



Juniper Networks
G10 CMTS

Pre-Installation Guide

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Juniper Networks G10 CMTS Pre-Installation Guide

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YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. The JUNOS software has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

The DOCSIS Module performs encryption that is subject to U.S. Customs and Export regulations. A DOCSIS Module shall not be exported, sold or transferred to a country outside the USA and Canada without an appropriate export license from the U.S. Government. The specific Regulations governing exports of encryption products are set forth in the Export Administration Regulations, 15 C.F.R. (Code of Federal Regulations), Parts 730-774.

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About This Manual

This section describes important information about the design of this document.

Purpose

The purpose of this document, *Juniper Networks G10 CMTS Pre-Installation Guide*, is to describe the installation site requirements that must be met prior to installing the G10 Cable Modem Termination System (CMTS). The requirements and recommendations given are prerequisites to those instructions provided in the *Juniper Networks G10 CMTS Installation and Configuration* manual.

The intended audience for this information consists of individuals involved in preparing an installation site for equipment installation or involved in installing the G10 CMTS.

Organization

This document is organized as follows:

“**Safety**” – Provides recommendations to ensure the safety and protection of system equipment and equipment installers.

“**Notices**” – Lists important UL, EN and FCC notices.

“**Power**” – Provides input power requirements for the AC and DC configuration options of the CMTS.

“**Environment**” – Provides specifications for maintaining proper environmental conditions for the CMTS.

“**Mounting**” – Provides recommendations for mounting the CMTS in an equipment rack, including the organization of cabling, thermal management considerations, and positioning of the rack to allow sufficient access clearance.

“**Tools and Equipment Required for Installation**” – Provides information regarding the tools, supplies, and equipment recommended for installing the CMTS.

“**Characterization of Installation Site**” – Provides a set of parameters relative to aspects of the installation site system, HFC network connections, and CMTS downstream and upstream transmissions. These parameters are to be characterized prior to the installation of the CMTS.

“**Summary Checklist**” – Provides a summary checklist of the pre-installation requirements discussed in this document.

“**Noise Measurement Methodology**” – Describes the proper methodology for conducting average and peak upstream noise measurements.

“**Additional Characterization Tables**” – Provides extra tables if additional DOCSIS services or DOCSIS Modules for the installation site need to be characterized.

Document Conventions

The following document conventions are used in this manual:

General Conventions	<i>Italic font</i>	Denotes a) emphasis, b) first use of a new term, or c) a document title.
	Screen Name font	Denotes a) the on-screen name of a window, dialog box or field, or b) keys on a keyboard.
Software Conventions	Computer font	Font denotes code or messages displayed on-screen.
	Computer Bold font	Font denotes literal commands and parameters that you enter exactly as shown.
	< <i>Computer Italic</i> > font	Font denotes parameter values that require a user-defined input. The value strings are enclosed in angle brackets < ... > .
	[parameter]	Square brackets denote optional parameters.
	{parameter}	Braces denote required parameters.
		Vertical bars separate parameters in a group from which you must choose only one.
	↵	Return symbol indicates pressing the Enter key at the end of a command line.

Notes, Cautions, and Warnings



A note indicates information that might be helpful in a particular situation, or information that might otherwise be overlooked.

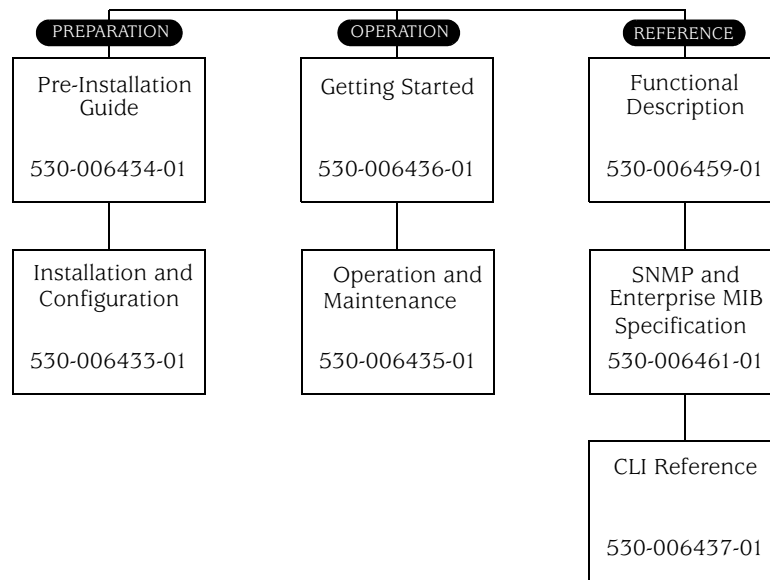


A caution indicates a situation that requires careful attention. Failure to observe a cautionary note could result in injury or discomfort to yourself, or serious damage to the product.



A warning is intended to alert the user of the presence of uninsulated dangerous voltage within the product's enclosure that may present a risk of electric shock.

G10 CMTS Document Set





Chapter 1

Site Requirements

This document describes the installation site requirements that must be met prior to installing the G10 Cable Modem Termination System (CMTS). These requirements and recommendations are prerequisites to those instructions provided in the *Juniper Networks G10 CMTS Installation and Configuration* manual.

Safety

The following guidelines are recommended to ensure the safety and protection of system equipment and equipment installers.

- Verify compliance with all pertinent local and national regulatory requirements
- Only trained or certified personnel should be involved in the installation of the CMTS
- Enforce the use of grounding straps to protect the CMTS equipment from electrostatic discharge (ESD) damage
- Leave all modules in the anti-static packaging until the time of installation
- Position the CMTS equipment in a clear, dry, dust-free area
- Use a minimum of 3 people to lift the chassis



High levels of electrical energy are distributed across the system midplane. Be careful not to contact the midplane connectors, or any component connected to the midplane, with any metallic object while hot-swapping or servicing components installed in the system.

Notices



Warning

- This equipment is intended only for installation in a restricted access location within a building.
- This equipment is intended for indoor use only.
- This equipment does not have a direct copper connection to the outside plant.
- Removal of power supplies or cards will result in access to hazardous energy.
- Each power cord must be connected to an independent branch circuit.



Caution

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.



Note

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.

Power

The G10 CMTS can be configured with either AC or DC power supply modules. To support a fully-populated CMTS, the installation site must be able to source 1700 watts of input power. Fully populated, the CMTS is configured with 10 power supplies.



