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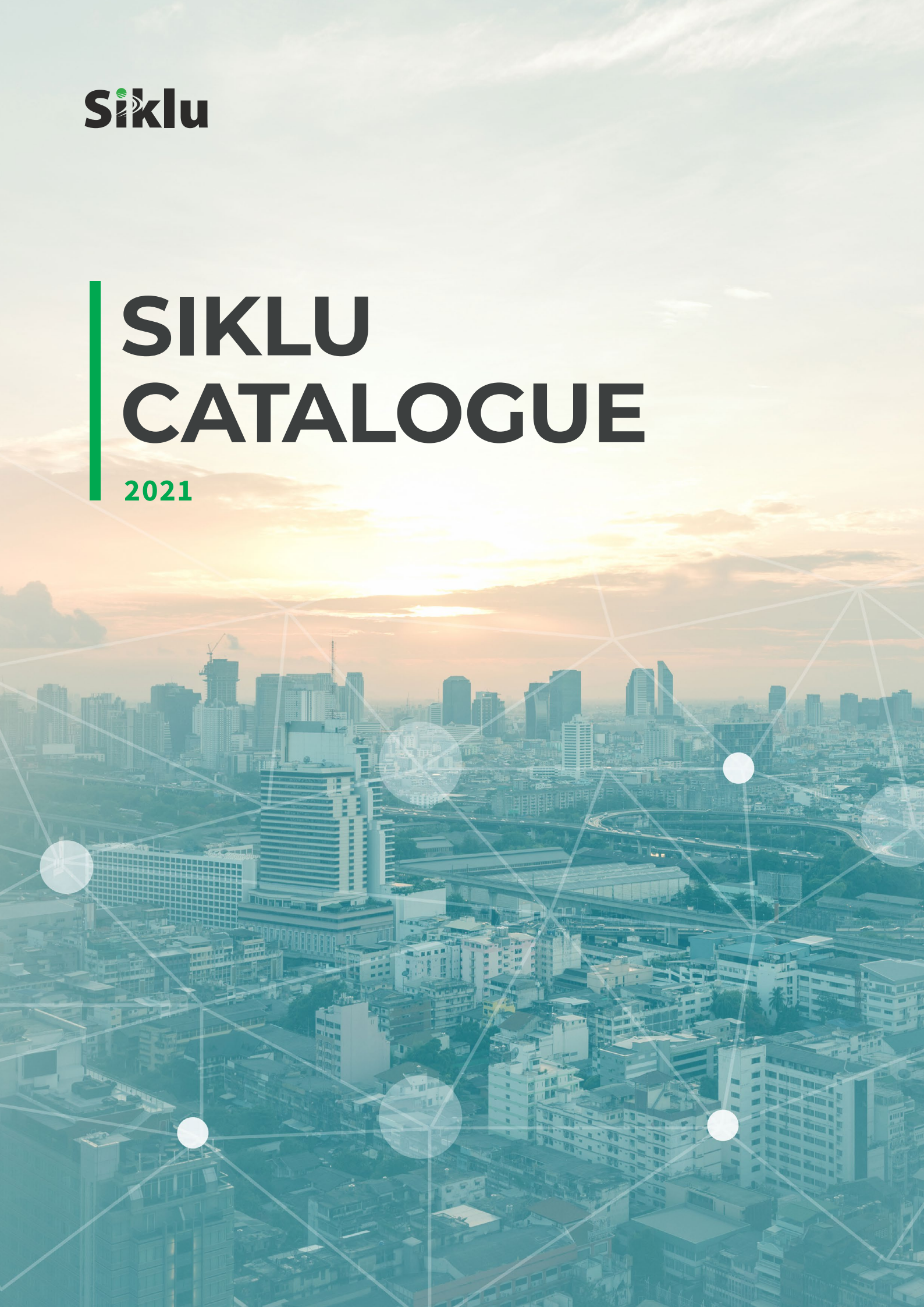
SIKLU CATALOGUE

2021



About Siklu

Siklu delivers multi-gigabit wireless fiber connectivity in urban, suburban and rural areas. Operating in the secure mmWave bands, Siklu's wireless solutions are used by leading service providers and system integrators to provide 5G Gigabit Wireless Access services.

Easily installed on street-fixtures or rooftops, Siklu solutions are also ideal for Smart City projects requiring extra capacity such as video security, WiFi backhaul, and municipal network connectivity all over one network. Thousands of carrier-grade systems worldwide are delivering fast interference-free performance and benefiting a true comprehensive end-to-end solution from planning to deployment.

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EtherHaul™ Kilo Series

ETHERHAUL™ – 1200 SERIES DATASHEET

Carrier-Grade 1000Mbps E-Band radio

The EtherHaul-1200 series provides carrier grade Gigabit connectivity with fast ROI.

Applications for a Wide Range of Markets

- Business Broadband
- GTTH - Gigabit to the Home
- Mobile Backhaul
- Campus Connectivity
- Video Surveillance Connectivity

Most Deployed Millimeter Wave Radio in the World

The EtherHaul-1200 series delivers carrier-grade ultra-high-capacity wireless point-to-point Ethernet. With up to 1000Mbps full-duplex over the uncongested 71-76/81-86GHz spectrum, the EH-1200 provides service providers and businesses around the world with an affordable, advanced wireless solution that is easy to install and maintain.

No Interference – Reliable Operations

Characterized by pencil thin beams, E-band radios guarantee no inter-ference and high reliability. The EH-1200 series has up to 32 non-over-lapping channels that are user selectable, making it the most scalable solution on the market for dense deployments.

Easy Spectrum Acquisition Anywhere

The E-band spectrum is uncongested, even in dense urban areas. E-band offers low licensing fees and quick coordination processes, while maintaining the advantage spectrum protection.

Carrier Grade Performance over Wireless

High throughput and low latency combine to deliver fiber-like performance. Siklu's EH-1200 series incorporates 8 levels of configurable QoS-aware, hitless adaptive bandwidth coding and modulation for high availability. An integrated L2 switch and extra ports enable implementation in resilient topologies like cascade or ring, without the need for additional equipment.

Streamline Operations with Carrier Ethernet & Synchronization

The entire 1200 product line comes with MEF-compliant integrated Carrier Ethernet features that streamline operations with service management and OAM. In addition, the F and T series are designed for mobile operators, with built-in Sync-E and 1588v2 to ensure smooth operation over packet backhaul.

Optional Asymmetric Capacity Optimization

Both T and TX models, with their unique TDD duplexing, allows you to set-up asymmetric capacity configuration. Match your upload/ download rates to your application and optimize use of spectrum, reduce power requirements and lower both CAPEX and OPEX.

Small Size, Easy to Deploy & Manage

The all-outdoor radio has a tiny footprint that eases site acquisition. Its lightweight and small size contribute to a quick and easy installation. Easy to commission and operate with an integrated capacity-tester and a user-friendly intuitive web GUI, manages local and remote units, while also allowing commissioning from a NOC.

Based on a Cost Reducing All-Silicon Technology

The EH-1200 series are based on Siklu's advanced integrated-silicon technology, which increases reliability and reduces size and cost. The result is a very small, very light radio with a proven 90-year MTBF and an unbeatable price/throughput.

The small and light form factor lowers installation costs, and the high reliability reduces site visits, lowering TCO even further.

Best ROI for any Application

The EH-1200 is available in TDD and FDD duplexing schemes, with throughputs scaling up to 1000Mbps full duplex. Selectable antenna sizes, range from street-level ½ft*. to rooftop 1ft. and 2ft. models, and match footprint with distance and link availability requirements.

*½ft antenna model with 38dBi gain, subject to local regulation scheme

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ETHERHAUL™ – 1200 SERIES SPECIFICATIONS

		EH-1200TX	EH-1200T	EH-1200FX	EH-1200F
Topologies	Ring, daisy-chain, mesh	✓	✓	✓	✓
Frequency / Duplexing	71-76GHz, TDD	✓	✓	–	–
	71-76GHz / 81-86GHz, FDD	–	–	✓	✓
Channel Bandwidth, Modulation & Adaptive Coding	32/16/8 non-overlapping channels, 125/250/500MHz wide	✓	✓	–	–
	16/8 non-overlapping channels, 250/500MHz wide ,QPSK ÷ QAM64	–	–	✓	✓
	5 level of hitless adaptive bandwidth, coding and modulation - boost gain by up to 25dB				
Line Rate / Throughput	1Gbps (with capacity license)	✓	✓	✓	✓
System Gain	64/90dB (channel bandwidth = 500MHz, maximum capacity / minimum modulation)	✓	✓	–	–
	71/96dB (channel bandwidth = 500MHz, maximum capacity / minimum modulation)	-	-	✓	✓
Antenna Options	0.5 ft. (16 cm) - 38dBi antenna gain (not applicable for FCC regulation) 1 ft. (31cm) – 43dBi antenna gain 2 ft. (65cm) – 50dBi antenna gain	✓	✓	✓	✓
Interfaces	4xGbE ports, (2x copper RJ-45 + 2x optical SFP SMF/MMF)	✓	✓	2x RJ45	✓
Ethernet Features	IEEE 802.1d transparent bridging. VLAN & VLAN stacking, 4K VLANs MEF 9, 14 and 21 compliant Ethernet services. Smart Pipes Transparent Ports Mode Link aggregation: LAG and LACP (IEEE 802.3ad) Ethernet Ring Protection Switching: ITU-T G.8032 ERPS. Link state propagation. 16KB Jumbo frames. Configurable QOS-aware forwarding. 8 level H-QoS with multi mapping options: L2: 802.1p, VLAN id., L2½: MPLS EXP, L3: DSCP	✓	✓	✓	✓
Security	AES 128-bit and 256-bit	✓	✓	✓	✓
Synchronization	Synchronous Ethernet and 1588v2 TC	–	✓	–	✓
Management & Provisioning	Zero-touch turn up; In-band, out-of-band management Web GUI (one-click configuration of local and remote units) & Embedded CLI SNMPv2/3, TACACS+, RADIUS Link OAM & Connectivity Fault Management (CFM): IEEE802.3ah & IEEE802.1ag; Performance Monitoring: ITU-T Y.1731 IPERF TCP/UDP capacity tester	✓	✓	✓	✓
PoE-Out	Port 2 (IEEE 802.3at)	26W	26W	13W	13W
Power Supply	PoE In PoE++ (IEEE 802.3at+) power consumption without PoE Out, 36÷57VDC (flexible grounding)	26W	26W	40W	40W
Conformance	Radio: FCC CFR Part 101, ETSI EN 302 217-2-2 EMC: USA FCC 47CFR.part 15 & ETSI EN 301 489; Safety: UL/EN 62368-1 and 60950	✓	✓	✓	✓
Environmental	Operating temperature: -45° to +55°C (-49° to +131°F) Ingress protection rating: IP67	✓	✓	✓	✓
Dimensions	ODU + 0.5ft antenna: 7.9” x 9” x 5.9” (20 x 23 x 15cm) ODU + 1ft antenna (Dia. x Depth): 12.6” x 8.6” (32 x 22 cm) ODU + 2ft antenna (Dia. x Depth): 28.7” x 18.1” (73 x 46 cm)	✓	✓	✓	✓
Weight	ODU + 0.5ft antenna: 8.8 lbs (4kg) ODU + 1ft antenna: 11.4 lbs (5.2kg) ODU + 2ft antenna: 30.4lbs (13.8kg)	✓	✓	✓	✓

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ETHERHAUL™ – 2500 SERIES DATASHEET

Efficient 2Gbps E-band radio with extended range

The EH-2500 series provides 2Gbps full-duplex capacity with extended range for accelerating broadband deployment in urban, suburban or rural areas. The carrier grade radio delivers fiber-like performance, reliability and throughput, with low CAPEX.

