

# *SpectrumPlus: System Overview*

## 4X to 32X RETURN PATH BANDWIDTH EXPANSION SYSTEM

### Features / Benefits

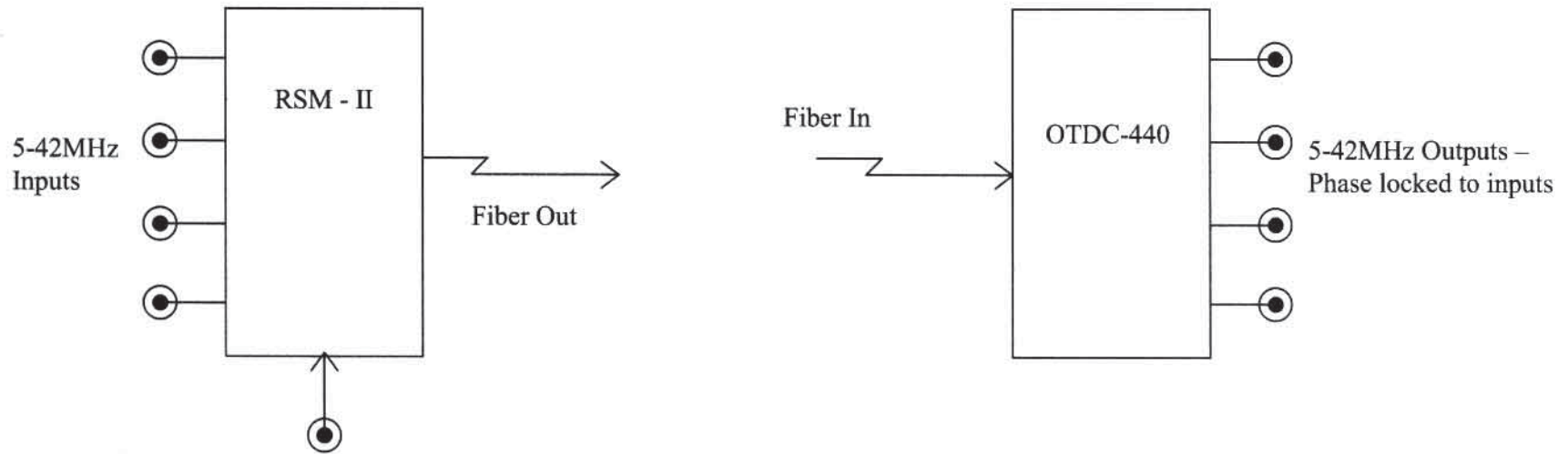
- Eliminates or delays wholesale node replacement because of insufficient return path capacity
- Ideal for systems with limited available optical fibers for upstream segmentation purposes
- Low-cost alternative to DWDM transmitters, digital return & other return segmentation methods
- Field-proven since 1999: Successfully deployed in thousands of nodes & hubs worldwide
- Transports both analog video & all high-order digitally modulated QAM/FSK/QPSK sub-carriers
- Capable of transporting up to 32 individual 5-42 MHz upstream signals onto a single fiber via:
  - 4:1 FDM frequency stacking: multiplex up to 4 individual returns onto 1 RF stream
  - 8:1 CWDM optical muxing: up to 8 RF streams onto a fiber via ITU grid CWDM TXs
- *SpectrumPlus* transports the ENTIRE 5-42 MHz band, unlike 4:1 digital systems (@ 5-40 MHz)
- Side-benefit: Facilitates return path monitoring by isolating ingress and noise sources
- Stable operation over Time, Temperature and Signal Loading
- Band-edge pilot tone phase locks input to output and stabilizes a directly modulated DFB laser
- Faithful Up → Down frequency translation of return bands with:
  - NO FREQUENCY ERROR
  - LOW PHASE NOISE
  - LOW DISTORTION
  - HIGH CNR / NPR
  - WIDE DYNAMIC RANGE
- Node & Hub Upconverters available with or without 1310nm, 1550nm & CWDM laser TX option
- Accommodates most major optical nodes, including both currently available AND legacy nodes
- Hub/Headend Downconverter packaged for high-density, cost-effective 3RU *LaserPlus* platform

The **OLSON TECHNOLOGY, INC. *SpectrumPlus* RETURN PATH BANDWIDTH EXPANSION SYSTEM** is a low-cost, high performance, field-proven optical transmission system which upgrades the functionality of currently installed optical nodes from almost every major manufacturer, by dramatically increasing upstream bandwidth (up to 32X) by combining the latest in block conversion and CWDM technologies.