Note

The G10 CMTS chassis midplane is electrically partitioned into A and B domains. To support redundancy, each domain must be sourced by separate power supplies and circuit protection measures.




Warning

Ensure that all power distribution panel switches on the rear of the CMTS are in the OFF position prior to connecting any electrical power cords. Also ensure that the CMTS chassis is properly grounded to earth prior to connecting any source of power.

AC Power

The G10 CMTS requires an AC power source that operates within a voltage and frequency range of 90 to 264 VAC and 47 to 63 Hz. In addition, appropriately sized circuit protection measures must be implemented to ensure compliance with electrical regulatory standards.

Use the factory-supplied power cables for AC power.

 Caution	AC power sources must use circuit breakers, rather than fuses, for current surge protection.
---	--

DC Power

The G10 CMTS requires a DC power source that operates within a voltage range of -36 to -72 VDC. Appropriately sized circuit protection measures must be implemented to ensure compliance with electrical regulatory standards.

Power cables of 10 AWG are recommended for DC power.

Environment

The installation site must meet the specifications provided in Table 1 on page 4 to maintain the proper environmental conditions for the G10 CMTS.



Table 1: G10 CMTS Environmental Specifications

Parameter	Condition	Requirement
Temperature	Ambient Operating	0°C to 40°C
	Ambient Non-operating	-35°C to 60°C
Humidity	Ambient Operating and Non-operating	10 % to 90 % (non-condensing)
Altitude	Operating and Non-operating	0 to 3,048 m (10,000 ft)
Vibration	Operating	5 Hz to 200 Hz, at 1.0g (1.0 oct/min)
	Non-operating	5 Hz to 200 Hz, at 1.0g (1.0 oct/min) 200 Hz to 500 Hz, at 2.0g (1.0 oct/min)

Mounting

The G10 CMTS is designed for mounting in a 19-inch EIA RS-310-C equipment rack or a 23-inch AT&T DATAPHONE equipment rack. Installation into non-standard racks may still be accomplished through the additional rail mounting bracket holes provided with the CMTS.



Note

Systems should be rack mounted from the bottom up to maintain the lowest possible center of gravity of the entire rack with its equipment.



Caution

An equipment shelf or tray is recommended beneath the CMTS to support its weight. The shelf avoids any backward toppling of the rack or excess torque applied to the mounting brackets when the CMTS is installed.

A cable organizer is recommended to assist with the routing of cables to and from the equipment rack. The cable organizer should be mounted after the CMTS is installed.

For thermal management, airflow enters from the lower front and sides of the CMTS chassis and ventilates through the upper rear. As a result, a clearance of 3 to 6 inches is required on each side of the CMTS. Additional equipment can be mounted flush on either the top or bottom of the CMTS without impacting system ventilation.



Caution

Neighboring equipment must be positioned such that its ventilation exhaust does not feed into the CMTS air intakes.

Proper clearance to the front and rear of the mounting rack is recommended so that the CMTS can be easily accessed during maintenance. The recommended clearance to the front and rear of the chassis is 3 feet and 2 feet, respectively.

Tools and Equipment Required for Installation

The following tools are needed to install power supplies and modules, and to rack mount the G10 CMTS chassis:

- M2.5 Phillips torque screwdriver
- M2.5 flathead torque screwdriver
- M3 Phillips torque screwdriver
- 1/8 in. Allen wrench, or 1/8 in. hex torque screwdriver
- M5 Phillips torque screwdriver
- #10 Phillips torque screwdriver
- #10 flathead torque screwdriver
- #12 Phillips torque screwdriver
- 7/16 in. torque wrench
- 22-10 AWG crimper/cutter

In addition, the following supplies may be required:

- RF cables and adapters
- Ethernet cables with RJ-45 connectors

The following equipment is required to configure the G10 CMTS and verify that the RF system has been setup properly:

- PC with asynchronous terminal emulation
- RF spectrum analyzer
- RF power meter



Characterization of Installation Site

Several parameters of the installation site need to be characterized prior to the installation of the CMTS. These parameters relate to specific aspects of the installation site system, HFC network connections, and CMTS downstream and upstream transmissions. The information collected will allow field engineers to verify that the installation site environment is compatible with the G10 CMTS. Table 2 is provided to collect information regarding the RF plant and HFC environment.

Table 2: RF Plant/HFC Environment Characterization

Parameter	Value
Plant architecture type	___ HFC ___ All Coax
Number of optical links within HFC	
Distance between optical links within HFC	___ max ___ average
Amplifier cascade depth from node	___ max ___ average
Homes passed per node	___ max ___ average
Total homes passed by installation site	
Node combining ratio per port	___:1 upstream ___:1 downstream
Average upstream noise measurement ¹	___ dB
Peak upstream noise measurement ¹	___ dB
Passive loss from upstream receiver to CMTS	___ dB
Maximum tap value used	___ dB
Maximum tap output level at highest frequency	___ dBmV
Maximum drop loss allowed from tap to home	___ dB
Method used for return path alignment	
DOCSIS services offered? If yes, complete Table 3 on page 7.	___ yes ___ no
Upstream frequency spectrum utilization	(complete Table 6 on page 11)

1. A statistical sample of the total nodes terminated at the headend (~ 10%) should be taken for average and peak noise measurements per the methodology described in "Noise Measurement Methodology" on page 13.

Table 3 is provided to collect information regarding the existing DOCSIS services supported by the installation site. If there are no existing DOCSIS services supported, skip Table 3 and proceed to subsequent tables. If more than two DOCSIS services exist, additional characterization tables can be found in “Additional Characterization Tables” on page 16.

