12.0	(0 - 30) V

Digital Input

Ignition	○ Enable ● Disable
Input 1	○ Enable ● Disable
Input 2	○ Enable ● Disable
Input 3	○ Enable ● Disable
Input 4	○ Enable ● Disable
Input 5	○ Enable ● Disable
Input 6	○ Enable ● Disable

NMEA Connection

- **Manager IP Address/Port**
  The IP address and service port of the NMEA server (manager).

- **Manager Connection Type**
  The connection protocol to communicate with the NMEA server (manager).

NMEA Identification

- **Unit ID**
  The Unit Name to be included in the NMEA message payload.

- **Source Identification**
  The Unit's IP address that will be included in the NMEA message payload.

- **Source Port**
  This is the port from which the NMEA message payload is transmitted.

SMS Notification

Destination Enable/Disable
The SMS notifications to the destinations can be enabled or disabled using the Radio buttons.

- **Destination 1 / Destination 2 / Destination 3**
  Alarms and notifications can be sent to up to three SMS destination addresses. Destination addresses are typically numeric digits only including the country code prefix. The radio buttons above each destination address can be used to enable or disable each address entered in the adjacent field. The report will consist of the Unit ID and colon (:) if the Unit ID is not blank, and the appropriate label from the I/O Settings » Labels tab.

Digital Output

- **Digital Output 1-7**
  Open or Close (**Ground**) the particular digital output.

Triggers – Device

- **Cell Temperature and thresholds**
  Enable or **disable** NMEA alarm and notification when temperature goes out of range.

Analog Input

- **Analog Input and thresholds (1 or 2)**
  Enable or **disable** NMEA alarm and notification when an temperature goes out of range.

Digital Input

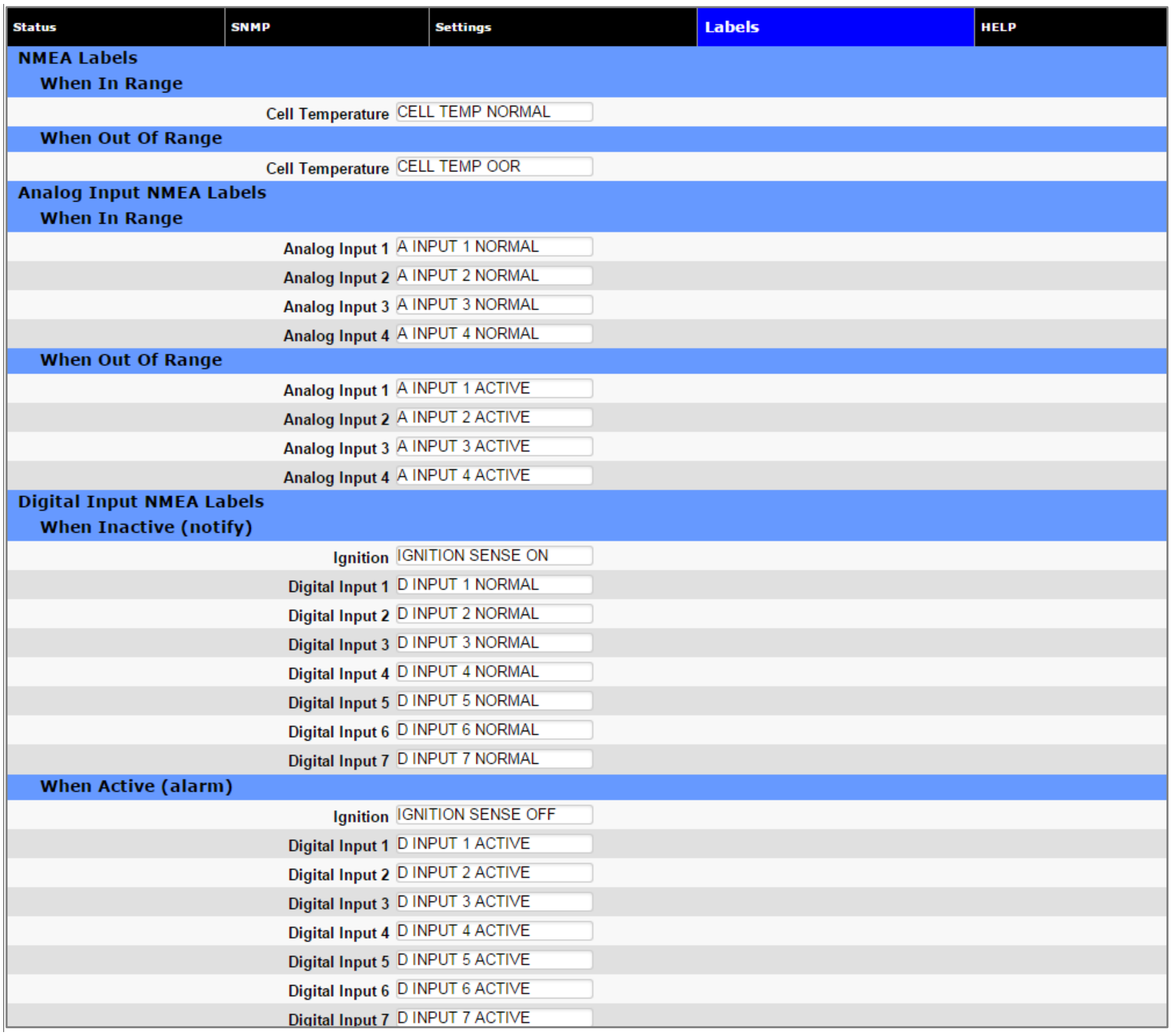
- **Digital Input 1-7**
  Enable or **disable** NMEA alarm and notification when the input state changes.

3.10.4 LABELS

Each diagnostic value can be user-defined messages indicating its normal and abnormal conditions.

I/O Labels can up to 64 characters long and can consist of letters, digits, space and the characters #%().=+-_$:;/?

Figure 58: I/O Settings — Labels



NMEA Labels

When In Range

Cell Temperature	CELL TEMP NORMAL

When Out Of Range

Cell Temperature	CELL TEMP OOR

Analog Input NMEA Labels

When In Range

Analog Input 1	A INPUT 1 NORMAL
Analog Input 2	A INPUT 2 NORMAL
Analog Input 3	A INPUT 3 NORMAL
Analog Input 4	A INPUT 4 NORMAL

When Out Of Range

Analog Input 1	A INPUT 1 ACTIVE
Analog Input 2	A INPUT 2 ACTIVE
Analog Input 3	A INPUT 3 ACTIVE
Analog Input 4	A INPUT 4 ACTIVE

Digital Input NMEA Labels

When Inactive (notify)

Ignition	IGNITION SENSE ON
Digital Input 1	D INPUT 1 NORMAL
Digital Input 2	D INPUT 2 NORMAL
Digital Input 3	D INPUT 3 NORMAL
Digital Input 4	D INPUT 4 NORMAL
Digital Input 5	D INPUT 5 NORMAL
Digital Input 6	D INPUT 6 NORMAL
Digital Input 7	D INPUT 7 NORMAL

When Active (alarm)

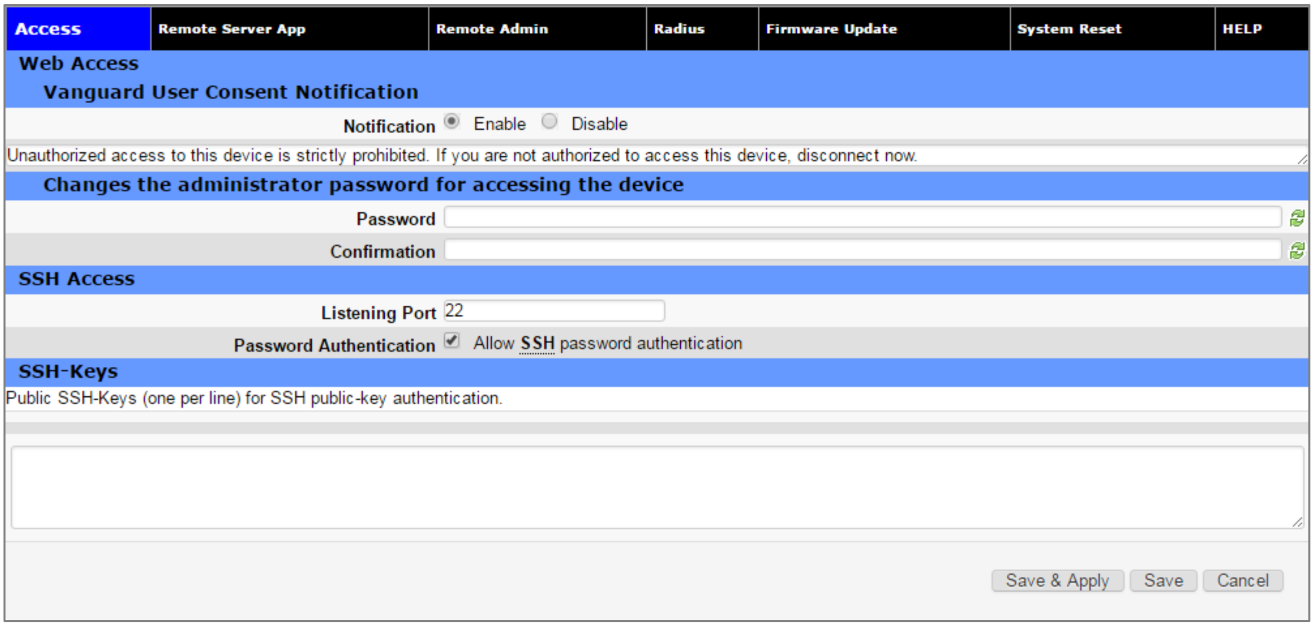
Ignition	IGNITION SENSE OFF
Digital Input 1	D INPUT 1 ACTIVE
Digital Input 2	D INPUT 2 ACTIVE
Digital Input 3	D INPUT 3 ACTIVE
Digital Input 4	D INPUT 4 ACTIVE
Digital Input 5	D INPUT 5 ACTIVE
Digital Input 6	D INPUT 6 ACTIVE
Digital Input 7	D INPUT 7 ACTIVE

3.11 ADMIN

3.11.1 ACCESS

The Access config page controls various settings for accessing the Vanguard's web pages and admin shell.

Figure 59: Admin — Access



Web Access

Vanguard User Consent Notification

Notification ● Enable ○ Disable

Unauthorized access to this device is strictly prohibited. If you are not authorized to access this device, disconnect now.

Changes the administrator password for accessing the device

Password

Confirmation

SSH Access

Listening Port 22

Password Authentication ☑ Allow SSH password authentication

SSH-Keys

Public SSH-Keys (one per line) for SSH public-key authentication.

Web Access

Vanguard User Consent Notification

For installations that have legal requirements for restricting access to devices, User Consent Notification displays a definable message and requires that the user click “AGREE” before the Login web page is presented.

- **Notification**
  The feature is disabled by default.
  Note: The long input field can accept a very long paragraph that will word-wrap as needed. Currently only the text up until the first carriage-return will be stored and displayed.

Admin password

- **Password / Confirmation**
  Changes the administrator password for accessing the device via the Web Interface. The password can be up to 32 characters long and can consist of any printable character except '&"<>

IMPORTANT NOTE. CalAmp strongly recommends that the default password be changed before the Vanguard is deployed on a public cellular network.

SSH Access

- **Listening Port**
  The SSH server’s port number on the LAN side of the Vanguard. The WAN side port number is changed in *Admin > Remote Admin*.

- **Password Authentication**
  When the **Allow SSH password authentication** checkbox is selected, the device will allow the SSH clients to login using a password. Uncheck this option to disable password-based SSH client login. The SSH admin account uses the same password as the web server.

SSH-Keys

Copy and paste the public key from an SSH client host into the SSH-Keys window and click on “Save & Apply” to login from a SSH client using a public-private key pairs.

