ChromaFlex CF-CCT2 Chromadigm Transmitter Module

Installation and Operation Guide

InnoTrans ChromaFlex CCT2 Transmitter Module
Document Number: 99-01-0007 Rev A

A	02/25/16	Initial Release

Table of Contents

1.

1 Important Safety Instructions

- Carefully read all safety and operating instructions contained in this user guide before operating this equipment, and retain them for future reference.
- Follow all installation and operating instructions. Pay attention to all warnings and cautions in the user guide as well as those that are affixed to this equipment.

1.1 Electric Shock Hazard

This equipment meets applicable safety standards.

WARNING:
To reduce risk of electric shock, perform only the instructions that are included in the operating instructions. Refer all servicing to qualified service personnel only.

Adhere to the following safety warnings and guidelines:

- Dangerous Voltages
  - Only qualified service personnel are allowed to perform equipment installation or replacement.
  - Disconnect power before servicing the unit.
  - Only qualified service personnel are allowed to remove chassis covers and access only field replaceable pluggable accessories.
- Grounding
  - Do not violate the protective grounding by using extension cables, power cables, or other devices on the mains power without a protective ground conductor.
  - If this equipment is equipped with an external grounding terminal, attach one end of an 18-gauge wire (or larger) to the grounding terminal; then, attach the other end of the wire to a ground, such as a grounded equipment rack.

1.2 Installation Site

When selecting the installation site, comply with the following:

- Maintain a Protective Ground - The protective ground lead of the building's electrical installation should comply with national and local electrical and safety requirements.
- Environmental Condition – The installation site should be dry, clean, and ventilated. Do not use this equipment where it could be at risk of contact with water. Ensure that this equipment is operated in an environment that meets the requirements as stated in this equipment's environmental specifications.

1.3 Installation Requirements

WARNING:
Allow only qualified service personnel to install this equipment. The installation must conform to all local codes and regulations.

1.4 Equipment Placement

WARNING:
Avoid personal injury and damage to this equipment. An unstable mounting surface may cause this equipment to fall.

- Install this equipment in a restricted access location.

- Place this equipment close enough to a mains AC outlet to accommodate the length of this equipment's power cord.
- Route all power cords so that people cannot walk on, place objects on, or lean objects against them.
- Make sure the mounting surface or rack is stable and can support the size and weight of this equipment.
- Make sure that the rack is placed on a stable surface. If the rack has stabilizing devices, install these stabilizing devices before mounting any equipment in the rack. The mounting surface or rack should be appropriately anchored according to the manufacturer's specifications.
- Ensure this equipment is securely fastened to the mounting surface or rack to protect against damage.
- This equipment has openings for ventilation to protect it from overheating. To ensure equipment reliability and safe operation, do not block or cover any of the ventilation openings.

WARNING:
Avoid personal injury and damage to this equipment. Mounting this equipment in the rack should be such that a hazardous condition is not caused due to uneven mechanical loading.

CAUTION:
Installation of this equipment in a rack should be such that the amount of airflow required for safe operation of this equipment is not compromised.

1.5 Power Connections

Connection to AC Power source

Important: If this equipment is Class I equipment, it must be grounded.

- Connect this equipment only to the power sources that are identified on the equipment-rating label.
- Overcurrent protection breakers or fuses must be sized appropriately for the total current rating of the modules and accessories contained within a system chassis or multiple chassis that are connected to a common mains circuit.
- This equipment may have two power sources. Be sure to disconnect all power sources before working on this equipment.
- If this equipment **does not** have a main power switch, the power cord connector serves as the disconnect device.

Connection to -48 VDC Power Source

- Use at least #16 AWG wire for all DC power wiring.
- Overcurrent protection breakers or fuses must be sized appropriately for the total current rating of the modules and accessories contained within a system chassis.
- Follow the recommended practices of the DC power system manufacturer.

CAUTION:
Consider the connection of this equipment to the supply circuit and the effect that overloading of circuits might have on overcurrent protection and supply wiring.

1.6 Fuse Replacement

To replace a fuse, comply with the following:

- Disconnect the power before changing fuses.
- Identify and clear the condition that caused the original fuse failure.
- Always use a fuse of the correct type and rating. The correct type and rating are indicated on this equipment.

