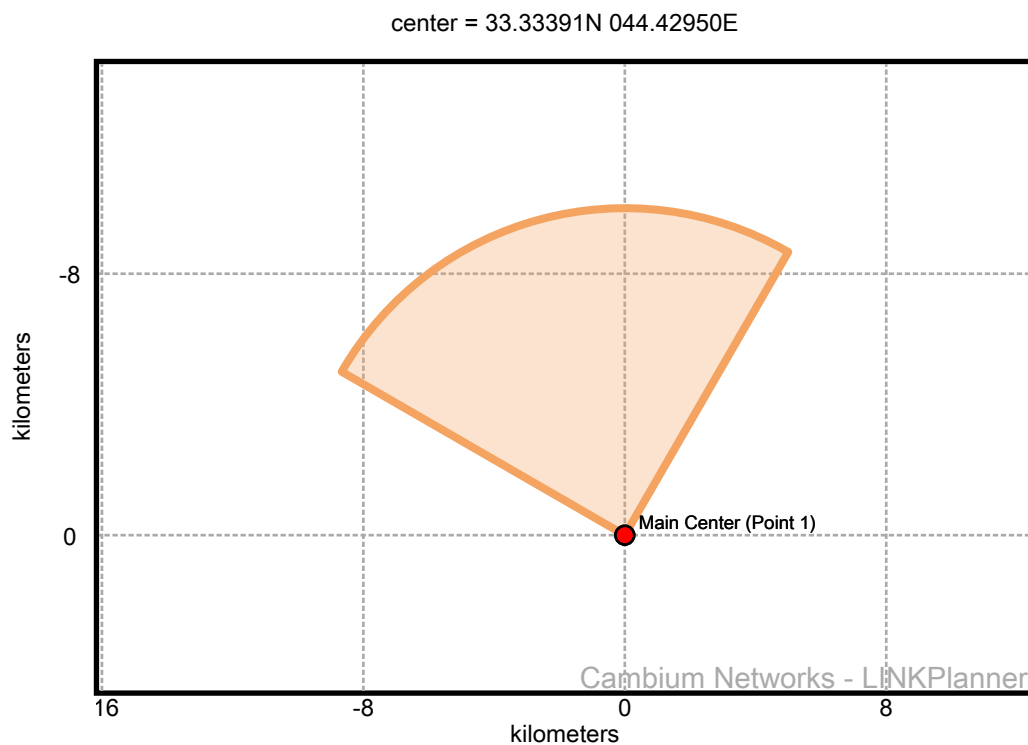


# Project Design, Hub Main Center (Point 1) LINKPlanner Hub Installation Report

22 February 2019

Mahmoud Ali  
Organization: Systel  
Phone: 01220109922  
Email: Mahmoud.ali@systel.com.eg



# Table of Contents

|                                                 |    |
|-------------------------------------------------|----|
| 1. Project Summary                              | 3  |
| 2. Main Center (Point 1)                        | 4  |
| 3. Main Center (Point 1) : 1                    | 7  |
| 4. Main Center (Point 1) : 1 - Access Point Map | 10 |
| 5. Main Center (Point 1) : 1 to Point 6         | 11 |
| 6. Main Center (Point 1) : 1 to Point 16        | 15 |
| Disclaimer                                      | 19 |

# 1. Project Summary

**Project:** Main Center (Point 1)

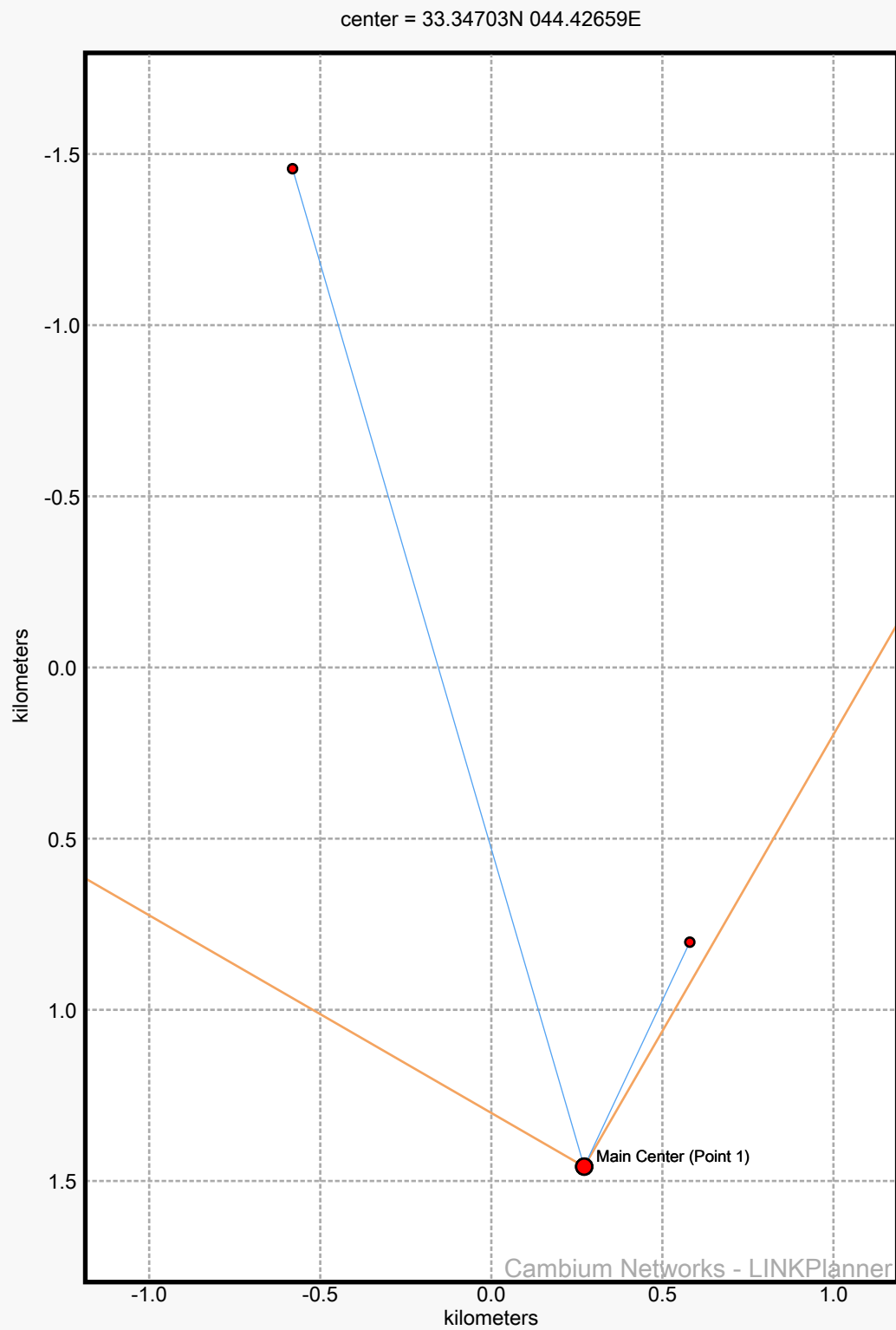
| General Information |  |
|---------------------|--|
| Customer Name       |  |
| Company Name        |  |
| Address             |  |
| Phone               |  |
| Cell Phone          |  |
| Email               |  |

