Project CAR-Benguet
LINKPlanner Proposal Report

01 February 2024

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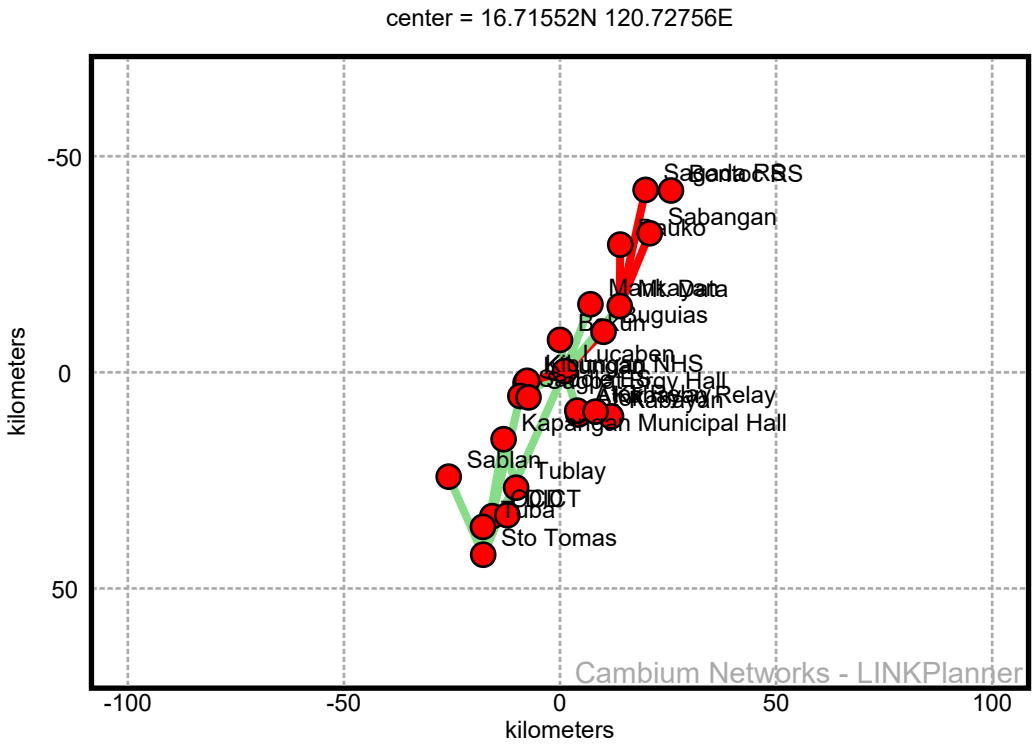


Cambium Networks™

Table of Contents

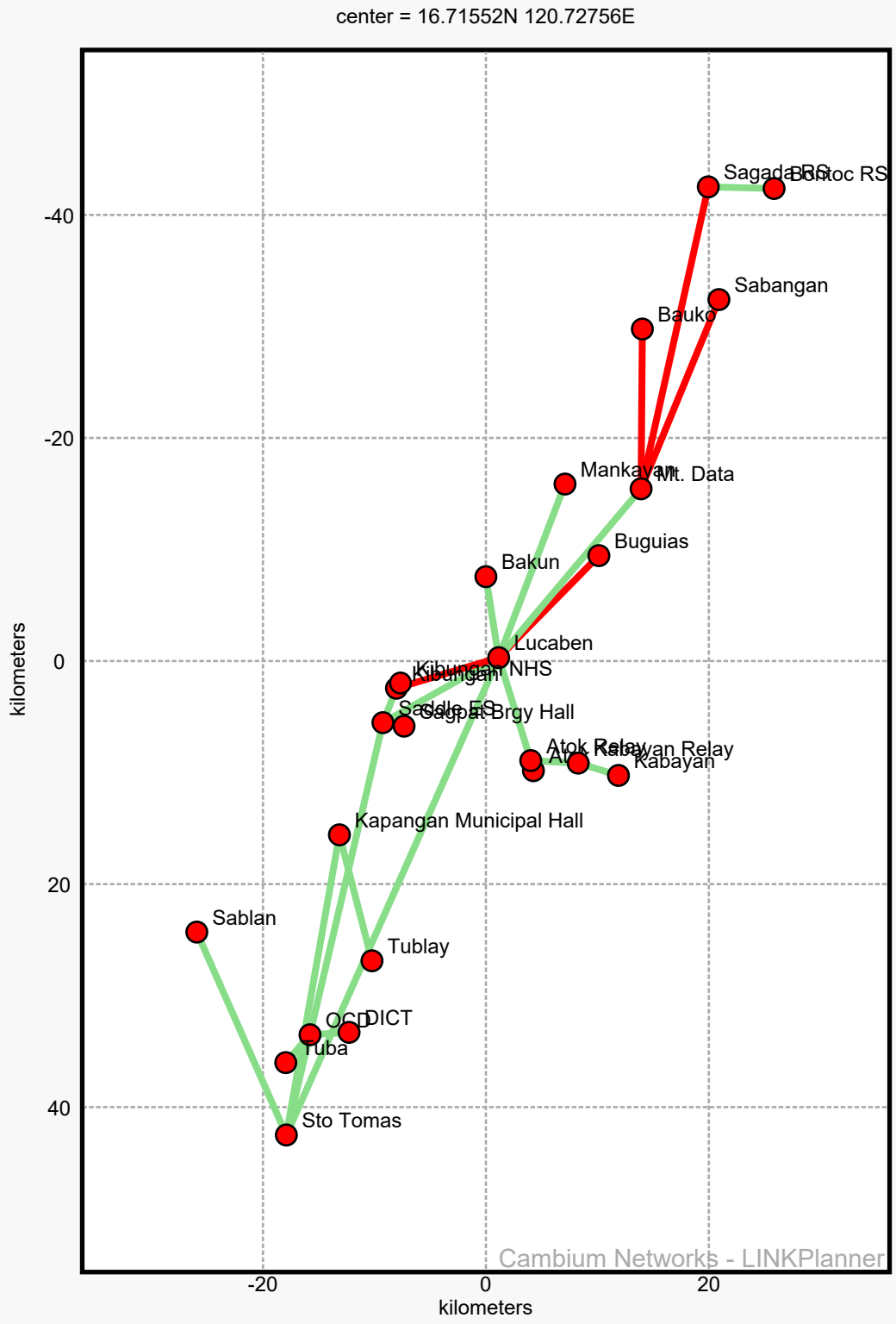
1. Project Summary

Project: CAR-Benguet

Description: CAR Broadband

General Information	
Customer Name	DICT CAR
Company Name	DICT CAR
Address	
Phone	
Cell Phone	
Email	

Network Map


center = 16.71552N 120.72756E
Sagada RHC
Bontoc RS
Sabangan
Bauko
Mankayan
Mt. Data
Buguias
Bakun
Lucaben
Kibungan NHS
Saddle ES
Gagpat Brgy Hall
Atok Relay
Kabayan Relay
Kapangan Municipal Hall
Sablan
Tublay
OCD
DICT
Tuba
Sto Tomas
-40
-20
0
20
40
kilometers
-20
0
20
kilometers
Cambium Networks - LINKPlanner

Link name	Product	Primary Local antenna	Primary Remote antenna	Max aggregate IP throughput
Atok Relay to Atok	PTP550	Cambium Networks 2ft High Performance Dual-Polar Parabolic RDH4508C	Cambium Networks 2ft High Performance Dual-Polar Parabolic RDH4508C	596.31 Mbps
Atok Relay to Kabayan Relay	PTP550	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	587.27 Mbps
Bauko to Mt. Data	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	0.00 Mbps
DICT to OCD	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	450.68 Mbps
Kabayan Relay to Kabayan	PTP550	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	591.79 Mbps
Kapangan Municipal Hall to Tublay	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	413.94 Mbps
Kibungan to Lucaben	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	1.10 Mbps
Lucaben to Atok Relay	PTP550	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	538.89 Mbps
Lucaben to Bakun	PTP550	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	580.15 Mbps
Lucaben to Buguias	PTP550	Cambium Networks 2ft High Performance Dual-Polar Parabolic RDH4508C	Cambium Networks 2ft High Performance Dual-Polar Parabolic RDH4508C	50.64 Mbps
Lucaben to Mankayan	PTP550E	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	665.19 Mbps
Lucaben to Mt. Data	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	343.13 Mbps
Mt. Data to Sabangan	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	0.00 Mbps
Mt. Data to Sagada RS	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	0.00 Mbps
OCD to Tuba	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	154.56 Mbps
Saddle ES to Kibungan	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	450.68 Mbps
Saddle ES to Lucaben	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	332.34 Mbps
Sagada RS to Bontoc RS	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	449.15 Mbps
Sto Tomas to Kapangan Municipal Hall	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	293.30 Mbps

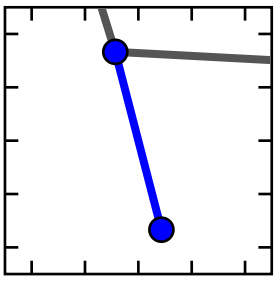
(continued)

Link name	Product	Primary Local antenna	Primary Remote antenna	Max aggregate IP throughput
Sto Tomas to Lucaben	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	79.81 Mbps
Sto Tomas to Sablan	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	341.54 Mbps
Sto Tomas to Saddle ES	PTP670	Cambium Networks High Gain Integrated	Cambium Networks High Gain Integrated	224.45 Mbps

Bill of Materials : PTP Network

Part Number	Qty	Description
01010419001	61	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	30	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000000L033	28	Gigabit Surge Suppressor (56V), 10/100/1000 BaseT
C000065L007	30	LPU and Grounding Kit (1 kit per ODU)
C050055H004	2	PTP 550 Connectorized 5 GHz (ROW) with US Line Cord. Kit includes radio with power supply, line cord and mounting bracket
C050055H005	2	PTP 550 Connectorized 5 GHz (ROW) with EU Line Cord. Kit includes radio with power supply, line cord and mounting bracket
C050055H010	8	PTP 550 Integrated 5 GHz (ROW) with US Line Cord. Kit includes radio with antenna, power supply, line cord and mounting bracket
C050055H019	2	PTP 550E Integrated including 4.9 GHz (ROW) with US Line Cord. Kit includes radio with antenna, power supply, line cord and mounting bracket
C050067H010	26	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
C050067H016	4	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - EU Line Cord). Kit includes ODU, power supply, mounting bracket and EU line cord
EW-E2PT550-WW	14	PTP 550 Extended Warranty, 2 Additional years (per END)
RDH4508C	4	High Performance 4.9-6 GHz, 2-FT (0.6M), DUAL-POL antenna with 2 x N-type Connector
WB3176	7	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

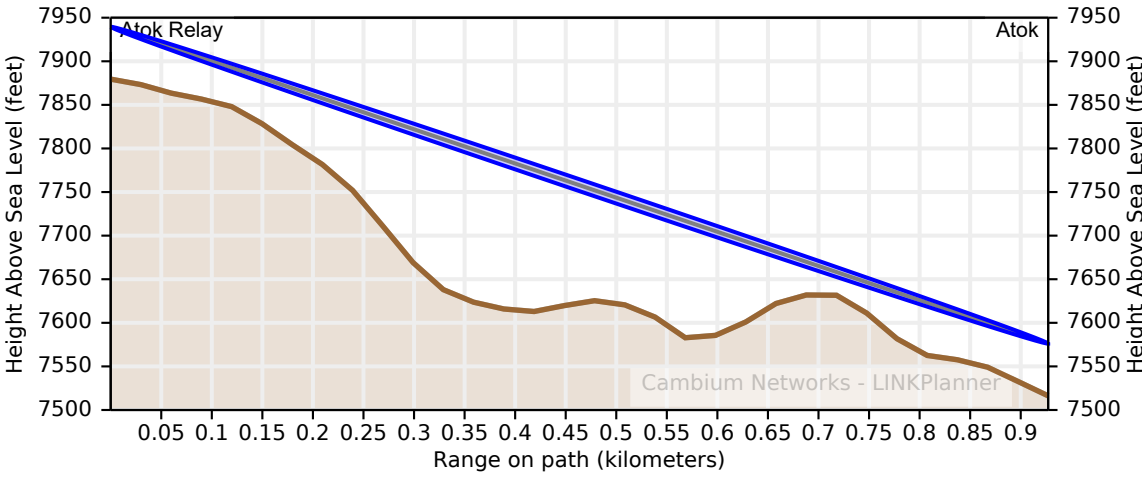
Atok Relay to Atok



Equipment: Cambium Networks PTP550 Connectorized

Cambium Networks 2ft High Performance Dual-Polar Parabolic RDH4508C @ 60 ft (Shared)

Cambium Networks 2ft High Performance Dual-Polar Parabolic RDH4508C @ 60 ft (Shared)



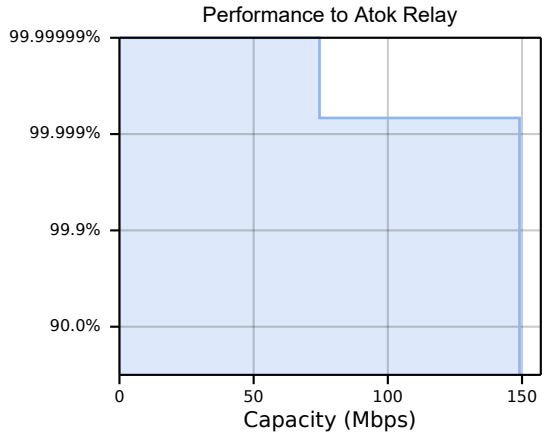
	Performance to Atok Relay - Link A	Performance to Atok - Link A
Mean IP	149.08 Mbps	149.08 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

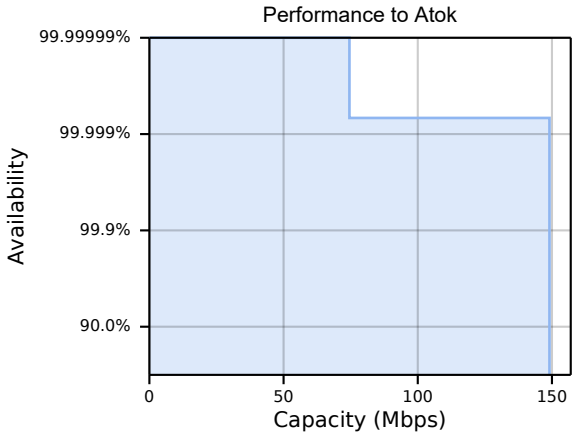
	Performance to Atok Relay - Link B	Performance to Atok - Link B
Mean IP	149.08 Mbps	149.08 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary		
	Link A	Link B
Link Length	0.927 km	0.927 km
Band	5.8 GHz	5.8 GHz
Regulation	Argentina	Argentina
Modulation	Adaptive	Adaptive
Bandwidth	40 MHz	40 MHz
Total Path Loss	107.05 dB	107.05 dB
System Gain	159.22 dB	159.22 dB
System Gain Margin	52.17 dB	52.17 dB
Mean Aggregate Data Rate	298.16 Mbps	298.16 Mbps
Annual Link Availability	100.0000 %	100.0000 %
Annual Link Unavailability	1 secs/year	1 secs/year

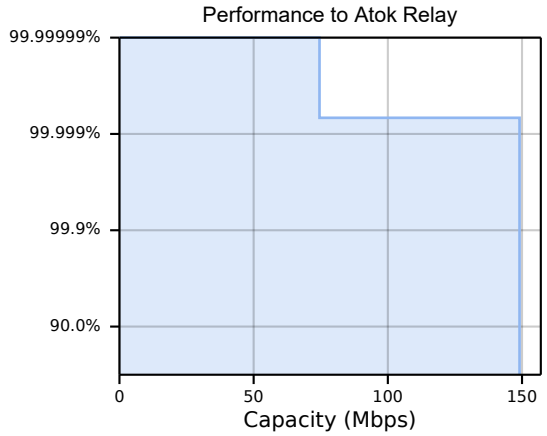
Link Summary (continued)		
	Link A	Link B
Frame Size	1518 Bytes	1518 Bytes
Prediction Model	ITU-R P.530-17	ITU-R P.530-17

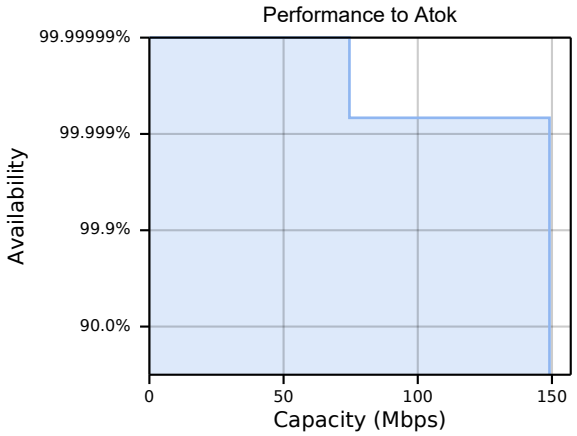
Performance Charts (Link A)





