Cisco GS7000 Super High Output Intelligent Node Software Installation and Configuration Guide

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Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

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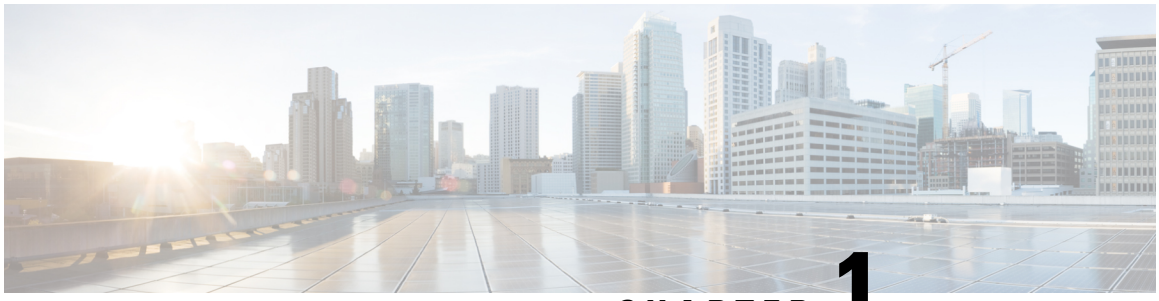
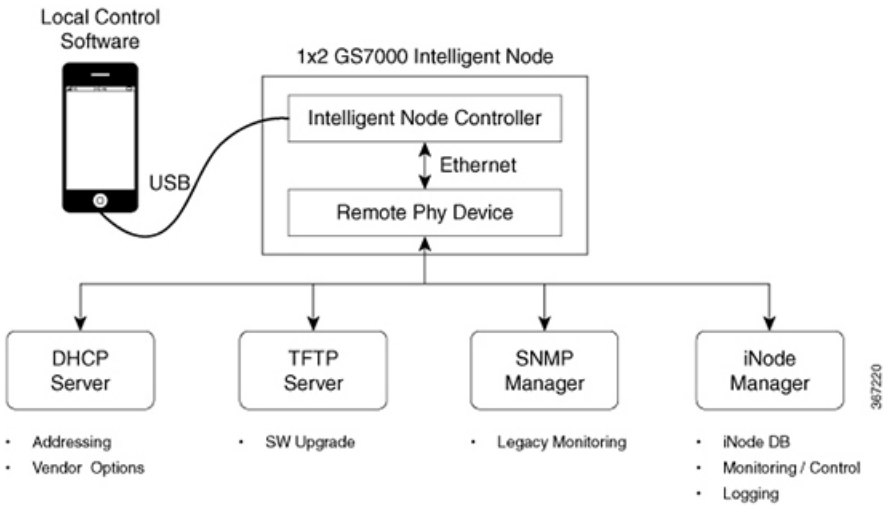


CHAPTER 1

Overview

This manual describes the installation, configuration, operation and troubleshooting of the Cisco GS7000 Super High Output Intelligent Node (iNode) software, as it relates to software, including the Local Control Software (LCS), software upgrade, and remote monitoring. The scope of this manual is for the iNode and the Local Control Software (LCS), and does not include details pertaining to the Intelligent Remote PHY Device (iRPD). For more information about the iRPD, see iRPD product page.

Figure 1: High Level Architecture



Background and Advantage

With the introduction of Remote PHY to cable access systems, the service group size for the typical Hybrid Fiber-Coax (HFC) node will reduce and the number of deployed HFC nodes will increase dramatically. The increase in the number of nodes deployed demands improved monitoring and control methods. Cisco's Intelligent Node brings greater stability, control, and visibility to cable operators. These advantages are realized through no-touch provisioning, elimination of RF accessories, remote control and monitoring, local control via a smart phone, and various features listed below. The remote access feature provides significant decrease in operating costs by reducing truck rolls to perform diagnostics.

Features

No Touch Provisioning

When the iNode boots up it has a default gain and tilt that can be overwritten locally or remotely. The node can obtain an IP address dynamically that can be used for software upgrades and monitoring.

Eliminates RF Accessories

There is no need for external plug-ins. Attenuation and Equalization are digitally controlled via software. Target levels and tilt can be adjusted using the LCS application on a mobile device.

Eliminates Specialized Test Equipment

Internal Spectrum analysis eliminates the need for external test equipment. LCS mobile application can be used to analyze spectrum capture results.

Local Control and Monitoring via Mobile Device

The Local Control Software (LCS) is a mobile application for smart phone or tablet device that communicates directly to the iNode over a USB port.

The LCS provides the following:

- Node status summary
- Forward and reverse path settings
- Spectrum display
- Alarms

Remote Control and Monitoring

Intelligent Node Manager (iNode Manager) allows the user to configure, organize, and monitor one or more iNodes remotely. Use iNode Manager with iNode software version 2.0 or later.

The iNode Manager provides capability similar to the LCS, including the following:

- Monitoring and Configuration
- Spectrum Capture
- Remote Reset
- Remote Log File Retrieval
- Auto-registration with iNode Manager

For more details, see the *Cisco Intelligent Node Manager 1.0.0 User Guide*.

Power Savings Mode

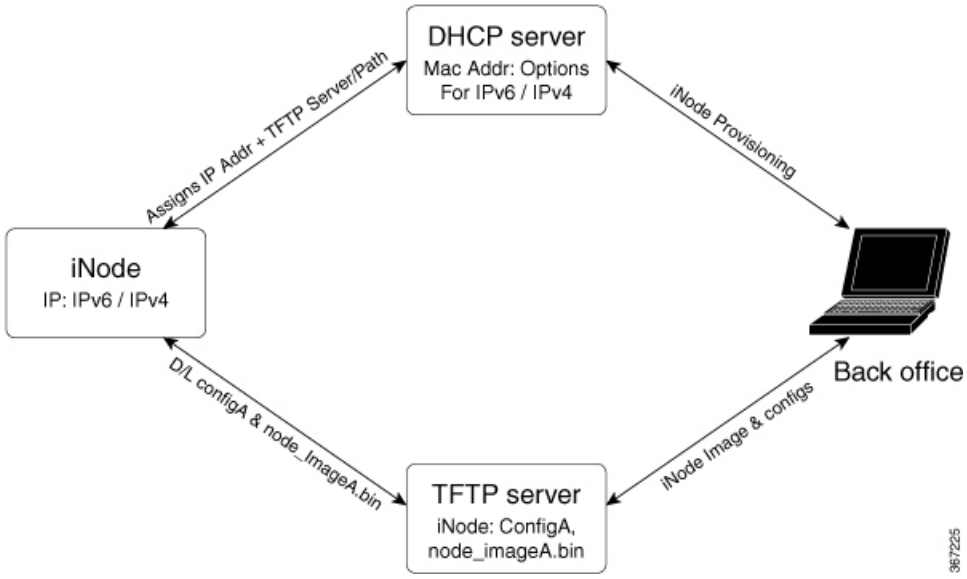
The iNode can be configured to automatically adjust the amplifier bias current based on the specific output power requirements. The bias current is automatically set based on plant configuration, such as maximum carrier frequency and modulation mode. It will adjust according to changes on the plant in order to maximize power savings without sacrificing performance.

Remote Software Upgrade

The software can be remotely upgraded. At boot-up the iNode attempts to download a configuration file that indicates the latest version of software. Then, the iNode automatically updates to this version (see Software Upgrade, on page 13). Software upgrade will not impact service.

Remote Monitoring

External interfaces of the iNode include the USB port built into the iNode, and access to the HFC plant via the iRPD installed in the node housing. The cloud software component communicates downstream with the iNode via the customer's existing subscriber data network. Messages are transmitted through an Ethernet connection provided by the iRPD. However, the iNode has a MAC address and an IP address assigned via DHCP that are separate and distinct from the MAC address and IP address of the iRPD.



Enable or Disable RF Ports

RF ports may be enabled or disabled individually via the LCS mobile application. This is helpful for power savings and in diagnosing issues. Also, forward or reverse can be disabled individually to assist in diagnosis.

Spectrum Capture

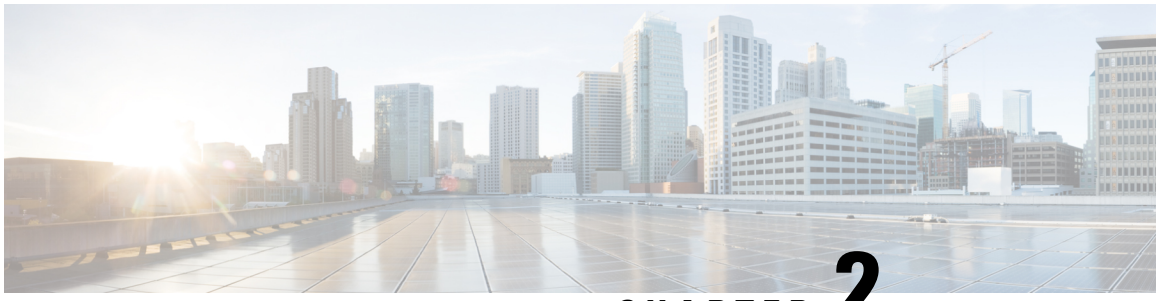
The Spectrum analyzer capability supports:

- Bandwidth: 5 MHz to 1.25 GHz
- Amplitude resolution: 16 bits
- Averaging: 1 to 128 points (by powers of 2)
- Dynamic range for frequency step size
- Reverse path max hold

The spectrum capture accesses live data and can be performed on a per port basis.

IPv4 and IPv6

The iNode works in either an IPv6 or IPv4, or dual stack environment. Dynamic addressing is supported via SLAAC or DHCP. A DHCP server is required to support the correct options for iNode remote operation (see Software Upgrade, on page 13).



CHAPTER 2

iNode Provisioning / Quick Start

This section provides a step-by-step initial setup of the iNode. The following components are necessary to implement the setup:

- 1x2 iNode Controller Software
- LCS on a mobile phone or tablet
- iRPD Software support for the iNode
- Customer provided TFTP server
- Customer provided DHCP server
- Converged equipment, such as cBR-8, for DEPI and UEPI traffic

Create the DOCSIS TLV Configuration File

A configuration file is needed to indicate the suggested version of software and where the software is located (TFTP IP address). We use a standard DOCSIS TLV configuration file. Any DOCSIS config file editor can be used. No other TLVs are required and any TLVs not listed below are ignored.

The following TLV's are used to support iNode software download:

```
Vendor ID           (TLV 8)     0x08, 0x03, < 3 byte OUI/Vendor ID = 0x00,0x21,0xbe>
IPv4 TFTP Server IP (TLV 21)    0x15, 0x04, < 4 byte IPv4 IP Address>
IPv6 TFTP Server IP (TLV 58)    0x3A, 0x10, < 16 byte IPv6 IP Address>
SW Upgrade Filename (TLV 9)     0x09, <len>, <asci hex string>
   SW Upgrade Filename is typically of the form: inode-oib.01.00.02.tar.gz
Optional Vender Specific Configuration (TLV 44) 0x2c, <length of all sub-type TLVs>
   U-Boot Upgrade Filename (TLV 44, Subtype 3)  0x03, <len>, <asci hex string>
        U-Boot Filename is typically of the form: u-boot.01.00.02.tar.gz
```

Note If both the IPv4 and IPv6 TFTP Server TLVs are provided, precedence is given to the IPv6 IP address, the IPv4 address will be ignored for software download.

Place the DOCSIS TLV configuration file created for the iNode in the appropriate TFTP download folder on the TFTP server designated to supply the iNode TLV configuration file.

Place the software upgrade files in the appropriate TFTP download folder on the TFTP server designated to supply the iNode software download files.

Prepare IPv4/IPv6 DHCP Server to Support iNode

Two types of Option Types are present:

- Default—Provided even if not requested by the iNode.
- Required—Necessary for iNode operation.

Table 1: IPv4 IP Address

Message Type and Sequence	DHCPv4 Options	Message From
DISCOVER	Provides Option: 60 Requests Options: 1, 2, 4, 66, 67, 43, or 125	iNode
OFFER	Provides IPv4 IP address and options: Default: 1, 3, 6, 15 Required: 2, 4, 66, 67, 43, or 125	DHCP Server

For IPv4 the DHCP Server should use Option 60 – Vendor Class ID provided by the iNode or it's MAC address to assign an IP address and return the requested options.