## 2. Main Center (Point 1)

| Hub Summary                     |                       |
|---------------------------------|-----------------------|
| Hub Name                        | Main Center (Point 1) |
| Latitude                        | 33.33391N             |
| Longitude                       | 044.42950E            |
| Number of Access Points         | 1                     |
| Number of Connected Subscribers | 2                     |
| Total Predicted DL Throughput   | 40.42 Mbps            |
| Total Predicted UL Throughput   | 40.42 Mbps            |
| Total Throughput                | 80.84 Mbps            |



### Network Map





| Access Point Name         | Product            | Antenna Azimuth | Beamwidth | Band    | Max Range     | Connected Subscribers | Total Predicted Throughput |
|---------------------------|--------------------|-----------------|-----------|---------|---------------|-----------------------|----------------------------|
| Main Center (Point 1) : 1 | PTP700 C-Only HCMP | 345.0°          | 90.0°     | 4.7 GHz | 10 kilometers | 2                     | 80.84 Mbps                 |

| Bill of Materials : PMP Network |     |                                                                                                                                      |
|---------------------------------|-----|--------------------------------------------------------------------------------------------------------------------------------------|
| Part Number                     | Qty | Description                                                                                                                          |
| 01010419001                     | 7   | Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable                                                                                 |
| C000000L066                     | 1   | cnPulse Sync Generator with CambiumSYNC                                                                                              |
| C000000L556                     | 1   | CMM5 Power and Sync Injector 56V.<br>CMM5 supports up to 4 radios. Requires suffix 'B' or newer of N000000L054                       |
| C000065L007                     | 1   | LPU and Grounding Kit (1 kit per ODU)                                                                                                |
| C000070K009                     | 1   | PTP 700 High Capacity Multipoint Upgrade - Per END                                                                                   |
| C045070B003                     | 1   | PTP 700 Connectorized ODU (Global)-White.<br>Requires suffix 'B' or newer                                                            |
| EW-E4PMC5PS-WW                  | 1   | CMM5 Power/Sync Injector Extended Warranty, 4 Additional Years                                                                       |
| EW-E4PT700-WW                   | 1   | PTP 700 Extended Warranty, 4 additional years (per END)                                                                              |
| N000000D003                     | 1   | 4.4-5.0 GHz, 16 dBi, Dual-Pol Sector Antenna                                                                                         |
| N000000L054                     | 1   | Power Supply, AC, 54V 240W                                                                                                           |
| N000000L125                     | 1   | CMM5 to cnPulse Shielded Cable - 20m                                                                                                 |
| N000045L002                     | 1   | Tilt Bracket Assembly                                                                                                                |
| WB3176                          | 1   | 328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP).<br>Total cable requirements are aggregated at the network level |

### 3. Main Center (Point 1) : 1

| Summary                       |                                                                         |
|-------------------------------|-------------------------------------------------------------------------|
| AP Name                       | Main Center (Point 1) : 1                                               |
| Equipment Type                | PTP700 C-Only HCMP (running Release 700-02-60)                          |
| Antenna Type                  | Cambium Networks 90° 4.4 - 5.0 GHz, Dual-Pol Sector Antenna N000000D003 |
| Modeled Beamwidth             | 90°                                                                     |
| Antenna Azimuth               | 345.00° from True North<br>340.30° from Magnetic North                  |
| Antenna Tilt                  | 0.0° (uptilt)                                                           |
| Connected Subscribers         | 2                                                                       |
| Max Range                     | 10.0 kilometers                                                         |
| RF Frequency Band             | 4.7 GHz (4400 to 5000 MHz)                                              |
| RF Channel Bandwidth          | 40 MHz                                                                  |
| Total Predicted DL Throughput | 40.42 Mbps                                                              |
| Total Predicted UL Throughput | 40.42 Mbps                                                              |
| Total Predicted Throughput    | 80.84 Mbps                                                              |

