

# Downlink Fiber to Antenna (FTA) User's Manual rev 2

## **PROPRIETARY**

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# Notes, Cautions, and Warnings

**Part 90 and Part 20 Signal Boosters THIS IS A 90.219 CLASS B DEVICE**

**WARNING.** This is NOT a CONSUMER Device. It is designed for installation by FCC LICENSEES and QUALIFIED INSTALLERS. You MUST have an FCC LICENSE or express consent of an FCC Licensee to operate this device. You MUST register Part 90 Class B signal boosters (as defined in 47 CFR 90.219) online at [www.fcc.gov/signal-boosters/registration](http://www.fcc.gov/signal-boosters/registration). Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

**FCC ID: 2AES2-1489FTA-DL**

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.

## Contact Information

For general information contact the FCC at:

<https://signalboosters.fcc.gov/signal-boosters/>

For information related to this product:

[smantel@appliedmicrodesign.com](mailto:smantel@appliedmicrodesign.com)

[dkho@cellgain.com](mailto:dkho@cellgain.com)



## **Invisible laser light is used on these equipment.**

DO NOT look directly into the fiber optic connectors when unit is in operation.

Connect RF Output to Antenna only.

DO NOT operate equipment with unauthorized antennas, cables, and/or coupling devices.

DO NOT operate equipment unless all RF connectors are secure.

DO NOT operate equipment unless it has been installed and inspected by a qualified radio technician.

# Acronyms

ALC - automatic level control

AGC - automatic gain control

CBC - cross-band coupler

DAS - distributed antenna system

DL - Downlink

DSP - digital signal processor

FO - fiber optic

HE - Head End

LNA - low-noise amplifier

NMS - Network Management System

PA - power amplifier

RF - radio frequency

UL - Uplink

# Introduction

There are two major elements to the system; the Head End (HE) hardware and the Remote Hardware. The Head End hardware is the interface to the user Base Stations (radios that are FCC certified). The Remote hardware consists of Uplink and Downlink Fiber-to-Antenna (FTA) units.

The system operates over four bands: VHF, 450 MHz, 700 MHz, and 800 MHz. These are the communications frequencies between the Base Stations and the remote FTA units. A Network Management System (NMS) sends polling messages from the HE to the FTA and receives status messages back from the FTA to the HE. These messages are modulated using 900 MHz ISM band radio modules.

The 900 MHz ISM signals are combined with the four communications bands (in the HE and FTA) as two Band Groups. Band Group A is the 450 MHz, 700 MHz, and 800 MHz communications bands. Band Group B is VHF communications band and the 900 MHz ISM polling/status messages. There is a separate fiber for each band group.

In the Downlink (DL) path, communications signals from user base stations and polling messages from the NMS are input to the DL HE hardware. The communications signals are combined with the 900 MHz ISM polling message and split into Band Group A and Band Group B. These band group signals are filtered, converted to light by a pair of Fiber Optic Transmitters, and transmitted to the FTA via fiber optic cable. In the FTA units, the light from the fiber optic cables is converted back to RF by a pair of Fiber Optic Receivers. The RF communications signals are filtered, amplified, and combined in a Cross-Band Coupler (CBC); the CBC output is fed to the antenna. A more detailed system description, including the polling and status messages, appears in the DL section below.

In the Uplink (UL) path, signals from portable radios are input the UL FTA via an antenna tied to a CBC. These signals are filtered and amplified. The VHF signals are combined with the 900 MHz status messages from the ISM module; the UHF and VHF communications, and 900 MHz ISM are split into Band Group A and Band Group B. These band group signals are filtered, converted to light by a pair of Fiber Optic Transmitters, and transmitted to the HE via fiber optic cable. A more detailed system description, including the polling and status messages, appears in the UL section below.

## Down Link FTA (Basic Operation / Purpose / Function)

The Model 1489FTA-DL is a Fiber-Fed, multi-band, antenna interface. Communications signals from user base stations and polling messages from the NMS are input to the DL HE hardware. The communications signals are combined with the 900 MHz ISM polling message and split into Band Group A and Band Group B. These band group signals are filtered, converted to light by a pair of Fiber Optic Transmitters, and transmitted to the FTA via fiber optic cable.

In the FTA units, the light from the fiber optic cables is converted back to RF by a pair of Fiber Optic Receivers. The RF communications signals are filtered, amplified, and combined in a Cross-Band Coupler (CBC); the CBC output is fed to the antenna.