Applications for a Wide Range of Markets

- Business Broadband
- Video Surveillance Networks
- GTTH - Gigabit To The Home
- Campus Connectivity
- Mobile Backhaul
- Smart City

Robust & Futureproof

The EH-2500 series delivers up to 2Gbps full duplex point-to-point wireless Ethernet connectivity, achieved at only QAM32 modulation, that will future proof your network. Operating over the interference-free 71-76/81-86GHz band, the EH-2500 makes it easy for providers and enterprises to extend their networks maintaining fiber-like performance.

Carrier Grade Performance and Reliability

High throughput and low latency combine to deliver fiber-like performance. Siklu's EH-2500 series hitless adaptive bandwidth coding and modulation, synced with user configurable 8 levels H-QoS, ensure correlated payload prioritization for high availability. An integrated L2 switch with fiber and copper ports enable implementation in resilient topologies like cascade or ring, without the need for additional equipment. In addition, the F series is designed for mobile operators, with built-in Sync-E and 1588v2 ensures the precise TDM synchronization across IP/MPLS/Ethernet backhaul networks.

Small Size, Easy to Deploy & Manage

The all-outdoor radio has a tiny footprint that eases site acquisition. Its light weight and small size contribute to a quick and easy installation. Easy to use web GUI manages local and remote units and commissioning from a NOC is possible.

No Interference – Reliable Operations

Characterized by pencil thin beams, E-band radios guarantee no interference and high reliability. The EH-2500 series has 16 non-overlapping channels that are user selectable, and also support both vertical and horizontal polarizations, making it the most scalable solution on the market for dense deployments.

Easy Spectrum Acquisition Anywhere

The E-band spectrum is uncongested, even in dense urban areas. E-band offers low licensing fees and quick licensing processes, while maintaining the advantage of spectrum protection.

Based on Siklu's Field Proven Platform

The EH-2500 series with its extended-range variant is the 2Gbps evolution of the best-selling EtherHaul™ series - the world's top millimeter-wave radio. Tens of thousands of links have been deployed and are performing reliably in diverse weather conditions all over the globe.

Exceptional Value

The EH-2500F/FX has additional output power and wider channels, making it the longest reach carrier-grade 70/80GHz radios on the market. The advanced 2Gbps system delivers an unbeatable price per MB. Its small and light form factor and simplified commissioning lower installation costs, and its field proven high reliability reduces site visits.

Best ROI for any Application

The EH-2500 is available with multi-step licenses for scalable rollouts. Selectable antenna sizes match footprint with distance and link availability requirements.

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ETHERHAUL™ – 2500 SERIES SPECIFICATIONS

		EH- 2500FX	EH-2500F
Topologies	Ring, daisy-chain, mesh	✓	✓
Frequency / Duplexing	71-76GHz / 81-86GHz, FDD	✓	✓
Channel Bandwidth, Modulation & Adaptive Coding	16/8/5/3 non-overlapping channels, 250/500//750/1250MHz , BPSK ÷ QAM32 Up to 5 level of hitless adaptive bandwidth coding, and modulation - boost gain by up to 25dB	✓	✓
Line Rate / Throughput	2Gbps (with capacity license), Full Duplex	✓	✓
System Gain	84 / 94.5 dB (channel bandwidth = 1,250MHz, maximum capacity / minimum modulation) 75 / 98 dB (channel bandwidth = 500MHz, maximum capacity / minimum modulation	✓	✓
Antenna Options	0.5 ft. (16 cm) - 38dBi antenna gain (not applicable for FCC regulation) 1 ft. (31cm) – 43dBi antenna gain 2 ft. (65cm) – 50dBi antenna gain	✓	✓
Interfaces	4xGbE ports, (2x copper RJ-45 + 2x optical SFP SMF/MMF)	✓	✓
Ethernet features	IEEE 802.1d transparent bridging. VLAN & VLAN stacking, 4K VLANs MEF 9, 14 and 21 compliant Ethernet services. Smart Pipes Transparent Ports Mode Link aggregation: LAG and LACP (IEEE 802.3ad) Ethernet Ring Protection Switching: ITU-T G.8032 ERPS. Link state propagation. 16KB Jumbo frames. Configurable QOS-aware forwarding. 8 level H-QoS with multi mapping options: L2: 802.1p, VLAN id., L2½: MPLS EXP, L3: DSCP	✓	✓
Security	AES 128-bit and 256-bit (order based HW model)	✓	✓
Synchronization	Synchronous Ethernet and 1588v2 TC	–	✓
Management & provisioning	Zero-touch turn up; In-band, out-of-band management Web GUI (one-click configuration of local and remote units) & Embedded CLI SNMPv2/3, TACACS+, RADIUS Link OAM & Connectivity Fault Management (CFM): IEEE802.3ah & IEEE802.1ag; Performance Monitoring: ITU-T Y.1731	✓	✓
PoE-Out	Port 2: up to 13W (IEEE 802.3af)	✓	✓
Power Supply	Dual Input, PoE In PoE++ (IEEE 802.3at+), 45W without PoE-Out, 60W with PoE Out or 36÷57VDC (flexible grounding); Hot Standby	✓	✓
Conformance	Radio: FCC CFR Part 101, ETSI EN 302 217-2-2 EMC: USA FCC 47CFR.part 15 & ETSI EN 301 489 Safety UL/EN 62368-1 & 60950	✓	✓
Environmental	Operating Temperature: -45° to +55°C (-49° to +131°F) Ingress Protection Rating: IP67	✓	✓
Dimensions	ODU + 0.5ft antenna: 7.9” x 9” x 5.9” (20 x 23 x 15cm) ODU + 1ft antenna (Dia. x Depth): 12.6” x 8.6” (32 x 22 cm) ODU + 2ft antenna (Dia. x Depth): 28.7” x 18.1” (73 x 46 cm)	✓	✓
Weight	ODU + 0.5ft antenna: 8.8 lbs (4kg) ODU + 1ft antenna: 11.4 lbs (5.2kg) ODU + 2ft antenna: 30.4lbs (13.8kg)	✓	✓

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ETHERHAUL™ – 8010FX DATASHEET

10Gbps 70/80GHz Radio – Wireless Fiber Connectivity

The EH-8010FX delivers up to 10Gbps Full Duplex throughput for high capacity networks in Metro, Aggregation and Infrastructure or Backhaul applications.

Applications for a Wide Range of Vertical Markets

- Fiber Network Extension/ Backup
- Enterprise Multi Gigabit-Connectivity
- Metro and Aggregation Networks
- Multi-Dwelling Unit Gigabit Broadband

Up to 10Gbps Over Longer Distances

The EH-8010FX radio delivers up to 10Gbps full duplex point-to-point wireless Ethernet connectivity with the longest mmWave reach by means of the highest system gain in the market. This advantage can be extended to several miles with the ExtendMM™ feature. Incorporating dozens of Siklu innovations, the EH-8010FX is based on the same platform that has been deployed in tens of thousands of links from the EtherHaul™ family.

Carrier Class Construction and Performance

High throughput and low latency combine to deliver fiber compatible performance. The EH-8010FX incorporates adaptive bandwidth coding and modulation together with QOS awareness(1) for high availability and easy integration with Ethernet switches or MPLS routers in highly resilient topologies. The EH-8010FX is designed to connect into existing networks with its support for both copper and fiber 10G interfaces allowing service providers and enterprises to extend their copper or fiber networks.

Small Size, Easy to Deploy & Manage

The all-outdoor radio has a small footprint and is light weight which makes site acquisition a breeze. The product comes pre-configured out of the box with no license to download greatly simplifying the time and cost for installation. The intuitive web GUI manages local and remote units to enable fast commissioning and configuration.

Wire-speed, AES Secure

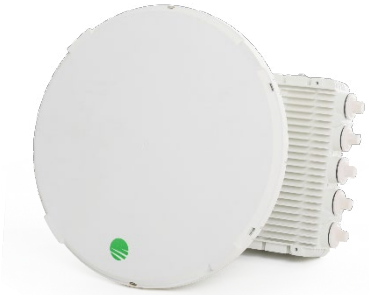
Innovative all-HW bridging and AES encryption ensure high-throughput and low latency at any traffic load levels or packet sizes, maintaining high performance and no bottle necks for all the services in the network backbone.

Exceptional Value, from 2Gbps to 10Gbps

Scalable capacity from 2Gbps full duplex to 10 Gbps full duplex allows deploying what you need and when you need. And with its IP67 construction, the EH-8010FX is extremely rugged and designed to last for years of growth in the harshest conditions at a price that yields quick Return-On-Investment (ROI) and minimizes Total Cost of Ownership (TCO). The advanced up-to-10Gbps system delivers an unbeatable price per Gb. Its small and light form factor lowers installation costs, increases reliability and reduces site visits.

Massive Spectrum Availability, and High Reuse

The EH-8010FX operates over the interference-free 71-76/81-86GHz E-Band spectrum, with a total of 10GHz of bandwidth for use worldwide. By using a high-gain pencil-beam antenna, this helps guarantee spectrum will be available everywhere and maximizes spectrum re-use. Additionally, E-band systems are governed by low licensing fees and quick licensing processes.