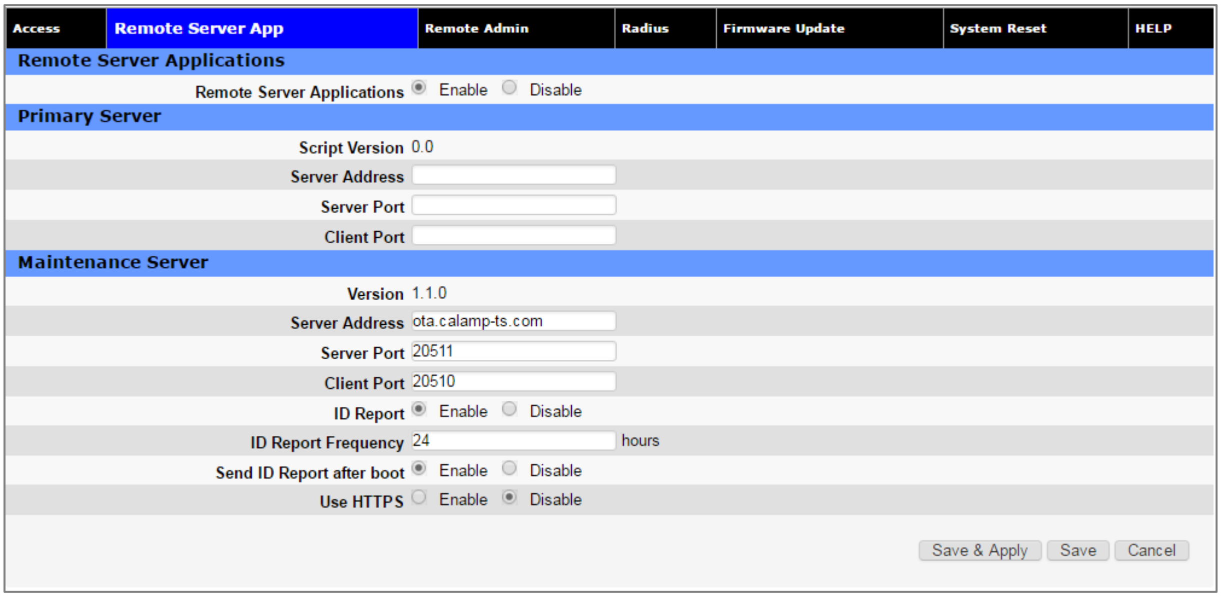
Note: If there are no keys configured in SSH-Keys, and Password Authentication is unchecked, then no SSH access is allowed in the device.

3.11.2 REMOTE SERVER APP

The Remote/Cloud Server Applications config page can be used to configure the built-in CalAmp Remote/Cloud Server and Client applications.

- The Client is built in the unit, and can be enabled/disabled.
- The Remote/Cloud Primary Server is used for event reporting and can be empty if there's no event reporting server.
- The Remote/Cloud Maintenance Server is used for ID report, unit firmware upgrade and configuration update. The Maintenance Server cannot be empty once this Remote Server Applications feature is enabled.

Figure 60: Admin — Remote Server App



Remote Server Applications

Remote Server Applications	● Enable ○ Disable

Primary Server

Script Version	0.0
Server Address	
Server Port	
Client Port	

Maintenance Server

Version	1.1.0
Server Address	ota.calamp-ts.com
Server Port	20511
Client Port	20510
ID Report	● Enable ○ Disable
ID Report Frequency	24 hours
Send ID Report after boot	● Enable ○ Disable
Use HTTPS	○ Enable ● Disable

Remote Server Applications

- **Remote Server Applications**
  The Client for Remote Server Applications can be enabled or disabled using this button.

- **Version**
  Displays the version of the Client currently running in the unit.

- **Port**
  The UDP port number on which the Client listens. The default UDP port used for this is 20510.

Primary Server

- **Server Address**
  This is the domain name or IP address of the Primary Server. The Client running in the unit uses this address to report event to the server.

- **Port**
  The UDP port number on the Primary Server that the Client uses to send all messages.

Maintenance Server

- **Server Address**
  This is the domain name or IP address of the Maintenance Server. The Client running in the unit uses this address to perform ID report to the server, and unit firmware upgrade and configuration update from the server.

- **Port**
  The UDP port number of the Maintenance Server that the Client uses to send all messages.

ID Report

- **ID Report**
  This is an identification report that can be sent to DeviceOutlook. Enable this to have the DeviceOutlook client app generate periodic ID reports. Disable to not generate ID reports. The default setting is to generate reports.

- **ID Report Frequency**
  If ID report generation is enabled, specify how often reports are to be generated by the DeviceOutlook client app.

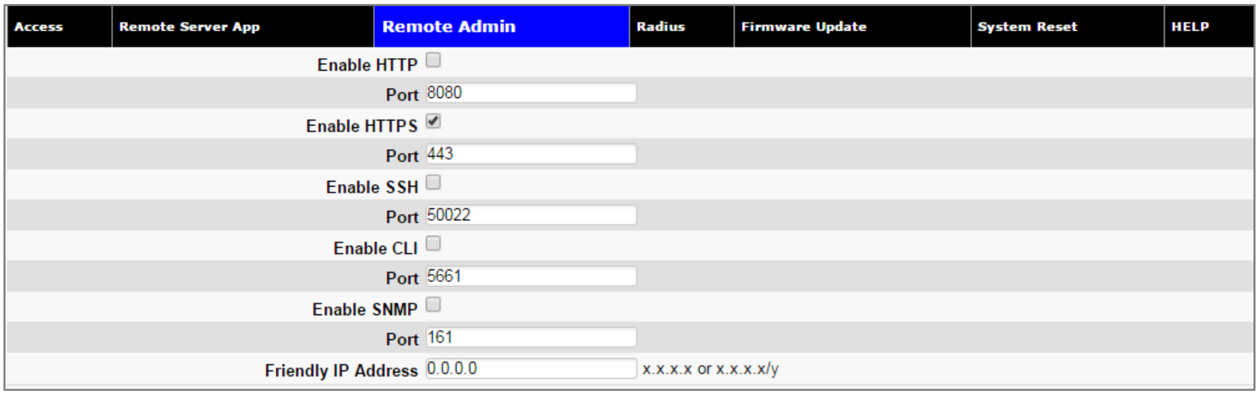
- **Send ID Report after boot**
  Enable or Disable the ID Reporting after the router reboot.

Maintenance Server Comm Security Settings

- **Use HTTPS**
  Enable/Disable the secure HTTPS communication to the Maintenance Server.

3.11.3 REMOTE Admin

Figure 61: Admin — Remote Admin



Enable HTTP	□
Port	8080
Enable HTTPS	☑
Port	443
Enable SSH	□
Port	50022
Enable CLI	□
Port	5661
Enable SNMP	□
Port	161
Friendly IP Address	0.0.0.0 x.x.x.x or x.x.x.x/y

This section allows you to enable various remote administration services and set their port numbers. Unless you have a specific reason to change a port number, choose the default value when enabling a service.

- **Enable HTTP**
  Enable remote administration via the standard (not secure) web server interface.

- **Enable HTTPS**
  Enable remote administration via the secure web server.

- **Enable SSH**
  Enable remote administration via Secure Shell.

- **Enable CLI**
  Enable remote administration via CLI.

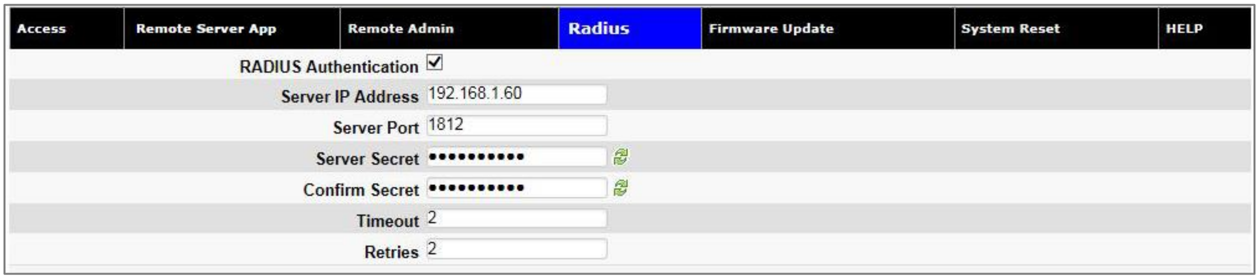
- **Enable SNMP**
  Enable remote administration via the Simple Network Management Protocol.

- **Friendly IP Address**
  Specify what IP address is allowed to connect (CIDR notation). The default **0.0.0.0/0** allows all IP addresses to connect.

3.11.4 RADIUS

Vanguard supports (RADIUS) Remote Authentication Dial In User Services for webpage access.

Figure 62: Admin — RADIUS



RADIUS Authentication	☑
Server IP Address	192.168.1.60
Server Port	1812
Server Secret	●●●●●●●●●●●
Confirm Secret	●●●●●●●●●●●
Timeout	2
Retries	2

- **RADIUS Authentication**
  Enable or disable RADIUS authentication for webpage access.

- **Server IP Address**
  The IP address of the RADIUS server.

- **Server Port**
  The port of the server.

- **Server Secret**
  Sets the secret to use with the server.

- **Confirm Secret**
  Re-type the Server Secret to confirm the correct spelling.

- **Timeout**
  Specify how many seconds to wait before a retry.

- **Retries**
  Specify how many times to retry authenticating with the server before giving up.

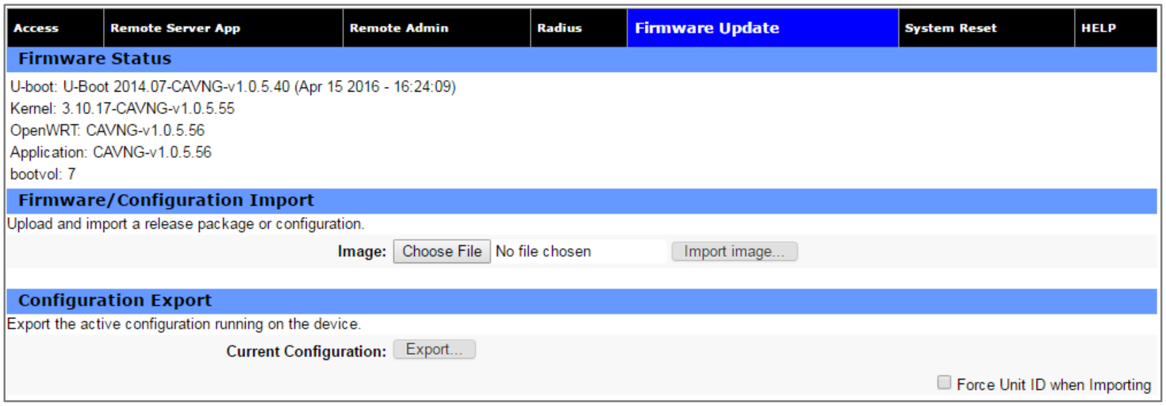
3.11.5 FIRMWARE UPDATE

When newer versions of the modem firmware become available, the user can download the proper file from the CalAmp web site and manually update the unit by uploading the new firmware. Time required for Importing new firmware depends on connection (WAN or LAN). Applying new firmware can take up to four minutes.

Firmware update files are typically given file names of the form CAVNG-`{version}.tar.gz` This archive is unpacked by the device and does not have to be unpacked by the user before importing.

Caution: It is important to have a stable power source and ensure that power to the Vanguard 5530 is not interrupted during a firmware upgrade.

Figure 63: Admin — Firmware Update



Firmware Status

U-boot: U-Boot 2014.07-CAVNG-v1.0.5.40 (Apr 15 2016 - 16:24:09)
Kernel: 3.10.17-CAVNG-v1.0.5.55
OpenWRT: CAVNG-v1.0.5.56
Application: CAVNG-v1.0.5.56
bootvol: 7

Firmware/Configuration Import

Upload and import a release package or configuration.

Image: No file chosen

Configuration Export

Export the active configuration running on the device.

Current Configuration:

☐ Force Unit ID when Importing

Firmware Status

This tab displays the currently running version of Vanguard firmware and its subcomponents.

- **U-boot**
  Displays the boot-loader version currently loaded in the device.

- **Kernel**
  Displays the Operating System Kernel version of the currently loaded in the device.

- **OpenWRT**
  Displays the Operating System version currently loaded in the device.

- **Application**
  Displays the Application version currently loaded in the device.

- **Bootvol**
  Displays the bitmap describing the active OS, rootfs and Application partitions in the device.

Firmware / Configuration Import

This section allows the user to upgrade to new firmware, import previously exported configurations and load ODP applications and PEG scripts. Imports can be done over the local Ethernet connection or over the cellular network if Remote Administration is enabled, allowing remote access to the Vanguard 5530 Web Interface and the Firmware Update page.

- **Image**
  Enter the package file name or you may use the Choose File button to locate the file from your hard drive.

- **Import Image**
  After selecting the package filename above, press the **Import Image** button to begin the import process.

Note:

- Firmware Update: the imported Firmware version has to be greater than the current running one.
- Configuration Update: the imported Configuration version has to be lower or equal to the current running one.

Upgrade Confirmation

After the package upload is completed, the **Upgrade Confirmation** will appear, displaying the uploaded file's Checksum and Size.

If the package is a firmware upgrade, **Apply Package Config** will revert all setting to factory default. If the package is a previously exported Configuration, **Apply Package Config** will be automatically checked.

Once the Proceed button is clicked, a non-reversable Firmware/Configuration update process is triggered. If the update succeeds, a reboot will happen after. If the update fails, no reboot will happen and the failure reason will be logged.

Note: Do not manually reboot the device while the device is being updated.

Configuration Export

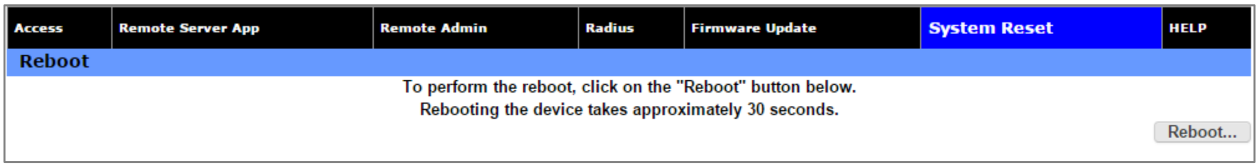
- **Current Configuration**
  Field to export the device configuration file. Clicking on the Export button will pop-up the browser's Download/Save As dialog.