Table 3: Existing DOCSIS Service Characterization

Parameter	Value
1st DOCSIS Service	
Upstream RF bandwidth allocated	___ MHz (max) ___ MHz (min)
Upstream modulation type	___ QPSK ___ 16QAM
Upstream input level expected at CMTS	___ dBmV
FEC enabled? If yes, FEC level parameters (T and K)	___ yes ___ no ___ T ___ K
Upstream measured C/N	___ dB
Downstream RF bandwidth allocated	___ MHz (max) ___ MHz (min)
Downstream modulation type	___ 64QAM ___ 256QAM
Downstream output signal level (relative to analog video)	___ dB
Downstream measured C/N	___ dB (DOCSIS carrier) ___ dB (Analog video carrier)
Downstream interleave depth setting	___ (# of taps) ___ (increments)
2nd DOCSIS Service	
Upstream RF bandwidth allocated	___ MHz (max) ___ MHz (min)
Upstream modulation type	___ QPSK ___ 16QAM
Upstream input level expected at CMTS	___ dBmV
FEC enabled? If yes, FEC level parameters (T and K)	___ yes ___ no ___ T ___ K
Upstream measured C/N	___ dB
Downstream RF bandwidth allocated	___ MHz (max) ___ MHz (min)
Downstream modulation type	___ 64QAM ___ 256QAM
Downstream output signal level (relative to analog video)	___ dB
Downstream measured C/N	___ dB (DOCSIS carrier) ___ dB (Analog video carrier)
Downstream interleave depth setting	___ (# of taps) ___ (increments)

Table 4 on page 8 is provided to collect upstream characterization information for a DOCSIS Module of the CMTS to be installed. If the desired CMTS configuration includes more than one DOCSIS Module, additional tables are available in “Additional Characterization Tables” on page 16.



Table 4: Upstream CMTS Parameter Characterization

Upstream Parameters	Port 0	Port 1	Port 2	Port 3
DOCSIS Module # _____				
Node combining ratio per port	____ : 1	____ : 1	____ : 1	____ : 1
Expected channels per port				
Expected port input level	____ dBmV	____ dBmV	____ dBmV	____ dBmV
Modulation type (where applicable)	_ QPSK _ 16QAM (CH0) _ QPSK _ 16QAM (CH1) _ QPSK _ 16QAM (CH2) _ QPSK _ 16QAM (CH3) _ QPSK _ 16QAM (CH4) _ QPSK _ 16QAM (CH5) _ QPSK _ 16QAM (CH6) _ QPSK _ 16QAM (CH7) _ QPSK _ 16QAM (CH8) _ QPSK _ 16QAM (CH9) _ QPSK _ 16QAM (CH10) _ QPSK _ 16QAM (CH11) _ QPSK _ 16QAM (CH12) _ QPSK _ 16QAM (CH13) _ QPSK _ 16QAM (CH14) _ QPSK _ 16QAM (CH15)	_ QPSK _ 16QAM (CH0) _ QPSK _ 16QAM (CH1) _ QPSK _ 16QAM (CH2) _ QPSK _ 16QAM (CH3) _ QPSK _ 16QAM (CH4) _ QPSK _ 16QAM (CH5) _ QPSK _ 16QAM (CH6) _ QPSK _ 16QAM (CH7) _ QPSK _ 16QAM (CH8) _ QPSK _ 16QAM (CH9) _ QPSK _ 16QAM (CH10) _ QPSK _ 16QAM (CH11) _ QPSK _ 16QAM (CH12) _ QPSK _ 16QAM (CH13) _ QPSK _ 16QAM (CH14) _ QPSK _ 16QAM (CH15)	_ QPSK _ 16QAM (CH0) _ QPSK _ 16QAM (CH1) _ QPSK _ 16QAM (CH2) _ QPSK _ 16QAM (CH3) _ QPSK _ 16QAM (CH4) _ QPSK _ 16QAM (CH5) _ QPSK _ 16QAM (CH6) _ QPSK _ 16QAM (CH7) _ QPSK _ 16QAM (CH8) _ QPSK _ 16QAM (CH9) _ QPSK _ 16QAM (CH10) _ QPSK _ 16QAM (CH11) _ QPSK _ 16QAM (CH12) _ QPSK _ 16QAM (CH13) _ QPSK _ 16QAM (CH14) _ QPSK _ 16QAM (CH15)	_ QPSK _ 16QAM (CH0) _ QPSK _ 16QAM (CH1) _ QPSK _ 16QAM (CH2) _ QPSK _ 16QAM (CH3) _ QPSK _ 16QAM (CH4) _ QPSK _ 16QAM (CH5) _ QPSK _ 16QAM (CH6) _ QPSK _ 16QAM (CH7) _ QPSK _ 16QAM (CH8) _ QPSK _ 16QAM (CH9) _ QPSK _ 16QAM (CH10) _ QPSK _ 16QAM (CH11) _ QPSK _ 16QAM (CH12) _ QPSK _ 16QAM (CH13) _ QPSK _ 16QAM (CH14) _ QPSK _ 16QAM (CH15)
Channel width (where applicable)	____ kHz/MHz (CH 0) ____ kHz/MHz (CH 1) ____ kHz/MHz (CH 2)	____ kHz/MHz (CH 0) ____ kHz/MHz (CH 1) ____ kHz/MHz (CH 2)	____ kHz/MHz (CH 0) ____ kHz/MHz (CH 1) ____ kHz/MHz (CH 2)	____ kHz/MHz (CH 0) ____ kHz/MHz (CH 1) ____ kHz/MHz (CH 2)
Circle the applicable unit.	____ kHz/MHz (CH 3) ____ kHz/MHz (CH 4) ____ kHz/MHz (CH 5) ____ kHz/MHz (CH 6) ____ kHz/MHz (CH 7) ____ kHz/MHz (CH 8) ____ kHz/MHz (CH 9) ____ kHz/MHz (CH 10) ____ kHz/MHz (CH 11) ____ kHz/MHz (CH 12) ____ kHz/MHz (CH 13) ____ kHz/MHz (CH 14) ____ kHz/MHz (CH 15)	____ kHz/MHz (CH 3) ____ kHz/MHz (CH 4) ____ kHz/MHz (CH 5) ____ kHz/MHz (CH 6) ____ kHz/MHz (CH 7) ____ kHz/MHz (CH 8) ____ kHz/MHz (CH 9) ____ kHz/MHz (CH 10) ____ kHz/MHz (CH 11) ____ kHz/MHz (CH 12) ____ kHz/MHz (CH 13) ____ kHz/MHz (CH 14) ____ kHz/MHz (CH 15)	____ kHz/MHz (CH 3) ____ kHz/MHz (CH 4) ____ kHz/MHz (CH 5) ____ kHz/MHz (CH 6) ____ kHz/MHz (CH 7) ____ kHz/MHz (CH 8) ____ kHz/MHz (CH 9) ____ kHz/MHz (CH 10) ____ kHz/MHz (CH 11) ____ kHz/MHz (CH 12) ____ kHz/MHz (CH 13) ____ kHz/MHz (CH 14) ____ kHz/MHz (CH 15)	____ kHz/MHz (CH 3) ____ kHz/MHz (CH 4) ____ kHz/MHz (CH 5) ____ kHz/MHz (CH 6) ____ kHz/MHz (CH 7) ____ kHz/MHz (CH 8) ____ kHz/MHz (CH 9) ____ kHz/MHz (CH 10) ____ kHz/MHz (CH 11) ____ kHz/MHz (CH 12) ____ kHz/MHz (CH 13) ____ kHz/MHz (CH 14) ____ kHz/MHz (CH 15)