Performance Charts (Link B)

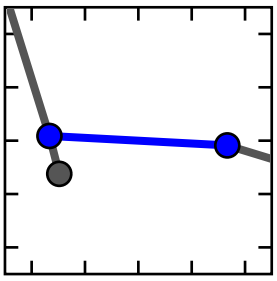




Climatic Factors, Losses and Standards		
	Link A	Link B
dN/dH not exceeded for 1% of time	-131.18 N units/km	-131.18 N units/km
Area roughness 110x110km	598.69 metre	598.69 metre
Geoclimatic factor	4.71e-06	4.71e-06
Fade Occurrence Factor (P0)	1.88e-11	1.88e-11
Path inclination	119.43 mr	119.43 mr
Value of K Exceeded for 99.99% (ke)	0.40	0.40
Excess Path Loss at ke	0.00 dB	0.00 dB
0.01% Rain rate	87.44 mm/hr	87.44 mm/hr
Rain Attenuation	0.47 dB/km	0.47 dB/km
Free Space Path Loss	107.04 dB	107.04 dB
Gaseous Absorption Loss	0.01 dB	0.01 dB
Link Type	Line-of-Sight	Line-of-Sight
Excess Path Loss	0.00 dB	0.00 dB
Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6	ITU-R P.676-12, ITU-R P.835-6
Diffraction Loss	ITU-R P.526-15	ITU-R P.526-15
Propagation	ITU-R P.530-17	ITU-R P.530-17
Rain Rate	ITU-R P.837-7	ITU-R P.837-7
Refractivity Index	ITU-R P.453-14	ITU-R P.453-14

Bill of Materials		
Part Number	Qty	Description
C000000L033	4	Gigabit Surge Suppressor (56V), 10/100/1000 BaseT
C050055H004	2	PTP 550 Connectorized 5 GHz (ROW) with US Line Cord. Kit includes radio with power supply, line cord and mounting bracket
EW-E2PT550-WW	2	PTP 550 Extended Warranty, 2 Additional years (per END)
RDH4508C	2	High Performance 4.9-6 GHz, 2-FT (0.6M), DUAL-POL antenna with 2 x N-type Connector

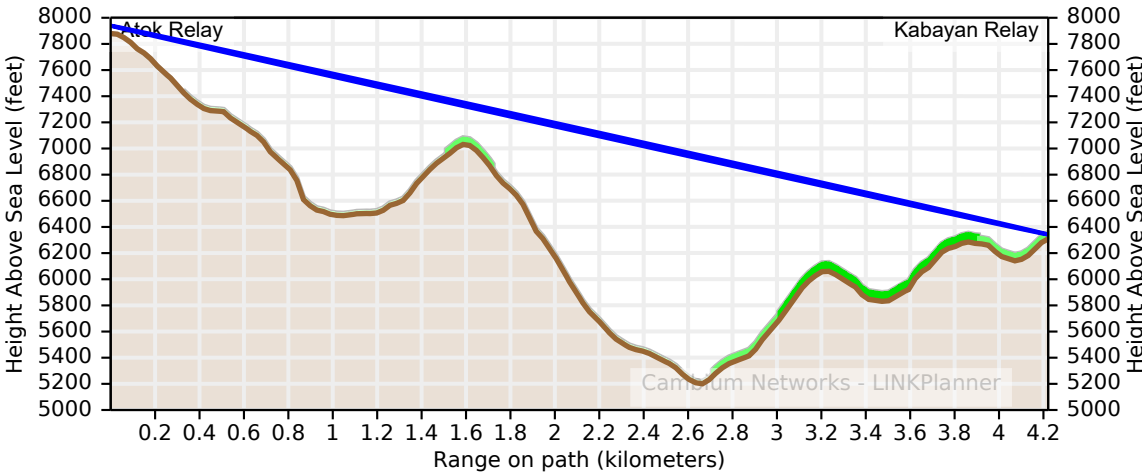
Atok Relay to Kabayan Relay



Equipment: Cambium Networks PTP550 Integrated

Cambium Networks High Gain Integrated @ 60 ft (Shared)

Cambium Networks High Gain Integrated @ 33 ft (Shared)



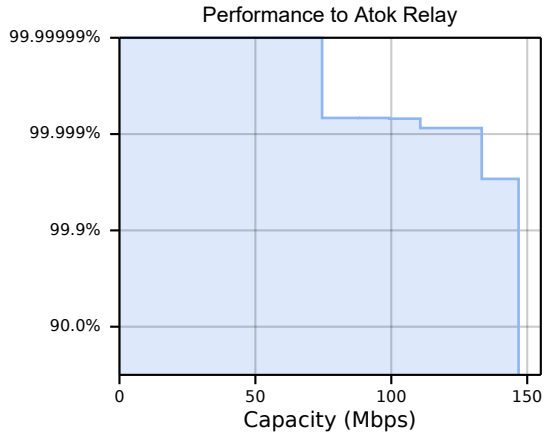
	Performance to Atok Relay - Link A	Performance to Kabayan Relay - Link A
Mean IP	146.82 Mbps	146.82 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

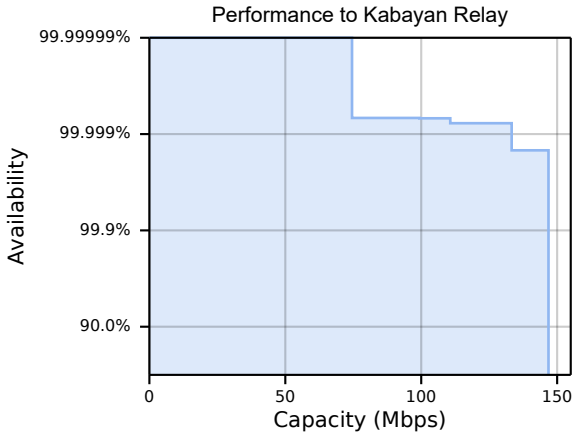
	Performance to Atok Relay - Link B	Performance to Kabayan Relay - Link B
Mean IP	146.82 Mbps	146.82 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary		
	Link A	Link B
Link Length	4.221 km	4.221 km
Band	5.8 GHz	5.8 GHz
Regulation	Argentina	Argentina
Modulation	Adaptive	Adaptive
Bandwidth	40 MHz	40 MHz
Total Path Loss	120.23 dB	120.23 dB
System Gain	152.00 dB	152.00 dB
System Gain Margin	31.77 dB	31.77 dB
Mean Aggregate Data Rate	293.64 Mbps	293.64 Mbps
Annual Link Availability	100.0000 %	100.0000 %
Annual Link Unavailability	1 secs/year	1 secs/year

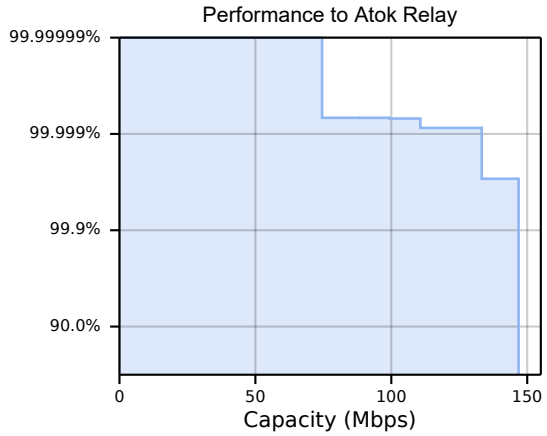
Link Summary (continued)		
	Link A	Link B
Frame Size	1518 Bytes	1518 Bytes
Prediction Model	ITU-R P.530-17	ITU-R P.530-17

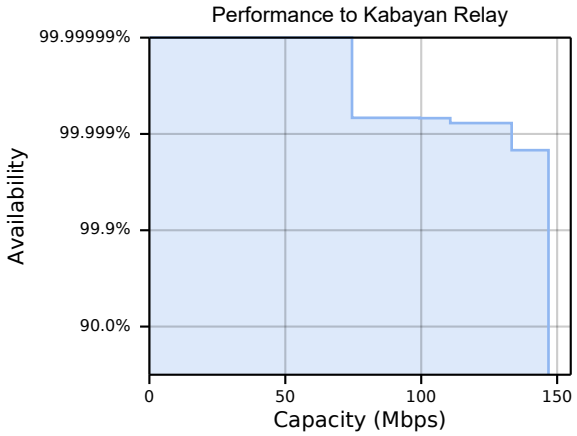
Performance Charts (Link A)





Performance Charts (Link B)

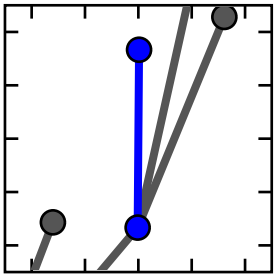




Climatic Factors, Losses and Standards		
	Link A	Link B
dN/dH not exceeded for 1% of time	-131.07 N units/km	-131.07 N units/km
Area roughness 110x110km	594.71 metre	594.71 metre
Geoclimatic factor	4.72e-06	4.72e-06
Fade Occurrence Factor (P0)	6.52e-09	6.52e-09
Path inclination	115.36 mr	115.36 mr
Value of K Exceeded for 99.99% (ke)	0.40	0.40
Excess Path Loss at ke	0.00 dB	0.00 dB
0.01% Rain rate	87.39 mm/hr	87.39 mm/hr
Rain Attenuation	0.47 dB/km	0.47 dB/km
Free Space Path Loss	120.21 dB	120.21 dB
Gaseous Absorption Loss	0.03 dB	0.03 dB
Link Type	Line-of-Sight	Line-of-Sight
Excess Path Loss	0.00 dB	0.00 dB
Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6	ITU-R P.676-12, ITU-R P.835-6
Diffraction Loss	ITU-R P.526-15	ITU-R P.526-15
Propagation	ITU-R P.530-17	ITU-R P.530-17
Rain Rate	ITU-R P.837-7	ITU-R P.837-7
Refractivity Index	ITU-R P.453-14	ITU-R P.453-14

Bill of Materials		
Part Number	Qty	Description
C000000L033	4	Gigabit Surge Suppressor (56V), 10/100/1000 BaseT
C050055H010	2	PTP 550 Integrated 5 GHz (ROW) with US Line Cord. Kit includes radio with antenna, power supply, line cord and mounting bracket
EW-E2PT550-WW	2	PTP 550 Extended Warranty, 2 Additional years (per END)

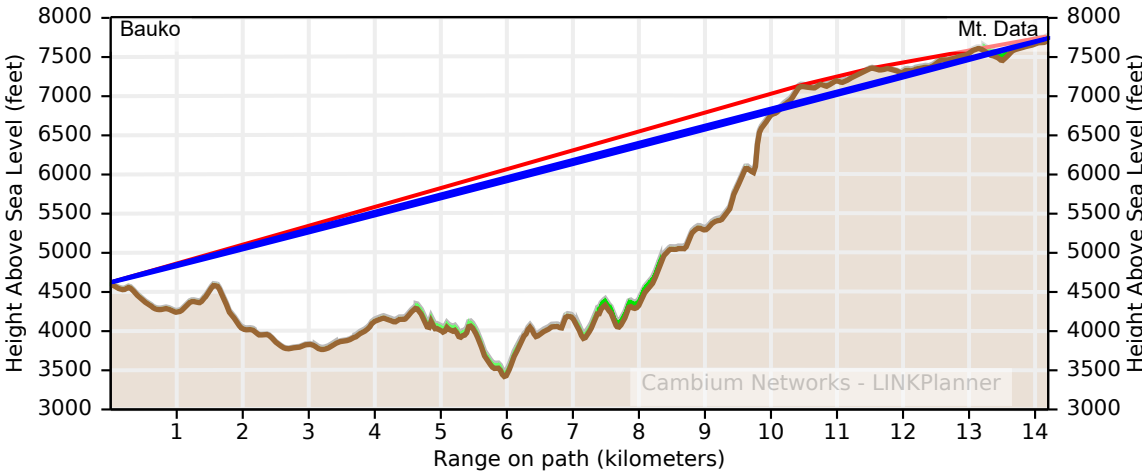
Bauko to Mt. Data



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 33 ft

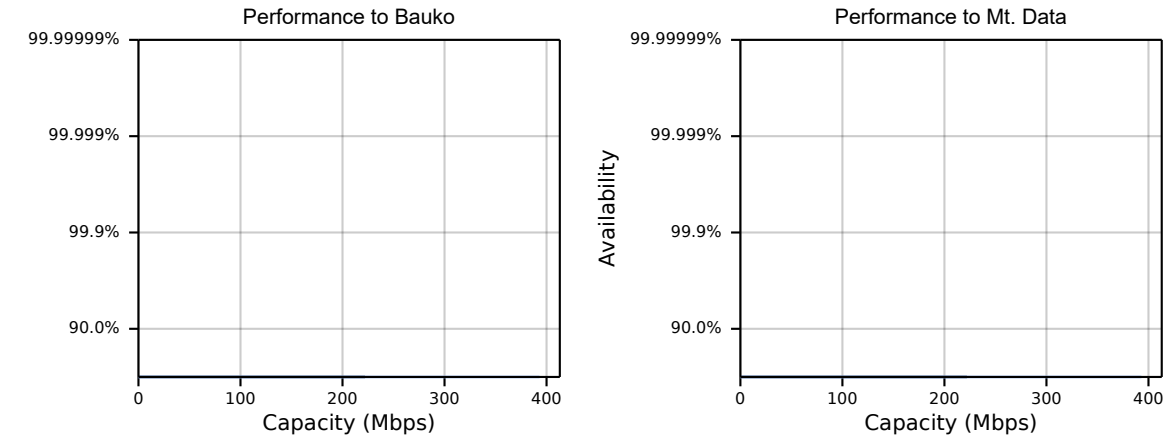
Cambium Networks High Gain Integrated @ 33 ft



	Performance to Bauko	Performance to Mt. Data
Mean IP	0.00 Mbps	0.00 Mbps
IP Availability	0.0000 % for 1.0 Mbps	0.0000 % for 1.0 Mbps

Link Summary			
Link Length	14.198 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	-21.24 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	0.00 Mbps
Modulation	Adaptive	Annual Link Availability	0.0000 %
Bandwidth	45 MHz	Annual Link Unavailability	365.0 days/year
Total Path Loss	182.52 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

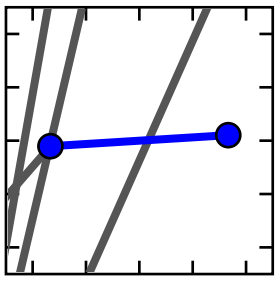
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-124.32 N units/km	Free Space Path Loss	130.74 dB
Area roughness 110x110km	611.76 metre	Gaseous Absorption Loss	0.09 dB
Geoclimatic factor	4.47e-06	Link Type	Non Line-of-Sight
Fade Occurrence Factor (P0)	1.66e-06	Excess Path Loss	51.68 dB
Path inclination	66.91 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.50	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	51.95 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	90.92 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.51 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

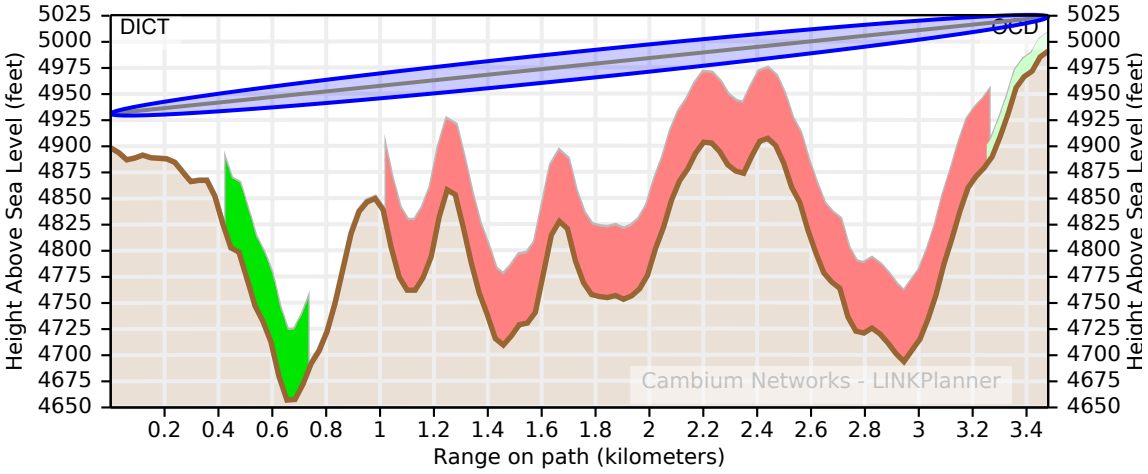
DICT to OCD



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 33 ft

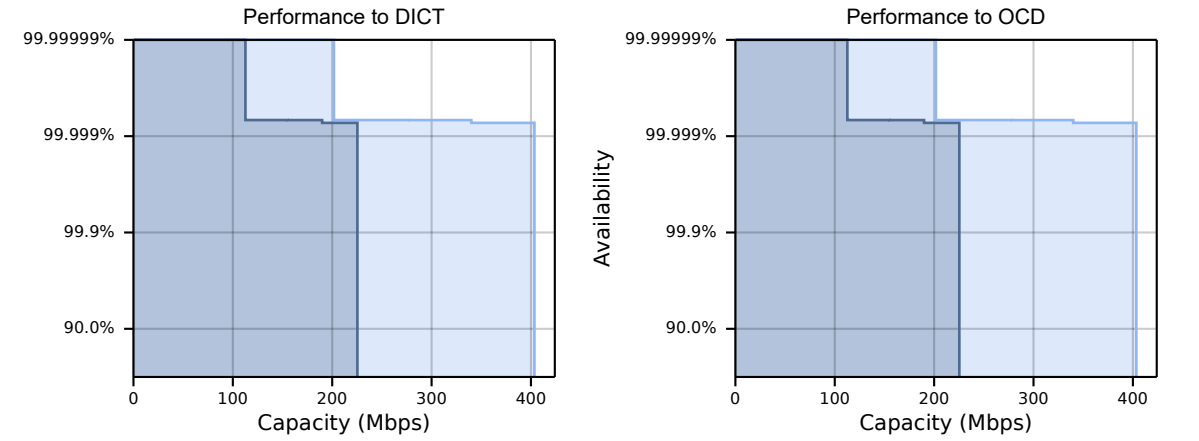
Cambium Networks High Gain Integrated @ 33 ft