The 900 MHz polling message is input to an ISM module; the demodulated polling message is input to the FTA processor. The status response message is output from the processor to the 900 MHz ISM module, the modulated signal is input to a Fiber Optic transmitter and output back to the HE on the Band Group B fiber. An optical diplexer allows for bi-directional communications over the Group B fiber. The FTA Fiber Optic Transmitter wavelength is 1310 nm and the HE Fiber Optic Transmitter wavelength is 1550 nm.

The 1489FTA-DL has a processor board that monitors overall unit operation. The processor board monitors diode currents for each of the two FO RX diodes, laser current for the FO TX laser, and amplifier current for each of the four filter-amplifier chains. Current is derived from a sense resistor in series with each element monitored.

The processor board receives polling messages from the HE and transmits status messages back to the HE. The HE chassis provide remote monitoring capability via Ethernet. The Graphical User Interface (GUI) of the Network Management System (NMS) computer can display the status of the FTA hardware.

## Down Link FTA Emissions, Frequency Ranges, Operating Power

The emission type for the FM analog channels is 12K5F3E.

The DL communications bands and Output Power to the antenna are:

151.115 – 171.175 MHz	0 dBm
453.2125 – 484.7625 MHz	0 dBm
763.000 – 775.0000 MHz	0 dBm
851.2125 – 853.9125 MHz	0 dBm

Note: Downlink power is not adjustable; it is set at the factory for the above-listed levels. An Automatic Level Control (ALC) circuit built into the Head End limits the input power to the FO TX and the FTA output power.

## Determining and Stabilizing Frequency

The FTA receives signals that are derived from FCC certified base stations. There are no frequency determining or frequency stabilizing elements.

## Limiting Power

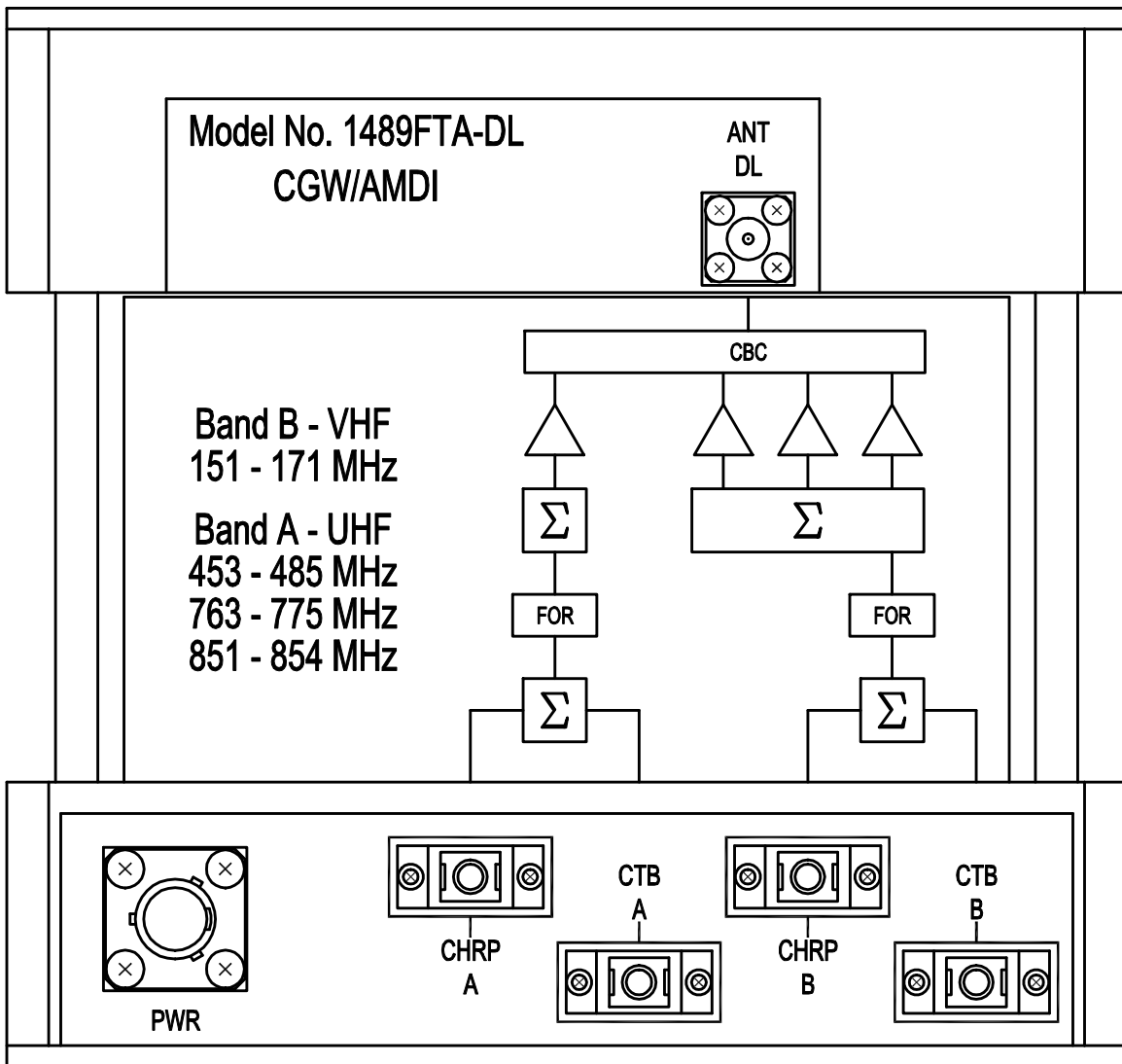
An Automatic Level Control (ALC) circuit built into the Head End limits the input power to the FTA. Downlink power is 0 dBm to the antenna.