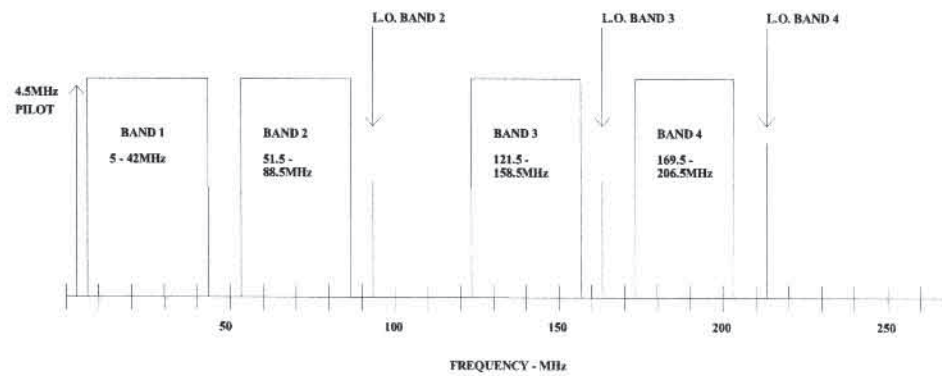
It provides outstanding return path performance, system design flexibility and scalability in almost any network architecture from traditional Hybrid Fiber Coax (HFC) to the newer fiber-deep Targeted Service Delivery (TSD) area topologies. As such, the *SpectrumPlus* is the ideal, cost-effective node upgrade solution specifically designed to accommodate increasing upstream bandwidth requirements in today's advanced HFC & PON networks. The *SpectrumPlus* system has a number of interchangeable components which provide for a wide variety of node-to-hub (or headend) and hub-to-headend configurations, such as the **Models FRMUC-4X, OTUC-400 and RSM-II** Block Upconverters and the **Models LP-DC-212/234 and OTDC-440** Block Downconverters.

In addition to being compatible with Olson's **Model OTMN-II 4-port MetroNode**, the *SpectrumPlus* system is also directly compatible with an ever-expanding number of optical nodes from other leading manufacturers, such as Motorola, Scientific-Atlanta, Arris, Harmonic, Augat, etc. for return path node segmentation purposes, without having to replace network infrastructure or deploy additional optical fibers, 1550nm ITU grid DWDM lasers, baseband digital reverse modules, or other expensive alternative return path segmentation technologies.

**System Application Diagram  
Spectrum Multiplier System**



**Spectrum for RSM-II**



# SpectrumPlus: System Overview

## Ordering Information - Upconverters and Downconverters

<u>Model Number</u>	<u>Description</u>
FRMUC-4X-NT	OT "SP" Upconverter; 4X 5-42MHz; ONU MODULE; <i>without</i> 5-300 MHz Upstream Transmitter
FRMUC-4X-3T	OT "SP" Upconverter; 4X 5-42MHz; ONU MODULE; DFB TX @ 1310nm; 3 mw; SC/APC
FRMUC-4X-5T	OT "SP" Upconverter; 4X 5-42MHz; ONU MODULE; DFB TX @ 1550nm; 2.5 mw; SC/APC
FRMUC-4X-47T	OT "SP" Upconverter; 4X 5-42MHz; ONU MODULE; CWDM TX @ 1470nm; 2.5 mW; SC/APC
FRMUC-4X-49T	OT "SP" Upconverter; 4X 5-42MHz; ONU MODULE; CWDM TX @ 1490nm; 2.5 mW; SC/APC
FRMUC-4X-51T	OT "SP" Upconverter; 4X 5-42MHz; ONU MODULE; CWDM TX @ 1510nm; 2.5 mW; SC/APC
FRMUC-4X-53T	OT "SP" Upconverter; 4X 5-42MHz; ONU MODULE; CWDM TX @ 1530nm; 2.5 mW; SC/APC
FRMUC-4X-55T	OT "SP" Upconverter; 4X 5-42MHz; ONU MODULE; CWDM TX @ 1550nm; 2.5 mW; SC/APC
FRMUC-4X-57T	OT "SP" Upconverter; 4X 5-42MHz; ONU MODULE; CWDM TX @ 1550nm; 2.5 mW; SC/APC
FRMUC-4X-59T	OT "SP" Upconverter; 4X 5-42MHz; ONU MODULE; CWDM TX @ 1590nm; 2.5 mW; SC/APC
FRMUC-4X-61T	OT "SP" Upconverter; 4X 5-42MHz; ONU MODULE; CWDM TX @ 1610nm; 2.5 mW; SC/APC
FRMUC-AR440KIT	FRMUC-4X-x Wiring & Installation Kit (Arris; LLRX400 Gemini Optical Node Unit)
FRMUC-SA6940KIT	FRMUC-4X-x Wiring & Installation Kit (Scientific-Atlanta; 6940 Optical Node Unit)
FRMUC-MOT2000KIT	FRMUC-4X-x Wiring & Installation Kit (Motorola; SG2000 Optical Node Unit)
FRMUC-MOT2440KIT	FRMUC-4X-x Wiring & Installation Kit (Motorola; SG2440 Optical Node Unit)
FRMUC-HLN3844KIT	FRMUC-4X-x Wiring & Installation Kit (Harmonic; HLN3844 Optical Node Unit)