- The configuration file generated from this device can be imported to another device to ease configuration effort.

- **Force Unit ID when Importing**
  Leave unchecked so that the unique per device Unit ID isn't over written when this configuration package is imported. When checked, the value of *Unit Status > Basic Settings > Unit ID > ID* will be over written on import.

3.11.6 SYSTEM RESET

Figure 64: Admin — System Reset



To perform the reboot, click on the "Reboot" button below.
Rebooting the device takes approximately 30 seconds.

Click the **Reboot…** button to reset the system. It takes approximately 30 seconds for the system to come back online.

4 IP ADDRESSING

4.1 OVERVIEW

When Vanguard cellular router is connected to a cellular carrier, it will always have at least two IP addresses. The first is the local area network (LAN) address. The Vanguard can be accessed through either the LAN 1 or LAN 2 Ethernet connectors on the front panel using this IP address. This IP address is user configurable and is saved locally in the Vanguard. The factory default IP address is 192.168.1.50 with a subnet mask of 255.255.255.0.

The second Vanguard IP address is assigned by the cellular carrier each time the Vanguard connects to the cellular network. Often, this IP address is publicly accessible from the Internet, however in some instances the cellular carrier may assign an IP address that is protected by firewalls. When a publicly accessible IP address is assigned, data flows can be initiated from either the Vanguard or from the Internet. When an IP address is protected by cellular firewalls, data flows can only be initiated from the Vanguard. In either case, after a data flow has been established, data is free to move in both directions.

For mobile models equipped with Wi-Fi, the Vanguard will be assigned a third IP address on the Wi-Fi wireless network.

4.2 IP ADDRESSING TUTORIAL

The default LAN subnet of the Vanguard consists of addresses from 192.168.1.0 to 192.168.1.255. The first and last IP addresses of a subnet are always reserved, no matter what the subnet size is. The first IP address in the subnet is the Network ID. The last IP address in the subnet is the Broadcast Address.

The example below illustrates a sample Vanguard network. The subnet consists of IP addresses ranging from 192.168.1.0 to 192.168.1.255. The subnet mask is 255.255.255.0. This is sometimes written in shorthand notation as: 192.168.1.50/24 since the subnet mask 255.255.255.0 contains 24 ones then 8 zeros when it is converted to binary.

The first address 192.168.1.0 is reserved for the Network ID. The last address 192.168.1.255 is reserved for the broadcast address. There are 254 valid IP addresses that may be assigned to hosts on the LAN network.

Ethernet Subnet Mask	255.255.255.0
Network ID	192.168.1.0 (reserved – first IP address in subnet)
Broadcast Address	192.168.1.255 (reserved – last IP address in subnet)
Vanguard 5530	192.168.1.50/24
PLC/RTU #1	192.168.1.10/24
Computer #1	192.168.1.125/24

By changing the subnet mask, the network can be made to include as many or as few IP addresses as desired. Ethernet devices can only talk directly to other devices that have IP addresses within the same IP subnet. For example, Computer #1 from the example above can only talk with locally connected devices that have IP addresses between 192.168.1.1 and 192.168.1.254. When Computer #1 wants to talk to another server on the Internet, it will send its data packet to the local gateway. In this case the local gateway is the Vanguard router. Since the Vanguard has two IP addresses (each IP address is on a separate subnet), it can forward the packet from the LAN network (192.168.1.0/24) to the cellular network. The packet will continue to be forwarded in a similar fashion, from subnet to subnet, until it reaches its final destination.

4.3 PRIVATE VERSUS PUBLIC IP ADDRESSES

Certain address ranges in the in IPv4 address space have been reserved as private IP address. Private IP addresses can be used by anyone, without the need to register for an IP address assignment from the IANA (Internet Assigned Numbers Authority). However, private IP addresses are not routable on the Internet. Routers on the Internet will typically drop any packets that are destined for a private IP address. These addresses are reserved for local use only.

Common Private IP Address Ranges

10.0.0.0 to	10.255.255.255	
172.16.0.0	to	172.31.255.255
192.168.0.0	to	192.168.255.255

Devices using Private IP addresses must have a router with NAT (network address translation) capability to access the Internet. By default, the Vanguard will perform the NAT function on all outgoing traffic. The Vanguard router will change the source IP address from the private IP of the local host to the Vanguard's public IP address which was assigned by the cellular carrier. Since the outgoing packet has been modified, a remote server or website on the Internet will think the packet came directly from the Vanguard radio. It will reply back to the cellular IP address of the

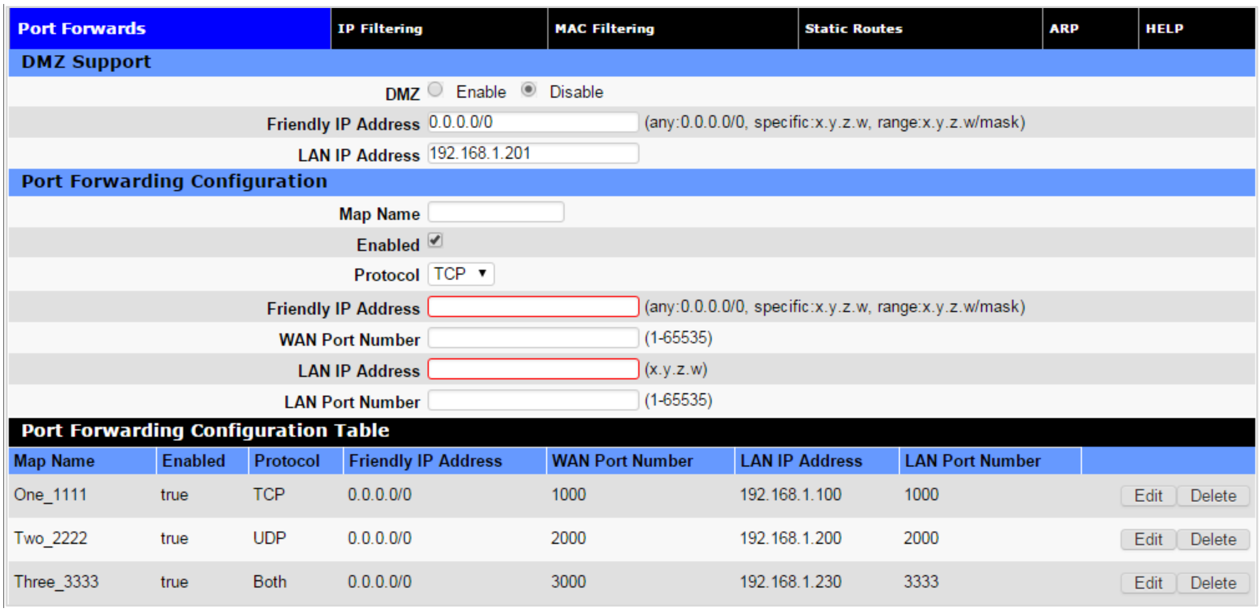
Vanguard. The Vanguard radio remembers which traffic flows have been established and routes the incoming return traffic back to the desired host device on the local area network.

4.4 PORT FORWARDING

NAT functionality is only useful for traffic flows that are initiated by the Vanguard or by a device that is physically connected to the Vanguard. Port forwarding can be enabled to allow remote devices connecting through the Internet to initiate traffic flows with a local device connected to a Vanguard router.

In the example configuration shown below, a host from the Internet can create either a TCP or UDP connection with the local host at 192.168.1.250 on port 7000 by sending a packet to the cellular IP address of the Vanguard at port 8010. When the Vanguard receives a packet destined for port 8010 it will look through the Port Forwarding table to see if a matching rule exists. It finds the rule that instructs it to forward this packet to port 7000 of IP address 192.168.1.250. The Vanguard then modifies the destination IP address and port number before forwarding the packet onto the local area network.

Figure 65: Port Forwarding Example



DMZ Support

DMZ	○ Enable ● Disable
Friendly IP Address	0.0.0.0/0 (any:0.0.0.0/0, specific:x.y.z.w, range:x.y.z.w/mask)
LAN IP Address	192.168.1.201

Port Forwarding Configuration

Map Name	
Enabled	☑
Protocol	TCP ▾
Friendly IP Address	(any:0.0.0.0/0, specific:x.y.z.w, range:x.y.z.w/mask)
WAN Port Number	(1-65535)
LAN IP Address	(x.y.z.w)
LAN Port Number	(1-65535)

Port Forwarding Configuration Table

Map Name	Enabled	Protocol	Friendly IP Address	WAN Port Number	LAN IP Address	LAN Port Number	
One_1111	true	TCP	0.0.0.0/0	1000	192.168.1.100	1000	Edit Delete
Two_2222	true	UDP	0.0.0.0/0	2000	192.168.1.200	2000	Edit Delete
Three_3333	true	Both	0.0.0.0/0	3000	192.168.1.230	3333	Edit Delete

Port forwarding is useful for field applications that use polling that is initiated by a polling master. The port forwarding function allows the polling master to establish a data connection through the Internet. The incoming polling message is forwarded by the Vanguard to the appropriate PLC or RTU on the Vanguard's local area network.

4.5 DMZ

Alternately, DMZ can be enabled on the Vanguard router. When DMZ is enabled, all traffic destined to the Vanguard's cellular IP address that is received from the Internet is forwarded to the DMZ host. The IP address of the DMZ host is specified by the user. Using DMZ can eliminate the need to specify many individual port forwarding rules. However, by exposing all the ports on the local device, the local device may become more susceptible to attacks.

If specific Port Forwarding rules exist in the IP Mapping Table, they will take precedence over the DMZ host.

4.6 FRIENDLY IP ADDRESS

Friendly IP addresses can be used with either port forwarding or DMZ to provide an additional layer of security. When Friendly IP addresses are used, the Vanguard will only forward packets to the LAN if the source IP address of the received packet matches either the specific IP address or range of IP addresses specified in the Friendly IP address field.

This feature can be disabled by entering 0.0.0.0 in the friendly IP address field. In this case, packets from any host on the Internet can be forwarded to the LAN when either DMZ or Port Forwarding is enabled.

5 IPSEC AND VPN PASS-THROUGH DEPLOYMENT GUIDE

This chapter will help anyone who wants to build a secure IP network using IPsec and the Calamp Vanguard 5530 Cellular Modem. Case #1: Vanguard Configured IPsec Client will demonstrate the Vanguard 5530 when used as an IPsec client. Case #2 Vanguard Configured to use a DMZ for VPN Pass-Through will show the Vanguard 5530 passing an IPsec connection from WAN to LAN. (VPN Pass-through).

5.1 BENEFITS OF IPSEC

IPsec (Internet Protocol Security Standard) is an industry driven standard that ensures confidentiality, integrity, and authenticity of an IP network. IPsec is a key component of this standard-based, flexible solution for deploying a network-wide policy.

There are two significant benefits to IPsec compliance for our customers: enhanced security features and interoperability.

— **Enhanced security features** provide the most secure and comprehensive standard available today for encryption and authentication.

The Vanguard IPsec encryption support: AES-128, AES-256 and 3DES.
The Vanguard IPsec authentication support: MD5 and SHA1.
All tunnels are created using the ESP (Encapsulating Security Payload) protocol.

— **Protocol interoperability** means that an IPsec compliant device, such as the Vanguard 5530, will be able to exchange keys and encrypted communications with another IPsec compliant product such as a CISCO router. IPSEC compliance ensures that these two different products can negotiate and maintain a secure communication with each other.

5.2 CONFIGURATION SUMMARY

The first case demonstrates configuring IPsec tunnels on the Vanguard 5530. The second example demonstrates configuring the Vanguard to use a DMZ for VPN pass-through between IPsec clients and a remote host over a router acting as a VPN server.

Detailed configuration examples are provided for each scenario.

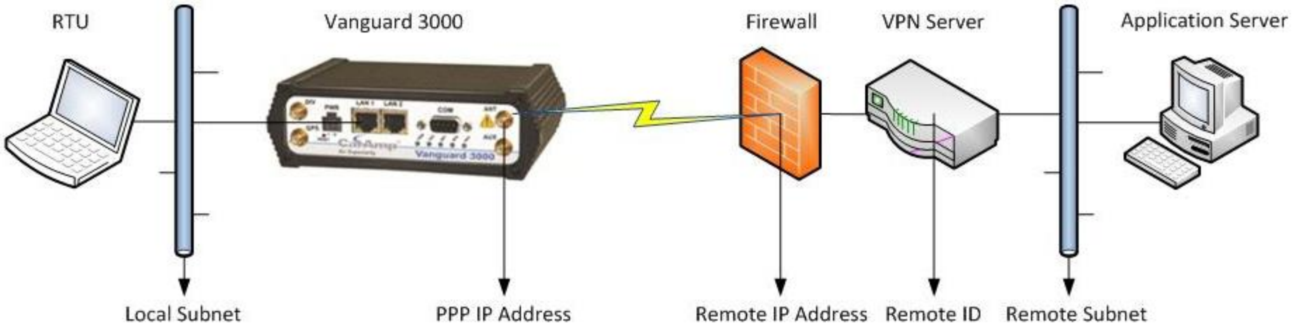
5.2.1 CASE #1: VANGUARD CONFIGURED IPSEC CLIENT

Overview

IPsec is a security protocol that provides secured communication tunnels over IP. As you create IPsec tunnels through the Vanguard 5530 Web interface in the Security » IPsec tab, they will be displayed in the Tunnel Table at the bottom of the IPsec tab. All tunnels are created using the ESP (Encapsulating Security Payload) Protocol.