| Bill of Materials : Access Point |     |                                                                                                                                     |
|----------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------|
| Part Number                      | Qty | Description                                                                                                                         |
| 01010419001                      | 7   | Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable                                                                                |
| C000000L066                      | 1   | cnPulse Sync Generator with CambiumSYNC.<br>This part replaces the UGPS (1096)                                                      |
| C000000L556                      | 1   | CMM5 Power and Sync Injector 56V.<br>CMM5 supports up to 4 radios. Requires suffix 'B' or newer of N000000L054                      |
| C000065L007                      | 1   | LPU and Grounding Kit (1 kit per ODU)                                                                                               |
| C000070K009                      | 1   | PTP 700 High Capacity Multipoint Upgrade - Per END                                                                                  |
| C045070B003                      | 1   | PTP 700 Connectorized ODU (Global)-White.<br>Requires suffix 'B' or newer                                                           |
| EW-E4PMC5PS-WW                   | 1   | CMM5 Power/Sync Injector Extended Warranty, 4 Additional Years                                                                      |
| EW-E4PT700-WW                    | 1   | PTP 700 Extended Warranty, 4 additional years (per END)                                                                             |
| N000000D003                      | 1   | 4.4-5.0 GHz, 16 dBi, Dual-Pol Sector Antenna                                                                                        |
| N000000L054                      | 1   | Power Supply, AC, 54V 240W.<br>This power supply also requires the filter N000000L056 when used in Europe with CMM                  |
| N000000L125                      | 1   | CMM5 to cnPulse Shielded Cable - 20m                                                                                                |
| N000045L002                      | 1   | Tilt Bracket Assembly                                                                                                               |
| WB3176                           | 1   | 328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP).<br>Total cable requirements are aggregated at the parent level |



| Bill of Materials : Subscriber Modules |     |                                                                                                                                     |
|----------------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------|
| Part Number                            | Qty | Description                                                                                                                         |
| (no part number)                       | 2   | Unspecified Power Lead.<br>(set the region in the Bill of Materials options)                                                        |
| 01010419001                            | 6   | Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable                                                                                |
| C000065L002                            | 2   | AC+DC Enhanced Power Injector 56V                                                                                                   |
| C000065L007                            | 2   | LPU and Grounding Kit (1 kit per ODU)                                                                                               |
| C000070K009                            | 2   | PTP 700 High Capacity Multipoint Upgrade - Per END                                                                                  |
| C045070B003A                           | 1   | PTP 700 Connectorized ODU (Global).<br>This item is no longer available for order                                                   |
| C045070B004                            | 1   | PTP 700 Connectorized+Integrated ODU (Global)                                                                                       |
| EW-E4PT700-WW                          | 2   | PTP 700 Extended Warranty, 4 additional years (per END)                                                                             |
| N000045L002                            | 1   | Tilt Bracket Assembly                                                                                                               |
| N000065L031                            | 1   | Mounting Bracket (integrated)                                                                                                       |
| RDH4499                                | 1   | 4.4-5.0 GHZ, 2-FT (0.6M), H-POL & V-POL, WITH FINE ADJUSTMENTS                                                                      |
| WB3176                                 | 1   | 328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP).<br>Total cable requirements are aggregated at the parent level |

| Physical Installation Notes for AP Main Center (Point 1) : 1 |                                                                         |
|--------------------------------------------------------------|-------------------------------------------------------------------------|
| Latitude                                                     | 33.33391N                                                               |
| Longitude                                                    | 044.42950E                                                              |
| Platform Variant                                             | 4.7 GHz PTP-700-ONLY-HCMP                                               |
| Antenna Type                                                 | Cambium Networks 90° 4.4 - 5.0 GHz, Dual-Pol Sector Antenna N000000D003 |
| Antenna Beamwidth                                            | 90.0°                                                                   |
| Antenna Gain                                                 | 16.0 dBi                                                                |
| Antenna Height                                               | 75.0 meters AGL                                                         |
| Antenna Tilt angle                                           | 0.0° (uptilt)                                                           |
| Antenna Azimuth                                              | 345.00° from True North<br>340.30° from Magnetic North                  |
| Magnetic Declination                                         | 4.70° E ±0.30° changing by 0.06° E per year                             |
| Cable Loss                                                   | 0.8 dB                                                                  |