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ETHERHAUL™ – 8010FX SPECIFICATIONS

Topologies	Point to Point
Frequency / Duplexing	71-76GHz / 81-86GHz, FDD
Channel Bandwidth, Modulation & Adaptive Coding	250, 500, 1,250 & 2,000MHz; BPSK to QAM128; Up to 9 levels of hitless adaptive bandwidth, coding and modulation – boost gain by over 29dB
Line Rate / Throughput	Up to 10,000Mbps full duplex (with capacity license)
System Gain	64 / 93 dB (channel bandwidth = 2,000MHz, maximum capacity / minimum modulation) 75 / 97.5 dB (channel bandwidth = 500MHz, maximum capacity / minimum modulation)
Antenna Options	0.5 ft. (16 cm) - 38dBi antenna gain (not applicable for FCC regulation) 1 ft. (31cm) – 43dBi antenna gain 2 ft. (65cm) – 50dBi antenna gain
Interfaces	1 combo 10GE port: 802.3ab/bz/an (RJ-45, CAT6a or better) or SFP+ (MMF or SMF) 1GE port: 802.3ab (RJ-45, CAT5e or better)
Ethernet features	Ethernet transparent bridge with flow control VLAN support(1) Jumbo frames Configurable QOS aware forwarding(1): 8-levels, L2: 802.1p, L3: DSCP LLDP
Security	AES 128-bits (order based HW model)
Management & Provisioning	In / Out-of-band management; Web GUI or CLI IPv4 or IPv6 SNMPv2/3, TACACS+, RADIUS Zero-touch turn-up
PoE-Out	
Power Supply	Dual input: PoE++ (4 pairs 802.3at type 2 PD) or 42÷57VDC; 50W; Hot standby
Conformance	Radio: USA FCC Part 15.101 & ETSI EN 302 217 EMC: USA FCC 47CFR.part 15 & ETSI EN 301 489 Safety UL/EN 62368-1 and 60950
Environmental	Operating Temperature: -45° to +55°C (-49° to +131°F) Ingress Protection Rating: IP67
Dimensions	ODU + 0.5ft antenna: 11” x 8.2” x 5.7”, 28cm x 21cm x 14.5cm (H x W x D) ODU + 1ft antenna: 12.6” x 8.2”, 32cm x 21cm (Dia. x Depth) ODU + 2ft antenna: 25.6” x 13.4”, 65cm x 34cm (Dia. x Depth)
Weight	ODU + 0.5ft antenna: 9.2 lbs (4.1kg) ODU + 1ft antenna: 11.7 lbs (5.3kg) ODU + 2ft antenna: 30.6lbs (13.9kg)

(1) HW revision dependent

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02

EtherHaul™ Hundred Series

ETHERHAUL™ – 600/614 SERIES DATASHEET

Street-level gigabit V-band radios

Applications for a Wide Range of Vertical Markets

- Safe/Smart City Networks
- Business Broadband
- Wi-Fi Hotspot Backhaul
- Gigabit to the Home (GTTH)
- Small Cell Backhaul

Gigabit Throughput on Every Street

The EtherHaul™-600 series delivers up to 1Gbps in a form factor that is small enough and rugged enough to be deployed at street level on poles and light fixtures. With the EH-614, Siklu offers a model that can tune in the lower and upper portions of the 60GHz V-Band, covering 11GHz of spectrum in a single product. When operating in the upper 60GHz portion of the band, distances can be achieved that are as much as 50% further than operation in the lower bands due to the absence of oxygen absorption.

Interference-Free Operation and Scalable Deployments

The unlicensed 60GHz V-band spectrum avoids interference typically seen in unlicensed bands through a combination of means. With 7 to 9GHz allocated around the world and 14GHz in the US and the UK, there is ample spectrum for mass, dense deployments. The V-band is also characterized by pencil-thin beams, meaning a small amount of spatial separation is often enough isolation, allowing aggressive frequency reuse schemas of the 14 full-capacity non-overlapping channels.

Robust Carrier Class Construction

The all-weather IP-67 sealed radio guarantees carrier–grade performance under even the harshest weather conditions. Designed to operate in temperatures from -45°C to +55°C this product has been deployed around the world from Siberia to Texas. Carrier class specifications are backed up by an MTBF measured in decades not years.

Streamline Operations with Carrier Ethernet & Synchronization

The EH-600/614 both have MEF-compliant integrated Carrier Ethernet switches. This helps streamline operations with configurable service- aware QoS, bandwidth management and OAM. For mobile operators, optional built-in timing synchronization with Sync-E and 1588v2 ensures smooth performance over packet based backhaul networks. With a built in switch, customers avoid additional boxes, power supplies etc and can leverage not only the layer 2 features but can be powered from a PoE out port on the radio.

Easiest Installation & Management

Virtually any installer can deploy the EH-600/614 with very little training or experience. Physical installation from opening the box to passing traffic can be as little as 15 mins when using pre-configurations loaded into the radio. Once deployed advanced configuration is available via an intuitive web GUI, while additional services may be remotely activated from a NOC. An IPERF integrated TCP and UDP load tester, and a spectrum analyser streamline the commissioning and the troubleshooting.

Exceptional Value

With minimal deployment costs and virtually no maintenance, the EH-600 series minimizes Total Cost of Ownership (TCO) and provides a Return On Investment (ROI) often measured in months, providing an unbeatable price/Mb. The EH-614 wide frequency support reduces TCO with less inventory while benefiting from extended range achievable with the upper 60GHz spectrum.

Field Proven Technology

EtherHaul™ is the world's bestselling millimetre wave radio. Tens of thousands of units have been deployed and are performing reliably in stringent weather conditions all over the globe. The EH- 600/614 incorporates Siklu's integrated all-silicon technology, which increases reliability while reducing size and cost. The result is a small form factor radio with a proven 90-year MTBF and an unbeatable price/throughput.

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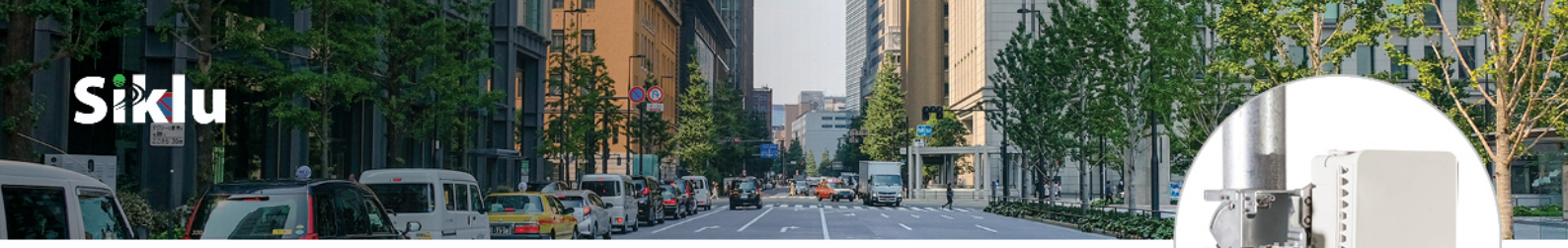

ETHERHAUL™ – 600/614 SERIES SPECIFICATIONS

		EH-614TX	EH-600TX	EH-600T
Topologies	Ring, daisy-chain, mesh.	✓	✓	✓
Frequency / Duplexing	57-66GHz, TDD		✓	✓
	57-68GHz, TDD	✓		
Channel Bandwidth, Modulation & Adaptive Coding	125/250/500MHz wide, 11 non-overlapping channels 125/250/500MHz wide, 14 non-overlapping channels	✓	✓	✓
	QPSK ÷ QAM64 .5 levels of hitless adaptive bandwidth, coding and modulation - Link budget boost up to 25dB	✓	✓	✓
Line Rate / Throughput	1Gbps Aggregated throughput (with capacity license)	✓	✓	✓
System Gain	65/90 (channel bandwidth = 500MHz, maximum capacity / minimum modulation)	✓	✓	✓
Antenna Options	Integrated 0.5 ft. (16 cm) - 36dBi antenna gain	✓	✓	✓
Interfaces	3xGbE copper ports	✓	✓	✓
Ethernet features	IEEE 802.1d transparent bridging VLAN & VLAN stacking, 4K VLANs. Jumbo Frames: 16KB. MEF 9, 14 and 21 compliant Ethernet services. Ring Protection Switching: ITU-T G.8031 ERPS (*FTL). Link state propagation. Configurable QOS aware forwarding. 8 level H-QOS with flexible mapping options: L2 (802.1p, VLAN id), L2.5 (MPLS EXP) and L3 (DSCP).	✓	✓	✓
Security	AES 128-bit and 256-bit (*FTL)	✓	✓	✓
Synchronization	Synchronous Ethernet and 1588v2 TC (*FTL)	–	–	✓
Management & provisioning	Zero-touch turn up; In-band, out-of-band management. Web GUI (one-click configuration of local and remote units) & Embedded CLI. SNMPv2/3, TACACS+, RADIUS. Link OAM & Connectivity Fault Management (CFM): IEEE802.3ah & IEEE802.1ag; performance monitoring: ITU-T Y.1731 (*FTL). IPERF TCP/UDP capacity tester.	✓	✓	✓
PoE-Out	Port 2 and Port 3 (IEEE 802.3at): 26W+26W / 13W+40W / 50W+0W (*FTL).	✓	✓	✓
Power supply	PoE+ (IEEE 802.3at), 26W without PoE-Out; up to 78W with PoE-Out	✓	✓	✓
Conformance	Radio: FCC Part 15.255, ETSI EN 302 217-3 & UK IR 2078 & IR 2000; EMC: USA FCC 47CFR.part 15 & ETSI EN 301 489; Safety: UL/EN 60950	✓	✓	✓
Environmental	Operating Temperature: -45° to +55°C (-49° to +131°F) Ingress Protection Rating: IP67	✓	✓	✓
Dimensions	ODU + 0.5ft antenna: 5.9” x 6.1” x 3.5” (16.5 x 16.5 x 10cm)	✓	✓	✓
Weight	ODU + 0.5ft antenna: 3.9 lbs. (1.8 kg)	✓	✓	✓

*FTL note: requires feature license.

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ETHERHAUL™ – 710 SERIES DATASHEET

70GHz Gigabit Wireless Bridge

World's smallest E-band radio, for street-level & rooftop deployments

Interference-free Ethernet everywhere

The EtherHaul™-700 wireless bridge series delivers cost-efficient, interference-free, Ethernet connectivity. Operating over the uncongested lightly-licensed E-band, the point-to-point radio link is easily deployed on any street furniture or rooftop.

Applications for a Wide Range of Vertical Markets

- Video Surveillance Connectivity (CCTV)
- Wi-Fi Hotspot Backhaul
- Business and Residential Broadband
- Campus Connectivity
- Mobile Backhaul

World's Smallest 70GHz Radio – less than 2 liters

The palm-sized radio simplifies site acquisition, and is quickly installed on any kind of street furniture or rooftop. The compact box solution incorporates, and comes with a choice of street-level 0.5ft. or 1ft. and 2ft. rooftops antennas for longer range. A GbE switch, with PoE-in and dual PoE-out. Easily cascade radios and power external devices like video surveillance cameras and Wi-Fi access points.