1.7 Laser Safety

This equipment may contain or be connected to an infrared laser source that transmits intensity-modulated light and emits invisible radiation.

WARNING: Avoid Personal Injury
The laser light source on this equipment or the fiber cables connected to this equipment emit invisible laser radiation. Avoid direct exposure to the laser light source.

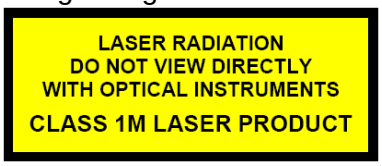
Viewing the laser output (if a transmitter) or fiber cable with optical instruments may pose an eye hazard.

This equipment may only be installed, operated and serviced by authorized personnel trained in the safe handling and operation of fiber optic cables and laser sources.

- Do not apply power to this equipment if the fiber is unmated or unterminated.
- Do not look into an activated fiber with optical instruments such as magnifiers, or microscopes.

1.8 Laser Power and Warning Labels

This equipment may contain or be connected to other equipment containing Class 1M laser sources. The following labels adhered to each product will indicate the type of laser source utilized along with general laser radiation labels.



2 Product Introduction

The ChromaFlex CF-CCT2 full-band DWDM transmitter incorporates InnoTrans' Chromadigm patented CHIRP Cancellation and Clipping Mitigation technology which significantly advances the performance of direct modulated optics, allowing full-band loading and the use of consecutive 100 GHz spaced ITU channels while delivering an exceptional MER and error-free pre-FEC BER performance.

The CF-CCT2 transmitter, with its innovative technology, sets the performance standard in DWDM full band systems offering a unique set of benefits:

- CHIRP Cancellation for distance independent performance
- Adaptive Clipping Mitigation for error-free QAM performance
- 1.218 GHz RF passband
- Improved dynamic range to support DOCSIS 3.1
- Full utilization of the ITU DWDM spectrum
- Extended reach to eliminate remote Hubs
- Reduced network complexity for reduced operating expense
- Drop in upgrade for node segmentation and Hub eliminations
- Increased network reliability

The CF-CCT2 transmitter module combines two, ITU-T 1550 nm C-band compliant lasers to transmit multiple wavelengths over a single fiber. The CF-CCT2 may include an integrated multiplex filter to eliminate external connections and additional rack space consumption along with optical test point and express ports for combining additional transmitter wavelengths or extracting bi-directional return path optical signals.

The CF-CCT2 transmitter occupies two module slots in the ChromaFlex chassis.

3 Unpacking and Inspecting a New Unit

Before shipment, InnoTrans Communications inspects and packs all the essential items carefully. Nevertheless, damage may occur during shipment. The carrier assumes full responsibility for a safe delivery of the equipment.

1) Inspect the package for any physical damage.
2) Open the package.
3) Remove any packing material.
4) Inspect the unit for any physical damage.
5) Shake the unit with care, paying attention to any rattling loose parts that may suggest a concealed damage (some noise due to moving cables is normal).
6) Check for any missing accessories.

When any damage is noticed to the merchandise, please notify the InnoTrans Customer Service representative (408-227-3400) and file a claim with the carrier as noted below.

3.1 What to do about physical damage

Record any evidence of physical damage or loss on the freight bill or receipt and have the carrier's agent sign it. If you fail to do so, the carrier may refuse to honor the damage claim. The carrier will supply you with any forms required to file such a claim.

3.2 What to do about concealed damage

Damage which is not apparent until the unit has been unpacked is considered concealed damage. The contents may have been damaged due to rough handling even if there is no external evidence. If you should notice damage upon unpacking the unit you should make a written request for inspection by the carrier's agent within 10 days of the delivery date. Afterwards file a claim with the carrier.

3.3 How to return equipment

Call InnoTrans Communications at 408-227-3400 for a Return Materials Authorization (RMA) number. You will need the unit's serial number, description of the problem, and some shipping information. We must receive the unit within thirty (30) days from the date a RMA number is issued. If for any reason, you want to ship the unit 30 days after the RMA number has been issued, you must obtain a new RMA number by calling InnoTrans Communications. Units received without an RMA number or one with an expired RMA number will not be accepted by our receiving department.

