Systems

High Capacity Microwave Systems

1+0, 1+1, 2+0, 4+0, XPIC Split Mount and Full Indoor Hardware Configurations

SKYLINKS Digital Microwave Systems product portfolio offers both Split Mount and Full-Indoor solutions. The product line covers the frequency range from 1,4 to 43GHz, and modulation schemes from QPSK to 256QAM.

Two different HW configurations are available, based on specific SDIDU providing several combinations of Line Interfaces with scalable Ethernet from 1 up to 620Mpbs. SKYLINKS Digital Microwave Radios flexibility allows customer to deploy any kind of wireless pint-to-point connections within public and private networks and can be tailored to be suitable for cellular mobile network up to 4G (LTE), for fixed and mobile video broadcasting distribution systems, for ISP and WIMAX backhauling, utilities and military networks.

Skylinks products portfolio includes the following systems:

Licenced

- DSR/SM Split Mount SDIDU DRS + ODU
- DRS/FI Full Indoor SDIDU DRS + RFU
- HS/SM Split Mount SDIDU HS + ODU
- HS/FI Full Indoor "ALL IN ONE" 2U Radio

License exempt

• HS-LINK/ISM



DRS/SM

Digital Radio System/Split Mount (Hybrid)



SDH Options

> 1-2 x SDH STM-1/OC-3 SONET GigaBit Ethernet

- > 2E1+ 4x1000BaseTx/Ethernet: Scalable 1-310 Mbps
- Support for multiple configurations for both PDH and SDH 1+0, 1+1 protection/diversity
- East/West Repeater (2+0) or East/East capacity doubler.
- Selectable Spectral Efficiency of 0.8 to 6.25 bits/Hz (including FEC and spectral shaping effects)
- QPSK, 16 –256 QAM Modulation
- Powerful Trellis Coded Modulation concatenated with Reed-Solomon Error Correction
- Built-in Adaptive Equalizer
- Support of Voice Orderwire Channels
- Adaptive Power Control
- Built-in Network Management System (NMS)
- Consecutive Point ring architecture
- Built-in Bit Error Rate (BER) performance monitoring
- Integrated Crosspoint switch: allows a total of 160 E1s (200 T1s) to be mapped any-to-any between front-panel ports and RF link(s).
- Optional STM-1 Mux/Demux: allows the SDIDU[™] to extract up to 63 E1 (or 84 T1) from an STM-1. In conjunction with an integrated Crosspoint Switch, up to 223 E1 (284 T1s) can be mapped any-to-any between front-panel ports, STM-1, and RF link(s).
- XPIC



The SkyLinks DRS shall meet the requirements for XPIC operation specified in ETSI EN 302-217-2-1 and ETSI EN 302-217-2-2., except for: • 256QAM XPIC operation is not currently supported.

- The DRS do not support class 6B (512QAM mode) operation in 40MHz channels.
- Class 6B operation in 7 MHz and 14 MHz channels is not supported.

The Digital Radio System provides a cost-effective solution to high capacity data transmission requirements. Operating from 4 to 38 GHz, it features compact/easy -to -install IDU and ODU.

The DRS provides user accessibility functions including Transmit Power, Receive Signal Level (RSL), and operating frequency. Additionally, it features enhanced software allowing capacity/configuration upgrade, downloadable field upgrades and an optional embedded SNMP agent for advanced network management capabilities, making it the ideal solution for networks operated by mobile service providers, internet service providers (ISP), utilities, public telephone operators, local governments, TV networks and corporate users.

The DRS represent a new microwave architecture designed to address universal applications.

The same ODU can be used for PDH, SDH and IP applications offering modulation schemes from QPSK up to 128QAM, and selectable channel BW of 3.5, 7, 14 and 28 MHz (from 10 to 56 Mhz in the WB option). The Software Defined Indoor Unit (SDIDU) offers a basic configuration, suitable for PDH application and can be upgraded with simple fw and plug-in hw modules for Super PDH, SDH, FE, GE and ASI options.

This advanced technology platform is designed to provide the flexibility to customers for their current and future network needs.

The ODU is fully calibrated over the temperature range and operates down to -50°C (optional).

The ODU supports all applications within the same HW platform covering from QPSK up to 128 QAM with very low Phase Noise and superior reliability (high MTBF).

The IDU supports both 1+0 and 1+1 protection and Ring architectures, it is provided in a chassis arrangement 1U 19 inch standard rack. The modem and power supply functions are supported using easily replaceable plug-in modules. An additional feature of the IDU is provision for a second plug-in modem / IF module to provide repeater or transit network configurations (East/West) or Capacity Doubling (East/East).

SkyLinks Digital Radio System includes integrated Operations, Administration, Maintenance, and Provisioning (OAM&P) functionality and also Design features enabling simple commissioning for the radio network installation in the customer's premises.

Another highlight of Skylinks Radio Products is the scalability and the capability to support a Ring architecture. This Ring or consecutive point radio architecture is self-healing in the event of an outage in the link and automatically re-routes data traffic, thereby ensuring the continuity of service to the end user.

The overall architecture consists of a single 1U rack mount Indoor Unit (IDU) with a cable connecting to an Outdoor Unit (ODU) with an external antenna.