**(PLEASE NOTE: Contact the Olson factory for additional standard & customized configurations for other ONU's).**

OTUC-400	OT "SP" Upconverter; 4X 5-42MHz; 1RU 19" EIA; <i>without</i> 5-300 MHz Upstream Transmitter
OTUC-404	OT "SP" Upconverter; 4X 5-42MHz; 1RU 19" EIA; DFB TX @ 1310nm; 3 mw; SC/APC
OTUC-405	OT "SP" Upconverter; 4X 5-42MHz; 1RU 19" EIA; DFB TX @ 1550nm; 2.5 mw; SC/APC
OTUC-447	OT "SP" Upconverter; 4X 5-42MHz; 1RU 19" EIA; CWDM TX @ 1470nm; 2.5 mW; SC/APC
OTUC-449	OT "SP" Upconverter; 4X 5-42MHz; 1RU 19" EIA; CWDM TX @ 1490nm; 2.5 mW; SC/APC
OTUC-451	OT "SP" Upconverter; 4X 5-42MHz; 1RU 19" EIA; CWDM TX @ 1510nm; 2.5 mW; SC/APC
OTUC-453	OT "SP" Upconverter; 4X 5-42MHz; 1RU 19" EIA; CWDM TX @ 1530nm; 2.5 mW; SC/APC
OTUC-455	OT "SP" Upconverter; 4X 5-42MHz; 1RU 19" EIA; CWDM TX @ 1550nm; 2.5 mW; SC/APC
OTUC-457	OT "SP" Upconverter; 4X 5-42MHz; 1RU 19" EIA; CWDM TX @ 1570nm; 2.5 mW; SC/APC
OTUC-459	OT "SP" Upconverter; 4X 5-42MHz; 1RU 19" EIA; CWDM TX @ 1590nm; 2.5 mW; SC/APC
OTUC-461	OT "SP" Upconverter; 4X 5-42MHz; 1RU 19" EIA; CWDM TX @ 1610nm; 2.5 mW; SC/APC
LP-DC-212-NR	OT "SP" 2X Downconverter "LP" Module (BANDS 1&3); <b>NO</b> OPTICAL RETURN RECEIVER
LP-DC-212	OT "SP" 2X Downconverter "LP" Module (BANDS 1&3) INCLUDING OPTICAL RX; SC/APC
LP-DC-234	OT "SP" 2X Downconverter "LP" Module (BANDS 2&4) (REQUIRES OTDC-212)
LP-CH-16B	OT "LP" 3RU CHASSIS (AC/DC COMPATIBLE); 16 SLOTS
LP-CH-MET	OT "LP" 3RU CHASSIS MODULE EXTRACTION TOOL
LP-CH-SNMP-1	OT "LP" 3RU CHASSIS SNMP ELEMENT MANAGER INTERFACE, RJ-45
037-000405	OT "LP" 3RU CHASSIS REPLACEMENT FAN ASSEMBLY
LP-PS-AC	OT "LP" 90-264 VAC POWER SUPPLY MODULE
LP-PS-DC	OT "LP" -48 VDC POWER SUPPLY MODULE
LP-OR-300	OT "LP" RETURN RX (TRIPLE) MODULE, 5-300MHz, -17 to +3dBm, 1310/1550nm, SC/APC
OTDC-440-NR	OT "SP" Downconverter; 4X 5-42MHz; 1RU 19" EIA; <b>NO</b> OPTICAL RETURN RECEIVER
OTDC-440	OT "SP" DownConverter; 4X 5-42MHz; 1RU 19" EIA; INCLUDING OPTICAL RX; SC/APC

## *SpectrumPlus: Node Block UpConverter & CWDM Tx (FRMUC-4X)*

### **4X to 32X RETURN BANDWIDTH EXPANSION SYSTEM**

#### **Features / Benefits**

- **Node-to-Headend frequency stacker with integrated return transmitter (1310, 1550nm, CWDM)**
- Deal for expanding architectures with limited optical fibers or return path bandwidth
- Multiplexes up to four (4) 5-42MHz upstream bands into on (1) 5-206.5MHz block
- Also able to combine up to (8) 5-206.5MHz blocks via CWDM DFB lasers onto 1 optical fiber
- Hence, multiplies available bandwidth up to 32X for effective return path segmentation
- **Reliable & field-proven in 1000's of deployments worldwide since 1999**
- Superior performance: Low Distortion, High CNR & Wide Dynamic Range
- Engineered for QAM digitally modulated sub-carriers
- Robust, stable performance based on:
  - Faithful Up → Down frequency translation of return bands
  - No frequency error and low phase noise
  - High dynamic range active mixers
  - Wideband, sharp cutoff SAW filters
  - Band-edge Pilot Tone phase locks Input to Output and stabilizes DFB laser
- Energy-efficient circuit design = low power dissipation & long-term reliability
- **Plug-and-Play Compatibility with other Manufacturers' Optical Node Units (ONU's)**
- Cost-effective



**Olson Technology, Inc.'s SpectrumPlus Return Path Bandwidth Expansion System** is a reliable, field-proven and cost-effective family of products which consolidates and transports up to 32 separate, phase-locked 5-42 MHz upstream signals per singlemode fiber to the receive system site, vastly enhancing network capacity and ultimately decreasing network complexity.