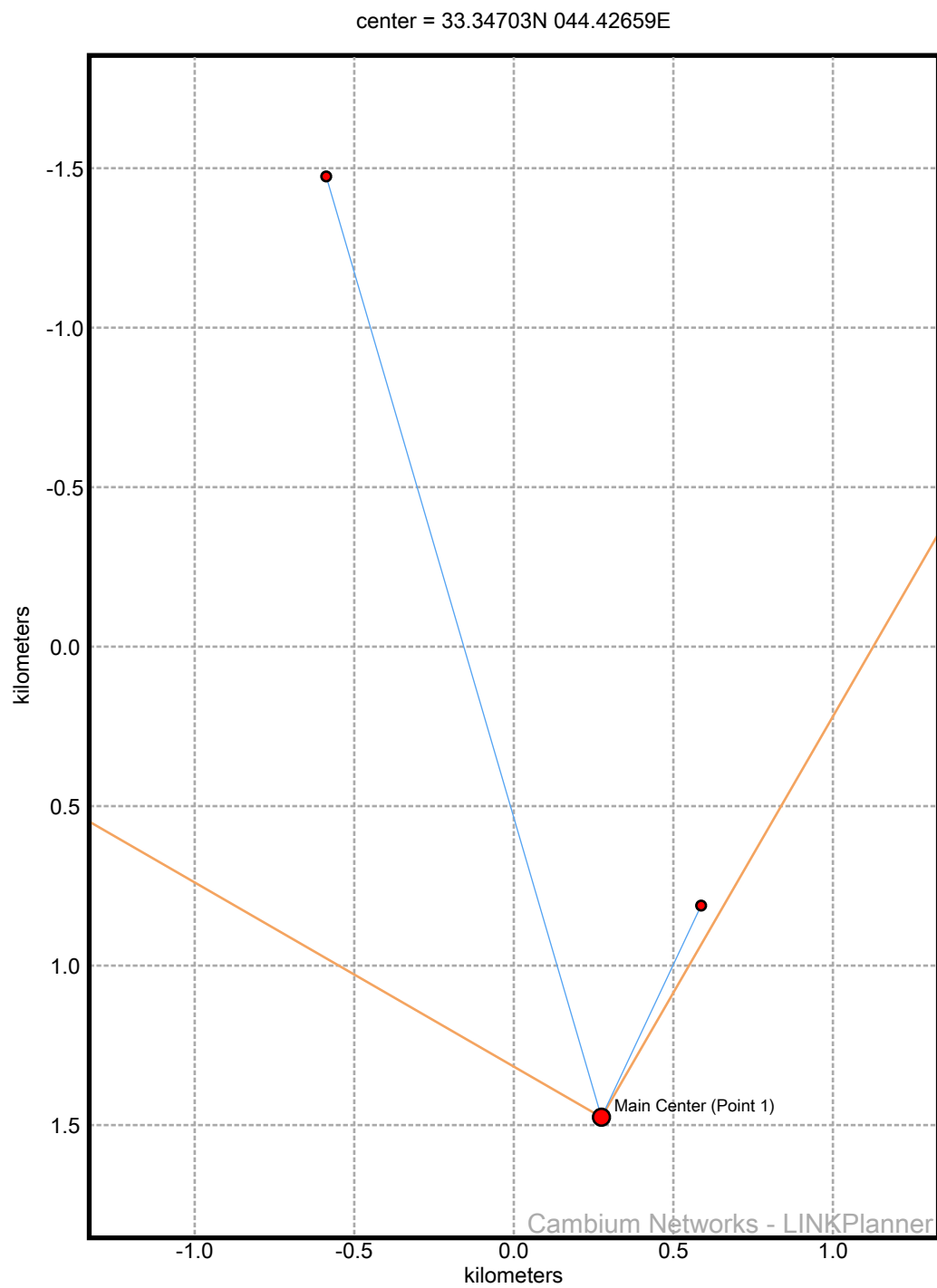
| Radio Commissioning Notes for AP Main Center (Point 1) : 1 |                           |
|------------------------------------------------------------|---------------------------|
| Link Name                                                  | Main Center (Point 1) : 1 |
| Site Name                                                  | Main Center (Point 1)     |
| Latitude                                                   | 33.33391N                 |
| Longitude                                                  | 044.42950E                |
| Altitude                                                   | 112 meters                |
| Wireless Topology                                          | High Capacity Multi-Point |
| Master Slave Mode                                          | Master                    |
| Dual Payload                                               | Enabled                   |
| Max Receive Modulation Mode                                | 256QAM 0.81 Dual          |



| Radio Commissioning Notes for AP Main Center (Point 1) : 1 (continued) |                       |
|------------------------------------------------------------------------|-----------------------|
| Lowest Data Modulation Mode                                            | BPSK 0.63 Sngl        |
| Link Mode Optimization                                                 | IP Traffic            |
| TDD Synchronization Mode                                               | Enabled               |
| Regulatory Band                                                        | 81 - 4.7 GHz          |
| Channel Bandwidth                                                      | 40 MHz                |
| Tx Color Code                                                          | A                     |
| Antenna Gain                                                           | 16.0 dBi              |
| Cable Loss                                                             | 0.8 dB                |
| Maximum Transmit Power                                                 | 29 dBm                |
| EIRP                                                                   | 44 dBm                |
| ATPC HCMP Master Target Rx Power                                       | -56.0 dBm             |
| HCMP Maximum Link Range                                                | 10.0 kilometers       |
| Maximum Number of Slaves                                               | 8                     |
| TDD Sync Device                                                        | Cambium Sync Injector |
| Frame Duration                                                         | 5495 $\mu$ s          |
| TDD Frame Configuration Mode                                           | Standard              |
| HCMP Link Symmetry                                                     | 1 to 1                |