The following figure depicts an IPsec tunnel between a Remote Telemetry Unit (RTU) and Application Server.

Figure 66 Vanguard configured as an IPsec client



Prerequisite Information

In order to implement IPsec with the Vanguard 5530 and to successfully connect to a VPN server and secure data between two endpoints, you will need to know the following information.

- Tunnel Label
- Vanguard 5530 local subnet
- Vanguard 5530 PPP IP Address
- Firewall IP Address (remote IP Address)
- VPN Server IP Address (Remote ID optional—not usually required if firewall and VPN server are the same unit)
- Remote Subnet
- Phase1 Encryption details
- Phase 2 Encryption details
- Pre-Shared Key (PSK)
- Perfect Forward Security (PFS) Enabled or Disabled
- Dead Peer Detection (DPD) delay (seconds), timeout (seconds) and action

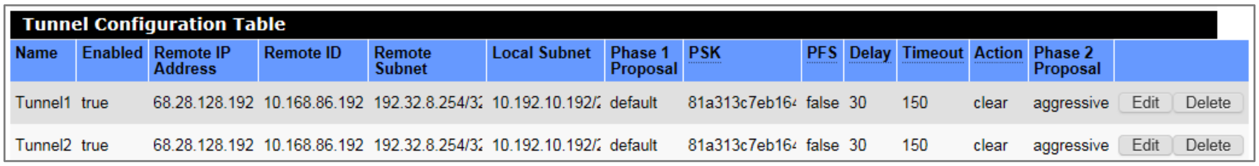
If you do not have this information, contact your network integrator.
Vanguard 5530 IPsec Client Connection

This example will use the following values to define two IPsec tunnels.

• Tunnel Label		Tunnel1	Tunnel2
• Vanguard 5530 local subnet		10.192.10.192/29 (LAN)	10.192.10.192/29 (LAN)
• Firewall IP Address (remote IP Address)		68.28.128.192	68.28.128.192
• VPN Server IP Address (Remote ID)		10.168.86.192	10.168.86.192
• Remote Subnet		192.32.8.254/32	10.0.198.198/32
• Phase1 Encryption		3DES/MD5/Group2	3DES/MD5/Group2
• Phase 2 Encryption details		3DES/MD5	3DES/MD5
• Pre-Shared Key (PSK)		Password1!	Secret2!
• Perfect Forward Security (PFS)		Disabled	Disabled
• Dead Peer Detection	delay	30	30
	timeout	150	150
	action	Clear	Clear

The objective in this example is to create two IPsec tunnels with the above parameters. These tunnels and the parameters used to define them will appear the Tunnel Table at the bottom of the Security » IPsec tab as shown in the figure below. Once these IPsec tunnels have been defined and added to the table, they must be enabled to be functional.

Figure 67: Tunnel Table using example values



Tunnel Configuration Table

Name	Enabled	Remote IP Address	Remote ID	Remote Subnet	Local Subnet	Phase 1 Proposal	PSK	PFS	Delay	Timeout	Action	Phase 2 Proposal	
Tunnel1	true	68.28.128.192	10.168.86.192	192.32.8.254/3	10.192.10.192/	default	81a313c7eb16	false	30	150	clear	aggressive	Edit Delete
Tunnel2	true	68.28.128.192	10.168.86.192	192.32.8.254/3	10.192.10.192/	default	81a313c7eb16	false	30	150	clear	aggressive	Edit Delete

Vanguard IPsec Client Configuration

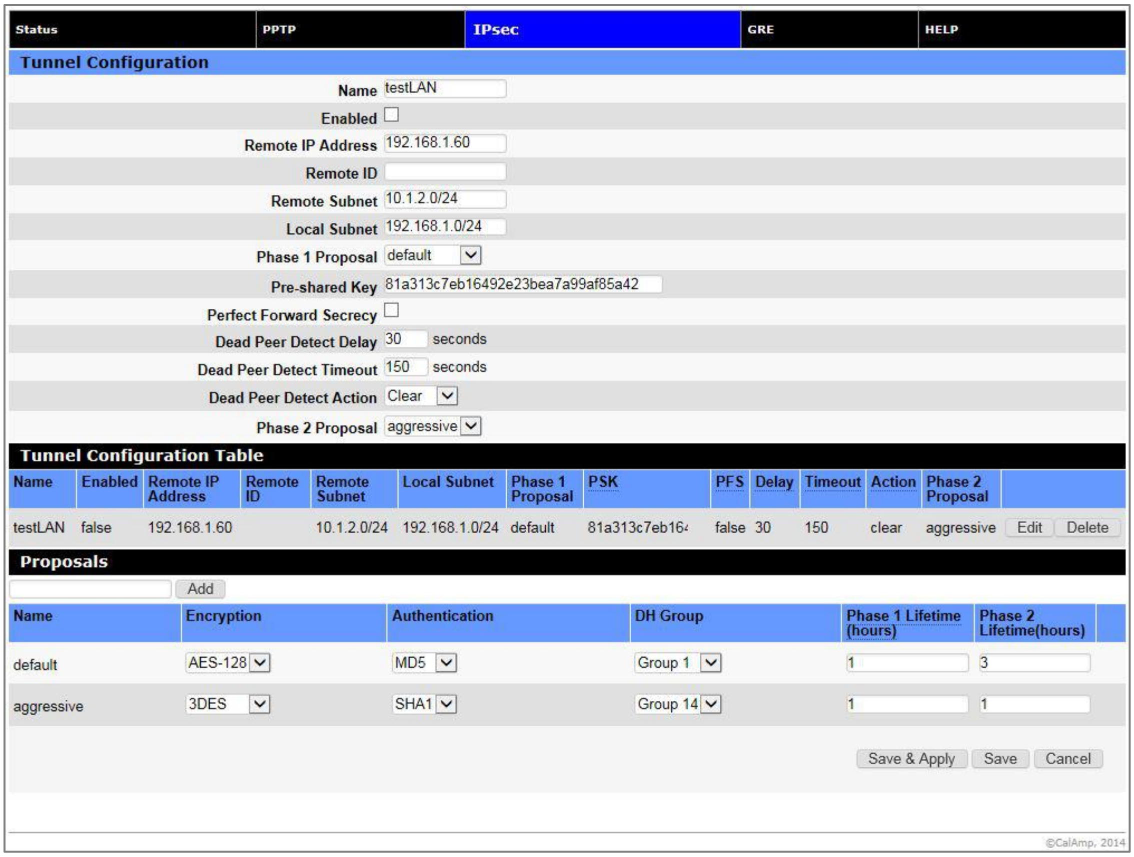
Step 1 From the laptop connected to the LAN port of the Vanguard 5530, ping the remote IP Address. The pings should receive replies.

Step 2 Open a Web browser on the connected laptop and navigate to the Vanguard Web interface.

Step 3 From the main navigation pane, select **Security**, and from the Security page, select the **IPsec** tab.

Step 4 Select a name for the IPsec tunnel and enable it by checking the Enable box.

Figure 68: IPsec Configuration Page



Tunnel Configuration

Name	testLAN
Enabled	□
Remote IP Address	192.168.1.60
Remote ID	
Remote Subnet	10.1.2.0/24
Local Subnet	192.168.1.0/24
Phase 1 Proposal	default
Pre-shared Key	81a313c7eb16492e23bea7a99af85a42
Perfect Forward Secrecy	□
Dead Peer Detect Delay	30 seconds
Dead Peer Detect Timeout	150 seconds
Dead Peer Detect Action	Clear
Phase 2 Proposal	aggressive

Tunnel Configuration Table

Name	Enabled	Remote IP Address	Remote ID	Remote Subnet	Local Subnet	Phase 1 Proposal	PSK	PFS	Delay	Timeout	Action	Phase 2 Proposal	
testLAN	false	192.168.1.60		10.1.2.0/24	192.168.1.0/24	default	81a313c7eb16	false	30	150	clear	aggressive	Edit Delete

Proposals

Name	Encryption	Authentication	DH Group	Phase 1 Lifetime (hours)	Phase 2 Lifetime(hours)
default	AES-128	MD5	Group 1	1	3
aggressive	3DES	SHA1	Group 14	1	1

Step 5 IPsec tunnel configuration information for the tunnels. Select a tunnel to configure by entering its name in the **Name** field. Current values for that tunnel are displayed. Changes do not take effect until you click **Save & Apply.**

After the page refreshes, the tunnel configuration will appear in the Tunnel Table at the bottom of the tab

Step 7 When the IPsec tunnel is established, all IP Packet traffic originating from 192. 32. 8.254/32 will pass through the IPsec VPN tunnel to the local subnet (10.192.10.192/29), and vice-versa. Click the **View** link in the far-right column of the table to monitor the IPsec client connection. A window opens to display the log of the tunnel's negotiation activity (early events appear near the top and more-recent events appear near the bottom). Search the log contents for "IPsec SA established tunnel mode."

```
002 "ttunnel1" #1: initiating Main Mode
104 "ttunnel1" #1: STATE_MAIN_I1: initiate
003 "ttunnel1" #1: ignoring Vendor ID payload [FRAGMENTATION c0000000]
002 "ttunnel1" #1: transition from state STATE_MAIN_I1 to state STATE_MAIN_I2
106 "ttunnel1" #1: STATE_MAIN_I2: sent MI2, expecting MR2
003 "ttunnel1" #1: received Vendor ID payload [Cisco-Unity]
003 "ttunnel1" #1: received Vendor ID payload [XAUTH]
003 "ttunnel1" #1: ignoring unknown Vendor ID payload [d194db099684f49320f6abd9829c7b65]
003 "ttunnel1" #1: ignoring Vendor ID payload [Cisco VPN 3000 Series]
002 "ttunnel1" #1: transition from state STATE_MAIN_I2 to state STATE_MAIN_I3
108 "ttunnel1" #1: STATE_MAIN_I3: sent MI3, expecting MR3
003 "ttunnel1" #1: received Vendor ID payload [Dead Peer Detection]
002 "ttunnel1" #1: Main mode peer ID is ID_IPV4_ADDR: '10.168.86.192'
002 "ttunnel1" #1: transition from state STATE_MAIN_I3 to state STATE_MAIN_I4
004 "ttunnel1" #1: STATE_MAIN_I4: ISAKMP SA established {auth=OAKLEY_PRESHARED_KEY
cipher=oakley_3des_cbc_192 prf=oakley_md5 group=modp1024}
002 "ttunnel1" #1: Dead Peer Detection (RFC 3706): enabled
002 "ttunnel1" #2: initiating Quick Mode PSK+ENCRYPT+TUNNEL+UP+IKEv2ALLOW {using isakmp#1 msgid:4328edc8
proposal=3DES(3)_192-MD5(1)_128 pfsgroup=no-pfs}
117 "ttunnel1" #2: STATE_QUICK_I1: initiate
003 "ttunnel1" #2: ignoring informational payload, type IPSEC_RESPONDER_LIFETIME msgid=4328edc8
002 "ttunnel1" #2: Dead Peer Detection (RFC 3706): enabled
002 "ttunnel1" #2: transition from state STATE_QUICK_I1 to state STATE_QUICK_I2
004 "ttunnel1" #2: STATE_QUICK_I2: sent QI2, IPsec SA established tunnel mode {ESP=>0x8e426351 <0xaeeb3b44
xfrm=3DES_0-HMAC_MD5 NATOA=none NATD=none DPD=enabled}
```

Step 8 Once the "IPsec SA established tunnel mode" message is displayed in the tunnel negotiation log, a communication test is required to ensure point-to-point connectivity. From the Application Server located behind the VPN server, ping the LAN IP of the local device connected to the Vanguard 5530 LAN port. The pings should receive replies from the local device.

Alternatively, ping the Application Server IP Address from a device on the Vanguard's local LAN and receive replies similar to the following.

```
[Prompt]$ping 192.32.8.254
PING 192.32.8.254 (192.32.8.254) from 10.192.10.195
64 bytes from 192.32.8.254: seq=0 ttl=126 time=136.646 ms
64 bytes from 192.32.8.254: seq=1 ttl=126 time=134.848 ms
```

```
64 bytes from 192.32.8.254: seq=2 ttl=126 time=135.274 ms
64 bytes from 192.32.8.254: seq=3 ttl=126 time=133.018 ms
^C
--- 192.32.8.254 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max = 133.018/134.946/136.646
```

Repeat the above steps to configure and enable the second tunnel.