The **Model FRMUC-4X** is a compact, rugged 4-band block upconverter module which frequency stacks up to four (4) 5-42 MHz return bands into an integrated, high-quality, cooled DFB laser transmitter module, at 1310nm, 1550nm, or any one of eight (8) ITU grid CWDM lasers (@ 1470-1610 +/- 3 nm). Utilizing the **Model OT-CWDM** mux/demux module, which combines/decombines multiple optical wavelength bands onto one dedicated singlemode fiber, up to 32 separate, phase-locked upstream bands can be transported from multiple remote ONU's to a centralized uib or Headend site over one dedicated singlemode fiber.

At the receiving end, the **Models LP-DC-212/234** 2/4-band block downconverters receive the optical signal and destacks the electrical 5 – 206.5 MHz block into the original four (4) 5-42 MHz return path signals. (See Olson Technology, Inc. **LaserPlus** spec sheet for **Models LP-DC-212/234** chassis and power supply details).

The **SpectrumPlus** system has a number of interchangeable components which provide for a wide variety of node-to-hub (or headend) and hub-to-headend configurations, such as the **Model OTUC-400** Hub Block Upconverter. In addition to being compatible with Olson's **Model OTMN-II 4-port MetroNode**, the **SpectrumPlus** system is also directly compatible with an ever-expanding number of optical nodes from other leading manufacturers, such as Motorola, Scientific-Atlanta, Arris, Harmonic, etc. for return path node segmentation purposes, without having to replace existing networking infrastructure

## Specifications

### RF PERFORMANCE PARAMETERS:

Input Frequency Range (4 Inputs)	5 MHz to 42 MHz
Output Spectrum (stacked) (Spectrum Inverted on Bands 2,3 & 4)	5 MHz to 206.5 MHz Band 1 - 5 MHz to 42 MHz (non-converted) Band 2 - 51.5 MHz to 88.5 MHz Band 3 - 121.5 MHz to 158.5 MHz Band 4 - 169.5 MHz to 206.5 MHz
Frequency Accuracy	Each converted band phase locked to internal 4.5 MHz pilot
Gain (each input to combined output)	15 dB +/- 1 dB
Gain Flatness	< 3 dB in any band
Noise Figure	14dB maximum
Maximum Input Signal	+15 dBmV/carriers (6 carriers)
Phase Noise	> -110dBc Hz @ 10 KHz
Input Return Loss	> 15 dB (5 MHz to 42 MHz)
Output Return Loss	> 15 dB (5 MHz to 206.5 MHz)
3 <sup>rd</sup> Order I.M. @ +15 dBmV Input/Carrier	> 55 dB; typically > 60 dB (6 carriers)
2 <sup>nd</sup> Order I.M. @ +15 dBmV Input/Carrier	> 55 dB (6 carriers)
L.O. Rejection (Measured relative to Input Carriers @ +15 dBmV/carrier)	Band 2 - 93.5162 MHz > 15 dB Band 3 - 163.5469 MHz > 15 dB Band 4 - 211.500 MHz > 15 dB
Image Rejection (55 dB minimum; 60 dB typical)	Band 2 - 98.5 MHz to 133.5 MHz Band 3 - 168.5 MHz to 203.5 MHz Band 4 - 216.5 MHz to 251.5 MHz
Pilot Output	4.5 MHz @ +25 dBmV

### OPTICAL PERFORMANCE PARAMETERS:

Composite Triple Beat (CTB)	> 55 dB below 6 carriers @ 10% mod. Index
Composite Order (CSO)	> 55 dB below 6 carriers @ 10% mod. Index
Return Loss (5-210 MHz)	> 15 dB (each)
Frequency Response	5 MHz to 300 MHz
Ripple (peak-to-valley)	+/- 0.5 dB (each)

### ENVIRONMENTAL PARAMETERS:

Power Requirements	24 VDC @ 0.5 amp; 12W power consumption
Size (Upconverter)	7.25"H x 4"W x 1.25"D
Size (Transmitter)	4.25"H x 3.25"W x 0.75"D
Operating Temperature Range	-40 to +85 degrees C (-40 to +185 degrees F)