Easy Spectrum Acquisition in Urban Areas

The 5000MHz-wide 70GHz spectrum is uncongested, even in dense urban areas. The combination of abundant spectrum and high-gain, pencil beam antennas guarantee channel availability everywhere, and maximize spectrum re-use. The E-band also has low licensing fees and quick acquisition procedures.

Interference-Free and Predictable Performance

Characterized by pencil thin beams, E-band radios guarantee no-interference and high reliability. The EH-700 series has 32 non-overlapping channels that are user selectable, making it the most scalable solution on the market for dense deployments.

Robust & Futureproof

The all weather IP-67 sealed radio guarantees carrier–grade performance under even the harshest weather conditions. The combination of high capacity and low latency, along with the integrated switch and extra ports enables deployment in ring, mesh or extended cascading, with fewer aggregation units needed. The EH-700 also incorporates. The EH-700 assures flawless critical services delivery at any weather condition due to prioritized payloads with 8 levels of carrier-grade QoS, synced with hitless adaptive modulations.

Field Proven

Siklu's EH-700 series utilizes EtherHaul's groundbreaking, all-silicon technology to provide proven reliability. Tens of thousands of units are successfully deployed around the globe with a 90-year MTBF.

Easiest Installation & Management

Any installer can deploy the EH-700, no telco expertise necessary. Physical installation with out-of-the-box 8-levels of QoS- aware Ethernet services typically takes just 15 minutes. Optional advanced configuration is available via an intuitive Web GUI, while additional services may be remotely activated from a NOC. Integrated TCP and UDP load tester eases commissioning and remote trouble-shooting procedures, and advanced OAM provides continuity testing and service monitoring.

Exceptional Value

With minimal deployment costs and virtually no maintenance, the EH-700 series minimizes Total Cost of Ownership (TCO) and provides a Return on Investment (ROI) often measured in months; providing an unbeatable price/Mb.

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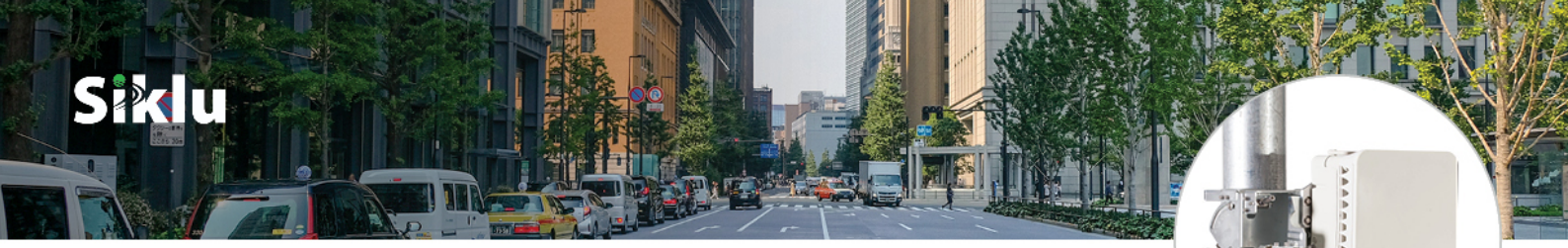

ETHERHAUL™ – 710 SERIES SPECIFICATIONS

70GHz GIGABIT WIRELESS BRIDGE

		EH-710TX	EH-710T
Topologies	Ring, daisy-chain, mesh	✓	✓
Frequency / Duplexing	71-76 GHz, TDD	✓	✓
Channel Bandwidth, Modulation & Adaptive Coding	125/250/500MHz wide, 32/16/8 non-overlapping channels, QPSK ÷ QAM64 Up to 5 level of hitless adaptive bandwidth, coding and modulation - boost gain by up to 25dB	✓	✓
Line Rate / Throughput	1Gbps (with capacity license) Aggregated throughput	✓	✓
System Gain	65/90 (channel bandwidth = 500MHz, maximum capacity / minimum modulation)	✓	✓
Antenna Options	0.5 ft. (16 cm) - 38dBi antenna gain (not applicable for FCC regulation) 1 ft. (31cm) – 43dBi antenna gain 2 ft. (65cm) – 50dBi antenna gain	✓	✓
Interfaces	3xGbE copper ports	✓	✓
Ethernet features	IEEE 802.1d transparent bridging, VLAN & VLAN stacking, 4K VLANs MEF 9, 14 and 21 compliant Ethernet services Smart Pipes Transparent Ports Mode Link aggregation: LAG and LACP (IEEE 802.3ad) Ethernet Ring Protection Switching: ITU-T G.8032 ERPS Link state propagation, 16KB Jumbo frames, Configurable QOS-aware forwarding, 8 level H-QoS with multi mapping options: L2: 802.1p, VLAN id., L2½: MPLS EXP, L3: DSCP	✓	✓
Security	AES 128-bit and 256-bit	✓	✓
Synchronization	Synchronous Ethernet and 1588v2 TC	–	✓
Management & provisioning	Zero-touch turn up; In-band, out-of-band management. Web GUI (one-click configuration of local and remote units) & Embedded CLI. SNMPv2/3, TACACS+, RADIUS. Link OAM & Connectivity Fault Management (CFM): IEEE802.3ah & IEEE802.1ag; performance monitoring: ITU-T Y.1731 (*FTL). IPERF TCP/UDP capacity tester.	✓	✓
PoE-Out	Port 2 and Port 3 (IEEE 802.3at): 26W + 26W, 40W + 13W or 52W + 0W	✓	✓
Power supply	PoE+ (IEEE 802.3at), 26W without PoE-Out; up to 78W with PoE-Out	✓	✓
Conformance	Radio: FCC CFR Part 101, ETSI EN 302 217-2-2; EMC: USA FCC 47CFR. part 15 & ETSI EN 301 489; Safety: EN 62368-1 & 60950	✓	✓
Environmental	Operating Temperature: -45° to +55°C (-49° to +131°F) Ingress Protection Rating: IP67	✓	✓
Dimensions	ODU + 0.5ft antenna: 6” x 6.5” x 3.5” (16.5 x 16.5 x 10cm) ODU + 1ft antenna (Dia x Depth): 12.2” x 4.3” (31 x 13cm)	✓	✓
Weight	ODU + 0.5ft antenna: 3.9 lbs (1.8kg) ODU + 1ft antenna: 6.6 lbs (3kg) ODU + 2ft antenna: 25.6lbs (11.6kg)		

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03

MultiHaul™ Series

MULTIHAUL™ PTMP 60GHZ RADIO DATASHEET

Multi-Gigabit Throughput in an Always-On Point-to-Multipoint Radio

MultiHaul™ is a PTMP multi-gigabit radio operating over millimeter waves. It brings the advantages of mmW – multi-gigabit capacity, immunity to interference and always-on reliability - to a cost-effective small form factor PTMP solution. MultiHaul™ is a plug & play system designed to easily scale, taking advantage of patent-pending scanning antennas that auto-align links, and enables connectivity for up 8 Terminal Units, as well as robust planning and management tools.

A Wide Range of Applications

- Security / Safe City Networks
- Smart City
- Business Services
- Wi-Fi Backhaul

Secure and Physically Immune Narrow Beams

MultiHaul™ radios operate over the millimeter wave spectrum using narrow beams. This confers several advantages including complete immunity to interference and network jamming, as well as high security. In contrast to wide-beam wireless systems that need to use multiple strategies to perform in dense areas, and are not successful 100% of the time, MultiHaul™ is inherently interference-free and secure under any circumstances thanks to a unique combination of narrow beams and high frequencies. Multiple subscribers and services can be connected with complete isolation based on physical port, VLAN ID and/or a Terminal Unit.

An Ocean of Spectrum

The MultiHaul™ takes advantage of large millimeter wave spectrum and wide channels in order to bring multi-gigabit 60GHz capacity to a PTMP system with a single Base Unit and up to 8 Terminal Units. With its extremely high reuse factor, the wide spectrum is available anywhere, even in dense urban areas and challenging deployment scenarios.

Ready Set Go

The plug and play system is designed for an easy single person installation. The patent-pending scanning antenna automatically aligns with the Base Units. For buildings with difficult roof-top access, a single base unit needs to be installed on a roof to serve multiple locations. The Base Unit (BU) supports advanced auto-provisioning: Terminal Units (TU) configuration files are stored in the BU to enable early and advanced provisioning. The TU can be located on building sides with no need for internal re-wiring of buildings to achieve net gigabit throughput.

Always-On Mission Critical Networks

When you cannot afford to lose a video stream, critical safe city sensor data or any other mission critical data, you need to use a wireless network that's as reliable and secure as fiber. With maximal immunity to interference and hacker-proof links with embedded AES encryption, MultiHaul™ delivers a network you can count on.

Very Large Scale Planning and Optimization

MultiHaul™ is available with robust network planning and optimization tools that help system integrators and large operators scale their networks fast and with low overhead.

Fiber Quality with Wireless Flexibility

Siklu's millimeter wave radios successfully combine the capacity of fiber with the flexibility, speed of deployment and low TCO of wireless networks. That's what makes them the world's best-selling millimeter wave radios every year since 2011. They provide rock solid performance, even under severe weather conditions, in thousands of networks around the globe.

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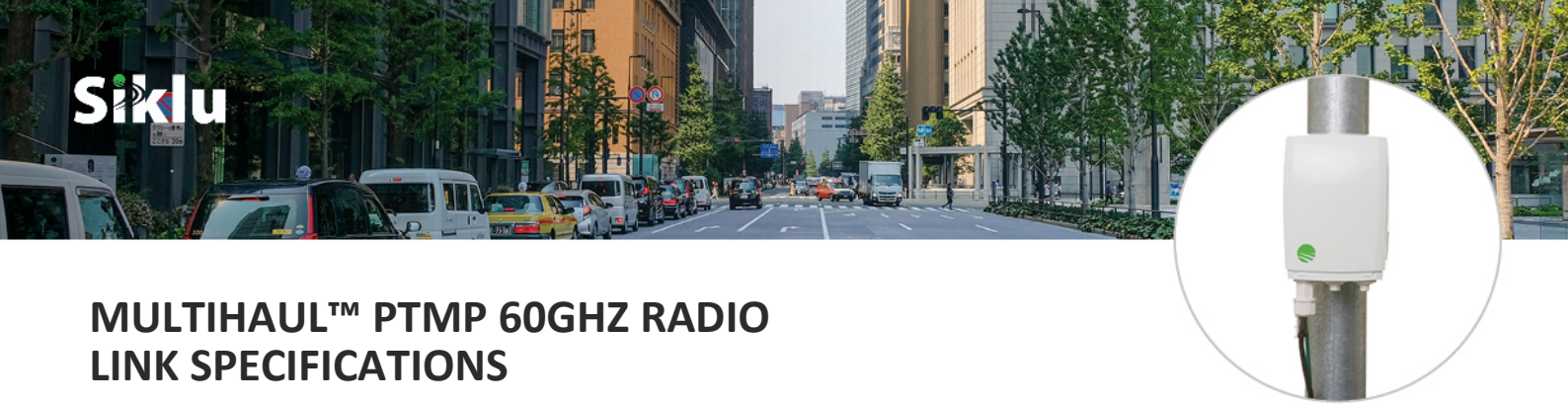

