PPC-1000
Gigabit Ethernet MM-wave Link

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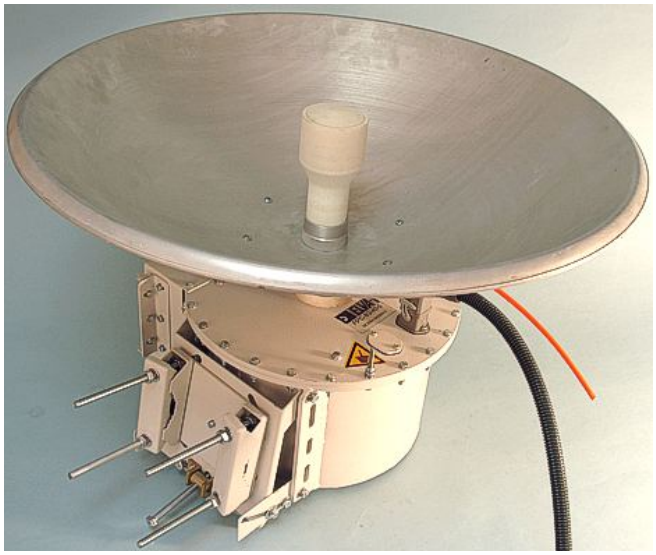

In response to market demand for ultra-wide broadband communication equipment, ElvaLink offers a new PPC-1000 series of Gigabit Ethernet radios.

The Gigabit ElvaLink radio bridge was designed for a wide range of applications such as mobile backhaul, business network, FSO backup, IP network and emergency recovery network. The operating frequencies cover 71-75 GHz, 81-86 GHz, and 92-95 GHz. These are FCC licensed bands recently released by the FCC for commercial use in wireless point-to-point communications.

ElvaLink's PPC-1000 is a full-duplex Gigabit point-to-point link especially designed according to FCC requirements. It provides interconnection between remote LAN segments at ultra high speed and utilizes Gigabit Ethernet protocols, which is the evolving standard for switches and routers available from a variety of telecommunication equipment manufacturers. One full-duplex Gigabit Ethernet link provides 1.25 gigabit-per-second connectivity that is the equivalent of approximately 650 T1 lines or 1,000 DSL connections. The PPC-1000 product has 1000 Base-SX connections at each end of the wireless link and transparently establishes the link outputs. The resulting connection can replace a fiber-optics cable physically connected end-to-end. The wireless mm-wave Gigabit link provides fiber equivalent performance, reliability and security but with no high deployment cost associated with outdoor fiber installations.

PPC-1000 links have remote management as well as parameter monitoring capabilities. A twisted pair patch cable connected to any RJ-45 socket within the LAN will allow remote SNMP management and parameter control of a set of PPC-1000 links from a central location.

The Gigabit Ethernet point-to-point millimeter wave radio links have been designed with compact parabolic Cassegrain antennas of 30 and 60 cm diameters. The 60 cm antenna has a 0.4° beam width and 50 dB antenna gain parameters, which are fully compliant with FCC specification requirements for E-band communication. Note, the FCC recently allowed the use of smaller, less expensive antennas with a minimum antenna gain of 43 dBi and a 1.2 degree half-power beamwidth available on the PPC-1000 ElvaLink systems as well. PPC-1000 equipment has been offered as a comprehensive link kit with antennas, mounting units and accessories to allow a turnkey installation into the customer’s communication system.

The PPC-1000 operating distances vary from 1 to 4.5 miles or 1.5 to 7 km for varying weather conditions depending of the link frequency and rain intensity. Planning for millimeter wave spectrum use must take into account the propagation characteristics of radio signals at this frequency range. While signals at lower frequency bands can propagate for many miles and penetrate more easily through buildings, millimeter wave signals can travel only a few miles or less. However, these characteristics of millimeter wave propagation are not necessarily disadvantageous. Millimeter waves can permit more densely packed communications links, thus providing very efficient spectrum utilization, and they can increase security of communication transmissions.

For weather availability, please see the diagram below.

PPC-1000 Gigabit Ethernet Point-to-point Link Specs

System Parameters		
Frequency Band	[E band]	
Bandwidth	71-76, 81-86, 92-95 GHz	
Capacity	1250 Mbps Full duplex	
Modulation Type	DQPSK	
Rx Sensitivity	-87 dBW	
Output Power	20 mW	
Network Management	SNMP Enabled	
Remote Parameters Monitoring	Proprietary adapter in ODU with software application [Windows 98/2000/XP]	
Data and Aux Interface		
Ethernet Interface	1000Base-SX (for multimode fiber, Standard IEEE 802.3z/D.50-1998)	
Diagnostics Port	RS-485 [with optional RS-232] or by Ethernet cable	
Antenna		
Antenna Type	Cassegrain type antenna with radome	
Antenna Gain/beamwidth 60 cm	50 dB/04°	
Power / Environment		
Power Supply AC	Input 88-132 / 176-264 Volts, 50/60 Hz [with manual voltage range switch]	
Transceiver Power Consumption	65 W [+15W heating]	
DC Power	36 to 60 Volts DC	
Power Connector Ethernet / Power connector	IP-65 [optional IP-68]	
Operational Temperature	-40°C to 50°C / -40°F to 122°F	
Humidity	0 to 95%, non-condensing	
Physical Dimensions		
Outdoor unit size w/o antenna	330 x 350 x 460 mm	
Weight (ODU w/o antenna)	14 kg max	

Weather Tolerance for Gigabit Ethernet Link

One can calculate the distance versus rain attenuation using FCC Bulletin Number 70, “Millimeter Wave Propagation: Spectrum Management Implications” July, 1997. Namely, for example, in the so called B-zone of the US rain map (Montana, Wyoming, Idaho, Colorado, N.Dakota) the relevant guaranteed PPC-1000 link distances will be from 1.2 miles (2.0 km) for 99.995% weather availability up to 4 miles (6.5 km) for 99.9% availability. Meanwhile, the carrier-class 99.995% availability corresponds to 0.4 hour outage per year caused by weather factors, and the enterprise-class 99.9% availability means 8.8 hours outage per year.