## ORDERING INFORMATION:

<u>Upconverter Model No.</u>	<u>Description (Upconverter; Wavelength; Optical Power; Connector)</u>
FRMUC-4X-NT	Upconverter (4X 42MHz); <i>without</i> 5-300 MHz Upstream Transmitter
FRMUC-4X-3T	Upconverter (4X 42MHz); TX = 1310nm +/- 20 nm; 3 mw; SC/APC
FRMUC-4X-5T	Upconverter (4X 42MHz); TX = 1550nm +/- 20 nm; 2.5 mw; SC/APC
FRMUC-4X-47T	Upconverter; TX = CWDM @ 1470nm +/- 3nm; 2.5 mW; SC/APC
FRMUC-4X-49T	Upconverter; TX = CWDM @ 1490nm +/- 3nm; 2.5 mW; SC/APC
FRMUC-4X-51T	Upconverter; TX = CWDM @ 1510nm +/- 3nm; 2.5 mW; SC/APC
FRMUC-4X-53T	Upconverter; TX = CWDM @ 1530nm +/- 3nm; 2.5 mW; SC/APC
FRMUC-4X-55T	Upconverter; TX = CWDM @ 1550nm +/- 3nm; 2.5 mW; SC/APC
FRMUC-4X-57T	Upconverter; TX = CWDM @ 1570nm +/- 3nm; 2.5 mW; SC/APC
FRMUC-4X-59T	Upconverter; TX = CWDM @ 1590nm +/- 3nm; 2.5 mW; SC/APC
FRMUC-4X-61T	Upconverter; TX = CWDM @ 1610nm +/- 3nm; 2.5 mW; SC/APC

<u>Accessories Model No.</u>	<u>Description (Manufacturer; ONU Node Model No.)</u>
FRMUC-AR440KIT	Wiring & Installation Kit (Arris; LLRX400 Gemini Optical Node)
FRMUC-SA6940KIT	Wiring & Installation Kit (Scientific-Atlanta; 6940 Optical Node)
FRMUC-MOT2000KIT	Wiring & Installation Kit (Motorola; SG2000 Optical Node)
FRMUC-MOT2440KIT	Wiring & Installation Kit (Motorola; SG2440 Optical Node)
FRMUC-MOT2440KIT	Wiring & Installation Kit (Motorola; SG2440 Optical Node)
FRMUC-HLN3844KIT	Wiring & Installation Kit (Harmonic; HLN3844 Optical Node)

*(PLEASE NOTE: Contact the factory for additional standard & customized configurations for other ONU's).*

## *SpectrumPlus: Node Block UpConverter & CWDM Tx (OTUC-400)* **4X to 32X RETURN BANDWIDTH EXPANSION SYSTEM**

### Features / Benefits

- **Hub-to-Headend frequency stacker with integrated return transmitter (1310, 1550nm or CWDM)**
- Ideal for expanding architectures with limited optical fibers or return path bandwidth
- Multiplexes up to four (4) 5-42 MHz upstream bands into one (1) 5–206.5 MHz block
- Also able to combine up to (8) 5-206.5MHz blocks via CWDM DFB lasers onto 1 optical fiber
- Hence, multiplies available bandwidth up to 32X for effective return path segmentation
- **Reliable & field-proven in 1000's of deployments worldwide since 1999**
- Superior performance: Low Distortion, High CNR & Wide Dynamic Range
- Engineered for QAM digitally modulated sub-carriers
- Robust, stable performance based on:
  - Faithful → Down frequency translation of the 4 return bands
  - No frequency error and low phase noise
  - High dynamic range active mixers
  - Wideband, sharp cutoff SAW filters
  - Band-edge Pilot Tone phase locks Input to Output and stabilizes DFB laser
- Energy-efficient circuit design = low power dissipation & long-term reliability
- Cost-effective



**Olson Technology, Inc.'s *SpectrumPlus* Return Path Bandwidth Expansion System** is a reliable, field-proven and cost-effective family of products which consolidates and transports up to 32 separate, phase-locked 5-42 MHz upstream signals per singlemode fiber to the receive system site, vastly enhancing network capacity and decreasing network complexity.

The **Model OTUC-4XX** is a 1RU 19" EIA rack-mount 4-band block upconverter and integrated laser transmitter package, which frequency stacks up to four (4) 5-42 MHz return bands into a high-quality, cooled DFB laser, at 1310nm, 1550nm, or any one of eight (8) ITU grid CWDM lasers (@ 1470-1610 +/- 3 nm). Utilizing the **Model OT-CWDM** mux/demux module, which combines/decouples multiple optical wavelength bands onto one dedicated singlemode fiber, up to 32 separate, phase-locked upstream bands can be transported from Hub-to-Headend over one dedicated singlemode fiber. At the receiving end, the **Models LP-DC-212/234** 2/4-band block downconverters receive the optical signal and destacks the electrical 5 – 206.5 MHz block into the original four (4) 5-42 MHz return path signals. (See Olson Technology, Inc. *LaserPlus* spec sheet for **Models LP-DC-212/234** chassis and power supply details).

