



### **FEATURES & BENEFITS**

- Field-Proven Optical Regeneration
- Versatile Hub Architecture
- 3 - 16 mW Output Power
- Up to 860 MHz Downstream Path
- Optical Regeneration with Minimal Environmental Requirements
- Automatic Backup Link
- Digital or Analog Upstream Path
- Provides the Highest Signal Quality over Long Distances or Selective Programming
- Create a Remote Headend or Double your Existing Link Budget
- Allows Easy Implementation of Telephony and PCN
- Flexible Platform Provides Digital Overlay or 110 Video Channels
- Eliminates the Expense of Temperature Controlled Enclosures
- Excellent System Reliability
- Excellent Customer Response with Upstream Status Monitoring

# FIBERHUB FUNCTIONAL DESCRIPTION - DOWNSTREAM

The IPITEK® FiberHub™ Optical Repeater Station is designed to double the reach of your fiber-optic plant using field proven optical regeneration. Utilizing highly reliable DFB lasers provides a lower cost solution than exotic optical amplifiers or external modulators. The FiberHub Optical Repeater Station is perfect for AM supertrunks, remote headend applications, and for delivering the benefits of fiber-optic distribution all the way to the subscriber's neighborhood. The FiberHub architecture allows easy implementation of advanced services, such as telephony and PCN.

## FIBERTRUNK TO FIBERHUB

The FiberTrunk can feed up to four FiberHubs from the headend location. A dual fiber approach can be used for those applications requiring high CNR over long distances.

## AT THE FIBERHUB

At the FiberHub Repeater Station, a downstream receiver module provides optical-to-electrical conversion. An optional plug-in optical receiver can also be included in the FiberHub for either redundancy or use with the Filter/Combiner module. In order to accommodate various lengths of fiber and age- or damage-induced impairments in the fiber plant, all FiberHub receivers are equipped with 10.7 MHz pilot tone Automatic Gain Control (AGC). In addition, a 24.5 MHz FSK carrier is received for monitoring and control of the fiber-optic network. After the optical signal is converted back to an electrical format, the FSK carrier is coupled off, filtered, and demodulated.

The electrical RF signal is then input to the FiberHub Splitter/Amplifier module. The Splitter/Amplifier

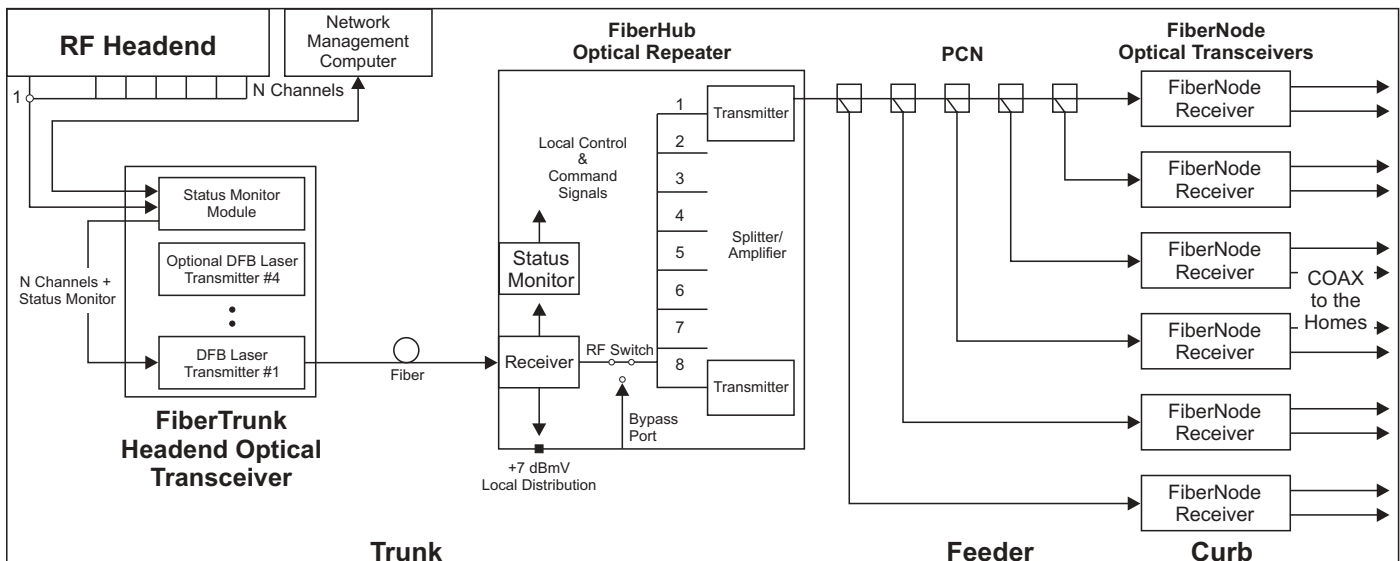
amplifies and splits this RF signal ten ways. Eight of these signals are input to the FiberHub laser transmitters and two low level outputs can be used for local distribution or for cascading additional FiberHubs.