Upstream Parameters	Port 0	Port 1	Port 2	Port 3
DOCSIS Module # ___				
FEC enabled? If yes, FEC level parameters	___ yes ___ no ___ T ___ K (CH 0) ___ T ___ K (CH 1) ___ T ___ K (CH 2) ___ T ___ K (CH 3) ___ T ___ K (CH 4) ___ T ___ K (CH 5) ___ T ___ K (CH 6) ___ T ___ K (CH 7) ___ T ___ K (CH 8) ___ T ___ K (CH 9) ___ T ___ K (CH 10) ___ T ___ K (CH 11) ___ T ___ K (CH 12) ___ T ___ K (CH 13) ___ T ___ K (CH 14) ___ T ___ K (CH 15)	___ yes ___ no ___ T ___ K (CH 0) ___ T ___ K (CH 1) ___ T ___ K (CH 2) ___ T ___ K (CH 3) ___ T ___ K (CH 4) ___ T ___ K (CH 5) ___ T ___ K (CH 6) ___ T ___ K (CH 7) ___ T ___ K (CH 8) ___ T ___ K (CH 9) ___ T ___ K (CH 10) ___ T ___ K (CH 11) ___ T ___ K (CH 12) ___ T ___ K (CH 13) ___ T ___ K (CH 14) ___ T ___ K (CH 15)	___ yes ___ no ___ T ___ K (CH 0) ___ T ___ K (CH 1) ___ T ___ K (CH 2) ___ T ___ K (CH 3) ___ T ___ K (CH 4) ___ T ___ K (CH 5) ___ T ___ K (CH 6) ___ T ___ K (CH 7) ___ T ___ K (CH 8) ___ T ___ K (CH 9) ___ T ___ K (CH 10) ___ T ___ K (CH 11) ___ T ___ K (CH 12) ___ T ___ K (CH 13) ___ T ___ K (CH 14) ___ T ___ K (CH 15)	___ yes ___ no ___ T ___ K (CH 0) ___ T ___ K (CH 1) ___ T ___ K (CH 2) ___ T ___ K (CH 3) ___ T ___ K (CH 4) ___ T ___ K (CH 5) ___ T ___ K (CH 6) ___ T ___ K (CH 7) ___ T ___ K (CH 8) ___ T ___ K (CH 9) ___ T ___ K (CH 10) ___ T ___ K (CH 11) ___ T ___ K (CH 12) ___ T ___ K (CH 13) ___ T ___ K (CH 14) ___ T ___ K (CH 15)
Channel frequency (where applicable)	___ MHz (CH 0) ___ MHz (CH 1) ___ MHz (CH 2) ___ MHz (CH 3) ___ MHz (CH 4) ___ MHz (CH 5) ___ MHz (CH 6) ___ MHz (CH 7) ___ MHz (CH 8) ___ MHz (CH 9) ___ MHz (CH 10) ___ MHz (CH 11) ___ MHz (CH 12) ___ MHz (CH 13) ___ MHz (CH 14) ___ MHz (CH 15)	___ MHz (CH 0) ___ MHz (CH 1) ___ MHz (CH 2) ___ MHz (CH 3) ___ MHz (CH 4) ___ MHz (CH 5) ___ MHz (CH 6) ___ MHz (CH 7) ___ MHz (CH 8) ___ MHz (CH 9) ___ MHz (CH 10) ___ MHz (CH 11) ___ MHz (CH 12) ___ MHz (CH 13) ___ MHz (CH 14) ___ MHz (CH 15)	___ MHz (CH 0) ___ MHz (CH 1) ___ MHz (CH 2) ___ MHz (CH 3) ___ MHz (CH 4) ___ MHz (CH 5) ___ MHz (CH 6) ___ MHz (CH 7) ___ MHz (CH 8) ___ MHz (CH 9) ___ MHz (CH 10) ___ MHz (CH 11) ___ MHz (CH 12) ___ MHz (CH 13) ___ MHz (CH 14) ___ MHz (CH 15)	___ MHz (CH 0) ___ MHz (CH 1) ___ MHz (CH 2) ___ MHz (CH 3) ___ MHz (CH 4) ___ MHz (CH 5) ___ MHz (CH 6) ___ MHz (CH 7) ___ MHz (CH 8) ___ MHz (CH 9) ___ MHz (CH 10) ___ MHz (CH 11) ___ MHz (CH 12) ___ MHz (CH 13) ___ MHz (CH 14) ___ MHz (CH 15)
Required channel input level (where applicable)	___ dBmV (CH 0) ___ dBmV (CH 1) ___ dBmV (CH 2) ___ dBmV (CH 3) ___ dBmV (CH 4) ___ dBmV (CH 5) ___ dBmV (CH 6) ___ dBmV (CH 7) ___ dBmV (CH 8) ___ dBmV (CH 9) ___ dBmV (CH 10) ___ dBmV (CH 11) ___ dBmV (CH 12) ___ dBmV (CH 13) ___ dBmV (CH 14) ___ dBmV (CH 15)	___ dBmV (CH 0) ___ dBmV (CH 1) ___ dBmV (CH 2) ___ dBmV (CH 3) ___ dBmV (CH 4) ___ dBmV (CH 5) ___ dBmV (CH 6) ___ dBmV (CH 7) ___ dBmV (CH 8) ___ dBmV (CH 9) ___ dBmV (CH 10) ___ dBmV (CH 11) ___ dBmV (CH 12) ___ dBmV (CH 13) ___ dBmV (CH 14) ___ dBmV (CH 15)	___ dBmV (CH 0) ___ dBmV (CH 1) ___ dBmV (CH 2) ___ dBmV (CH 3) ___ dBmV (CH 4) ___ dBmV (CH 5) ___ dBmV (CH 6) ___ dBmV (CH 7) ___ dBmV (CH 8) ___ dBmV (CH 9) ___ dBmV (CH 10) ___ dBmV (CH 11) ___ dBmV (CH 12) ___ dBmV (CH 13) ___ dBmV (CH 14) ___ dBmV (CH 15)	___ dBmV (CH 0) ___ dBmV (CH 1) ___ dBmV (CH 2) ___ dBmV (CH 3) ___ dBmV (CH 4) ___ dBmV (CH 5) ___ dBmV (CH 6) ___ dBmV (CH 7) ___ dBmV (CH 8) ___ dBmV (CH 9) ___ dBmV (CH 10) ___ dBmV (CH 11) ___ dBmV (CH 12) ___ dBmV (CH 13) ___ dBmV (CH 14) ___ dBmV (CH 15)