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SYSTEM PARAMETERS

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Frequency	4/L6/U6 GHz	7/8 GHz	10 GHz	11/13 GHZ	
Standards	ETSI/FCC	ETSI	ETSI/FCC	ETSI/FCC	
Operating Frequency (GHz)	3.8 to 4.2 , 4.40 to 5.00 5.90 to 7.10	7.10 to 8.50	10.00 to 10.70	10.70 TO 11.70 12.75 TO 13.25	
Channel BW 28 MHz Channel BW 56 MHz	128 QAM STM-1 32 QAM 1STM-1 / 128 QAM 2*STM-1				
Tx Power (dBm) QPSK 16, 32, 64ΩAM 128, 256QAM	SDT / HI +27/+32 +24/+29 +22/+27		SDT / HI +26/+31 +23/+28 +21/+26	STD / HI +26/+31 +23/+28 +21/+26	
Rx Sensitivity @ 10-6 BER 28 MHz, 56 MHz, 155 / 310 Mbps	-70 -72 / -	dBm 66 dBm	-69 dBm -71/-65 dBm		
Frequency	15 GHz	18 GhzH	23/26 GHz	38 GHz	
Stamdards	ETSI	ETSI/FCC	ETSI/FCC	ETSI/FCC	
Operating Frequency (GHz)	14.40 to 15.35	17.70 to 19.70	21.20 to 23.60 24.55 to 26.45	31.80 to 33.40 37.00 to 39.50	
Channel BW 28MHz Channel BW 56MHz	128 QAM STM-1 32 QAM STM-1 / 128 QAM 2*STM-1				
Tx Power (dBm) QPSK 16, 32, 64QAM 128, 256QAM	STD / HI +25 +22 +20	STD / HI +24 +21 +19	STD / HI +23 +20 +18	STD / HI +18 +15 +13	
Rx Sensitivity @ 10-6 BER 28 MHz, 56 MHz, 155 / 310 Mbps	-69 dBm -67 dBm -71/-65 dBm -69/ -64 dBm		-66 dBm -68/ -63 dBm		
Freqeuncy Stability	0.0010%				
Background BER	<10-12				
Radio ETSI EN 302 217, EN 301 216, EN 301 128, EN 300 198					
Standards Compliance	Power Supply ETSI EN 300	132-2			
	EMC / Safety ETSI EN 301 489 / IEC EN 60950				

PAYLOAD INTERFACE PARAMETERS

PDH	Line Rate	1 to 32 x E1/T1
	Interfaces	120 Ω balanced or 75 Ω unbalanced
	Stamdards Compliance	ITU-T G.703, G783
	Line Rate	Full-Duplex, scalable up to 150 Mbps
Fast Ethernet	Interfaces	2 x 100 Base-Tx
	Stamdards Compliance	IEEE 802.3
	Line Rate	1 or 2 STM -1/ OC3 155.52 Mbps
SDH	Interfaces	Optical Type Sc Single mode 1310nm, Electrical BNC
	Stamdards Compliance	Telcordia
Gigabit Ethernet	Line Rate	Full-Duplex, scalable up to 300 Mbps
	Interfaces	4 x 1000 Base-Tx
	Stamdards Compliance	IEEE 802.3

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MECHANICAL/ENVIROMENTAL

Dimensions	IDU: 19" standard rack (1U), 445 x 238.5 x 44.5mm ODU: D 240mm x 240mm x 70mm
Weight	IDU: 4 Kg; ODU: 6.0 Kg
Operating Temperature	IDU: -5° to +45°C; ODU: -33° to +55°C
Altitude	Up to 4500 meters
Humidity	IDU: 95% condensing; ODU: 100% all-weather
Power Input	-48V DC (-36V to -60V DC)
Power Consumption	IDU: <25 watts; ODU: <25 watts, HP version <35W
Cooling	Natural convection
Coaxial Interfaces	IDU N-type female, ODU N-type female
IDU-ODU Cable	Belden 9913/RG-8, up to 300m
Antenna Interface	Standard Rectangular WG or Coaxial N-type connector (6-11 GHz); proprietary direct mount (13GHz and above)
Standards Compliance	ETSI ETS 300 019

NETWORK MANAGEMENT & CONFIGURATIONS

Support	SNMP, Fully featured Mib, Web based GUI, Embedded HTML server, CLI
Local Access	Ethernet 10/100 Base - T / RJ - 45
Control Channel	In band
Support Configuartions	1+0 (1U), 1+1 (1U)
Radio Protection	Hot stanbdy, hitless switching with frequency or space diversity





DRS/SM 1+0

1+0 Basic Configuration



DRS/SM 2+0 EAST/WEST

2+0 East/West Configuration

The Software Defined IDU supports a 2+0, or east-west, configuration that allows a consecutive point architecture to be achieved with only a single 1 RU chassis at each location. In this configuration the SDIDU contains two modems and may contain two power supplies. One modem is referred to as the west modem and the other as the east modem. The SDIDU is connected to two ODUs, one broadcasting/receiving in one directing of the ring architecture and the other broadcasting/receiving in the other.





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DRS/SM 2+0 EAST/EAST

2+0 East/East Configuration

The SDIDU is capable of aggregating link bandwidth in 2+0 mode to achieve up to 600 Mbps Ethernet throughput when used with the Wideband Modem/IF modules in 56MHz with 128-QAM capable ODUs. The 2+0 East/East configuration allows for the doubling of the throughputs. When configured for 2+0 East/East, the SDIDU balances the traffic between the two links based upon the source and destination MAC addresses of the Ethernet packets. Sufficient diversity of MAC addresses is required to achieve fullutilization of the 2+0 East/East configuration. In the event of a link failure, throughput will only be reduced by one-half, and traffic on the failed link will be automatically re-routed to the remaining link.



DRS/SM 1+1 HSB

Protected Non-Diversity (Hot Standby)

Operating in Protected Non-Diversity mode, also called Hot Standby, one ODU at each location transmits to two ODUs at the other location. This mode does not require the extra bandwidth or interference protection. It provides hitless receive switching and hot standby. The SDIDU automatically switches transmit ODU upon appropriate ODU alarm or ODU interface error, minimizing transmit outage time. The SDIDU supports couplers with asymmetric attenuation. The SDIDU can be configured to automatically compensate for coupler loss during switching.





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DRS/SM 1+1 SD

Space Diversity Configuration

In Protected Diversity mode, the link between each pair of modems is the same, as shown in Figure, providing complete redundancy. This arrangement requires bandwidth for both links and non-interference between the links, but it provides hitless receive and transmit switching. The SDIDU supports both frequency and spatial diversity. In spatial diversity, two non-interfering paths are used. The proprietary framer chooses the best, or error-free, data stream and forwards it to the Line Interface Units (LIUs).



DRS/SM 1+1 FD

Frequency Diversity Configuration

In Protected Diversity mode, the link between each pair of modems is the same, as shown in Figure, providing complete redundancy. This arrangement requires bandwidth for both links and non-interference between the links, but it provides hitless receive and transmit switching. The SDIDU supports both frequency and spatial diversity. In frequency diversity, two frequencies are used to achieve non-interference. The proprietary framer chooses the best, or error-free, data stream and forwards it to the Line Interface Units (LIUs).