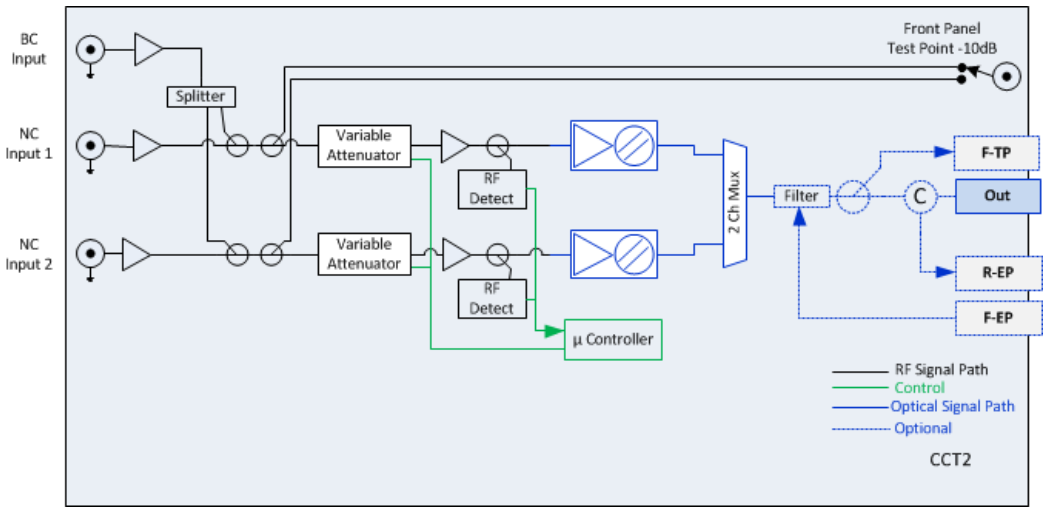
4 Specifications

Optical Parameter	Units	CF-CCT2 Value
Wavelength	nm	1530 to 1562 Ch 20 to 59 with 100 GHz or 200 GHz spacing following standard ITU channel assignments
Optical Power	dBm per λ	6 with test point Derate 0.5 dB for each expansion port
Optical connector		LC/APC
Laser RIN	dB/Hz	<155
Optical Return Loss	dB	>50
RF Parameter	**Units**	**Value**
Broadcast BW	MHz	54-1218
Narrowcast Freq	MHz	54-1218
Broadcast Port RF Input Level	dBmV/channel	Analog +15 dBmV QAM +9 dBmV when combined with analog QAM +13 dBmv when all QAM loading
Narrowcast Port RF Input Level	dBmV/channel	QAM +9 dBmV when combined with analog QAM +13 dBmv when all QAM loading
RF Input Level Range	dBmV	9 to 18 dBmV
AGC Offset Range	dB	+/- 2.0 dB in 0.25 dB steps
MGC Offset Range	dB	+/- 3.0 dB total
Flatness	dB	±0.75 from 50 to 1218 MHz
Return loss	dB	>16 up to 860 MHz, > 14 dB 860 MHz to 1218 MHz
Test Port	dB	- 10 dB below module input
RF Isolation	dB	> 55 between individual NC ports with terminations

Performance	Units	Value
		155 QAM (Up to 40 WL & 40 km with 1 EDFA)
MER BER	dB	>40 <1.0 e-9 pre FEC
Electrical & Operational	**Units**	**Value**
Power Consumption	W	18 W/λ, 36 W total
Operating Temperature	°C	0 to 50
Storage Temperature	°C	-40 to +65
Width/Depth/Height	inches	7.5/13.75/1.3
Weight	lbs	4

5 Block Diagram and Operation

The following block diagram depicts the RF and optical signal flow through the CF-CCT2 transmitter module.



ChromaFlex CF-CCT2 Transmitter Module Block Diagram

The ChromaFlex CF-CCT2 has two ITU C-Band laser transmitters, each operating at a discrete wavelength and multiplexed together onto a single optical output within the module. There are three RF input ports, a Broadcast (BC) RF input and two Narrowcast (NC) input ports. The RF signals that are common to each of the two wavelengths are connected to the BC input port. The common RF loading into the BC RF input port should occupy the RF spectrum to at least approximately 270 MHz to avoid SRS crosstalk degradation. The two NC RF input ports are utilized for channels which are unique to each individual ITU laser or wavelength and should be placed above 270 MHz.