Table 2: IPv4 IP Address

DHCPv4	Type	Name	Data
Option 1	default	Subnet Mask	255.255.255.240
Option 2	required	Time Offset	Seconds adjustment to clock
Option 3	default	Default Gateway	IPv4 IP address
Option 4	required	Time Servers (TOD)	IPv4 IP address list
Option 6	default	Domain Servers	IPv4 IP address list
Option 15	default	Domain Name	Text string

DHCPv4	Type	Name	Data
Option 43	Use if option 125 is not provided	Vendor specific option	
Option 43.1	required	iNode Manager IPv4 IP address	IPv4 IP address
Option 60	required	Vendor Class ID	“Cisco.iNode.oib.1.0”
Option 66	required	IPv4 TFTP Server IP Address	IPv4 IP address
Option 67	required	Bootfile Name	DOCSIS TLV config filename
Option 125	Use if Option 43 is not provided	VIVSO Option, Cisco Enterprise ID (9)	-
Option 125.1	required	iNode Manager IPv4 IP address	IPv4 IP address

Table 3: IPv6 IP Address

Message Type and Sequence	DHCPv6 Options	Message From
SOLICIT	Provides Option 1,16 Requests Options: 17	iNode
ADVERTISE	Provides IPv6 IP address and Options: Required: 17.1, 17.32, 17.33, 17.37, 17.38	DHCP Server

For IPv6, the DHCP server should use the Vendor Class ID provided by the iNode or its DUID to assign an IP address and return the requested options.

Table 4: IPv6 IP Address

DHCP	Type	Name	Data
Option 1	default	Vendor Class ID or DUID	Derived from MAC address
Option 16	required	Cisco Enterprise ID (9), Vendor Class ID	9, “Cisco.iNode.oib.1.0”
Option 17	required	Vendor Specific Option, Cable Labs Enterprise ID (4491)	4491
Option 17.32	required	IPv6 TFTP Servers	IPv6 IP Address List

DHCP	Type	Name	Data
Option 17.33	required	Config File Name	Text string
Option 17.37	required	IPv6 Time Servers (TOD)	IPv6 IP Address List
Option 17.38	required	Time Offset	Seconds adjustment to clock
Option 17	required	Vendor Specific Info Option Cisco Enterprise ID (9)	9
Option 17.1	required	iNode Manager IPv6 IP address	IPv6 IP address

Note The iRPD may still be booting up after 7 minutes. The iNode waits for the Ethernet connection between the iNode and the iRPD to become active before it can acquire an IP address and start the downloading the software.

Note You can download the iNode software only for a factory fresh installation or if the DOCSIS TLV configuration file is providing a software version that is not yet loaded in the iNode.

Troubleshooting

1. Check to see that the iNode has an IP address and that it can reach the TFTP server. There may be more than one TFTP server, for example, one TFTP server with the configuration file and another TFTP server with the software image. Ensure that both TFTP servers are reachable.
2. Look at the var logs messages on the DHCP server using the “tail –f /var/log/messages”.
3. Use Wireshark to look into packets sent and/or received.

To start the software download and upgrade again remotely, use the SNMP Reset.

Node Level and Tilt

The default values for the level and tilt pairs are, for the low level 261 MHz and tilt 39.9 dBmV, and for the high level 855 MHz and tilt 51.1 dBmV.

If the non-default values are desired, then the iNode level and tilt can be adjusted via LCS. Attach the LCS via the mobile phone or tablet to the USB port (For more information see the chapter on LCS).

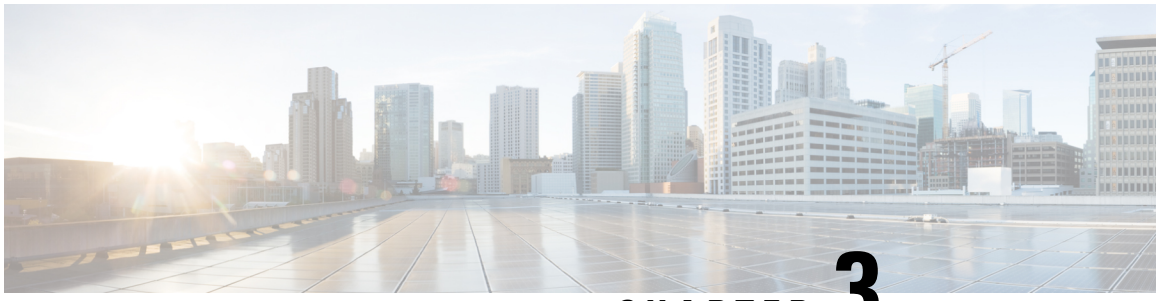
Using the LCS screens:

1. Go to Port 1 (and Ports 2, 4, 5)

2. Set low end frequency and high end frequency.
3. Set low end level and high end level.
4. Frequency and level sets tilt. Tap **Save**.
5. Port 1 has to be enabled and saved on RF settings.
6. Be sure to setup, enable and save Port 1 before Auto Setup.
7. Then, go to node settings.
8. Auto Setup START button. Add Port 1 or all ports.
9. Auto Setup takes into consideration variations between units in gain and output on the iRPD.
10. Check the Max Tilt and Level.
11. Check the Status and Alarms.
    - Normal – no alarms at least for Auto Status and AGC on each port.
12. Then, check the Spectrum for each port and see what they look like (between 4 to 7 minutes after Auto Setup).

Note iRPD has to be online and attached to the iNode.

DEPI pipes set up, downstream carriers present and turned ON giving input into the iNode.



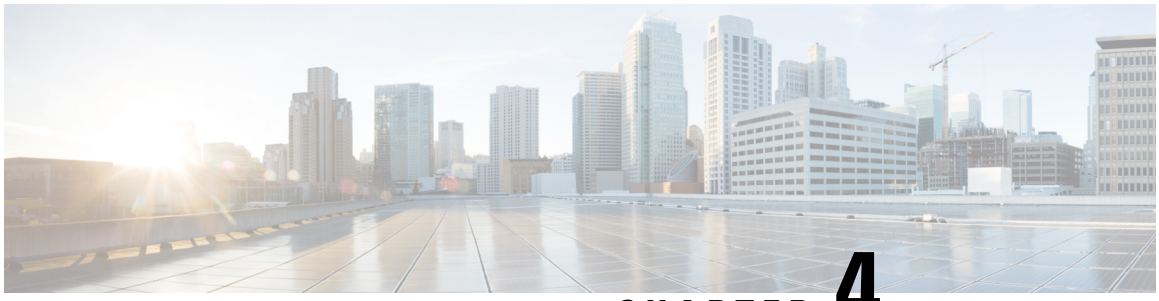
CHAPTER 3

Hardware Compatibility

Hardware Compatibility

- iRPD PIDs:
  - iRPD-1X2
  - iRPD-1X2-PKEY
- iRPD software version – v4.1 or later
- Independent of CCAP Core
- For more information, see Cisco GS7000 Super High Output iNode Installation and Operation Guide
- For Theory of Operation details, check the chapter of the same name in the Cisco GS7000 Super High Output iNode Installation and Operation Guide

Hardware Compatibility



CHAPTER 4

Software Upgrade

This chapter describes the iNode software upgrade process.

Overview

The methods used for triggering and transferring software images are initiated and completed in a manner similar to a cable modem software download. There are two ways to trigger the software upgrade. The first method involves an automatic software upgrade during boot-up of the iNode. The second method includes a planned upgrade of one or more iNodes, using the SNMP SCTE-HMS-COMMON-MIB commonReset to initiate a warm reboot. With either method, upon boot-up a software upgrade is started.

The iNode contains two memory partitions for holding a Primary and Secondary software image. A new image will be downloaded into the partition marked as Secondary if the upgrade image name in the inode.cfg file is not currently loaded in either partition. After the download operation has successfully completed, the partition containing the desired software image is marked as the Primary partition and the iNode is rebooted into that partition.

The downloaded image is a monolithic image that contains the Linux Kernel and the Root File System needed to upgrade the iNode. Prior to release, the monolithic image is signed with the Cisco digital signature. Signatures are used for image validation prior to installation on the iNode. Following validation, and only if the specified image does not already exist on the iNode, the image is downloaded to flash memory. If for any reason the download fails, the current working image continues to execute on the iNode.

Each time the iNode boots a “boot counter” is incremented. The “boot counter” is reset when a successful Software Download operation has been completed. If the iNode is in a cyclic reset condition where the “boot counter” reaches a limit of 7 boot attempts the U-Boot module will revert the Secondary partition to a Primary partition state and mark the current partition as defective. This is a “fall-back” feature to ensure the iNode is able to boot correctly and recover from a defective image.

Figure 2: iNode SW Download Sequence IPv4

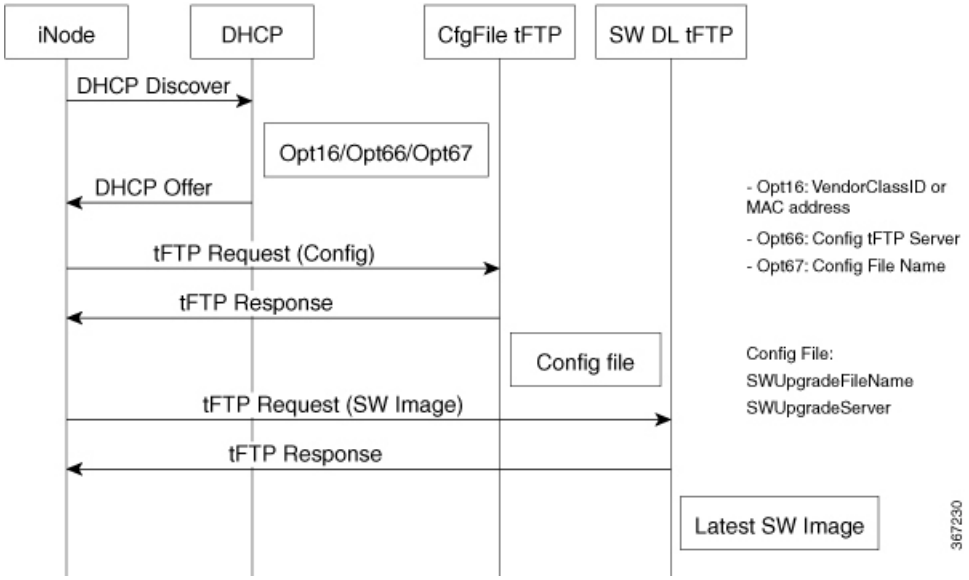
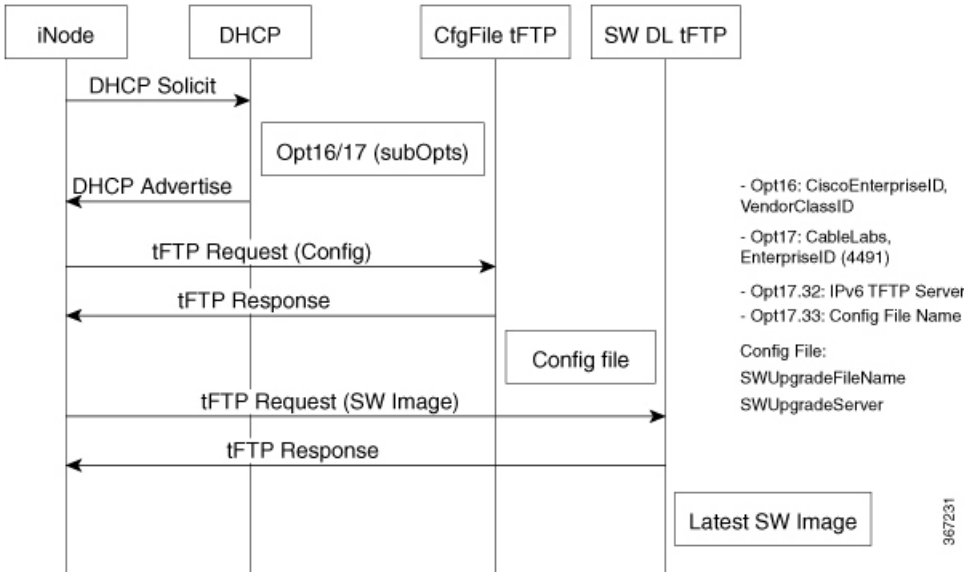


Figure 3: iNode SW Download Sequence IPv6



System Requirements

- DHCP server is configured to provide the iNode with an IPv4 and Options 60, 66, 67 and/or an IPv6 IP address with Options 16, 17.16, 17.32, 17.33.
- IPv4/IPv6 TFTP server is configured to provide a DOCSIS TLV configuration file and any software images to be downloaded to the node.
- Capability to create a DOCSIS TLV Configuration file.