MULTIHAUL™ PTMP 60GHZ RADIO LINK SPECIFICATIONS

		BU MH-B100-CCS	TU MH-T200-CCC	TU MH-T200-CCS	TU MH-T200-CNN
Topologies	Point to Multi-point, Point to Point	✓	✓	✓	✓
Frequency / Duplexing	57-64GHz	✓	✓	✓	✓
Channel Bandwidth, Modulation & Adaptive Coding	2 non-overlapping channels, 2160MHz wide, BPSK÷QPSK 9 level of adaptive coding and modulation	✓ ✓	✓ ✓	✓ ✓	✓ ✓
Line Rate / Throughput	Max capacity (Mbps), (with capacity license) Line rate up to (Mbps)	1800 2300	1000 2300	1000 2300	1000 2300
System Gain	128.5dB (including antenna gain)	✓	✓	✓	✓
Antenna Options	Horizontal scanning: 90° Vertical beam-width: 20°	✓	✓	✓	✓
Interfaces	Up to 3x RJ-45 100/1000 Base-T 2x RJ-45 100/1000Base-T + 1x SFP (supports 1GbE & 2.5GbE)	– ✓ (SFP 1 & 2.5GbE)	3	– ✓ (SFP 1GbE)	1
Terminal Units (TU)	Up to 8 Terminal Units	✓	–	–	–
Ethernet Features	IEEE 802.1d transparent bridging Provider bridge - VLAN & VLAN stacking Jumbo frames; Port isolation; TU isolation; LLDP	✓	✓	✓	✓
Security	AES 128-bits	✓	✓	✓	✓
Management & Provisioning	TU auto-provisioning; In-band, out-of-band management Web GUI (one-click configuration of local and remote units) & Embedded CLI; SNMPv2/3, TACACS+, RADIUS	✓	✓	✓	✓
PoE-Out	ETH2: 26W, 802.3at ETH3: 13W, 802.3af	✓ (SFP)	✓ ✓	✓ (SFP)	– –
Power Supply	PoE, 15W (IEEE 802.3af) without PoE-Out, 55W with PoE-Out (IEEE 802.3at+)	✓	✓	✓	✓
Conformance	Radio: US FCC 47 CFR Part 15.255; Japan Radio Equipment Certification Ordinance 2-1-19-4-2. EMC: US FCC 47 CFR Part 15; EN 301 489 Safety: EN 62368-1 and 60950	✓	✓	✓	✓
Environmental	Operating Temperature: -27°F ÷ 131°F (-33°C ÷ 55°C); Ingress Protection Rating: IP67	✓	✓	✓	✓
Dimensions	7.5 x 5.2 x 3.5 in (19x14.5x6.3cm)	✓	✓	✓	✓
Weight	3 lbs. / 1.4 Kg (including mounting kit)	✓	✓	✓	✓

[1] Actual throughput varies with traffic patterns to/from the Terminal Units

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MULTIHAUL™ PTP 60GHZ RADIO LINK DATASHEET

Gigabit-in-a-Box with a Dynamic Auto-Aligning Point-to-Point Radio Link

MultiHaul™ PtP is a gigabit radio link operating over congestion-free millimeter waves. It brings the advantages of mmWave – gigabit capacity, immunity to interference and always-on reliability - to a cost-effective small form factor PtP solution. MultiHaul™ PtP is a plug & play system designed for easy deployments, taking advantage of patent-pending scanning antennas that auto-align focused beams, and enables Gigabit connectivity at up to 400 meters range, as well as robust planning and management tools.

A Wide Range of Applications

- Video Security
- Smart Safe Cities
- Public Wifi BackHaul
- Enterprise Backhaul

Ready Set Go: Gigabit-in-a-Box

The plug and play system is designed for an easy one person installation. The 2 units in the box are factory configured to auto-align and auto-connect, 15 minutes or less to have 1000Mbps in the air. The patent-pending scanning antenna automatically aligns the link, tolerating pole sway due to high-wind, without any impact on performance.

Fiber Quality with Wireless Flexibility

Siklu's millimeter wave radios successfully combine the capacity of fiber with the flexibility, speed of deployment and low TCO of wireless networks. That's what makes them the world's best-selling millimeter wave radios every year since 2011. Siklu's portfolio of mmWave solutions provides rock solid performance, even under severe weather conditions, in thousands of networks around the globe.

Secure and Physically Immune Narrow Beams

MultiHaul™ PtP radios operate over the millimeter wave spectrum using narrow beams. This confers several advantages including virtually zero interference and immunity from network jamming. In contrast to wide-beam wireless systems that need to use multiple strategies to perform in dense areas, and are not successful 100% of the time, MultiHaul™ PtP is inherently interference-free and secure under any circumstances. The product is also able to support multiple subscribers and services on a single link- these can be connected with complete isolation based on physical port or VLAN ID.

Always-On Mission Critical Networks

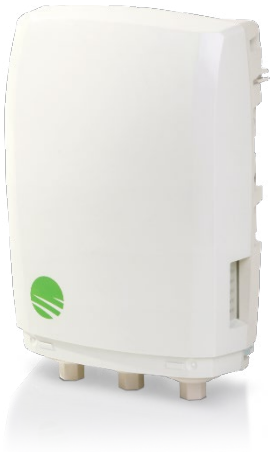
When you cannot afford to lose a video stream, critical safe city sensor data or any other mission critical data, you need to use a wireless network that's as reliable and secure as fiber. With maximal immunity to interference and hacker-proof links with embedded AES encryption, MultiHaul™ delivers a network you can count on.

An Ocean of Spectrum

The MultiHaul™ PtP takes advantage of the large swath of millimeter wave spectrum and wide channels in order to bring Gigabit capacity to a 60GHz PtP link. With narrow beams and other features the MPL400 supports an extremely high reuse factor, even in dense urban areas and challenging deployment scenarios.

Very Large Scale Planning and Optimization

MultiHaul™ is available with robust network planning and optimization tools that help system integrators and large operators scale their networks fast and with low overhead.



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MULTIHAUL™ PTP 60GHZ RADIO LINK SPECIFICATIONS

The main specifications of the MultiHaul™ PtP radio bundle links are outlined in the following table.

		MPL-400-CNN	MPL-400- CCC	MPL-400-CCS
Topologies	Point to Point, Hub & spoke, Daisy Chain	✓	✓	✓
Frequency / Duplexing	57-64GHz	✓	✓	✓
Channel Bandwidth, Modulation & Adaptive Coding	2 non-overlapping channels, 2160MHz wide 9 level of adaptive coding and modulation	✓ ✓	✓ ✓	✓ ✓
Line Rate / Throughput	Max capacity (Mbps), 1000Mbps any direction	✓	✓	✓
System Gain	128.5dB (including antenna gain)	✓	✓	✓
Antenna Options	Horizontal scanning: 90° Vertical beam-width: 20°	✓	✓	✓
Interfaces	Local side, BU: 2x RJ-45 100/1000 Base-T & one 1G/2.5G SFP Remote side, TU: up to 3x RJ-45 100/1000 Base-T + up to 1 SFP 1GbE	✓ 1+0	✓ 3+0	✓ 2+1
Ethernet Features	IEEE 802.1d transparent bridging Provider bridge - VLAN & VLAN stacking Jumbo frames; Port isolation; TU isolation; LLDP	✓	✓	✓
Security	AES 128-bits	✓	✓	✓
Management & Provisioning	Remote auto-provisioning; In-band, out-of-band management Web GUI (one-click configuration of local and remote units) & Embedded CLI; SNMPv2/3, TACACS+, RADIUS	✓	✓	✓
PoE-Out	Local side, BU: ETH2: 26W (802.3at) Remote side, TU: ETH2: 26W (802.3at), ETH3: 13W (802.3af)	✓ –	✓ Eth2&3	✓ Eth2
Power Supply	PoE, 10W (IEEE 802.3af) without PoE-Out, 55W with PoE-Out (IEEE 802.3at+)	✓	✓	✓
Conformance	Radio: US FCC 47 CFR Part 15.255; Japan Radio Equipment Certification Ordinance 2-1-19-4-2. EMC: US FCC 47 CFR Part 15; EN 301 489 Safety: EN 62368-1 and 60950	✓	✓	✓
Environmental	Operating Temperature: -27°F ÷ 131°F (-33°C ÷ 55°C); Optional -49°F ÷ 131°F(-45°C ÷ 55°C) Ingress Protection Rating: IP67	✓	✓	✓
Dimensions	Each unit, BU or TU: 7.5 x 5.2 x 3.5 in.	✓	✓	✓
Weight	3 lbs. (1.4kg) (including mounting kit)	✓	✓	✓

A5

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MULTIHAUL™ CTU
SMALL PTMP 60GHZ RADIO DATASHEET

Same Features and Throughput of the MultiHaul™ TU in a Form Factor 85% Smaller

The MultiHaul™ system consists of a Base Unit (BU) operating over millimetre waves and connecting Terminal Units (TU) and now the new ultra-small compact TU (cTU). MultiHaul™ brings the advantages of mmWave spectrum – multi-gigabit capacity, immunity to interference and massive amounts of available spectrum - to a cost-effective small form factor

PtMP solution. With the cTU, the customer premise side of the system has been reduced over 85% in total volume when compared to the standard TU with no loss in performance and features. A size only 6.5”x3.1”x1” and a selection of colors will blend the cTU into existing surroundings, making it even easier to deploy.

A Wide Range of Applications

- Security / Safe City Networks
- Gigabit to the Home
- Smart City
- Business Services
- Wi-Fi Backhaul

Small but Powerful – Virtually Invisible

There can be no doubt that the smaller the TU is, the more options customers have for deployment. Typically, in wireless systems, going smaller means sacrificing performance. With the cTU Siklu has broken new ground delivering the exact same throughput as the TU but in a form factor that is dramatically smaller.

In addition to the technology that goes into enabling identical performance in an ultra-small package comes the ability to choose from a selection of colors to further reduce the sight lines of deployed cTUs.

Secure and Physically Immune Narrow Beams

The MultiHaul™ cTU operates over the millimetre wave spectrum using narrow beams. This confers several advantages including complete immunity to interference and network jamming, as well as high security. In contrast to wide-beam wireless systems that need to use multiple strategies to perform in dense areas, and are not successful 100% of the time, the MultiHaul™ cTU is inherently interference-free and secure under any circumstances thanks to a unique combination of narrow beams and high frequencies, same as they are implemented on the standard TU. Multiple subscribers and services can be connected with complete isolation based on physical port, VLAN ID and/or a Terminal Unit.