	Performance to DICT	Performance to OCD
Mean IP	225.34 Mbps	225.34 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary			
Link Length	3.480 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	42.72 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	450.68 Mbps
Modulation	Adaptive	Annual Link Availability	100.0000 %
Bandwidth	45 MHz	Annual Link Unavailability	1 secs/year
Total Path Loss	118.56 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

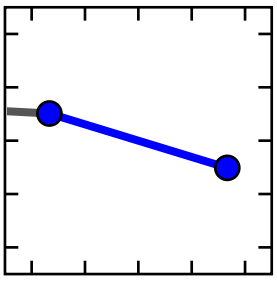
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-148.73 N units/km	Free Space Path Loss	118.53 dB
Area roughness 110x110km	595.61 metre	Gaseous Absorption Loss	0.03 dB
Geoclimatic factor	5.27e-06	Link Type	Line-of-Sight
Fade Occurrence Factor (P0)	1.10e-07	Excess Path Loss	0.00 dB
Path inclination	8.12 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.40	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	0.00 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	94.12 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.53 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

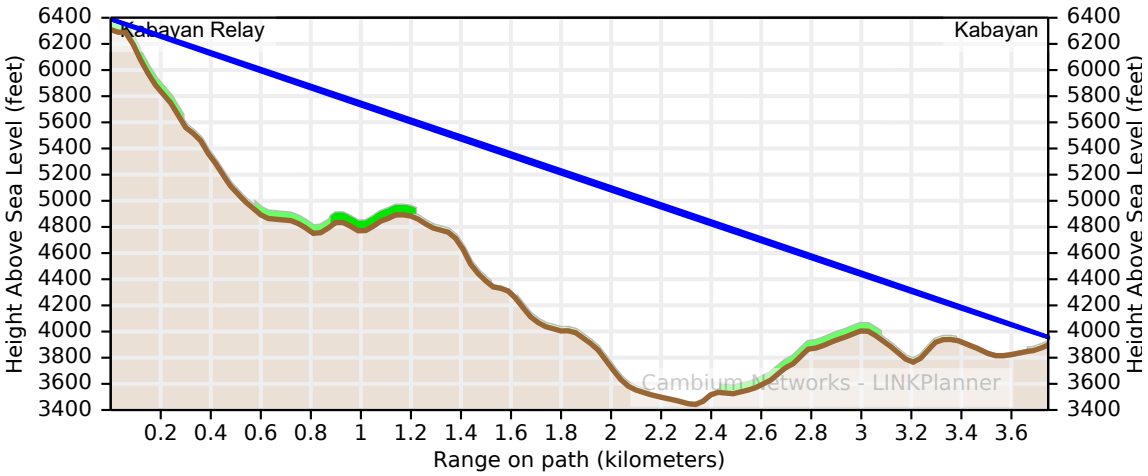
Kabayan Relay to Kabayan



Equipment: Cambium Networks PTP550 Integrated

Cambium Networks High Gain Integrated @ 80 ft (Shared)

Cambium Networks High Gain Integrated @ 60 ft (Shared)



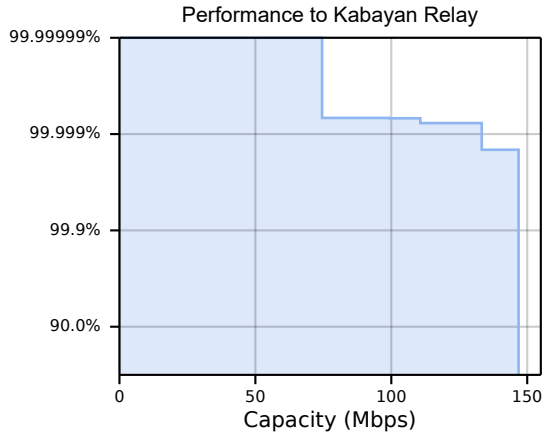
	Performance to Kabayan Relay - Link A	Performance to Kabayan - Link A
Mean IP	146.82 Mbps	149.08 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

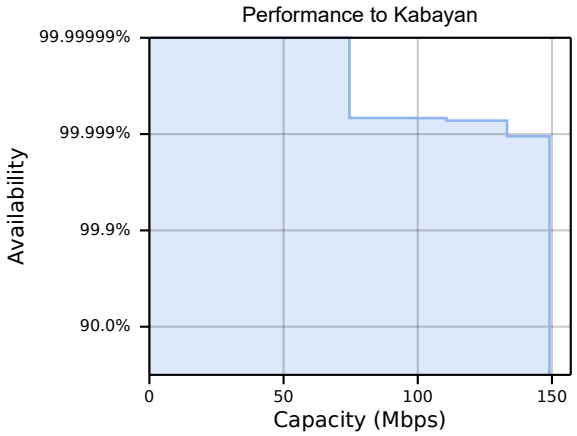
	Performance to Kabayan Relay - Link B	Performance to Kabayan - Link B
Mean IP	146.82 Mbps	149.08 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary		
	Link A	Link B
Link Length	3.747 km	3.747 km
Band	5.8 GHz	5.8 GHz
Regulation	Argentina	Argentina
Modulation	Adaptive	Adaptive
Bandwidth	40 MHz	40 MHz
Total Path Loss	119.20 dB	119.20 dB
System Gain	152.00 dB	152.00 dB
System Gain Margin	32.80 dB	32.80 dB
Mean Aggregate Data Rate	295.90 Mbps	295.90 Mbps
Annual Link Availability	100.0000 %	100.0000 %
Annual Link Unavailability	1 secs/year	1 secs/year

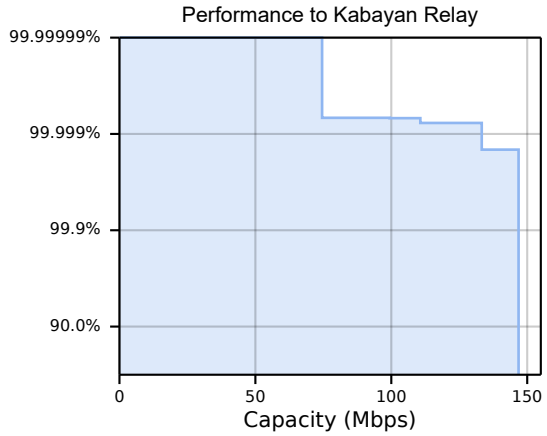
Link Summary (continued)		
	Link A	Link B
Frame Size	1518 Bytes	1518 Bytes
Prediction Model	ITU-R P.530-17	ITU-R P.530-17

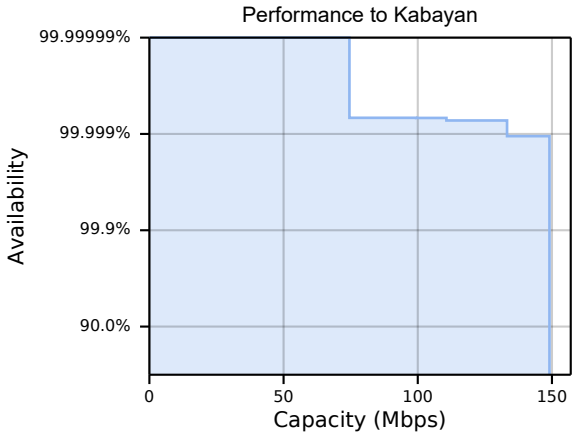
Performance Charts (Link A)





Performance Charts (Link B)

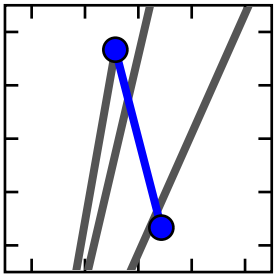




Climatic Factors, Losses and Standards		
	Link A	Link B
dN/dH not exceeded for 1% of time	-131.17 N units/km	-131.17 N units/km
Area roughness 110x110km	585.66 metre	585.66 metre
Geoclimatic factor	4.76e-06	4.76e-06
Fade Occurrence Factor (P0)	9.00e-09	9.00e-09
Path inclination	197.83 mr	197.83 mr
Value of K Exceeded for 99.99% (ke)	0.40	0.40
Excess Path Loss at ke	0.00 dB	0.00 dB
0.01% Rain rate	87.17 mm/hr	87.17 mm/hr
Rain Attenuation	0.47 dB/km	0.47 dB/km
Free Space Path Loss	119.17 dB	119.17 dB
Gaseous Absorption Loss	0.03 dB	0.03 dB
Link Type	Line-of-Sight	Line-of-Sight
Excess Path Loss	0.00 dB	0.00 dB
Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6	ITU-R P.676-12, ITU-R P.835-6
Diffraction Loss	ITU-R P.526-15	ITU-R P.526-15
Propagation	ITU-R P.530-17	ITU-R P.530-17
Rain Rate	ITU-R P.837-7	ITU-R P.837-7
Refractivity Index	ITU-R P.453-14	ITU-R P.453-14

Bill of Materials		
Part Number	Qty	Description
C000000L033	4	Gigabit Surge Suppressor (56V), 10/100/1000 BaseT
C050055H010	2	PTP 550 Integrated 5 GHz (ROW) with US Line Cord. Kit includes radio with antenna, power supply, line cord and mounting bracket
EW-E2PT550-WW	2	PTP 550 Extended Warranty, 2 Additional years (per END)

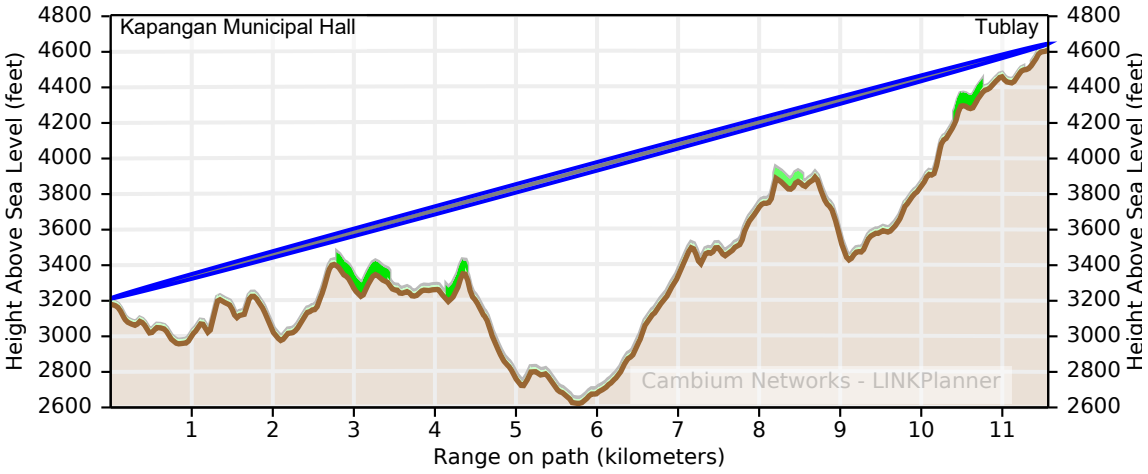
Kapangan Municipal Hall to Tublay



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 33 ft

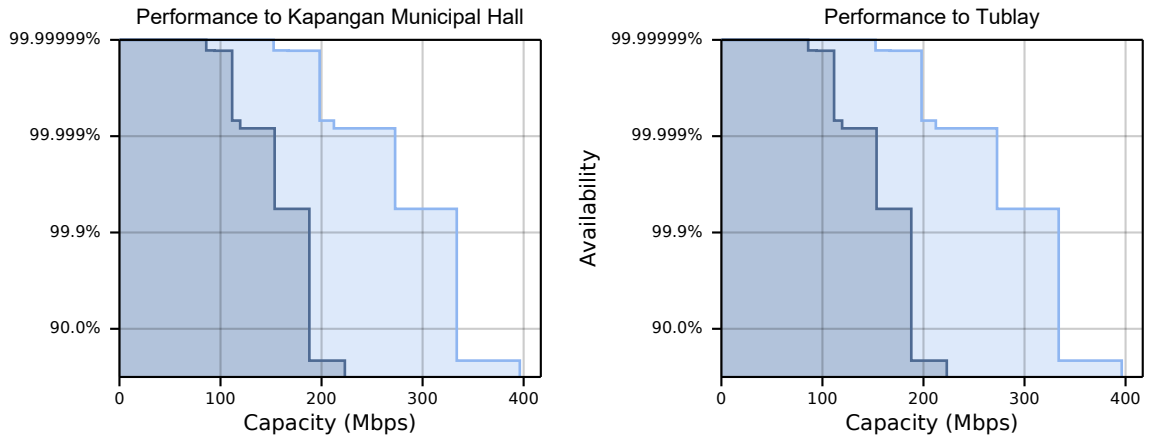
Cambium Networks High Gain Integrated @ 33 ft



	Performance to Kapangan Municipal Hall	Performance to Tublay
Mean IP	206.97 Mbps	206.97 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary			
Link Length	11.566 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	32.22 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	413.94 Mbps
Modulation	Adaptive	Annual Link Availability	100.0000 %
Bandwidth	45 MHz	Annual Link Unavailability	1 secs/year
Total Path Loss	129.05 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

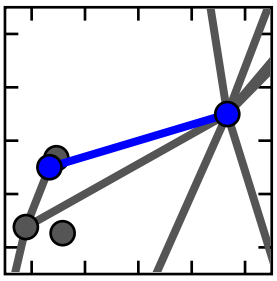
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-146.48 N units/km	Free Space Path Loss	128.96 dB
Area roughness 110x110km	625.11 metre	Gaseous Absorption Loss	0.09 dB
Geoclimatic factor	5.08e-06	Link Type	Line-of-Sight
Fade Occurrence Factor (P0)	3.56e-06	Excess Path Loss	0.00 dB
Path inclination	37.74 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.44	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	0.00 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	91.91 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.51 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