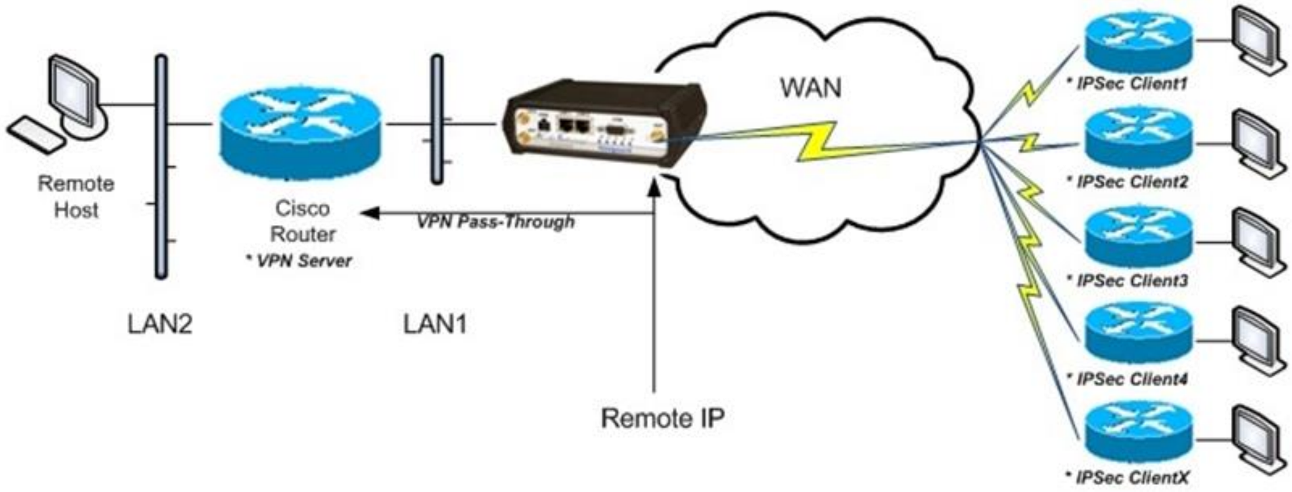
Edit and Delete buttons in the table allow you to change configuration settings or remove the tunnel the Tunnel Table. You can also select a tunnel to configure by simply typing its name in the **Name** field.

- To change settings, enter the Tunnel Item number in the Tunnel Configuration section, enter the configuration settings, and click **Save & Apply**.

- To delete a tunnel, click the **Delete** button in the far-right column that is associated with the tunnel item.

5.2.2 CASE #2 VANGUARD CONFIGURED TO USE A DMZ FOR VPN PASS-THROUGH

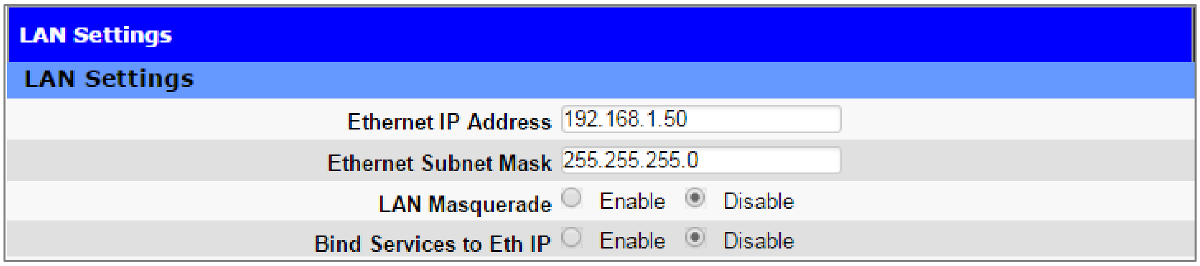
Figure 69 Vanguard configured with a DMZ for VPN Pass-Through



Vanguard – VPN Pass-Through Configuration Example Using a DMZ

In this scenario, the Vanguard is configured to use a DMZ to facilitate pass-through for the VPN connection. Apply these parameter changes into the Vanguard.

LAN » LAN Settings » LAN Masquerade = Disabled

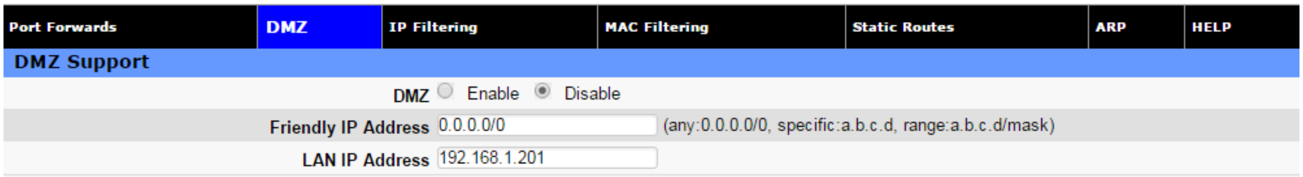


LAN Settings

LAN Settings

Ethernet IP Address	192.168.1.50
Ethernet Subnet Mask	255.255.255.0
LAN Masquerade	○ Enable ● Disable
Bind Services to Eth IP	○ Enable ● Disable

Router > DMZ = Enabled » Friendly IP Address = 0.0.0.0 » Destination IP Address = CISCO Router (VPN server) LAN 1 IP Address.



DMZ Support

DMZ ○ Enable ● Disable

Friendly IP Address 0.0.0.0/0 (any:0.0.0.0/0, specific:a.b.c.d, range:a.b.c.d/mask)

LAN IP Address 192.168.1.201

Note: It is also possible to use port forwarding (using configuration settings in the lower sections of this same tab) instead of DMZ to configure the Vanguard for VPN Pass-through.

6 USER I/O PORT

The Vanguard has a 22 pin connector on the back panel that can be used for general purpose analog and digital inputs as well as open collector digital outputs. The signals listed in the User I/O Port Connector Pin Out Table are available, and the electrical characteristics are defined in the following section. All unused pins should be left floating.

Figure 70: User I/O port connector

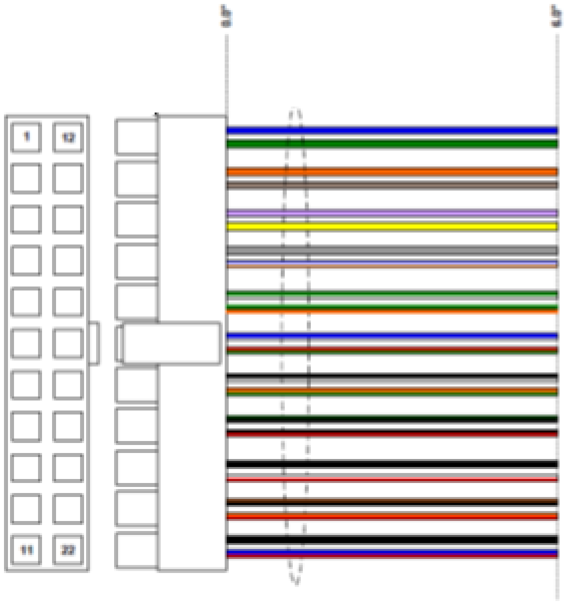


Table 18: User I/O Port connector pin out

Pin number	Signal Name	Notes
1	DIGITAL INPUT1	Digital Input
2	DIGITAL INPUT2	Digital Input
3	DIGITAL INPUT3	Digital Input
4	DIGITAL INPUT4	Digital Input
5	DIGITAL INPUT5	Digital Input
6	DIGITAL INPUT6	Digital Input

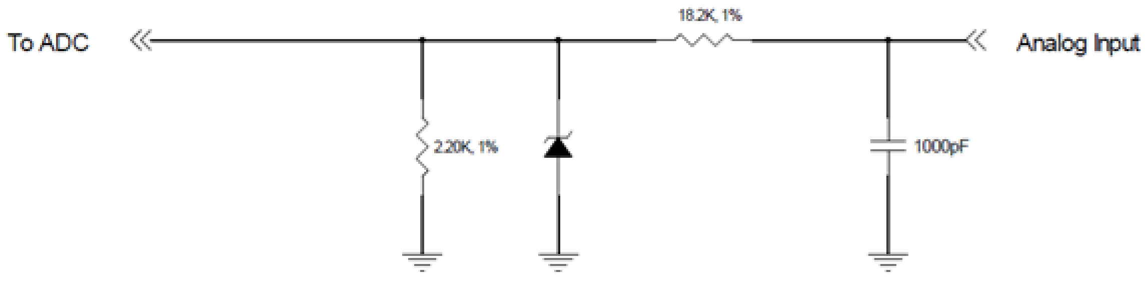
7	DIGITAL INPUT7	Digital Input
8	1BB_1_DATA	One Bit Bus
9	GND	GND
10	1BB_2_DATA	One Bit Bus
11	GND	GND
12	DIGITAL OUTPUT0	Open Collector Output
13	DIGITAL OUTPUT1	Open Collector Output
14	DIGITAL OUTPUT2	Open Collector Output
15	DIGITAL OUTPUT3	Open Collector Output
16	DIGITAL OUTPUT4	Open Collector Output
17	OUT_LED1	LED Driver
18	OUT_LED2	LED Driver
19	Analog Input 1	Analog Input/HW ADC2
20	Analog Input 2	Analog Input/HW ADC3
21	Analog Input 3	Analog Input/HW ADC4
22	Analog Input 4	Analog Input/HW ADC5

6.1 ELECTRICAL CHARACTERISTICS

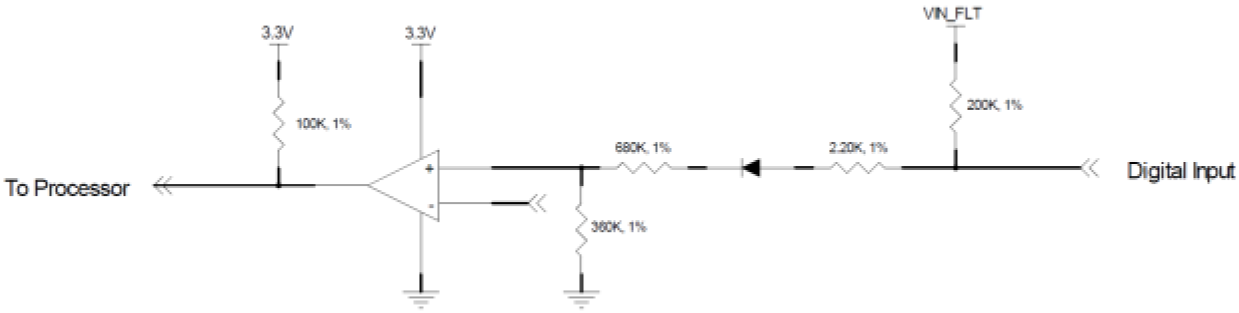
Table 19: External connectors

Symbol	Parameter	Min	Typ	Max	Units
Digital Inputs					
V_{IN}	Digital Voltage Recommended Input Range	0.0		30.0	V
V_{P}	Positive Threshold Voltage for Digital Inputs		3.1	3.4	V
V_{N}	Negative Threshold Voltage for Digital Inputs	2.8	3.1		V
V_{H}	Hysteresis Voltage for Digital Inputs	0.07	0.1		V
Analog Inputs					
V_{IN}	Analog Voltage Recommended Input Range	0.0		30.0	V
Accuracy	ADC accuracy		+/- 2%	+/-5%	V
Digital Outputs					
Iout	Drive current for Relay Outputs		200		mA
Iout	Drive Current for LED Outputs		20		mA

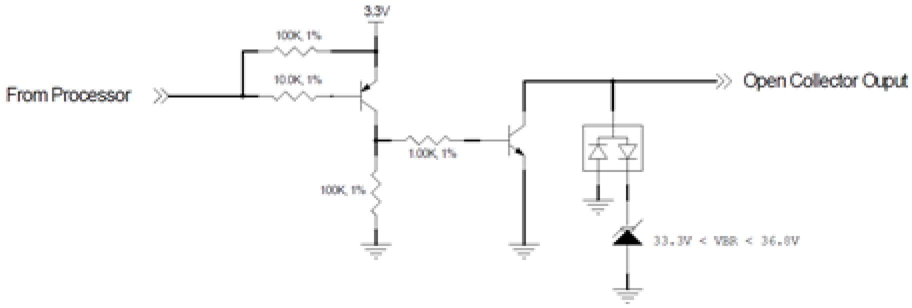
6.2 INPUT CIRCUIT FOR ANALOG INPUTS



6.3 SIMPLIFIED CIRCUIT FOR DIGITAL INPUT



6.4 SIMPLIFIED CIRCUIT FOR OPEN COLLECTER OUTPUTS



APPENDIX A — ABBREVIATIONS AND DEFINITIONS

AAVL: Autonomous Automatic Vehicle Location

ADC: Analog to Digital Converter

APN: Access Point Name

CDMA: Code Division Multiple Access

CHAP: Challenge Handshake Authentication Protocol

CSD: Circuit-Switched Data

CSMA: Carrier Sense Multiple Access

CTS: Clear To Send

DCD: Data Carrier Detect

DCE: Data Communication Equipment

DHCP: Dynamic Host Configuration Protocol

DNS: Domain Name System or Domain Name Service

DO: DeviceOutlook™

ECIO: (Also Ec/IO) A ratio expressed in decibels referenced to a milliwatt (dBm), of received energy on the carrier (Ec) to interference or noise (IO).