Software Architecture

The iNode supports the storage of up to two images. This provides the capability to fall back to the last known good image in the event of a catastrophic failure during the download process. The U-boot keeps track of the number of failures and when the iNode is unable to boot from a new image after 7 attempts, it falls back to execute the last known working image.

As the iNode comes up and sets up the root file system, it contacts the DHCP server to obtain its IP address, the vendor class identifier used by the iNode, the IP address of the TFTP server and the name of the DOCSIS configuration file to be downloaded from the TFTP server. The iNode supports IPv4 and IPv6 using the IPv6 SLACC or Stateful address modes.

When the iNode boots, it attempts to obtain its IP address and DHCP options once a minute using a CRON job until either an IPv4 address or an IPv6 address is obtained. If the iNode is operating in a dual stack environment, IPv6 will be given priority over IPv4.

Once an IP address is obtained, the iNode will attempt a software download operation.

The format of the DOCSIS TLV configuration file varies depending on the IP protocol (IPv4 or IPv6) used and the desired software download actions to be performed.

Since the download is only performed following initialization after a reboot/reset condition, an SNMP trigger allows the operator to force a reboot and download a new image, provided that the DOCSIS TLV configuration file has been modified to reference a new image and the new image has been placed on the TFTP server.

The SNMP reset may be initiated by setting SCTE-HMS-COMMON-MIB::commonReset.0 to integer 1 for reset(1) OID 1.3.6.1.4.1.5591.1.3.1.7.0

IPv4/IPv6 DHCP Server Configuration

Several DHCP Servers are available to provide the iNode an IP Address and Options. Refer to the Prepare IPv4/IPv6 DHCP Server to Support iNode, on page 6 for IPv4 and/or IPv6 DHCP Options for the iNode.

Resolving Software Download Issues

This section describes issues commonly encountered during software download, along with their associated causes and possible remedies.

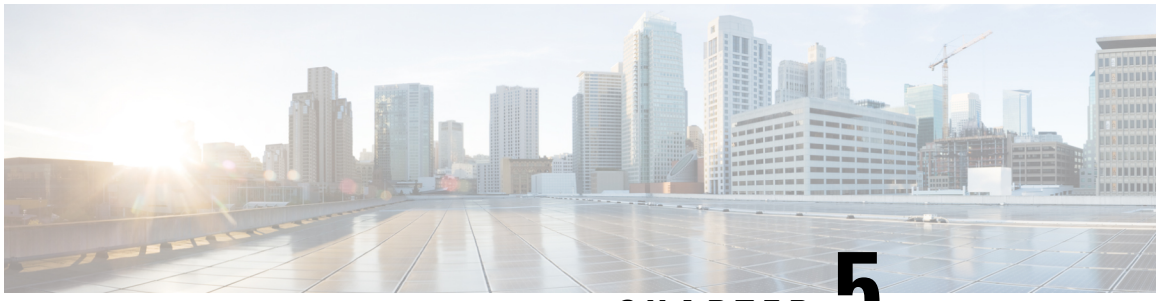
Download Does Not Start

Several conditions may cause a download to be rejected by the iNode before the image transfer begins.

- Invalid DOCSIS TLV configuration file
- File not available on the TFTP server
- TFTP server error or invalid TFTP server IP address
- Unsigned or incorrectly signed software image

Resolution:

- Verify that the iNode has received the requested IP address from the DHCP server.
- Verify that the TFTP server IP address used in the DOCSIS TLV configuration file is correct and can be reached.
- Verify that the specified software image is not already running on the iNode.



CHAPTER 5

Local Control Software

Introduction

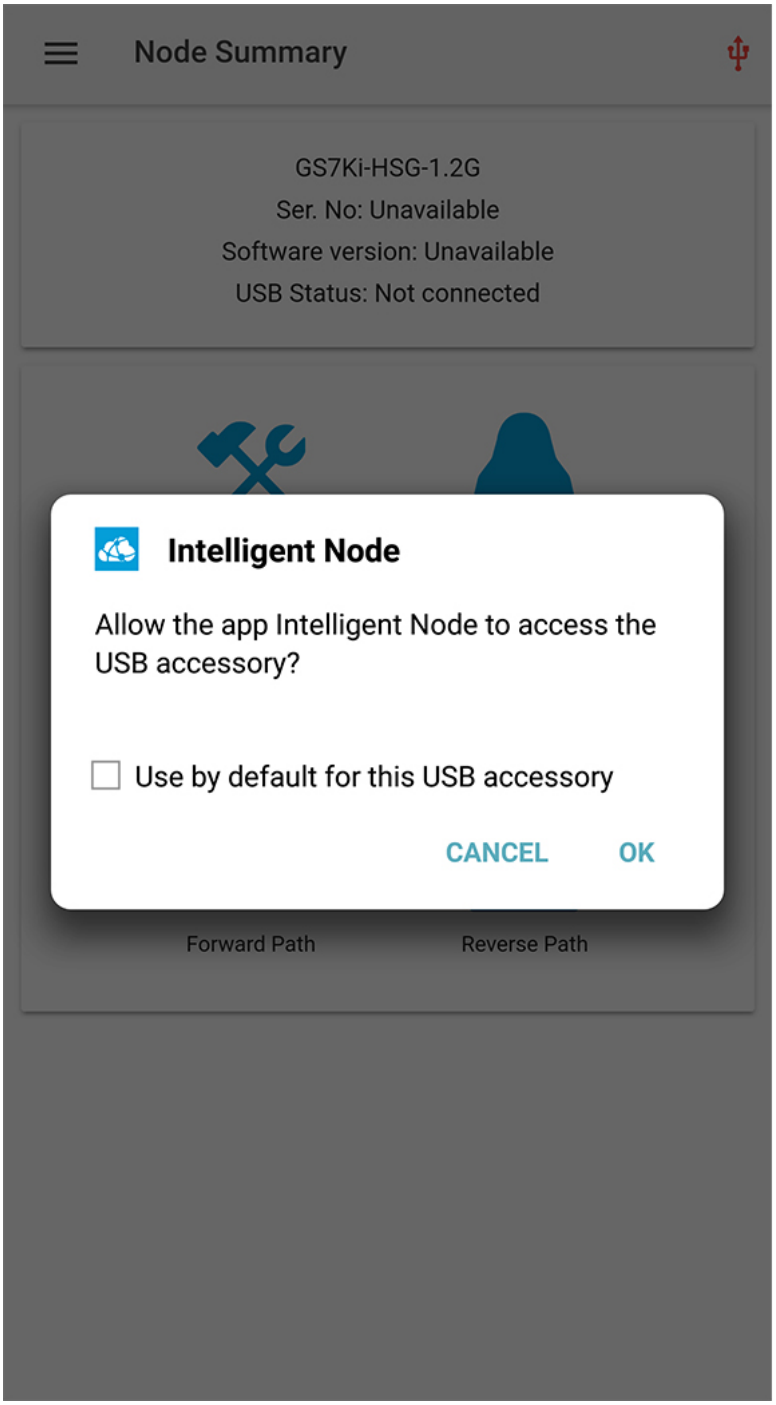
The iNode Local control software is a mobile device application that runs on an iOS or Android™ mobile platform. The application is called Intelligent Node and can be searched for using that name. It must be downloaded from a trusted source, such as Apple App Store or Google Play to your mobile device. The app communicates directly with the iNode over a USB port. It can be used to configure and monitor the iNode.

Figure 4: Intelligent Node

USB Permissions

The first time that the LCS is used with the USB port, and occasionally after that, you can see the USB permissions popup. To continue, tap the checkbox and then tap OK.

Figure 5: USB Permission



iNode App Dashboard

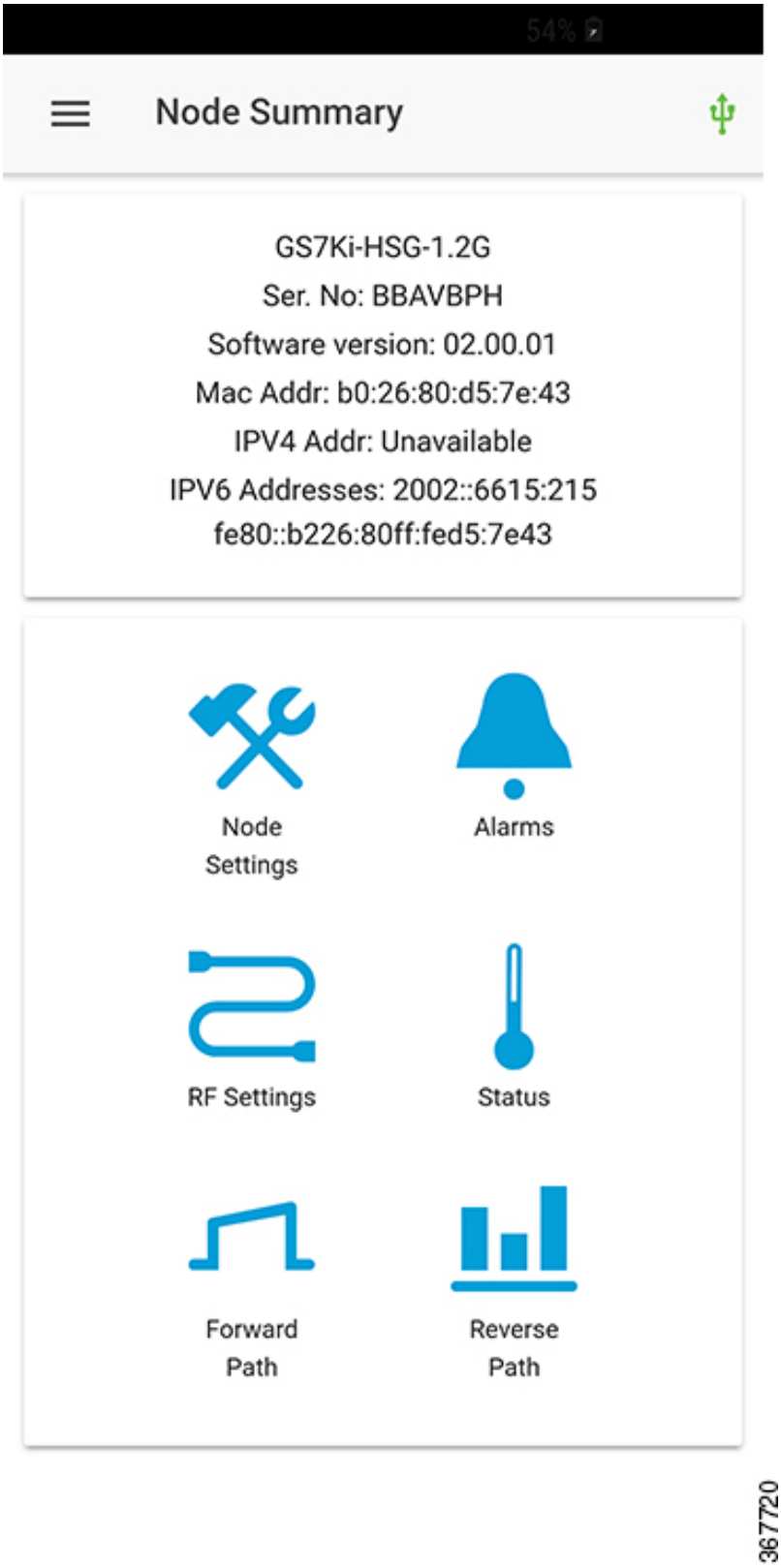
Connect the LCS to the iNode via a USB cable. The main dashboard screen is the first screen the user sees when the application starts. Common tasks appear on this screen.

The USB icon in the upper right corner of the screen indicates the USB connectivity status. It is red when the LCS is plugged in for the first time. The USB icon turns green when the LCS is properly connected and the iNode is ready to respond to the LCS commands.

The USB icon appears red if the LCS loses connectivity to the iNode at any point. Check the USB icon. If it is red, touch it to reconnect.