The *SpectrumPlus* system has a number of interchangeable components which provide for a wide variety of node-to-hub (or headend) and hub-to-headend configurations, such as the **Model FRMUC-4X** Node Block Upconverter. In addition to being compatible with Olson's **Model OTMN-II 4-port MetroNode**, the *SpectrumPlus* system is directly compatible with an ever-expanding number of optical nodes from other leading manufacturers, such as Motorola, Scientific-Atlanta, Arris, Harmonic, etc. for return path node segmentation purposes, without having to replace existing network infrastructure.

# SpectrumPlus: Node Block UpConverter & CWDM Tx (OTUC-400)



## Specifications

### RF PERFORMANCE PARAMETERS:

Input Frequency Range (4 Inputs)	5 MHz to 42 MHz
Output Spectrum (stacked) (Spectrum Inverted on Bands 2,3 & 4)	5 MHz to 206.5 MHz
	Band 1 - 5 MHz to 42 MHz (non-converted)
	Band 2 - 51.5 MHz to 88.5 MHz
	Band 3 - 121.5 MHz to 158.5 MHz
	Band 4 - 169.5 MHz to 206.5 MHz
Frequency Accuracy	Each converted band phase locked to internal 4.5 MHz pilot
Gain (each input to combined output)	15 dB +/- 1 dB
Gain Flatness	< 3 dB in any band
Noise Figure	14dB maximum
Maximum Input Signal	+15 dBmV/carriers (6 carriers)
Phase Noise	> -110dBc Hz @ 10 KHz
Input Return Loss	> 15 dB (5 MHz to 42 MHz)
Output Return Loss	> 15 dB (5 MHz to 206.5 MHz)
3 <sup>rd</sup> Order I.M. @ +15 dBmV Input/Carrier	> 55 dB; typically > 60 dB (6 carriers)
2 <sup>nd</sup> Order I.M. @ +15 dBmV Input/Carrier	> 55 dB (6 carriers)
L.O. Rejection	Band 2 - 93.5162 MHz > 15 dB
<i>(Measured relative to Input Carriers @ +15 dBmV/carrier)</i>	Band 3 - 163.5469 MHz > 15 dB
	Band 4 - 211.500 MHz > 15 dB
Image Rejection	Band 2 - 98.5 MHz to 133.5 MHz
<i>(55 dB minimum; 60 dB typical)</i>	Band 3 - 168.5 MHz to 203.5 MHz
	Band 4 - 216.5 MHz to 251.5 MHz
Pilot Output	4.5 MHz @ +25 dBmV

### OPTICAL PERFORMANCE PARAMETERS:

Composite Triple Beat (CTB)	> 55 dB below 6 carriers @ 10% mod. Index
Composite Order (CSO)	> 55 dB below 6 carriers @ 10% mod. Index
Return Loss (5-210 MHz)	> 15 dB (each)
Frequency Response	5 MHz to 300 MHz
Ripple (peak-to-valley)	+/- 0.5 dB (each)



## ENVIRONMENTAL PARAMETERS:

Power Requirements	90-250 VAC @ 50-60 Hz; 12W power consumption
Size	1.75"H x 19"W x 10"D
Operating Temperature Range	0 degrees C to +50 degrees C (+32 to +122 degrees F)
Humidity Range	to 95% non-condensing (Recommended for use only in non-condensing environments)

## ORDERING INFORMATION:

<u>Model No.</u>	<u>Description (Upconverter; Wavelength; Optical Power; Connector)</u>
OTUC-400	Upconverter (4X 42MHz); <i>without</i> 5-300 MHz Upstream Transmitter
OTUC-404	Upconverter (4X 42MHz); TX = 1310nm +/- 20 nm; 3 mW; SC/APC
OTUC-405	Upconverter (4X 42MHz); TX = 1550nm +/- 20 nm; 2.5 mW; SC/APC
OTUC-447	Upconverter; TX = CWDM @ 1470nm +/- 3nm; 2.5 mW; SC/APC
OTUC-449	Upconverter; TX = CWDM @ 1490nm +/- 3nm; 2.5 mW; SC/APC
OTUC-451	Upconverter; TX = CWDM @ 1510nm +/- 3nm; 2.5 mW; SC/APC
OTUC-453	Upconverter; TX = CWDM @ 1530nm +/- 3nm; 2.5 mW; SC/APC
OTUC-455	Upconverter; TX = CWDM @ 1550nm +/- 3nm; 2.5 mW; SC/APC
OTUC-457	Upconverter; TX = CWDM @ 1570nm +/- 3nm; 2.5 mW; SC/APC
OTUC-459	Upconverter; TX = CWDM @ 1590nm +/- 3nm; 2.5 mW; SC/APC
OTUC-461	Upconverter; TX = CWDM @ 1610nm +/- 3nm; 2.5 mW; SC/APC