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DRS/SM 4+0 EAST/EAST

4+0 East/East Configuration

In addition to aggregating two links, the SDIDU is capable of pairing with another SDIDU to aggregate a total of four links to achieve a maximum throughput of over 1000 Mbps when used with Wideband Modem/IF modules in a 50 or 56 MHz RF cannel BW.

As with 2+0 East/East, the SDIDU balances the traffic among- the four based upon the source and destination MAC addresses of the Ethernet packets. Sufficient diversity of MAC addresses id required to archieve full-utilization of the 4+0East/East configuration.

In the event of a link failure, throughput will only be reduced by one-quarte, and traffic on the failed will be automatically re-routed to the remaining links.





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HIGH CAPACITY MW SYSTEMS

DRS/SM 2+0 XPIC

2+0 XPIC

2+0 XPIC operates similarly to East-East operation. Both links are required to have the same configuration.

Each one carries independent payloads based on channel mapping and Ethernet link Aggregation.

- •-The DRS SDIDU shall insure that the both links are configured to compatible modes.
- •-The DRS SDIDU shall insure that both links are configured to the same frequency.



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2+2 XPIC (Transmitter Switching)

When configured into 2+2 XPIC mode, the DRS SDIDU shall perform transmitter switching as actually implemented for 1+1 transmitter switching. This includes, but is not limited to:

- ODU alarm switching
- ODU disconnect switching
- $\bullet \mbox{Manual switching via GUI, CLI, and SNMP}$
- •Remote protection switching

A protection switch shall also be required if the XPIC Serdes is unlocked.

Each modem shall maintain a "Local protection state", which shall be bad if any of the Protection switching criteria is currently met, and good otherwise. Each modem shall report its "Local protection state" to the XPIC partner modem via the XPIC Serdes interface. The other modem shall track this as the "Serdes remote protection state". The "Serdes remote protection state" shall be set to bad if the XPIC Serdes interface is unlocked. Each modem shall cause a protection switch to occur if either the "Local protection state" OR the "Serdes remote protection state" is bad.





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IDU Master Trunk 2

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GUI EXAMPLE



GUI EXAMPLE

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HIGH CAPACITY MW SYSTEMS

DRS/FI

Digital Radio System/Full Indoor (Hybrid) Frequency Range from 4 to 11GHz



> RFU UHP - In 1+1 configuration

System Features

- Selectable Rates and Interfaces PDH Options
 - > Up to 16 x E1/T1
 - > 100BaseTX/Ethernet: Scalable 1-100 Mbps
 - > DS-3/E-3/STS-1
 - Super PDH Options
 - > Up to 32 x E1/T1
 - > 100 BaseTX/Ethernet: Scalable 1-100 Mbps
 - SDH Options
 - > 1-2 x SDH STM-1/0C-3 SONET
 - GigaBit Ethernet
 - > 2E1+ 4x1000BaseTx/Ethernet: Scalable 1-310 Mbps
- Support for multiple configurations for both PDH and SDH 1+0, 1+1 protection/diversity Hot Standby
- East/West Repeater (2 + 0) • Selectable Spectral Efficiency of 0.8 to 6.25 bits/Hz (including FEC
- and spectral shaping effects)QPSK, 16 –256 QAM Modulation
- Powerful Trellis Coded Modulation concatenated with Reed-Solomon Error
- Correction
- Built-in Adaptive Equalizer
- Support of Voice Orderwire Channels
- Adaptive Power Control
- Built-in Network Management System (NMS)
- Consecutive Point ring architecture Built-in Bit Error Rate (BER) performance monitoring

Integrated Crosspoint switch: allows a total of 160 E1s (200 T1s) to be mapped any-to-any between front-panel ports and RF link(s).

Optional STM-1 Mux/Demux: allows the SDIDU^M to extract up to 63 E1 (or 84 T1) from an STM-1. In conjunction with an integrated Crosspoint Switch, up to 223 E1 (284 T1s) can be mapped any-to-any between front-panel ports, STM-1, and RF link(s).



The SkyLinks DRS/FI provides a cost-effective solution to high capacity data transmission requirements. Operating from 4 to 38GHz, it features compact/easy -to -install IDU and RFU.

The DRS/FI provides user accessibility functions including Transmit Power, Receive Signal Level (RSL), and operating frequency. Additionally, it features enhanced software allowing capacity/configuration upgrade, downloadable field upgrades and an optional embedded SNMP agent for advanced network management capabilities, making it the ideal solution for networks operated by mobile service providers, internet service providers (ISP), utilities, public telephone operators, local governments, TV networks and corporate users. The DRS/FI represents a new microwave architecture designed to address universal applications where the customers/installations require all the equipments to be fitted indoor into standard 19"RU.

The RFU (\overrightarrow{GRU}) is actually mounted in the rear side in vertical position in order to easy connect the antenna port flanges to the WG feeders. The same RFU can be used for PDH, SDH and IP applications offering modulation schemes from QPSK up to 256QAM, and selectable channel BW of 3.5, 7, 14 and 28 MHz (from 10 to 56 Mhz in the WB option). The Software Defined Indoor Unit (SDIDU) offers a basic configuration, suitable for PDH application and can be upgraded with simple fw and plug-in hw modules for Super PDH, SDH, FE, GE and ASI options. This advanced technology platform is designed to provide the flexibility to customers for their current and future network needs. The RFU is fully calibrated over the temperature range ($-5 + 45^{\circ}$ C).

The RFU supports all applications within the same HW platform covering from QPSK up to 128, 256QAM with very low Phase Noise and superior reliability (high MTBF).

The IDU supports both 1+0 and 1+1 protection and Ring architectures, it is provided in a chassis arrangement 1U 19 inch standard rack. The modem and power supply functions are supported using easily replaceable plug-in modules. An additional feature of the IDU is provision for a second plug-in modem / IF module to provide repeater or transit network configurations (East/West) or Capacity Doubling (East/ East).

SkyLinks Digital Radio System includes integrated Operations, Administration, Maintenance, and Provisioning (OAM&P) functionality and also Design features enabling simple commissioning for the radio network installation in the customer's premises.

Another highlight of Skylinks Radio Products is the scalability and the capability to support a Ring architecture. This Ring or consecutive point radio architecture is self-healing in the event of an outage in the link and automatically re-routes data traffic, thereby ensuring the continuity of service to the end user.