The following image shows the startup interface of the LCS:

Figure 6: Node Summary

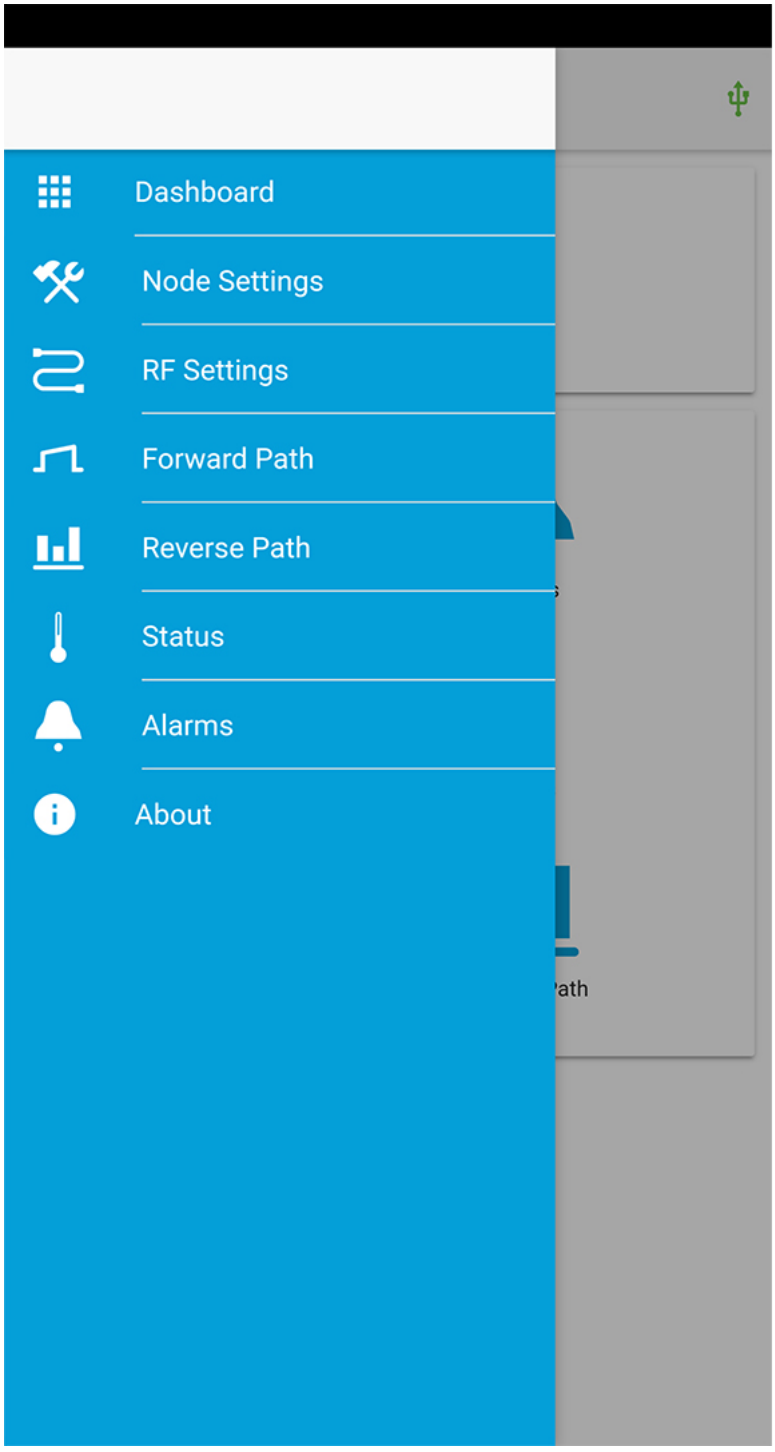

54%
Node Summary
GS7Ki-HSG-1.2G
Ser. No: BBAVBPH
Software version: 02.00.01
Mac Addr: b0:26:80:d5:7e:43
IPV4 Addr: Unavailable
IPV6 Addresses: 2002::6615:215
fe80::b226:80ff:fed5:7e43
Node Settings
Alarms
RF Settings
Status
Forward Path
Reverse Path
367720

The **Dashboard** displays the iNode name, serial number, software version, MAC address, IPv4 address, IPv6 address, and the USB connection status.

Name	Description
Node Config	Configure general iNode settings.
RF Config	Adjust Port specific settings.
Alarms	Lists monitored items with their values if in an alarm state.
Status	Observe the status of all monitored items in the iNode.
Forward Path	Spectrum Analysis of the Forward Path.
Reverse Path	Spectrum Analysis of the Reverse Path.

The Navigation bar in the top left corner gives immediate access to all the common tasks listed by the icons on the dashboard as well as the About screen. This bar can be accessed from any of the other iNode App screens and is useful for navigation.

Figure 7: Navigation Bar



Node Configuration

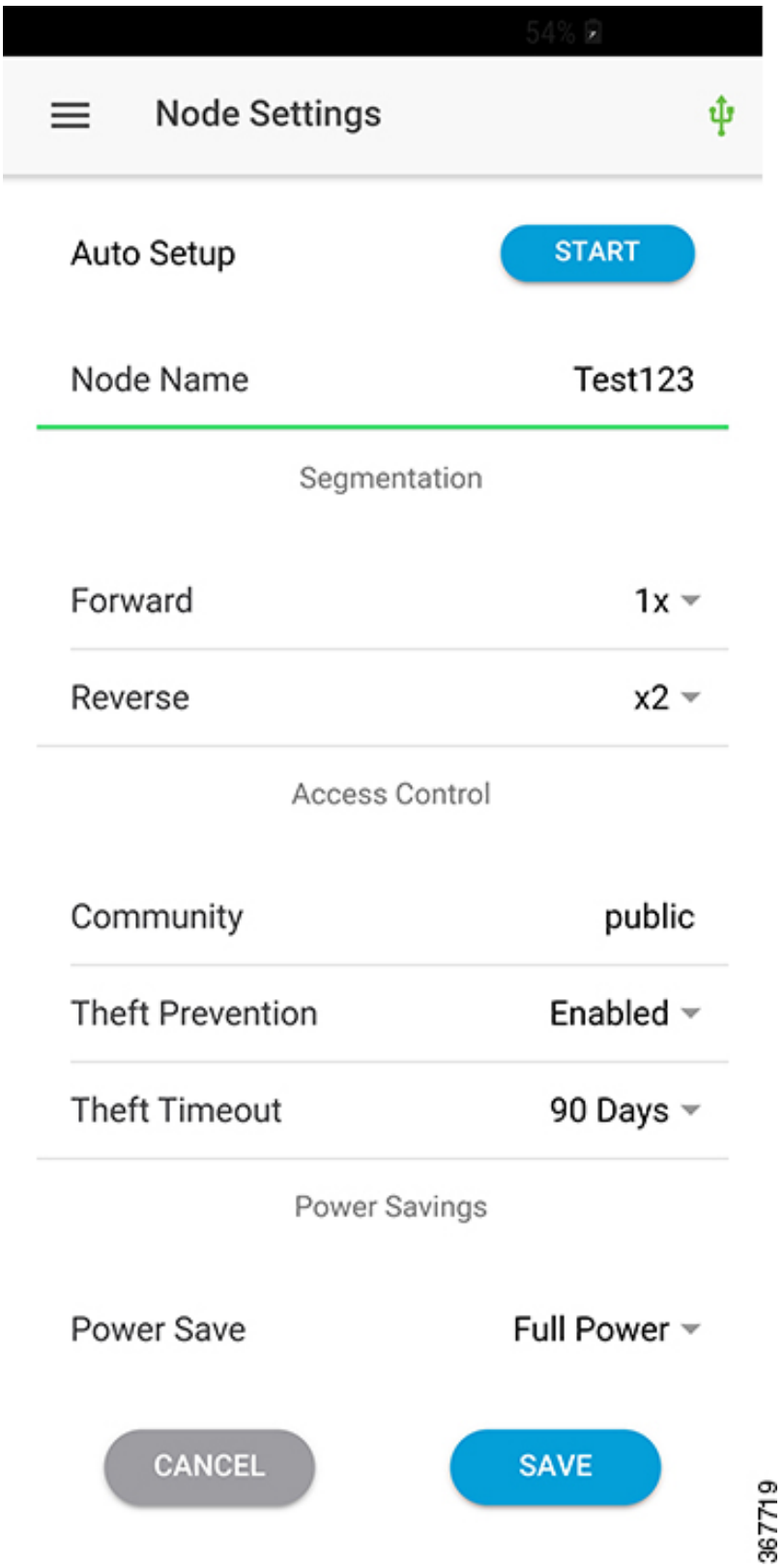
The general Node Configuration is one of the two screens that allow the user to configure iNode settings. In most cases, the factory settings are sufficient and no configuration is necessary. However, adjustments can be performed here if needed.

Auto Setup

Auto setup only affects the forward path. It automatically sets up the input RF attenuators, located on the Optical Interface Board (OIB), to provide the optimum drive level into the launch amplifier. First, it checks whether the output levels (set by the user, see “RF Configuration” below) are valid. Then it measures the actual levels at the low and high frequencies to determine the RF level coming into the node. After those levels are measured, it validates that they are within the node’s operating range and then updates the attenuator setting. The auto setup process takes less than one minute to complete.

Note Before touching the Auto Setup button, be sure to set the port frequencies and levels, enable at least Port 1 and save the configuration on the RF configuration screens. Then, return to the Node Configuration screen to touch the Auto Setup button. When the Auto Setup is in progress, no other RF screens is available for adjustment, and the user will see a spinner.

Figure 8: Node Settings


54%
Node Settings
Auto Setup
START
Node Name
Test123
Segmentation
Forward
1x
Reverse
x2
Access Control
Community
public
Theft Prevention
Enabled
Theft Timeout
90 Days
Power Savings
Power Save
Full Power
CANCEL
SAVE
367719

Name	Description
Auto Setup	See Auto Setup, on page 24.
Node Name	(Optional) Set the Node Name
Forward	Set the forward path segmentation of the node. Only 1x is available now.
Reverse	Set the reverse path segmentation of the node. 1x1 or 1x2 are the options.
Community	Specify the SNMP community string, which is an alphanumeric string of not more than 32 characters.
Theft Prevention	Enable/Disable Theft Prevention.
Theft Timeout	Set the Theft Prevention Timeout.
Power Save	Choices are Full Power or Power Save.

Use Save button to save the configuration. Use Cancel button to restore the previously saved configuration, if the Save button has not been tapped since then.

RF Configuration

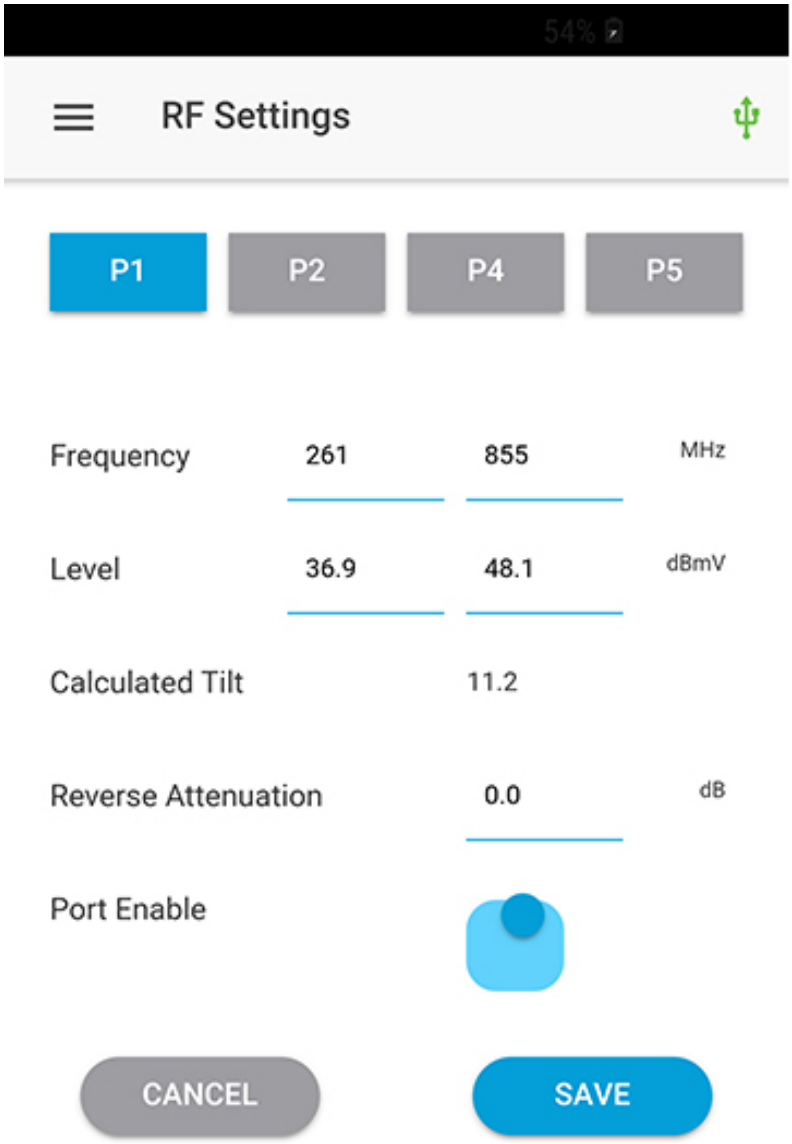
The RF Configuration screen is the second screen where parameters can be changed. Specifically, the low and high frequency settings as well as the low and high RF levels can be adjusted on this screen. These settings control the overall gain and tilt of the launch amplifier.