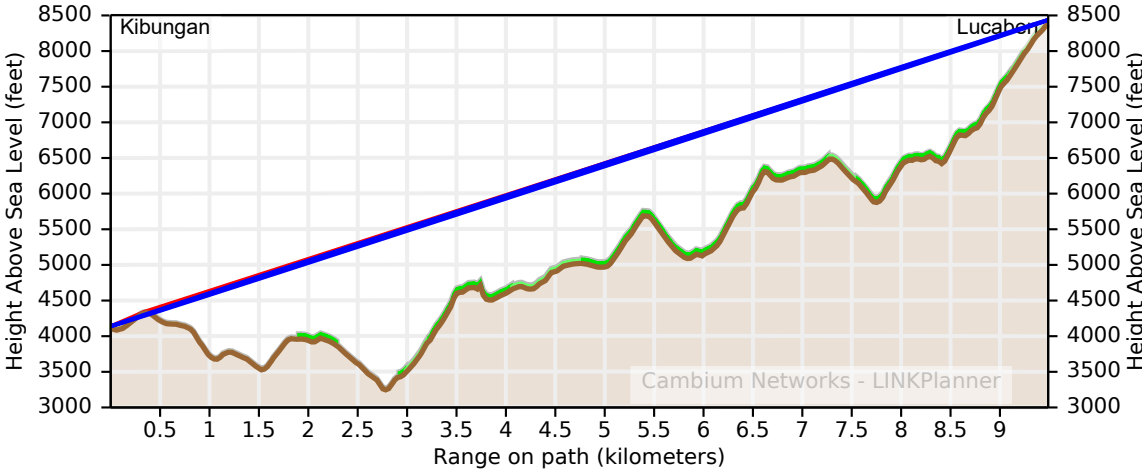
Kibungan to Lucaben



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 33 ft

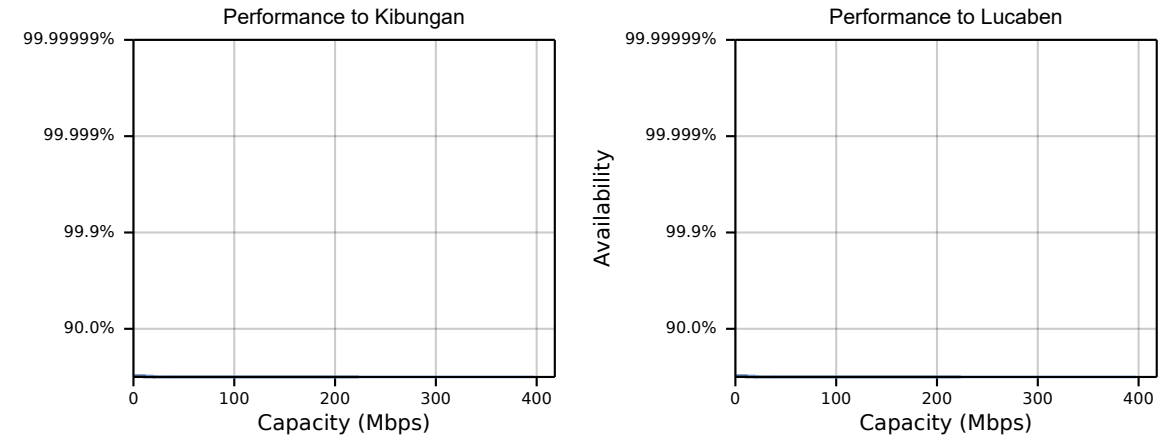
Cambium Networks High Gain Integrated @ 60 ft



	Performance to Kibungan	Performance to Lucaben
Mean IP	0.55 Mbps	0.55 Mbps
IP Availability	5.1315 % for 1.0 Mbps	5.1315 % for 1.0 Mbps

Link Summary			
Link Length	9.488 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	-3.10 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	1.10 Mbps
Modulation	Adaptive	Annual Link Availability	5.1315 %
Bandwidth	45 MHz	Annual Link Unavailability	346.3 days/year
Total Path Loss	164.38 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

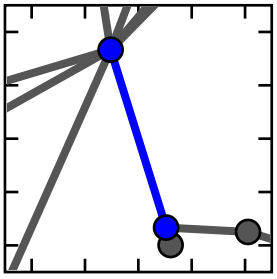
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-133.89 N units/km	Free Space Path Loss	127.24 dB
Area roughness 110x110km	621.26 metre	Gaseous Absorption Loss	0.06 dB
Geoclimatic factor	4.71e-06	Link Type	Non Line-of-Sight
Fade Occurrence Factor (P0)	2.75e-07	Excess Path Loss	37.07 dB
Path inclination	138.06 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.40	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	37.32 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	89.53 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.49 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

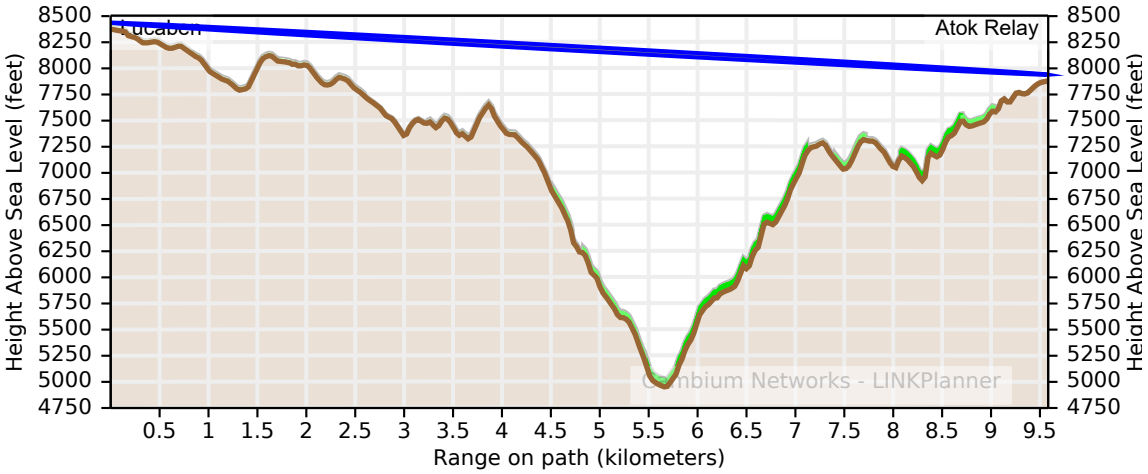
Lucaben to Atok Relay



Equipment: Cambium Networks PTP550 Integrated

Cambium Networks High Gain Integrated @ 60 ft (Shared)

Cambium Networks High Gain Integrated @ 60 ft (Shared)



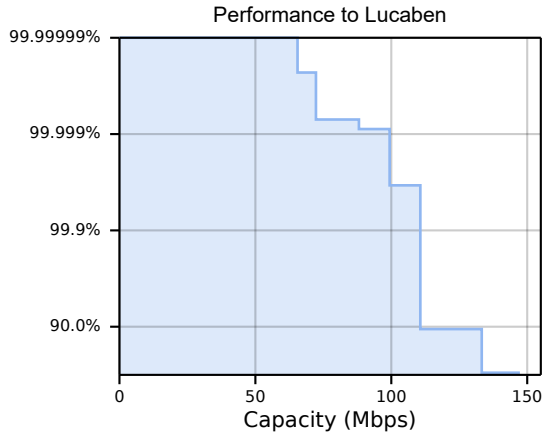
	Performance to Lucaben - Link A	Performance to Atok Relay - Link A
Mean IP	132.05 Mbps	137.40 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

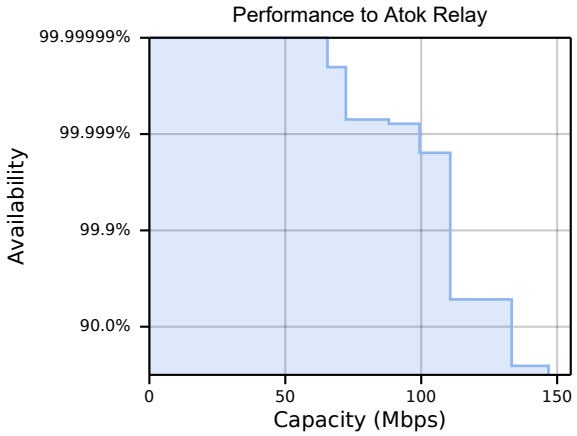
	Performance to Lucaben - Link B	Performance to Atok Relay - Link B
Mean IP	132.05 Mbps	137.40 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary		
	Link A	Link B
Link Length	9.584 km	9.584 km
Band	5.8 GHz	5.8 GHz
Regulation	Argentina	Argentina
Modulation	Adaptive	Adaptive
Bandwidth	40 MHz	40 MHz
Total Path Loss	127.38 dB	127.38 dB
System Gain	152.00 dB	152.00 dB
System Gain Margin	24.62 dB	24.62 dB
Mean Aggregate Data Rate	269.44 Mbps	269.44 Mbps
Annual Link Availability	100.0000 %	100.0000 %
Annual Link Unavailability	1 secs/year	1 secs/year

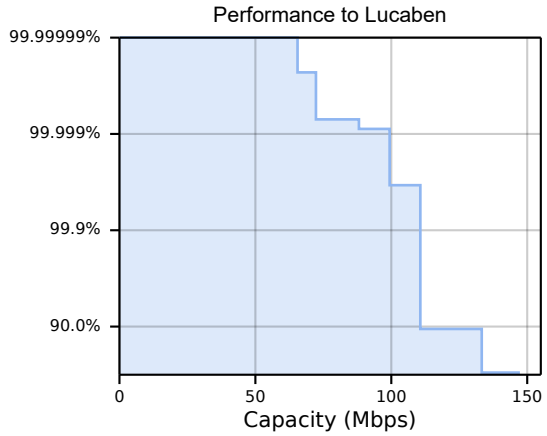
Link Summary (continued)		
	Link A	Link B
Frame Size	1518 Bytes	1518 Bytes
Prediction Model	ITU-R P.530-17	ITU-R P.530-17

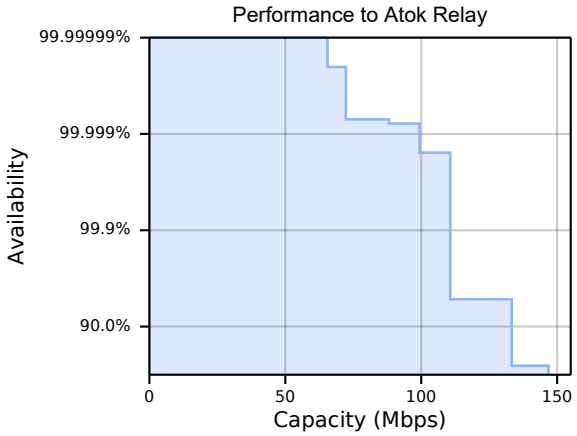
Performance Charts (Link A)





Performance Charts (Link B)

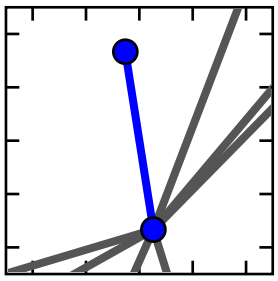




Climatic Factors, Losses and Standards		
	Link A	Link B
dN/dH not exceeded for 1% of time	-129.91 N units/km	-129.91 N units/km
Area roughness 110x110km	606.42 metre	606.42 metre
Geoclimatic factor	4.65e-06	4.65e-06
Fade Occurrence Factor (P0)	3.26e-07	3.26e-07
Path inclination	15.81 mr	15.81 mr
Value of K Exceeded for 99.99% (ke)	0.40	0.40
Excess Path Loss at ke	0.00 dB	0.00 dB
0.01% Rain rate	87.92 mm/hr	87.92 mm/hr
Rain Attenuation	0.48 dB/km	0.48 dB/km
Free Space Path Loss	127.33 dB	127.33 dB
Gaseous Absorption Loss	0.05 dB	0.05 dB
Link Type	Line-of-Sight	Line-of-Sight
Excess Path Loss	0.00 dB	0.00 dB
Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6	ITU-R P.676-12, ITU-R P.835-6
Diffraction Loss	ITU-R P.526-15	ITU-R P.526-15
Propagation	ITU-R P.530-17	ITU-R P.530-17
Rain Rate	ITU-R P.837-7	ITU-R P.837-7
Refractivity Index	ITU-R P.453-14	ITU-R P.453-14

Bill of Materials		
Part Number	Qty	Description
C000000L033	4	Gigabit Surge Suppressor (56V), 10/100/1000 BaseT
C050055H010	2	PTP 550 Integrated 5 GHz (ROW) with US Line Cord. Kit includes radio with antenna, power supply, line cord and mounting bracket
EW-E2PT550-WW	2	PTP 550 Extended Warranty, 2 Additional years (per END)

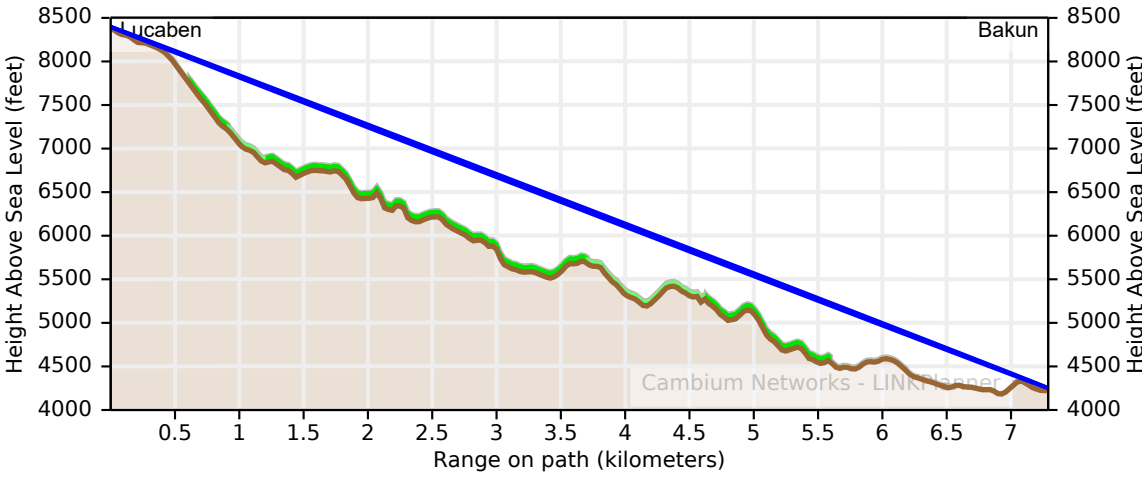
Lucaben to Bakun



Equipment: Cambium Networks PTP550 Integrated

Cambium Networks High Gain Integrated @ 20 ft (Shared)

Cambium Networks High Gain Integrated @ 30 ft (Shared)



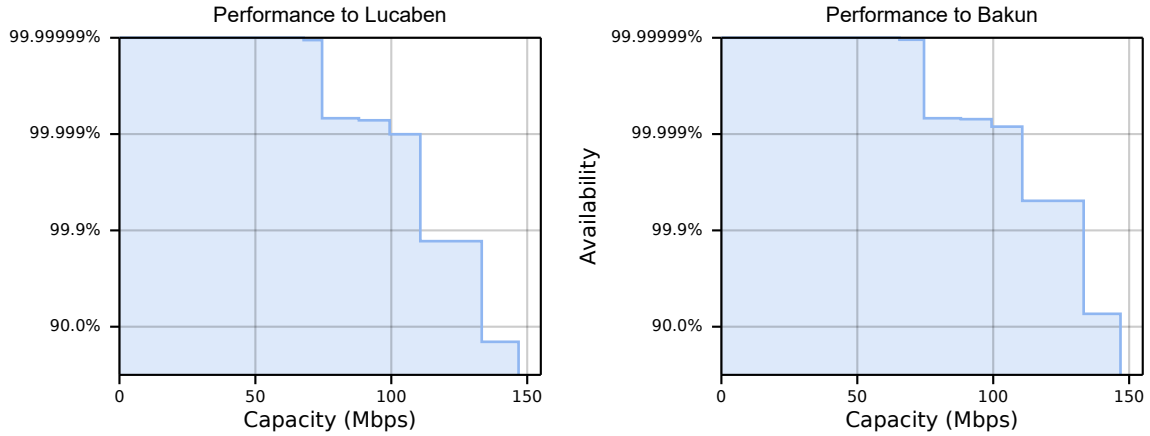
	Performance to Lucaben - Link A	Performance to Bakun - Link A
Mean IP	143.99 Mbps	146.08 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

	Performance to Lucaben - Link B	Performance to Bakun - Link B
Mean IP	143.99 Mbps	146.08 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

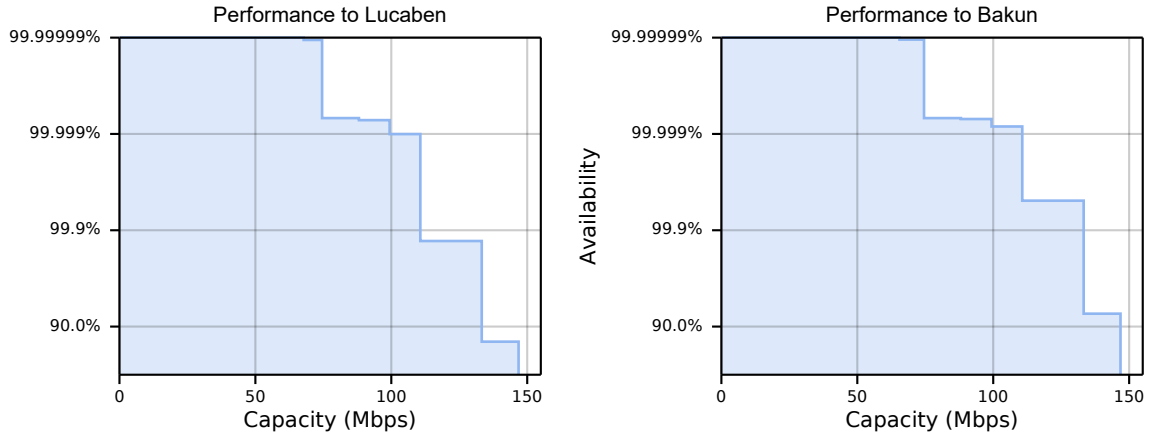
Link Summary		
	Link A	Link B
Link Length	7.289 km	7.289 km
Band	5.8 GHz	5.8 GHz
Regulation	Argentina	Argentina
Modulation	Adaptive	Adaptive
Bandwidth	40 MHz	40 MHz
Total Path Loss	125.00 dB	125.00 dB
System Gain	152.00 dB	152.00 dB
System Gain Margin	27.00 dB	27.00 dB
Mean Aggregate Data Rate	290.07 Mbps	290.07 Mbps
Annual Link Availability	100.0000 %	100.0000 %
Annual Link Unavailability	1 secs/year	1 secs/year