The overall architecture consists of a single 1U rack mount Indoor Unit (IDU) with a cable connecting to a Full Indorr RFU and then to an external antenna by means a WG feeders.



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DRS/FI

SYSTEM PARAMETERS

Frequency	4/L6/U6 GHz 7/8 GHz		10 GHz	11 GHZ	
Standards	ETSI/FCC	ETSI	ETSI/FCC	ETSI/FCC	
Operating Frequency (GHz)	3.8 to 4.2, 4.40 to 5.00 7.10 to 8.50 5.90 to 7.10 7.10 to 8.50		10.00 to 10.70	10.70 TO 11.70 12.75 TO 13.25	
Channel BW 28MHz Channel BW 56MHz	128 QAM STM-1 32 QAM 1STM-1 / 128 QAM 2*STM-1				
Tx Power (dBm) QPSK 16, 32, 64QAM 128, 256QAM	VH +3 +3 +3	P / UHP 55/+40 52/+37 50/+35	VHP / UHP +34/+38 +31/+35 +29/+33		
Rx Sensitivity (dBm) @10-6 BER 28MHz, 56MHz, 155 / 310Mbps	-7	-70 2 / -66	-69 -71/-65		
Freqeuncy Stability	0.0010%				
Background BER	<10-12				
Standards Compliance	Radio ETSI EN 302 217, EN 301 216, EN 301 128, EN 300 198				
	Power Supply EISE N 300 132-2 EMC / Safety ETSI EN 301 489 / IEC EN 60950				

PAYLOAD INTERFACE PARAMETERS

	Line Rate	1 to 32 x E1/T1
PDH	Interfaces	120 Ω balanced or 75 Ω unbalanced
	Stamdards Compliance	ITU-T G.703, G783
	Line Rate	Full-Duplex, scalable up to 150 Mbps
Fast Ethernet	Interfaces	2 x 100 Base-Tx
	Stamdards Compliance	IEEE 802.3
	Line Rate	1 or 2 STM -1/ OC3 155.52 Mbps
SDH	Interfaces	Optical Type Sc Single mode 1310nm, Electrical BNC
	Stamdards Compliance	Telcordia
Gigabit Ethernet	Line Rate	Full-Duplex, scalable up to 300 Mbps
	Interfaces	4 x 1000 Base-Tx
	Stamdards Compliance	IEEE 802.3



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		MECHANICAL/ENVIROMEN	TAL	
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Dimensions	IDU: 19" standard rack (1U), 445 x 238.5 x 44.5mm - RFU: 19" Rack 6U 482 mm x266mm x 126mm			
Weight	IDU: 4 Kg; RFU: 9,8 Kg	DU: 4 Kg; RFU: 9,8 Kg		
Operating Temperature	IDU & RFU: -5° to +45°C	IDU & RFU: -5° to +45°C		
Altitude	Up to 4500 meters			
Humidity	IDU: 95% condensing; ODU: 100% all-weather			
Power Input	-48V DC (-36V to -60V DC)			
Power Consumption	IDU: <25 watts; RFU: Standard < 55 W, High <145 W			
Cooling	Natural convection			
Coaxial Interfaces	IDU N-type female			
Antenna Interface	4 GHz	6GHz	7/8 GHz	10/11 GHZ
	UDR48/N-Type	UDR70 (CPR137)	UDR84	UDR100/120
IDU-RFU Cable	N-Type			

NETWORK MANAGEMENT & CONFIGURATIONS

Support	SNMP, Fully featured Mib, Web based GUI, Embedded HTML server, CLI
Local Access	Ethernet 10/100 Base - T / RJ - 45
Control Channel	In band
Support Configuartions	1+0 (1U), 1+1 (1U)
Radio Protection	Hot stanbdy, hitless switching with frequency or space diversity



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DRS/F1 1+0

1+0 Basic Configuration



DRS/F1 2+0 EAST/WEST

2+0 East/West Configuration

The Software Defined IDU supports a 2+0, or east-west, configuration that allows a consecutive point architecture to be achieved with only a single 1 RU chassis at each location. In this configuration the SDIDU contains two modems and may contain two power supplies. One modem is referred to as the west modem and the other as the east modem. The SDIDU is connected to two ODUs, one broadcasting/receiving in one directing of the ring architecture and the other broadcasting/receiving in the other.



DRS/F1 2+0 EAST/EAST

2+0 East/East Configuration

The SDIDU is capable of aggregating link bandwidth in 2+0 mode to achieve up to 600 Mbps Ethernet throughput when used with the Wideband Modem/IF modules in 56MHz with 128-QAM capable ODUs. The 2+0 East/East configuration allows for the doubling of the throughputs. When configured for 2+0 East/East, the SDIDU balances the traffic between the two links based upon the source and destination MAC addresses of the Ethernet packets. Sufficient diversity of MAC addresses is required to achieve fullutilization of the 2+0 East/East configuration. In the event of a link failure, throughput will only be reduced by one-half, and traffic on the failed link will be automatically re-routed to the remaining link.



DRS/FI 1+1 HSB

Protected Non–Diversity Configuration (Hot Standby)

Operating in Protected Non-Diversity mode, also called Hot Standby, one ODU at each location transmits to two ODUs at the other location. This mode does not require the extra bandwidth or interference protection. It provides hitless receive switching and hot standby. The SDIDU automatically switches transmit ODU upon appropriate ODU alarm or ODU interface error, minimizing transmit outage time. The SDIDU supports couplers with asymmetric attenuation. The SDIDU can be configured to auto-matically compensate for coupler loss during switching.





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HIGH CAPACITY MW SYSTEMS

DRS/F1 1+1 SD

Space Diversity Configuration

In Protected Diversity mode, the link between each pair of modems is the same, as shown in Figure, providing complete redundancy. This arrangement requires bandwidth for both links and non-interference between the links, but it provides hitless receive and transmit switching. The SDIDU supports both frequency and spatial diversity. In spatial diversity, two non-interfering paths are used. The proprietary framer chooses the best, or error-free, data stream and forwards it to the Line Interface Units (LIUs).