In addition to the aforementioned single downstream optical feed to the FiberHub, it is also possible for two FiberTrunk transmitters to feed two FiberHub receivers. The outputs of these receivers are input to a Filter/Combiner module. This allows for splitting the channel loading in half for each laser transmitter. The result is an increase in the OMI, which provides a greater CNR for each link.

The Splitter/Amplifier and Filter/Combiner also feature a fiber bypass provision. If no optical signal is detected and there are backup signals detected at the "Fiber Bypass" (Secondary RF input) port, then an RF switch is automatically activated and the backup link (either coaxial, microwave or another fiber) is passed to the FiberHub laser transmitters.

## FIBERHUB TO THE NODES

The FiberHub Downstream Laser Transmitters have similar features to the FiberTrunk units. The FiberHub can provide up to eight additional optical distribution paths in a "star" configuration, terminated in a conventional coaxial tree and branch distribution to the subscribers' homes. For distances of less than the link's specified optical budget, single mode optical splitters can divide the optical power to feed extra nodes. This ability provides for the division of power adding further resource sharing across a larger number of subscribers.



# FIBERHUB FUNCTIONAL DESCRIPTION - UPSTREAM

With increased emphasis on customer satisfaction and network availability, the ability to remotely isolate and troubleshoot faults is critical in reducing Mean-Time-To-Repair (MTTR). The FiberHub upstream path is a user-friendly fiber-optic status monitor and control link which can reduce MTTR on the fiber network. When this fiber-optic upstream path is used with network management software, the system minimizes network downtime, dramatically reduces service calls and enhances service quality.

## FIBERNODES TO THE FIBERHUB

The figure below depicts an overview of an optical upstream path showing a FiberNode cluster attached to a single fiber using fiber-optic splitters. The upstream fiber is completely separate from the downstream fiber. Note that the upstream splitters can all be installed at the FiberHub rather than in the field. A "home run" architecture without any splitters can also be implemented depending on the link budget.

Each node has a plug-in FiberNode Status Monitor module. This module is a plug-in daughterboard with an FSK demodulator, microcontroller and an upstream LED transmitter module operating at a data rate of 9600 bps. Each FiberNode is polled in sequence by the headend computer so that FiberNodes on a particular fiber do not send information upstream at the same time.

## AT THE FIBERHUB

Each of the eight fibers from the FiberNode clusters are fed into a FiberHub Upstream Receiver module located at the FiberHub. This module incorporates a multi-pigtailed connector which mechanically aligns the eight optical fibers with a large area detector. This permits all of the

FiberNodes to communicate with the FiberHub without using multiple receivers or high optical loss star couplers. Using simple LED transmitters and a single receiver results in significant cost savings. The optical signals are converted back to TTL-level electrical signals and fed to the FiberHub Status Monitor module.