Link Summary (continued)		
	Link A	Link B
Frame Size	1518 Bytes	1518 Bytes
Prediction Model	ITU-R P.530-17	ITU-R P.530-17

Performance Charts (Link A)



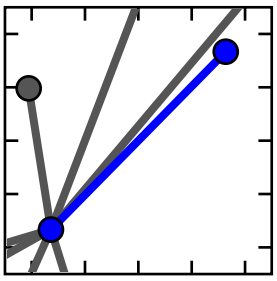
Performance Charts (Link B)



Climatic Factors, Losses and Standards		
	Link A	Link B
dN/dH not exceeded for 1% of time	-129.30 N units/km	-129.30 N units/km
Area roughness 110x110km	617.43 metre	617.43 metre
Geoclimatic factor	4.59e-06	4.59e-06
Fade Occurrence Factor (P0)	8.16e-08	8.16e-08
Path inclination	173.38 mr	173.38 mr
Value of K Exceeded for 99.99% (ke)	0.40	0.40
Excess Path Loss at ke	0.00 dB	0.00 dB
0.01% Rain rate	88.99 mm/hr	88.99 mm/hr
Rain Attenuation	0.49 dB/km	0.49 dB/km
Free Space Path Loss	124.95 dB	124.95 dB
Gaseous Absorption Loss	0.05 dB	0.05 dB
Link Type	Line-of-Sight	Line-of-Sight
Excess Path Loss	0.00 dB	0.00 dB
Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6	ITU-R P.676-12, ITU-R P.835-6
Diffraction Loss	ITU-R P.526-15	ITU-R P.526-15
Propagation	ITU-R P.530-17	ITU-R P.530-17
Rain Rate	ITU-R P.837-7	ITU-R P.837-7
Refractivity Index	ITU-R P.453-14	ITU-R P.453-14

Bill of Materials		
Part Number	Qty	Description
C000000L033	4	Gigabit Surge Suppressor (56V), 10/100/1000 BaseT
C050055H010	2	PTP 550 Integrated 5 GHz (ROW) with US Line Cord. Kit includes radio with antenna, power supply, line cord and mounting bracket
EW-E2PT550-WW	2	PTP 550 Extended Warranty, 2 Additional years (per END)

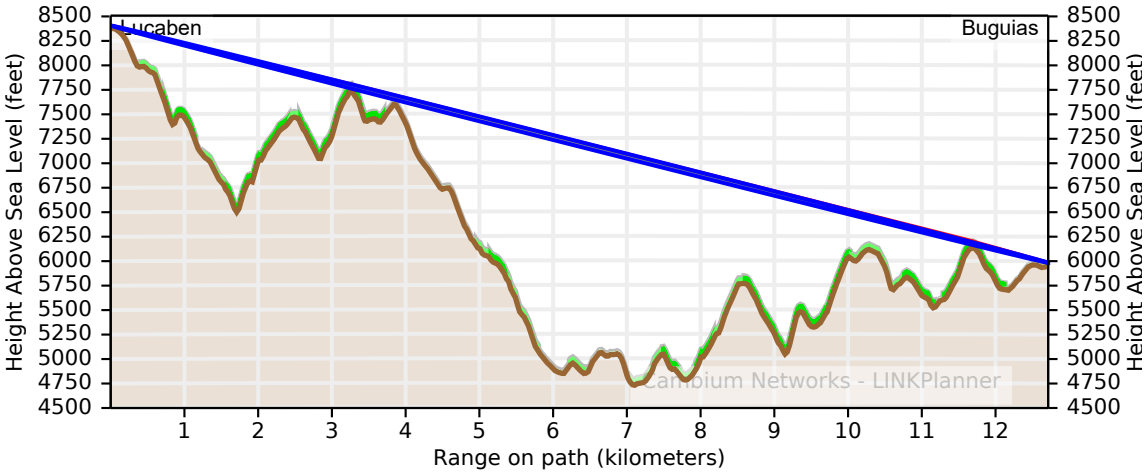
Lucaben to Buguias



Equipment: Cambium Networks PTP550 Connectorized

Cambium Networks 2ft High Performance Dual-Polar Parabolic RDH4508C @ 30 ft (Shared)

Cambium Networks 2ft High Performance Dual-Polar Parabolic RDH4508C @ 30 ft (Shared)



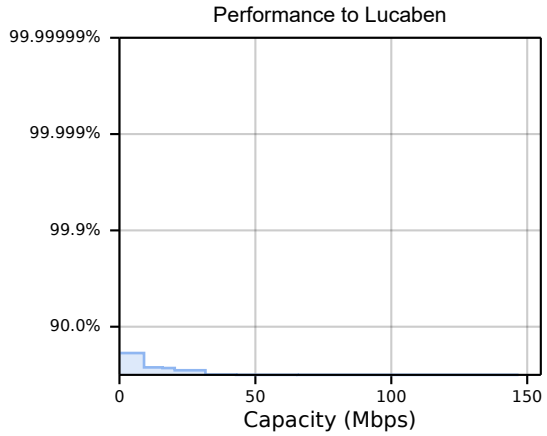
	Performance to Lucaben - Link A	Performance to Buguias - Link A
Mean IP	11.55 Mbps	13.77 Mbps
IP Availability	64.7851 % for 1.0 Mbps	64.7851 % for 1.0 Mbps

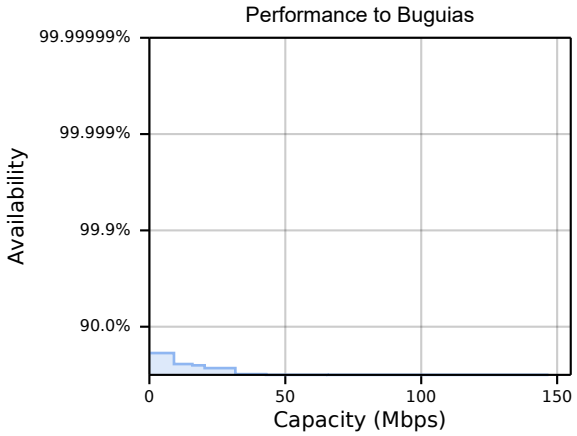
	Performance to Lucaben - Link B	Performance to Buguias - Link B
Mean IP	11.55 Mbps	13.77 Mbps
IP Availability	64.7851 % for 1.0 Mbps	64.7851 % for 1.0 Mbps

Link Summary		
	Link A	Link B
Link Length	12.714 km	12.714 km
Band	5.8 GHz	5.8 GHz
Regulation	Other	Other
Modulation	Adaptive	Adaptive
Bandwidth	40 MHz	40 MHz
Total Path Loss	160.94 dB	160.94 dB
System Gain	162.24 dB	162.24 dB
System Gain Margin	1.30 dB	1.30 dB
Mean Aggregate Data Rate	25.32 Mbps	25.32 Mbps
Annual Link Availability	64.7851 %	64.7851 %
Annual Link Unavailability	128.5 days/year	128.5 days/year

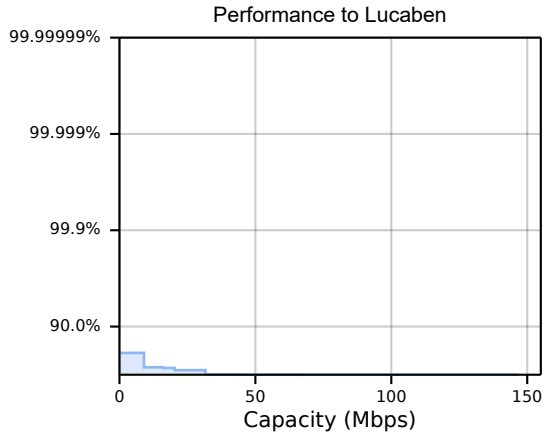
Link Summary (continued)		
	Link A	Link B
Frame Size	1518 Bytes	1518 Bytes
Prediction Model	ITU-R P.530-17	ITU-R P.530-17

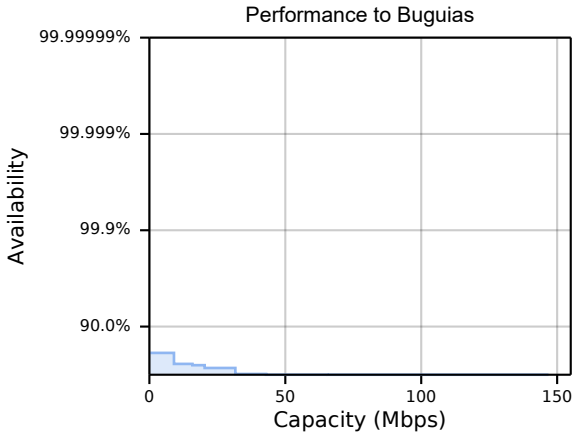
Performance Charts (Link A)





Performance Charts (Link B)

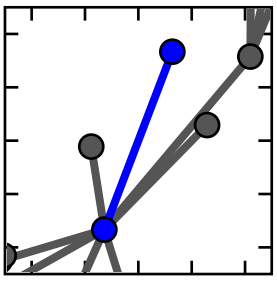




Climatic Factors, Losses and Standards		
	Link A	Link B
dN/dH not exceeded for 1% of time	-127.71 N units/km	-127.71 N units/km
Area roughness 110x110km	608.63 metre	608.63 metre
Geoclimatic factor	4.58e-06	4.58e-06
Fade Occurrence Factor (P0)	6.54e-07	6.54e-07
Path inclination	58.09 mr	58.09 mr
Value of K Exceeded for 99.99% (ke)	0.47	0.47
Excess Path Loss at ke	33.73 dB	33.73 dB
0.01% Rain rate	88.72 mm/hr	88.72 mm/hr
Rain Attenuation	0.49 dB/km	0.49 dB/km
Free Space Path Loss	129.80 dB	129.80 dB
Gaseous Absorption Loss	0.08 dB	0.08 dB
Link Type	Non Line-of-Sight	Non Line-of-Sight
Excess Path Loss	31.06 dB	31.06 dB
Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6	ITU-R P.676-12, ITU-R P.835-6
Diffraction Loss	ITU-R P.526-15	ITU-R P.526-15
Propagation	ITU-R P.530-17	ITU-R P.530-17
Rain Rate	ITU-R P.837-7	ITU-R P.837-7
Refractivity Index	ITU-R P.453-14	ITU-R P.453-14

Bill of Materials		
Part Number	Qty	Description
C000000L033	4	Gigabit Surge Suppressor (56V), 10/100/1000 BaseT
C050055H005	2	PTP 550 Connectorized 5 GHz (ROW) with EU Line Cord. Kit includes radio with power supply, line cord and mounting bracket
EW-E2PT550-WW	2	PTP 550 Extended Warranty, 2 Additional years (per END)
RDH4508C	2	High Performance 4.9-6 GHz, 2-FT (0.6M), DUAL-POL antenna with 2 x N-type Connector

Lucaben to Mankayan



Equipment: Cambium Networks PTP550E Integrated

Cambium Networks High Gain Integrated @ 20 ft (Shared)

Cambium Networks High Gain Integrated @ 20 ft (Shared)

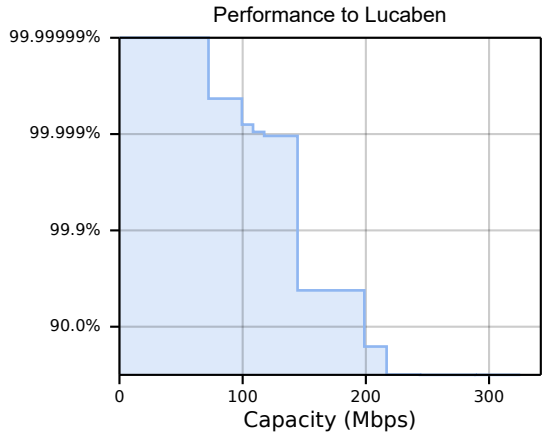
	Performance to Lucaben - Link A	Performance to Mankayan - Link A
Mean IP	211.57 Mbps	236.65 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

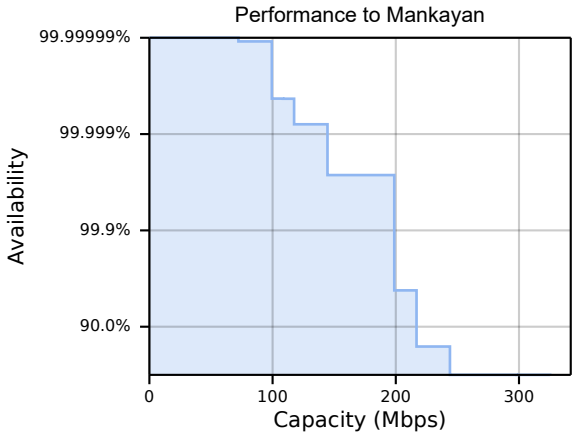
	Performance to Lucaben - Link B	Performance to Mankayan - Link B
Mean IP	105.89 Mbps	111.08 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary		
	Link A	Link B
Link Length	16.518 km	16.518 km
Band	5.8 GHz	5.8 GHz
Regulation	Argentina	Argentina
Modulation	Adaptive	Adaptive
Bandwidth	80 MHz	40 MHz
Total Path Loss	132.16 dB	132.16 dB
System Gain	151.00 dB	153.00 dB
System Gain Margin	18.84 dB	20.84 dB
Mean Aggregate Data Rate	448.22 Mbps	216.97 Mbps
Annual Link Availability	100.0000 %	100.0000 %
Annual Link Unavailability	1 secs/year	1 secs/year

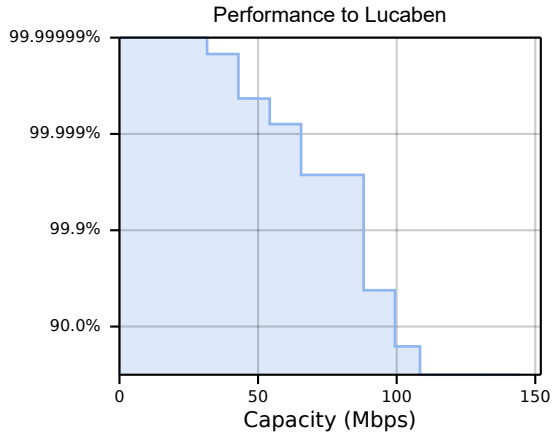
Link Summary (continued)		
	Link A	Link B
Frame Size	1518 Bytes	1518 Bytes
Prediction Model	ITU-R P.530-17	ITU-R P.530-17

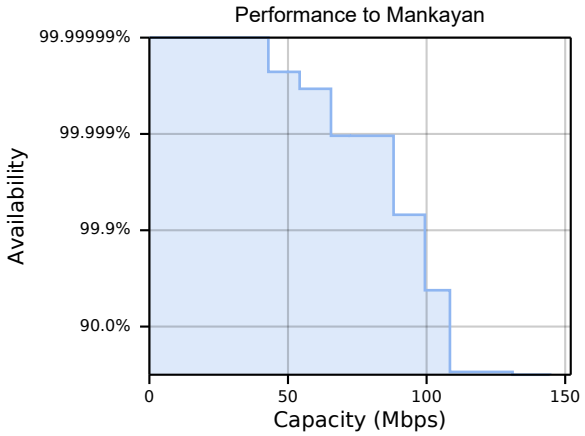
Performance Charts (Link A)





Performance Charts (Link B)

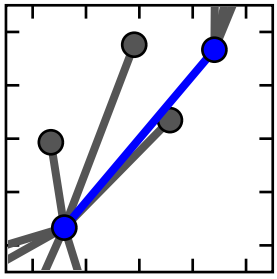




Climatic Factors, Losses and Standards		
	Link A	Link B
dN/dH not exceeded for 1% of time	-126.85 N units/km	-126.85 N units/km
Area roughness 110x110km	614.39 metre	614.39 metre
Geoclimatic factor	4.54e-06	4.54e-06
Fade Occurrence Factor (P0)	2.89e-06	2.89e-06
Path inclination	74.14 mr	74.14 mr
Value of K Exceeded for 99.99% (ke)	0.54	0.54
Excess Path Loss at ke	0.80 dB	0.80 dB
0.01% Rain rate	88.98 mm/hr	88.98 mm/hr
Rain Attenuation	0.49 dB/km	0.49 dB/km
Free Space Path Loss	132.06 dB	132.06 dB
Gaseous Absorption Loss	0.11 dB	0.11 dB
Link Type	Line-of-Sight	Line-of-Sight
Excess Path Loss	0.00 dB	0.00 dB
Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6	ITU-R P.676-12, ITU-R P.835-6
Diffraction Loss	ITU-R P.526-15	ITU-R P.526-15
Propagation	ITU-R P.530-17	ITU-R P.530-17
Rain Rate	ITU-R P.837-7	ITU-R P.837-7
Refractivity Index	ITU-R P.453-14	ITU-R P.453-14