The BC signal first passes through a variable RF attenuator. The attenuator is either automatically set through the feedback loop when operated in the AGC mode or may be set in the manual mode via the chassis controller interfaces, LAN / Handheld Display / Local RS232. Next the BC signal is amplified and split into two paths, one for each transmitter wavelength, and then combined with each of the two NC input signals. Each of the two NC RF input ports is utilized for channels which is unique to each of the two transmitter wavelengths. The NC RF input signal first passes through a variable RF attenuator. The attenuator is either automatically set through the feedback loop when operated in the AGC mode or may be set in the manual mode via the chassis controller interfaces, same as the BC operation. Next the NC channels are combined with the BC channels creating a full-spectrum of channel loading from 54 MHz to 1218 MHz. The combined signal is coupled to a -10 dB front panel RF test point. There is a front panel switch to select between each individual test point. The signal is amplified and then passes through a directional coupler used to sample the RF signal for the AGC control loop back to the input variable attenuator and the through path is applied to the optical laser. Our patented Clipping Mitigation circuit is also within the RF path to mitigate

instantaneous peak bursts of the Analog or QAM modulated signals which normally would overdrive the laser briefly resulting in bit errors of the QAM signals.

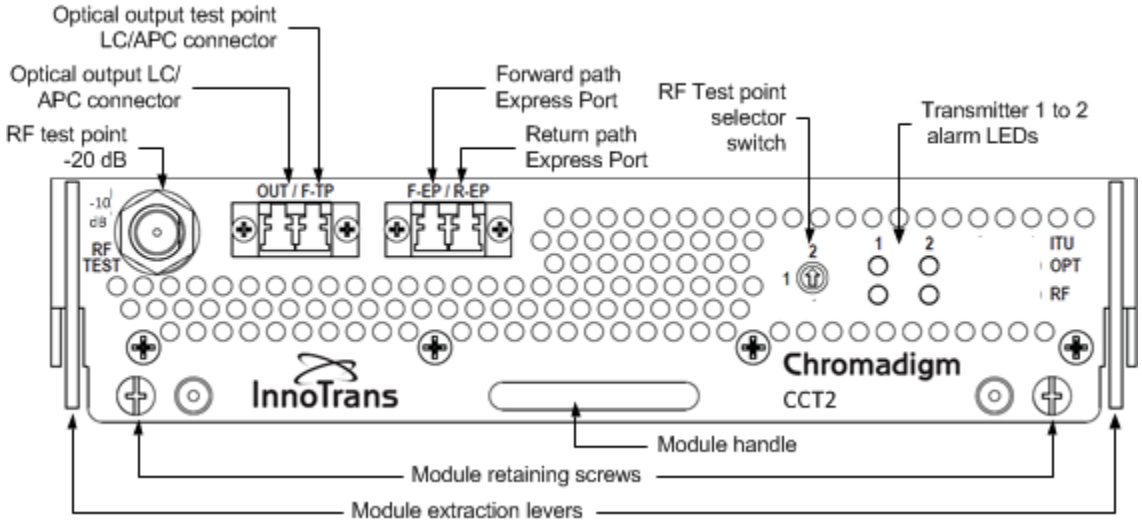
Each laser transmitter modulates the RF signals onto an optical signal with an assigned wavelength between ITU C-Band channel 23 to 58 or other desired channels. Each of the two optical signals on their discrete wavelength channel are multiplexed together to a single fiber output port. An optional forward direction express port (F-EP) may be present to internally combine additional optical signals with the two internally generated channels. The optical pass band of the F-EP port is 1260 to 1620 nm. The optical signals to be combined must be a different channel or wavelength than the two produced by the CCT2 module with proper operating levels. Following the F-EP input filter is a Forward Test Point (F-TP) 5% optical coupler which taps a sample of the signal to a front panel F-TP connector. Next is an optional Return Path express port circulator (R-EP) which separates any upstream optical signals from the forward path signals to the R-EP front panel connector. The optical output power of the CF-CCT2 transmitter module depends on the installed options as follows.

Option	**Output Power**
No Options	6 dBm
1 EP only	5.5 dBm
2 EP	5 dBm

6 Front Panel

6.1 Front Panel Illustration

The following diagram and table depicts the features of the transmitter module front panel.