Table 5: Downstream CMTS Parameter Characterization

Downstream Parameters	Port 0	Port 1	Port 2	Port 3
DOCSIS Module #__				
Node combining ratio per port	___ : 1	___ : 1	___ : 1	___ : 1
Channel frequency allocated	___ MHz	___ MHz	___ MHz	___ MHz
Modulation type	_ 64QAM _256QAM	_ 64QAM _256QAM	_ 64QAM _256QAM	_ 64QAM _256QAM
Output signal level (relative to analog video)	___ dB	___ dB	___ dB	___ dB
Required channel output level	___ dBmV	___ dBmV	___ dBmV	___ dBmV
Interleave depth setting	___ [I] (# of taps) ___ [J] (increments)	___ [I] (# of taps) ___ [J] (increments)	___ [I] (# of taps) ___ [J] (increments)	___ [I] (# of taps) ___ [J] (increments)

Table 6: Upstream Frequency Spectrum Utilization

Frequency	Description of Utilization	Frequency	Description of Utilization
5 – 6 MHz		24 – 25 MHz	
6 – 7 MHz		25 – 26 MHz	
7 – 8 MHz		26 – 27 MHz	
8 – 9 MHz		27 – 28 MHz	
9 – 10 MHz		28 – 29 MHz	
10 – 11 MHz		29 – 30 MHz	
11 – 12 MHz		30 – 31 MHz	
12 – 13 MHz		31 – 32 MHz	
13 – 14 MHz		32 – 33 MHz	
14 – 15 MHz		33 – 34 MHz	
15 – 16 MHz		34 – 35 MHz	
16 – 17 MHz		35 – 36 MHz	
17 – 18 MHz		36 – 37 MHz	
18 – 19 MHz		37 – 38 MHz	
19 – 20 MHz		38 – 39 MHz	
20 – 21 MHz		39 – 40 MHz	
21 – 22 MHz		40 – 41 MHz	
22 – 23 MHz		41 – 42 MHz	
23 – 24 MHz			

Summary Checklist

Table 7 provides a summary checklist of the pre-installation requirements discussed in this document. This checklist must be completed and approved by Juniper Networks field engineers to ensure the installation site is properly prepared for installing the G10 CMTS.

Table 7: Pre-Installation Requirement Summary Checklist

Requirement	Verified
Safety	
Grounding straps provided for ESD protection	
Compliance verified with all local and national regulatory requirements	
Equipment to be positioned in a clear, dry, dust-free area	
Power	
AC Power	
AC-input supply operates within range of 90 to 264 VAC and 47 to 63 Hz	
Appropriate circuit protection in place for compliance with area electric regulations	
Separate AC-input power supply sources for CMTS A and B domains	
DC Power	
DC-input supply operates within range of -36 to -72 VDC	
Appropriate circuit protection in place for compliance with area electric regulations	
Environment	
Ambient temperature conditions satisfied	
Ambient humidity conditions satisfied	
Altitude conditions satisfied	
Vibration conditions satisfied	
Mounting	
19-inch rack, 23-inch rack, or appropriate non-standard rack or shelf available	
Cable organizer available for mounting rack	
Adequate access clearance to front, rear, and sides of CMTS	
Hardware	
Specified tools and supplies available	
Test equipment available for installation and verifying RF setup	
Installation Site	
Characterization of RF Plant/HFC environment parameters completed	
Characterization of existing DOCSIS services completed	
Characterization of upstream CMTS parameters completed	
Characterization of downstream CMTS parameters completed	

Noise Measurement Methodology

This section describes the proper methodology for conducting average and peak upstream noise measurements. The procedures provided are designed to establish a consistent methodology for obtaining the requested information during the characterization of the installation site. The HP 8591C is the recommended spectrum analyzer to use for conducting these measurements.

Average Upstream Noise Measurement

This section defines a procedure for taking the average upstream noise measurements requested as part of the RF plant/HFC environment characterization. A statistical sample of total nodes terminated at the installation site (10 % recommended) should be taken. Table 8 provides the appropriate setup configuration settings for the HP 8591C spectrum analyzer.

Table 8: Average Noise Spectrum Analyzer Settings

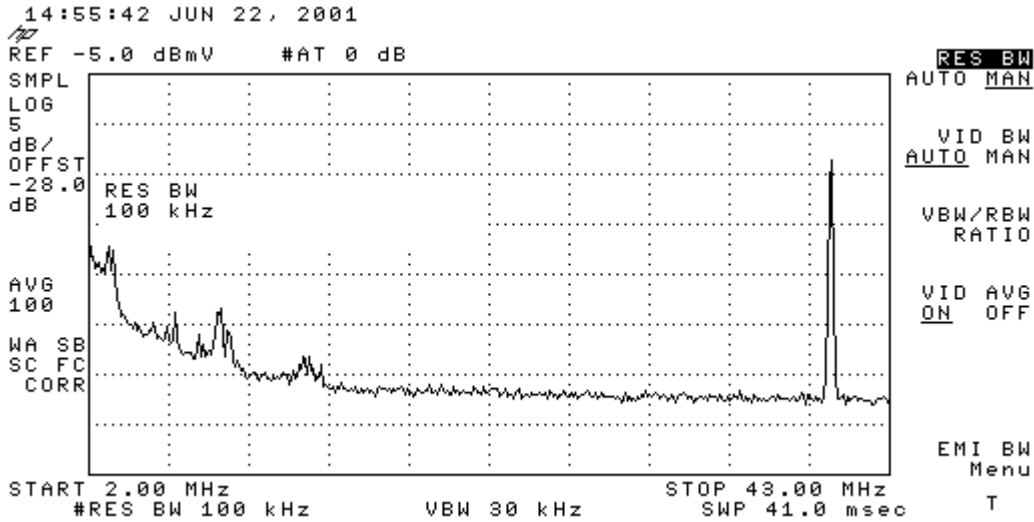
Setting	Value
Start Frequency	2 MHz
Stop Frequency	45 MHz
Resolution Bandwidth	100 kHz
Video Bandwidth	30 kHz
Scale	5 dB/div
Internal Amplifier	On
Attenuator	0 dB
Reference Level Offset	-28 dB
Reference Level ¹	-5 dBmV
Number of Averages	100

1. This value may need to be adjusted for your particular test environment.

1. Connect the spectrum analyzer to the selected upstream signal at the upstream splitter or at the CMTS upstream port.
2. Configure the spectrum analyzer per the values defined in Table 8.
3. Start the measurement.