Bill of Materials		
Part Number	Qty	Description
C000000L033	4	Gigabit Surge Suppressor (56V), 10/100/1000 BaseT
C050055H019	2	PTP 550E Integrated including 4.9 GHz (ROW) with US Line Cord. Kit includes radio with antenna, power supply, line cord and mounting bracket
EW-E2PT550-WW	2	PTP 550 Extended Warranty, 2 Additional years (per END)

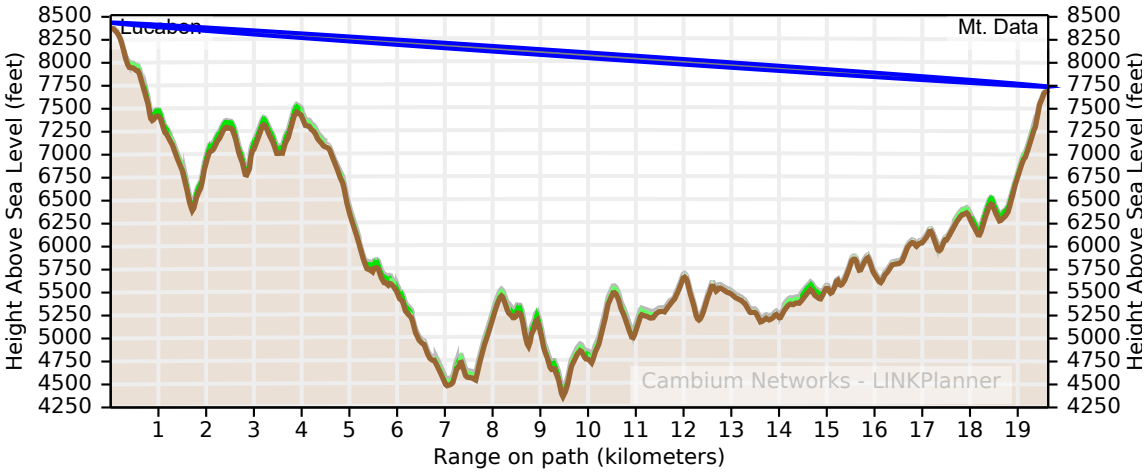
Lucaben to Mt. Data



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 60 ft

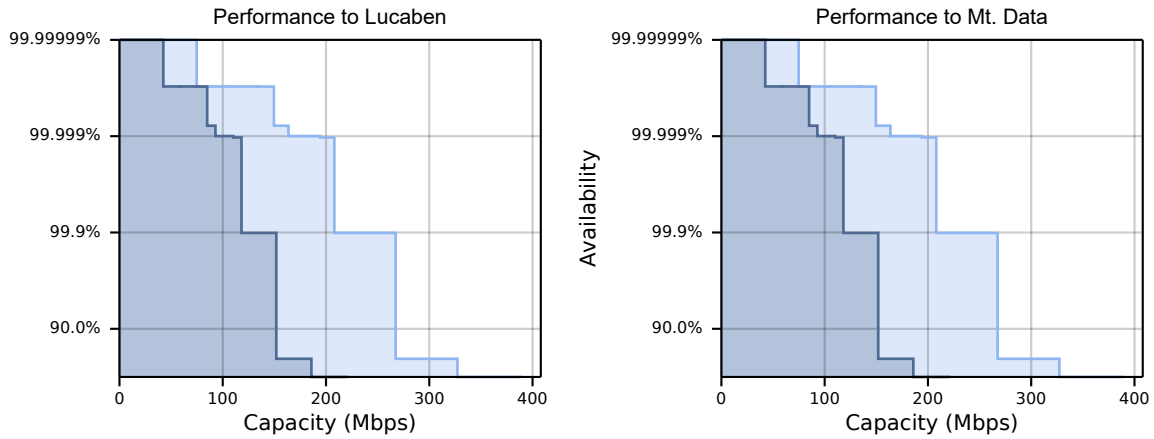
Cambium Networks High Gain Integrated @ 33 ft



	Performance to Lucaben	Performance to Mt. Data
Mean IP	171.57 Mbps	171.57 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary			
Link Length	19.638 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	27.61 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	343.13 Mbps
Modulation	Adaptive	Annual Link Availability	100.0000 %
Bandwidth	45 MHz	Annual Link Unavailability	1 secs/year
Total Path Loss	133.67 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

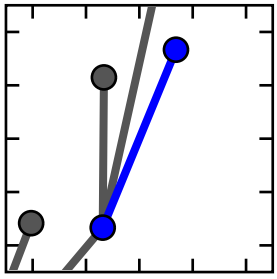
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-127.08 N units/km	Free Space Path Loss	133.56 dB
Area roughness 110x110km	607.92 metre	Gaseous Absorption Loss	0.11 dB
Geoclimatic factor	4.56e-06	Link Type	Line-of-Sight
Fade Occurrence Factor (P0)	5.86e-06	Excess Path Loss	0.00 dB
Path inclination	10.82 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.58	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	0.00 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	89.05 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.49 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

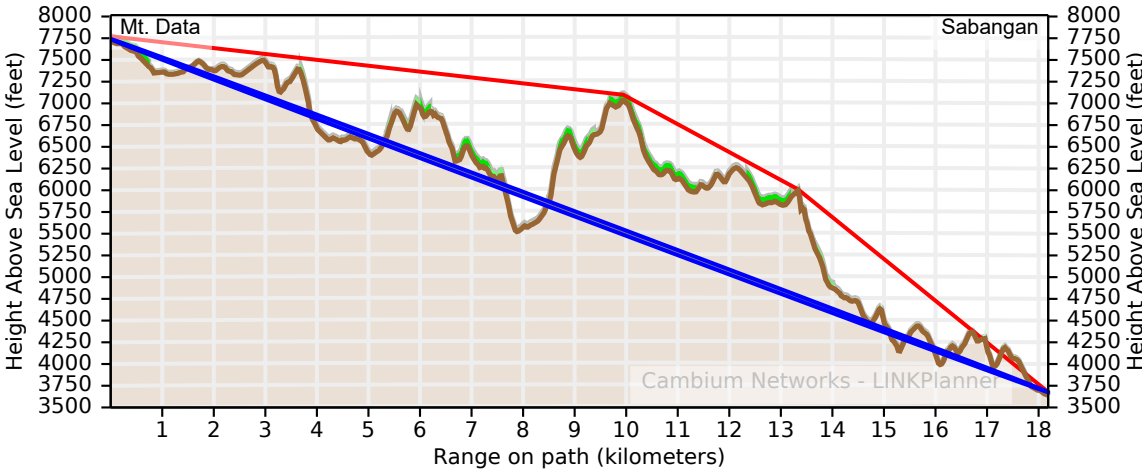
Mt. Data to Sabangan



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 33 ft

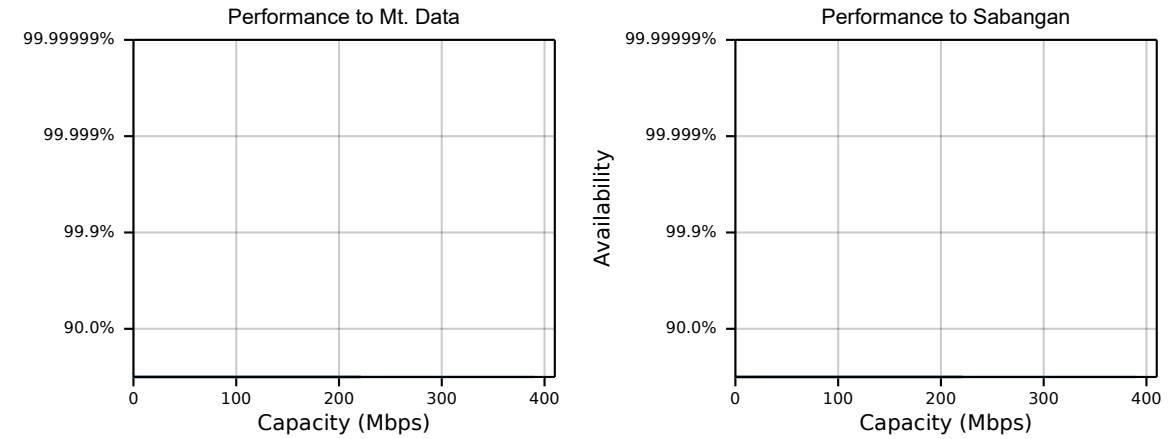
Cambium Networks High Gain Integrated @ 33 ft



	Performance to Mt. Data	Performance to Sabangan
Mean IP	0.00 Mbps	0.00 Mbps
IP Availability	0.0000 % for 1.0 Mbps	0.0000 % for 1.0 Mbps

Link Summary			
Link Length	18.186 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	-38.84 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	0.00 Mbps
Modulation	Adaptive	Annual Link Availability	0.0000 %
Bandwidth	45 MHz	Annual Link Unavailability	365.0 days/year
Total Path Loss	200.11 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

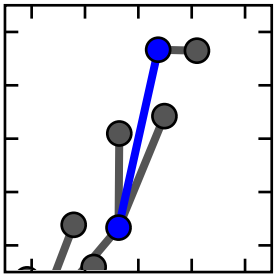
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-124.43 N units/km	Free Space Path Loss	132.89 dB
Area roughness 110x110km	607.80 metre	Gaseous Absorption Loss	0.12 dB
Geoclimatic factor	4.49e-06	Link Type	Non Line-of-Sight
Fade Occurrence Factor (P0)	6.29e-06	Excess Path Loss	67.09 dB
Path inclination	68.09 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.56	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	67.17 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	91.10 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.51 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

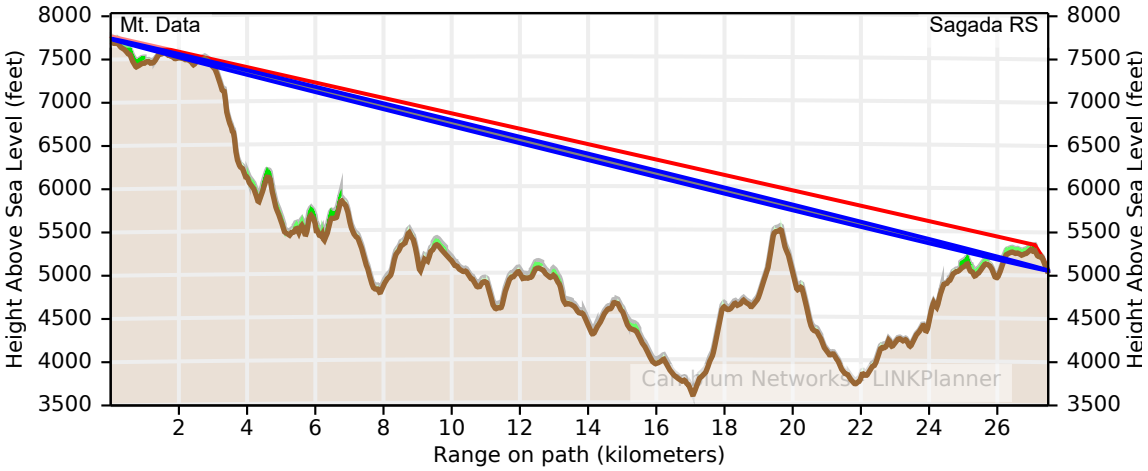
Mt. Data to Sagada RS



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 33 ft

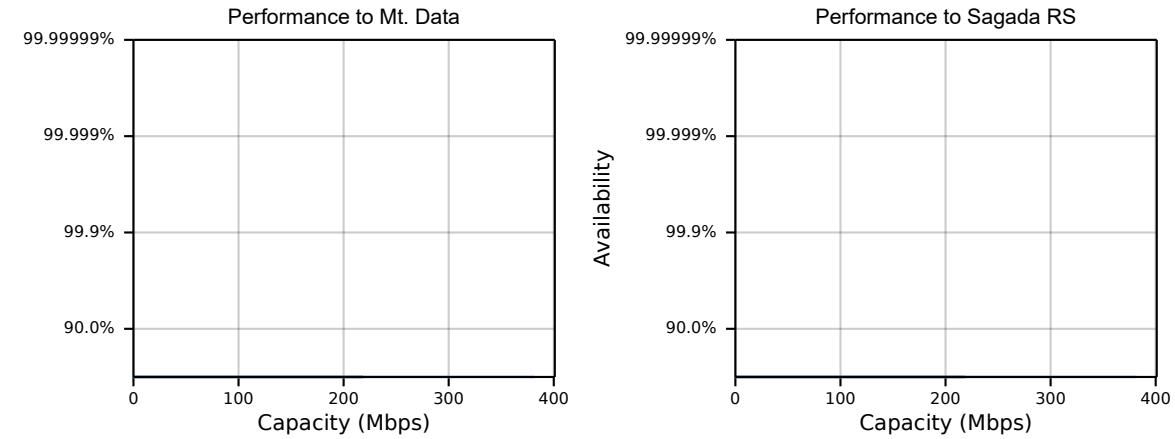
Cambium Networks High Gain Integrated @ 33 ft



	Performance to Mt. Data	Performance to Sagada RS
Mean IP	0.00 Mbps	0.00 Mbps
IP Availability	0.0000 % for 1.0 Mbps	0.0000 % for 1.0 Mbps

Link Summary			
Link Length	27.492 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	-46.23 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	0.00 Mbps
Modulation	Adaptive	Annual Link Availability	0.0000 %
Bandwidth	45 MHz	Annual Link Unavailability	365.0 days/year
Total Path Loss	207.51 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

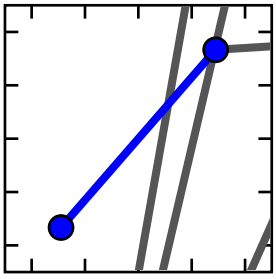
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-123.37 N units/km	Free Space Path Loss	136.48 dB
Area roughness 110x110km	614.19 metre	Gaseous Absorption Loss	0.18 dB
Geoclimatic factor	4.44e-06	Link Type	Non Line-of-Sight
Fade Occurrence Factor (P0)	2.80e-05	Excess Path Loss	70.85 dB
Path inclination	29.72 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.67	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	70.91 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	91.62 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.51 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

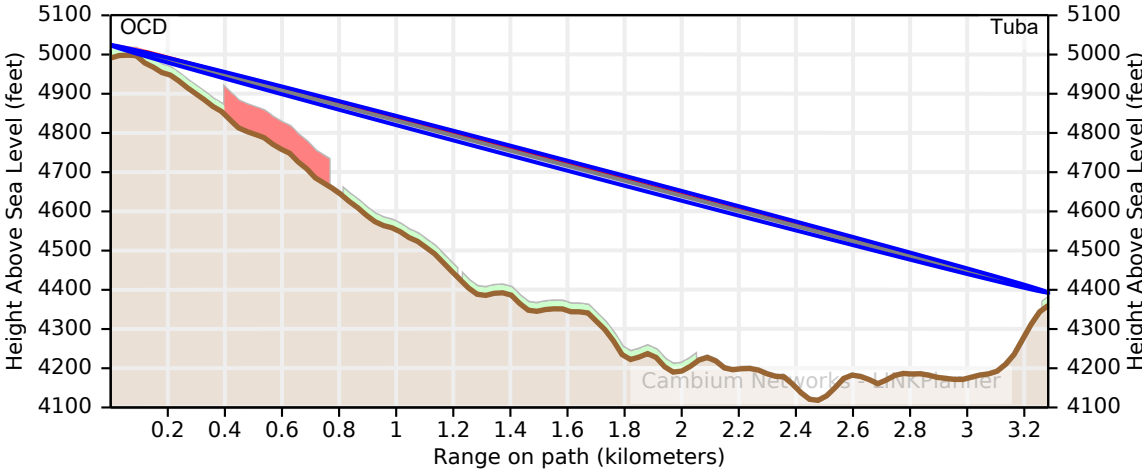
OCD to Tuba



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 33 ft

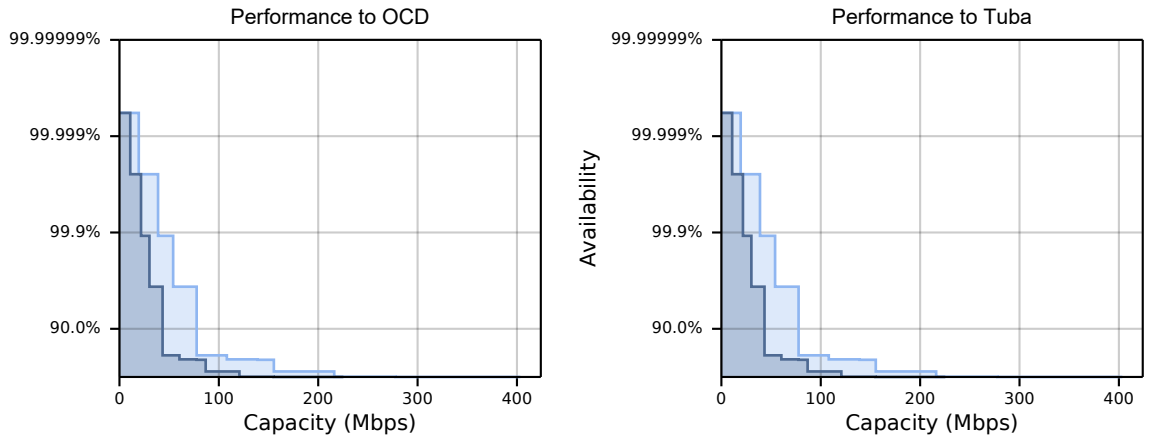
Cambium Networks High Gain Integrated @ 33 ft