The amplitude and tilt of each port are set by specifying two points on a line. Those two points are defined by a low frequency and corresponding target level, and a high frequency and corresponding target level. Enter the frequencies in MHz and the levels in dBmV. For examples of RF Frequencies, Levels and Tilt, see RF Configuration Parameters, on page 61.

Note Before running Auto Setup on the Node configuration screen, both the low and high frequencies as well as the low and high levels must be set for at least Port 1. The port can be enabled by toggling the slider next to the Port Enable. After the parameters are entered and the port is enabled, tap the Save button. You can continue to adjust the settings for the other ports by tapping the buttons at the top of the screen with the port number and then adding the frequency and level. Remember to enable the port and save the configuration. Then return to the Node Configuration screen and tap Auto Setup.

The reverse attenuation setting can be used to assist in RF diagnostics and troubleshooting, and can be used in conjunction with the port enable switch, to simulate a wink switch.

Figure 9: RF Settings


54%
RF Settings
P1
P2
P4
P5
Frequency
261
855
MHz
Level
36.9
48.1
dBmV
Calculated Tilt
11.2
Reverse Attenuation
0.0
dB
Port Enable
CANCEL
SAVE

367723

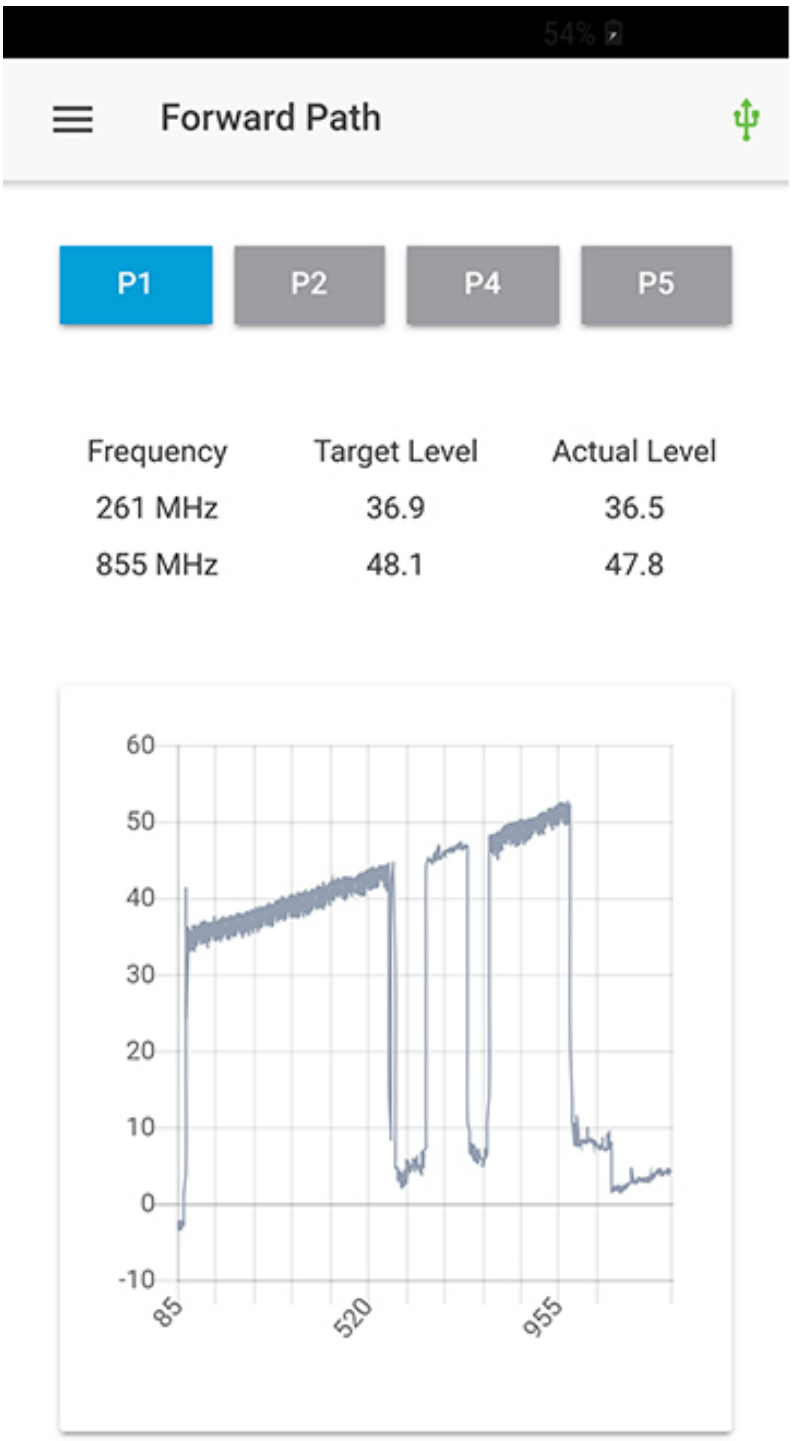
Name	Description
Frequency	Low and high RF frequency for this port.
Level	Low and high RF output level for this port.
Reverse Attenuation	Adjust reverse attenuation.
Port Enable	Enable or disable the corresponding port.

Tap the port number to set the parameters for the corresponding port. Use Save button to save the configuration; use Cancel to restore the previously saved configuration, if the Save button has not been tapped since then.

Forward Path

One of the unique features of the iNode is the capability for spectrum analysis on a per port basis. Live spectrum data is generated at regular intervals and displayed on the mobile device. This Forward Path screen presents the summary spectrum data, as well as displaying the configured target frequencies and levels, and the actual levels achieved. The next screen presents the detailed spectrum analysis. Access the details by rotating the mobile device.

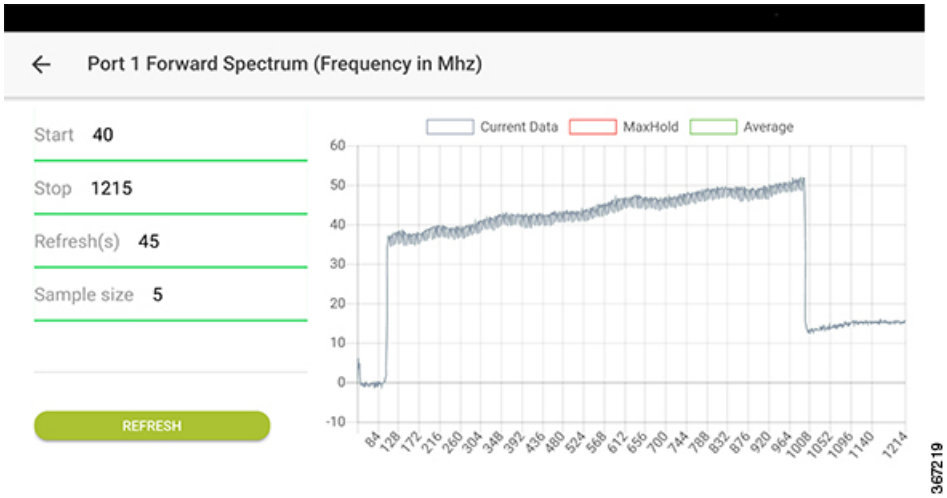
Figure 10: Forward Path


54%
Forward Path
P1
P2
P4
P5
Frequency
Target Level
Actual Level
261 MHz
36.9
36.5
855 MHz
48.1
47.8
60
50
40
30
20
10
0
-10
85
520
955

367716

It displays the target level, actual level, and forward spectrum of a specified port. Tap the port number to see the parameter value and chart for the corresponding port.

Figure 11: Forward Path Landscape



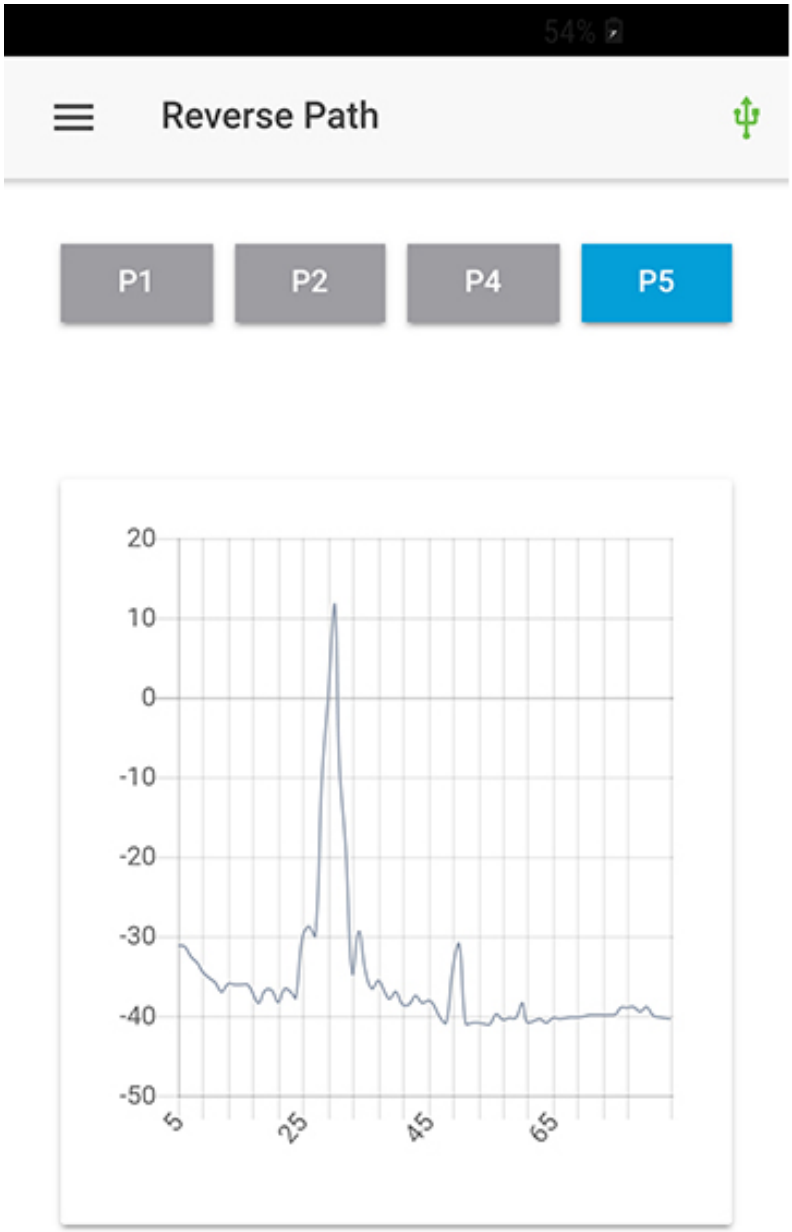
When the mobile device is in landscape orientation, this interface changes to landscape mode to allow the user to customize the parameters, and display the forward spectrum with these parameters to get more details.

Name	Description
Start	Start Frequency in MHz.
Stop	Stop Frequency in MHz.
Refresh	Rate in seconds at which the data is collected.
Sample Size	The number of samples used in averaging.

Reverse Path

Similar to the forward path, spectrum data for the reverse path is also captured on a per port basis. Thus, live data is generated at regular intervals and displayed on the mobile device. This Reverse Path screen represents the summary spectrum data, whereas the next screen presents the detailed spectrum analysis. Access the details by rotating the mobile device to landscape orientation.

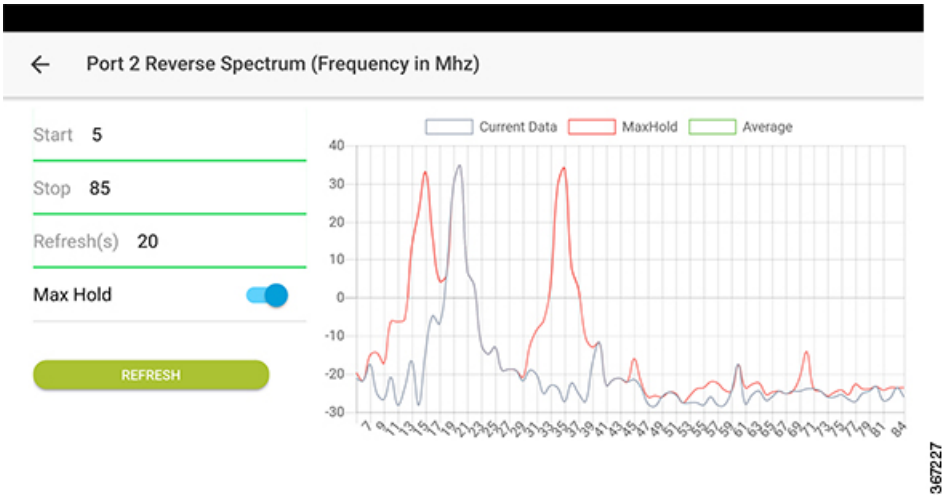
Figure 12: Reverse Path



367722

It displays the spectrum of the reverse path on a specified port. Tap port number to see the chart for the corresponding port.