6.2 Table of Front Panel Features

Module extraction levers	Levers assist in removing the module from the chassis backplane connector.
Module retaining screws	Secures the module to the chassis.
Module handle	Utilized to insert and remove the module.
RF test point	-10 dB sample of the RF input to the module.
RF test point selector switch	Selects the transmitter (1 to 2) for the RF test point.
Optical output LC/APC connector (OUT)	Optical output signal connection.
(Optional) Optical output test point LC/APC connector (F-TP)	5% (-14.9 dB) sample of the optical output
(Optional) Forward path Express Port (F-EP)	Utilized to combine additional ITU channels from another transmitter. 1260 to 1620 nm. ***Important Note:*** be certain not to combine same channels.
(Optional) Return path Express Port (F-EP)	Utilized to extract return path or upstream ITU channels that are

	combined with the forward or downstream channels. 1260 to 1620 nm. ***Important Note:*** be certain not to combine same channels.
Transmitter Alarm LEDs	Visual alarm status indicators for each of the two transmitters.

6.3 Alarm Status Indicators

LED	**Function**	**Value**
OPT	One LED for each laser 1 thru 2. Optical output power Laser temperature Module temperature	Green = Normal Amber = Minor Temp alarm or Opt power +/- 1dB Red = Major temp alarm or Opt power +/- 2 dB
RF	One LED for each laser 1 thru 2. Monitors the RF drive level to each laser.	Green = Normal Amber = Minor alarm, RF out of range +/- 2 dB Red = Major alarm, RF out of range +/- 3 dB

For more information regarding alarm status and monitoring refer to InnoTrans Document No: 99-01-0001, ChromaFlex Chassis – User Interface.

7 Module Installation

The CF-CCT2 transmitter module occupies two ChromaFlex chassis module slots. Each module will occupy slots 1 & 2, 3 & 4, 5 & 6 or 7 & 8. The modules may be inserted or removed while the chassis is powered without interrupting other operational modules in the chassis. The following module installation procedures assume the chassis is installed and powered following the instructions in the ChromaFlex Chassis Installation and Operational Guide document # 99-02-0001.

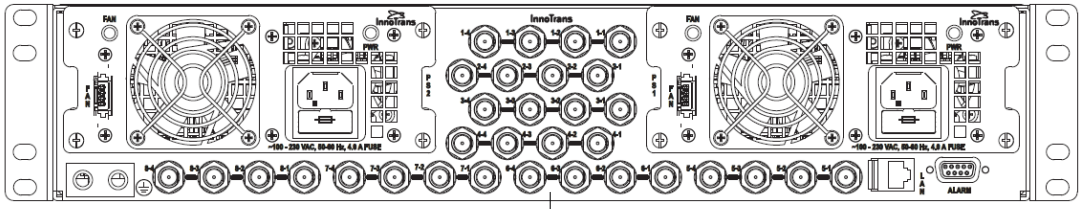
1. Align the module into the desired two slot opening in the ChromaFlex chassis.
2. Using the handle push the module into the slot with even pressure until the module is mated with the chassis mid-plane connector.
3. Press the module extraction levers downward against the module face.
4. Tighten the two module retaining screws until snug in an even manner.
5. The module LEDs should now be lit with the two OPT LEDs green and the two RF LEDs red if RF has not already been connected to the chassis rear panel RF connectors.

8 Module Connections

The following describes the initial RF and optical connections to the chassis and module.

8.1 RF Connections

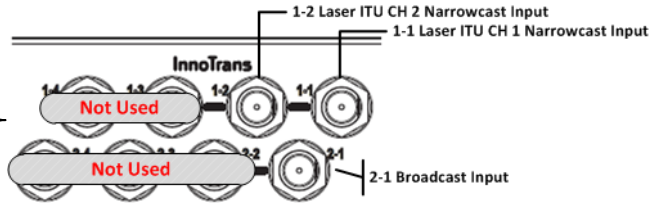
RF connections are made at the back of the ChromaFlex chassis. Each module has one Broadcast input which is shared across each of the two laser transmitters and two narrowcast inputs for dedicated services to each laser transmitter.



The following table and diagram shows the corresponding RF connectors to module slots for the CF-CCTX transmitter module. Each two wavelength transmitter module occupies two slots with one Broadcast input and two narrowcast inputs for a total of three connections.