Ready Set Go

The plug and play system is designed for an easy single person installation with a goal of self-installation. The patent-pending scanning antenna automatically aligns with the Base Units. For buildings with difficult roof-top access, a single base unit needs to be installed on a roof to serve multiple locations. The Base Unit (BU) supports advanced auto-provisioning: Terminal Units (TU and cTU) configuration files are stored in the BU to enable early and advanced provisioning, optionally with no IP address on the TU/cTU. The TU/cTU can be located on building sides with no need for internal re-wiring of building to achieve net gigabit throughput.

Always-On Mission Critical Networks

When you can’t afford to lose a video stream, critical safe city sensor data or any other mission critical data, you need a wireless network that’s as reliable and secure as fiber. With maximal immunity to interference and hacker-proof links with embedded AES encryption, MultiHaul™ delivers a network you can count on.

Self-Installation

When operators and Smart Cities are considering deployments of mmWave networks, the total cost of ownership is reviewed, just like with any new product. At Siklu we understand the large role in a business case that installation can play with costs anywhere from $100 to upwards of $500 or more. The cTU represents the first of several advances Siklu will be introducing over the next 12 months enabling a true, outdoor self-install system for our customers.

Fiber Quality with Wireless Flexibility

Siklu’s millimeter wave radios successfully combine the capacity of fiber with the flexibility, speed of deployment and low TCO of wireless networks. That’s what makes them the world’s best-selling millimetre wave radios every year since 2011. They provide rock solid performance, even in very dense networks or under severe weather conditions, in thousands of networks around the globe.

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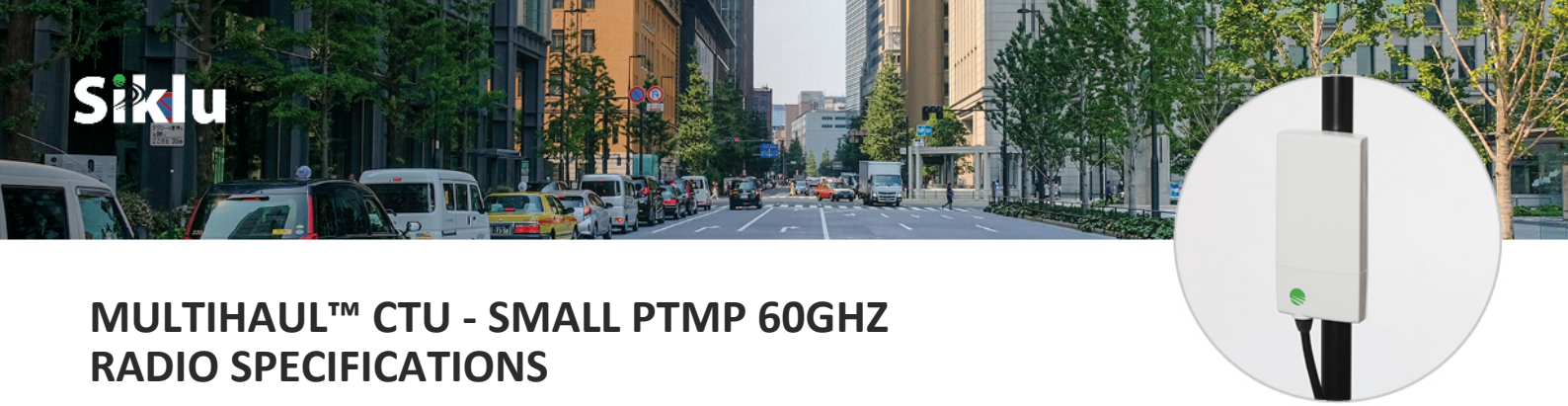

MULTIHAUL™ CTU - SMALL PTMP 60GHZ RADIO SPECIFICATIONS

The main specifications of the MultiHaul™ compact Terminal Units (cTU) are outlined in the following table.

Topologies	Point to Multi-point
Frequency / Duplexing	57-64GHz TDD
Channel Bandwidth, Modulation & Adaptive Coding	2 non-overlapping channels, 2160MHz wide 9 level of adaptive coding and modulation
Line Rate / Throughput	Line rate up to 2300 (Mbps) Max capacity 1000 (Mbps), license dependent
System Gain	124dB (including antenna gain)
Antenna Options	Horizontal scanning: 90° Vertical beam-width: 20°
Interfaces	1x RJ-45 100/1000 Base-T
Ethernet Features	IEEE 802.1d transparent bridging Provider bridge - VLAN & VLAN stacking Jumbo frames; LLDP Centralized port lock/unlock 802.1x
Security	AES 128-bits Managed TU/cTU ID
Management & Provisioning	TU auto-provisioning from BU, no IP address required on TU; In-band, Out-of-band management Web GUI (one-click configuration of local and remote units) & Embedded CLI SNMPv2/3, TACACS+, RADIUS
Power Supply	PoE, 10W (IEEE 802.3af)
Conformance	Radio: US FCC 47 CFR Part 15.255; EN 302 567 EMC: US FCC 47 CFR Part 15; EN 301 489 Safety: UL 60950
Environmental	Operating Temperature: -22°F÷131°F (-30°C÷55°C), Ingress Protection Rating: IP65
Dimensions	6.5 x 3.1 x 1 in. / 165 x 80 x 25 mm.
Weight	1/2 lbs. (250 gm), including the *AnyMount* mounting kit

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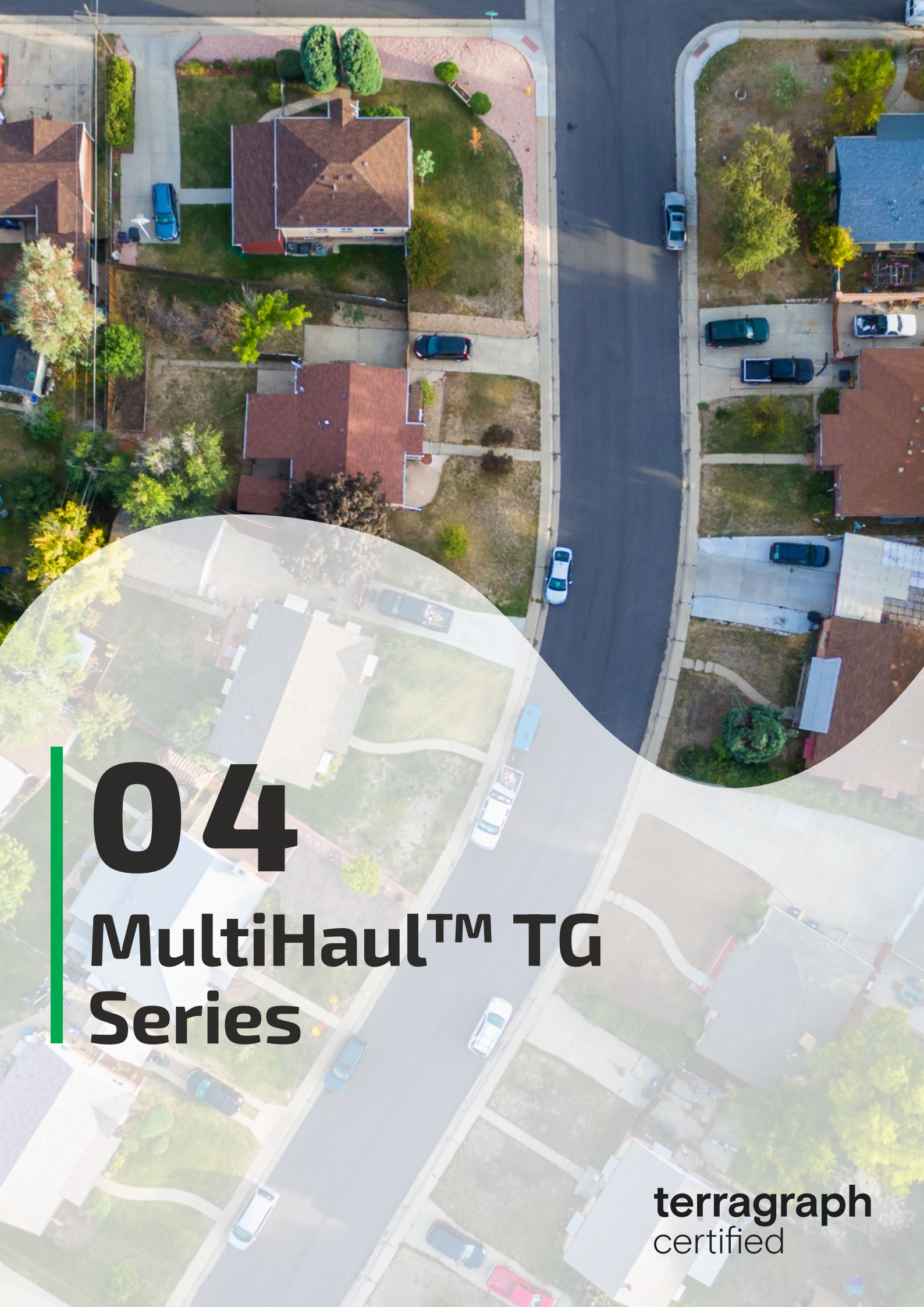
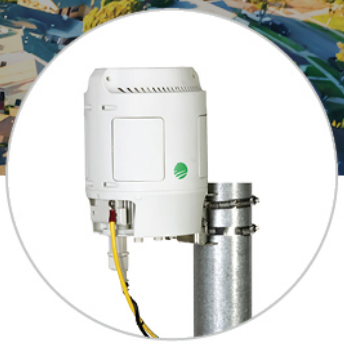


04

MultiHaul™ TG Series

terragraph
certified



MULTIHAUL™ TG NODE N366

Complete 360-degree coverage in one unit for Terragraph deployments

The MultiHaul™ TG system marks the release of Siklu's 3rd generation point to multipoint 60GHz products, with Terragraph certification. The solution consists of Nodes operating over millimetre waves in a redundant mesh topology which connect a suite of Terminal Units (TU). The MultiHaul™ TG family of products brings the advantages of mmWave spectrum – multi-gigabit capacity, immunity to interference and massive amounts of available spectrum - to an easy to deploy solution with the addition of L2 SDN mesh, enabled by Siklu's SmartHaul™ Runner application, for stress-free coverage extension and multi-path reliability. MultiHaul™ TG Node, N366, is the ideal solution for scalable deployments across neighbourhoods and business environments.