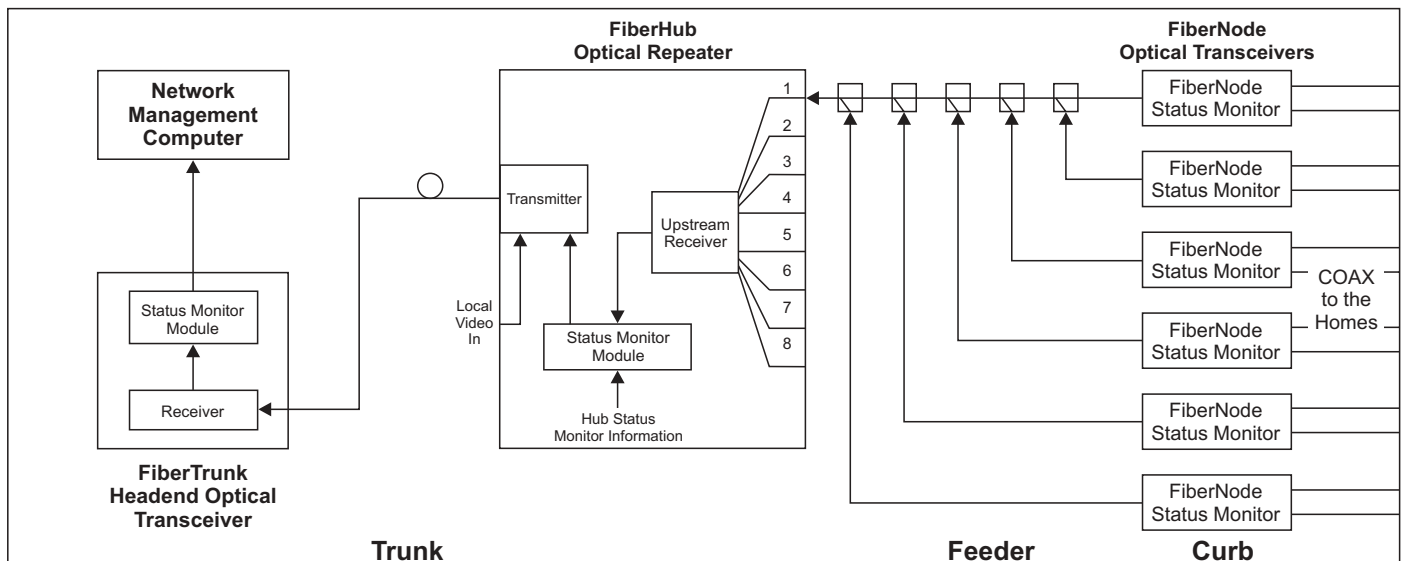
The FiberHub Chassis is designed to be mounted inside of a pedestal housing in the field requiring minimal environmental control. Dual redundant on-line power supplies are offered to prevent network outages due to supply failure.

## FIBERHUB TO THE FIBERTRUNK

The electrical digital signals are fed to an FSK modulator in the FiberHub Status Monitor module via the FiberHub backplane. The status monitor digital signals from the FiberNodes or FiberHub modulate an FSK carrier at 24.5 MHz. This FSK signal, and any local video feeds, are input to the FiberHub Upstream Transmitter module. The FiberHub Upstream Laser Transmitter uses a low RIN Fabry-Perot laser to provide transport for both the FSK carrier and up to three video channels to the FiberTrunk.

The FiberTrunk Upstream Receiver converts the signal from optical to electrical and feeds these signals to the FiberTrunk Status Monitor module. The FiberTrunk Status Monitor module contains an FSK modem which converts the signal into RS-232 9600 baud format (the video carriers are passed through to customer-supplied AM demodulators).

The Status Monitor module has a "D" connector which can be used with network management software running on a PC - compatible computer.