	Performance to OCD	Performance to Tuba
Mean IP	77.28 Mbps	77.28 Mbps
IP Availability	99.9997 % for 1.0 Mbps	99.9997 % for 1.0 Mbps

Link Summary			
Link Length	3.284 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	17.66 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	154.56 Mbps
Modulation	Adaptive	Annual Link Availability	99.9997 %
Bandwidth	45 MHz	Annual Link Unavailability	1.7 mins/year
Total Path Loss	143.61 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

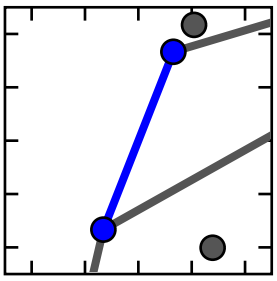
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-150.85 N units/km	Free Space Path Loss	118.02 dB
Area roughness 110x110km	595.98 metre	Gaseous Absorption Loss	0.02 dB
Geoclimatic factor	5.34e-06	Link Type	Non Line-of-Sight
Fade Occurrence Factor (P0)	1.77e-08	Excess Path Loss	25.56 dB
Path inclination	58.57 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.40	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	25.72 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	94.72 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.54 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

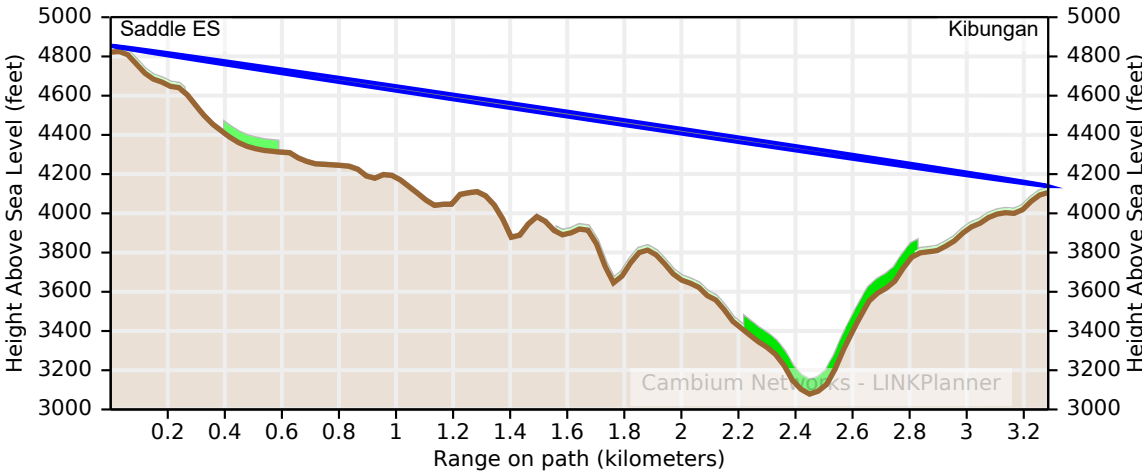
Saddle ES to Kibungan



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 33 ft

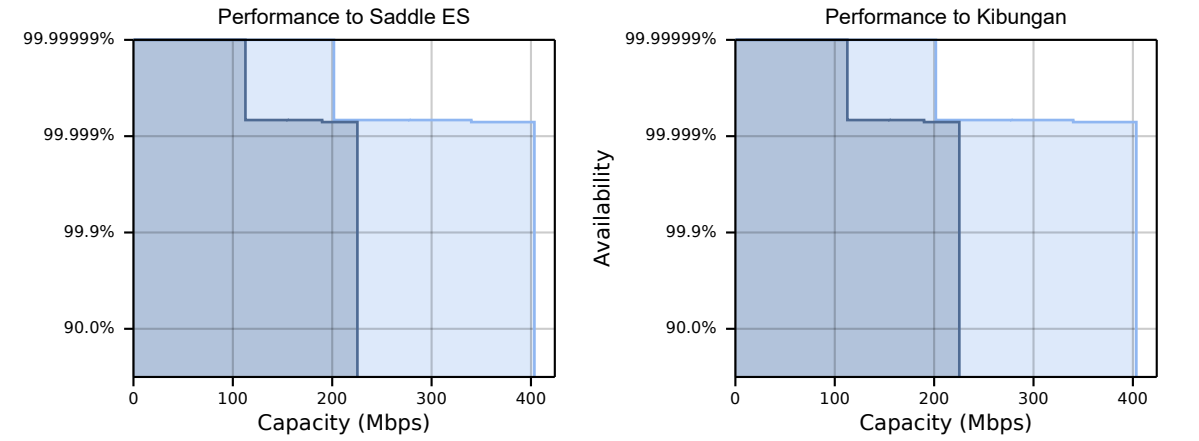
Cambium Networks High Gain Integrated @ 33 ft



	Performance to Saddle ES	Performance to Kibungan
Mean IP	225.34 Mbps	225.34 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary			
Link Length	3.286 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	43.22 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	450.68 Mbps
Modulation	Adaptive	Annual Link Availability	100.0000 %
Bandwidth	45 MHz	Annual Link Unavailability	1 secs/year
Total Path Loss	118.05 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

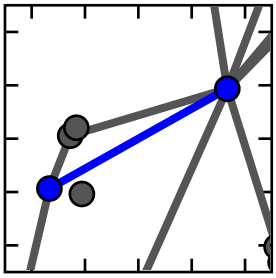
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-138.96 N units/km	Free Space Path Loss	118.03 dB
Area roughness 110x110km	629.64 metre	Gaseous Absorption Loss	0.03 dB
Geoclimatic factor	4.84e-06	Link Type	Line-of-Sight
Fade Occurrence Factor (P0)	1.62e-08	Excess Path Loss	0.00 dB
Path inclination	66.40 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.40	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	0.00 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	90.59 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.50 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

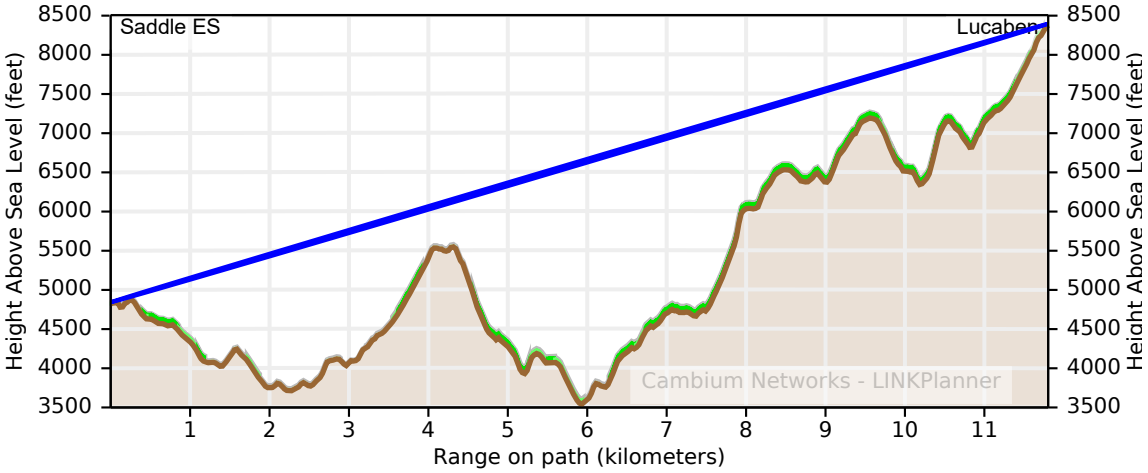
Saddle ES to Lucaben



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 20 ft

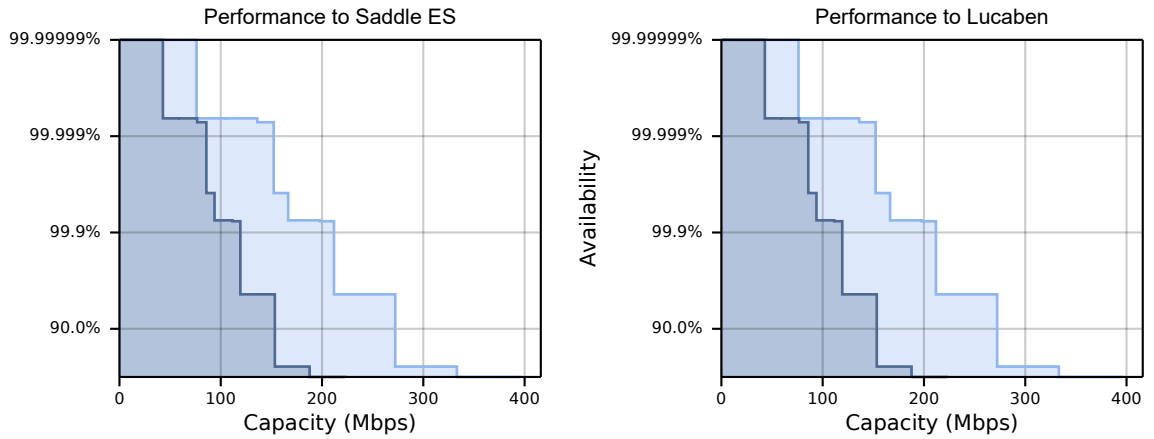
Cambium Networks High Gain Integrated @ 20 ft



	Performance to Saddle ES	Performance to Lucaben
Mean IP	166.17 Mbps	166.17 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary			
Link Length	11.803 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	26.99 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	332.34 Mbps
Modulation	Adaptive	Annual Link Availability	100.0000 %
Bandwidth	45 MHz	Annual Link Unavailability	1 secs/year
Total Path Loss	134.28 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

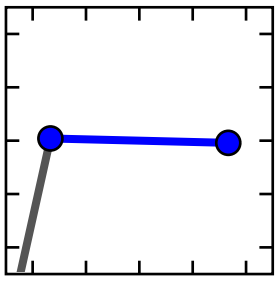
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-134.80 N units/km	Free Space Path Loss	129.14 dB
Area roughness 110x110km	621.30 metre	Gaseous Absorption Loss	0.07 dB
Geoclimatic factor	4.74e-06	Link Type	Near Line-of-Sight
Fade Occurrence Factor (P0)	6.06e-07	Excess Path Loss	5.07 dB
Path inclination	91.80 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.45	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	5.85 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	89.58 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.49 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

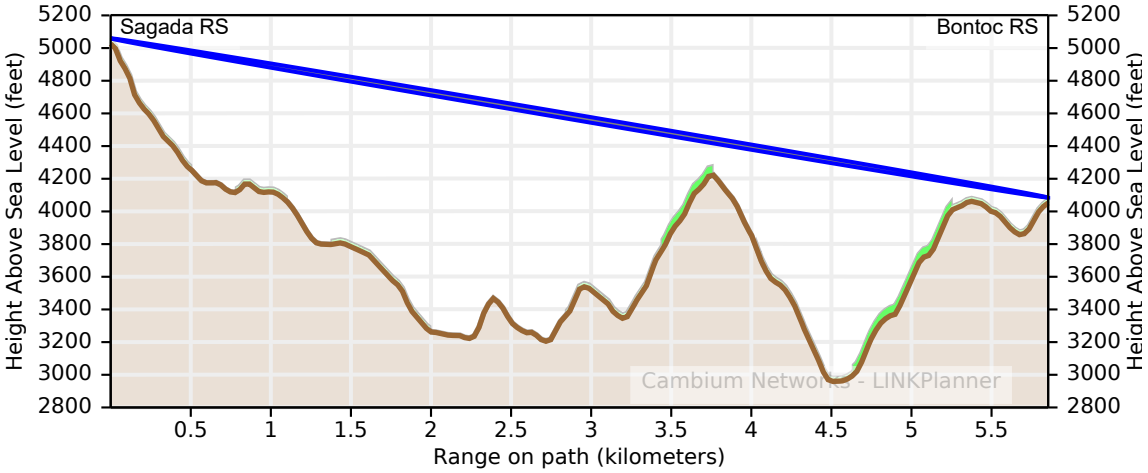
Sagada RS to Bontoc RS



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 33 ft

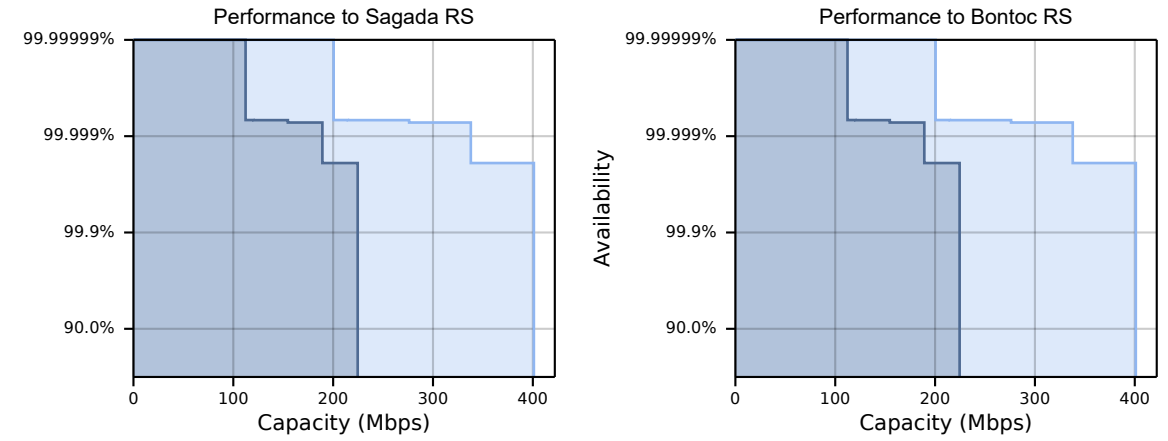
Cambium Networks High Gain Integrated @ 33 ft



	Performance to Sagada RS	Performance to Bontoc RS
Mean IP	224.58 Mbps	224.58 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary			
Link Length	5.854 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	38.19 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	449.15 Mbps
Modulation	Adaptive	Annual Link Availability	100.0000 %
Bandwidth	45 MHz	Annual Link Unavailability	1 secs/year
Total Path Loss	123.09 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

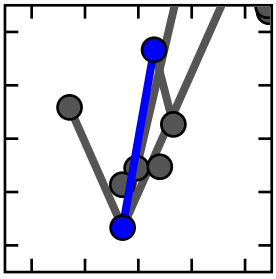
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-121.80 N units/km	Free Space Path Loss	123.05 dB
Area roughness 110x110km	590.92 metre	Gaseous Absorption Loss	0.04 dB
Geoclimatic factor	4.47e-06	Link Type	Line-of-Sight
Fade Occurrence Factor (P0)	1.44e-07	Excess Path Loss	0.00 dB
Path inclination	50.75 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.40	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	0.00 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	92.72 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.52 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