Figure 13: Reverse Path Landscape



When the mobile device is in landscape orientation, this interface changes to landscape mode to allow the user to customize the parameters, and display the reverse spectrum with these parameters to get more details.

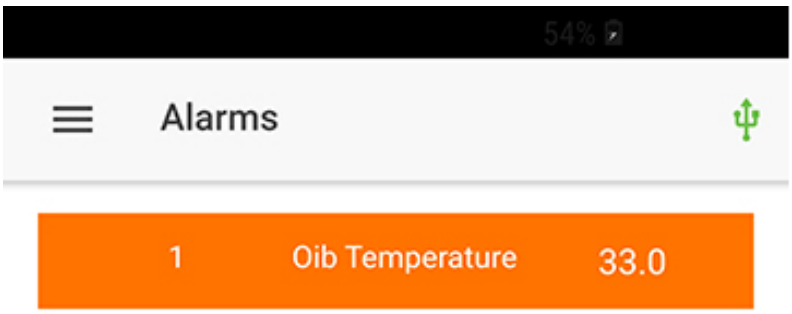
Name	Description
Start	Start Frequency in MHz.
Stop	Stop Frequency in MHz.
Refresh	Rate in seconds at which the data is collected.
Max Hold	Keeps the maximum value while new sample data is collected, since the reverse path data experiences bursts.

Alarms

A monitored item is displayed in the Alarms screen only when it is in an alarm state. In normal operation, the Alarms screen is blank and does not contain any entries.

The following screen displays a sample alarm, which shows that the iNode temperature (OIB) is in minor alarm state (orange). If a monitored item is in a major alarm state, it is displayed in red.

Figure 14: Alarms

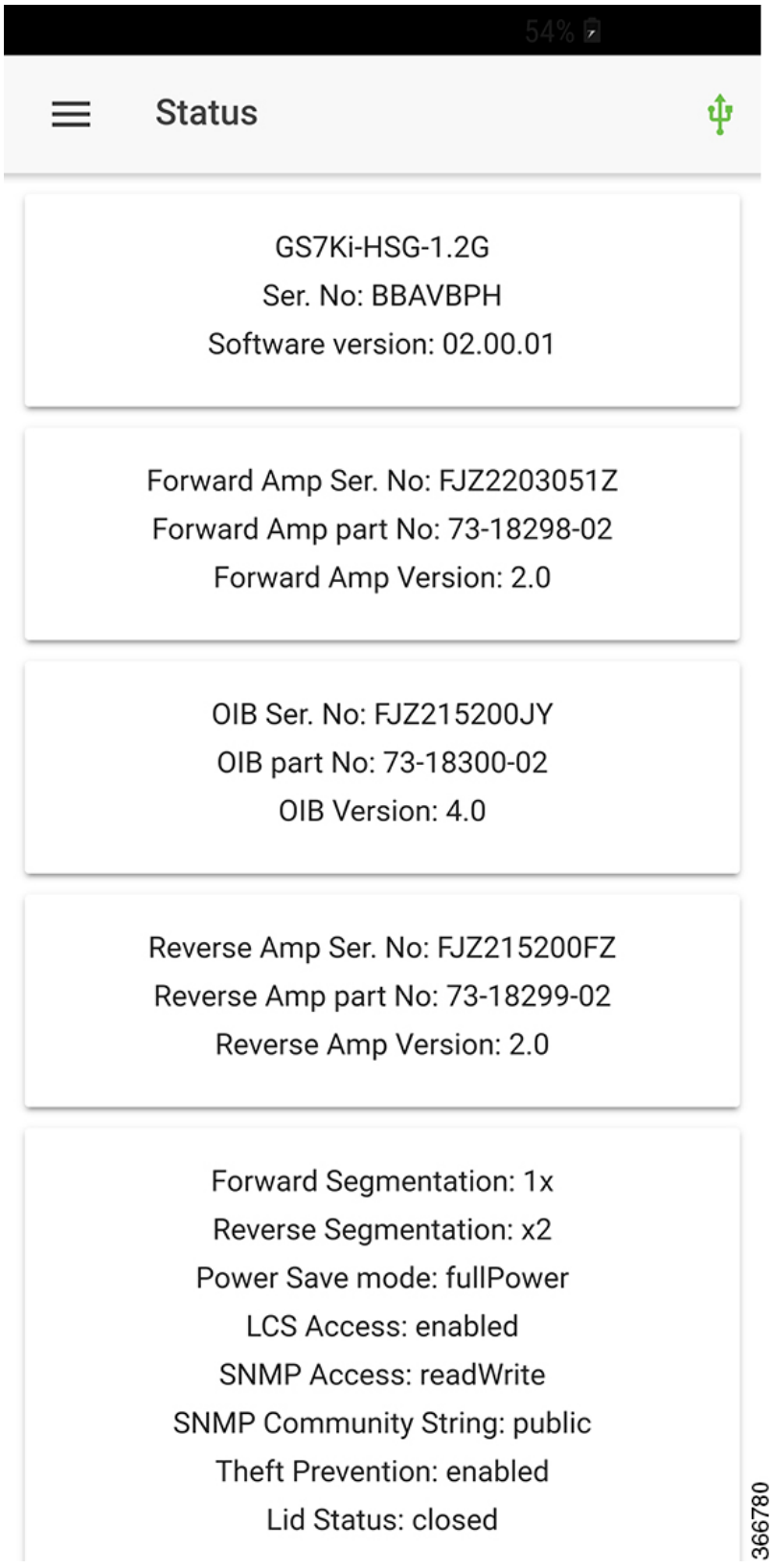


367721

Status

The Status screen has two sections. The top section lists iNode information. The bottom section lists all monitored items with their values. Scroll down to see all the items listed.

Figure 15: Status


54%
Status
GS7Ki-HSG-1.2G
Ser. No: BBAVBPH
Software version: 02.00.01
Forward Amp Ser. No: FJZ2203051Z
Forward Amp part No: 73-18298-02
Forward Amp Version: 2.0
OIB Ser. No: FJZ215200JY
OIB part No: 73-18300-02
OIB Version: 4.0
Reverse Amp Ser. No: FJZ215200FZ
Reverse Amp part No: 73-18299-02
Reverse Amp Version: 2.0
Forward Segmentation: 1x
Reverse Segmentation: x2
Power Save mode: fullPower
LCS Access: enabled
SNMP Access: readWrite
SNMP Community String: public
Theft Prevention: enabled
Lid Status: closed
366780

Node Information	Example
Model	GS7ki-HSG-1.2G
Serial Number	BBAVBPH
Software Version	02.00.01
Forward Amp Ser. No	FJZ2203051Z
Forward Amp part No.	73-18298-02
Forward Amp Version	2.0
OIB Ser. No	FJZ2215200JY
OIB part No	73-18300-02
OIB Version	4.0
Reverse Amp Ser. No	FJZ2215200FZ
Reverse Amp part No.	73-18299-02
Reverse Amp Version	2.0
Forward Segmentation	1x
Reverse Segmentation	x2
Power Save Mode	full Power
LCS Access	enabled
SNMP Access	readWrite
SNMP Community String	public
Theft Prevention	enabled
Lid Status	closed
Monitored Items	**Sample Current Value or Status**
Oib temperature	39.0
Ps 1 AC Input	57.2
Ps 1 Plus24 Vdc Output	24.8
Ps 1 Plus8 Vdc Output	8.7
Ps 1 Plus5 Vdc Output	6.1
Ps 1 Minus6 Vdc Output	-6.1
Ps 2 AC Input	0.0

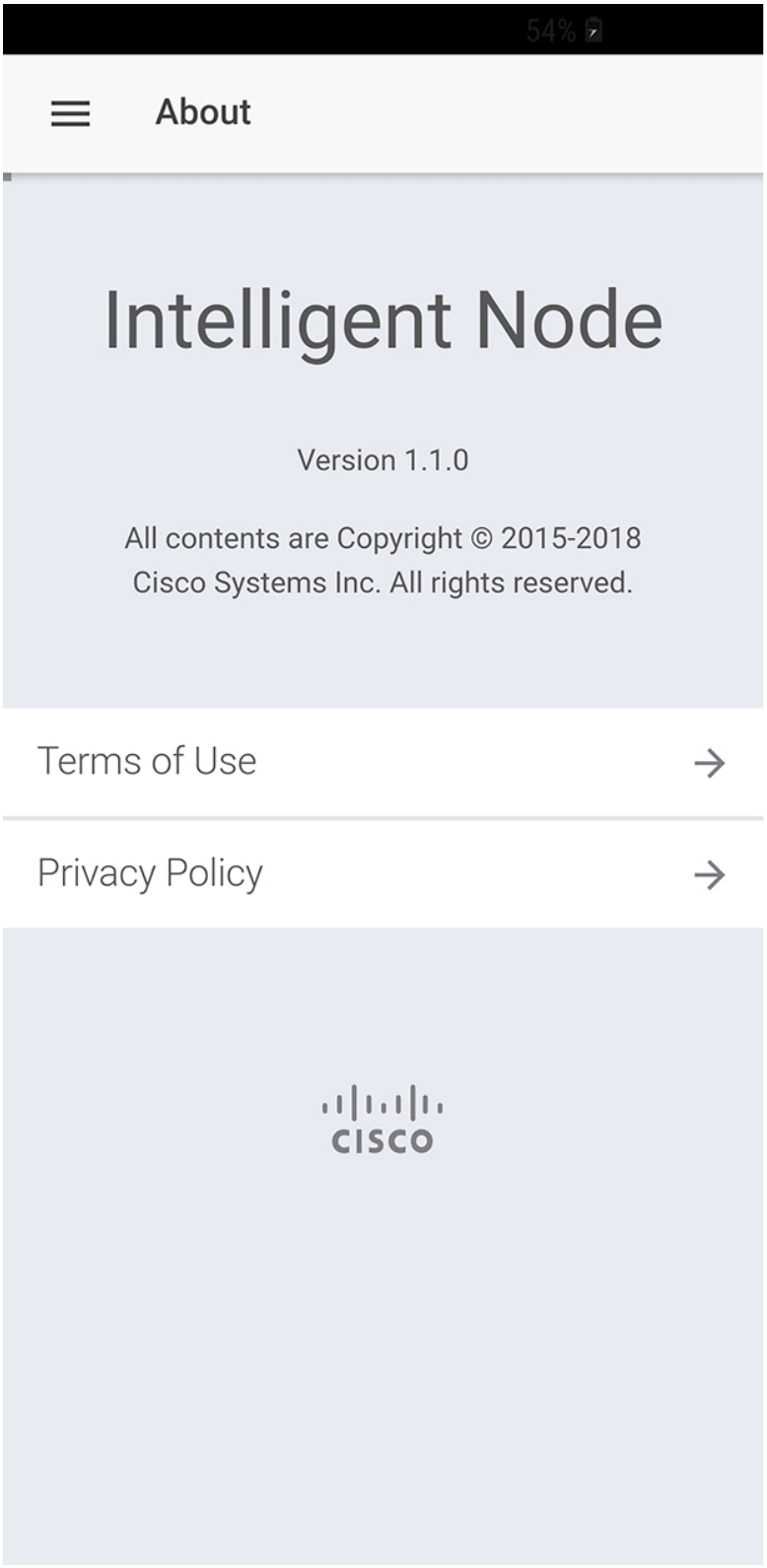
Node Information	Example
Ps 2 Plus24 Vdc Output	0.1
Ps 2 Plus8 Vdc Output	0.0
Ps 2 Plus5 Vdc Output	0.0
Ps 2 Minus6 Vdc Output	0.0
Optical Receiver Input Power	-30.0
Optical Transmitter1 Output Power	3.9
Optical Transmitter2 Output Power	3.9
Tamper	Normal
Auto Setup Status	Normal
Spectrum Capture Device Status	Normal
Rf Port1 Agc Lock	Normal
Rf Port2 Agc Lock	Normal
Rf Port14Agc Lock	Normal
Rf Port5 Agc Lock	Normal

About

The About screen displays the following details:

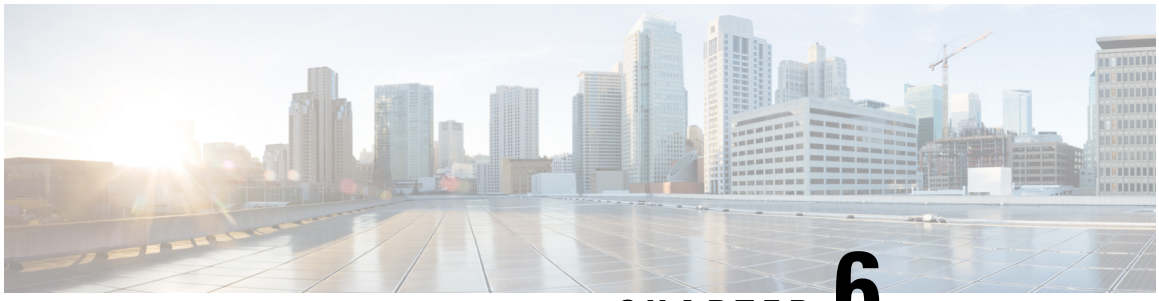
- Version of the iNode
- Terms of use
- Privacy policy

Figure 16: About screen



Troubleshooting LCS

The USB icon appears red if the LCS loses connectivity to the iNode. If the icon is red, touch the USB icon to reconnect. If the USB icon does not turn green in a reasonable time, verify your connection and restart the iNode App.