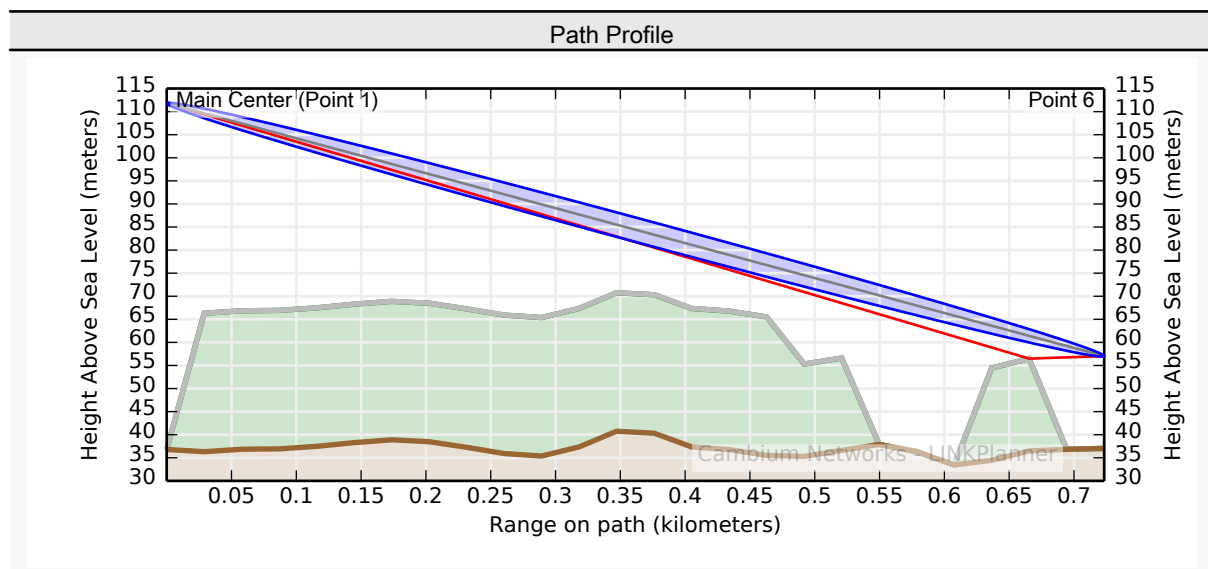
| Mode             | Total Mean Predicted Throughput (Mbps) | SMs per DL modulation |         |                   | SMs per UL modulation |         |                   |
|------------------|----------------------------------------|-----------------------|---------|-------------------|-----------------------|---------|-------------------|
|                  |                                        | Quantity              | Percent | Throughput (Mbps) | Quantity              | Percent | Throughput (Mbps) |
| 256QAM 0.81 Dual | 80.84                                  | 2                     | 100.0   | 40.42             | 2                     | 100.0   | 40.42             |
| 64QAM 0.92 Dual  | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |
| 64QAM 0.75 Dual  | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |
| 16QAM 0.87 Dual  | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |
| 16QAM 0.63 Dual  | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |
| 256QAM 0.81 Sngl | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |
| 64QAM 0.92 Sngl  | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |
| 64QAM 0.75 Sngl  | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |
| 16QAM 0.87 Sngl  | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |
| 16QAM 0.63 Sngl  | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |
| QPSK 0.87 Sngl   | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |
| QPSK 0.63 Sngl   | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |
| BPSK 0.63 Sngl   | 0.00                                   | 0                     | 0.0     | 0.00              | 0                     | 0.0     | 0.00              |

#### 4. Main Center (Point 1) : 1 - Access Point Map



## 5. Main Center (Point 1) : 1 to Point 6

| Summary              |                                                |
|----------------------|------------------------------------------------|
| AP Name              | Main Center (Point 1) : 1                      |
| SM Name              | Point 6                                        |
| Link Type            | Line-of-Sight                                  |
| AP Equipment Type    | PTP700 C-Only HCMP (running Release 700-02-60) |
| SM Equipment Type    | PTP700 C+I HCMP (running Release 700-02-60)    |
| Maximum Obstruction  | 30 meters                                      |
| Link Distance        | 0.723 kilometers                               |
| Free Space Path Loss | 103.08 dB                                      |
| Excess Path Loss     | 0.00 dB                                        |
| RF Frequency Band    | 4.7 GHz (4400 to 5000 MHz)                     |
| RF Channel Bandwidth | 40 MHz                                         |



| Bill of Materials |     |                                                                              |
|-------------------|-----|------------------------------------------------------------------------------|
| Part Number       | Qty | Description                                                                  |
| (no part number)  | 1   | Unspecified Power Lead.<br>(set the region in the Bill of Materials options) |
| 01010419001       | 2   | Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable                         |
| C000065L002       | 1   | AC+DC Enhanced Power Injector 56V                                            |
| C000065L007       | 1   | LPU and Grounding Kit (1 kit per ODU)                                        |
| C000070K009       | 1   | PTP 700 High Capacity Multipoint Upgrade - Per END                           |
| C045070B004       | 1   | PTP 700 Connectorized+Integrated ODU (Global)                                |
| EW-E4PT700-WW     | 1   | PTP 700 Extended Warranty, 4 additional years (per END)                      |



| Bill of Materials (continued) |     |                                                                                                                                     |
|-------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------|
| Part Number                   | Qty | Description                                                                                                                         |
| N000065L031                   | 1   | Mounting Bracket (integrated)                                                                                                       |
| WB3176                        | 1   | 328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP).<br>Total cable requirements are aggregated at the parent level |

| Physical Installation Notes for SM Point 6 |                                                        |
|--------------------------------------------|--------------------------------------------------------|
| Link Name                                  | Main Center (Point 1) : 1 to Point 6                   |
| Access Point                               | Main Center (Point 1) : 1                              |
| Latitude                                   | 33.33981N                                              |
| Longitude                                  | 044.43281E                                             |
| Site Elevation                             | 57 meters AMSL                                         |
| Platform Variant                           | 4.7 GHz PTP-700-HCMP                                   |
| Antenna Type                               | Cambium Networks 10° Integrated Dual Polar Antenna     |
| Antenna Beamwidth                          | 10.0°                                                  |
| Antenna Gain                               | 22.6 dBi                                               |
| Antenna Height                             | 20.0 meters AGL                                        |
| Antenna Tilt angle                         | 4.3° (uptilt)                                          |
| Antenna Azimuth                            | 205.22° from True North<br>200.51° from Magnetic North |
| Magnetic Declination                       | 4.70° E ±0.30° changing by 0.06° E per year            |

| Radio Commissioning Notes for SM Point 6 |                                      |
|------------------------------------------|--------------------------------------|
| Link Name                                | Main Center (Point 1) : 1 to Point 6 |
| Site Name                                | Point 6                              |
| Latitude                                 | 33.33981N                            |
| Longitude                                | 044.43281E                           |
| Altitude                                 | 57 meters                            |
| Wireless Topology                        | High Capacity Multi-Point            |
| Master Slave Mode                        | Slave                                |
| Dual Payload                             | Enabled                              |
| Max Receive Modulation Mode              | 256QAM 0.81 Dual                     |
| Lowest Data Modulation Mode              | BPSK 0.63 Sngl                       |
| Link Mode Optimization                   | IP Traffic                           |
| TDD Synchronization Mode                 | Enabled                              |
| Antenna Selection                        | Integrated                           |
| Regulatory Band                          | 81 - 4.7 GHz                         |
| Channel Bandwidth                        | 40 MHz                               |
| Tx Color Code                            | A                                    |
| Maximum Transmit Power                   | 28 dBm                               |
| EIRP                                     | 39 dBm                               |
| ATPC HCMP Master Tx Power                | 29 dBm                               |
| ATPC HCMP Master Target Rx Power         | -56.0 dBm                            |
| HCMP Maximum Link Range                  | 10.0 kilometers                      |