Upon completing the measurement, the analyzer display should resemble Figure 1 on page 14.

Figure 1: Average Upstream Noise Measurement Example



Peak Upstream Noise Measurement

This section defines a procedure for taking the peak upstream noise measurements requested as part of the RF plant/HFC environment characterization. A statistical sample of total nodes terminated at the installation site (10% recommended) should be taken. Table 9 provides the appropriate setup configuration settings for the HP 8591C spectrum analyzer.

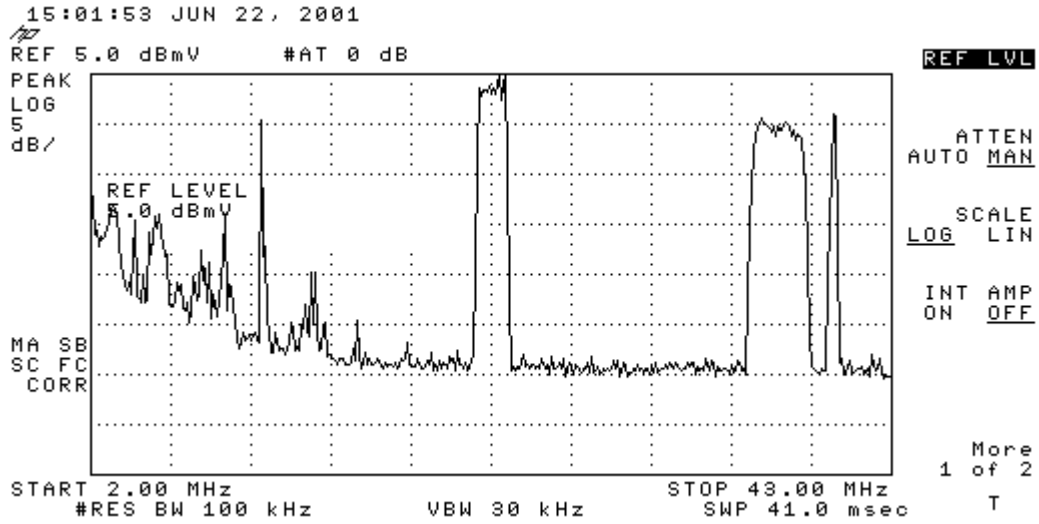
Table 9: Peak Noise Spectrum Analyzer Setup

Setting	Value
Start Frequency	2 MHz
Stop Frequency	45 MHz
Resolution Bandwidth	100 kHz
Video Bandwidth	30 kHz
Scale	5 dB/div
Internal Amplifier	Off
Attenuator	0 dB
Reference Level of Headend	0 dBmV
Max Hold	1 minute

1. Connect the spectrum analyzer to the selected upstream signal at the upstream splitter or at the CMTS upstream port.
2. Configure the spectrum analyzer per the values defined in Table 9.
3. Start the measurement.

Upon completing the measurement, the analyzer display should resemble Figure 2 on page 15.

Figure 2: Peak Upstream Noise Measurement Example



Additional Characterization Tables

If the installation site supports more than two DOCSIS services, the characterization of the additional services is to be captured in Table 10. In addition, if the desired CMTS configuration includes more than one DOCSIS Module, the additional tables, beginning on page 17, can be used as needed.

Table 10: Existing DOCSIS Service Characterization

Parameter	Value
___ DOCSIS Service	
Upstream RF bandwidth allocated	___ MHz (max) ___ MHz (min)
Upstream modulation type	___ QPSK ___ 16QAM
Upstream input level expected at CMTS	___ dBmV
FEC enabled? If yes, FEC level parameters (T and K)	___ yes ___ no ___ T ___ K
Upstream measured C/N	___ dB
Downstream RF bandwidth allocated	___ MHz (max) ___ MHz (min)
Downstream modulation type	___ 64QAM ___ 256QAM
Downstream output signal level (relative to analog video)	___ dB
Downstream measured C/N	___ dB (DOCSIS carrier) ___ dB (Analog video carrier)
Downstream interleave depth setting	___ (# of taps) ___ (increments)
___ DOCSIS Service	
Upstream RF bandwidth allocated	___ MHz (max) ___ MHz (min)
Upstream modulation type	___ QPSK ___ 16QAM
Upstream input level expected at CMTS	___ dBmV
FEC enabled? If yes, FEC level parameters (T and K)	___ yes ___ no ___ T ___ K
Upstream measured C/N	___ dB
Downstream RF bandwidth allocated	___ MHz (max) ___ MHz (min)
Downstream modulation type	___ 64QAM ___ 256QAM
Downstream output signal level (relative to analog video)	___ dB
Downstream measured C/N	___ dB (DOCSIS carrier) ___ dB (Analog video carrier)
Downstream interleave depth setting	___ (# of taps) ___ (increments)