Spectrum fidelity is further improved via the filter-amplifier chains in the FTA. There is a separate filter-amplifier chain for each of the four communications bands.

## Third-Party Configuration

Laser currents are set at the factory before shipping. There are no user control or adjustments on the FTA.

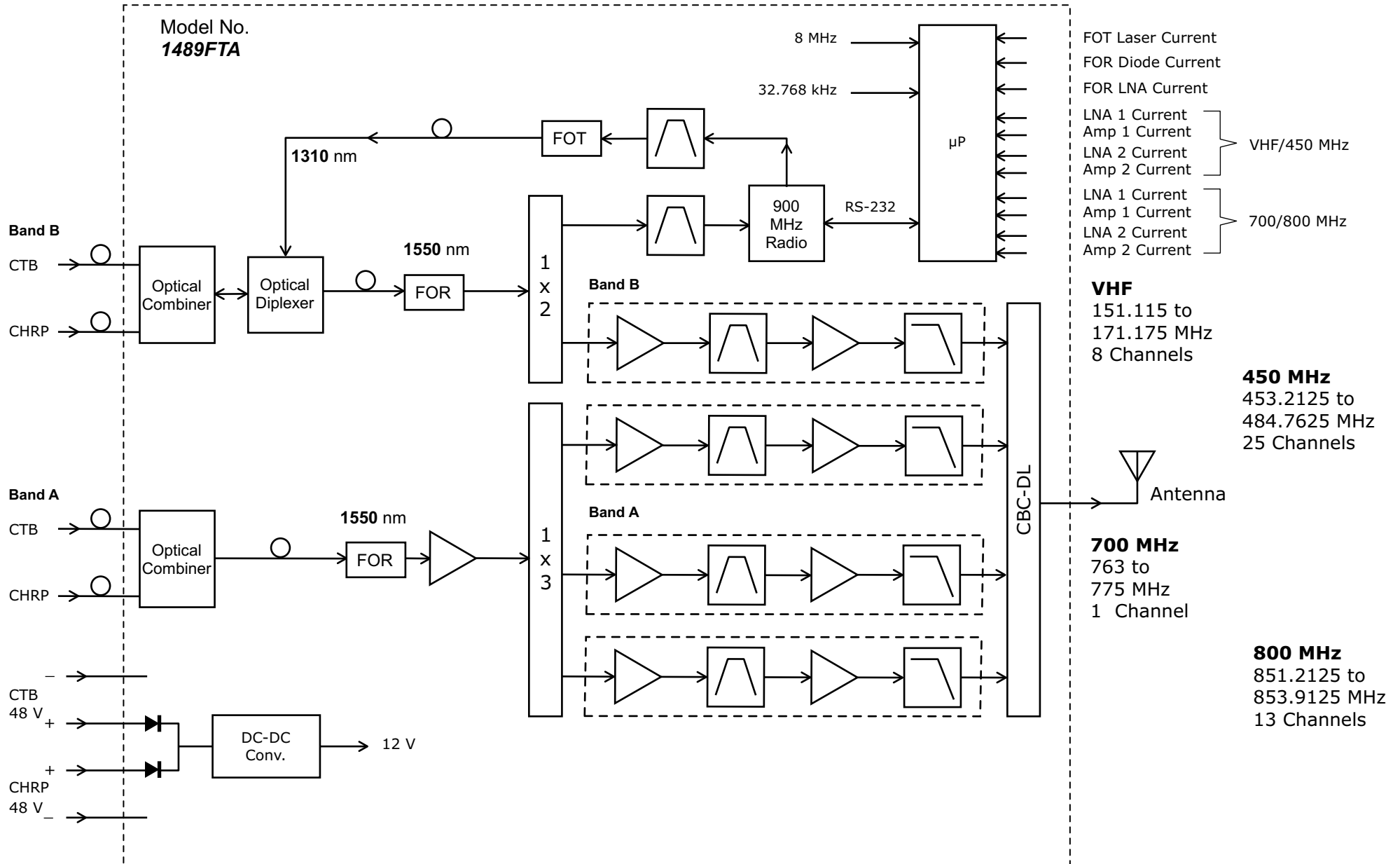
# FTA Front View



Downlink FTA



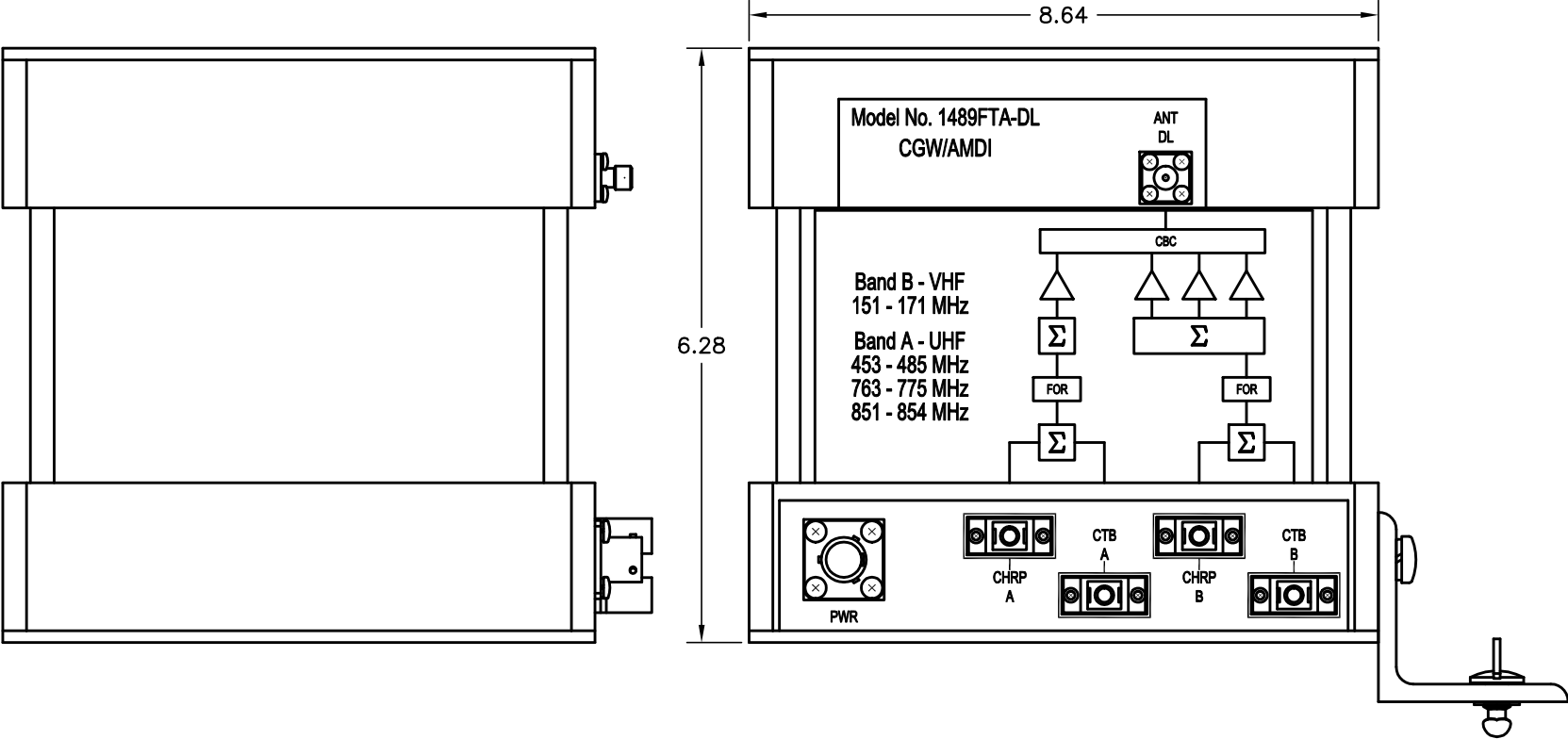
# Downlink FTA Diagram



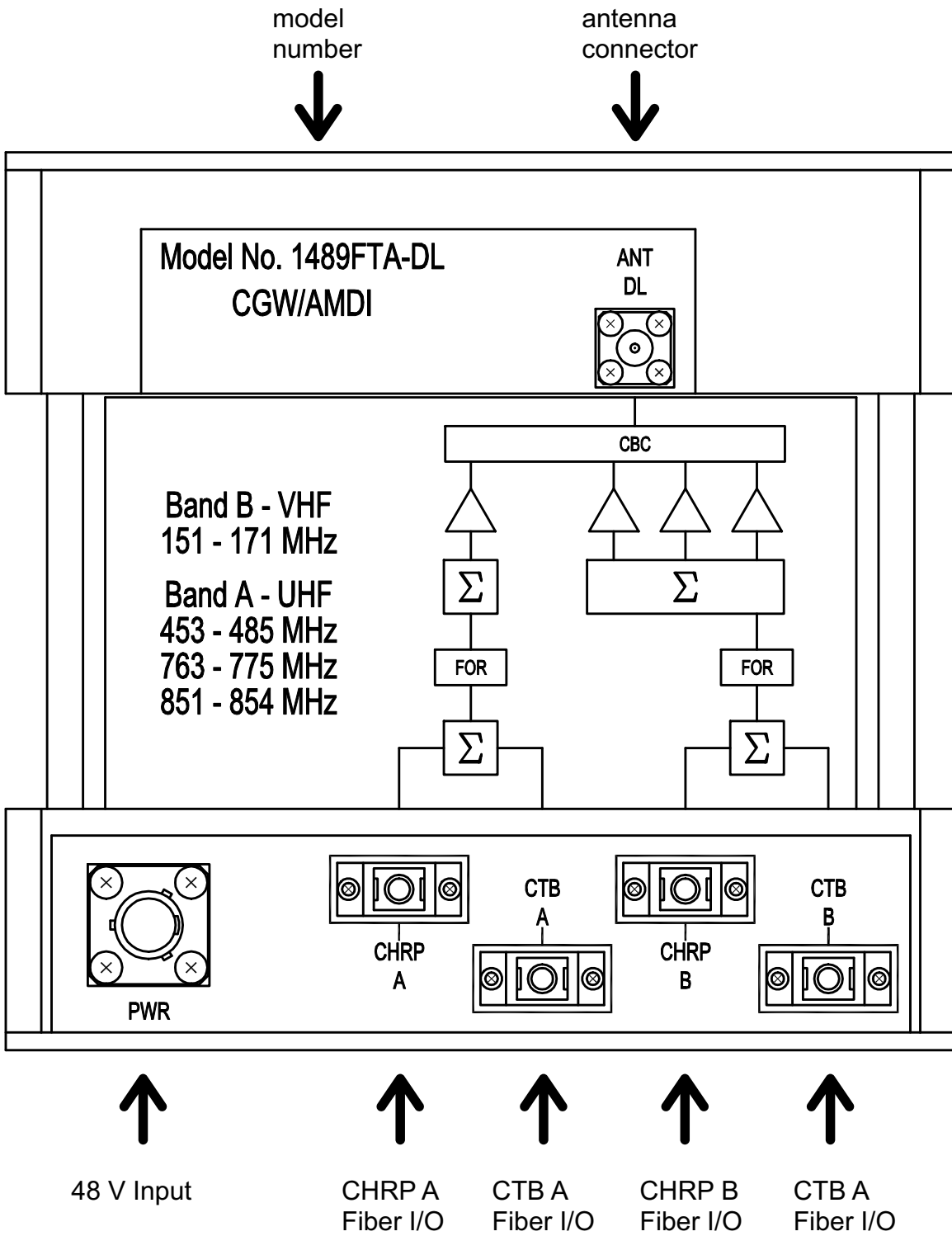
# FTA Specifications

	<b>FTA UL</b>	<b>FTA DL</b>
<b>Optical specifications</b>		
Fiber transmitter:	> 0 dBmo	> 0 dBmo