| Radio Commissioning Notes for SM Point 6 (continued) |                         |
|------------------------------------------------------|-------------------------|
| Maximum Number of Slaves                             | 8                       |
| TDD Frame Configuration Mode                         | Standard                |
| HCMP Link Symmetry                                   | 1 to 1                  |
| Predicted Receive Power                              | -43 dBm $\pm$ 5 dB      |
| Predicted Link Loss                                  | 103.08 dB $\pm$ 5.00 dB |

#### Installation Instruction

Perform the following checks during the installation (Check the deployment guide and the User Guide.)

1. Check with a GPS that you are installing at the correct location.
2. Check carefully the direction to Access Point. Either use a corrected compass or use the GPS waypoint feature about 300 meters from the installation location.
3. When aligning antenna, it is important to find the centre of the main beam. This is done by adjusting the antenna and monitoring the receive level until the peak is found. Once the peak level is found, it should be checked against the predicted receive power to ensure that the antenna has not been aligned on a side lobe.

| Performance to AP Main Center (Point 1) : 1 * |                    |
|-----------------------------------------------|--------------------|
| Predicted Receive Power                       | -56 dBm $\pm$ 5 dB |
| Min Mod Mode Required                         | BPSK 0.63 Sngl     |
| Min Availability Required                     | 99.0000 %          |
| Max Usable Mode                               | 256QAM 0.81 Dual   |
| Predicted Availability                        | 100.0000 %         |

| Performance to SM Point 6 * |                    |
|-----------------------------|--------------------|
| Predicted Receive Power     | -43 dBm $\pm$ 5 dB |
| Min Mod Mode Required       | BPSK 0.63 Sngl     |
| Min Availability Required   | 99.0000 %          |
| Max Usable Mode             | 256QAM 0.81 Dual   |
| Predicted Availability      | 100.0000 %         |

\* Multipath availability calculated using ITU-R

| Mode             | Main Center (Point 1) |                    |                          | Point 6          |                    |                          |
|------------------|-----------------------|--------------------|--------------------------|------------------|--------------------|--------------------------|
|                  | Fade Margin (dB)      | Availability (%) * | Receive time in Mode (%) | Fade Margin (dB) | Availability (%) * | Receive time in Mode (%) |
| 256QAM 0.81 Dual | 3.68                  | 99.5519            | 99.5519                  | 10.18            | 99.9994            | 99.9994                  |
| 64QAM 0.92 Dual  | 7.24                  | 99.9985            | 0.4465                   | 13.74            | 99.9995            | 0.0001                   |
| 64QAM 0.75 Dual  | 11.18                 | 99.9995            | 0.0010                   | 17.68            | 99.9995            | 0.0000                   |



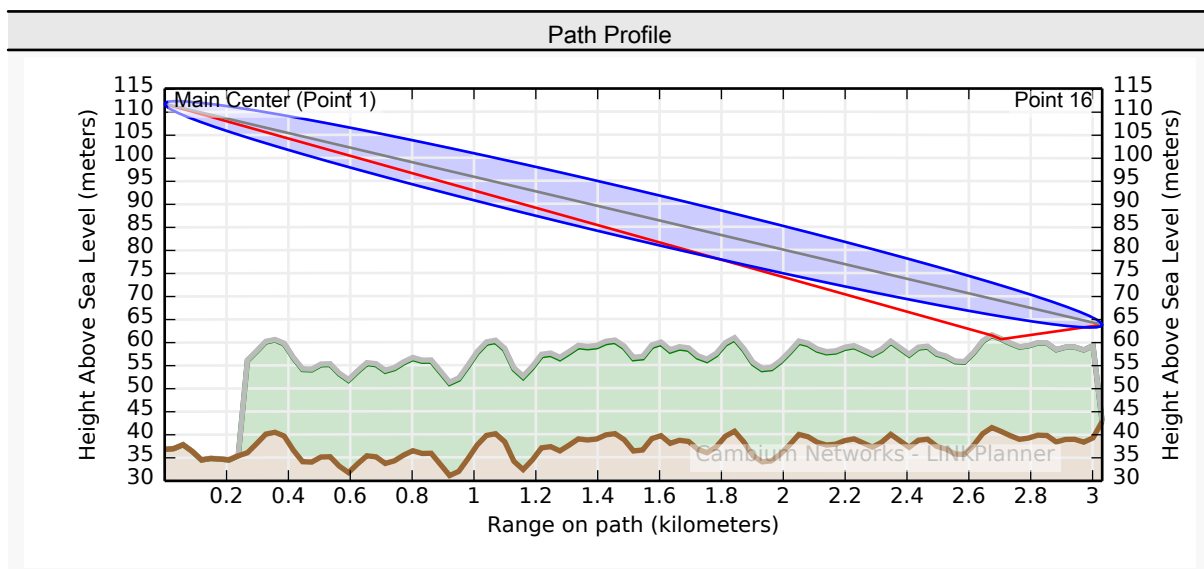
(continued)