## *SpectrumPlus*: Block Down Converter & Rx Module (LP-DC-212/234)

### 4X to 32X RETURN PATH BANDWIDTH EXPANSION SYSTEM

#### Features / Benefits

Olson Technology, Inc.'s *SpectrumPlus* Return Path Bandwidth Expansion System is a reliable, field-proven and cost-effective family of products which consolidates and transports multiple upstream signals from a node, a group of nodes or a remote hub site to a centralized headend receive site, vastly enhancing network capacity and decreasing network complexity. Utilizing the **Model OT-CWDM** mux/demux module, which combines/decombines multiple optical wavelength bands onto one dedicated singlemode fiber, up to 32 separate, phase-locked upstream signals can be transported from Node-to-Headend or Hub-to-Headend or over one (1) dedicated singlemode optical fiber.

The **Models LP-DC-212/234** are 2/4-band block downconverter modules (available with or without integrated high-sensitivity 1310/1550nm optical receiver) which typically reside at the receive-end of the *SpectrumPlus* 4X Return Path Bandwidth Expansion System. They can double or quadruple the bandwidth of a typical 5-42 MHz optical return path link. The **Model LP-DC-212** by itself functions as a bandwidth doubler. Combined, the two units effectively quadruple the available upstream bandwidth.

These block downconverter/receivers are designed to compliment the **Model RSM-II**, **Model FRMUC-4X**, **Model OTUC-400**, and other compatible Olson Technology, Inc. *SpectrumPlus* 4X block upconverter/transmitters. A high-sensitivity optical upstream receiver accepts the 1310nm or 1550nm optical signal and destacks the electrical 5 – 206.5 MHz block into the original four (4) 5-42 MHz return path signals. All outputs are phase locked to their to their inputs, providing reliable, robust, transparent system operation. The 4.5 MHz phase lock pilot is also used for AGC, allowing for a wide optical input range of -10dBm to 0dBm to the receiver.

The units plug into an Olson Technology, Inc. *LaserPlus* optical transmission platform's **Model LP-CH-16** chassis. Each module occupies one slot. This allows for up to **seven** bandwidth quadruplers or **fifteen** bandwidth doublers in the 3RU (5.25") EIA package. AC and/or DC powering (single or redundant) and a variety of status monitoring options are also available. (See the latest *LaserPlus* spec sheet at [www.olsontech.com](http://www.olsontech.com) -or- contact the factory for more details).



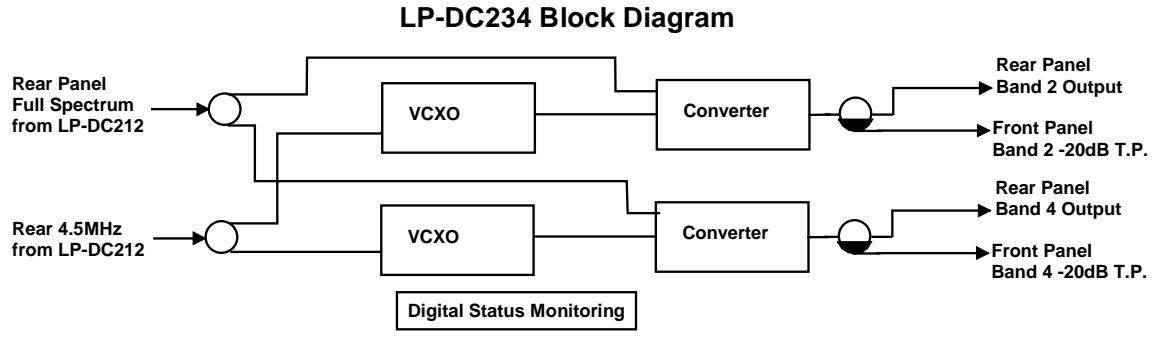
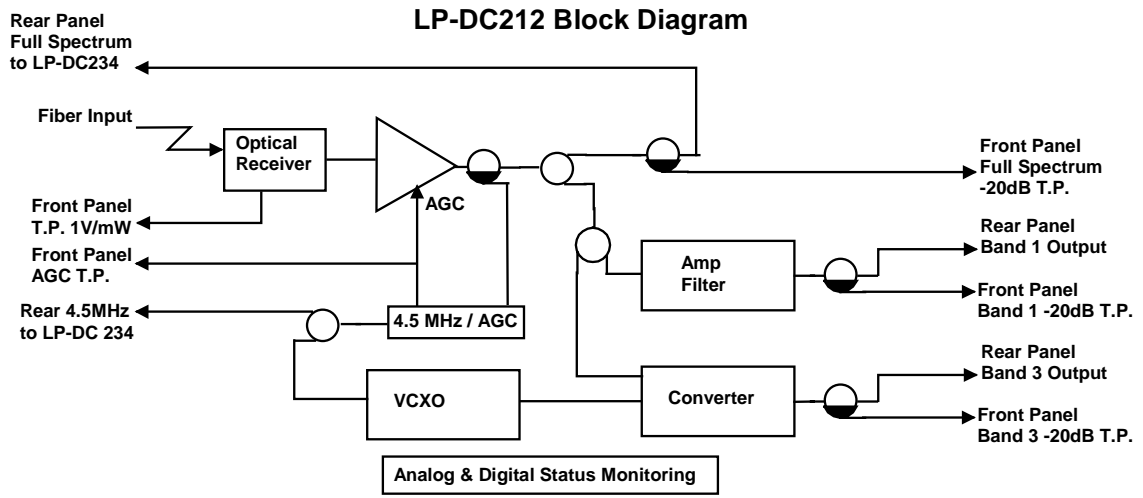
The *SpectrumPlus* system has a number of interchangeable components which provide for a wide variety of node-to-hub (or headend) and hub-to-headend configurations. In addition to being compatible with Olson's **Model OTMN-II 4-port MetroNode**, the *SpectrumPlus* system is directly compatible with an ever-expanding number of ONU optical node units from other leading manufacturers, such as Motorola, Scientific-Atlanta, Arris, Harmonic, etc. for return path node segmentation purposes, without having to replace existing network infrastructure. (Contact the factory for additional details).