CHAPTER 6

Management via SNMP

This chapter provides information about using Simple Network Management Protocol (SNMP) commands for remote system monitoring and control. This system recognizes SNMP v1 and v2c commands.

Introduction

Simple network management protocol (SNMP) is an ISO standard communication protocol widely used by network and element management systems to monitor network devices for both alarms and other significant conditions.

SNMP accesses information about network devices through management information base (MIB) objects. MIBs are hierarchical tree-structured descriptions used to define database elements. SNMP is used to manage individual data elements and the values assigned to MIB objects.

SNMP addresses a single MIB object using a numeric string called an object identifier (OID). The OID defines a branching path through the hierarchy to the location of the object. In addition to the OID, a MIB object is identified by its object descriptor. Both are unique to each MIB object.

Also defined for each MIB object is the access that SNMP can afford to the object data value. For example, if a MIB object has read-write access, SNMP can be used to both get (retrieve) and set (define or change) the value of the object. If an object is read-only, SNMP can be used to get the object value, and cannot change it.

MIBs Used in the iNode

MIBs used in the iNode are listed in the following table. There are not any proprietary MIBs in the iNode; only standard MIBs are supported.

HMS MIBs and Related MIBs -- MODULE	Load and Compile Order
Prerequisites	SNMPv2-SMI, SNMPv2-TC, SNMPv2-CONF, SNMPv2-MIB, INET-ADDRESS-MIB
HMS028 - SCTE-ROOT	SCTE-ROOT
HMS072 - SCTE-HMS-ROOTS	SCTE-ROOT, SCTE-HMS-ROOTS
HMS025 - SCTE-HMS-FIBERNODE-MIB	SCTE-ROOT, SCTE-HMS-ROOTS, RFC1215-MIB, SCTE-HMS-FIBERNODE-MIB
HMS024 - SCTE-HMS-COMMON-MIB	SCTE-ROOT, SCTE-HMS-ROOTS, RFC1215-MIB, SCTE-HMS-COMMON-MIB
HMS023 - SCTE-HMS-ALARMS-MIB	SCTE-ROOT, SCTE-HMS-ROOTS, RFC1215-MIB, SCTE-HMS-COMMON-MIB, SCTE-HMS-ALARMS-MIB
HMS026 - SCTE-HMS-PROPERTY-MIB	SCTE-ROOT, SCTE-HMS-ROOTS, SCTE-HMS-PROPERTY-MIB
SNMP-TARGET-MIB	SNMP-FRAMEWORK-MIB, SNMP-TARGET-MIB
SNMP-FRAMEWORK-MIB	SNMP-FRAMEWORK-MIB
SNMP-NOTIFICATION-MIB	SNMP-FRAMEWORK-MIB, SNMP-TARGET-MIB, SNMP-NOTIFICATION-MIB

The following access codes (Code) are used in the MIB tables in this chapter.

Code	Description	
RO	Read Only	Data is displayed for reading.
RW	Read-Write	Data can be read and changed.
na	Not Applicable	Data is not applicable to the equipment.

SNMP Community String

You should change the SNMP community string only using the LCS or iNode Manager. It is an alphanumeric string of not more than 32 characters.

MIB-2 System MIB

The System MIB gives an overview for the iNode. By default, sysContact, sysName, and sysLocation can be changed. All three are saved in nonvolatile memory.

Note The iNode does not have a Real Time Clock (RTC). Therefore, sysUpTime is only a time estimate.

HMS MIB Specifications

SCTE-HMS-PROPERTY-MIB

The Property MIB consists of the following tables:

- analog properties table
- discrete alarms table
- current alarms table

Note Information contained in the current alarms table can be determined by studying the other Property MIB tables.

Analog Property Table

The analog property table allows you to adjust certain alarm thresholds, hysteresis values, and settings with respect to alarm and trap generation. The thresholds displayed by the property MIB fall into two categories.

1. Thresholds that cannot be changed (na and RO in the following table). These parameters are informational and cannot be changed. Since the MIB itself has read-write access, you can edit the table. However, if an edited value has read-only access in the module, information coming from the module on the next polling cycle will overwrite your edits for that particular setting.
2. Threshold values that represent alarm thresholds (Alarm). These are used to generate a trap if the monitored value crosses one of these thresholds.

Equipment	Parameter OID	Thresholds Changed	Code
LinePowerVoltage	fnLinePowerVoltage	na	RO
nodeTemperature	commonInternalTemperature	Alarm	RW
Transmitter	fnReturnLaserOpticalPower	na	RO
Receiver	fnOpticalReceiverPower	na	RO

Equipment	Parameter OID	Thresholds Changed	Code
Power Supply	fnDCPowerVoltage	Alarm	RW

The following table indicates the default values for the analog properties table.

Name	Major Hi	Minor Hi	Minor Lo	Major Lo	Dead band	Units
fnLinePowerVoltage	95	90	45	40	1	VAC
commonInternalTemperature	70	65	-35	-40	2	degC
fnReturnLaserOpticalPower	-30	-50	-120	-150	10	mW
fnOpticalReceiverPower	16	13	2	1	1	mW
fnDCPowerVoltage (-6Vb)	-46	-48	-64	-66	1	0.1 VDC
fnDCPowerVoltage (5Vb)	72	70	53	51	1	0.1 VDC
fnDCPowerVoltage (8Vb)	99	97	81	79	2	0.1 VDC
fnDCPowerVoltage (24Vb)	265	263	241	239	1	0.1 VDC

Current Alarm Table Sample

Instance	currentAlarmOID	currentAlarmAlarmState	currentAlarmVal
12.1.3.6.1.4.1.5591.1.3.1.12.0	commonTamperStatus	caasDiscreteMajor(6)	2

Discrete Property Table

The discrete property table alerts you when a specific monitored value changes state. The alarms are set up to send a trap when a value changes from a nominal state to alarm state. Some are also set up to signal other states. The following table provides an overview of discrete property parameters and the values that may cause trap generation.

Equipment	Parameter OID	discreteAlarmValue
TamperSwitch	commonTamperStatus	Compromised(2)

SCTE-HMS-ALARMS-MIB

The alarm MIB keeps a copy of the last 50 alarms generated when a monitored value crosses an alarm threshold. The alarmLogTable contains the alarmLogInformation OID with values defined in the properties of the OID. Significant is the fifth octet that describes the Alarm Type as an enumeration representing one of the following:

1. Nominal

2. HiHi
3. Hi
4. Lo
5. LoLo
6. Discrete Major
7. Discrete Minor

Starting with octet seven until the value at the end, the OID of the monitored value causing the alarm state displays. Finally, the actual value shows in the last few octets. Traps are similar to the logged alarms.

Table 5: Alarm Table Sample

Ins	alarmLogIndex	alarmLogInformation
11	11	5A.7B.5A.FB.06.08.0C.2B.06.01.04.01.AB.57.01.03.01.0C.00.02.02.00.02

In the preceding sample, the commonTamperStatus, with a numeric OID of 1.3.6.1.4.1.5591.1.3.1.12.0 or hexadecimal 2B.06.01.04.01.AB.57.01.03.01.0C.00, is in an alarm state of 6 (Discrete Major) with a value of 2 (compromised) or 00.02 in hexadecimal. The commonTamperStatus, has a positive value. However, if the value of a monitored item is negative then the hex value would display like the following example. For the decimal value of -242, the hexadecimal equivalent is FF.0E. The 12 (or hex 0C) at the start of the OID in the current alarm table instance is the number of octets in the OID that follows.

Table 6: Alarm Log Example Shown With Decimal and OID Equivalents

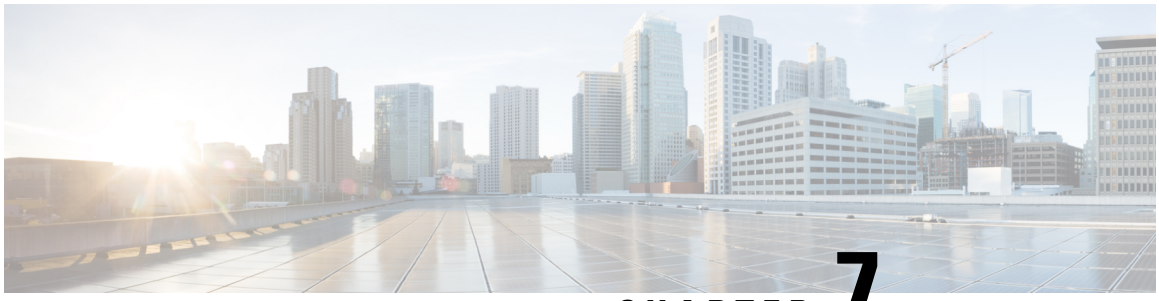
	Alarm Type	OID	Value	Value
Octet	5	7-m	n-z	decimal
Hex	06	06.01.04.01.AB.57.01.03.01.0C.00	00.02	2
Decimal	6	1.3.6.1.4.1.5591.1.3.1.12.0		
OID		SCTE-HMS-COMMON-MIB:: commonTamperStatus.0		

SCTE-HMS-COMMON-MIB

The Common MIB is self-explanatory. A few significant OIDs are highlighted here. The iNode's serial number is found in commonSerialNumber, the iNode's software version is found at commonVendorInfo, while the MAC address is found in commonPhysAddress. Set commonReset to 1 to reboot the iNode. This triggers a software upgrade, if a newer image exists (see Software Upgrade, on page 13).

SCTE-HMS-FIBERNODE-MIB

The fibernode MIB displays data related to the transmitters, receivers, redundancy, and power supplies.