| Mode             | Main Center (Point 1) |                    |                          | Point 6          |                    |                          |
|------------------|-----------------------|--------------------|--------------------------|------------------|--------------------|--------------------------|
|                  | Fade Margin (dB)      | Availability (%) * | Receive time in Mode (%) | Fade Margin (dB) | Availability (%) * | Receive time in Mode (%) |
| 16QAM 0.87 Dual  | 14.18                 | 99.9995            | 0.0000                   | 21.68            | 99.9995            | 0.0000                   |
| 16QAM 0.63 Dual  | 18.92                 | 99.9995            | 0.0000                   | 27.42            | 99.9995            | 0.0000                   |
| 256QAM 0.81 Sngl | 7.24                  | 0.0005             | 0.0005                   | 13.74            | 0.0005             | 0.0005                   |
| 64QAM 0.92 Sngl  | 10.50                 | 0.0005             | 0.0000                   | 17.00            | 0.0005             | 0.0000                   |
| 64QAM 0.75 Sngl  | 14.29                 | 0.0005             | 0.0000                   | 20.79            | 0.0005             | 0.0000                   |
| 16QAM 0.87 Sngl  | 17.24                 | 0.0005             | 0.0000                   | 24.74            | 0.0005             | 0.0000                   |
| 16QAM 0.63 Sngl  | 21.94                 | 100.0000           | 0.0000                   | 30.44            | 100.0000           | 0.0000                   |
| QPSK 0.87 Sngl   | 23.86                 | 100.0000           | 0.0000                   | 33.36            | 100.0000           | 0.0000                   |
| QPSK 0.63 Sngl   | 27.88                 | 100.0000           | 0.0000                   | 38.38            | 100.0000           | 0.0000                   |
| BPSK 0.63 Sngl   | 31.39                 | 100.0000           | 0.0000                   | 42.89            | 100.0000           | 0.0000                   |

\* Multipath availability calculated using ITU-R

## 6. Main Center (Point 1) : 1 to Point 16

| Summary              |                                                |
|----------------------|------------------------------------------------|
| AP Name              | Main Center (Point 1) : 1                      |
| SM Name              | Point 16                                       |
| Link Type            | Line-of-Sight                                  |
| AP Equipment Type    | PTP700 C-Only HCMP (running Release 700-02-60) |
| SM Equipment Type    | PTP700 C+I HCMP (running Release 700-02-60)    |
| Maximum Obstruction  | 20 meters                                      |
| Link Distance        | 3.031 kilometers                               |
| Free Space Path Loss | 115.52 dB                                      |
| Excess Path Loss     | 0.00 dB                                        |
| RF Frequency Band    | 4.7 GHz (4400 to 5000 MHz)                     |
| RF Channel Bandwidth | 40 MHz                                         |



| Bill of Materials |     |                                                                                   |
|-------------------|-----|-----------------------------------------------------------------------------------|
| Part Number       | Qty | Description                                                                       |
| (no part number)  | 1   | Unspecified Power Lead.<br>(set the region in the Bill of Materials options)      |
| 01010419001       | 4   | Coaxial Cable Grounding Kits for 1/4" and 3/8" Cable                              |
| C000065L002       | 1   | AC+DC Enhanced Power Injector 56V                                                 |
| C000065L007       | 1   | LPU and Grounding Kit (1 kit per ODU)                                             |
| C000070K009       | 1   | PTP 700 High Capacity Multipoint Upgrade - Per END                                |
| C045070B003A      | 1   | PTP 700 Connectorized ODU (Global).<br>This item is no longer available for order |



| Bill of Materials (continued) |     |                                                                                                                                     |
|-------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------|
| Part Number                   | Qty | Description                                                                                                                         |
| EW-E4PT700-WW                 | 1   | PTP 700 Extended Warranty, 4 additional years (per END)                                                                             |
| N000045L002                   | 1   | Tilt Bracket Assembly                                                                                                               |
| RDH4499                       | 1   | 4.4-5.0 GHZ, 2-FT (0.6M), H-POL & V-POL, WITH FINE ADJUSTMENTS                                                                      |
| WB3176                        | 1   | 328 ft (100 m) Reel Outdoor Copper Clad CAT5E (Recommended for PTP).<br>Total cable requirements are aggregated at the parent level |

| Physical Installation Notes for SM Point 16 |                                                        |
|---------------------------------------------|--------------------------------------------------------|
| Link Name                                   | Main Center (Point 1) : 1 to Point 16                  |
| Access Point                                | Main Center (Point 1) : 1                              |
| Latitude                                    | 33.36014N                                              |
| Longitude                                   | 044.42036E                                             |
| Site Elevation                              | 64 meters AMSL                                         |
| Platform Variant                            | 4.7 GHz PTP-700-HCMP                                   |
| Antenna Type                                | Cambium Networks 7° Dual-Polar Parabolic RDH4499       |
| Antenna Beamwidth                           | 7.1°                                                   |
| Antenna Gain                                | 26.6 dBi                                               |
| Antenna Height                              | 21.0 meters AGL                                        |
| Antenna Tilt angle                          | 0.9° (uptilt)                                          |
| Antenna Azimuth                             | 163.70° from True North<br>158.99° from Magnetic North |
| Magnetic Declination                        | 4.71° E ±0.30° changing by 0.06° E per year            |
| Cable Loss                                  | 1.0 dB                                                 |

| Radio Commissioning Notes for SM Point 16 |                                       |
|-------------------------------------------|---------------------------------------|
| Link Name                                 | Main Center (Point 1) : 1 to Point 16 |
| Site Name                                 | Point 16                              |
| Latitude                                  | 33.36014N                             |
| Longitude                                 | 044.42036E                            |
| Altitude                                  | 64 meters                             |
| Wireless Topology                         | High Capacity Multi-Point             |
| Master Slave Mode                         | Slave                                 |
| Dual Payload                              | Enabled                               |
| Max Receive Modulation Mode               | 256QAM 0.81 Dual                      |
| Lowest Data Modulation Mode               | BPSK 0.63 Sngl                        |
| Link Mode Optimization                    | IP Traffic                            |
| TDD Synchronization Mode                  | Enabled                               |
| Regulatory Band                           | 81 - 4.7 GHz                          |
| Channel Bandwidth                         | 40 MHz                                |
| Tx Color Code                             | A                                     |
| Antenna Gain                              | 26.6 dBi                              |
| Cable Loss                                | 1.0 dB                                |
| Maximum Transmit Power                    | 28 dBm                                |