DRS/F1 1+1 FD

Frequency Diversity Configuration

In Protected Diversity mode, the link between each pair of modems is the same, as shown in Figure, providing complete redundancy. This arrangement requires bandwidth for both links and non-interference between the links, but it provides hitless receive and transmit switching. The SDIDU supports both frequency and spatial diversity. In frequency diversity, two frequencies are used to achieve non-interference. The proprietary framer chooses the best, or error-free, data stream and forwards it to the Line Interface Units (LIUs).





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HS/SM

High Speed/Split Mount (IP native)



Main Features

- Up to 310Mbps data throughput, full duplex.
- Available modulation schemes:
- Programmable QPSK/6QAM/32QAM/64QAM/128QAM/256QAM.
- Available channel bandwidth:
 - ETSI standards : 7/14/28/40 and 56 MHz
 - ANSI standards : 10/20/30/40 and 50 MHz.
- Customer network data interface:
 - 1 x Gigabit Ethernet (100/1000Base-T)
 - 1.1 x 10/100BaseTX for data or management

Options

- 2 or 4 x ASI (BNC input/output)
- 1-2 x E1 / T1 plug-in extension module
- 1 x E3 / DS3 plug-in extension module

> SDIDU - HS - In configuration 1 + 0 (Option)

System Features

- The smallest IDU in the market! Possibility to place 2 IDUs in 1U 19" std. rack module.
- QPSK, 16 –256 QAM Modulation
- FEC Forward Error Correction with Reed-Solomon Coding
- Built-in Adaptive Modulation system with dynamic capacity allocation and priority data transmission (PBPS Packet Based Priority System)
- Asymmetrical data rates different modulation setup for upstream and downstream
- On-line Ethernet packet compression with reduced length of frames allowing throughput efficiency increase up to 25%
- Two USB ports for connecting USB-flash disk or PC
- "In-Band"/"Out-of-Band" Management
- NAT, Proxy ARP support for effective IP management setup

Option

310Mbps @ 256QAM

56Mhz Ch BW

- Large range of System and Ethernet Counters
- Adaptive Power Control ATCP

Default

155 Mbps @ 128 QAN 28 MHz Ch BW

- Built-in Network Management System (NMS) Web, SNMP, TELNET
- Built-in Bit Error Rate (BER) Tester + Built-in Spectrum analyzer







The SKYLINKS High Speed/Split Mount Radio System HS/SM provides a cost-effective solution to high capacity data transmission requirements. Operating in the licensed bands from 1.4 to 43GHz, it is composed by new very compact IDU and ODU with enhanced features that include line interface, alarms and diagnostics and network management interfaces.

Easy-to-install, HS/SM provides user accessibility functions including Transmit Power, Receive Signal Level (RSL), and operating frequency.

Additionally, HS/SM features enhanced software allowing capacity / configuration upgrade, downloadable field upgrades and an optional embedded SNMP agent for advanced network management capabilities, making it the ideal solution for networks operated by mobile service providers, internet service providers (ISP), utilities, public telephone operators, local governments, TV networks and corporate users.

These SKYLINKS Digital Radios represent a new microwave architecture designed to address universal applications for GE platforms. The advanced technology is designed to provide flexibility to customers for their current and future Ethernet network needs. It supports links for high speed wireless Ethernet networking.

It is spectrum and data rate scalable from 5 to 310 Mbps, giving opportunity to service providers and companies to trade-off system gain with spectral efficiency and channel availability for optimal network connectivity.

SKYLINKS HS/SM enables network operators (mobile and private), access service providers and government to provide a portfolio of secure, scalable wireless applications for data, video, and voice over IP (VoIP).

This family includes the following blocks: Indoor Unit (IDU), Outdoor Unit (ODU) and Antenna.

Mainly used Antennas are the Arkivator (previously Comhat) low profile to connect through a flex WG up to 11 GHz or directly connect with the patented WG interface from 13 to 38 GHz; other manufactures' aerials like, e.g., the Andrew Valuline[™] might be used on custom requirement.

The Software Defined Indoor Unit is designed to be frequency independent, and the Outdoor Unit is designed to be capacity independent. The companion ODU can supports frequency bands from 1.4 to 43 GHz with high linearity allowing high order modulation scheme, high Output Power and low consumption.

The ODU is fully calibrated over the temperature range and operates down to -50°C (optional).

The ODU covers from QPSK up to 256QAM with very low Phase Noise and superior reliability (high MTBF).

The SDIDU supports 1+0 configuration and it is it is provided in a chassis arrangement 1U half-19" standard rack.

Additional features of the SDIDU is provision for a plug-in module to provide either 2xE1 or 1xE3 wayside channel interfaces.

The overall architecture consists of a single 1U "half size" rack mount Software Defined Indoor Unit (SDIDU) with a cable connecting to an Outdoor Unit (ODU) with an external antenna.



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HS/SM

SYSTEM PARAMETERS

Frequency	4/6 GHz	7/8 GHz	10 GHz	11/13 GHz	15 GHz	18 GHz	23GHz	31/38 GHz
Standard	ETSI/FCC	ETSI	ETSI/FCC	ETSI	ETSI	ETSI/FCC	ETSI/FCC	ESTI/FCC
Operating Frequency (GHz)	3.7 to 4.42, 4.40 to 5.00 - 5.90 to 7.10	7.10 to 8.50	10.00 to 10.70	10,70 to 11,70 12.75 to 13.25	14.40 to 15.35	17.70 to 19.70	21.20 to 23.60 24.55 to 26.45	31.80 to 33.40 - 37.00 to 39.50
Channel BW 28 MHz Channel BW 56 MHz		128QAM STM-1 32QAM STM-1/128QAM 2*STM-1						
Tx Power (dBm) QPSK 16, 32, 64QAM 128, 256QAM	SDT / HI +27/+32 +24/+29 +22/+27		SDT +26/ +23/ +21/	/ HI /+31 /+28 /+26	SDT +25 +22 +20	SDT +24 +21 +19	SDT +23 +20 +18	SDT +18 +15 +13
Rx Sensitivity (dBm) @10 ⁻⁶ BER 28 MHz, Mbps 56 MHz, 155/310Mbps	-70 dBm -72/-66 dBm		-69 dBm -71/-65 dBm		-69 dBm -71/-65 dBm	-67 dBm -69/-64 dBm		-66 dBm -68/-63 dBm
Frequency Stability	0.0010%							
Background BER	< 10-12							
Standard Compliance	Radio ETSI EN 302 217, EN 301 216, EN 301 128, EN 300 198 Power Supply ETSI EN 300 132-2							
	EMC / Safety EISI EN 301 489 / IEC EN 60950							