In particular, when considering link availability levels (99.9% - 99.999%), heavy rain conditions are the principal factor in determining the actual operating distance of the link. This table shows link availability levels and relevant outage times per year.

Link Availability Table

% per year	Outage, minutes per year	Outage, Hours per year
99.999	5.26	0.1
99.998	10.5	0.2
99.995	26.3	0.4
99.99	52.6	0.9
99.98	105	1.8
99.95	263	4.4
99.9	526	8.8
99.8	1052	18
99.5	2630	44
99	5260	88
98	10520	175
95	26298	438

It has been proven experimentally that in actual practice the operating distance for a mm-wave link could be longer for the same availability than the above mentioned theoretical distance estimations. The explanation is that the distances are generally calculated assuming that rain intensity is equal along the entire distance. But rain cloud intensity varies along the distance between the link antennas. For instance, there might be heavy rain at one end of the link and it may not be raining at all at the other end. This natural factor improves overall link performance during actual rain conditions and allows extending the operating distances while keeping the same level of link availability.

On the graph below there are experiment-calculated dependences for rain rate intensity vs. attenuation for PPC-1000 gigabit point-to-point radios at FCC E-band.
Rain intensity are 0 mm/hour, 5 mm/hour, 10 mm/hour and 25 mm/hour. ElvaLink has developed the experimental graphs of rain attenuation for all frequency bands among the available product matrix.

To understand what a 5mm/hour rain is, see the list of meteorological data below to compare (for continental USA and Europe):

- Drizzle 2mm/hour
- Light rain 5mm/hour
- Steady rain 12mm/hour
- Summer cumulus rain 15mm/hour
- Heavy rain 20mm/hour

These data allow network providers to optimize link ranges for geographical areas with wet climates and steady rains. The transceiver sensitivity limit for Gigabit Ethernet link lines is 70 dB (theoretical limit is 90 dB).

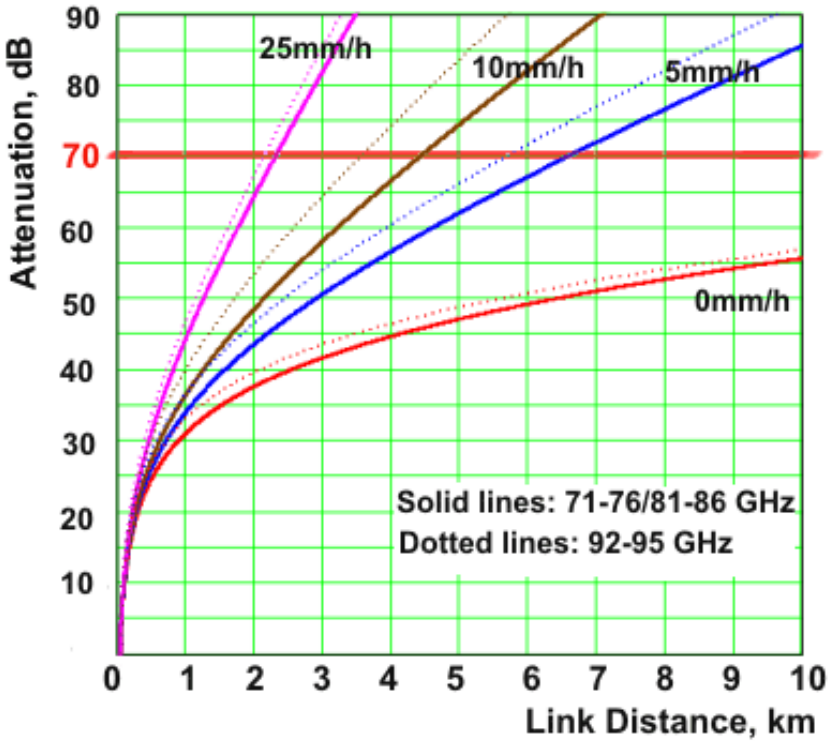

Fig.1 Distance versus rain graph for FCC E-band. The transceiver sensitivity limit for gigabit links line is 70 dB

About ElvaLink

ElvaLink LLC is a company specializing in high-speed radio communication devices, with headquarters in Solon, OH. Recently, ElvaLink LLC has aggressively expanded its product range to mm-wave telecom products, such as 60 GHz, 70/80 GHz, and 94 GHz high transfer rate Ethernet LAN bridges, enabled by patented company technology. The point-to-point, high performance ElvaLink PPC-1000 Series of mm-wave digital radios provide exclusive last mile solutions for businesses, college campuses, ISPs, government agencies, and may also serve as inexpensive back-up. The ElvaLink wireless link is a new fiber optics substitute for urban inter-building high-speed data services. Company product development roadmap includes next generation 1.25Gpbs Gigabit Ethernet radios for 70/80 GHz and 94 GHz bands that are available since Q1/2005.

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