| Radio Commissioning Notes for SM Point 16 (continued) |                         |
|-------------------------------------------------------|-------------------------|
| EIRP                                                  | 46 dBm                  |
| ATPC HCMP Master Tx Power                             | 29 dBm                  |
| ATPC HCMP Master Target Rx Power                      | -56.0 dBm               |
| HCMP Maximum Link Range                               | 10.0 kilometers         |
| Maximum Number of Slaves                              | 8                       |
| TDD Frame Configuration Mode                          | Standard                |
| HCMP Link Symmetry                                    | 1 to 1                  |
| Predicted Receive Power                               | -47 dBm $\pm$ 5 dB      |
| Predicted Link Loss                                   | 115.55 dB $\pm$ 5.00 dB |

#### Installation Instruction

Perform the following checks during the installation (Check the deployment guide and the User Guide.)

1. Check with a GPS that you are installing at the correct location.
2. Check carefully the direction to Access Point. Either use a corrected compass or use the GPS waypoint feature about 300 meters from the installation location.
3. When aligning antenna, it is important to find the centre of the main beam. This is done by adjusting the antenna and monitoring the receive level until the peak is found. Once the peak level is found, it should be checked against the predicted receive power to ensure that the antenna has not been aligned on a side lobe.

| Performance to AP Main Center (Point 1) : 1 * |                    |
|-----------------------------------------------|--------------------|
| Predicted Receive Power                       | -56 dBm $\pm$ 5 dB |
| Min Mod Mode Required                         | BPSK 0.63 Sngl     |
| Min Availability Required                     | 99.0000 %          |
| Max Usable Mode                               | 256QAM 0.81 Dual   |
| Predicted Availability                        | 100.0000 %         |

| Performance to SM Point 16 * |                    |
|------------------------------|--------------------|
| Predicted Receive Power      | -47 dBm $\pm$ 5 dB |
| Min Mod Mode Required        | BPSK 0.63 Sngl     |
| Min Availability Required    | 99.0000 %          |
| Max Usable Mode              | 256QAM 0.81 Dual   |
| Predicted Availability       | 100.0000 %         |

\* Multipath availability calculated using ITU-R

| Mode             | Main Center (Point 1) |                    |                          | Point 16         |                    |                          |
|------------------|-----------------------|--------------------|--------------------------|------------------|--------------------|--------------------------|
|                  | Fade Margin (dB)      | Availability (%) * | Receive time in Mode (%) | Fade Margin (dB) | Availability (%) * | Receive time in Mode (%) |
| 256QAM 0.81 Dual | 3.82                  | 99.6740            | 99.6740                  | 6.32             | 99.9963            | 99.9963                  |



(continued)

| Mode             | Main Center (Point 1) |                    |                          | Point 16         |                    |                          |
|------------------|-----------------------|--------------------|--------------------------|------------------|--------------------|--------------------------|
|                  | Fade Margin (dB)      | Availability (%) * | Receive time in Mode (%) | Fade Margin (dB) | Availability (%) * | Receive time in Mode (%) |
| 64QAM 0.92 Dual  | 7.38                  | 99.9984            | 0.3244                   | 9.88             | 99.9994            | 0.0031                   |
| 64QAM 0.75 Dual  | 11.32                 | 99.9995            | 0.0011                   | 13.82            | 99.9995            | 0.0001                   |
| 16QAM 0.87 Dual  | 14.32                 | 99.9995            | 0.0000                   | 17.82            | 99.9995            | 0.0000                   |
| 16QAM 0.63 Dual  | 19.05                 | 99.9995            | 0.0000                   | 23.55            | 99.9995            | 0.0000                   |
| 256QAM 0.81 Sngl | 7.37                  | 0.0005             | 0.0005                   | 9.87             | 0.0005             | 0.0005                   |
| 64QAM 0.92 Sngl  | 10.64                 | 0.0005             | 0.0000                   | 13.14            | 0.0005             | 0.0000                   |
| 64QAM 0.75 Sngl  | 14.43                 | 0.0005             | 0.0000                   | 16.93            | 0.0005             | 0.0000                   |
| 16QAM 0.87 Sngl  | 17.38                 | 0.0005             | 0.0000                   | 20.88            | 0.0005             | 0.0000                   |
| 16QAM 0.63 Sngl  | 22.08                 | 100.0000           | 0.0000                   | 26.58            | 100.0000           | 0.0000                   |
| QPSK 0.87 Sngl   | 24.00                 | 100.0000           | 0.0000                   | 29.50            | 100.0000           | 0.0000                   |
| QPSK 0.63 Sngl   | 28.02                 | 100.0000           | 0.0000                   | 34.52            | 100.0000           | 0.0000                   |
| BPSK 0.63 Sngl   | 31.53                 | 100.0000           | 0.0000                   | 39.03            | 100.0000           | 0.0000                   |

\* Multipath availability calculated using ITU-R

# Disclaimer

Cambium Networks assumes no responsibility for the accuracy of the information produced by the Cambium LINKPlanner. Reference to products or services which are not provided by Cambium Networks is for information purposes only and constitutes neither an endorsement nor a recommendation. All information provided by the Cambium LINKPlanner is provided without warranty of any kind, either expressed or implied.

**All product or service names are the property of their respective owners. © Cambium Networks. 2019**