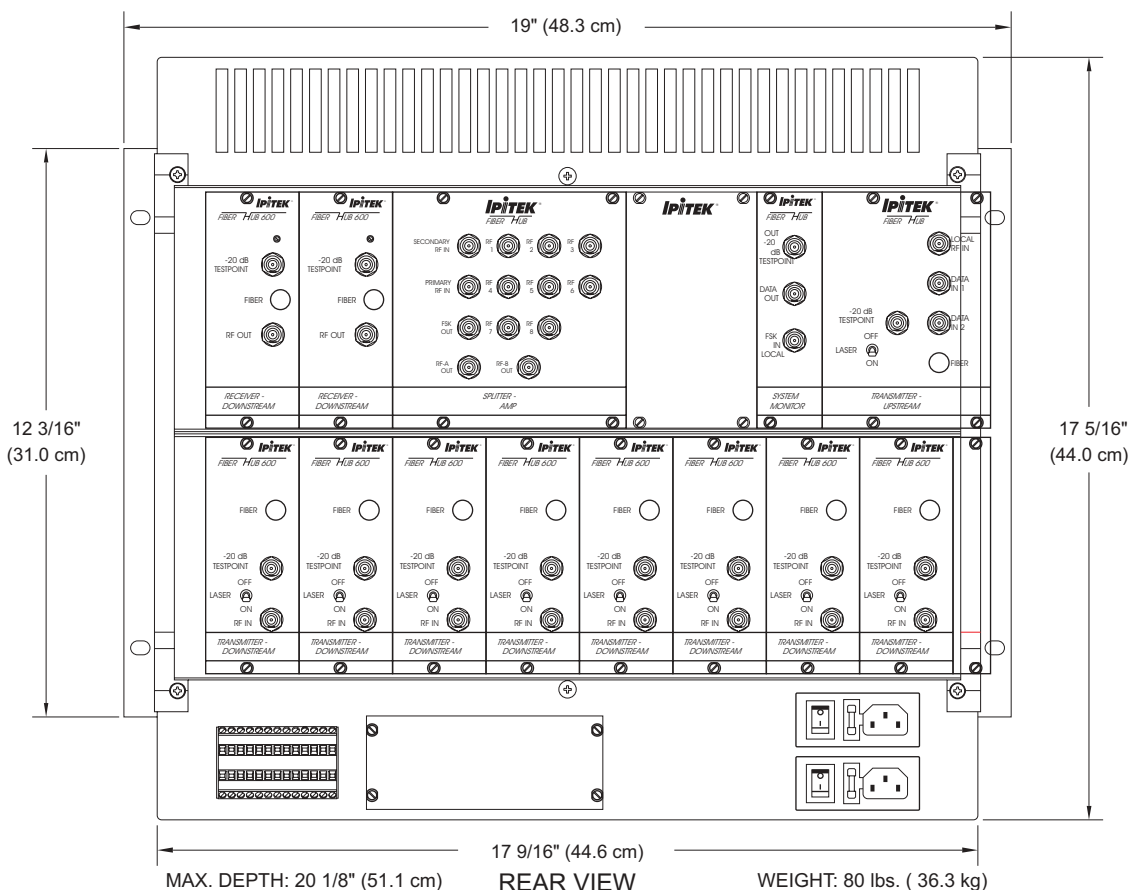
## FIBERHUB MODULE DESCRIPTIONS AND SPECIFICATIONS - DOWNSTREAM

MODEL NUMBER	MODEL DESCRIPTION
<b>FH - DRX</b>	<p>Downstream optical receiver plug-in module for FiberHub chassis with pilot tone AGC. Includes status monitor sense points.</p> <p><b>Optical</b>            Optical Connector: Single mode FC, SC or E-2000            Optical Wavelength: 1310 nm or 1550 nm</p> <p><b>Electrical</b>            Output Impedance: 75 ohms            Output RF Level: +20 dBmV per channel            RF connector: F-type            Frequency Response: <math>\pm 1.0</math> dB over specified range            RF Test Point: -20.0 dB from RF output level</p>
<b>FH - SA</b>	<p>Downstream splitter/amplifier plug-in module for FiberHub chassis. Splits RF signals from the FH-DRX ten ways providing RF levels to eight laser transmitter modules, a local RF output and one auxiliary port. Includes status monitor sense points.</p> <p><b>Electrical</b>            Input RF Connector: F-type            Input RF Level: Two +20 dBmV inputs; one primary, one secondary            Output RF Connectors: F-type            Output RF Level: <math>\geq</math>Eight +32 dBmV outputs, two +7 dBmV local            Input/Output Impedance: 75 ohms            Input/Output Return Loss: <math>\geq 14.0</math> dB</p>
<b>FH - FC</b>	<p>Downstream filter/combiner plug-in module for FiberHub chassis. Takes the RF outputs from the two FH-DRX receivers, filters out the unused band in each and then combines the two signal streams. This is used for increased CNR or long distances, in place of the splitter/amplifier. Includes status monitor sense and control points.</p> <p><b>Electrical</b>            Input RF Connectors: F-type            Input RF Level: Two +20 dBmV inputs            Output RF Connectors: F-type            Input/Output Impedance: 75 ohms            Input/Output Return Loss: <math>\geq 14.0</math> dB</p>
<b>FH - DTX</b>	<p>Downstream laser transmitter module for FiberHub, 1310nm DFB laser, packaged modularly with ALC, fully connectorized, automatic power control, thermo-electric cooler, opto-isolator and laser on/off switch. Includes status monitor sense and control points.</p> <p><b>Electrical</b>            RF Connector: F-type            Input RF Level: +32 dBmV per channel            Input Impedance: 75 ohms            Input Return Loss: <math>\geq 14.0</math> dB            RF Test Points: -20 dB from RF input level</p> <p><b>Optical</b>            Optical Connector: Single mode FC, SC or E-2000            Optical Wavelength: 1310 nm <math>\pm 30</math> nm            Frequency Response: <math>\pm 1.0</math> dB over the specified frequency range</p>