EDGE: Enhanced Data rates for Global Evolution

ESN: Electronic Serial Number

EV-DO or **EVDO:** Evolution Data Optimized

FCC: Federal Communications Commission (U.S.)

GPRS: General Packet Radio Service

GPS: Global Positioning System

GSM: Global System for Mobile communications

HSPA: High Speed Packet Access

HSDPA: High-Speed Downlink Packet Access

HSUPA: High-Speed Uplink Packet Access

IC: Industry Canada

IMEI: International Mobile Equipment Identity

IMSI: International Mobile Subscriber Identity

kbps: Kilobits per Second

LAN: Local Area Network

LED: Light-Emitting Diode

Mbps: Megabits per Second

MDN: Mobile Directory Number

ME: Mobile Equipment

MEI: Mobile Equipment Identity

MEID: Mobile Equipment Identifier

MHz: Megahertz

MSGPS: Multi-Satellite Global Positioning System

NMEA: National Marine Electronics Association

NTP: Network Time Protocol

ODP: Open Developers Platform

OMA-DM: Open Mobile Alliance Device Management

OTA: Over The Air

PAD: Packet Assembler and Disassembler

PAP: Password Authentication Protocol

PCS: Personal Communications Service

PDP: Packet Data Protocol

PDU: Protocol Data Unit

PIN: Personal Identification Number

PPP: Point-to-Point Protocol

PPTP: Point-to-Point Tunneling Protocol

PRL: Preferred Roaming List

RADIUS: Remote Authentication Dial In User Service

RF: Radio Frequency

RSSI: Received Signal Strength Indication

RTU: Remote Terminal Unit

Rx: Receive

SIM: Subscriber Identity Module

SMA: SubMiniature version A (connector)

SMS: Short Message Service

TAIP: Trimble ASCII Interface Protocol

TCP/IP: Transmission Control Protocol / Internet Protocol

TNC connector: Threaded Neill-Concelman connector

Tx: Transmit

UDP: User Datagram Protocol

UTMS: Universal Mobile Telecommunications System

VDC: Voltage, Direct Current

VPN: Virtual Private Network

Wi-Fi: Wireless Fidelity

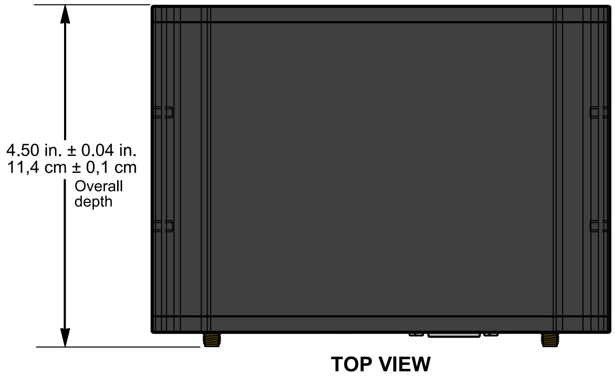
APPENDIX B — MECHANICAL SPECIFICATIONS

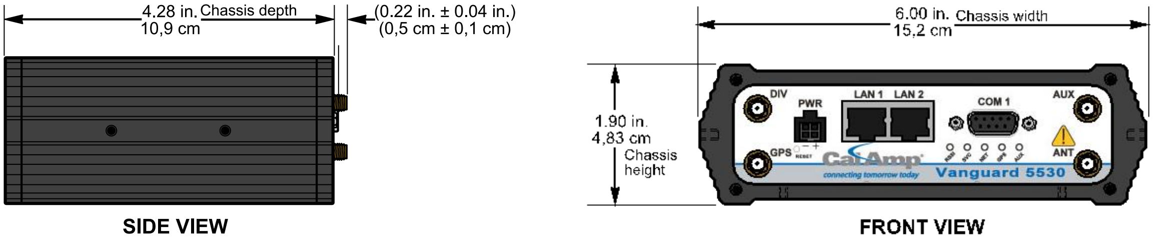
Following figures show Vanguard 5530 standard and mobile models. Dimensions are shown for the unit alone and with mounting brackets that allow them to be secured to any surface that can be drilled for this purpose. The drawings may be used for layout reference, but it is advised that a physical comparison be made to the modem and bracket before laying out and drilling mounting holes.

Table 20 Overall Dimensions, Vanguard 5530 standard and mobile models

Dimension	Inches	Centimeters
Height	1.90	4,83
Width	6.00	15,2
Depth	4.50 ± 0.04	11,4 ± 0,1
Depth (Chassis only)	4.28	10,9

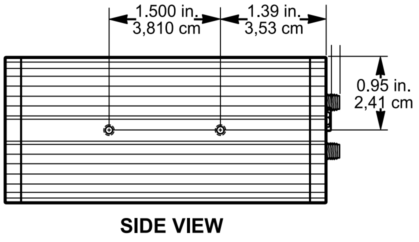
Figure 71 Vanguard 5530 standard and mobile overall dimensions. Same mounting holes (not shown) and dimension on bottom of Chassis



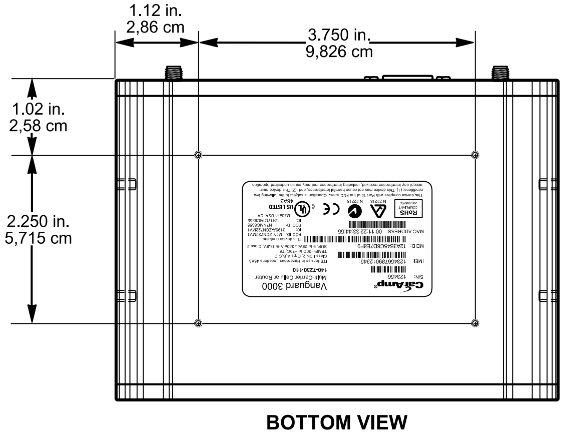


Base tapped mounting hole location detail — bottom of chassis. Same mounting holes and dimension on top of Chassis.

Side tapped mounting hole location detail — typical both sides.



#8-32 UNC – 2B thread × 0.30 in. (0,76 cm) depth
2 holes for mounting both sides (4 holes total).

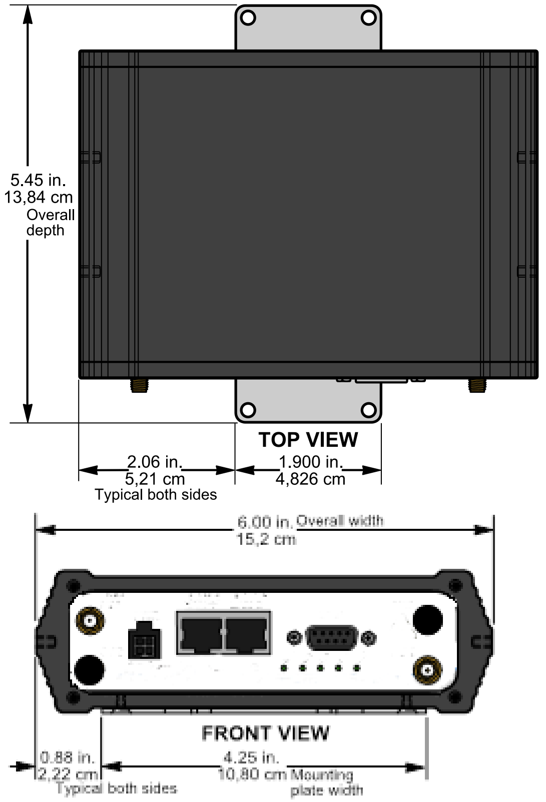


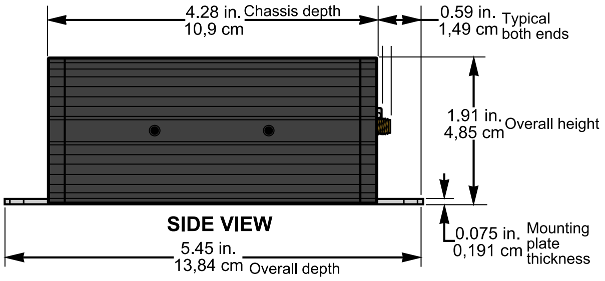
#6-32 UNC – 2B thread × 0.12 in. (0,30 cm) depth
4 holes for base mounting (bottom surface only).

Table 21 Overall Dimensions, Vanguard 5530 with mounting plate

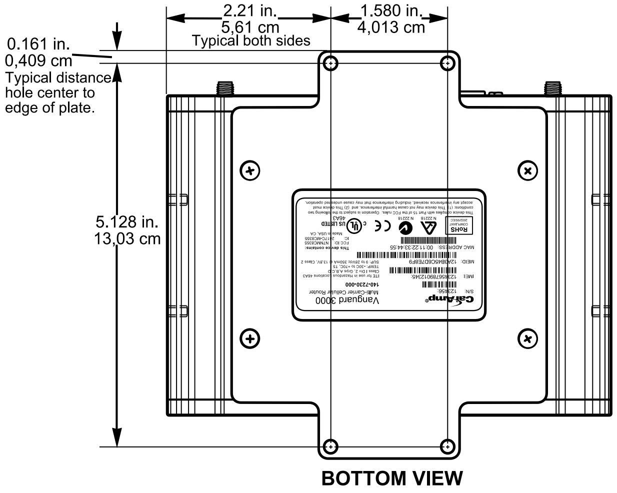
Dimension	Inches	Centimeters
Height	1.91	4,88
Width	6.00	15,2
Depth	6.45	13,84

Figure 72 Vanguard 5530 with mounting plate overall dimensions





Base plate mounting hole location detail



ø 0.176 in. (0,447 cm) – 4 thru holes for securing base plate to a surface suitable for mounting.

Figure 73 Vanguard 5530 with DIN rail mount overall dimensions

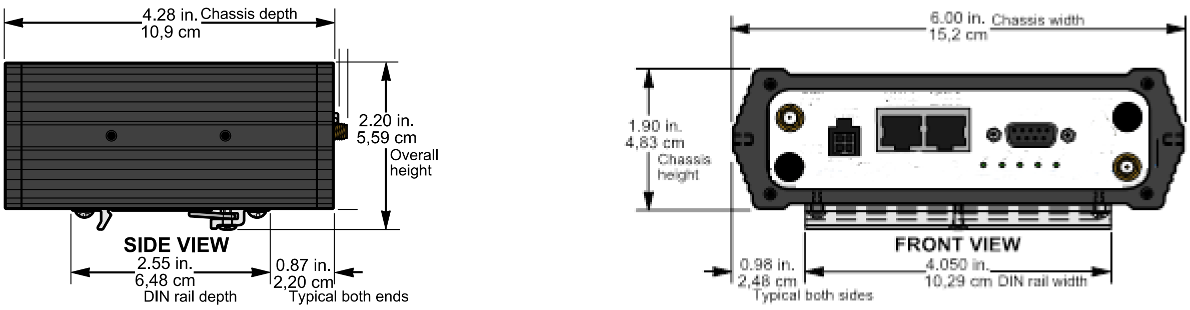
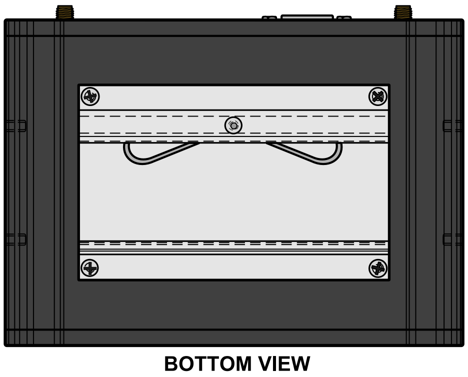


Table 22 Overall Dimensions, Vanguard 5530 with DIN rail mount

Dimension	Inches	Centimeters
Height	2.20	5,92
Width	6.00	15,2
Depth	4.50 ± 0.04	11,2 ± 0,1
Depth (Chassis only)	4.28	10,9

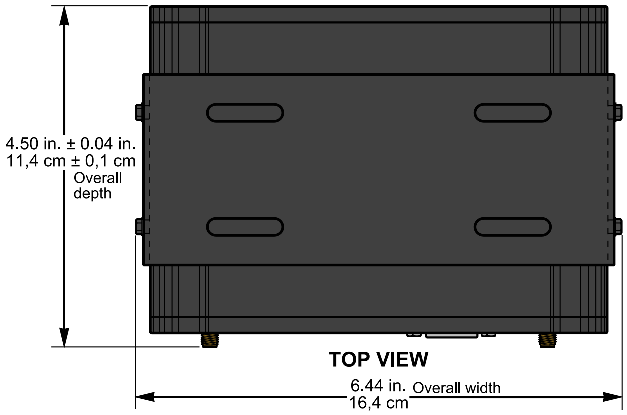


DIN rail mount attaches to underside of unit as shown.