Module Slot	Rear Panel Connector	CCT-2
1	1-1	Narrowcast 1
	1-2	Narrowcast 2
	1-3	N/A
	1-4	N/A
2	2-1	Broadcast In
	2-2	N/A
	2-3	N/A
	2-4	N/A
3	3-1	Narrowcast 1
	3-2	Narrowcast 2
	3-3	N/A
	3-4	N/A
4	4-1	Broadcast In
	4-2	N/A
	4-3	N/A
	4-4	N/A
5	5-1	Narrowcast 1
	5-2	Narrowcast 2
	5-3	N/A
	5-4	N/A
6	6-1	Broadcast In
	6-2	N/A
	6-3	N/A
	6-4	N/A
7	7-1	Narrowcast 1
	7-2	Narrowcast 2
	7-3	N/A
	7-4	N/A
8	8-1	Broadcast In
	8-2	N/A
	8-3	N/A
	8-4	N/A

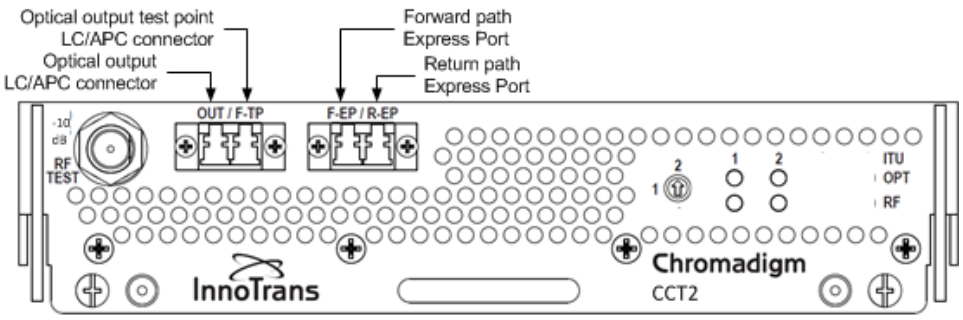
Example connections for a CF-CCT2 populated in slot 1 & 2.



8.2 Optical Connections

There are many different optical system configurations that are possible with the ChromaFlex CF-CCT2 transmitter. It is common to optically combine multiple transmitter modules with an optional express port or externally with band combiners in groups of two wavelengths. An optional return path express port can also route upstream wavelengths to return path termination equipment through the same fiber connected to the CF-CCT2 module. The internal express ports reduce or eliminate external filters, additional optical connectors and rack space. Your specific design may include additional components such as an EDFA, return path receivers, de-stacker modules or other external components.

Important Note: Always clean and inspect optical connectors prior to making a connection to the CF-CCTx optical ports. Never look into an optical connector when a signal is present.



Please take the following steps for first time set up of the unit.

- Identify the transmitter unit at the corresponding slot location.
- Connect the output port (labeled OUT) utilizing a good quality clean LC/APC connector to the next device or fiber cable per your specific design schematic drawing.
- The optional Forward Express Port (labeled F-EP) of the CF-CCT2 may be utilized to multiplex additional forward path wavelengths that will connect to the output network device or fiber cable.
- The optional Return Express Port (labeled R-EP) may be utilized to extract return path wavelengths that will connect to return path terminating equipment such as return path receivers.
- Always clean and inspect optical connectors prior to connecting to the Forward Test Point (F-TP).
- Confirm the total power is approximately equal to the total rated power of the unit, using the following rule:

Total Power (dBm) = Per Wavelength Power (dBm) + 6.0 dB (for 4 wavelengths)

Note that all wavelengths may not have exactly equal powers, but will be typically within 0.5 dB from each other.

9 Module Setup

9.1 Setting RF input levels

The RF signals that are common to each of the two wavelengths are connected to the Broadcast (BC) input port as shown in the rear panel connector table in section 8.1. The common RF loading into the BC RF input port should occupy the RF spectrum to at least approximately 270 MHz to avoid SRS crosstalk degradation.

The Narrowcast (NC) signals for each of the individual CCT2 ITU lasers is connected to the corresponding input port as shown in the rear panel connector table in section 8.1. Note that the NC input should be all QAM signals and above 270 MHz.