CHAPTER 7

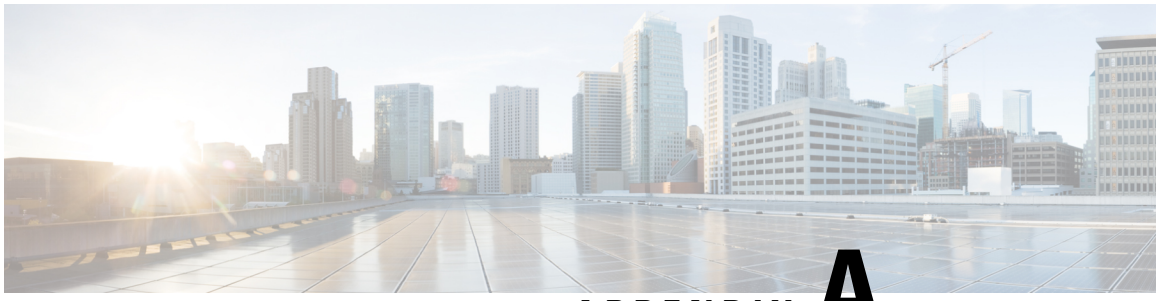
Troubleshooting

Troubleshooting

Table 7: Troubleshooting Table

Problem	Solution
LCS can not connect	Check the USB icon. If it is red, touch it to reconnect. If the USB icon does not turn green in a reasonable time, restart the iNode App.
Auto Setup fails	Verify the RF configuration settings.
Software can not update	See Download Does Not Start, on page 15.
Alarms	The information regarding alarms can be found in: • Alarms, on page 55 • Alarms, on page 36 and Status, on page 39 • Analog Property Table, on page 49, Current Alarm Table Sample, on page 50 and SCTE-HMS-ALARMS-MIB, on page 50

Troubleshooting



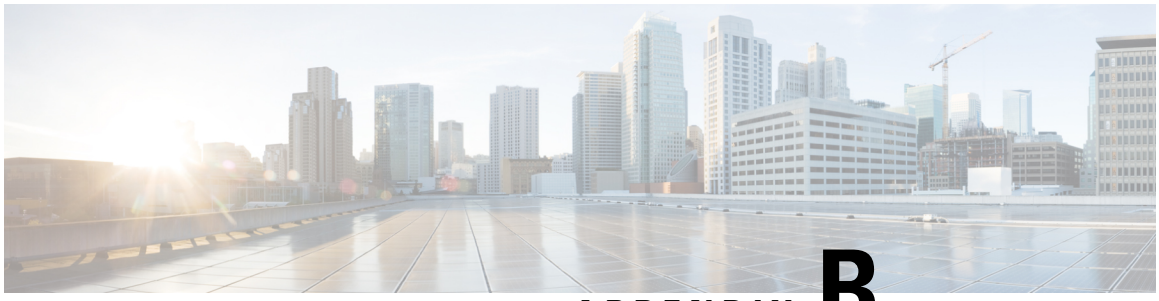
APPENDIX A

Alarms

Item	Units	Type[1]	Major Low Limit[2]	Minor Low Limit[3]	Minor High Limit[4]	Major High Limit[5]	Hyst	Notes
Lid status	n/a	B	n/a	n/a	n/a	n/a	n/a	Open (alarm) or closed
PS1 AC input	Vrms	A	40	45	90	95	1.0	True RMS
PS2 AC input	Vrms	A	40	45	90	95	1.0	True RMS
PS1 +24.5V	VDC	A	23.9	24.1	26.3	26.5	0.1	
PS1 +8.5V	VDC	A	7.9	8.1	9.7	9.9	0.1	
PS1 +5.5V	VDC	A	5.1	5.3	7.0	7.2	0.1	
PS1 -6V	VDC	A	-6.6	-6.4	-4.8	-4.6	0.1	
PS2 +24.5V	VDC	A	23.9	24.1	26.3	26.5	0.1	
PS2 +8.5V	VDC	A	7.9	8.1	9.7	9.9	0.1	
PS2 +5.5V	VDC	A	5.1	5.3	7.0	7.2	0.1	
PS2 -6V	VDC	A	-6.6	-6.4	-4.8	-4.6	0.1	
Analog receiver								
Status	n/a	B	n/a	n/a	n/a	n/a	n/a	Installed (1) or not (0)
Optical input power	dBm	A	-10	-8	1	2	0.5	
Transmitter 1								Right-most OIB slot
Status	n/a	B	n/a	n/a	n/a	n/a	n/a	Installed (1) or not (0)
Optical output power	dBm	A	-15	-12	-5	-3	1.0	
Transmitter 2								
Status	n/a	B	n/a	n/a	n/a	n/a	n/a	Installed (1) or not (0)

Item	Units	Type[1]	Major Low Limit[2]	Minor Low Limit[3]	Minor High Limit[4]	Major High Limit[5]	Hyst	Notes
Optical output power	dBm	A	-15	-12	-5	-3	1.0	
IFAM								
“AGC lock”, port 1	n/a	B	n/a	n/a	n/a	n/a	n/a	Ok if gain is within ± 1.0 dB at low and high points
“AGC lock”, port 2	n/a	B	n/a	n/a	n/a	n/a	n/a	
“AGC lock”, port 4	n/a	B	n/a	n/a	n/a	n/a	n/a	
“AGC lock”, port 5	n/a	B	n/a	n/a	n/a	n/a	n/a	

1 B = Boolean, A = Analog
2 Default
3 Default
4 Default
5 Default



APPENDIX B

Control Setting Tables

Intelligent Forward Amplifier Module (IFAM) Control Settings

Item	Units	Center Frequencies Range	Center Frequencies Default	
Low band edge for AGC/Auto setup, port 1	MHz	50 – 200	105	
High band edge for AGC/Auto setup, port 1	MHz	750 - 1200	987	
Low band edge for AGC/Auto setup, port 2	MHz	50 – 200	105	
High band edge for AGC/Auto setup, port 2	MHz	750 - 1200	987	
Low band edge for AGC/Auto setup, port 4	MHz	50 – 200	105	
High band edge for AGC/Auto setup, port 4	MHz	750 - 1200	987	
Low band edge for AGC/Auto setup, port 5	MHz	50 – 200	105	
High band edge for AGC/Auto setup, port 5	MHz	750 - 1200	987	
Atten setting, port 1	dB	0 – 15	0	Not user accessible
Eq setting, port 1	dB	0 – 15	0	Not user accessible

Item	Units	Center Frequencies Range	Center Frequencies Default	
Atten setting, port 2	dB	0 – 15	0	Not user accessible
Eq setting, port 2	dB	0 – 15	0	Not user accessible
Atten setting, port 4	dB	0 – 15	0	Not user accessible
Eq setting, port 4	dB	0 – 15	0	Not user accessible
Atten setting, port 5	dB	0 – 15	0	Not user accessible
Eq setting, port 5	dB	0 – 15	0	Not user accessible
AGC enable, port 1	n/a	On – off	On	
AGC enable, port 2	n/a	On – off	On	
AGC enable, port 4	n/a	On – off	On	
AGC enable, port 5	n/a	On – off	On	
Bias current, port 1	n/a	Low-high	high	Auto set per port based on highest active freq.
Bias current, port 2	n/a	Low-high	high	Auto set per port based on highest active freq.
Bias current, port 4	n/a	Low-high	high	Auto set per port based on highest active freq.
Bias current, port 5	n/a	Low-high	high	Auto set per port based on highest active freq.
Port 1 amplifier control	n/a	On – off	On	DC power control
Port 2 amplifier control	n/a	On – off	On	DC power control
Port 4 amplifier control	n/a	On – off	On	DC power control
Port 5 amplifier control	n/a	On – off	On	DC power control

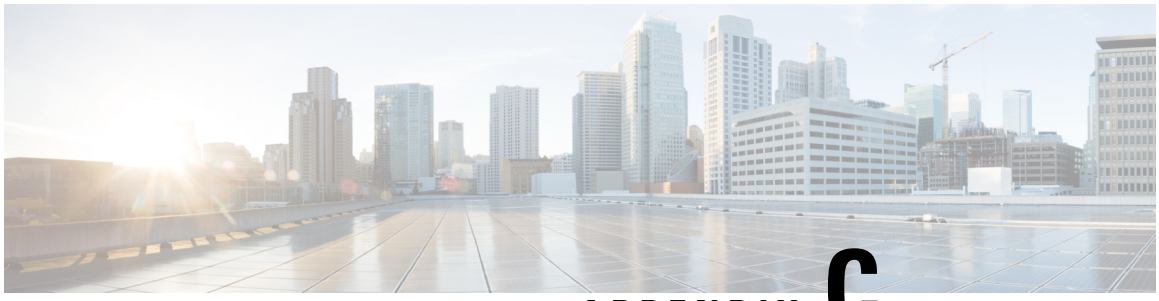
Intelligent Reverse Amplifier Module (IRAM) Control Settings

Item	Units	Range	Default
Atten setting, port 1	dB	0 - 10	0
Atten setting, port 2	dB	0 - 10	0
Atten setting, port 4	dB	0 - 10	0

Item	Units	Range	Default
Atten setting, port 5	dB	0 - 10	0
Input enable, port 1	n/a	Off - On	On
Input enable, port 2	n/a	Off - On	On
Input enable, port 4	n/a	Off - On	On
Input enable, port 5	n/a	Off - On	On

Optical Interface Board (OIB) Control Settings

Item	Units	Range	Default	
Atten setting, receiver	dB	0 - 30	0	Not user accessible
Atten setting, rphy	dB	0 - 30	0	Not user accessible
Atten setting, tx	dB	0 - 10	0	Not user accessible
Atten setting, rphy	dB	0 - 30	0	Not user accessible
Output port (port 1 + port 2)	n/a	0 - 1	0	Tx1 (0) or RPHY (1)
Output port (port 4 + port 5)	n/a	0 - 1	0	Tx1 (0) or RPHY (1)
Spectrum analyzer input select	n/a	0 - 10	0	Per LCS 0 = Port 1 forward 1 = Port 1 reverse 2 = Port 2 forward 3 = Port 2 reverse 4 = Port 4 forward 5 = Port 4 reverse 6 = Port 5 forward 7 = Port 5 reverse 8 = Reverse port 1 + 2 9 = Reverse port 4 + 5 10 = Reverse port 1 + 2 + 4 + 5



APPENDIX C

RF Configuration Parameters

RF Frequency Settings

For the Low frequency setting, enter the center frequency of an active channel at or near the low end of the forward band. For the High frequency setting, enter the center frequency of an active channel at or near the high end of the forward band. For example, if you have an 870 MHz plant, you can enter 105 MHz for the low frequency and 867 MHz for the high frequency.

RF Levels

For the Low and High level setting, enter the desired output level (in dBmV) for the active channel specified above. For example, you might enter 37 dBmV for the low frequency level and 51 dBmV for the high frequency level.

Tilt

The tilt displayed here is calculated based on the levels specified above, but is not necessarily the same as the overall launch amplifier tilt. Using the level values from the example above (37 and 51 dBmV), the displayed tilt is 14 dB based on this equation:

Tilt=High level-Low level=51-37=14 dB

But to verify that these settings are also within the operating range of the node, use the following formula:

Tilt=(High level-Low level) x (Max freq-Min freq)/(High freq-Low freq)=(51-37) x (1215-54)/(867-105)=21.3 dB

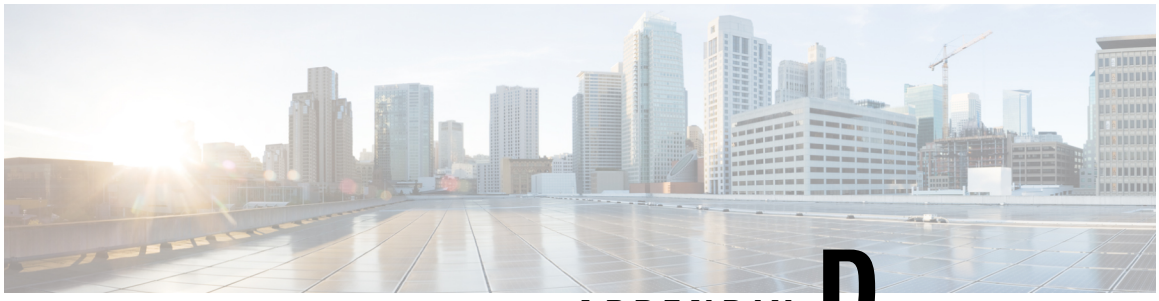
The calculated tilt is less than 22 dB, so these values are within the operating range of the node.

Then check whether the output level is valid, use this formula:

Level=High level+Tilt x (Max freq-High Freq)/(Max freq-Min freq)=51+21.3 x (1215-867)/(1215-54)=57.4 dBmV

The calculated level at the high end is 57.4 dBmV, which is less than the 58 dBmV specification, so these levels are valid.

If either the tilt or high end level are out of range, auto setup will fail and AGC will not reliably lock.



APPENDIX D

Glossary

The following list describes acronyms and definitions for terms used throughout this document:

- **DHCP:** Dynamic Host Configuration Protocol
- **DOCSIS:** Data Over Cable Service Interface Specification
- **FPGA:** Field Programmable Gate Array
- **HFC:** Hybrid Fiber-Coax
- **IAM:** Intelligent Amplifier Module
- **IFAM:** Intelligent Forward Amplifier Module
- **IRAM:** Intelligent Reverse Amplifier Module
- **ICI:** Intelligent Control Interface (aka INC)
- **INC:** Intelligent Node Controller (aka ICI)
- **iNode:** Intelligent Node
- **iRPD:** Intelligent Remote PHY Device
- **LCS:** Local Control Software
- **MIB:** Management Interface Base
- **OIB:** Optical Interface Board
- **RPHY:** Remote PHY
- **SCTE:** Society of Cable Telecommunications Engineers
- **SNMP:** Simple Network Management Protocol
- **USB:** Universal Serial Bus

Glossary