A Wide Range of Applications

- Fixed 5G Wireless Access, Gigabit to the Home, the MDU and the Enterprise
- Wi-Fi Hotspot Backhaul
- Security / Safe City Networks
- Smart City Business Services, Municipal networks
- Small Cell Backhaul

High Capacity and Flexibility for Dense Deployments

The MultiHaul™ TG Nodes operate with 4 independent sectors over the millimetre wave spectrum using narrow beams. This confers several advantages including multi-gigabit capacity in dense deployments. With 4 independent high-gain beam-forming antennas, a multitude of network topologies can be realized to optimize coverage, capacity and performance.

Always-On Mission Critical Networks

When you can't afford to lose a video stream, critical safe city sensor data or any other mission critical data, you need a wireless network that's as reliable and secure as fiber. With maximal immunity to interference and hacker-proof links with embedded AES encryption, MultiHaul™ TG delivers a network you can count on. An additional layer of reliability is available through the L2 self-organizing (SON) capabilities enabled by SmartHaul™ Runner, enabling automatic reorganization and rerouting around site failures.

Simple Integrated Future-safe Multi-Functional Node

Wireless infrastructure should be simple, and future proof. Organizations want to quickly deploy a single box across the target neighbourhood, knowing that this infrastructure will address the needs of self-backhaul, distribution, local services, redundancy, SLA enforcement, with enough horse power to scale the bandwidth and accommodate new features over the foreseeable future, achieving a long and useful life time.

Fiber Quality with Wireless Flexibility

Siklu's millimetre wave radios successfully combine the capacity of fiber with the flexibility, speed of deployment and low TCO of wireless networks. That is what makes them the world's best-selling millimetre wave radios every year since 2011. They provide rock solid performance, even in very dense networks or under severe weather conditions, in thousands of networks around the globe.

Highly Secure and Physically Immune Beams

The narrow beamwidth confers several advantages including immunity to interference and network jamming. In contrast to wide-beam wireless systems that need to use multiple strategies to perform in dense areas.
Multiple subscribers and services can be connected with complete isolation based on physical port, VLAN ID and/or a Terminal Unit.

Ready Set Go

The plug and play integrated node is designed for an easy single person installation. The patent-pending scanning antennas automatically aligns with other Nodes or with TUs. For buildings with difficult roof-top access, a single Node is installed on its roof to serve multiple locations.

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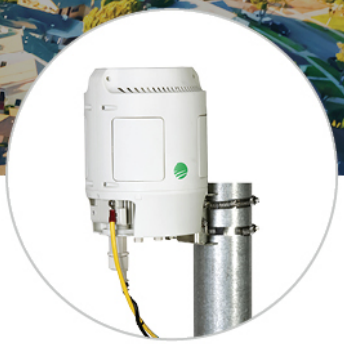

MULTIHAUL™ TG NODE - N366

60GHz 4-Sector wireless L2 SDN mesh Node Specifications

The main specifications of the MultiHaul™ TG Nodes are outlined in the following table.

Topologies	Point to Point, Point to Multi-point, Self-Backhaul L2 SDN Mesh.
Frequency / Duplexing	57-66GHz, TDD/TDMA. 4 channels.
Channel Bandwidth, Modulation & Adaptive Coding	2160MHz, BPSK to QAM16, up to 10 levels of hitless adaptive bandwidth, coding and modulation – boost gain by over 29dB.
Line Rate / Throughput	OTA up to 4,600 Mbps per sector, Throughput > 3,800 Mbps per sector (> 16Gbps per node)
System Gain	110dB (Node to Node/TU, including antenna gain).
Sector(s)	4x 90° sector, for 360° coverage, any sector on any channel. Horizontal scanning: 90° per sector, Vertical scanning: 50°.
Interfaces	3 ports: 1x RJ-45 10/5/2.5/1GbE with PoE-In, 1x RJ-45 1GbE with PoE-Out (35W), 1x SFP+ 10GbE.
Ethernet Features	IEEE 802.1d transparent bridging, Provider bridge - VLAN & VLAN stacking.
Security	AES 128-bits OTA, GUI over HTTPS, CLI over SSH.
Synchronization	On-board GPS
Management & Provisioning	In-band, Out-of-band management, Web GUI (one-pane configuration of local and remote units) & Embedded CLI, NETCONF.
PoE-Out	1 port, 35W POE-Out (IEEE 802.3bt)
Power Supply	PoE-In (IEEE 802.3bt or passive), or 48V DC (via RJ-45 adaptor) 55W no POE-Out, 90W with 35W POE-Out.
Conformance	Radio: US FCC 47 CFR Part 15.255; EN 303 722, EMC: US FCC 47 CFR Part 15; EN 301 489, Safety: UL/IEC 62368-1; UL/IEC 60950-22.
Terragraph	Terragraph certified.
Environmental	Operating Temperature: -49° ÷ +131°F (-45° ÷ +55°C); Ingress Protection Rating: IP67.
Dimensions	9.4 x 7.3 in. / 236 x 186 mm. (height x diameter).
Weight	7.9 lbs. / 3.6 Kg.

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MULTIHAUL™ TG TERMINAL UNIT T265

Service Options in Terragraph deployments

The MultiHaul™ TG system marks the release of Siklu's 3rd generation point to multipoint 60GHz products, this one with Terragraph certification. The TG network solution consists of Nodes operating over millimetre waves in a redundant mesh topology which also connect to Terminal Units (TU). The T265 communicates to the N366 TG Distribution node using the TG protocol, acting as an end point in a fully meshed MH TG topology. The T265 is Siklu's first TG TU and incorporates several features from our standard MH TU. The T265 offers up to 3 ports with both copper and fiber interfaces as well as a PoE out port to power third party devices such as video cameras.

A Wide Range of Applications

- Fixed 5G Wireless Access, Gigabit to the Home, the MDU and the Enterprise
- Wi-Fi Hotspot Backhaul
- Security / Safe City Networks
- Smart City Business Services, Municipal networks
- Small Cell Backhaul
- Fiber hand-off

Capacity and Flexibility for Demanding Applications

The MultiHaul™ TG Terminal Units operate over the millimetre wave spectrum using self-aligned, dynamic beam steering RF. This confers several advantages including multi-gigabit capacity in dense deployments. With 3 ports, RJ-45 up to 2.5GE or fiber up to 10Gbps, a multitude of service deliveries and interfaces can be realized to meet the need of any demanding application.

Always-On Mission Critical Networks

When you can't afford to lose a video stream, critical safe city sensor data or any other mission critical data, you need a wireless network that's as reliable and secure as fiber. With maximal immunity to interference and hacker-proof links with embedded AES encryption, MultiHaul™ TG delivers a network you can count on. With the mesh topology there are built in redundant paths for traffic if an outage occurs in a given link.

Simple Integrated Future-safe Terminal Unit

Wireless infrastructure should be simple, and future proof. Organizations want to quickly deploy a single box across the target neighbourhood, knowing that they have options to meet the interface requirements of any application. With a built-in software configured ethernet switch, PoE out up to 65W for collocated CPEs, cameras or other devices, plus fiber termination, the T265 Unit can address all your applications.

Fiber Quality with Wireless Flexibility

Siklu's millimetre wave radios successfully combine the capacity of fiber with the flexibility, speed of deployment and low TCO of wireless networks. That is what makes them the world's best-selling millimetre wave radios every year since 2011. They provide rock solid performance, even in very dense networks or under severe weather conditions, in thousands of networks around the globe.

Highly Secure and Physically Immune Beams

The narrow beamwidth confers several advantages including immunity to interference and network jamming. In contrast to wide-beam wireless systems that need to use multiple strategies to perform in dense areas. Multiple subscribers and services can be connected with complete isolation based on physical port, VLAN ID and/or a Terminal Unit.

Ready Set Go

The plug and play TU is designed for an easy single person installation. The patent-pending scanning antennas automatically aligns with serving Node(s).

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MULTIHAUL™ TG TERMINAL UNIT T265

60GHz Terminal Unit Radio - specifications

The main specifications of the MultiHaul™ TG T265 units are outlined in the following table.

Topologies	Point to Point, Point to Multi-point.
Frequency / Duplexing	57-66GHz, TDD/TDMA. 4 channels.
Channels & Width	2160MHz, BPSK to QAM16, up to 10 levels of hitless adaptive bandwidth, coding and modulation – boost gain by over 29dB.
Line Rate / Throughput	OTA up to 4,600 Mbps, Throughput up to 1000 Mbps.
System Gain	110dB (Node to TU, including antenna gain).
Self-alignment scanning	Horizontal scanning: 90°, Vertical scanning: 50°.
Interfaces	T265-CCP, 3 ports: 1x RJ-45 2.5/1GbE with PoE-In, 1x RJ-45 1GbE with PoE-Out (35W), 1x SFP+ 10GbE. T265-CNN, 1 port: 1x RJ-45 2.5/1GbE with PoE-In.
Ethernet Features	IEEE 802.1d transparent bridging, Provider bridge - VLAN & VLAN stacking.
Security	AES 128-bits OTA, GUI over HTTPS, CLI over SSH.
Synchronization	To N366
Management & Provisioning	In-band, Out-of-band management, Web GUI (one-pane configuration of local and remote units) & Embedded CLI, NETCONF.
PoE-Out	1 port, 55W POE-Out (IEEE 802.3bt)
Power Supply	All T265 models: PoE-In (IEEE 802.3bt or passive), or 48V DC (via RJ-45 adaptor) 35W no POE-Out, T265-CCP: 90W with 55W POE-Out.
Conformance	Radio: US FCC 47 CFR Part 15.255; EN 302 567, EMC: US FCC 47 CFR Part 15; EN 301 489, Safety: UL/IEC 62368-1; UL/IEC 60950-22.
Terragraph	Terragraph certified.
Environmental	Operating Temperature: -49° ÷ +131°F (-45° ÷ +55°C); Ingress Protection Rating: IP67.
Dimensions	6.9 x 8.6 x 4.9 in. / 175 x 220 x 125 mm. (W x H x D).
Weight	4.84 lbs. / 2.2 Kg.

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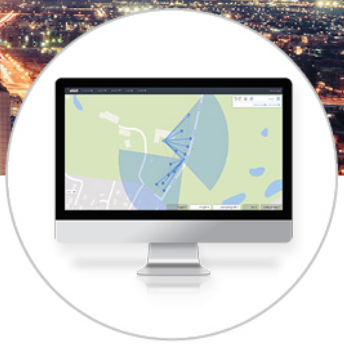
SmartHaul™ Series



SMARTHAUL™ WIRELESS NETWORK DESIGN ENGINE DATASHEET

SmartHaul™ Wireless Network Design Engine (WiNDE)

Accelerate your time to deployment by automating complex mmWave network designs.