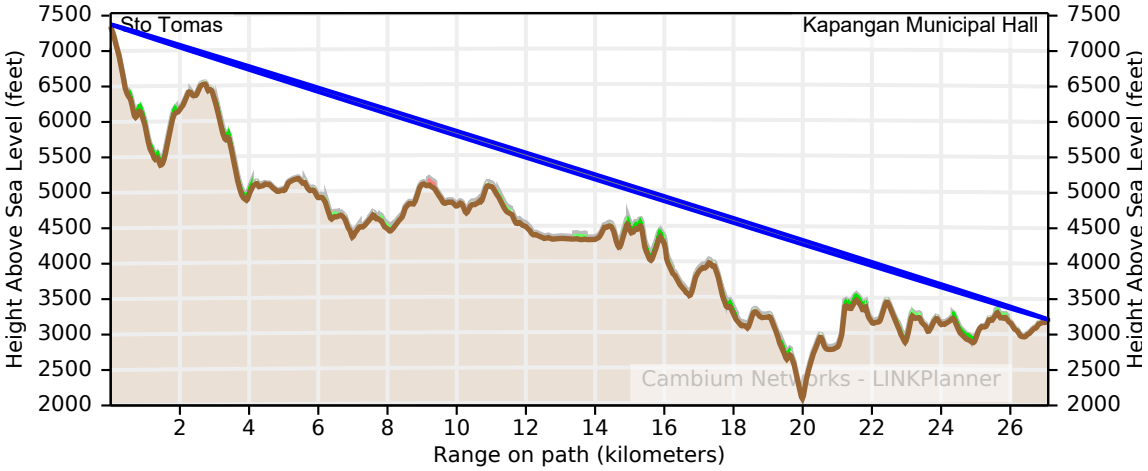
Sto Tomas to Kapangan Municipal Hall



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 33 ft

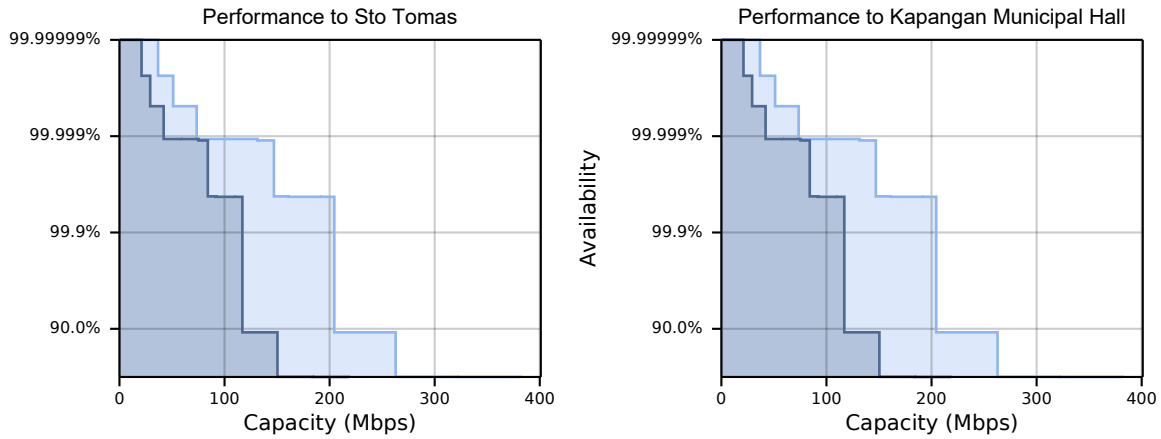
Cambium Networks High Gain Integrated @ 33 ft



	Performance to Sto Tomas	Performance to Kapangan Municipal Hall
Mean IP	146.65 Mbps	146.65 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary			
Link Length	27.094 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	24.73 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	293.30 Mbps
Modulation	Adaptive	Annual Link Availability	100.0000 %
Bandwidth	45 MHz	Annual Link Unavailability	1 secs/year
Total Path Loss	136.55 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

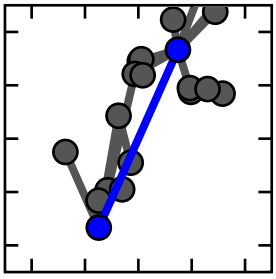
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-150.26 N units/km	Free Space Path Loss	136.36 dB
Area roughness 110x110km	614.35 metre	Gaseous Absorption Loss	0.19 dB
Geoclimatic factor	5.25e-06	Link Type	Line-of-Sight
Fade Occurrence Factor (P0)	5.34e-05	Excess Path Loss	0.00 dB
Path inclination	46.83 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.66	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	0.00 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	93.51 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.53 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

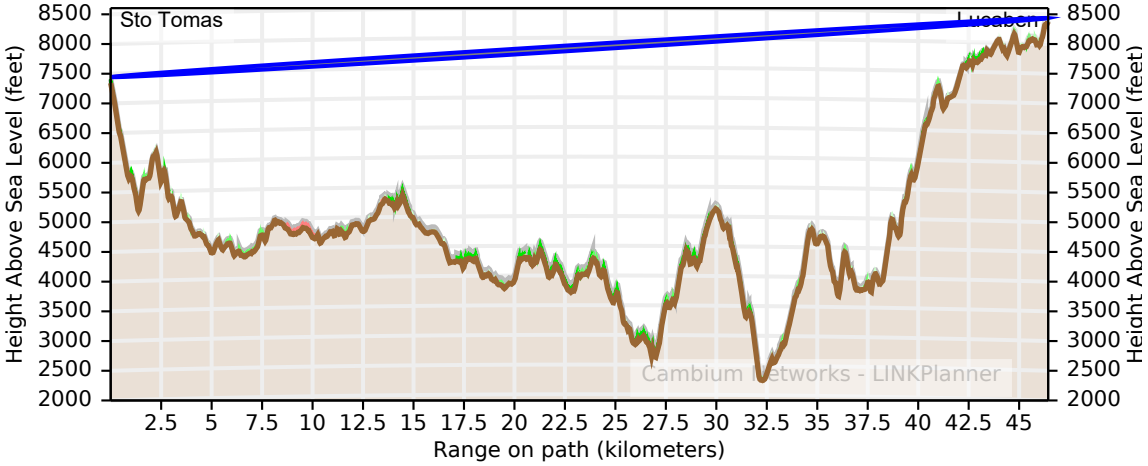
Sto Tomas to Lucaben



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 100 ft

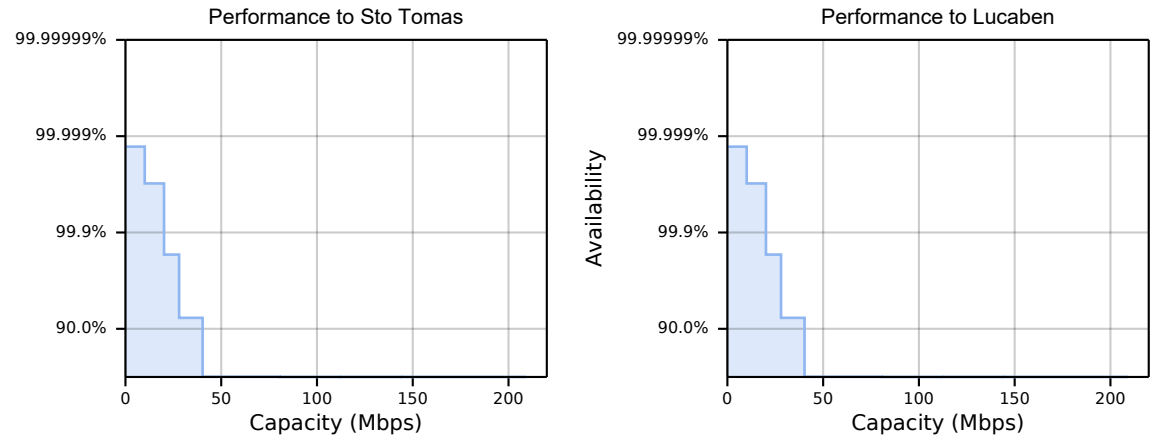
Cambium Networks High Gain Integrated @ 60 ft



	Performance to Sto Tomas	Performance to Lucaben
Mean IP	39.90 Mbps	39.90 Mbps
IP Availability	99.9983 % for 1.0 Mbps	99.9983 % for 1.0 Mbps

Link Summary			
Link Length	46.438 km	System Gain	152.28 dB
Band	5.8 GHz	System Gain Margin	11.00 dB
Regulation	Philippines	Mean Aggregate Data Rate	79.81 Mbps
Modulation	Adaptive	Annual Link Availability	99.9983 %
Bandwidth	45 MHz	Annual Link Unavailability	8.7 mins/year
Total Path Loss	141.28 dB	Prediction Model	ITU-R P.530-17

Performance Charts



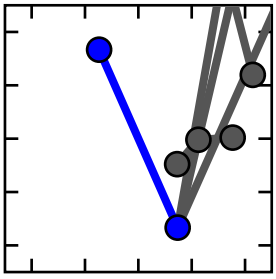
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-143.56 N units/km	Free Space Path Loss	141.02 dB
Area roughness 110x110km	617.46 metre	Gaseous Absorption Loss	0.26 dB
Geoclimatic factor	5.02e-06	Link Type	Line-of-Sight
Fade Occurrence Factor (P0)	2.24e-04	Excess Path Loss	0.00 dB
Path inclination	6.52 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.78	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	0.00 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	91.02 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.50 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	5	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H016	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - EU Line Cord). Kit includes ODU, power supply, mounting bracket and EU line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

Sto Tomas to Sablan



Equipment: Cambium Networks PTP670 Integrated

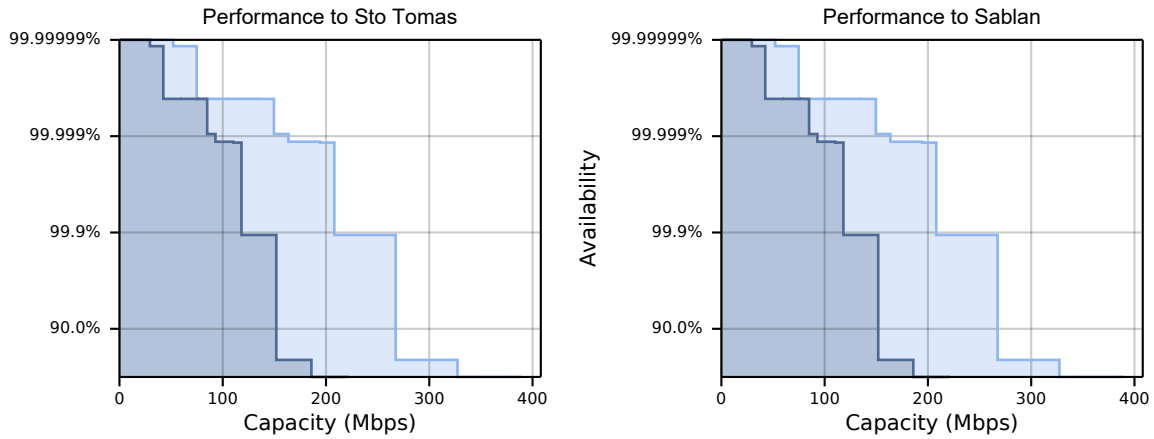
Cambium Networks High Gain Integrated @ 49 ft

Cambium Networks High Gain Integrated @ 33 ft

	Performance to Sto Tomas	Performance to Sablan
Mean IP	170.77 Mbps	170.77 Mbps
IP Availability	100.0000 % for 1.0 Mbps	100.0000 % for 1.0 Mbps

Link Summary			
Link Length	19.715 km	System Gain	161.28 dB
Band	5.8 GHz	System Gain Margin	27.53 dB
Regulation	Argentina (Private)	Mean Aggregate Data Rate	341.54 Mbps
Modulation	Adaptive	Annual Link Availability	100.0000 %
Bandwidth	45 MHz	Annual Link Unavailability	1 secs/year
Total Path Loss	133.74 dB	Prediction Model	ITU-R P.530-17

Performance Charts



High Capacity, assumes there is no load in the other direction

Symmetrical Capacity, assumes a saturated load in the other direction

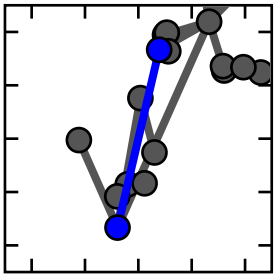
Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-154.97 N units/km	Free Space Path Loss	133.59 dB
Area roughness 110x110km	610.65 metre	Gaseous Absorption Loss	0.15 dB
Geoclimatic factor	5.42e-06	Link Type	Line-of-Sight
Fade Occurrence Factor (P0)	1.96e-05	Excess Path Loss	0.00 dB
Path inclination	82.64 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.59	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	0.00 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	95.09 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.54 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H010	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - U.S. Line Cord). Kit includes ODU, power supply, mounting bracket and US line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

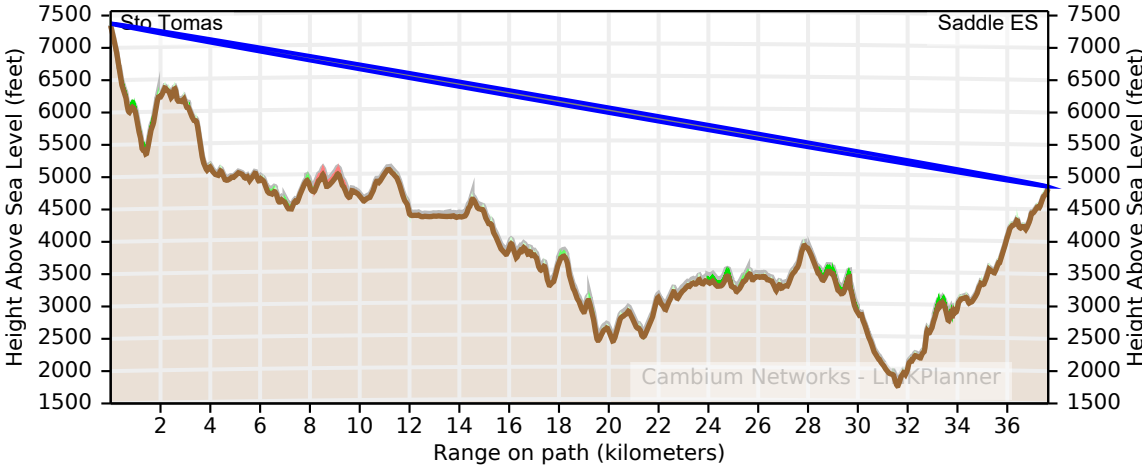
Sto Tomas to Saddle ES



Equipment: Cambium Networks PTP670 Integrated

Cambium Networks High Gain Integrated @ 33 ft

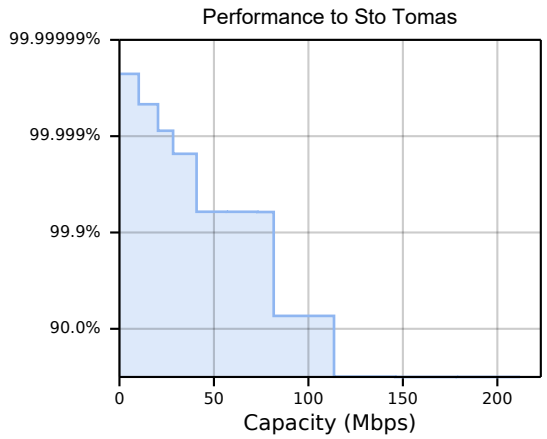
Cambium Networks High Gain Integrated @ 33 ft

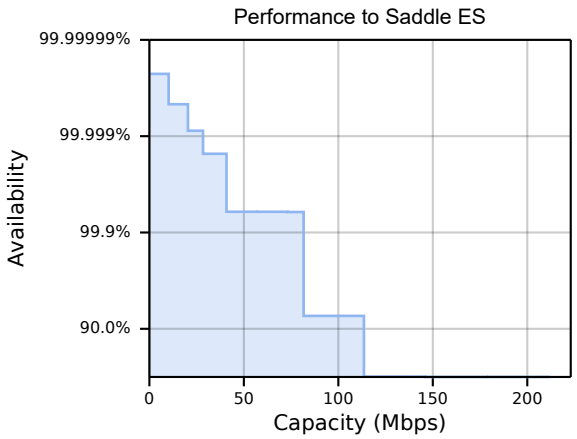


	Performance to Sto Tomas	Performance to Saddle ES
Mean IP	112.22 Mbps	112.22 Mbps
IP Availability	99.9999 % for 1.0 Mbps	99.9999 % for 1.0 Mbps

Link Summary			
Link Length	37.643 km	System Gain	160.77 dB
Band	5.9 GHz	System Gain Margin	21.09 dB
Regulation	Other	Mean Aggregate Data Rate	224.45 Mbps
Modulation	Adaptive	Annual Link Availability	99.9999 %
Bandwidth	45 MHz	Annual Link Unavailability	16 secs/year
Total Path Loss	139.69 dB	Prediction Model	ITU-R P.530-17

Performance Charts





Climatic Factors, Losses and Standards

dN/dH not exceeded for 1% of time	-148.94 N units/km	Free Space Path Loss	139.43 dB
Area roughness 110x110km	627.88 metre	Gaseous Absorption Loss	0.25 dB
Geoclimatic factor	5.15e-06	Link Type	Line-of-Sight
Fade Occurrence Factor (P0)	1.56e-04	Excess Path Loss	0.00 dB
Path inclination	20.41 mr	Atmospheric Gasses	ITU-R P.676-12, ITU-R P.835-6
Value of K Exceeded for 99.99% (ke)	0.74	Diffraction Loss	ITU-R P.526-15
Excess Path Loss at ke	0.00 dB	Propagation	ITU-R P.530-17
0.01% Rain rate	92.36 mm/hr	Rain Rate	ITU-R P.837-7
Rain Attenuation	0.58 dB/km	Refractivity Index	ITU-R P.453-14

Bill of Materials

Part Number	Qty	Description
01010419001	4	Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable
AR-E4PT6XX-WW	2	PTP 670 All Risks Advance Replacement, 4 additional years (per END)
C000065L007	2	LPU and Grounding Kit (1 kit per ODU)
C050067H016	2	PTP 670 Integrated 23dBi END with AC+DC Enhanced Supply (ROW - EU Line Cord). Kit includes ODU, power supply, mounting bracket and EU line cord
WB3176	1	328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP)

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