PAYLOAD INTERFACE PARAMENTERS

	Line Rate	1 or 2 x 2048/1 x 34.368 Mbps	
E1/E3	Interfaces	Optical Type SC single mode 1310nm, Electrical BNC	
	Standards Compliances	Telcordia	
	Line Rate	Full Duplex, scalable up to 310 Mbps	
Gigabit Ethernet	Interfaces	G703 RJ45/BNC	
	Test Utility	Loopback, Internal BER tester	
	Half-Duplex-TX	4 X AS TX	
ASI	Half-Duplex-RX	4 X ASI RX	
	Full-Duplex	2X ASI TX + 2X ASI RX	

	CONFIGURATION
Supported Configurations	1+0 (1U), 1+1 (1U)
Radio Protection	Hot standby, hitless switching with frequency or space diversity



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MECHANICAL/ENVIROMENTAL

Dimensions	IDU: Half 19" standard rack (1U), 210 x 44 x 210 mm. ODU: 260mm x 160mm
Weight	IDU: 2 Kg; ODU: 6.0 Kg
Operating Temperature	IDU: -5° to +45°C; ODU: -33° to +55°C (arctic Option -55°C)
Altitude	Up to 4500 meters
Humidity	IDU: 95% condensing; ODU: 100% all-weather
Power Inpu	-48V DC (-36V to -60V DC)
Power Consumption	IDU + ODU: Standard <25W, High <35W
Cooling	Natural convection
Coaxial Interfaces	IDU N-Type connector female, ODU N-Type connector female
IDU-ODU Cable	Belden 9913/RG-8, up to 300m
Antenna Interface	Standard Rectangular WG or Coaxial N-type connector (6-11 GHz); proprietary direct mount (13GHz and above)
Standards Compliance	ETSI ETS 300 019, Part 1-3 Class 3.2 (IDU) - Part 1-4 Class 4.1 (ODU)

NETWORK MANAGEMENT

Support	SNMP, WEB based GUI, TELNET, ASCII console
Local Access	Ethernet 10/100 Base-T / RJ-45, RS232, USB-A, USB-B
Out-of-Band Management	115 Mbps
In-band Management	Via LAN
IP Addresses	Primary, secondary
IP Option	NAT, Proxy ARP
IP Utilities	Ping, telnet





HS/SM 1+0

1+0 Basic Configuration



HS/SM 2+0

2+0 Capacity Doubler Configuration







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GUI EXAMPLE

		* REMOTE	H HSLINK
Sky	TxP: 27dBm	TxP: 27dE	3m Logour
Links	RxL: -40dBm	RxL: -41dE	im ADMIN
Wed 29.02.2012 11:33:03	TXF: 0052.000W112 OK	OK 14F. 0510.000W	WRITE WO
	General Alarms Radio Ports IP	Count Maintenance	
PEEPESH	ODU CONFIGURATION		HELP
NET REOIT	ODU Setting: ok	Setting: local only -	Description
Parameters	Remote Cmd: not applied		Basic Radio Configuration
Analuzor	¹⁾ TX Frequency: 8052.000MHz	TX Band: 8017 -8136	1) These parameters will be
Analyzei	"RX Frequency: 8318.000MHz	Actual T/R: 266.000	set on both sides when
Diagram	Max TX Power: 27dBm	IXP Range: 027	Second=local+temote
ODII Detaile		ATPC RxL: -55dBm	Details ODU Setting:
ODO Detalia	ODU Mute: auto -	Status: unmuteo Status: wide	confirmation that ODU
IDU Details	Spectrum: auto	Status: no inversion	was configured Remote Cmd:
	ODU Supply: on V	Status, no intersion	status of last
	MODEM CONFIGURATION		(valid only for)
	¹⁾ ActualModulation: gam128 56e6 01 2	284.81Mb ▼ (-27dB-65dBm)	(local+remote selection) TX Band (T/R):
	¹⁾ Enable ACM:	i	valid TT freq. and T/R
	¹⁾ ACM0 - High: none		(correct frequency must be lowered/increased
	1)ACM1 - Mid: none	-	about one half of BW)
	1)ACM2 - Low: none	-	SPECIAL SETTING
	User Rate: 273.99Mbps		spectrum: spectrum inversion request
	MSE: -35.3dB	Sync: ok	(for special purposes only) ACM:
	AGC Mode: auto -	AGC Gain: 29.026dB	Enable adaptive modulation
	Modulation: on -		(AGMO is used for best receive conditions,
	¹⁾ Latency Mode: standard •		ACM2 is used for
		Apply Undo	AGC Mode:
			modes of IDU AGC loop for cable loses
			compensation
			latency of ETH port
			selection
Uptime : 0d 00:11:04			© SKYLINKS - www.skvlinks.it

GUI EXAMPLE



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HIGH CAPACITY MW SYSTEMS

HS/F1 All-in-One

High Speed/Full Indoor (IP native)





Main Features

- Up to 310Mbps data throughput, full duplex.
- Available modulation schemes:
- Programmable QPSK/6QAM/32QAM/64QAM/128QAM/256QAM.
- Available channel bandwidth:
 - ETSI standards : 7/14/28/40 and 56 MHz
 - ANSI standards : 10/20/30/40 and 50 MHz.
- Customer network data interface:
 - 1 x Gigabit Ethernet (100/1000Base-T)
 - 1.1 x 10/100BaseTX for data or management

Options

- 2 or 4 x ASI (BNC input/output) OPTION
- 1-2 x E1 / T1 plug-in extension module OPTION
- 1 x E3 / DS3 plug-in extension module OPTION



The SKYLINKS High Speed/Full Indoor All-in-One MW Radio System provides a cost-effective solution to high capacity data transmission requirements. Operating in the licensed bands from 4 to 11GHz (lower frequencies down to 1,4GHz and higher up to 14GHz available upon request), it is fitted into a 2RU chassis where both modem and RF units are included. The result is a brand new equipment specifically designed for application where room saving is a constraint.

It has enhanced features that include line interface, alarms and diagnostics and network management interfaces.