Key Features & Benefits

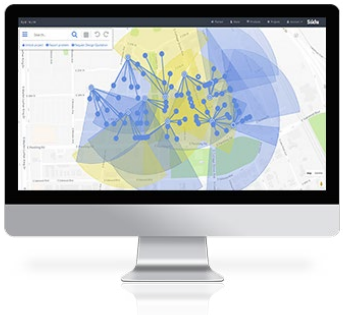
- Automated network-wide Topology Designs
- Comprehensive RF Planning
- Bill of Materials generated from rule-based configurations
- Deploy as Designed with auto-generated configuration files
- SaaS, constantly up to date, no installation required

SmartHaul™ WiNDE, Experience Not Necessary

Siklu SmartHaul™ Wireless Network Design Engine (WiNDE) automates the many tasks involved in designing a complete millimetre wave wireless network. WiNDE integration in an operator's planning environment takes days compared to traditional tools that can take weeks or months. The engine reduces days of complex work and tedious details to hours. Intuitive and easy to use, the 5-step wizard will guide a user with 40 years or 40 days of network design experience to the same swift results.

Topology Design Optimized for Cost or Performance

SmartHaul™ WiNDE supports traditional Point-to-Multipoint (P2MP) designs as well as our MultiHaul Terragraph (MH TG) mesh topologies. The app crunches through thousands of possible designs in an iterative process to optimize the network for performance or cost, with any mix of P2MP, Point-to-Point (P2P), rings, mesh, fibre-links, single- or multi-PoP wireline interfaces. The resulting designs are presented graphically and numerically for straightforward evaluation of the results.



Always Relevant (RDOF, Terragraph)

SaaS tools like WiNDE are always up to date. WiNDE is constantly being improved to address new products such as MultiHaul™ TG or new regulations. WiNDE supports the Rural Digital Opportunity Fund (RDOF) in the US, a program granting money to communities struggling for Digital Inclusion with detailed information on what regions/houses qualify. Similar features can be added for any jurisdiction or program anywhere in the world.

Bill of Materials

WiNDE will assemble a detailed Bill of Materials with all the required accessories and licenses. The user can amend and annotate the BOM with additions or subtractions or include 3rd party deliverables, easily maintaining a consistent project scope.

Sectors & Azimuths, Channels, Polarization

WiNDE allocates frequencies to sectors and point-to-point links utilizing the minimum number of channels and calculates the noise levels on all links to deliver an interference-free design achieving the target performance levels.

SmartHaul™ Apps from Siklu

Siklu SmartHaul™ Apps pack 10 years of leadership in millimetre waves network deployments and business models, into a set of planning and operations tools.
A growing set of Apps hosted in the cloud or on-premises accelerate your time to decision and deployment, with consistency of information and decisions, reducing labor with automation and flow-through.

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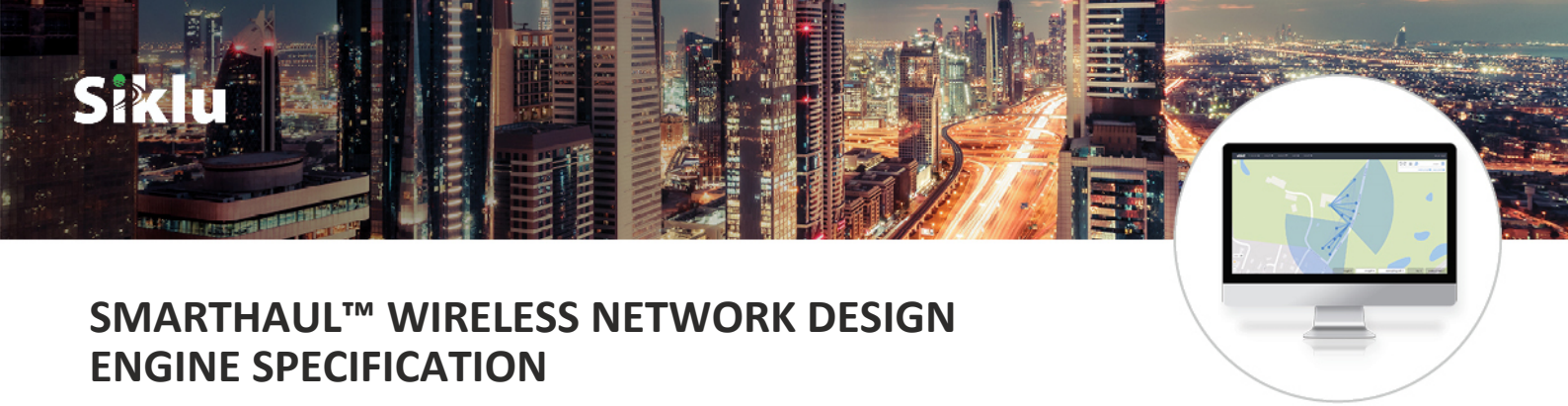

SMARTHAUL™ WIRELESS NETWORK DESIGN ENGINE SPECIFICATION

Design Features

Single-click complete topology designs	Topology optimization for P2MP, P2P, rings and mixed modes. Sector maximization to reduce installs while following collocation rules.
Automated RF design	Allocation of RF channels to all Siklu radios, operating in V-band or in E-band. Selection of polarizations. Calculations of azimuths for MultiHaul™ sectors and EtherHaul™ links...
Integrated interference validation	Network wide calculation of interference for each link end separately, utilizing nominal location or range of distances from centre point.
Choice of design constraints	Distance from wired network interface (hop count), devices per roof / pole, redundancy levels, polarization preferences.
Automatic Bill of Materials (BOM)	A Bill of Materials is assembled automatically from the network topology and product selection and can be amended globally or selectively.

User Interface and Data Input/output

Wizard driven	User is guided to progress logically from start to finish through the 5 steps of the network design.
Home recognition	Artificial Intelligence powers identification of home features on lots, improving the placement of the target sites
Layered design	Sites and links can be grouped in layers, representing the different functions of the network (example: transport, distribution, access)
Complete project and wireless network information	Bill of Materials can be annotated to include site information, building materials or additional tasks.
Radio Configuration Files auto generation	Configuration files generated for all the radios in the project, assuring trouble-free deployment and commissioning as designed.
Easy node imports	Point-and-click or bulk-import with standard file formats (Excel, Keyhole Mark-up Language (KML/KMZ)).
Topology import	Import an existing network, generated with WiNDE or not, to plan next phases of extensions; BOM will be focused on the new elements only.
Project defaults	Radio type & antenna size preferences, max radios per roof or pole.
Map modes	Google Earth, map or satellite view modes.
Rich reports in standard formats	Design results presented in graphical and tabular formats, allow quick evaluation and validation of the results. Information can be extracted into standard files (Excel, KML) for off-line processing or presentation to 3rd parties.
Database backups	Complete project database automatically saved in the cloud, available anywhere and anytime, shareable between multiple users.

General

Software as a Service (SaaS)	No desktop installation, instantaneous access over the internet, always up to date, maintenance free.
Terragraph certified	WiNDE can design Terragraph certified network, with MultiHaul™ TG Terragraph certified

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SMARTHAUL™ ELEMENT MANAGEMENT SYSTEM DATASHEET

SmartHaul™ Element Management System (EMS)

Key Features & Benefits

- Unified management umbrella for all Siklu radios
- Reduce OPEX
- Full FCAPS support
- Complete lifecycle management of the network
- Maximize network performance
- Faster time-to-resolution of problems
- Scalable – from small to full telco network
- REST API (northbound interface)

SmartHaul™ EMS, Complete Lifecycle Management for Siklu Products

Siklu SmartHaul™ EMS is a scalable and reliable network management platform specially designed to provide end-to-end life cycle management for Siklu's products, including EtherHaul™ P2P and MultiHaul™ PtMP offerings. Siklu SmartHaul™ EMS provides a fast and simple approach to network management. The platform allows all Siklu's network elements to be viewed from a single unified dashboard supporting full FCAPS functionality with a wide range of network management functions including fault, performance, topology, maps, configuration, monitoring, and dashboard reporting.

Efficient Dashboard – Optimized Performance

SmartHaul™ EMS Dashboard provides a unified view in a single, easy-to-use page that highlights essential data at the network, site, and Siklu elements levels. The EMS provides comprehensive support to help zero-in on equipment failures and troubleshoot the network.

Full comprehensive tool kit for OPEX reduction

Fault management- Centralized list of active and historical alarms for quick network diagnostics and fast remediation.

Performance management- Real-time and historical performance measurements provide a comprehensive understanding of the current state of the network and its elements, allowing fast and full insight into your network.

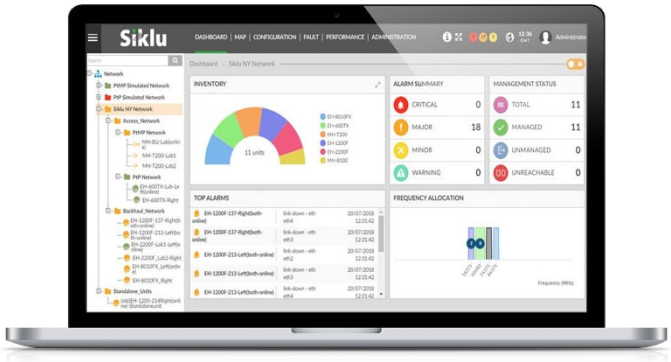
Configuration management - Direct Access to each element. Use GUI or CLI access links to individual network element making it a breeze to dive into any radio. No need to remember IP addresses or other credentials.

Networkwide SW upgrade

Campaign tasks, such as SW upgrades acrossyour entire network, can be run manually or scheduled automatically, and indicators are provided for of task progress and task completion. The Campaign Manager saves time and significantly cuts management costs.

Scalable Pay as you grow

Quick to implement and simple to use, the SmartHaul™ EMS scales to fit any network size.



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SMARTHAUL™ ELEMENT MANAGEMENT SYSTEM SPECIFICATION

Features

Dashboard	Network status at a glance Inventory summary of elements by type Alarms summary by severity Availability summary with management status Radio spectrum and channels used Device Dashboard
Map	Hierarchical network visualization Street map or Satellite view modes Elements Location and links between elements
Configuration	Frequency allocations Device list and summary of radio parameters and status Specific device configuration via direct GUI or CLI links
Fault Management	Centralized Alarm list Alarm action Events
Performance	Current and historical data Radio -RSSI, CINR , Modulation Data BW utilization
Administration	User Management covering permissions and credentials Domain Management supports multiple domains and assigns user/device to a given domain Licence Management based on number of managed elements File Management of SW images and configuration files
Campaign Management	Schedule: Mass SW Upgrades Broadcast of network wide configuration files

General

License basic options	Up to 20, 50, 100, 250, 500 elements and higher

Minimum EMS Server Requirements

Operating System	CentOS Linux 7.2 (1511) on x86_64 bit (English Edition)
CPU	2 cores at least 2 GHz CPU frequency
Memory	8 GB RAM
Hard Disk	128 GB (SSD preferred)
Network interface	2 x 1GB ETH NICs

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