Table 23 Overall Dimensions, Vanguard 5530 with mobile mounting bracket

Dimension	Inches	Centimeters
Height	2.33	5,92
Width	6.44	16,4
Depth	4.50 ± 0.04	11,2 ± 0,1
Depth (Chassis only)	4.28	10,9
Depth (Bracket only)	2.50	6,35

Figure 74 Vanguard 5530 with mobile mounting bracket for under-surface mounting



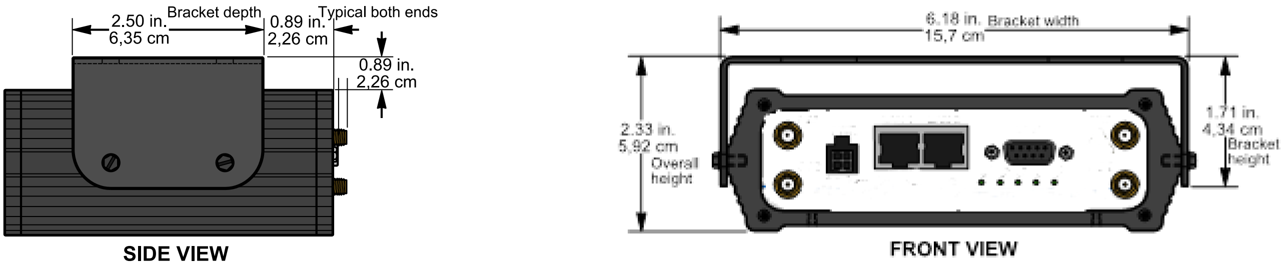


Figure 75 Vanguard 5530 with mobile mounting bracket for top surface mounting

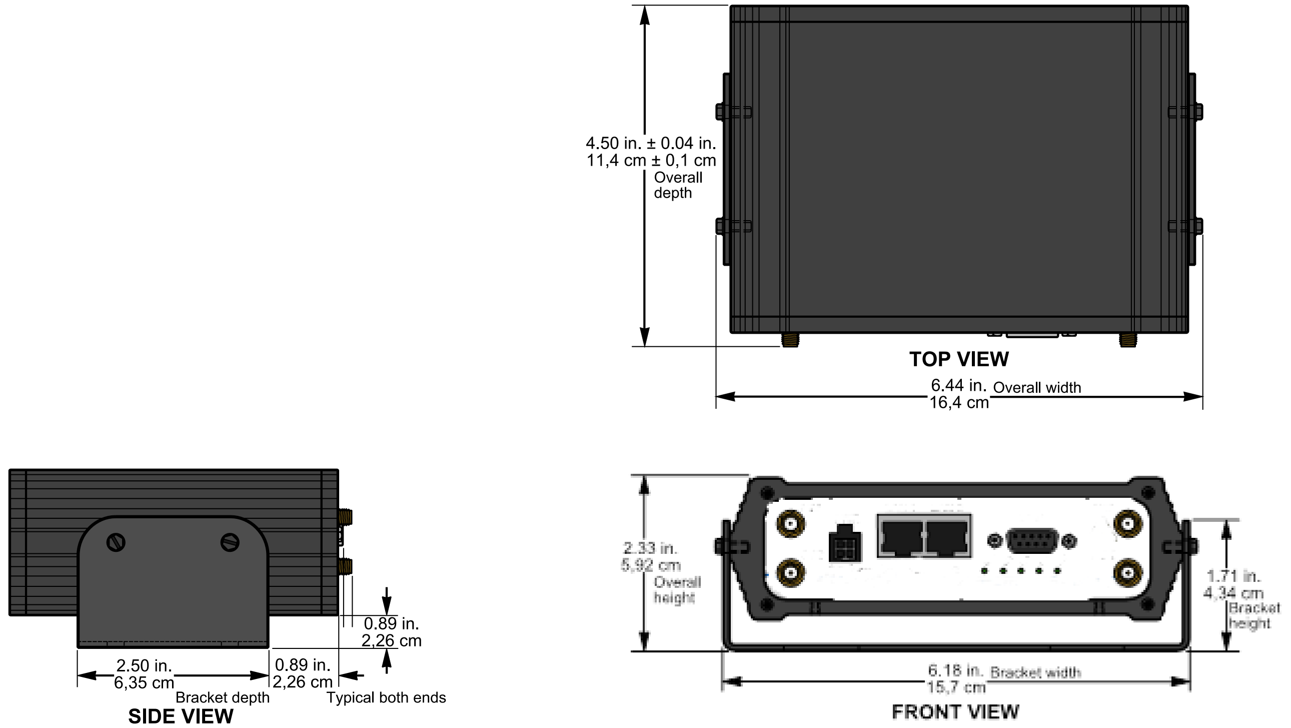
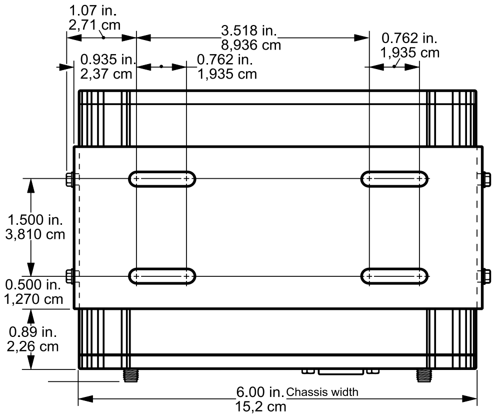


Figure 76 Mobile mounting bracket slot dimension detail



APPENDIX C — UL INSTALLATION INSTRUCTIONS

UL acceptance requires the following installation instructions. These installation instructions are available and may be downloaded from the www.calamp.com website listed on the Quick Start Guide with each unit and include the following:

This equipment is suitable for use in Class I, Division 2, Groups A, B, C and D or non-hazardous locations only.

WARNING — EXPLOSION HAZARD, Do not connect while circuit is live unless area is known to be non-hazardous.

WARNING –- EXPLOSION HAZZARD, Substitution of components may impair suitability for Class I, Division 2.

When operating at elevated temperature extremes, the surface may exceed +70 Celsius. For user safety, the Vanguard should be installed in a restricted access location.

The Unit is to be powered with a Listed Class 2 or LPS power supply, rated 10 – 30 Vdc or equivalent.

Device is open-type and must be installed in a tool only accessible enclosure **suitable for the environment.**

All wiring routed outside the housing, except for the antenna, must be installed in grounded conduit, following acceptable wiring methods based on installation location and electrical code.

The USB and SIM connector is for temporary connection only during maintenance and setup of the device. Do not use, connect, or disconnect unless area is known to be non-hazardous. Connection or disconnection in an explosive atmosphere could result in an explosion.

Do not operate reset switch unless area is known to be non-hazardous.

The following table shows accessories that, when approved by the manufacturer, represent antennas and cables used with modules in UL testing.

Table 24 Vanguard 5530 Accessories used in UL testing

Accessory	Part Number / Description	Quantity
	401-7100-003 GPS SMA Mag-Mount Antenna	1
	401-7100-004 Wi-Fi Mag-Mount Antenna	1

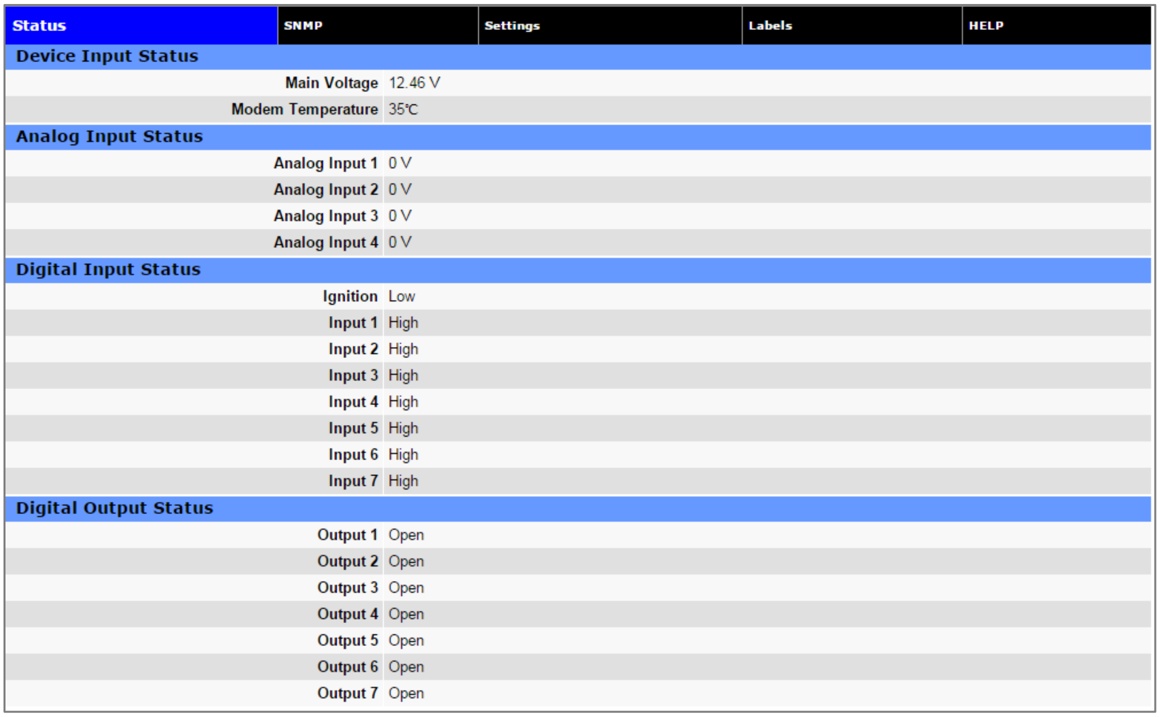
Accessory	Part Number / Description	Quantity
	150-7001-002 22' DC Power Cable (Mobile models) 150-7500-004 6' DC 3-wire Power Cable (Fixed models)	1
	L2CAB0006 7' Ethernet Cable	1

APPENDIX D — NMEA I/O AGENT

As described in section 3.10 I/O Settings of this User Manual, the Vanguard 3000 router supports the following I/Os:

- Vanguard 5530 Input Status: Ignition Sense, Main Voltage Indication and Modem Temperature.
- Two general-purpose external analog input lines.
- Two general-purpose external digital input/output lines.

The Vanguard 5530 I/O agent subsystem is configured via the Vanguard 5530 Web interface. Status monitoring is provided via an NMEA-based protocol. The Vanguard 5530 I/O subsystem operates according to a manager/agent model. The manager sends requests to the Vanguard 5530 I/O agent, which performs the required actions. The Vanguard 5530 agent reports alarms and indications to the manager



Device Input Status	
Main Voltage	12.46 V
Modem Temperature	35℃
Analog Input Status	
Analog Input 1	0 V
Analog Input 2	0 V
Analog Input 3	0 V
Analog Input 4	0 V
Digital Input Status	
Ignition	Low
Input 1	High
Input 2	High
Input 3	High
Input 4	High
Input 5	High
Input 6	High
Input 7	High
Digital Output Status	
Output 1	Open
Output 2	Open
Output 3	Open
Output 4	Open
Output 5	Open
Output 6	Open
Output 7	Open

6.5 SPECIFICATIONS

Communication Model

The Vanguard 5530 I/O subsystem operates according to a manager/agent model.

→ The manager sends requests to the Vanguard 5530 I/O agent, which performs the required actions.

← The Vanguard 5530 agent also reports asynchronous events (alarms and indications) to the manager.

PDU Transport

TCP/IP: Exchanges between the manager applications and the Vanguard 5530 support TCP/IP.
UDP/IP: Exchanges between the manager applications and the Vanguard 5530 support UDP/IP.

The Vanguard 5530 I/O agent uses and arbitrary IP port (default: 6263), configured via the Vanguard 5530 Web interface.

The manager is able to send I/O requests and ACKs to the Vanguard 5530 via:

(a) TCP (connection is initiated by the Vanguard 5530).

(b) UDP (carrier-assigned WAN-side IP address, or LAN address).

The manager is able to send I/O responses, alarms, and indications to a manager IP address via:

(a) TCP (connection initiated by the Vanguard 5530).

(b) UDP

A single operator-configurable transport service (UDP or TCP) is available at any moment and is used for both directions (manager → Vanguard 5530; manager ← Vanguard 5530).

Congestion Control

Messages are not queued up. If the Vanguard 5530 cannot deliver them (for example, configured for TCP but no socket opened), they are silently dropped.

Congestion Control for established TCP-based connections follow and are limited to the built-in Vanguard 5530 TCP/IP stack congestion control mechanisms.