Fiber receiver sensitivity:	- 20 dBmo	- 20 dBmo
Wavelength:	DWM 1310 and 1550 nm	DWM 1310 and 1550 nm
IP3:	+30 dBm	+30 dBm
<b>RF</b>		
Broadband:	VHF to UHF in three bands	VHF to UHF in four bands
IP3:	+30 dBm per band	+30 dBm per band
RSSI dynamic range:	-90 to -30 dBm	-10 to 0 dBm
Unconditionally Stable:	Yes	Yes
Noise Figure overall:	< 3 dB	< 3 dB
VHF (Channel 1):	150 to 172 MHz	150 to 172 MHz
UHF (channel 2):	458 to 488 MHz	453 to 485 MHz
UHF ( channel 3):	792 to 809 MHz	763 to 775 MHz
UHF (channel 4):	N/A	851 to 854 MHz
RF gain:	33 dB/band	33 dB/band
DC power.	+ 48 vdc reverse polarity protected 3 watts nominal	+ 48 vdc reverse polarity protected 3 watts nominal
Alarming :	All key parameters are monitored and alarms programmed via window for correct operation	All key parameters are monitored and alarms programmed via window for correct operation
Control:	Laser shut-down via GUI	none
Redundancy via NMS:	two port optic selection	two port optic selection
900 MHz NMS:	Optional system that monitors and controls FTAs	Optional system that monitors and controls FTAs
<b>Connectors</b>		
Optical;:	SC/APC	SC/APC
RF:	SMA female	SMA female
Power	ITT Canon MS3112E8-2P	ITT Canon MS3112E8-2P