Table 11: Upstream CMTS Parameter Characterization

Upstream Parameters	Port 0	Port 1	Port 2	Port 3
DOCSIS Module # _____				
Node combining ratio per port	___ : 1	___ : 1	___ : 1	___ : 1
Expected channels per port				
Expected port input level	___ dBmV	___ dBmV	___ dBmV	___ dBmV
Modulation type (where applicable)	_ QPSK _ 16QAM (CH0) _ QPSK _ 16QAM (CH1) _ QPSK _ 16QAM (CH2) _ QPSK _ 16QAM (CH3) _ QPSK _ 16QAM (CH4) _ QPSK _ 16QAM (CH5) _ QPSK _ 16QAM (CH6) _ QPSK _ 16QAM (CH7) _ QPSK _ 16QAM (CH8) _ QPSK _ 16QAM (CH9) _ QPSK _ 16QAM (CH10) _ QPSK _ 16QAM (CH11) _ QPSK _ 16QAM (CH12) _ QPSK _ 16QAM (CH13) _ QPSK _ 16QAM (CH14) _ QPSK _ 16QAM (CH15)	_ QPSK _ 16QAM (CH0) _ QPSK _ 16QAM (CH1) _ QPSK _ 16QAM (CH2) _ QPSK _ 16QAM (CH3) _ QPSK _ 16QAM (CH4) _ QPSK _ 16QAM (CH5) _ QPSK _ 16QAM (CH6) _ QPSK _ 16QAM (CH7) _ QPSK _ 16QAM (CH8) _ QPSK _ 16QAM (CH9) _ QPSK _ 16QAM (CH10) _ QPSK _ 16QAM (CH11) _ QPSK _ 16QAM (CH12) _ QPSK _ 16QAM (CH13) _ QPSK _ 16QAM (CH14) _ QPSK _ 16QAM (CH15)	_ QPSK _ 16QAM (CH0) _ QPSK _ 16QAM (CH1) _ QPSK _ 16QAM (CH2) _ QPSK _ 16QAM (CH3) _ QPSK _ 16QAM (CH4) _ QPSK _ 16QAM (CH5) _ QPSK _ 16QAM (CH6) _ QPSK _ 16QAM (CH7) _ QPSK _ 16QAM (CH8) _ QPSK _ 16QAM (CH9) _ QPSK _ 16QAM (CH10) _ QPSK _ 16QAM (CH11) _ QPSK _ 16QAM (CH12) _ QPSK _ 16QAM (CH13) _ QPSK _ 16QAM (CH14) _ QPSK _ 16QAM (CH15)	_ QPSK _ 16QAM (CH0) _ QPSK _ 16QAM (CH1) _ QPSK _ 16QAM (CH2) _ QPSK _ 16QAM (CH3) _ QPSK _ 16QAM (CH4) _ QPSK _ 16QAM (CH5) _ QPSK _ 16QAM (CH6) _ QPSK _ 16QAM (CH7) _ QPSK _ 16QAM (CH8) _ QPSK _ 16QAM (CH9) _ QPSK _ 16QAM (CH10) _ QPSK _ 16QAM (CH11) _ QPSK _ 16QAM (CH12) _ QPSK _ 16QAM (CH13) _ QPSK _ 16QAM (CH14) _ QPSK _ 16QAM (CH15)
Channel width (where applicable)	___ kHz/MHz (CH 0)	___ kHz/MHz (CH 0)	___ kHz/MHz (CH 0)	___ kHz/MHz (CH 0)
	___ kHz/MHz (CH 1)	___ kHz/MHz (CH 1)	___ kHz/MHz (CH 1)	___ kHz/MHz (CH 1)
	___ kHz/MHz (CH 2)	___ kHz/MHz (CH 2)	___ kHz/MHz (CH 2)	___ kHz/MHz (CH 2)
Circle the applicable unit.	___ kHz/MHz (CH 3)	___ kHz/MHz (CH 3)	___ kHz/MHz (CH 3)	___ kHz/MHz (CH 3)
	___ kHz/MHz (CH 4)	___ kHz/MHz (CH 4)	___ kHz/MHz (CH 4)	___ kHz/MHz (CH 4)
	___ kHz/MHz (CH 5)	___ kHz/MHz (CH 5)	___ kHz/MHz (CH 5)	___ kHz/MHz (CH 5)
	___ kHz/MHz (CH 6)	___ kHz/MHz (CH 6)	___ kHz/MHz (CH 6)	___ kHz/MHz (CH 6)
	___ kHz/MHz (CH 7)	___ kHz/MHz (CH 7)	___ kHz/MHz (CH 7)	___ kHz/MHz (CH 7)
	___ kHz/MHz (CH 8)	___ kHz/MHz (CH 8)	___ kHz/MHz (CH 8)	___ kHz/MHz (CH 8)
	___ kHz/MHz (CH 9)	___ kHz/MHz (CH 9)	___ kHz/MHz (CH 9)	___ kHz/MHz (CH 9)
	___ kHz/MHz (CH 10)	___ kHz/MHz (CH 10)	___ kHz/MHz (CH 10)	___ kHz/MHz (CH 10)
	___ kHz/MHz (CH 11)	___ kHz/MHz (CH 11)	___ kHz/MHz (CH 11)	___ kHz/MHz (CH 11)
	___ kHz/MHz (CH 12)	___ kHz/MHz (CH 12)	___ kHz/MHz (CH 12)	___ kHz/MHz (CH 12)
	___ kHz/MHz (CH 13)	___ kHz/MHz (CH 13)	___ kHz/MHz (CH 13)	___ kHz/MHz (CH 13)
	___ kHz/MHz (CH 14)	___ kHz/MHz (CH 14)	___ kHz/MHz (CH 14)	___ kHz/MHz (CH 14)
	___ kHz/MHz (CH 15)	___ kHz/MHz (CH 15)	___ kHz/MHz (CH 15)	___ kHz/MHz (CH 15)