PDU Format

Vanguard 5530 I/O requests and responses, alarms/indications, and ACKs use existing NME 0183 (v2.30) sentences.

Frame format is as described in the following section.

The “II” (Integrated Instrumentation) NMEA talker mnemonic is used.

Protocol Exchanges

Read Vanguard 5530 I/O value

(1) manager requests value (NMEA msg: ACK)
(2) Vanguard 5530 responds with requested data (NMEA msg: XDR)

```
[manager application] ---(1)--- request ----------> [Vanguard 5530]
[manager application] <-------- response ---(2)---- [Vanguard 5530]
```

Set the state of an output line

(1) manager requests operation (NMEA msg: ACK)
(2) Vanguard 5530 acknowledges that the command has been executed by returning the updated output line state (NMEA msg: XDR)

```
[manager application] ---(1)--- request ----------> [Vanguard 5530]
[manager application] <-------- ack --------(2)---- [Vanguard 5530]
```

Receive and acknowledge an alarm sent by the Vanguard 5530

(1) Vanguard 5530 sends alarm (NMEA msg: ALR)
(2) manager acknowledges alarm (NMEA msg: ACK)

```
[manager application] <-------- alarm ------(1)---- [Vanguard 5530]
[manager application] ---(2)--- ack --------------> [Vanguard 5530]
```

Receive an indication generated by the Vanguard 5530

(1) Vanguard 5530 sends indication (NMEA msg: ALR)

```
[manager application] <-------- alarm -----(1)---- [Vanguard 5530]
```

Alarms and Indications

Alarms

Alarms are abnormal conditions or faults declared by the Vanguard 5530.
The manager is able to acknowledge alarms to stop their repeated generation.

Reporting

Alarms are reported continually at GPS AVL reporting rate until acknowledged by the manager or until the alarm root cause disappears.
Upon original assertion, alarms force the immediate generation of an alarm report

Indications

Indication messages are unacknowledged.

Alarm return-to-normal

The Vanguard 5530 generates an indication message when the root cause of a previously-declared alarm has disappeared.

Informational messages

The Vanguard 5530 generates an indication message when a non-alarm, informational event is detected (for example, power-up boot sequence has completed).
A single informational message is currently supported by the Vanguard 5530: vehicle power-up (corresponds to initial detection of ignition sense).

Position Fix

Immediately following an alarm or indication message, the Vanguard 5530 sends a $GPRMC message followed by a $GPVTG message to help track the vehicle.

The $GPRMC and $GPVTG messages are sent in the same UDP datagram (when UDP is used) or in the same TCP datagram (when TCP is used) as the alarm or indication message.

Multiple Alarms or Indications Reports

The Vanguard 5530 is able to send up to twelve (12) alarm and/or indication messages in a single transmission.

Each alarm or indication is sent using its own ALR message.

The GPS position fix is appended only after the last ALR message.

Example:

```
$IIALR ... $IIALR ... $IIALR ... $GPMRC ... $GPVTG
```

6.6 PDU TYPES

Note: In all the examples provided below, for clarity the checksum is replaced by the value “FF.”
ACK Message

- I/O value read request (manager --> Vanguard 5530)

- Output line setting request (manager --> Vanguard 5530)

- Alarm acknowledgement (manager --> Vanguard 5530)

```
$IIACK,xxx*hh<CR><LF>

xxx:    ASCII-encoded hex target descriptor,
composed of three fields <F1><F2><F3>

<F1> Operation being performed
        0       Acknowledge an alarm or opening a digital output
        1       Close a digital output
        2       Read an analog or digital input
        3-F     Reserved for future use

<F2> Class of I/O being operated on
        0       Digital input
        1       Analog input
        2-F     Reserved for future use

<F3> I/O Channel number

Digital Inputs (when <F2> is 0)
        0       Ignition sense
        1       DIN1
        2       DIN2
        3-F     Reserved for future use

Analog Input (when <F2> is 1)
        0       Vanguard 5530 input voltage sense
        1       Board/Cell module temperature sense
        2       AIN1
        3       AIN2
        4-F     Reserved for future use

Digital Output (when <F2> is 2)
        0       DO1 (COM1/NO1)
        1       DO2 (COM1/NO1)
        2-F     Reserved for Future use

hh:     NMEA-compliant checksum
```

Example: Acknowledge a “Cell module temperature out of range” alarm

$IIACK,011,*FF<CR><LF>

- Response to I/O read request (manager <-- Vanguard 5530)

- Response to output line state setting request (manager <-- Vanguard 5530)

```
$IIXDR,t,x.x,u,ioid;ip*hh <CR><LF>

t:          NMEA-compliant I/O type
C           temperature       (Cell, PCI module temperature sense)
U           Voltage  (AIN1..4, Vanguad 5530 input voltage sense)
S           switch or valve    (digital  I/O, ignition sense)
--- other NMEA types are not used at this time ---

x.x         NMEA-compliant free-form integer or floating-point value.
As per NMEA0183, digital I/O values are:
0 = OFF/OPEN
1 = ON/CLOSED

u:          NMEA-compliant unit of measurement
C = degrees Celsius
V = Volts

ioid:       I/O Identifier composed of <F2><F3>

<F2> Class of I/O being operated on
            0           Digital input
            1           Analog input
            2-F         Reserved for future use

<F3> I/O Channel number

Digital inputs (when <F2> is 0)
            0           Ignition sense
            1           DIN1
            2           DIN2
            3-F         Reserved for future use

Analog      Input (when <F2> is 1)
            0           Vanguard 5530 input voltage sense
            1           Board/Cell module temperature sense
            2           AIN1
            3           AIN2
            4-F         Reserved for future use

ip:         Operator-specified IP address

hh:         NMEA-compliant checksum
```

Example: Reports a temperature of 42.1 (in degrees Celsius) for the Cell module

$IIXDR,C,42.1,C,11;172.20.41.9*FF<CR><LF>

As per NMEA 0183, the <u> field is left empty for digital I/Os, including ignition sense (switches and valves, <t> field value: S).

ALR Message

Vanguard 5530-generated alarms and indications (manager <-- Vanguard 5530)

$IIALR,hhmmss.ss,xxx,c,s,ip;uid;txt*hh<CR><LF>

hhmmss.ss: NMEA-compliant time (UTC) of initial condition change

xxx: ASCII-encoded hex target descriptor,
composed of three fields <F1><F2><F3>

<F1> Type of alarm message

0	Original message for a given alarm
1	Repetition of an event already reported
2-F	Reserved for future use

<F2> Class of I/O being operated on

0	Digital input
1	Analog input
2	Digital output (contact closure)
3-F	Reserved for future use

<F3> I/O Channel number

Digital Inputs (when <F2> is 0)

0	Ignition sense
1	DIN1
2	DIN2
3-F	Reserved for future use

Analog Input (when <F2> is 1)

0	Vanguard 5530 input voltage sense
1	Board/Cell module temperature sense
2	AIN1
3	AIN2
4-F	Reserved for future use

c: NMEA-compliant alarm condition
A = Threshold exceeded (alarm is active)
V = Threshold not exceeded (indication of return to normal state)

s: NMEA-compliant alarm's acknowledge state
V = unacknowledged

ip: User-specified IP address (as configured via the Vanguard Web Interface)

uid: Free-form text unit identifier (8 characters max)

txt: Free-form alarm/indication text (20 characters max)

hh: NMEA-compliant checksum

Example: Report a temperature-back-in-range indication for the Cell module

$IIALR,135912.01,011,V,V,172.30.41.9;ADAM12;PCI TEMP NORMAL*FF<CR><LF>

Example: Report a "repeat: digital input #1" alarm

$IIALR,211545.22,101,A,V,172.30.41.9;ADAM12;MAN DOWN*FF<CR><LF>
Notes:

- <hhmmss.ss>: If the alarm message is being sent as a repetition of an event already declared, this field will bear the timestamp of the original report.
- Output line setting request (manager --> Vanguard 5530)
- <txt>: Freeform text is hard-coded for dedicated usage I/Os and user-configurable for generic I/Os. NMEA 0183 character restrictions apply ([1] 6.1 Table 1 and Table 2).

APPENDIX E SERVICE AND SUPPORT AND WARRANTY STATEMENT

Product Warranty, RMA, and Contact Information

CalAmp guarantees that every Vanguard 5530 Modem will be free from physical defects in material and workmanship for three (3) years from the date of purchase when used within the limits set forth in the specifications section of this manual.

The manufacturer’s warranty statement is available on the following page. If the product proves defective during the warranty period, contact CalAmp Customer Service to obtain a Return Material Authorization (RMA).

RMA Request/Contact Customer Service
CalAmp
1401 North Rice Avenue
Oxnard, CA 93030
Tel: 805.987.9000
Fax: 805.987.8359

BE SURE TO HAVE THE EQUIPMENT MODEL AND SERIAL NUMBER AND BILLING AND SHIPPING ADDRESSES ON HAND WHEN CALLING.

When returning a product, mark the RMA clearly on the outside of the package. Include a complete description of the problem and the name and telephone number of a contact person. RETURN REQUESTS WILL NOT BE PROCESSED WITHOUT THIS INFORMATION.

For units in warranty, customers are responsible for shipping charges to CalAmp. For units returned out of warranty, customers are responsible for all shipping charges. Return shipping instructions are the responsibility of the customer.

Product Documentation
CalAmp reserves the right to update its products, software, or documentation without obligation to notify any individual or entity. Product updates may result in differences between the information provided in this manual and the product shipped. For the most current product documentation and application notes, visit www.calamp.com.

Tech Support
CalAmp
1401 North Rice Avenue
Oxnard, CA 93030
1.805.987.9000
E-mail: wngsupport@calamp.com

6.7 WARRANTY STATEMENT

CalAmp warrants to the original purchaser for use ("Buyer") that data telemetry products manufactured by CalAmp ("Products") are free from defects in material and workmanship and will conform to published technical specifications for a period of, except as noted below, three (3) year from the date of shipment to Buyer. CalAmp makes no warranty with respect to any equipment not manufactured by CalAmp, and any such equipment shall carry the original equipment manufacturer's warranty only. CalAmp further makes no warranty as to and specifically disclaims liability for, availability, range, coverage, grade of service or operation of the repeater system provided by the carrier or repeater operator. Any return shipping charges for third party equipment to their respective repair facilities are chargeable and will be passed on to the Buyer.

If any Product fails to meet the warranty set forth above during the applicable warranty period and is returned to a location designated by CalAmp. CalAmp, at its option, shall either repair or replace such defective Product, directly or through an authorized service agent, within thirty (30) days of receipt of same. No Products may be returned without prior authorization from CalAmp. Any repaired or replaced Products shall be warranted for the remainder of the original warranty period. Buyer shall pay all shipping charges, handling charges, fees and duties for returning defective Products to CalAmp or authorized service agent. CalAmp will pay the return shipping charges if the Product is repaired or replaced under warranty, exclusive of fees and duties. Repair or replacement of defective Products as set forth in this paragraph fulfills any and all warranty obligations on the part of CalAmp.

This warranty is void and CalAmp shall not be obligated to replace or repair any Products if (i) the Product has been used in other than its normal and customary manner; (ii) the Product has been subject to misuse, accident, neglect or damage or has been used other than with CalAmp approved accessories and equipment; (iii) unauthorized alteration or repairs have been made or unapproved parts have been used in or with the Product; or (iv) Buyer failed to notify CalAmp or authorized service agent of the defect during the applicable warranty period. CalAmp is the final arbiter of such claims.

THE AFORESAID WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED AND IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CALAMP

AND BUYER AGREE THAT BUYER'S EXCLUSIVE REMEDY FOR ANY BREACH OF ANY OF SAID WARRANTIES IT AS SET FORTH ABOVE. BUYER AGREES THAT IN NO EVENT SHALL CALAMP BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL, SPECIAL, INDIRECT OR EXEMPLARY DAMAGES WHETHER ON THE BASIS OF NEGLIGENCE, STRICT LIABILITY OR OTHERWISE. The purpose of the exclusive remedies set forth above shall be to provide Buyer with repair or replacement of non-complying Products in the manner provided above. These exclusive remedies shall not be deemed to have failed of their essential purpose so long as CalAmp is willing and able to repair or replace non-complying Products in the manner set forth above.

This warranty applies to all Products sold worldwide. Some states do not allow limitations on implied warranties so the above limitations may not be applicable. You may also have other rights, which vary from state to state.

EXCEPTIONS

THIRTY DAY:	Tuning and adjustment of telemetry radios
NO WARRANTY:	Fuses, lamps and other expendable parts

ABOUT CALAMP

CalAmp (NASDAQ: CAMP) is a proven leader in providing wireless communications solutions to a broad array of vertical market applications and customers. CalAmp's extensive portfolio of intelligent communications devices, robust and scalable cloud service platform, and targeted software applications streamline otherwise complex Machine-to-Machine (M2M) deployments. These solutions enable customers to optimize their operations by collecting, monitoring and efficiently reporting business critical data and desired intelligence from high-value mobile and remote assets. For more information, please visit www.calamp.com.