Determining the proper rear panel RF input level is important to ensure optimum transmitter performance. The following will provide guidance in calculating the proper adjustment to the per channel RF level for your actual channel loading from the reference channel loading and the total RF input power requirement.

Each CCT2 transmitter is factory optimized for a rear panel total input power of +35 dBmV for the combined BC and NC signals. This level provides 3 to 4 dB of reserve gain for the AGC operation. The reserve gain is the amount of headroom above the +35 dBmV reference level.

All QAM channels

The all QAM reference channel loading and per channel input level is 155 ITU-T J.83 Annex B QAM 256 channels between 54 - 1002 MHz set to 13 dBmV. The RF per channel level of 13 dBmV is calculated from the total power as follows:

*Total Power - [10*log$_{10}$(channel load)]*
*35 dBmV - [10*log$_{10}$(155)] = 35 dBmV – 22 = 13 dBmV*

Using the same formula to adjust for a lower channel loading such as a 750 MHz system with 110 channels:

*35 dBmV - [10*log$_{10}$(110)] = 35 dBmV – 20.4 = 14.6 dBmV*

Therefore with 110 of all QAM channel loading the correct rear panel RF input level is 14.6 dBmV at the input of both the BC and NC ports.

Mix of Analog and QAM channels

The mix of Analog and QAM reference channel loading and per channel input level is 30 NTSC analog (54 – 258 MHz) set to 17 dBmV and 124 ITU-T J.83 Annex B QAM 256 channels (258 - 1002 MHz) set to 11 dBmV. The RF level per channel for analog and QAM is calculated from the total power as follows:

Since there is a 6 dB power level difference between the QAM and analog channels it is easier if we convert the QAM channels to an equivalent analog power level in the formula below. The QAM

RF level being 6 dB lower means the QAM power level is 1/4th the analog level. As a point of reference, -3 dB is 1/2 power and -6 dB is 1/4 power.

*Total Power - [10*log$_{10}$(Analog channel load)+(QAM channel load/4))]*
*35 dBmV - [10*log$_{10}$(30)+(124/4))] = 35 dBmV – 18 = 17 dBmV*

Therefore the analog channels are set to 17 dBmV and the QAM channels are 6 dB lower or 11 dBmV.

Use the same formula to increase the number of analog channels to 60 and decrease the number of QAM channels to 94 and calculate the correct input level for each:

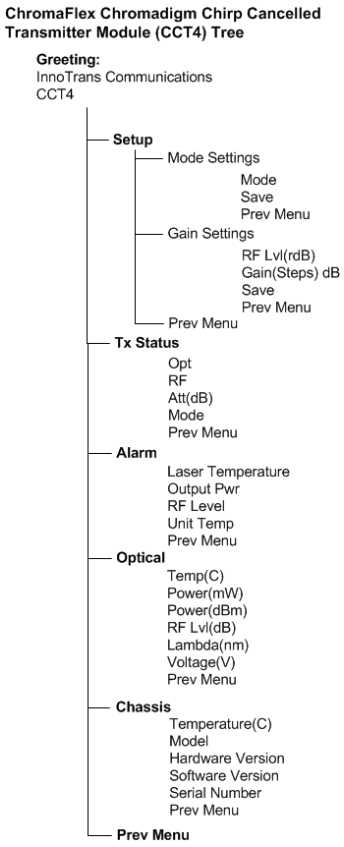
35 dBmV - [10*log$_{10}$(60)+(94/4))] = 35 dBmV – 19 = 16 dBmV

Therefore the analog channels are set to 16 dBmV and the QAM channels 6 dB lower or 10 dBmV.

9.2 Configuring the CCT2 transmitter module

To setup, configure and verify the RF drive level for the CCT2 requires the operator to become familiar with the Hand Held Display or GUI status and configuration menus. Refer to the InnoTrans Document No: 99-01-0001, ChromaFlex Chassis – User Interface as a supplement to the following procedures which will reference the associated display parameters.

The following CCT2 Hand Held Display menu tree will assist in navigating the Hand Held Display.



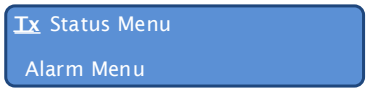
9.2.1 AGC mode (Hand Held Display)

Operating in the AGC mode provides for plug-and-play RF level setting as the transmitter automatically sets the internal attenuator for the optimal laser drive level and OMI. The following provides the procedures and associated menus for configuring the CCT2 with the Hand Held Display in the AGC mode.