## FIBERHUB MODULE DESCRIPTIONS AND SPECIFICATIONS - UPSTREAM

MODEL NUMBER	MODEL DESCRIPTION
<b>FH - URX</b>	<p>Upstream optical digital receiver plug-in module for the FiberHub Repeater chassis. Includes multi-pigtailed large area detector with associated receiver electronics. Digital output. Includes status monitor sense points.</p> <p><b>Optical</b>            Optical Connector: Eight single mode FC, SC or E-2000.            Optical Wavelength: 1310 nm            Sensitivity: -31 dBm</p> <p><b>Electrical</b>            Output Connector: Via backplane            Output Level: TTL            Data Rate: 9600 bps</p>
<b>FH - SMM</b>	<p>Upstream and downstream FSK modem plug-in module for FiberHub chassis. Provides status monitor feed for the FH-UTX.</p> <p><b>Electrical</b>            Input Sense Points: Via backplane            Sense Points Input Level: TTL            Output RF Connectors: F-type            Output RF Level: +5 dBmV            Output Impedance: 75 ohms            Up/Down Carrier Frequency: 24.5 MHz, FSK            Items Controlled: Laser on/off, Force backup, Other (terminal block)            Items Monitored: AC lines, DC power supplies, RF drive level in, Laser, bias and temperature, Optical signal in, Bypass level low, Bypass on-line.            RF Test Points: -20 dB from RF input level</p>
<b>FH - UTX</b>	<p>Upstream transmitter module using a Fabry-Perot laser, 5-105 MHz, with automatic power control, thermo-electric cooler with temperature compensation circuitry. Carries local video and status monitor data on FSK carrier.</p> <p><b>Electrical</b>            RF Connector: F-type            Input Level: +20 dBmV per channel            Input Impedance: 75 ohms</p> <p><b>Optical</b>            Optical Connector: Single mode FC, SC or E-2000            Optical Output Power: <math>\geq -0.5</math> dBm            Optical Wavelength: 1310 nm <math>\pm 30</math> nm            Frequency Response: 1.0 dB over specified range</p>
<b>FH - CH - X</b>	<p>Optical Repeater 19" rack mount chassis with front panel LED displays, including two on-line power supplies at 110 VAC, 220 VAC or -48 VDC. Backplane board and external status monitor sense &amp; control points at chassis terminal block.</p> <p><b>Electrical and Environmental</b>            Operating Power: 404 watts under full load            Input Voltages: 110 VAC @ 60 Hz or 220 VAC @ 50 Hz or -48 VDC            Fully Loaded Oper. Temp.: +0°C to +50°C            Humidity: 5% to 95%            EMI: Fully Compliant to VDE 0871 Class B            Thermal Load: 1500 BTUs/hour</p>

# MECHANICAL



## ORDERING INFORMATION

**FH - DTX - XX - XX - X - X**

<i>FiberHub Compatible</i>	Type	Bandwidth	Output Power		Connector	Polish
	Downstream Transmitter Module	75 = 45-750 MHz 90 = 45-862 MHz	04 = 4 mW 06 = 6 mW 08 = 8 mW	10 = 10 mW 13 = 13 mW 16 = 16 mW	F = FC S = SC E = E-2000	A = APC

**FH - DRX - XX - X - X      FH - SA - 90**

<i>FiberHub Compatible</i>	Type	Bandwidth	Connector	Polish	<i>FiberHub Compatible</i>	Type	Bandwidth
	Downstream Receiver Module	90 = 45-862 MHz	F = FC S = SC E = E-2000	A = APC		Splitter/Amplifier Module	90 = 45-862 MHz

**FH - UTX - X - X      FH - URX - X - X**

<i>FiberHub Compatible</i>	Type	Connector	Polish	<i>FiberHub Compatible</i>	Type	Connector	Polish
	Upstream Transmitter Module	F = FC S = SC E = E-2000	A = APC		Upstream Receiver Module	F = FC S = SC E = E-2000	A = APC

**FH - SMM      FH - CH - 2 - XX - X**

<i>FiberHub Compatible</i>	Type	<i>FiberHub Compatible</i>	Type	Power Supplies	Rack Mounting	Input Power
	Status Monitor Module		Chassis	2 = 2 Supplies	19 = 19" Rack 23 = 23" Rack	1 = 110/220 VAC 4 = -48 VDC



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