Upstream Parameters	Port 0	Port 1	Port 2	Port 3
DOCSIS Module # ___				
FEC enabled? If yes, FEC level parameters	___ yes ___ no ___ T ___ K (CH 0) ___ T ___ K (CH 1) ___ T ___ K (CH 2) ___ T ___ K (CH 3) ___ T ___ K (CH 4) ___ T ___ K (CH 5) ___ T ___ K (CH 6) ___ T ___ K (CH 7) ___ T ___ K (CH 8) ___ T ___ K (CH 9) ___ T ___ K (CH 10) ___ T ___ K (CH 11) ___ T ___ K (CH 12) ___ T ___ K (CH 13) ___ T ___ K (CH 14) ___ T ___ K (CH 15)	___ yes ___ no ___ T ___ K (CH 0) ___ T ___ K (CH 1) ___ T ___ K (CH 2) ___ T ___ K (CH 3) ___ T ___ K (CH 4) ___ T ___ K (CH 5) ___ T ___ K (CH 6) ___ T ___ K (CH 7) ___ T ___ K (CH 8) ___ T ___ K (CH 9) ___ T ___ K (CH 10) ___ T ___ K (CH 11) ___ T ___ K (CH 12) ___ T ___ K (CH 13) ___ T ___ K (CH 14) ___ T ___ K (CH 15)	___ yes ___ no ___ T ___ K (CH 0) ___ T ___ K (CH 1) ___ T ___ K (CH 2) ___ T ___ K (CH 3) ___ T ___ K (CH 4) ___ T ___ K (CH 5) ___ T ___ K (CH 6) ___ T ___ K (CH 7) ___ T ___ K (CH 8) ___ T ___ K (CH 9) ___ T ___ K (CH 10) ___ T ___ K (CH 11) ___ T ___ K (CH 12) ___ T ___ K (CH 13) ___ T ___ K (CH 14) ___ T ___ K (CH 15)	___ yes ___ no ___ T ___ K (CH 0) ___ T ___ K (CH 1) ___ T ___ K (CH 2) ___ T ___ K (CH 3) ___ T ___ K (CH 4) ___ T ___ K (CH 5) ___ T ___ K (CH 6) ___ T ___ K (CH 7) ___ T ___ K (CH 8) ___ T ___ K (CH 9) ___ T ___ K (CH 10) ___ T ___ K (CH 11) ___ T ___ K (CH 12) ___ T ___ K (CH 13) ___ T ___ K (CH 14) ___ T ___ K (CH 15)
Channel frequency (where applicable)	___ MHz (CH 0) ___ MHz (CH 1) ___ MHz (CH 2) ___ MHz (CH 3) ___ MHz (CH 4) ___ MHz (CH 5) ___ MHz (CH 6) ___ MHz (CH 7) ___ MHz (CH 8) ___ MHz (CH 9) ___ MHz (CH 10) ___ MHz (CH 11) ___ MHz (CH 12) ___ MHz (CH 13) ___ MHz (CH 14) ___ MHz (CH 15)	___ MHz (CH 0) ___ MHz (CH 1) ___ MHz (CH 2) ___ MHz (CH 3) ___ MHz (CH 4) ___ MHz (CH 5) ___ MHz (CH 6) ___ MHz (CH 7) ___ MHz (CH 8) ___ MHz (CH 9) ___ MHz (CH 10) ___ MHz (CH 11) ___ MHz (CH 12) ___ MHz (CH 13) ___ MHz (CH 14) ___ MHz (CH 15)	___ MHz (CH 0) ___ MHz (CH 1) ___ MHz (CH 2) ___ MHz (CH 3) ___ MHz (CH 4) ___ MHz (CH 5) ___ MHz (CH 6) ___ MHz (CH 7) ___ MHz (CH 8) ___ MHz (CH 9) ___ MHz (CH 10) ___ MHz (CH 11) ___ MHz (CH 12) ___ MHz (CH 13) ___ MHz (CH 14) ___ MHz (CH 15)	___ MHz (CH 0) ___ MHz (CH 1) ___ MHz (CH 2) ___ MHz (CH 3) ___ MHz (CH 4) ___ MHz (CH 5) ___ MHz (CH 6) ___ MHz (CH 7) ___ MHz (CH 8) ___ MHz (CH 9) ___ MHz (CH 10) ___ MHz (CH 11) ___ MHz (CH 12) ___ MHz (CH 13) ___ MHz (CH 14) ___ MHz (CH 15)
Required channel input level (where applicable)	___ dBmV (CH 0) ___ dBmV (CH 1) ___ dBmV (CH 2) ___ dBmV (CH 3) ___ dBmV (CH 4) ___ dBmV (CH 5) ___ dBmV (CH 6) ___ dBmV (CH 7) ___ dBmV (CH 8) ___ dBmV (CH 9) ___ dBmV (CH 10) ___ dBmV (CH 11) ___ dBmV (CH 12) ___ dBmV (CH 13) ___ dBmV (CH 14) ___ dBmV (CH 15)	___ dBmV (CH 0) ___ dBmV (CH 1) ___ dBmV (CH 2) ___ dBmV (CH 3) ___ dBmV (CH 4) ___ dBmV (CH 5) ___ dBmV (CH 6) ___ dBmV (CH 7) ___ dBmV (CH 8) ___ dBmV (CH 9) ___ dBmV (CH 10) ___ dBmV (CH 11) ___ dBmV (CH 12) ___ dBmV (CH 13) ___ dBmV (CH 14) ___ dBmV (CH 15)	___ dBmV (CH 0) ___ dBmV (CH 1) ___ dBmV (CH 2) ___ dBmV (CH 3) ___ dBmV (CH 4) ___ dBmV (CH 5) ___ dBmV (CH 6) ___ dBmV (CH 7) ___ dBmV (CH 8) ___ dBmV (CH 9) ___ dBmV (CH 10) ___ dBmV (CH 11) ___ dBmV (CH 12) ___ dBmV (CH 13) ___ dBmV (CH 14) ___ dBmV (CH 15)	___ dBmV (CH 0) ___ dBmV (CH 1) ___ dBmV (CH 2) ___ dBmV (CH 3) ___ dBmV (CH 4) ___ dBmV (CH 5) ___ dBmV (CH 6) ___ dBmV (CH 7) ___ dBmV (CH 8) ___ dBmV (CH 9) ___ dBmV (CH 10) ___ dBmV (CH 11) ___ dBmV (CH 12) ___ dBmV (CH 13) ___ dBmV (CH 14) ___ dBmV (CH 15)

Table 12: Downstream CMTS Parameter Characterization

Downstream Parameters	Port 0	Port 1	Port 2	Port 3
DOCSIS Module #__				
Node combining ratio per port	___ : 1	___ : 1	___ : 1	___ : 1
Channel frequency allocated	___ MHz	___ MHz	___ MHz	___ MHz
Modulation type	_ 64QAM _256QAM	_ 64QAM _256QAM	_ 64QAM _256QAM	_ 64QAM _256QAM
Output signal level (relative to analog video)	___ dB	___ dB	___ dB	___ dB
Required channel output level	___ dBmV	___ dBmV	___ dBmV	___ dBmV
Interleave depth setting	___ [I] (# of taps) ___ [J] (increments)	___ [I] (# of taps) ___ [J] (increments)	___ [I] (# of taps) ___ [J] (increments)	___ [I] (# of taps) ___ [J] (increments)