1. Connect power to the chassis. Unit should power up (no switches).
2. Plug the RS-232 cable from the Hand Held Display into the RS-232 port on the CF-CTLR control and communications module.
3. Using the Hand Held Display choose the appropriate slot for the desired module location.
4. Using slot 1 as an example:

   With a combined Broadcast/Narrowcast total RF power of 35 dBmV plug the Broadcast cable into port 2-1, Narrowcast cable into port 1-1 to 1-4. *(see section 8.1)*
5. From the front panel RF Test Point confirm the Narrowcast QAM RF channels are at the same level as the Broadcast QAM RF channels. If not, correct the level difference coming into the chassis on each individual NC port.
6. Using the Hand Held Display navigate to the Tx Status Menu.

7. Under the Tx Status menu the RF *(reference level)* reading should be approximately 0.0dB, ±0.5 dB. The Att (dB) *(reserve gain level)* should be between 3 dB and 4 dB.

The reserve gain is the amount of headroom above the +35 dBmV reference level.

9.2.2 MGC mode (Hand Held Display)

The following provides the procedures and associated menus for configuring the CCT2 with the Hand Held Display in the MGC mode.

1. Connect power to the chassis. Unit should power up (no switches).
2. Plug the RS-232 cable from the Hand Held Display into the RS-232 port on the CF-CTLR control and communications module.
3. Using the Hand Held Display choose the appropriate slot for the desired module location.
4. Using slot 1 as an example:

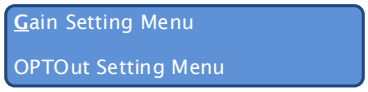
   

   With a combined Broadcast/Narrowcast total RF power of 35 dBmV plug the Broadcast cable into port 1-1, Narrowcast cable into port 1-2. *(see section 8.1)*
5. From the front panel RF Test Point confirm the Narrowcast QAM RF channels are at the same level as the Broadcast QAM RF channels. If not, correct the level difference coming into the chassis on each individual NC port.

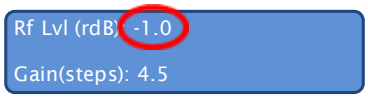
6. Using the Hand Held Display navigate to the Setup/Mode Settings menu.

7. Under the Setup/Mode Settings menu place the unit in MGC mode and save the setting.

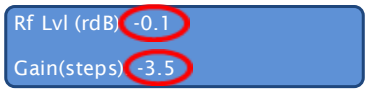
8. Next using the Hand Held Display navigate to the Setup/Gain Settings menu.



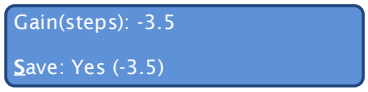
9. Under the Gain Setting Menu note the *RF Lvl*.



10. Using the *Gain (Steps)* menu add or remove the attenuation steps until the *RF Lvl* displays 0.0 dB -±0.5 dB in the Tx Status/RF menu.



11. Save Gain (Steps) value.



12. Next using the Hand Held Display navigate to the Tx Status menu.

13. Under the Tx Status Menu note the *RF* level. The level should be the same value as the *RF Lvl* value set in step #10. The Att(dB) value should be +3.5 ±0.5dB with a total combined input power of 35 dBmV at the back of the chassis.

10 Troubleshooting the CCT2

Condition	Steps to Check
Power LED OFF (AC)	1) Check if Power Cable is plugged in and Power Switch is in ON position. 2) Verify AC Outlet is Functional and confirm fuse on the AC feed is fine, replacing it if necessary. 3) Look for other signs of life in unit like running fan, LCD display etc.
Power LED OFF (DC)	1) Verify DC Feed is active and fuse is intact on fuse panel. 2) Verify DC Feed is not reversed. 3) Look for other signs of life in unit like running fan, LCD display etc.
Optical LED is Amber or Red	1) Check output light level.
RF LED is Amber or Red	1) Check RF Input level. 2) If in MGC mode Attn set too high.
Communication Issue with Unit	1) Please confirm setup is as described in the User Interface document 2) If problem persists, please contact InnoTrans for further help.