## Specifications

Input Frequency Range.....	5MHz to 206.5MHz Band 1: 5MHz to 42MHz Band 2: 51.5MHz to 88.5MHz Band 3: 121.5MHz to 158.5MHz Band 4: 169.5MHz to 206.5MHz
Optical Input Range.....	-10dBm to 0dBm
Optical Connector.....	SC/APC (standard) FC/APC (optional)
Down Converter Response.....	5-42MHz: $\pm 1.5$ dB 7-40MHz: $\pm 1.0$ dB
RF Output and Test Connectors.....	75 $\Omega$ Type F
Rear Interconnections.....	4.5MHz pilot, Band 2-4 interconnect: 75 $\Omega$ Type SMB
Output Level (6 carriers).....	+35dBmV
Output Frequency Range.....	4 outputs of 5-42MHz
Output Return Loss.....	>15dB
Output Frequency Accuracy.....	Phase locked to input via pilot carrier
Pilot Frequency.....	4.5MHz $\pm$ 150Hz
Phase Noise.....	<-110dBC/Hz @ 10KHz
Noise Power Ratio (NPR).....	>14dB range @ 40dB threshold (Measured with all bands loaded, 3mW OT DFB laser into 10dB of fiber.)
3 <sup>rd</sup> Order Distortion.....	<-55dBC (U/C input: 6 CXRs @ +15dBmV)
2 <sup>nd</sup> Order Distortion.....	<-55dBC (U/C input: 6 CXRs @ +15dBmV)
Power Requirements.....	LP-DC212: 5.2V @ 1.25A LP-DC234: 5.2V @ 0.9A
Dimensions.....	Laser Plus Chassis LP-DC212: 1 Slot LP-DC234: 1 Slot
Operating Temperature.....	0°C to 45°C
Humidity.....	<95%, non-condensing

**ALL SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE**

# SpectrumPlus: Block Down Converter & Rx Module (LP-DC-212/234)



# SpectrumPlus: Block Downconverter

## 4X to 32X RETURN PATH BANDWIDTH EXPANSION SYSTEM

### Features / Benefits



The **OTDC-440** Down Converter is the companion unit for the OLSON **FRMUC** or any other spectrum multiplier system. It is housed in a single rack chassis with a universal 90-250VAC power supply. Some of the many features are as follows:

- 1) Wide AGC range derived from 4.5MHz pilot. -8dBm to 0dBm on the standard unit and -12dBm on the High Sensitivity version.
- 2) All four outputs are phased locked to their inputs
- 3) Transparent Phase Noise Performance

### Specifications

Input Frequency Range .....	5MHz to 206.5MHz
	Band 1 - 5MHz to 42MHz
	Band 2 - 51.5MHz to 88.5MHz
	Band 3 - 121.5MHz to 158.5MHz
	Band 4 - 169.5MHz to 206.5MHz
Optical Input .....	-8dBm minimum to 0dBm maximum
	-12dBm to 0dBm w/High Sensitivity option
Optical Connector .....	SC/APC or specify
RF Input Level .....	+20dBmV ±10dB (without Optical Receiver)
RF Connectors .....	Type F
Output Frequency .....	Four outputs of 5MHz to 42MHz
Frequency Accuracy .....	Locks to 4.5MHz pilot from up-converter
	4.5MHz ±150Hz
Phase Noise .....	>-110dBc Hz @ 10KHz



# Block Diagram