The ASI interface is a PLUS that enhance this complete radio terminal into the broadcasting market as a top level, brilliant star.

Easy-to-install, All-in-One provides user accessibility functions including Transmit Power, Receive Signal Level (RSL), and operating frequency.

Additionally, All-in-One features enhanced software allowing capacity/configuration upgrade, downloadable field upgrades and an optional embedded SNMP agent for advanced network management capabilities, making it the ideal solution for networks operated by mobile service providers, internet service providers (ISP), utilities, public telephone operators, local governments, TV networks and corporate users.

These SKYLINKS Digital Radios represent a new microwave architecture designed to address universal applications for GE platforms and thanks to the ASI interface to meet the most evolved broadcasters. The advanced technology is designed to provide flexibility to customers for their current and future networking needs.

It supports links for high speed wireless Ethernet networking, through the optional sw upgrade that delivers up to 310Mbps in a 56MHz ch BW (for this option a specific license has to be acquired).

It is spectrum and data rate scalable from 4 to 310Mbps, giving opportunity to service providers and companies to trade-off system gain with spectral efficiency and channel availability for optimal network connectivity.

SKYLINKS All-in-One enables broadcasters and network operators (mobile and private), private, defense and utilities, to provide a portfolio of secure, scalable wireless applications for data, video, and voice over IP (VoIP).

System Features

- Complete Digital Microvwave System placed into a 2RU 19" std.
- QPSK, 16-256 QAM Modulation
- FEC Forward Error Correction with Reed-Solomon Coding
- Built-in Adaptive Modulation system with dynamic capacity allocation and priority data transmission (PBPS Packet Based Priority System)
- Asymmetrical data rates different modulation setup for upstream and downstream
- On-line Ethernet packet compression with reduced length of frames allowing throughput efficiency increase up to 25%
- Two USB ports for connecting USB-flash disk or PC
- "In-Band"/"Out-of-Band" Management
- NAT, Proxy ARP support for effective IP management setup
- Large range of System and Ethernet Counters
- Adaptive Power Control ATCP
- Built-in Network Management System (NMS) Web, SNMP, TELNET
- Built-in Bit Error Rate (BER) Tester + Built-in Spectrum analyzer



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HS/FI All-in-One

SYSTEM PARAMETERS

Frequency	4 GHz	6/7/8 GHz	10/11 GHz
Standards	ETSI/FCC	ETSI	ETSI/FCC
Operating Frequency (GHz)	3.8 to 4.2, 4.40 to 5.00 7.10 to 8.50 5.90 to 7.10 5.90 to 7.10		10.70 to 11.70
Channel BW 28 MHz Channel BW 56 MHz	128 QAM 157 Mbps 32 QAM 157 Mbps / 128 QAM 310 Mbps		
Tx Power (dBm) QPSK 16, 32, 64QAM 128, 256QAM	VHP / UHP +35/+40 +32/+37 +30/+35		VHP / UHP +34/+39 +31/+35 +29/+33
Rx Sensitivity (dBm) @ 10-6 BER 28 MHz, 157 Mbps 56 MHz, 157 / 310 Mbps	-70 -72 /-66		-69 -71 /-65
Frequency Stability	0.0010%		
Background BER	< 10-12		
Standards Compliance	Radio ETSI EN 302 217, EN 301 216, EN 301 128, EN 300 198 Power Supply ETSI EN 300 132-2 EMC / Safety ETSI EN 301 489 / IEC EN 60950		

PAYLOAD INTERFACE PARAMENTERS

	Line Rate	Full-Duplex, scalable up to 310 Mbps
Gigabit Ethernet	Interfaces	1 x 10/100/1000 Base-T (RJ45) 1 x 10/100 base-T (Rj45)
	Maximum packet lenght	1632 Bytes
	Line Rate	1-2 x 2.048 / 1 x 34.368 Mbps
E1 / E3	Interfaces	G703 RJ45 / BNC
	Test Utility	Loopback, Internal BER tester
ASI	Half-Duplex-TX	4 X AS TX
	Half-Duplex-RX	4 X ASI RX
	Full-Duplex	2X ASI TX + 2X ASI RX

MECHANICAL/ENVIROMENTAL

Dimensions	standard rack (2U), 210 x 88 x201mm			
Weight	Kg: 9,8 Kg	Кд: 9,8 Кд		
Operating Temperature	-5° to +45°C			
Altitude	Up to 4500 meters			
Humidity	IDU: 95% non condensing			
Power Input	-48V DC (-36V to -60V DC)			
Power Consumption	< 140 Watts			
Cooling	Air Force Cooled			
Standards Compliance	ETSI ETS 300 019, Part 1-3 Class 3.2			
Antenna Interface	4 GHz	6GHz	7/8 GHz	11 GHZ
	UDR48/N-Type	UDR70 (CPR137)	UDR84	UDR 100/120



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HS/FI All-in-One 1+0

1+0 Basic Configuration



HS/FI All-in-One 2+0

2+0 Capacity Doubler Configuration





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HIGH CAPACITY MW SYSTEMS

HS-LINK/ISM

High Speed–Link/ISM Bands 17 and 24GHz License–Exempt





Main Features

- Up to 310Mbps data throughput, full duplex.
- Available modulation schemes:
- Programmable QPSK/16QAM/32QAM/64QAM/128QAM/256QAM.
- Available channel bandwidth:
 - ETSI standards : 7/14/28/40 and 56 MHz
 - ANSI standards : 10/20/30/40 and 50 MHz.
- Customer network data interface:
 - 1 x Gigabit Ethernet (100/1000Base-T)
 - 1 x 10/100BaseTX for data or management

Options

- 2 or 4 x ASI (BNC input/output)
- 1-2 x E1 / T1 plug-in extension module
- 1 x E3 / DS3 plug-in extension module

Product Features

- Simple configuration reduces deployment time and lowers installation costs
- Compact and Lightweight
- Superior reliability High MTBF

Option

310Mbps @ 256QAM 56Mhz Ch BW

- Fully Calibrated Outdoor Unit with >30 dB Tx Dynamic Range
- 1U "half size" Indoor Unit

Default

155 Mbps @ 128 QAM 28 MHz Ch BW







The SKYLINKS Digital Radio System HS/ISM[™] provides a cost-effective solution to high capacity data transmission requirements. Operating in **the unlicensed bands 17 and 24GHz**, it is composed by new very compact IDU and ODU with enhanced features that include line interface, alarms and diagnostics and network management interfaces.