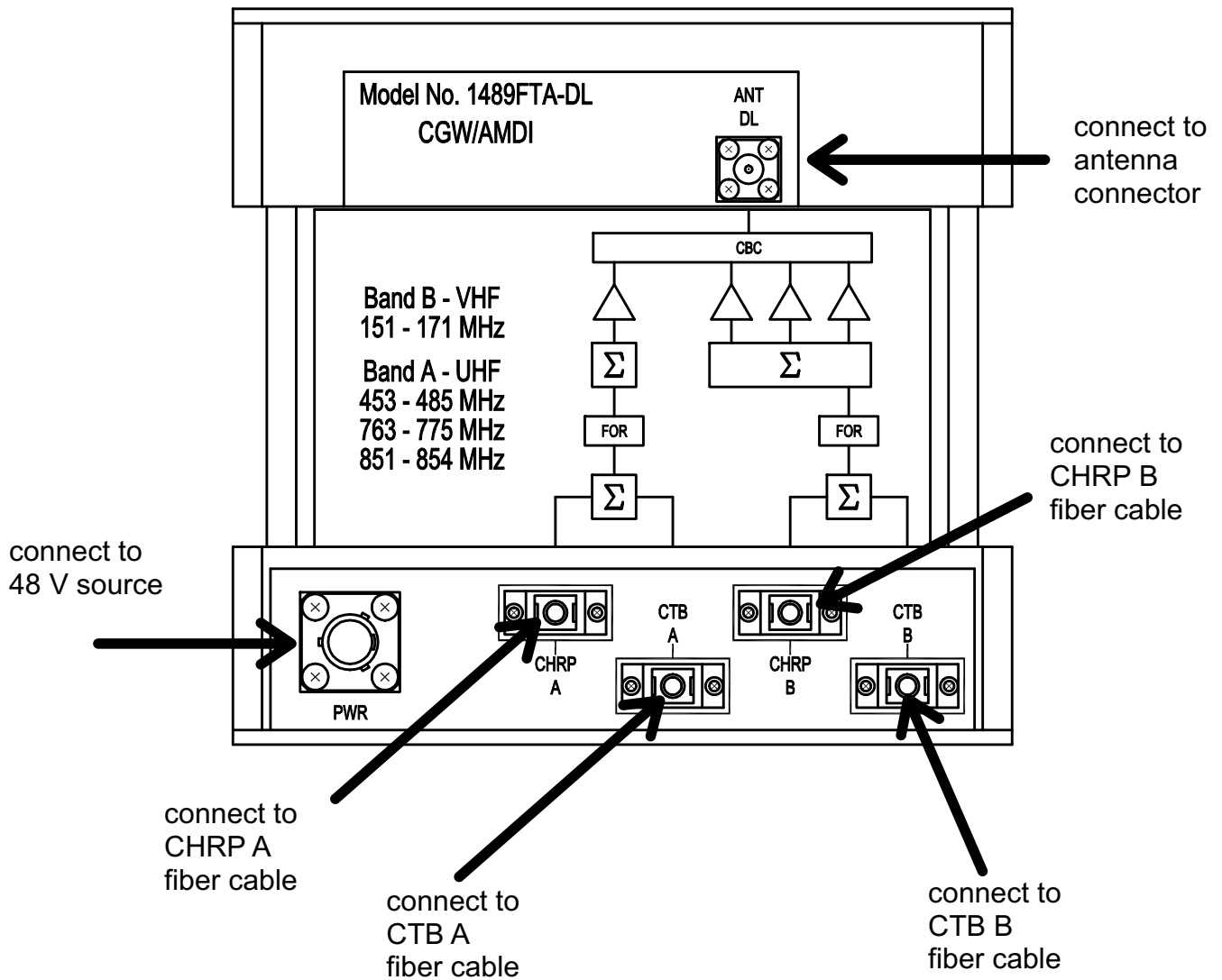
# Mechanical Views



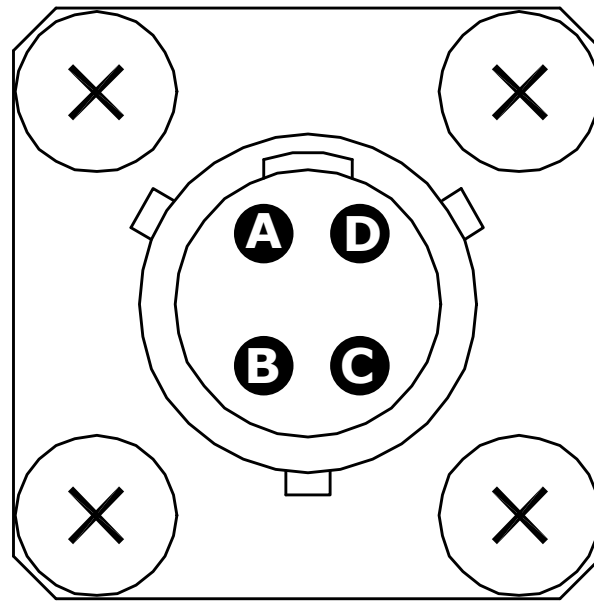
# Downlink FTA



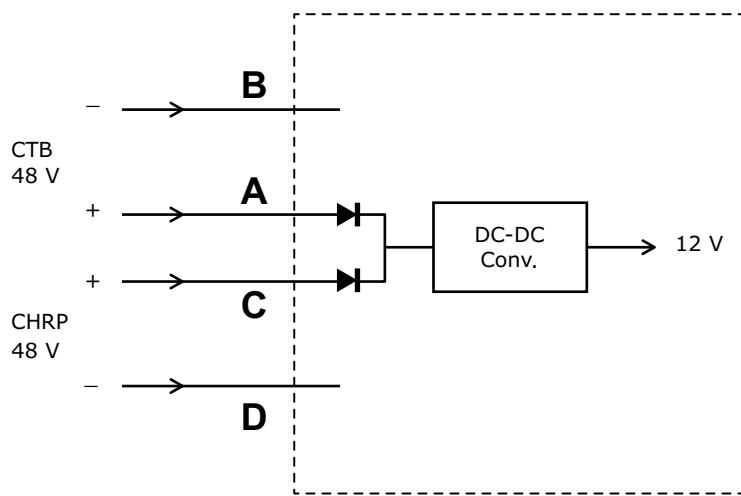
# Connections



# DC Power Wiring



power connector front view



power connection diagram

- A + 48 V
- B - 48 V
- C + 48 V
- D - 48 V

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