Easy-to-install, HS/ISM provides user accessibility functions including Transmit Power, Receive Signal Level (RSL), and operating frequency.

Additionally, HS/ISM features enhanced software allowing capacity / configuration upgrade, downloadable field upgrades and an optional embedded SNMP agent for advanced network management capabilities, making it the ideal solution for networks operated by internet service providers (ISP).

The ODU antenna front-end is equipped with a orthogonal circular WG transformer for operating in cross-polarization mode. This solution allows for wider available Bandwidth and low order branching filters for better Receive Sensitivity and higher Output Power

Ilt supports links for high speed wireless Ethernet networking.

It is spectrum and data rate scalable from 5 to 310 Mbps, giving opportunity to service providers and companies to trade-off system gain with spectral efficiency and channel availability for optimal network connectivity.

SKYLINKS HS/ISM enables access service providers to provide a portfolio of secure, scalable wireless applications for data, video, and voice over IP (VoIP). This family includes the following blocks: Indoor Unit (IDU),Outdoor Unit (ODU) and Antenna. Antennas are directly connected through a patented WG interface.

The Software Defined Indoor Unit is designed to be frequency independent, the Outdoor Units are designed to offer the best alternative solution to the "bridging" equipments actually working in the saturated 5GHz Wi-Fl bands.

The ODU covers from QPSK up to 256QAM with very low Phase Noise and superior reliability (high MTBF).

The SDIDU supports 1+0 configuration and it is it is provided in a chassis arrangement 1U half-19" standard rack.

Additional features of the SDIDU is provision for a plug-in module to provide either 2xE1 or 1xE3 wayside channel interfaces.

The overall architecture consists of a single 1U "half size" rack mount Software Defined Indoor Unit (SDIDU) with a cable connecting to an Outdoor Unit (ODU) with an external antenna.

System Features

- The smallest IDU in the market! Possibility to place 2 IDUs in 1U 19" std. rack module.
- QPSK, 16 –256 QAM Modulation
- FEC Forward Error Correction with Reed-Solomon Coding
- Built-in Adaptive Modulation system with dynamic capacity allocation and priority data transmission (PBPS Packet Based Priority System)
- Asymmetrical data rates different modulation setup for upstream and downstream
- On-line Ethernet packet compression with reduced length of frames allowing throughput efficiency increase up to 25%
- Two USB ports for connecting USB-flash disk or PC
- "In-Band"/"Out-of-Band" Management
- NAT, Proxy ARP support for effective IP management setup
- Large range of System and Ethernet Counters
- Adaptive Power Control ATCP
- Built-in Network Management System (NMS) Web, SNMP, TELNET
- Built-in Bit Error Rate (BER) Tester + Built-in Spectrum analyzer

• 5.4-5.8GHz sub-bands available upon request

• 30, 60 and 90 cm diameter parabolic antenna, according to the distance between the 2 link terminals and to the required payload/link availability %



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SYSTEM PARAMETERS

Frequency	17 GHz	24 GHz	
Standards	ETSI/FCC	ETSI/FCC	
Operating Frequency (GHz)	17.10 to 17.30	24.00 to 25.24	
Channel BW 28 MHz Channel BW 56 MHz	128 QAM 157 Mbps 32 QAM 157 Mbps / 128 QAM 310 Mbps		
Tx Power dBm (adjustable from/to) QPSK 16, 32, 64QAM 128, 256QAM	-24/+13 -24/+10 -24/+8	-24/+10 -24/+7 -24/+5	
Rx Sensitivity dBm @ 10-6 BER/128QAM 20 MHz, 100Mbps 28 MHz, 157Mbps 40 MHz, 200Mbps 56 MHz, 300Mbps	-73 -70 -71 -66	-73 -70 -71 -66	
Frequency Stability	0.0010%		
Background BER	< 10-12		
	Radio ETSI EN 302 217, EN 301 216, EN 301 128, EN 300 198		
Standards Compliance	Power Supply ETSI EN 300 132-2		
	EMC / Safety ETSI EN 301 489 / IEC EN 60950		

PAYLOAD INTERFACE PARAMENTERS

	Line Rate	Full-Duplex, scalable up to 310 Mbps
Gigabit Ethernet	Interfaces	1 x 10/100/1000 Base-T (RJ45) 1 x 10/100 base-T (Rj45)
	Maximum packet lenght	1632 Bytes
	Line Rate	1-2 x 2.048 / 1 x 34.368 Mbps
E1 / E3	Interfaces	G703 RJ45 / BNC
	Test Utility	Loopback, Internal BER tester
ASI	Half-Duplex-TX	4 X AS TX
	Half-Duplex-RX	4 X ASI RX
	Full-Duplex	2X ASI TX + 2X ASI RX

MECHANICAL/ENVIROMENTAL

Dimensions	IDU: "HALF"19" standard rack (1U), 210 x 44 x201mm 0DU: D 260mm x H 160mm
Weight	IDU: 2 Kg; ODU: 6.0 Kg
Operating Temperature	IDU: -5° to +45°C; ODU: -33° to +55°C (Arctic option -50°C)
Altitude	Up to 4500 meters
Humidity	IDU: 95% condensing; ODU: 100% all-weather
Power Input	-48V DC (-36V to -60V DC)
Power Consumption	IDU + ODU < 40 Watts
Cooling	Natural convection
Coaxial Interfaces	IDU N-type female, ODU N-type female
IDU-ODU Cable	Belden 9913/RG-8, up to 300m
Antenna Interface	Proprietary direct mount (Circular Waveguide)
Standards Compliance	ETSI ETS 300 019, Part 1-3 Class 3.2 (IDU) - Part 1-4 Class 4.1 (ODU)

NETWORK MANAGEMENT

Support	SNMP, WEB based GUI, TELNET, ASCII console
Local Access	Ethernet 10/100 Base-T / RJ-45, RS232, USB-A, USB-B
Out-of-Band Management	115 Mbps
In-band Management	Via LAN
IP Addresses	Primary, secondary
IP Option	NAT, Proxy ARP
IP Utilities	Ping, telnet

